A WORLD BANK STUDY

Green Infrastructure Finance

LEADING INITIATIVES AND RESEARCH

Aldo Baietti, Andrey Shlyakhtenko,
Roberto La Rocca, and Urvaksh D. Patel

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Aldo Baietti
Andrey Shlyakhtenko
Roberto La Rocca
Urvaksh D. Patel

THE WORLD BANK
Washington, D.C.

Australian AID

East Asia and Pacific Region/East Asia Infrastructure Unit (EASIN)
1818 H Street NW
Washington DC 20433
Telephone: 202-473-1000
Internet: www.worldbank.org

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Foreword

Increasing concerns over the effects of climate change together with an expanding global, and particularly, urban population have heightened the importance of accelerating investments in green growth and development. The International Energy Agency, for example, estimates that to reduce carbon dioxide emissions by 50 percent by 2050, global investments in the energy sector alone will need to total US$750 billion a year by 2030 and over US$1.6 trillion a year from 2030–2050.

Despite global efforts to mobilize required capital flows, the investments still fall far short. Bloomberg NEF argues that by 2020 investments will be US$150 billion short from the levels required simply to stabilize CO2 emissions. For the East Asia and Pacific region alone, the World Bank study *Winds of Change* suggests that additional investments of US$80 billion a year over the next two decades are required.

Investments in green projects are constrained by multiple factors: (i) numerous financial and institutional constraints; (ii) pronounced risks; (iii) unfavorable structure of cash flow profiles; (iv) anti-green market distortions. In order to boost investment flows private financing is essential, but the public and private sectors need to work together. Public instruments and concessional funding will, therefore, need to be used carefully to leverage private flows.

While a number of innovative mechanisms and instruments have already been introduced, the analytical tools, financing instruments, and policy options available to governments have not been fully developed; particularly in ways these can be applied in a coherent and complementary fashion to accelerate the deployment of green technologies. More fundamentally, many governments still lack a comprehensive framework for assessing green investment climate and formulating an appropriate mix of measures to accelerate green investments.

In order to address this challenge, the World Bank, with support from AusAID, has begun the work on improving the financing opportunities for green infrastructure investments among its client countries. This activity attempts to identify practical ways to value and monetize the environmental externalities of investments and improve the promotion and bankability of green projects.

This research report is a key step in this activity. It summarizes current investment challenges of green projects as well as proposed solutions, financing schemes and instruments, and initiatives that have set the stage for promoting green growth.

The results of this work are intended to benefit the international community and policymakers who are seeking to deepen their knowledge of green investment environment. In addition, it is hoped that this work will be useful to practitioners, including fund managers and investors, seeking to have a better understanding of current trends, global initiatives, and available funding sources and mechanisms for financing green projects.

John Roome
Director
Sustainable Development
East Asia and Pacific Region
The World Bank Group

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Acronyms and Abbreviations

AAU	Assigned Amount Units
ABS	Asset-backed Securities
ACES	American Clean Energy and Security Act of 2009, U.S.
ADB	Asian Development Bank
ADBI	Asian Development Bank Institute
AfDB	African Development Bank
AGF	UN High-Level Advisory Group on Climate Change Financing
APCF	Asia Pacific Carbon Fund
APEC	Asia-Pacific Economic Cooperation
APP	Asia-Pacific Partnership on Clean Development and Climate
ASTAE	Asia Sustainable and Alternative Energy Program
AWG-KP	Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol
AWG-LCA	Ad Hoc Working Group on Long-term Cooperative Action
BAU	Business as Usual
BTF	Task Force on Biofuels
CAF	Corporaciyn Andina de Fomento
CARMA	Carbon Monitoring for Action
CASES	Cost Assessment of Sustainable Energy Systems
CAST	Collaborative Assessment of Standards and Testing
CBEEX	China Beijing Environment Exchange
CBRC	China Banking Regulatory Commission
CCGT	Combined Cycle Gas Turbine
CCS	Carbon Capture and Storage
CCWG	UNEP Climate Change Working Group
CCX	Chicago Climate Exchange
CDC	Caisse des Depots
CDIAC	Carbon Dioxide Information Analysis Center
CDM	Clean Development Mechanism
CDP	Carbon Disclosure Project
CDSB	Climate Disclosure Standards Board
CECAFA	Clean Energy and Climate Adaptation Facility for Africa
CEET	Carbon Emissions Estimator Tool
CEFPF	Clean Energy Financing Partnership Facility
CEG	Clean Energy Group
CEIF	Clean Energy Investment Framework for Africa
CER	Certified Emission Reduction
CERN	European Organization for Nuclear Research
CFC	Chlorofluorocarbons
CFT	Climate Friendly Technology
CGD	Center for Global Development
CHUEE	China Utility-Based Energy Efficiency Finance Program

CICERO	Center for International Climate and Environmental Research at the University of Oslo
CIF	Climate Investment Funds
CMI	Carbon Market Initiative
CTF	Clean Technology Fund
CO_2	Carbon Dioxide
COP	Conference of Parties
CPF	Carbon Partnership Facility
CSLF	Carbon Sequestration Leadership Forum
CSR	Corporate Social Responsibility
DFID	Department for International Development
DOE	U.S. Department of Energy
EAP	East Asia and Pacific Region
EBN	EWG Business Network
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECA	Export Credit Agencies
ECCP	European Climate Change Programme
ECGD	UK Export Credit Guarantee Department
EE	Energy Efficiency
EEA	European Environmental Agency
EEI	Energy Efficiency Initiative
EEP	Environmental Exports Program
EFIC	Australian Export Finance and Insurance Corporation
EFR	Environmental Fiscal Reform
EGCFE	Expert Group on Clean Fossil Energy
EGEDA	Expert Group on Energy Data and Analysis
EGEEC	Expert Group on Energy Efficiency and Conservation
EGNRET	Expert Group on New and Renewable Energy Technologies
EIA	Energy Information Administration
EIB	European Investment Bank
EISA	Energy Independence and Security Act of 2007, U.S.
EMM	APEC Energy Ministers Meetings
EP	Equator Principles
EPA	U.S. Environmental Protection Agency
EPAct	Energy Policy Act of 2005, U.S.
EPFI	Equator Principles Financial Institutions
ERG	Energy and Resource Group
ERMS	Emissions Reduction Market System
ERPA	Emission Reductions Purchase Agreement
ERUs	Emission Reduction Units
ESCO	Energy Service Company
ESG	Environmental Social Governance
ESI	Energy Security Initiative
ESIS	Energy Standard Information System
ESMAP	Energy Sector Management Assistance Program

ETFP	Energy Trust Funded Programs
ETR	Environmental Tax Reform
ETS	Emission Trading Scheme (System)
EU	European Union
EWG	Energy Working Group
FCPF	Forest Carbon Partnership Facility
FERN	Forests and the European Union Resource Network
FI	Financial Institution
FINESSE	Financing Small Scale Energy Users Programme
FIP	Forest Investment Program
FiT	Feed-in Tariff
FSC	Financial Services Commission, Korea
GCF	Green Climate Fund
GCN	Global Climate Network
GDP	Gross Domestic Product
GEEREF	Global Energy Efficiency and Renewable Energy Fund
GEF	Global Environment Facility
GEI	Green Economy Initiative
GGAS	Greenhouse Gas Reduction Scheme
GGGI	Global Green Growth Institute
GHG	Greenhouse Gas
GIB	Green Investment Bank, UK
GRI	Global Reporting Initiative
GTBR	Green Tax and Budget Reform
GW	Gigawatt
HFCs	Hydrofluorocarbons
IBRD	International Bank for Reconstruction and Development
ICT	Information and Communication Technology
IDA	International Development Association
IDB	Inter-American Development Bank
IEA	International Energy Agency
IFC	International Finance Corporation
IIASA	International Institute for Applied Systems Analysis, Vienna, Austria
IIGCC	Institutional Investors Group on Climate Change
IKLU	Initiative for Climate and Environmental Protection
IMF	International Monetary Fund
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
IPHE	International Partnership for the Hydrogen Economy
IPR	Intellectual Property Rights
ISO	International Organization for Standardization
ITER	International Thermonuclear Experimental Reactor
JBIC	Japan Bank for International Cooperation
JCI	UN Joint Crisis Initiatives
JI	Joint Implementation
JVETS	Japanese Voluntary Emissions Trading Scheme
KoSIF	Korea Sustainability Investing Forum

kWh	Kilowatt-hour
LCDF	Low Carbon Development Facility
LCET	Low Carbon Energy Technologies
LEED	Leadership in Energy and Environmental Design
LI	Low-interest
LSE	London School of Economics
LULUCF	Land Use, Land-Use Change, and Forestry
MARPOL	International Convention for the Prevention of Pollution from Ships
MCCF	Multi-lateral Carbon Credit Fund
MDB	Multilateral Development Bank
MEP	Ministry of Environmental Protection, China
METI	Ministry of Economy, Trade and Industry, Japan
MOE	Ministry of Environment
MOEJ	Ministry of Environment, Japan
MRV	Monitoring, Reporting and Verification
$MtCO_2e$	Millions of tonnes of carbon dioxide equivalent
MWh	Megawatt-hour
NAMA	Nationally Appropriate Mitigation Action
NAPCC	National Action Plan on Climate Change, India
NATF	North American Task Force
NEEDS	National Economic, Environment and Development Study for Climate Change
NEF	Bloomberg New Energy Finance
NEX	The WilderHill New Energy Global Innovation Index
NGO	Non-Governmental Organization
NMEEE	National Mission on Enhanced Energy Efficiency, India
NREL	National Renewable Energy Laboratory
NSW	New South Wales
ODA	Official Development Assistance
ODS	Ozone Depleting Substances
OECD	Organisation for Economic Cooperation and Development
OPEC	Organization of the Petroleum Exporting Countries
OPIC	Overseas Private Investment Corporation
OTC	Over-the-Counter Stock Market
PACE	Professional Association for China's Environment
PAT	Perform, Achieve and Trade System
PBL	Netherlands Environmental Assessment Agency
PE	Price-to-Earnings (ratio)
PFM	Public Finance Mechanism
PFS	Perfluorinated Compounds
PLAC	Latin American Carbon Program
PNAS	U.S. Proceedings of the National Academy of Sciences
PoA	Program of Activities
PPA	Power Purchase Agreement
PPCR	Pilot Program for Climate Resilience
PPP	Public Private Partnership
PRC	People's Republic of China

PREE	Peer Review on Energy Efficiency
PRGF	Partial Risk Guarantee Fund
PRI	UN Principles for Responsible Investment
PROPER	Program for Pollution Control Evaluation and Rating, Indonesia
PV	Photovoltaic
R&D	Research and Development
RAF	Rapid Assessment Framework
RD&D	Research, Development and Demonstration
RE	Renewable Energy
REA	Renewable Energy Association
REC	Renewable Energy Certificates
RECLAIM	Regional Clean Air Incentives Market
REDD	Reducing Emissions from Deforestation and Forest Degradation
REED	Renewable Energy Enterprise Development
REEEP	Renewable Energy and Energy Efficiency Partnership
RFF	Resource for the Future
RGGI	Regional Greenhouse Gas Initiative
ROC	The Republic of China
RPS	Renewable Portfolio Standards
SAR	Special Administrative Region
SBI	UN Subsidiary Body for Implementation
SBSTA	UN Subsidiary Body for Scientific and Technological Advice
SCAF	Seed Capital Assistance Facility
SCC	Social Cost of Carbon
SCF	Strategic Climate Fund
SDR	Special Drawing Rights
SECCI	Sustainable Energy and Climate Change Initiative
SEEE	Shanghai Environment and Energy Exchange
SEFI	UN Sustainable Energy Finance Initiative
SGP	Small Grants Programme
SIDA	Swedish International Development Cooperation Agency
SME	Small and Medium Enterprises
SO_2	Sulfur Dioxide
SREP	Scaling Up Renewable Energy Program in Low Income Countries
SRI	Socially Responsible Investing
STI	Sustainable Transport Initiative
TA	Technical Assistance
TBL	Triple Bottom Line
tc	Tonnes of Carbon
tce	Tonnes of Coal Equivalent
tCO_2e	Tonnes of Carbon Dioxide Equivalent
TCX	Tianjin Climate Exchange
TOA	Technology-Oriented Agreement
TSP	Total Suspended Particulates
UN	United Nations
UNCED	UN Conference of Environment and Development
UNEP	United Nations Environment Programme

UNEPFI	UNEP Finance Initiative
UNESCAP	UN Economic and Social Commission for Asia and the Pacific
UNFCCC	UN Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
VCFEE	Venture Capital Fund for Energy Efficiency
VER	Verified Emission Reduction
VOC	Volatile Organic Compounds
VOM	Volatile Organic Materials
WB	The World Bank
WBCSD	World Business Council for Sustainable Development
WEF	World Economic Forum
WEO	World Energy Outlook
Wh	Watt-hour
WMO	World Meteorological Organization
Wp	Watt of Peak Power
WRI	World Resources Institute
WWF	World Wildlife Fund
ZETT	Zero-Emission Technology Treaty

Assessment of Leading Initiatives

Overview

Over the past decades, there has been an increased focus on climate change, the need to reduce greenhouse gas emissions, and as a consequence the necessity to cultivate more sustainable business and lifestyle practices. This has catalyzed initiatives to create "greener" economies by emphasizing that sustainable environments should command a more prominent role on how green investments are designed, evaluated and implemented. In response, a number of multilateral institutions, policy makers, and researchers have launched *green growth* initiatives to create more sustainable economies and communities by emphasizing that policies that favor environmentally sustainable growth should have a more prominent role in development criteria and plans. Infrastructure development is central to these initiatives and significant attention is now being devoted to the way green investments are evaluated, designed, financed, and accelerated.

Financing green infrastructure is one aspect of green growth that still requires further attention. Many renewable energy (RE) or energy efficiency (EE) opportunities that are consistent with the tenets of green growth are still neglected in favor of less eco-friendly alternatives. Further, while a number of innovative mechanisms and instruments have been introduced to promote such green growth, the analytical tools, financing instruments, and policy options available to governments have not been fully developed, particularly in the ways these can be applied in a coherent and complementary fashion to accelerate the deployment of green technologies.

"Green infrastructure finance", as defined in this report, is a combination of financial and nonfinancial interventions and instruments that can be utilized for making green investments in infrastructure more affordable and less risky to private sponsors, financial markets and governments. The definition is applied broadly and beyond solely financial instruments with the assumption that more suitable policies and programs are equally needed to increase the attractiveness of green investments. Without fully considering all criteria that influence investment decisions, financial interventions on their own can only deal with a limited set of solutions.

To address this challenge, the East Asia and Pacific (EAP) Region of the World Bank is seeking to improve the financing opportunities for green infrastructure investments among its client countries. This activity, among other objectives, attempts to identify practical ways to value and monetize the environmental externalities of investments and, alongside other financial and economic considerations, aims to improve the promotion and bankability of green projects.

This stocktaking report is an initial step in the work on green infrastructure finance. Its objective is to document and summarize current initiatives and leading approaches related to the challenges described as well as present the possible solutions that have been proposed. This compilation serves as a foundation for the next steps of the work, which will include an analytical framework for green finance.

A large body of literature exists on issues relating to climate finance. In total, several hundred sources of information have been included in this compilation. In addition, many more were reviewed but not included as they lacked a clear and direct link to the area of focus. Moreover, there is likely to be a much greater number of relevant sources that have not been identified during the research. Nonetheless, the current compendium reflects the central issues relating to the subject matter and provides a balanced perspective of the issues.

This work is a presentation and is not intended to be an analytical assessment of the body of research. However, this summary, besides highlighting the main conclusions of the research, also provides an assessment of the gaps in the current body of work.

Conclusions from Research

Green investment demands are significant and shortfalls in financing are staggering.

Many estimates have been made on the amount of total investment needed to counter the detrimental impact of global warming. For example, the International Energy Agency (IEA) concluded that to reduce carbon dioxide (CO_2) emissions by 50 percent by 2050, global investments in the energy sector alone will need to total approximately US$46 trillion over 2010–2050[1]. This translates into US$750 billion a year by 2030 and over US$1.6 trillion a year from 2030–2050. For the East Asia and Pacific region alone, the World Bank study *Winds of Change*[2] suggests that additional investments of about US$80 billion a year would be required collectively if a low-carbon energy path is to be achieved by the year 2030. In addition, estimates of investments required to adapt communities to impending climate change concerns (i.e., sea level rise, weather-related events, changes in eco-systems, movements of populations etc.) are estimated to be of a similar, if not of a larger magnitude of US$30 to US$90 billion by 2030.

Although investment trends have been promising, the actual volume of investment still falls short of the necessary targets. Bloomberg New Energy Finance (NEF) noted that investment in clean energy soared from US$34 billion in 2004 to approximately US$150 billion in 2007 and 2008—maintaining investor interest even during the global recession.[3] While the analysts differ in the exact figures, their conclusions are similar. Essentially, "the current level of investments, and its anticipated growth, will not be sufficient to meet the challenge of global warming and the shortfalls are staggering."[4] Bloomberg NEF, for example, estimated that by 2020, investments will be about US$150 billion short from the levels required simply to stabilize CO_2 emissions.

Attracting private financing is essential to close the funding gap.

The Copenhagen Accord took a significant step to mobilize the necessary funding and reached agreement to a goal of raising US$100 billion a year by 2020. A High-Level Advisory Group on Climate Change Financing (AGF) was established by the UN Secretary General for Climate Change to identify the potential sources of financing from developed countries to scale up investments in the developing world.

Among the various findings the Advisory Group emphasized the importance of a carbon price between of US$20 to US$25 per ton of CO_2, which it estimated would generate US$100 billion to US$200 billion of gross private capital flows. The Advisory Group categorized the sources of funds into four groups: (i) public sources for grants and highly concessional loans including the removal of fossil fuel subsidies, direct budgetary contributions and a variety of taxes on carbon and other transactions; (ii) the development of

bank-type instruments; (iii) carbon finance; and (iv) private capital, as a major source of the total financing required.

Significantly, the AGF clearly recognized that a solution can only be attained by a combination of public and private funds, and that instruments should be combined for maximum effect.

However, public instruments and concessional funding are essential to leverage private flows.

Most experts agree that concessional financing needs to be utilized strategically and that about 85 percent of the capital needed must come from private finance.[5] However, private financial markets behave rationally and require adequate returns after factoring in the various country and institutional risks. These "hurdle rates" are substantially higher in developing countries especially if there are any institutional and regulatory governance weaknesses. Under these circumstances the private sector alone does not possess the incentives to mobilize financing to the required scale necessary to lead this agenda. The private sector instead requires a collaborative effort of support from public finance as well as from international donors if the requisite magnitudes of financing are to flow into low-carbon investments.

Unfortunately, many green investments are less financially attractive when compared against traditional but less eco-friendly alternatives.

The problem is not that global financing is limited or unavailable. The global sources of financing are vast. The problem is how to mobilize or channel these global sources towards green investments. One of the principal barriers to attracting green investments is that many technologies and projects are not financially attractive, and as such, they will not attract investment purely by private finance without some level of support from the public sector. Many RE or EE opportunities that could guide an economy toward a low-carbon pathway are not as financially attractive as their less eco-friendly alternatives.

Also, traditional GHG emitting investments are supported by a sophisticated and well organized financing and investment framework that is well established. In contrast, the framework for financing green investments is still in its infancy and its sponsors have limited experience in this market. Governments are actively seeking practical solutions that can deliver immediate results to accelerate the greening of their economies and infrastructure.

The financial and institutional constraints to accelerating green investments are numerous.

Many studies, including those by the Brookings Institution,[6] the Green Investment Bank Commission (UK),[7] United Nations Industrial Development Organization (UNIDO),[8] and United Nations Environment Programme (UNEP) have focused on this specific point with the constraints showing that Climate Friendly Technologies differ from conventional energy projects "in five important areas: (a) transactions tend to be smaller, (b) development activity tends to be led by non-traditional project developers, (c) the availability and assessment of resources is very project-specific, (d) projects tend to rely heavily on regulatory support and carbon pricing mechanisms, and (e) in some instances, projects rely on new or emerging technologies."[9] Further, green investments confront a range of additional challenges including information or knowledge gaps, confidence gaps, uncertainty over the protection of intellectual property rights, and political and regulatory risks. All of these challenges increase the uncertainty over the reliability of being able to calculate a straightforward mathematical rate of return.

Many green investments present unique risks because of their cash flow profiles.

Green infrastructure investments possess risks that conventional projects do not, or at least not to the same degree. These typically include demand and regulatory risks, risks associated with resource availability and in quantifying benefits, technology risks, among others. Moreover, green investments exhibit different cash flow streams than the traditional less eco-friendly technologies which generally tend to be more upfront loaded with lower operating costs. For example, the initial upfront cost for energy efficiency replacement investment is generally offset by savings in electricity costs. This upfront cost differential presents a greater burden in the initial financing decision, even though the project may be considered viable through a stream of positive cash flows in the operational years. In addition, risk factors associated with different technologies need explicit consideration on a project-by-project basis. Such risks heavily influence the "hurdle" rate used by private sponsors to assess financial viability. Given the upfront characteristic of the cash flows,[10] the higher the rate used when considering the investment decision, the more disadvantaged a green investment would be when compared, for example, against a typical coal fired plant.

Distortions present in an economy can widen the financing viability gap of many green investments.

Policy distortions in an economy can favor traditional technologies. Several notable examples are subsidies for fossil fuels, and politically set tariffs that do not recover appropriate costs as in the case of many infrastructure services (notably, electricity, urban transport, water supply and sanitation). Depending on the magnitude of such subsidies, these may have a negative impact on the financial viability of a proposed green investment, or extend the required payback period beyond a level that investors and financiers are willing to accept.[A]

While most green investments confront similar financing constraints, the extent of such barriers facing different technologies differs markedly. As illustrated by the McKinsey & Co. study in its GHG cost abatement curve, the finance challenges for green investments can differ widely between the different approaches and technologies.[11] One set of investments—generally those involving improving energy efficiency initiatives—generate negative costs or positive returns while another set including renewable energy investments as well as the newest and unproven technologies such as carbon capture and storage (CCS), are fundamentally more costly, making them the least likely to attract financing from private financial markets. Currently there are few instruments available that can effectively shoulder "technology" risks in a cost effective manner. While the McKinsey & Co. study does not suggest that the abatement curve is a measure of financial viability or bankability, it provides a useful approach for categorizing the three principal markets for green infrastructure investments in terms of EE, RE and new technologies.

Green finance requires country-specific public policies and instruments with the public sector taking the lead.

Accelerating investment in green infrastructure will not only involve new financial tools but also the design and application of various country-specific policies and regulatory mechanisms that will complement financing instruments. The public sector needs to play a pivotal role in leveraging private financing because the "greening" of investments

essentially requires mitigating externalities that are conventionally not valued by markets and investors. Governments can send the appropriate signals to markets through a variety of public policies and instruments. Further, the ability to mobilize the extraordinary level of capital investment required is heavily dependent on the leadership taken by national governments in setting the stage for creating an appropriate investment climate for greening their economies. Public policies need to address issues related to carbon markets and taxes, regulations and standards, and financial support mechanisms as well as correcting policy distortions.[12] Currently, private investors consider that public funds (i) should be spent when commercial entities are not willing to invest; (ii) would be best utilized to make low-carbon technologies commercially viable; and (iii) should be used strategically at different stages of the technology development/diffusion process to leverage and attract private investment.[13] In terms of unproven technologies this may mean more involvement in financing research and development (R&D) efforts, incubation and demonstration projects to the point where technologies can demonstrate their commercial viability, and reduce technology risks.

In May 2010, the Organisation for Economic Cooperation and Development's (OECD) Council of Ministers interim report on green growth strategies articulated that both demand and supply sides must be addressed by policy interventions.[14] On the supply side, the interventions would include introduction of environmentally-related taxes, tradable permits, charges and fees, and the removal of environmentally harmful subsidies. On the demand side, the interventions would seek to influence the behavior of firms, households or individuals through regulations, and policies to support green technologies and new innovation, as well as voluntary approaches based on the dissemination of information and agreements between government, sub-national entities and specific industrial sectors. Another UNEP publication noted that "a portfolio of fiscal, regulatory and information-based policy measures will likely be required for effective and fair transition to a green economy."[15]

In addition to top-down elements, such as binding national commitments, other mechanisms and initiatives, including information dissemination and public education, are needed to stimulate more direct, rapid behavioral shifts among both the consuming public as well as producers that have high energy needs.[16] In a recent Global Metro Summit, the Brookings Institution stated: "The first [imperative is that] public the sectors must come together to finance the investments that green growth needs."[17]

Public and private sectors need to work together to develop unique solutions.

Although many entities including, UNEP's Sustainable Energy Finance Initiative (SEFI),[18] the Clean Energy Group (CEG), along with Bloomberg NEF have proposed the idea that public and private sectors must work together, the most recent collaborative approaches have focused on specific issues or concerns rather than on developing broad arrangements for working together.[19] Moreover, the private sector has frequently indicated its preference to have more input in proposing viable solutions. For example, private groups in the United States introduced the concept of a *Clean Energy Accelerator Corporation*[20] that would be modeled around the role of Overseas Private Investment Corporation (OPIC) to support the creation of privately-owned and managed investment funds in response to the critical shortfall of private equity capital. Similarly, the *Coalition for Green Capital*, a non-profit private organization advocates tax and financial policies to promote new investment in clean energy.

Private sector investors appear to be strongly motivated by the business opportunities available in green technologies provided the public sector demonstrates its steady and consistent support. In November 2010, the Institutional Investors Group on Climate Change (IIGCC) along with other organizations jointly issued a simple but powerful message: "Investors are interested in the potentially large economic opportunities presented by a transition to a low-carbon economy. However, as governments lack strong, stable policies, investors do not yet see clean technology financing as viable".[21]

This statement indicates that countries need to reassess their approaches to setting policy and targets, mobilizing financing mechanisms and developing regulatory instruments. In addition, governments need to examine the institutional frameworks needed to guide the promotion and processing of clean technology investments.

In combining interventions some are more important than others.

The financing plan for such investments needs to consider all possible financial tools and incentives and financial engineering solutions if the goal is to leverage private financing. However, because of the distinct characteristics of green investments, some instruments and measures are more effective than others in closing the financial viability gap. For example, the Clean Development Mechanism (CDM) mechanism, provides benefit after the investment is already financed and operational while feed-in tariffs for renewable energy work in a similar way. Conversely, a reduction of import duties would lower the initial capital requirements, and this yields a more substantial return in terms of present value than another measure that amounts to the same nominal cost but instead enhances the revenue stream only in later years. Similarly, income tax deferrals may have less impact than a tax-equity scheme, because in the case of the latter a sponsor can trade the tax deferment with another company in need of the reduction in exchange for an upfront payment. Apart from the effects on the rates of return for a given investment, the reduction of the capital cost can actually facilitate the closing of the transaction financing as it reduces the initial sum of cash that would have to be raised.

The international donor community, together with the multilateral development banks, has developed some innovative financial instruments and programs to offset the higher costs of viable clean technologies to support developing countries. However, more clarity is needed in the ways these financing mechanisms can be blended in a more effective and complementary fashion to address the inherent financing difficulties of green investments, particularly when these are combined with a mix of other public sector measures that have been or can be developed by individual governments in order to shoulder their portion of the financing viability gap.

While there are strong hopes that the carbon markets can be revived there is also great uncertainty.

Many proponents of green growth have great hope in a well-functioning carbon market with a predictably stable and appropriate global price for carbon.

OECD concluded that, in general, the single most efficient measure to address many environmental externalities is when governments put a price on either a pollution source or the over-exploitation of a scarce resource and, since environmental damage is often due to several inter-acting market failures, this practice often involves a mix of instruments.[22] The AGF report states that a carbon price of US$20-US$25 could generate around US$100 billion-US$200 billion of gross private capital flows and this is likely to be a reference price which could have a significant impact on investment levels.

A 2007 Stern Review on the Economics of Climate Change[23] estimated that the global cost of actions to reduce GHGs and alleviate climate change was US$18-US$44 per tonne of CO_2.[24] Based on these numbers, various UK programs impose a burden of about US$28 per tonne of CO_2 produced in electricity generation.[25] The use of these funds to adopt measures to curb CO_2 emissions might produce dramatic results.

However, cap-and-trade regimes or tradable permit schemes have been difficult to operationalize because of political difficulties in concluding a negotiations process. Today the carbon market price of the ETU trading scheme is hovering at approximately US$17 per tonne of CO_2, or roughly 35 percent less that the upper limit of the referenced AGF target price. Moreover, in earlier years, the trading price has experienced substantial volatility falling to just 1 in 2007, regaining to 30 in July 2008, and then falling again to 14 in 2009.[26] A continuation of this extent of volatility can have significant negative impact on the credibility of these market mechanisms.

Another optimal instrument is the use of Pigouvian taxes[B] and subsidies, but again the political reality has made it difficult to reach international agreements. A carbon tax, if correctly designed and implemented could be the preferred instrument to provide the right market signals and could be used to target the appropriate types of investments from its proceeds. Such carbon taxes can have the effect of penalizing carbon intensive activities, and the resulting proceeds could be used to subsidize carbon friendly technologies. Due to their characteristics, carbon taxes are also less prone to perverse behaviors and may be an advantageous option to use because developing countries may find it difficult to establish a formal tradable permit scheme due to its complexity and requirements for strict governance rules. A carbon tax, however, is easier to implement and the funds generated could be targeted to the desired investments.

Nonetheless, developing countries that rely more on international assistance and which could potentially benefit from these schemes, must establish a credible and cost effective system of verification, reporting and monitoring of GHGs. Finally, the pricing of externalities has additional implications at the project assessment stage. It is, as mentioned earlier, essential to conduct a proper economic analysis in order to ensure economic justification. It is equally important that practitioners, donors and governments have a significant degree of certainty that international support will be earmarked for the externality portion of the financial viability gap, and will not reward current distortionary policies that may be currently present in some economies. It is also necessary that such support be accompanied by a time-bound action plan whereby beneficiary governments remove such distortions.

The CDM, Climate Investment Funds (CIF) and Global Environment Facility (GEF) have made major contributions to the financing of green investments. However, refinements are necessary to make these instruments more effective. The CDM, which originated from the Kyoto Accord, has shown promise in demonstrating the significance of carbon markets. Despite its successes, carbon finance alone—as an incremental financing mechanism—cannot overcome the existing constraints to low-carbon growth that are so often found in developing countries. Moreover, the CDM is not considered to be the optimal solution because it possesses a number of weaknesses. These include (i) an overly bureaucratic process which results in high transaction costs; (ii) an approval and certification process that is highly uncertain with funds only transferred to a project proponent after the investment has been made and GHG reductions are verified; (iii) a methodology for funding that has been biased towards the destruction of gases or other

investments which require low upfront capital, thus displacing other important clean investment opportunities with higher upfront financing needs; (iv) the inability to provide upfront financing where it is most needed and where the impact on rates of return are the highest; and (v) the inability to encourage innovation and risk taking to develop incubator renewable technologies. Following the Cancún Summit, agreement was reached on reforming CDM limitations and other similar schemes have been proposed in line with this objective. However, what remains critical to the success of an upgraded CDM is a well-functioning and reliable carbon market as the future flows of carbon finance are clearly dependent on price stability as well as a continuation of the program.

Climate Investment Funds (notably the CTF and the Strategic Climate Fund, SCF) have provided significant financial support in the form of concessional loans and technical assistance (TA) for clean projects. Generally, these funds are blended with other financing to reduce the overall cost of borrowing. The TA is typically applied toward project development and assessment. The CTF helps to scale up financing for demonstration, deployment and transfer of low-carbon technologies with significant potential for long-term GHG reductions. In contrast, the SCF serves as an umbrella fund to support targeted programs with dedicated funds to pilot new approaches that could scale up and transform activities related to specific climate change problems or sectoral responses.

The GEF was established in 1991 as a multilateral trust fund with a Secretariat and a governing Council operating in partnership with three original Implementing Agencies (World Bank, United Nations Development Programme, and United Nations Environment Programme). Today it has expanded to work with governments through a wider range of agencies and is one of the largest grant facilities supporting activities aimed at improving the global environment. The GEF provides upfront funding for both TA and project investments in a co-financing arrangement that emphasizes leverage to the GEF contribution.

While these funds have made a significant contribution in funding clean investments, it is not necessarily evident how the operational guidelines of these funds could have been adequately shaped without the consideration of the externality costs or of the combined deployment of public interventions. CTF's desire to maximize the leveraging of other financing, for example depends substantially on the cash flow characteristics of individual projects as well the extent of the total externality costs inherent in a given green investment. As such, CTF funding of one investment can achieve a very different leverage ratio than another. Moreover, CTF could conceivably support projects already viable on their own, or alternatively, reward policy distortions in a given economy.

Governments still lack a comprehensive framework for assessing their investment climate for green investments and for determining an appropriate mix of measures required to accelerate investments.

A significant number of governments have proposed approaches in order to classify the broad array of possible public interventions. However, these attempts have not yet yielded a comprehensive framework tailored to country-specific environments to promote green investment opportunities. Public sector interventions should be conducted more broadly by deploying various policy, fiscal, financial, regulatory, and other instruments in concert.

Countries are however, adopting pro-green policies at increasing rates and are also developing financing schemes and instruments for funding clean investments within their boundaries. This is especially evident in Western Europe, Japan and the United States as well as in China, India and South Korea. Many of these countries have set aside sizable funds toward clean investments following the recent global crisis. The UK and the United

States are considering establishing a Green Bank to specifically address the financing problems of green investments. China, Japan and the EU as well as the United States have also created various forms of carbon trading schemes either at a national, state or city level. These are countries with well-developed capital markets and sophisticated tax policies resulting in a wide of array of both public and private financing options.

In this context, it is also important to emphasize that some developed countries are pursuing a green growth agenda and an investment financing framework in pursuit of multiple objectives. Not only are these governments focusing on improving both the global environment as well as their own environments, but are also recognizing a major opportunity to develop and deploy as well as export their own green technologies to foster industrial growth along with its related income and employment benefits. As such, much of the discussion reviewed on financing mechanisms and instruments is in part directed to this latter objective through R&D efforts, venture capital, public offerings of emerging technology companies which would not necessarily apply to those countries that possess few opportunities in technology development.

For less developed nations, the options for national interventions are significantly fewer. Not only do these countries have limited capacity to compete in the field of technology, but their own public funding is constrained by budgetary restrictions and competing commitments from other important initiatives such as health, education and other basic services including water supply and sanitation. These countries have fewer prospects for cross subsidies from one group of industries or consumers to others. Moreover, local capital markets and financial institutions of poorer economies are still not adequately advanced, lacking the capacity to develop sophisticated instruments or mobilize long-term finance.

Consequently, many less developed nations rely heavily on donor support through a number of international financing mechanisms including carbon markets through CDM, the clean investment funds as well as direct grants. Nonetheless, governments need to contribute to close the financing gap, especially in addressing policies that distort prices and disadvantage green investments in their own economies. Removing policy distortions outright creates a number of difficult economic and political challenges. For this reason it is essential that poorer nations are guided by a proper benchmark that sets realistic expectations for what can be accomplished in the short term and provides appropriate actions to make progress in both the medium and longer term.

Assessment of Gaps—What Can Be Achieved in the Short-Term?

The stocktaking exercise has highlighted many initiatives designed to reduce the effects of climate change and to improve the investment climate and financing of green investments. The challenge is significant and while a certain amount of progress has been made additional time is required to resolve outstanding issues. This assessment has, however, identified some crucial gaps that can be ameliorated in the short term.

First, regardless of the functioning of carbon markets or what financing mechanisms are used to support green investments, there is a need to incorporate some elements of externality pricing at the assessment stage of any given green project. A stable and common shadow price of carbon provides the economic justification for why any given green investment should be selected. Moreover, it provides a benchmark for international support, whether it comes from the markets themselves or through direct and voluntary subsidies as part of an international program of support. Instead of focusing on the price of carbon in the markets, it may perhaps be more worthwhile to determine

the subsidy cost per tonne of carbon that a project assessment yields, thus benchmarking all green investments on the same basis.

Second, while many pro-green measures have been proposed, currently the question of what constitutes a comprehensive set of tools, measures, instruments, regulation and programs remains unresolved. National governments need to be able to gauge their standing in the global community and set realistic expectations for what can be pursued in the short term in order to promote their own climate agenda.

The financing equation is a complex one and, in many countries, the financing gap of many green investments is too wide for them to address on their own. International donor support is clearly needed. An analytical tool needs to be developed to be able to critically examine the financial viability gap of any green investment. It could then be determined which portion of the gap should be the responsibility of a given government in order to rebalance distortions as well as local externalities. With this tool, international donors and international funding institutions will also have a better understanding of how, and to what extent, to deploy their existing instruments and subsidies. In addition, this tool will be helpful in assisting the development of operational guidelines for existing funds as well as new instruments.

The finance equation must be addressed comprehensively by assessing all possible tools and instruments collectively. This cannot be solely a financing or policy exercise. A pro-green investment climate of a country inevitably determines the number of green investments that can be pursued in the short-term. Country assessments are necessary to determine this as well as to shape the policy dialogue and actions that can be reasonably taken in order to expand the total portfolio of green projects for the medium and longer term. Given the characteristics of the cash flows and the impediments identified, there is a special need to identify the specific fiscal and policy measures that have the highest financial impacts and to develop new ones such as enhancements and guarantees that reduce discount rates, especially.

Another possible area for further work includes developing a framework for improved collaboration between public and private sectors. This may occur through the development of a practitioners' network that would focus knowledge exchange and build working relationships. As more tradable permit schemes are developed, emerging countries become more interested in setting up a cost efficient monitoring and verification system in order to access the potential financial benefits that these schemes can offer in terms of financial support. For example, the Tokyo Emissions Trading Scheme allows for the issuance of green certificates outside its boundaries and Japanese manufacturers are now seeking opportunities within developing countries to export their technologies at discounts in exchange for verified tradable permits. Such a scheme which would be highly beneficial to both importer and exporters can only be achieved under the auspices of a reliable Monitoring, Reporting and Verification (MRV) system.

While the agenda is formidable, these items are the ones that can be pursued in the next phases of this work.

Notes

[A] Assessment methodologies not only need to consider what makes up the viability gap of many green projects, but also determine the respective roles of the various stakeholders including governments for closing it.

[B] Pigouvian taxes are taxes levied to correct the negative externalities linked to certain market activities.

CHAPTER 1

Introduction

If energy use continues on a "business as usual" path between the present and 2030, global climate change consequences almost certainly will be severe and irreversible. To mitigate these consequences, and stop and potentially reverse the growth of greenhouse gas emissions, investments in climate-friendly technologies must be increased and accelerated. As many of the investments needed are neither commercially viable nor attractive to the private sector, the solution will require public sector interventions through policies, programs, fiscal and economic instruments and regulations to create an environment in which various financing schemes—from all quarters—can succeed. Also, some developing economies (including many East Asia and Pacific countries) will need international support as their public resources are limited.

To address this challenge, the World Bank's East Asia and Pacific (EAP) Region is exploring how to improve the financing for green infrastructure through a combination of public interventions and instruments that can make such investments more attractive and affordable to public sector institutions and less risky to private sponsors and financial markets.

This report reviews a wide array of global efforts in green infrastructure finance, assembling documents and summarizing current initiatives, research, and approaches that it is hoped, can form the basis for future analyses on ways to promote green investments.

Background

Recently, there has been greater attention to climate change and the need to reduce greenhouse gases (GHG), along with cultivating more sustainable business and lifestyles.[27] Many industrialized countries have created stimulus packages to support climate friendly technologies (CFTs)[A] that could reduce GHGs. These have produced some demand-side technologies that reduce or eliminate carbon emissions while lowering operating costs through energy efficiency (EE) and conservation.

The United Nations Environmental Programme (UNEP) launched a Green Economy Initiative (GEI)[28] to help governments shape their policies, investments and spending for clean technologies and industry, renewable energies (RE), transport, waste management, sustainable agriculture and forests, and green buildings. GEI defined a *green economy* as one that improves human well-being and reduces inequalities, environmental risks and ecological scarcities over the long term.[29] The GEI advises countries and regions, conducts research, and encourages partnerships to promote such green-oriented growth (*green growth*).

The Organisation for Economic Cooperation and Development (OECD)[30] describes green growth as the process of "promoting economic growth while reducing emissions,

minimizing waste and the inefficient use of natural resources, and maintaining biodiversity." In EAP, such growth involves mitigation measures to tackle the long-term costs of global warming (in all EAP countries) and the local costs of environmental degradation (mainly in the region's developing countries). Local efforts will be spatial, particularly as they affect settlements in flood plains, and coastal and forested areas.[31]

Recent World Bank (WB)[32] and International Energy Agency (IEA)[33] studies have noted the global consequences of GHG emissions if energy consumption continues on a *business as usual* (BAU) path between now and 2030 in major East Asian developing countries. The studies also found that to reduce the projected environmental impacts and adopt green growth, up to US$80 billion a year will be needed for EE and RE projects, and other clean investments. Moreover, most EAP developing economies (China, Indonesia, Thailand, Vietnam, Philippines and the Pacific island nations) are extremely vulnerable to variations in the water cycle caused by climate change. Since water variability affects food security, human health, and the ecosystem, a few cycles of excess precipitation or drought can negate any gains the countries have made over decades to reduce poverty—very quickly.

Further, the studies estimate that a similar amount will be needed to protect communities and ecosystems against flash floods, rising sea levels, more frequent typhoons and droughts. Clearly, such massive amounts are far greater than the public sector and traditional overseas development assistance can offer. Thus, private-sector loans and equity capital are vital to alter the current path of climate change. Also particular attention needs to be focused on how to expand the flow of public and private finance to the developing world for both mitigation and adaptation.[34]

These studies show that developing countries are required to make the US$200 billion of additional investment, half of the funding is expected to be procured in developing countries but the remaining half will come from industrialized countries.[35] Several developing countries have begun to study and experiment with policy reforms and economic instruments[36] in support of their national mitigation strategies and are preparing to trade forest carbon assets through, for instance, participation in the Forest Carbon Partnership Facility (FCPF[B]).[37]

Benefits of innovation of policy instruments in developing nations were also widely recognized in Cancún, where a new *Partnership for Market Readiness* was launched by the World Bank and by ministers from 15 countries.[38] This initiative should create a platform for sharing experience, fostering new and innovative carbon market instruments, harnessing financial flows, and building market readiness capacity for countries to scale up their climate change mitigation efforts.

To further address this challenge, the World Bank's East Asia and Pacific Region is exploring ways to improve the financing for green infrastructure investments. Among other approaches, it attempts to identify ways to value and monetize the true environmental externalities of current practices and also seeks to improve the financial viability of green projects. This aspect is critical, because while carbon markets and emission trading schemes (ETSs) have helped improve the financial viability of green projects to some extent, many green investments and activities are still summarily rejected as too costly because the full global externalities of GHG emissions are systematically underpriced and/or not factored in. Conversely, if these were monetized at their true economic cost, many green investments would become viable.

Impediments to Accelerating Green Investments

The IEA estimates that to reduce carbon dioxide emissions 50 percent by 2050, investments in the energy sector will total roughly US$46 trillion from 2010–2050,[39] this translates into US$750 billion a year by 2030 and over US$1.6 trillion a year from 2030–2050. Thus, although Bloomberg New Energy Finance (NEF) notes that investment in clean energy soared from US$34 billion in 2004 to approximately US$150 billion in 2007 and 2008—maintaining investor interest even during the global recession[40]—NEF estimates that by 2020, investments will be at least US$150 billion less than the level required to stabilize and reduce carbon dioxide emissions. Other publications arrive at slightly different volumes of investments needed but the conclusions are identical. The current level of investments, and their anticipated growth, will not be sufficient to the meet the challenge of global warming.[41] Thus, investments must be markedly increased. However, the scale of the increase is not likely to be achieved solely by private investors, as numerous barriers make clean energy and technology projects unattractive and non-viable.

Studies by the Brookings Institution,[42] the Green Investment Bank Commission of the UK,[43] United Nations Industrial Development Organization (UNIDO),[44] and others have identified and discussed the numerous barriers to the financing of green investments. For instance, Duncan Ritchie in a follow-up to his UNEP publication, suggests that the green investments are at a disadvantage for the following reasons: (i) transactions tend to be smaller, (ii) development activities tend to be led by non-traditional project developers, (iii) the availability of resources is project-specific, (iv) projects typically rely on regulations and carbon pricing mechanisms, and on new or emerging technologies.[45] In general, the impediments include the following elements.

- **The price of carbon.** As noted earlier, much of the problem stems from the unpredictable, unreliable, and low price of carbon emissions, which was observed to vary in a wide range.[46] A recent report by the United Nations Secretary-General's High-level Advisory Group on Climate Change Financing (AGF) concluded that unless the price of carbon emissions is set at US$25 per tonne, it will be difficult to raise US$100 billion a year for emerging economies to invest in green projects. Indeed, if carbon's true value is not factored into the revenue stream, a significant imbalance persists.

  Many green investments appear more costly and financially less attractive than other investments. Under these circumstances, even cost-effective innovations in CFTs cannot cross the valley of death[C] from the research and development phase to market uptake. Thus, public policies and the mechanisms or agreements for internalizing the price of the externalities are crucial, as they will allow investors to predictably assess the demand and supply-side risks.
- **Fossil fuel subsidies.** Many countries substantially under-price the cost of fossil fuels and traditional technologies, creating another problem. Such practices essentially become subsidies that distort prices and resource allocations, alter the pattern of production and consumption, and make green investments in many economic sectors decidedly unattractive. According to the IEA, approximately US$312 billion was spent globally on fossil fuel subsidies in 2009, while only US$57 billion was allocated to promote RE investments.[47]

Moreover, OECD countries annually transfer at least US$400 billion in subsidies to different economic sectors.

- **High up-front costs[48] and long payback periods.** Although many green investments have been proven technologically sound, they are not yet competitive with higher GHG-emitting systems: a life-cycle cost difference exists, in many cases largely due to higher upfront expenses. Further, many RE and EE projects require higher rates of return because of long payback periods and bear greater uncertainties with respect to revenue streams.
- **Technology risks.** While investments in unproven technologies and processes may present cost and revenue characteristics similar to those of conventional projects, they often involve substantial technology risks (about whether the technology will function as planned) that most lenders are unwilling to assume. Thus, these investments will require different financing approaches for research and development (R&D) to determine if the technology can be commercialized. Also, the risks can be reduced through different processes, such as incubation, demonstration, and other public and corporate R&D investments. While some investors may be willing to assume these types of risks if public support or venture capital funding are available, generally the financial community does not find these projects attractive until the risk-return profiles stabilize to more commonly accepted levels.
- **Revenue risks.** Many investors even find proven technologies unattractive because of the uncertainties related to realizing the full value of estimated revenues. In particular, some energy-efficiency projects cannot measure with the certainty the savings generated by the investment, which translates into higher financing and transaction costs. For example, in the United States, renewable-energy projects tend to have low credit ratings or none at all, and banks demand higher reserve deposits in such cases; in effect increasing the cost of financing. In China, many low-carbon project developers struggle to provide qualified collateral to cover their risk and find financial institutions willing to act as guarantors.

Other impediments cited include:

- **High transaction costs.** These discourage institutional funders from making a large number of small, low-carbon investments;
- **Information, knowledge,[49] and confidence gaps.** Lenders often have limited experience with low-carbon projects, have little awareness of the opportunities, and lack the technical capacity to appraise them. Investors are sensitive to the lack of transparency regarding government policies and tend to overestimate technology risks and levels of capital needed;
- **Insufficient international participation.** Grants and concessional loans through multilateral development banks (MDBs), regional development agencies, and bilateral aid agreements have helped launch many projects. However, the amount of funds provided (compared with what is needed) is still low, which limits their overall effect;
- **Residual value of existing assets that would need to be replaced.** This issue is particularly important with respect to EE projects conducted by either public or private investors. The residual value of the existing assets needs to be deducted

from the achieved savings, which, in turn, reduces the rates-of-return of EE replacement investments;

- **High costs to integrate clean energy sources into the system.** These occur because of the higher upfront transmission costs, slow replacement cycles of existing energy assets, the intermittent nature of RE energy supply, and limited projects with acceptable risk-return profiles;[50]
- **Political and regulatory risks.**[51] Expected rates-of-return of many green investments largely rely on government policies, which frequently change; this creates the perception that projects are risky and cash flows are not clear or stable;[52]
- **Uncertain intellectual property rights (IPR).** Illegal use of technology, such as transfers to third parties without the title holders' permission, negatively affects the trade of technology. Thus, many global companies want the legal environment, especially for protecting intellectual property, to be improved;[53]
- **Inadequate domestic financial instruments.** The limited domestic financing possibilities (particularly long-term products) are a barrier to stimulating investments in CFTs.

Most experts believe that about 85 percent of the capital needed to reduce GHG emissions must come from the private sector,[54] which will require a shift in private sector behavior and in the way public finances need to be deployed. At present, investors think that[55] (i) public funds should be spent when commercial entities are unwilling to invest; (ii) the funds would be best used to make low-carbon technologies commercially viable; and (iii) they should be used strategically at different stages of the technology development and diffusion process in order to leverage and attract private investment. In addition to top-down elements, such as binding national commitments, other mechanisms and initiatives, including information dissemination and public education, are needed to stimulate a more direct, rapid behavioral shift.[56]

Objectives and Scope of the Report

This report attempts to take stock of global efforts in the area of green infrastructure finance. It assembles, documents, and summarizes current initiatives, research and approaches and will serve as a foundation for future analyses on ways to promote green investments.

The paper draws from many reports on an array of topics and views. It begins by presenting the broad, global initiatives that have set the stage for climate change reforms, including the UN Framework Convention on Climate Change (UNFCCC) and subsequent updates such as the Kyoto Protocol, Copenhagen Accord, and Cancún Agreements, as well as other international and initiatives including the framework introduced by the European Union and others (see chapter 2).

The next sections summarize various approaches and interventions that aim to produce a positive environment for green investments and address some of the obstacles. First, they summarize the most important financing programs of bilateral and international donors (see chapter 3). Then, they present examples from the literature on public sector interventions, which include economic and fiscal measures, including development of carbon markets (see chapter 4), along with regulations, monitoring, reporting and verification (MRV) schemes (see chapter 5). Next, private sector financing schemes and instruments are discussed (see chapter 6). This is followed by the description of the

examples of policies and initiatives devised by countries to address the challenges of global warming, including China, Republic of Korea, Japan, Germany, and the United States (see chapter 7).

The report concludes with a set of annexes and a comprehensive reference list. The first annex contains a collection of compilations of public policy instruments and finance mechanisms that can serve to help mobilize private investments in CFTs. The second annex provides abstracts of the literature sources that were researched as a part of the overall exercise. It is hoped that these resources will help government officials and other practitioners involved in exploring viable ways to promote green finance.

Methodology

The research examined publications, project reports, and other data sources on the financing of green infrastructure and measures to influence the investment climate. The reference list includes more than 500 sources.

Given the international spotlight on climate change, the literature grows daily. However, the sources reviewed for this report accurately present the initiatives, policy interventions, financial instruments and other mechanisms designed to reduce the barriers to green investment.

Notes

[A] Technologies that reduce the emissions of the greenhouse gases by reducing the carbon imprint of economic activity. The term is used here interchangeably with low-GHG, clean, low-carbon, low-emission, green, and eco-friendly technologies.

[B] The FCPF assists developing countries to reduce emissions from deforestation and forest degradation and foster conservation, sustainable management of forests, and enhancement of forest carbon stocks.

[C] The "valley of death" term describes the period of time a technology needs to evolve from "appearing promising" to "commercialized." Given twhe challenges of securing funding, acquiring licenses, establishing development and manufacturing partners, as well as myriad other impediments, many technologies never effectively cross "the valley of death" to become mainstream commercialized products.

CHAPTER 2

Global and Regional Initiatives

Over the past two decades, the United Nations (UN) and other multi-lateral organizations have been addressing the issues surrounding climate change. To this end, the UNFCCC—an international environmental treaty produced during the 1992 Earth Summit—laid the groundwork for numerous multi-lateral activities and, later, for the adoption of specific protocols and other agreements including the Kyoto Protocol, Copenhagen Accord, and recent Cancún Agreements.

The Kyoto Protocol, the first of many international agreements on climate change, set binding targets for reducing GHGs. The Copenhagen Accord announced commitment by the developed countries to strengthen their GHG reduction targets and raise US$100 billion a year by 2020 to help developing countries cut their emissions. The Cancún Agreement consolidated the essential elements of the Copenhagen Accord, along with mitigation targets and actions pledged there, into the UNFCCC. At the same time, various other global and regional initiatives targeting the private sector were launched; most seek to meet their goals by emphasizing corporate social responsibility (CSR).

UN Framework Convention on Climate Change (UNFCCC)

The UNFCCC[57] is an international environmental treaty signed by 154 nations at the June 1992 UN Conference on Environment and Development (UNCED) in Rio, informally known as the *Earth Summit.* The objective of the treaty is to stabilize concentrations of six GHG emissions[A] in the atmosphere at a level that would prevent dangerously high temperature increase and damage to the world's ecosystems. Since 1995 the parties of the convention have met annually in conferences of the parties (COPs) to evaluate progress.

The UNFCCC is also the name of the United Nations Secretariat charged with supporting the operation of the Convention. In its work UNFCCC and the COPs rely on information and services provided by the Inter-Governmental Panel on Climate Change (IPCC).[58] The IPCC is the leading international body for the assessment of climate change. It was established by the UNEP and the World Meteorological Organization (WMO) to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts. Every five years, the IPCC publishes comprehensive reviews of the status of climate change and climate-change science, along with special reports and technical papers on request. While the IPCC does not conduct the research, it assesses the most recent scientific, technical and socio-economic information on the subject produced globally.[59]

The UNFCCC sets no mandatory limits on each country's GHG emissions and contains no enforcement mechanisms; thus, it is legally non-binding.[60] However, it provides

for updates (called protocols) that do set mandatory limits: The principal update is the Kyoto Protocol, which has become much better known than the UNFCCC itself.

The Kyoto Protocol

The Kyoto Protocol, adopted in Japan in December 1997, was entered into force in February 2005.[61] The rules for introducing it were adopted at the 7th COP in Marrakesh in 2001, and are called the Marrakesh Accords.[62] Although 193 parties (192 nations and one regional economic organization) ratified it, some uncertainty exists about whether the Protocol delivers the most effective framework for setting and achieving GHG emission targets.

Its key feature sets binding targets for 37 industrialized countries and the European community (Annex I countries[63]) to reduce GHG emissions by an average of five percent (based on 1990 levels) from 2008 to 2012. Because the developed countries are mainly responsible for the current high levels of accumulated GHG concentrations (due to over 150 years of industrial activity), the Protocol assigns them a heavier burden under the principle of "common but differentiated responsibilities."[64]

The Protocol is generally seen as an important first step to reducing GHGs and providing the basis for future international agreements on climate change. Under it, countries must meet their targets primarily through national measures; however, it also offers three mechanisms by which to achieve them. These include:[65]

1. **Emission trading, also known as carbon trading.** An emission trading, as set out in Article 17 of the Kyoto Protocol, allows parties with commitments under the Protocol (Annex B[B] Parties), but whose emissions fall below their accepted targets, to transfer (sell) their excess emission capacity to countries that are over their targets. These targets are expressed as levels of allowed emissions, or assigned amounts, over the 2008–2012 commitment period. The allowed emissions are divided into assigned amount units (AAUs).
   Other units which may be transferred under the emission trading scheme are removal units (RMUs) generated on the basis of LULUCF activities and units generated by a joint implementation project or a clean development mechanism project activity. Transfers and acquisitions of these units are tracked and recorded through the registry systems under the Kyoto Protocol. An international transaction log ensures secure transfer of emission reduction units between countries.
2. **The Clean Development Mechanism (CDM).**[66] The CDM, defined in Article 12 of the Kyoto Protocol, allows a country with an emission-reduction commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reduction (CER) credits, each equivalent to one tonne of CO_2, which can be counted towards meeting Kyoto targets. The projects must qualify through a rigorous and public registration and issuance process. Approval is given by the Designated National Authorities. The CDM is the first global, environmental investment and credit scheme of its kind.
3. **Joint Implementation (JI).**[67] This mechanism, defined in Article 6 of the Kyoto Protocol, allows a country with an emission reduction or limitation commitment under the Kyoto Protocol (Annex B Party) to earn emission reduction units (ERUs) from an emission-reduction or emission removal project in another Annex B

Party, which can be counted towards meeting its Kyoto target. Joint implementation offers Parties a flexible and cost-efficient means of fulfilling a part of their Kyoto commitments, while the host Party benefits from foreign investment and technology transfer.

Copenhagen Accord

In December 2009, the 15th COP in Copenhagen signed a non-binding agreement that listed points for countries to "take note of."[68] Mainly, it stated that "developed countries shall provide adequate, predictable and sustainable financial resources, technology and capacity-building to support the implementation of adaptation action in developing countries" and help them launch mitigation measures.

Also, developed nations agreed to (i) raise US$100 billion a year by 2020 from a wide variety of sources to help developing countries cut carbon emissions; (ii) create a Green Climate Fund (GCF) to support their projects, policies and other activities through programs such as the REDD-plus (Reducing Emissions from Deforestation and Forest Degradation); and (iii) help developing countries build capacity and develop and transfer CFTs. Further, the Accord asked all countries to set targets to reduce their GHG emissions.

Overall, the global community received the Copenhagen conference with mixed reactions, largely because the outcome did not contain binding commitments. Moreover, the emissions targets the countries set do not appear large enough to limit global warming to below two degrees Celsius (the goal set in the agreement).[69] However, the Copenhagen talks were followed by the Cancún Agreements, which created more concrete, binding goals.

Cancún Agreements

The Cancún Agreements were reached at the 16th COP in Cancún, Mexico in December 2010. They imported the key elements of the Copenhagen Accord into the UNFCCC,[70] and presented the details in the Ad Hoc Working Group on Long-Term Cooperative Action (AWG-LCA) report. These included mitigation targets and actions pledged by all major economies under the Copenhagen Accord, and confirmed their intent to mobilize US$30 billion in fast-start financing, as well as US$100 billion annually by 2020. The AWG-LCA also took initial steps to implement certain elements of the Copenhagen Accord such as the new Green Climate Fund for developing countries[71] and a system of "international consultations and analysis" to help verify the countries' actions. Also, the Cancún Agreement sought to finesse the more difficult questions of "if," "when," and "in what form" countries would make binding commitments.

The Cancún Conference effects have not yet been fully evaluated. As of the beginning of 2011, many observers noted that, although it generated positive responses, the question remains whether it is symbolic of the stalemate surrounding international policies to prevent dangerous human interference with the climate.

However, any final evaluation will depend on regional and national perspectives.[72] Many countries believe that the Conference succeeded, particularly given the difficult political environment after the COP 15. At the same time, many others think COP 16 did not represent significant progress in protecting the climate and that its efforts on the most controversial question—obtaining more ambitious emission targets and financial commitments from the developed world—had yet to take shape.

Other Global Initiatives

Various other global initiatives attempt to address the issues of green infrastructure finance and climate change.[73] Many, especially those launched by the UN and the International Organization for Standardization (ISO), stress the role of corporate social responsibility. The following is a representative list of climate-change global standards and agreements arranged in categories proposed by the Korean Capital Market Institute.[74]

Global Standards for Sustainable Management

- **Global Reporting Initiative (GRI).**[75] The GRI is a network-based organization that developed the framework most adopted to report on sustainable activities. It was created in 1997 by the U.S.-based non-profit *Ceres* (formerly the Coalition for Environmentally Responsible Economies) and the Tellus Institute, with support from the UNEP.

  GRI collects material about environmental, social and governance performance and produces some of the most commonly-applied standards for reporting on sustainability in the areas of ecological footprints, environmental social governance (ESG), the triple bottom line (TBL),[C] and CSR.

  As of January 2009, more than 1,500 organizations from 60 countries applied these standards in their reports on sustainability. Current and former institutional supporters include organizations such as the Netherlands Ministry of Foreign Affairs, International Finance Corporation (IFC), Swedish International Development Cooperation Agency (SIDA), European Commission, Ford Foundation, Bill and Melinda Gates Foundation, United States Environment Protection Agency, as well as governmental entities from the UK, Germany, Australia and many others.
- **ISO 26000 (International Organization for Standardization).**[76] The ISO standard, 26000:2010 *Guidance on Social Responsibility,* provides globally-relevant guidance based on consensus among international experts from the main stakeholder groups about best practices in the area of social responsibility. It is intended for public and private sector organizations, developed and developing countries, and economies in transition, helping them operate in a manner that is increasingly demanded. Since ISO 26000 contains voluntary guidance, rather than requirements, it is not a certification standard (such as the ISO 9001:2008 and ISO 14001:2004).

Voluntary Initiatives

A recent OECD publication on voluntary programs for environmental policy describes their merits and shortcomings.[77] Like other voluntary instruments, these programs give firms flexibility in how they reduce pollution. Since they are not held to uniform emission standards and regulations, firms with lower abatement costs are likely to reduce pollution to a greater extent than those where the costs are higher. As such, voluntary programs can be more cost-effective than regulations—assuming companies can meet environmental goals.

However, voluntary initiatives only obtain limited participation.[78] Also, some firms with low abatement costs may still choose to remain outside the scheme despite the cost advantages they might gain. Indeed, companies that pollute only participate if the payoff

is at least as high as it would be if they did not. Thus, since there are no penalties for not participating, polluters often need incentives to participate in voluntary programs. Ultimately, while low participation often leads to small, if any, environmental gains, voluntary programs can still play a part in a country's green growth agenda. Research shows that voluntary programs are trying to induce polluters to pursue three kinds of incentives:[79]

- **Environmental stewardship.** Polluters that directly gain utility from reducing pollution, such as achieving their own social responsibility goals, might be willing to participate in a voluntary program even if there is no direct monetary incentive.
- **Financial incentives.** If a firm has environmentally-conscious customers who prefer "*green*" companies, it may voluntarily reduce pollution to satisfy them. Or, participation may help the firm reduce its costs and thus increase profits. For example, in many energy audit programs, involvement is voluntary, but energy users participate because increased EE reduces energy costs.
- **Government-created incentives.** Firms may participate in voluntary programs when they believe this will reduce the threat of government-imposed mandatory regulations. Similarly, those penalized (by agency regulations) can join voluntary programs to obtain regulatory relief (since participation demonstrates their improved environmental performance). Governments can also provide subsidies, grants and cost-sharing incentives to encourage firms to participate.

Another research in 2009 identified four types of voluntary programs:[80] (i) unilateral actions by industries where only the first two incentives are significant; (ii) private agreements between firms and those affected by pollution where the first incentive is important; (iii) negotiated agreements between the firm(s) and a regulatory agency, where all three incentives are involved; and (iv) public voluntary programs, where the regulatory agency sets terms and conditions for participating and industries then decide whether to join.

Some observers caution that relying excessively on voluntary programs may lead to the incorrect assumption that a great deal is being done to tackle pollution and thus dampen the need for more, potentially ambitious, mandatory policies (such as cap-and-trade). In Australia, for example, the voluntary *Greenhouse Challenge* may have reduced the possibility of creating a more comprehensive national plan for tackling GHG emissions.

The following are some global voluntary initiatives:

- **UNEP Finance Initiative (UNEP FI).**[81] This involves a partnership between UNEP and the financial sector. UNEP and nearly 200 institutions, including banks, insurers and fund managers explore the environmental and social considerations related to financial performance. Through peer-to-peer networks, research and training, UNEP FI identifies and promotes best environmental and sustainability practices at all levels of these institutions' operations.
- **UN Principles for Responsible Investment (PRI).**[82] PRI is an initiative that offers voluntary guidelines for investors wanting to address ESG issues and was created to help investors implement the Principles. It is managed by the PRI Secretariat and supports investors by sharing best practices, promoting collaboration and managing various work streams. As of October 2010, over 800 investment institutions from 45 countries were signatories.

- **UN Global Compact.**[83] With over 8,700 corporate participants and stakeholders from over 130 countries, this is the largest voluntary corporate responsibility initiative. This initiative is for businesses committed to functioning according to 10 universally accepted principles regarding human rights, labor, the environment and corruption. By participating, businesses, as primary drivers of globalization, can help ensure that markets, commerce, technology and finance advance in ways that benefit economies and societies. Among the 10 principles, three are drawn from a Declaration of Principles and an International Action Plan (Agenda 21) that emerged from the 1992 Earth Summit in Rio.
  According to these principles businesses should: (i) support a precautionary approach to environmental challenges; (ii) undertake initiatives to promote greater environmental responsibility; (iii) encourage the development and diffusion of environmentally friendly technologies.[84]
- **The Equator Principles.**[85, 86] The Equator Principles (EPs) are voluntary standards used to identify, assess, and manage social and environmental risks in project financing.[87] Equator Principles Financial Institutions (EPFIs) commit to not approve loans for projects where the borrowers will not or cannot comply with the EP's social and environmental policies and procedures.
  Launched in June 2003, the Principles were developed by private sector banks—led by Citigroup, ABN AMRO, Barclays and WestLB. The banks chose to model the Principles on the World Bank's environmental standards and the IFC's social policies. As of October 2009, 67 financial institutions (FIs) had adopted the Principles, which are now the de facto standards for banks and investors on how to assess environmental risks in major development projects worldwide.
- **Carbon Disclosure Project (CDP).**[88] The CDP is an independent non-governmental organization (NGO) that created the largest database of GHG emissions and climate change strategies of thousands of corporations in the world's major economies. These data are available to a wide audience including institutional investors, corporations, government policymakers and their advisors, public sector organizations, academics and the public. CDP acts on behalf of 534 institutional investors that manage US$64 trillion in assets and about 60 purchasing organizations such as Cadbury, PepsiCo and Walmart.
- **Institutional Investors' Group on Climate Change (IIGCC).**[89] The IIGCC is a European forum for leading asset owners and managers to assess and oversee the investment risks and opportunities associated with climate change. The IIGCC brings investors together to use their significant collective influence to engage in dialogue with policymakers and companies in order to accelerate the shift to low-carbon emissions.
- **Green Economy Initiative (GEI).**[90] The GEI helps governments focus their policies, investments and spending toward a range of green sectors—such as clean technologies, industries, renewable energies, water services, transport, waste management, sustainable agriculture and forests, and green buildings.[91] It is one of the nine UN-wide *Joint Crisis Initiatives* (JCI) and it aims to provide convincing macro-economic evidence for significantly increasing environmental investments as a way to promote sustainable economic growth and job creation, and reduce poverty, while limiting GHGs, extracting fewer natural resources, and creating less waste.[92] The GEI advises countries and regions, conducts

research, and produces documents—such as *The Green Economy Report, the Economics of Ecosystems and Biodiversity Report,* and *the Green Jobs Report.* It also participates in partnerships to promote green economy strategies.

- **Global Green Growth Institute (GGGI).**[93] Founded in June 2010, the GGGI is a global non-profit institute that promotes economic growth and sustainable development while reducing carbon emissions, and strengthening green growth. It was founded on the belief that economic growth and environmental sustainability are not only compatible but vital for the future of humankind.
  GGGI supports several projects in partner countries by developing and introducing programs, building capacity, sharing best practices and providing grants to local institutions. Through its work, GGGI, which is based in Seoul, seeks to make the green growth model both practical and effective.
- **UN Secretary-General's High-Level Advisory Group on Climate Change Financing (AGF).**[94] The Secretary-General established this group in February 2010 with a mandate to operate for 10 months. The group studied potential sources of revenue that could increase the level of financing promised during the 2009 UN Climate Change Conference in Copenhagen. The AGF also developed proposals to significantly scale up long-term financing for mitigation and adaptation strategies in developing countries from various public and private sources.

Examples of organizations participating in some of these initiatives are described in Table 1.

Table 1: Participation of organizations in global initiatives

Initiative	Number of signatories	Major signatories
Global Reporting Initiative	Over 960 organizations	ABN AMRO, HSBC, Citigroup, Barclays
UNEP Finance Initiative	176 institutions	Bank of America, Credit Suisse Group, JPMorgan Chase and Co.
UN Principles for Responsible Investment	Over 850 organizations	CalPERS, ABP, Swiss Re, etc.
UN Global Compact	8,700 organizations (6,500 organizations and business associations and 2,200 non-profits)	Deutsche Bank, ING Group, Mitsubishi, UFJ
The Equator Principles	67	Citigroup, ABN AMRO, Barclays, WestLB
Carbon Disclosure Project	534 FIs holding US$64 trillion in assets, 60 purchasing organizations 3,000 organizations in about 60 countries	Goldman Sachs, Morgan Stanley, CalPERS Cadbury, PepsiCo, WalMart
Institutional Investors' Group on Climate Change	Over 65 organizations that collectively represent around €6 trillion[96]	Hermes, BBC Pension Trust, BNP Paribas Investment Partners, BlackRock, Good Energies
Green Economy Initiative	Over 20 UN agencies	The Bretton Woods Institutions, an Issue Management Group (IMG) on Green Economy
UN Secretary-General's High-Level Advisory Group on Climate Change Financing	Three heads of state and 16 high office holders and public and private sector leaders	N/A

Source: Authors Compilation based on Noh, H.J., 2009.[74]

Technology-Oriented Agreements

Recently, much discussion has surrounded possible alternatives for international agreements on climate change, particularly post-2012. Some experts indicated that technology-oriented agreements (TOAs) may begin gaining greater importance and their contribution to climate change may gradually increase. In addition, TOAs can enhance international cooperation on climate-related issues.[95]

TOAs are the international agreements that are aimed at advancing research, development, demonstration, and/or deployment of technologies. With respect to addressing global climate change, these technologies would be aimed specifically at reducing GHG emissions. TOAs are similar to the agreement framed in terms of emission reduction targets, such as the Kyoto Protocol, in that they all have GHG reduction as their ultimate aim. However, in contrast with emission reduction agreements, commitments to actions under TOAs are framed in terms of technological development activities or technology-specific mandates and incentives.

The success of specific TOAs will depend on their design, implementation, and the role they are expected to play relative to other policies. Table 2 lists examples of current and proposed agreements.

Table 2: Examples of technology-oriented agreements

Type of TOAs	Example of agreements
Knowledge sharing and coordination	• Carbon Sequestration Leadership Forum (CSLF) and the International Partnership for the Hydrogen Economy (IPHE) • Methane to Markets Partnership • Task-Sharing in the International Energy Agency Implementing Agreements (IEA-IA) • Asia Pacific Partnership on Clean Development and Climate (APP) • Energy Star bilateral agreements
Research, Development and Demonstration (RD&D)	• European Organization for Nuclear Research (CERN) • International Thermonuclear Experimental Reactor (ITER) • Cost Sharing in International Energy Agency Implementing Agreements (IEA-IA) • The Solvent Refined Coal II Demonstration Project (SRC-II)
Technology transfer	• Multilateral Fund under the Montreal Protocol • Global Environment Facility (GEF)
Technology mandates and incentives	• International Convention for the Prevention of Pollution from Ships (MARPOL) • European Union Renewables Directive
Prospective TOAs	• Carbon Capture and Storage Technology Mandate • Zero-Emission Technology Treaty (ZETT) proposal • Proposals for combined technology R&D and standards

Source: International technology oriented to address climate change, H. de Coninck et al., 2007.[95]

Regional and Country Initiatives

European Union (EU) Initiatives

To date, the EU efforts are perhaps the most advanced, as member countries are seeing the potential benefits from greater cooperation.[97] The EU has long been committed to tackling climate change through various policies. In 1991, the European Commission (EC) issued the first EU strategy to limit CO_2 emissions and improve EE[98] which included a directive

to produce electricity from renewable energy and obtain voluntary commitments from car manufacturers to reduce CO_2 emissions by 25 percent. It also introduced proposals on appropriate taxation of fossil fuels by-products.

In 2000, the EC introduced a package of policies to reduce GHGs through its European Climate Change Programme (ECCP)[99] whose goal was to identify, develop and apply a strategy to execute the Kyoto Protocol. The first ECCP (2000–2004) brought all the stakeholders together, including representatives from the Commission's various departments, member nations, and industrial and environmental groups.

The second European Climate Change Programme (ECCP II), launched in 2005 at a major stakeholder conference in Brussels, aimed to explore cost-effective options to reduce GHGs together with the EU's Lisbon strategy for economic growth and job creation. New working groups were established that focused on carbon capture and geological storage, CO_2 emissions from light-duty vehicles and airplanes, and adaptation to the effects of climate change. The first task was to support the actual implementation of the priorities identified in the first phase. The steering committee has followed the progress made through the first ECCP.

The EU Emissions Trading Scheme (EU-ETS) is perhaps the EU's most significant effort (through the ECCP) to combat climate change by reducing industrial GHG emissions cost-effectively. As the first and largest international scheme for trading GHG emission allowances,[D] the EU-ETS involves about 11,000 power stations and industrial plants in 30 countries. However, investors state that the scheme has not yet provided them with the strong price signals they need if they are to commit to long-term, low-carbon investments on a much larger scale.[100] They note they need clarity on the EU-ETS until 2030, along with ambitious caps to create sufficient scarcity and a robust price signal in line with the longer life-span of their assets.

In January 2008, the EC proposed binding legislation designed to reduce EU GHG emissions by 2020 to at least 20 percent below 1990 levels with 20 percent of energy consumption to come from renewable resources. This legislation is also known as the *20-20-20 targets.* The European Parliament and Council agreed to this climate and energy package in December 2008, which became law in June 2009. It includes four complementary laws that pertain to:

1. **A revised, strengthened EU-ETS.** A single EU-wide cap on allowable emissions will apply from 2013 and be reduced each year—with businesses required by 2020 to meet targets that are 21 percent below 2005 levels. The allocation of allowances will be progressively replaced by auctioning of certificates. The sectors and gases covered will eventually expand.
2. **An effort-sharing decision.** This will govern emissions from sectors not covered by the EU-ETS, such as transport, housing, agriculture and waste. Under the decision, each EU member agreed to a binding national emissions target for 2020, which is based on its relative wealth. By 2020, the targets are expected to cut the EU's overall emissions from non-ETS sectors by 10 percent, when compared to 2005 levels.
3. **Binding national targets for renewable energy.** These will increase the average renewable share across the EU to 20 percent by 2020. National targets range from 10 percent in Malta to 49 percent in Sweden.
4. **Promoting carbon capture and storage (CCS).** The EU plans to create a network of CCS demonstration plants by 2015 to test their viability and ultimately

commercialize the technology by 2020. Revised EU environmental protection guidelines for state aid, issued along with the legislative package, were proposed to help governments financially support CCS pilot plants.

The climate and energy package promotes energy efficiency, but does not address it directly—this is done through a separate EU action plan.

Asia-Pacific Economic Cooperation (APEC) Regional Initiatives

The APEC region is one of the world's most important regional organizations. It consists of 21 member economies that are home to more than 2.7 billion people and represents approximately 54 percent of the world's real Gross Domestic Product (GDP), 44 percent of world trade, as well as 62 percent of global CO_2 emissions.[101] The sheer size of the group of APEC economies provides them with significant opportunities for collaboration and puts them into a position to be able to affect the pace and direction of global economic growth and potentially accelerate the shift toward green growth.[102] While regional cooperation between APEC countries is built around the goals to achieve free and open trade in the region,[103] also known as the *Bogor Goals,*[E] the objectives of the regional activities exceed simply promoting trade activities and include promoting sustainable economic growth agenda.

Although the collective regional efforts of the APEC economies so far have been relatively modest compared to those of EU members, the APEC initiative has created a structure that allows key policy initiatives to reach top leaders and ministries, and generate practical results.[104] As such, the Energy Working Group (EWG) that was established in 1990 seeks to maximize the energy sector's contribution to the region's economic and social wellbeing, while mitigating the environmental effects of energy supply and use. The EWG is assisted by four Expert Groups,[F] two Task Forces,[G] and Asia Pacific Energy Research Centre (APERC).[105, 106] Recognizing that business can make an important contribution to the development and implementation of its work program, the EWG established its own public-private sector dialogue mechanism—the EWG Business Network (EBN). Many different initiatives have been suggested by the EWG and then established at one of the regular APEC Energy Ministers Meetings (EMM) held since 1996. These include:

- **Energy Security Initiative (ESI).** Endorsed by the APEC leaders in 2001, ESI consists of a series of short-term measures to respond to temporary energy supply disruptions, and longer-term measures to address the broader energy challenges facing the APEC region.[107]
- **Peer Review on Energy Efficiency (PREE) Initiative.** PREE was endorsed in 2008 and tasked with disseminating best practices and technologies for improving energy efficiency.[108] PREE has prepared a Compendium of Energy Efficiency Policies of APEC Economies[109] and published extensive studies on energy efficiency policies of five individual APEC economies.[110]
- **Task Force on Renewable Energy & Energy Efficiency Financing.** This was established with the objective to work with the private sector and financial institutions to facilitate greater investments in clean and more efficient energy infrastructure and technologies. In 2008, on completion of its work program, EWG members decided to terminate this Task Force.[111]
- **Energy Standard Information System (ESIS).** ESIS was initiated with the objectives to provide up-to-date information about appliance and equipment energy

> standards and regulations, facilitate access to experts and Communities of Practice to harmonize and rationalize the testing, labeling, and minimum energy standards for specific appliances and equipment, and assist in dissemination of information across the region.[112]

At the recent Ninth Meeting of the APEC Energy Ministers, the parties signed the Fukui Declaration on Low Carbon Paths to Energy Security: Cooperative Energy Solutions for a Sustainable APEC.[113] This Declaration proposed even more ambitious GHG emission reduction targets, launched a Collaborative Assessment of Standards and Testing (CAST) that would serve to deepen the work on energy efficiency, and announced the first-ever joint meeting of energy and transport high level officials in the United States in 2011.

The collaboration between APEC economies is likely to become broader on all fronts, especially if developed and developing countries agree to a *division of labor* in order to create a conducive environment for green growth. An optimal flow of green finance can take place when middle- and high-income APEC countries assume the technology risks and invest in cutting edge technology and low-income countries invest in reducing their future vulnerability by adopting proven technologies. Both groups of APEC countries may establish a culture of learning and information sharing, so that a green growth path is achieved through partnership with each other. To help this culture develop and to facilitate the establishment of the platform for knowledge co-creation, learning, and dialogue among APEC member economies, the 17th Finance Ministers' Meeting (Japan, November 2010) suggested considering a creation of a Virtual Green Finance Institute.[114]

Notes

[A] UNFCCC GHG inventories include six direct GHGs (carbon dioxide, methane, nitrous oxide, sulfur hexafluoride, HFCs, and PFCs) from six sectors (Energy, Industrial processes, Solvents, Agriculture, Land Use, Land-Use Change and Forestry (LULUCF), and Waste).

[B] Annex B countries are defined in Annex B of the Kyoto Protocol. These are industrialized countries as well as countries that are currently making a transition to a market economy and have assumed GHG emissions limitations or reduction commitments. The only difference between the Annex I and Annex B countries is that Turkey and Belarus are not Annex B countries.

[C] Triple bottom line, also known as "*people, planet, profit*" or "*the three pillars,*" captures an expanded spectrum of values and criteria for measuring organizational (and societal) success: economic, ecological and social. With the ratification of the UN TBL standard for urban and community accounting in early 2007, this became the dominant approach to public sector full cost accounting.

[D] Allowances are the level of pollution that companies are "allowed" to emit. Companies are required to surrender a quantity of allowances commensurate with their total emissions. Unused allowances can be then sold privately or in the market at the prevailing market price. Those companies that fail to operate within their emission limits are required to purchase emission allowances to cover any excess emissions. For trading purposes, one allowance is considered equivalent to one metric tonne of CO_2 emissions.

[E] The *Bogor Goals* refer to the ambitious but hard-to-reach commitment made by leaders of APEC economies in 1994 to achieve free and open trade and investment in the region. At the APEC summit held in Bogor, Indonesia in 1994, the Bogor Declaration was announced, with the industrialized economies committed to achieving free and open trade and investment by 2010 and developing economies by 2020.

[F] Clean Fossil Energy (EGCFE), Energy Efficiency & Conservation (EGEEC), Energy Data & Analysis (EGEDA), as well as New & Renewable Energy Technologies (EGNRET).

[G] Biofuels Task Force (BTF) as well as Energy Trade and Investment Task Force.

CHAPTER 3

Established and Proposed International Funding Programs

Most experts, including the UN High-Level Advisory Group on Climate Change Financing (AGF), recognize that private investment flows are vital for the transition to a low-carbon future; however these flows may not materialize without public sector support. The AGF also noted that US$100 billion should and could be mobilized annually for climate actions in developing countries by 2020. This funding will come from a wide variety of sources, public and private, bilateral and multilateral, including alternative sources of finance. The sources of funding may include the auctioning of emission certificates, international transportation taxes, as well as increased amounts from private international sources.

On a project level, two types of funding are (or may become) the most reliable sources for financing Climate Friendly Technologies (CFT) investments: GHG trading (through monetizing the value of abated GHG emissions), or concessional financing. In GHG trading, the Clean Development Mechanism (CDM) has become a critical first step that established a foundation for and an example of carbon markets and demonstrated the significance of carbon finance. However, while CDM still holds promise as an incremental financing source, its approach, procedures and analytical framework need further review.

Climate Investment Funds—most notably the Clean Technology Fund—have provided significant financial support in the form of concessional loans for clean projects. The main constraint of these funds, however, is that they do not offer outright grants or subsidies in order to reduce the additional upfront financing requirements associated with many clean technologies. An exception is the Global Environment Facility (GEF), which does offer upfront funding, but usually for technical assistance, rather than direct project financing.

Generally, these funds can be blended with other IBRD financing. However, as the recent report "Beyond the Sum of Its Parts: Combining Financial Instruments for Impact and Efficiency" illustrated, combined financing can not only exploit the synergies among different financial instruments—with each addressing a slightly different set of needs, risks, or barriers—it can also reduce transaction costs.

Funding Needs and Funding Sources

The AGF reviewed potential sources of CFT investments in 2010. It stressed that private investment flows are vital for the transition to a low-carbon future. However, they may only begin if supported by public funding and improved regulations and policies.[115]

The AGF noted that while the goal is challenging, US$100 billion could be mobilized annually for climate actions in developing countries by 2020 but will require a

mix of sources.[116] About US$30 billion could be raised annually through auctions of emission certificates and domestic carbon taxes in developed countries, with up to 10 percent of these revenues allocated for international climate actions. Further, about US$10 billion could be mobilized annually from taxing international transportation such as the airline industry to offset their carbon emissions, and another US$10 billion from other instruments, such as the reallocation of fossil fuel subsidies in developed countries.[117] However, reallocating subsidies is a contentious issue, which makes it difficult to implement.

According to the AGF report, "a carbon price of US$20-US$25 could generate around US$100 billion-US$200 billion of gross private capital flows." Based on methodologies suggested by some members and explained in the report, "such gross flows could lead to private net flows in the range of US$10 billion-US$20 billion. Moreover, US$30 billion-US$50 billion could be generated annually in increased carbon market flows", which the authors of the report expected to lead "to around US$10 billion of net transfers." The need for much greater movement on carbon markets was stressed in Cancún, at the UN Climate Change Conference[A] at the end of 2010.[118]

The 2010 World Bank report, *Beyond the Sum of Its Parts: Combining Financial Instruments for Impact and Efficiency*[119] noted that MDBs offer different types of financial instruments for CFTs, which are designed to move the market towards low-carbon development. As the report highlighted, at present, there are three primary dedicated sources of financing for low-carbon development: (i) the CDM and the carbon market that catalyze low-carbon investment through revenue enhancement; (ii) the Clean Technology Fund (CTF) that provides highly concessional investment capital; and (iii) the Global Environment Facility (GEF) that has been the largest provider of grants to address climate change for the past 20 years (see Table 3 for details on GEF and CTF).

Many MDBs have established their own carbon facilities to help facilitate CDM/Joint Implementation (JI) transactions through providing technical assistance, stimulating capacity building, or acting on behalf of entities willing to purchase emission reductions.[120, 121] Thus, the World Bank's Carbon Finance Unit (CFU),[122] on behalf of the contributors—governments and companies in OECD countries—carries out purchasing of project-based GHG emission reductions in developing countries and countries with economies in transition (generated within the CDM or JI frameworks). Unlike other World Bank products, the CFU's activities are not related to lending or granting resources to projects, but rather are focused solely on purchasing emission reductions (similar to commercial transactions), paying for them annually or periodically once they have been verified by a third party auditor.

The CFU conducts the transactions through a variety of its carbon funds and facilities. By the beginning of 2011, there were 14 carbon funds and facilities under the management of the World Bank's CFU and the combined size of the funds and facilities reached US$2.3 billion.[123] Among these carbon funds, 12 were engaged in purchasing CERs from projects that would generate sizeable CERs before the end of 2012. Of the remaining two, one, the BioCarbon Fund,[B] purchased emission reductions from projects which reduce deforestation in developing countries (REDD-plus)[124] while the other, the Carbon Partnership Facility (CPF),[125] was looking to support large programs (Program of Activities) which will generate emission reductions after 2012 (see Table 3). Specifically, the CPF was engaged in purchasing emission reductions for at least eight

Table 3: Three international funding sources supporting low-carbon growth

Attribute	GEF	CTF	CPF
Objective	To transform the market development paths of eligible countries into trajectories with lower greenhouse gas (GHG) emissions in the energy, industry, transport, and land-use sectors	To provide scaled-up financing to contribute to demonstration, deployment, and transfer of low-carbon technologies with a significant potential for long-term GHG emission savings	To target long-term emission reductions; scale up low-carbon interventions; and support strategic, transformational interventions in key sectors
Overall approach	Removing barriers for sustainable market development and growth through pilots and demonstration; includes reduction of risks and support to innovation	Scaling up low-carbon development through support to investments in 17 countries on a pilot basis	Increasing the scope and scale of verifiable GHG offsets and generation of carbon revenues by reducing GHG emissions through output-based approach
Determination of funding requirements	Initial resource allocation through resource allocation framework; incremental costs of each project, including costs of barrier removal	Financing gap necessary to make project viable	Payment made upon certification of emission reductions at pre-negotiated or prevailing market rates
Financial tools	Grants and limited non-grant instruments	Loans and risk mitigation instruments at concessional (IDA) rates; limited grants available	Emission reduction purchase agreements, typically with payment on delivery; pricing based on market prices for emission reductions
Scale of financing	$350 million per year over four years of GEF 5 (2010–14); cumulatively, $2.7 billion since inception	$4.4 billion over 4 years (2009–12), or $1.1 billion per year	CDM primary transactions in 2009 totaled $2.7 billion; cumulatively, $26 billion since 2002
Typical project size	From $5 million to $50 million GEF grant allocation per project, linked to larger Bank project (average size = $8 million)	Between $50–200 million concessional loan, linked to larger client project utilizing Bank loan resources	CPF aims to scale up the size of the transactions significantly, typically at least 1 million emission reductions
Leverage on underlying finance	1:6.3	1:8.3	Up to 1:9, depending on sector

Source: Adapted from Beyond the Sum of Its Parts: Combining Financial Instruments for Impact and Efficiency, Environment Department, the World Bank, 2010.[119]

years after 2012, and potentially much longer, focusing on activities that could be scaled up.[126]

As discussed, a significant number of various carbon finance instruments (see *carbon finance* definition) have been established and made available. Further, the report *Beyond the Sum of Its Parts* demonstrates that "the GEF, the CTF, and carbon finance naturally complement one another. If carefully crafted, projects that combine these sources can create synergies, increasing their impact beyond what might be expected simply on the basis of adding together the resources being used." However, effective blending of these loans with financing from other sources will require sophisticated institutional and technical capacity, i.e. familiarity with how the various instruments function. The requirements for building institutional capacity are only expected to increase as the number of available instruments continues to grow. Besides the CDM/JI, CIF, and GEF instruments, financing through other programs that are in operation or at the concept stage is becom-

ing available. These programs include green bonds, *Green Climate Fund*, the proposed Low-Carbon Development Facility (LCDF), and others.

Kyoto Protocol's CDM/JI[C]

The CDM is an innovative financing technique created by the Kyoto Protocol to help firms finance green projects in developing countries. The CDM provides supplemental cash during operational years and improves the returns of projects that qualify on the basis of expected CO_2 reduction. Such projects can earn saleable certified emission reduction (CER) credits, each equal to one metric tonne of CO_2.[127] These CERs can be then monetized through trading in the carbon market, thereby providing the project with an additional cash flow (carbon finance) to improve financial viability of the project.

The term *carbon market* is somewhat ambiguous. While the Kyoto Protocol defines it narrowly as the process of trading CERs (referring to the market nature of this exchange process), others prefer a broader definition that also includes the mechanisms for generating carbon credits.[128] The term *carbon finance* has not yet reached a commonly accepted definition either. The World Bank Carbon Finance Unit defines this type of finance as "the revenue streams generated by trading carbon permits that were originated either through trade itself or were issued against verifiable and certifiable GHG emission reductions."[129]

As noted in the World Bank 2009 report, *State and Trends of the Carbon Market*, the CDM demonstrated the significance of carbon markets.[130] At the international level, carbon markets, in particular the JI and the CDM, have become an important new source of financing for mitigation projects and programs. Thus, the revenues delivered by the CDM mechanism between 2001 (the first year CDM projects could be registered) and 2012 are estimated to be US$18 billion with some 1.5 billion tonnes of carbon dioxide equivalent (CO_2e) in emission reductions. In addition, each dollar of carbon revenue leverages on average US$4.60 in investment, bringing the total CFT investments facilitated by the CDM activities to over US$80 billion.[131]

It was noted, however, that certain types of projects have so far been under-represented on the global carbon market, even though they may play an important role in climate policy. For instance, the participation of urban authorities and of urban mitigation projects in the global carbon market remains extremely limited, which can be linked both to the difficulties to implement urban mitigation projects and to the difficulties for cities to access the carbon market.[132]

However, as the result of uncertainty in the continuation of the Kyoto targets post 2012 and high carbon price volatility, the CDM mechanism is not viewed by the investors as a sufficiently reliable source of additional cash flow. Moreover, with the current level of carbon prices, the CDM alone can only provide an incremental financial support to the projects[133] and is not sufficient to overcome the constraints to low-carbon growth in developing countries. The mechanism has also been criticized by both environmental groups and investors, and other practitioners, highlighting a number of weaknesses.[134] The Dag Hammarskjöld Foundation well summarized these weaknesses as follows:[135]

- **The project certification process** is long and bureaucratic;
- **Monitoring and verification** audits under the program are very costly as they use international experts who require travel expenses and are paid high fees;

- **CDM revenues** are based on the outputs and generated at later stages, once the projects are operating. The problem for most green investments, however, is obtaining upfront financing;
- **The 'additionality'**[D, 136] criterion that determines if projects will get CDM support[137] is subjective and may not address the real needs (for financial support);
- **CDM has demonstrated it can create perverse incentives.** In well-documented cases firms ventured to increase the production of certain industrial gases, such as potent greenhouse gas HFC-23 in order to qualify for CDM program. Once qualified they returned to normal emission levels, showing the 'decrease' and maximizing funding from the mechanism;
- **Concerns about the Kyoto Protocol continuing after 2012** may cause projects that are delayed not to receive benefits;
- **CDM's slow and bureaucratic process** may divert funding from other viable projects, lowering its impact on reducing GHG emissions.

As indicated the main concern with the Kyoto Protocol relates to its post-2012 status. To end the uncertainty, there must be political will and consensus to set long-term emission reduction targets, particularly for the critical period from 2013–2030.[138] At the Cancún conference the parties agreed to continue negotiations with the aim of avoiding a continuation gap between the first and second commitment periods of the treaty. However, the parties highlighted that the CDM mechanism needed to be reformed.[139] This will mean building upon the successes of the current CDM and JI regulatory frameworks, addressing weaknesses, and abandoning what is not working. The 2010 World Bank publication, *10 Years of Experience in Carbon Finance,*[140] presented an in-depth analysis of carbon markets strengths and weaknesses and provided insights and recommendations from a practitioner's experience and perspective, indicating possible directions of evolvement of the global carbon trading mechanisms.

In developing countries, discussions about carbon markets have recently shifted beyond the *regular* CDM activities to include concepts such as the Programme of Activities (PoA), sectoral trading, cap and trade within metropolitan jurisdictions (see Tokyo ETS, page 103), and payments for nationally appropriate mitigation actions (NAMAs).[E] The UNEP Risoe Centre[F] describes a PoA, also known as Programmatic CDM, as a "voluntary coordinated action by a private or public entity which coordinates and implements any policy, measure or stated goal, which leads to anthropogenic GHG emission reductions or net anthropogenic greenhouse gas removals that are additional to any that would occur in the absence of the PoA."[141] At the end of 2010, 71 PoA projects were submitted, of which five projects were registered, with the remaining 66 in the approval process.

Under the regular CDM mechanism, only individual projects can be accredited. With the PoAs, new CDM modality, multiple projects that are eligible to join a registered programme can be added to the programme over a long period of time. The key features of the PoAs are: (i) activities rather than individual projects can be registered; (ii) activities may consist of numerous similar projects brought into a coordinated activity by either private or public entities, (iii) the schedules of the activities are flexible and related activities can occur in many different locations (various countries) for up to 28 years. This approach allows PoAs to reduce the high transaction costs and other barriers normally associated with regular CDM projects.

Climate Investment Funds (CIF)

The CIF are a pair of funds to help developing countries pilot low-emissions and climate-resilient development.[142] With CIF support, 45 developing countries are piloting transformations in clean technology, sustainable management of forests, increased energy access through renewable energy, and climate-resilient development. CIF are two distinct funds: the Clean Technology Fund (CTF) and the Strategic Climate Fund (SCF). The CIF are additional to existing Official Development Assistance (ODA) and aim to enable countries to continue on their development path and achieve the Millennium Development Goals.

The CIF funds are disbursed through Multilateral Development Banks (MDBs) to support effective and flexible implementation of country-led programs and investments. The instruments are often combined with other bilateral or multilateral loans, and technical assistance as well as other concessional financing, in particular pro-green financing such as the GEF and carbon finance, to reduce the overall cost of borrowing.

The Clean Technology Fund (CTF) helps scale up financing for demonstration, deployment and transfer of low-carbon technologies that possess significant potential for long-term GHG reductions. The Fund provides support through its country- and region-level programs and is expected to finance from 15 to 20 programs. When a country expresses interest, the World Bank and other MDBs conduct a joint mission aimed to prepare an investment plan, meeting with government officials, private industry and other stakeholders to determine how the CTF could help scale up low-carbon activities. Based on the discussions, an investment plan is then reviewed and approved by the CTF Trust Fund Committee.

The Strategic Climate Fund (SCF) serves as an umbrella framework to support three programs to pilot new approaches that could scale up and transform activities related to specific climate change problems or enhance sectoral responses. The SCF includes the Forest Investment Program (FIP), the Pilot Program for Climate Resilience (PPCR), and the Program for Scaling-Up Renewable Energy in Low Income Countries (SREP).

By October 2010, CIF donors financed about US$6.3 billion in activities covering 13 countries with US$4.4 billion funded through the CTF and US$1.9 billion through the SCF. Of the SCF financing, US$1 billion was allocated to PPCR, US$587 million to FIP, and US$318 million to SREP programs.[143] To date, CIF funding has been able to leverage an average of other MDBs or private financing at a ratio of US$1 to US$8.4.[144]

Global Environment Facility (GEF)

The GEF unites 182 governments in partnership with international institutions, NGOs, and the private sector to address global environmental issues.[145] As an independent financial organization (as GEF identifies itself), the GEF provides grants to developing countries and those with economies in transition for projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and organic pollutants. These projects benefit the environment, linking local, national, and global challenges to promote sustainable livelihoods. GEF generally provides upfront funding for technical assistance (and for project financing to a lesser extent) in a co-financing arrangement with other programs by MDBs or other organizations.

GEF was established in 1991 and today is the largest source of financing for activities aimed at improving the global environment. It has allocated a total of US$9.2 billion,

supplemented by more than US$40 billion in co-financing over 2,700 projects in more than 165 countries. Through its Small Grants Programme (SGP), it has also made over 12,000 small grants to NGOs and community organizations, totaling US$495 million.

The GEF partnership includes 10 agencies: the UN Development Programme, UN Environment Programme, UN Food and Agriculture Organization, UN Industrial Development Organization, World Bank, African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter-American Development Bank and International Fund for Agricultural Development. The Scientific and Technical Advisory Panel provides technical and scientific advice on GEF policies and projects.

Examples of the World Bank Funding Programs

Energy Sector Management Assistance Program (ESMAP)

ESMAP assists low and middle-income countries to increase knowledge and institutional capacity in order to achieve environmentally sustainable energy solutions for poverty reduction and economic growth.[146] Established in 1983, ESMAP is a global, multidonor technical assistance trust fund administered by the World Bank and co-sponsored by 13 official bilateral donors. ESMAP's mission is driven by a Results Framework endorsed by its governing Consultative Group (CG) for the Energy Trust Funded Programs (ETFPs).

Asia Sustainable and Alternative Energy Program (ASTAE)

ASTAE grew out of the Financing Energy Services for Small-Scale Energy Users (FINESSE) project initiated by ESMAP and bilateral donors in 1989.[147] Following a joint request from East Asian and Pacific Island borrowers and donor partners, the World Bank acted to implement the FINESSE recommendations by creating ASTAE in January 1992.

Since then ASTAE has played a key role in supporting sustainable energy use in Asian and Pacific Island developing countries by increasing World Bank lending for energy efficiency, renewable energy and access projects. In its latest business plan period (2007–2009) ASTAE funded 42 activities totaling US$2 billion. The work was categorized into three areas: renewable energy, energy efficiency, and access.

Clean Energy Investment Frameworks

The *Clean Energy for Development Investment Framework* is an initiative that was designed to help developing countries reduce carbon emissions while increasing their ability to generate electricity. The goal is to help the private and public sectors increase their investments in cleaner energy production, RE and EE, and to promote access to clean energy. It was launched in 2005 following up on the recommendations of the G-8 Summit at Gleneagles.[148]

The initiative was intended to broaden energy sector policy reforms in order to attract private sector investments and more public sector funds. In 2007, an initiative progress report stressed that "international financial institutions, along with public and private resources alone cannot create a meaningful transition to low carbon economies. Rather, a long-term stable global regulatory framework, with differentiated responsibilities, is needed to stimulate private investments and provide predictability."[149]

Also, a 2007 World Bank report[150] noted that it would continue to promote clean energy investments through cooperation with governments, other international financial institutions, and regional development banks. Further, it would work with the IEA to produce EE indicators that will complement efforts of the G8+5 and middle-income countries.

In 2008, the World Bank launched its *Strategic Framework for Development and Climate Change* to help further stimulate and coordinate public and private sector activity towards environmentally sustainable growth. The framework included an instrument known as the *green bond*.[151]

The World Bank Green Bonds

The green bond is an instrument aimed at raising funds from investors for low-carbon development projects. Since 2008, the World Bank has issued over US$1.5 billion in such bonds, which have varying coupon rates (from under one percent to as high as 10 percent), maturities from three to ten years, are traded in multiple currencies and are AAA-rated.[152]

The borrowing terms are similar to those of other World Bank instruments: e.g. repayment is not linked to the projects' credit or performance, which significantly reduces the risk assumed by the bondholders. However, the eligibility criteria are unique as they are designed to guarantee that the projects selected will have a positive climate impact. To ensure that the chosen criteria, in fact, facilitate the selection of the climate friendly projects, the Center for International Climate and Environmental Research at the University of Oslo (CICERO) was retained to conduct an independent review of the criteria. After careful examination of the selection process and the criteria CICERO agreed that, given the Bank's governance structure and safeguards for its projects, the criteria would provide a sound basis for selecting climate-friendly projects.[153]

Low-Carbon Development Facility Proposed by the World Bank

In 2010 the World Bank proposed an innovative financing mechanism, the Low Carbon Development Facility (LCDF), which could be capitalized by US$68 billion from Annex I countries[154] and would lend to non-Annex I[155] countries to expand their low-carbon development projects. Proposed financing terms would be set at just 10 basis points above LIBOR but could be increased if project sponsors fail to comply with requirements. Although the LCDF was envisioned as an alternative to the CDM, the projects were still intended to be registered under the CDM process and would have to comply with its monitoring requirements and verification process. The LCDF would offer an advantage over the CDM in that it provides much-needed up-front financing for the projects. However, as with the CDM, it may be constrained by the high cost of audits and administrative compliance.

Partnership for Market Readiness

The establishment of Partnership for Market Readiness (PMR) was announced by the President of the World Bank, Robert B. Zoellick at an event on the sidelines of the UNFCCC conference in Cancún in December 2010.[156] The Partnership received pledges of more than US$20 million from Australia (A$10 million), the European Commission (€5 million) and the United States (US$5 million) in Cancún, building on an earlier pledge of US$5 million from Norway. In addition, Germany, Japan and the UK announced their intention to support the initiative financially. The Partnership is aiming for a total capitalization of US$100 million.

The PMR is a grant-based, capacity building trust fund operated under the umbrella of the Carbon Finance Unit of the World Bank and provides funding and technical assistance for the collective innovation and piloting of market-based instruments for greenhouse gas emissions reduction.[157] The Partnership brings together developed and developing countries, as well as other key experts and stakeholders, in order to provide a platform for

technical discussions on market instruments, foster south-south exchange, facilitate collective innovation for pilot efforts and harness financial flows for implementation and scale up.

For many countries, the first step toward implementing a market-based instrument is to build market readiness capacity, such as measuring, reporting and verification systems or the creation of a regulatory framework. As such, market preparation is also a crucial part of the work of the PMR. The PMR aims to: (i) establish opportunities to design and develop market instruments (such as a forum for technical exchanges and the sharing of lessons learned); (ii) build the necessary in-country capacity to implement these instruments; and (iii) provide opportunities to pilot new instruments.

The PMR will work towards achieving these objectives by bringing together interested countries, international organizations and private sector entities. It will be country-led and build on individual countries' mitigation priorities and their development of market instruments.

On June 2, 2011 the PMR announced that it approved grants for eight carbon market initiatives. Eight countries (Chile, China, Columbia, Costa Rica, Indonesia, Mexico, Thailand, and Turkey) have each received an initial grant of US$350,000 to help evaluate and plan how they will design, pilot, and eventually implement market-based instruments for greenhouse gas mitigation.[158]

Carbon Finance by International Finance Corporation (IFC)

IFC aims to be a thought leader on climate issues, including among other things, developing reference methods for setting and monitoring climate standards and helping its clients assess the impact of carbon emissions.[159] It intends to support greater private-sector investment in this area, including investments in new climate business models and new and transferable clean technologies while helping clients incorporate climate change into their sustainable-business strategies. IFC has recently undergone a consolidation of its climate-related businesses and has established a new Climate Business Group to integrate climate issues into its investment and advisory services activities across all industries and regions.

Among the climate products, IFC offers innovative debt financing to projects that rely on carbon revenue from sale of post-2012 carbon credits to bankable buyers.[160] By monetizing firm carbon offtake agreements, IFC helps projects reach financial closure despite few or no fixed assets and substantial dependence on future generation of emission reduction credits. Furthermore, IFC manages a portfolio of 12 transactions consisting of more than 40 projects from which US$135 million worth of carbon credits have been purchased for the two facilities that IFC manages on behalf of the government of the Netherlands.

Finally, IFC has completed three Carbon Delivery Guarantee (CDG) transactions with structured carbon finance exposure for IFC's account.[161] These transactions will guarantee delivery of 2.2 million credits from CDM projects. By offering a CDG product, the IFC assures the delivery of carbon credits from projects in developing countries to buyers based in industrialized countries.

Acting as an intermediary, IFC sells carbon credits with guaranteed delivery, enabling these credits to fetch a price higher than through a direct transaction between buyer and seller, as the CDG eliminates delivery risk to the buyer. The seller benefits from the IFC's credit rating and profits from this higher price (minus a transaction fee). IFC signed its first CDG agreements in early 2008.

Green Fund Proposed by International Monetary Fund (IMF)

In 2010, the IMF proposed a *Green Fund* that could raise finances from multiple sources on a scale envisioned by the Copenhagen Accord ($100 billion a year by 2020).[162, 163] The Green Fund could also promote global agreements to reduce GHG emissions and allow emerging countries to begin scaling-up their climate change responses in the near future. To expedite the financing, developed countries would provide the Green Fund with initial capital in the form of reserve assets, which could include special drawing rights (SDRs) to leverage resources from investors. To do this the Fund would issue highly-rated, low-cost green bonds in global capital markets. Contributors could agree to set the level of their equity stakes in proportion to their IMF quota shares, making this the key consideration for burden sharing.

In addition, contributors would be tasked with providing subsidies in order to support the Green Fund financing effort, which would mostly be carried out through grants or concessional loans. To this end, contributing governments may need to identify new sources of fiscal revenues, such as carbon taxes or well-developed carbon-trading schemes. Implementing these arrangements, however, could require a great deal of time. In the intervening time, subsidy needs could be covered by interest earned on the Fund's reserve assets, bond proceeds and other innovative instruments such as international tax schemes.[164]

Green Climate Fund

The Cancún Agreement launched the Green Climate Fund (GCF) as an operating entity of the financial mechanism of the UNFCCC and recommended that the Fund be governed by a Transitional Committee[G] which would include the World Bank as the interim Trustee for the first three years.[165] Building on the commitment by developed countries to transfer US$100 billion a year by 2020 to developing countries for adaptation and mitigation, the Green Climate Fund will be key for channeling such funds to developing countries.[166]

Some have criticized the GCF concept, noting that while many see the fund as the solution to addressing climate finance, it could ultimately be an *empty fund* given the difficulty getting member countries to agree to a binding international climate policy regime.[167]

Between March and November, 2011, the Transitional Committee will seek to design the Fund in a way so as to obtain approval (to begin operating) during the 17th session of the UNFCCC in Durban, South Africa. Its design must address various concerns that are as yet unresolved including the way it will: (i) provide sustainable finance at the scale needed; (ii) fit into existing development assistance and climate financing programs; and (iii) allocate and deliver funds to developing countries. This is an ambitious agenda if a working proposal is to be submitted to delegates at the next Conference of the Parties (COP) meeting.

Other Programs by Multilateral Development Banks (MDBs), Export Credit Agencies (ECAs), and International Institutions

According to UNEP, most public-sector international financial institutions including multilateral and regional banks, their private arms, bilateral funding agencies, export credit agencies (ECA), and other organizations have established environmental or climate-change

policies as well as lending programs for RE and EE projects.[168] The programs share some of the following characteristics:

- **Low-interest-rate loans** for specific activities and technologies, often driving market activity beyond national standards or norms;
- **Grants to clients** for special technical assistance (TA), or use of internal TA (both internally and with clients);
- **Risk-mitigation options**, such as partial-risk guarantees;
- **Assistance to develop policies and regulations** at the government level, generally in response to specific requests;
- **Contributions to funds** being developed (public-private, or privately managed) to provide equity investment to enterprises;
- **Carbon-finance expertise** for EE projects or programs.

Differences exist, however, with respect to the (i) scale of financial resources allocated, (ii) starting points and maturity of the programs; and (iii) internal resources and integration of the FIs.[169]

MDBs, Their Private Arms, and Other Donor Agencies

Asian Development Bank (ADB).[170] The ADB has been actively involved in developing Asia's sustainable energy sector through project funding and TA. For example, the ADB seeks to significantly increase its investments in green technologies in Asia through the *Climate Change and Clean Energy Venture Capital Initiative.* Through this initiative, ADB provides up to 25 percent of the funding of a venture capital's fund with the remaining 75 percent capitalized by the fund owner. At least 85 percent of the money must also be invested in any of the ADB's developing member countries.[171] The ADB has also established the *Clean Energy Financing Partnership Facility* (CEFPF) and *Clean Energy Fund,* which are both donor trust funds to support technical assistance and grants for clean energy and energy efficiency projects.

Inter-American Development Bank (IDB).[172] The IDB has been advocating a climate change and renewable energy agenda. In its recent report[173] the IDB addresses the rationale for increasing mitigation and adaptation support in the inter-American region, discusses mechanisms for addressing financial gaps, and identifies sectors where support can have a positive impact. Further, IDB has launched the "planetBanking" program, which was launched to promote sustainability among Latin American financial institutions.[174] The program aims to provide technical and financial support from IDB to Latin American banks in implementing innovative financial products that promote climate change investments in the region.

Organisation of Economic Cooperation and Development (OECD).[175] The OECD has been active in the climate change and green finance area since the late 1980s, and has been tackling the problem from the standpoint of collecting and analyzing information on countries' approaches to stimulate green growth.[176] In a 2009 report[177] the OECD attempted to address some financing issues and the limitation of emissions trading schemes, and emphasized that establishing a single world market price for carbon would be an attractive though politically and institutionally challenging option.

Table 4 gives examples of other programs funded by international donor agencies, MDBs, and their private arms.

Table 4: Examples of other climate-friendly activities of MDBs and other organizations

Organization	Programs	Key features
AfDB[178]	*Financing Small Scale Energy Users* (FINESSE) aims to mainstream EE&RE investments across the bank	Through the FINESSE program the Dutch government provides US$5.4 million to help task managers and investment officers identify potential EE finance and prepare pre-feasibility studies
	Clean Energy Investment Framework for Africa (CEIF) is aimed to increase access to energy while making maximum use of clean energy	Created under CEIF, a *Clean Energy and Climate Adaptation Facility for Africa* (CECAFA) provides both TA and project management funds
	Many EE projects are integrated into operations, handled by bank's private sector department and government lending divisions	
ADB[179]	*Energy Efficiency Initiative* (EEI) launched in 2005,[180] promotes EE and RE projects in six priority countries	EEI aims to invest US$1 billion a year from 2008 to 2010. In 2008 initiative was expanded to six more countries
	Clean Energy Financing Partnership Facility (CEFPF), launched in 2007, aims to build the policy, regulatory, and institutional environment for RE and EE, and provide grants for projects that reduce GHGs	CEFPF goal is to raise US$250 million to help finance the EEI
	In 2008, US$100 million of investments in five new private equity funds operating in the clean energy sector was approved	This investment capital should help establish the equity funds that will invest up to US$1.2 billion in clean energy projects. Some activities are conducted jointly with UNEP
	Other initiatives include: • *Carbon Market Initiative* (CMI), 2006 • *Energy for All Initiative,* 2008 • *The Sustainable Transport Initiative* (STI), 2006	Initiatives aim to: • Provide CDM TA and funds for carbon project development through the *Asia Pacific Carbon Fund* (APCF) • Scale up access to modern sustainable energy for the poor through regional partnerships for village-based projects • Invest US$1.5 billion to promote capital flow to EE, low-GHG, transport systems
Corporacion Andina de Fomento (CAF)[181]	*Latin American Carbon Program* (PLAC), launched in 1999; more recently, a stronger focus on RE/EE	With a carbon-emission market as a starting point, CAF is now interested in EE/RE opportunities both in CDM project development, and beyond
	In 2007, jointly with KfW, a fund for equity positions in clean energy	The US$130 million for investments in supply and demand side, including EE
Caisse des Depots (CDC)[182]	CDC loans for social housing now include EE incentives for construction and renovation	CDC's program of EE loans, in the social housing sector, totaled 16 million in 2008. These were long-term loans with lower interest rates. A renovation program was launched in 2007 with low interest rates (for a proportion of costs, weighted to a list of EE technologies)
	Since 2004 CDC has conducted the research of the economics of climate change and has been gradually mainstreaming carbon performance	
	In 2007, a three year €150 million investment program was launched to promote RE	

(Table continues on next page)

Table 4 (continued)

Organization	Programs	Key features
EBRD[183]	EBRD has an environment mandate since inception; senior management supports EE as part of broader *sustainable energy initiatives*	EE targets are allocated by country and sector, covering activities on supply and demand. In 2007, spent about €1 billion
	EBRD is the only IFI with a dedicated EE team which identifies and provides specialist resources across all operations	EE activities include developing specific investment mechanisms, e.g. Energy Service Companies (ESCOs), industrial EE opportunities with bank clients, carbon credit opportunities, RE promotion with power team
	Includes the *Netherlands EBRD Carbon Fund* and *Multi-lateral Carbon Credit Fund* (MCCF)	
IDB[184]	*Sustainable Energy and Climate Change Initiative* (SECCI) supports RE, EE, carbon finance, and adapting to climate change, targeting both public and private sectors	SECCI has a US$20 million fund from the Bank and about US$17 million from a multi-donor fund. Includes EE audits, training and maintenance workshops
JBIC[185]	Broad range of financial instruments for environmental conservation projects and improvements in developing countries.	Focused on EE and low-carbon agenda: co-generation projects; broader use of natural gas; energy savings; RE; EE projects in major sectors in developing countries and large economies. Finances both private and public sectors. In 2008, mandated to expand equity finance to environmentally friendly options (US$150 million that year)
KfW[186]**—Activities in Germany**	Long-term low-interest (LI) loans via retail and savings banks. The LI loans are provided to commercial enterprises, SMEs for EE and environmental activities	€16.6 billion for environmental and climate protection measures in 2007 (about 20% of total financing), dispersed through banks within the group
	Various low LI loan programs cover private housing sector for EE and modernization that exceeds national standards (for retrofit or construction), along with municipalities and schools	€1 billion is allocated from the German national budget for interest subsidies and grants in private housing sector for EE and modernization
KfW—Development Finance Activities	Special facility for RE and EE ('*4E*' Facility), launched in 2005	4E met its original €500 million commitment in three, rather than five years; more than half went to EE projects
	Since 2008, continues *Initiative for Climate and Environmental Protection* ('IKLU')	IKLU provides LI loans to developing and emerging countries climate protection investments. A large part is for energy generation, transmission, distribution, rational use, and EE transport systems
UNEP	*UNEP Seed Capital Assistance Facility (SCAF)*	Helps energy investment funds provide seed financing to early-stage clean energy enterprises and projects. Implemented through the UNEP, and both ADB and AfDB
	UNEP Renewable Energy Enterprise Development program (REED)	Promotes enterprise and seed financing for clean energy entrepreneurs in developing countries, e.g. Yunnan province in China (CREED), northeastern Brazil (B-REED), Ghana, Mali, Senegal, Tanzania, and Gambia (A-REED)
European Commission	*Global Energy Efficiency and Renewable Energy Fund* (GEEREF)[187] is a *public-private partnership* (PPP) providing global risk capital through private investment for EE and RE projects in developing countries and transition economies.	GEEREF is open for both public and private investors and as a Luxembourg SICAV. It invests in private equity funds that specialize in equity finance for small and medium-sized projects that focus on RE and EE production and technologies requiring up to €10 million equity investment and covering a substantial gap in the market. Private funds must demonstrate that team members are experienced in RE & EE, as well as infrastructure investments
	GEEREF aims to accelerate the transfer, development, use and enforcement of environmentally sound technologies for poor regions	

Source: Compiled based on Energy Efficiency and the Finance Sector, UNEP, 2009.[168]

In recent years, all the major multilateral development banks have also established either freestanding private sector arms (such as the IFC of the World Bank Group) or internal departments that focus on financing private sector activities. These private arms of the MDBs can play an important role in facilitating the flow of international and domestic private capital to CTF investments and are participating in the wide array of international programs, including CDM, CIF, etc.

Export Credit Agencies (ECAs)

Currently, CFT markets are rapidly expanding. In this context, ECAs have the potential to greatly foster private sector investments in developing countries. Between 2002 and 2006, ECAs issued over US$120 billion of medium- and long-term loans and credit lines. In 2007, ECAs supported about US$1.4 trillion of transactions and investments worldwide. Collectively ECAs are now the largest source of official financing for developing countries.[188] Many countries use ECAs to promote their exports and offer credit insurance and guarantees. These agencies use a wide range of instruments, such as working capital guarantees to foster production and meet contract requirements, as well as provide export credit insurance to ensure buyer repayments. Also, they provide loan guarantees to buyers. Through such credits, foreign buyers are allowed to defer payments for the goods and services they import over a period of time.[189] Thus, ECAs are in a position to address trade issues in highly volatile markets by mediating between national governments and exporters.

In 2007, some OECD countries adopted environmental standards for ECA financing for renewable energy-related projects. The U.S. Export-Import Bank (Ex-Im Bank), UK Export Credit Guarantee Department (ECGD) and Australian Export Finance and Insurance Corporation (EFIC) are among the ECAs that have been subjected to these standards.

The Export-Import Bank of the United States, through its Office of Renewable Energy and Environmental Exports, runs an Environmental Exports Program (EEP) that enhances levels of financial support for a broad range of renewable energy and other environmentally beneficial exports.[190] EEP provides enhanced medium-term insurance and guarantees, and long-term loans and guarantees for environmentally beneficial export transactions. The enhancements include: (i) maximum allowable repayment terms of up to 18 years for RE and environmentally beneficial exports[191]; (ii) capitalization of interest during construction; and (iii) support for local costs up to 30 percent of the U.S. contract price.

The Ex-Im Bank provides financing for the export of RE-related equipment, EE and air pollution technologies, wastewater treatment projects, and waste management services, among others. In 2009, it authorized US$363 million to support an estimated US$640 million of U.S. exports of environmentally beneficial goods and services. In 2010 EEP launched a *solar express* product that further helps to expedite financing of U.S. exports to small solar projects. Under the terms of this product, the approval process for financing of the U.S. export to small solar-power projects (between US$3 million and US$10 million) is supposed to be done within 60 days.[192]

Export Credit Guarantee Department of UK is an export credit agency that offers various products to facilitate exports and investments in markets across the world (see Table 5).

The ECGD complies with the OECD's environmental, social and human right standards, and has also urged renewable energy (RE) markets to expand their growth. To

Table 5: UK's ECGD products

Products	Description
Buyer credit	Guarantee extended to banks that lend to overseas borrowers to purchase over £5 million of capital goods and/or services from UK suppliers
Supplier credit financing (bills and notes facility)	Guarantee extended to banks to cover payments due under bills of exchange or promissory notes they purchase from UK suppliers on exports over £25,000
Supplier credit financing—loan facility (without bills and notes)	Guarantee extended to banks to cover loans made to overseas borrowers to finance contracts over £25,000 with UK suppliers
Lines of credit	Guarantee extended to banks that lend to overseas borrowers to finance several export contracts with different exporters
Project financing	Guarantee extended to banks that lend over £20 million on projects on a non- or limited-recourse basis
Export insurance	Insurance provided to UK exporters to cover costs for reasons other than the exporter's performance such as political events
Bond insurance	Insurance provided to exporters for wrongful calling of bonds under export contracts (for example, advance payment bonds or performance bonds)
Overseas investment insurance	Political risk insurance (up to 15 years) provided to UK investors who invest in overseas enterprises
Letter of credit guarantee scheme	Guarantee extended to UK banks to cover letters of credit issued by overseas banks to UK exporters. The guarantee covers part of the overseas issuing bank's obligation to reimburse the UK bank for payments it makes under the letter of credit
Bond support scheme	Exporters raise tender and contract bonds by sharing the risk of not being reimbursed (following a call on the bond) with banks that issue the bonds (or arrange for them to be issued by giving counter-indemnities to another bank)

Source: Quick guide to the Export Credits Guarantee Department, ECGD, 2011.[194]

this end, ECGD obtained 36 percent of its electricity from RE in 2008–2009 and collaborated with the Renewable Energy Association (REA) to analyze the credit insurance needs of UK exporters in the RE sector.[193]

Australian Export Finance and Insurance Corporation provides both finance and insurance to promote environmentally sound goods and services. For example, it helped a Melbourne-based manufacturer of satellite ground stations used for environmental monitoring by providing US$363,000 of bonds to its Chinese buyer. Also, its guarantees facilitate transactions since the agency provides funds to buyers to reduce their losses when exporters do not meet contract requirements.[195] Moreover, it adopted the Equator Principles (discussed earlier in the report) and discloses its participation in projects with adverse environmental impacts.

Notes

[A] This included the 16th COP and 6th Conference of the Parties, serving as the Meeting of the Parties to the Kyoto Protocol (CMP), as well as the 33rd sessions of both the Subsidiary Body for Implementation (SBI) and the Subsidiary Body for Scientific and Technological Advice (SBSTA), the 15th session of the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP) and 13th session of the AWG-LCA.

[B] The BioCarbon Fund provides carbon finance for projects that sequester or conserve greenhouse gases in forests, agro- and other ecosystems.

[C] The key distinction between CDM and JI is where the project is based: under the CDM project activities must be hosted by a developing (non-Annex I) country, while under the JI project activities

should be carried out in another developed (Annex I) country. An important consequence arising from this distinction is that CDM generates additional emissions reduction credits while JI only results in the exchange of allowances between two developed economies.

[D] A CDM activity is *additional* if anthropogenic emissions of GHGs by sources are reduced below those that would have occurred in the absence of the registered CDM activity.

[E] NAMA refers to a set of policies and actions countries undertake as part of a commitment to reduce GHG emissions. The term recognizes that different countries may take different nationally appropriate action on the basis of equity and in accordance with common but differentiated responsibilities and respective capabilities. It also emphasizes financial assistance from developed countries to developing countries to reduce emissions. NAMA was first used in the Bali Action Plan and also formed part of the Copenhagen Accord.

[F] UNEP Riscoe Centre is the entity that implements the ACP-CD4CDM Project under the European Commission Programme for Capacity Building related to Multilateral Environmental Agreements (MEAs) in African, Caribbean and Pacific (ACP) Countries. ACP-CD4CDM Project is a continuation of "Capacity Development for the Clean Development Mechanism" (CD4CDM) Project, implemented by the UNEP Risoe Centre in select countries from Asia, Latin America, Middle East, North Africa and Sub-Saharan Africa.

[G] The Transitional Committee is a 24-member board, with an equal number from developed and developing countries. Those from the latter include representatives from UN regional groups, small island nations and the least-developed countries. Each board member will have an alternate member who may participate at board meetings only through the principal member, without the right to vote, unless they serve as the member. If the member is absent from all or part of the board meeting, his/her alternate shall serve as the member.

CHAPTER 4

Public Interventions: Fiscal and Economic Instruments

Governments can play a pivotal role in promoting investments in climate friendly technologies by adopting a wide range of fiscal, economic and financial policies, such as environmental tax and budget reforms, and tax neutrality measures, as well as introducing tradable permit schemes and creating new markets through assigning property rights. Tradable permit schemes require companies to reduce their GHG emissions below a specific level and allow them to trade their permits with firms that cannot meet their set limit. These schemes generate tax revenues and reduce GHGs, and have been extremely effective in both voluntary and mandated programs.

Governments can also use policy interventions to make carbon–intensive technologies less attractive to private investors.

Public Interventions

Public interventions to promote investments in Climate Friendly Technologies (CFT) directly affect financial flows: e.g. an EcoFys publication[196] suggests that well-designed public interventions can reduce the cost of renewable electricity by 10–30 percent and ensure long-term commitment towards RE through the following channels:

- **Removing risks** (by eliminating investment barriers) or sharing risk (through loan guarantees or project participation), which decreases the cost of capital;
- **Offering investment subsidies** at the demonstration and market introduction phases;
- **Introducing special debt measures** (low-interest loans and debt terms that are linked to a project's lifetime);
- **Introducing fiscal measures** and energy production supports (through Power Purchase agreements (PPAs) and Feed-in-Tariffs).

The course that is cost-effective, more successful than regulation, and helps achieving environmental and abatement goals is if polluters are offered fiscal or economic incentives—subsidies, taxes, charges, and emission-trading schemes. Research shows that economic instruments also provide incentives for innovation in pollution control.[197]

In general, fiscal and economic public interventions can be grouped into (i) public finance policies, (ii) fiscal instruments, (iii) tradable permits schemes, and (iv) property rights instruments.

Public Policies and Finance

Studies by the OECD, UNEP SEFI, World Bank, London School of Economics (LSE) and others described the ways public policy and financing mechanisms can help mobilize investments in CFTs.

A 2010 World Bank issues brief #2[198] offered examples of pilot programs that leverage climate and development finance by combining resources and instruments to maximize synergies, explore new opportunities to expand market mechanisms, and strengthen the capacity to access resources and use them effectively. It also described ways to scale up financing to produce innovations in carbon finance-activities and increase leverage. The 1st weather derivative in Malawi and the MultiCat Program in Mexico are provided as examples of successful financial innovations.

A 2008 UNEP SEFI report[199] discussed the mechanisms to mobilize and leverage commercial financing, build commercially sustainable markets, and increase capacity to promote clean energy and other climate-mitigation technologies, projects and businesses. Drawing on experience from various developed and developing countries, the report described how to help launch an international mitigation strategy and suggested ways in which public finance mechanisms (PFMs) can be used at the national level, offering scale-up and replication strategies, and identifying how they might fit into a new financial framework under the UNFCCC (see Table 22, Annex 1).

The report also found that PFMs can be made most effective and efficient if they: (i) accurately assess technology market barriers and financial market conditions; (ii) target market segments where the project economics are compelling; (iii) take a programmatic approach to financial mechanism design; (iv) use and strengthen existing capacities throughout the chain of financial intermediation; (v) address the lending or investment criteria of commercial financial actors; (vi) define project responsibilities based on a complete roles and risk analysis; (vii) Include marketing and market aggregation plans; and (viii) develop plans for public or donor-supported technical assistance programs to build capacities, fill gaps, and take on any roles or risks not assumed by commercial parties.

A 2009 LSE study[200] emphasized that the private sector does not yet take into account expected returns from carbon revenue streams when making their investment decisions and it is, therefore, important to use public finance to leverage private investments and promote sufficient financial flows. Further, the publication proposed that it is likely that in order to raise public finance governments will use mostly traditional instruments, including treasury bonds, combining them with some innovative approaches. For instance, governments can use index-linked carbon bonds—a government issued bond where principal or interest payments are linked to the actual GHG emissions of the issuing country against published targets. Another example proposed by the study is establishing the Enterprise Climate Insurance Facility that could build and draw on the range of insurance proposals currently being discussed and developed. Further, the study offered that the design of government interventions should be guided by the following (see Table 25, Annex 1):

- **Goals:** (i) to correct market failures (environmental, informational and technological, and financial); (ii) to improve credibility of regulations; and (iii) to ensure equity;

- **Criteria:** (i) appropriate risk allocation between the private and public sectors; (ii) alignment of incentives between public and private sector; (iii) scale, scope and usability; (iv) political acceptability;
- **Consideration points:** (i) concessional debt is an instrument favored by the private sector; (ii) public procurement of low-carbon technologies should play a strong role in creating appetite for investment; (iii) the use of a '*cornerstone funds*'[A] and '*challenge funds*'[B] offers an effective means of mobilizing climate finance at scale; (iv) an enhanced mandate for the MDBs to leverage private investments should be a key priority; and (v) national action plans in developing countries, particularly if backed by credible international and domestic financial commitments, will be crucial in generating private investment.

The report also indicated that the decisions on the global financial architecture will have a significant impact on the perceived risk by private investors and on the returns they expect from their investments. The global architecture can help reduce the regulatory risk to private investors in a variety of ways including: (i) ensuring that international financing flows covering incremental cost are predictable, reliable and at the scale required; (ii) ensuring that the financing instruments used minimize regulatory risk to investors; (iii) keeping transaction costs low; among others. Finally, the study emphasized that there is a need for reforms and scaling-up of the carbon market.

A 2010 OECD working paper[201] proposed an analytical framework for assessing policies that will contribute to a better integration of environmental externalities in the pursuit of economic efficiency and growth objectives. The framework consists of two parts.

The first part lays out principles and criteria for the identification and selection of policies that will benefit both income and the environment or that will boost income at the least cost in terms of the environment (and vice-versa). In general, putting a price on a pollution source or on the over-exploitation of a scarce resource was found to be the most efficient single policy to address many environment externalities. However, given that environmental damage often results from several interacting market failures, an appropriate policy response will in many cases involve a mix of complementary instruments.

The second part of the framework focuses more on issues of structural adjustment related to the transition towards a greener economy. It found that green growth policies could lead to significant re-allocation of resources within and across broad economic sectors. A policy framework facilitating the re-deployment of labor across firms and sectors, as well as the entry of new firms and the exit of firms in declining industries, will thus be important for countries to seize the opportunities brought about by green growth policies (see Table 19, Annex 1).

The 2011 UNDP guidebook, *Catalysing Climate Finance,*[202] argues that only a limited number of developing countries are currently benefitting from new financing opportunities, as their markets are not yet in a position to attract climate investments. Contrary to the view that a post-2012 global climate policy regime should focus on the largest GHG-emitting countries, this guidebook argues that a failure to provide fair access to climate finance to all developing countries would have severe political, financial and climate change consequences.

The guidebook emphasizes that even favorable climate investment policies are not a substitute for an overall positive investment environment. Before making a climate

investment, financiers will assess a number of project-specific (resources, technology, skills, energy intermediaries, operations and management, etc.) and non-project-specific risks (country risks, size of the economy, macro-economic conditions, investment policies, currency risk, tax rates, proximity to markets, technology, supporting and delivery infrastructure, etc.). The publication then concludes that a comprehensive strategy to attract investment would seek to enhance capacity in all of these areas.

Building on UNDP market-transformation and development experiences for low-emission climate-resilient technologies in over 100 countries over the past 20 years, the guidebook proposed a four-step methodology to assist developing countries select and deploy an optimal mix of public policies and financing instruments to catalyze climate finance in line with national development priorities: (i) identify priority mitigation and adaptation technologies options; (ii) assess key barriers to technology diffusion; (iii) determine appropriate policy mix; and (iv) select financing options to create an enabling policy environment.

The guidebook summarized a broad range of public intervention options and grouped them under three primary categorizes: capacity and information-based instruments, regulatory instruments, and market-based instruments. For a deeper discussion of comparative advantages of a wide diversity of market-based instruments category, this was further divided into four sub-categories: fiscal incentives (including direct subsidies), early market-development instruments, debt-based and equity-based instruments, and trading instruments (see Table 20, Annex 1).

The *Green Investment Bank* report by UK government[203] discusses the rationale and foundation for establishing a UK Green Investment Bank (GIB) as an essential means of unlocking the enormous scale of private sector investment. A fundamental role of the GIB should be to advise the government on low-carbon and green infrastructure policy, to ensure policies are joined up across departments and to help meet investors' need for stable policy frameworks to give them the confidence and certainty to invest. As such, the Green Investment Bank will become an institution mandated with developing low-carbon policy directions, overseeing implementation, facilitating the financing of the low-carbon development, and carrying out analysis of the policies' impact providing government with the feedback. The GIB, therefore, will require systems to collect good quality and timely data on investment levels, the impact of new policies or regulations, any signs of 'crowding out' of other investment, and the costs and effectiveness of different types of investment.

In June 2010, the Green Investment Bank Commission recommended that a GIB be set up by the end of 2010. In May 2011, after carefully considering and market-testing several options, the government announced the business model for the GIB.[204] It is expected that the GIB will start to make direct, state aid compliant investments in green infrastructure projects from April 2012. A key issue has been whether the new body will be a *bank* or a *fund,* which in turn hinges on the National Accounts treatment of the Bank. There have been persistent reports of disagreement within government about whether the Bank will be able to raise money from the finance markets, due to such classification issues.

Proponents of the Green Investment Bank maintain that the GIB must not be just another fund to disburse government money, but a bona fide bank able to raise its own finance and fill a gap in the market for government-backed bonds, bring in banking expertise and offer a range of commercially-driven interventions—loans, equity and risk-reduction finance. In May 2011, the government announced that is committed to

fund the GIB with £3 billion over the period through 2015, so that the GIB will become a key component of the transition to a green economy, complementing other green policies to help accelerate additional investment. However, the amount of funding is only sufficient to start to lever in the scale of private sector finance required if it is able to operate as a bank.

Fiscal Instruments: Taxes and Subsidies

A substantial body of literature describes various types of fiscal instruments, the mechanisms by which they function, their effectiveness and importance. For example, a 2009 European Commission paper notes that fiscal instruments can be divided into two main categories—subsidies and tax instruments.[205]

Subsidies

Subsidies can be offered directly or through the tax system to encourage producers as well as consumers to make choices that are not environmentally harmful. Unlike taxes, they provide incentives by decreasing the price or purchasing costs of products and are often labeled as *fiscal incentives.* Along with tax breaks, they are designed to provide economic incentives to correct market failures with respect to natural resources and pollution control. Thus, they motivate firms to reduce pollution loads on the environment. However, by definition, subsidies distort prices and tend to increase producer profits and lower consumer prices,[206] and can negatively affect the environment. This occurs when they support activities that encourage over-consumption and, ultimately degrade the environment. For example, governments in emerging economies often control consumer prices for energy, keeping them below the real market level in order to promote economic development and alleviate poverty. But fuel tax rebates and low energy prices stimulate the use of fossil fuels, while subsidies for road transport increase congestion and air pollution. Also, agricultural subsidies can lead to the overuse of pesticides and fertilizers.

According to a recent IEA report on energy subsidies, fossil fuel (consumption) subsidies totaled US$557 billion in 2008 (over one percent of global GDP),[207] with non-OECD countries providing US$400 billion or 72 percent. In 2008 alone, Malaysia allocated about US$14 billion to oil subsidies, or 25 percent of its spending, and in 2010, it spent US$15 billion in energy subsidies, jeopardizing the country's excellent credit rating, foreign reserves and budget surplus.

As noted in a 2010 OECD publication,[208] some subsidies have merit, at least in the short term, and removing them can create negative effects: e.g. phasing-out fossil fuel subsidies in regions where it is used for cooking and heating could create greater pressure on natural biomass resources and negatively affect indoor air quality even further.

However, subsidies on fossil fuels generally deplete resources and increase carbon dioxide emissions. The OECD estimates[209] that global GHG emissions would be reduced by 10 percent from business-as-usual levels in 2050 if fossil fuel subsidies were phased out by 2020. Further, if governments stopped subsidizing environmentally-harmful activities and instead supported the use of energy-saving devices or the development of RE, such practices would be more cost-effective in the long-term and remove barriers to green growth.

Lately, the use of subsidies and tax credits to encourage investment in green energy has grown. Increasingly, countries seek to accelerate green growth by encouraging private

sector participation through incentives, sending signals that could significantly affect the behavior of economic agents. Conversely, in the past few years, several countries have announced either a cut or the intention to cut oil subsidies to consumers, raising the conventional fuel prices and favoring renewable energy source: e.g. Indonesia is raising prices by 30 percent and Malaysia is contemplating similar action.[210] China may do the same when inflationary pressures drop.

Carbon Taxes and Charges

Taxes, including carbon taxes, are levied on goods directly or indirectly linked to polluting activities and can be defined as compulsory fees charged by government, regardless of whether the revenue accrues directly to the government budget or is earmarked for other purposes. For example, the revenues can be spent either on more environmental friendly practices or used to create a *double dividend*.[C, 211] These carbon taxes and charges are often seen as *pricing instruments,* as they raise the price of the environmentally harmful aspects of production or consumption—incorporating the costs of environmental damage into the price of the goods and services, which creates incentives for producers or consumers to shift to more environmentally-friendly activities. However, a major drawback of a tax instrument is that the environmental outcome is not guaranteed. As the carbon tax does not fix the emission level the actual emission amounts will vary according to economic activity. This weakness is not present in some of the alternative emission control instruments, among which are tradable permit schemes and hybrid options.

Unlike carbon taxes and charges, tradable permit schemes (discussed later in detail) are quantity instruments because they fix the overall emission level (quantity) and allow the price to vary. Uncertainty in future supply and demand conditions (market volatility) coupled with a fixed number of pollution credits creates an uncertainty in the future price of pollution credits, and the industry must accordingly bear the cost of adapting to these volatile market conditions. The burden of a volatile market thus lies with the industry rather than the controlling agency, which is generally more efficient. However, under volatile market conditions, the ability of the controlling agency to alter the caps will translate into an ability to pick "winners and losers" and thus presents an opportunity for corruption.

Safety valve, another alternative to carbon taxes and charges, is a hybrid of the price and quantity instruments. The system is essentially an emission cap and permit trading system but the maximum (or minimum) permit price is capped. Emitters have the choice of either obtaining permits in the marketplace or purchasing them from the government at a specified trigger price (adjusted over time). The system is sometimes recommended as a way of overcoming the fundamental disadvantages of both systems by giving governments the flexibility to adjust the system as new information emerges. It can be shown that by setting the trigger price high enough, or the number of permits low enough, the safety valve can be used to mimic either a pure quantity or pure price mechanism.[212]

There has been longstanding debate on the relative merits of *price versus quantity* instruments to achieve emission reductions. The theoretical economic foundation was established in 1974 when Weitzman published his research on the effectiveness of application of price and quantity instruments under the condition of uncertainty of marginal costs of supplying a good.[213] He demonstrated that price instruments could be more

efficient than quantity ones in cases when the marginal benefits of the abovementioned good are flat in comparison with the marginal costs. For instance, in case of climate change, if the marginal cost of reducing emissions increases quickly and marginal benefits from abating a unit of CO_2 is relatively flat, then a price instrument—a carbon tax—is the more appropriate instrument to use.[214]

However, due to the multitude of other factors affecting the efficiency of the outcome (including political, implementation and technical difficulties, etc) the debate, on both theoretical and practical sides, is still continuing. All three methods are currently being used as policy instruments to control GHG emissions. For instance, the EU-ETS is a quantity system that uses the cap and trade approach. Denmark has a price system using a carbon tax[215] and China uses the CO_2 market price for funding of its CDM projects, but imposes a safety valve of a minimum price per tonne of CO_2.[216]

Many researchers believe that a harmonized international carbon tax, if correctly designed and implemented, is likely to be a more effective mechanism for responding to the threat of climate change.[217] Indeed, carbon taxes can lead to more predictable energy prices by eliminating the volatility that historically has disadvantaged investments in low-carbon projects. Due to their nature, carbon taxes are also less subjected to opportunistic behaviors in comparison to cap-and-trade schemes.

Nevertheless, a certain caution should be exercised when designing carbon tax instruments, as the introduction of the carbon taxes may injure the poor disproportionally more than the rich.[218] Studies typically find that poor consumers spend a greater proportion of their income on energy-intensive goods and fuel. Since in most instances firms find a way to pass the costs of a carbon tax onto consumers, cost increases in energy tend to impact the poor more than the rich.

Further, introduction of carbon taxes (as well as other types of environmental taxes) traditionally raises the following contentious and important considerations:

- **Transfer of revenue from industry to government.** A carbon tax scheme introduces a transfer of revenue from industry to government. This, it is argued, guarantees that the tax will not be set at the appropriate level, but will instead be determined by the politics of large-scale revenue transfers.[219]
- **Carbon leakage.**[D] It has been demonstrated that an increase in local fossil fuel prices resulting, for example, from mitigation policies may lead to the reallocation of production to regions with less stringent mitigation rules (or with no rules at all), leading to higher emissions in those regions and therefore to carbon leakage.[220] Leakage effects, however, can be negative (i.e., leading to overall reduction of emissions) or positive (increasing overall emissions). Negative leakages, which are desirable, are usually referred to as *spillovers*.[221]
  According to Goldemberg, short-term leakage effects need to be judged against leakage effects in the long-term.[222] A policy that sets carbon taxes only in developed countries might lead to leakage of emissions to developing countries. However, a desirable negative leakage could occur due to a lowering in demands of coal, oil, and gas from the developed countries and thus the world prices. This will lead to developing countries being able to afford more of any fossil fuel type, thus being able to substitute more oil or gas for coal, in effect lowering their national emissions. In the long-run, however, if the transfer of less polluting technologies is delayed, this substitution by income effects might have no long-term benefit.

- **Border adjustments.** Border tax adjustments account for emissions attributable to imports from nations without a carbon price. A number of policies have been suggested to address concerns over competitive losses due to one country introducing a carbon tax while another country does not.[223] Similarly, policies have also been suggested in an attempt to induce countries to introduce carbon taxes. Alternative approaches would be the introduction of trade bans or tariffs applied to non-taxing countries. It has been argued, however, that such approaches could be disadvantageous to a target country as a trade measure.[224]

The use of individual environmentally related tax instruments has been growing in popularity.[225] As such, in 2011 South Africa is expected to set in place the most comprehensive carbon tax regime in the world.[226] The tax will initially be charged on all new cars and light commercial vehicles. Buyers will pay a preset amount (likely R75) for each g/km of $C0_2$ emissions above a threshold of 120g/km, the lowest threshold in the world, which will lead to the expected price increase of about two and a half percent. A carbon tax regime is already implemented in Denmark (as indicated above) and the possible introduction of carbon taxes is also being discussed by the governments of many other countries, including the Republic of South Korea, Japan, and others.

Moreover, some countries have chosen to institute a wide spectrum of fiscal pricing measures (known as tax reforms) restructuring the tax system whereby the tax base is shifted from traditional taxes, such as those based around labor, to taxes that have environmental relevance. Three progressive tax reforms that have attracted a large number of countries include: environmental tax reform (ETR), environmental fiscal reform (EFR), and more recently Green Tax and Budget Reform (GTBR). They are discussed in more detail below.

Environmental Tax Reform (ETR)

Many countries have adopted the concept of ETR since the late 1980s to address issues related to resource productivity and economic progress.[227] ETR is the process of shifting the tax burden from employment, income and investment, to pollution, resource depletion and waste, for example taxing pollution or natural resource extraction.[228]

While ETR can greatly help internalize the negative external social and environmental costs not usually reflected in market prices, it does not address the problem of subsidies, which can also distort prices. Thus, environmental fiscal reform (EFR) has entered the foreground of sustainable development policy dialogues.

Environmental Fiscal Reform (EFR)

The EFR is a critical element of policies related to sustainable development. Indeed, it extends beyond ETR, since it also modifies subsidies, redirecting them from environmentally negative activities and products, such as petroleum, to more environmentally friendly ones, such as RE.

According to the OECD, EFR refers to "a range of taxation and pricing measures which can raise fiscal revenues while furthering environmental goals."[229] These measures apply to both environmental and fiscal policies, and are adopted in developed and developing countries, and those in transition. Although the concept may apply universally, the rationale for implementing EFR differs in countries at various stages of development; and, its design depends on economic, social, institutional and political conditions, and particularly, on the policy objectives when it is launched.

In developed countries, EFR includes a *tax shifting program*.[230] In several EU member states, these involve the principle of *revenue neutrality*—where the increased revenues from the environmental tax are offset by a reduction in other taxes or charges.

As governments recognize that incentives stimulate green growth, they are reshaping policies and fiscal instruments to promote green business. Thus, most have incorporated green components in their budgets. In the fiscal year 2009, green stimulus measures accounted for 16 percent (US$521 billion) out of total national stimulus measures of US$3.2 trillion.[231]

Green Tax and Budget Reform (GTBR)

The GTBR is the third stage in the evolution of environmental tax reform. GTBR refers to a wide range of fiscal pricing measures that could simultaneously increase revenue and foster green growth. It entails: (i) shifting the tax burden from traditional areas such as income, savings, and capital gains, to environmentally relevant products and activities like fossil fuels and waste; and (ii) redirecting subsidies from environmentally negative activities towards those that promote green growth and reduce poverty. The entire reform of the fiscal system has the aim of maintaining revenue neutrality: a net-zero increase in the level of taxes.

GTBR includes all the major principles of EFR but expands the scope to include poverty reduction objectives. In 2005, at the 5th Ministerial Conference on Environment and Development in Seoul UN Economic and Social Commission for Asia and Pacific (UNESCAP), member countries accepted GTBR as a way to achieve green growth.[232] GTBR's fiscal instruments are applied in areas such as transportation, raw materials, natural resources, waste, and energy, which can create jobs, reduce poverty, and at the same time improve resource productivity, international competitiveness, and environmental quality. In addition to reallocating revenues from subsidy reform and green taxes into development programs designed to help the poor, tax brackets need to be designed so as to reduce any negative impact on lower income groups. To ensure the measures are accepted and adopted over the long term, the public should be educated about GTBR's benefits.

Many experts believe that green taxes can be effectively imposed in various areas—e.g. transport, energy, consumer products, waste, raw materials, and natural resources—and as such, are effective tools of environmental policy.[233] The OECD also believes green taxes are more cost-efficient to implement and maintain than traditional[E] regulatory approaches.[234] Revenue from green taxes can be used to finance sustainable infrastructure projects that can increase green jobs, monitor and adjust the reformed tax system, or for other programs designed to reduce poverty.

Tradable Permit Schemes

A recent paper by the APEC panel of experts on green finance[235] noted that tradable permit schemes offer excellent prospects to tackle environmental problems, as they can reduce pollution levels at the least cost to society. Tradable permit schemes apply a price to pollution and allow consumers and producers to select the most cost-effective abatement options, both in the short- and long-run, ensuring the achievement of environmental targets by specifying the quantity of total allowed emissions. Further, as has been seen, tradable permit schemes leave room for the intervention of different environmental groups that can purchase tradable permits reducing the supply of permits available for trading, therefore driving the price up and broadening the effect achieved by the scheme.

In addition, tradable permits is an example of self-financing mechanism for firms as emission reductions can be financed through the sale of emission reduction credits. Tradable permit schemes work best in competitive markets when the price of pollution is applied as broadly as possible.[236] In order to achieve high efficiency of the tradable permit scheme there must be low transaction costs, a strong compliance regime, and legally secure and transparent rights over permits. Specific design of the scheme may depend on the policy goals and local conditions, but it is widely believed that the more targeted the scheme and the greater certainty regarding future legislation, the higher the efficiency gains.[237]

However, tradable permit schemes can become inefficient when the initial permits' allocation (through auctioning or otherwise) among emitters is sub-optimal or when perverse behaviors are enacted. Further, complete coverage may not be possible, given difficulties such as the cost related to measuring how much companies are polluting as well as political considerations. When some polluting sources cannot be (or are not) included, complementary measures, including regulations where necessary, could be adopted to avoid unnecessary distortions and reduce pollution in non-covered sectors.

For the schemes to succeed, they must be designed in a way that is consistent with a politically feasible and equitable distribution of costs. For example, some tradable permit schemes will negatively affect various polluting industries and their employees (along with their households), who may subsequently lose their jobs. When this occurs, governments may need to offer assistance. Other implementation difficulties such as measurement costs can be overcome if the schemes are well designed.

Some propose that permit schemes be divided into credit programs and cap-and-trade systems.[238] The APEC expert panel[239] classified tradable permits into five groups: cap and trade, baseline and credit, voluntary offset schemes, white certificates (energy efficiency) and green certificates (green energy).

- **Cap and trade programs.**[F] Set a binding cap (limit) on the amount of pollution that can be emitted by a company during each compliance period. Countries set these limits, which may be adjusted to achieve specific environmental objectives. A cap and trade scheme provides an opportunity to reduce pollution at the least cost to society. Moreover, it can also reduce the longer-term costs of reducing pollution by providing a price signal and thus alter the relative payoffs of more- or less-polluting durable assets. However, a government's commitment to follow through is key to a program's success.
- **Baseline and credit programs.** The schemes can reduce the amount of pollution by rewarding firms and projects that lower their levels beneath the predetermined base with permits that equal the difference between their actual emissions and the base. Those that fail to meet the level will be required to purchase permits or pay a non-compliance penalty. Governments set a baseline level of pollution to which all regulated firms or projects must adhere (in all sectors). Projects that can reduce large volumes of GHGs relative to the baseline are more likely to attract investors and carbon asset buyers.[240] Also, in most cases, firms that receive permits will be able to sell them to those with a permit shortfall—which pollute more than their allowable cap as set by the permits they hold.
- **Voluntary offset schemes.** These schemes are variations of the baseline and credit scheme. An emissions baseline is established and permits are issued to voluntary participants which launch a project that reduces emissions beyond

that level. Because the scheme is voluntary, companies are not penalized for polluting more than the permits they hold. However, a voluntary offset scheme may be linked to a mandatory cap and trade or baseline and credit scheme. This would occur if permits issued under the voluntary scheme were recognized for the purpose of compliance in the mandatory scheme.

- **Tradable white certificate schemes.** These schemes are also variations of the baseline and credit schemes. Some groups (typically large energy suppliers) are required to introduce EE measures for consumers. The quantity of such measures that each entity must produce is often determined as a proportion of its energy sales. Firms can meet their individual quotas by relinquishing white certificates that are issued for each unit of eligible energy savings that exceeds an agreed-upon baseline. At the end of every compliance period, each entity must relinquish enough of its white certificates to meet its quota or pay a penalty. Governments may introduce a white certificate scheme to promote EE measures that can reduce GHGs and energy bills, or increase energy security by reducing demand.[241]
- **Tradable green certificate schemes.** This is another type of baseline and credit plan to encourage the production of green energy. In this case, governments must specify green energy quotas and the responsibility for meeting them can be applied as a proportion of total energy consumed anywhere in the supply chain—e.g. at the producer, supplier or consumer level. Entities that generate green energy above their quota receive permits, while those that do not are required to purchase certificates or pay a penalty.

Further, a publication by NERA Consulting provides specific discussion of green and white certificates schemes and their interaction with ETS. It notes that, under certain conditions, the schemes could yield even greater CO_2 reductions or might lower the cost of meeting the CO_2 cap.[242] Table 6 gives examples of the ETS schemes.

Table 6: Examples of ETSs in operation

Governmental unit	Name of ETS	Target pollutant(s)	GHG	Target organizations
International ETS				
European Union	EU-ETS	CO_2, CH_4, N_2O, HFCs, PFCs, SF_6	Yes	Electricity generation and energy-intensive industries
Country-Based ETSs				
United Kingdom	CRC Energy Efficiency Scheme	Energy-based CO_2	Yes	Large organizations with high energy consumption (although exempts those covered by Climate Change Agreements or the EU-ETS)
Sub-National ETSs				
Northeastern and Mid-Atlantic, United States	Regional Greenhouse Gas Initiative (RGGI)	Energy-based CO_2 from power plants	Yes	Electricity generators
New South Wales, Australia	Greenhouse Gas Reduction Scheme (GGAS)	GHGs from electricity production	Yes	Energy producers and highly energy-intensive users

(Table continues on next page)

Table 6 (continued)

Governmental unit	Name of ETS	Target pollutant(s)	GHG	Target organizations
City-Based ETSs				
Los Angeles, United States	Regional Clean Air Incentives Market (RECLAIM)	Nitrogen Oxides, Sulfur Oxides	No	Facilities emitting more than 4 tonnes a year of either gas.
Chicago, United States	Emissions Reduction Market System (ERMS)	Volatile Organic Materials (VOMs) (particularly tropospheric ozone)	No	Stationary sources emitting more than 10 tonnes per season (2 seasons per year)
Santiago, Chile	Emission Offset Program of Supreme Decree No. 4	Total Suspended Particles (TSP)	No	Stationary combustion sources with a rated exhaust gas flow rate greater than 1,000 m3/hour

Source: Cities and Climate Change Mitigation: Case Study on Tokyo's Emissions Trading System, the World Bank, 2010.[243]

Additional improvements in the efficiency of tradable permits schemes, market liquidity, and reduction in implementation and compliance costs may be achieved by establishing links between different tradable permit systems.[244] Recently, the possibility of linking systems (like cap-and-trade) to each other and to emission-reduction-credit systems such as the CDM has generated considerable interest. A linkage could promote the near-term goals of participation and cost-effectiveness, while helping to build the foundation for a more comprehensive future agreement to address global climate change. To establish a direct linkage between two systems, either one or both systems must accept the other's allowances or credits as valid.

Some linkages have already been established among tradable GHG permit systems. The EU ETS can be viewed as a multilateral linkage among the systems of its own member states, where a central authority enforces the harmonization of certain characteristics of each system, and where allowances issued by any member state are recognized by all participating governments. Also, through its Linking Directive, the European Commission has allowed EU ETS participants to use CDM CERs to meet compliance obligations beginning in 2005, and Joint Implementation Emission Reduction Units (ERUs) beginning in 2008.[245] As a result of these linkages, EU ETS allowance prices are considered a major factor influencing CER prices, and—to a lesser extent—ERU prices. However, the Directive places restrictions on these linkages. CERs and emission reduction units generated from nuclear facilities, land use change, and forestry activities are not recognized by the EU, and quantitative limits are placed on the use of CERs and ERUs.

Voluntary Emission Trading Schemes

Just as companies with mandatory GHG emission targets can potentially meet some of them by buying emission reduction credits (if a cap and trade market exists), those with voluntary targets can also meet the requirements by purchasing verified emission reduction (VER) credits under a voluntary offset scheme. VER credits are similar to certified emission reduction (CER) credits, but differ in that they do not meet all the requirements of the Kyoto Protocol and thus cannot be applied to mandatory targets—unless they are upgraded to CER status. Nevertheless, they may be accepted towards meeting voluntary targets, particularly if the *Gold Standard* methodology[G] is utilized to verify the VERs.[246]

As more voluntary programs are created, the potential economic gains from trading VER credits will grow and thus achieve environmental goals at lower overall costs. In 2009, Japan's Ministry of the Environment reported that Japan's Voluntary Emissions Trading Scheme (JVETS) has achieved its targets in the first two years of its program.[247] Now the experience with JVETS as well as with the mandatory city-wide Tokyo ETS program is intended to be leveraged into a country-wide mandatory emission trading program.

However, some controversy is associated with voluntary programs, as in some other countries the voluntary ETS have been less successful. For instance, although Australia's *Greenhouse Challenge* program has succeeded in the stabilization of CO_2 emissions of program participants, the effect on the country's overall emission is quite marginal. Moreover, some argue that the *Greenhouse Challenge* may have detracted from the efforts of assembling more comprehensive regulations. Similarly, Mexico's voluntary agreements with tanneries, which sought to limit the release of waste, had only minimal success, mainly because of ineffective enforcement and little threat from regulators. Essentially, authorities could not impose any mandatory regulations (when tanneries ignored their voluntary commitments), which removed a key incentive for compliance.[248]

Nevertheless, the voluntary carbon markets are quite active. According to the 2009 Bloomberg NEF report *Building Bridges*,[249] businesses reported that 93.7 $MtCO_2e$ (millions of tonnes of CO_2 equivalent) valued at US$387.4 million were transacted in various voluntary carbon markets during 2009. The largest volume occurred in the over-the-counter (OTC) market (54 percent), while most of the remainder was on the Chicago Climate Exchange (CCX) (45 percent, or 41.4 $MtCO_2e$). The volume-weighted average price of a voluntary carbon credit on the OTC market declined from US$7.3/$tCO_2e$ in 2008 to US$6.5/$tCO_2e$ in 2009, still 5 percent above 2007 prices. In contrast, CCX average prices declined from US$4.4/$tCO_2e$ in 2008 to US$1.2/$tCO_2e$ in 2009. In total, the OTC market value only declined by 22 percent, while the CCX value dropped by 84 percent.

While other exchanges are still contributing only marginally to the overall market, their number is increasing and the role is becoming more important. Recently Taiwan (ROC) proposed a GHG reduction plan that would include VER trading.[250]

However, many of the constraints that impede cross-border trading in mandatory schemes also apply for regional trading in VER credits. Thus, national voluntary markets would need to be linked with those in other countries in order to increase their breadth and efficiency.

Tradable Permit Schemes in the East Asia Region

Tradable permit schemes in East Asia are not as widespread as regulatory approaches. Apart from the implementation difficulties, such schemes appear to be more expensive because their costs are direct and more obvious than those of regulations. In general, these schemes tend to operate outside Asia, as illustrated in Table 7.

In the last few years, several new programs have been proposed, with Asian countries now taking the lead (see Table 8). It should be noted, however, that most initiatives are still at the proposal stage.

Price of Carbon

Increasing the price of carbon is a necessary condition to reduce GHG emissions through four different means. Firstly, it would translate into a higher degree of consumer aware-

Table 7: Existing tradable permit schemes in the APEC region

Country	Program	Type	Description
Australia	Renewable energy scheme	Green certificates	Certificates are issued for each kWh of electricity produced from renewable sources. The certificates can be traded to help energy suppliers meet their RE targets
	NSW greenhouse abatement scheme	Baseline and credit	Large consumers and electricity generators in New South Wales (NSW) are required to purchase greenhouse abatement credits
Canada	ODS allowance trading	Cap and trade	Trading of ozone-depleting substances (ODS)
Chile	Santiago air emissions trading	Cap and trade	A system of tradable permits for total suspended particulates (TSP) from stationary sources in the Santiago area
Japan	CO_2 emission trading	Cap and trade	In April 2010, Tokyo introduced its own city-wide cap-and-trade program
Mexico	CFC tradable permits	Cap and trade	A system of tradable permits for chlorofluorocarbons (CFC)
New Zealand	CFC import permits	Cap and trade	This applies to CFC, with the cap based on the Montreal Protocol, and trading allowed between permit holders
Singapore	ODS permit trading	Cap and trade	The ODS permits are allocated through auction and at no charge
The United States	Acid rain reduction	Cap and trade	This program regulates SO_2 emissions
	CFC trading	Cap and trade	This applies to CFC production, and is combined with a CFC tax
	Emissions trading	Baseline and credit	A credit program operates for VOCs, CO, SO_2, particulates and NO_x, allowing firms to employ netting, offsetting and banking[H]
	Lead trading	Baseline and credit	This program functions the for lead-content of gasoline among U.S. refineries, with inter-refinery trading of lead credits allowed

Source: Green Finance for Green Growth. Track 4: Development of Green Finance through Other Market-Based Instruments, APEC, 2010.[235]

ness. On a daily basis, consumers might use high-carbon goods and services more sparingly. Simultaneously, consumers could pay more attention to eco-friendly alternatives. Secondly, it would also increase producer awareness towards low-carbon inputs. For example, producers could consider electricity produced from wind rather than one of its higher carbon counterparts, such as coal. Thirdly, high carbon prices provide incentives for investments in clean technology, which could potentially reduce the number of carbon-based technologies in the long-term. Accordingly, it is important to introduce a price floor to ensure that the price of carbon does not fall below a set level. Finally, spillover effects can help spread information across interconnected sectors and markets and, therefore, benefit the three above-mentioned mechanisms. Within this context, establishing sound carbon pricing policies represents a strong signal towards a global low-carbon growth path.

The strength and financial significance of the tradable permit schemes rely on well-functioning carbon markets as well as firm and predictable carbon prices. However, the schemes' credibility and reliability may suffer if disconnection arises between carbon prevalent *market price* and an effective abatement price paid for CFT technologies (that

Table 8: Proposed tradable permit schemes in the APEC region

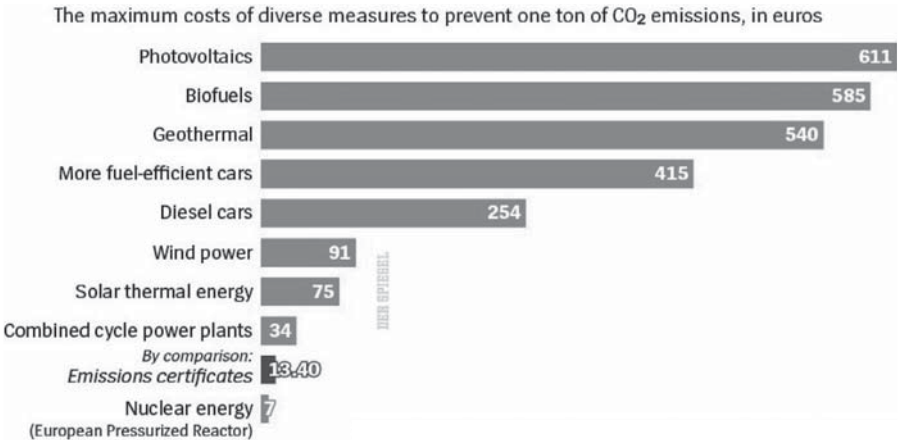
Country	Program	Type	Description	Status
Australia	Carbon pollution reduction	Cap and trade	Covers 1,000 of the largest emitters and approximately 75% of national GHG emissions	Rejected twice by the Senate and in 2010 was shelved until at least 2013
Canada & the United States	Western climate initiative	Cap and trade	Region-wide caps on GHG emissions with 4 Canadian provinces & 7 U.S. states participating	To begin in 2012
China (PRC)	Energy intensity trading[i]	Baseline and credit	An energy intensity trading scheme in Tianjin began in 2010	Pilot trades conducted in February 2010
Japan	Carbon emissions	Cap and trade	Nationwide program approved by the Cabinet	National bill not yet passed by the Diet
Mexico	Domestic trans-sector cap-and-trade	Cap and trade	The program places a cap on GHG emissions; it will start by targeting the three largest carbon emitters and may eventually link with carbon markets in U.S. and Canada	To be launched by 2012
New Zealand	Emissions trading (NZ ETS)	Cap and trade	For all GHG gases covering all sectors	Operating since 2008, but some economic sectors have not yet joined
The Republic of Korea	Emissions trading	Cap and trade	Covers most CO_2 emissions and may be linked to bigger markets, such as China	Trading likely to start in 2012[251]
Taiwan	GHG emissions	Cap and trade	The final stage of the GHG reduction program, with a cap on emissions	Bill passed by executive but not yet by legislature
The United States	Waxman-Markey Bill	Cap and trade	Program on nationwide GHG emissions	Abandoned[252]

Source: Green Finance for Green Growth. Track 4: Development of Green Finance through Other Market-Based Instruments, APEC, 2010.[235]

internalizes the cost of externalities). Thus, if the incremental cost of abating a unit of the emission (*shadow price*) is noticeably higher than the current trading price of the unit of emission reduction, the rational investor may not be willing to invest in CFT project. Most recently, the trading price for CERs almost collapsed due to uncertainty about the continuation of the Kyoto Protocol. At the same time, schemes such as feed-in-tariffs establish the carbon abatement cost (*shadow price*) at much higher levels.

One study found that the price of carbon, which can be set either through mandatory cap and trade schemes or the voluntary market, is significantly lower than what consumers effectively pay for a tonne of carbon saved through FiT-based CFTs. For example, in Germany when the FiT is calculated for photovoltaic (PV) technology, it results in a shadow price of roughly €716—this is how much it costs rate-payers to prevent one tonne of CO_2 although the IEA estimates the cost to be even higher, around €1,000 per tonne.[253] In the short-run, this may appear high, since the EU ETS market price for CERs has never exceeded €30 per tonne. Indeed, the study stresses that bridging the financial gap in order to support low-carbon technologies places a tremendous financial burden on consumers.

Figure 1: Cost of cleaner energy



Source: The Expensive Dream of Clean Energy, Spiegel, 2009.[254]

A similar disadvantage with other CFTs, and especially RE technologies, is revealed when their abatement costs are calculated (see Figure 1). However, when government actions to reduce CO_2 emissions are evaluated, researchers should adopt a much broader view—one that includes the (i) long-term impact on the PV upstream industry development, (ii) increase in PV production internationally (e.g. a great many panels installed in Germany are manufactured in China), (iii) remarkable progress in R&D, and (iv) substantial job creation.

Social Cost of Carbon (SCC) can be considered as a benchmark when assessing the magnitude of the shadow and market prices. The SCC is estimated as the present value of the total damages inflicted globally when a marginal unit of carbon is emitted into the atmosphere and resides there for its nominal 100-year lifetime.[255] A number of independent studies have attempted to estimate the SCC.[256, 257] In a series of research publications (2005 and 2008), Richard Tol prepared a compilation and summary of results of most of the available SCC estimations.

In 2005 Tol reported on the 28 studies containing 108 different estimates and concluded that the median price of carbon was US$14/tC ($3.82/tCO_2), the mean US$93/tC ($25.36/tCO_2), and the 95 percentile US$350/tC ($95.45/tCO_2).[258] Having looked at the present value of the damage cost and varied discount rate, he further concluded that "one can therefore safely say that, for all practical purposes, climate change impacts may be very uncertain but is unlikely that the marginal damage costs of carbon dioxide emissions exceed US$50/tC [$13.63/tCO_2] and are likely to be substantially smaller than that." In Tol's updated study of 2008, he reported on 211 independent estimates from 41 studies of the SCC and shows that the renewed mean and median values are slightly lower.[259]

The most likely initiative to reduce CO_2 emissions will be the one that has the least cost of CO_2 abatement—*marginal cost.* Thus, actions must be created that can reduce emissions at a lower price (than the SCC incurred). The 2007 Stern Review on the Economics

of Climate Change[260] estimated that with respect to the economic costs linked to climate change and the costs/benefits of actions to reduce GHGs, the global cost of actions to alleviate climate change was US$18–US$44 per tonne of CO_2.[261] Based on these numbers, the UK's various programs impose a burden of about US$28 per tonne of CO_2 produced in electricity generation.[262] If these funds were used to adopt measures to curb CO_2 emissions, UK authorities might produce dramatic results.

Property Rights (Market Creation)

The OECD defines *market creation* as a process of assigning or clarifying property rights over environmental inputs or outputs.[263] Thus, when owners of environmental goods and services (such as forests) are granted secure property rights over these resources, it provides them with incentives to maximize the benefits from their use over time, rather than over-exploit them for short-term gains. The concept (of market creation) has merit and should be pursued, despite implementation difficulties, such as who is assigned the property rights, along with enforcement issues.

One approach to market creation would involve restructuring the electricity sector. This would create a market because the process would change the nature of property rights (effectively clarifying them). It can occur in several ways: (i) the electricity market could be deregulated and privatized to make it more competitive, (i.e. remove regulations that give state-owned power companies the exclusive right to sell electricity to the power grid); and (ii) incentives could be provided for generating electricity from renewable sources through mechanisms such as feed-in-tariffs (FiT) and renewable portfolio standards (RPS). Under the RPS, electricity grid operators must purchase a certain fraction (quota) of their power from RE sources, with the price set by market forces. Under the FiT, firms and households may sell any excess electricity they generate back to the grid at a guaranteed price that is higher than current tariffs imposed by their local electricity provider—which should promote more RE sources.

In 2001, Malaysia followed this course. Since then, power generated from renewable sources has been distributed through the national grid under long-term contracts.[264] See Table 9 for other examples of market creation.

Table 9: Examples of market creation

Market	Description	Economic & environmental effectiveness
Electricity restructuring—privatization and deregulation	Makes the electricity market more competitive e.g. by privatizing state utilities	Economic: Greater competition can make the electricity market more efficient by providing strong discipline to investment and operation decisions on market prices for fuels and technologies Environmental: Favors innovation which can lead to cleaner technologies. Also, a more flexible electricity market increases the effectiveness of other market-based instruments, although it may reduce prices and increase consumption with potentially adverse impacts
Electricity restructuring—FiTs and RPS	Provides incentives for producing electricity from RE sources	Economic: Through potential economies of scale in generating renewable electricity, these policies can lower costs and produce long-run returns. The difficulty for policy makers is to know which technologies to back. Since they favor certain technologies, to the detriment of others, they can create costly market distortions Environmental: Reduced pollution from fossil-fuel power plants. However, they can increase the cost of achieving desired environmental outcomes

Source: Based on Green Finance for Green Growth. Track 4: Development of Green Finance through Other Market-Based Instruments, APEC, 2010.[235]

Privatization of the electricity industry carries the risk that private power companies will be less concerned about environmental issues than state-owned firms, particularly with regard to using RE.[265] FiTs and RPS counter this risk but raise implementation issues.

For example, authorities must determine the length of time subsidies should support higher RE costs, the extent of government support (particularly with FiTs) and distribution costs, and the amount that consumers should be compensated for having to pay higher electricity prices. Also, while FiTs encourage low-emission technologies, they may ignore other options to reduce emissions, e.g. promoting wind energy at the expense of switching from coal (with high emissions) to gas (with lower emissions).

Notes

[A] Cornerstone funds are equity-focused public financing mechanisms that are structured as "funds of funds" that invest in a number of commercial managed funds, each of which then invests in projects or companies. The cornerstone funds approach can be very catalytic, leveraging private capital both into the fund itself and later into the investments that the fund makes.

[B] Challenge funds are public financing mechanisms that are aimed at projects or companies that have the potential to overcome a particular challenge. Normally, the challenge fund would solicit proposals from organizations and institutions working in the targeted field and select the projects that best meet the objectives. A key feature of the challenge fund mechanism is the sense of competition that is created among the organizations involved.

[C] A tax that reduces pollution and raises revenue that is used to cut distorting taxes (such as income tax) and thus reduce the efficiency loss due to distortive taxation.

[D] Carbon leakage is defined as the difference between the increase in CO_2 emissions outside the countries taking domestic mitigation action and the reduction in the emissions of these countries.

[E] The OECD refers to regulatory approaches with the term *command and control.* These controls have traditionally outlined limits and/or approaches for specific industries. These can take the form of emission intensity limits, technology ordinances, or absolute emission limits. They are typically directed at individual industries or specific product characteristics and with the focus usually being on the larger operators.

[F] For a detailed explanation on how cap and trade schemes work, please visit www.carbonfinance.org.

[G] Gold Standard is a methodology specifically designed to assess and certify the sustainability performance, and especially the environmental integrity, of potential CDM/JI projects. Gold Standard helps ensure that carbon credits are not only real and verifiable but that they make measurable contributions to sustainable development worldwide. The Gold Standard is the world's only independent standard for creating high-quality emission reductions projects in the CDM, JI and voluntary carbon markets.

[H] Netting allows for emission reductions anywhere in the firm to count towards its overall reduction requirement. Offsetting is when firms can subtract the extent of new emissions (i.e. those from new sources) by reducing existing emissions. Banking is when firms *store* earned emission credits, either for future internal expansion or for sale to other firms.

[I] The amount of energy required to produce one unit of GNP.

CHAPTER 5

Regulations and Monitoring Programs

For policies to be effective, they need to be supported by adequate regulations and credible monitoring, reporting and verification systems (MRV). Two regulatory instruments are liability rules and information standards and programs.

Liability rules hold entities legally responsible for their environmental footprint. These rules tend to be country-specific and their success depends very much on the effectiveness of the judicial and enforcement systems.

Standards and information programs, such as product labeling, best practice guidelines and technical information, reporting requirements and energy auditing, are the foundation for the information system of each country. In the EAP countries, shared information programs can also benefit green infrastructure financing.

MRV systems should support economic instruments that are consistent with national regulatory and fiscal policies and international climate finance policies. Lessons from developed countries (e.g. the EU ETS, Tokyo ETS system, City GHG inventories, green or carbon taxes) are instructive, although the policy and institutional capacities differ. While verification would be difficult in most developing countries—since they lack incentives to collect accurate statistics—public disclosure systems such as the one developed by Indonesia's PROPER and some schemes in China could be replicated in other developing countries.

Liability Rules

Liability rules hold polluters accountable for environmental damage from their activities. Thus, the rules force companies to consider the impact of the cost of environmental damage to their bottom line. However, implementing such rules is more effective in countries with well-functioning judicial systems; even more important is the effectiveness of the enforcement system, particularly when it can be co-opted through corrupt practices.

In designing liability rules, governments must consider how they should be imposed, including to whom they should be applied, how far into the future the rules should extend, if they should apply retroactively, and the extent to which polluters are liable (see Table 10 for examples). A key problem in implementing them is accurately measuring the extent of environmental damage that can be linked to any given firm.

Table 10: Examples of liability rules for environmental protection

Country	Description of liability rule
China	The revised Tort Liability Law (July 1, 2010) brought major changes in liability standards for cleanup of hazardous substances, including the imposition of strict liability for disposal of such substances, shifting the burden of proof in pollution cases, and the enunciation of standards by which liability for contamination is allocated among those responsible for pollution[266]
Indonesia	The 1997 Environmental Management Act sets strict liability for release of hazardous and toxic materials[267]
Japan	Covers damage from environmental accidents and illegal disposal of waste
Singapore	The Merchant Shipping Act covers civil liability and compensation for oil pollution from shipping[268]
The United States	Firms are liable for cleanup costs/damages caused by waste disposal, oil spills and those of hazardous substances

Source: Compiled based on Green Finance for Green Growth. Track 4: Development of Green Finance through Other Market-Based Instruments, APEC, 2010.[235]

Information Standards and Programs

Information programs can change behavior patterns with respect to consumption and production, and can consolidate the collecting and processing of data relevant to many market participants which can ultimately help them reduce costs. Such programs can encourage companies to offer or better promote greener products when it is economically rational to do so. For example, information about EE ratings would help consumers make more informed decisions on many consumer durable products' lifetime costs—as opposed to only upfront costs.

Interestingly, a recent study shows that consumers' perceptions about the cost savings related to the EE of various appliances is largely inaccurate. In a recent U.S. survey, 505 participants reporting on what they thought was the most effective energy conservation strategy said turning off lights or driving less were more effective than what could be gained by installing more efficient light bulbs and appliances.[269]

In another survey by the same authors, 15 activities were reviewed to assess consumer perceptions with regard to energy use and savings. The findings showed that participants significantly underestimated their energy use and savings, recording small over-estimates for low-energy activities and large under-estimates for high-energy consuming activities. The disparity was more pronounced with the latter. Interestingly, the participants who indicated they attempted to conserve energy had less accurate perceptions. These results suggest that well-designed efforts to improve public understanding of energy use and savings could have substantial benefits in promoting more EE products and services.

Many information programs are simple to design and implement, and should be pursued where possible. For instance:

- **Product labels** inform consumers about EE—usually on electrical appliances—and environmentally-sound goods;[270]
- **Best practice guidelines** and technical information provisions can be made widely available and help governments to close information gaps. Also, governments can publicize results from trials on ways households can adopt pro-green practices;[271]
- **Reporting on the environmental risks** and impacts from the activities can be required of firms;

- **Energy audits** assess the level of EE of a wide variety of products and equipment and can provide practical and cost-effective ways to conserve energy. Information from EE audits is often used to promote energy-conservation programs.

Information needs to be accurate, easy to access, inexpensive, user-friendly, and current.[272] It must also be well publicized and continue throughout the time needed to actually change behavior patterns.

Availability of climate-change related information varies among countries,[273] however information and communications technology (ICT) can help narrow the gaps worldwide, since ICT raises awareness at grassroots levels about mitigation and adaptation strategies, fuel consumption, etc. ICT can also empower affected groups to hold elected politicians accountable for taking concrete actions.

It is widely believed that ICT will be important to EE and RE industries.[274] Beyond providing consumers with important information that can affect their behavior and decisions, ICT can also play a significant role in automation of appliances and the electric grid and more efficient control of use of natural resources.[275] Systematic integration of ICT such as community radios, mobile phones, knowledge centers and interactive media can help communities reduce climate change vulnerability and risk. ICT has demonstrated its value in networking within and across specific sectors (education, health, governance, and sustainable livelihoods, etc.).

Several attempts have been made to establish an information sharing platform across East Asia and other countries. For example, based on participants' responses, a common database—*Compendium of Energy Efficiency Policies of APEC Economies*—was produced.[276] Examples of various information programs in APEC region are provided in Table 11.

Table 11: Summary of selected information programs

Program type	Countries	Comments
Product labeling	Australia, Canada, China, Indonesia, Japan, Singapore, Taiwan, Thailand, U.S.	Energy-efficient labels are used in the U.S. and Australia, while the rest use environmental labeling
Best practice guidelines and technical information	All	Organizations whose focus is meteorological issues are producing information pertinent to the renewables' industry; schemes are emerging to create revolving funds to support programs (e.g. Indonesia's proposed geothermal exploration fund)
Reporting requirements	China, Indonesia, U.S., Philippines, Vietnam, Mexico	Public disclosure programs in Mexico, Philippines and Vietnam were modeled on one in Indonesia
Energy auditing	Australia, Canada, China, Japan, Mexico, South Korea, Singapore, Taiwan, U.S.	One example is China, where energy audits of enterprises diagnose the levels of consumption, identify problems, analyze the conservation potential and make suggestions that could help enterprises improve EE

Source: Compendium of Energy Efficiency Policies of APEC Economies, Asia Pacific Energy Research Centre, 2010.[109]

Monitoring, Reporting and Verification (MRV)

The Kyoto Protocol introduced emission MRV system in order to create a mechanism to systematically verify emission reductions. Since then the role and importance of the MRV has increased.[277] In 2007, the members of the 13th COP in their Decision 1/CP.13

adopted the Bali Action Plan.[278] Among other actions, the Plan focused on the importance of developing and transferring technologies to support mitigation and adaptation activities, as well as measuring, reporting and verification of the findings (MRV).

Any type of emission trading system would rely on MRV to determine real progress (so as to monetize carbon credits). The MRV, therefore, is an essential component of any carbon finance mechanism, and the MRV term is used in a broader context that goes beyond the Kyoto Protocol and includes any type of market-based emission control or trading mechanisms. Strong, consistent MRV frameworks provide transparency, help build trust, establish commitment to mitigate climate change and track global emissions, and are vital to a comprehensive and credible international or domestic climate regime.

UNFCCC MRV

Many MRV provisions for GHGs were developed under the UNFCCC, including the accounting of Kyoto Protocol units, mitigation measures, and financial and technology commitments.[279] The provisions and requirements differ depending on (i) the types of commitments and (ii) whether they are applied to Annex I or non-Annex I parties. For example, while Annex I parties of the Kyoto Protocol must annually submit detailed inventories on all six GHGs, non-Annex I parties report on only three GHGs and in a more relaxed manner.

The UNFCCC MRV system is often criticized for using imperfect metrics to assess emissions. The often-used example is HFC-23 gas destruction projects. Of 2,000 project registered under the CDM, 19 HFC-23 projects account for more than half (51 percent) of all CERs,[280] but recent investigations revealed that, through loopholes in the system, some CDM projects intentionally increased the amount of HFC-23 waste gas produced in order to maximize the available CDM benefits. This has likely resulted in millions of carbon credits being issued with little benefit to the climate.

Further, one of industry's main concerns is the way in which the internalized costs of emissions are shared—since many believe the carbon burden should be extended to the developing countries (beyond the Kyoto Protocol) as well. This could be done either by introducing carbon costs in these countries or making CO_2 border adjustments.

MRV-like Methodologies

An ability to measure and obtain accurate quantitative information is vital with respect to at least two types of initiatives: (i) those that aim to optimize energy production, transmission, distribution, and consumption, so as to conserve energy, and (ii) those that aim directly at GHG reduction and require GHGs measurements and estimation of the environmental footprint of goods and services. The following are examples of successful efforts in both areas.

1. **Energy-conserving initiatives**
   - **Urban metabolism analysis.**[281] This analysis quantifies the overall flow of energy, water, materials and waste in and out of an urban area. It provides comprehensive information about the health of a city with regard to EE, recycling, waste management and the effectiveness of infrastructure. Following Abel Wolman's 1965 analysis of a typical American city's urban metabolism, similar studies were conducted for several cities around the world. Comparisons between cities show how factors such as the spatial form of the area, groundwater withdrawals, urban heat islands, nutrient cycles and material

supplies affect the metabolism. Some suggest that the degree to which cities have circular rather than linear metabolisms[A] is a measure of their sustainability.

- **Rapid Assessment Framework (RAF).**[282] This framework presents a quick sectoral analysis on a city's energy use. It prioritizes sectors with significant energy savings potential, and identifies appropriate interventions which can be used to improve EE. The RAF covers six sectors—transport, buildings, water and wastewater, public lighting, solid waste, and power and heat. It is a simple, low-cost, user-friendly, and practical tool that can be applied under different socio-economic conditions.
- **The Perform, Achieve and Trade system (PAT).**[283] This system from India is a market-based mechanism to improve cost-effective EE in energy-intensive industries, using tradable energy-savings certificates. The PAT differs from other trading schemes in that the carbon reduction targets vary depending on current levels of EE: i.e. the most inefficient facilities must reduce their energy use by a higher amount. Companies that improve their targets are issued *energy savings certificates* that can be traded on power exchanges and the India Energy Exchange. Thus, the trading element serves as a bonus for facilities that exceed their targets.

2. **Emission reduction initiatives**
   - **Program for Pollution Control Evaluation and Rating (PROPER).**[284] Indonesia's PROPER, the first major public disclosure program in the developing world, targeted major industrial water polluters and used a five-color scale to grade their environmental performance. Launched in 1995, it released four rounds of evaluations to the media from 1995–1998. A study by the Resources for the Future organization[285] showed a strong, positive response to the scheme, particularly among firms with poor compliance records, which cut their emissions by about a third and also pursued further reductions afterwards.

     PROPER aims to correct information asymmetries[B] by intensifying interactions among individuals, organizations, financial markets and regulators.[286] By requiring disclosures, the expected costs of non-compliance are increased, through channels that do not directly involve regulations. However, while enforcing traditional regulations is often difficult and expensive, it is critical if policies are to succeed. Thus, disclosure of information can be seen an alternative to other instruments, such as taxes.
   - **GreenWatch.**[287] The *GreenWatch* program was sponsored by the Professional Association for China's Environment (PACE) and developed by the country's environmental protection agency, with technical assistance from the World Bank's Development Research Group. This low-cost program interprets pollution data for the general public, using charts with colors to highlight the cleanest and dirtiest factories. It divides environmental performance into five categories, each represented by a different color—with green the best and black the worst. After rating and color-coding performances, the program sends the information to Chinese-language newspapers and television stations. Some cities also publish the information on their websites.

     After the success of the pilot projects in 22 municipalities, the program was expanded nationally in 2010. Following 10 years of program implementa-

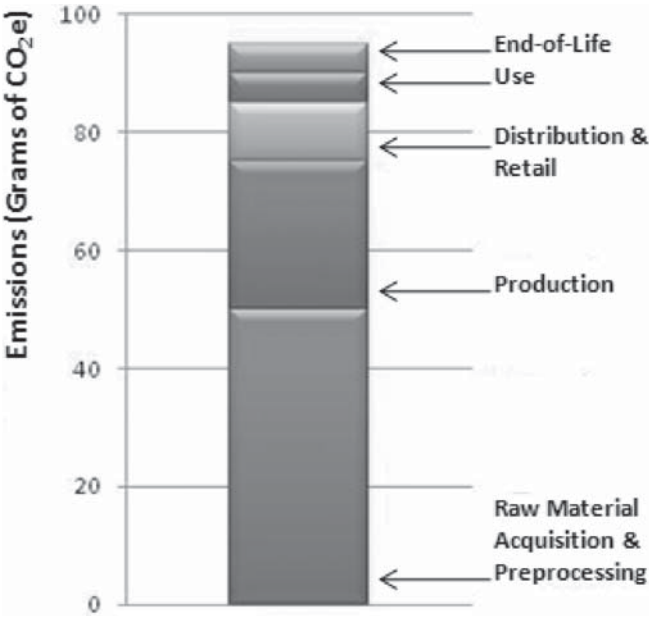
tion, an evaluation found that firms covered by GreenWatch improved their environmental performance more than those that were not covered: e.g. in Jiangsu Province, the percentage of firms with positive ratings (green, blue, and yellow) increased from 83 percent in 2001 to 90 percent in 2006.[288]

- **Climate Disclosure Standards Board (CDSB).**[289] This Board was created at the 2007 annual meeting of the World Economic Forum in response to increasing demands for standardized guidelines for climate change information in mainstream reports. CDSB developed a globally accepted framework, based on existing standards, for corporate reporting on climate change. The Carbon Disclosure Project (CDP) acts as Secretariat to CDSB and, along with members of the CDSB Board, advisory committee and technical working group, promotes the CDSB framework.
- **Factor X by Matsushita Corp.**[290] 'Factor X' created by the Japanese corporation, Matsushita, is a simple ratio of the *improved quality of life* divided by the *reduced environmental impact.* Factor X was introduced in 2003, and by 2005 Matsushita was already measuring and reducing the amount of its carbon emissions and materials, which allowed it to win first place in the Nikkei Environmental Management Survey.[291]
- **Green Procurement.**[292] In general, green procurement refers to consumers using their purchasing power to select (and thus promote) goods and services that minimize environmental impact. This involves decisions that include environmental issues in all stages of the purchasing process—from avoiding unnecessary purchases and identifying greener products, to specifying environmentally conscious targets for contracts and whole-life costing.[C] There are now increasing examples of Green Procurement initiatives being implemented by most of the multinational companies.[293, 294, 295] Among these, however, the London's Green Procurement Code is unique as it combines a support service with an extensive survey that leads to performance targets, sharing best practices and awards.[296]

  London's Green Procurement Code is a support service for London-based organizations committed to reducing their environmental impact through responsible purchasing. The LDA provides practical advice and online assistance to include green purchasing in an organization's activities. Those organizations which sign on to the Code commit to achieving progressive environmental targets and can be awarded bronze, silver or gold statues, depending on their success. Since October 2007, participants spent over £742 million on green products and diverted 191,131 tonnes of waste from landfills. This represents a saving of 78,863 tonnes of CO_2 emissions.
- **Product Life Cycle Accounting and Reporting Standard.**[297] This includes the Scope 3 (corporate value chain)[298] and consists of standards developed by the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD) which provide methods to account for emissions associated with individual products across their life-cycles and of corporations across their value chains.

  In early 2010, 60 corporations began measuring the GHGs of their products and supply chains by applying this new global framework (see Figure 2).[299] While many companies had already been measuring emissions related to

Figure 2: An example of GHG emissions across the product life-cycle



Source: Sixty Corporations Begin Measuring Emissions from Products and Supply Chains, World Resource Institute, 2010.[299]

their operations and electricity use, the Scope 3 Standard[D] allowed them to look comprehensively at the impact of their corporate value chains, including outsourced activities, supplier manufacturing, and the use of the products they sell.[300]

In March 2011, stakeholders reviewed the second draft of the Product Life Cycle Accounting (including corporate value chain), which is aimed at making the accounting methodology more comprehensive and more relevant.[301, 302]

- **IFC GHG Accounting.**[303] In addition to measuring its operational footprint, IFC began measuring the GHG emissions associated with its direct investment activities (in a first phase, the focus is on the real sector, while activities via financial intermediaries will be examined in a second phase) to identify potential mitigation opportunities, as well as to inform its appreciation of business risk associated with a carbon constrained future.

  Since February 1, 2009, IFC requires the estimation of GHG emissions to be calculated and submitted for all its new direct investments. To support this work, IFC developed the Carbon Emissions Estimator Tool (CEET)[304] based on the Carbon Tool developed by Agence Française de Développement (AFD) and consistent with the widely used Product Life Cycle Accounting and Reporting Standard by WBCSD/WRI (see above). The CEET provides a simple way to estimate project emissions.

MRV and the Financial Sector

The influence of MRV on the financial sector is also becoming increasingly important, as it helps to (i) assign environmentally-sensitive credit ratings to corporate and individual borrowers, (ii) develop a carbon-related risk index, and (iii) create accounting procedures (on tracking, monitoring and reporting of various types of financial flows).[305] Several areas have been proposed for *greening* capital markets through activities that rely on MRV procedures (see Table 12).

Table 12: Strategy for greening capital markets through activities and products that rely on MRV procedures

Area	Actions
Environmental requirements reflected in statutes for investment, lending, credit rating, accounting, etc.	• Require financial institutions to address environmental concerns: assign fiduciary and lenders' liability on environmental degradation • Reflect environmental factors into credit ratings and accounting practices
Corporate disclosure of environmental information	• Require this information be disclosed • Gradual shift from voluntary to mandatory disclosure: FIs in developed countries already require firms to disclose this information, though with voluntary guidelines, e.g. GRI
Certification of green technologies, enterprises and industries to guide investment and lending	• Introduce green business certification programs, which are specific to industry, technology, business type and size • Leading FIs, such as Goldman Sachs, rate environmental performance, e.g. listing firms as green or non-green.
Green indices	• Develop a *Green Enterprise Index* to promote green investment • Develop a *Green (Carbon) Risk Index* to promote investments in green bonds • JPMorgan and Innovest co-developed the JENI Carbon Beta Index, the world's first bond index that reflects climate change businesses risks
System for providing green information	• Build mechanisms to access key green information • Develop data for FI's credit and investment decisions: e.g. licenses/approvals by MOE and other authorities, regulatory compliance, green enterprise designation, participation in voluntary agreements
Green enterprise rating agencies	• Encourage agencies to rate green companies • Three major rating agencies specialize in corporate environmental performance: Innovest (U.S.), EIRIS (UK), SAM (Switzerland)

Source: Developing Green Finance in Korea, Korean Capital Market Institute, 2009.[74]

Some evidence exists that information systems may be inaccurate or incomplete, thus increasing the possibility of fraudulent schemes. The following are examples of MRV systems imperfections that may negatively affect their credibility.

- **Country level.** The independent research firm, *CO2Scorecard,* states that the Netherlands Environmental Assessment Agency (PBL) and 2010 BP's *Statistical Review of World Energy* present wildly disparate assessments of carbon emissions, creating doubt as to whether either source is accurate enough to be used as a basis for policy development and evaluating baseline emissions and trends.[306] The analysis by *CO2Scorecard* showed that if the national data generated by PBL is compared with the BP data then the total discrepancy for the 23 largest emitters would be about 2 billion tonnes (see Table 13). At the country level, the differences were even more significant: 66 percent for the Netherlands (a discrepancy of 105 million tonnes of CO_2) and 51 percent for Saudi Arabia (181 million tonnes of CO_2).

Table 13: CO_2 emission data according to BP and PBL

Countries	PBL CO2 — Energy Use 2009	PB CO2 — Energy Use 2009	Diff PBL-BP / PBL	Diff (PBL-BP) (mill. Tons)	Abs (Diff)
[A]	[B]	[C]	[D] = [B]–[C])/[B]	[E] =[B]–[C]	[F] = |[E]|
China	7,420	7,518	–1%	–98	98
United States	5,724	5,942	–13%	–668	668
India	1,605	1,539	4%	65	65
Japan	1,153	1,222	–6%	–69	69
Germany	753	796	–6%	–42	42
Iran	547	540	1%	7	7
S. Korea	536	663	–24%	–128	128
Canada	538	603	–12%	–65	65
United Kingdom	481	529	–10%	–48	48
Mexico	449	437	3%	12	12
Indonesia	424	388	8%	36	36
Italy	390	435	–11%	–45	45
Australia	392	387	1%	5	5
Brazil	363	409	–13%	–47	47
South Africa	375	469	–25%	–94	94
Saudi Arabia	356	538	–51%	–181	181
France	358	399	–11%	–41	41
Spain	299	339	–13%	–39	39
Ukraine	301	281	7%	20	20
Poland	269	320	–19%	–51	51
Taiwan	254	320	–26%	–66	66
Thailand	225	274	–22%	–49	49
Netherlands	160	265	–66%	–105	105
Summary	22,922	24,613	–7.38%	–1,691	1,983

Source: Adapted from CO2 Discrepancies between Top Data Reporters Create a Quandary for Policy Analysis, Afsah, S. and Aller, M., 2010.[306]

Research by the International Institute for Applied Systems Analysis (IIASA) offered two possible reasons that could explain these discrepancies.[307] First, deeply rooted institutional and political incentives cause reporting entities to resist collecting and publically announcing negative findings. Second, the reports published at the international level do not apply a uniform approach to measuring statistics: e.g. global emissions reported by BP and EIA differed by as much as 11 percent of global output, equal to more than twice the energy output of the UK.

- **Company level.** A popular climate management initiative, Carbon Monitoring for Action, (CARMA) run by the U.S.-based Center for Global Development (CGD), uses one set of data on CO_2 emissions data to motivate public activism. However, research by Performeks shows that the numbers that CARMA made

public do not match other publicly available real coal plant data, and discrepancies are systematic and wide-spread.[308] If the CARMA data was used as a basis for global CO_2 trading, the cost of disputable CO_2 would be US$366 billion.

Notes

[A] Circular metabolism refers to a city's sustainable model where inputs and outputs are balanced and harmonized.

[B] In "Disclosure Strategies for Pollution Control" (1998) Tietenberg argues that providing information intensifies interactions among firms, workers, community groups, consumers, and financial markets as well as the regulators themselves. It thus increases the expected costs of non-compliance through channels that do not directly involve regulators.

[C] Whole-life costing (also known as life-cycle costing) is the process of assessment of the present value of all the effects that the product has on the environment over its lifetime.

[D] The GHG emissions are categorized into three broad scopes: *Scope 1:* All direct GHG emissions; *Scope 2:* Indirect GHG emissions from consumption of purchased electricity, heat or steam; *Scope 3:* Other indirect emissions, such as the extraction and production of purchased materials and fuels, transport-related activities in vehicles not owned or controlled by the reporting entity, electricity-related activities (e.g. T&D losses) not covered in Scope 2, outsourced activities, waste disposal, etc.

CHAPTER 6

Private Financial Products and Services

A key aspect to promoting Climate Friendly Technologies (CFT) is ensuring that the private sector invests alongside the public sector to bring these technologies to the market. While the public sector is needed to incentivize green investments—particularly in the early stages—eventually the private sector should drive green growth. Thus, the financial sector and capital markets must provide the right products and services.

Although public financial institutions are usually in a better position to provide low-cost concessional loans, guarantees, and funding to greater risk-bearing projects, some private financial services companies have also devised a number of financial products including loans and equity investments that focus on the CFTs. These products include wholesale banking products, asset management tools specifically tailored for CFT investments, insurance instruments, and retail finance products. The voluntary and mandated carbon finance market has also been a significant source of fees and commissions for private companies and banks, which have used carbon trading as a source to manage various risks.

Role of Private Sector

Evidence suggests that governments need to create policies to encourage and support enterprises to adopt new environmental technologies and practices. However, as the private sector generates and consumes most of the energy, it should take the lead in investing in CFTs. This will need a wide range of cost-effective financial products and services.

The UNEP report '*Green Financial Products and Services: Current Trends and Future Opportunities in North America*'[309] classifies financial services and products into the following: (i) wholesale (corporate) banking; (ii) asset management; (iii) insurance; and (iv) retail finance. The following sections describe each of these groups and begin with an overview of private equity investments in clean energy.

Private Equity in Green Investments

Recently, interest in clean energy by venture investors has soared, as they are attracted by the potentially significant size of the markets. NEF identified over 1,500 separate venture and private equity groups investing in CFT companies that mainly focus on the next generation of technologies, such as cellulosic and algae based bio-fuels, energy storage and digital energy management. Between 2003 and 2005, there was a rapid

increase in the levels of venture activity in the hydrogen and fuel cell sector. Further, many equity firms invest in companies with technologies that are proven and commercialized but still have significant potential for growth: e.g. EE has attracted record investments, especially from earlier-stage investors.[310] Wind is the most mature clean energy technology and accounts for more than a third of total investments—more than either nuclear or hydroelectric power.[311] However, solar energy is the fastest-growing sector.

From 2003–2008, energy investment spread from developed countries, with developing (non-OECD) countries attracting 23 percent ($26 billion) of RE asset financing in 2007, compared to 13 percent ($1.8 billion) in 2004, although most went to the fast-growing economies of China, India and Brazil. In particular, India and China are leading in clean energy. In 2007, investment in China's clean generation capacity (excluding large hydro projects such as the Three Gorges dam), soared to US$10.8 billion.

The WilderHill New Energy Global Innovation Index[A] tracks the performance of about 90 leading clean energy companies, spanning different sectors, geographic areas, and business models. From 2003–2007, the NEX rose 100 points annually to a peak of 549.08, for a compound annual growth rate of over 40 percent (although in 2008, due to the financial crisis, it collapsed and remained depressed through 2010). The average price-to-earnings (PE) ratio for energy-saving and clean-energy companies is 1.5 to 3 times higher than the average PE ratio for all companies listed.[B]

Wholesale Banking

Wholesale banking[C] responds to the complex financial needs of large corporations, governments and other public entities that use corporate and investment green products, including project finance, partial credit guarantees, trading operations (carbon finance), bonds, and others.

Project finance. This refers to equity (generally 30–40 percent) and debt (generally 60–70 percent), including loans for large infrastructure projects that are repaid from the cash flows generated solely by the finance project. Many banks have created service divisions dedicated to large-scale RE project financing schemes. Some banks specialize in one or more RE technologies.

Partial guarantees. The most common partial guarantees are issued to support loans, bonds, or credit facilities for environmental projects. Financial institutions can provide a risk-sharing arrangement by guaranteeing the securities, making them more attractive to investors because risk is transferred to the guarantor. Risk can also be reduced through the securitization mechanism and by raising funds through the issuance of asset-backed securities (ABS).

Carbon finance. This is another service that banks offer their corporate clients, and which takes various forms. Private banks (i) acquire carbon credits on clients' behalf to help them meet their needs or liquidate (monetize) the excess supply of credits; (ii) provide brokerage services for a commission, and risk-management services for speculative operations on emissions markets with these services occurring through forward contracts, swaps, options, allowances lending and the monetization of allowances; (iii) provide funds in CDM/JI projects to acquire carbon credits; (iv) participate

in projects with equity contracts at the early stages, and project finance during implementation; and (v) provide derivatives for project developers to manage the market risk of their carbon assets.

Below are examples of wholesale products and services provided by private sector FIs and private arms of the MDBs (see Table 14).

Unlike project finance—which requires that details be provided for the activities proposed—corporate finance is available on the strength of the clients' balance sheets. Thus, it is possible that many EE investments are not documented, because companies may not specifically request loans for this purpose (e.g. financing of energy improvements

Table 14: Corporate and investment products and services

Product	Product design, results, potential	Financial institution(s)	Region
Project Finance	Banks' special divisions focus on long-term financing of clean energy projects. Often, the focus is on one or more specific RE technologies and/or on certain countries	BNP Paribas (Wind), Rabobank, Barclays, Fortis, Standard Chartered Bank, West LB (Biofuels and Wind)	Global
	Led effort to raise US$1.5 billion of equity for the wind-power market in 2006, with its own portfolio of about US$650 million. RE equity portfolio is about US$1 billion (26 wind farms); also pursues investments in biomass, geothermal, and solar power	JPMorgan	U.S.
	Portfolio financing technique: Combined financing of wind energy projects with the construction risk attached to developing wind farms	Dexia (Wind)	U.S.
	Led energy-from-waste project financing that included a 25-year loan supported by waste contracts with local authorities and corporate backing on non-contracted waste	Bank of Ireland	Europe
Partial Credit Guarantee	Financial institution provides a bond (issued by a municipality) to fund environmental projects	IFC	Global
Securitization	A risk-sharing arrangement for environmental projects. FIs represent a guarantor at the mezzanine level of risk, allowing client to transfer risk to the bank	IFC	Global
	Eco-Securitization scheme will test the feasibility of financing "*natural infrastructure*" by linking sustainable management of resources with the funding capacity and requirements of asset-backed securitization	IFC and UK Department for International Development (DFID)	Global
	Proposed green mortgage-backed securities. Designed to package mortgages on buildings that meet energy-use and environmental targets. Products would be rated higher and worth more due to the operating benefits associated with *green* buildings	Not yet implemented	U.S.
Bonds	Designed to fund large-scale reforestation in Panama. Re-insurers underwrite a 25-year bond, while investors and frequent Panama Canal users purchase the bond	Various	Latin America
	Cat bonds provide ancillary capital for risks from natural catastrophes and can pay higher than average yields, diversify investors' portfolios and improve industry reserves	BNP Paribas and others	Global
Technology Leasing	Provides environmentally-friendly technologies at preferential rates	Deutsche Bank, ABN AMRO, and ING Group	Europe

(Table continues on next page)

Table 14 (continued)

Product	Product design, results, potential	Financial institution(s)	Region
Private Equity	Investments in wind, solar and bio-fuels through Alternative Investments' Sustainable Development Program	Citigroup	U.S.
	Focused on forest conservation, preserving biodiversity. Provides 100% financing with discounted rate to non-profits to acquire biologically sensitive land and launch sustainable forestry practices and management	Bank of America	U.S.
Indices	Private investor eco-market products include a biofuels commodity basket, total returns solar energy index, clean RE index and total returns water index (e.g., enables interested parties to invest in water as a commodity)	ABN AMRO, JPMorgan	Europe, U.S.
Carbon Finance and Emissions Trading	Banks provide equity and/or loans as an up-front capital or upon-delivery payments to acquire carbon credits from CDM and JI projects. Most acquire carbon credits to serve their corporate clients' compliance needs, supply a tradable product to the banks' trading desks, or develop lending products backed by emissions allowances and carbon credits	Barclays Capital, HSBC, Fortis, ABN AMRO, BNP Paribas, JPMorgan, Goldman Sachs, Citigroup, among others.	Global (mainly Europe)
	Allowance trading products can include, but are not limited to (i) placement of physical orders, (ii) fixed-or-floating swaps and indexed sales or purchases, (iii) options, (iv) allowances repurchase structures, (v) market-making for spot and forward trades; and price hedging based on cross-commodities	Various	Europe

Source: Based on Green Financial Products and Services: Current Trends and Future Opportunities in North America, UNEP FI, 2007.[309]

in a commercial company may be combined with that needed to expand production or for other purposes).[312]

Asset Management

According to a 2006 Deloitte study, asset management has become one of the fastest growing segments of financial services and most banks regard it as part of their core business.[313] It involves providing advice to clients on estate planning, mutual funds, managed asset programs, taxes, trust services, international financial planning, global private banking and full-service and discount brokerages. Asset managers generally specialize in services that require financial analyses, combined with asset and stock selection, plan implementation, and regular monitoring of investments. The green side of asset management includes fiscal funds, investment funds, carbon funds, and others.

Carbon funds, for example, receive money from investors in order to purchase CO_2 CERs or ERUs or invest in new projects to earn more credits. Carbon funds can be government-led or private. The former are a tool by which governments can meet their Kyoto objectives, while the latter provide cost-effective compliance instruments to regulated companies, along with cash returns and marketing/CSR-related opportunities for investors.

Sustainable investment funds have evolved through three generations, where the complexity of assessing investment eligibility rises at each level.[314] First generation funds solely employ exclusionary social or environmental criteria. Second generation funds use positive criteria that concentrate on progressive social or environmental policies and practices. The third generation funds apply both exclusionary and positive criteria

Table 15: Asset management products and services

Product	Product design, results, potential	Financial institution(s)	Region
Fiscal Green Funds	By purchasing shares or investing in Dutch Green Funds, customers receive an income tax discount, and accept a lower interest rate on investment. Banks can offer loans at lower cost to finance environmental projects related to five eligible categories	Dutch Banks	Europe
Fund	*Eco Performance,* UBS (Lux) Equity Fund, is the world's largest "green" fund. 80% of assets are channeled towards eco and social leaders. *Future Energy,* UBS (Lux) Equity Fund, focuses on clean energy sector investments in four business segments	UBS	Europe
Cat Bond Fund	Leu Prima Cat Bond Fund. World's first public fund for catastrophe bonds, a portion of which is aimed at climate-related natural disasters (or climate adaptation). Vehicle designed to hedge climate risks typically difficult to cover in the traditional insurance market	Credit Suisse	Europe

Source: Based on Green Financial Products and Services: Current Trends and Future Opportunities in North America, UNEP FI, 2007.[309]

to assess and select potential investments, with a focus on relative performance within a sector using a best-in-class approach. Table 15 provides examples of the Asset Management Products and Services.

Insurance

This sector involves life insurance and general insurance. *Green* insurance falls under the latter, offering two types of products: (i) those that allow an insurance premium to differ based on environmentally-relevant features; and (ii) those specifically tailored for clean technologies and emissions-reducing activities. For instance, some insurance companies are backstopping warranties on solar panels, or protecting against lulls in the wind needed to drive turbines. This is helpful to start-ups whose customers can rely on guaranteed performance. These types of policies can also help to make project financiers feel more secure. The number of companies offering warranty insurance policies is growing quickly, from only a few a year ago, to approximately 12 companies today. Table 16 gives examples of insurance products.

Table 16: Insurance products and services

Product	Product design, results, potential	Financial institution(s)	Region
	Pay As You Drive Insurance: mileage-based insurance	Aviva, GMAC Insurance	Europe and North America
	10% discount for hybrid and fuel efficient vehicles. Bank can also choose to offset vehicle's annual emission (e.g. 20% emissions offset by CFS through Climate Care)	CFS, Aviva	Europe and North America
	Recycling Insurance: Customers pay less for car insurance, by up to 20%, if recycled parts are used when vehicle is damaged and requires service.	Credit Suisse	Europe

(Table continues on next page)

Table 16 (continued)

Product	Product design, results, potential	Financial institution(s)	Region
Building/Home Insurance	*Green Building Replacement and Upgrade Coverage:* Product covers unique type of "green" risks related to the sustainable building industry	California's Firemen Fund	U.S.
	"Climate Neutral" Home Insurance Policy: First home insurance product to carry out GHG offsetting based on customer usage	UK ETA	Europe
Business Insurance	*Environmental Damage Insurance*	Rabobank	Europe
Carbon Insurance	*Contingent Cap Forward* for emission reduction trades	Swiss Re	Europe
	Carbon emission credit guarantees	AIG, Marsh	Europe

Source: Green Financial Products and Services: Current Trends and Future Opportunities in North America, UNEP FI, 2007.[309]

Retail Finance

Some private financial institutions provide green retail financial products, such as loans with lower interest rates, but these are usually not designed for profit-making.[315] Rather, they are utilized to strengthen a bank's image or meet the needs of its other marketing strategies. As such, the volume of this kind of business cannot substantially increase without creating financial difficulties for the bank. If such programs are to expand beyond marketing or promotion strategies, they need to be implemented with some supporting actions from governments. See Table 17 for examples of retail products and services.

Table 17: Retail products and services

Product	Key product designs, results, potential	Bank	Region
Home Mortgage	Government led *green mortgage* initiative: 1% interest reduction for loans that meet environmental criteria	Dutch banks	Europe
	Free *home energy rating* and carbon emissions offsets for every year of loan	CFS	Europe (UK)
	Private green mortgages by the largest mortgage providers in those countries	Abbey, HBOS, Halifax, etc.	Europe (UK)
	Generation green™ home loan, offered for both new and existing housing stock; those already with mortgages can take advantage of discounted rates	Bendigo Bank	Australia
	Green power mortgage provides financial incentive for homeowners to use renewable power. Design focuses on sustainable behavior or customer, rather than building's physical infrastructure	N/A	N/A
	MyCommunityMortgage™ and *Smart Commute Initiative Mortgage* help borrowers buy EE homes and use public transport	Fannie Mae (Citigroup)	U.S.
	Refund (10%) on CMHC mortgage loan insurance premiums and extended amortization to a maximum of 35 years to purchase EE homes or make EE renovations	CMHC (CIBC, BMO)	Canada
Commercial Building Loan	*Green loans* for new condominium buildings that demonstrate 25%+ energy savings over conventional designs. Developer (Tridel®) repays loan with funds that would otherwise be spent on operating costs using conventional equipment and material	TAF/Tridel®	Canada

(Table continues on next page)

Table 17 (continued)

Product	Key product designs, results, potential	Bank	Region
	First mortgage loans for constructing and refinancing LEED-certified commercial buildings. Developers can avoid paying initial premium for green commercial buildings	Wells Fargo	U.S.
	1/8 of 1% discount on loans to green leadership projects in the commercial or multi-unit residential sectors	NRB	U.S.
Home Equity Loan	One-step solar financing under the terms as long as the solar panel warranty (25 years)	NRB	U.S.
	Environmental home equity program. For customers using line of Visa access credit, bank will donate to an environmental NGO	Bank of America	U.S.
	Financing options for residential customers to purchase and install solar technologies (offered jointly with Sharp Electronics), including home equity loans or lines of credit (as opposed to savings or loans)	Citigroup	U.S.
Auto Loan	*Clean-air* auto loan with preferential rates for hybrids. Product recently redesigned to cover all low-emitting vehicle types	VanCity	Canada
	goGreen® auto loan product	mecu	Australia
Fleet Loan	Small Business Administration *express loans,* with rapid approval process, no collateral, and flexible terms, are offered to truck companies to finance fuel-efficient technologies and the purchase of SmartWay Upgrade kits (that improves fuel efficiency by up to 15%)	Bank of America	U.S.
Deposit	*Landcare* term deposit. Australia's first environmental deposit product. For every dollar spent, bank lends equal amount to sustainable agriculture practice	Westpac	Australia
	EcoDeposits®. Fully-insured deposits earmarked for lending to local EE companies aiming to reduce waste/pollution, or conserve natural resources. *EcoCash*™ checking account allows for 5 free paper checks a month, with US$3 per check fee applied. Part of this fee goes to the Climate Trust	Shorebank Pacific	U.S.
Credit Card	Affinity cards. Banks partner with ENGO, which accepts future royalties in exchange for the use of its name and logo. APR 15%–22%, many with annual fees	Various	Various
	Climate credit card. Bank will donate to WWF. Amount depends on the energy-intensity of the product or service purchased with the card	Rabobank	Europe
	GreenCard Visa is the world's first credit card to offer an emissions-offset program. Cards will soon be available in Germany and parts of Scandinavia	Tendris Holding B.V.	Europe (NL)
	BarclayBreathe card includes discounts and low borrowing rates to users when buying green products and services. 50% of card profits will fund emissions-reduction projects, worldwide	Barclays	UK
	Cardholders can donate Visa *WorldPoints* rewards to organizations that invest in GHG reductions or redeem the points for green merchandise	Bank of America	U.S.
	Bank donates £1.25 per £100 spent by personal (co-op debit and credit cards) and business customers (Co-op Business Visa) to the bank's "Customers Who Care" campaigns	CFS	UK
Sales	Consumers can offset CO_2 emissions associated with air travel, with no funds channeled to the bank. This new initiative is in partnership with the organization, Climate Care	Barclays, HSBC	Europe

Source: Green Financial Products and Services: Current Trends and Future Opportunities in North America, UNEP FI, 2007.[309]

Notes

[A] Ticker symbol NEX.

[B] According to the definition of 'Energy Saving' and 'New Energy' by Ifeng.com and the data sources of GuoTai JunAn database.

[C] Also referred to as corporate banking.

CHAPTER 7

Country Examples of Pro-Green Policies and Programs

Many countries are adopting pro-green policies and developing financing schemes and instruments to fund CFTs, often targeting one or more of the four elements of green growth: (i) eco-tax reform, (ii) sustainable infrastructure, (iii) the greening of business, and (iv) sustainable consumption. This is particularly evident in more developed countries such as the U.S., Japan, and those in Western Europe, but also to a large extent in China, India and South Korea. Many have set aside stimulus funds for CFT investments following the recent global crisis, and the UK and the U.S. are considering creating a green bank. Also, China, Japan, the EU, and the U.S. have established various carbon trading schemes either at the national, state or municipal levels.

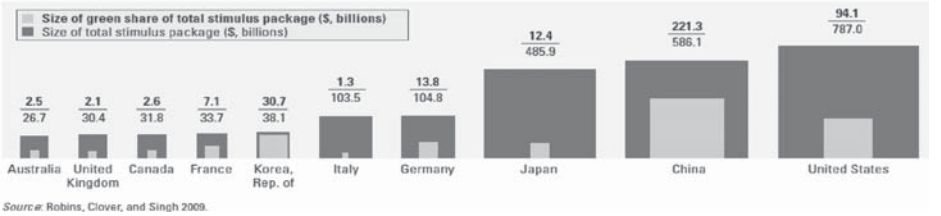
Countries are creating green growth targets and new funding mechanisms to ensure that these targets (such as GHG emissions reduction) are achieved. Thus, in 2008, China's State Environmental Protection Agency was upgraded to a Cabinet level, and named the Ministry of Environmental Protection (MEP). In South Korea, the government established a Green Growth Commission to pursue public and private policies, making such growth a focal point of development.

As a part of this study, five countries—China, South Korea, Japan, Germany, and the U.S.—were selected in order to review their green initiatives.

The five countries selected for further review (China, South Korea, Japan, Germany, and the U.S.) have all set aggressive targets to reduce their GHG emissions and energy consumption and adopted pro-green policies. Thus, China's 11th Five-Year Plan for National Economic and Social Development (2006–2010) set a binding goal, by year 2010 to reduce energy consumption per unit of GDP by 20 percent relative to the 2005 baseline.[316] Having met this goal, China established 10 green technology-related objectives for its 12th Five-Year Plan, which was approved in March 2011.[317] Japan is committed to reduce its 1990 GHG emissions by 25 percent in 2020, if other developed countries adopted similar cuts.[318] The United States pledged to reduce 2005 levels of CO_2 emissions by 17 percent in 2020, and reduce them by 83 percent, by 2050.[319] The EU promised to reduce the CO_2 emissions by 20 percent by 2020, although Germany has set a more ambitious target of 40 percent by that year.[320]

Convinced that the green growth will bring about broader economic growth implications, these countries developed various financing mechanisms and allocated funds to their green growth initiatives. Most countries devoted significant portions of their recent economic stimulus plans to fund them. Around the world, governments have allocated

Figure 3: Ratio of green share of select countries' stimulus packages



Source: World Development Report 2010: Development and Climate Change, The World Bank Group, 2010,[131] based on the data from Climate for Recovery: The Colour of Stimulus Goes Green, Robins, N., et al, HSBC, 2009.[322]

more than US$470 billion in fiscal stimulus to climate change investment themes, leveraging a total of over US$980 billion[321] (see Figure 3).

For each of these five countries, indicative examples of their green growth activities are discussed.

China

China is almost certainly the largest national CO_2 emitter in the world—although its per capita emissions are still a fraction of those in the United States and EU, and below the global average.[323] Less widely acknowledged is the leading role China already plays in promoting green growth through policies, laws, economic mechanisms, and information programs.

Policies

A major force behind China's move to a greener economy is its Five-Year Plan for National Economic and Social Development. The 11th Plan (for the period 2006–2010) committed China to building an energy-conserving and environmentally-friendly society and reducing its energy consumption per unit of GDP by 20 percent during this period. To achieve these goals, its State Environmental Protection Agency was upgraded to a full Cabinet ministry in 2008, and is now the Ministry of Environmental Protection (MEP). Further, the government directed a large part of a US$586 billion fiscal stimulus towards investment in energy conservation, emission reductions, and ecological engineering.[324]

On the financing side, China's policies include a green tax, green procurement, green credit, insurance, and security policies.[325] Of the last three, the green credit policy is the most advanced, with three agencies—MEP,[326] the Peoples' Bank of China, and the China Banking Regulatory Commission (CBRC)—responsible for implementation. However, there is some doubt about the degree to which this policy has been implemented. Some researchers conclude that success has been limited by its (i) widely varying impact on different enterprises, (ii) ambiguous policy details and implementing standards, and (iii) lack of environmental information.[327] Researchers also suggest that the green credit policy at the local level (e.g., Jiangsu Province) is more practical, as it is integrated with environmental performance ratings.

Laws

A broad range of green laws were recently passed to implement China's national policies. These include:

- **The Energy Conservation Law.** This law makes conservation a "national priority"[328] and includes provisions mandating local governments to report to the State Council on their energy conservation work and achievements, and establishes funds at the national and local levels including tax and financial subsidies and loans for energy-conserving projects;
- **The Renewable Energy Law.** This law obligates grid companies to purchase all the electricity generated from renewable energy sources;
- **The Cleaner Production Promotion Law.**[329] This law requires local governments to develop and implement cleaner production plans and periodically release pamphlets and guidebooks with instructions. To support the development of clean technologies, it also formulates tax incentives, such as relief from Enterprise Income Tax for CDM projects;[330]
- **The Adjustment and Revitalization Plan for the Automotive Industry.** This law is designed to promote EE, low-emission compact vehicles. The plan allocates US$2.9 billion through 2012 to develop low-carbon vehicles, with a focus on battery-charging stations and grid construction. The funds are appropriated through tax reductions (to the companies) to producer fuel efficient vehicles. China's Ministry of Science and Technology anticipates that 10 percent of new vehicles will be low-carbon models by 2012, leading to one million low-carbon vehicles on China's roads, and reducing carbon emissions by 2.3 million tonnes.

Economic Instruments

China has employed various economic instruments to promote green growth and investments in clean technologies. These include taxes and subsidies, tradable permits and public finance mechanisms.

Taxes and Subsidies. Recently, China has been actively working on both fronts—phasing out subsidies to energy intensive industries and making the investment environment in RE industries more favorable. For example in 2007, the government abolished electricity rebates and concessions, and halted regional preferential electricity pricing measures on high energy-consuming industries.

At the same time, for certain types of clean projects, such as wind power, the value-added tax was reduced to 8.5 percent (from 17 percent) and income tax was cut from 33 percent to 15 percent. Further, China provides a subsidy of US$88/kW to wind turbine manufacturing companies for the first 50 wind-turbine power units above 1.5 MW and provides a refund on import duties. As a result, China has become the fourth largest wind power supplier in the world.

Similarly, in 2009 the government was covering up to 60 percent of production costs of PV modules through a US$2.93/Wp subsidy. This measure, along with strong world demand, generated such a favorable investment environment that it significantly boosted China's PV production capacity and allowed the country to become the leader of the PV upstream industry capturing close to 40 percent of the world market.

The government also provides subsidies to companies to support technology upgrades, according to the amount of energy they save (standard subsidies are US$29–US$37 per tonne of carbon saved).

Public Finance Mechanisms. It has been noted that the country is experiencing a green revolution and that a green economy is likely to become the key factor in China's future economic growth. Thus, it is expected that China's banking industry will actively promote green infrastructure finance.[331, 332]

The government created green financial services institutions that provide loans to clean energy projects on a trial basis. For instance, the People's Bank of China has a pilot project that factors the loans that other banks provide for EE projects and technology service providers. Further, CBRC commission (i) stipulates the type of financial institutions that can make special energy-savings loans and (ii) maintains a *credit blacklist* of companies that do not meet environmental standards, and prohibits banks from lending to them.[333] In 2007, banks lent US$16 billion for energy-saving and emissions-reduction projects,[334] while US$570 million was recovered from enterprises that did not meet national policy standards. The Agricultural Bank of China has been committed to deny credit to any projects that do not comply with China's conservation and emission requirements.

China has been using various financing instruments including IFC's China Utility-Based Energy Efficiency Finance Program (CHUEE) which has provided 98 loans worth US$512 million as of June 2009.[335] The program uses two main instruments: bank guarantees for EE loans and technical assistance to market players, including utilities, equipment vendors, and energy service companies, to help implement EE projects. China has also been raising funds through treasury bond issuances to support these projects. As of 2007, the country lent to 681 key projects and saved 25.5 million tonnes of coal equivalents (tce).[336]

The country has the highest number of CDM projects (417 as of February 2009) and of CER credits worldwide. This demonstrates its commitment to developing alternative energy—even excluding the CER credits for highly ambiguous HFC-23 projects.

Tradable Permits. Four environment exchanges have been established and are now operational. These are the Shanghai Environment and Energy Exchange (SEEE), China Beijing Environment Exchange (CBEEX), Tianjin Climate Exchange (TCX), and an energy intensity trading scheme in Tianjin, in 2010.

Information and Voluntary Programs

Information. To make the information more available, the country passed a law on the Prevention of Environmental Pollution by Solid Wastes, which requires solid waste producers to declare and register information about the amount, flow direction, storage, and treatment of their waste to the environmental protection bureau of the regional government.[337]

Voluntary Programs. In 2003, two Energy Conservation Voluntary Agreement schemes were launched in Shandong Province and also in the city of Qingdao (in Shandong Province).[338] In Shandong Province, voluntary EE targets were negotiated with two iron and steel companies while in Qingdao, 15 large enterprises agreed on targets for EE and CO_2/SO_2 emissions.

The Republic of Korea

Since the Republic of Korea imports 97 percent of its energy, this poses a significant risk to its energy security and makes developing renewable and clean energy a strategic imperative. Thus, in February 2009, the Republic of Korea created a Presidential

Commission on Green Growth to pursue public and private policies, making this a focus of the country's development.[339] It also views green sector growth as both a means to stimulate its economy and as a demonstration of global leadership—aiming to become the world's 7th green power by 2020 and 5th by 2050.[340] It intends to achieve international recognition by leveraging its comparative advantages in R&D to stimulate export of CFTs.

Policies

In July 2009, the country launched a National Strategy and the Five-Year Plan (2009–2013) that focuses on three areas: (i) mitigation of climate change and promoting energy independence, (ii) creating new engines for economic growth, and (iii) improving the quality of life and Korea's international standing. For the first goal, it will need to reduce the use of fossil fuels and GHG emissions. For the second, it must invest more in green technologies and develop structural foundations for a green economy. Finally, to improve the quality of life, it must accelerate and broaden green growth by promoting more sustainable land and water management practices, green transport infrastructure, and other initiatives that influence people's daily activities.

Laws

Korean policymakers understand that in order to promote the green growth agenda, a number of problems need to be overcome, including lack of public consensus, a weak regulatory system, inadequate technical infrastructure, along with insufficient human resources and involvement of financial institutions.[341] Thus, the government announced plans to voluntarily cut its emissions by 30 percent by 2020 under a BAU scenario (through its "Framework Act on Low Carbon, Green Growth"[342]). To achieve this goal, the government introduced a scheme which requires 374 local companies (78 in petro-chemicals, 57 in paper and wood-processing, 36 in power generation, 34 in steel, and 31 in electronic chips) to set GHG reduction targets by September 2011.[343] Together, the companies produced 361 million tonnes of carbon dioxide in 2007, or 58 percent of the nation's emissions, according to the Korean Ministry of Knowledge Economy.

Economic Instruments

Emission Trading Schemes (ETS). According to the presidential secretary, the Republic of Korea will start carbon emission trading from January 1, 2015.[344] Under the revision, yet to be approved by parliament, the percentage of free carbon allowances is over 95 percent, up from the original of 90 percent. The remainder is set to be auctioned. However, the ETS idea has been facing strong opposition from South Korean industry leaders. In February 2005, major business groups filed a petition to the government calling for a moratorium on the plan, arguing that full-fledged trading could cost up to 14 trillion won ($12.43 billion) to South Korean manufacturers if 100 percent of credits were eventually provided at a cost via auctioning.

Public Finance Mechanisms. Although the Korean administration has placed a top priority on green growth, the country's actual actions in green finance are relatively modest compared with those of other advanced countries.[345] In April 2011, local financial companies, banks, insurers, securities firms, and the government jointly formed the Green Finance Council to develop a key finance agenda and establish a network linking businesses and finance. The council serves as a regular dialogue between 50 key leaders both from the government and private sector. In line with the government's

Low Carbon Green Growth initiative, local banks and insurers have introduced a wide variety of green finance products. For instance, Kookmin Bank, the nation's largest lender, established the Renewable Energy Private Equity Fund worth KRW 330 billion with the government and allocated KRW 750 billion to invest in low-carbon, green growth industries.

In 2009 the Korean government's *Low Carbon Green Growth* initiative triggered local Socially Responsible Investing (SRI) funds to grow at an increased rate. As shown by research, by the end of 2009, environment funds accounted for the largest portion of SRI public offering funds.[346] Common themes of these funds are climate change, future energy, water, and green growth. By the end of 2009, the size of these growing environment funds was KRW 783.5 billion, accounting for the largest portion of entire local SRI public offering funds. However, the rate of growth of the climate change-related funds was lower than expected by the *Low Carbon Green Growth* initiative.

Information Programs

To leverage the country's experience, the government created the Global Green Growth Institute (GGGI) in 2010.[347] It supports several projects in partner countries through program development, implementation, capacity building, sharing best practices and providing grants to local institutions. Through its work, GGGI seeks to make the green growth model both practical and effective in the pursuit of economic growth and sustainable development.

In June 2010, the Financial Services Commission (FSC) also announced its plan to build up a database featuring how companies work for the initiative of an eco-friendly world as well as making firms proactively announce environment-related information.

Japan

In 2009, the Japanese government injected US$155 billion (3.2 percent of GDP) into the economy to stimulate the green sector, intending to create four million jobs, bolster private sector financing, and increase Japan's environmental competitiveness.[348] Its energy policies focus on environmental protection, efficient supply, and energy security[349] in a similar fashion to other countries that aim to secure their energy supply and hedge against geo-political risks.

Policies and Laws

In the same year, it announced the Hatoyama Initiative, which targets a 25 percent cut in global warming emissions below 1990 levels by 2020. It replaced the Cool Earth Partnership, a previous (2008–2010) initiative of the government of Japan.[350] The Hatoyama Initiative aims to provide assistance to developing countries that are already making efforts to reduce greenhouse gas emissions to enable them to achieve economic growth in ways that will contribute to climate stability, on the basis of policy consultations between Japan and those countries. The Hatoyama Initiative has pledged US$15 billion to curb climate change, until 2012.

Domestic energy sector development and emissions curbing initiatives are governed by the Strategic Energy Plan of Japan. The current revision (June 2010) of the Strategic Energy Plan of Japan articulates the fundamental direction of energy policy in Japan—energy security, environmental protection, and efficient supply.[351] According to the Plan, Japan will fundamentally change its energy supply and demand system by

2030 and reduce its CO_2 emissions by 30 percent or more by 2030. This strategic vision is supported by a collection of laws and implementation regulations such as:

- **Basic Act for Establishing a Sound Material-Cycle Society.** This aims to establish a society in which the amount of new resource extraction is minimized at all stages of social and economic activities;
- **Law Concerning the Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities.** This contains the basic policies for promoting comprehensive and planned procurement of materials, components, products and services with low environmental impact;
- **Law Concerning the Promotion of the Measures to Cope with Global Warming.** This law aims to promote measures to cope with global warming through defining the responsibilities of the central government, local governments, businesses and citizens to take measures to cope with global warming, and establishing a basic policy on measures to cope with global warming.

Economic Instruments

The Japan Bank for International Cooperation (JBIC) will support the Hatoyama Initiative by financing emission-reduction projects that aim to prevent global warming through simple, practical quantification measures.[352] This initiative will build on the country's experience with its national Voluntary Emission Trading Scheme (JVETS), as well as its mandatory Tokyo Emission Trading Scheme (Tokyo ETS).

In 2005, the Ministry of the Environment (MOEJ) launched the JVETS to accumulate experience regarding emissions trading in Japan and support CO_2 emissions-reduction activities by Japanese businesses. In the ensuing years, over 300 Japanese companies joined the scheme, including some of the largest companies in the paper, steel, ceramics, glass and chemical sectors, such as Nippon Electric Glass Co., Mitsubishi Gas Chemicals Co., and Sumitomo Light Metal Industries Ltd.[353] In 2009, JVETS was incorporated into *Experimental ETS* as an option for companies without an industrial sector-specific *Voluntary Action Plan.* By July 2009, 715 companies were participating.[354]

Based on this experience, in 2010, Tokyo's metropolitan government launched the first city-wide cap-and-trade scheme to cut emissions by 25 percent by 2020, against a 2000 baseline.[355] The new regulations affect 1,400 business, factories and public buildings which, together, are responsible for 20 percent of the city's emissions. Large facilities are required to participate in the cap-and-trade scheme, while small and medium-sized facilities receive technical assistance aimed at lowering emissions.

In the future, a national mandatory scheme might be introduced, based on Tokyo's new regulations. The city submitted a proposal for a national scheme which would cover more than 100,000 installations, including power plants and heavy industry.[356]

Information Programs

To support the emission-trading schemes, JBIC set guidelines to measure, report, and verify GHG reductions—called J-MRV Guidelines.[357] JBIC says it will continually improve these guidelines by following international discussions on the issues among investors, governments and those involved in carbon markets. J-MRV principles were revised by early 2011 and JBIC plans to create an advisory committee that can promote the process of quantifying GHG reductions. The committee will include experts in climate-change mitigation projects, Kyoto mechanisms, ISO standards, and other methods to quantify the level to which emissions are reduced in energy-related projects.

Germany

Germany is one of the leading countries in Europe, as well as globally, in terms of its renewable energy and climate change policies. Germany has been globally successful in setting climate protection examples and could support a 30 percent reduction by the EU with its own reduction commitment of 40 percent by 2020. Germany is already profiting from its position as a market leader in CO_2-saving technologies and could continue to improve it.

Policies

The multiple levels of government within the European Union (EU) mean that the German government must interact both with EU institutions (e.g., the Commission, Council, and Parliament) and sub-national, or states, when formulating and implementing policy. The government has set demanding national climate change and renewable energy goals and actively supports international climate negotiations, often spurring EU policy.[358]

The Kyoto Protocol targets for 2012 are within reach for Germany and the EU, but they are only a first step. As part of EU-15 burden-sharing under the Kyoto Protocol, Germany committed itself to a 21 percent reduction in greenhouse gas emissions between 1990 and the period of 2008–2012.[359]

Not only has Germany demonstrated strong leadership and ambitious targets in GHG reduction policies it has also achieved a high level of development of overall institutional, informational, technological, and scientific capacities in RE and EE space. The extent to which there has been an international diffusion of Germany's policy instruments (e.g., the feed-in law for renewable electricity promotion) and technologies (especially wind and solar power) supports the international perception of Germany as a leader in this field.

Economic Instruments

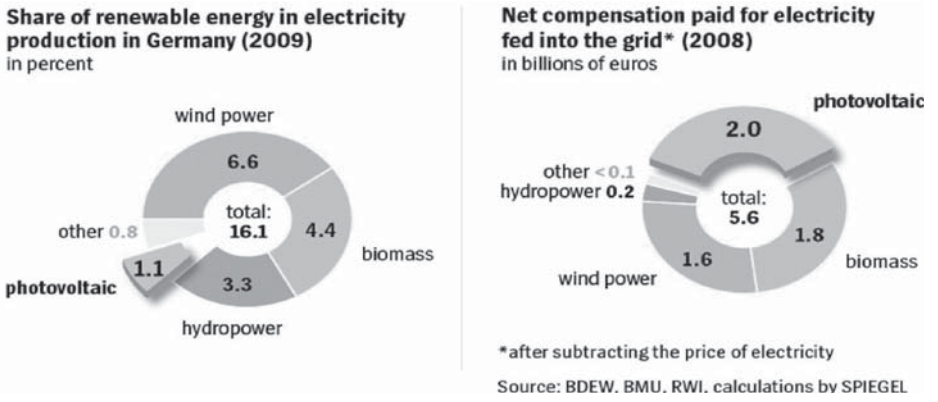
Germany is often cited as a country that successfully pursues an EE agenda. The government has been willing to pass energy and environmental laws and quickly adopt RE technologies such as solar PV and wind power.[360] It has promoted renewable technologies through feed-in-tariff (FiT) schemes, where utilities are legally required to enter into agreements with RE producers to purchase electricity at a fixed, guaranteed price per unit (for a certain time period). Germany has used FiTs to stimulate the development of its RE sector[361] (see Figure 4).

The mandatory power-purchase agreements for all photovoltaic systems built from 2000–2010 over the 20-year funding period amount to a net cost of €85.4 billion, in real terms.[362] Germany's Renewable Energy Act guarantees a FiT for 20 years, which is several times higher than the price of conventional electricity. According to calculations by the Consumer Federation (VZBV), new photovoltaic systems (introduced in 2010) will alone cost German consumers €26 billion over 20 years, which will increase the price of electricity by 10 percent in 2011.

The United States

The United States has the most developed capital and credit markets of the reviewed countries, but has been slow in advancing green to the national policy level. While the government has introduced some tax credits, subsidy policies, and other incentives they have not reached the level as those in China and South Korea, where EE and a green economy are national priorities.

Figure 4: Renewable energy in Germany



Source: Revolt of the Sun Kings: Solar Industry Fights to Save Subsidies, Der Spiegel, 2010.[363]

Policies and Laws

Despite the signing of two significant pieces of energy legislation—the Energy Policy Act of 2005 (EPAct) and the Energy Independence and Security Act of 2007 (EISA)—there is still no federal U.S. legislation to address GHG emissions and the United States is not party to the Kyoto Protocol. In September 2008, Congress permitted the Congressional ban on offshore drilling to expire. In October 2008, Congress re-authorized tax credits for clean technology and renewable energy as part of the US$700 billion financial rescue package. However, apart from EISA, the 110th Congressional record on environmental legislation was notably thin.[364]

In contrast, the U.S. sub-national level is very active. Frustrated by the gridlock in Washington, U.S. states, cities and communities are taking action with three major regional efforts underway to trade carbon emissions. More than 800 mayors have pledged to meet the Kyoto Protocol targets for their communities.

In response to calls for a green industrial revolution and rising consumer interest in environmentally-conscious goods and services, certain sectors of U.S. industry are repositioning to take advantage of opportunities in the climate and energy markets. Federal and state-level incentives, and soaring global demand, are boosting returns for firms that supply clean energy technologies and renewable energy.

Economic Instruments

Renewable Portfolio Standard (RPS). One effective and wide-spread program at the state level is the renewable portfolio standard (RPS). An RPS provides states with a mechanism to generate more RE using a low-cost approach that is administratively efficient. The standard requires electric utilities and other retail electric providers to supply a specified minimum amount of customer load with electricity from eligible RE sources.

According to the U.S. Environmental Protection Agency (EPA), as of 2009, 33 states and the District of Columbia had established RPS requirements.[365] While they differ across states (generally, between 4–30 percent of electricity should be generated from renewable sources), electricity suppliers can comply with the RPS in three ways:

(i) owning an RE facility and the energy it generates; (ii) purchasing RE certificates (RECs); or (iii) purchasing electricity from a renewable energy facility (sometimes called "bundled renewable electricity"). The necessity to comply with the state-level RPS regulations leads to trading by the electric utilities RECs certificates and therefore development of the compliance RECs markets.

Besides the compliance markets, there are also voluntary markets—in which customers choose to buy renewable power out of a desire to use renewable energy. Most corporate and household purchases of renewable energy are voluntary purchases. Renewable energy generators located in states that do not have a RPS can sell their RECs to voluntary buyers, usually at a cheaper price than compliance market of RECs.

Emission Trading Schemes (ETS). As of the beginning of 2011 there was no functioning ETS scheme in the United States. The *American Clean Energy and Security (ACES) Act of 2009* was the first greenhouse gas emissions trading scheme to have been passed by the United States House of Representatives.[366] However, it did not proceed in 2010 due to lack of support in the Senate and similar proposals may be debated in future years.

The most advanced effort in uniting states under the umbrella of emission trading is the Regional Greenhouse Gas Initiative (RGGI).[367] The Regional Greenhouse Gas Initiative (RGGI) is the first mandatory market-based CO_2 emissions reduction program in the United States. Ten Northeastern and Mid-Atlantic States (Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont) have capped and will reduce CO_2 emissions from the power sector by 10 percent by 2018.

RGGI is composed of individual CO_2 Budget Trading Programs in each of the ten participating states. Through independent regulations, based on the RGGI Model Rule, each state's CO_2 Budget Trading Program limits emissions of CO_2 from electric power plants, issues CO_2 allowances and establishes participation in regional CO_2 allowance auctions. Regulated power plants can use a CO_2 allowance issued by any of the ten participating states to demonstrate compliance with an individual state program. In this manner, the ten state programs, in aggregate, function as a single regional compliance market for CO_2 emissions.

Some other states are also working on creating state-wide schemes. Thus, in 2010, California confirmed that it intends to adopt a state-wide ETS in 2012 with progressive phasing-in of sources that will lower emissions to 1990 levels by 2020 (15 percent below baseline).[368]

Public Finance Mechanisms. In 2009, the *Green Bank Act*—designed to spur private investment in the domestic clean energy industry–was introduced to the U.S. Congress. The Green Bank-related bill reached the Subcommittee on Energy and Environment, but has not progressed since.[369] The concept was to establish an independent, tax-exempt, wholly-owned public corporation that would help finance qualified clean energy and EE projects. The Green Bank would provide clients with loans, loan guarantees, debt securitization, insurance, portfolio insurance, and other forms of financing or risk management support and would charge reasonable fees on its activities to cover its costs and expenses.

The Green Bank would be capitalized with US$10 billion through green bonds (issued by the Treasury) with an authorized limit of US$50 billion outstanding at any one time, and the federal government would guarantee the principal and interest. The

financial support to the projects would not exceed 80 percent of a project's capitalization and would be secured by the project or other collateral.

The Green Bank would be authorized to provide financial support to projects that meet the following requirements: (i) the private credit market is not providing adequately low-priced financing to allow otherwise creditworthy entities to carry out such projects; (ii) the financial support would accelerate construction or expansion of such projects; and (iii) it would stimulate, aid, or otherwise support domestic manufacturing of finished products or component parts used in such projects.

ANNEX 1

Policy Instruments and Public Finance Mechanisms to Mobilize Private Sector Investments in CFTs

Table 18: Classification of climate-change mitigation instruments

This report proposes that the policy instruments to cope with climate change mitigation-related issues can be divided into carbon-pricing and technology-based policies. Carbon pricing policies include a carbon tax, emissions trading schemes, and hybrids of these two approaches. All other policies are labeled technology-based (or, simply, technology) policies because they are all, to some extent or another, technology-specific.

Carbon pricing	Technology-based	Institution-based
Fiscal Instruments • Emission trading • Carbon tax • Hybrid trading-tax schemes	Fiscal Instruments • Demonstration grants • Public R&D • Investment subsidies • Public investment in venture capital • Public investment vehicles • Feed-in tariffs • Tax Credits • Public Procurement • Renewable energy certificate trading • Subsidies for energy-efficiency purchases	Regulatory • Improving information availability • Technology performance standards • Renewable fuel/energy standards • Building regulations • Automobile regulations • Information standards

Source: Climate Change and Economic Policies in APEC Economies, World Bank, 2010.[370]

Table 19: Policies to promote green growth

A) Relative strength and weaknesses of policy instruments

This publication studies the strength and weaknesses of different green growth policy instruments. For that purpose the instruments are organized into two categories: market-based and non-market based. The report indicates that the best choice of instrument will vary according to the nature and size of the predominant market failures. The latter will tend to differ across environmental areas as well as across country or region-specific circumstances. Table 19A summarizes the strengths and weaknesses of different green growth policy instruments:

	Strengths	Weaknesses
	Market-based instruments	
(1) Cap-and-trade permit systems	• Tend toward equalisation of pollution abatement costs (static efficiency) and can raise revenues (double dividend). • Once in place will be defended by stakeholders and provide natural mechanism for financial transfers in international context • Certainty over pollution emission levels • Continuous incentives to innovate to reduce abatement costs (dynamic efficiency)	• Steep learning curve and strong learning-by-using effects. Potentially high start-up administrative and transaction costs • Costs to producers/consumers reduce adoption incentives though less so than in the case of taxes • Concerns of competitiveness and income distribution • Potential price volatility and frequent adjustments to cap
(2) Baseline-and-credit permit systems	• Tend toward equalisation of pollution abatement costs (static efficiency) • Relatively low start-up administrative costs • Relative simplicity and flexibility. Can be linked with, or turned into, a cap-and-trade system	• Potentially high running costs associated with ensuring that emission reductions are real, additional and verifiable • Perverse incentives to raise pollution emissions • Uncertainty about level of pollution emissions
(3) Taxes or charges on pollution	• Tends to equalise pollution abatement costs (static efficiency) and can raise revenues (double dividend). • Implementation can be done through existing national institutions • Lower adoption and compliance incentives than permit systems • Continuous incentives to innovate to reduce abatement costs (dynamic efficiency)	• Potentially high monitoring costs for pollution emission controls • Adoption incentives lowered by costs to producers/consumers which are more visible than with permits • Concerns of competitiveness and income distribution • Uncertainty about level of pollution emissions • Lower predictability of future policy adjustments than with permits
(4) Taxes or charges on a proxy for pollution	• Lower monitoring and administrative costs than permits or taxes on pollution • Implementation can be done through adjustment to existing taxes	• Loss of static and dynamic efficiency relative to (3) which can be large in the case of distant proxy.

(Table continues on next page)

Table 19 (continued)

	Strengths	Weaknesses
(5) Subsidies	• High adoption and compliance incentives relative to permits or taxes	• Potentially large budgetary costs • May trap excessive resources in subsidized "clean" activity • Uncertainty about impact on negative externality • No incentives to search for cheaper abatement options
(6) Deposit-refund systems	• Low monitoring costs • Higher adoption incentives than taxes or permits	• Low monitoring costs • Higher adoption incentives than taxes or permits
	Non market-based instruments	
(7) Command and control performance standards	• Leave flexibility to search for cheapest option to meet standard • High adoption and compliance incentives relative to pricing instruments • Certainty over pollution emission levels • Preserve incentives to innovate to reduce costs of meeting standard though incentives may be weaker than with pricing instruments	• Do not naturally tend towards equalisation of marginal abatement costs • Potentially high administrative costs • Weak adoption incentives in an international context given difficulty in reaching agreement on burden sharing. • More information required than for permits and taxes in order to be effective and efficient
(8) Command and control technology standards	• Low monitoring costs • High adoption and compliance incentives relative to pricing instruments • Certainty over pollution emission levels (at individual units level)	• Provides no flexibility to search for cheaper abatement options. • Cannot be easily adapted in response to new information about costs and benefits • No incentives to innovate (dynamically inefficient)
(9) Active technology support policies	• High adoption and compliance incentives • High incentives to invest in research and development of new technologies	• Do not directly address negative environmental externality • Can lead to low-cost available abatement options being overlooked • Potentially large budgetary costs and deadweight losses • Uncertainty about the level of pollution emission
(10) Voluntary approaches	• Contribute to information gathering and dissemination on abatement costs and benefits • High (political) adoption incentives	• No intrinsic mechanism to encourage adoption of least-cost abatement options • Uncertainty about outcomes as effectiveness varies with perceived benefits of participants • Risk of collusion among participants

B) Conditions favorable to the use of specific instruments

The following table (Table 19B) reports the conditions that seem particularly favorable to the use of specific market and non-market-based instruments. Given the presence of several interacting market failures, it is likely that the most appropriate policy response will in many cases involve a combination of instruments, with the possibility that different optimal policy mixes might be identified across countries.

	Circumstances under which instrument works best	Examples/common applications
	Market-based instruments	
(1) Cap-and-trade permit systems	• Public-good market failure is not dominated by monitoring and information costs. • Sufficient institutional capacity (experience) and potential size of market sufficiently large to function properly. • Environmental damage depends on overall amount of a pollutant and not on specific location or timing of emission sources • Precise control over emissions is available at reasonable cost • Cross-border spill-over effects are important	• GHG emission reductions (EU-ETS) • Air pollution (SO2, NOx, VOC) • Fishing quotas
(2) Baseline-and-credit permit systems	• Public-good market failure is not dominated by monitoring and information costs. • Insufficient capacity or scope to set-up a cap-and-trade system • Baselines can be set and verified at reasonable cost • Cross border spill-over effects are important	• Clean Development Mechanism • Lead content of gasoline
(3) Taxes or charges on pollution	• Public-good market failure is not dominated by monitoring and information costs. • Pollution sources are small and diffuse • Environmental damage depends on overall amount of a pollutant and not on specific location or timing of emission sources • Temporary deviations in emission levels from target have little consequences for environmental damage (e.g., flat damage function) • Precise control over emissions is available at reasonable cost	• Water effluents • Water abstraction or consumption
(4) Taxes or charges on a proxy for pollution	• Control of direct pollution discharge difficult or costly • Close and stable relationship between use of input or output used as proxy and targeted pollutant • Several pollutants associated with single input or output	• Fuels and coal • Motor vehicles • Fertilisers

(Table continues on next page)

Table 19 (concluded)

	Circumstances under which instrument works best	Examples/common applications
(5) Subsidies	• Enforcement of alternative pricing instruments is difficult or very costly • Activity to be subsidised is a strong substitute for targeted "dirty" activity • Subsidy programme can be designed in a relatively simple way, for a time-limited period and with minimal secondary effects	• Forest management and conservation • Purchase of environmental-friendly house energy equipment
(6) Deposit-refund systems	• Control of pollution source impossible or difficult • Solid wastes involving simple and relatively homogeneous products or heavy metals	• Beverage and chemical containers • Lead acid batteries
	Non market-based instruments	
(7) Command and control performance standards	• Pollution control at the source of emissions is infeasible or very costly • No adequate proxy for pollutant that could be object of taxation • Weak response of agents to price signals • Pollution emissions can be measured from application of technology	• Limits on CO2 emissions of a passenger vehicle • Energy efficiency standards for various manufactured goods.
(8) Command and control technology standards	• Pollution control at the source of emissions is infeasible or very costly • No adequate proxy for pollutant that could be object of taxation • Administrative costs of performance standards are too high • Abatement costs are relatively homogeneous across agents	• Minimum percentage of a low-carbon source in the overall fuel mix of passenger vehicle • Specific housing building codes for energy-saving purposes
(9) Active technology support policies	• Technology areas where market size and learning-by-doing effects are dominant • Infrastructures in areas where network considerations are important	• Feed-in tariffs for electricity generated by renewable sources • R&D subsidies for green technologies
(10) Voluntary approaches	• When the authorities can put strong pressures (credible threat of follow-up actions) • Where information is not too costly to provide	• Agreements to encourage energy efficiency in energy-intensive industries • Publicly-available inventories of various pollutants

Source: Adapted from A Framework for Assessing Green Growth Policies, OECD, 2010.[371]

Table 20: Summary of policy instruments to catalyse green, low-emission and climate-resilient investment

A broad range of public interventions to reduce investment risks or increase investment returns for low-emission climate-resilient technologies is summarized in this publication. The publication categorizes the various climate policy options under three primary categories: capacity and information-based instruments, regulatory instruments, and market-based instruments. To enable a more precise discussion of comparative advantages of a wide diversity of market-based instruments, it further divides them into four sub-categories.

Policy instruments/stage	Research and development (R&D)	Proof of concept & scale-up	Commercial roll-out	Diffusion & maturity
Capacity and information-based	• Schemes to improve data collection and climate forecasting capacity • Reliable information on ecosystem impact scenarios, including threatened species			• Green Accounting • Institutionalized Consumer/producer/community/policy decision maker awareness campaigns • Citizen monitoring and reporting schemes • Voluntary labels and certification schemes • Worker/farmer/professional retraining schemes • Carbon, water, biodiversity and other ecosystem services risk disclosure • Ecological footprint assessments • Energy audits/smart meters • National/local regulations and incentives databases • Monitoring and reporting of subsidies • Public investment and expenditure reviews • Public registry of global environment goals and obligations
Regulatory	• Regulatory requirements to incorporate climate risk information into policy planning and public investment Plans (e.g. national irrigation policy, etc.) • Protection of innovation (copyright/patents) • Redesigning of intellectual property rights • Payments for access to biodiversity research permits • Bio-prospecting rights	• Mandatory energy insurance programmes • Hazard insurance programs to cover risks from adverse events and floods on investments in coastal areas	• Streamlined, accelerated permitting • Contractor licensing • Equipment certification • Interconnection policy • Line extension policy • Renewable energy access law	• Best Available Technology Requirements • Standards and mandatory labeling • Utility Regulations (Renewable Portfolio Standard [RPS], etc.) • Building codes • Priority sector lending regulations • Land zoning to protect climate sensitive ecosystem services and public goods • Property laws and asset rights • Regional planning and water allocation • Climate-resilient and low-carbon infrastructure standards • Removal of trade barriers to climate technologies • Establishment of environment rights • Compliance standards aligned with water allocation plans • Water storage regulations

(Table continues on next page)

Table 20 (continued)

Policy instruments/stage	Research and development (R&D)	Proof of concept & scale-up	Commercial roll-out	Diffusion & maturity
				• Development of conflict resolution mechanisms (e.g. catchment forum resolving water-use conflicts) • Modification of protected area network planning and coverage to include climate risks considerations: e.g. implementation of strategic environmental zoning plan • Integration of criteria related to adaptation to global change into the regular grant-making activities of government authorities • Requirements to avoid, reduce, mitigate and offset impacts on ecosystems through Environmental Impact Assessment (EIA) legislation, endangered species legislation • Renewable transport fuel obligations • Mandatory emission caps and air quality directives • Trade reforms to support agricultural specialization and virtual water trading
Fiscal mechanisms	• Capital gains tax waivers • R&D tax credits	• Tax-free development zones	• Accelerated depreciation • Investment tax credits • Production tax credits • Modified accelerated cost recovery system	• Phase-out of fossil fuel subsidies • Carbon tax • Water pricing reforms to encourage improved irrigation methods and water techniques • Energy emissions taxes • Public benefit charges (e.g. utility customer charges) • Environmental levies on old cars, old refrigerators, polyethylene bags, etc. • Fishery user levy • Ecological fiscal transfers • Phase-out of perverse irrigation/agricultural encroachment subsidies • Phase-out of insurance subsidies for settlement in disaster-prone areas • Waste disposal fees • Water consumption fees • Municipal rates rebates for creating conservation set asides • Clean energy production tax breaks • Income tax deductions for avoiding economic production practices that undermine ecosystem resilience

Early market development mechanisms	• R&D grants (e.g. to develop climate resistant varieties, etc.) • Inducement prizes for innovation	• National/state/local procurement • Advanced market commitment • Green power purchasing	• Reverse auctions/requests for contract • RPS/Green Certificates • Renewable fuel standards • Feed-in tariffs • Production subsidies • Insurance/financial incentives to promote agricultural and non-agricultural diversification	• Project development grants • Net metering • Restructuring aid for industries • Negotiated and voluntary industry/investment agreements • Rural micro-finance facility for climate-resilient practices • Crop certification • Seed grants (e.g. diffusion of drought-adapted crop varieties to vulnerable communities)
Debt and equity finance mechanisms	• Incubators • National laboratories • Prizes • National/state-funded venture capital (VC) • National/state-run VC	• Project grants • Venture loan guarantees • Mezzanine, subordinated debt funds	• Public-private emerging technology funds • Green bonds • Loan softening/loan guarantees • Senior debt funds • Technology insurance packages	• Technology transfer funds • National/state/local infrastructure funds • 'First loss' public equity position in Public Equity Funds (PEFs) • Export trade credit • Microfinance • Sovereign/policy risk insurance • National/state/local energy service company (ESCO) funds • Agricultural insurance • Weather indices • Catastrophe bonds
Environmental market trading mechanisms				• Domestic compliance and voluntary carbon cap and trade markets • Project-based carbon credits • National & multilateral carbon funds • Payment for ecosystems-based services • Conservation easements—payments for biodiversity conserving management practices • Payments for biodiversity-conserving business (organic/green markets etc.) • Water trading (nutrient and salinity trading) • Fishing quotas • Tradable wetland mitigation credits • Habitat banking: tradable development rights • Voluntary biodiversity offsets • Tradable biodiversity credits

Source: Adapted from Catalysing Climate Finance, UNDP, 2011.[372]

Table 21: Types of RE policy mechanisms and incentives and their comparison

A) Types of RE policy mechanisms and incentives

This publication discusses the emerging trends and general experience with the use of various policy tools to support RE deployment in the developed and developing world. A general classification of main policy instruments and incentives is provided in the table below (Table 21A).

Classification	Type of instrument/incentive
I. Direct	
Price Based Incentives	Feed-in Policies (FITs or Premiums over Spot Price) Other Premiums: Generation Based Incentives (GBIs), Premiums for Use of Domestic Equipment or Services Reduced T&D Costs
Quantity Based Incentives or Quota Obligations	Targets on RE penetration Renewable Portfolio Standards (RPS) in combination with Renewable Energy Certificate or Credit (REC) markets (also known as Tradable Green Certificates, TGC markets) RE Policy (quota) through Competitive Procurement Mechanisms (competitive biddings, auctions)
Fiscal and Financial Incentives	Tax Credits/Incentives and Fiscal Exemptions (such as accelerated depreciation) Grants/Capital Subsidies Preferential Loans and Loan Guarantees Carbon Financing (through CDM) R&D grants, loans or subsidies
Voluntary Measures	Green Tariffs Investment focused (shareholder/contribution programs)
II. Indirect	
Pricing of Environmental Externalities	Carbon Tax Cap-and-Trade or Emissions Trading Schemes (ETS)
Environmental Standards	Performance Standards: penalize high emitting sources
Voluntary Measures	Voluntary agreements

B) Types of RE policy mechanisms and incentives

A review of the experience of a sample of developing countries shows that the design of policy instruments aimed at creating sustainable RE markets is a dynamic process, which requires frequent adjustments and the introduction of complementary mechanisms to leverage the overall effectiveness of the policy mix. Clearly, along the way, regulators need to establish a solid track record of decisions that consider and involve the various stakeholders participating in the market. The following table (Table 21B) provides a relative comparison of most important price and quantity setting instruments.

Investment risks	Effectiveness/efficiency	Complexity
Feed in tariff policy (FITP)		
• Low price, volume and balancing risks • In spot market transactions, balancing risk may arise (this risk can be minimized introducing a "per area" mechanism) • Designed to create stable investment environment (although successive FITP design adjustments may decrease investors' confidence) • Predictable revenue streams • Help increase debt financing	• Effectiveness in terms of market growth is high (subject to compliance with RPO) • Sophisticated FIT design can reduce inframarginal rents • Allows for strategic support of different types of RE • No incentive for cost reductions (entire supply chain) • Overall cost of FITP may be high (depends on FITP design and market conditions)	• In general complexity is low, but depends on type of FIT (tradeoffs between simplicity and complexity) • Depending on design complexity, calibration may require a complex administrative process

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Table 21 (continued)

Investment risks	Effectiveness/efficiency	Complexity
RPS-REC		
• Moderate to high price risk (value of REC depends on market dynamics) • Moderate to high volume risks (once targets are met, suppliers do not have an incentive to purchase RE generation) • Balancing risk may be high (depends on market rules and support mechanisms) • Less predictable revenue streams require higher IRRs • Participation in bids may entail high transaction costs • More difficult to secure financing	• Effectiveness in terms of market growth depends on actual compliance with quotas (market share) • Market based instrument, fosters competition among RE suppliers (least-cost RE introduced first) • Favors mature technologies	• REC market design and the periodic setting or targets/ quotas may be complex • REC market requires high institutional and administrative capacity
Competitive procurement (auctions, biddings)		
• Moderate to high price risk (depends on contract design, market rules) • Stop-and-go nature creates uncertainty • Less predictable revenue streams require higher IRRs • Awarded contracts provide predictable revenue streams • Participation in bids may entail high transaction costs • More difficult to secure financing	• If competition is effectively fostered, delivers low prices (entire supply chain) • Allows for strategic support of different types of RE • High deployment risk (project delays or no implementation at all due to difficulties in financial closure, administrative or licensing barriers, weak rule of law or weak enforcement of contracts or project completion guarantees)	• Design of auction mechanism may be complex (depends on type of market and market conditions) • Requires high institutional and administrative capacity • Requires robust rule of law, enforcement of contracts • Regulatory stability is crucial (stable auction rules) • Requires proper design of project completion guarantees and penalties for delays and underperformance.

Source: Adapted from Design and Performance of Policy Instruments to Promote the Development of Renewable Energy: Emerging Experience in Selected Developing Countries, World Bank, 2011.[373]

Table 22: Overview of public finance mechanisms

Public Finance Mechanisms seek to mobilize and leverage commercial financing, build commercially sustainable markets and increase capacity to deliver clean energy and other GHG mitigation projects. The following table summarizes the key features of PFMs and provides a short description of each mechanism.

PFMs	Description	Financial barriers addressed	Financial market characteristics	Applicable market segment	LP	Example
1. Credit line for Senior debt	Debt facilities provided to commercial FIs for on-lending, and usually on a full-recourse basis. Typically meets 50–80% of project cost. Can also be offered on limited or non-recourse basis depending on FIs willingness to take project risks.	(i) lack of funds among FIs; (ii) shortage of long-term funds; (iii) high interest rates.	Underdeveloped financial markets where there is lack of liquidity and borrowing costs are high.	(i) large scale and medium scale RE and EE (ii) wholesale loans for energy access markets	L to M	Thailand Energy Efficiency Revolving Fund; CORFO credit line programme
2. Credit line for Subordinated debt	Debt provided to CFIs for on-lending, in combination with senior debt to improve security for senior lender. Typically meets 10–25% of project cost. Can take other legal structures such as convertible debt or preferred shares.	(i) lack of available equity among project sponsors; and (ii) restrictive debt-to-equity ratio	Lack of liquidity in both equity and debt markets	Medium and small scale	M to H	E+Co CAREC Fund, FIDEME Fund
3. Guarantee	A risk management tool shares in the credit risk of project loans which commercial FIs make with their own resources. Typically covers 50–80% of outstanding loan.	(i) high credit risks, particularly perceived risks	Existence of guarantee institutions & experience with credit enhancements	(i) large-scale and grid-connected RE (ii) medium scale RE and EE (iii) energy access markets	M to H	IFC/GEF Hungary Energy Efficiency Co-Financing Programme

4. Project Loan Facility	Debt facilities organized by entities other than commercial FIs and providing direct financing to clean energy projects on a project finance basis. Can be combined with commercial financing or can be provided as credit lines to small CFIs for on-lending.	(i) lack of experience with clean energy project finance; (ii) unwillingness or inability to underwrite loans on a project finance basis; (iii) lack of long-term lending capacity.	Strong political environment to enforce contractual obligations and enabling laws for special purpose entity	Medium and small scale EE and RE	L to M	India Renewable Energy Development Agency; Bulgaria Energy Efficiency Fund
5. Soft Loan Programmes	Provide debt capital at concessional interest rates	Financing gap during project development stages	Lack of liquidity or interest in the target sectors	Medium and small scale EE and RE	L to M	Massachusetts' Sustainable Energy Economic Development Initiative
6. Equity Fund	Equity investments in clean energy companies and/or clean energy projects. Can be targeted at specific market segments, or full range.	(i) lack of long term capital; (ii) restrictive debt-to-equity ratio requirements	Highly developed capital markets to allow equity investors an exit from investees	(i) large scale grid-connected RE (ii) energy companies	M to H	(i) ADB Clean Energy Private Equity Investment funds (ii) FE Clean Energy Group
7. Venture Capital	Equity investments in technology companies.	Lack of risk capital for new technology development	Developed capital markets to allow eventual exits.	Any new technology	M to H	China Environment Fund, Carbon Trust VC Fund
8. Carbon Finance	Monetisation of future cash flows from the advanced sale of CERs which can be used to finance project investment costs or enhance project revenues. Can also be in the form of carbon delivery guarantee to minimize the risk of under-delivery of carbon credits.	(i) lack of early stage project development capital (ii) lack of cash flow to provide additional security to project lenders (iii) uncertainty in the delivery of carbon credits	Developing countries, or emerging markets	(i) large scale and grid-connected RE (ii) medium–scale RE and EE (iii) programme of activities such as in energy access markets	M to H	ADB Asia Pacific Carbon Fund
9. Project Development Grants	Grants that are "loaned" without interest or repayment until projects demonstrate financial viability.	(i) lack of sufficient capital during project development stage; (ii) costly development process	Developing countries, or emerging markets	Large-scale grid-connected RE considered high risk with lengthy project preparation cycle	M to H	Canadian Green Municipal Funds

(Table continues on next page)

Table 22 (concluded)

PFMs	Description	Financial barriers addressed	Financial market characteristics	Applicable market segment	LP	Example
10. Loan softening programmes	Grants to help CFIs begin lending their own capital to end-users initially on concessional terms.	Lack of FI interest in lending to new sectors; limited knowledge of market demand.	Competitive local lending markets	Medium and small scale EE and RE	M	MNRE/IREDA SWH interest subsidy programme, UNEP Indian Solar Loan Programme
11. Inducement Prizes	"Ex-ante prizes" to stimulate R&D or technology development. Still needs to be proven in the climate sectors.	High and risky technology development costs and spill-over effects	Sufficient financing availability to deploy winning technologies	Any technology sector	M to H	X Prize
12. Grants for Technical Assistance	Funds aimed at building the capacities of market actors. Technical assistance programmes include: (i) market research and marketing support; (ii) transaction structuring support and development of new financial products; (iii) staff training and business planning; (iv) establishment of technical standards and engineering due diligence, and (v) market aggregation programmes to build deal flow.	(i) lack of investment ready project (ii) lack of skills and knowledge among market actors	Developing countries, or emerging markets	(i) all segments in the supply side of the market (ii) demand side (iii) FIs	H	GEF, WB, ADB, UNEP, UNDP TA Programmes

Source: Adapted from Public Finance Mechanisms to Mobilize Investment in Climate Change Mitigation, UNEP SEFI, 2008.[374]

Table 23: Government policy practices

This publication argues that a wide range of policy practices can be used to address climate change and presents a way to structure them. It contends that better policy systems with proper mix of instruments, improved implementation and monitoring are needed to make government intervention more effective.

Policy instrument category	Policy type	Examples on SC	Examples on EE
Legislation instruments	Law & Regulations Standards Codes of Practice	Recycling-Based Society Law; compulsory labeling; Producer take-back responsibility; etc.	Energy Conservation Law (India, Japan, Thailand, New Zealand), (annual audit, energy manager, minimum EE standards, product labels, etc)
Economic instruments	Taxes and fees/charges Subsidies Property and tradable rights Bonds and deposit refunds Liability systems	Deposit-refund scheme; Pay as you throw; Tax reduction/subsidies for renewable energy supply; Emission trade; etc.	Energy conservation tax on petrol; Tax deduction for investing in EE technologies; favorable loans, tax break etc.
Voluntary Instruments	Voluntary agreements Programme & projects Reporting Public information	Eco-labeling; Product declaration; Sustainable procurement; Benchmark information; Education programmes	Voluntary agreements are rarely seen in Asia; Capacity building, EE programmes, Voluntary labeling (Top Runner Labeling Programme

Source: Adapted from Tools and Instruments for Policy Intervention to Change Consumption Patterns, UNEP, 2010.[375]

Table 24: Green growth policy overview

The following table provides a brief summary of key *Green Growth* initiatives which can be undertaken by policy makers. The publication notes that a vast array of policy options and mixes exist both across and within each *Green Growth* path.

• Demand-side management • Green taxation (e.g. carbon and energy taxes, fuel charges, congestion pricing) • Green subsidy reform • Investment in sustainable infrastructure • Public private partnerships • Payment for environmental services (PES) • Government-backed financing for new green business initiatives • Voluntary environmental agreements (between governments and the private sector) • Carbon and energy registries/energy and water Auditing • Urban growth boundaries • Value capture • Waste exchange programmes	• Extended producer responsibility • Net metering • Life-line tariffs • Full-cost pricing • Full-variable pricing and differential taxes • Subsidizing research on climate change impacts in and across specific sectors and individual regions • Government funded technical vocational and educational training (TVET) for developing new green skills, especially for small and medium-sized enterprises • Government support for the adoption and transfer of environmentally sound technologies (ESTs) • Eco-labeling • Mandating the use of sustainability impact assessments on the policy and project level and adoption of integrated sustainability assessment for long-term, national development strategy	• Prioritization of eco-efficiency indicators as measurements for benchmarking development progress • Green public procurement • Green Growth capacity building for public administrators and policy makers • Decentralization with effective training and financing for local governments • Feed-in tariffs • Upgrading/enforcing of efficiency standards (e.g. building codes and energy efficiency of appliances) • Funding of research on the effects of climate change and techniques for adaptation within and across industries, sectors and regions • Promotion of eco-industrial parks and smart growth zones • Public awareness raising campaigns about the significance of climate change, resource scarcity and Low Carbon Green Growth

Source: Adapted from Policies and Instruments, Green Growth, UNESCAP, 2010.[376]

Table 25: Raising finance from capital markets to address climate challenge

Of the two main possible options to raise funds in order to fund public interventions in climate change—taxation and debt—this table focuses on the latter and more specifically on the use of traditional capital markets instruments. The reason why debt issuance is of particular interest is that government bonds can be designed to play additional roles besides raising finance. They can increase government commitment to policy change by creating financial incentives for governments to deliver the regulatory framework and, if designed appropriately, can provide a hedging instrument for investors against the risk of delivery of policy change. Further, instruments that link bonds to direct investments in emission reduction projects may be particularly suitable to developing countries, as they would allow governments to take a direct stake in project finance.

	Criteria			
Instruments	**Appropriate risk allocation**	**Alignment of incentives**	**Scale, scope and usability**	**Political acceptability**
Traditional government bonds	• Government bears risks related to projects financed by the bonds. • No formal link between risk and specific management of the regulatory framework on emissions.	• No additional incentive for Governments to deliver on the regulatory framework (e.g. incentive to create a carbon market).	• Ideal for raising large investments through institutional investors. However, limited by current concerns about borrowing. • No effect in terms of pushing large policy changes. • Administrative simplicity.	• As hard as any government debt issuing at this stage.
Bonds linked to specific investments (green bonds)	• Risk remains with Government. • Returns from projects that Governments invest in are dependent not only on the ability of Governments to implement regulatory framework but also on other factors (e.g. evolution of global carbon markets).	• Both public and private sectors have similar incentives to ensure maximum returns from the projects. • As a result, greater incentive for Governments to implement an efficient regulatory framework.	• Potential for large investments from institutional investors if bonds have sovereign guarantee and standard characteristics. • Bonds could be administratively easily to develop, but institutional set-up could be complex.	• Impact on budget similar to traditional bonds (perhaps slightly different depending on the nature of the assets financed with the revenues). Bonds could be marketed successfully around specific 'green instruments', hence increasing their political acceptability.
Indexed bonds	• Government has only indirect control over risks associated with returns (e.g. risk around the regulatory framework). • Bond buyers would face the risk of lower returns if the Government achieves its objectives fully: hence it should be treated as a good hedging instrument only.	• Aligned incentives between financiers in emission reduction projects and the Government, as both would want higher carbon prices or emission targets to be met (depending on indexing). • Bond buyers would have opposite incentives. However, because it is a hedging instrument, bond buyers are likely to be the same agents as financiers in emission reduction projects.	• Niche product, because only attractive as a hedging instrument. • Indexed bonds set the right policy incentives, but not as powerful as other instruments in creating radical policy change.	• Potentially hard in current context because of burden it creates on public budgets. • Risk would need to be limited by putting a ceiling on returns. • Treating this as a niche product could make it more acceptable.

Long-term option contracts for carbon emissions	• Governments issuing put options would face the risk of carbon prices lower than the option's exercise price. • Appropriate alignment of risks, as with indexed bonds.	• Sale of put options by Governments would be a credible commitment to a carbon price floor and would provide upfront finance. • Governments could differentiate price of put options according to the investors (e.g. charging a lower price to CCS investors). • Safe hedging instrument for companies investing in emissions reductions, while increasing Government's incentive to minimise policy and regulatory risks.	• Mostly hedging instruments, as indexed bonds. • Provides an instrument to limit the carbon price risk and reach substantial scale. • Characteristics of options could be determined according to Governments' policy priorities in terms of technologies. • Does not require a fully functioning option market to price the option contracts.	• If issued at scale, the burden on the public purse could be substantial.
Higher upfront proportion of offsets in early stages	• Although no financial risk to Governments, there is a strong environmental effectiveness risk, as effectiveness of early emission reductions investments in developing countries may be questionable. • Potential to access larger amounts of cheap abatement opportunities early on.	• Governments would have to take on the responsibility of ensuring that emissions reductions paid for upfront by regulated entities are actually achieved.	• Potential scale of offsets purchased by regulated entities is substantial (especially in Europe and even more so in the US), hence creating a large pot of money available for investments in developing countries in the short-term. • Administratively simple, but potential negative effect on domestic investments to reduce emissions.	• No additional financial liability for Governments. • Could be very difficult for Governments to guarantee the environmental effectiveness of the measure, hence creating potential political liability.

Source: Adapted from Meeting the Climate Challenge: Using Public Funds to Leverage Private Investment in Developing Countries, LSE, 2009.[377]

Table 26: Examples of publicly backed guarantee schemes

This publication argues that the deployment of clean energy technologies at a necessary level requires an intelligent mix of *demand-pull* and *technology-push* instruments. The instruments that can be engaged are the instruments that establish the *overall economic framework for investments* and *Specific barrier removal instruments.* Publicly Backed Guarantees (PBGs), as *Specific* instruments, can be very effective and can help achieve a green policy target at a low cost to the economy. PBGs use risk mitigation to steer the flow of private funds towards priority investments. The table following provides examples of types of PBGs.

Name of PBG	Purpose	PBG tool
PBGs for business finance for technology development		
Sowalfin (Belgium)	Attract new BA investors & new BA investments	Guarantees to subordinated loans or capital increase investments made by BAs
SME Guarantee Facility, SMEGF (EU)	Increase in FI mezzanine finance and FI guarantee cover for equity	Portfolio and counter guarantees to FIs involved in SME mezzanine finance or equity guarantees
Safaris (France): • Développement Technologique pour les FCPI/FCPR Fund • SME Performance Guarantee	• Increased Investments by VC funds in high-tech unlisted SMEs under seven years old • Encourage corporations to entrust new projects to innovate SMEs	• Guarantees to VC-Funds (counter guaranteed by the EIF) • Counter guarantees to bank guarantees for pre-payments made by large firms for service and product deliveries by SMEs
AWS (Austria) • Equity guarantee • Double Equity guarantee • Technology Finance • Profit sharing bonds	• Attract new entrants into the BA finance business • Provide FI loan finance to SMEs without collateral • Attract joint VC-FI finance for innovative firms with growth p.- Capital for expansion projects + introduction to capital market finance	• Guarantee for third party seed equity investments • Guarantee to subordinated loans by FIs • 100% guarantee for FI subordinated loan, 50% guarantee for VC investment • Guarantee for bonds registered at the unregulated secondary market at the Vienna Stock Exchange
Emerging Technology Fund, ETF (Massachusetts)	Enable bank mortgage finance of special-purpose laboratory buildings in depressed market	PBG for commercial mortgages for specialized buildings used by bio-tech firms
PBGs for project finance		
Us Dept. of Agriculture Business and Industry Loan Guarantee Program	Promote investments in starch-based ethanol plants	Up to $25 million in loan guarantees
US DOE guarantee program 2009	Promote investments in leading edge RE demonstration plants, transmission for RE-connected power and smart grids	Partial credit guarantees
Structured finance facility EIB	Pursue EIB equity financing and guarantee operations in favor of large-scale infrastructure schemes	Guarantees for pre-completion and early operational risk, subordinated loans, and mezzanine finance
Geothermal Energy Development Fund GEF/World Bank	Increase investments in exploration of geothermal resources	Partial risk guarantee against the short-term up-front geological risk of exploration and/or the long-term geological risk of facing a lower than estimated temperature, higher than estimated mineralization, or difficult re-injectivity

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Table 26 (continued)

Name of PBG	Purpose	PBG tool
Resource Risk in Deep-Geothermal Exploration Drilling, KfW, German Ministry of Environment	Increase investments in deep-well drilling for exploration of geothermal resources	Ministry of Environment partial counter guarantee for KfW loans to project developers
Municipal Guarantees for private investments in collective energy supply (Denmark)	Enable investments in RE-based energy supply for district heating systems	Local municipal guarantee to loans given by Danish Municipal Bank to private investments in RE-based energy plants connected to local collective energy system
Renewable Energy and Energy Efficiency Guarantee Program, CORFO, Chile	Enabling project finance by FIs for small-scale grid connected wind, hydro, and geothermal power plants	50% pari-passu guarantee to long-term project loans by FIs
	PBGs for asset finance	
Bulgarian Energy Efficiency Fund, BEEF **– ESCO portfolio guarantee** **– Residential portfolio guarantee**	Enable ECO access and get better interest rates on loans from FIs Enable collective finance of EE improvements in residential buildings	Portfolio guarantee to ESCO for consumer payment default + to cover disruptions in flow of receivables Portfolio guarantee to loans made by FI to individual condominium owners, each covering his pro-rate share of EE investment in residential building block
Hungary Energy Efficiency Co-Financing Program, HEECP, IFC/GEF	Promote FI involvement in EE finance through leasing, end-user finance, and ESCO finance modalities	First loss guarantee by GEF to IFC's involvement in pari-passu, subordinated recovery, portfolio guarantees, and first loss guarantees to FIs providing EE loans
Phase II China Energy Conservation Project ESCO loan guarantee program, GEF/World Bank	Promote entry of ESCOs by enabling these to access bank loans for their project finance	90% guarantee to commercial banks that make loans to ESCOs for the financing of qualifies EE projects
OTP-Bank PBG-scheme for ESCOs (Romania) GEF/IFC	Provide ESCO services for public sector clients	First-loss facility for OTP-bank loans to EE projects in municipal buildings
Energy Efficiency Community Challenge (City of Bellingham)	Enable FIs to offer longer terms and lower interest rates on finance for EE investment by residential and small commercial sector	Loan Loss Reserve Fund established by municipality to support FIs making EE project loans
Energy Efficient Mortgage program, EEM, Federal Housing Administration, FHA	Allow low-income households to purchase or refinance a residence and incorporate the cost of EE improvements into the mortgage	Mortgage insurance by HUD of mortgage loans to borrowers who would not otherwise qualify for conventional loans on affordable terms
US Federal Energy Efficiency Finance Facility, FEEFF (proposal)	Increase EE finance by developing a secondary market for numerous small and disaggregated loans for EE&RE (securitization)	Credit enhancement of bond issues through federal loan repayment guarantee
FOGIME (France)	Promote EE investments by SMEs	70% guarantee cover for FI loans to SMEs for EE investments up to €750,000
Rural Energy for America Program, REAP	Promote EE in agricultural operations	60–85% guarantee cover for FI loans for EE investments up to USD 25m

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Table 26 (concluded)

Name of PBG	Purpose	PBG tool
PBGs for technology transfer and RE%EE market penetration in developing economies		
FASEP managed by OSEO (France)	Foster the growth of French companies wishing to expand by creating subsidiaries abroad	Guarantee covering economic risk of failure of successful implantation
Multilateral Investment Guarantee Agency, MIGA	Promote foreign direct investments	Insurance against political risks (was and civil disturbance, expropriation, currency transfer risks, and breach of contract)
Leyte-Luzon geothermal power project (Philippines) World Bank	Help government energy company access bond finance at low interest rates on the international capital market and with loan tenor	PCG to the bond issue structured as a put option for principal repayment at maturity
West Nile Rural Electrification Company, WENRECO (Uganda)	Expand loan tenor on commercial bank loan from 7 years to 14 years	Option for bullet payment of rest-debt payment at year 7 guaranteed through a zero coupon bond with 7 year maturity
Central American Renewable Energy and Cleaner Production Facility, CAREC	Provide risk finance for investments in grid-connected RE up to 5 MW and creation of clean energy service enterprises	Loan guarantee facility to private sector debt to the CAREC fund
Solar Home Systems Financing Program in Palawan, (Philippines) UNEP/GEF	Enable FI lending to household purchases of solar home systems	Loss reserve fund to support FI loans for household purchases of solar home systems
Joint Implementation Project for EE in residencies in Eastern and Central Europe	Reduce interest rates	Guarantee carbon revenues for lenders who acquire entitlements to carbon credits in return for providing low-interest loans

Source: Adapter from Publicly Backed Guarantees as Policy Instruments to Promote Clean Energy, UNEP SEFI Alliance, 2010.[378]

ANNEX 2

Compendium of Abstracts

Publications[A]

10 Years of Experience in Carbon Finance, Insights from Working with the Kyoto Mechanisms, World Bank, May 2010[129]

This report evaluates the World Bank's experience of working with the Kyoto Protocol's project-based mechanisms over the past decade. The CDM, as the much larger system in terms of projects, emission reductions and host countries, is the basis for much of the report's discussion. Furthering the use of market instruments should incorporate the lessons of the past into future designs, making full use of the experience and learning that has been gained. This publication seeks to make a constructive contribution to this debate, in full respect of the ongoing international climate change negotiations, by providing insights and recommendations from a practitioner's experience and perspective.

27 National Action Plans = 1 European Energy Policy?, Heinrich Boll Stiftung, December 2010[97]

This publication fosters the important debate on a common and sustainable European Union energy policy. The analysis discusses the relationship between the long-term goal of 100 percent of electricity generation coming from renewable sources and national renewable energy action plans. Moreover, the analysis focuses on the relationship between the potential benefits that arise from increased European cooperation and the above-mentioned action plans. Finally, this publication points out the areas in which further measures need to be taken so that the transformation of the energy sector is seriously addressed.

The 6th Changchun High-level International Finance Meeting of Northeast Asia Investment and Trade Expo, Songyuan Consensus on G-Finance, 2010[331]

This article examines the 6th Changchun High-level International Finance Meeting of Northeast Asia Investment and Trade Expo held in China. The theme of the meeting was Green Finance: New Drive for Development Model Transformation. The meeting focused on how to boost green financial innovation, and the linkage, interaction and fusion between green finance and existing financial systems. As a part of this meeting, a definition for green finance was adopted. The article highlights the growing importance of green finance as the green economy develops. Indeed, the development of a green economy calls for the support of green finance, which can become a new drive for the transformation of the economic growth pattern only when it is incorporated into a sustainable green economy. The article also reports the contents of the Songyuan Consensus on green finance that was read by Li Ruogu, Chairman and president of Export-Import

Bank of China. Above all, international cooperation and positive incentive mechanisms are needed in order to make green finance a reality.

Accelerating Energy Conservation in China's Provinces, Taylor, et al., the World Bank, 2010[379]

China's comprehensive 2006–10 energy conservation drive has succeeded in both delivering strong results and laying policy and program foundations for delivering more energy savings well into the future. China's provincial governments have been at the core of program implementation. The policies, program concepts, and implementation platforms created over the last four years will serve China well to achieve further energy conservation results during the next five-year planning cycle, and to help meet China's target to reduce the carbon intensity of its economy by 40–45 percent by 2020. However, much work remains, to improve, adjust, and strengthen the programs further, and to continue to interject new and creative solutions.

Current program coverage already is extensive; greater efforts now need to turn to improving the quality of implementation. Use of energy pricing tools can be expanded, and market forces can be further tapped into for delivery of energy savings. The increased attention to energy efficiency by key enterprises mandated under the new target system and the Energy Conservation Law needs to be nurtured through a wide range of initiatives to yield continual benefits to both enterprises and society at large. Efforts need to be made to expand energy savings resulting from use of public funds further, such as through trying out additional approaches and increasing the leveraging of other financing sources.

This report provides provincial agencies and groups in China, and those that support them, with some outside perspectives and ideas on further development of provincial-level energy conservation programs over the next several years. The report also describes the provincial energy conservation programs developed during the last four years in some detail, since these programs are generally not well known outside of China.

Alternative Thinking 2011: A Look at 10 of the Top Issues and Trends in Renewable Energy, Deloitte, 2010[380]

This report explores some of the most crucial issues and trends related to clean energy activities. The analysis investigates uncertainty-related issues, funding, social impact, customer relationship management, income resource development, infrastructure challenges and supply chain development of renewable energy sectors. In addition, the report provides a roadmap for the future of renewable energies.

Analysis of the Scope of Energy Subsidies and Suggestions for the G-20 Initiative, IEA, OPEC, OECD, World Bank, June 2010[209]

This report shows that subsidies are one of many policy instruments used by governments to attain economic, social, and environmental objectives. Energy subsidies, in particular, are often used to alleviate energy poverty and promote economic development by enabling access to affordable modern energy services. Poorly implemented energy subsidies are

economically costly to taxpayers and can damage the environment through increased emissions of greenhouse gas and other air pollutants. The report also provides a roadmap to guide policy makers, based on lessons drawn from case studies in developed and developing countries.

Analytical Framework for Climate Change Action, Inter-American Development Bank, March 2010[173]

The Latin America and the Caribbean (LAC) region is highly vulnerable to the detrimental effects of climate change and, like all other regions in the world, must invest in climate change adaptation activities as the region's poor are especially vulnerable to climate change effects. According to the most recent Intergovernmental Panel on Climate Change (IPCC) assessment report, important changes in precipitation and increases in temperature have been observed in the region. This increased vulnerability has several potential negative consequences and to address climate change adaptation challenges, LAC countries should target such key economic sectors as land use, land use change, and forestry (LULUCF), agriculture, water resource management, and urban development, as the consequences of inaction in these sectors could be catastrophic for the economic sustainability of LAC nations. The means to protect these sectors should be developed and concrete adaptation measures fully incorporated into sector planning. Not only can the IDB help Latin American and Caribbean countries fulfill to a fuller extent their responsibilities with regard to global GHG mitigation, but the effect would be to buffer to the greatest extent possible the setbacks that climate change presents to the Millennium Development Goals by fostering clean and adaptable development methods.

APEC 2010: Bogor Goals, Achieving the APEC Bogor Goals Progress by Australia and the Region, APEC, 2010[103]

This report considers APEC's progress towards the 2010 Bogor Goals, focusing primarily on the achievements of industrialized economies—Australia, Canada, Japan, New Zealand and the United States. In 2010, eight developing economies also volunteered for assessment against the 2010 Bogor Goals. These economies are Chile, Hong Kong Special Administrative Region (SAR), Korea, Malaysia, Mexico, Peru, Singapore, and Chinese Taipei (ROC). Progress made by these developing economies provides a useful comparison for the industrialized group of APEC members.

The evidence indicates that as a group, APEC's industrialized economies have reduced the average applied tariff rate from 7.0 percent in 1996 to 3.9 percent in 2008, with an estimated 60.1 per cent of imports entering duty free, up from 42.6 percent in 1996. This has contributed to the high levels of trade among APEC economies. Under APEC's business facilitation agenda, a focus on policy and regulatory harmonization and co-operation has lowered non-tariff barriers. APEC's comparatively recent work on services and investment is opening up new sectors to trade and reducing restrictions on inward and outward investment flows.

While APEC's industrialized economies have made good collective progress towards the Bogor Goals, Australia's individual achievements in trade and investment liberalization

and facilitation have been exceptional. Australia is one of the most open, and as a result, strongest performing economies in all of APEC.

But despite APEC's overall progress, the lowering of barriers to trade and investment has not been uniformly impressive across all sectors. The agricultural sector and some industrial sectors (such as textiles, clothing and footwear) are still afforded conspicuously high levels of protection, both at the border and through domestic support for producers and manufacturers. In the agricultural sector, the level of protection for producers varies greatly among economies. Australia, as a vigorous proponent of free agricultural trade, has one of the most open agricultural sectors in APEC.

As well as in agriculture, there is considerable scope among APEC economies for further progress in freeing up investment and trade in services. Australia has played an instrumental role in forging a renewed commitment in APEC to tackle impediments to services and investment through multiyear Action Plans on services trade and investment facilitation.

APEC Energy Overview 2009, APERC, 2009[381] and APEC Energy Overview 2010, APERC, 2010[382]

The APEC Energy Overview is an annual publication containing energy demand and supply data as well as energy policy information for each of the 21 APEC economies. It also contains information on notable energy developments, including policy updates, upstream development, energy efficiency, low-carbon energy, and environmental issues.

The Appeal of Voluntary Environmental Programs: Which Firms Participate and Why?, J. Videras, A. Alberini, October 2009[80]

This article examines the determinants of participation in voluntary environmental programs and analyzes the effect of the voluntary programs' regulatory stringency and the visibility of firm participation to regulators and consumers. Rather than focusing on one program and the regulatory background control of the industry to which the firm belongs, the focus is on a specified universe of firms (manufacturing firms among the large, publicly traded companies in the Standard & Poor 500), and on their participation in each of three EPA voluntary programs covering differently regulated pollutants.

Assessing the Impact of IFC's China Utility-Based Energy Efficiency Finance Program, IEG, 2010[335]

China's size, rapid economic growth, and inefficiencies in energy use make it one of the world's largest emitters of carbon dioxide. The utilization of the International Finance Corporation's energy efficiency finance program, which started in 2006, has been compared with other similar programs. As of June 2009, the 98 energy efficiency investments supported by the program have reduced greenhouse gas emissions by 14 million CO_2 tonnes per year, slightly in excess of the target set at the beginning of the program. This evaluation report assesses the performance of IFC's energy efficiency finance program in China aimed at stimulating energy efficiency investments through bank guarantees and technical assistance.

Barriers to Private Sector Investment in the Clean Energy Sector of Developing Countries, Duncan Ritchie, May 2010[9]

This paper examines the barriers that private sector organizations encounter when investing in the clean energy sector of developing countries. The preparation phase is essential in clean energy projects. It is also comparatively more costly, particularly in developing countries. Investment volumes continue to be insufficient as a result of the transaction costs and the higher level of risk. Moreover, being a *pioneer* in this sector and these countries carries very few advantages as differential costs are, in this case, even higher. Governments and development institutions can help reduce preparation costs, reward *pioneers,* and secure a future for the sector.

Beyond the Sum of Its Parts: Combining Financial Instruments to Support Low-Carbon Development, World Bank, 2010[119]

While the climate finance landscape is rapidly evolving, three dedicated climate financing instruments are currently available to the World Bank Group (WBG) as key tools for increasing support to low-carbon infrastructure, particularly the energy and transport sectors. These are the Global Environment Facility (GEF), the Clean Technology Fund (CTF), and carbon finance, especially the Carbon Partnership Facility (CPF). This paper provides further information and clarity on these three mitigation-related climate financing instruments available for the WBG and their application in the context of specific projects and national policy frameworks. This paper considers six projects that are using resources from one or all of these sources in combination with development finance to advance low-carbon development. It lays out a conceptual basis for how GEF, carbon finance, and CTF resources can be brought together to make a wider range of mitigation projects financially and economically attractive. Moreover, the paper describes objectives, overall approaches, project sizes, and financing-related issues of the above-mentioned financing instruments to support low-carbon growth. Finally, this paper draws lessons for the broader development community on how resources from different climate financing instruments can be combined for expanded impact, increased leverage, and enhanced efficiency.

Brazil Low-Carbon Country Case Study, the World Bank, 2010[383]

Brazil's commitment to combat climate change had already begun when the country hosted the United Nations Conference on Environment and Development, also known as the Rio Earth Summit, in June 1992. In prior decades, the steady expansion of crop land and pasture has required the conversion of more native land, making land-use change the country's main source of GHG emissions today. At the same time, Brazil has used the abundant natural resources of its territory to explore and develop low-carbon renewable energy. Despite this, Brazil was one of the largest GHG emitters from deforestation and would probably continue to be so if not for the government's recent adoption of a series of measures to protect the country's forest. Like many other developing countries, Brazil faces the dual challenge of encouraging development and reducing GHG emissions. Urgent solutions are thus needed to reduce Brazil's vulnerability to climate change and to enable the implementation of adaptation actions in the country.

Bretton Woods Institutions and Green Economy, 2010[144]

In their Joint Statement of December 2, 2009, for the Copenhagen Climate Change Conference, the Heads of the Multilateral Development Banks (MDBs) and the International Monetary Fund (IMF) pledged to build upon their respective mandates, expertise and resources to help developing countries and their public and private sectors respond to the challenge of climate change while achieving the Millennium Development Goals. This report provides some highlights given by each of five MDBs in their efforts to promote a transition to a green economy.

Building Bridges: State of the Voluntary Carbon Markets 2010, Ecosystem Marketplace & Bloomberg New Energy Finance, 2010[249]

Throughout 2009, while voluntary carbon market transaction volumes remained relatively small, the marketplace thrived as an incubator of innovative protocols, registries, alliances, and project types. In the context of the regulated markets, the voluntary carbon markets proved they could be "the size of a mouse but have the roar of a lion." For example, proposed federal climate legislation in the United States and federal offset programs in Australia referenced standards developed in the voluntary carbon markets. Also, reduced emissions from deforestation (REDD), a project type still exclusive to the voluntary carbon markets, was prominent at the international climate negotiations in Copenhagen at the end of 2009.

In 2009 many entities engaged in the voluntary carbon markets solely as a precursor for ensuing major compliance. However, half the marketplace remains driven by "pure" voluntary buyers seeking to offset emissions. These buyers grew increasingly sophisticated, seeking specific credit types from specific locations. Despite the recession, numerous companies initiated offset programs or continued to commit to offsetting goals. However, the concept of offsetting has not lost its controversial edge and many stakeholders continued to emphasize the importance of reducing internal emissions before purchasing offsets. Amidst these fluctuations, the marketplace continued to mature at a rapid pace, building infrastructure to ensure accountability and quality, incubating carbon market innovation and developing new GHG emissions reduction projects.

Building Partnerships for Climate Action, Climate Investment Funds, 2009[384]

With the United Nations Framework Convention on Climate Change (UNFCCC) discussions ongoing, and in accord with the Bali Action Plan, the 18-month-old Climate Investment Funds (CIF) are an interim measure established to fill a financing gap for climate mitigation and adaptation until a new institutional arrangement for climate finalized, as expected in 2012. This annual report covers the CIF's first year of operation (November 1, 2008 to October 31, 2009), describing the CIF and its evolution. The purpose of this report is to publicize the CIF to a wide range of stakeholders and to describe the design and early implementation process. In the coming years, through the CIF, climate mitigation and adaptation investment activities will be piloted that initiate transformational change in sectors affecting or being affected by the climate. The lessons from the CIF design and implementation, shared with the international community, will inform

the negotiating parties during their deliberations for a new climate system under the UNFCCC.

Buying and Cancelling Allowances as an Alternative to Offsets for the Voluntary Market: A Preliminary Review of Issues, OECD, August 2010, © OECD 2010[78]

This paper explores scenarios under which, as an alternative to offsets, voluntary buyers could instead buy and cancel allowances from compliance markets. Accordingly, this paper examines the implications of allowance cancellation, considering lessons from other, related experience. The paper argues that the purchase and cancellation of allowances reduces the available allowances in a cap-and-trade system, "tightening the cap" and, in principle, reducing the emissions that can be produced by covered sources. By this logic, purchasing and cancelling an allowance compels covered sources to achieve additional mitigation. Opportunities for voluntary buyers to purchase and cancel tradable compliance units currently exist in several markets, but in small quantities. If the practice of cancelling allowances remains limited to individuals and voluntary corporate buyers, it is likely to remain small and is unlikely to send a strong price signal. In the medium- and long-term this might change if large numbers of sub-national actors choose to cancel allowances.

Can REDD, Finance and MRV Make It in Cancún?, L. Zelljadt, 2010[385]

The upcoming negotiating session on Cancún may offer some limited progress toward overcoming stalemates over (i) financing and MRV, and (ii) market mechanisms for avoided deforestation. This paper investigates these two issues at stake. Industrialized countries pledged a significant amount of money—US$100 billion annually by 2020, as well as *fast start* funding approaching US$30 billion cumulatively through 2012 for developing country mitigation and adaptation in the Copenhagen Accord. However, this has created new questions regarding both the sources of that money and the policies it is supposed to pay for. Secondly, another problem which permeates the finance discussion with respect to market mechanisms is exemplified by the area where most progress has been made: reducing emissions from deforestation and degradation (REDD).

Carbon Crunch: Meeting the Cost, UNEP, December 2007[138]

The finance sector has an important role to play in addressing climate change because it can influence investment and financial flows. Against the background of recent assessments and studies, this paper reviews what leading financial institutions are already doing in this respect, and what should be done to extend and deepen these actions across the entire finance sector. In doing so, this paper provides key recommendations on climate change for both policy makers and financial institutions.

Carbon Disclosure Project 2010: Asia ex-Japan Report, Association for Sustainable & Responsible Investment in Asia, 2010[386]

The Carbon Disclosure Project (CDP) is an independent not-for-profit organization holding the world's largest database of primary corporate climate change information.

CDP was launched in 2000 to accelerate solutions to climate change by putting relevant information at the core of business, policy and investment decisions. CDP furthers this mission by harnessing the collective power of corporations, investors and political leaders to accelerate unified action on climate change. This report provides updates regarding the progress in carbon disclosure despite the mixed success of Copenhagen conference. It also shows key trends, sector overviews and Carbon Disclosure Scores that assess companies on the quality and completeness of their disclosures. In addition, changes in emissions disclosure are discussed.

Carbon Disclosure Project Overview, Carbon Disclosure Project, 2010[88]

Approximately 3,000 organizations in some 60 countries around the world now measure and disclose their greenhouse gas emissions and climate change strategies through the Carbon Disclosure Project (CDP), so they can set reduction targets and make performance improvements. This data is made available for use by a wide audience including institutional investors, corporations, policymakers and their advisors, public sector organizations, government bodies, academics and the public.

Carbon Finance for Sustainable Development—Annual Report, World Bank, 2009[387]

The World Bank's carbon unit 2009 report highlighted case studies, key data, and some project information for country-level funds being utilized through the Carbon Fund. 2009 represented a significant milestone for the World Bank's Carbon Finance Unit marking its first ten years in developing carbon markets. Starting in 1999, with the Prototype Carbon Fund, capitalized at US$180 million of investible resources, the unit now manages a robust suite of ten carbon funds and facilities with a total capitalization of US$2.5 billion, involving 16 governments and 66 private companies in the *Kyoto Funds* and 51 governments and organizations in the Forest Carbon Partnership Facility. These funds and facilities are described in this annual report.

Carbon Monitoring for Action (CARMA): Climate Campaign Built on Questionable Data—A Due Diligence Report on CARMA's Data and Methodology, S. Afsah, E. Ness, May 2008[308]

This paper reports three key policy messages. First, climate management actions need a disciplined data based analysis, and the public and the media should be made fully aware of any potential shortcomings in the data quality. Second, monitoring and verification of CO_2 emissions is likely to remain a considerable challenge, but statistical shortcuts are not an adequate substitute for the real measured data obtained from proper onsite monitoring and verification as required by the established protocols of various international and national agencies. Finally, the surging popularity of climate issues has created a tempting environment for public recognition, but the focus should remain on objective and cost-effective solutions and policies. The most fundamental issue remains—climate campaigns simply cannot be built on erroneous and questionable data because it would only undermine the chances of policy success and negatively affect the col-

lective interest in managing the challenges of global warming. Indeed, this due diligence report contends that the popular climate management initiative Carbon Monitoring for Action (CARMA.org) run by a prominent Washington DC based think-tank, the Center for Global Development (CGD), utilizes erroneous and questionable CO_2 emissions data to rank power plants and motivate public activism.

Carbon Trading: How It Works and Why It Fails, T. Gilbertson and O. Reyes, November 2009[135]

This paper provides an introductive explanation to carbon trading. It explores the origins and key factors involved in building the architecture of emission trading. This paper also examines the performance of the EU ETS and finds that it has generously rewarded polluting companies while failing to reduce emissions. Moreover, the paper outlines the performance of the CDM and looks at four case studies of CDM projects in Thailand, India, Indonesia and Brazil. Finally, this paper outlines possible solutions and ways forward for political organizing on questions of climate change.

CASES: Cost Assessment of Sustainable Energy Systems, Fondazione Eni Enrico Mattei, 2008[216]

This report describes the results of work package 8 on the "Assessment of Policy Instruments to Internalize Environment-Related External Costs in EU Member States, excluding renewables". One of the objectives of the CASES project is to evaluate policy options to improve the efficiency of energy use, taking account of the full cost data which has been assembled in the first part of the CASES project. The other work packages related to this objective are WPs 9, 10 and 11. Work packages 8, 9 and 10 share a common methodology.

WP 8 first objective is to assess policy instruments to internalize externalities in EU member states, excluding renewables. The second objective is to investigate stakeholders' preferences for those policy instruments through a stakeholder workshop which is organized together with WPs 9, 10 and 11. The organization of the report is based on the description of work. Chapter 2 provides a synopsis of policy instruments corresponding to task 8.1. The analysis of the extent to which policy instruments succeed to internalize external costs (task 8.2) is covered in chapter 3. Chapter 4 deals with the linkages between policy instruments (task 8.3) and chapter 5 with the analysis of the policy instruments (task 8.4) including the validation of the instruments by stakeholders. An extra technology analysis is performed and briefly described in chapter 6. Policy recommendations and conclusions are given in chapter 7.

Catalysing Climate Finance, UNDP, 2011[202]

This guidebook is offered as a primer to countries to enable them to better assess the level and nature of assistance they will require to catalyze climate capital based on their unique set of national, regional and local circumstances. It serves as a companion manual to a comprehensive UNDP toolkit on policy and financing options to catalyze climate capital. It is also part of a series of UNDP publications that provides guidance to national

and sub-national policy makers to prepare, finance, implement, and report on green, low-emission and climate-resilient development.

Building on UNDP market-transformation and development experiences for low-emission climate resilient technologies in over 100 countries over the past 20 years, this document outlines a four-step methodology to assist developing countries select and deploy an optimal mix of public policies and financing instruments to catalyze climate finance in line with national development priorities.

This guidebook focuses on clean energy as illustrated in the four-step framework figure. However, this framework can be as readily applied to most mitigation and adaptation technologies, including agricultural and ecosystems-based mitigation and adaptation technologies/solutions. It serves as an introduction and companion manual to a comprehensive UNDP toolkit Policy Instruments and Financing Options for Low-Emission and Climate-Resilient Development (UNDP, 2011a). This toolkit applies the methodology presented in this guidebook to a wide range of priority mitigation and adaptation technologies.

China, Meeting the Challenges of Offshore and Large-Scale Wind Power: Regulatory Review of Offshore Wind in Five European Countries, the World Bank, 2010[388]

This publication focuses on identifying lessons learned from international experience, defines a roadmap for the promotion of offshore and large-scale onshore wind development in China, and summarizes the messages emerging from a high-level workshop held in Beijing.

The paper includes strategic messages and an implementation guide for offshore and large-scale wind power in China. Moreover, it provides recommendations for offshore wind, intertidal wind and wind power bases.

In addition, technical notes on resource assessment, construction and grid integration are provided summarizing the discussions emerging from the Workshop on Offshore Wind and Coastal Wind Base Development held in Beijing in January 2009, focusing on the key concerns raised, and possible solutions.

China, Meeting the Challenges of Offshore and Large-Scale Wind Power: Strategic Guidance, the World Bank, 2010[389]

The objective of this study is to review international experience in offshore wind power development and draw on the lessons learned from the experience of different countries. To date, that experience has predominantly been limited to Europe. Significantly different regulatory and physical planning approaches have been taken in other, different countries. Hence, the experience is particularly helpful in providing suggestions for a new market.

China's Clean Revolution, J. P. Morgan's Hands-On China Series, Hands-On China Report, December 7, 2009[316]

This report discusses China's role in solving the climate change challenge. It explains how the Chinese government is working with the private sector to increase efforts to commercialize clean technologies and renewable energy, reduce GHG emissions, and increase green urban space in China's cities.

China's Envisaged Renewable Energy Target: The Green Leap Forward, World Bank, 2010[390]

The Chinese government embarked on the preparation of the 12th Five-Year Plan (FYP, 2011–15) and is envisaging increasing existing renewable energy (RE) targets substantially. Ongoing discussions focus mainly on the RE share in primary energy, technology choices, and the impact on electricity prices. This policy note first evaluates the existing and envisaged RE government targets against two optimal solutions determined based on the same economic and technical assumptions, but two contrasting values for environmental externalities. The environmental externality assumptions cover the wide range of estimates in recent studies. Second, the policy note assesses the existing policies and their adequacy to achieve RE scale-up and the government targets. Finally, the policy note provides high-level policy recommendations that could be considered during the revision of the targets.

China's Green Revolution: Prioritizing Technologies to Achieve Energy and Environmental Sustainability, McKinsey & Company, 2009[391]

As the world's most populous country and with one of the fastest growing economies, China faces the challenge of satiating its increasingly large appetite for energy. Confronted with a need to balance more sustainable practices without compromising its economic goals, China is investing large sums of money into developing its green sector, especially in the area of renewable energy and energy efficiency technologies. To provide a quantitative, fact-based analysis to help policy makers and business leaders identify and prioritize potential solutions, McKinsey & Company, in cooperation with leading researchers in China and across the world, undertook a study of the range of technologies that China could deploy to address its energy and environmental sustainability challenges. The purpose of this report is to facilitate the definition and prioritization of economically sensible approaches to address the challenges that China faces with regard to energy security and environmental sustainability.

This study provides a review of the market and regulatory approaches taken by the various different active European countries and provides some conclusions about the efficacy of these varying approaches. The study also makes recommendations to develop suggested best practice for the regulation of offshore wind power.

China's Policies and Actions for Addressing Climate Change, Information Office of the State Council of the People's Republic of China, October 2008[336]

China is vulnerable to the adverse effects of climate change, which has brought substantial threats to the natural ecosystems as well as the economic and social development of the country. These threats are particularly pressing in the fields of agriculture and livestock breeding, forestry, natural ecosystems and water resources, and in coastal and eco-fragile zones. Therefore, China's current priority task is to adapt itself to climate change. The multiple pressures of developing the economy, eliminating poverty and mitigating the emissions of greenhouse gases constitute difficulties for China in its efforts to cope with climate change, especially as the country is undergoing rapid economic development.

This report highlights China's strategies and policies toward both mitigating and adapting to climate change while also discussing the means to raise public awareness of the issue and enhance international cooperation.

Cities and Carbon Market Finance: Taking Stock of Cities' Experience with Clean Development Mechanism (CDM) and Joint Implementation (JI), OECD, 2010, © OECD 2010[132]

The importance of cities in climate policy stems from the simple reality that they house the majority of the world's population, two-thirds of world energy use and over 70 percent of global energy use emissions. At the international level, global carbon markets have become an important new source of financing for mitigation projects and programs. Yet to date, the participation of urban authorities and of urban mitigation projects in the global carbon market remains extremely limited. The under-representation of urban carbon projects can be linked both to the difficulties in implementing urban mitigation projects and to the difficulties for cities to access the carbon market. This paper reviews 10 in–depth case studies of urban projects proposed and operating within the realm of Joint Implementation (JI) and the Clean Development Mechanism (CDM) of the Kyoto Protocol. It explores the drivers of success for projects, examining in particular: the types of projects that have been successful and their profitability; leadership and other roles of various actors in project initiation development and operation (i.e. local, regional and national governments as well as international, private sector or other non-governmental organizations); the role of local co-benefits; and project financial structure and risk management approaches. This paper also considers how these lessons learned may inform future decisions how to best access the potential for carbon markets to offer increased levels of financial support for urban mitigation projects or programs.

Cities and Climate Change Mitigation: Case Study on Tokyo's Emissions Trading System, World Bank, May 2010[243]

The Tokyo Metropolitan Government has developed the world's first cap and trade program (Emissions Trading System, or ETS) at the city level targeting energy-related CO_2. The ETS covers around 1,340 large facilities including industrial factories, public facilities, and educational facilities, as well as, uniquely, commercial buildings. The ETS went into effect in April 2010. The city aims to reduce emissions by 25 percent from 2000 levels by 2020. CO_2 reductions are aimed at 6–8 percent of 2000 levels in the first compliance period (2010–2014) with a possible further 17 percent reduction by the end of the second compliance period (2015–2019) in order to achieve this goal. In addition to its status as the world's first city level ETS specifically for greenhouse gases (GHGs), the Tokyo program is particularly notable for the organized strategy that simultaneously gained wide stakeholder acceptance while setting stringent goals for GHG emitters in its jurisdiction. The strategy built an ETS framework that is sufficiently complex to tackle the practical problems in realizing GHG reductions while also reducing, as far as possible, the burden on the participatory facilities.

Cities and Climate Change, OECD, 2010, © OECD 2010[392]

This book shows how city and metropolitan regional governments working in tandem with national governments can change public attitudes to responding to climate change. The chapters analyze trends in urbanization, economic growth, energy use and climate change; the economic benefits of climate action; the role of urban policies in reducing energy demand, improving resilience to climate change and complementing global climate policies; frameworks for multilevel governance of climate change including engagement with relevant stakeholders; and the contribution of cities to *green growth,* including the *greening* of fiscal policies, innovation and jobs. The book also explores policy tools and best practices from both OECD and some non-member countries.

Clean Development Mechanism Annual Report, United Nations, 2009[393]

This report highlights the effort of the CDM Executive Board in enhancing the consistency and efficiency of its operations and those of its support structure, increasing the transparency of decision-making processes, and increasing stakeholders' understanding of required standards, which should lead to improved quality of submissions. The CDM annual report also suggests that quality remains the overriding concern, ensured through a regimen of performance monitoring and assessment that is an essential part of the revised procedure. In addition, the report focuses on streamlined procedures for the vetting of CDM-related methodologies and provides recommendations to expand the benefits of the CDM.

The Clean Energy Accelerator Corp., D. Goldman, August 2009[20]

Commercialization of new low/zero-carbon energy technologies is essential to addressing job creation, climate change, energy independence, economic competitiveness and long-term energy affordability. Private equity and project finance debt capital markets have historically funded projects and manufacturing facilities once they are commercially proven. However, neither government, venture capital firms nor capital markets have tended to bear the risks associated with providing equity capital, which can amount to hundreds of millions of dollars, for initial deployment of capital intensive new clean energy technologies at commercial scale—described here as "first project commercialization". This paper discusses how to finance large scale low-carbon investment and highlights the role of the *Clean Energy Accelerator Corp.* in order to solve the problem often referred to as the "commercialization valley of death".

Clean Energy Financing Partnership Facility: Establishment of the Clean Energy Fund and Clean Energy Trust Funds, ADB, 2007[394]

Financing partnership facilities are operational mechanisms for strategic, long-term, multi-partner cooperation, which link various forms of assistance in a coordinated manner for a well-defined purpose. This report introduces the overall concept of the Clean Energy Financing Partnership Facility (CEFPF) and details the Clean Energy Fund (CEF) and clean energy trust funds.

Clean Energy for Development Investment Framework: Progress Report of the World Bank Group Action Plan, World Bank, 2007[149]

This progress report is a response to the World Bank Development Committee's request for an update on the implementation of the Action Plan for the Annual Meetings in October 2007. It summarizes accomplishments in the three areas of the Action Plan: (i) energy for growth, with a particular emphasis on access to energy in Sub-Saharan Africa; (ii) transition to a low-carbon development trajectory; and (iii) adaptation to the impacts of climate change. This report also outlines an approach to scaling up actions on climate change and provides a review of options to further reduce the financial barriers to support low-carbon and adaptive growth in developing countries.

Clean Energy Trends 2010, Clean Edge, 2010[395]

In 2009, arguably one of the worst years in recent economic history, overall venture capital spending fell to its lowest level in more than a decade. However, signs of recovery have begun to emerge for the clean-tech sector. From Beijing to Seoul, and Washington, D.C. to Brussels, clean energy has become a driving force for economic recovery and while total venture activity was down, clean energy's share of the total continued to increase, to 12.5 percent of total venture activity in 2009 in the United States alone. Further, the combined global revenue in 2009 for solar photovoltaics (PV), wind power, and biofuels expanded by 15.8 percent over the previous year, reaching US$144.5 billion.

Clean Tech Handbook for Asia Pacific: May 2010, Thomson Reuters, 2010[264]

This handbook was produced to assess the growth and opportunities in clean technology in the Asia Pacific region. The pace and scale at which countries in this region such as China and India have set targets, aligned policy with industry, and then followed through with implementation is notable. This version of the handbook focuses on renewable energy for power generation and technologies (such as CCS and Clean Coal) to reduce impact from fossil fuels.

This handbook is intended as a reference guide for investors interested in the clean technology space in the Asia Pacific Region. It provides an overview of the different sectors by geography as well as highlights of the different policies and drivers for each market. The handbook: (i) defines the clean technology market in the Asia Pacific region by sector and geography; (ii) sizes the market opportunity by sector and geography; (iii) highlights the regulatory framework and the drivers across the Asia Pacific region; (iv) highlights the key players within each sector and each geography from new emerging private companies to public companies listed on the stock market; (v) looks at the various support structures for clean technology from government, private sector funding, and academic institutions; and (vi) highlights key technologies from universities.

Cleantech Matters: The Future of Energy, Ernst and Young, 2009[396]

A range of players, from venture-backed start-ups to utilities, oil and gas giants, public technology companies and governments, have all made substantial investments on the

cleantech sector. To gain insight into how cleantech innovations are being evaluated and utilized in the traditional energy and manufacturing industries, *The Future of Energy,* was organized, an executive roundtable discussion held during the Ernst & Young Strategic Growth Forum in Palm Springs, California, on November 13, 2009. More than 50 investors, entrepreneurs, corporate executives and industry advisors from the utility, oil and gas and cleantech sectors gathered to exchange their perspectives. The key points included: (i) despite rising energy demand, regulatory and financial obstacles could continue to hinder the adoption of cleantech; (ii) overcoming regulatory and financial hurdles requires new financing and corporate partnership models to facilitate cleantech development and commercialization; (iii) government plays a larger role in the development of cleantech than in most other industries—as regulator, customer and partner.

Climate Change and Economic Policies in APEC Economies, APEC, September 2010[370]

This report is a synthesis of the background studies on Climate Change and Economic Policies prepared as part of the APEC Finance Ministers' Policy Initiatives of 2008. The synthesis presents a menu of options for fiscal, regulatory, trade and investment policies to reduce the emission of greenhouse gases (GHG), and increase the use of energy efficiency and renewable technologies. The four background studies on which this synthesis is based are: (i) *Climate Change and Fiscal Policy;* (ii) *Trade and Investment Policies to Promote Climate Friendly Technologies in APEC;* (iii) *Assessing Capacity Building Needs for the Use of Market-Based GHG Mitigation Instruments;* and (iv) *The Impact of Extreme Climate Events on the Poor and Policy Responses.* Most APEC economies, especially the developing economies, have established ambitious targets to cap and reduce greenhouse gas (GHG) emissions while APEC economies are among the global leaders in the use, production and trading of climate friendly technologies. These economies have also been experimenting with a range of fiscal, trade and regulatory policies to curb emissions, which show considerable potential. However, absent further strengthening of the design of these policies and implementing institutions, APEC economies are unlikely to meet their national targets for reducing GHG emissions.

Climate Change and Energy Security: Lessons Learned, American Institute for Contemporary German Studies, Johns Hopkins University, 2008[397]

This is the first policy report in a series of AICGS policy reports on climate and energy policies following the AICGS policy report *Overcoming the Lethargy: Climate Change, Energy Security, and the Case for a Third Industrial Revolution.*

Climate Change and Energy Security: Lessons Learned delivers some extremely valuable insights into the respective debates on both sides of the Europe and the United States. Joe Aldy, Camilla Bausch, and Michael Mehling shed light on the experiences of Germany and the United States in these important issue areas over the course of the last few decades. They examine the extensive climate and energy track records in both countries including action at the federal and sub-federal levels, voluntary and mandatory measures, and the use of diverse instruments such as emissions trading, energy efficiency programs, support for research and development, and fuel diversification programs. Their essays examine

measures that have been highly contested domestically as well as policies which have an impact on shaping the international agenda.

Climate Change and Fiscal Policy: A Report for APEC, World Bank, 2010[398]

APEC economies display large variation in per capita income. The richest APEC economies have an income per capita about twenty times higher than the poorest ones. This report corrects that bias with a particular focus on the developing economies of APEC. It draws on examples from three developing economies in particular, China, Indonesia and Vietnam.

The report's main focus is on mitigation noting that many developing as well as developed economies have now proposed or adopted emissions reduction targets. Mitigation in developing countries requires a broad-based response with four key components. First, carbon pricing is critical, but on its own will not suffice, and in some economies and some sectors may have little or no impact due to pre-existing distortions. Second, energy sector reforms in many countries will be a prerequisite for effective mitigation, though they may on their own increase emissions. Third, broader policy reforms in some economies may bias economic growth to be more capital and energy intensive than is optimal. Fourth, technology-based mitigation policies will also be needed, but, given the mixed track record in this area, must be chosen with care. Given the many uncertainties involved, and the multiple reforms needed, a verifiable quantity anchor for mitigation policy is recommended for developing economies, such as the energy-intensity target recently adopted by China.

The report also focuses on adaptation. Fiscal analysis of adaptation has so far largely focused on cost projections, but for policy makers adaptation instruments and decision-making tools are as or more important. Adaptation instruments include the provision of public and club goods, public sector pricing reform and financial instruments which can be cost-effective alternatives to subsidies. Key to the right choice of instruments will be the correct use of appropriate decision-making tools. In particular, the social costs and benefits of alternative strategies need to be analyzed under conditions of uncertainty, in many ways the hallmark of climate change. A combination of Monte Carlo and *real options* analysis within a cost-benefit framework is recommended. Examples from a range of economies are provided to demonstrate the utility of such an approach.

Climate Change: Meeting the Challenge to 2050, OECD, February 2008, © OECD 2008[27]

This policy brief highlights the OECD's work on the likely impact of various courses of action to mitigate climate change, and the costs of inaction. Without further policies to combat climate change, the OECD projects GHG emissions will grow by about 52 percent by 2050. Accordingly, this policy brief confirms the importance of climate change countermeasures and discusses the trends in GHG emissions and their future. Moreover, this policy brief describes the role of policies and their related goals. In addition, this policy brief also considers the costs and the actors involved in fight against climate change.

Climate Finance Additionality: Emerging Definitions and Their Implications, Overseas Development Institute, 2010[399]

Additionality is an important issue on which to focus attention to ensure that sufficient finance is channeled toward climate change needs while simultaneously avoiding

diversion from development needs. Thus the way additionality is defined by donor governments needs focused attention and debate. This report explores the different definitions of additionality along with their technical and political implications. It also focuses on finance tracking, measurement, reporting and verification of each of the different definitions of additionality.

Climate Finance after Tianjin: How to Reach a Deal at Cancún?, Müller, B., 2010[400]

The UN climate change conference in the Chinese city of Tianjin (October 2–9, 2010) was the final preparatory UN meeting for the annual UN Climate Change Conference to be held in Cancún, Mexico in December 2010. The aim of this paper is to assess how the momentum achieved in Tianjin could be harnessed to deliver the outcome required for a comprehensive agreement. The analysis is divided into two sections. The first elaborates on what needs to be done, while the second focuses on how to achieve it.

Climate Finance in the Urban Context, World Bank, 2010[401]

Cities and their residents account for more than 80 percent of the world's total greenhouse gas emissions. In addition, more than 80 percent of the overall annual global costs of adaptation to climate change are estimated to be borne by urban areas. This report looks at potential financing opportunities and costs of mitigation and adaptation in the urban context. Wide-ranging potential sources for finance for climate action are described, and suggestions are made for more-effective responses to climate investment challenges in cities.

Climate Finance, The Harvard Project on International Climate Agreements, 2009[402]

This policy brief presents options for improving and expanding climate finance. It discusses the reform of the Clean Development Mechanism (CDM) offset market to leverage large-scale foreign direct investment in emission-reducing activities in developing countries, most importantly in technology transfer. It focuses on allocating emissions allowances in an international cap-and-trade scheme such that developing countries are (partly) compensated for their emission reductions. The establishment of an international greenhouse gas charge or other mechanism in major developing countries that creates domestic streams of revenue is also discussed. The reform of energy subsidies to free funds for government expenditure for climate mitigation and adaptation is considered. In addition, the paper analyzes the options of employing export credit agencies to leverage foreign direct investment in climate-related activities, increasing bilateral and multilateral official development assistance for climate-related projects and providing large-scale financing for incremental costs contingent on implementation of emission reduction policies in developing countries.

Climate for Recovery: The Colour of Stimulus Goes Green, HSBC, London, UK, 2009[322]

As governments struggle to revive their economies, they are also seeking to establish the foundations for the next phase of growth. Increasingly this is being linked with the climate change agenda, with a sizeable portion of fiscal stimulus plans allocated to

launching a low-carbon recovery. This analysis covers more than 20 economic recovery plans and has categorized the spending and tax-cutting measures according to the 18 investment themes identified in the HSBC Climate Change Index. This reveals that around 15 percent of the US$2.8 trillion in fiscal measures can be associated with investments consistent with stabilizing and then cutting global emissions of greenhouse gases.

Five key questions need to be answered: is the green stimulus sufficiently large; when will it materialize, is it really green, how many jobs will be created and how effective will it be in mobilizing private investment? The momentum behind this agenda will likely grow through 2009 and further green stimulus initiatives linked to the G-20 economic recovery summit in April and the Copenhagen conference in December are expected, particularly in Japan.

Climate Panel Faces Heat, Ball, J., August 2010, © 2011 Dow Jones & Company[59]

An independent investigation called for "fundamental reform" at the United Nations' Intergovernmental Panel on Climate Change, claiming that the organization's 2007 report played down uncertainty about some aspects of global warming. IPCC leaders requested the council to conduct the probe following the disclosure of a few errors in its 2007 climate-science report, which concluded, among other things, that climate change is "unequivocal" and is "very likely" caused by human activity. This article sheds light on the critics against the procedure the IPCC used in reaching its conclusions and toward the organization's management.

Climate Risk and Financial Institutions, IFC, 2010[403]

This report demonstrates that climate change and its impacts are likely to alter a number of conditions that are material to the objectives of financial institutions. If changing conditions are not actively managed, investments and institutions may underperform.

Most investments will be channeled through financial institutions. Given that the main affects of climate change are now well established, there is a considerable opportunity, as well as a responsibility, for these institutions to take a leading role in adaptation to climate change. Institutions managing investments in long-lived assets have both a direct financial risk to consider and the opportunity to create value by working proactively with their clients and other stakeholders to take steps to manage the risks. Each institution has specific objectives and procedures, and as a result approaches to assessing and managing changing climate risks will vary. Many of the risks highlighted in this report may already be part of institutions' standard risk-management processes. Rather than creating new instruments for climate-related risks, the challenge for financial institutions and companies will be integrating investment-relevant information into existing procedures.

Several developmental and commercial financial institutions are already taking steps toward these goals. International Finance Corporation's Climate Risk Pilot Program has produced initial case studies that assess approaches to real-sector climate risk and adaptation, in addition to the present analysis of risks to financial institutions. In the future, IFC will initiate the development of more general tools addressing climate risks and investments.

CO_2 Discrepancies between Top Data Reporters Create a Quandary for Policy Analysis, S. Afsah, M. Aller, August 2010[306]

This report examines the differing methodologies and the use of back-end data that have produced data sets with wildly divergent CO_2 emissions estimates for monitored countries. These discrepancies are so vast that they dwarf the annual reduction targets generally proposed under cap-and-trade programs, the Kyoto Protocol and negotiations surrounding the UN Framework Convention on Climate Change. With inadequately standardized methods for monitoring CO_2 emissions, it is not possible to verify the year-over-year impact of emissions mitigation programs at the national level. Greater attention, standardization, empirical testing, and third party audit of estimation methodologies is necessary to create a CO_2 emissions reporting infrastructure that is able to support verification of impacts from efforts to reduce overall CO_2 emissions at national and global levels.

Co-Benefits of Climate Change Mitigation Policies: Literature Review and New Results, Bollen, J. et al., April 2009, © OECD 2009[31]

The main purpose of this paper is to assess the extent to which local air pollution co-benefits can lower the cost of climate change mitigation policies in OECD and non-OECD countries and can offer economic incentives for developing countries to participate in a post-2012 global agreement. The paper sets out an analytical framework to answer these questions. After a literature review on the estimates of the co-benefits, new estimates, which are obtained within a general equilibrium, dynamic, multi-regional framework, are presented. The main conclusion is that the co-benefits from climate change mitigation in terms of reduced outdoor local air pollution might cover a significant part of the cost of action. Nonetheless, these alone may not provide sufficient participation incentives to large developing countries. This is partly because direct local air pollution control policies appear to be typically cheaper than indirect action via greenhouse gases emissions mitigation.

Community Wind: Once Again Pushing the Envelope of Project Finance, Bolinger, M., 2011[404]

The *community wind* sector in the United States—defined in this report as consisting of relatively small utility-scale wind power projects that sell power on the wholesale market and that are developed and owned primarily by local investors—has historically served as a "testing grounds" not only for emerging wind turbine manufacturers trying to break into the broader U.S. wind market, but also for wind project financing structures.

More recently, a handful of community wind projects built over the past year have been financed via new and creative structures that advance the sophistication of wind project finance in the United States—in many cases, moving beyond the now-standard partnership flip structures involving strategic tax equity investors. This paper discusses the following examples of recent projects and financing arrangements: (i) a 4.5 MW project in Maine that combines low-cost government debt with local tax equity; (ii) a 25.3 MW project in Minnesota using a sale/leaseback structure; (iii) a 10.5 MW project in South Dakota financed by an intrastate offering of both debt and equity; (iv) a 6 MW project in Washington state that taps into New Markets Tax

Credits using an "inverted" or "pass-through" lease structure; and (v) a 9 MW project in Oregon that combines a variety of state and federal incentives and loans with unconventional equity from high-net-worth individuals.

Compendium of Energy Efficiency Policies of APEC Economies, APERC, 2010[109]

This publication is a compendium of survey results intended to promote information sharing in the field of energy efficiency and energy conservation across the APEC economies under a common format. It contains energy efficiency policy information for all APEC economies (with the exception of Papua New Guinea) based on responses to a questionnaire.

Creating Markets for Energy Technologies, OECD/IEA, 2003, © OECD/IEA, 2003[405]

The IEA has collected 22 studies of successful market development programs. These case studies provide a wealth of information on the variety of programs undertaken and the evolution of ideas in this policy area. Most importantly they inform of the benefits of experience in successfully facilitating technology market development. The case studies were examined from three perspectives on deployment policy-making that have evolved over the last quarter of a century: (i) the Research, Development and Deployment Perspective; (ii) the Market Barriers Perspective; and (iii) the Market Transformation Perspective. The analysis highlights that the combined effect of technology potential and customer acceptance has an impact on the market and hence on energy systems. Developing a deeper understanding of both, including how they are influenced by the actions of government, is an essential ingredient of effective deployment policy.

Crossing the Valley of Death: Solutions to the Next Generation Clean Energy Project Financing Gap, Bloomberg New Energy Finance 2010[50]

In March 2009, Clean Energy Group (CEG) and Bloomberg New Energy Finance (BNEF) undertook a year-long study aimed at two goals: first, to survey and size the *valley of death,* and second, to examine potential financial or policy mechanisms that might allow companies to successfully traverse it. This paper seeks to summarize the interviewees' comments and contextualize them with quantitative research from BNEF's intelligence database. The report briefly analyzes what the valley of death actually is and why traversing it is so critical. Leveraging investment and other data compiled by BNEF over five years, the report documents the meteoric rise in investment in clean energy and in new technologies. The study also identifies where cracks in the financing value chain have emerged, both through quantitative analysis and via interviews with participants in the marketplace. In addition, an exploration of various potential financing or policy solutions to address the valley of death conundrum is provided.

Dealing with Climate Change, Leadership in Emissions Trading, European Climate Exchange, 2010[406]

This booklet is a compilation of articles related to how cap-and-trade works, carbon risk management solutions and strategies, business opportunities for climate change, international developments after Copenhagen and carbon market issues.

Delivering the Green Stimulus, N. Robins, R. Clover, March 2010[231]

This report highlights that the era of announcing green stimulus measures as part of government recovery plans has ended. The analysis estimates the fiscal commitment to climate-change measures has risen 21 percent from US$430 billion to US$521 billion and assesses actual spending in 2009 to be US$82 billion, around 16 percent of the total. That is less than the November 2009 estimate of US$94 billion, largely due to the reduced expectations for China and South Korea. Elsewhere, Australia, Canada, France and the United States are now on track to spend their stimulus funds. The analysis also expects spending to rise in 2010 as a result, hitting 45 percent of the total. China will continue to lead with an estimated 39 percent of the total US$248 billion. The European Union and the United States will follow with around 18 percent each. Rail, grids, energy efficiency, and renewable energy receive the largest allocations. Beyond the stimulus, recent budget proposals in China, India, and the United States will boost the low-carbon economy. In China's 2010 budget, spending on environmental protection is projected to rise by more than 20 percent. In India, clean-energy measures amount to over US$1 billion. In the United States, the government's 2011 budget request increases allocations to environmental and climate-change measures 46 percent, some US$21 billion more than actual spending in the 2010 budget.

Delivering the Next Economy, Global Metro Summit, Keynote Address, The Brookings Institution, 2010[6]

At the G20 Business Summit in Seoul around a hundred of the world's CEOs gathered to discuss the ways business could help stimulate sustainable growth. The discussion focused significantly on green or low-carbon growth especially the question of how to deliver the next economy. There are many facets to the answer, ranging from the shifting geography of growth to shifts between industries. One thing is clear; the next economy must be cleaner and more energy efficient. In this keynote address, three questions are discussed: (i) why green growth is at the heart of a new industrial revolution—and, in the near term, why it can help set a road to global economic recovery; (ii) what does it take for private companies and for governments to win the race for leadership in energy technology; (iii) how will the next economy be paid for? Additional questions ask what mechanisms are to be used to finance this needed transformation and how can the public and private sectors work together to achieve this?

Design and Performance of Policy Instruments to Promote the Development of Renewable Energy: Emerging Experience in Selected Developing Countries, World Bank, 2011[373]

This paper summarizes the results of a recent review of the emerging experience with the design and implementation of policy instruments to promote the development of renewable energy (RE) in a sample of six representative developing countries and transition economies. The review focused mainly on price- and quantity-setting policies, but it also covered fiscal and financial incentives, as well as relevant market facilitation measures. The lessons learned were taken from the rapidly growing literature and reports

that analyze and discuss RE policy instruments in the context of different types of power market structures.

The analysis considered all types of grid-connected RE options except large hydropower: wind (on-shore and off-shore), solar (photovoltaic and concentrated solar power), small hydropower (SHP) (with capacities below 30 MW), biomass, bioelectricity (cogeneration), landfill gas, and geothermal. The six countries selected for the review were Brazil, India, Indonesia, Nicaragua, Sri Lanka, and Turkey.

The key findings are: (i) a tailor-made approach is necessary; (ii) policy sequencing is critical for policy effectiveness; (iii) policies that successfully lead to the scale-up of renewable energy may not necessarily be efficient; (iv) policy interaction and compatibility need to be considered; (v) policy and regulatory design is a dynamic process; (vi) RE policy performance (effectiveness/efficiency) depends on a number of key factors.

Design Challenges for the Green Climate Fund, Bird, N., Brown, J., and Schalatek, L., January 2011[167]

The design of the Green Climate Fund (GCF) has to address a large number of concerns, the details of which remain unresolved within the negotiations. Issues relating to what role it will play in providing sustainable finance at scale; how it will fit into the existing development assistance and climate financing architecture; how it will allocate finance to developing countries; and how finance will be delivered effectively, all remain to be clarified. This paper offers an early contribution to the debate by highlighting some of the more pressing design issues and describing the implications of these features. The report assesses the fund according to the following three core functions: (i) governance (how the funds will be managed), (ii) sourcing (how funds will be raised—who will pay and how) and (ii) disbursement (how funds will be delivered and distributed).

Designing Energy Conservation Voluntary Agreements for the Industrial Sector in China: Experience from a Pilot Project with Two Steel Mills in Shandong Province, LBNL, 2004[338]

China faces a significant challenge in the years ahead to continue to provide essential materials and products for a rapidly growing economy while addressing pressing environmental concerns. China's industrial sector consumes about 70% of the nation's total energy each year and is heavily dependent on the country's abundant, yet polluting, coal resources. Industrial production locally pollutes the air with emissions of criteria pollutants, uses scarce water and oil resources, emits greenhouse gases contributing to climate change, and produces wastes. Fostering innovative approaches that are tailored to China's emerging market-based political economy to reduce the use of polluting energy resources and to diminish pollution from industrial production is one of the most important challenges facing the nation today.

The use of Voluntary Agreements as a policy for increasing energy-efficiency in industry, which has been a popular approach in many industrialized countries since the early 1990s, is being tested for use in China through a pilot project with two steel mills in Shandong Province. The pilot project was developed through international

collaboration with experts in China, the Netherlands, and the Unites States. Designing the pilot project involved development of approaches for energy-efficiency potential assessments for the steel mills, target-setting to establish the Voluntary Agreement energy-efficiency goals, preparing energy-efficiency plans for implementation of energy-saving technologies and measures, and monitoring and evaluating the project's energy savings.

Developing Green Building Programs: A Step-by-step Guide for Local Governments, Global Green, 2008[407]

This paper discusses the benefits of green buildings to local governments and the steps to create local green building programs. The paper argues that governments should (i) identify existing efforts and gaps, (ii) analyze current and projected building trends, (iii) review existing guidelines and programs, (iv) outreach to stakeholders, (v) develop a green building framework and (vi) focus on the adoption, the components and the staff of the abovementioned local green building programs. By doing do, governments can promote green building programs that minimize the use of resources, are healthier for people and reduce negative impacts on the environment.

Double Jeopardy: What the Climate Crisis Means for the Poor, Brookings Institute, 2008[408]

From August 1–3, 2008, more than fifty preeminent policymakers, practitioners, and thought leaders from around the world convened at the Aspen Institute to explore the links between global climate change and poverty alleviation. Starting from the premise that climate solutions must empower the poor by improving livelihoods, health, and well-being, and that poverty alleviation itself must become a central strategy for both mitigating greenhouse gas emissions and reducing vulnerability to the adverse effects of climate change, the roundtable sought to shape a common agenda to tackle two of the greatest challenges of our time. This report seeks to reveal to what extent the challenge of climate could be turned into opportunities for sustainable development. By promoting clean energy technologies and sound tropical forestry, it is possible to involve the poor in an urgent global effort to mitigate greenhouse gas emissions, in ways that improve livelihoods while reducing climate vulnerability.

Driving a Green Economy through Public Finance and Fiscal Policy Reform, Green Economy Initiative, UNEP, 2010[15]

A green economy (GE) can be defined as one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities. A GE is characterized by substantially increased investments in economic sectors that build on and enhance the earth's natural capital or reduce ecological scarcities and environmental risks. Both fiscal policy and public finance can be key drivers of a country's transition to a greener economy—or a brake on green growth and low-carbon job creation. This paper explores the linkage and options available to policy-makers considering ways to drive and accelerate the transition to lower-carbon, more resource-efficient, and socially-inclusive economic growth.

Achieving a transition to a GE has become a priority for many governments. It will require substantial policy reforms at the international, national, and local levels to help realize the economic opportunities arising from a shift to less polluting or resource efficient patterns of production and consumption, including new sources of employment. A GE sets new priorities for macroeconomic policy, with growth being generated by economic sectors that are critical or highly material for greening the global economy. A portfolio of fiscal, regulatory, and information-based policy measures will likely be required to promote an effective and fair transition to a GE.

Green subsidies are likely to be less effective than pollution pricing measures, but well-targeted, transitional measures may facilitate the shift towards a GE in cases where market barriers and positive social spillovers clearly exist, or where there are technical or political obstacles to the alternatives.

Economic and Fiscal Policy Strategies for Climate Change Mitigation in Indonesia: Ministry of Finance Green Paper, 2009[36]

The Green Paper identifies economic and fiscal policy strategies for climate change mitigation—reducing emissions of carbon dioxide and other greenhouse gases—and the most cost effective way to achieve this. It lays out strategies for the Ministry of Finance for efficient and effective policies, both in the short and long term. The paper is grounded in economic principles, and applies emerging international experience to Indonesia's circumstances. The Green Paper presents strategies that can guide longer-term policy reform for climate change mitigation, including a move toward pricing of carbon emissions. It sets out concrete options for geothermal policy, and for creating abatement incentives for regional governments, especially to reduce emissions from land use change and forestry. In these areas it illustrates how economic principles can be used to devise efficient and effective climate policies in the short term. These principles can be extended to other aspects of energy and land-use change/forestry, and to other parts of the economy such as agriculture and mining. The Green Paper also sets out strategies to access international financing and canvasses the need for further institutional development.

The Economic Development Potential of the Green Sector, P. Ong, R. V. Patraporn, 2006[409]

This report contains policy recommendations on establishing a regional economic development and job creation initiative to grow the green sector into a significant export base. The report argues that although the uncertainties are high, taking the risk to implement green initiatives is worthwhile because of the potential high pay off. The proposed strategy is an opportunity for a region to become a recognized global leader in both the promotion of a greener city and world and as the preeminent promoter of industries needed to make the green vision a reality.

Economic Impacts from the Promotion of Renewable Energy Technologies, Ruhr-Universität Bochum (RUB), November 2009[253]

The allure of an environmentally benign, abundant, and cost-effective energy source has led an increasing number of industrialized countries to back public financing of renew-

able energies. Germany's experience with renewable energy promotion is often cited as a model capable of being replicated elsewhere, as it is based on a combination of far-reaching energy and environmental laws that have been in place nearly two decades. This paper critically reviews the current centerpiece of this effort, the Renewable Energy Sources Act (EEG), focusing on its costs and the associated implications for job creation and climate protection. This paper shows that German renewable energy policy, and in particular the adopted feed-in tariff scheme, has failed to harness the market incentives needed to ensure a viable and cost-effective introduction of renewable energies into the country's energy portfolio. To the contrary, the government's support mechanisms have in many respects subverted these incentives, resulting in massive expenditures that show little long-term promise for stimulating the economy, protecting the environment, or increasing energy security.

Economic Issues in a Designing a Global Agreement on Global Warming, Nordhaus, W.D., 2009[217]

Addressing global warming involves not only understanding the science of climate change but also designing effective economic instruments to provide appropriate incentives for nations to join agreements and for market participants. There are three major lessons from economics about climate-change policies. First, raising the price of carbon is a necessary condition for implementing policies in a way that will reach the multitude of decisions and decision makers over space, time, nations, and sectors. Second, universal participation at a harmonized level is a critical part of an efficient global-warming regime. There are extremely high costs of non-participation. Third, the cap-and-trade approach embodied in the Kyoto model is a poor choice of mechanism. It is completely untested in the international context; it has been unable to attain anything close to universal participation; it loses precious fiscal revenues; it leads to volatile prices; and it is an invitation to rent-seeking. It is unlikely that the Kyoto model, even if strengthened, can achieve its climate objectives in an efficient and effective manner. A harmonized international carbon tax is likely to be a more effective mechanism for responding to the threat of climate change.

The Economics of Climate Change Mitigation: How to Build the Necessary Global Action in a Cost Effective Manner, Jean-Marc Burniaux, Jean Chateau, Rob Dellink, Romain Duval and Stéphanie Jamet, OECD, 2009, © OECD 2009[177]

This paper examines the cost of a range of national, regional and global mitigation policies and the corresponding incentives for countries to participate in ambitious international mitigation actions. The paper illustrates the scope for available instruments to strengthen these incentives and discusses ways to overcome barriers to the development of an international carbon price, based on the quantitative assessment from two global and sector-disaggregated CGE models.

A key step towards the emergence of a single international carbon price will most likely involve the phasing out of subsidies of fossil fuel consumption and various forms of linking between regional carbon markets, ranging from direct linking of existing emission trading systems to more indirect forms through the use of crediting mechanisms. The paper discusses regulatory issues raised by the expansion of emission trading

and crediting schemes as well as the complementary contribution of R&D policies. Finally, the paper emphasizes the importance of incorporating deforestation into a global agreement as well as the key role of international transfers, not least to overcome the relatively strong economic incentives in some countries to take advantage of other regions' mitigation actions.

The Economics of Climate Change Mitigation: Policies and Options for Global Action beyond 2012, OECD, 2009, © OECD 2009[410]

The analysis presented in this book aims to support countries in developing and implementing an ambitious, cost-effective, equitable, and comprehensive approach to global climate change mitigation. It is part of a broader and long-standing program of work that aims to assist countries in their efforts to build sustainable economies. This book shows how a global carbon price can be built up gradually, from the existing piecemeal and scattered approaches. It also illustrates how governments can encourage climate-friendly economic growth. This includes expanding the use of cap-and-trade schemes to reduce emissions and linking them together; complementing these with taxes and other policy instruments, including support for R&D, regulations and standards; scaling-up and reforming the use of the Clean Development Mechanism (CDM); and possibly introducing sectoral approaches and incentives to reduce emissions from the forestry sector in developing countries. The analysis looks critically at the incentives for different countries to participate in a global approach to climate change, and how financing and technology can help to support action in developing countries.

The Economics of Climate Change Mitigation: Policies and Options for the Future, OECD, 2008, © OECD 2008[411]

The main aim of this paper is to explore feasible ways to meet these two basic requirements for successful future climate policies. Using a range of modeling frameworks, it analyzes cost-effective policy mixes to reduce emissions, the implications of incomplete coverage of policies for the costs of mitigation action and carbon leakage, the role of technology-support policies in lowering future emissions and policy costs, as well as the incentives—and possible options to enhance them—for emitting countries to take action against climate change.

The Economics of Climate Change, the Stern Review, House of Lords, UK, 2005, © Crown copyright 2005[24]

This publication attempts to systematically evaluate the effects of climate change, whether the increased greenhouse gas emissions amplify the climate change process, and how and at what cost the effects could be tackled. The review calls on the government to give HM Treasury a more extensive role, both in examining the costs and benefits of climate change policy and presenting them to the United Kingdom public, and in the work of the Intergovernmental Panel on Climate Change (IPCC). This publication announces some concerns about the objectivity of the IPCC process, with some of its emissions scenarios and summary documentation apparently influenced by political consider-

ations. There are significant doubts about some aspects of the IPCC's emissions scenario exercise, in particular, the high emissions scenarios. The government should press the IPCC to change their approach. There are some positive aspects to global warming and these appear to have been played down in the IPCC reports. The government should press the IPCC to reflect in a more balanced way the costs and benefits of climate change.

The Economics of Climate Change: The Stern Review, N. Stern, Cambridge: Cambridge University Press, 2007, © Crown copyright 2007[23]

This analysis presents a state-of-the-art independent review of the economics of climate change. First, this paper examines the latest scientific evidence on climate change. Second, the paper considers how economic theory can help analyze the relationship between climate change and the divergent paths for growth and development. The paper also investigates the economics of stabilization while policy responses for mitigation and adaptation are also described. In addition, the importance of an international collective action is discussed.

The Economics of Infrastructure Finance: Public-Private Partnerships versus Public Provision, E. Engel, R. Fischer and A. Galetovic, 2010[412]

The study examines the economics of infrastructure finance, focusing on public provision and public-private partnerships (PPPs). The analysis shows that project finance is appropriate for PPP projects, because there are few economies of scope and assets are project specific. Furthermore, the analysis suggests that the higher cost of finance of PPPs is not an argument in favor of public provision, since it appears to reflect the combination of deficient contract design and the cost-cutting incentives embedded in PPPs. Thus, in the case of a correctly designed PPP contract, the higher cost of capital may be the price to pay for the efficiency advantages of PPPs. The study also examines the role of government activities in PPP financing (e.g. revenue guarantees, renegotiations) and their consequences. Finally, the analysis discusses how to include PPPs, revenue guarantees and the results of PPP contract renegotiation in the government balance sheet.

The Effectiveness of Renewable Energy Policy in Germany, Runci, P., 2005[360]

In its assessment of Germany's renewable energy policy, this paper takes a broader look at the development of the country's renewable energy portfolio, considering three key dimensions as criteria for success. First, it addresses the familiar question of effectiveness of policy in its influence on the deployment of renewable energy technologies and on greenhouse gas emissions. A second key criterion is the effect of renewable energy policy on technological advance. A third criterion addressed is the effectiveness of policy in promoting German renewable technology exports and economic competitiveness.

Efforts in Moving Towards a Low Carbon Future: China's Energy Conservation and Renewable Energy Laws, L. Ellis, February 2008[328]

Recently, the Chinese government has promulgated a number of progressive energy laws that lay out an important legal framework to support energy efficiency and renewable

energy projects and development. This report sheds light on the China Environment Forum's key points emerging from the discussion held by Wang Mingyuan, executive director of the Center for Environmental, Natural Resources & Energy Law at the Tsinghua University Law School, who was involved in drafting some of the abovementioned energy laws. The report analyzes the failure of the 1997 Energy Conservation Law and discusses the amended Energy Conservation Law that went into effect in 2008.

The Emergence of the Eco-Efficient Economy, IBM, 2010, © IBM Corporation 2010[413]

This report explores the key messages emerging from the global Eco-efficiency Jam, a 51-hour, online interactive event, conducted by IBM and the Economist Intelligence Unit. The aim of this event was to discuss the primary drivers, opportunities and challenges associated with the continued advancement of eco-efficiency, as well as to share best practices. The report includes three core conclusions emerging from this collaborative discussion: (i) eco-efficiency is poised to become the biggest economic game-changer for organizations over the next 20 years; (ii) direct and collaborative action from a range of stakeholders will be needed to address the challenges and opportunities posed by eco-efficiency; and (iii) there is a strong imperative for stakeholders to advance the eco-efficient economy.

Emissions Trading: EU ETS, U.S. Voluntary Market & Carbon Credit Projects as Offsets, Nicholas School of the Environment and Earth Sciences of Duke University, 2008[237]

This paper examines the Kyoto Protocol-based European Union Emissions Trading Scheme (EU ETS), the current U.S. voluntary carbon market, and the role of carbon credit projects as offsets within emissions trading programs. The paper will discuss existing state/regional policies aimed at addressing climate change domestically, structures of potential federal regulation, and the potentially complicated interrelations between domestic and international trading programs. The objectives of this paper are to ascertain the risk factors associated with a carbon credit generating renewable energy projects that have the greatest impact on the rate of return for an investor, and to identify factors of trading programs that have been or will be particularly successful, as well as factors that have/will lead to inefficiencies when implemented in the trading market. The methods used will include a quantitative analysis of a carbon credit generating project, as well as a qualitative policy discussion of the existing and proposed emissions trading program designs. This method will attempt to analyze the impact of different risk factors (i.e. project timing risk, credit delivery risk, and price risk) on the rate of return of investment in a hypothetical carbon credit project. The results of this paper will include a written discussion of the design and implementation of distinct trading schemes and quantitative output will include sensitivity tables relating to the carbon credit project valuation model.

Empowering the Community: Information Strategies for Pollution Control, T. Tietenberg, D. Wheeler, Frontiers of Environmental Economics Conference, October 1998, © European University Association[272]

Disclosure strategies, which involve public and/or private attempts to increase the availability of information on pollution, form the basis for what have been called the

third wave in pollution control policy (with legal regulation being the first wave and market-based instruments the second). While these strategies have become commonplace in natural resource settings (for example, forest certification programs), they are less familiar in a pollution control context. Yet both the research on, and experience with, this approach is now growing in both OECD and developing countries. This paper reviews what is known and not known about the use of disclosure strategies to control pollution. Following a review of the conceptual foundations for disclosure strategies, the paper considers how the policy setting influences the type of information strategy employed. Examples of innovative disclosure strategies in the United States, Latin America and Asia, and the channels through which they operate are followed by a review of the empirical research on their effectiveness.

Energy and Carbon Dioxide Emission Data Uncertainties, J. Macknick, August 2009[307]

Uncertainties in official CO_2 emissions reports, and the energy data from which they are derived, are understated, if mentioned at all in scientific studies or policy proposals. These unmentioned uncertainties have the potential to undermine policies and scientific studies. This paper has three primary objectives: (i) to compare the different methods used by organizations in their published energy and carbon statistics; (ii) to critically examine articles that use energy and CO_2 emissions data; and (iii) to introduce a tool that allows users to compare harmonized energy and carbon statistics across organizations to facilitate uncertainty analyses.

Energy Efficiency and the Finance Sector, UNEP, January 2009[168]

For decades, our market system has left "cash on the table" with its failure to recognize and integrate energy and broader resource efficiency disciplines across the broad sweep of business, industrial, commercial and construction activities. This report probes the reasons for this failure to see energy efficiency as a distinct asset in its own right. The document offers practical, pragmatic and market relevant recommendations for both the financial sector and policy-makers to take into consideration before meeting for the landmark UNFCCC COP 15 in Copenhagen, Denmark, in December 2009.

Energy Efficiency Economics and Policy, Gillingham, Newell, and Palmer, 2009[414]

Energy efficiency and conservation are considered key means for reducing greenhouse gas emissions and achieving other energy policy goals, but associated market behavior and policy responses have engendered debates in the economic literature. This paper reviews economic concepts underlying consumer decision making in energy efficiency and conservation and examines related empirical literature. In particular, it provides an economic perspective on the range of market barriers, market failures, and behavioral failures that have been cited in the energy efficiency context. The paper also assesses the extent to which these conditions provide a motivation for policy intervention in energy-using product markets, including an examination of the evidence on policy effectiveness and cost. Although theory and empirical evidence suggests there is potential for welfare-enhancing energy efficiency policies, many open questions remain, particularly relating to the extent of some key market and behavioral failures.

Energy Efficiency in Buildings: Business Realities and Opportunities, Summary Report, World Business Council for Sustainable Development[415]

This report summarizes the first year's work of the Energy Efficiency in Buildings (EEB) project—a WBCSD project co-chaired by Lafarge and United Technologies Corporation. It presents the challenge of energy use in buildings and a preliminary, high-level approach to addressing that challenge. This report combines the findings from existing research and stakeholder dialogues during hearings, workshops, and forums with a breakthrough market research study that measures the stakeholder perceptions of sustainable buildings around the world. The report sets out to establish a baseline of current facts and trends that will be used in scenario planning and modeling approaches to assess the needed and prioritized actions for change to affect buildings' energy consumption. In the final year (by mid-2009), the project will seek to gain commitments to actions by the various stakeholders involved with the building sector, including those of the project itself. The EEB project covers six countries or regions that are together responsible for two-thirds of world energy demand, including developed and developing countries and a range of climates: Brazil, China, Europe, India, Japan and the United States.

Energy Efficiency Indicators and the Design and Progress Monitoring of National and Sector Energy Efficiency Strategies in Developing Countries, The World Bank, 2010[169]

This communications note, drawing on the presentations and discussions of the International Roundtable on Energy Efficiency Metrics and National Energy Efficiency Assessment in developing countries, summarizes the main findings, broadly agreed conclusions, and specific recommendations on energy efficiency indicators development and applications and related international collaboration and assistance. The paper's findings contribute to the existing body of knowledge about EE indicators and help inform relevant international partner organizations, including the World Bank, in determining the approaches to providing future assistance for the development and applications of EE indicators in developing countries.

Energy Efficiency Policies around the World: Review and Evaluation, World Energy Council, 2008, Used by permission of the World Energy Council, London, www.worldenergy.org[416]

This study aims to describe and evaluate energy efficiency trends and policies. The first objective of the study is to identify recent trends in energy efficiency performance in selected countries and regions at macro and regional levels. The second objective is to describe and evaluate energy efficiency policies carried out in a sample of countries throughout the world.

Energy Labelling Programmes and Their Effective Implementation: Perspectives on Consumer Behaviour, UNESCAP, 2007[270]

During the past decade, introduction of energy standards as well as energy labeling programs for electrical appliances have played an increasingly important role in national energy efficiency promotion strategies both in developed and developing countries. The

purposes of energy labeling programs are multifaceted. At the national level, the main objective is energy conservation and reduction of carbon dioxide emissions.

By its nature, the issue of sustainable energy consumption is multi-faceted and multi-dimensional and is influenced by cultural, social practices and human feelings. Yet this nature has been largely overlooked and remains a vital blind spot in energy policy. Given this background, this brief paper seeks to impart a psychological perspective of consumer behavior in promoting effective energy labeling programs.

Energy Subsidies—Getting the Prices Right, International Energy Agency, 2010[207]

The IEA has undertaken an extensive survey to identify countries that offer subsidies that reduce prices of fossil fuels below levels that would prevail in an undistorted market, thus leading to higher levels of consumption than would occur in their absence. The survey identified 37 countries and it is estimated that these represent over 95 percent of global subsidized fossil-fuel consumption, with the remaining subsidized consumption occurring in countries for which reliable energy consumption and price data is not available.

The IEA analysis has revealed that fossil fuel consumption subsidies amounted to US$557 billion in 2008. This represents a significant increase from US$342 billion in 2007. Since 2008, a number of countries—including China, Russia, India and Indonesia—have made notable reforms to bring their domestic energy prices in line with world prices. These efforts are expected to contribute to a reduction in the cost of energy subsidies to these countries in 2009. The country with the highest subsidies in 2008 was Iran at US$101 billion, or around a third of the country's annual central budget.

Energy Technology Perspectives: Scenarios and Strategies to 2050, Executive Summary, IEA, 2010[1]

This publication provides an IEA perspective on how low-carbon energy technologies can contribute to deep CO_2 emissions reduction targets. Using a techno-economic approach that assesses costs and benefits, the publication examines least-cost pathways for meeting energy policy goals while also proposing measures to overcome technical and policy barriers. Specifically, it examines the future fuel and technology options available for electricity generation and for the key end-use sectors of industry, buildings and transport. It also includes an analysis of OECD Europe, the United States, China and India, which together account for about 56 percent of today's global primary energy demand. It then sets out the technology transitions needed to move to a sustainable energy future, and provides a series of technology roadmaps to chart the path. In addition, financing, behavioral change, the diffusion of technologies amongst developed and emerging economies, as well as the environmental impacts of key energy technologies are discussed.

Energy Use in the New Millennium, IEA, 2007[417]

At the Gleneagles Summit in July 2005, the Group of Eight (G8) leaders addressed the interrelated challenges of tackling climate change, promoting clean energy and achieving

sustainable development. They launched the Gleneagles Plan of Action (GPOA), which identifies transforming the way energy is used as a key priority. To advance this initiative, the G8 leaders asked the International Energy Agency (IEA) to play a major role in delivering elements of the GPOA, including those relating to energy efficiency in buildings, appliances, transport and industry.

As part of its response, the IEA is developing in-depth indicators to provide state-of-the-art data and analysis on energy use, efficiency developments and policy pointers. This book is a major output from the indicator work and an important contribution to the GPOA.

Environmental Data Book 2006, Matsushita Group, 2006[290]

The Matsushita Group has established environmental management systems at more than 250 business sites worldwide and is promoting environmental sustainability management based on its environmental action plan (The Green Plan 2010). The corporation has been issuing environmental reports since the 1996 fiscal year. The Environmental Data Book aims to provide detailed data to supplement environmental information available in the Sustainability Report.

Environmental Fiscal Reform for Poverty Reduction, OECD, 2005, © OECD 2005[229]

This document outlines the key issues to be faced when designing environmental fiscal reform (EFR). The objective is to provide insights and good practice on how development cooperation agencies can help developing countries take advantage of EFR approaches in their development and poverty reduction strategies.

Experience shows that despite its potential fiscal, poverty reduction, and environmental benefits, EFR measures are constrained by political and institutional factors. Overcoming these factors requires thorough analysis of the political context, followed by effective management of the reforms as an inclusive political process. Accordingly, following a review of the instruments of EFR and related technical issues, the document focuses on the political economy and governance aspects of EFR. This includes an examination of the precondition for successful design and implementation, the various steps involved through the EFR policy cycle, the challenges to be faced at each stage and the main stakeholders involved. The role of donors in supporting EFR processes is also outlined. In Part II of the document, these issues are reviewed in relation to sectors of particular relevance for developing countries: forestry, fisheries, fossil fuel, electricity, drinking water, and industrial pollution control.

Environmental Performance Rating and Disclosure: An Empirical Investigation of China's Green Watch Program, Yanhong Jin, Hua Wang, and David Wheeler, World Bank, 2010[288]

Environmental performance rating and disclosure has emerged as an alternative or complementary approach to conventional pollution regulation, especially in developing countries. However, little systematic research has been conducted on the effectiveness of this emerging policy instrument. This paper investigates the impact of a Chinese performance rating and disclosure program, *Green Watch,* which has been operating for

10 years. To assess the impact of *Green Watch,* the authors use panel data on pollution emissions from rated and unrated firms, before and after implementation of the program. Controlling for the characteristics of firms and locations, time trend, and initial level of environmental performance, the analysis finds that firms covered by *Green Watch* improve their environmental performance more than non-covered firms. Bad performers improve more than good performers, and moderately non-compliant firms improve more than firms that are significantly out of compliance. The reasons for these different responses seem to be that the strengths of incentives that the disclosure program provides to the polluters at different levels of compliance are not the same and the abatement costs of achieving desired levels of ratings vary between firms.

Environmental Tax Reform: Does it Work? A Survey of the Empirical Evidence, the World Bank, Ecological Economics Vol. 34, 2000[228]

Environmental tax reform is the process of shifting the tax burden from employment, income, and investment, to pollution, resource depletion, and waste. Can environmental tax reform produce a double dividend and help the environment without harming the economy? This paper reviews the practical experience and available modeling studies. It concludes that when environmental tax revenues are used to reduce payroll taxes, and if wage-price inflation is prevented, significant reductions in pollution, small gains in employment, and marginal gains or losses in production are likely in the short to medium term, while investments fall back and prices increase. Results are less certain in the long term. They might be more positive if models selected welfare instead of production indicators for the second dividend, and if several important variables, such as wage rigidities and the feedback of environmental quality on production, were factored into simulations.

Environmental Taxes, Fullerton, D., Leicester, A. and Smith, S. 2010. © 2008 by Don Fullerton, Andrew Leicester, and Stephen Smith.[418]

This paper provides an overview of key economic issues in the use of taxation as an instrument of environmental policy in the UK. It first reviews economic arguments for using taxes and other market mechanisms in environmental policy, discusses the choice of tax base, and considers the value of the revenue from environmental taxes. It is argued that environmental tax revenues do not significantly alter economic constraints on tax policy, and that environmental taxes need to be justified primarily by the cost-effective achievement of environmental goals. The paper then assesses key areas where environmental taxes appear to have significant potential—including taxes on energy used by industry and households, road transport, aviation, and waste. In some of these areas, efficient environmental tax design needs to make use of a number of taxes in combination—a "multi-part instrument".

Environmental Taxes, in 'Dimensions of Tax Design': The Mirrlees Review, Oxford University Press Inc., Institute for Fiscal Studies, 2010[197]

The case for using taxes, charges, and emissions trading schemes (rather than regulations) to help achieve environmental goals is primarily a matter of cost-efficiency. Economic

instruments may be able to achieve a given level of environmental protection at lower cost by providing incentives for polluters to choose the most cost-effective abatement mechanisms and by encouraging the greatest abatement effort from those polluters for whom it is least expensive. Economic instruments also provide ongoing incentives for innovation in pollution control. They may also be less prone to influence by polluters themselves than regulations negotiated case-by-case with individual firms. However, they are not a panacea. They can encourage costly avoidance activities, such as illegal waste dumping, and in some cases they may have significant distributional consequences, placing heavy burdens on the poor. They are most useful when wide-ranging changes in behavior are needed across a large number of polluters—the costs of regulation in such cases are large, and the efficiency benefits of economic instruments are likely to be greater. Little will be gained, however, by making the tax structure too sophisticated when the environmental costs are low.

The choice and design of the instrument is crucial. One broad choice is between taxes and emissions trading schemes. The paper considers the elements of design and the consequences of implementing the different instruments including various types of environmental taxes.

Environmentally Harmful Subsidies: Challenges for Reform, OECD, 2005, © OECD 2005[47]

The first section of this report provides an extended summary of the findings of the horizontal project on environmentally harmful subsidies. It addresses the definition of subsidies and presents a checklist approach to identifying when the removal of subsidies is likely to have a beneficial effect on the environment. The report then presents the key findings from case studies conducted as part of the project. The sectors examined were agriculture, fisheries, transport, energy and water. The range of issues involved in the reform of environmentally harmful subsidies is discussed in the last part of the report, focusing on the political economy of subsidy policy reform.

The second chapter develops a checklist that could help identify subsidies whose removal would most benefit the environment. The checklist focuses on two interrelated issues: the effects of subsidy removal on producers' and consumers' decisions and the directness of the link between those decisions and the environment.

The last chapter indicates that the removal of environmentally harmful subsidies offers the prospect of a win-win situation for both the economy and the environment. This chapter therefore attempts to identify the political and economic impediments to subsidy reform in developed economies.

The 'Equator Principles': A Financial Industry Benchmark for Determining, Assessing and Managing Social and Environmental Risk in Project Financing, the Equator Principles, 2006[85]

This paper discusses the *Equator Principles* that have been adopted by The Equator Principle Financial Institutions (EPFI) in order to ensure that the projects they finance are developed in a manner that is socially responsible and reflect sound environmental management practices. The Equator Principles discussed in this paper cover a number

of project-related areas namely (i) review and categorization, (ii) social and environmental assessment, (iii) applicable social and environmental standards, (iv) action plan and management system, (v) consultation and disclosure, (vi) grievance mechanism, (vii) independent review, (viii) covenants (ix) independent monitoring and reporting and (x) EPFI reporting.

Experience with Market-Based Environmental Policy Instruments, R. N. Stavins, November 2001[238]

Environmental policies typically combine the identification of a goal with some means to achieve that goal. This chapter for the forthcoming *Handbook of Environmental Economics* focuses exclusively on the second component, the means. The report defines these instruments broadly, and considers them within four categories: charge systems, tradable permits, market friction reductions, and government subsidy reductions. The report also focuses on normative lessons for design and implementation, analysis of prospective and adopted systems and identification of new applications.

Financial Resources and Investment for Climate Change, Africa Partnership Forum, UN, 2009[419]

The report provides a description of the overall context for financial resources and investments for climate change. It also discusses the existing financing mechanisms and describes a future financial framework that reflects Africa's priorities. Moreover, the paper sheds light on a description of the main financing proposal. The conclusion of the report provides recommendations to both African countries and developed country partners.

Financial Risk Management Instruments for Renewable Energy Projects: Scoping Study, UNEP SEFI, 2006[420]

This study was commissioned by UNEP Division of Technology, Industry and Economics (DTIE) under its Sustainable Energy Finance Initiative (SEFI) with the aim of providing an overview of the barriers/risks affecting investment in Renewable Energy (RE) projects, "financial risk management" instruments currently supporting RE projects and those that could be developed to reduce uncertainty and facilitate more efficient and effective financing of such projects.

Among many other observations, this study also proposes that there is a distance between the developers, their advisors and institutional investors. On one side are the boutiques and consulting firms that really interact with the majority of RE project developers. On the other side are the major financial institutions who interact at a high level with policymakers but, despite good intentions, are usually too large or inflexible to operate usefully in the RE space. There is a useful role for the public sector to act as a "mezzanine player" or bridge between the expertise, creativity and nimbleness of boutiques and the distribution networks, balance sheet and market influence of major financial institutions.

A key objective of this study is to accelerate plans to develop product blueprints for actual application in the market. A learning-by-doing approach to developing new and

commercially acceptable RE financing and risk management products could be usefully adopted through focused interactions between the public sector, specialist financial boutiques/insurers and several global financial intermediaries. This can be accomplished through joint ventures that combine the perceived support and credit rating of public sector entities with the creative vision of specialist private boutiques and the distribution networks of large financial services companies.

Financing a Global Deal on Climate Change, UNEP, June 2009[34]

The UNEP Finance Initiative (FI) is a unique global partnership between the United Nations Environment Programme and over 170 financial institutions from the banking, investment and insurance sectors across the globe. The Initiative aims to promote linkages between the environment, sustainability and financial performance through a comprehensive work programme, including research and training. This paper builds on this experience and focuses on the priorities identified by UNEP FI to mobilize the skills and resources of the banking, investment and insurance sectors behind an effective, efficient and equitable global deal on climate change at COP 15 in Copenhagen. The paper addresses the types of decisions that governments could take in Copenhagen to stimulate financial involvement. This paper also seeks to identify the priority actions that financial institutions need in a future agreement to enable them to provide the scale of finance and support required for both mitigation and adaptation.

Financing Climate Change Action, Supporting Technology Transfer and Development, OECD, 2010[421]

The OECD is ready to assist G20 countries in their efforts to find lasting solutions to finance action on climate change, building on the long-standing work of the organization to share country experiences and identify lessons learnt and policy recommendations for good practice. Public and private financing for climate action will need to be scaled up significantly. In this paper, suggestions for international finance support are provided, along with a set of recommendations to strengthen governance of international public finance.

Financing Energy Efficiency Building Retrofits, Climate Strategy and Partners, 2010[422]

This report focuses on cost effective opportunities to improve the energy efficiency of the residential building and commercial building stock and in doing so, improve living quality and reduce greenhouse gas emissions. Such energy efficiency retrofits require significant up-front capital that can be paid back through future lower building energy costs. Engaging adequate finance together with supportive policies and broad-scale education initiatives are the keys required to unlock this largely untapped global opportunity.

Financing Energy Efficiency Projects, Neil Zobler and Katy Hatcher, 2003[423]

This publication introduces energy performance contracts and the corresponding benefits of using tax-exempt lease-purchase agreements as the underlying financing vehicle. It explains how to use energy inefficiencies concealed within current operating budgets to

pay for energy-saving equipment. Clear financial reasoning and cost modeling demonstrates that energy efficiency projects can pay for themselves out of the existing operating budgets without having to compete with capital budget projects. The article also presents a 'cost of delay' model that quantifies the opportunity losses caused by delaying the installation of energy efficiency projects.

The publication argues that energy efficiency equipment differs from other capital equipment. However, because the dollars saved by installing energy efficiency equipment can be used to service the debt used for such projects, governments can install the equipment without increasing operating costs or using precious capital budget dollars. In fact, as long as the lease payments are lower than the energy dollars saved, a positive cash flow is created that can be used for other projects or to maintain the equipment. Extending the repayment terms will reduce the monthly payment, providing even more cash.

Financing Energy Efficiency: Lessons from Brazil, China, India, and Beyond, World Bank, 2008[10]

This publication reviews the reasons for the success or failure of a range of recent energy efficiency programs in developing countries and economies in transition. It also draws heavily on an intensive program to exchange ideas and operational lessons learned in energy efficiency projects in Brazil, China, and India, undertaken during 2002–2006 with funding from the United Nations Foundation. The publication attempts to synthesize lessons learned from the many practical experiences shared by many professionals working on energy efficiency in these three large developing countries and the thoughts of these practitioners on how to overcome the obstacles faced.

The report goes beyond those experiences to review lessons learned in various recent energy efficiency programs, especially by the World Bank. Part II of the publication presents 13 case studies of specific energy efficiency investment delivery mechanisms implemented in eight different countries. One of the recurring themes is that effective delivery of energy efficiency investments is essentially an institutional development challenge. As such, attempted solutions must fit within prevailing local economic institutional contexts, which vary dramatically. Where initiatives have been most successful, they have been built following careful, in-country diagnostic work, with parallel attention to both financial intermediation and technical support requirements and with flexibility to make many adjustments.

A Financing Facility for Low-Carbon Development in Developing Countries, World Bank, 2010[154]

This paper proposes an international financing instrument that meets the challenges and the conditions set out above. The Low-Carbon Development Facility (LCDF), as its name suggests, is designed to foster development together with mitigation. The LCDF could be a modality of the Copenhagen Green Climate Fund to implement the financial pledges made by Annex I countries as a result of Copenhagen and post COP 15 negotiations to support projects, programs, policies, and/or other activities in developing countries related to NAMAs. By neither limiting financing to incremental costs nor focusing on

transformational projects, the LCDF will not replace the GEF and the CTF, but instead would support the scaling-up of innovative projects pioneered by these instruments.

Financing Mechanisms and Public/Private Risk Sharing Instruments for Financing Small Scale Renewable Energy Equipment and Projects, GEF, UNEP, 2007[424]

UNEP commissioned this report to assess experience with and recommend designs for financial risk management instruments (FRMIs) that support scaled-up delivery and financing of small scale renewable energy (SSRE) projects. The assessment provides guidance to the UNEP and the Global Environment Facility (GEF) to inform designs of future UNEP, GEF and other donor programs. A main objective of this work is fulfilling the "energy access" agenda of GEF eligible countries, delivering energy services as a key component of programs to alleviate poverty and promote economic development.

Financing Pollution Abatement: Theory and Practice, M. Lovei, World Bank, 1995[425]

The first part of the paper reviews theoretical issues influencing the pollution abatement financing framework including (i) the need for government intervention to correct externalities; (ii) the effects of environmental policy and implementation approaches; (iii) the connection with fiscal policies; and (iv) the development of capital and financial markets. The paper also reviews various subsidy schemes that OECD countries have used to speed up private pollution abatement and to reduce the financial burden of compliance with new regulations and standards in the past decades. The paper reviews various subsidy schemes that OECD countries used to accelerate private pollution abatement and to reduce the financial burden of compliance with new regulations and standards in the past decades. Finally, the paper reviews the role of external financing in pollution abatement.

Financing the Climate Mitigation and Adaptation Measures in Developing Countries, Stockholm Environment Institute, 2009[426]

This paper examines the question of mobilizing financing for investments in a low-carbon economy, with a focus on the problems of developing countries. It surveys the opportunities and costs for mitigation of carbon emissions, including the potential for sale of offsets, or carbon allowances, to developed countries. The related question of adaptation to the effects of climate change, and its implications for funding needs, is also addressed. In addition, the principal multilateral international funding programs for climate investments are discussed, including the Clean Development Mechanism (CDM), the Global Environment Facility (GEF), and the World Bank's Clean Investment Funds (CIF). Finally, the paper offers critiques of the existing institutions and suggestions for alternatives, including a comparison to the more successful experience of the Montreal Protocol.

Financing the Future: A Green Investment Bank to Power the Economic Recovery, the Aldersgate Group, 2010[427]

The UK is facing a time of considerable economic stress. Restoring growth and rebalancing the economy are urgent priorities. Focusing the recovery effort on low-

carbon growth can re-power the economy, increase energy security and help tackle climate change. This discussion paper demonstrates how the Global Investment Bank (GIB) can help address the significant investment barriers impeding the delivery of this vital investment in the UK's future. By directly reducing the risks to investors the cost of the energy transition will be significantly lessened for taxpayers and consumers. Rapidly accelerating investment in low-carbon and environmental technologies will also increase the competitiveness of the UK's businesses in the global market, protect consumers from fossil fuel price shocks and stimulate growth, especially in the regions. But fulfilling this low-carbon vision for the UK will require financial as well as technological innovation.

Financing the Transition to a Low-Carbon Society, Glemarec, Y., UNDP, 2010[428]

This paper proposes an innovative country-driven, multi-stakeholder climate finance framework to assist developing countries to scale-up efforts to address climate change. The framework is built on four mechanisms at the country level: (i) formulation of low-carbon, climate resilient strategies—to bring about bottom-up national ownership, incorporate human development goals, and adopt a long-term outlook; (ii) financial and technical support platforms—to catalyze capital from businesses and households; (iii) nationally appropriate mitigation action/national adaptation plan-type instruments—to bring about balanced access to international public finance; and (iv) coordinated implementation and monitoring, reporting and verification systems—to bring about long-term, efficient results.

Five Emerging U.S. Public Finance Models: Powering Clean-Tech Economic Growth and Job Creation, R. Pernick, C. Wilder, 2009[429]

This report analyzes the history, current state of activity and potential impact on clean-tech economic growth and job creation of five of the most promising financing models, namely: (i) Clean Energy Deployment Administration (CEDA) aka The Green Bank; (ii) Clean Energy Victory Bonds; (iii) Tax Credit Bonds; (iv) Federal Loan Guarantee; and (v) Clean Tech City Funds. This report also provides the following four key lessons. Firstly, federal involvement is necessary in order to finance clean-energy development at the city, state, regional and federal levels. Secondly, there is a need for strong and innovative federal clean-energy financing mechanisms to provide a framework for clean-energy deployment. Moreover, a solid, predictable, and long-term federal regulatory and policy framework is required. In addition, the report points out that the outlined financing models are not mutually exclusive.

A Framework for Assessing Green Growth Policies, OECD Economics Department Working Papers, OECD, 2010, © OECD 2010[22]

This paper proposes an analytical framework for assessing policies that will contribute to a better integration of environmental externalities in the pursuit of economic efficiency and growth objectives. The framework consists of two parts. The first part lays out principles and criteria for the identification and selection of policies that will benefit both income and the environment, or that will boost income at the least cost in

terms of the environment (and vice-versa). The second part focuses more on issues of structural adjustment related to the transition towards a greener economy. It finds that green growth policies could lead to significant re-allocation of resources within and across broad economic sectors.

From Climate Finance to Financing Green Growth, Project Catalyst, November 2010[115]

This document outlines the benefits of green growth and the importance of developing the right policies to support a transition towards the low-carbon economy. It assesses the financing needs of green growth in developing countries, the role of the financing described by the UN High Level Advisory Group on Climate Change Financing (AGF), and how the climate finance system should develop over the next decade. It concludes by illustrating why climate finance needs to be framed in the wider context of growth and development finance.

From Innovation to Infrastructure: Financing First Commercial Clean Energy Projects, CalCEF Innovations, June 2010[19]

For many clean energy companies, the struggle to find a source of project finance for early commercial scale projects has proven, and will continue to prove, to be the proverbial "valley of death." This financing challenge threatens the development and deployment of the very technologies best poised to address the myriad energy and environmental challenges. This paper analyzes the features of this funding challenge, and proposes actionable solutions for both the public- and private-sector participants in the clean energy transition. It also seeks to both describe the specific reasons why the valley of death exists, and to explore a range of policy and market solutions that can help to bridge it.

The Future of Finance, Turner, A., et.al., 2010[430]

This book shows an innovative approach to reform the world's financial system. The complexity of the existing financial system is not positively correlated to its functionality. The proposed analysis investigates the relationship between finance and the real economy, identifying its most crucial issues and highlighting how credit supply and price volatility lead to unstable bargains. The book discusses drastic remedies such as the restructuring of incentives by regulators in order to discourage executives with responsibility for risk-management from "gaming the state". The authors argue that since outside supervision is likely to fail, the best way to achieve this result is to make management liable in the event of bankruptcy or state rescue. The books focuses on the public interest and on the crucial point of abandoning the idea that shareholder interests alone count. Aligning the interests of those who work in the financial sector with those of creditors would not solve every problem in the industry, but it is the best way to realign incentives.

German Climate Change Policy: A Success Story With Some Flaws, The Journal of Environment & Development, Volume 17, Number 4, 2008[358]

This article discusses the various factors behind Germany's climate change policy leadership. Germany is one of the leading countries in Europe, as well as globally, in

terms of its renewable energy and climate change policies. The multiple levels of government within the European Union (EU) mean that the German government must interact both with EU institutions (e.g., the Commission, Council, and Parliament) and sub-national Länder, or states, when formulating and implementing policy. The grand coalition government of the Christian Democrats and Social Democrats that came into power in 2005 has set demanding national climate change and renewable energy goals and actively supports international climate negotiations, often spurring EU policy. This progressive policy has its roots in the air pollution control policies that started to develop in the 1970s.

Germany Sticking to Ambitious CO_2 Target, E. Kirschbaum, Jan 2010[320]

Germany is the world's sixth largest emitter yet nonetheless has a firm target spelled-out by the government in its coalition agreement to cut emissions by 40 percent by 2020. Some industry groups have urged Berlin to drop ambitious emissions targets, saying they could jeopardize jobs. Germany has created hundreds of thousands of green tech jobs in the last decade. This article briefly describes Germany's commitment to adhere to a more ambitious goal of cutting greenhouse gas emissions by 40 percent by 2020 even though the UN climate conference in Copenhagen fell short of expectations.

Getting Back in the Game: U.S. Job Growth Potential from Expanding Clean Technology Markets in Developing Countries, WWF, 2010, © 2010 WWF[431]

As the largest future market, developing economies present an important opportunity to regain lost ground. By supporting clean energy policies and technology partnerships in developing countries, the United States can help lay the foundation for developing countries to leapfrog polluting "energy technologies" and reduce emissions, while building competitive clean technology markets open to U.S. firms. The report analyzes the importance of investing in clean energy markets in developing countries. It also shows economic, financial and social reasons to invest in the clean energy market within developing countries.

Global Asset Management Industry Outlook: Integrating Strategy with Experience in a Changing World, Deloitte, 2006[313]

This report identifies critical market drivers to achieve long-term success. This report finds that while issues like risk management and regulatory compliance remain a challenge, there are several distinct opportunities for growth—particularly through globalization and expansion into new markets, a differentiated product set and new strategies for the retirement market.

A Global Financial Architecture for Climate Change, WWF, 2008, © 2008 WWF[432]

This report discusses the need for a global financial architecture for climate change in order to shift public and private finance and investment flows towards decoupling economic growth from increasing greenhouse gas emissions to a low-carbon and climate resilient future. The analysis investigates fundraising mechanisms, funds management and use of funds of the above-mentioned global financial architecture.

Global Futures 2009: Clean Energy Investment Not on Track to Prevent Climate Change, New Energy Finance, March 2009[3]

This report demonstrates that investment needs to reach US$500 billion per annum by 2020 if CO_2 emissions from the world's energy system are to peak before 2020. Scientific experts fear that continued growth of emissions beyond 2015, or 2020 at the latest, would create the strongest risks of severe and irreversible climate change. This analysis shows that a peak much before 2020 currently looks highly unlikely. The report also shows that US$150 billion per annum investment is insufficient to drive down CO_2 emissions from the energy system before 2030. Total investment is set to reach US$270 billion by 2015 and US$350 billion by 2020. However, emissions from fuel combustion will continue to rise from the present level of 28 Gton of CO_2 to nearly 36 Gton of CO_2 by 2030.

The report also investigates the 2020 peak scenario, in which emissions peak before 2020. This shows that to achieve peak CO_2 emissions prior to 2020, investment has to reach US$370 billion by 2015, and US$500 billion by 2020 (44 percent higher than in the base scenario). In this case, emissions from fossil fuels peak at 30.8 Gton in 2019, and reduce to 29.1 Gton by 2030. In addition, the report estimates that the recession's direct impact on CO_2 emissions is likely to be moderate, reducing the total by around one Gton per year (three percent), and certainly not enough to avert a continued upward trend.

Global Gaps in Clean Energy RD&D: Update and Recommendations for International Collaboration, IEA, OECD, 2010[51]

The IEA's Energy Technology Perspectives 2010 study shows tangible signs that some of the necessary changes are starting to occur, in part due to recent implementation of green stimulus package funding for clean energy technologies. However, this is just a start—sustaining and accelerating the transition will require unprecedented intervention by governments in developing policies that work with and influence energy and consumer markets. It will also require a significant expansion in the research, development and demonstration (RD&D) of all available low-carbon energy technologies (LCETs).

This report seeks to inform decision makers seeking to prioritize RD&D investments in a time of financial uncertainty. It is an update of the December 2009 IEA report *Global Gaps in Clean Energy Research, Development and Demonstration,* which examined whether rates of LCET investment were sufficient to achieve shared global energy and environmental goals. It discusses the impact of the green stimulus spending announcements, and provides private sector perspectives on priorities for government RD&D spending. Finally, it includes a revised assessment of the gaps in public RD&D, together with suggestions for possible areas for expanded international collaboration on specific LCETs. The conclusion re-affirms the first *Global Gaps* study finding that governments and industry need to dramatically increase their spending on RD&D for LCETs.

This analysis may be characterized as an international discussion paper that identifies options for consideration by interested governments. It is recognized that all RD&D decisions will be made by individual countries, based on their own policy contexts, priorities and needs.

Global Investor Statement on Climate Change: Reducing Risks, Seizing Opportunities, and Closing the Climate Investment Gap, November 2010[96]

Investors are concerned with the risks presented by climate change to regional and global economies and to individual assets. Also, investors are interested in the large potential economic opportunities that the transition to a low-carbon economy presents. Investors have a fiduciary responsibility that requires them to seek optimal risk-adjusted returns on their investments. In the absence of strong and stable policy frameworks, many low-carbon investment opportunities do not currently pass this test. This article looks at some of the challenges involved in closing the climate investment gap and proposes some possible tools to mobilize private investment including GHG reduction targets, transportation policies, price signals, and subsidies.

Global Renewable Energy Markets and Policies, Eric Martinot, 2004[433]

This paper provides a survey of the existing markets for renewable energy, the past and existing policies that have facilitated those markets, and the implications of electric power sector restructuring for renewable energy. The paper concludes by considering future prospects from both economic and policy perspectives.

Green Bonds: A Model to Mobilize Private Capital to Fund Climate Change Mitigation and Adaptation Projects, H. Reichelt, 2010[153]

This report discusses climate change mitigation and adaptation-related issues. The capital markets will need to play an important role in mobilizing private funding for climate change mitigation and adaptation projects. However, to raise the funds required to make an impact in the fight against climate change, investment products must be designed to appeal to investors with a substantial asset base. Pension funds and sovereign wealth funds have large allocations of fixed income. Green bonds are an example of an innovative fixed-income investment product that appeals to investors for this asset class and can pave the way for the next phase of products to mobilize significant capital to finance solutions to the climate change challenge.

Green Buildings, Kofo, Green Growth, UN ESCAP, 2008[434]

Green Growth emphasizes the need to improve the "ecological efficiency" of the growth patterns of countries in a region so that the region may continue the much needed economic growth necessary for poverty reduction without compromising its environmental sustainability. Eco-efficiency was first promoted by the World Business Council on Sustainable Development as a business concept to improve the economic and environmental performance of individual firms. In this case, eco-efficiency is being suggested as a concept for economy wide application for a country as a whole. Eco-efficiency means improving the efficiency of the use of natural resources, while minimizing the environmental impact of pollution.

Global awareness of the urgent need to reduce greenhouse gas emissions and other environmental degradation has increased over the last decade. Buildings are a part of infrastructure which also consists of industries, transportation, and telecommunications.

It has been identified as being responsible for about 25–40 percent of energy consumption, 30–40 percent of material resource consumption, 30–40 percent of waste production, and 30–40 percent of the greenhouse gas released globally. Additionally, estimates reveal that about 30 percent of newly built or renovated buildings suffer from "sick building syndrome", exposing occupants to unhealthy environmental conditions.

To reduce the global impacts of buildings, the Environmentally Sustainable Economic Growth (Green Growth) concept is being promoted as the foremost strategy to ensure the sustainable infrastructural development of any economy. The Green Growth concept has been embraced by some 340 delegates, including representatives from 52 member and associate member countries of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) at the 5th Ministerial Conference on Environment and Development (MCED 2005) held in Seoul, Republic of Korea, in March 2005.

Green Credit, Green Stimulus, Green Revolution? China's Mobilization of Banks for Environmental Cleanup, The Journal of Environment & Development, 2010[325]

To tackle China's profound environmental problems Chinese leaders are now incorporating environmental targets in Five-Year Plans and experimenting with market-based mechanisms to supplement their traditional command and control mechanisms for environmental protection. Recently, China has produced a series of green policies, including green tax, green procurement, as well as green policies relevant to the financial sector, namely, green credit, insurance, and security policies. Of the three, the green credit policy is the most advanced, with three agencies (the Ministry of Environmental Protection, the Peoples' Bank of China, and the China Banking Regulatory Commission) sharing the responsibility for implementation. The policy, approaching its fourth year of implementation, has proved resistant to China's massive economic upheaval following the global financial crisis. Its future success depends on effective environmental data collection and dissemination, technical guidance, and provision of true financial incentives for banks. The continued success in implementation could potentially provide China with the experience and confidence to address new challenges, such as the environmental and social conduct of its enterprises overseas.

Green Economy Report: the Preparatory Committee for the United Nations Conference on Sustainable Development, UNEP, 2010[91]

The Green Economy Report uses economic analysis and modeling approaches to demonstrate that greening the economy across a range of sectors can drive economic recovery and growth and lead to future prosperity and job creation, while at the same time addressing social inequalities and environmental challenges.

This report explains the core principles and concepts underlying a green economy and makes the case for more sustainable use of natural, human, and economic capital. The report also examines the actions governments can take to facilitate the transition to a green economy. The scope of these enabling conditions is wider than financial support for investments, and covers the key policy tools and supporting infrastructure that can influence investment and consumption decisions.

The report addresses some of the fundamental questions regarding the reallocation of pools of capital, predominantly from private sources, required to achieve a green economy globally. It explores the extent to which these pools of capital will have to be "greened" in the coming decades to serve the (upfront) capital needs in order to shift the economy into low-carbon and resource efficient sectors. Recognizing the instability of the global financial system, the report highlights the need for adequate international and local policy and regulatory frameworks and effective measures to reduce external costs of portfolio holdings.

The report targets decision-makers, seeks to influence business leaders, and explains in simple terms the need for increased environmental investments to promote sustainable economic growth, generate employment, reduce poverty, and increase the quality of life.

The Green Evolution: Environmental Policies and Practice in China's Banking Sector, A. Matisoff, M. Chan, Friends of the Earth and BankTrack, November 2008[326]

This report finds that there has been significant progress in the development of sustainable finance in China, including the creation of influential regulations, internal bank compliance mechanisms, and some public reporting. In the best cases, banks have established deeper credit risk management systems that may enhance the strength of bank lending portfolios, or adopted international best practices. But overall, Chinese banks still lag behind their international peers especially when it comes to developing comprehensive environmental and social management systems and engaging stakeholders.

Green Finance for Green Growth, Track 1: Green Growth, Hongo, T., Japan Bank for International Cooperation, APEC, 2010[53]

The global economy is threatened by energy constraints, climate constraints and the financial crisis. Together they could be termed the "Triple Threats." Green growth is the solution to these challenges. Technologies for Green Growth should be required to fulfill two conditions; namely have a high reduction potential globally and be an economically sound investment. These technologies are defined here as "commercially viable best available technologies" (BAT).

Green Finance for Green Growth, Track 2: Supporting Green Companies and Industries through Banks, Koo, J., APEC, 2010[315]

There are green financial products in the retail banking sector such as green home mortgages, auto loans, green deposits, etc. There are also corporate and investment green financial products including project finance, partial credit guarantees, and bonds, among others. Private banking sectors can implement green finance through either financing or lending instruments. It is necessary to separate green financial products in the private sector from those in the public sector because they have different roles. It is ideal that the private sector provides enough green financial products to meet demands in the market. However, it is hard to expect that the private sector will fully cover market demands due to the uncertainty on risks and returns in the green industry. While some

private financial institutions have released green financial products, such as loans with lower interest rates, the products are usually not for making profits but for increasing their brand values or for marketing purposes.

Green Finance for Green Growth, Track 3: The Role of Capital Markets for Green Growth, Zou, APEC, 2010[310]

This report has reviewed the fundamental background and the progress of green growth, and has summarized the role of capital markets in achieving green growth with the main focus on representative countries such as the United States, Japan, South Korea, China, and India, among many others.

Green Finance for Green Growth, Track 4: Development of Green Finance through Other Market-Based Instruments, APEC, 2010[235]

Market-based instruments are policy tools—based on regulations—that use market signals (e.g. changes in relative prices) to change behavior. In comparison, the traditional method of achieving environmental outcomes ("command and control" regulation) uses explicit government directives such as mandated technologies to improve environmental outcomes.

There are four key types of market-based instruments: taxes and subsidies, tradable permits, market friction reductions, and voluntary programs. This paper looks at the last three while taxes and subsidies are covered in track 5 of the study.

Green Finance for Green Growth, Track 5: Subsides, Tax Benefits and Tax Breaks for Green Companies, Anbumozhi, V., Patunru, A. A., APEC, 2010[211]

To stimulate green growth and bolster the formation of new companies, subsidies, tax benefits, and tax breaks are needed. The imperative is that (i) green companies and products produce positive externalities that are not factored into either production or purchasing decisions. If, for example, a greener production process lessens carbon emissions then an incentive equal to the value of those externalities could be given. Similarly, on the consumer side, if use of the good produces positive externalities that are not captured by the user, then the price of the good can be subsidized or a tax break given; (ii) if non-green companies or products generate negative externalities but no tax or disincentive is levied, then governments could either tax those firms or give incentives to the green firms. This is an attempt to achieve the correct mix of green and non-green industries. In the absence of either (i) or (ii), giving incentives can lead to inefficient resource uses.

Governments need resources to kick-start their green growth. Fortunately, working models exist proving this is possible. For APEC countries, there are lessons that can be learned from countries that have already started on a green growth path. The aim of this paper is to show what lessons can be learned from country experiences. The paper focuses on current trends in green companies and government fiscal policies in selected APEC economies, which have been influenced by recent developments at the national and international level.

Green Financial Products and Services: Current Trends and Future Opportunities in North America, NATF, August 2007[309]

The purpose of this report is to examine the currently available green financial products and services, with a focus on lesson learning opportunities, the nature and transferability of best practices, and how key designs can potentially increase market share and generate profits, while improving brand recognition and enhancing reputation. Following an overview of the current state of green banking, both in North America and elsewhere, this report discusses potential options for future environmental banking products and services for the North American financial sector.

Green Investing: Towards a Clean Energy Infrastructure, World Economic Forum, January 2009[311]

This report explores a wide range of green investment-related issues. The sums involved in a shift to a low-carbon energy system are daunting and there are varying views regarding the exact amount of investment necessary. Moreover, a description of the role of carbon markets is provided along with an analysis of the current financial crisis's impact on a sustainable energy future. In addition, the paper investigates the need for a smart policy to support the shift toward clean energy infrastructure.

The Green Investment Bank, Second Report of Session 2010–11, UK Parliament, 2011[203]

In June 2010, the Green Investment Bank Commission recommended that a Green Investment Bank be set up by the end of 2010. The government is currently still considering and market testing options, and has indicated that it will make an announcement on the business model for the Bank in May 2010. It expects the Bank to be operational in late 2012. A key issue has been whether the new body will be a "bank" or a "fund", which in turn hinges on the National Accounts treatment of the Bank. There have been persistent reports of disagreement within the government about whether the Bank will be able to raise money from the finance markets, due to such classification issues.

The UK Government plans to include an update on its work developing the Bank in the budget later in March-April, 2011, and to announce the proposed business model in May 2011. The aim of this report is to contribute to those deliberations and to encourage their quicker conclusion and to prompt action.

Green Investment Schemes: Options and Issues, W. Blyth and R. Baron, OECD, 2003, © OECD/IEA, 2003[435]

Green Investment Schemes (GIS) have been discussed as a way of promoting the environmental efficacy of transactions that involve such surplus allowances. The idea would be to ear-mark funds generated from the sale of allowances for use in environmentally-related projects. The GIS would be set up by the seller countries, and would operate as a domestic scheme within their climate policy framework, with operational details to be agreed on a bilateral basis between buyer and seller nations. If supported by the international community for its environmental effectiveness, GIS schemes could be

broadly relevant to those non EU-accession countries with economies-in-transition (EITs) that have surplus AAUs. This paper explores the pros and cons of setting up such a scheme, identifies some policy and funding gaps that GIS could fill, and investigates some of the issues that would arise if such a scheme was implemented.

Green Road to Growth, Environmental Assessment Institute, Denmark, 2006[436]

"Green Roads to Growth" describes a program of work carried out by the Danish Environmental Assessment Institute to explore the possible linkages between environmental policy and economic progress. The emphasis is on the EU but the principles apply broadly.

The economic background to "Green Roads to Growth" in the EU is characterized by intensified competition from abroad, an ageing population and in many member states a need to secure jobs to facilitate social cohesion. The policy context is set by the so-called Lisbon Agenda that was initiated at the Lisbon Council (2000) to focus on growth and employment, was broadened to include sustainable development as an aspiration at the Gothenburg Council (2002), and was re-launched at the European Council in March 2005 re-focusing priorities on jobs and growth. This re-focusing was intended to be achieved in a way that was coherent with the Sustainable Development Strategy brought into focus at Gothenburg. However there was still a perception that environmental policy was being marginalized and an understandable reaction from the advocates of environmental policy was to promote the view that such policy would not only not get in the way of economic progress but that, "good environmental regulation in Europe can support a clean, competitive economy and a healthy environment in which to work and live."

Green Sectoral Bonds, International Energy Trading Association, March 2010[437]

This concept note is intended to stimulate discussion about new instruments for financing low-carbon development in developing countries. The size of the investment requirements is massive, and there is a high expectation that some means will be found to make the investments attractive to private sector investors. This is despite the problems of political risk in many of the countries concerned, the low or even negative economic return from low-carbon investments in the absence of a significant carbon price, and the slow progress towards creating a scaled-up carbon price incentive from the impressive but small-scale beginnings of the Clean Development Mechanism (CDM). New approaches, new instruments, and different investors need to become involved. The type of instrument described here attempts to blend a variety of ideas to stimulate the market. If any progress is to be made, some instrument must be devised that is acceptable to borrowers, lenders and developed country governments providing guarantees.

Recent research with institutional investors has found a significant appetite for bond investments related to carbon abatement and mitigation projects, provided the instruments attain acceptable levels of risk ratings and rates of return. In response, a handful of government-backed green bonds have been issued to private sector investors, with the aim of generating funds to finance climate mitigation activities. However, existing green bond designs have—and will presumably continue to—fall short in stimulating material sums of private climate capital, due to their less-than attractive risk-return features vis-à-vis

those of their conventional counterparts. Unless their features can ultimately become competitive with those of normal bonds—while satisfying the objectives of mainstream investors—green bonds will remain niche products and levels of private climate capital into developing countries will continue to lag.

Greenhouse Gas Market Report 2010, IETA, 2010[438]

The International Emissions Trading Association's (IETA) focus on emerging markets, CDM reform and the ongoing negotiations for a post-2012 international agreement has increased. The papers in this publication reflect the experiences and views of IETA members on emissions trading around the world. The report provides an assessment of greenhouse market and carbon market developments. It discusses flexible mechanisms, technology and finance on the global GHG marketplace.

Greening Growth in Asia and the Pacific, United Nations, 2008[291]

This report provides a wide range of policy options and approaches that can expand economies while simultaneously improving welfare, reducing poverty, and protecting natural capital for countries in Asia and the Pacific area. The publication explores the potential for eco-tax reform, developing sustainable infrastructure, encouraging sustainable consumption, and greening business activity. Equally as important, it illustrates these options with examples from across the region.

Greening Household Behavior: The Role of Public Policy, OECD, March 2011, © OECD 2011[271]

As governments promote strategies to encourage more environmentally sustainable consumption patterns, this new OECD households' survey offers insight into what really works and what factors affect people's behavior. The study focuses on five areas: household water use, energy use, personal transport choices, organic food consumption, and waste generation and recycling. This publication presents the main results arising from the analysis of the survey responses, as well as the policy implications of these findings. It is based on responses from over 10,000 households in ten OECD countries: Australia, Canada, the Czech Republic, France, Italy, Korea, Mexico, the Netherlands, Norway and Sweden. The findings confirm the importance of providing the right incentive to spur behavioral change. The survey shows that price-based incentives encourage energy and water savings. Moreover, the evidence indicates that the effect of pricing consumption on a volumetric basis is partially informational—providing a signal to households about consumption levels. In general, the results suggest that introducing price-based measures and changing relative prices (for electricity, water, fuel or waste disposal services) is necessary if emissions are to be reduced and natural resources to be conserved.

Handbook of Market Creation for Biodiversity: Issues in Implementation, OECD, 2004[263]

This handbook provides a conceptual guide, with practical examples, to creating markets for the sustainable use and conservation of biodiversity. It outlines many of the issues that policymakers and practitioners should take into consideration when developing agendas for making biodiversity-related policy more compatible with

economic development. Market creation is effective because it is often the most direct approach to solving the problem of biodiversity decline. Market creation may take many different forms: markets in land, markets in uses of land, markets in specific flows of biodiversity, markets in things associated with biodiversity. The fundamental elements of market creation concern taking steps to establish the desired market, and then taking the steps needed to address the remaining imperfections within that market.

The problems that cause valuable biodiversity-related goods and services to go un-provided are associated with various types of market failures, which are often caused by the existence of externalities and imperfect information, as well as the "public" nature of some goods and services. The latter, public good, source of market failure has its origins in the non-excludability or non-rivalry of some goods or services. The implication of these problems is that there are goods and services that are not easily marketable. The policymaker is faced with the problem of addressing market failures in order to provide for the existence of the valued good or service.

How Many People Does It Take To Administer Long-term Climate Finance?, D. Ciplet, B. Müller, and J. Timmons Roberts, 2010[439]

This policy brief seeks to raise a small but nearly unaddressed question in the larger debate about the governance of climate change-related funds. The influx of these funds will require additional staff capacity to conduct activities such as project identification, screening, research, selection, appraisal, project feasibility and design approval, operationalization, monitoring and control, technical assistance, capacity building, implementation, and evaluation. Moreover, to get approximate idea of what level of staffing will be needed to administer and conduct development work with the "new and additional" climate finance promised at Copenhagen, this policy brief investigates the current levels of full-time equivalent (FTE) staff in 11 major international development agencies.

HP Green Procurement Guidance, White Paper, Hewlett-Packard Company, L.P., 2010, © 2011 Hewlett-Packard Development Company, L.P. Reproduced with Permission[294]

This white paper examines some general principles for developing environmental procurement criteria for information technology (IT) products and services. As sustainability goals become increasingly important to organizations, HP recommends some broad principles to ensure that procurement guidelines are useful, fair, understandable, and environmentally and economically viable for suppliers. HP recommends that procurement guidance be based on the following principles: (i) fairness and equitability; (ii) harmonization and recognition of international standards; (iii) material restrictions; (iv) prioritization; (v) measurability and verifiability; (vi) process transparency; and (vii) compliance verification.

ICT Solutions for Energy Efficiency, Youngman, R., 2010[274]

The purpose of this report is to explore the transformative role information and communication technologies (ICT) can play in acting now, together, and differently toward a

more energy efficient agenda. The report focuses on showing a wide range and variety of ways in which ICT solutions could play a transformative role, and the bulk of the report provides case studies of examples of ICT solutions already developed and operating to enable energy efficiency in three particular areas—namely, smart logistics, smart grid/ smart metering, and smart buildings.

IMF Proposes 100-Billion-Dollar Climate Fund, A. R. Green, March 2010[162]

This article details the International Monetary Fund's commitment to unveil the first details of a proposed financing framework, dubbed the "Green Fund", intended to mobilize US$100 billion a year by 2020 to help developing countries cope with the consequences of climate change and to mitigate further emissions.

Impact of Global Recession on Sustainable Development and Poverty Linkages, V. Anbumozhi, A. Bauer, July 2010[324]

This paper centers on the use of energy and other related services, the human activity with probably the largest impact on the global environment. The consequences of energy use are larger for climate change, and the paper focuses on this aspect, with some discussions on land use, which is closely related to the livelihood of the poor. Next the paper explores the linkages between poverty incidence and vulnerability to the global financial crisis, identifying the interactions between poverty reduction and green stimulus measures. Finally, key long-term policy issues that are closely related to environment and poverty are introduced.

Implementation of Industrial Energy Efficiency Measures Through PAT Scheme, Independent Power Producers Association of India, 2010[283]

The government of India has been trying to promote greater energy efficiency through various policy measures. Now, because of convergence of several factors, EE has assumed greater attention and policy makers are increasingly recognizing the urgency of improving energy efficiency. Increased attention at the policy level is also visible with the release of the National Action Plan on Climate Change (NAPCC) with the National Mission on Enhanced Energy Efficiency (NMEEE) as one of the missions under NAPCC. An action plan under NMEEE seeks to implement four major initiatives, overviews of which are provided in this paper.

The most important aspect of the mission is the Perform Achieve and Trade (PAT), which is a market-based mechanism to enhance cost effectiveness of improvements in energy efficiency in energy intensive industries and facilities, through certification of energy savings that could be traded.

Other initiatives under NMEEE include expanded use of the carbon market to help achieve market transformation toward more energy-efficient equipment and appliances, and institution of two innovative fiscal instruments namely the Partial Risk Guarantee Fund (PRGF) and Venture Capital Fund for Energy Efficiency (VCFEE) to help channel investment into energy-efficiency projects. PRGF will provide back-to-back guarantees to banks for loans to energy-efficiency projects so as to reduce the perceived risks of these projects, whereas VCFEE would support

investment in the manufacturing of energy-efficient products and provision of energy-efficiency services.

NMEEE also supports the promotion of Energy Service Company (ESCO) based upgrades to energy efficiency in buildings, municipalities and agricultural pumpsets Through this business model, ESCOs invest in energy-efficiency investments, and are paid over several years from the resulting energy savings.

The Implicit Price of Carbon in the Electricity Sector of Six Major Economies, Vivid Economics, October 2010[25]

This report considers policies to promote low-carbon electricity generation in six major economies: Australia, China, Japan, South Korea, the UK and the United States. In all six countries, including those without emissions trading schemes or carbon taxes, domestic policies are creating some financial incentive to produce low-carbon electricity and, consequently, an implicit price on carbon. The aim of this report is to capture the extent to which policy in a country increases the incentive for low-carbon electricity generation; either through increasing the price received, or reducing the costs incurred, by low-carbon generators.

Infrastructure and Infrastructure Finance: The Role of the Government and the Private Sector in the Current World, D. Helm, 2010[440]

This article considers why there is a strong distinction between the cost of debt for existing regulated assets and the cost of debt and equity for new infrastructure. It explains why and how regulation can address the core economic problems which infrastructure brings: (i) the nature of long-term fixed and sunk costs in a context where average and marginal costs sharply diverge: and (ii) where political and regulatory incentives to expropriate the sunk costs are strong. The article then considers the implications for the respective roles of government and the private sector. The specific problems of private finance are considered next, and a model for extending the concept of regulated asset bases across the wider infrastructure space is set out. The immediate and longer-term effects of the credit crunch and the resulting economic crisis on infrastructure provision and finance are then considered and a number of policy implications and conclusions are drawn.

Infrastructure as an Asset Class, Georg Inderst, European Investment Bank, 2010[441]

Infrastructure as a new asset class is said to have several distinct and attractive investment characteristics. This paper reviews concepts, market developments and empirical evidence on the risk-return and cash flow profile, and the potential for diversification and inflation protection in investor portfolios. Furthermore, a new, global analysis of the historical performance of infrastructure funds is undertaken. There is no proper financial theory to back the proposition of infrastructure as a separate asset class. Infrastructure assets are very heterogeneous, and empirical evidence suggests an alternative proposition that treats infrastructure simply as a sub-asset class, or particular sectors, within the conventional financing vehicle on which it comes (e.g. listed and private equity, bonds).

Infrastructure Finance in Developing Countries: An Overview, A. Estache, 2010[442]

This paper analyzes the main approaches to infrastructure financing in developing countries and their evolution. It places the discussion in the context of the importance of infrastructure investment and maintenance needs to achieve growth and broader social objectives. It summarizes the evidence on the efficiency, equity and fiscal consequences of the main public and private financing options commonly used to achieve these goals in these countries. It shows the limits of the role of the private sector as a source of financing of infrastructure and the wide underestimation of public-sector financing support needed to serve the poorest and ensure that services are offered at prices consistent with their ability to pay. It concludes with forward-looking lessons from roughly 20 years of efforts to diversify the sources of infrastructure finance in developing countries.

Innovative Finance for Development Solutions, World Bank[443]

This report describes what innovative finance is and investigates its importance in developing countries. Moving from innovative finance's early stages of implementation to its growth, the report explores the World Bank Group's initiatives to generate additional funds, make them more efficient and link funds to results. Moreover, eleven case studies are described to provide evidence and support to the analysis.

Interactions of the EU ETS with Green and White Certificate Schemes: Summary Report for Policy Makers, European Commission Directorate-General Environment, 2005[242]

This report considers the interactions between the European Union Emissions Trading Scheme (EU ETS) for carbon dioxide (CO_2) and trading programs for renewable electricity generation (tradable green certificates) and for energy savings (tradable white certificates). It provides an overview of the impact of the EU ETS on electricity markets, including effects on wholesale prices, retail prices, and electricity demand. The report contains the corresponding analyses for green and white certificate schemes. It also provides a summary of the major effects of the green and white certificate programs on the EU ETS, including overall CO_2 emissions and the costs of achieving the CO_2 targets.

Interim Report of the Green Growth Strategy: Implementing our Commitment for a Sustainable Future, Meeting of the OECD Council at Ministerial Level, 27–28 May 2010, © OECD 2010[14]

The OECD will deliver a Green Growth Strategy Synthesis Report to the 2011 Ministerial Council Meeting, which will elaborate specific tools and recommendations to help governments to identify policies that can help achieve the most efficient shift to greener growth. The 2010 Interim Report highlights preliminary findings on a number of key issues that policymakers are currently facing in transitioning to greener economies. These reflect only a sub-set of the broader range of issues that will be addressed in the 2011 Synthesis Report. The Interim Report also presents recent OECD analysis on the use of environmentally-related taxes, charges and emission trading schemes.

International Climate Finance: Principles for European Support to Developing Countries, By N. Bird & J. Brown, 2010[444]

The commitment to provide new finance in support of climate change actions in developing countries was one of the few areas where tangible progress was made at the Copenhagen COP meeting. Therefore, securing a system that supports such financial flows to developing countries is an immediate challenge for the international community. This paper examines Europe's approach to the provision of such finance.

The estimates of global needs for climate finance are considerable and it is expected that the requirement for funding will see a significant upwards trajectory over the next decade. Despite considerable uncertainties, the European Commission's own estimates suggest that up to €15 billion of additional public financing will be required each year from the EU by 2020 to support both mitigation and adaptation needs in developing countries. As new funding initiatives have been established, a number of principles have been proposed to assess their relative worth. However, little emphasis has been given to how these principles might fit together in a coherent, over-arching framework. This paper proposes such a framework and describes the criteria and indicators by which compliance with the principles could be assessed. The commentary identifies three sequential phases that relate to the mobilization, administration and disbursements of funds, examining the principles, criteria and indicators that are relevant for each of these three phases. In addition, a number of European initiatives are compared using this analytical framework.

International Development Frameworks, Policies, Priorities and Implications, A. Fowler, 2003[445]

This report provides basic information about key features of international aid and development. The focus is on major ideas, policy frameworks and their application that are important for all NGOs to understand. Each section first summarizes the major elements of current international thinking and official agreements and then considers probable implications. This booklet is intended be a short, straightforward guide to the "big picture" of the NGO environment, supported by references to sources of more detailed information. While written for NGOs in general, specific conditions in Africa are included. It is divided into three parts. The first contains information about the major policy frameworks that guide international development and aid. The second concentrates more on how these and other policies are being applied in international practice. The third section focuses on two frameworks specific to Africa.

Introduction to Green Tax and Budget Reform, Green Growth, UN ESCAP, 2010[227]

Green Tax and Budget Reform (GTBR) refers to a wide spectrum of fiscal pricing measures that have the potential to simultaneously increase revenue and foster Green Growth. More specifically, it entails (i) a shifting of the tax burden from traditional areas of taxation, such as income, savings, and capital gains, to environmentally relevant products and activities like fossil fuels and waste; and (ii) the redirecting of subsidies away from environmentally perverse activities towards activities that promote Green Growth and poverty reduction. The entire reform of the fiscal system has the

aim of maintaining revenue neutrality: a net-zero increase in the level of taxation on the economy.

GTBR encompasses a broad array of fiscal instruments in areas such as transportation, raw materials, natural resources, waste, and energy. Applying GTBR policies within these areas can create jobs; reduce poverty; and improve resource productivity, international competitiveness, and environmental quality. Effectively educating the public and private sectors, as well as a country's citizenry on the benefits of GTBR, has been deemed as crucial for ensuring effective implementation and long-term adoption. In addition to recycling revenue from subsidy reform and green taxation into pro-poor development programs, the setting of thresholds for taxation is another means for reducing any negative distributive impact on lower income groups.

Investing Across Borders 2010: Indicators of Foreign Direct Investment Regulation in 87 Economies, World Bank Group, 2010[446]

Investing across Borders (IAB) is a new initiative that the IAB team aims to continue to improve. The World Bank Group's Doing Business project provides the methodological foundation for the IAB indicators. The Doing Business indicators compare regulation of domestically owned small and medium enterprises. Those indicators have helped stimulate hundreds of reforms worldwide and draw millions of visitors to their online database every year. Many users of Doing Business data—including governments, policymakers, academics, and other stakeholders—have expressed interest in complementary indicators on regulation of foreign-owned companies. The IAB indicators aspire to meet different stakeholders' needs for information, analysis, and policy action.

Foreign investors and governments concerned about the competitiveness of their economy's business environment have a broad range of resources at their disposal. This publication lists some widely used international indicators and assessments of investment climates. IAB does not provide a complete picture of economies' investment climates and should be used in conjunction with other tools to analyze business environments, diagnose their strengths and weaknesses, and, if appropriate, guide reforms. IAB's value is based on its ability to identify specific, actionable, and practical steps that governments can take to increase domestic investment competitiveness in the policy and regulatory areas measured by the IAB indicators.

Investing in Clean Energy: How to Maximize Clean Energy Deployment from International Climate Investments, Center for American Progress, 2010[13]

This paper summarizes four separate, national studies, examining and making estimates of the costs of installing renewable and low-carbon electricity generation capacity in China, India, Nigeria and South Africa. Specific sectors examined are hydro, wind and solar in China; solar in India; gas and small-scale hydro in Nigeria; and solar and wind in South Africa. These have been identified as priority sectors for each nation by the respective governments. In the case of many clean energy technologies and especially those included in this study, the high per-unit energy generation costs compared with incumbent technologies—known as incremental costs—largely result from capital costs. They are cheap to run but very expensive to install. Thus, the

investment challenge is twofold. Developing countries need help in gaining access to capital, because they are seen as riskier jurisdictions in which to invest (and the technologies themselves as riskier investments). Furthermore, any factor that can reduce the investment costs, by making the technologies or the capital cheaper, will reduce the incremental cost.

The authors have examined in detail how governments can intervene to help increase the sum and reduce the cost of clean energy investments in developing countries. While the paper acknowledges that the issue of how to finance developing country incremental costs remains open and highly contentious, it is increasingly clear that governments should commit a proportion of a future climate funds to help provide incentives and reduce risks for private investors, thereby reducing the costs of capital and sparking a rapid deployment of clean energy. The authors propose five mechanisms that could be used by individual developed country governments or an international climate fund to help developing countries access private capital. These are: (i) loan guarantees; (ii) policy insurance; (iii) foreign exchange liquidity facility; (iv) pledge fund; and (v) subordinated equity fund.

Investing in Climate Protection: Projected Based Mechanisms CDM and JI, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), 2010[447]

This publication aims to provide an introduction to the Clean Development Mechanism (CDM) and Joint Implementation (JI) and to describe the current status of their implementation. It is written for project developers who are thinking of registering a project as a CDM/JI project and for anyone seeking a general introduction to the project-based mechanisms. The presentation is divided into two main parts. The first part explains the theoretical and legal structure of CDM and JI and the status of their implementation. It begins with a general definition outlining what constitutes a climate change project under the Kyoto Protocol and the phases that make up a typical project cycle. This provides the background for a detailed description of the CDM and JI mechanisms, with sections explaining their legal basis and the phases involved in each type of project. There follows a description of the market for carbon credits generated by CDM/JI projects. The first part is completed with an over-view of Germany's KfW Carbon Fund and the distribution of responsibilities between the German federal government and Federal Environment Agency. The second part illustrates this presentation with selected sample projects. The examples aim to explain how CDM and JI work in practice and to give an idea of the possible range of project types. Finally, a comprehensive glossary clearly and concisely defines key terms and abbreviations, and a service chapter lists further information sources and contact addresses. Clear, informative figures illustrate all project procedures and key inter-relationships.

Investment and Financial Flows Needed to Address Climate Change, E. Haites, 2008[4]

Addressing climate change will require significant shifts and an overall net increase in global investment and financial flows. This paper focuses on investment and financial flow-related needs that are crucial to address climate change. The report is split into four sections. The first two cover the incremental investment requirements for mitigation and adaptation respectively. Data are provided at global, sector, and in some cases country

levels. The third section identifies the likely sources of incremental mitigation and adaptation investment, while the final section discusses how the additional funds needed by developing countries could be raised.

Investment and Financial Flows to Address Climate Change, UNFCCC, 2007[54]

This technical background paper reviews and analyses existing and projected investment flows and financing relevant to the development of an effective and appropriate international response to climate change, with particular focus on the needs of developing countries. It provides an assessment of the investment and financial flows that will be necessary in 2030 to meet worldwide requirements for mitigating and adapting to climate change under different scenarios of social and economic development, especially as they impact the well-being of developing countries. In particular it provides (i) detailed information on current investment and financial flows; (ii) projection of investment and financial flows by major sources to address adaptation and mitigation needs in 2030; (ii) a summary of priorities identified by Parties not included in Annex I to the Convention (Non-Annex I Parties) as part of the UNFCCC process; and (iv) an analysis of the potential role of different sources of investment and financing and their future potential.

An Investment Framework for Clean Energy and Development: A Platform for Convergence of Public and Private Investments, World Bank, 2007[150]

This paper discusses the three linked pillars around which the investment framework for clean energy and development has been organized. The first pillar is about meeting the energy needs of developing countries and widening access to energy services for their citizens in an environmentally responsible way. The second pillar refers to the path towards a low-carbon economy and greenhouse gas emission reductions. The third pillar refers to climate change adaptation and variability and is concerned with helping developing countries adapt to climate risks.

Key Recommendations from the APEC Experts Panel on Green Finance for Green Growth to the APEC Finance Ministers Summit in Kyoto, World Bank, 2010[102]

The joint study, *Green Finance for Green Growth,* was initiated by Korean Ministry of Strategy and Finance at Senior Finance Officials Meeting in Singapore in July, 2009 and was reported to Finance Ministers Meeting in November 2009 to be implemented during 2010 and 2011. This report is the result from the first year study in 2010. The study details a wide range of green finance-related aspects such as technology, PPPs, the role of capital markets, the adoption of market-based instruments for green finance, tradable permits and fiscal policies, among other key topics.

Legal and Institutional Dimensions of the Copenhagen Regime, Carbon and Climate Law Review, Volume 3, Number 3[448]

This booklet provides a compilation of various expert-written articles covering areas such as the legal forms of a post-2012 climate regime, a review of the Copenhagen draft,

indentifying countries particularly vulnerable to climate change, and the financing of climate policy in developing countries.

Linking Tradable Permit Systems: A Key Element of Emerging International Climate Policy Architecture, Jaffe, J., Ranson, M., and Stavins, R. N., 2009[244]

This article analyzes the role that linkage between emission trading systems could play in future international climate policy architecture. Cap-and-trade systems—regional, national, and international in scope—are emerging as a preferred instrument for addressing global climate change throughout the industrialized world, and the Clean Development Mechanism—an emission-reduction-credit system—has also developed a significant constituency. Because links between tradable permit systems can reduce compliance costs and improve market liquidity, the possibility of linking cap-and-trade systems to each other and to emission-reduction-credit systems such as the Clean Development Mechanism has generated considerable interest. This article considers whether linkage could pave the way for a future international agreement, play a role as part of a future agreement, or substitute for an agreement. The argument is made that such linkage could promote the near-term goals of participation and cost-effectiveness, while helping to build the foundation for a more comprehensive future agreement to address global climate change.

The Little Green Data Book, the World Bank, 2010[449]

This publication is a knowledge resource that aids policymakers in using environmental data more effectively to support priority-setting and improved development outcomes. It focuses on (i) agriculture, (ii) forests and biodiversity, (ii) energy, (iv) emissions and pollution, (v) water and sanitation, (vi) environment and health, and (vii) national accounting aggregates. It allows an easy comparison of country-level data with benchmark regional and income group values. The analysis also estimates adjusted net savings, which measures the annual changes in a country's total wealth.

Low Carbon Development Options for Indonesia, Fiscal Policy Office, Ministry of Finance and the World Bank, 2008[450]

This report covers the discussions and findings of technical assistance and analytical studies conducted under the first phase of a low-carbon options study in Indonesia. The current global climate context is creating an historic opportunity for an integrated approach to climate issues without compromising growth and development. Indonesia understands that accessing this innovative financing presents a strategic opportunity. Moreover, Indonesia's development planning cycle is ready for integration of climate change actions and policy reforms. Indeed, the government of Indonesia (GOI) acknowledges that addressing climate change and energy issues will also generate secondary development benefits and improve quality of life. The Fiscal Policy Office appointed a working group to study and map out fiscal issues for climate change. The GOI is collaborating with the World Bank and other donors to conduct the technical studies needed to inform the low-carbon development strategy.

Low Carbon Growth Country Studies Program: Mitigating Climate Change through Development, ESMAP, the World Bank, 2009[451]

Six emerging economies—Brazil, China, India, Indonesia, Mexico and South Africa—are proactively seeking to identify opportunities and related financial, technical, and policy requirements to move towards a low-carbon growth path. The governments of these countries have initiated country-specific studies to assess their development goals and priorities, in conjunction with GHG mitigation opportunities, and examine the additional costs and benefits of lower carbon growth. This requires analysis of various development pathways—policy and investment options that contribute to growth and development objectives—while moderating increases in GHG emissions.

The Energy Sector Management Assistance Program (ESMAP) is assembling the lessons generated from these six country studies to develop knowledge products—modeling toolkits, best practices and 'how to' guidance, and interactive training. ESMAP will foster knowledge exchange and capacity building with its clients—low- and middle-income countries—to support their exploration of low-carbon growth opportunities.

The Macro-Economic and Financial Framework of the Green New Deal: Adopted Policy Paper, 13th EGP Council, 2010[452]

This paper argues that a green economic vision places social and environmental justice and equity within nations and between nations at the centre. It contends that this includes a just use of the earth's resources and one which reverses the trend of the widening gap between rich and poor, seeking to reduce inequalities in the distribution of power and access to resources. The paper continues on to hold that every person has the right to meet their basic needs: clean air, water, food, shelter, energy, health, freedom, education and that every human being has the right to solidarity, democracy, self determination, autonomy, responsibility, dignity and self-fulfillment. The paper concludes by stating that the economy should enhance wellbeing rather than detract from it and that the *Green New Deal* is the endeavor that will bring about this transformation.

Making the Most of Public Finance for Climate Action, World Bank, 2010[161]

Through a range of examples, this issues brief illustrates how public finance can catalyze climate action by piloting innovative ways to leverage both climate and development finance, such as combining resources and instruments to maximize synergies, exploring new opportunities to expand the scope for market mechanisms, and strengthening the capacity to facilitate access to resources and their effective use. The report discusses opportunities for scaling up financing and climate-smart transformation. The issues brief also describes the role of innovation in carbon-finance related activities. Moreover, carbon-finance related instruments to simplify access, increase leverage, maximize synergies are discussed.

The Management of Hazardous Waste in China, Zhang Jialing, June 2007[337]

Overall, solid waste management has become a huge challenge to China, but with the growing number of laws and international assistance there are many opportunities

to strengthen its management and better protect the environment. This research brief describes the framework of laws, regulation and policies on hazardous waste in China. In addition, a description of management mechanisms for hazardous waste is provided along with an analysis of international projects focused on hazardous waste management.

Managing Expectations, A. Kossoy, 2010[453]

This paper assesses the impact of market-based offsets in the transition to a low-carbon economy. Moreover, this study sheds light on the relationship between investment barriers and CDM projects. After 10 years of experience with CDM projects, it appears that this effectiveness is inversely related to its investment barriers, no matter whether these barriers are sectoral or regional. Therefore, the lower the investment barriers, the more successful the CDM projects. In addition, the paper analyzes carbon revenues-related issues. Carbon revenues have made relatively low-risk investments in proven technologies with marginal rates of return being more attractive and profitable, enhancing their chances of being developed and remaining operational.

Mapping the Characteristics of Producer Subsidies: A review of Pilot Country Studies, D. Koplow, C. Lin, A. Jung, M. Thöne, L. Lontoh, 2010[454]

This report analyzes the availability of fossil fuel subsidies data in a selection of pilot countries. This research project finds that the fossil-fuel sector is supported by a multitude of policies, ranging from direct payments to preferential access to government-owned lands. In addition to a wide mixture of policy types, the pilot studies also finds that information on these support measures was held by a variety of government ministries and non-governmental organizations. The analysis also highlights that the importance of sub-national policies in supporting the fossil-fuel sector varies across countries. The study concludes with several policy recommendations to improve the access, organization and transparency of data.

The Marginal Damage Costs of Carbon Dioxide Emissions: an Assessment of the Uncertainties, Energy Policy 33, 2005[258]

A total of 88 estimates of the marginal costs of carbon dioxide emissions were gathered from 22 published studies and combined to form a probability density function. The uncertainty is strongly right-skewed. If all studies are combined, the mode is US$5/tC, the mean US$104/tC, and the 95 percentile US$446/tC. Studies with a lower discount rate have higher estimates and much greater uncertainties. Similarly, studies which use equity weighing, have higher estimates and larger uncertainties. Interestingly, studies that are peer-reviewed have lower estimates and smaller uncertainties. Using standard assumptions about discounting and aggregation, the marginal costs of carbon dioxide emissions are unlikely to exceed US$50/tC, and are probably much smaller.

Market-Based Instruments for Environmental Policy in Europe, EEA Technical report, August 2005[230]

This report presents an overview and assessment of the main recent developments in the use of market-based instruments in Europe. It gives a concise description of the use and

experience of environmental taxes, charges and deposit-refund systems, emissions trading schemes, subsidies, and liability and compensation requirements, as tools to achieve environmental objectives, in the whole European area.

The aim of this report is to inform those involved in making environmental policy across Europe and beyond, as well as all those who are otherwise interested in this area, about market-based instruments (MBIs), a category of policy tools that is being increasingly used to achieve environmental objectives. Specific examples from countries as well as the wider range of interesting applications, lessons and future challenges aim to help generate ideas and inform decisions that will be made in the coming years. The report summarizes the wide-ranging choice of market-based instruments available to environmental policy-makers in Europe, and reports results from their use. It covers all European countries: the recently enlarged EU-25, the candidate countries, the Balkan countries, EFTA countries and the eastern European countries.

The Materiality of Climate Change: How Financing Copes with the Ticking Clock, UNEP, October 2009[12]

This report brings together key reports from the investment world that demonstrate best practice on climate change, identifying the risks and opportunities, assessing how companies are dealing with them, and translating their performance and intentions into future financial returns. The emphasis is on corporate sector assets, but real estate is clearly an asset class sensitive to climate change and leading investors are also active on this front.

Measuring Emissions against an Alternative Future: Fundamental Flaws in the Structure of the Kyoto Protocol's, Clean Development Mechanism, December 2009[134]

This paper examines the possibility of improving the CDM's environmental integrity and effectiveness as a project-based offsetting mechanism by studying how the CDM is working in practice in the Indian power sector. It is based on interviews conducted in India during 2004 and 2009 with over 80 CDM and renewable energy professionals involved in CDM project development, including project developers, consultants, validators (hired to audit each project applying for CDM registration), carbon traders, bank employees, government officials, members of the CDM governance panels, and others involved in renewable energy and hydropower development in India. In addition, it also draws on analysis of the UNEP Risoe CDM project database, and analysis of documents from 70 CDM projects comprising all of the large (over 15 megawatt) wind, hydro, and biomass projects registered in India since 2007 and the 20 most recently registered hydro projects in China.

Meeting the Climate Challenge: Core Elements of an Effective Response to Climate Change, Center for American Progress—United Nations Foundation, 2009[455]

This paper assesses four core elements of an effective global response to climate change: energy efficiency, renewable energy, forest conservation and sustainable land use, and adaptation. The paper argues that these four core elements provide substantial economic, security, and environmental benefits that make them attractive beyond their value as responses to climate change. This paper discusses that energy efficiency is one of the few

large-scale mitigation options that yield a positive economic return while providing a wide range of other social, environmental, and security benefits. This paper also highlights the importance of renewable energy technologies and discusses their related costs. In addition, this paper focuses on forest conservation-related issues and sustainable land management. In addition, adaptation implications are discussed.

Meeting the Climate Challenge: Using Public Funds to Leverage Private Investment in Developing Countries, LSE, Grantham Institute, September 2009[200]

The analysis attempts to identify the most efficient instruments that governments could use to leverage private finance and thereby enable sufficient financial flows to developing countries to achieve their mitigation and adaptation objectives. The first part is an introduction to the topic of using public finance in order to leverage private investments in developing countries. The second section proposes an analytical framework for the case for government intervention in climate change, focusing on the various forms of market failures and the criteria for public sector mechanisms. The third section considers ways of raising public finance, describing and analyzing mechanisms through the capital markets. The fourth section considers spending public finance, through the use of "specific instruments for specific challenges". It examines the nature of risk in key sectors and what an appropriate package of measures could look like for clean energy and technology, energy efficiency, forestry and adaptation in order to derive specific recommendations for each sector. Finally, the analysis reviews the elements of the global financial architecture that would be needed to underpin and enable the types of instruments discussed in the previous two chapters to be deployed.

Monitoring and Reporting on Financial Flows Related to Climate Change, World Bank, 2009[35]

This discussion paper focuses on tracking, monitoring and reporting various types of flows, primarily from ODA and other public sources, but also briefly reflecting on flows from private sources. It reviews available information on the various (current and upcoming) financial and investment flows to support climate action in developing countries as a first step in assessing the challenges associated with monitoring of such flows. It considers both climate finance (i.e., the amount of additional resources required to catalyze the shift of a much larger volume of public and private development investments to climate-friendlier options) and underlying finance (i.e., the almost 10 to 20 times larger amount of financial and investment flows in developing countries that must be increasingly put to climate action).

The second part of the paper focuses on possible ways of tracking *additionality* in ODA flows only, with the aim of stimulating the discussion within the World Bank Group and its partners on this issue. It describes the various perceptions of different groups of countries as well as possible baselines, benchmarks and tools for tracking progress. It concludes that the future technical solutions for monitoring official (ODA and non-ODA) financial flows towards climate action will most likely be a combination of the application of (current and improved) OECD DAC Rio Markers, more consistent reporting by MDBs,

and reporting by UNFCCC on new funding through levies, and increased capacity by recipient countries in tracking incoming flows, etc. Increasingly reliable, comprehensive and transparent reporting is needed to demonstrate that new climate finance instruments are not introduced at the expense of those targeting other objectives. Finally, the paper provides proposals for further action by developed and developing countries, the UN system and MDBs.

Monitoring Climate Finance and ODA, World Bank, May 2010[305]

This issues brief examines the challenges of monitoring financial flows related to climate change. The first part focuses on tracking, monitoring, and reporting various types of flows, primarily from official development assistance (ODA) and other public sources, but also from private sources. The second part explores possible ways of tracking *additionality* in ODA flows, with the aim of stimulating global discussion on this issue.

National Economic, Environment and Development Study for Climate Change: Initial Summary Report, UNFCCC, 2009[133]

The present report provides a summary of the initial inputs received from the first seven case studies under the National Economic, Environment and Development Study (NEEDS). The purpose of this study is to facilitate the identification of priority mitigation and adaptation measures by the participating countries, in line with their national sustainable development strategies, and how these measures can be effectively supported financially by public and private sector funding, multilateral initiatives, carbon markets and other sources of funding or investment.

Overall total costs for implementing priority adaptation and mitigation measures ranged from approximately US$721.13 million by 2030 to US$6.8 billion by 2012, as reported by some countries. In one case, the average annual abatement cost of all potential measures until 2030 amounted to €12.84 billion. Differences in the level of funding allocated were dependant on the countries' unique climate change context, identified vulnerabilities, scope of activities planned, as well as the present development of existing climate change policies, instruments and mechanisms (for example, national climate change strategies).

National Funding Entities: Their Role in the Transition to a New Paradigm of Global Cooperation on Climate Change, L. Gomez-Echeverri, 2010[456]

The purpose of this report is to survey some of these new initiatives and to derive lessons that can inform the decisions of others considering setting up similar mechanisms, national funds, or national funding entities. The report is also intended to highlight the immense support and capacity development task that is required to make these and other similar future initiatives successful. The analysis shows that most developing countries are well equipped to receive and manage funds from international institutions. By contrast, what are not as well developed in many countries, and consequently in need of support, are the capacities for managing the intricacies of financing climate change.

New Research Outlines Plan to Unleash Energy Efficiency Opportunity in Buildings, Climate Strategy & Partners, 2010[457]

This report unravels many of the complex issues surrounding the financing of energy efficiency in buildings. Climate Strategy believes that a saving of 30 percent of the energy used in Spanish homes and small commercial buildings is worth over 3,000 million per year in saved costs to consumers and would create thousands of new jobs in a vibrant Spanish energy efficiency upgrade industry. The size of the opportunity is enormous. Buildings use 40–45 percent of the energy consumed in the United States, the UK, and Europe and studies show that this could be cost effectively reduced by 20–50 percent. Energy efficiency retrofits will reduce greenhouse gas emissions and improve the energy security of any country where they are implemented by reducing energy demand. Yet, deploying energy efficiency upgrades in buildings at scale has proven elusive, to date, as there are insufficient financial resources available to energy efficiency upgrades and many stakeholders' interests in individual projects are misaligned.

The New Universe of Green Finance: From Self-Regulation to Multi-Polar Governance, Bar Ilan University, 2007[73]

Green finance represents a wide-ranging challenge to the traditional constructs of financial law. New green instruments threaten to transform conventional investment practices (ethical investment), lending standards associated with project finance (environmental/social impact assessment), and accounting conventions (green/social reporting). To a large extent this process was inspired by civic forces: environmentally-socially conscious citizens, environmental groups and private financial institutions. International organizations such as the World Bank and UNEP added further impetus to this process. From a legal perspective the phenomenon of green finance reflected a highly patchy social process, constituted by segregated contractual instruments and uncoordinated organizational routines.

This chaotic picture of detached legal structures evolving in an uncoordinated fashion has started to change over the last years with the emergence of new global centers of governance. While these new normative centers are highly diverse in terms of their institutional structure and mode of operation, they are all dominated by non-state actors. The main goal of this article is to expose the contours of these emerging regulatory orders, highlighting the move from self governance to multi-polar governance. In particular, it explores the question of coordinating the regulators: what were the processes that shaped the allocation and redistribution of normative power at the global level. In that respect the article considers two theoretical puzzles. The first concerns the historical forces that shaped the contemporary governance structure; specifically, it focuses on the dominant role of non-state forces and the relatively minor role of state regulation. This division of normative powers seems to be changing however, with signs of increasing governmental intervention. To a large extent one can view the emergence and transformation of the field of green finance as the product of two conflicting narratives: neo-liberal capitalism and the emergence of globally oriented civic networks that highlighted the adverse social and environmental repercussions of the neo-liberal order. The second puzzle involves a different question: is the current normative struc-

ture, with its idiosyncratic distribution of normative powers, the most efficient one, in terms of achieving a more sustainable society? The paper will argue, in this context, that the contemporary governance structure, with its multiple layers, and private and public components, constitutes a regulatory ensemble whose synergistic capacities compensate for some of its evident shortcomings.

In answering these questions the paper first describes the various instruments that constitute the new field of green finance. It distinguishes between three fields of financial regulation: project finance, ethical-green investment, and environmental reporting. Project finance represents the supply side of the market, while green investment represents the demand side. Environmental reporting is part of the institutional framework that facilitates the work of the financial market. In each of these domains it explores the evolvement of new global centers of governance. The next section discusses the causal question: to what extent have the new centers been efficient in changing social practices? The last section examines the two puzzles described above.

One Step Forward and Two Sideward, Regional Analyses of Climate Policy in 2010 and the Cancún Climate Conference (COP 16), Santarius, T., Heinrich-Böll-Stiftung, January 2011[72]

This paper contextualizes the Cancún conference within the landscape of the different regional climate policy developments during 2010, analyzes the different national expectations of the conference, explains negotiation positions, and analyzes how perceptions of the Cancún conference varied between key countries and regions. The paper concludes with an outlook on challenges to the international climate policy process on the road to COP 17 in Durban, South Africa in 2011 and suggests rethinking current negotiation procedures in order to secure more ambitious climate policies in the years ahead.

Pathways to a Low-Carbon Economy, McKinsey & Company, 2009[458]

This report incorporates updated assessments of the development of low-carbon technologies, updated macro-economic assessments, a detailed understanding of abatement potential in different regions and industries, an assessment of investment and financing needs in addition to cost estimates, and the incorporation of implementation scenarios for a more dynamic understanding of how abatement reductions could unfold. The analysis finds that there is potential by 2030 to reduce GHG emissions by 35 percent compared with 1990 levels, or by 70 percent compared with levels expected by 2030 if no or little attempt is made to curb current and future emissions. If the most economically rational abatement opportunities are pursued to their full potential, the total worldwide cost could be €200 to 350 billion annually by 2030. This is less than one percent of forecasted global GDP in 2030, although the actual effect on GDP of such abatement efforts is a more complex matter that depends, among other things, on the financing of such abatement efforts.

People's Republic of China: Study on Beijing Green Finance Development Strategy, ADB, 2010[459]

During the 2009 country programming mission, the government of the People's Republic of China (PRC) requested technical assistance (TA) from the Asian Development Bank

(ADB) for the Study on Beijing Green Finance Development Strategy. ADB is providing TA focusing on project design document development, validation, registration, verification, and credit issuance. This report provides a description of this technical assistance in terms of impact, outcome, methodologies, key activities, costs, financing, and implementation arrangements.

Planting the knowledge seed: Adapting to climate change using ICTs, BCO Alliance, September 2009[273]

This publication frames the issue by conceptualizing what ICTs are, how they have been applied within ongoing development programs, and how the linkages to climate change can be established through building on existing, practical experiences. Furthermore, the linkages to and potential of communication and interactive media are explored within the context of climate change. The report also highlights the need for systematic awareness raising and capacity development at all levels to embrace the application of ICTs as strategic tools within climate change programs. This is followed by a concrete demonstration of innovative project examples from Africa, South-East Asia and Latin America showing how ICTs can be utilized as strategic tools to contribute to climate change adaptation programs. A summary of the BCO Learning Day on ICTs and Climate Change held in December 2008 is then provided, including key conclusions and recommendations that emerged. In conclusion, the publication summarizes the key points emerging from the conceptual overview, the learning day and the practical examples, with some actionable recommendations.

Policy instrument design to reduce financing costs in renewable energy technology projects, D. de Jager and M. Rathmann, 2008[196]

This report concerns the role of policies and policy instrument design in reducing the financing cost of renewable energy technology projects. This report investigates the key elements of successful policy schemes and the conditions that should be set for successful design of future policies. This report also discusses risk management measures that can be included in policy schemes to mitigate or transfer risks away from investors. The analysis presents the interactions of risks and policy design in general, and considers the specific project finance case of four large-scale renewable energy project cases in more detail: a 20 MWe onshore wind energy project, a 100 MWe offshore wind energy project, a 0.5 MWe solar photovoltaic energy plant, and a 10 MWe/26 MWth biomass co-generation plant.

A Policymaker's Guide to Feed-in-Tariff Policy Design, U.S. DOE, NREL, 2010[460]

Contemporary FIT policies offer a number of design options to achieve policy goals for renewable energy deployment. However, careful policy design is crucial to ensuring success. Policy designers must weigh how different design options will function together as an integrated framework. This evaluation can help ensure that renewable energy develops at both the pace and scale desired and can help avoid unintended consequences such as runaway program cost.

As this report demonstrates, FIT policy structures can differ widely among jurisdictions, reflecting a broad spectrum of policy objectives. This ability to adapt to particular situations—and address particular policy goals—is an important element in the success of FIT policies. Their ongoing success at fostering rapid RE growth is likely to continue to fuel interest in these policies worldwide.

Project 2011: Cutting the Cost of Clean Energy, Version 2.0, Coalition for Green Capital, 2010[461]

This publication presents a single, coherent proposal that the authors hope will be adopted in whole by the next Congress. The authors intend this proposal to spark creative discussion about how to improve any or all of its features.

Central to this proposal are five thematic ways to create continued, efficient, profitable private investment in clean energy technologies, products, and services (or what is referred to below as clean energy) relating to the more sustainable and efficient supply, transportation and consumption of energy in its many forms thereby enhancing national competitiveness and creating many new jobs: These themes are (i) lower the cost of clean energy to facilitate market competition between clean energy and existing forms of energy; (ii) increase American ability to compete effectively with firms supported by other nations that utilize demand growth and low-cost long-term finance to provide competitive advantages to their national champions for clean energy deployment; (iii) immediately provide a stable, long-term investment environment over the next decade to encourage profitable private sector investment in and deployment of clean energy, thus allowing private capital to respond to America's clean energy investment challenge in unpredictable but surprisingly large and helpful ways that create new jobs, increase national income, produce productivity gains, and bolster national security; (iv) reduce artificial regulatory barriers to private sector investment in clean energy through promotion and development of uniform and predictable practices for regulation of utility rates and utility mergers, joint ventures, and other forms of corporate re-organization that tend to maximize efficient, long-term private sector investment in clean energy. In addition to the development of uniform and predictable utility ratemaking practices of general applicability, provide performance-based ratemaking incentives targeted to utility investments in or purchases of clean energy; and (v) target public sector engagement in clean energy investment and deployment where it is most needed, while freeing the private sector to lead where it is best suited to innovate, including minimizing the use of agencies and instrumentalities of government in direct financing and deployment of clean energy, and focusing the federal role instead on research, development, and first-of-a-kind deployment of breakthrough clean energy technologies.

Public Disclosure of Industrial Pollution: The PROPER Approach for Indonesia?, Resources for the Future, 2004[284]

This paper evaluates the effectiveness of the Program for Pollution Control Evaluation and Rating (PROPER) in Indonesia. PROPER, the first major public disclosure program in the developing world, was launched in June 1995. Although it collapsed

in 1998 following the Asian financial crisis, it is currently being revived. There have been claims of success for this pioneering scheme, yet little formal analysis has been undertaken. Changes in emissions concentrations (mg/L) were analyzed using panel data techniques with plant-level data for participating firms and a control group. The results show that there was a positive response to PROPER, especially among firms with poor environmental compliance records. The response was immediate, and firms pursued further emissions reductions in the following months. The total estimated reductions in biochemical oxygen demand (BOD) and chemical oxygen demand (COD) were approximately 32 percent.

Public Finance Mechanisms to Increase Investment in Energy Efficiency, UNEP SEFI, 2006[462]

This report was prepared by BASE as part of the UNEP Sustainable Energy Finance Initiative (SEFI) with financial support from the UK Department for Environment, Food and Rural Affairs (DEFRA). Its objective is to demonstrate the importance, value and methods of public sector financing of energy efficiency for its uptake in the market and for increasing private investment in the sector. The report is a sequel to the SEFI report on Public Finance Mechanisms to Catalyze Sustainable Energy Sector Growth (2005), which focused on renewable energy.

The report identifies the market barriers and financing gaps that energy efficiency technologies, companies and projects encounter on the way from conception to commercialization and highlights existing public sector finance mechanisms that address those gaps. It has been written for policymakers, energy efficiency stakeholders, public financing agencies and other finance practitioners and targets both developed and developing countries.

The report makes a distinction between three main areas of energy efficiency market activity: technology innovation, energy efficiency ventures and energy efficiency projects, and takes into consideration the different local conditions, particularly between developed and developing countries. The financing of technology innovation with venture capital, for instance, is more relevant for mature, developed country markets, whereas in developing countries the focus is on financing energy efficiency projects.

Public Finance Mechanisms to Mobilise Investment in Climate Change Mitigation, UNEP, 2008[199]

This report provides an overview of PFMs that mobilize and leverage commercial financing, build commercially sustainable markets, and increase capacity to deliver clean energy and other climate-mitigation technologies, projects and businesses. These mechanisms can play a prominent role in the implementation of an international mitigation strategy. The report is based on a substantial body of experience with PFMs that have been used to mobilize investment in renewable energy (RE) and energy efficiency (EE) technologies in a wide variety of developed and developing countries. The report summarizes the rationale and design criteria for PFMs, describes a range of mechanisms, and offers strategies for their scale up and replication, should they be included in a new financial architecture under the UNFCCC.

Public Perceptions of Energy Consumption and Savings, S. Z. Attari, M. L. DeKay, C. I. Davidson, and W. B. de Bruin, July 2010[269]

In a national online survey, 505 participants reported their perceptions of energy consumption and savings for a variety of household, transportation, and recycling activities. When asked for the most effective strategy they could implement to conserve energy, most participants mentioned curtailment (e.g., turning off lights, driving less) rather than efficiency improvements (e.g., installing more efficient light bulbs and appliances), in contrast to the recommendations of experts. For a sample of 15 activities, participants underestimated energy use and savings by a factor of 2.8 on average, with small overestimates for low-energy activities and large underestimates for high-energy activities. Additional estimation and ranking tasks also yielded relatively flat functions for perceived energy use and savings. Across several tasks, participants with higher numeracy scores and stronger pro-environmental attitudes had more accurate perceptions. The serious deficiencies highlighted by these results suggest that well-designed efforts to improve the public's understanding of energy use and savings could pay large dividends.

Public Venture Capital Study, NEF on behalf of UNEP SEFI, 2008[463]

This is the first publication of the UNEP SEFI Public Finance Alliance ("SEF Alliance"). The SEF Alliance is a member-driven coalition of public and publicly-backed organizations that finance sustainable energy markets and technologies in various countries. It was established in January 2008 and operates under the remit of the Sustainable Energy Finance Initiative (SEFI) of the United Nations Environment Programme (UNEP). The platform is currently funded by the member organizations, UNEP, and the Oak Foundation.

This study, conducted by New Energy Finance for the SEF Alliance, examines venture capital as a clean energy financing tool with a specific analysis of the role of public sector sponsored venture capital. Using a selection of existing public venture capital clean energy funds the study answered three key questions: (i) whether there is a role for public venture capital in clean energy investment and whether more such funds are needed; (ii) if there is a role, where are public venture funds best positioned to help achieve clean energy innovation; and (iii) what are core commonalities and what differentiates the approaches, structures, and metrics of success for existing public venture capital funds.

NEF discovered two critical funding gaps in clean energy venture investment which public venture capital could help address. The first gap exists at the global level where investment data shows a decrease in the proportion of funds going to seed/Series A investments. The second gap is also global (except for the United States), where alternative investment funds with the potential to invest in venture capital or private equity choose to focus on private equity stage deals. This results in relative underinvestment at the seed/Series C stages of venture capital, both with respect to the current number of deals and the average deal size.

Publicly Backed Guarantees as Policy Instruments to Promote Clean Energy, United Nations Environment Programme, 2010[18]

This report on investment guarantees is the second in a series focused on public investment as an instrument in which to boost the clean energy market targeted at industry

experts. The report focuses on the understanding of public financing agencies and the knowledge they have gained from past experiences with publicly backed guarantees (PBGs). The first section discusses where PBGs stand among the different types of public financing programs for clean and renewable energy development and provides a survey of PBG typologies. The second section focuses on the details of different RBG programs in the context of clean energy policy, providing in-depth focus on specific sub-policy areas of development. The final sections provides recommendations on how to design, plan and implement RBGs including how to realize leverage, pricing, and account for liabilities in the public budget.

The Rapid Assessment Framework: A Practical Tool for Instituting Urban Energy Efficiency, World Bank, June 2010[282]

The Rapid Assessment Framework—RAF is designed to present a quick, first-cut, sectoral analysis on city energy use. This assessment framework prioritizes sectors with significant energy savings potential, and identifies appropriate energy efficiency interventions. The RAF covers energy efficiency across six sectors—transport, buildings, water and waste water, public lighting, solid waste, and power and heat. The RAF consists of two principal components: (i) a city energy benchmarking tool and, (ii) a "playbook" of tried and tested energy efficiency interventions.

Reassessing Carbon Leakage, Peter, G., 2008[221]

The issue of carbon leakage—where emission reductions in Annex B countries are offset by emission increases in non-Annex B countries—is often raised as an issue that will undermine climate policy. It is argued that under tight emissions constraints, some production will relocate to regions without emission constraints. The IPCC finds little evidence of carbon leakage and if it exists, it is most likely to be offset by positive spill-over effects. This finding seemingly contradicts the rapid growth in both global CO_2 emissions and international trade. The underlying reason is that the IPCC only considers climate policy induced changes in emissions, while currently much of the growth in international trade and the location of production are driven by existing economic factors. This paper argues for a redefinition of carbon leakage to include all emissions emitted in the production of traded products. This quantifies the separation between the environmental impacts of a countries consumption compared to production. Analysis of the emissions embodied in trade flows from 1990 to 2002 show evidence of a shift in the location of production and the products traded. There is a notable growth in China and given trends since 2002, and it is likely that the separation between consumption and production has increased further. By considering the total emissions from the production of traded products, a different perspective of the role of trade in climate policy can be taken. This new focus considers trade as a tool to mitigate emissions and is a fruitful area for further research.

Reducing Carbon Emissions from Transport Projects, ADB[464]

The Asian Development Bank (ADB) has signaled a change in its transport investments to shift to low-carbon growth across Asia and the Pacific. The aim of this evaluation

knowledge brief (EKB) is to contribute to this change—aimed at making ADB's transport sector assistance more protective of the environment. It is acknowledged that greenhouse gas (GHG) emission reduction is a global issue but the cost of emission reduction has to be borne locally, with support from various global incentive mechanisms. ADB is in a position to affect this change by providing options and related cost-benefit analysis at project conceptualization and appraisal, as well as to assist in attracting funding mechanisms geared for low-carbon initiatives. This EKB provides a retrospective analysis of land transport projects approved by ADB in the last decade. Moreover, this EKB combines an evaluation of the indicative carbon footprint of ADB's land transport sector assistance with an identification of global good practices in reducing carbon emissions from transport projects. The outputs of this EKB are (i) new analytical tools for carbon emissions intensity measurement, which feed into the Sustainable Transport Initiative Operational Plan; and (ii) suggestions for improving the quality-at-entry, which feed into future project designs.

Reducing Greenhouse Gas Emissions: The Carbon Tax Option, Republic of South Africa, 2010[226]

The two main economic policy instruments available for putting a price on carbon and curbing GHG emissions are carbon taxation and emissions trading schemes. The carbon tax seeks to reduce emissions through the price mechanism directly, while emissions trading schemes establish targets for specific levels of emissions through the trade in allowances. To date, the relative merits and feasibility of these policies have been demonstrated primarily in Europe.

Uniform application of carbon taxes, however, tends to be regressive, because a disproportionate share of the tax burden falls on the poor. In a South African context, government would need to counteract this tendency, addressing other economic development imperatives such as poverty alleviation, and ensuring access to basic and affordable energy services for low-income households. The design of the tax should include compensating measures to minimize adverse impacts on low income households.

This paper attempts to build on the work contained in the *Environmental Fiscal Reform Policy Paper* (2006) and considers the economic rationale for introducing a carbon tax.

Removing Market Barriers to Green Development: Principles and Action Projects to Promote Widespread Adoption of Green Development Practices, US EPA, JOSRE, 2009[49]

This paper examines how the market may intentionally or unintentionally create barriers to green development practices. It also offers ideas and recommendations for those who build, finance, and are in positions to approve or support green development in all communities on how to eliminate these barriers to make green development the norm rather than the exception.

Renewable Energies: Innovations for a Sustainable Energy Future, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, 2009[465]

This publication completed by the German government attempts to provide the most up-to-date report on the current status, future potential, and possible development of

nine different technologies used to harvest renewable energy. It commences by discussing why renewable energy is important to a sustainable energy future around the globe, what is at risk, and provides a long-term vision for how renewable technologies can be integrated into development strategies for both developed and developing economies. The remainder of the paper gives a comprehensive analysis of wind power, hydropower, photovoltaics, solar thermal power plants, solar collectors and the passive use of solar energy, biomass fuels, biofuels, geothermal energy and heat pumps, and electricity from the ocean. Additionally, the paper concludes with recommendations on how individuals can contribute to climate protection through their everyday habits.

Renewable Energy Global Status Report: 2009, Renewable Energy Policy Network for the 21st Century, 2009[466]

Since 2004, when the *Renewables Global Status Report* was launched, many indicators of renewable energy have shown dramatic gains. Annual renewable energy investment increased fourfold to US$120 billion in 2008. In the four years from the end of 2004 to the end of 2008, solar photovoltaic (PV) capacity increased six-fold to more than 16 gigawatts (GW), wind power capacity increased 250 percent to 121 GW, and the total power capacity from new renewables increased 75 percent to 280 GW, including significant gains in small hydro, geothermal, and biomass power generation. During the same period, solar heating capacity doubled to 145 gigawatts-thermal (GWth), while biodiesel production increased six-fold to 12 billion liters per year and ethanol production doubled to 67 billion liters per year.

Annual percentage gains for 2008 were even more dramatic. Wind power grew by 29 percent and grid-tied solar PV by 70 percent. The capacity of utility-scale solar PV plants (larger than 200 kilowatts) tripled during 2008, to 3 GW. Solar hot water grew by 15 percent, and annual ethanol and biodiesel production both grew by 34 percent. Heat and power from biomass and geothermal sources continued to grow while small hydro increased by about 8 percent.

By early 2009, policy targets existed in at least 73 countries, and at least 64 countries had policies to promote renewable power generation, including 45 countries and 18 states/provinces/territories with feed-in tariffs (many of these recently updated). The number of countries/states/provinces with renewable portfolio standards increased to 49. Policy targets for renewable energy were added, supplemented, revised, or clarified in a large number of countries in 2008.

Many forms of policy support for renewables were added, supplemented, or extended in a number of countries during 2008. For example, new solar PV subsidy programs were adopted in Australia, China, Japan, Luxembourg, the Netherlands, and the United States with new laws and policy provisions for renewables appearing in developing countries, including Brazil, Chile, Egypt, Mexico, the Philippines, South Africa, Syria, and Uganda; new mandates for solar hot water and other renewable heating appeared in Cape Town (South Africa), Baden-Württemberg (Germany), Hawaii, Norway, and Poland; new biofuels blending mandates or targets appeared in at least 11 countries, including a new 20 percent target in India; and the number of green power consumers grew to more than five million households and businesses worldwide. City and local government policy was a growing segment of the policy landscape, with several hundred cities and local governments around the world actively planning or implementing renewable energy policies and planning frameworks linked to carbon dioxide emissions reduction.

Renewable Energy Policies and Markets in the United States, Eric Martinot, Ryan Wiser, and Jan Hamrin, 2005[467]

The history of renewable energy policies and incentives in the United States yields some clear lessons. First, policy consistency is essential. U.S. renewable energy policy has suffered from inconsistency as incentives have been repeatedly enacted for short periods of time and then suspended. Second, the wind and solar industries are constrained by the fact that the major renewable energy markets are now overseas, particularly in Europe and Japan. It is more difficult to develop a strong domestic industry without a strong domestic market. Third, U.S. experience shows that state-level policies will likely be crucial in ensuring the expansion of renewable energy in the United States over the coming years, but that complimentary federal policies are also important. Fourth, for renewables to develop smoothly and efficiently, they need clear and equitable power transmission system rules and cost allocation methods.

Renewable Energy: Investing in Energy and Resource Efficiency, UNEP, 2011[468]

The publication delivers the following key messages: (i) renewable energy presents major economic opportunities; (ii) greater investments in renewable energy, as well as energy efficiency, are required now because the costs of inaction are high; (iii) renewable energy can make a major contribution to energy security at global, national and local levels; (iv) renewable energy sources can play an important role in a comprehensive strategy to eliminate energy poverty; (v) Renewable energy technologies are becoming more competitive; (vi) renewable energy is even more competitive when the negative externalities associated with fossil fuel technologies are taken into account; (vii) increasing investment in greening the energy sector can make a substantial contribution to decreasing carbon emissions; (viii) a shift to renewable energy sources brings many new employment opportunities; (ix) increasing investment in renewable energy requires additional incentives to ensure profitability; (x) government policy has an essential role to play in enhancing incentives for investing in renewable energy.

Report of the Conference of the Parties on Its Fifteenth Session, UNFCCC, December 18, 2009[68]

As climate change has been identified as one of the greatest challenges, the Conference of the Parties emphasizes its strong political will to urgently combat climate change in accordance with the principle of common but differentiated responsibilities and respective capabilities. This was the accord agreed upon by the Conference of Parties and includes all twelve aspects as drafted at the conference.

Report of the Conference of the Parties on Its Seventh Session, UNFCCC, 2002[62]

The President of the Conference at its sixth session held that the adoption of the Bonn Agreements on the implementation of the Buenos Aires Plan of Action (decision 5/CP.6) had proved that the international community was capable of reaching agreement on global problems—multilateralism did work. Those agreements also signified the centrality of international cooperation to the higher common objectives of the

global community. While globalization could be criticized, those political agreements had been the outcome of dialogue, mutual understanding, a sense of conciliation, a willingness to compromise, and a dedication to the sustainability of the earth as well as humankind. Moreover, these elements now made the Kyoto Protocol ratifiable, so that it could enter into force before the World Summit on Sustainable Development in 2002.

The focus at the seventh session was on completing the translation of the Bonn Agreements into legal language. In Bonn, all Parties had reaffirmed their intention to complete the work on the outstanding issues in a manner that would be faithful to those agreements. The president's own consultations in the inter-sessional period with political leaders had led to the view that maintaining the integrity of the political agreements reached was a universal wish.

Report of the Energy Efficiency Initiative: Draft for Circulation to the Board of Directors, Asian Development Bank, 2006[180]

Energy Efficiency Initiative (EEI) requires three phases of implementation due to the depth and breadth of the sustainable energy challenges. A wide consensus on the approach has been reached during Phase I. This EEI report reflects the completion of Phase I and provides a framework for initial actions and continued learning, and an outline of the Phase II activities that will lead to preparation of the EE investment and action plan.

The EEI Report provides a strong rationale for greatly expanding ADB's EE investments. While some EE operations already exist in ADB's portfolio, such projects need to be highlighted, emphasized, and given a high priority. EE investments should be assessed in the context of CSP formulation, and developed as a specific category. The management has endorsed this report and advised that the Phase II activities outlined in the report should commence. The EE investment and action plan developed in Phase II will be submitted for management approval.

Report of the Secretary-General's High-level Advisory Group on Climate Change Financing, United Nations, November 2010[116]

The Secretary-General of the United Nations established the High-level Advisory Group on Climate Change Financing in February 2010. Following its terms of reference, the Advisory Group worked around the goal of mobilizing US$100 billion per year by 2020. The Advisory Group emphasized the importance of a carbon price in the range of US$20–US$25 per tonne of CO_2 equivalent in 2020 as a key element in pushing incentives in the right direction, raising substantial public revenue, and fostering strong private investment crucial to the new industrial revolution which will make the transition to the low-carbon economy a reality.

If rich countries introduce domestic carbon taxes or auction permits for emissions based on this price level, they could potentially provide US$30bn a year for developing countries by using just 10 percent of the revenues. Similarly, a carbon tax on international shipping and aviation set at the same level (or auction revenues from emissions caps if that route to pricing is followed) could generate US$10bn annually for international climate action from just 25–50 percent of the revenues, even after ensuring any costs to developing

countries are covered. Other policies, such as redirecting subsidies that are currently paid by the rich countries to the fossil fuel industries, or levying a tax on financial transactions, could provide a further US$10bn each year. New public grant resources will likely be necessary for much of adaptation. But some grant funding will also be crucial to support low-carbon investments, promote new technologies and tackle deforestation. In addition, the multilateral development banks (MDBs), including the regional development banks and the World Bank, could raise an additional US$30–40bn in gross public flows through a strengthening of their resources by rich countries. With a price of around US$25 per tonne of carbon dioxide, increased flows from the carbon markets could be US$30 billion-US$50 billion.

International collaboration involves much more than finance. But new finance could unlock current inertia. Delay is dangerous as greenhouse gas concentrations continue to rise; now is the time to translate these ideas into concrete actions.

Report of the Secretary-General's High-level Advisory Group on Climate Change Financing: Work Stream 1: Carbon Market Public Revenues, UN, 2010[469]

This paper focuses on public revenues derived from carbon markets through the following mechanisms: AAU auctioning (auctioning of international country-level emission allowances); ETS auctioning (auctioning of national emission allowances); and offset levies. This paper shows that through carbon market public mechanisms, climate funding could be significantly scaled up. However, the revenue estimates will depend on the carbon market in 2020, and the estimates are clearly assumption driven.

Report of the Secretary-General's High-level Advisory Group on Climate Change Financing: Work Stream 2: Paper on Potential Revenues from the International Maritime and Aviation Sector Policy Measures, UN, 2010[470]

This paper is part of the AGF's exploration of potential sources of revenue that may be used to enable and support climate change action in developing countries. Under the Copenhagen Accord, Parties agreed to the goal of mobilizing up to US$100 billion by 2020, from a variety of sources. Currently the environmental externality associated with emissions from fossil fuel use in both the international maritime and aviation sectors is under-priced at a global level. In 2007, greenhouse gas emissions from international shipping represented around 1.7 percent of world emissions, while aviation emissions represented around 0.8 percent, with these shares expected to rise in coming years. Policy measures which appropriately price this externality could deliver environmental and net social benefits whilst also raising revenues which could be made available to enable and support climate change action in developing countries.

This paper canvases three possible generic policy constructs—an emission trading scheme (ETS), a fuel levy and an aviation ticket tax—that may be used to raise revenue whilst also attempting to target the externality. The paper makes broad qualitative assessments of the policies against the AGF's criteria, and also outlines some quantitative analysis of the policies' revenue potential and their effect on the pattern of trade. It is important to note that this paper does not seek to provide a comprehensive examination of all possible

policy measures or related issues in this sphere. Nor should it be seen as pre-empting or superseding consideration of such measures in appropriate venues. Rather, it has instead been framed to facilitate a broad internal discussion of the major issues related to this topic within the advisory group.

Report of the Secretary-General's High-level Advisory Group on Climate Change Financing: Work Stream 3: Revenue Options from Carbon-Related Sources, UN, 2010[471]

This paper examines five potential carbon-related sources of public revenue that could make a contribution to the US$100 billion goal advanced by specialists in international climate finance by 2020. The report covers redirecting revenue from a carbon tax; redirecting fossil fuel subsidies; redirecting fossil fuel production taxes or royalties; a tax imposed by developing countries on their energy-intensive exports to developed countries with carbon pricing ("carbon optimization tax"); and lastly, a tax on electricity generation in developed countries (a "wires charge"). Each variation on one of the potential systems for raising money takes into account the range of revenue potential; reliability and predictability; efficiency; incidence and equity; practicality; and political acceptability. Also, consideration is given to what would require national efforts and, in some cases, international coordination.

Report of the Secretary-General's High-level Advisory Group on Climate Change Financing: Work Stream 4: Contributions from International Financial Institutions, UN, 2010[472]

The purpose of this paper is to assess the role of International Financial Institutions (IFIs) in delivering the climate finance goal agreed in the Copenhagen Accord of US$100 billion per annum in 2020 for developing countries. The paper considers the possible contributions from both the Multilateral Development Banks (MDBs) and the International Monetary Fund (IMF), and assesses these against the criteria established by the High Level Advisory Group on climate finance (AGF). The remit of the paper is not to consider the role of the IFIs alongside the UN in any future climate finance governance structure or new institutions. However, it is clear that there will need to be close co-operation in any future scenario.

Report of the Secretary-General's High-level Advisory Group on Climate Change Financing: Work Stream 5: Financial Transaction Tax (FTT), UN, 2010[473]

There is a renewed interest for a tax on financial transactions (FTT) in the context of the economic and financial crisis. Some argue that such taxation could reduce speculation or raise revenues as a contribution of the financial sector to the costs of wide public support. Others contend that it might also finance global public goods, development goals or climate change, because of the significant amounts it could raise with a minimum distortion on the economy. This paper presents the case for a tax on the financial transactions, its technical feasibility and a pros and cons analysis. The most relevant options are presented in some detail, including the modalities of their implementation.

Report of the Secretary-General's High-level Advisory Group on Climate Change Financing: Work Stream 6: Assessed Budget Contributions, UN, 2010[474]

Proposals on financing presented in the context of the UNFCCC AWG-LCA negotiations have indicated assessed budget contributions as a source of funding for actions in mitigation and adaptation by developing countries. This paper investigates assessed contributions in the context of climate finance in terms of range of potential revenue, practicality, political acceptability, reliability and incidence and equity.

Report of the Secretary-General's High-level Advisory Group on Climate Change Financing: Work Stream 7: Public Interventions To Stimulate Private Investment In Adaptation And Mitigation, UN, 2010[475]

This paper examines the barriers that inhibit private investment in mitigation and adaptation. It also explores the options for deploying public sector interventions to overcome these barriers and the potential scale of international private investment. Four conclusions emerge from the analysis presented in the body of this paper: (i) potential private investment in 2020 is substantial (ranging from US$100 billion to US$200 billion/year); (ii) for this level of private investment to be realized, a range of existing country and project specific barriers will need to be overcome by domestic and international public interventions; (iii) the existing menu of interventions is largely sufficient, but needs better packaging, strategic focus, and greater scale; and (iv) the large potential for private investment to achieve climate-related objectives justifies using a substantial share of the public funding available in and before 2020 to stimulate this investment.

Report of the Secretary-General's High-level Advisory Group on Climate Change Financing: Work Stream 8: Carbon Markets: Benefits to Developing Countries and Options for Expansion, UN, 2010[476]

Carbon markets can generate significant abatement financed by developed countries to the benefit of both developed and developing countries. This paper seeks to explore the potential benefits to developing countries that arise from financial flows from developed countries via carbon markets, as one of several possible sources of funds to meet international financing commitments.

In this context, broad quantitative estimates of the size of the potential financial flows under different scenarios are provided. The size of these potential carbon market flows is dependent on a number of factors, including policy and institutional arrangements in both developed and developing countries.

The most important determinant of carbon market flows is the global level of mitigation ambition: higher levels of mitigation ambition are likely to drive higher carbon market flows.

The second most important determinant of the size of carbon market flows is likely to be the extent to which developed countries use abatement sourced in other countries to meet their own mitigation targets.

Finally, the design of carbon markets themselves—what types of units can be created, and under what circumstances—will influence the overall size of carbon market flows

and potential benefits arising from those. There has been a range of different proposals to improve existing carbon market mechanisms and to create new mechanisms—creating more effective and efficient modes of trade will assist in maximizing the benefits to developing countries through carbon market-based financial flows.

Reviewing Existing and Proposed Emissions Trading Systems, Information Paper, IEA, 2010[366]

This paper reviews key design elements of mandatory emissions trading systems that had been established or were under consideration in 2010. It does not review existing and proposed carbon tax policies, or the relative merits of taxes versus trading. Rather, the intention is to explore key design features of emissions trading systems, based on practical experience to date, with a particular focus on the energy sector.

Based on the review of the experience to date in the practical implementation and design of emissions trading systems, the following key lessons emerge: (i) stabilizing atmospheric temperature rise at 2°C requires a revolution in energy systems and strong investments; (ii) in competitive markets no free allocation of allowances to electricity generators should be made; (iii) clear long-term investment signals are crucial; (iv) the allocation system needs to have certain degree of flexibility; (v) cost impacts should not be over-estimated, and (vi) complementary and supplementary policies will be needed.

Risk, Return and Cash Flow Characteristics of Infrastructure Fund Investments, F. Bitsch, A. Buchner, C. Kaserer, 2010[477]

This report analyzes the risk, return and cash flow characteristics of infrastructure investments by using a unique dataset of deals done by private-equity-like investment funds. It shows that infrastructure deals have a higher performance than non-infrastructure deals, despite lower default frequencies. This study also offers some evidence in favor of the hypothesis that higher infrastructure returns could be driven by higher market risk. In fact, these investments appear to be highly levered and their returns are positively correlated to public equity markets, but uncorrelated to GDP growth. The results also indicate that returns could be influenced by the regulatory framework as well as by defective privatization mechanisms. By contrast, returns are neither linked to inflation nor subject to the "money chasing deals" phenomenon.

Role of Economic instruments in Managing the Environment, Staff Research Paper, Industry Commission, 1997[478]

Ramping up the use of economic instruments to address environmental problems in Australia will require action from government, industry and community. Governments have a role in coordinating and implementing environmental policy, providing information and developing mechanisms to ensure community and industry involvement in decision-making processes. Industry and community involvement provides local knowledge at low cost, ownership of solutions and may provide valuable leverage to government funds. Effective implementation of incentive-based mechanisms requires devolving responsibility and authority to the lowest practical level.

The report identifies several areas for further research. There is a need for better data and information about specific environmental problems in order to understand any external effects involved and to address problems relating to information failure. There is also a need to develop effective performance indicators to monitor and evaluate instruments used to address specific environmental problems, and to investigate more closely opportunities for economic instruments to be included in strategies to address these problems.

The Role of Fiscal Instruments in Environmental Policy, European Commission, 2009[205]

Environmental protection is one of Europe's key values. The EU has set clear policy objectives to achieve its environmental goals. The EU has favored market-based instruments, with fiscal instruments to tackle the climate change problem. This paper takes a policy-making perspective and provides an overview of key issues on the role of fiscal instruments in energy and environmental policies. It describes fiscal instruments as cost-effective means to promote environmental goals and highlights in which cases taxes and other types of fiscal instruments can usefully complement each other to achieve an environmental target.

The Role of the World Bank in Carbon Finance, Bretton Woods Project, 2011[126]

This paper outlines the World Bank's involvement in the carbon market and reviews concerns about its impacts on greenhouse gas emission reductions and development. First, it introduces the role and aims of the Bank's Carbon Finance Unit and the various funds and facilities that it manages. The Bank has worked to shape the carbon market by reducing risk for other investors, setting social and environmental standards, and developing new types of projects. It is now focusing on promoting national programs, reducing emissions from deforestation, and large-scale, long-term carbon finance.

The paper then summarizes the concerns that have emerged from official evaluations and scrutiny by civil society groups regarding the effectiveness of the Bank's carbon finance in reducing emissions and generating development benefits, adding new evidence where available. Examples of the concerns raised by this paper are: (i) failure to produce expected emissions reductions; (ii) very limited finance going to smaller, poorer countries, despite these being an express priority for the Bank; (iii) negative social impacts associated with Bank carbon projects and programs, including conflicts over resource rights and sharing of benefits; (iv) limited effectiveness in achieving the official Bank goal of transferring and diffusing technologies to developing countries and poor communities; and others.

The Safety Valve and Climate Policy, MIT Joint Program on the Science and Policy of Global Change, 2002[212]

The "safety valve" is a possible addition to a cap-and-trade system of emissions regulation whereby the authority offers to sell permits in unlimited amount at a pre-set price. In this way the cost of meeting the cap can be limited. It was proposed in the

United States as a way to control perceived high costs of the Kyoto Protocol, and possibly as a way to shift the focus of policy from the quantity targets of the Protocol to emissions price. In international discussions, the idea emerged as a proposal for a compliance penalty. The usefulness of the safety valve depends on the conditions under which it might be introduced. For a time it might tame an overly stringent emissions target. It also can help control price volatility during the introduction of gradually tightening target, although permit banking can ultimately serve the same function. It is unlikely to serve as a long-term feature of a cap-and-trade system, however, because of the complexity of coordinating price and quantity instruments and because it will interfere with the development of systems of international emissions trade.

Shifting Private Capital to Low Carbon Investment, An IIGCC position paper on EU climate and energy policy, IIGCC, 2010[52]

This report sets out a series of recommendations prepared by the Institutional Investors Group on Climate Change (IIGCC) on the additional policy steps that the EU can take to unlock the significant flows of private capital that are necessary for the transition to a low-carbon economy. This report investigates effective policy measures to shift the risk reward balance from carbon intensive to less carbon intensive investment. This paper describes EU emission reduction targets and the EU Emissions Trading Scheme. Moreover, this report discusses renewable energy, energy infrastructure-related issues, subsidies for fossil fuels and energy efficiency in buildings.

Small Electric Motors Final Rule Technical Support Document. Appendix 15A: Social Cost Of Carbon For Regulatory Impact Analysis Under Executive Order 12866, Interagency Working Group On Social Cost Of Carbon, United States Government, 2010[257]

This document presents a summary of the interagency process that developed these SCC estimates. Technical experts from numerous agencies met on a regular basis to consider public comments, explore the technical literature in relevant fields, and discuss key model inputs and assumptions. The main objective of this process was to develop a range of SCC values using a defensible set of input assumptions grounded in the existing scientific and economic literatures. Through this approach, key uncertainties and model differences transparently and consistently inform the range of SCC estimates used in the rulemaking process.

Social Cost of Carbon, Paul Watkiss Associates, UK, 2002[256]

The study identified a number of research priorities. The most important priority is to fill the gaps in the risk matrix—both in terms of acquiring better information on sector and regional values, and extending the analysis to the important omissions of major events and socially contingent effects.

The paper emphasizes that further work to bring all the impact and valuation data together in a form useful for policy analysis (i.e. a multi-analysis framework) is needed.

Future policy considerations will need to balance impact analysis, monetary benefits, and work with significant uncertainty and sensitivity analysis to allow informed decisions. There is a need to develop a framework to maximize the usefulness of all the information for policy makers.

The Social Cost of Carbon: Trends, Outliers and Catastrophes, Economics: The Open-Access, Open-Assessment E-Journal, Vol. 2, 2008[259]

A total of 211 estimates of the social cost of carbon are included in this meta-analysis. The results confirm that a lower discount rate implies a higher estimate, and that higher estimates are found in the gray literature. It is also found that there is a downward trend in the economic impact estimates of the climate; that the Stern Review's estimates of the social cost of carbon is an outlier; and that the right tail of the distribution is fat. It estimates that there is a reasonable chance that the annual climate liability exceeds the annual income of many people.

SRI Korea Report 2010, Korea Sustainability Investing Forum (KoSIF), 2010[346]

This is the third report for Socially Responsible Investing (SRI) in Korea issued by the Korea Sustainability Investing Forum (KoSIF). The first was issued in April 2008 and the second in July 2009. As these two reports used different time horizon it was very difficult to compare the trends of SRI activities. Accordingly it was decided to issue the report every year with same time horizon for data comparability. From this report, all data will be based on the statistics covering each year from January 1 to December 31.

SRI in Korea is still in its early phase but is slowly but steadily growing. In particular, it is encouraging that the National Pension Service (NPS) signed the United Nations Principles for Responsible Investment (UN PRI) in 2009 and has since demonstrated its commitment to SRI practices. As of December 2009, professionally managed assets that are following at least one of SRI strategies stood at ₩3,582 billion.

State and Trends of the Carbon Market: 2009, World Bank, 2009[130]

During 2008, the global economy cooled significantly in various countries and across markets while at the same time, the scientific community communicated the heightened urgency of taking action on climate change. Policymakers at national, regional and international levels have put forward proposals to respond to the climate challenge. The most concrete is the adopted EU Climate & Energy package (20 percent below 1990 levels by 2020), which guarantees a level of carbon market continuity beyond 2012. The EU package, along with proposals from the United States and Australia, tries to address the key issues of ambition, flexibility, scope and competitiveness. Taken together, the proposals tabled by the major industrialized countries do not match the aggregate level of Annex I ambition called for by the Intergovernmental Panel on Climate Change (IPCC) (25–40 percent reductions below 1990). Setting targets in line with the science will send the right market signal to stimulate greater cooperation with developing countries to scale up mitigation.

State and Trends of the Carbon Market: 2010, World Bank, 2010[128]

This report discusses the state of the global carbon market since the beginning of the global economic crisis in late 2008. Despite the carbon market experiencing its worst year yet, with a definitive decrease in both supply and demand, it weathered 2009 and growth actually increased to US$144 billion, up 6 percent from 2008. This remarkable level of growth can be attributed to the trading of European Union Allowances (EUAs) and secondary Kyoto offsets under the European Union Emissions Trading Scheme (EU ETS). It also evaluates transactions under the Kyoto markets: Certified Emission Reductions (CERs), Emission Reduction Units (ERUs), and Assigned Amount Units (AAUs), as well as data from voluntary markets, such as in New Zealand. In the growing field of national mitigation efforts, carbon finance remains an important tool to provide incentives to move towards emission reducing economies, but significant effort must be made by leaders along with policy and finance instruments in order to meet the growing climate challenge.

Summary of COP 16 and CMP 6, Pew Center on Global Climate Change[B], 2010[70]

In large measure, the Cancún Agreements import the essential elements of the Copenhagen Accord into the UN Framework Convention on Climate Change (UNFCCC). They include the mitigation targets and actions pledged under the Accord—marking the first time all major economies have pledged explicit actions under the UNFCCC since its launch nearly two decades ago. The Agreements also take initial steps to implement the operational elements of the Accord, including a new Green Climate Fund for developing countries and a system of "international consultations and analysis" to help verify countries' actions.

Agreement in Cancún hinged on finding a way to finesse for now the more difficult questions of if, when, and in what form countries will take binding commitments. In particular, the deal had to strike a balance between developing country demands for a new round of developed country targets under the Kyoto Protocol and the concern of developing countries in having to adhere to a rigid target. The final outcome leaves all options on the table and sets no clear path toward a binding agreement.

Apart from its specific substantive outcomes, the major accomplishment of Cancún was demonstrating that the UN negotiations can still produce tangible results—the most tangible since the Marrakesh Accords nearly a decade earlier.

Tackling Carbon: How to Price Carbon for Climate Policy, University of Cambridge, 2008[218]

Pricing carbon has become widely acknowledged as a central pillar in international efforts to address climate change. Economists have long argued that the problem cannot be effectively and efficiently tackled, until the myriad decisions through which carbon is emitted factor in the environmental costs. Furthermore, pricing carbon would provide an incentive for companies to invest seriously in low-carbon innovations.

The basic theory is relatively straightforward. However, to date the literature has been missing a comprehensive analysis that combines this theory with the emerging

practical experience and the live policy debates, which this study attempts to address. This book explains the rationale for using carbon pricing and discusses the details of the implementation of carbon pricing using cap and trade schemes.

Taiwan's Voluntary GHG Reduction Program: Strategies for Assisting Domestic Emission Sources to Acquire Foreign CDM Credits to Offset GHG Emissions (Draft), Environmental Protection Administration, Republic of China, 2009[250]

Taiwan accounts for almost 1% of global GHG emissions. Although Taiwan is currently not subject to UN reduction commitment, Taiwan's Executive Yuan's Sustainable Energy Development Framework has already proclaimed carbon reduction targets, and the GHG Reduction Bill is about to be passed by the Legislative Yuan.

After the analysis of the suitable ways for foreign carbon management by the Environmental Protection Administration, this paper concludes that although Taiwan is not subject to reduction commitments under the UNFCCC, acquiring Certified Emissions Reductions (CERs) from the Clean Development Mechanism (CDM) through public-private partnership is currently the most assuring way to acquire foreign reduction credits. During the voluntary reduction period or when Taiwan takes on international reduction commitment in the future, the use of CERs would allow gaining international recognition for offsetting domestic emissions, and providing the best assurance for emission sources through such investments. Based on the above concept, the paper establishes the designs and recommendations for strategies related to operational manners.

Task Force on Low-Carbon Prosperity: Recommendations, World Economic Forum, October 2009[16]

The Task Force recommends that UNFCCC parties agree at COP 15 to create a set of public-private initiatives in close consultation with business and other non-governmental experts. The process to create these initiatives should engage finance, economic, energy and environmental officials in substantive dialogue with business and other non-governmental experts over the next two years. This report presents detailed descriptions of the concrete proposals the Task Force has developed regarding energy efficiency, technology development, investment in developing countries, common standards and metrics, avoided deforestation and land use change, market mechanisms and adaptation.

Taxation, Innovation and the Environment, OECD, October 2010, © OECD 2010[234]

This report focuses on the relationship between innovation and environmentally-related taxes and covers different case studies such as Japan, Korea, Spain, Sweden, Switzerland, the United Kingdom, and Israel among others. It also covers a wide set of environmental issues and technologies, as well as the economic and policy contexts. The research methods range from econometric analysis to interviews with business owners and executives. In addition, the report explores the use of environmentally related taxes in OECD countries and outlines considerations for policymakers when implementing these taxes.

A Tax–Based Approach to Slowing Global Climate Change, National Tax Journal, 2008[479]

This paper discusses the design of CO_2 taxes at the domestic and international level and the choice of taxes versus cap and trade. There is a strong case for taxes on uncertainty, fiscal, and distributional grounds, though this critically hinges on policy specifics and how revenues are used. The efficient near–term tax is at least US$5–US$20 per tonne of CO_2 and the tax should be imposed upstream with incentives for downstream sequestration and abatement of other greenhouse gases. At the international level, a key challenge is the possibility that emissions taxes might be undermined through offsetting changes in other energy policies.

A Taxonomy of Instruments to Reduce Greenhouse Gas Emissions and Their Interactions, OECD, 2008, © OECD 2008[480]

This paper reviews alternative (national and international) climate change mitigation policy instruments and interactions across them. Carbon taxes, cap-and-trade schemes, standards and technology-support policies (R&D and clean technology deployment) in particular are assessed according to three broad cost-effectiveness criteria. These include (i) static efficiency, defined to cover not just whether the instrument is cost-effective *per se* but also whether it provides sufficient political incentives for wide adoption; (ii) dynamic efficiency, which implies an efficient level of innovation and diffusion of clean technologies in order to lower future abatement costs; and (iii) ability to cope effectively with climate and economic uncertainties. Multiple market failures and political economy obstacles need to be addressed in order to meet these criteria and in this regard, carbon taxes or cap-and-trade schemes appear to perform better than alternatives. However, their cost-effectiveness can be enhanced through targeted use of other instruments indicating that there is scope for climate policy packages.

Toward An Effective Global Carbon Market, IIGCC, 2009[481]

The Institutional Investors Group on Climate Change (IIGCC) recognize that carbon markets will not be able to provide a full solution to climate change mitigation across all sectors. Therefore, these instruments should be complemented by other policies, including incentives, regulation, product and process standards and/or taxation. This paper provides IIGCC's perspective on the measures that should be put in place in order for carbon markets to fulfill their potential in catalyzing the necessary investment in a low-carbon economy. This report argues that emission trading schemes should ensure environmental integrity and increase predictability to investors. Moreover, the paper discusses carbon offsets and moves towards emission trading in developing countries.

Toward Low Carbon Resilient Economies, M. Araya, 2010, © E3G 2010[482]

A low-carbon transition is underway but current efforts do not meet the <2°C imperative. Moving toward a transformative fast-start finance package has operational implications for donors, recipients, investors and multilateral development agencies.

This paper stresses the importance of a hybrid system of public and private finance in order to provide incentives to leave behind business-as-usual growth and development formulas, and to mobilize capital toward low-carbon resilient economies. To ensure the highest level of learning and experimentation, some tolerance for risk and failure in 2010–2012 is needed among donors, as that is the key to build robust models for change.

Towards Green Growth, OECD, 2011, © OECD 2011[483]

This report carries three companion reports: *Towards Green Growth—Monitoring Progress: OECD Indicators, Tools for Delivering Green Growth,* and *Towards Green Growth: A Summary for Policy Makers.*

Strategies to achieve greener growth are needed in order to ensure that living standards are maintained. However, this may mean that it becomes necessary to redefine what is meant by progress and how it is measured. The challenges are global, and recent efforts to tackle environmental issues collectively, including the path-breaking Cancún agreements to address climate change, have been encouraging.

At the OECD Ministerial Council Meeting in June 2009, Ministers acknowledged that green and growth can be compatible, and asked the OECD to develop a Green Growth Strategy. Since then, a wide range of partners from across government and civil society have worked to provide a framework for countries to achieve economic growth and development while at the same time combating climate change and preventing costly environmental degradation and the inefficient use of natural resources.

This publication summarizes the work performed to date. As a lens through which to examine growth, the analysis presented here is an important first step to designing green growth strategies while at the same time providing an actionable policy framework for policy makers in advanced, emerging and developing economies. The OECD will continue to support global efforts to promote green growth, especially in view of the Rio+20 Conference. The next step will see green growth reflected in OECD country reviews and the output of future OECD work on green growth indicators, toolkits and sectoral studies, to support countries' implementation efforts towards green growth.

Tradable Permits in Principle and Practice, T. Tietenberg, Penn State Environmental Law Review, 2006[236]

This paper reviews the experience with three main applications of tradable permit systems—air pollution control, water supply and fisheries management—as well as some unique programs such as the U.S. program to mitigate the loss of wetlands and the program in the Netherlands to control the damage to water pollution from manure spreading. The purpose of this review is to exploit the large variation in implementation experience that can be gleaned from this rich variety of applications. This experience provides the basis for formulating some general lessons about the effectiveness of these systems in practice. The essay opens with some of the methodological questions that are raised by any *ex post* attempt to assess how well these approaches have been working in practice, followed by a brief survey of what those evaluations have found. The essay proceeds with a description of the common elements shared by these pro-

grams and the design questions posed by the approach. These include the setting of the limit on access, the initial allocation of rights, transferability rules (both among participants and across time) as well as procedures for monitoring and enforcement. It continues by examining how these design questions have been answered by the targeted applications and how the answers have evolved. As this essay points out, this evolution has been influenced by changing technology, increased familiarity with the system and a desire to respond to some of the controversies surrounding the use of these approaches. The final section draws together some tentative lessons that can be drawn from this experience.

Transitioning to a Low Carbon Economy: How to Make Successful Policy and Regulation Happen, R. Williamson, 2010[484]

This report encapsulates in a series of 19 points the main discussion topics of the June 2010 Wilton Park Conference. It discusses the role of regulation of growing renewable energy economies and the ways in which regulators can both help and hinder growth. In conclusion it talks about how regulators are key players with various roles that must be flexible to new technologies, protecting the industry, setting reasonable pricing and educating and incentivizing to enable informed purchases.

The Treatment of Renewable Energy Certificates, Emissions Allowances, and Green Power Programs in State Renewables Portfolio Standards, Ernest Orlando Lawrence Berkeley National Laboratory, 2007[485]

This report summarizes the treatment of renewable energy attributes in state RPS rules. Its purpose is to provide a source of information for states considering RPS policies, and also to draw attention to certain policy issues that arise when renewable attributes and RECs are used for RPS compliance. Three specific issues are addressed: (i) the degree to which unbundled RECs are allowed under existing state RPS programs and the status of systems to track RECs and renewable energy attributes; (ii) definitions of the renewable energy attributes that must be included in order to meet state RPS obligations, including the treatment of available emissions allowances; and (iii) state policies on whether renewable energy or RECs sold through voluntary green power transactions may count towards RPS obligations.

UN Climate Change Conference in Cancún Delivers Balanced Package of Decisions, Restores Faith in Multilateral Process, United Nations, December 2010[139]

The UN Climate Change Conference in Cancún, Mexico, ended with the adoption of a balanced package of decisions that set all governments more firmly on the path towards a low-emissions future and supports enhanced action on climate change in the developing world.

This article builds on the momentum created in Cancún and explores the elements of the Cancún Agreements. Above all, the article highlights that a total of US$30 billion in fast-start finance from industrialized countries to support climate action in the developing world up to 2012 and the intention to raise US$100 billion in long-term funds by 2020 is included in the decisions.

United States Climate Change and Energy Policy: An Overview and Analysis, FACET Analysis No. 2, 2009[364]

This FACET Analysis examines the state of U.S. climate change and energy policy at the federal and sub-national levels, capturing the key developments in 2008, and looking ahead to 2009. It refers to the role of the U.S. courts, and the activities of American industry. It argues that the United States is entering a period of opportunity and considerable challenges, in which growing political and popular support for action against climate change will confront economic difficulties that may shrink political and corporate agendas.

Universal Ownership—Why Environmental Externalities Matter to Institutional Investors, UNEP Finance Initiative, 2010[82]

This study provides an important rationale for action by large institutional investors that have a financial interest in the wellbeing of the economy as a whole. By exercising ownership rights and through constructive dialogue with companies and public policy makers, these "Universal Owners" can encourage the protection of natural capital needed to maintain the economy and investment returns over the long term. Many Universal Owners are signatories to the Principles for Responsible Investment (PRI), and it is hoped they continue to exercise leadership and responsible ownership by acting on the ideas and recommendations in this report.

Unlocking Investment to Deliver Britain's Low-Carbon Future, Green Investment Bank Commission, UK, 2010[7]

This report sets out the challenges facing the UK's transition to a low-carbon economy, the market failures and barriers to investment and the case for intervention to address them. It proposes the establishment of the Green Investment Bank (GIB) to tackle the low-carbon investment needs of the UK, working as a key part of overall government policy. The core recommendations of the Commission are the following: (i) the scale of the investment required to meet UK climate change and renewable energy targets is unprecedented, with estimates of investment required reaching £550 billion between now and 2020. In contrast, only £11 billion was invested in Britain's "dash for gas" during the 1990s, which was considered transformational at the time; (ii) the Commission has identified a number of market failures and investment barriers in financing low-carbon infrastructure, which have led it to conclude that, without intervention, the UK's low-carbon targets will not be achieved; (iii) in addition to ensuring the UK meets its legal decarburization targets, the case for intervention is supported by a number of arguments; (iv) the Commission recommends that the GIB be established "to support the delivery of the UK's emission reduction targets as set by the Climate Change Act 2008. The support should be based on a public-private investment model and address specific market failures and investment barriers in a way that will achieve emission reductions at least cost to taxpayers and energy consumers"; (v) operationally, the GIB should work under strict principles to ensure it does not crowd out the private sector, with the private sector leading and executing deals wherever activity is viable and the GIB operating only where its actions achieve

a result that would not otherwise have been possible and then in partnership with the private sector wherever possible; and (vi) the GIB will need to raise three forms of funding to sustain its ongoing operations, leveraging the institutional appetite for long-dated sterling bonds and existing government grants: a government funding for disbursement of grant, financing for ongoing activities and "commercial" investments, with options for government consideration, and Initial Bank capitalization and funding, to support the first and second source of funding and with options for government consideration.

Update on the Design of the Green Investment Bank, Department for Business, Innovation and Skills, HM Government, UK[203]

The UK Government is committed to achieving the transition to a green economy and delivering long-term sustainable growth. However, this transition requires unprecedented investment over the coming decades, with an estimated investment of up to £200 billion in the energy system alone over the period to 2020, and further significant investment in other key green sectors such as transport, waste, water and flood defences. The Government committed in the 2011 Budget to fund the GIB with £3 billion over the period to 2015. The Green Investment Bank (GIB) will become a key component of the transition to a green economy, complementing other green policies to help accelerate additional investment.

This report further discusses the role and organization of the GIB. The report highlights that (i) the GIB will play a key role in addressing financial market failures; (ii) the GIB will be set up as an enduring institution; (iii) the GIB will use a range of product interventions to achieve its mission, including risk mitigation, innovative finance mechanisms, capital provision; and (iv) implementation will consist of three phases, including incubation (from April 2012 to achievement of state aid approval), establishment (following state aid approval), and full borrowing GIB (from April 2015).

Uptake of Energy Efficiency in Buildings, Element Energy, 2009[486]

In its recent report, the Committee on Climate Change (CCC) brought together an extensive evidence base to produce the first carbon budgets for the UK. As part of this evidence base the CCC commissioned work to assess the maximum technical potential CO_2 savings of a range of energy efficiency measures in buildings across the domestic, non-domestic and industrial sectors. This report found remaining technical potential for low or zero cost energy efficiency measures in the domestic, non-domestic, and industrial sectors of 40 Mt, 11 Mt, and 7 Mt of annual CO_2 savings respectively.

Urban Metabolism, National Council for Science and the Environment, 2007[281]

The concept of an urban metabolism provides a means of understanding the sustainable development of cities by drawing an analogy with the metabolic processes of organisms. The parallels are strong: "Cities transform raw materials, fuel, and water into the built environment, human biomass and waste" In practice the study of an urban metabolism (in urban ecology) requires quantification of the inputs, outputs and storage of energy, water, nutrients, materials and wastes.

Urban metabolism can be defined as "the sum total of the technical and socio-economic processes that occur in cities, resulting in growth, production of energy, and elimination of waste". The metabolism of an ecosystem involving the production, via photosynthesis, and consumption, by respiration, of organic matter is often expressed by ecologists in terms of energy. A few studies of urban metabolism have focused on quantifying the embodied energy in cities, while others have more broadly included fluxes of nutrients and materials, and the urban hydrologic cycle.

Voluntary Approaches for Environmental Policy: Environmental Effectiveness, Economic Efficiency and Usage in Policy Mixes, OECD, 2003[77]

The report *Voluntary Approaches for Environmental Policy* provides an up-to-date discussion of the use of such approaches in meeting environmental policy goals. It builds on a number of case studies, and focuses in particular on the environmental effectiveness, economic efficiency and the administrative costs related to these approaches—when used either in isolation or as part of "policy mixes" together with other types of policy instruments. The report demonstrates that a large, and seemingly increasing, number of voluntary approaches is being used in environmental policy in OECD member countries, most often in combination with one or more other instruments. The report concludes that: (i) the environmental effectiveness of such approaches is questionable; (ii) the willingness to give priority to reaching environmental targets remains unclear in any event; and (iii) the use of voluntary approaches can reflect a desire to avoid making trade-offs between environmental and social policy targets.

Voluntary Environmental Regulation in Developing Countries: Fad or Fix? A. Blackman, 2007[248]

Hampered by weak institutions that undermine conventional environmental regulatory tools, policymakers in developing countries are increasingly turning to voluntary approaches. Yet the evaluative literature on this topic is poorly developed. To help fill this gap, this paper reviews arguments for and against the use of voluntary regulation in developing countries and presents three case studies: a series of agreements negotiated between regulators and leather tanners in Guanajuato, Mexico; a national environmental audit program in Mexico; and a national public disclosure program in Indonesia. While admittedly few in number, these case studies nevertheless suggest that although voluntary environmental regulation in developing countries is a risky endeavor, it is by no means certain to fail. The risks can be minimized by emphasizing the dissemination of information about pollution and pollution abatement options and by avoiding voluntary tools in situations where regulatory and non-regulatory pressures for improved environmental performance are weak and where polluters can block quantified targets, individual sanctions for noncompliance, and other widely accepted prerequisites of effective initiatives.

What's Next For Alternative Energy?, B. Balagopal, P. Paranikas and J. Rose, BCG, 2010[487]

This report focuses on two critical areas that have a disproportionate impact on energy and climate considerations. For the first, transportation, the report discusses advanced

biofuels and electric-propulsion vehicles. For the second, power generation, the report investigates solar power (CSP), solar PV, onshore and offshore wind power, and clean coal through carbon capture and sequestration (CCS). For each of these sectors, the report offers a snapshot of its current position and assesses its competitiveness, its viability, its barrier-related issues and its penetration levels by 2025.

Who's Winning The Clean Energy Race?, Pew Charitable Trusts, 2010[488]

This report documents the arrival of a new worldwide industry—clean energy—which has experienced investment growth of 230 percent since 2005. The report argues that global investments in clean energy are growing and discusses the roles of China and the United States in the clean energy economy. Moreover, the report describes asset financing, public market financing, venture capital and private equity financing, renewable energy capacity and stimulus funding of the clean energy economy. In addition, the analysis shows the profiles of the G-20 countries in terms of priorities and progress, along with key renewable energy targets and incentives developed to encourage growth in the clean energy sector.

Winds of Change: East Asia's Sustainable Energy Future, World Bank and AusAID, May 2010[2]

The underlying study for this report found that large-scale deployment of energy efficiency and low-carbon technologies can simultaneously stabilize East Asia's CO_2 emissions by 2025 and significantly improve the local environment and enhance energy security, without compromising economic growth. Energy efficiency contributes to more than half of the emission reductions between the Sustainable Energy Development (SED) and Reference (REF) scenarios, and is fully justified by development benefits and future energy savings. To fully realize the huge energy efficiency potentials in the region requires the removal of fossil-fuel subsidies and incorporation of environmental externalities into energy pricing as well as a concerted strategy to tackle market failures and barriers with effective regulations, financial incentives, institutional reforms, and financing mechanisms. Under the SED scenario, low-carbon fuels for power generation—renewable energy and nuclear power—would meet half of the power demand by 2030. Scaling up renewable energy requires putting a price on carbon and providing financial incentives to deploy renewable energy technologies. Not-yet-proven advanced technologies, such as carbon capture and storage, also are needed to bend the emission curve beyond 2030, but require immediate accelerated research, development, and demonstration.

To achieve these goals requires governments to take immediate action but a major hurdle is to mobilize financing for the net additional investment of US$80 billion per year over the next two decades. It is estimated that approximately US$25 billion per year would be required as concessional financing to cover the incremental costs and risks of energy efficiency and renewable energy. In addition, substantial grants are also needed to build capacity of local stakeholders. The technical and policy means exist for such transformations, but only strong political will and unprecedented international cooperation will make them happen. Delaying action would lock the region into a long-lasting high-carbon infrastructure.

World Development Report 2010: Development and Climate Change, World Bank, 2010[131]

Climate change is one of the most complex challenges of this new century. As a multilateral institution whose mission is inclusive and sustainable development, the World Bank Group has a responsibility to try to explain some of those interconnections across disciplines—development economics, science, energy, ecology, technology, finance, and effective international regimes and governance. With 186 members, the World Bank Group faces the challenge, every day, of building cooperation among vastly different states, the private sector, and civil society to achieve common goods. This 32nd World Development Report seeks to apply that experience, combined with research, to advance knowledge about Development and Climate Change. First, this report helps to understand the links between climate change and development. Second, this report analyzes human vulnerability and provides recommendations to cope with climate change. Land and water management are described along with natural systems protection. This report also suggests different ways to foster development without compromising the climate. Moreover, the World Development Report sheds light on mitigation and adaptation-related aspects. In addition, this report focuses on overcoming behavioral and institutional inertia in order to take immediate action on climate change.

World Energy Outlook, IEA, 2009[33]

This report explores a wide range of energy-related issues such as financial crisis implications, the far-reaching consequences of falling energy investments, energy policies, new financing mechanisms for a low-carbon growth and the future of natural gas.

The policy and regulatory frameworks established at national and international levels will determine whether investment and consumption decisions are steered towards low-carbon options. Accordingly, this report also presents the results of two scenarios: a Reference Scenario, which provides a baseline picture of how global energy markets would evolve if governments make no changes to their existing policies and measures: and a 450 Scenario, which depicts a world in which collective policy action is taken to limit the long-term concentration of greenhouse gases in the atmosphere to 450 parts per million of CO_2-equivalent (ppm CO_2-eq), an objective that is gaining widespread support around the world.

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Notes

[A]Disclaimer: The following abstracts were prepared by the Green Infrastructure Finance team. The abstracts may or may be not a verbatim representation of executive summaries of corresponding documents.

[B]Please, note that the Pew Center on Global Climate Change is now the Center for Climate and Energy Solutions (C2ES); www.C2ES.org.

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This report provides a compendium of ongoing leading initiatives and activities designed to accelerate private investment flows in low-emission projects. The research identifies current investment challenges of green projects and summarizes the extensive body of work that has been evolving over the past few years. The report presents a number of conclusions that emerged from the research, along with an identification of additional work needed to move the agenda forward.

Research has shown that climate change is heightening the importance of accelerating investments in low-emission projects. However, many such projects are financially unattractive when compared with traditional but less eco-friendly alternatives. Further, private sector investments have fallen far short of the amounts required to stabilize CO_2 emissions at levels that will ensure sustainable development.

While there is much hope that carbon markets can be revived, there is also great uncertainty regarding the breadth and stability of these markets. As such, additional sources of financing and innovative approaches for accelerating investments need to be found. Public instruments and concessional funding will be essential to leverage private flows, and governments will need to take the lead in deploying public financing for maximum effectiveness.

These issues and possible solutions to the financing challenge of low-emissions projects are discussed at length in the report's companion volume, *Green Infrastructure Finance: Framework Report.*

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