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Information Technology plus ET — A New Approach

*Dr Klaus Rave,* President, European Wind Energy Association (EWEA)

Infrastructures and Innovation: The Metropolitan Bilbao Experience

*Alfonso Martinez Cearra,* Director General of Bilbao Metropolis-30

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*Dr Madhu Babu, D A C Maunder* and *T Pearce,* Association of State Road Transport Undertakings (ASTRU) and Transport Research Laboratory

Water-related Infrastructure Towards Recycling Society

*Dr Janusz Niemczynowicz,* Associate Professor, Department of Water Resource Engineering, University of Lund

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*The Following papers can be found in the Reference Library of the CD-ROM accompanying this Business Briefing*

The Single Buyer Model — A Dangerous Path Towards Competitive Electricity Markets

*Lazlo Lovei,* Energy Sector Unit, World Bank

Energy Infrastructure for a Digital Economy.

*Karl Stahlkopf* and *John H Douglas,* Electric Power Research Institute

Promoting Private Investment in Rural Electrification — The Case of Chile

*Alejandro Jadresic,* The World Bank

Distributed Generation — A Solution for Our Times

*Tony Prophet,* President and Chief Executive Officer, Honeywell Power Systems, Inc.

FACTS: A Powerful Means for Increasing the Availability of Electric Power

*Rolf Grünbaum,* ABB Power Systems AB, Sweden

Sustainable Delivery of Electric Energy

*Roberto Rudervall* and *Lena Kjellin,* ABB Power Systems AB, Sweden

Multiservice Infrastructure — Privatising Port Services

*Lourdes Trujillo* and *Gustavo Nombela,* Professor of Economics and Director, and Professor of Economics, Department of Applied Economics, University of Las Palmas de Gran Canaria
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Multi-utility Trends — Blurring Industry Boundaries
Dirk Sommer, Private Sector Development Specialist, The World Bank

Road Financing and Management in the Baltic States
Eva Rodzik and Cesar Queiroz, The World Bank

Urban Transport Patterns in a Global Sample of Cities and their Linkages to Transport Infrastructure, Land Use, Economics and the Environment
Jeff Kenworthy and Felix Laube, Institute for Sustainability and Technology Policy, Murdoch University, Murdoch, Perth, WA, Australia

Urban Transport Networks for Social Cohesion
Marc Ellenberg, Deputy Director for Scientific and Technical Coordination, CERTU

Infrastructure Investment — Vital for Quality Public Transport
Eric Bruun, Systems Consulting Group, LLC and former Assistant Director of the National Transit Institute at Rutgers University,

The Industrial Organisation of Public Transport in Developing Countries
Binyam Reja, The World Bank

Corruption, Transport Infrastructure Stock and Economic Development
Alex Visser and Cesar Queiroz, Professor of Transportation Engineering, Department of Civil Engineering, University of Pretoria and Lead Highway Engineer, Infrastructure Sector Unit, The World Bank

Subsidies and Sustainable Rural Energy Services — Can We Create Incentives Without Distorting Markets?
Douglas F Barnes and Jonathan Halpern, The World Bank

Potable Water Pricing and the Poor
Ian Walker and Jonathan Halpern

Pricing, Subsidies and the Poor: Demand for Improved Water Services in Central America
Ian Walker and Jonathan Halpern

Independent Water Entrepreneurs in Latin America — The Other Private Sector in Water Services
Tova Maria Solo

Women IT Entrepreneurs in China
Kate Zhou, Assistant Professor, Politics and political Economy of East Asia, Department of Political Science, University of Hawaii

The 'Integrity Pact' of Transparency International — The Concept and the Present Applications
Michael Wiehen, A former Director, World Bank and member of the Board, Transparency International

Business Infrastructure for Environmental Information
Mantha Mehallis, Director and Professor, Florida Atlantic University
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Join us. Together we can change the world.
In addition to the panel members below, the World Markets Research Centre would like to thank the Directorate General for Energy and Transport, European Commission, Brussels.

Dr Johan Bastin  
*Business Group Director, European Bank for Reconstruction and Development (EBRD)*

Dr Johan Bastin is a Business Group Director at the European Bank for Reconstruction and Development (EBRD), heading the Infrastructure Group ("the Group"), which includes the Energy Efficiency, Municipal and Environmental Infrastructure, Power and Energy and Transport teams. The Group is responsible for the development, appraisal and structuring of public and private infrastructure financing in Central and Eastern Europe, the Baltic States and the Commonwealth of Independent States. Dr Bastin joined the EBRD in 1993 and, before assuming his current position in June 1999, was Director of the Municipal and Environmental Infrastructure team, dealing with investment financing of municipal services and infrastructure, including water and sewerage services, solid waste collection and disposal, urban transport and district heating. Since 1983, Dr Bastin has worked in infrastructure financing in emerging markets and transition economies. He holds degrees in urban planning; business administration; and public administration and finance.

Margaret Catley-Carlson  
*Chair, Global Water Partnership (GWP)*

Margaret Catley-Carlson is Chair of the Global Water Partnership (GWP). She chairs Group Suez Lyonnaise des Eaux: Water Resource Management Advisory Committee, is a Commissioner of the World Commission for Water in the 21st Century and serves on the Canadian Committee of the International Ocean Institute. Ms Catley-Carlson is a board member and advisor to numerous other international and national public and private groups in the fields of agricultural development, health and population and finance and development. She has an international career spanning 35 years, gaining experience in a variety of governance, public policy, regulatory, management, economic, health and development issues. She has worked with organisations, applying science and knowledge to the better management of national and international problems in freshwater governance, health, agriculture, information management, environmental protection, international development and development finance.

Jean-Pierre Charpentier  
*Senior Energy Specialist and Infrastructure Forum 2001 Manager, Water & Energy Department, Private Sector and Infrastructure Vice Presidency, The World Bank*

Jean-Pierre Charpentier has been with The World Bank Group since 1987 and is currently Senior Energy Specialist within the Energy and Water Unit of its Central Infrastructure Department. His main fields of activity focus on the development of regional energy markets and power sector restructuring. Prior to joining The World Bank, Mr Charpentier worked for the International Atomic Energy Agency (IAEA) in Vienna since 1977, where he was responsible for analysing possible peaceful uses of nuclear energy for the organisation’s member states. Up to this time, his activities were essentially in France, where he worked for the Atomic Energy Commission and the Ministry of Industry, where he was engaged as Adviser for Nuclear Issues until 1977. He was also Assistant Professor in Mathematics Economics at the University of Paris. Mr Charpentier has a double academic background in electrical engineering and economics.
Luis Dodero joined The World Bank Group’s Multilateral Investment Guarantee Agency (MIGA) in October 1989 as Vice President and General Counsel. He is an expert on investment and export credit insurance, claims negotiation, settlement and recovery and international commercial law. In 1971, Mr Dodero joined Compañía Española de Seguros de Crédito a la Exportación, SA (CESCE), where he held the position of Deputy General Manager and General Counsel. Prior to joining CESCE, Mr Dodero was the Legal Advisor to the Claims Department of Compañía Española de Seguros de Crédito y Caución, which, prior to CESCE’s formation, was the credit insurance agency of Spain. He practised for several years in his own law firm, and acted as the local Spanish associate of major English law firms. He is a member of the Spanish Court of Arbitration, the Madrid Bar Association and the International Bar Association, and is a frequent lecturer before international, national, private and legal venues. Among his many writings, he has co-authored the Guidelines for the Protection of Foreign Investment. Mr Dodero received his LL.M degree from Madrid University, after which he studied International Commercial Law, obtaining diplomas from various institutions in England, Spain and the US. He has also completed the Harvard Executive Development Program for managers of The World Bank.

Declan Duff is Director of the International Finance Corporation’s (IFC’s) Infrastructure Department, a group providing advice to, and investing in, a range of infrastructure projects (including roads, railways, ports, airports, pipelines and the like), and utilities (including water, waste treatment, gas distribution and logistics systems). IFC is able to draw on a broad range of specialist skills to achieve the successful financing of infrastructure projects. Mr. Duff and his department have developed a reputation in the market for bringing challenging financing to closure. In the past 10 years IFC has financed infrastructure projects worth US$40 billion. Mr. Duff is on the board of a number of infrastructure companies and funds. Previously Mr. Duff was Vice President and head of business development for Europe, Africa and the Middle East with Mellon Bank.

Geoff Haley is Chairman of the International Project Finance Association (IPFA), with extensive experience of advising on major projects in the construction and private finance sectors. He has also managed legal services for many projects worldwide. Mr. Haley was admitted as a solicitor in 1971 and holds a Masters Degree in Business Administration from Henley Management College. Prior to practising with SJ Berwin in 1989, he was Legal Adviser at Peterborough Development Corporation and, later, Legal Advisor to Costain UK, General Manager of Costain Ventures Ltd and Deputy Group Legal Advisor to Costain Group plc. He was a Partner for two years at the US firm Arnold & Porter and joined KLegal as Consultant in September 2000. He has specialist expertise in large and complex projects in the fields of energy, waste management, water treatment, transportation, private power generation, waste to energy schemes, urban renewal, property, healthcare and education.

Frannie A Léautier is the Chief of Staff for the President of The World Bank Group. Prior to this, she was the Director for The World Bank’s Infrastructure Group and served as Sector Director for Infrastructure in South Asia from 1997 to 2000. Ms Léautier joined The World Bank Group in 1992 and is recognised as a leading expert in infrastructure strategy formulation in developing countries. Prior to joining The World Bank, she taught at the Center for Construction Research and Education, and the Department of Urban Planning at the Massachusetts Institute of Technology (MIT). She is a recipient of a number of excellence awards, is Associate Editor for the Journal of Infrastructure Systems and a member of a number of international committees on infrastructure development. She has completed the Harvard Executive Development Program and received her MSc in Transportation, and her PhD in Infrastructure Systems, from MIT.
Kyu Sik Lee
Consultant, Urban Development

Kyu Sik Lee recently retired from The World Bank, after nearly 25 years of research, policy, operational and evaluation work in the urban development and infrastructure sectors. He conducted major impact evaluation studies of municipal and regional development projects and major research and policy work on the impacts of infrastructure deficiencies on productivity; and on employment (industrial) location and spatial policies. He has published numerous books, journal articles and research reports. Prior to joining The World Bank in 1975, Mr Lee taught Economics at New York University and Wayne State University and was on the staff of the Conference Board, New York, and the Korea Development Institute, Seoul. He holds a PhD in Economics from the University of Wisconsin at Madison.

Dr Anthony Milburn
Executive Director, International Water Association (IWA)

Dr Anthony Milburn is currently the Executive Director of International Water Association (IWA), formed from the merger of the International Water Services Association (IWSA) and International Association on Water Quality (IAWQ) in 1999. Dr Milburn was Executive Director of IAWQ and the architect and leader of the merger process that formed IWA. Originally a civil engineer by profession, he holds bachelor, master and doctoral degrees in Engineering and a Diploma in Company Direction. He was a manager with the UK National Water Council Training Division and produced a number of UK national training schemes for the water and wastewater industry. He was consultant to The World Bank on the manpower aspects of the Brazilian national plan for water and sanitation and, as adviser to the Government of Indonesia, produced a national manpower development programme for the water supply sector. Dr Milburn is a fellow of the International Water Academy and the European Academy of Science and Arts, a Governor of the World Water Council, fellow of the UK Institution of Civil Engineers and a fellow of the UK Chartered Institute of Water and Environmental Management.

Dr Klaus Rave
President, European Wind Energy Association (EWEA)

Dr Klaus Rave has served as President of the European Wind Energy Association (EWEA) since 1999, and as Managing Director of Investitionsbank Schleswig-Holstein since 1995. From 1988 to 1995, he was Head of Division in the Ministry of Finance and Energy, State of Schleswig-Holstein, responsible for energy affairs, and from 1981 to 1988, he was General Secretary of the Social Democratic Party, Schleswig-Holstein. Dr Rave was a Lecturer in German and International Law at Surrey University from 1978 to 1981, and studied legal practice and his PhD at the Institute of International Law from 1974 to 1978. He was a student of Law at Christian-Albrechts-Universität, Kiel and Trinity College, Dublin, from 1968 to 1974.

Professor J Rodney Turner
Chairman, International Project Management Association (IPMA)

J Rodney Turner is Chairman of the International Project Management Association (IPMA), Professor of Project Management at Erasmus University, Rotterdam and Operations Director for the European Construction Institute, Benelux Region. He is also a member of the associate faculty at Henley Management College and a visiting fellow at the University of Technology, Sydney. Professor Turner is a director of EuroProjex, the European Centre for Project Excellence. He worked for six years for ICI as a mechanical engineer and project manager on design, construction and maintenance projects, before joining Coopers & Lybrand as a management consultant. He worked for Henley Management College for eight years and joined Erasmus University in 1997. Professor Turner is the author of four books on project management, he edits The International Journal of Project Management and has written articles for journals, conferences and magazines. He lectures on and teaches project management worldwide. Professor Turner studied engineering at Auckland University and obtained his doctorate at Oxford University.
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As The World Bank Group and many of its partners have been refining and scaling up their effort in the battle for poverty reduction, access to infrastructure services has increasingly been seen as central to all dimensions of that endeavour. The ‘infrastructure-poor’ are increasing, in spite of the large investment flows – especially private flows – of the past decade:

- 1.2 billion are without access to safe water;
- two billion lack sanitation;
- two to three billion are without modern energy services;
- 40% to 50% of residents of large cities in the developing world live in slums or squatter settlements without basic services;
- the digital divide is wide; and
- there is a lack of access to employment, healthcare and education services.

Today, no one can deny the impact of increased access to infrastructure services on expanding economic opportunities, on improving health, education, living conditions and personal security, and on increasing inclusion and empowerment of individuals and communities. In fact, the poor themselves perceive access to infrastructure as one of their priority requirements towards sound and sustainable development.

The challenge of poverty alleviation remains immense, making the infrastructure agenda anything but complete. While the poor are requesting increased access to infrastructure services, and are willing to pay for them, and while large investment flows – public and private – have been observed over the past decade, the poor still number billions and insufficient access to infrastructure remains of dreadful consequence to them.

In this context, it is essential that infrastructure professionals gain a solid understanding of the nature of the problems, a successful enabling environment for development be maintained and that all stakeholders be involved in the identification of the problems and the design of the right solution. The latter requires smart partnerships including the private sector, local and national governments, communities, non-governmental organisations and other development partners. It is in an attempt to facilitate a better understanding of these challenges and possible synergistic approaches that the Infrastructure Forum (“the Forum”) was created. The World Bank Group is launching this Forum with the aim of providing a unique opportunity to discuss and learn more about the strategic importance of infrastructure in improving people’s lives and the problems associated with poverty. The Forum is aimed at emphasising cross-sectoral issues across infrastructure activities – notably transport, energy, water and urban development – by offering the opportunity for a variety of infrastructure professionals from all over the world to meet and share their experiences and knowledge. The Forum is to focus on three main themes:

- **Infrastructure, poverty and human development**: what is the role of infrastructure in poverty reduction strategies? This includes the role of infrastructure in national poverty strategies through urban and rural development, as well as the role of the private sector in poverty reduction.

- **Infrastructure and Convergence**: how to build synergies across traditional sectors and through private partnerships – including, for example, private sector experience with cross-sectoral project development and implementation, as well as communities’ experiences with holistic infrastructure approaches.

- **Infrastructure and Innovation**: the role that leading innovations can play in business practices and exchange of information – including innovations in infrastructure technology, delivery mechanisms and the impact of advances in electronic technology on business practices and the exchange of information.

As a further contribution to the sharing and thinking that the Forum aims at promoting, this business briefing offers a series of articles and thoughts from infrastructure sector players that we hope will prove complementary to the Forum, both of which should be invaluable tools in our committed work in making access to infrastructure services a success story.
There's a difference between offering advice and delivering results.

PA Consulting Group, a leading management, systems, and technology consulting firm, helps clients design and implement innovative, workable solutions to achieve lasting change. Established almost 60 years ago, PA operates from over 40 offices in more than 20 countries, with a staff of some 3,700.

Multi- and bi-lateral organizations working to improve public infrastructure and institutions must help countries balance their development goals with the needs of their private sectors and citizens. In such key sectors as energy, water, environment, tourism, transportation, and the network industries, PA works with governments to manage the transition to competitive markets, promote private investment, realize organizational and environmental efficiencies, and sustain policy reforms. PA has helped over 100 countries to design and establish regulatory agencies, create public-private partnerships, develop and evaluate policies, devise pricing frameworks, promote sustainable development, structure and obtain private sector financing, manage risks, design partnering strategies, and implement effective asset management and operational efficiencies.

In the transport sector, traditional competitive pressures (customer service, pricing, safety, and logistics) are being compounded by such new issues as deregulation, asset financing and management, and supply/access constraints in the airline, road, rail, and maritime industries. PA has helped both the private and public sectors to deliver practical, multidisciplinary solutions, from developing strategic alliances through to complex systems delivery across ticketing, logistics, scheduling, and customer relationship management.

Government and public service organizations worldwide must now meet the challenge of providing value-for-money services — which are now increasingly delivered through online channels — while taking the need for public service into account. PA is at the forefront of designing and implementing electronic government initiatives, helping deliver secure public services through PCs, Internet devices, kiosks, and integrated legacy systems.

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Connecting People to Resources – What Role for the Private Sector?

a report by

Peter Woicke

Managing Director, The World Bank Group

There are three main reasons why infrastructure needs to be discussed:

1. Despite the centrality of infrastructure for economic and social life, the role of infrastructure in development finds itself in need of defence. It is no longer enough to remain comfortable with general assumptions. An effort must be made to demonstrate the actual linkages and to show progress towards achieving economic and social results through infrastructure.

2. Trends in innovation and technology that have shaped the conduct of numerous activities in daily lives, from the nature of travel and communications to the simple act of ‘going to the market’, have enormous implications for infrastructure, only some of which have begun to be experienced and explored.

3. Key drivers of innovation and change – entrepreneurs and leaders of companies seeking to match the opportunity offered by technology with the demand for services and service improvements – are now, more than ever, seeking to expand their markets while, at the same time, there is an explosion in the demand for services that until now were being provided through what is called the ‘traditional approach to infrastructure provision’.

Role of Infrastructure

The role of infrastructure in development is being questioned for two main reasons:

- widening inequalities; and

- the failure of traditional approaches to infrastructure provision.

Widening Inequalities

Widening inequalities put to question the central assumption of the importance of growth for development. For example, during the 1990s, Europe was reunited after more than 50 years, but, 10 years later, the job of reconstruction has barely begun.

In eastern Europe in the 1990s, 23 million formerly middle-class citizens of the then Union of Soviet Socialist Republics, or its satellites, were reduced to living on the equivalent of US$1 or less a day. Another 10 to 12 million eastern Europeans are now living on incomes equivalent to between US$1 and US$2 a day. Over the same period in western Europe, incomes increased by more than US$1,700 billion equivalent.

The same, but more sharply defined, inequalities are present in other regions. In sub-Saharan Africa, southern Asia and Latin America, the numbers of underprivileged are steadily rising. Sub-regional, ethnic and gender-based inequality is also rising, while diseases such as malaria and HIV/AIDS put special groups at risk.

Failure of Traditional Approaches to Infrastructure Provision

In recent years, developing countries have invested about 4% of national output in infrastructure – nearly 20% of total investment, or about US$250 billion annually – yet the results have been disappointing, particularly in terms of the impact on the underprivileged. The numbers of ‘infrastructure-poor’ people are vast in each region. Some one billion do not have access to safe water, and spend up to 10% of their income trying to obtain it. More than two billion lack sanitation, with serious consequences on their health, and two to three billion are without modern energy services, spending up to one-third of their disposable income to purchase energy services. In sub-Saharan Africa, less than 8% of the population is connected to the power grid system.

In human terms, these statistics are devastating. In developing countries, water-related infections are the primary cause of the high incidence of diarrhoeal diseases, which kill about two million children and cause 900 million episodes of illness each year.

Another troubling aspect, because of its long-term consequences for educational attainment, are the numbers of children who cannot adequately prepare for school due to a lack of proper illumination. These children are further incapacitated by brain damage and lung diseases brought about by indoor air pollution, as their households are reliant on traditional fuels.

Until marked improvement in the reduction of inequality around the world can be shown, there will be impatience about the slow results, or the total lack of results, of the large investments in infrastructure.

**Private Investors Can Lead the Way**

Private investors can lead the way in bringing innovation and change to work at the global scale for better development results. There are a number of conditions that need to be in place for innovation to take place, allowing entrepreneurs to create new types of services, that can then be made available to consumers at cheaper prices and better quality. It is often claimed that there are 10 key activities that the government needs to undertake.

**Greater efficiency and productivity in the provision of public services are essential to fostering growth and closing inequality.**

**Trends in Innovation and Technology**

Infrastructure has long been recognised as having a key role in opening up markets and promoting innovations, as it provides the basic building blocks needed for economic and social life – a way to communicate ideas and a way to exchange goods and services.

In the 18th century, the Scottish social philosopher and political economist Adam Smith recognised transport’s role as, for example, a means for enlarging markets, promoting innovations and generating surpluses for reinvestment. What has changed today is that this role is shared between transport and communication, with the Internet playing a bridging role in connecting communities that may not even have a transport link with one another, as all these connections are now made in cyberspace. This provides a great opportunity for the developing world, where access to physical transport is seriously lacking, but, as indicated by the statistics on the digital divide, it has not yet been possible to make this technology relevant to meet this communication gap.

Modern utility services can also make quantum leaps in a community’s living and health standards by substituting for expensive traditional supplies of basic services. Tapping into innovative ways of generating energy, instead of waiting for communities to be connected to the grid, has shown great potential. An example of this is the women in a village in Bangladesh using solar-panel technology to make lamps for household illumination, while generating income for themselves.

The ingenuity of private investors in the face of often daunting conditions for doing business is to be admired. Focus on the ingenuity that makes it possible to buy a can of soft drink in the remotest parts of the developing world should be shifted onto also making it easy to get a drink of clean water. For example, an innovative financing tool for a small-scale company from the West, in partnership with a small-scale company in a developing country, can be combined to provide innovations in new ways of filtering water.

Conducting business in the emerging markets’ infrastructure sectors is not that much more difficult than making other investments:

- The developing world does not lack entrepreneurship and there are many local partners who could provide international investors with the required ‘local knowledge’.
- It is not necessarily more burdensome in terms of business permits, clearances, environmental licences, etc., to start a utility than to open a retail business. In fact, it may be less cumbersome in infrastructure because of special and recently enacted enabling legislation.
- There are few technology issues in many cases - the largest single ingredient in any soft drink, for example, is clean drinking water.
- Projects that raise the productivity of whole communities are more likely to be directly affordable and to have wholehearted public support, perhaps, than retail or commercial ventures.
Of course, governments also must do more. They need to focus beyond just addressing the backlog in the availability of adequate physical assets. Greater efficiency and productivity in the provision of public services are essential to fostering growth and closing inequality. As well as roads to drive on, communities need improvements in how governments are run and in the reach of public services.

In India, for example, it takes about 10 years to obtain a court date in a simple commercial suit. Such bottlenecks hamper change and deter development. Strengthened administrative capacities and improvements in institutional support and oversight are needed to sustain the gains from expanded fixed investment. Governments also need to reach out to improve the quality of people's lives. Enhanced quality of life and enriched human resources will help to cement improvements as each new generation carries the gains forward. Governments also need to slim down. Communities need improved macroeconomic and fiscal management in order to avoid crowding private investors out of thin capital markets by government spending and borrowing activities. Governments need to retire from providing services that the private sector can and will deliver.

In short, governments need to exploit all avenues for raising productivity and encouraging productive use of assets now lying idle. Two prongs of this approach can be seen as especially important to promoting the productivity of physical infrastructure:

- the human and social systems that support the development of literacy, good health practices and skills needed for personal development; and

- the institutional systems of licences, permissions, permits, regulations and administrative and review functions that provide essential services to firms and create the business environment.

Lastly, the international community must do more. Of the US$800 billion in private capital market-flows to developing countries during the 1990s, only around US$130 billion was for infrastructure projects, and a little over one-third of that was private loans or bonds that financed public-sector projects. Allowing for direct equity contributions, as much as US$120 billion to US$130 billion may be needed in international financing for private infrastructure over the course of the decade, compared with estimated 'needs' in developing countries of US$250 billion a year. In the 21st century, the bulk of international capital flows will be between western Europe and North America.

However, the international markets are not the only players in financing infrastructure. There are strong synergies between long-term finance needs of infrastructure projects and the development of local savings instruments, but most of the long-term credit available in many countries is absorbed by government deficits. Improved public-sector management is key to making more of the domestic savings pool available for productive investment, but private investors must also be willing to work with fledgling financial institutions, and it is one of the principal roles of the multilateral banks to promote financial markets development.

The international community has also accepted ambitious targets for reducing inequality over the next 15 years. Meeting these goals will require more than just money and 'development projects'. They require creating opportunity for poor people to take advantage of the resources they have.

It is argued that the poor have vast wealth, but they are unable to capitalise on it because it is not part of the system of wealth that is recognised by institutional or traditional practices. Thus, they are unable to capture the value of that wealth in access to financial and real resources. The value of looking at how property rights are exercised is identified as much as at how wealth is created in attempting to raise living standards. They require making public services more accountable and more responsive to the needs of all in society and particularly the poor.

Voices of the Poor: A Study To Inform The World Development Report 2000/01 on Poverty and Development shows, for the first time, that 'having a

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2. Sixty-two per cent of US$130 billion is US$80.6 billion. At a debt/equity ratio of 70/30, total investment is US$115 billion. At a ratio of 60/40 it is US$134 billion.


5. Voices of the Poor consists of three books, published by The World Bank, that bring together the experiences of over 60,000 poor women and men. The first, Can Anyone Hear Us?, gathers the voices of over 40,000 poor women and men in 50 countries from The World Bank's participatory poverty assessments. The second book, Crying Out for Change, draws material from a new 23-country comparative study. The final book, From Many Lands, offers regional patterns and country case studies.
sean at the table’ is important, and that participatory
decision systems are more likely to result in the types
of improvement that are most effective in raising
living standards. They require reducing vulnerability
so that unexpected events do not tumble families and
communities back into the poverty they have worked so painstakingly to overcome.

‘Safety nets’ were first heard of in the context of the
dismantling of the Soviet state enterprises during the
ey 1990s and, later, during the ravages of the Asian
financial crisis. Protection against vulnerability is also
important at the family level – protection against
illness or accidents – or for the community, like all-
weather connections that defy periodic interruptions
to economic and social activities from storms or
floods. Protection against catastrophic risk is also
critical, as disasters are a downward trigger into
poverty in the absence of insurance and other risk-
management instruments.

... infrastructure extends beyond physical structures and
municipal services to include social and institutional norms
that help to define the business environment.

Summary

The changing emphasis of the role of infrastructure
emphasises that infrastructure is central to reaching
the social targets that have been set, as it provides the
basic building blocks needed for economic and social
life by providing:

• a way to communicate ideas and a way to
exchange goods and services that enhances
innovation and also allow increased inclusion and
empowerment of individuals and communities
through information connectivity and reduced
geographic isolation;

• expanding economic opportunities and the
possibilities for creating more competitive
enterprises and services, and widening options for
earning income; and

• improving health, quality of education, living
conditions and personal security through
improved hygiene, illumination of homes and
neighbourhoods and safe and reliable transport.

This centrality, which was recognised as early as the
18th century in Adam Smith’s writings, is even truer
with the changes in technology and innovation
faced today.

More importantly, infrastructure extends beyond
physical structures and municipal services to include
social and institutional norms that help to define the
business environment.

The author identifies four aspects of infrastructure
that are necessary to make lasting changes for
economic and social conditions:

• physical infrastructure, to provide the basic fixed
capital for private and commercial activities;

• guaranteed service flows from the physical
infrastructure, ensuring that providers are
responding to effective demand and are doing so
efficiently – a form of social infrastructure;

• business (or commercial) infrastructure that
creates a supportive environment for commercial
activities and investments; and

• financial infrastructure that mobilises domestic
and international investment resources.

Finally, in order to meet the social goals that have
been set, renewed efforts by the following are
needed:

• project developers, to seek long-term market-
building investments, making best use of local
skills and resources;

• governments, to open their economies widely to
the financial discipline and ingenuity of the
private sector;

• international financiers, to see value in the
emerging markets and appropriate risk-reward
opportunities; and

• multilaterals, to help share risks and focus on
improvements that will provide long-term
solutions to reducing inequalities.
Facing the Poverty Challenge — The Role of Infrastructure

a report by
Frannie A Léautier
Chief of Staff, Office of the President, The World Bank Group

The Challenge of Poverty

The Global Development Community is facing a grave challenge that can be summarised as how the environments and lives of the urban and rural poor can be transformed, helping them to build communities and improve their living conditions, strengthen their ability to integrate into a rapidly globalising world and, at the same time, maintaining a sense of community and place. Not only does this challenge need to be met, but it must be to scale and within our lifetime. Despite major gains over the past 25 years, there are still around 1.5 billion extremely poor people, and this number is increasing daily. Inequality is rising in many countries. There are 125 million children out of school — 80 million of which are girls. There are five million infant deaths per year and 22 million people have AIDS in sub-Saharan Africa alone.

This problem is played out in grim reality in the urban centres around the world. Today, over 300 million people live a life of degradation in urban slums without access to most basic services. On a daily basis, slum residents face multiple threats to their health and security. They are excluded from the city’s prosperity and have little voice in the public decisions that control their destiny. Conditions in slums are becoming worse and the slum population in the developing world will double by 2025.

The Role of Infrastructure

What this has to do with infrastructure has provoked much debate in recent years. It has to do with whether infrastructure has a role in poverty reduction. Evidence from various sources ranging from surveys of poor people, theoretical work, empirical studies and project results has uncovered a number of powerful linkages.

A survey of over 40,000 poor men and women in 50 countries on their view of development indicates that they consider infrastructure as important as health and education.1 When The World Bank Group develops Country Assistance Strategies along with its clients, they rank infrastructure as an extremely important element in the process of their development.

Economic theory has identified that physical capital and infrastructure capital are complementary to and can be substituted with human capital and social capital at different stages of development.2 Others have emphasised that, when knowledge economies are considered, there is a lock-in effect of history, and that the starting point matters.3 Economies richly endowed with infrastructure and other physical capital are better able to garner the benefits from knowledge embedded in people and technology.4 Furthermore, countries already endowed with rich infrastructure, as a result of past investment, are better able to benefit from opportunities presented by globalisation and locational advantages or geography.5 Empirical work has demonstrated further inroads on the nature of the linkages between infrastructure, economic growth, inequality and poverty. It has been shown that growth is good for the poor, in particular, it has been found that:

"The income of the poor rises one-for-one with the overall growth of the economy. This general relationship between income of the bottom fifth of the population and per capita GDP holds in a sample of 80 countries covering four decades. Although there is a fair amount of variation around this general relationship, a number of popular views about the poverty-growth relationship are not true. The effect of growth on income of the poor is no different in poor countries than in rich ones."

It is further argued that trade and openness benefit the poor to the same extent that it benefits the whole economy, and therefore, by extension of the argument, that globalisation is good for the poor.

Other analyses indicate that globalisation reduces the number of absolute poor and also decreases income inequality. They also indicate that the complementary role of infrastructure to human capital is critical for balanced growth. More detailed empirical work argues that there is an impact of infrastructure on productivity, but it depends on industry type, location and starting point of infrastructure endowment. Others show that there is an impact of infrastructure on productivity and growth in the manufacturing sector, and slight positive impact of infrastructure on income distribution.

However, there are also a number of empirical findings that caution against this positive impact of infrastructure on poverty reduction and on economic growth. The first cautionary result is that the benefits of infrastructure depend on the level of wealth a country has achieved. Middle-income countries get very high returns from infrastructure compared with low-income countries, where priorities are numerous, and infrastructure is only one of many needed inputs to development.

The second reason is that the cost of infrastructure is high in low-income countries, which are also the countries that need to have the infrastructure. Costs are high because of the need to import technology and know-how, as well as the network effects, since fewer people can afford to connect to the networks of water, electricity and roads, making the cost per unit of stock much higher when compared with that of higher-income countries.

Table 1: Burden of Disease Attributable to Lack of Water and Sanitation

<table>
<thead>
<tr>
<th>Disease</th>
<th>Burden of disease (000 disability-adjusted life years (DALYs))</th>
<th>Distribution of % burden of disease attribution to poor water and sanitation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rural</td>
<td>Urban</td>
</tr>
<tr>
<td>Diarrhoeal diseases</td>
<td>1,024</td>
<td>184</td>
</tr>
<tr>
<td>Polio</td>
<td>76</td>
<td>21</td>
</tr>
<tr>
<td>Hepatitis</td>
<td>137</td>
<td>15</td>
</tr>
<tr>
<td>Filariasis</td>
<td>28</td>
<td>12</td>
</tr>
<tr>
<td>Trachoma</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>Intestinal helminths</td>
<td>117</td>
<td>34</td>
</tr>
<tr>
<td>Protein energy malnutrition</td>
<td>312</td>
<td>62</td>
</tr>
<tr>
<td>H. pylori (peptic ulcers)</td>
<td>70</td>
<td>24</td>
</tr>
<tr>
<td>Other digestive disorders</td>
<td>70</td>
<td>48</td>
</tr>
</tbody>
</table>

Distribution of percentage of burden of disease by sector, attributable to poor water and sanitation (percentiles)

<table>
<thead>
<tr>
<th>Sector</th>
<th>10th</th>
<th>50th</th>
<th>90th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>8.2%</td>
<td>8.7%</td>
<td>9.2%</td>
</tr>
<tr>
<td>Rural households</td>
<td>8.6%</td>
<td>9.1%</td>
<td>9.6%</td>
</tr>
<tr>
<td>Urban households</td>
<td>6.8%</td>
<td>7.2%</td>
<td>7.6%</td>
</tr>
</tbody>
</table>


Table 2: Differing Strategies and Ability to Attract Private Capital

<table>
<thead>
<tr>
<th>Change in... private investment as a % of fixed investment 1980-1997</th>
<th>decentralisation as a % of spending 1980-1997</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>8.3</td>
<td>-3.0</td>
</tr>
<tr>
<td>Brazil</td>
<td>-1.1</td>
<td>1.2</td>
</tr>
<tr>
<td>Canada</td>
<td>-1.1</td>
<td>-9.3</td>
</tr>
<tr>
<td>Costa Rica</td>
<td>18.6</td>
<td>-0.2</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>14.6</td>
<td>1.0</td>
</tr>
<tr>
<td>Guatemala</td>
<td>16.6</td>
<td>0.2</td>
</tr>
<tr>
<td>India</td>
<td>17.1</td>
<td>2.2</td>
</tr>
<tr>
<td>Kenya</td>
<td>7.1</td>
<td>-0.9</td>
</tr>
<tr>
<td>Malaysia</td>
<td>10.3</td>
<td>-1.1</td>
</tr>
<tr>
<td>Mexico</td>
<td>24.5</td>
<td>8.3</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>1.2</td>
<td>-2.9</td>
</tr>
<tr>
<td>New Zealand</td>
<td>18.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Paraguay</td>
<td>-3.1</td>
<td>0.7</td>
</tr>
<tr>
<td>Peru</td>
<td>9.1</td>
<td>14.6</td>
</tr>
<tr>
<td>South Africa</td>
<td>22.0</td>
<td>29.1</td>
</tr>
<tr>
<td>Thailand</td>
<td>-0.5</td>
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<tr>
<td>United Kingdom</td>
<td>17.0</td>
<td>-2.0</td>
</tr>
<tr>
<td>United States</td>
<td>-0.6</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Source: World Development Indicators (1999);

- poverty and growth are negatively correlated from a regression over 10 years in 63 countries;
- overall long-term growth over a 10-year period is significantly larger than that of shorter periods; and
- reduction in poverty can come from growth or an improvement in the social sectors, or both.

Other results, taken at the project level, are also quite striking. For example, transport projects in Morocco and Bhutan have shown that there is a positive link between transport and the enrolment of girls in primary school, a completely unintended effect.

Infrastructure and Poverty

The discovery of these positive but unintended consequences, coupled with the urgency of finding scalable solutions to reduce poverty at the global scale, has resulted in a rethinking of the linkages between infrastructure and poverty. New thinking at The World Bank in the context of the work that is being done to help countries prepare Poverty Reduction Strategies® has resulted in a typology that links infrastructure services to impacts on poverty reduction.

Using the energy sector as an example, one can find that improving the quantity, quality and reliability of energy services to a community or a city can lead to economic growth, job creation and increased productivity. These benefits map into higher income

for the poor and enhances their capabilities (see Figure 1).

Expanded access to modern energy services can help small-scale enterprises that cannot afford back-up generators for unreliable/unavailable electricity. This is also critical for poor households, as poor power quality reduces the lifetime of electricity appliances, and the poor cannot afford repair costs. With respect to the health dimension of capability, it has been observed that no access to modern fuels leads to low labour participation rates for women, high indoor air pollution and a high rate of child mortality.

Considering the ability of the poor to participate in the benefits of globalisation and the knowledge economy, it is expected that access to electricity improves access to information and opportunities to study, which consequently results in higher educational achievements. Similar linkages can be made with respect to water and sanitation, as well as transport and other infrastructure services (see Figure 2).

**Empirical Evidence of Expanded Linkages**

The new thinking at The World Bank is bolstered by empirical results. For example, a provocatively titled study conducted in 2000 found that environmental health is, to a large extent, a child and maternal health issue. In particular, the prevalence of health risks caused by the lack of access to infrastructure services makes environmental health a poverty-related issue. This study found that the distribution of the burden of environmental health cannot be simply explained by income levels or the level of a particular service. Thus, environmental health adds another important dimension to the multi-faceted nature of poverty, and needs to be integrated better into poverty-reduction strategies.¹⁴

Traditional environmental risks at household and community levels, such as the lack of access to protected water and sanitation, and indoor air pollution due to the use of biomass fuels, are responsible for the majority of illnesses and premature deaths related to environmental causes (see Table 1).

According to the study, the death of young children under the age of five, primarily in rural areas, is the largest component of the burden of disease due to unhealthy household environments. The next most vulnerable group includes rural women who are particularly affected by exposure to smoke from dirty cooking fuels, and by unsafe water and poor sanitation.¹⁵

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Housing and the Poor —
What Has Been Learned and What Can Be Done

a report by
Thakoor Persaud

Senior Economist, Finance, Private Sector and Infrastructure Department,
Latin America and the Caribbean Region, The World Bank

As indicated by several publications on this topic, poverty appears easier to recognize than to define. Most recent definitions have focused on feelings of insecurity, powerlessness and marginalisation, together with insufficiency of assets, savings and income, and low purchasing power and lack of access to basic necessities.

While some see insecurity, powerlessness, marginalisation and similar features as separate poverty indicators, it may be that these are consequences of the low income and purchasing power of the poor, and that they would be most likely easier to address through a focus on income improvement rather than as separate issues. In a similar vein, increasing asset associating poverty with such issues as human rights, women’s rights and indigenous rights, while important, could complicate the debate and weaken focus on the key area of income insufficiency. A more important area of focus for these groups could be income distribution issues. There are indications that greater distributional inequality is generally associated with higher levels of dissatisfaction, violence and polarisation.

Where the Poor Live
and Why They Live There

Poor people live in the areas in which they perceive that they can maximise the overall benefits of the money they spend at their income level and on their preferred consumption ‘baskets’, e.g., food, shelter and municipal services. There may be a related issue regarding the degree to which the poor select the area in which they live and to what degree this is decided for them as a result of their poverty and circumstances. It should be noted that, at some point, and to a certain degree, all income groups face some type of constraint, although those constraints facing the poor may be relatively much more.

The poor receive poor services due to low purchasing power (demand side) and poor quality of goods and services offered (supply side). While non-poor areas may have relatively better goods and services available, in most less-developed countries (LDCs), there is generally an overall low quality. In many cases, supply factors better explain the poor quality of goods and services.

Poverty Alleviation

As the most recent World Development Report shows, poverty alleviation is high on the agenda of The World Bank, donors and governments. Many efforts are being made to address poverty issues. However, indications are that there is need for a clearer vision on the type of intervention needed, the real cost and benefit of such intervention, its sustainability, where it should be focused and how it is to be implemented. Apart from deciding whether the focus should be on demand or supply issues and constraints (or both), there is also the element of the timeframe, where at least three time-horizon periods can be identified: short-term, medium-term and long-term.

Equity, transparency, sustainability and replicability should be among the key features of any viable poverty reduction initiative. For the long term, a focus on the demand side to increase income level and distribution may be the most logical and desirable option. Along with growth, this means, among other things, a focus on the main determinants of earning capacity, e.g., education and skills, employment opportunities, health, age, sex, assets. On the supply side, the long-term focus should be to help improve product and service quality, production efficiency and related actions aimed at providing more quality output at lower cost, with improved reliability and choices.

With increased income on a sustainable basis, households will generally improve their purchasing power (by moving to different areas offering better baskets, for example, stay and spend more, buy better quality products, etc.) with greater empowerment and less feeling of insecurity and helplessness, assuming that parallel institutional and related changes occur.

Short-term and medium-term approaches of donors/ lenders and governments have generally focused on
Group BES a Leading Player in Project Finance

BES Investimento's Project Finance Division is responsible for the Advisory, Arranging, Underwriting and Lending activities of both BES Investimento and Banco Espírito Santo.

Advisory

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Project Finance Division

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ways of augmenting the purchasing power of select target groups for specific consumption items (both public and private goods) that are deemed to be priority ones— for example, in nutrition and health programmes, social safety nets and social investment funds. Strategies for interlinking and transitioning among short-term, medium-term and long-term approaches, with all of the necessary complementary actions for sustained income enhancement initiatives, have generally not been clear at many levels among donors, lenders, borrowers and other players.

The private formal housing market in most LDCs is thin and suffers from many institutional, financial, legal, normative and related constraints. Consumers that enter such formal markets are generally among the upper-income groups with access to credit or having their own resources to finance their purchases. Due to previously mentioned constraints, the cost of the solutions they buy is usually much higher and the quality generally lesser than similar solutions provided under less constrained conditions. Partly as a result of supply-side, as well as purchasing power constraints on formal housing, private informal housing usually accounts for a majority of the solutions built. These usually include some high-quality units, along with a large number of low-cost, poorly constructed units located in vulnerable or less-desirable zones. One typical characteristic of most informal units is the gradual improvement and modifications they undergo over time, reflecting the concept of housing as a socioeconomic process rather than a finished product.

The importance of self-help and microemployment activities to help improve income levels and finance a continuation of the consolidation process is also a key element.

Housing

At any given income level, families make decisions on what to spend on food, shelter, transport, education, utilities, health, clothing and other necessities. For the poor, food, shelter and transport generally account for most of their household expenditures. From the point of view of residents, housing is important because, apart from the size of expenditures, there are many associated sociocultural and economic factors.

Among these factors are the uniqueness of housing for protection, as a centre of family and community life, health and social wellbeing, a source of employment and a store of value. The latter two characteristics have been very important during periods of high inflation and uncertainty. In the absence of easy access to the formal banking system, housing has been used as a store of wealth and to help finance other household and income-earning activities.

The social security role of housing for many owners, particularly the poor, is also an important one. From a more macroeconomic point of view, housing comprises one of the most important categories of a nation’s stock of wealth. It can also be a key component of the construction sector, generating direct and indirect employment at various levels. Overall, while it can be viewed as a private good, housing generates high positive externalities.

It is worth repeating that the best way to encourage improvement in consumption level for the poor is to improve their income on the demand side and to ensure that the supply of basic items is being provided efficiently under competitive conditions.

What Has Been Learned

So far, most interventions in public housing programmes have generally had the impact of augmenting shelter consumption with little or no associated linkages to changes on the income side. Additionally, to a large degree, these programmes do not address several key supply constraints that keep most private-sector housing suppliers and financiers away from the market and prevent efficient market-supply conditions, e.g., possible quality improvement and lower prices. In several ways, by focusing on new housing programmes and ignoring or neglecting such issues as reform of the land titling and mortgage finance systems, public programmes prevent most existing homeowners, especially the poor, from enjoying the full commercial benefit of their assets.

Moreover, these public programmes provide completed units that invariably cost more than comparable units built by the private sector. In terms of economic impact and cost efficiency, while traditional public housing programmes have generally created some employment, these are usually minimal and temporary and they do not have the strong...
multiplier effect that is usually associated with such activities. For most beneficiaries, the ratio of the new unit cost to beneficiary income compared with the ratio of their prior unit cost (ownership or rental) to their income generally shows the former to be much higher. This has been a significant explanatory factor for many high-turnover problems observed in public housing programmes.

After decades of efforts, most governments now admit that the goal of adequately providing for all qualified needy groups through traditional housing programmes is not sustainable for several reasons. Among the chief reasons are the large and growing number of applicants, the high programme cost and its adverse impact on the budget. Consequently, many have sought new approaches for addressing shelter needs. Unfortunately, even with the experience of past problems, there are still apparently several misconceptions about what is needed to develop a viable shelter programme and, while most of the old-style national housing banks and public housing programmes have disappeared, they are being replaced by similarly unworkable upfront subsidy entities and programmes.

By incorporating various forms of saving incentives, the new approach of explicit subsidies tries to avoid exclusive focus on the large and selective increase of housing consumption on the demand side alone. However, while they are now packaged as income-augmenting programmes that have some relation to the savings of recipients, beneficiaries are still required to spend the subsidy received on land and building, and not on any other high-priority areas the beneficiary may have.

A problem with most of the past housing investment programmes has been their efforts to selectively change household expenditure patterns without considering that they are derived from specific income and preference levels. Other things being equal, such interventions invariably lead to consumers trying to rebalance their basket of goods over time, the end result being efforts to sell or trade part of the housing windfall, generally at steep discounts, in order to re-establish their overall consumption-preference ratios. This is one explanation for the relatively high turnover of ownership (informal sales and rental) in many public housing operations, notwithstanding efforts by the authorities to block such sales by insisting on first-buyback options or no-sale clauses.

In several instances, selectively increasing housing consumption with no sustained income increase can push a family into a worse economic condition if, for example, the recipient cannot or does not wish to sell the unit but, at the same time, cannot afford the incremental operation and maintenance costs. A related issue here is that, when beneficiaries acquire units under public or private sector formal programmes, many of them may face several additional expenses they were not formerly incurring, either because they had no previous service connections or because such connections were clandestine. Even titling, which is desirable and beneficial in many ways, can add new tax liability for owners after municipalities update their cadastre and tax-collection system.

An important lesson is that, if the absolute poverty level encompasses, for example, the lowest 20% of households, who cannot afford to satisfy their nutrition needs even if they use all of their income for food, any programme aimed at improving their housing position has to be either provided free of charge or with an additional income source for them to meet the incremental housing costs. Failing such actions, they would have to consume less in order to meet additional housing costs.

A common error in many public housing programmes has been the way in which, perhaps for political expediency, social welfare issues have been intertwined with public-sector housing programmes. This has invariably resulted in great difficulty in trying to reconcile cost recovery, replicability and sustainability goals on one hand with that of assisting the poorest strata of the population on the other. This also makes it almost impossible to resolve ‘willingness to pay’ and ‘ability to pay’ issues, and it creates several targeting problems and distortions. In order to demonstrate their commitment to the poor, many countries have had constitutional or other legal requirements mandating high and uniform norms and quality standards in shelter programmes, service quality, access, etc., for public entities, without apparently analysing several associated affordability and investment cost issues. Even in cases where no such constitutional mandates exist, policymakers generally insist on such high and uniform norms and standards.

**What Can Be Done?**

The experience of the last three decades shows that a new approach is needed to help address housing policy issues. Many of the elements of the required new approach are already incorporated in the policy paper, *HOUSING: Enabling Markets to Work,* ("the policy paper") where the primary focus is on addressing supply-side constraints through proposals for improving the institutional, administrative, legal, financial and related framework.

Whatever form the new approach takes, it should take the assumption that housing and other basic needs deficiencies are largely an income and poverty problem – people do not have adequate housing units, food, services, etc., because they are poor. The long-term solution to these problems is to assist all affected families in improving their income level, rather than trying to selectively and temporarily assist only some members from an equally disadvantaged group, leaving the majority with no assistance. Apart from equity and sustainability issues associated with such actions, there is also the problem of trying to prevent such favoured groups from attempting to transform all or part of their ‘windfall’ to finance other priority needs.

In order to develop a workable new approach, borrowers, lenders and donors have to explicitly identify and address social welfare issues, separating these from other housing policy issues. It should be clarified that this is not a call for ignoring vulnerable low-income groups; rather, it is a proposal for clearer identification of such groups along with transparent and viable social welfare assistance policies and programmes for addressing the needs of these vulnerable groups on a consistent, equitable and sustainable basis. Perhaps because this is such a politically and socially complicated and costly issue to address most governments seem unwilling or unable to take the necessary action.

The focus on supply-side constraints and proposals for improving institutional, administrative, legal, financial and related frameworks should be a key medium and long-term strategy in any new housing policy initiative since, as explained in the policy paper, it affects all household income groups in various ways and provides the only sustainable path for sector development. For example, for the upper-income deciles, legal reform of foreclosure laws, mortgage lending conditions, rent control and related laws could encourage more private-sector participation. Some form of concessionary assistance to create and develop private-sector interest, e.g., greater mortgage financing for middle-income groups could be done as long as there are clear and measurable goals, clear timeframes and exit strategies. For low-income groups, simplified land titling procedures and systems, revised building codes and similar actions could help reduce land and construction costs and increase access.

The policy paper does not argue against assistance, including subsidies, for targeted groups if these can be justified and sustained; however, because the primary emphasis has been on policy and related sector intervention, it is sometimes felt that an important component on project-level intervention has not been given enough attention. For the poorest and most vulnerable groups (those among the lowest two to three deciles in income distribution), social welfare mechanisms should be put in place as their first line of support. The macroeconomic/budgetary implications of this may require such assistance to be offered only to those households most in need, while more creative low-cost options (such as incentives for room rentals by the relatively wealthier residents and community-based mutual assistance groups) are considered.

The largest asset base of most poor is their unskilled labour. By the process of elimination, if the poor have few other assets and low short-term prospects for obtaining additional resources (income or grants), they would have to begin using their labour or ‘sweat’ equity if they want to improve their housing or other consumption item. It may be argued that the poor are already using their labour to earn a living (mostly in the informal sector), and any additional demand from them would be unrealistic. If this is so, and there are no sustainable ways of augmenting their income or purchasing capacity, then the situation becomes bleak. There is ample evidence, however, that with appropriately leveraged assistance from such groups as non-governmental organisations (NGOs) and congressional budget offices, most residents, except for specific vulnerable groups, are willing to put some sweat equity into improving their own living conditions.

With the exception of those countries with significant open homelessness, most people have housing units, although these may suffer from several deficiencies, e.g., poor quality material and workmanship, unclear or no titles, location in distant areas, poor access to basic services, overcrowding and vulnerability to disasters. Beginning with the premise that people live somewhere, although the area or unit in which they live may not be ideal, the proposal is to focus not on an abstract ideal of ‘dignified’ housing costing a multiple of their income or the value of their current dwelling but on looking more realistically at what households now have, and to undertake to improve their existing units, or helping them to acquire new space, ensuring that these would in no case be worse than what they currently have.

For the significant number who live in overcrowded units or in hazardous areas, the goal should be to help them to find basic starter units that do not drastically distort housing as a share of their expenditures and would provide them with an opportunity to consolidate their units at the pace that their budgets would allow. Similarly, for basic services such as water, while the long-term goal may be to provide each family with in-house service, the short-term strategy, from an affordability and sustainability
standpoint, may be no more than ensuring that the water currently provided by private vendors is clean, reliable and reasonably priced. We need to work more with such non-traditional suppliers as water vendors and help them to improve their service and move into the formal sector over time.

Apart from the most vulnerable groups, the needs of which should be addressed under appropriately formulated social programmes, the goal of providing a shelter solution and level of service commensurate with a person's income is important for many reasons. First, it reduces the temptation for that person to try to dispose of the asset to rebalance expenditures since the value of the improvement is not substantial in the short term. Second, it is an extremely low-cost approach that does not have many of the 'lumpy' outlays as those for new housing and infrastructure investments under public programmes. Third, it can be done with sweat equity being a core input, leveraged in line with family needs and customs and depending on the circumstances of the beneficiary. Also, its impact on the national budget should be significantly smaller than new investment programmes. It is also a sustainable alternative.

With the above framework, dialogue on the enabling environment between The World Bank and individual countries can continue. At the same time, for the relatively poor, i.e. those above the extreme poverty line, who need shelter assistance, the options would primarily be among urban upgrading, urbanised lots and core units. Those above the fifth decile in household income level may need some assistance to encourage private-sector mortgage and related services. Assistance for home improvement would also be important for many income groups.

Even with this proposed approach, subsidies will not be eliminated. Instead, such subsidies would be used to reinforce some of the key policy reform measures. For example, given the importance of title for home consolidation, it may be extremely cost effective to offer to subsidise, for example, 70% to 80% of the title cost for qualified poor residents. Parenthetically, this assumes that the government would also be ensuring that the titling system is reformed appropriately so that it facilitates ease of titling, system updates, reliability, etc.

Similarly, if there is a programme promoting urbanised lots or core units, it is expected that there would have been a review of the appropriate building norms and standards, codes, etc., so that overdesign, review and approval and related bottlenecks are eliminated and the system encourages code compliance. Several variations of matching grants and subsidies can be offered as incentives to leverage such activities as community participation, home improvement, maintenance, private mortgage financing and related initiatives. In this way, the national authorities can determine on an annual basis what resources they have for subsidies and can then set priority areas for the period in question. In those instances where there are public lands or assets that are not being used, instead of using these directly in shelter programmes, the assets could be sold and the proceeds used to complement the subsidy programme, providing greater site flexibility.

The importance of a broad-based development approach is important in any effort to aid the poor. This means that, apart from providing incentives and helping the poor to improve their shelter facilities, there should be strong efforts to facilitate a variety of self-employment and microenterprise opportunities, education, health and related community services. The role of the communities and NGOs in these initiatives should be an integral one, with almost equal emphasis being placed on maintenance and sustainability factors as in the initial capital investment.

As noted in this article, there has been an inherent internal inconsistency in most of the attempts being made so far by donors, lenders, governments and other actors to address shelter problems in LDCs in a sustainable and replicable manner. In focusing on increased shelter consumption without commensurate changes on the income side, expenditure patterns are distorted, the budget burden increases and demand for new units grows. In many countries, social welfare issues have been intertwined with public-sector housing programmes, the result being great difficulty in reconciling cost recovery, replicability and sustainability goals on the one hand with that of assisting the poorest strata of the population on the other. Under such conditions, it becomes almost impossible to sort out willingness-to-pay and ability-to-pay issues and it creates several targeting problems and distortions.

By adopting policies aimed at improving the existing housing stock, along with selective low-cost intervention such as land titling, home improvement, serviced sites, appropriate technology services and core units, and addressing supply-side constraints through proposals for improving the institutional, administrative, legal, financial and related framework, a more viable path could emerge. The importance of self-help and microemployment activities to help improve income levels and finance a continuation of the consolidation process is also a key element. Judicious use of subsidies and similar incentives to encourage and leverage desirable private sector participation is another important element in the process.
Utility Reform — Regulating Quality Standards to Improve Access for the Poor

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Privatisation of infrastructure services is often followed by stricter enforcement of quality standards, which pushes up costs, with no positive effect on the exclusion of the poor. The poor could get easier access to service if the main provider was permitted to deviate from this uniform standard, offering poorer consumers a service in which an acceptable relaxation in quality led to a lower price. This article reviews the legal and technical challenges for quality diversification by utilities, and early results from efforts by some to diversify.

An important reason for reforming or privatising public providers of infrastructure services is the need to improve the efficiency and quality of service. When private participation is introduced, the tendency of governments is to focus on the service provided by the main utility and set high quality standards for the sector as a whole.

Private participation also goes hand-in-hand with setting up independent regulatory agencies. These agencies have better capacity for monitoring and enforcing quality arrangements than the government bodies previously in charge. As a result, governments tend to become tougher on standards following utility privatisation and the costs of quality usually go up (even if the quality standards set by law have not been modified).

Quality standards, defined in law or the private provider’s contract, can cover production (resource management), product and service delivery (chemical and biological, continuity) and customer relations (flexibility in payment methods). These quality targets for private provision can be set through a variety of legal instruments. The choice of instrument depends on the frequency with which the standard will need to be changed and the number of parties involved in agreeing changes to the standard, among other things.

Health, security and environmental requirements (such as the regulation of drinking-water quality standards, or the quality of sewage discharges) have a significant impact on mortality and morbidity and on the utility’s costs, and should preferably have foundations in primary legislation. The process for modifying laws is usually more complex and difficult than for secondary legislation or bilateral contracts. If consumers and third parties see laws protecting their interests, they will be more likely to accept the private participation as legitimate. If the provider is satisfied that these rules are not going to be modified overnight and that it would be duly consulted in the process for modifying them, this can lower its perception of risk and ultimately reduce the cost of service through a lower cost of capital.

For standards requiring greater flexibility, regulations (founded in laws) that can be more easily amended by the regulatory agency might be more appropriate. Less fundamental aspects of quality, which may need to be changed frequently (for instance, when pricing conditions are reviewed), are better expressed in contractual clauses (for example, customer service standards, such as the delays for responding to an enquiry by mail or by telephone).

High Quality Standards

There are three main reasons why quality standards tend to be set high for main utility providers in developing countries. First, such providers have often inherited operating structures and tariffs from large-scale operations not used to considering low-cost options or alternative provisions at the community level. The culture in such large organisations is often to derive 'professional pride' from top-quality uniform service, not from bold innovations in low-cost alternatives.

Second, investment designs are often based on developed countries’ standards. Quality standards are often driven by engineering specifications, such as standards for the installation of electrical wiring in houses or the minimum depth for pipes beneath roads. Usually, these engineering norms were designed in developed countries and, in the absence of anything more relevant, exported unchanged to the regulatory handbooks in developing countries. The expectations of the elite in developing countries also push towards the adoption of developed countries’ standards of service. While lower-cost alternatives do exist in developed countries, they are
no longer the norm and are not necessarily considered when setting standards in developing countries. For example, in-house septic tanks are often still in use in rural areas in France and the US.

Third, large private utility providers tend to focus on high-margin customers and often have no financial incentive to develop low-cost provisions. They have generally entered the market through international tender processes to carry out large-scale investments. In some utility markets, however, the optimal scale of production has declined and even main providers now consider small-scale low-cost alternatives far more seriously.

**Practical Challenges for Diversification**

High standards of quality result in higher costs, limiting access to the service for the poor. Regulators could make services more accessible, if they allow diversification of quality, making it legal for other providers to offer poorer consumers a service in which acceptable reductions in quality reduced the price. One way to achieve this diversity is to end the main provider’s monopoly, permitting alternative providers to meet the needs of poorer consumers at a lower price. Another is to permit the main provider to diversify its quality, especially if network supply remains cheaper in the long term than decentralised supply. Electricity supplied through a network, for example, is potentially of much higher quality than electricity from solar panels or diesel generators. Networks’ economies of scale and scope make their prices likely to be lower in the long run.

However, there will sometimes be technical limits to quality diversification. For infrastructure services that tend to be jointly consumed (such as water or grid electricity), it can be technically difficult to vary the quality of service for different social groups or service areas. **Figure 1** illustrates a main production plant feeding into the network for the whole of the urban centre. Some poor areas (A) are fed from this main network, so quality characteristics such as voltage consistency or drinking-water quality cannot be differentiated easily for these peripheries. Only characteristics such as reliable hours of service, payment methods or customer services could be differentiated for these areas. For other areas (B) that are supplied by other plants (which might belong to the main provider or alternative providers), quality of supply could be more extensively varied.

Another difficulty is that cost differences driven by quality differences might be difficult to reflect in tariff terms. If quality differentiation affects the level of initial capital costs, it can be relatively easy to relate quality differences to tariffs by varying the connection charge. However, if quality variations lead to differences in marginal production costs, these might be more difficult to reflect by varying the volumetric charge. In some cases, variations in the quality of service provided through the network are likely to have a relatively small impact on operating costs, and the administrative cost of reflecting these cost differences in tariffs might be higher than the savings. For example, if lower quality means restricted supply hours, sophisticated meters would need to be installed so that consumers could be charged different prices at different times of the day.

In addition to this, identifying the target group for lower-quality, lower-cost service might prove difficult. There is little socio-economic data in most customer registers. Poor customers may sometimes live in well-defined areas as in **Figure 1**, but they are often mixed with rich customers within the same administrative unit. As in the allocation of subsidies, the important issue then becomes delivering the lower price (and the associated lower quality) to the element of the population that is most in need.

**Some Efforts to Diversify Quality**

Despite these difficulties, some main providers have varied service quality in an attempt to make their services more affordable for poor customers. This diversification has taken several forms – the provision of more flexible customer-service arrangements or the use of low-cost technologies to reduce the cost of service, at the expense of quality. Consumers have also agreed to receive the service during a reduced number of hours each day in exchange for a

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Cheaper is Not Always Better

According to a report by ESMAP (the Energy Sector Management Assistance Programme), managed by The World Bank, the costs of labour and materials for building a three-phase line can be cut from between US$8,000 and US$10,000 per kilometre, to US$5,000 per kilometre (and to US$4,000 per kilometre for single-phase lines) by using higher voltage and higher-quality poles to reduce life-cycle costs, and properly sizing and placing transformers. Single-phase lines are often sufficient to carry the type of loads used in rural areas, and are more suited to business uses than alternatives to network supply, such as solar or diesel generation. However, the study emphasises that not all construction savings are necessarily efficient: “An initially inexpensive line that needs frequent maintenance, overhauling, and upgrading can require considerably greater investment during its lifespan than a line that has been adequately designed from the outset.”

In some cases, diversification of quality has required entering into agreements with alternative providers or community organisations that tend to be more specialised in the delivery of low-cost services. For example, Aguas Argentinias, the concessionaire of water and sanitation services in Buenos Aires, worked in partnership with a low-income community, a non-governmental organisation and local government when taking over the low-cost system in the Barrio San Jorge. In this district, the community had experimentally developed a double system of water provision – one system connected to the existing network to provide small volumes of potable water, and another that can draw on groundwater sources, too salty for drinking but sufficient for washing and bathing. The sewerage system was based on a combination of cesspits within each household and a small-bore pipe network. Aguas Argentinias took over the operation, maintenance, and repair of the system and the residents pay a fixed rate for these services.

The company has since introduced the low-cost sewerage system to other poor areas of the city. The double water system, however, proved too expensive to develop and did not go beyond the experimental stage. To increase the network expansion rate, Aguas Argentinias also takes over networks built by communities at lower costs (but respecting the minimum quality standards) in exchange for which customers receive a discount on the price of the service.

Interesting cases of collaboration between the main providers and small-scale entrepreneurs have emerged in the telecoms sector through the development of public telephone booths. In Senegal, for example, small private operators run telecentres and rent lines from Société Nationale des Télécommunications du Sénégal (SONATEL), the national operator, which was privatised in 1998. These telecentres have grown very quickly, and produce about four times more revenue per line than individual lines run by SONATEL.

Conclusion

To increase access for the poor, the regulator of service quality should allow the main provider to diversify the quality of service, and should also allow alternative providers to operate. It should be left to the consumer to decide whether to accept the lower-quality service from the main provider. When regulating service quality for the main provider (privatised or not), governments should allow the delivery of different quality levels to different customer groups, to be identified on objective criteria and enforced. This would help with the problem of undersupply or oversupply of quality. This possibility should be explicitly allowed in the contract, so that penalties are not unically paid for sub-standard quality. Flexible payment options should also be explicitly allowed, such as the capacity to spread payment of the connection charge over a number of years. Main utility providers should also be encouraged to work with alternative providers in order to combine service options. If individual choice is difficult and costly to organise (for example, for service characteristics that are jointly consumed), ways of identifying group preferences should be defined in order to vary service quality at the level of well-identified groups. Several methods for measuring group taste can be considered – the transfer of experiences from other locations, deliberate experiments (for instance, voluntarily varying the quality of service in a number of locations and measuring relative customer satisfaction), group and community consultations and survey studies.

Infrastructure Delivery, Poverty Alleviation and Related Problems

a report by

Middleton Nyoni

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Infrastructure Defined

‘Infrastructure’ is defined by Webster's New Collegiate Dictionary as “the underlying foundation or basic framework (as of a system or organisation)”. Elsewhere, it has been defined as “the system which supports the operation of an organisation”. In developed countries, the term could well relate to air, road and rail networks, water supply systems, communications networks, education and health delivery systems and more. However, in the Zimbabwean local government's vocabulary, more often than not, the term ‘infrastructure’ refers to water storage, delivery, purification and reticulation systems, sewage treatment and disposal networks, road networks, public lighting and refuse removal and disposal systems. All other above-ground development or construction is usually referred to as ‘superstructure’, for example buildings such as schools, houses, clinics and community halls.

The rather restricted definition of infrastructure also results from the fact that, in Zimbabwe, urban local authorities are not responsible for rail, air and communications networks. However, given the inseparable benefits in the alleviation of poverty arising from superstructure, it has been considered appropriate to treat it as an extension of infrastructure. For the purposes of this article, therefore, any reference to infrastructure shall be deemed to include superstructure as explained above.

Infrastructure Benefits

It goes without saying that the construction, or putting in place, of infrastructure is a source of employment. In Zimbabwe, the contribution of infrastructure delivery to employment is so significant that it has meaningfully supported the construction industry.

According to June 2000 figures, an average of some 67,600 employees with earnings of US$689.6 million were employed in the construction industry in December 1999. Some of the jobs included the digging of trenches, laying of pipes and clearing and construction of roads, as well as actual building. Further jobs have been created for the actual operation of the assets constructed. These have included the operation of water and sewerage works and pump-stations, the running of schools, clinics and community centres and the operation of workshops for the maintenance of roadworks and public lighting. Employment during and after the construction period leads to poverty alleviation for those directly involved.

Road Network

The existence of a good road network not only facilitates the smooth movement of people and goods, but also creates opportunities for business. For the small enterprising businessperson, the presence of roads has led to thriving transportation businesses. These range from commuter omnibuses to street vendors’ barrows, which have gained popularity as a cheap means of moving vegetables and other small items in the informal business sector. A sizeable number of people depend on these activities for their livelihood.

Water Delivery System

The delivery of clean water has assisted in the control of waterborne diseases and the conveyancing of sewer to disposal sites. In addition, for most residents, the presence of water means cultivation of a small vegetable patch from which survival is possible. The need for abundant water supplies is one reason why the City of Bulawayo (“the City”) has always directed its efforts at increasing the amount of water available for its residents. In fact, the City also runs a social welfare programme whereby it allocates some open spaces serviced by standpipes for vegetable gardening by the underprivileged members of the community. Through these programmes, some of the beneficiaries have managed to ward off extreme poverty by catering for their basic requirements.

Schools, Clinics and other Community Centres

The provision of primary education at urban local authority schools provides an important base for further education for some, and basic literacy for
those who leave school prematurely in order to take up jobs or start their own small businesses.

An effective primary healthcare system offered by the local authority clinics provides benefits in that clogging of the referral hospitals that should deal with more serious cases has been alleviated.

**Problems Arising from Infrastructure Failure and Backlogs**

A good understanding of infrastructure delivery could well be facilitated by consideration of the forces that drive its provision. The basic reason for infrastructure delivery is need. For the City, delivery of infrastructure has been demand-driven with guided implementation. This demand has arisen from two sources:

- the rural-to-urban migration as people drift into the City in search of jobs or some other opportunity of making a living; and
- the increase in the population at the rate of 4% per annum.

Unfortunately for the City, the infrastructure in place is not only old, but is also inadequate to take the pressure from the additional load. Worst affected are the water and sewerage systems, where the frequency of water and sewer faults has been a cause for concern. The faults have inconvenienced some sections of the City either by depriving them of water supplies while the problem is being attended to, or by being a source of intolerable smells and a possible health hazard. By way of illustration, throughout 1999, burst water pipes numbered 335, while 15,298 choked sewers required attention. Other problems resulting from the infrastructure backlog are outlined below.

**Housing Needs**

Due mainly to the rural-to-urban migration, the waiting list of those in need of accommodation has increased to about 27,000. Most of these are presently lodging in other people's premises. In fact, lodgers only in the high-density areas are estimated at slightly more than 10% of the population in those areas, which is approximately 690,000. Apart from the City's inability to provide serviced stands and houses at a fast pace, the unpalatable economic situation has put paid to a lot of these people's hopes of ever owning accommodation of their own.

**Financing Local Government in an Uncertain Environment**

While the local authority is grappling with the problems outlined above, it is doing so in a most uncertain economic environment. The environment is characterised by high inflation, an unpredictable interest-rate regime and serious foreign currency shortages.

The latter has led to periodic shortages of fuel, the price of which has been increased several times within a short period. The increases in the prices of inputs, coupled with the prohibitive interest rates ruling to December 2000, have brought about the restructuring of a number of companies that have been forced to reduce both their production and workforce. Companies have either relocated from the City, liquidated or are on the verge of liquidation, which would leave scores of people unemployed. The obvious result is an increase in the numbers of the urban underprivileged. The City has also witnessed an increase in debtors as increasing numbers of consumers are experiencing difficulties in paying for services.

**Financing Recurrent Operations**

Due to the shortage of money, the City has had to rely frequently on overdraft facilities and credit lines offered by its financial partners. This has only been possible because of the its 1999 credit rating of BBB-.

However, the City has also embarked on a restructuring programme that should result in the streamlining of operations in order to cut down on costs. While not intended to contribute to unemployment, it is inevitable that some redundancy and separation packages will have to be offered if the restructuring process is to succeed.

**Capital Finance**

The City's success in raising capital finance through stock issues has relied on the implied guarantee related to the prescribed assets regime. Contrary to expectations that the prescribed assets - investments in government or quasi-government securities - were going to be phased out, the regime is still in place with insurance companies required to hold 45% of their investment portfolios in prescribed assets, while pension funds have to maintain a ratio of 30%. With the central government's limitations in providing local authorities with adequate concessionary loans at its current rate of 18%, it is highly unlikely that the City's capital finance requirements will be met from this source.

It is worth noting that the City's capital budget for 2001 stands at US$1,282 billion. As government moves to convert part of its short-term liabilities to long-term loans, a cash saturation from treasury bill maturities, together with other measures, have seen short-term interest rates tumbling from between
70% and 80% to all-time lows of less than 20%. These rapid unprecedented changes have created an opportunity for the City to raise capital funding for its infrastructure. Currently, the City is in the process of raising some US$400 million for part financing of, among other projects, those outlined in Table 1.

Should efforts to raise the US$400 million be successful, it is logical for the City to attempt to raise a further amount to finance its infrastructure backlog, provided the interest rates remain favourable.

**Donor-funded Projects**

There is little doubt that the financial assistance provided in the past by donor agencies such as USAID (The United States Agency for International Development) and The World Bank has been greatly appreciated. Such assistance has largely been directed at funding the servicing of stands, with some financing for the provision of clinics, schools and community halls. In the case of Bulawayo, these funds have been put to good use as the intended projects are there for all to see.

One shortcoming has been the lack of provision of funds to the local authority for the construction of houses with preference for the delivery of housing by the private sector. While the private sector has played a part in the provision of houses, these have tended to be unaffordable for the intended beneficiaries. The result is that the houses have, in a number of cases, been taken up by those who can afford them and, in turn, rent out portions of the houses to those originally intended as beneficiaries.

Yet another scenario is one where the serviced stands are allocated to the intended beneficiaries who, because of a lack of financial ability to construct the houses themselves, enter into agreements with those who can afford them, who then construct the houses and lease them out to the originally-intended beneficiaries. Either way, the intended beneficiaries end up as lodgers who have to pay more than would otherwise be expected. In some instances, the prohibitive building costs discourage the beneficiaries to the extent that they leave the allocated serviced stands undeveloped for years. The obvious result is that good money continues to be ploughed into the ground through the provision of unproductive services. This state of affairs calls for consideration to be given to allocating a sizeable portion of available funding for the construction of houses through force account, particularly where viable building brigades are in place.

Another problem is the lack of flexibility in as far as it relates to implementation of projects where they are least needed. A case in point is the location of projects such as public lighting and clinics. What has tended to happen is that the implementation monitoring process has insisted on the location of some of these projects being carried out in areas in which it was believed they would be needed at the inception of the programme more than five years ago, despite changes in circumstances on the ground and advice to the contrary.

A difficulty that local authorities have had to live with is the disbursement mechanism, which, on termination of the programme, has tended to leave local authorities with significant liabilities arising from delayed settlement of contractor claims and consequent interest charges. For future programmes, it might be worthwhile, on the basis of merit, to consider disbursements directly to the local authorities. This should not only improve the payment of contractors, but would speed up the delivery of projects, especially in volatile economies.

All things considered, the donor-funded programmes have been successful in putting the much-needed infrastructure in place. Given the backlog that the City of Bulawayo has to deliver, it is unfortunate that this kind of assistance has been curtailed when it is most needed. Poverty alleviation certainly deserves better.

**Author’s Note**

Reference to the City of Bulawayo throughout this paper is meant for purely illustrative purposes, and does not seek to project the official position of the Bulawayo City Council. Similarly, any reference to the country, Zimbabwe, is meant to achieve the same illustrative intention. This paper represents the author’s personal views that are the result of his close association with the City of Bulawayo.

The Re-emergence of Infrastructure Finance in Emerging Markets

Introduction

The unremitting concentration of population and economic activity into large urban centres throughout most emerging market countries in Latin America and Asia has overwhelmed both the capacity and pace of investment in basic public infrastructure systems, whether it is for water, sewerage or transportation. The drive towards privatisation and concession-based project financing in the mid-1990s was seen by many governments as a way to jump start infrastructure investments. The feeling was that project finance could infuse new capital and better management practices into their poorly maintained and over-utilised infrastructure systems. The initial efforts of the mid-1990s were promising, but they soured with the contagion effect from the Asian financial crisis of 1997. While this explains the sudden interruption of new capital, it does not fully explain why infrastructure finance never really recovered. Evidence from the last decade points to difficulties caused by the government sector’s rush to privatise basic public services, in most cases, without a proper transition period. This resulted in the inevitable ‘clash of cultures’ between public policy goals, public expectations and the private sector’s desire for a reasonable rate of return.

Project finance can undoubtedly assist in developing a country’s infrastructure. Nevertheless, traditional project finance techniques, which proved efficient for developing industrial, energy and telephone capacity, may not work as well for traditional public infrastructure. The key difference is the political nature of these basic infrastructure services. Only in areas such as those with electricity or telephone services, where there is a broad public acceptance for a corporate role in a public service can the traditional project finance model provide an alternative capital for development.

Sustainable private investment in the public infrastructure arena may best be achieved through strong public-private partnerships. The key elements include an adequate foundation for private sector participation, and a clear articulation of public and private sector goals and expectations, not only in project documentation, but also through local public support. It is also tempting to introduce the cliché of ‘putting your best foot forward’ as a metaphor for selecting economically viable projects to finance. In infrastructure finance, a favourable impression is created with investors if a country’s first few projects demonstrate strong economic viability. If these rules are followed, some capital market observers may be disappointed by the supply of projects to be financed, but never by the quality.

Continuing Impediments

While the government sector can improve the climate for infrastructure finance, there are still major impediments to creating a sustainable supply of finance-ready projects. The recent Asian financial crisis exposed the fact that global investors still paint all emerging market countries with the same unfortunate brush, when it comes to political or economic volatility. Nevertheless, the sluggish recovery of infrastructure finance since then suggests deeper, problematic roots. Some of the more significant impediments include the following.

- The absence of dependable revenue streams to back debt securities. Capital markets count on dependable revenue streams in order to make ‘full and timely payment’ of debt service. State and local revenues, outside of federal transfers, rarely make a dependable revenue stream for infrastructure debt in emerging markets. This is partly because local government depends on federal transfers as the main source of revenues. The relative newness of decentralised government services is another factor. Local enterprises, such as water or transit authorities, are often plagued with poor revenue collections, reflecting their relative inexperience in operating as a business, but also the weak public acceptance for paying user fees. Toll roads can fare better, but still face difficult ramp-up risks during initial years of operation. Among the public infrastructure sectors, airports probably fare the best, but even this sector faces the challenges of airline route rationalisation and more pronounced economic cycles.
Jihomoravská plynárenská, a.s. (JMP)

1. Company history
This South Moravia Gasworks dates back to the middle of the last century. On 22 January 1848 the streets of the city of the Brno were first illuminated with gas lighting which was produced by the gasworks that had been established in the years 1846 – 1847. Since that time the Company has undergone a broad range of important technological changes, from its own production of gas lighting at the beginning of its existence to the distribution and sale of natural gas today.

2. Current Company Profile
The joint stock company Jihomoravská plynárenská is a gas distribution company, delivering natural gas and rendering ancillary services to customers of all categories in the region of South Moravia.
It is the largest gas distribution company in the Czech Republic, with a 24 % share of the country's natural gas market.

- maximal pipeline system operations, safety and absolute reliability of natural gas deliveries
- expanding the distribution network, with new customers hooking up to the gas infrastructure, a process connected with the extensive gasification of the South Moravia region, continues
- one indicator of the solidarity and commercial success of JMP is its economic prosperity, expressed in increased Company value

3. Company Strategy
The premium position of JMP in the future will be influenced by anticipated changes arising from amendments (the New Energy Act) to full adherence to EU standards (application of the EU directives on natural gas market liberalisation).

4. Company Vision
JMP has started a new mission to be closer and friendlier to customers. Massive support for data processing and billing, establishing a call-centre and the launch of E-business will be new phenomena. Another great opportunity is in using our extremely extensive pipeline grid for co-installation of fiber optic cables to reach a new dimension in business.

5. Opportunities
This represents an excellent investment opportunity and chance for co-operation, and we are open to discussion on all aspects of our business.

Interested companies can contact us:
Jihomoravská plynárenská, a.s.
Plynárenská 1
657 02 Brno
Czech Republic
tel: 00420 5 4554 8111
fax: 00420 5 57 85 71
e-mail: jmpbrno@jmpbrno.cz
www: http://www.jmpbrno.cz
- The inability of governments to satisfy internal political considerations that are often associated with privatisation. The rush to ‘privatise now and worry about the consequences later’ has defined the efforts of many governments to date, and is responsible for the general public backlash against privatisation. This is especially true in the water sector throughout Latin America, where project contractual covenants, government budgetary capabilities and public expectations all follow independent paths. There is not enough precedence where corporatisation precedes privatisation, and where public consultations provide sufficient awareness of not only the benefits but also of the cost of private sector participation.

- The short-term project debt maturities result in remarketing risk. Most emerging markets do not enjoy fully developed yield curves, so bonded debt beyond three to 10 years is not possible. Infrastructure projects require long lead times in order to develop a sufficient revenue base to retire debt. While many projects may have economic profiles well suited to long-term debt, market realities result in periodic debt remarketing risk. The litany of debt remarketing circumstances that can face infrastructure projects in emerging markets can be alarming – a volatile macroeconomic environment, politically motivated lawsuits, contradictory government mandates from varying ministries, etc. The cost of capital under such circumstances can be prohibitive.

- The lack of sustainable project supply can deter investors. In many cases, the small size of a country, or the limited number of large urban centres prevents a sustainable supply of projects from being able to come to market. Institutional investors like to know that the current transaction will not be the only transaction, and that other similar transactions will follow. One of the things that make toll roads in Chile or in São Paolo interesting for investors is the continuing supply of debt offerings made possible from a basket of operating projects. In other cases, there may be a large number of projects, but the proposed financings are simply too small to attract institutional buyers. Large international investors, for instance, seem to have a transaction threshold in excess of US$100 million.

Maximising Chances for a Successful Infrastructure Project

There are never guarantees for a successful infrastructure project. This is true even if a government guarantees revenue or debt payment, since the resilience of their representations may not last through changes of administration, or times of financial crisis. Nevertheless, experience suggests some important ways to maximise a project’s chances for survival, as follows.

- Implement sufficient legal and regulatory reforms to induce private sector participation. This entails not only concession law, which many emerging market countries are getting good at, but also the necessary financial, taxation and bankruptcy law reforms.

- Select projects that best fit the national, state or local priorities for economic development. Placing the project within the broader scope of a region’s economic future helps to galvanise both public and private support.

- Select projects with strong economic value. The best projects, in terms of economic value, often serve an already developed area, so that revenue growth does not depend upon speculative future development. If demand for the service is high, this increases the potential to raise rates if and when necessary.

- Select project partners with a strong commitment and experience. This often involves a consortium of foreign partners with vast experience in constructing or operating projects within a particular sector, and equally suited local partners. The foreign partner may bring new capabilities and capital to the project, but the local partner best understands how to navigate through a country’s legal and regulatory system.

- Provide an adequate period of corporatisation prior to privatisation, in order to gain interim efficiencies in the delivery of public services. If the public enterprise has time to operate as a publicly-owned business, including productivity gains and rate increases for capital improvements, this can facilitate its transition to the private sector.

- Endow projects with sufficient financial protections to mitigate risk. Project finance is risky by definition, but there are predictable financial pitfalls that can be mitigated. Endowing a project with sufficient liquidity during its initial operating period (either through reserves upfront, subordinate lines of credit or revenue guarantees) can mitigate operating ramp-up risk. Debt structure should also minimise (as much as possible within a local market) debt remarketing risk, given the often fluid nature of economic, political and legal supports for a project. Finally, foreign currency debt should be avoided where project revenues are earned solely in a local currency, or where project revenues are highly volatile.
Improving Governance and Infrastructure in a Developing World Context — Public-Private Partnerships in South Africa

a report by
André Fourie
Director, Effective Governance, National Business Initiative (NBI), South Africa

Introduction

Public authorities in developing countries are faced with increased demands for improved services, infrastructural challenges, fiscal constraints and scarce resources. There is a global trend to use public-private partnerships (PPPs) to improve the delivery of services, utilising the expertise, investment and management capacity of the private sector to develop infrastructure, as well as to improve and extend services to all residents.

In South Africa, the rationale behind such PPPs is that, although public authorities are responsible for ensuring that basic services are delivered, they need to actually deliver the services themselves. By sharing risk and reward with private operators, enhanced services are possible on a more cost-effective basis. Other rationales include the traditional inefficiencies in public provision, the opportunity for economic pricing and cost recovery, the deepening of private capital markets and major advances in technology.

However, there are a number of implications for democratic governance and public accountability. A number of critics have expressed reservations that PPPs will alienate communities, increase prices, marginalise the underprivileged, lead to corruption and undermine democratic accountability. This article addresses concerns that, although PPPs clearly enhance efficiency and improve access to finance, such arrangements could undermine local governance and accountability.

Public-Private Partnerships in South Africa

This article defines PPPs within the full continuum of infrastructure options (ranging from relatively basic service contracts to very complex concession arrangements). In South Africa, opportunities for private sector participation in infrastructure and service delivery at national level includes the transport sector (toll roads, high-speed rail), healthcare, schools, information technology, eco-tourism, fleet management and prisons. At local level, a number of PPP projects have been initiated, including water, urban transport, parking facilities, refuse collection, parks and recreation grounds and emergency services.

The South African Treasury has developed an explicit policy regime for enabling PPPs. Key requirements include demonstrable value for money (lower net cost of private provision), clear affordability within budget parameters (including whole-life costing), procurement through a transparent and competitive process, substantial risk transfer to the private sector, appropriate contractual arrangements spelling out public and private sector responsibilities and a schedule of outcome-based financial rewards. The state maintains ultimate accountability and becomes a contract manager rather than service provider. There are also strict requirements for monitoring private sector performance and ensuring compliance.

At local government level, a complementary set of policies and guidelines facilitate private sector participation in municipal infrastructure services. The council retains responsibility for ensuring that service is provided to the relevant residents and communities. The council must control the setting and adjustment of customer tariffs, monitor implementation of the agreement and manage the performance of the service provider. The Municipal Service Partnerships policy framework stipulates that decisions regarding the form and duration of PPP contracts will be left to the discretion of municipal councils (subject to certain guidelines and minimum standards) with a strong focus on performance monitoring, community participation and the elimination of corruption.

Good Governance

Good governance is a primary element necessary for sustained welfare gains and the reduction of poverty. The levels of development in societies and the effect of economic growth are positively correlated with the quality of governance. This fundamental lesson relates to both the capability of the state and the accountability and transparency of other institutions in society, including the private sector.
Despite the fact that there is no exact definition of governance that is useful to apply in all countries and conditions, there is increasing evidence of consensus around the core elements. At the macroeconomic or state level, key aspects that must be in place include democracy, peace, law and order, rule of law, secure property rights, transparent adjudication and application of the law, political stability, a sound legal framework, the enforceability of contracts and no tolerance of corruption.

The levels of development in societies and the effect of economic growth are positively correlated with the quality of governance.

Given the wide scope of the governance concept, it is useful to identify the core dimensions, which include the political, institutional, civic and corporate governance contexts. The political/public policy level requires policy effectiveness, prioritisation, equity, accountability, honesty, legitimacy, oversight mechanisms, monitoring, regulation, leadership and an ethical approach. Civic requirements include social relevance and priorities, community and stakeholder participation in the governance and decision-making process, sustainability of interventions, empowerment of minorities and a focus on the underprivileged.

At institutional or programme level, issues such as affordability, policy linkages, impartiality, performance management, cost recovery, human resource development and financial management are important governance elements. In the current global development context there is a growing focus on market-oriented development, reducing state interference (more steering and less rowing) and facilitating a conducive business climate.

The importance of good corporate governance is being increasingly recognised as vital for the world economy, corporate competitiveness and sustainable development. Indeed, it is attracting similar attention as the governance of countries. For institutions, it is all about the overall strategic direction, standards of behaviour, oversight of allocation of financial and human resources and balancing the interests of various stakeholders, as well as the sustainability of the enterprise.

Corporate governance defines the relationship between an institution and its owners, also recognising accountability to a wider group of stakeholders. The board must remain in control of the company, monitor the executive, ensure clear division of responsibility, determine executive pay packages and bring independent judgement on strategy, risks, resources and ethics. Controls and reporting functions are very important on the viability of business, ensuring a direct relationship with the auditors, and for the board to accept responsibility for the accounts. These standards are becoming more acceptable within the public domain.

Improvements in Governance and Accountability

The traditional inefficiencies of public provision and financing is a key motivation for private provision of infrastructure, focusing on potential savings by addressing leakage, overstaffing, dated technology, improper maintenance, etc. Other benefits include the tendency for inefficient pricing and under-recovery of costs so typical of public delivery in developing countries.

Official South African literature is filled with examples of standards and criteria to be applied to private sector providers of public services. For infrastructure services, the general principles for sustainable PPP arrangements and standards demanded of private providers include financing (limited tariff increases, clear investment requirements, financial scrutiny and access to accounts); operational performance (cost effectiveness, performance indicators, equipment specification, standard of services, response times); service standards (equitable coverage, environmental management, customer orientation, health and safety, environmental management); and oversight (transparency, competitiveness and monitoring of service levels). Particular attention is also paid to mitigation of labour displacement and sufficient stakeholder participation (especially workers and communities).

Table 1 summarises the likely governance impact of PPPs in South Africa, and can be applied to most developing contexts. At the country level, PPPs clearly create an additional demand for good governance, a sound macroeconomic framework and sound legal and contractual administration. The policy management implications appear to strengthen
Table 1: The Likely Governance Impact of Public-Private Partnerships in South Africa

<table>
<thead>
<tr>
<th>Governance Dimension</th>
<th>Likely PPP Impact</th>
<th>Governance Contribution of PPPs</th>
<th>Governance Risk of PPPs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Macroeconomic/state level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Democracy, peace and political stability</td>
<td>✓</td>
<td>Creates demand for democracy</td>
<td></td>
</tr>
<tr>
<td>Legal certainty regarding rule of law, property rights, enforceability of contracts</td>
<td>✓</td>
<td>Creates demand for legal architecture</td>
<td></td>
</tr>
<tr>
<td>No tolerance of corruption</td>
<td>?</td>
<td>Competition and transparency to reduce corruption</td>
<td>Private sector bribes and false allegations by losing bidders</td>
</tr>
<tr>
<td><strong>The political/public policy level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy effectiveness, prioritisation, legitimacy</td>
<td>✓</td>
<td>Concessions require clear prioritisation</td>
<td>Affordable, rather than required, projects</td>
</tr>
<tr>
<td>Oversight, monitoring and regulation</td>
<td>✓</td>
<td>Explicit mechanisms needed, outputs contracted</td>
<td>Regulatory capture, skill &amp; information asymmetry</td>
</tr>
<tr>
<td>Honesty and ethics</td>
<td>?</td>
<td>Highlights issue</td>
<td>Neither sector has inherent advantage</td>
</tr>
<tr>
<td><strong>Civic requirements</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social relevance stakeholder participation</td>
<td>✓</td>
<td>Demand for priorities and customer focus</td>
<td>Could lose citizen perspective</td>
</tr>
<tr>
<td>Empowerment, minorities, poverty impact</td>
<td>?</td>
<td>Explicit targets, requirements</td>
<td>Could be excluded</td>
</tr>
<tr>
<td><strong>Project impact</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policy linkages, outcome focus</td>
<td>✓✓</td>
<td>more explicit budget choices and policy outcomes</td>
<td>Project focus rather than policy outcome</td>
</tr>
<tr>
<td>Human resource development</td>
<td>✓</td>
<td>Demand-based staffing, training targets</td>
<td>New public skills required (non-traditional)</td>
</tr>
<tr>
<td>Cost recovery, financial management, economic pricing</td>
<td>✓✓</td>
<td>Economic viability, ring fencing, revenue collection, deepening capture, rational investment &amp; costs</td>
<td>Financial focus only, affordability concerns</td>
</tr>
<tr>
<td>Performance, expansion, maintenance</td>
<td>✓✓</td>
<td>Visibly better delivery and performance, rational risk sharing</td>
<td>Unrealistic expectations</td>
</tr>
<tr>
<td>Corporate governance</td>
<td>✓✓</td>
<td>Clear standards and requirements, corporatisation encouraged</td>
<td>Inappropriate standards</td>
</tr>
</tbody>
</table>

✓ = positive impact expected, ✓✓ =very positive impact likely, ? = neutral or +/-

the governance process by focusing policy-makers on strategic management rather than operations. Given the high process and output standards expected from PPPs in South Africa, it is arguable that compliance with such conditions will greatly enhance the governance of South African public authorities. The level of community consultation, transparency and end-user involvement will provide for enhanced governance relations. Some of the visible governance improvements at project and institutional levels are:

- incentives and discipline for cost-effective delivery;
- demand-based staffing, investment and operating cost;
- improved revenue management and customer care;
- commercial orientation and value for money;
- lower public spending, reduce public borrowing and improve credit rating;
- operational improvements in construction costs, project schedules and operating efficiencies;
- benchmarking and ring-fencing promoted to determine true costs;
- involvement of private sector and experienced financiers provide clear signal of project feasibility; and
- risks are identified, quantified and allocated to the party best placed to carry, mitigate and manage the risk.

Governance Gains Not Automatic

It is clear that infrastructure PPPs have the potential to dramatically strengthen governance, public management, institutional capacity and policy implementation. Table 1 highlights the fact that such governance gains will not be automatic. Just as a private monopoly is unlikely to be more productive or more efficient than a public monopoly, it is important to ensure appropriate competition, regulation and incentives for private participation.

The following are key elements in ensuring that the governance gains of private infrastructure provision are secured.

- Transparent procurement, continued government responsibility, a proper contractual relationship and effective monitoring must be implemented.
- Value-for-money calculations are critical to calculating true, whole-life costs (including maintenance and capital charges) and to compare such cost and envisaged benefits against alternative service providers (public and private provision).
- Regulation is needed to protect the public interest regarding the abuse of market power and to ensure that the desired quality and quantity of services are provided.
- Competition for contracts and benchmarking of service standards and cost efficiencies can exert considerable pressure on the private sector to provide effective services at reasonable costs.
- Continuous service delivery improvements are possible if competitive forces are not limited to winning the contract, but are also utilised during the contract period. This is particularly useful during a 20 to 30-year concession.

The expected increase in private sector accounting standards, asset management, credit control and control procedures will provide a platform for higher government accountability.

Conclusion

This article argues that, through transparent procurement processes, effective contractual arrangements and effective regulation, it is possible for PPPs to enhance accountability within a sound governance framework.

Given the levels of accountability demanded of PPPs and the insistence of output specifications and contracted levels of service and customer satisfaction, it is clear that accountability in most public authorities will be greatly improved by PPPs if conceptualised and implemented within a sound development policy framework. The expected increase in private sector accounting standards, asset management, credit control and control procedures will provide a platform for higher government accountability. Indeed, it can be argued that most departments and municipalities would do well to study the expectations of private sector delivery, and actually implement some of the performance dimensions in current public management practice.

Private sector service delivery is not automatically more efficient than public delivery. It is the introduction of competition that provides the incentive for efficient operation and the potential for profit that encourages entrepreneurship and innovation. Using private finance, management and resources for the public good will thus be optimally beneficial within an effective contractual and regulatory environment.
Some utilities have responded to recent changes in technology and market liberalisation by turning themselves into ‘multi-utilities’ that bundle traditionally distinct services. “Multi-utility Trends – Blurring Industry Boundaries”, which can be found in the Reference Library of the CD-ROM accompanying this Business Briefing, reviews recent trends in horizontal integration of utilities, while this article looks at the policy and regulatory implications of those trends for developing countries. The question facing policy-makers is whether the emergence of multi-utilities should be encouraged as a means of improving access and quality of utility services, or subjected to closer control to guard against potential dangers arising from less competition, greater regulatory complexity and more concentrated political power in the utilities.

For the past 20 years, governments have sought to lower costs, improve service quality and expand access to utility services such as electricity, telecoms, water and sanitation. Their strategy has been to liberalise markets and encourage private-sector participation. To take advantage of the opening provided by governments and new opportunities created by technological developments, the private sector has adopted new corporate strategies. One strategic response has been to expand from supplying a single utility service to a multi-utility format in which the firm offers two or more traditionally distinct utility services.

**Potential Benefits**

- **Lower costs, increased convenience** – utilities that bundle two or more services can often cut costs through economies of scale and scope, involving rights of way, physical assets, customer service functions, project development expertise and administrative costs. A recent review of the British gas and electricity industries found, for example, that utilities dealing in both forms of energy could achieve cost savings of up to 10%, compared with those supplying gas alone.

  The magnitude of savings will vary, and the extent to which savings are shared with consumers or accrued to shareholders will depend on the effectiveness of competition and regulation. In some cases, consumers may benefit from the convenience of dealing with a single service provider.

- **Critical mass** – remote communities are often too small to attract the attention of private investors in a single utility service. Bundling several services together in a multi-utility may help to provide critical mass and thereby reduce the costs of investigating opportunities, developing projects, participating in bidding processes and establishing a local presence. Several countries and municipalities have adopted such a strategy when privatising their existing assets (e.g., Cape Verde, Comoros, Gabon, Morocco) or extending services to rural areas (e.g., La Rioja, Argentina). Bundling also holds promise for extending services to the poor in rural or peri-urban areas.

- **Removing barriers to competitive entry** – competitive supply is feasible in a growing number of utility services that were once considered to be natural monopolies. In developing countries, networks are often undeveloped. New entrants may be discouraged if large investments are required to build out network infrastructure. The opportunity to leverage existing distribution networks, customer bases and other assets put in place to provide one utility service may reduce barriers to entry for companies intending to provide additional utility services in the same market. Several countries have used this strategy to enhance competition in telecoms services, and similar advantages may arise in other markets.

- **Lower payment risks** – government-owned utilities in many developing countries have low payment-collection rates – arising from corruption, inept management, poor service or theft – that contribute to a culture of non-payment and discourage new entrants. The threat of service cuts is often required to induce consumers to pay their bills, but in the case of some utility services – notably water and sewerage services – it is technically difficult and costly to disconnect consumers. Firms that offer several services may have greater leverage. Non-payment of water bills, for example, may be reduced by a credible...
threat to withhold other, less essential, services that are easy to disconnect. Reducing commercial risks will cut costs and prices and increase firms’ interest in expanding services.

- **Lower political risks** – the price of utility services tends to be politically sensitive, and investments, once made, are specific and immobile. As a result, investors are vulnerable to opportunistic action by governments. Firms will not invest in a country if they believe that their investment will be compromised by direct expropriation or by a succession of small regulatory actions that amount to expropriation. A firm that supplies more than one service may perceive that it has greater influence with local political authorities and thus is less vulnerable to such risks.

**Potential Disadvantages**

- **Decreased competition between substitute services** – some utility services, notably power and gas, compete for the same customers in many areas. The potential for inter-fuel competition can reduce market power and thus facilitate regulators’ tasks. Where such competition exists, the integration of electricity and gas distribution in one firm may increase the need for supervision, the extent to which will depend on the potential for competition from other service providers and the regulatory capacity of the government in question.

- **Other competition blockers** – multi-utilities may give rise to other policy concerns related to competition. For example, an incumbent multi-utility providing telecoms and electrical power may be able to leverage its position in the power market to enhance its market power in telecoms, thereby deterring competitive entry. The increased market power may flow from its knowledge of existing customers, its established brand name or its ability to bundle services. In addition, the multi-utility may be able to allocate common costs within the firm in a way that gives it an unfair competitive advantage in the contestable business.

The risks presented by such anticompetitive strategic behaviour have led to regulatory disputes in the US and the UK. For example, the transfer of telecoms assets to an unregulated subsidiary at prices alleged to be below market value triggered a high-profile US court case (Boston Edison/RCN Corporation v. Cablevision Corporation). Allegations of unfair allocation of costs in connection with dual-fuel offers brought against a British gas supplier led to an investigation by the regulator. Where such risks arise, additional demands are placed on regulators to investigate allegations and determine remedies. The resulting cases tend to be complex and may constitute a significant problem in countries with limited regulatory experience and capacity.

- **More complex tariff regulation** – effective tariff regulation requires the regulator to have access to reliable information about a utility’s costs and to be able to compare those costs with industry benchmarks. Multi-utility structures have the potential to greatly complicate that process. Several of the potential advantages of multi-utilities hinge on the use of common assets to provide more than one service. Allocating the value of those assets among services for purposes of setting and regulating prices is complicated under the best of circumstances and can present opportunities for firms to frustrate the regulatory process. Problems may also arise in determining a fair return on investments during price reviews. It may be difficult, for example, to determine the appropriate cost of capital for firms that provide multiple services but rely on undistinguishable financing sources.

- **Competing regulators** – multi-utilities pose challenges to co-ordinated oversight by regulators, which, in many countries, remain organised along industry-specific lines and located at different levels of government. For example, a firm offering electricity, telecoms and water services may fall within the regulatory jurisdictions of three separate regulators at two or more levels of government.

Overlapping authority and unco-ordinated regulation complicate regulators’ tasks and create opportunities for firms to manipulate the regulatory process. Such conditions can also increase the compliance costs of regulated firms, especially where regulatory requirements or approaches are inconsistent. Poorly defined responsibilities among regulators may also cause delays in tariff adjustments and lengthy processes for approval of changes in services. Multi-utilities formed as a result of acquisitions and mergers often fall within the jurisdiction of several industry regulators as well as the authorities responsible for regulating competition.

- **Political power** – multi-utilities may have more leverage in disputes with governments, but from the government’s perspective the accretion of political power may not be a welcome development. The additional influence such firms may have – through their roles as tax-payers, employers and contractors – can create instability in emerging democracies.

**When Choices Must be Made**

Governments and regulators may need to consider the public policy implications of emerging multi-utilities at several junctures:
General Description

Intercontinental Consultants and Technocrats Pvt. Ltd. (ICT), an ISO-9001 Company, is a leading international Consulting Organisation specialising in Highways, Structures, airports, Urban and Rural Infrastructure Development, Water Supply, Traffic and transportation Studies, Ports and Tourism projects including Institutional Strengthening, Socio-Economic and Environmental Studies. ICT has a dedicated team of over 900 professional staff with state-of-the-art knowledge of international standards in the fields of Planning, Feasibility Studies, Detailed Engineering, Techno-economic Studies, Cost Appraisal, Financial Analysis, Project Management, Construction Supervision, etc. ICT with its deep commitment to quality, client's satisfaction, and high standards of professionalism continuously endeavours to serve the cause of infrastructure development.

The company offers services in various disciplines of Civil Engineering ranging from Planning, Topographic Survey, Traffic studies, Feasibility Studies, Preliminary and Detailed Engineering, Computer Aided Designs, Privatisation Schemes under BOOT/BOLT to Construction Supervision, Training and Institutional Strengthening.

Highways including Expressways, Widening and Strengthening of Existing Roads and Construction Supervision

Bridges including Interchanges, Flyovers, Overbridges, Special Inspection and Rehabilitation Services and Bridge Management Systems

Airports including Airport Master Plans, Pavement Designs, Geometries, Layouts, Airport Terminals and Support Services, Airport Lighting and Power Supply Systems, Communication and Navigation Equipment

Tourism Development Studies including Eco-tourism, Cultural & Heritage Tourism, Adventure Tourism, Environmental Planning and Landscaping


Build, Operate & Transfer Projects including Project Identification, Feasibility Studies, Economic Viability, Identification of Funding Sources, Construction Agencies, Detailed Engineering and Construction Supervision

Ports and Support Services including Layout and design of services, buildings, access roads, infrastructure improvement studies and civil engineering structures

Value of Services

Bangladesh Bhutan Burkina Faso Egypt Nepal Tanzania Vietnam

Services

Typical Projects

Detailed Project report for strengthening & four-laning of National Highways 5, 8 & 9 (ADB Projects), India

Feasibility study, detailed design of 800 km of roads of the NCR, India

Construction Supervision of ADB/World Bank Projects in India

Road master plan and feasibility study and preliminary engineering of road network in Mongolia - (ADB Technical Assistance) Rural Infrastructure Project - Consultancy services for Technical Assistance for Project Management, Nepal (IDA funded)

Bangalore - Mysore Infrastructure Corridor (BOT Project), India

Darhan - Erd enet Road Project Mongolia (KFAED funded)

Consultancy Services for Construction Supervision of Awasharba - Gewane Section of Modjo - Awash - Mille Road Rehabilitation Project (IDA funded)

Rural Access Roads Project, Lao PDR (ADB TA Project)

Third Road Rehabilitation and Maintenance Project, Bangladesh (IDA funded)

Bridges

DPR-Construction of 13 bridges in Kohalpur-Mahakali highway, Nepal Feasibility studies for repairs and rehabilitation of Gia Bay and Vinh Tuy bridges, Vietnam

Airports

Domestic Civil Aviation Study, Nepal (ADB Project)

Runway Rehabilitation, Hulule Airport, Maldives

Tourism

Second Tourism Infrastructure Dev. Project, Nepal (ADB Project)

Infrastructure

Non-Motorised Transport study, Africa (African Development Bank Project)
before privatisation, to determine whether an integrated utility should be restructured into several distinct utilities;

- in bidding, to determine whether restrictions should be imposed bidders for about-to-be-privatised assets;

- in mergers and acquisitions, to determine whether to allow post-privatisation mergers and acquisitions that would result in multi-utility structures; and

- in new entry situations, where incumbents in one sector seek to provide services in another.

The response by policy-makers, competition authorities and sector regulators will depend on an evaluation of the pros and cons in each industry and country and may well shift over time with changes in competition and other factors. In some cases, the arguments for multi-utility approaches may be so overwhelming that governments will elect to promote such arrangements. In other cases, some degree of restriction may be deemed necessary or appropriate. In the latter situation, three main policy and regulatory controls are available:

- Cross-ownership restrictions – restrictions on cross-ownership between utilities may be temporary or permanent. To protect nascent competition in the gas retail markets, British regulators imposed temporary restrictions on electricity suppliers offering dual-fuel services in areas not yet open to retail competition in electricity. The Republic of Korea chose to allow its power utility to provide leased-line telecoms services in competition with the incumbent telephone company only until 2002, by which time broader market competition was expected to have developed.

Governments in several Organisation for Economic Co-operation and Development (OECD) countries have required telephone companies to divest their holdings in cable television companies and imposed cross-ownership restrictions. In the US, the Telecommunications Act of 1996 repealed provisions that had prevented local telephone companies from providing new cable service within their telephone markets. The same legislation imposed new limitations on joint ventures by local telephone companies and cable-television operators serving the same market. Such companies may not acquire more than a 10% financial or management interest in each other or combine to provide telecoms or video services in the same area. Chile banned significant cross-ownership between water utilities and providers of other utility services in overlapping areas.

- Account separation and 'ring fencing' – the potential of firms to manipulate costs and engage in anticompetitive conduct or to frustrate effective tariff regulation may be addressed by mandating that the costs of each regulated business must be accounted for separately, a practice known as ring fencing. For example, detailed rules may be designed to govern the allocation of joint costs, and restrictions may be imposed on transfer pricing between business lines. Rules of this kind have been developed in the US and the UK, and a similar approach was adopted when a single concession for several utilities was awarded in Gabon. Designing and administering such rules can be difficult, however, particularly in countries with limited experience in regulating utilities.

- Co-ordination among sector regulators may be addressed in several ways. One approach is to create multi-sectoral regulatory bodies, which have a long history at the state level in Australia, Canada and the US, and are increasingly common in developing countries. Indeed, the growing integration of the British gas and electrical power industries recently led to the merger of two previously separate regulators. Similarly, the accelerating convergence of the telecoms and cable television sectors has led in South Africa, for example, to the consolidation of responsibility for regulating both industries.

In the absence of full integration between regulatory bodies, it may be feasible for the regulators responsible for overseeing an integrated utility to agree on common approaches to key regulatory issues and to facilitate co-ordination more generally through joint working groups, an approach being followed by the sector regulators in Brazil and the UK.

Conclusion

The emergence of multi-utilities has important policy and regulatory implications for developing countries. The potential advantages of multi-utilities include lower costs, improved customer service, enhanced competition and expanded private investment, particularly in smaller or remote communities and in markets perceived to exhibit high risks. At the same time, offsetting costs emerge in some situations that include negative impacts on competition, regulatory complications and the concentration of political power. The costs and benefits of multi-utility strategies will need to be considered individually. In many instances, it may be possible to achieve balance through carefully calibrated regulatory responses, but the feasibility of those responses must be tested against the regulatory experience and capacity of the country in question.
Scorecard for Subsidies — How Utility Subsidies Perform in Transition Economies

a report by
Laszlo Lovei, Eugene Gurenko, Michael Haney, Philip O’Keefe and Maria Shkaratan
The World Bank

Unlike the poor in many developing countries, those in Central and Eastern Europe and the former Soviet Union are highly connected to network utilities. During the early 1990s, it became clear that, without subsidies, many households would have difficulty paying their utility bills and governments began to experiment with various subsidy schemes. This article describes the main schemes, scores their performance and provides a methodology for governments designing subsidies to decide which scheme is likely to be most suitable for their country.

The Scoring System

The performance of a subsidy can be measured in several dimensions. A subsidy’s success in reaching the poor, and the amount of purchasing power it transfers to them, is a key performance measure. However, the evaluation of any subsidy mechanism should go beyond the amount of support provided to the poor. Subsidies have a cost that needs to be financed from somewhere. For a given level of purchasing power to be transferred to the poor, this cost depends on the targeting efficiency of the subsidy mechanism. Some subsidy mechanisms are highly unpredictable, which tends to encourage corruption in countries with poor governance. Some subsidies distort price signals and other incentives, resulting in the waste of resources, while certain types of subsidies demand sophisticated institutions or technology to administer them while others are simple. Thus, the following criteria are used to ‘score’ the various subsidy schemes:

- the extent to which the poor are being reached (coverage);
- the share of the subsidy that goes to the poor (targeting);
- predictability of the benefit for the poor;
- the extent of pricing distortions and other unintended side effects; and
- administration cost and difficulty.

Not all criteria are of the same importance. A financially strapped government may prioritise reducing the leakage of the subsidy to the non-poor. Another with limited administrative capacity may value simplicity more. Few mechanisms perform well on all criteria — for instance, high coverage is usually associated with low targeting. Furthermore, not all subsidy mechanisms are applicable or perform equally well across the full range of utility services. Lack of water meters, for example, may pose a problem for lifeline tariffs. It is therefore impossible to rank subsidy mechanisms independently of time, place and sector.

Whoever assumes responsibility for the cost of the subsidy is also important. The discussion of each subsidy mechanism below includes a brief assessment of their financial impact on those who will have to pay — taxpayers, non-household consumers (businesses) and the supplier utilities. The methodology does not cover the interaction between various utility subsidy mechanisms — for example, the combined effect of a lifeline tariff and a burden limit — or between utility subsidies and other sector-specific subsidies.

The Variety of Subsidies

There are seven main types of utility subsidies in Central and Eastern Europe and the former Soviet Union:

- No-disconnection — in several countries in the region, utilities are pressured by governments not to disconnect households who do not pay their bills. Non-payment by residential (and many other) consumers has remained particularly widespread in the Balkans and the former Soviet Union.

- Across-the-board price subsidy — at the beginning of the 1990s, it was widely believed in all transition countries that real wages would start growing in the near future. Many governments postponed the realignment of utility prices and costs, hoping to minimise the associated social costs and political repercussions. Most countries in Central and Eastern Europe have by now abandoned across-the-board price subsidies, but
governments in the former Soviet Union have not, although residential tariffs have been brought closer to costs than they were in the early 1990s.

- **Lifeline tariff** – restricting the price subsidy to the initial block of consumption (called the basic need level) offers a less costly alternative to across-the-board price subsidies, while preserving their politically attractive universal protection feature. Not surprisingly, many governments in the region introduced lifeline tariffs for utility services with metered or relatively easily estimated consumption, such as electricity and gas.

- **Price discount for privileged consumers** – the Soviet Union operated a system of utility price discounts between 25% and 100% – not as a measure of reducing poverty, but to reward certain occupations (police, firemen, judges, etc.) or to compensate for hard labour, war, or man-made catastrophes such as the Chernobyl disaster. Afraid of popular discontent, few newly independent republics dared to overhaul this system.

- **Burden limit** – an alternative to limiting prices is to help selected households to pay their bills – limiting the burden on household budgets. The burden limit typically varies from 15% to 30% of income. In Ukraine, for example, the burden limit was set at 20% in 1998. The subsidy is calculated on the basis of actual utility bills, and household income must be verified by employers, the social security office or the taxation authority.

- **Other earmarked cash transfers** – an alternative way of reducing the burden is to provide a subsidy calibrated to ensure a certain level of income after paying for rent and utilities. The Bulgarian government and most Latvian municipalities operate such schemes.

- **Non-earmarked cash transfers** – general social assistance payments can also help households to pay their utility bills, even though the money is not designated for that purpose. However, for politicians, these payments may lack the appeal of introducing specific relief from utility bills at the same time as utility prices increase.

A subsidy’s success in reaching the underprivileged, and the amount of purchasing power it transfers to them, is a key performance measure.

**Findings**

The performance of these subsidy mechanisms was analysed using household survey data and information provided by various government agencies in Central and Eastern Europe and the former Soviet Union. Table 1 sets out the scores for each type of subsidy by the performance criteria and Box 1 describes how the scores were calculated.

All the subsidy mechanisms reached at least one-third of the poor. Two mechanisms – across-the-board
Box 1: How the Scores were Determined

The scores assigned to each subsidy mechanism were determined in the following way:

- Coverage ratios below 33% scored zero, between 33% and 66% scored one and higher than 66% scored two. A number of subsidy mechanisms scored from one to two, since the share of the poor who are connected (and can be reached) varies greatly from one utility to another.

- Targeting ratios below that attainable by random selection scored zero, above that ratio scored one and above twice that ratio scored two.

- For predictability, no-disconnection, the most unpredictable mechanism, scored zero. Mechanisms that provide benefits with high certainty (across-the-board price subsidy, two-block and floating-block lifeline tariffs and privileged discounts) scored two. The remaining subsidy mechanisms scored one.

- For pricing distortion, the two subsidy mechanisms that do not affect the effective price of the last unit of consumption (non-earmarked cash transfer and the burden limit based on utility expenditure norms) scored zero. Mechanisms that distort the effective price for most households (across-the-board price subsidy and three-block lifeline tariff) or greatly distort this price for the beneficiaries (no-disconnection and the burden limit based on actual utility expenditures) scored two. The remaining subsidy mechanisms scored one.

- For administration cost and difficulty, subsidy mechanisms that can be administered by the utilities with little extra effort (no-disconnection, across-the-board price subsidy and two-block and three-block lifeline tariffs) scored zero. Mechanisms that require significant extra effort ('floating' lifeline and privileged discounts) scored one. Subsidy mechanisms needing a network of offices to administer the income tests scored two.

- Scores for the last two criteria were assigned a negative value to facilitate the calculation of aggregate scores.

Price subsidy and lifeline tariff – reached more than two-thirds of the poor, but only for electricity and water, since at least one-third of the poor do not have access to gas, district heating and sewerage in most countries in the region.

Targeting ratios for the across-the-board price subsidy, two-block lifeline tariff and burden limits based on actual utility expenditures were below that attainable by random selection. For no-disconnection, the two-block 'floating' lifeline tariff, and burden limits based on utility expenditure norms they were somewhat better than random selection. They were at least twice that produced by random selection for the three-block lifeline tariff and income-tested (earmarked or non-earmarked) cash transfers.

Across-the-board price subsidies, two-block lifeline tariff and price discounts for privileged consumers provided highly predictable support to the poor. Burden limit, most earmarked and non-earmarked cash transfers and three-block lifeline tariff (with a 'penalised' third block) had medium predictability. No-disconnection and certain non-earmarked cash transfers were highly unpredictable.

No-disconnection and the burden limit based on actual utility expenditures created large price distortions (by making the effective price of the household's last unit of consumption zero). Across-the-board price subsidy and the three-block lifeline tariff created significant price distortions for all (or almost all) households. Two-block and floating-block lifeline tariffs and privileged discounts created significant price distortions for the minority of households connected. Non-earmarked cash transfers and the 'normative' burden limit created no utility price distortions.

No-disconnection, across-the-board price subsidy and lifeline tariffs – with the exception of lifelines with floating blocks – were simple to administer.

Price discounts for privileged consumers and the floating lifeline tariff posed significant administrative challenges, since the utilities needed to correspond meter readings with certain household characteristics. Burden limits and other income-tested cash transfers would have overloaded the administrative capacity of utilities, and required specialised networks of local offices.
**How to Use the Scoring System**

To find the subsidy mechanism that best suits their circumstances, decision-makers need to:

- obtain information on the proportion of the poor connected to each type of utility (this will help to narrow the coverage scores of across-the-board subsidies and lifeline tariffs);

- see whether reliable estimation and billing of actual household consumption is possible (this will show whether lifeline tariffs can be meaningfully considered);

- determine the weights that they assign to each of the five criteria (if neither metering nor estimation of actual consumption is feasible, zero weight should be assigned to the price distortion criterion);

- calculate the aggregate scores for each subsidy mechanism and for each type of utility service; and

- identify the mechanisms with the highest aggregate scores for each type of utility service.

**Funding**

In principle, the cost of the subsidies can be covered by the utilities themselves (through decapitalisation), non-household consumers (by setting the prices they pay above cost) or the budget (from general taxation). The first option, however, should be used as a short-term buffer only, because it rapidly depletes the working capital of the utilities, undermines their services and ultimately reverses the poverty alleviation impact of the subsidy.

The second option may also become unsustainable if demand from industrial consumers is highly elastic with respect to price (for example, in the district heating sector). In this case, the surcharge simply drives down demand and fails to raise the revenue needed for the subsidy.

Thus, financing of the subsidy from the budget seems to be the best option in most utility sectors and countries. The higher the targeting efficiency of the subsidy mechanism, the lower this burden is going to be. For a given amount of purchasing power to be transferred to the poor, the three-block lifeline tariff and the income-tested cash transfer schemes require the least money. In fact, three-block lifeline tariffs can be designed so that the ‘penalty’ at high consumption levels (in the third block) covers the subsidy at low consumption levels (in the first block).

Across-the-board subsidies cost so much that most governments have phased them out. While, at first sight, no-disconnection appears to have no impact on the budget, in reality it tends to be so costly for utilities that the budget not only receives lower revenues from corporate taxes, but, over time, has to finance maintenance and rehabilitation costs and assume responsibility for the accumulated debt in order to prevent the utility collapsing.

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*This article is based on Maintaining Utility Services for the Poor – Policies and Practices in Central and Eastern Europe and the Former Soviet Union, by Laszlo Loei, Eugene Gureenko, Michael Haney, Philip O’Keefe and Maria Shikanian, published by The World Bank in September 2000, for the Annual Meetings of the World Bank and International Monetary Fund in Prague.*
Global Electricity Investment Requirements to 2020

a report by

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New Capacity and Investment Requirements

Over the next two decades, nearly 3,000 gigawatts (GW) of new capacity is projected to be installed worldwide. About one-fifth of this will be needed to replace existing installations, while four-fifths will be installed to meet new demand. New capacity around the world is projected to be added at annual increments of 103GW per year over the period to 2010 and increments of 158GW per year in the period from 2010 to 2020.

A little more than one-third of new capacity will be built in the Organisation for Economic Co-operation and Development (OECD) countries. Replacement capacity represents almost one-third of the additions. Some of the older steam plants and about 30% of existing nuclear capacity could be retired over the projection period. Although electricity demand in the OECD countries slows down in the second half of the projection period, capacity additions are more important during this period mainly because of the need to replace retired units.

In the transition economies, new capacity will be required mostly in the second half of the projection period. The current capacity is under-utilised because of low electricity demand. Capacity additions are limited to 9GW per year in the period 1997 to 2010, but will have to be two and a half times higher in the following decade to meet rising electricity demand.

More than half of the projected new capacity over the period 1997 to 2020 will be installed in developing countries. Of the 1,564GW of new capacity required by developing countries, two-thirds will be in developing Asian economies. Projections of capacity requirements by region are shown in Table 1.

The total cost of new power plants, excluding the cost of new transmission and distribution lines, is estimated at nearly three trillion dollars in today’s money. In the OECD, power sector investment in the period to 2020 is US$894 billion.

The transition economies will need more than US$300 billion in new capacity over the next two decades. A large number of existing plants in the region will need to be refurbished because of their age and, more importantly, because of inadequate maintenance. The amount required for this operation is highly uncertain and is not included in the projection.

Developing countries will require US$1.7 trillion to invest in new power plants, which is 58% of the global amount. Clearly, over the next 20 years, developing countries will need to devote significant funds to the development of their electricity sector. In the past, growth in the electricity sector was achieved through public sector support but was often constrained because of insufficient resources, often resulting in a large gap between supply and demand.

The economic downturn experience between 1997 and 1999 had a negative impact on private activity and made it clear that, in order to ensure that long-term capital flows can be available, electricity market reforms are necessary. In order to generate the necessary funds for power generation expansion, many countries in the developing world will very likely need to accelerate reform of their often public-dominated electricity sectors.

Over the next two decades, global installed generating capacity could increase by more than 70%, rising from 3,221GW in 1997 to 5,515GW by 2020. Natural gas will be the preferred fuel for new applications where it is available, as long as its price remains low. Coal-fired plants will continue to be built in countries with a rich resource base.

Coal

Coal-fired capacity is expected to increase from 1,030GW in 1997 to 1,677GW in 2020. Most of the new coal-fired plants will be built in developing countries, particularly in China and India.

Within the OECD, the importance of coal in power generation decreases over time. However, in the absence of more stringent environmental regulations,
more coal plants could be built in OECD countries. Natural gas prices could start rising after 2010, or earlier in North America, making coal plants competitive against gas. Advanced coal technologies offering higher conversion efficiencies become competitive towards the end of the projection period. As 2020 approaches, integrated gasification combined cycle (IGCC) technology could become an economic option for new power generation schemes. The role of IGCC could become more important, relative to other coal technologies, if emission standards become more stringent in the future. In OECD countries, coal-fired capacity is expected to increase from 595GW in 1997 to 663GW in 2020.

Although a large number of new power generation projects in the OECD and elsewhere in the world are expected to be gas-fired, coal will still be the most important source of electricity generation in many developing countries, where coal-fired capacity could nearly triple by 2020. India and China show the highest increase in coal-fired generation and could account for 40% of global coal-fired capacity in 2020. China alone could be producing one-quarter of the global coal-based electricity and half of the developing country coal-based electricity by 2020.

**Natural Gas**

Global natural-gas-fired capacity will rise from 643GW in 1997 to 1,822GW in 2020. Natural gas is expected to be the world’s second largest source of electricity generation within the next 10 years, surpassing both hydroelectric and nuclear power. The OECD countries will account for nearly half of the increase. Pipeline natural gas is the preferred fuel for most new applications while gas prices remain low. Liquefied natural gas is also expected to be used increasingly, mostly in Asia.

Natural-gas-fired combined cycle gas turbine (CCGT) plants are the preferred option for many new power generation schemes, particularly in the OECD. CCGT plants accounted for 45% of the total OECD capacity increase between 1990 and 1998. Gas turbine technology developed rapidly in the 1980s as a result of concentrated programmes of military jet engine development and the end of policies restricting natural gas use in power generation.¹

Competition between manufacturers has sustained further technical development. Efficiency has been improved steadily by increasing combustion temperatures. CCGT plants have the highest efficiency of any fossil power plant today. Their capital costs can be as low as half the cost of a coal plant and maintenance costs are also relatively low.

Use of natural gas in CCGT’s produces the lowest carbon dioxide emissions per unit of output among currently commercial technologies. Emissions of nitrogen oxides are also low and there is no evidence of sulphur dioxide.

**Oil**

Oil-fired capacity increases slightly. Oil-fired plants are likely to be built in several developing countries over the next two decades. In rural areas, internal combustion engines will continue to be used along with renewables to supply rural households with electricity.

In OECD countries, where the use of oil in power generation has been decreasing since the first oil shock, oil-fired capacity is expected to fall to about two-thirds of its present level by 2020. The use of oil in baseload operation has been shrinking, but will still be used for peaking purposes or as a back-up fuel. A similar decline in oil use in the power sector is expected for the economies in transition.

¹ See also Electric Power Technology - Opportunities and Challenges of Competition, IEA/OECD, Paris, 1999.
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**Nuclear Electricity**

Nuclear capacity stood at 352GW in 1997, in 435 commercial units in 31 countries. Nuclear power has been providing baseload electricity for several decades. It gained momentum in the 1970s after the oil shocks when it was regarded by many countries as a stable and economic source that would ensure the security of supply. Annual capacity additions were in the order of 12GW on average in the 1970s and 18GW in the 1980s. However, in recent years growth has stalled because lower fossil fuel prices have made generation from coal and gas more economically attractive and because of increasing safety concerns over nuclear power, particularly since the Chernobyl disaster.

New nuclear electricity capacity throughout the world, up to 2020, represents a little more than 100GW plants that are under construction and planned nuclear reactors, including those that came online in the period between 1997 and 2000. Over the same period, some 135GW of existing nuclear reactors are expected to be retired. The share of nuclear power in the global electricity mix is therefore projected to drop to 9% by the end of the outlook period.

The OECD countries currently account for more than four-fifths of global nuclear electricity production. Nuclear electricity provides nearly one-quarter of the OECD’s electricity demand and is the second largest single source of electricity generation after coal. Over the projection period, about 30% of existing plants are expected to be retired.

New construction is limited for two reasons. First, nuclear electricity faces strong competition from fossil fuels – natural-gas-fired CCGT plants in particular – and, second, several countries have imposed restrictions on nuclear electricity.

Most of the future growth in nuclear power is likely to come from developing countries, and from Asia in particular. South Korea, China and India all have ambitious nuclear power programmes. Nuclear electricity production in developing countries will grow by two and a half times by 2020 and its share in electricity generation will remain at around 4%.

Nuclear capacity in the transition economies is expected to decline over the projection period. There are several nuclear reactors under construction, but their completion depends largely on the availability of the necessary funds and financing new reactors may prove to be equally difficult. Some of the existing nuclear reactors may be refurbished and operated for another 10 years due to a lack of large-scale investment.

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**In developing countries, renewables may have an important role in providing electricity to remote off-grid locations as part of rural electrification programmes.**

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**Hydroelectric Power**

There was a total of 738GW of hydroelectric capacity installed worldwide in 1997. Hydroelectric power is currently the world’s second largest source of electricity, providing more than 18% of global power. It is at present the only renewable energy source that has been exploited at large scale, particularly in OECD countries. Global hydroelectric plant capacity is expected to reach 1,078GW in 2020.

In the OECD, hydroelectric power played an important role in the early years of the development of the electricity industry, but its share in electricity generation has been declining in most countries. Only Canada, Turkey and Japan are expected to develop their hydroelectric resources further. At the opposite end, existing hydroelectric dams in the US are faced with much criticism and relicensing may be difficult for several of them.

The developing countries are projected to account for 80% of the increase in hydroelectricity from the present to 2020. Most new hydroelectric capacity will be built in China and Latin America. The unexploited economic potential is still great in many developing countries, but there is much discussion about the potential environmental and social impacts of large dam construction, including hydroelectric power.

The development of large-scale hydroelectric power may in some cases have negative environmental impacts by disturbing the local ecosystem, affecting biological diversity or modifying the water quality. It may also have significant socioeconomic impacts by causing the often involuntary displacement of local populations. A number of projects in
developing countries have been stalled or resized due to such problems.

Although these impacts can to some degree be managed and mitigated, they could adversely affect the future of hydroelectric power. Obtaining loans from international lending institutions and banks, for example, could become more difficult.

Small-scale hydroelectric power seems to have relatively modest and localised impacts on the environment, but its development is, in general, more costly. It is often included in policy packages to promote renewables.

Other Renewables

Other renewables (wind, geothermal, solar, biomass and waste) account for a small but increasing percentage of global electrical capacity. Most of it is in OECD countries, but several developing countries are amongst the world’s leaders in producing electricity from renewables. The Philippines and Indonesia rank second and sixth in the world in geothermal electricity production. India and China have been actively promoting wind power development. The world’s renewables capacity will nearly triple over the projection period, to reach 142GW in 2020.

Electricity generation from renewables is, in general, expensive compared with most technologies using fossil fuels, especially CCGT plants. The costs of renewable technologies could decline further in the future, but the capital costs and efficiencies of fossil fuel technologies are also likely to improve over the projection period, offsetting fuel price increases to some extent. Moreover, in liberalised energy markets, utilities will choose the most cost-effective options for power generation and a technology that is already proven and with which they are familiar. Most of the projected growth in renewables is therefore expected to be achieved through various forms of incentives.

As OECD countries will be seeking increasingly more ways to reduce their greenhouse gas emissions, the popularity of renewables will be growing. In these countries, renewables capacity will grow from 37GW in 1997 to 111GW in 2020.

In developing countries, renewables may have an important role in providing electricity to remote off-grid locations as part of rural electrification programmes, in doing so providing basic electric services to rural households. Renewable energy sources in developing countries are projected to account for 29GW of installed capacity in 2020 — equivalent to a little more than 1% of their total electricity production.

Wind, biomass and wastes are expected to supply most of the future growth in renewables. Combustible renewables and wastes now provide the bulk of non-hydro renewable electricity, accounting for nearly three-quarters of electricity from renewables, although wind power is growing rapidly. Figure 2 shows recent increases in wind capacity in OECD Europe, where most of the current growth is concentrated.

This article draws on the 2000 World Energy Outlook, which was published by the International Energy Agency in November 2000.

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Key Challenges for the Energy Sector in Latin America and the Caribbean

a report by

Giovanni Giovannelli

Investment Officer, Private Sector Department, Inter-American Development Bank

Poverty and inequality are a persistent problem in Latin America and the Caribbean (LAC). Poverty affects 50% of the region’s population and 60% of children in the region. Overall poverty levels have grown 10 percentage points in the last 18 years, while inequality measures in the region have failed to decline over the past decade. Latin American and Caribbean governments need to engage in the fight against poverty by creating a suitable environment for economic growth at the national level and by empowering individuals with new opportunities to participate in the global economy. In this context, access to reliable and low-priced energy for all residents is widely regarded as one of the key requirements for people to contribute to growth and development.

Latin American and Caribbean countries are increasingly viewing energy as a strategic sector and are trying to take the necessary measures to develop its full potential and turn it into an engine for growth.

Background

Historically, Latin America’s energy policy has been focused primarily on the exploitation of its oil reserves and on the increase of oil exports. Hard currency proceeds from oil sales were viewed as the simple way of balancing current account deficits and were in part used to finance subsidies to the energy sector, particularly to support the expansion plans of inefficient government-owned electricity companies. Subsidies distorted prices, limited foreign investment and hampered growth and modernisation of the energy sector. The disparity of country regulations and subsidy structures also limited the potential for regional integration of electricity markets, increasing the vulnerability of national systems, especially in small countries.

The crisis of the 1980s strongly affected the economy of the Latin American region and prompted structural adjustment policies in many countries, leading to an overall reconsideration of energy policy. Governments started to decrease their participation in the energy market as direct operators, aiming at raising much-needed revenues by selling assets, reducing ongoing subsidies that their budget could no longer afford and taking advantage of the globalisation trend in the energy industry. In addition, following the example of Chile, many countries began reforming the legislation and regulation of the energy sector, redefined the role of the state as regulator and supervisor and allowed private-sector participation in activities once considered strategic for the country, such as state oil companies, electricity generating companies and distribution companies. These reforms increased transparency and competition and, together with technical progress in the generation, transmission, measurement and use of energy, were the main driving factor of the increased private appetite for energy assets in LAC.

After the successful completion of these first-generation reforms, four key challenges remain open in the Latin American and Caribbean energy sector.

Attracting Foreign Investment

Driven by economic development and population growth, the demand for energy in LAC will continue to increase over the next decade. On one hand, higher income levels and improvements in road infrastructure will stimulate the demand for oil above its average annual growth rate of 3.5% over the past decade. On the other hand, economic development will push up demand for electricity, at least to match the current average annual growth rate of 6%, resulting in an additional 80 gigawatts (GW) to 85GW of new capacity required by 2006.

Market analysts predict that the composition of sources of energy will also shift significantly, increasing the share of natural gas and renewable resources, and decreasing that of coal and other heavy fuels. Technology may also soon bring to market breakthrough innovations in energy, such as the large-scale use of hydrogen-based energy sources and the increasing role for micropower and decentralised energy systems. All of this requires substantial research and development in LAC to allow those technologies to be used and to maintain the region’s competitive position. The first challenge for LAC is therefore to increase its capacity to attract investment in the energy sector.
Large energy companies are likely to respond positively and increase their presence in the region as suggested by the industry trends of the last few years:

- A dramatic wave of concentration in the energy sector can be observed worldwide as companies strive to increase in size and leverage their expertise in increasingly related fields, such as gas and electricity.

- In the last five years, the Asian and the Russian crises have confirmed that the best way to manage country risk for companies operating in a global market such as energy is to assume a global scale through a portfolio of foreign investments.

- Regulatory reform in many Latin American and Caribbean countries is redefining the concept of energy sources as a negotiable commodity, which means, as discussed in the following section, that the prospective market for a foreign investor goes beyond national boundaries.

In order to catalyse substantial foreign investment in energy, Latin American and Caribbean countries need to concentrate their efforts on lowering political risk. This can be done by adopting clear and transparent rules of the game within the sector, by improving the quality of regulation and the effectiveness and independence of regulatory agencies and by accepting international arbitration as a dispute settlement mechanism.

In parallel, the development of local capital markets must be made a priority throughout Latin America. Energy projects have a long useful life, often beyond 20 years, and usually generate local currency revenues. Therefore, they require long-term local currency funding, which is available only if long-term savings such as pension funds are generated, and capital markets are able to develop instruments to channel them to productive investments.

**Integrating Latin American and Caribbean Energy Markets**

The countries of LAC possess abundant and varied energy resources (including oil, natural gas, coal, biomass and other renewable sources), as well as great hydropower potential. Given that some countries have a higher concentration of those resources, there is a high potential for energy trading, which has so far mostly resulted in oil trade within the region. The last few years have witnessed a substantial growth of natural gas and electricity interconnections via new pipelines and transmission lines that could soon open the path to large-scale trading of those commodities as well.

This market enlargement affecting many energy commodities enables a more efficient use of resources and stimulates a greater reliance on cheaper and cleaner fuels that result in lower costs for end-users. Also, larger markets are more attractive for international investors, so the possibility of regional trading provides an incentive to large-scale projects from international developers. Mexico is an important case to observe and is likely to attract substantial foreign investment due to both its rapidly increasing internal demand and its potential in cross-border trading with the US. The second challenge to Latin American and Caribbean countries is therefore to create the conditions for further integration of their energy markets.

This involves the harmonisation in the legal, regulatory and commercial rules governing the sector, as well as the promotion of private investments in integration projects, through bilateral agreements and joint bidding procedures. The southern cone of Latin America is providing a good example, with increasing electricity and gas trade taking place between Argentina, Brazil, Bolivia and Chile. Central American countries have signed an Electric Grid Integration Treaty, which will contribute to both sector integration and reform, and are now in the process of implementing the SIEPAC (Complementary Feasibility Studies and Support for the Central American Power Grid) project for electric interconnection.

**Increasing Electricity Coverage in Rural Areas**

LAC boasts high electricity coverage, at 84% of the total population, although 60% of the rural population, or approximately 75 million people, lacked electricity in 1997. This problem is, unsurprisingly, more severe in the least-developed countries – Nicaragua, Guatemala, Honduras, Haiti, Bolivia, El Salvador and Peru – where less than one-fifth of rural households have electricity. Such low coverage rates are in part attributable to government-owned electricity companies, for the following three reasons.

- Centrally planned expansion policies were pursued without seeking active community participation, which led to poor targeting of the initiatives aimed at increasing coverage.

- Government-owned distribution companies in many instances failed to keep illegal connections under control for many years. This was a major obstacle to increasing electrification once private operators were allowed to enter distribution, given the strong resistance of the population to pay for electricity.
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• Political interference in the electricity sector often resulted in restrictions posed to other potential providers of electricity that could have played an important role in rural areas. In particular, new technologies have significantly reduced the scale at which economies are made in generation activities and this has made competitive small hydroelectric and gas thermal power plants.

The third challenge for Latin American and Caribbean countries is therefore to increase electricity penetration in rural areas, both by promoting private investment and by setting up clearly targeted subsidy schemes where private investment is not possible. It is evident that the necessary expansion of the grid to connect the underprivileged will not take place simply as a consequence of privatisation and restructuring. If large subsidies are completely removed, most customers will not be able to pay for electricity on the new terms and private owners will not supply the significant capital necessary to expand the network.

The plan to fight poverty and increase coverage must be an integrated part of all electricity sector reforms and needs to include a rationalisation of the current subsidy programmes targeting subsidies where they are truly needed.

**Protecting the Environment**

In LAC, outside of the cities much of the energy consumed comes from use of biomass materials, and this trend persists even after the population is connected to the grid. This causes environmental problems, such as deforestation, air pollution and water pollution in rural areas.

As for urban areas, the rapid growth of cities in the last 30 years has multiplied the demand for transportation. Local governments have often been unable to respond with the creation of mass transit systems, while central governments have kept prices of fuel low in order to stimulate economic activity.

The result has been a dramatic increase in the use of automobiles, leading to congestion and air pollution. Relative to other regions of the world, Latin America, as a whole, still ranks low in carbon-dioxide (CO₂) emissions, primarily because of its low use of coal for electricity generation and high reliance on hydroelectric power. The Intergovernmental Panel on Climate Change estimated that emissions from LAC accounted for 4.8% of global gas emissions with a greenhouse effect in 1990. Transportation and manufacturing are the main sources of air pollution in the region, accounting for 35% and 22% of CO₂ emissions, respectively. Even if this situation is not alarming when viewed on a regional scale, in many cities across LAC, pollution is beyond acceptable levels and is affecting the quality of life of the residents and, in certain instances, their health and wellbeing.

In the 21st century, Latin American and Caribbean governments need to include environmental protection as one of the key pillars of their energy policy, promoting good practices, such as the use of clean fuels, adopting environmental standards for the energy industry and enforcing local and international environmental regulation.

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An interesting phenomenon that can provide an incentive to private companies to increase coverage is the fact that, over the past decade, electricity distribution has become a more interesting business than electricity generation, particularly in developing countries. Experience has shown many international investors that distribution can be a profitable business once competent management is devoted to it.

More interestingly, the distribution business allows important consumer information, often not otherwise available in developing countries, to be obtained. The local power company knows where people live, how much energy they consume (often correlated with income) and the reliability of each family in paying its bills. All of this is relevant information for many other businesses, from banks to credit card companies, from retail businesses to municipal government and other taxation authorities.

Latin American and Caribbean countries are increasingly viewing energy as a strategic sector and are trying to take the necessary measures to develop its full potential and turn it into an engine for growth.
Innovative Private Sector Participation in Transport Infrastructure

a report by

Cesar Queiroz

Lead Highway Engineer, Europe and Central Asia Region, The World Bank

Introduction

In the 19th and early 20th centuries, many transport infrastructures were privately financed. After World War I, public financing of infrastructure was dominant with virtually no further private financing of highway infrastructure. However, in the 1980s and up to 1997, private financing of transport infrastructure increased dramatically. The difficult conditions in emerging markets in the late 1990s contributed to a shift in project finance efforts from new projects to the privatisation, rehabilitation and expansion of existing facilities. Countries have been seeking alternative sources of financing because of the magnitude of the needs to maintain and upgrade a country’s infrastructure, and the difficulty of financing the totality of these needs out of budgetary resources.

In many countries, the private sector has been involved in financing infrastructure through concessions - i.e. legal arrangements in which a firm or consortium (“the concessionaire”) obtains the right to provide a particular service from the government, such as building, operating and maintaining a highway for a specific period. The concessionaire is usually compensated through tolls collected from the road users or from ‘shadow tolls’.

A feature of private sector financing is the large number of ‘actors’ involved, each with their own, often conflicting, objectives. Principally because of this, private-sector financing for a proposed project takes considerably more time to develop and is more complex than would be the same project financed entirely from budgetary sources. This article reviews the current trend to involve the private sector in the financing of road infrastructure, and discusses how the World Bank can contribute in attracting private capital to infrastructure projects through use of its guarantee power.

Several innovative options to involve the private sector are addressed, even if financing still comes from public sources, towards improved management of transport assets. The process begins with separating the functions of planning and management from implementation of civil works. Forms of contract between the public and the private sectors include:

- price-based and cost-based;
- procedural and functional specifications (or method-based and performance-based); and
- short-term and long-term.

These different forms have several implications on the risk allocation between client and contractor. The risks to the public agency tend to decrease as the agency shifts from force account (or direct labour) to short-term and long-term forms of contract with the private sector, including concessions. Transport agencies have increased private sector involvement in an attempt to:

- reduce the amount of budgetary resources required on a project;
- reallocate performance risk;
- increase contractor innovation;
- increase the quality of constructed products; and
- reduce life-cycle costs of projects.

Recent experience in the increased involvement of the private sector in highway asset management is summarised for countries such as Australia, New Zealand, the US, the UK and Argentina.

Transition Economies and Transportation

Many of the newly independent states of Russia and other economies in transition are emerging from an era in which the state planned the size, nature and distribution of transport activities, operated the transport system, designed and constructed the entire infrastructure and provided most services. In contrast, transition to a market economy requires governments to focus on the creation and supervision of competitive markets, and the regulation necessary to protect the public interest and allow the private sector to operate efficiently.

In this new context, the government’s main roles are to:

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• determine transport policy and encourage a market environment in which customer choice can be exercised freely, and private individuals and firms can maximise their rewards by responding to those choices; and

• create regulatory frameworks that protect consumers against abuse of market power, permit concessionaires to earn a reasonable rate of return, allow adequate response to market failures and ensure compliance with environmental and safety standards.

Implementing an adequate reform of the transport sector can assist the government in achieving several main objectives:

• stabilise the economy through minimising the public deficit;

• catch up on large backlogs of asset maintenance and renewal, neglected during the past decade;

• ensure the continued affordability of essential passenger transport;

• avoid social tensions caused by large-scale elimination of jobs in the public sector; and

• reduce air and water pollution.

The World Bank’s Role in the Sector

The World Bank Policy Paper on Sustainable Transport1 states that institutional and policy reform should be the primary focus of the World Bank Group’s efforts to make transport services more sustainable. In the absence of extensive reforms to deregulate and open up the sector to competition and to strengthen its institutional capacity, projects are not likely to achieve their goals. The World Bank can help governments fulfil their enabling and supervisory role in a free transport market through more selective and focused technical assistance for building the capacity and skills needed by the public sector.

The World Bank can also contribute through a continued strong lending programme in transport that is complementary to policy and institutional reform – investment requirements in transport will continue to grow; and the private sector cannot supply all the transport infrastructure financing that is needed. For the most part, existing lending instruments allow the freedom necessary to design

and finance operations that support a reform agenda. The World Bank Group can also contribute to greater private sector involvement in financing transport infrastructure by International Finance Corporation loans, equity participation and capital market activities, Multilateral Investment Guarantee Agency insurance and World Bank guarantees.

Expansion of Private Financing for Infrastructure

Since the 1980s, most notably since 1988, private financing of transport infrastructure has been impressive, particularly in the financing of assets for which:

• access can be limited (as in airports and seaports, tunnels, bridges, and major highways, in contrast to urban and rural local roads);

• projected volume of traffic is high (container ports, freight rail, main roads, major bridges);

• generation of cash is reasonably predictable and stable (market or regulated tariffs with reasonable pass-through arrangement, limited exposure to non-commercial risk and the availability of buy-out provisions); and

• foreign exchange earnings are possible (ports, airports).

Private financing of construction is usually associated with continuing public sector responsibility for strategic network and location planning. In the case of toll roads and urban mass transit infrastructure, private firms are normally given a concession to manage and operate the facility for a period of years, with ownership of the asset returning at some point to the public sector. Build-operate-transfer (BOT) is one possibility, with the transfer occurring at the end of the operational concession period. The difficult conditions in emerging markets in the late 1990s contributed to a shift in project finance efforts from new projects to the privatisation, rehabilitation and expansion of existing facilities.

Failures and mistakes in project finance deals in the 1990s were sharp and persistent, but much has been learned about sound project economics, conservative financial structures, comprehensive sensitivity analysis, the effects of macroeconomic factors and the need for proper incentives and sound institutional and regulatory arrangements.1


http://www.worldbank.org/research/workingpapers
**Concessions**

Private firms can maintain and manage operations more efficiently if political interference in their affairs is minimised. Concession schemes can facilitate this process. Concessions can ease a government’s fiscal problems by moving infrastructure projects off-budget during the years of construction. This advantage is reduced to the extent that the government makes payments that allow dividends to be paid to investors before the facility is commissioned or gives revenue guarantees in excess of the revenue-earning potential of the facility.

Private-sector financing of transport infrastructure must be seen as a partnership between the public and private sectors. The potential for raising private finance on both domestic and international capital markets can be enhanced by making policy reforms that create clear rules allowing investors to form reasonably firm expectations about cash flows generated in an infrastructure business.

Developing a successful programme depends on a number of important prerequisites:

- an active government role in planning the network;
- strong commitment to private funding;
- steady economic growth;
- the acceptance of some risk-sharing between private and public sectors (although governments should not guarantee normal commercial risks);
- strong local capital markets; and
- an entrepreneurial private sector.  

The selection of a preferred form of public-private partnership, and of the specific form of private-sector participation, should be based on an analysis of the total social costs and benefits of the alternatives available. The government will play an important role in any private transport investment because of the inextricability of transport from the rest of the economy. Such a role may be limited to that of regulator, but more often involves provision of ancillary services, such as approach roads or interconnections. It may also involve limited financial underpinning of the project, commensurate with the degree of control the government has over that project.

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**The World Bank Guarantee and Infrastructure Financing**

Countries in transition increasingly interested in attracting private capital to infrastructure projects may benefit from the World Bank’s guarantee power. At the request of a government, World Bank guarantees are provided to private project lenders where the demand for funding is large, political and sovereign risks are significant, and long maturity financing is often critical to a project’s affordability.

By covering sovereign risks that the market is not able to bear or adequately evaluate, a World Bank guarantee assists a project entity in attracting new sources of financing, reducing financing cost and, most importantly, extending maturities. The guarantee can be especially valuable where activities traditionally undertaken and financed by the government are being shifted to the private sector, but where the government and its agencies remain involved – for example, as regulator – provider of inputs or buyer of outputs. The World Bank’s participation in a government’s international competitive bidding heightens price competition and, by offering the guarantee as an option to all bidders, contributes to the transparency of the bidding.

The World Bank’s guarantee is intended to be catalytic. To this end, the World Bank offers only partial guarantees, and risks are clearly and carefully allocated between the World Bank and private lenders. The objective is to cover risks that it is uniquely positioned to bear, given its credit experience with developing countries and special relationship with governments. Other project risks would typically be allocated to equity sponsors who would likely further allocate some of them to contractors, vendors, insurers and/or lenders. A partial risk guarantee covers specified risks arising from non-performance of sovereign contractual obligations, or certain political force majeure events.

**Partial Risk Guarantees for Project Finance**

Partial risk guarantees are particularly relevant in the context of the major worldwide shift towards privatisation and private financing of infrastructure. Such guarantees cover specific government obligations spelled out in a support agreement – e.g., concession agreement, implementation agreement, BOT contract – with the project entity. They are appropriate for enhancing a project’s limited recourse project financing, the most common method of

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financing concessions for transport infrastructure. A schematic representation of a partial risk guarantee is presented in Figure 1, while Figure 2 provides an illustration of how this general structure can apply to a highway concession contract.

Partial risk guarantees ensure payment in the case of debt service default resulting from the non-performance of sovereign contractual obligations undertaken by governments or their agencies in private sector projects. Sovereign contractual obligations vary depending on project, sector and country circumstances, and would be embodied in a support agreement negotiated between the government and the project sponsors. Typical government contractual obligations include:

- maintaining the agreed regulatory framework, including tariff rates or formulas;
- construction assistance, such as permitting and rights-of-way, land, interconnections, ancillary service, etc.;
- operations assistance, such as maintaining access roads to a toll road;
- financial assistance, such as minimum revenue guarantee, if any, or guarantee of payment by government users;
- assistance with currency issues, such as foreign currency convertibility and availability, and banking permits; and
- payment of damages in the event of breach of the support agreement by the government or its agencies.

A partial risk guarantee is triggered by debt service default resulting from government non-compliance with one or more of its obligations as stipulated in the support agreement with the project company.

**Allocation of Risks and Innovation in Contract Management**

Even if financing still comes from public sources, there are several innovative options to involve the private sector so as to improve management of transport assets. For example, in recent years, several countries have gradually moved from procedural (or method) to performance (or end-product, functional, results) specifications. Instead of amount of works to be executed, e.g., cubic metres of cement concrete, a performance contract may specify a road or airport pavement performance in terms of roughness, rutting or surface friction. Performance-based contracts tend to minimise the amount of supervision required of the public agency, and encourage contractors to find the best way to meet performance requirements. Public agencies are accountable for the management of extensive public assets and hence for the management of risks associated with the ownership of those assets. Risk should be the responsibility of the party best able to manage it.

Under a traditional method-specification, the contractor takes the risk on physical performance in accordance with specifications – subject to external factors – and other risks are allocated by the contract, compared with under a long-term performance-based specification, where the risks associated with asset management, planning and method are transferred in large measure to the contractor. With a method-specification-based contract there will be very little room for innovation. With an outcome-oriented, performance-based type of specification, however, there is scope for the contractor to offer innovative solutions to maintenance needs, such as introducing new or modified materials and methods.

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As a public agency moves from force account (or direct labour) to different forms of contract maintenance, there is a redistribution of risks as illustrated in Figure 3. Agency risks tend to decrease and contractor risks increase when long-term contracting procedures are adopted, particularly if a concession-type approach is used. A public agency remains responsible for the overall performance of the transport assets under its responsibility, thus increasing the importance of proper monitoring of the tasks transferred to the private sector. Countries such as Australia and the UK have adopted a partnering approach between the public and private sectors to help ensure successful outcomes in the long-term performance-based contracts. As indicated in Figure 3, reform-oriented public agencies, which successfully switch from force-account to contract maintenance, and replace the traditional quantities and unit price-based contracts by performance-based contracts, are able to transfer a significant degree of risk to the private sector.

Contracting out maintenance is a growing trend and generally results in cost savings over traditional practices. The private sector has demonstrated its ability to respond to the opportunities, which has led to innovation and efficiency in delivering a quality product. However, there are potential downsides related to setting the appropriate end-result specifications, the risk of contractor defaults, ineffective dispute resolution procedures and loss of politically driven decisions.

**Long-term Performance-based Contracts**

A number of states in Australia and in New Zealand have introduced competitively tendered medium-term (three to five years) and long-term (ten years) contracts for highway networks. Long-term performance-based contracts are also known as 'performance specified maintenance contracts'. Payment is based on objectively measured outcomes.

Determination of appropriate performance appraisal criteria and intervention levels are still evolving and continue to be the subject of much debate. The development of firm specifications is required and should include performance bonus, penalties or both.

As an example, the British Columbia Ministry of Transportation and Highways has developed a comprehensive manual on *Standards for Road and Bridge Maintenance Services* while in Argentina, several requirements are stipulated for the pavement surface condition after construction.

**Warranty Contracts in the US**

Warranty is a form of performance-based contract that has been used in the US as an attempt to:

- reduce the amount of highway agency resources required on a highway project;
- reallocate performance risk;
- increase contractor innovation;
- increase the quality of constructed products; and
- reduce life-cycle costs of highway projects.

A warranty has been defined as "a guarantee of the integrity of a product and of the maker's responsibility for the repair or replacement of deficiencies." Under a warranty specification, quality is measured based on actual end-product performance, not on the properties of construction materials.

Under a warranty programme, a contractor has more

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freedom to select materials and construction methods than under a traditional specification, and a contractor may develop a tailored quality control programme to fit each project. With warranty contracting, a contractor’s knowledge and experience may be fully utilised, without the restrictions inherent in method-based specifications.

**Design, Build, Finance and Operate in the UK**

The UK long-term performance contracts cover a 30-year period for roads requiring major rehabilitation or new investments. Payments are indexed to traffic flows. This type of contract requires well-developed contractors and a highly professional road agency.

Design, build, finance and operate (DBFO) has developed as an option for procuring a highway management service for trunk roads in the UK. A similar approach has also been adopted in other countries, including Finland and Portugal. DBFO can be considered a form of concession where the contractor is paid by the highway agency based on shadow tolls, that is, a cash amount based on the volume and composition of traffic on the road, instead of real toll collection.

The government has two main aims when seeking DBFO contracts. These aims are to develop a private sector road-operating industry providing an equivalent level of public safety and service to that which exists on the rest of the trunk road network; and to transfer significant risk to the private sector, and minimise the project cost and extent of the risk borne by the public sector.

**Summary and Conclusion**

Throughout the 1980s and up to 1997, private financing of transport infrastructure increased dramatically. The difficult conditions in emerging markets in the late 1990s contributed to a shift in project finance efforts from new projects to the privatisation, rehabilitation and expansion of existing facilities. Countries have been looking for alternative sources of financing because of the magnitude of the needs to maintain and upgrade a country’s infrastructure, and the difficulty of financing the totality of these needs out of budgetary resources. In many countries, the private sector has been involved in financing infrastructure through concessions – i.e. legal arrangements in which a firm or the concessionaire obtains the right to provide a particular service from the government. The World Bank is well positioned to assist the transition economies in improving their transport infrastructure through institutional reforms, direct loans to the public sector or using its guarantee power to facilitate private financing.

Forms of contract between the public and private sectors have several implications on the risk allocation between client and contractor. The risks to the public agency tend to decrease as the agency shifts from force account (direct labour) to short-term and long-term forms of contract with the private sector, including concessions. Public agencies have increased private sector involvement in an attempt to reduce the amount of budgetary resources required on a project, to reallocate performance risk, to increase contractor innovation, to increase the quality of constructed products and, ultimately, to reduce lifecycle costs of transport projects. Experience in the increased involvement of the private sector in asset management was summarised in the paper. Most of the concessions and long-term maintenance contracts so far have been implemented for only a few years. Consequently, caution is required in assessing the potential success of these long-term projects.

**Additional References**


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Unintended Consequences — a Story of Public Transport Finance

a report by
Paul L Marx

Senior Economist, Federal Transit Administration (FTA)

The use of debt to advance public transport projects in the US has been limited until quite recently. Since the implementation of the Urban Mass Transportation Act of 1964, only the largest public transit operations made use of the bond markets to support some of their major capital projects. In many cases, the use was made possible because the public transit authority was able to make a ‘full faith and credit’ pledge of the state as security for the debt. Enactment of the Transportation Equity Act for the 21st Century (TEA-21) changed all that by making it possible for public transport agencies to issue debt secured in whole, or in part, by future federal grant receipts. Inevitably, there will be repercussions.

Background

Most public transport agencies in the US are municipal entities, created under state or municipal laws. The overwhelming majority of these depend on their city or their state for debt issuance and, in fact, most do not rely on debt for capital purposes. The traditional method for supporting a capital investment is accrual and cash on delivery. Even for relatively modest acquisitions, such as two or three buses, a public transport operator will not place the order until 80% of the cost is accrued in federal grant commitments in addition to the required 20% locally funded share.

Until recently, there were less than 10 recurring exceptions to this practice across the US. New York City’s Metropolitan Transit Authority was a notable exception, generating sufficient revenue from fares to act as a cost-effective pledge for relatively short-term debt issues. Others, such as New Jersey Transit (NJT) or the Massachusetts Bay Transit Authority, could, under certain circumstances, pledge the full faith and credit of the state, yet others, such as the Southeastern Pennsylvania Transit Authority, worked for many years to develop secured and unsecured borrowing capacity in the US and abroad.

In the early 1990s, increasing congestion and air-quality concerns led to local pressure for greater amounts of public transport investment. The federal share of capital expenditure for public transport fell to below 50% nationwide in 1992 for the first time. The level of investment overall (federal and local), however, increased from US$7.5 billion per year in 1991 to more than US$12 billion per year in 1999. This was made possible in large part by an increase in the use of debt to accelerate projects that had been held up for lack of funding.

The TEA-21 Effect

TEA-21 is the most recent, multi-year, federal law authorising surface transportation programmes, including public transport. In an effort to insulate transportation infrastructure from budget reductions, TEA-21 included two provisions. One was to limit the use of Federal Highway Trust and Mass Transit Account funds to transportation purposes only. These are the accounts that provide 80% of the federal surface transportation appropriations, from motor fuels and other automotive taxes. The second provision authorised a ‘minimum guarantee’ funding level. This level could be reduced by appropriating committees, but the ‘non-appropriated’ funds could not be used for any other purpose than transportation. The effect of the two provisions was to provide a predictable floor that public transport providers could depend on for capital planning.

The minimum-guarantee funding level provided the last piece of supporting information needed by rating agencies to analyse municipal debt that might be issued by public transport agencies on the basis of federal grants. At first, such debt issuances were secured by multiple pledges, usually including local sales taxes, appropriated funds and even fares. With the enactment of TEA-21, however, the first true Grant Anticipation Notes (GANs) were issued. These municipal debt issuances were rated from A to A+, even when their terms exceeded the current authorisation period (2003) and even though there was no underlying full faith and credit pledge.1

1 An example rating using the Fitch IBCA format. This would be referred to as an ‘underlying rating’ in an official statement when the issuer purchased bond insurance, thus allowing the bonds to be sold with a street rating of AAA.
The Outcome – Hudson-Bergen Light Rail GANs

Since enactment of TEA-21, more than US$1 billion in grant anticipation debt has been issued without a local backstop pledge – i.e. based solely on anticipated federal grant receipts. NJT has been an aggressive user of this mechanism and, on one project in particular, has issued bonds in anticipation of a flow of federal funds that will not begin for some years. The Federal Transit Administration executed a Full Funding Grant Agreement (FFGA) for the second phase of this project with NJT in October 2000. The FFGA committed a maximum of US$500 million in federal funds towards the US$1.2 billion project. However, due to federal budgetary pressures, funds will not be available for this FFGA until 2003.

NJT had contracted with a design-builder firm to build the Hudson-Bergen Light Rail Transit System, and the first phase was completed in 2001. Under a more traditional process, NJT would have allowed the contract to lapse, issued a new contract for phase two and begun construction in early 2003, which would have been costly and extremely inefficient. Contract termination procedures would have been expensive and time-consuming, as would a new bid-and-offer process. In addition, the delay of construction for two or three years would have raised the cost significantly. Issuing grant anticipation bonds allowed NJT to proceed with the next phase of the project, ensuring a seamless integration of both phases due to having used a common designer-builder for both parts.

Thus, in November 2000, NJT issued US$452.18 million in Capital GANs (Series 2000B), secured solely with a pledge of its FFGA revenues. The underlying rating of this issue was A-, with an average yield of 4.75%. The maximum term of the bonds is 2011, but bonds maturing after August 2008 may be redeemed prior to maturity. If the bonds are redeemed as expected, NJT will face interest payments of US$142 million through to 2009. If the federal grant reimbursements are delayed (appropriations risk) the interest paid could exceed US$200 million.

Is It Worth It?

NJT already has to raise US$650 million in local funds to bring this project to a close, yet burdens itself with an additional interest cost. This is for reasons of timing and Figure 1 illustrates the time disparity between the Hudson-Bergen Light Rail Transit System construction costs and the federal grant reimbursements.

Fully 80% of the project construction costs will be incurred prior to receipt of the first federal dollar. If the arrival of those funds was delayed due to appropriation risk, the cost could be much higher. By issuing GANs, NJT assures itself of a project completed on time and on budget – possibly even under budget. The nature of the FFGA allows NJT to retain all construction cost savings, provided the final federal share of eligible costs does not exceed 80%.

In practical terms, this means that NJT avoids construction inflation by completing the project sooner than otherwise anticipated. Depending on the aspect of construction, NJT faces an inflation rate of between 5% and 9% annually. Any time saved reduces costs materially, and any costs it can avoid rebound to its immediate benefit. Preliminary estimates indicate that NJT will save as much as US$300 million net of interest costs as a result of using this GAN mechanism.

Prognosis

GANs for public transport are still in their infancy. While more than US$3 billion in highway grant anticipation bonds have been issued as of October 2000, the public transport total remains closer to US$1.5 billion. However, the level of interest in the mechanism is growing. At least five US states have developed new statutes to allow their public transport agencies to issue GANs, and three more are seeking to add such authority.

New participants in this market include the Port Authority Transit in Pittsburgh, Pennsylvania; the

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Regional Transit District in Denver, Colorado; Phoenix Transit in Arizona; and possibly the Bay Area Rapid Transit in San Francisco, California. Their GANs, already sold and currently planned together, would total in excess of US$800 million. The cash would accelerate their projects (or assure their completion on time) by an average of three years.

This does very little for the grant programme. There is a limited (and known) pool of formula funding, and an exhausted pool of discretionary funding in TEA-21. Funds will not be appropriated any faster because of the increased use of GANs, which itself may lead to a more stable cycle of infrastructure replacement and financing at the local level. If a public transport system routinely uses a balanced combination of debt and ‘pay-as-you-go’ procurement to manage its capital, it has the flexibility to react to unexpected situations. These could include surges in demand, catastrophic events or changes in operations resulting from changes in technology or law.

GANs, backed with FFGAs, are being issued with maturities of 12 years or more. Surface transportation authorising acts generally do not exceed six years. There is an authorisation risk to these securities and the rating agencies have factored this risk into the bond ratings. The mitigating factors to this risk include the history of the Federal Transit Program, the importance of the investments to their local communities and the fact that congressional support for infrastructure investment has been consistently bipartisan. Another mitigating factor is the knowledge that any change in the Federal Motor Fuels Tax regime will be discussed for many months (even years) before implementation, thus providing ample time for the market to react.

The public transport agencies’ use of their grants for debt service does not really reduce the need for appropriations in the near term, and Congress could not really reduce appropriations now to take advantage of the current use of debt. In the case of formula grants, it would be difficult to interrupt the flow of grant funds to some urban areas or transit operators and not to others, without raising significant equity issues. In the case of capital grant funds, the FFGA represents a commitment against available balances in the Mass Transit Account. When the FFGA is executed, these funds are committed even though they may still require an appropriations act to make them available. Thus, although NJT will not receive its first grant funds until 2003, the full US$500 million of its FFGA has already been debited against the projected Mass Transit Account receipts. There are many additional projects ‘in the pipeline’ that are depending on future authorising acts to provide additional funding.3

This means that, for the surface transportation programmes as a whole, that the use of grant anticipation debt is likely to rise to a level where it becomes routine. Public transport operators will not commit much more than 60% of their anticipated formula revenues – in part because the market would raise the cost of their debt if they tried. Many public transport operators will never use GANs because their cities or their boards of directors do not believe in the use of debt.

Ultimately, an equilibrium will be reached where the level of new GANs sold is enough to replace maturing GANs and sufficient to handle incremental investment needs resulting from growth in demand for public transport services. The factor that will control this equation will be the cost of debt as compared with the internal cost of capital. As more public transport operators gain access to sales taxes, property taxes or other local funding support, the use of GANs is likely to tail off. In the interim, it fulfils a vital function in capital asset management.4

3. A rough estimate is that US$22 billion of projects are seeking FFGAs under the Federal Transit Program. At a Federal share of 50%, this results in a ‘new starts’ estimate of US$11 billion. At current funding levels, this implies that two full authorisation cycles will be needed to meet the existing pipeline of projects.

4. It should be borne in mind that public transport projects have useful lives for as long as 60 years. Bonds maturing in 12 or 15 years would still be regarded as medium-term financing for such assets. It would generally be more cost-effective to issue longer-term bonds to support long-lived capital assets. Thus, whenever possible, we would expect more traditional bonds to be issued based on sales taxes or other, stable revenue sources.
A 20-year airport concession contract, signed recently in the South African city of Richards Bay, illustrates how public-private partnerships are becoming essential tools in sustaining rapid economic development in some of South Africa's fastest-growing urban areas. The Richards Bay deal also illustrates an innovative approach through which the municipal owners of these facilities can make the sometimes difficult choice between concession and sale as the best option for dealing with their assets.

Thirty years ago, Richards Bay was a fishing village of 200 residents, located in the north-eastern section of KwaZulu-Natal Province. Today, with a population of over 110,000, it is one of Africa's premier deep-water ports and a busy gateway to many tourist attractions to the north. Port development initially triggered the city's growth, and growth came rapidly in the form of a host of heavy industries that relocated to the municipal area. Transport facilities played a key role in cementing this growth, and business at the municipal airport expanded constantly over the years.

However, by the late 1990s, the city had clearly exceeded its ability to manage and maintain the airport in a way that met regional needs. By 1998, the airport was running at a ZAR1.5 million annual deficit. Business potential clearly existed at the airport - annual passenger movements had reached 80,000 per year and were expected to continue increasing by 10% per year over the next decade - but local government rules and procedures for managing such a facility meant that the city was unable to exploit its full business potential.

Richards Bay ("the city") began the process of identifying a private partner who could take over airport operations by conducting a thorough project feasibility study, with the help of outside consultants.

The study looked at the condition of the airport and the potential for business growth, as well as the viability of several public-private partnership options. The city's goals in seeking private sector help were factored carefully into the analysis, as follows:

- The city wanted the facility to remain a functioning airport, but wanted its operating deficit from the municipal budget.
- The city also wanted to receive some income from the airport, in order to pay off the debts associated with the infrastructure, which had added to the burden on the city budget.
- It was also clear that some capital expenditure for development and expansion of airport operations, although not an immediate problem, would be needed eventually.

The city's transaction consultants assessed the options and determined that either a concession or a sale would satisfy the main objectives of the city. City officials learned how a contract of sale can impose various conditions on the new owner of such a facility, including the stipulation that it remain a functioning airport. The airport was not viewed by the city as an essential municipal service, so there was no particular legal or regulatory reason why it could not be sold. City officials also learned that, with a concession, the city could maintain ownership and perhaps sell the airport later at a better price, but would also have to monitor compliance with the terms of a usually complicated long-term concession contract.

Either way, the city decided to insist that aeronautical tariffs be charged according to official government levels published in the Government Gazette, with other tariffs adjusted in accordance with consumer price index changes, so there would be no proposals or negotiations regarding tariffs. Also, the airport had no municipal staff (all airport services were already contracted out), so the deal involved no union problems and no staff transition issues - another potential source of complication in public-private partnerships developed in South Africa. There was nothing for potential private partners to propose or negotiate regarding staff.

All things considered, a sale probably would have been the most beneficial option for the city, particularly in terms of total income, but this was a small, marginal business, with set tariffs. There were opportunities to increase overall revenue (e.g., via airport advertising and increased efficiencies), but it would have taken a long time to recoup the purchase price. (The airport was expected to continue losing...
Most private firms clearly preferred not to buy the airport, but rather to operate it, making a modest profit from management efficiencies, without paying the upfront price.

The transaction consultants concluded that a concession was the option with the highest realistic potential for a successful, completed deal with strong benefits for the city, while city officials still preferred a sale. The overall level of private sector interest in either sale or concession was low and somewhat volatile, therefore the consultants suggested that the city avoid prematurely excluding either option from consideration and possibly ending up with few or no offers for the airport. Accordingly, the decision was taken to let firms prequalify for either sale or for concession, or both (as long as they indicated what they were prequalifying for), with the clear understanding that the ultimate award would be made on the basis of overall income for the city, plans and capabilities of the bidders and other considerations important in the South African environment.

It is important to remember that tariffs, employees and capital investment were not issues in this deal. If they were, they probably would have been best handled in a long-term concession contract, with review procedures and sanctions to ensure compliance over the long term (because it is simply more difficult to hold a purchaser to such commitments than a concessionaire). If these were issues in Richards Bay, it would have been difficult to justify bidding out for sale in addition to concession; it would also have been difficult to compare the two kinds of bids because potential concessionaires would be offering the city continuing control over important aspects, in addition to offering income. It is possible that the city could have ‘priced’ its willingness to give up long-term concession-style control over these issues; then that price could have been added as a premium to sale price offers. Determining the premium ahead of time and adequately informing bidders would have been a difficult process, particularly for local managers and politicians, to manage and fully understand.

Three firms prequalified for the airport project, and all three indicated that concession was their first choice, although one said it might also still consider a sale. The request for proposal was written to accommodate both options, with a term sheet (rather than a specific contract) attached to apply to either sale or concession. The two final bidders both preferred a concession arrangement. A 20-year concession contract was eventually negotiated with the preferred bidder, Black & Veatch, a US-based engineering firm with a strong corporate presence in South Africa.

If the council had been forced to make a decision between sale and concession, the decision would have depended on a judgement regarding which is larger – the discounted value of the concession fee cash flow over the lifetime of the contract (minus costs of contract compliance monitoring, plus capital investment commitment, plus empowerment benefits) or the value of the sale price offer (plus/minus the same factors).

City officials and their consultants felt that such a comparison was fair, as the potential concessionaire could estimate what a reasonable sale price offer would be, and then adjust the cash flow of its concession fee proposal to be competitive. City officials also noted that this approach was fair in the sense that it allowed firms without the upfront purchase price capital to compete (via a concession offer) with firms that did have such capital and chose to make an offer to purchase.

The 20-year concession contract was modelled to a significant degree on another water and sanitation concession, signed in early 1999, in the same province. The Richards Bay contract involves ZAR13 million in payments to the city, which will be used to repay the debts associated with the facility, plus a probable investment of another ZAR7 million in runway upgrading (depending on the results of an independent assessment later in the contract period). In addition, 20% of the concession company and 20% of its dividends will go into a ‘community trust’ dedicated to the development and support of the local community, particularly the traditional communities near the airport. The council will make grant decisions for this fund based on grant-making procedures already prepared.

Pursuant to the contract, the private partner must arrange for a performance bond that will eventually
An Innovative Partnership Approach to Solving a South African City’s Airport Problems

expand in size to 12% of annual turnover. They must also arrange for a maintenance bond towards the end of the contract to ensure that money is available to maintain the assets as the concession winds down. The private partner must commit to service levels and investments that will be formalised in a masterplan for the airport, along with annual business plans. Annual service level reports will help the council monitor operations, plus the council can use an independent ‘maintenance consultant’ who will have the last word on required maintenance expenditure.

Other municipal airport public-private partnerships in South Africa include Johannesburg’s Rand Airport, sold in 2000, and Margate Airport, a small facility south of Durban that has recently gone out to tender. Both of these deals have faced the same choice, between concession and sale, which Richards Bay successfully managed. In both cases, either a sale or concession would have met the needs of the municipalities involved; in both cases, the cities’ first choice would have been a successful sale, but the first choice of most potential private partners would probably have been concession. Fortunately, in situations like these, where tariffs, employee transition and capital investment are not major issues, and thus not major factors in evaluating proposals, sale and concession can compete together, as the basis for the award of either is the same (total income to the local council, minus monitoring costs, plus capital investment and empowerment commitments). In the case of Rand Airport, Johannesburg officials eventually decided to go only for a sale – they were lucky to get a single bidder who made an attractive offer. Margate will probably use the more flexible approach used successfully in Richards Bay.

The careful, often innovative, preparation of all of these airport projects, along with other municipal public-private partnerships (water, sanitation, solid waste, electricity), has been made possible by the South African government’s commitment to making full use of the private sector in improving the quality of essential urban infrastructure-related services for its citizens. A key aspect of that government commitment is the role being played by the Municipal Infrastructure Investment Unit, a government-supported company that is helping to guide the process of preparing and negotiating concession contracts and other forms of public-private partnerships at the municipal level across South Africa.

Further information about the Municipal Infrastructure Investment Unit (MIIU) can be found on their website www.miiu.org.za

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Infrastructur e and Convergence

Tri-sector Partnerships in Water and Sanitation

a report by

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The private sector, the public sector and civil society can improve water and sanitation project outcomes in poor areas by working together. This hypothesis was the driving force behind the creation of the Water and Sanitation Cluster ("the Cluster") of the Business Partners for Development (BPD), an organisation that seeks to learn from and support the work of innovative tri-sector partnerships. The Cluster is currently working with eight focus projects in seven countries to learn about the partnership process and about how partnerships affect water and sanitation outcomes for the poor. The eight projects are located in Buenos Aires, Argentina; La Paz-El Alto, Bolivia; Cartagena, Colombia; Port-au-Prince, Haiti; Jakarta, Indonesia; Dakar, Senegal; Northern Province and Eastern Cape, South Africa; and KwaZulu-Natal, South Africa. To this end, the Cluster recently commissioned a study of cost recovery within the eight tri-sector projects. The objectives of this study included understanding cost recovery goals, documenting approaches used to maximise tariff payment and considering whether partnerships facilitate cost recovery.

Many of the private sector, public sector and non-governmental organisations (NGOs) staff surveyed for this study listed ‘working with other project partners’ as one of the most difficult aspects of their projects. Nonetheless, they also expressed confidence that working together had helped improve cost recovery.

Putting Cost Recovery in Context

Achieving financial sustainability is an increasingly important goal in water and sanitation projects worldwide. This stems from a growing recognition that water is an economic good and that the benefits of projects are likely to be short-lived if the projects are unable to recover costs. While cost recovery is an important piece of sustainable service delivery, it cannot be studied in a vacuum. Sustainability in water and sanitation projects is multifaceted.

Technical, institutional and financial sustainability are all important. The technical (service level, service quality and reliability) and institutional (community involvement, service delivery institution) structure of a water and sanitation programme will affect whether and how much households are willing to use and pay for service. Household decisions about whether to use and pay for a service in turn have a direct effect on cost recovery. The cost recovery challenge in any water and sanitation project is to find the right balance between these elements:

- a service that households want to use, are willing to pay for, and actually do pay for; or
- an operational and institutional system that is capable of collecting these contributions.

The Business Partners for Development Focus Projects

What the eight focus projects have in common is that they all operate in poor areas, and are all partnerships between public or private utilities, NGOs, government institutions and/or community organisations. Beyond that, the projects are quite diverse. They range in scope from providing services in one peri-urban district (600 households in Jakarta) to a major government investment programme for rural and peri-urban areas (the BOTT (build operate train and transfer) initiative of the South African Department of Water Affairs and Forestry). Technology choice also varies across projects, and includes stands, in-house connections with full or reduced pressure, condominial sewerage and traditional sewerage.

Most of the projects are located in urban or peri-urban areas. Before work began on these focus projects, households in the focus communities relied on a variety of traditional, informal and/or illegal water services (rivers, private water vendors, illegal

1. More information on the projects and BPD’s partner organisations can be found on the website http://www.bpd-waterandsanitation.org or by contacting bpd@wateraid.org.uk
2. Further information on the study can be found in K Komives and L Prokopy, “Cost Recovery in the Focus Projects: Results, Attitudes, Lessons and Strategies”, BPD Water and Sanitation Cluster, London; Forthcoming.
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connections, purchasing water from neighbours) or on poorly functioning utility services. The challenge for the focus projects is to find a way to bring reliable utility water (and in some cases sewerage) services to underprivileged, poorly served areas in a financially sustainable way. In some projects, the public or private utility is itself responsible for service in the poor neighbourhoods (including billing and collection). In others, the utility is a bulk water supplier, and community organisations or trained community members run the service, charge and collect revenue.

**Cost Recovery Goals and Strategies in the Focus Projects**

All of the BPD projects are trying to recover all or most of their operation and maintenance costs through some form of tariff. In contrast, the projects aim to recover none, or only part, of the capital cost of building the actual system from consumers. In the standpost projects, households have usually not been required to make any significant contribution towards the infrastructure costs. In the case of private connections, households are asked to pay a connection fee, but this fee is often lower than the actual cost of the household connection. To partially make up for this shortfall, customers in some BPD projects contribute to infrastructure expansion through the monthly tariff or through a set monthly fee for network expansion. In other projects, governments or cross-consumer subsidies fill the gap. This situation creates two general types of cost recovery problems for the projects:

1. Tariffs and fees are set high enough to cover costs, but many households are not paying their bills.
2. The tariffs and fees are too low to lead to full cost recovery, at least at current usage levels. The eight BPD projects have adopted a variety of strategies for addressing these problems:

   - **Service improvement** – none of the projects is trying to increase cost recovery without offering customers some type of service improvement in return.
   - **Institutional solutions** – in the BPD standpost projects, the project partners have created new institutional structures to manage the standposts and cost recovery (e.g., use of community organisations or village water committees to serve clients and collect revenue). Institutional solutions such as these are less common in the projects with private connections. In these projects, the cost recovery relationship remains the traditional direct relationship between the customer and the utility.

   - **Educational/promotional campaigns** – every BPD project has implemented some kind of educational or promotional campaign, ranging from pre-project information, to hygiene education during the project period, to follow-up training for standpost operators once the project is constructed. A few projects with low household consumption are trying to use these programmes to increase water consumption, and thus cost recovery.

   - **Technology options** – technology plays an important role in a number of the projects – through prepayment technology and lower-cost technologies like condominial sewerage and lower-pressure water connections. Lowering costs brings down the cost recovery target.

   - **Billing, charging and payment systems** – improving billing, charging and payment systems is of major importance for several projects. Getting bills to customers is clearly a common problem in underprivileged urban areas.

   - **Tariff and subsidy design** – for the most part, the tariffs applied in the BPD project areas are the same tariffs applied in the larger service area. Tariffs were not reduced to make service especially affordable in the BPD areas, but in some cities, the general tariff includes a cross-subsidy to the poorest households.

   - **Disconnection** – three BPD projects are employing disconnection as a strategy to encourage households to pay. In the other BPD projects, disconnection is either not allowed or not enforced.

**Partnerships and Cost Recovery**

One could argue that these strategies for improving cost recovery could have, or even would have, been implemented without the tripartite co-operation that characterises the BPD projects. There is no inherent reason, for example, why an NGO working alone could not improve billing procedures, or why a private utility could not conduct hygiene education across the board, the private utilities, public utilities and NGOs surveyed for this report felt that their partnerships were improving their cost recovery efforts. When questioned, the most common response was that, by working together, the partners can each focus on their areas of strength. Having the best-qualified actor doing each job leads to the team as a whole producing better results.

While governments are traditionally responsible for providing and administering water and sanitation
services for the poor, they often lack the necessary
capital for the large investments that water systems
require. When government forms partnerships with
the private sector, financial and technical burdens are
relegated.

With the involvement of the private sector, the
government often takes on a regulatory role, to set or
approve tariffs, monitor operations and ensure that
political goals, such as reliable service for the poor,
are achieved. The private sector, which moves in to
operate or assist with the operation of a system, is
expected to have the experience and incentive to
continuously improve consumer relations and
maintain a functioning system in order to collect revenue.

There is a great deal of evidence to support the
notion that communities need to participate and be
educated during all project phases - planning,
implementation and operation - in order for
households to feel a 'sense of ownership' over a
project and be willing to pay for the service. Civil
society actors, or NGOs, are considered to have a
distinct comparative advantage over both the
government and the private partner in working with
the community and incorporating the community's
needs and preferences into the project.

In the BPD focus projects, project partners are, for
the most part, following this traditional view of each
sector's strengths. The public sector (either the
public utility, a public-sector law, local government
or a national regulatory or government body) is
responsible for setting and approving tariffs. Billing
and collection, on the other hand, is usually carried
out by the private sector - either a private urban
utility or a small private standpost operator. Even
when the public sector runs the billing process, the
private-sector partner has been involved in helping
improve billing procedures and systems.

Work with the community has largely been done by
the civil society partner. In some cases, an
independent NGO assumes responsibility for
organising the community and getting a project off
the ground. In other cases, the operator calls on an
NGO to undertake certain tasks in the community
(survey work, hygiene education, community
organisation, standpost siting).

In some projects, the value of these partnerships is
seen by the fact that a similar partnership structure is
replicated beyond the initial project area (e.g.
Argentina, Haiti), but, in general, partnerships appear
to play a more subtle but important role in
reaching cost recovery goals. Partnerships between
the private sector, public sector and NGOs open up avenues of communication that help solve the problems that inevitably arise in water and sanitation projects. They also open the project up to a wider range of options for dealing with the problems and help ensure wider support for the projects and the cost recovery objectives.

Examples of Partnership at Work

Billing Problems

Billing is clearly one of the most difficult cost-recovery-related problems for the projects with private household connections. Through the private-sector partner, NGOs and the public sector have found the technical assistance and expertise they need to devise and implement solutions to the billing problems. In South Africa’s Northern Province, for example, the private consortium Metso is helping local governments begin billing systems and set up payment points. In Cartagena, Colombia, Aguas de Cartagena has initiated a study to determine what type of billing schedule (weekly, monthly, etc.) would be most convenient for poor households.

While governments are traditionally responsible for providing and administering water and sanitation services for the underprivileged, they often lack the necessary capital for the large investments that water systems require.

Even in projects where billing systems are in place, problems arise as the projects get underway. Billing and collection problems are particularly acute in poor neighbourhoods where door-to-door delivery of bills is complicated by community layout, or where payment points are difficult for households to access. In an Argentinian project, a tripartite project management committee (with representatives of the private utility, NGO and community) was created to solve billing problems quickly and to avoid misunderstandings between the utility and the community. The customers are able to bring concerns directly to the company at meetings of this committee.

Charging for Water from Standposts

Traditionally, the cost-recovery relationship in an urban water project is directly between the utility and each of its customers. The utility sends a bill and the customer pays the bill directly to the utility. When utilities are reluctant to operate in poor neighbourhoods or shanty towns, these areas are left without service.

The BPD projects in Haiti and Senegal seek to bridge the gap between utilities and communities. The NGO partners in these projects played instrumental roles in creating new community level organisations to act as intermediaries between the utility and the individual customers in unserved neighbourhoods. These intermediary organisations assumed responsibility for running the standposts, collecting revenue and paying the utility for bulk water.

Introducing New Technologies

The eight focus projects include a number of new technology options for households. Households need much information about these new options in order to make choices, use the systems properly and understand the importance of paying for the service. In Bolivia and South Africa’s KwaZulu-Natal, the utility companies initially turned to NGOs for help introducing these new technologies to the community. Aguas del Illimani in Bolivia eventually

learned from the NGO model and incorporated many of these community education components into its own operations.

Political Support and Tariff Setting

When private utilities raise tariffs or increase collection efforts, they risk opposition from the community. In some of the BPD projects, the support of the public sector or NGOs has helped private-sector partners avoid community opposition and increase community commitment to cost recovery. Metso, for example, found that it was more successful at helping the local government increase tariff collection once local politicians voiced their support for the cost recovery efforts. In Jakarta, Indonesia, consumer interests are represented in tariff discussions with the private utility by a consumer protection NGO.

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Water Concessions —
Who Wins, Who Loses and What To Do About It

Water concessions create value by boosting service coverage and quality, and by improving the efficiency of utility operations. Who wins and who loses, and by how much, from these concessions depends on how the contract is designed and regulated. This article proposes a simple exercise in modelling the distribution of benefits before a contract is awarded as a way to avoid later problems with skewed distribution of benefits. It uses data from Argentina where failure to anticipate the distribution of benefits has meant that some transactions went sour or had to be renegotiated.

Argentina was a pioneer in utility reforms in the 1990s. The water reforms began in the capital, Buenos Aires, with the concession awarded to Agus Argentinas in May 1993. Operations and service improved rapidly, there was a tenfold increase in capital investment and one million new consumers gained access to the system over the following five years. A series of smaller transactions in the provinces followed. Private concessionaires now operate 11 provincial and municipal utilities (not including co-operatives), serving about half the urban population. Most of these concessions have brought significant improvements.

However, some concessions have run into problems, largely because design flaws were left undetected before the contract was awarded. It was assumed that, if concessions were tendered competitively, with clear service quality and coverage expansion targets, and were supervised by a credible regulator, investors would earn market returns on their investment, and the bulk of the benefits would accrue to customers. Contract design did not specifically address the distribution of benefits. As a result, in Buenos Aires, for example, a tariff structure that was favourable to existing users and skewed against new connections created difficulties in expanding services to the poor, and the contract had to be renegotiated to meet its coverage targets. A skewed concession – which disadvantages a major constituency of stakeholders – is not a good long-term business for anyone. Most likely, over the 25 or 30 years of the contract, the regulator and concessionaire will come under pressure (as happened in Buenos Aires) to amend the contract terms or tariff structure. However, amending existing contracts is a contentious and risky process, which may at the extreme lead to termination (as in Tucuman province) or loss of credibility of the regulator or at least entail large legal and process costs. It is better to start with a more balanced contract.

Winners and Losers

A number of stakeholders can claim the value created by concessions.

The Government’s Treasury

Before privatisation, national and local governments in developing countries tend to be large net contributors to their water utilities. They may provide explicit operating or investment subsidies, hold equity on which they do not expect dividends or backstop multilateral loans without pricing the guarantee – and they rarely collect corporate income tax from public water undertakings. When deciding to award a concession, most governments terminate these supports, and often expect that the utility will quickly become a contributor to their budgets.

Treasuries can also claim future benefits through the bidding process for the concession. Recent provincial concessions in Argentina have been awarded to the bidder offering the highest annual concession fee (canon) or the highest one-off entry fee. Also, in some provincial concessions, regulatory fees levied from the concessionaires are quite high (as much as 6% of gross revenues).

It is not unreasonable for governments to expect a return on investment in assets they devolve to concessionaires, but this means that users will pay more and, if the treasury’s cut exceeds the value created by the winning bidder, may end up worse off than before the reform.

Downstream Water Resource Users

Governments are rarely effective in regulating themselves, so publicly run utilities in developing countries often infringe environmental law, especially on wastewater discharge, without incurring penalties.
Although most countries in Latin America have strict effluent regulations, about 90% of municipal sewage flows are discharged raw. Concessions often come loaded with wastewater investment mandates and tight deadlines for environmental compliance, while penalties are more likely to be enforced. These mandates, however necessary to protect the resource, drive up capital expenditure early in the contract, and may create significant incremental expenditure in operating new wastewater plants and sludge disposal schemes. The environmental benefits accrue mainly to society at large, or to river and coastal users downstream, not to the utility’s direct users who have to meet the costs.

**Existing versus New Customers**

If customers ‘win’ as a group, different categories of customers may still see different outcomes, depending mainly on the service expansion targets and standards, exclusivity of licence and alternative modes of getting the service and the tariff structure. In Buenos Aires, the concession was awarded to the lowest tariff bidder, resulting in an immediate benefit to existing users. However, the connection fee remained high – in fact unaffordable to low-income households – because it included an ‘infrastructure charge’ that was meant to finance not just the connection, but the incremental cost of expanding the secondary water distribution and sewer networks. Elsewhere, ambitious coverage expansion targets in a contract, if the cost of expansion is not borne by new users, can put pressure on a utility’s cash needs and drive up charges for existing users. Benefits to new users may be overstated in the analysis of a concession by ignoring the fact that some already had acceptable service from alternative sources (through private wells or small providers).

Some groups have neither benefits nor losses: for instance, if municipal ordinances prevent the utility (public or private) from hooking up households who live on untended land, the concession will make no difference to them, and the adoption of ‘universal’ coverage rates in the contract may lead to legal difficulties at the end of the contract period. At least one significant group of customers always loses from a more effective commercial management: those who were able to dodge payment (fraudulent users, or users who are delinquent in paying their bills).

**Legacies**

The distribution of benefits is not determined by privatisation alone. Governments could decide (and have in many developed countries) to improve public utilities’ environmental performance and authorise them to increase their tariffs accordingly. Likewise, the way the tariff structure shares the costs of system development between users has nothing to do with a decision to privatise per se. However, these decisions are perceived by the public (and often by the designers themselves) as one ‘reform package’. Some issues that remained latent under public operation can emerge more strongly after privatisation. High charges for new connections matter little in a public utility that does not expand coverage, but they are binding for a reformed operation driven by contractual expansion targets with penalties.

... the Argentine experience shows that many incentive distortions carried over into the concession contracts may make it difficult to provide services effectively, particularly to the poor.

**Stakeholder Analysis**

To predict problems in the proposed concession structure of the second generation of water concessions, The World Bank developed a model that differs from those used by most financial advisers, which focus only on the viability of the transaction and on its fiscal impact. This new model determined:

- the overall net benefits from utility reform;
- the impact of utility reform programmes on the different stakeholders; and
- whether the proposed reform model was likely to attract private operators.

The second-generation concessions in Argentina are much smaller than the first, with customer populations between 25,000 and 250,000 and starting annual revenues between US$2 million and US$11 million. Most of them are in the poorer regions, which require special care in designing concessions.
INFRASTRUCTURE AND CONVERGENCE

Figure 1: Winners and Losers – Before and After Adjustments to the Draft Concession Contract in Paraná

<table>
<thead>
<tr>
<th>Net present value of cash flow to stakeholders (US dollars)</th>
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</thead>
<tbody>
<tr>
<td>Before</td>
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</tr>
<tr>
<td>-30</td>
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Government
Customers
Poor customers
Non-poor customers
Society
Shareholders

Note: The model shows that, in the case of Paraná, further work on the tariff structure (which this simple simulation tool does not include) is required to make the concession design more pro-poor. The internal rate of return on shareholder returns is still 12% after adjustments in the draft concession contract. Whether that is a sufficient risk premium for the shareholders will be reflected in a trade-off with canon paid to the government.

The modelling was based on draft concession documents. Four major stakeholder groups were identified: governments (federal, provincial and local); the existing and future utility customers; residents who are not necessarily customers of the water utility, but would benefit from environmental improvements; and the shareholders of privatised utilities.

The analysis was applied to three provincial utilities, with no change in their tariff structures (tariff levels, tariff groups and blocks and connection policies). The data indicated that in all cases reform would benefit society, with high economic rates of return between 24% and 54%, because the incumbent utilities are grossly

Box 1: Modifications to the Concession Structure

<table>
<thead>
<tr>
<th>Initial Proposal and Associated Problems</th>
<th>Adjustments to Draft Concession Documents</th>
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<tbody>
<tr>
<td><strong>Proposal</strong></td>
<td>• Expansion targets in the initial years were reduced.</td>
</tr>
<tr>
<td><strong>Ambitious service expansion targets in the initial years of concession.</strong></td>
<td>• Capital subsidy, especially for sewage treatment, was introduced.</td>
</tr>
<tr>
<td><strong>Problems</strong></td>
<td>• Secondary network costs were charged to all customers, through a surcharge, instead of being charged to new and mostly poor customers.</td>
</tr>
<tr>
<td>• Concessionaires will suffer liquidity problems in the early years of concession.</td>
<td></td>
</tr>
<tr>
<td>• Concessionaires will not get sufficient rates or return on investments.</td>
<td></td>
</tr>
<tr>
<td>• Expansion targets are likely to exceed customers’ willingness to pay for services.</td>
<td></td>
</tr>
</tbody>
</table>

**Proposal**
No clear strategy to address the issue of the poor.

**Problem**
• New and poor customers may be losers of the reform programme.

**Proposal**
• Secondary network costs charged to all customers, through a surcharge, instead of being charged to new and mostly poor customers.

**Problem**
• Use of cannon payments to provide direct investment subsidies to the poor.

**Problem**
• Introduction of appropriate technologies to reduce cost of service to the poor.

**Problem**
• In very special cases, the introduction of lifeline rates can be considered.
inefficient. However, a closer look at the distribution of the benefits showed that the stakeholders would not share the cost and benefits of reform equally.

The government came up as the sure winner, at the expense of consumers. In two of the three utilities, consumers would lose from the proposed reform. Features of the current tariff structure, such as high connection costs and mandatory obligations to connect to networks, combined with several features of the proposed concession contract, such as the use of canon payments to award concessions, made consumers unlikely to benefit. Concessionaires would have little incentive to serve new customers, as most of the rewards of the concession came from serving the existing customer base more efficiently. If the investments were separated into rehabilitation (or efficiency improvement) and expansion investments, the former would result in large benefits, whereas the latter would largely be a loss-maker for the concessionaire under an unchanged tariff structure.

After seeing these simulation results, the provincial and local authorities decided to modify the design, producing a more balanced and probably more robust contract. In one of the contracts, the new design (with re-balancing of infrastructure charges alone and use of canon revenue to subsidise social connections) would not be enough to create positive benefits for customers – a better design could be achieved only by further change within the tariff structure and possibly a slower sequencing of proposed environmental improvements.

The changes to the three contracts are summarised in Box 1. Figure 1 shows the distribution of gains for key stakeholder groups, in the original and the modified design for one of the three contracts. Under the initial design, the total loss to consumers from the concession design was US$25 million over the 30-year concession in Paraná. After the redesign, consumers gain by US$3 million, or about US$49 per connection.

Conclusions

Although the move to private sector provision offers an opportunity to address inefficiencies, the Argentine experience shows that many incentive distortions carried over into the concession contracts may make it difficult to provide services effectively, particularly to the poor. Also, distortions may become more conspicuous as the utility's service objectives become embedded in an 'arm's-length' contract (rather than the softer undertakings which exist between a public corporation and its government owner).
The Impact of Infrastructures on Co-evolution and Sustainable Development

a report by

Dr Paul Jeffrey and Clive Temple

School of Water Sciences, Cranfield University

Infrastructures and Primary Goods Provision

Infrastructures play a vital role in primary goods provision. Primary goods can be defined as those commodities that humans require for survival. Article 25(1) of the United Nation's (UN's) Universal Declaration on Human Rights, provides some guidance for identifying such resources. It is therefore no coincidence that one of the central achievements of technological development has been to facilitate the delivery and consumption of allied goods and services, (e.g. water, electricity, and gas), through the development of networked infrastructures.

The influence of infrastructures such as those responsible for the delivery of water, electricity and gas on both economic and social welfare should not be underestimated. In particular, there is a sense in which we are highly dependent on such systems for our wellbeing, if not for our immediate survival. This point is not made lightly. Disruptions to the supply of a resource, reductions in its quality and increases in its price all result in disutility of some kind, ranging from a loss of profit for a large industrial concern to the death of vulnerable community members such as the old and the sick. The total breakdown of a system would cause social and economic chaos and, quite possibly, civil unrest. Unfortunately, it is usually only when infrastructures have reached such a critical condition that they attract the attention of politicians and planners. Such is the motivation for considering the relationship between infrastructures and sustainable development.

Sustainability as Adaptive Capacity

The ability of our societies to adapt in a sustainable way depends, in part, on the co-evolution of communities with those utilities that deliver fundamentally important services and products such as water, food, and energy. Difficulties in the supply and distribution of these resources are direct threats to security or survival. In its broadest sense, steering a sustainable course through a largely unknown future will test the resilience of a community’s internal dynamics as well as that of its relationship with the wider environment. Community resilience through adaptation is therefore a central component of sustainability. Although knowledge of the environment provides information concerning threats and opportunities, such knowledge is of little use unless it can be exploited.

Sustainability is therefore generally about adaptive capacity and only specifically about saving species or controlling global warming in the context of present-day threats. Sustainable development will require an understanding of those social, political, educational, and economic processes that enhance adaptive capacity, and this includes the role of infrastructures.

Technology as the Problem

As is the case with the majority of research fields, the current global concern with sustainable development exerts an influence on the study of technologies and technological systems. Most of the sustainable development literature is in broad agreement that technology has been a central cause of many of the problems currently being faced by both urban and rural communities. Unchecked technological development in general is considered to have been at least partly responsible for some of the undesirable and survival-threatening phenomena observed today. Problems of pollution, over-production, resource (and capital) concentration, restricted product life-cycles and lack of social control have all been laid, rightly or wrongly, at the door of what is generically termed ‘technology’. However, whilst there is general consensus regarding the role of technology in creating the problem, there are diverse attitudes towards its future contribution. Two broad opinions concerning sustainable development and technological futures are identifiable. The first of these advocates a ‘reining-in’

1. Article 25(1) was adopted by the UN General Assembly in 1948 without a dissenting vote: “Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control.”
of technology and a return to more simple modes of technology use. The alternative opinion is that the solutions to problems of sustainability will be found in the use of even more advanced technologies.

Interestingly, although there is much written on the relationship between technology and sustainable development, there are two particular features of the debate on technological futures that restrict the breadth of debate. The first of these restrictions concerns the perceived nature of the problem. In summary, queries concerning the identification of a desirable and positive role for technology within sustainable societies has been dominated by questions about how much technology rather than what type of technology. The second restriction on debate has been an emphasis on environmental issues, which has resulted in a prescriptive movement that espouses a ‘greening’ of the economy; i.e. designing environmentally friendly technologies and production systems. As already noted, issues such as pollution and habitat destruction are today’s challenges to a sustainable future: the challenges of tomorrow may be quite different.

Historically, design assumptions concerning utility technologies have been about the need for large processing or production plants and elaborate fixed-structure distribution systems. These were historically appropriate when the range of technologies available was limited and spatial patterns of urban activity were assumed to be relatively static. However, decisions about such physically massive infrastructure at one point in time may lock communities into design configurations that are inappropriate for future potential uses. Indeed, it may be argued that utility systems have inhibited healthy urban evolution, since the timescale for economic replacement of traditional process, production and distribution functions is often decades longer than the timescale of potential changes in location and level of demand for their output.

Infrastructures support development by facilitating centralised service provision and by being a means for quality control. They also restrict development by imposing spatial configurations and requiring enormous sunk costs that must be recouped. By their

... issues such as pollution and habitat destruction are today’s challenges to a sustainable future: the challenges of tomorrow may be quite different.

Infrastructures and Co-evolution

Due to the restricted nature of the debate on desirable technologies for sustainable development, a significant aspect of the problem has been largely ignored. If technologies are to make a genuine contribution to the achievement of sustainable communities and a sustainable world, the pertinent focus of attention should be on the design, operation and management of technologies and infrastructures that support adaptive change. For example, the planning of long-term technological infrastructures concerns the development of planning methods and implementation strategies designed to ensure reliability of a delivery function over changing operating conditions. Consistency of performance may relate to a number of aspects of the system, such as product/service quantity, quality, reliability, cost and availability. Various characteristics of the system will influence its ability to achieve reliability. These include the system’s spatial configuration, the technological attributes of individual items of plant and the interactions between specific technological attributes such as scale, cost functions, design life and the diversity of technologies being used.

very nature, infrastructures tend to lock communities into ‘set ways of doing things’ and promote standardisation rather than diversity. Infrastructure relates to the human aspect as much as to the technological aspects. Individuals and communities suffer not only when infrastructures fail (in a service provision sense), but also when they are unable to meet the new challenges of technological, economic and social change.

In the assessment of sustainable utility technology, which has traditionally been oriented towards long-lived physical infrastructures, flexibility – the options that are held open for the future – and adaptability – the ease or difficulty with which those options can be taken up when needed – must be distinguished from one another. Using the example of water supply infrastructures, while it may be feasible to support additional demand, the constraints of the established infrastructure, (e.g., pipe networks and treatment plants) often means that this flexibility can only be consumed with considerable expenditure, or a long time into the future when utility infrastructure and plant is due for replacement. In other words, adaptability is, in practical terms, low.
However, co-evolution is, by its very nature, a multi-dimensional process and the flexibility/adaptability of systems is only one aspect of the problem. Scientists and engineers also need to develop technologies and bundles of complimentary technologies that exhibit adaptive capacity. Many contemporary process technologies (e.g., grey water recycling, hydrogen fuel cells, small gas turbine combined heat and power, etc.) exhibit such properties due to their small scale, enabling them to be both spatially distributed and used as part of a modular system, (e.g., several linked but identical units to meet design capacity rather than one large unit).

Infrastructures support development by facilitating centralised service provision and by being a means for quality control.

A New Research Agenda

Demand for the type of primary goods that forms the focus of this contribution, in terms of user attributes and spatial configurations, will change over time, dependent on what individuals, households and organisations see as relevant to themselves. Equally, scientists and technologists will 'create' new resource processing opportunities. These two worlds interact through the interaction of supply and demand attributes. Such issues are common to many other types of technology embedded in infrastructures and are derived from research into sustainable systems, complex dynamic systems and technology assessment. Relevant issues for research include the following:

- **Flexibility – temporality and uncertainty.** In design terms, flexibility is promoted by providing a technology function and performance envelope that goes beyond immediate or anticipated needs. Individual technologies will typically exhibit modularity, long life-cycles and resilient operating efficiencies over changing throughput volumes and qualities. The beneficial application of such technologies in terms of providing support for a changing community is dependent on the nature of the network within which they are embedded.

- **Adaptability – system configurations and cost/performance trade-offs.** Exploiting a stock of flexible technologies involves providing a suitable infrastructure or network that translates flexibility into adaptivity. The nature of the network in terms of its spatial arrangement, level of connectedness, directionality, functional potential and capacity for expansion will not only determine its value as a source of adaptivity, but also set an agenda for technology design.

- **Scale, hierarchy and complexity.** It is necessary to formally identify how utility provision can be introduced as an interactive subsystem into a wider concept of community development. The way in which utility supply (and disposal) systems will consist of different technologies at different spatial scales (building, street, community, district, city) and hierarchies, all of which have some economic, physical and social dynamic, is part of a wider research agenda that focuses on sustainable cities as complex, dynamic and evolving systems.

It is particularly important for further work to be carried out on formalising the structure of these hierarchical elements and developing an appropriate language for describing their main features. For example, diversity, flexibility and adaptivity are reflected in different aspects of an infrastructure and its associated technologies, and strategic analysis tools should be able to capture the pertinent sources of diversity, etc., for each technology or group of technologies. Furthermore, effective, general ways of analysing attributes rather than states need to be developed. Finally, the 'not infrastructure' option should be given the same consideration and weighting as 'which infrastructure?'.

Infrastructures that are charged with primary goods supply will continue to play a significant role in the development of sustainable economies and communities. The way in which the desirable performance characteristics for such infrastructures are identified, instilled and managed constitutes a challenge for both the research and commercial communities. Making various dimensions of adaptive capacity and resilience a significant, if not the foremost, criterion for system design accentuates the connections between technology, economy and society. Unless technological systems are able to exhibit adaptivity, these connections will become strained, turning infrastructures into the burden rather than the servant of our communities.
Information and Communications Technologies and Poverty

a report by
Charles Kenny

Information Infrastructure Economist, The World Bank

Introduction

Few would argue that lack of access to information and communications technologies (ICTs) is an element of poverty in the same way that insufficient nutrition or inadequate shelter are. If being poor, or underprivileged, is defined as lacking access to the Internet, for example, no one in the world escaped poverty prior to 1969, when the first network was built.

ICTs are increasingly central in the effort to escape poverty, and the poor recognise this. Given the option, they are willing to spend more than 2% of their income on telecoms. As Figure 1 illustrates, the poor in Chile spend about the same amount on telecoms as they do on electricity – the average consumer spends more of his or her income on telecoms than on electricity and water combined. This expenditure excludes the numerous other communications tools accessed by the poor – including radio and television.

ICTs provide access to information that can create earnings opportunities, improve availability of basic services or increase the impact of education and health interventions. ICTs also provide the poor with a voice to demand government support and reform. This article looks at some of the ways that ICTs – and the Internet in particular – can be used to improve the lives of the poor in developing countries, before turning to a discussion of access to the Internet and the use of intermediate ICTs to overcome access barriers.

ICTs and Income Opportunities

Recent econometric studies have found increasing evidence of a causal link between telecoms development and economic development. Other studies have provided evidence of high returns on investment in telecoms equipment and, more generally, in the telecoms sector. Other studies have extended these links to other indicators, such as social development, cost savings for industry and increased transport efficiency.1

The Internet, because it leverages the potential value of computers and a telephone connection, suggests that the economic effects of networking will be far greater in the future. At the macroeconomic level, the Internet provides an opportunity for firms, farms and entrepreneurs to reduce costs, increase market coverage and achieve economies of scale. Thus, the Internet may have a dramatic impact on trade and investment in developing countries, spurring growth – provided that complementary measures covering macroeconomic, financial and educational policies are in place.

ICTs including the Internet do not only have an impact on the poor through ‘trickle-down’ growth. Small manufacturers of traditional handicrafts are already discovering how ICTs can assist in the marketing and distribution of their wares to a worldwide client base, for example. In Kenya, the Naushad Trading Company2, which sells local wood carvings, pottery and baskets, has seen revenue growth from US$10,000 to over US$2 million in the two years since it went online.3 Consumers and shopkeepers can access constantly updated colour pictures of Naushad’s product line, place orders and make enquiries about other types of handicrafts.

The increasingly tradeable data-entry sector also offers significant possibilities for employment in less-developed countries. There are some 10 million people performing data entry tasks in North America, many of which could be competitively provided by literate workers in low-income countries.4 Finally, creating call centres itself is a means for creating jobs. In the Indian state of Punjab,
Beyond general trading, employment and investment opportunities, advanced ICTs can provide particular economic benefits to rural populations. First, they can provide access to information on subjects such as crop prices, the weather and new farming techniques. In Chile, the national agricultural extension service created an Internet-based rural information service for farmers’ groups, rural governments and non-governmental organisations (NGOs), which could pass on the information to individual farmers. As the UN Food & Agriculture Organization reports:

“It was estimated that transmitting price and market information this way cost 40 per cent less than using traditional methods. In addition, the information was more timely, reaching farmers much faster. In the past, the publication and distribution of a printed bulletin took 45 days.”

ICTs can also offer rural populations increased opportunities for non-farm business and job creation. An International Telecommunication Union (ITU) study of factories in rural Bangladesh, for example, found that introducing a telephone line reduced the amount of management travel, thus cutting associated travel costs, such as gasoline and salaries, by a factor 13 times the cost of installing the line.

**ICT, Empowerment and Security**

Beyond creating new wealth for the poor, ICTs can allow the opinions of the poor and the needs of the poor to be heard. For example, in India, the women’s rights NGO Sakshi had faced difficulties in lobbying for sexual harassment legislation. With help from international women’s networks provided over the Internet, Sakshi was able to receive advice and technical assistance on legal issues surrounding sexual harassment. As a result, the group succeeded in convincing the Supreme Court to establish sexual harassment guidelines in workplaces and brought the issue within the purview of human rights violations.

ICTs can also improve the quality of services received by the poor. In Andhra Pradesh, India, for example, ICTs have been used in the reform of processes to register deeds and stamp duties. Using traditional methods, this took 13 cumbersome steps in a highly opaque process that invited bureaucratic delay and

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The Federal Government of Nigeria is determined to compete, survive and succeed as a nation in the 21st century as our new democracy has a positive vision to guide our science and technology policies in general and the National Information Technology (IT) Policy in particular.

The Government believes that our future will overwhelmingly depend on our capacity not only to invent, create and master new and emerging technologies of the future, but to ensure that these ideas move to global market and spur growth, create new jobs for our people, strengthen our industrial performance and create abundant wealth for our nation.

GOVERNMENT EFFORTS SO FAR:

✓ An Enduring National IT Policy has been put in place.
✓ For effective e-governance, a pilot phase of the ‘Presidential Network Project’, intended to electronically link all ministries of government, has taken off.
✓ Encouraging the manufacture of low-cost computers by local IT entrepreneurs.
✓ The recent licensing of four companies to provide GSM telephone lines to facilitate communication and access to the Internet.
✓ With majority of its populace in rural areas, the government is already putting in place a program that will electronically incorporate the rural dwellers into its programs thereby creating an avenue for an equitable share of scarce resources between urban and rural areas, and improve the standard of living.

These efforts, though preliminary, are a launching pad from which the government aims to reduce the “Digital Divide” that exists between Nigeria and the developed countries.

Federal Ministry of Science & Technology
March, 2001
corruption. It took from three to as many as 15 days—and the process involved the registration of over 120 million documents a year. Using a new, networked system, the same task can be accomplished in just over two hours, with far less opportunity for graft. Again in Andhra Pradesh, a programme to computerise the issuance of caste certificates, essential for obtaining government services and access to educational scholarships, managed to decrease the time for certificate issuance from 20 to 30 days to only 10 minutes.8

By opening up opportunities to education, ICTs can further impact on both income and empowerment of the poor. In Brazil’s urban slums, the Committee to Democratize Information Technology (CDI) has created 110 sustainable and self-managed community-based ‘Computer Science and Citizenship Schools’, using recycled technology, volunteer assistance and very limited funds. CDI schools train more than 25,000 young students per year in ICT skills that provide them with better opportunities for jobs, education and life changes. CDI also provides social education on human rights, non-violence, environmental issues, health and sexuality. CDI cites many cases in which participants have developed renewed interest in formal schooling, resisted the lure to join drug gangs and greatly increased their self-esteem. Also, many of the programme’s ‘graduates’ are putting their computer skills to work in various community activities, including health education and AIDS-awareness campaigns. Most teachers in CDI’s schools are themselves graduates of the programme who have embraced technology and want to continue CDI’s good work in their own communities.9

Finally, ICTs can also have a major role in reducing the impact of natural disasters on the poor in low-income countries. Between June and December 1996, a total of 1,689 people died in Andhra Pradesh in heavy rains, floods and cyclones. The total economic loss caused by the 1996 disasters in Andhra Pradesh is estimated at US$2 billion. The following year, a project backed by The World Bank was passed, designed to help prepare and implement a hazard management programme in high-risk areas and improve warning capacity. Both elements involved a significant ICT component—especially in cyber-physical systems. Despite these potential links between ICTs and poverty reduction, direct access by the poor to ICTs is extremely limited. Citizens of poor countries have significantly less access than those living in developed countries, while the poorer within these countries are even further excluded. For example, Rwanda has a population of over 6.5 million. In 1998, it had 11,000 telephones—about half the number of telephones as Gibraltar, with a population of 27,000. Within Rwanda, these telephones were almost exclusively concentrated in Kigali, the capital. There were four telephones per 100 people in Kigali, compared with four per 10,000 in the rest of the country.

While Rwanda represents an extreme case, the general lesson holds across countries and technologies. The underprivileged—and especially the rural underprivileged—have almost no access even to basic ICTs, let alone advanced services. In 1998, Bangladesh had a population of 125 million, with just over 1,000 Internet users. Although the average Organisation for Economic Co-operation and Development (OECD) country has roughly 30 times the per capita income of a sub-Saharan African country—excluding South Africa—it has 40 times as many computers, 110 times as many mobile phones and 1,600 times as many Internet hosts. The availability of local content on the Internet is a further pointer to the dominance of industrial countries. A recent host survey shows that Africa generates only 0.4% of global content. Excluding South Africa, the rest of Africa combined generates a mere 0.02%.10-13

For the Internet in particular, use is dominated by a tiny educational elite. Ninety eight per cent of Ethiopian Internet users have a university degree—in a country where 65% of the adult population is illiterate. Finally, women have less access to ICTs.

From Cyprus' eastern Mediterranean shores, bridging Europe, Asia and Africa, we have built up one of the most advanced telecommunications networks in Europe today.

Consulting through telecommunications, information technology & business knowledge we can provide total global solutions. We have the people, the products, the expertise and the experience that provide the key to success.

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What helps to set us apart at CYTAGlobal is our approach. In creating and sustaining partnerships with our customers we work hard at the extras. We know that the answer to customer satisfaction is asking, “What more can we do?” And, then, of course, doing just that.
Only 38% of the population polled in urban Latin America who use a computer and the Internet are women. The numbers are even more skewed in Africa – a survey of African users found that the percentage of male Internet users in Ethiopia, Senegal and Zambia was 86%, 83% and 64%, respectively.

Using Intermediate Technology to Reduce the Access Divide

There are a range of techniques to improve the access of the poor to advanced ICTs. Telecoms sector reform, including universal access programmes, will have a dramatic impact on the reach of telephone services and on the poor’s ability to access the Internet. There are myriad benefits of direct Internet access to the poor, and these techniques should be utilised to the full.

Nonetheless, a range of barriers suggest that the poor will remain disadvantaged in their direct use of the Internet, despite its potential power as a tool for poverty reduction:

- The Internet is expensive – it requires use of a telephone line, a computer, a modem and electricity.

- The poor in developing countries are typically rural. Rural populations have less access to, and pay more for, telephony and electricity, and find it more difficult to access supplies and repairs for computer equipment.

- The poor also have higher rates of illiteracy and disability and frequently speak minority languages. The Internet is a technology for the literate largely designed by the able-bodied, and material tends to be presented in only a few world languages.

This suggests that a tool that allows some of the benefits of Internet use to be accessed by a larger percentage of the underprivileged would be useful. The radio might be one such tool. Radios have many advantages over the Internet as a form of communication. Receivers are cheap (perhaps US$10 plus the cost of batteries, or a wind-up model that does not need batteries can be purchased for US$70 to US$100), they do not require an electrical connection and (unlike fixed-line telephony, for example) they are stand-alone appliances. On the transmission side, programming and broadcasting are also relatively inexpensive. A low-power transmission system can cost as little as US$1,000.14 Digital sound recordings can be made on equipment that costs US$800 or less. In central Mali, a station supported by Oxfam is broadcasting information to 92,500 people a year at a cost of just US$0.40 per person.15

Both receivers and local radio broadcasters are relatively common in developing countries, even amongst the poor as a result of these features. Figure 2 illustrates that levels of radio density in low-

15. one world http://www.one world.com
income countries are, on average, about 10 times higher than levels of teledensity. The 20th to 30th percentile, for example, has approximately 11 telephones per 1,000 people, compared with 100 radios per 1,000 people.

At the same time, radio programming is inexpensive enough to be produced locally and in a range of languages. For example, in Latin America most radio is produced locally or nationally, compared with just 30% of television programming. Quechua, a language spoken by some 10 million people in Bolivia, Ecuador and Peru, is all but absent from the region’s television screens (and completely absent from the Internet), but in Peru alone an estimated 180 radio stations offer programmes in the language. Radio signals can also provide information access to the illiterate – a significant issue given that adult illiteracy in low-income countries in the developing world is 30% for men and 49% for women (including a far higher percentage of the poorer).

Recent pilot projects suggest that the radio can act as a powerful intermediary for the Internet, providing much of the new technology at a low cost to a large audience. In Kothmale, Sri Lanka, a joint project between the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Ministry of Posts, Telecommunications and the Media, the Sri Lanka Broadcasting Corporation and the Sri Lanka Telecommunication Regulatory Commission uses radio as an interface between rural people and the Internet, for example. A daily one-hour live radio programme in which an announcer and a panel of resource persons browse the Internet at the request of listeners, has proven capable of overcoming linguistic barriers in using the Internet by non-English speakers.

In addition to the radio programme, the Kothmale FM Community Radio station is developing a rural database, primarily by packaging public domain information often requested by listeners for offline use. The radio station also functions as a mini Internet service provider by providing Internet access points at two public libraries located within the radio’s target area as well as maintaining an Internet café at the radio station.18

**ICTs provide access to information that can create earnings opportunities, improve availability of basic services, or increase the impact of education and health interventions.**

**Conclusion**

The poor see ICTs as a necessary service that has a dramatic impact on the quality of their lives. The Internet only strengthens the link between ICTs and poverty alleviation. Despite reform and technological advance, however, the Internet in particular remains a tool of the wealthy. Any strategy to overcome the divide in access to information that skewed access statistics represent should have at least two elements. The first is to increase direct access to ICTs, such as the telephone and the Internet, through policy reform and universal access programmes. The second element is to use intermediate ICTs, particularly radio, to provide some of the benefits of direct Internet access to those who cannot afford or are not equipped to use the technology. This two-pronged strategy will help overcome the information divide that underlies the digital divide.

This article is extracted from:


The opinions expressed in this article are the author’s own, and do not necessarily reflect those of The World Bank, its executive directors, or the countries they represent.


17. An Internet search found no websites in Quecha, but one website, in Spanish, run by Peru’s Red Scientifica, that discussed the Quecha language.

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Xantec is the leader in satellite communications and for years the company has been putting organisations in touch to and from the four corners of the globe. Formerly Station 12, Xantec is the result of a merger between three organisations; Station 12, Australian-based Telstra Global Satellite and the maritime software specialists SpecTec. As a result, the company represents a true one-stop shop for all satcom-based IT requirements.

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Users can enjoy full colour, full motion video capabilities for the first time and the service is not only being used by the media industry, but also those providing relief services. The capabilities are impressive too; it's been used in Eastern Timor by the UN peacekeeping forces while telecom specialist Infonet is using Xantec's M4 to assist disaster relief and activities.

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Xantic's satellite communications offers coverage from even the remotest of regions

In today's ruthless business environment, wherever your organisation goes, so should your communications. Whether it's the African dessert, the South American rainforest, or the middle of the jungle, the ability to communicate 24 hours a day 365 days a year is essential to your organisation's success.

Satcom (just) for you
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With commercial introduction expected in August 2001, Xantic's Content Delivery services are available to almost all market segments, from Telco's (ADSL operators, ISPs) to independent small businesses. The company has already developed a prepaid High Speed Internet Access solution for small and medium enterprises. This hybrid service (return channel via narrowband telephone line) gives the end-user broadband Internet access up to 600kbps.

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Are Poor Countries Losing the Information Revolution?

Francisco Rodríguez and Ernest J Wilson III
University of Maryland

Introduction

After an initial period of optimism by many observers, questions have recently begun to arise about the distributive impact of the new information and communications technologies (ICTs). Evidence indicates that the new ICTs can be highly beneficial to individual communities, projects and countries. It is known that, under the right circumstances, ICTs can improve education, health, job creation, governance and other services.

There is weaker evidence and less serious speculation about the equity implications of these new technologies. Informed policy decisions require that as much as possible is known about their likely economic and social equity impacts, either across the international community as a whole or within selected developing countries.

This paper is concerned with whether underdeveloped countries and underprivileged people are catching up with their more privileged counterparts. That is, whether the data on ICTs is characterised by convergence or divergence between developed and developing countries, and between underprivileged and privileged people within economies.

What is meant by divergence is that developing countries’ ICT use will not catch up with that of developed countries if existing trends continue. Convergence, by contrast, means that they will catch up at some point in the future, given existing trends. Thus, there is convergence when the gap between privileged and underprivileged is shrinking, and divergence when it is growing.

This article poses and answers six empirical questions that are central to the growing policy debate over the potential development contributions of ICT to underprivileged countries:

- Is there evidence of convergence or divergence between less-developed countries (LDCs) and developed countries (DCs) in their use of ICT products? In other words, is there a gap between the use of ICTs such as computers, faxes and mobile telephones between north and south, and, if so, is the gap growing or diminishing?

- Is there convergence or divergence between LDCs and DCs in their commitment of capital and other critical inputs to ICTs?

- Is there convergence or divergence between LDCs and DCs in their gross domestic product (GDP) growth and other indicators of relative economic performance? Is the gap in the wealth between the richer and poorer countries growing or shrinking?

- Is there convergence or divergence within countries in the availability of these new technologies? Is there ICT convergence or divergence of incomes domestically?

- What is the link between ICT and trends in inequality across and within economies? Does higher exposure to technological progress contribute to lessening the gaps between the poor and the rich?

- What explains differences in technological progress across countries? What countries have taken advantage of the information revolution, and what have they done right?

The answers to these empirical questions should be of interest to international financial institutions, national governments in LDCs, non-governmental organisations and the private sector operating in developing areas. Regrettably, at this early stage of our understanding, most programmatic and policy decisions for developing countries are being made in the context of very little empirical information about the distribution and societal impacts of these powerful new tools.

1. Absolute convergence can be spoken of — when the gap in absolute terms is growing — and relative divergence — when the gap is growing as a fraction of countries’ present levels of technology. Within a context of growth in the use of ICTs, relative divergence implies absolute divergence, but the converse is not true.
If the analysis and answers to these six questions show that the gaps between developed and developing countries’ ICT sectors are narrowing, then it may suggest one set of programmes and policies that can be somewhat less urgently focused on equity dimensions, since private markets are adequately addressing equity concerns. On the other hand, if the evidence points in the other direction towards growing inequality, then it may point to market and other failures that call for a more proactive mix of programmes and policies to address the equity dimensions.

Drawing on data from a variety of sources, our evidence shows that the majority of underprivileged countries are being left behind by the information revolution. Along several distinct dimensions, the number of underprivileged countries that are managing to keep up with the developed countries is small, but there are also policies that can be followed by those countries that want to improve their chances of joining the information revolution and gaining from it.

This article uses the most reliable indicators of ICT across nations that exist to date. These indicators are drawn from reports published by well-known statistical organisations and reputable market research firms. We therefore have confidence in the general reliability of the data we use, and believe the findings to be correct, given the existing data.

Although the problem of a lack of adequate data is not uncommon in the field of development economics, the relatively new and extremely time-sensitive nature of the ICT phenomenon makes the contrast between the questions asked and the answers we are able to give much starker in our case. In particular, the results almost surely err on the side of optimism, as countries with little or no available data are most likely to be the same countries that are being left behind by the information revolution. All the findings of this report must therefore be considered as preliminary. Rather than a full assessment of the information revolution, this is a report from its front lines. These findings will certainly require many more years of improved data to be confirmed with a satisfactory degree of confidence. However, the importance of the questions is so pressing that it would be irresponsible to postpone making an assessment of the existing evidence until the data becomes satisfactory.

**Technology and Inequality**

The information revolution is beginning to reshape the flow of investment, goods and services around the world economy. The global telecoms market is worth in excess of US$1 trillion. Multinational and local companies rank robust ICT networks as a requirement for investment, and claim that weak networks retard investment and growth. The computer components of automobiles cost more today than the steel components. From 1988 to 1997, the average number of computers per capita in the world multiplied more than tenfold; in the US, studies show that one-sixth of recent economic growth can be attributed to computer outputs. It is estimated that inter-company trade of goods over the Internet will double every year for the next five years, increasing from US$43 billion to US$1.3 trillion by 2003.

Who benefits and who loses from these changes? Is the new information revolution likely to widen the gap between the privileged and the underprivileged, or is it a force that can be harnessed to achieve higher living standards for the 3.5 billion people currently living on an income of less than US$2 a day?

The answers to these questions are far from clear. On the one hand, new technologies open up new spaces for competition and challenges to the established order. The recent history of the information revolution is full of stories of small start-up enterprises that were able within years to topple established ‘giants’. Indeed, the power of the Internet appears to be bringing world economies closer together over time. By bringing down impediments to trade and communications and lowering entry barriers, ICTs seem to be introducing a powerful force towards the convergence of world incomes.

Although the potential benefits from advances in ICTs appear to be clear, how they will be distributed is not. Well-founded fears exist that the poor are being left behind by the information revolution. Access to ICTs requires education, infrastructure and institutions – three resources that many developing countries lack. Without them, it is increasingly likely that the underprivileged may be on the losing side of this revolution.

**Technology Across the World**

ICTs are defined as the set of activities that facilitate by electronic means the processing, transmission and display of information. In order to measure and evaluate the reach of ICTs in different countries, both the outputs produced by those industries – those that directly contribute to the electronic processing, transmission and display of information – and the inputs that make those activities possible must be examined, as well as how these inputs and outputs vary across countries and over time.

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2. This is the definition adopted by the OECD’s ICCP panel of statistical experts. See http://www.oecd.org/dsti/sti/it/stats/
The information revolution started in today’s developed countries, therefore these countries have higher levels of technological attainment and higher use of ICT products, yet the magnitude of the differences is staggering. There are five indicators of technological outputs – the products of technology that actually benefit consumers – for different regions of the world: personal computers (PCs), mobile phones, Internet hosts, fax machines and television. Although the average Organisation for Economic Co-operation and Development (OECD) country has roughly 11 times the per capita income of a South Asian country, it has 40 times as many computers, 146 times as many mobile phones and 1,036 times as many Internet hosts.

The differences are less marked with respect to the forms of technology that have been around longer – particularly television sets – but there are still differences. There are also important gaps in ICT inputs. If developing economies were investing more in technology than richer countries, one could anticipate that the ‘first mover’ advantages of the latter would be reversed over time. However, the evidence shows that technological investment is also much higher in developed economies. Several of the most important measures of technological inputs – the investment necessary to produce high-technology goods – are substantially higher in developed economies than in developing economies.

OECD economies invest nine times as much of their income in research and development – that is, in creative, systematic activities intended to increase the stock of knowledge and on the use of this knowledge to devise new applications – and have roughly 17 times as many technicians and eight times as many scientists per capita as the economies of sub-Saharan Africa. These ‘soft infrastructures’ are as essential for successful ICT diffusion as the ‘hard’ technologies. Indeed, the OECD nations also have 21 times as many telephone mainlines per capita – a measure of the infrastructure necessary to take advantage of communications technology advances – as sub-Saharan Africa.

The indicators of technology – in particular the indicators of technological outputs, which measure the availability of appliances and applications to consumers – not only capture many aspects of technological change, but also other characteristics of particular markets and nations. For example, Qatar has more television sets per capita than Sweden, but it would not be sensible to call Qatar a more technologically advanced economy than Sweden, particularly because Qatar is far behind Sweden on all of the other indicators. Likewise, Japan is far behind Slovenia, but is far ahead of Slovenia on all other indicators. A country with a high number of television sets per capita, but without high marks on other indicators of technology, may be a country in which mass media communications has developed successfully despite lagging in other technology. Likewise, a high number of mobile phones per capita may just reflect a lack of fixed telephone infrastructure rather than technological progress.

How can it be said that one country has made more advances than another in terms of information technology (IT)? A solution to this problem has been to construct what has been termed an Index of Technological Progress (ITP) in which information on all five indicators of technological outputs is combined. Through a statistical technique called ‘principal components analysis’, the common source of variation that these five indicators have in common is captured – in other words, the index measures to what extent the variations in its five components are due to a single common phenomenon that differs across countries.

The level of the ITP ranges from 0 to 100, with the US at the top of the scale and Mozambique at the bottom. Almost 100 economies, for which there is insufficient data to calculate the index, have been excluded. Among the excluded observations are some of the world’s least privileged nations; therefore the ITP almost certainly exaggerates the technological progress of the underprivileged. Despite that upward bias, it is clear that the picture painted by the ITP is not an encouraging one for developing countries. The top 10 economies are all members of the OECD group; the only two non-OECD economies to make it into the top 20 places are Hong Kong, China (12) and Singapore (13). The 10 bottom economies are all in sub-Saharan Africa. The lowest ranked OECD economy is Greece (38); the highest ranked sub-Saharan African economy is Mauritius (46).

The differences in technological progress are strongly related to differences in income – developed

3. There is one relevant dimension of inputs in which developing countries are not diverging from developed countries: investment in telecoms. Investment in telecoms as a percentage of total investment is generally higher for developing countries than for developed countries, and highest in very small economies such as Barbados and Fiji. Although this could be taken to be contradictory to the hypothesis of divergence, it is viewed as most likely reflecting the increasing returns to scale inherent to telecoms investment. Very small economies must pay high fixed costs in order to set up and maintain even a minimal telecoms infrastructure. Despite the fact that small economies tend to have high rates of investment in telecoms, the correlation between telecoms investment and growth in telephone main lines is practically zero.
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countries enjoy higher technological progress. As others have noted for years, the level of GDP per capita is strongly associated with the level of ICTs. A higher level of development or privilege is no guarantee of superior technological progress. Belgium has a higher GDP per capita (public-private partnership value) than Finland but lags far behind it in technological development.

There are many things that governments can do to raise or lower their levels of technological progress. Thus, structural features such as GDP per capita help shape ICT outcomes, but they are not perfectly determinate. Human volition, institutional arrangements and policy choices also play their part.

The statistical method employed to calculate the ITP includes several robustness tests to evaluate to what extent the results are sensible to the choice of variables that were included in the index. The main consideration in choices of variables is that they represent industries that facilitate, by electronic means, the processing, transmission and display of information – industries that are consistent with the definition of ICT. It should be emphasised that the statistical technique used to construct the index captures the common source of variation in the variables used.

The ITP has been conceived as an index of new ICTs – technologies that have emerged in the world economy during recent years and have supported the idea that an 'information revolution' is taking place. There are a variety of views as to what the information revolution actually consists of. On the one hand, those who hold a restricted concept of ICTs, defining them as a set of core technologies, would argue that variables such as televisions and fax machines are not new technologies and should not be included in the ITP. On the other hand, those who believe in a broad definition of ICTs would argue that the information revolution is not as new as it is commonly made out to be and that more traditional means of communication such as radios and newspapers are also legitimate means of electronic data transmission. In order to calculate the ITP, a dividing line has been drawn somewhere in the middle of these two polarised views. For that reason, television and fax machines have been included, but radios and newspapers have been excluded.

The results, however, are not sensitive to this assumption. Calculating two other versions of the index obviously yields two results. One is a version that restricts it to the 'core' components of new technologies: PCs and the Internet. The other extends it to include newspapers and radios – products of traditional ICT sectors. The former is known as 'ITP-core' and the latter 'ITP-broad', the indices for which are similar – the correlation between ITP and ITP-core is .94, and between ITP and ITP-broad, 0.99.

The ITP is an index of products measuring the capacity of different countries to process information useful to consumers and firms. It does not take into account the other dimension of ICT functions – the hard and soft infrastructures necessary to provide them. Obviously, the dividing line between an ICT product and an ICT input is very difficult to pin down. The choice of what to classify as input is, in the end, somewhat arbitrary. The choice is based on the desire to capture the capacity to process information electronically, and not the possibilities for its future development.

A reason for which inputs may be of interest are the possible enabling capacities that they have for future generations of ICT products. In that sense, it is possible to think of telephone mainlines and television as potential enablers (telephone mainlines now, televisions in the future) of Internet communications. An ICT that includes information on these two factors, along with PCs and Internet hosts, could be seen as an index of possibilities for future development of ICT. This is what we call the forward-looking core ITP. Again, the correlation with the ITP is impressive (.97).

This set of alternative calculations point to the fact that, despite the vast differences that exist in how to measure ICT products, the ITP is able to capture the main differences across countries in their capacity to process information by electronic means. The ITP is robust to the use of alternative methods for its calculation, regardless of whether they reflect more inclusive, exclusive, backward-looking or forward-looking definitions of ICT. The basic reason for this is that the common source of variation seems to be affecting all of the defining variables in the same direction.  

The rest of this article, including references, tables and graphics, can be found in the Reference Library of the CD-ROM accompanying this business briefing. It discusses "Catching Up or Falling Behind?"; "Getting Policies and Institutions Right"; "Investment"; "The Causes of Investment"; "Foreign Direct Investment"; "Investments in Education and Health"; "Underprivileged Nations and Underprivileged People"; "Technological Progress and Economic Growth"; and "Policy Implications and Conclusions".

Further material can be found at http://www.infodev.org

4. The factor loadings for each of the indices were remarkably similar and in none of the experiments was a second factor close to significant.
Rural Electrification in Bangladesh

a report by
Dr Hasna J Khan
Member, G8 Renewable Energy Task Force

Introduction

Infrastructure for developing countries is the foundation for growth for the 21st century, and has an impact on the developing countries themselves as much as it can influence the performance of the developed nations. It can be said with certainty that the impacts are unequal in measure, but potentials are nevertheless significant and visible.

The countries concerned are dealing typically with the various social, economic and political parameters that contribute to the final process of infrastructure development. Limited capital funds being divided in multi-directions, each with its own figure of demand, makes the process slow. At times the speed reduces to the level of near-stagnation in a short timeframe, especially when decisions come to cost intensive investments. Yet, coherent solutions are sought for meeting the ends in spite of the varied problems.

Among the many aspects of infrastructure development lies the crucial role of ‘energy scenario’. This sector passes on the fuel for economic development, and thereby lies in the heart of all integrated planning. Some of the developing nations have recognised the benefit of liberal marker economy, taking the accelerated path towards globalisation, while others are slow to change. Energy sector reform, however one identifies it, is a necessary, but not sufficient, condition for growth considering the characteristics of the problem itself.

A major barrier to economic growth in the developing countries is that the majority of the population lives in the rural areas, where a lack of economic activities leaves no options beyond meeting the basics. With such conditions prevailing, the social indicators often demand more attention, leaving reforms lagging behind. The lack of a political will in the absence of a mature public system that governs and invests on the infrastructures and regulates and operates them is also damaging. Furthermore, setbacks from natural calamities are disproportionately high for the less-privileged nations. It is therefore a vicious cycle of creating the self-sufficient population that will bear the cost of the system itself under the prevailing conditions.

The energy infrastructure, particularly the rural electrification services, are not cost-effective under the above circumstances unless economic activities are initiated for the people. Next to the overall lack of national capital for energy infrastructure, the economic condition of the rural sector is a major barrier for extension of the services. The closed nature of the problem is evident, where energy security is tied closely to the economic security of the rural people.

Given the constraints for the developing countries – and although the public sector is the major player in setting the economic trend – private organisations, non-governmental organisations (NGOs) and community-based organisations (CBOs) also have developed alternative mechanisms influencing the economic growth at local and national levels. Examples are the number of micro-finance institutions operating in the rural sector of the developing countries. Their collective impact on the rural economy is clearly evident, and experience demonstrates that they are financially sustainable.

However, energy is not the common denominator among these players and it either contributes marginally or not at all to the tax-base used to feed the energy infrastructure. Hence, there is a disparity between the different players of growth, i.e between the public infrastructure builders and the microeconomy lenders. The latter, being close to the livelihood of the rural people, can play a role in accelerating the access of modern energy into rural homes and influencing them about the benefits. A collaborative effort between the public organisations, private organisations, NGOs, CBOs and micro-finance institutions in energy service delivery may remove some of the barriers to access for modern energy and rural electrification into the dispersed households.

As history has shown for most developed nations, extension of rural electrification needs access to both suitable financial resources and eligible consumers, and together they produce the well-developed rural electrification programmes. This article provides a brief overview of one of the most successful rural electrification service infrastructures from the developing countries. It focuses on the rural...
The rural electrification service in Bangladesh is carried out by 57 autonomous Palli Buditt Samities (PBSs), which are consumer co-operatives working under the regulatory guidelines of the Rural Electrification Board (REB) since 1980. The government has invested in this public utility programme over the years with nearly US$880 million in multilateral and bilateral support to build the rural grid distribution service. Power is purchased by REB at a bulk rate from the national power development board, and serves more than three million consumers through 116,452km of grid lines.

In spite of the impressive performance of the rural electrification service, which serves an additional two million consumers each year, only 18% of the total households are electrified today, and approximately 10 million households remain unserved. The task of meeting the needs of this population requires significant capital investment, and a sound consumer base. Some of these unelectrified households have the ability and willingness to pay for the services; however, they cannot be reached in the near term by economical means. Low power consumption of sparsely distributed households and geographic inaccessibility are barriers to grid extension in many areas. Alternative methods of household electrification is therefore an issue of serious consideration for the rural electrification programme.

The industrial sector of Bangladesh is quite limited within the urban and peri-urban regions, with a lack of energy infrastructure for industries in the rural sector. Strategically located PBSs serve the peri-urban industries and, hence, derive a major proportion of their revenue from these consumers, especially those close to metropolitan Dhaka. Overall, the rural industrial sector is cross-subsidising the rural domestic sector, which is not characteristic of a rural electrification programme.

Table 1: Rural Electrification Tariff for Consumers

<table>
<thead>
<tr>
<th>Tariff</th>
<th>Domestic</th>
<th>Commercial</th>
<th>Irrigation</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>In US$ per kWh</td>
<td>0.040</td>
<td>0.081</td>
<td>0.044</td>
<td>0.061</td>
</tr>
</tbody>
</table>

The consumers of rural electrification service include domestic households, commercial markets and industrial and irrigation. There is great variation in the consumer mix for the PBSs covering the whole country. Typically, the domestic consumers represent households that are small users of electricity — they are large in number and often underprivileged. Energy consumption and its growth rate are slow for these consumers and an overwhelming 50% use less than 30 kilowatt hours (kWh) per month. Therefore, revenue earned per consumer is low for the investment on physical infrastructure needed for providing electricity to the sparsely distributed domestic consumers, considering the least cost of grid extension to be US$6,000 per kilometre.

The commercial consumers for rural electrification are small shops located within rural markets. These consumers are also small energy users of approximately 35kWh per month. However, their physical entity in clustered groups make them a less capital-intensive infrastructure. In addition, rural markets are typically the commercial centre for the local economy and growth centres for rural development, therefore provision of electricity is found to attract other small industrial operations to these areas. Table 1 shows the average power tariff for rural consumers of different categories. The tariff rates for commercial consumers being higher, these rural markets are the target for expansion of rural grid electrification service.

The industrial sector of Bangladesh is quite limited within the urban and peri-urban regions, with a lack of energy infrastructure for industries in the rural sector. Strategically located PBSs serve the peri-urban industries and, hence, derive a major proportion of their revenue from these consumers, especially those close to metropolitan Dhaka. Overall, the rural industrial sector is cross-subsidising the rural domestic sector, which is not characteristic of a rural electrification programme.

Finally, agriculture, as the basic building block for the rural economy, has a strong demand for grid electrification service. For the consumer, relative cost of irrigation with grid service is nearly 30% less expensive than its alternatives. Although seasonal, irrigation plays a significant role in the energy demand and revenue structure of rural electrification. In one small rural distribution network, the

1. Management Information System (MIS), Rural Electrification Board of Bangladesh, December 2000.
introduction of only three irrigation facilities has outweighed the yearly energy demand of 200 domestic consumers, as shown in Figure 2. It has also been found that some areas served with the grid service for irrigation produce three crops per year compared with the average of two. This is an important observation on the economic impact of rural electrification for a country where 20% of the gross domestic product is from agriculture.

Infrastructure development is met by the PBSs through long-term debt service. The cost of reaching the dispersed households and irrigation facilities is subsidised by the commercial and industrial sectors.

Parallel to the long-term energy infrastructure build-up and power-sector reform, there is a requirement to attend to the immediate need for improving the livelihood of the rural population.

A Self-supported Off-grid Service

The national grid serves only about 50% of the nearly 10,000 rural markets and commercial centres in Bangladesh. The majority of the unelectrified markets continue their business operations through the evening hours with electrification service from private diesel generator service providers, with an estimated total energy supply of the order of 20 megawatt hours per day, which is already 10% of the grid service for the rural commercial sector.

Utilisation of stand-alone diesel generators for electrification has grown rapidly in the recent past, although services are limited to regular lighting and other low-power-consumption applications. Nearly 90% of the consumers of these micro-grids use less than 20kWh per month at high tariff-rates, ranging from US$0.30 to US$0.60 per kWh. It has been found that the age of the diesel generator sets, and quality of the fuel used, are the determining factors for operational reliability.

Due to the lack of capital, the private diesel service providers invest approximately US$200 per kilowatt in second-hand diesel generators of 5kW to 20kW range. Since the price of diesel is subsidised and fixed by the regulatory authority, investment for production of electricity through diesel fuel is still cost-competitive and investment is recovered within eight to 14 months.

The self-financed private service providers meet the needs of the rural commercial sector operating as a supplement to the national grid electrification programme, without any training, safety standards or legal support. Many of the grid-connected rural and urban markets in poorly performing supply areas are also using back-up diesel service during load shedding of existing grid. The range of supply from these networks is small, being limited to 50 to 150 users, and a large market often has multiple service providers operating in different parts of the market area. Some of the systems have extended their supply to include domestic consumers located short distances from these markets. However, the tariff rate of service from private provider appears to be prohibitively high for the middle and low-income households. A recent study found the consumers of decentralised diesel electrification to be from the higher income group of the rural sector, where nearly 30% of the service users earn more than US$150 per month, and 15% earn more than US$200 per month. For multiple applications and productive use of power, diesel engines of suitable capacities are either owned and operated by individuals or collectively as a group.

In spite of its indispensable nature, the private diesel electrification service sector has not yet entered the legal framework of the country and, hence, operates without authority and support. Overall business development is limited by the expendable capital available to the individual service provider. The limited financial capability of the individual service providers and small operational budget therefore does not allow this off-grid electrification service to spread, or to meet the needs of the sparsely distributed rural households.

Alternative Solutions for Electrification of Rural Households

The two technical options for off-grid electrification that can be considered for immediate use are the solar home systems (SHSs) and mini/micro-grid-using diesel generators, considering that the decentralised use of other renewable energy resources has not yet been

established in Bangladesh. Both of these applications have their own market niche and potential. Of the two choices, experience with diesel power generation is extensive in the rural sector, while the potential of solar power is relatively unknown. With suitable choice for level of service, alternative modes of payment with financing and service providers, both technical options can play key roles in rural household electrification.

The unelectrified households that are not to be connected to the grid in the near future may be readily pre-electrified by the PBSs using SHSs with cost-competitive investment per consumer, thereby reducing their waiting time. In view of their extensive coverage, field offices and close linkage with the local population, the PBSs are in a unique position to provide this service. Thus, consumers should be encouraged to use SHSs as a first stage of pre-electrification and, when sufficient consumers are available, the PBS may extend grid service. Alternative supply modes can therefore be used to ‘prime’ the demand needed for grid electrification. A 1998 survey found an existing market size of 0.5 million households eligible for solar electrification on a pay-for-service basis.³

Households within the unelectrified villages and riverine or coastal islands are valid candidates for SHS services provided by private dealers or agents, local co-operatives, NGOs or others on a commercial basis. Since SHS service requires simple yet specific maintenance, such small-scale infrastructure would require well-designed institutional mechanism at the village level. In co-ordination with the local NGOs or relevant PBSs, the private co-operatives may utilise financial incentives and technical support and thereby manage SHS service on a pay-for-service basis.

Bangladesh has a unique characteristic for the successful provision of various services at grass-roots level by the NGOs. As a result of long-term commitment with the rural population, the NGOs have developed confidence within the private and public sectors. With an appropriate framework for financial and technical support, the NGOs can participate in:

- organisation of training on off-grid electrification services;
- co-ordination of technical experts and business interest groups at the local level;
- motivation of households in adoption of off-grid electrification options; and
- dissemination of information.

Finally, with the participation of the micro-finance institutions, the beneficiaries of the NGOs can access consumer credit for procuring energy appliances such as solar home systems for household electrification.

In summary, considering the existing number of unelectrified rural homes with varied economic conditions in the developing countries, viable solutions are needed for rural electrification. Parallel to the long-term energy infrastructure build-up and power-sector reform, there is a requirement to attend to the immediate need for improving the livelihood of the rural population. Using the comparative advantage of the alternative technologies and delivery options discussed in this article, an early access may be attained; however, long-term sustainability will also require economic security of the rural population. □

New Lamps for Old —
Solar Photo-voltaics Light Up Rural Sri Lanka

a report by
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About 45% of households in Sri Lanka do not have access to grid electricity. If only the rural sector is taken into consideration, this figure is more than 60%. The availability of electricity, even for basic applications such as lighting, radio and television, is necessary for the economic growth and social development of these communities. Although the on-going rural electrification programme aims to reduce this gap to 20% by about 2006, there will still exist a large unserved rural market demanding electricity services, amounting to about one million households. Most of them are likely to be low energy consumers situated in geographically dispersed locations and, hence, grid extension is not financially feasible. This is where photo-voltaic (PV) powered solar home systems (SHSs) offer an attractive alternative to people who would otherwise depend on kerosene lamps.

The challenge facing the adoption of solar PVs is more than technological. It calls for a paradigm change in the mindsets of people who, hitherto, depended on the state for the provision of almost all services — including electricity. If the state does not provide it, they would rather wait in hope. People seldom realise that solutions can be found from within, nor are they aware of alternatives. This requires a fresh look at the role of the private sector in rural development, the practicalities of decentralised energy options and empowering people to access them.

The Energy Services Delivery Project Credit Programme

The Energy Services Delivery Project Credit Programme (ESD Project) was set up by the Government of Sri Lanka in 1997 with assistance from The World Bank and the Global Environment Facility to address these challenges. The ESD Project promotes private sector participation in the provision of electricity services using renewable energy resources. By the close of 2000 it had financed 12 grid-connected mini hydro projects (22.4MW), 11 off-grid village hydro schemes (611 households) and 12 SHS projects (2,574 households) on market-based terms. SHSs were initially introduced to Sri Lanka in 1978 and 1979. Several players made their entrances and exits, but the market failed to scale up. Under the ESD Project, the approach is different. It is comprehensive, market-driven and builds on public-sector/private-sector partnerships in providing rural infrastructure support for human development.

An SHS typically consists of a PV module to convert solar energy into electricity, a battery to store the electrical energy, a controller to regulate the flow of electricity, wiring and light fixtures/socket outlet to enable the user to consume the electricity so generated. Batteries and modules are sized to permit three days of autonomy in the event of prolonged gloomy weather. A charge controller is provided in the circuitry to regulate the charging and discharging of the battery. A typical 35W SHS will provide power for at least three lights and a small black-and-white television set, or a similar appliance, for about three hours a day.

Delivery Mechanisms

Consumer Credit by Microfinance Institutions

In this model, which has proved to be the most successful so far, rural householders obtain consumer loans from a microfinance institution (MFI) to purchase SHSs from a dealer/developer of their choice. The dealer/developer in turn has an agreement with the MFI regarding the technical package offered and other product features. A schematic diagram identifying the players and cash flows is presented in Figure 1.

Banks provide working capital loans to dealers/developers to carry an inventory of SHSs and components. They also provide term loans to MFIs to purchase SHSs from dealers/developers on a project or batch basis. Banks presently participating in the ESD Project comprise two development banks and three commercial banks, all privately owned. These participating credit institutions receive 80% refinance on loans disbursed, at a floating rate of interest benchmarked to the market deposit rate. Their on-lending rates are also market-based.
Dealers/developers provide technical inputs including system design and sizing, SHS delivery and installation, service and warranty arrangements. They also conduct market studies and sales promotions to identify suitable customers, install SHSs and collect down payments on behalf of the partner MFI. At present there are four dealers/developers marketing ESD Project compliant systems.

MFIs design the consumer loan package, which includes an initial down payment followed by monthly installments, usually spread over two to four years. MFIs screen applicants, execute loan agreements and pay the dealer/developer for SHSs installed on households. MFIs thus assume the credit risk on consumer loans and are free to set on-lending rates. One active MFI has satisfied the ESD Project eligibility criteria and is being admitted as a participating credit institution. It will thus have direct access to the ESD credit line, thereby reducing the number of layers in the loan delivery channel.

Customers targeted are rural householders unlikely to be connected to the national grid in the next five years or more. These households invariably include schoolgoing children who benefit most by the clean, safe and good quality lighting provided by SHSs. As some degree of income stability is anticipated in the MFI's credit appraisal, the household would usually include wage earners (e.g., factory or plantation workers), farmers, tea smallholders or self-employed persons.

Cash Sales

Cash sales take place, to a limited extent, in instances where the initial cost is not a barrier. However, sales to such niche markets do little to scale up market penetration. Households with a large seasonal income also favour cash purchases, for example, farmers after a bountiful paddy harvest.

Consumer Credit by Banks

With the loan delivery channel becoming flatter in this model, there is scope for decreasing the final interest burden borne by the household. A state bank operating outside the ESD Project is providing such consumer loans in association with a dealer/developer on a limited scale. However, a similar attempt by a private bank failed to take off and the sustainability of this model is yet to be established.

Consumer Credit by Dealer/Developer

This model integrates the marketing, technical services and consumer financing functions into a single entity. This was the model originally envisaged when the ESD Project was launched, but had to be abandoned as dealers/developers could not manage consumer credit on a large scale. The model shown in Figure 1 evolved from this by unbundling consumer credit to another entity.

Fee for Service

This is a service model and not a sales model. The concept of an energy service company that installs and maintains SHSs in homes for a monthly fee was attempted by a firm. However, this model also did not work well, again because of the difficulty in combining microfinancing with other functions.

Configuring the Marketing Mix

The marketing mix, comprising product, price, place
and promotion, are the controllable variables that SHS dealers/project developers design and implement to satisfy the target customer. The ESD Project also provides technical assistance to stakeholders where necessary. The external environment comprising the political, economic, social and technological factors are usually beyond the control of the firm. This is where the ESD Project performs a facilitating role in removing barriers, illustrated in Figure 2.

Product

Product features extend beyond the tangible and keep evolving as innovative solutions emerge to manage the various risks. To provide comfort to lenders an insurance scheme was designed to cover risks such as damage or theft of the PV module as well as death or permanent disability of the householder. To reduce the credit risk on the MFI’s loan, some dealers/developers undertake to repossess modules from defaulting customers. These modules have a ready resale market. The uncertainty of future grid extension and false expectations raised by politicians deter many willing and able households from purchasing SHSs. Some dealers/developers overcome this obstacle by offering a buy-back scheme covering a real grid extension.

Price

The price of an SHS mainly depends on its capacity. A typical 35W SHS, complete with four lights, retails at about US$375. While improvements in system efficiencies and cost reductions are possible with technological advancement and market growth, the expenses associated with conducting business in remote, dispersed locations and maintaining the product features noted earlier are all factored into the final price and interest rates borne by the consumer. The grants provided to developers under the ESD Project for project preparation activities and co-financing helps to mitigate these initial disadvantages.

Consumer loans are necessary to overcome first-cost and affordability barriers. Monthly installments are structured so that they are not much more than the present expenses borne by the householder on kerosene. As in most market-based consumer financing, interest rates on SHS loans also tend to be high, on account of the large transaction costs relative to the size of the loan. To address this issue the ESD Project is presently structuring a technical assistance programme for MFIs meeting the ESD eligibility criteria to set up efficient solar financing units within their organisations.

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Sales, service and financing need to be provided where the customer is, and this requires good outreach and understanding of local norms. Dealers/developers have so far set up more than twelve dedicated solar centres in dispersed locations to serve neighbouring communities. These shorten the response time to a service call, a key aspect of customer satisfaction and hence, loan recovery. The partner MFI, chosen to provide the financing package, is usually an existing local organisation willing to add solar loans to its credit portfolio.

Promotion

While individual dealers/developers conduct sales promotions at a local level, a larger generic awareness creation campaign is carried out by the ESD Project. The latter targets end-users, government authorities, MFIs and the business community and educates end-users of the advantages and limitations of SHSs, informs them about service and warranty arrangements and about available loan schemes. These messages are communicated through the mass media as well as through more focused workshops and demonstrations at villages.

Creating an Enabling Environment

Political Environment

The absence of a national policy on renewable energy, the non-availability of reliable grid extension plans for use by project developers and false promises of grid extension made by politicians seeking votes at elections are the main barriers faced by the PV industry in the political environment. Many politicians fail to realise that solar PV complements grid supply in areas where it is not economical to extend the grid. The ESD Project is presently creating greater awareness among policy-makers on the prospects of including such options into the budgets of local authorities.

Some recent breakthroughs are noteworthy. Two government agencies, a provincial council and the ministry for plantation infrastructure have realised that full grid electrification is not a practical reality. In response, they have included solar electrification in their plans and are presently arranging to link their solar programmes with the ESD Project. They will use the market-based demand-driven approach already in place in the ESD Project and, in addition, provide a transparent subsidy. They recognise that leveraging their own subsidy funds through the ESD Project improves the sustainability of their respective programmes. Their success will provide a model for others to emulate, and hence, the potential impact on the rural community is enormous.

Economic Environment

Apart from duty-free imports of PV modules, the industry receives little other assistance from government. In contrast, the state-owned power utility subsidises small domestic consumers through a low tariff band and tax exemptions. The price of kerosene, a direct substitute, is also subsidised. Although this is a complex issue, it is recognised that the solar PV industry competes on an uneven playing field.

Social Environment

Given the high literacy rates even in rural areas, it is not difficult to create awareness or teach the operation and maintenance aspects of SHSs among end-users. Further, rural communities, being more closely knit, are sensitive to peer pressure and so loan recovery rates are good as long as external interference is kept out. On the whole, the social environment is conducive to the market-based approach adopted.

Technological Environment

Solar PV technology is ready for commercialisation provided certain checks are in place. Compliance with technical specifications that spell out minimum design and performance standards, provision of warranties on components, prompt after-sales service and a system for independent customer complaint investigation are safeguards established by the ESD Project until the industry matures enough to regulate itself. Specifications are regularly reviewed. The product itself is relatively easy to install, operate and maintain and is long-lasting.

Assistance to establish and operate the Solar Industries Association (SIA) is also being provided under the ESD Project. The SIA is organising training programmes for technicians and will address other industry-related issues.

Conclusion

It took about three years for the number of SHSs installed under the ESD Project to reach the 1,000 milestone. The industry is presently installing about 300 systems per month with sales showing exponential growth. Over 2,500 SHS were installed in 2000, and the number is estimated to more than double in 2001. When the ESD Project ends in 2002, it is estimated that some 15,000 rural households will "light up" with solar electricity. It is anticipated that this critical mass will spur the solar PV market on a sustainable growth path.
Energy Infrastructure, Energy Markets and Poverty in Latin America and the Caribbean

a report by
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Introduction

Energy demand and economic growth are well-known to be strongly correlated; without energy, economic growth is highly improbable. Although energy conservation programmes lowered the degree of coupling between these processes in the 1970s, they remain tightly bound. Thus, the energy infrastructure is of relevance to worldwide development within the global infrastructure that has to be created.

In many countries, the recent transformation of the centrally controlled energy systems into liberalised markets, especially in gas and electricity (independent of ownership status – private or public), has had an important impact on energy sectors. The fundamental change has been to transform the concept of energy as a highly strategic input into the economy, and thus tightly controlled in its production, transport and distribution, into a highly desirable commodity that, as such, can be managed in the above processes through market forces.

According to the results, analysts worldwide seem to observe that, although the newly created energy markets have been successful in most instances (California being the example of failure most often cited), there are certain important areas in which the operation of an energy system solely through market mechanisms does not seem to be particularly effective. Two of these areas are long-term planning, which is essential to the energy systems, and the reduction of energy poverty in the population.

In relation to the Latin American and Caribbean economic situation, the gross domestic product of 1999 was US$1.38 trillion and the average gross domestic product (GDP) per capita was US$2,773. It varies from US$198 per capita in Haiti to US$7,360 per capita in Barbados. Six countries are below the value of US$1,000 per capita, 13 countries are between US$1,000 and US$3,000 per capita, and seven countries are above US$3,000 per capita. Important variation of the economic wellbeing of the inhabitants of these countries that obviously reflects in the development of the countries’ energy sector can clearly be seen.

The Energy Sector

The energy sector of the region is a net exporter of primary energy resources, mainly oil and coal, and is expected to continue to be an exporter in the next 25 years. The region, as of 1999, produces 8.8% of the world total (67.482 billion barrels of oil equivalent (boe) per year) and consumes 6.7% of the world total (66.941 billion boe per year). It holds 13.5% of the world oil proven reserves (1,088.5 billion barrels of oil), and produces 13.6% of the total world daily production (58.156 million barrels of oil per day), yet it only holds 8.4% of world oil-refining capacity.

Mexico and Venezuela are the two countries with the largest proven oil reserves (47.882 billion barrels and 76.108 billion barrels, respectively) and the largest production (2.91 million barrels per day and 2.79 million barrels per day, respectively), as well as the main oil exports (1.55 million barrels per day and 1.89 million barrels per day, respectively).

The region holds 5.6% of the world's natural gas reserves (147 trillion cubic metres) and contributes 7.3% to the world production (2.37 trillion cubic metres per year). The countries that hold the largest gas reserves are, again, Mexico and Venezuela (1.96 trillion cubic metres and 4.15 trillion cubic metres, respectively). Argentina is also a main gas producer in the region (41.85 million cubic metres per year).

With regard to coal, Latin America and the Caribbean holds only 1.7% of the world resources (978 billion tons), with Colombia and Brazil having the largest amounts (6.65 billion tons and 5.27 billion tons, respectively). Colombia and Mexico are at present the main producers (32.81 million tons per year and 10.34 million tons per year, respectively).

As far as electricity is concerned, the predominant resource is hydroelectric energy. Latin America and the Caribbean holds 22.7% of the world total hydroelectric power potential (3,235GW), with Brazil possessing the largest share (143.38GW) as well as the largest installed capacity (57.34GW).

Conventional thermal electricity generation with
fossil fuels in the region is lead by Mexico (30.87GWe). Nuclear power is a reality only in three countries: Argentina (1.018MWe), Brazil (657MWe) and Mexico (1,309MWe), with a new unit expected to reach commercial operation in Brazil in the near future. Geothermal electricity generation only contributes marginally to the total, with Mexico (790MWe) having the largest installed capacity. As for commercial biomass, sugar-cane bagasse is the most important, with approximately 2,000MWe total installed capacity. Non-commercial biomass as a direct fuel is important in the rural areas of the region, and it is estimated that its contribution is about 8% of the total energy supply of the region.

The final consumption of the Latin America and Caribbean region in 1999 was 3,326 billion boe and the average final energy consumption was 6.7 boe per capita. The spread in the variation of this parameter is great, the minimum being 1.6 boe for Haiti and the maximum 34.7 boe for Trinidad and Tobago, although 23 countries had consumption rates below 10 boe. With regard to the energy intensity, the average is 2.4 boe per US dollar, with the minimum at 0.9 boe for Barbados and the maximum at 9.8 boe for Guyana.

With respect to final electricity consumption, the total for the region was 754,979TWh with an average consumption per capita of only 1,478kWh (42kWh for Haiti and a maximum of 3,422kWh for Trinidad and Tobago). As for oil products, total consumption was 2,126 billion boe in 1999 with an average consumption of 4.3 boe per capita.

Energy Sector Restructuring

Progress made in the reforms of the energy sectors of the Latin American countries is quite heterogeneous. Argentina and Chile were pioneers in carrying out liberalisation efforts, while resource-energy-rich countries such as Mexico and Venezuela have been much slower in taking steps in that direction. Although there is now a strong link between electricity and gas due to combined-cycle gas-fuelled electricity generation units, the reforms in the two energy systems have not necessarily advanced at the same pace in individual different countries.

For electricity, Argentina, Bolivia, Chile, Colombia, El Salvador, Guatemala, Panama and Peru have created open markets where ownership ranges from totally private to mixed public-private. Suriname, Guyana, Nicaragua, Jamaica, Honduras, Trinidad and Tobago and the Dominican Republic have opened their energy sectors to varying degrees of private-sector participation and new regulatory approaches.

Brazil, Costa Rica, Ecuador and Venezuela have allowed partial participation of private sector and mixed ownership in their electrical sectors with greater autonomy and more business orientation of their integrated public enterprises. Haiti, Mexico, Paraguay and Uruguay still have a centralised control and a vertically integrated system, although some of them have initiated actions towards private capital participation and certain business autonomy.

Predictions for the future are difficult to make, but the general perception is that the countries in the first group will slowly identify the weak spots of their electricity markets and correct them. The other groups will probably tend to move to a situation of a more liberalised market, carefully studying what has transpired in other countries, to avoid situations that are considered troublesome for market development. It is interesting to note that regional integration is a driving force to implement reforms, as has been observed in Central America (Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and Panama), and perhaps less in extended Mercosur countries (Argentina, Bolivia, Brazil, Chile, Paraguay, Uruguay).

With respect to natural gas downstream activities, Argentina, Bolivia and Mexico have developed open markets. Argentina’s markets are all private sector, while the markets of the latter two are a mixed ownership or partial participation of the private sector. Brazil, Colombia, Chile, Trinidad and Tobago and Venezuela have a regulated integrated-structure scheme of privately owned companies, mixed enterprises or public entities under state jurisdiction, with a regulatory body open to a certain amount of political considerations. In the remaining countries, natural gas markets are only beginning to be developed. The future of downstream natural gas natural markets seems to be in the creation of open markets in those countries – Brazil, Chile, Colombia, Venezuela and Trinidad and Tobago – that still have an integrated monopoly with some sort of regulation in place. Perhaps, but at slower pace, an increase in the privatisation of the remaining public assets will occur.

With respect to the upstream activities in natural gas production, in many cases, because it is associated with oil production, the future is closely linked to what may happen in the oil sector. In general, there is a perception that non-associated gas fields will be allowed to be explored for, and developed by, the private sector in those countries where this is not the case and that, at a slower pace, the predominance of the public sector will decrease to allow private sector activities to grow.

Poverty

The last part of the 1990s was economically detrimental for Latin America and the Caribbean. As
a region, the percentage variation (with respect to the previous year) of the GDP per capita went from 3.7% in 1997, to 0.4% in 1998, to -1.6% in 1999. Urban unemployment increased from 7.3% to 8.7% of the active population between 1997 and 1999, with increases greater than two-digit percentages in Brazil, Chile, Colombia, Ecuador and Venezuela. In most countries, real income fell in 1998 and 1999. Consequently, it is expected that the estimated percentage of the population under the poverty line, which dropped from 48% in 1990 to 46% in 1994 and to 44% in 1997, will have again increased in the last three years of the decade.

From the energy sector perspective, urban and rural poverty have to be looked at differently. It is usually found that the urban underprivileged have illegal access to electricity (theft) and, in many cases, manage to buy liquid petroleum gas for cooking and heating or use biomass. In rural areas, where there is no electrical infrastructure (12.1% of population is not electrified), biomass is the main fuel, with perhaps oil-product fuelled lamps for lighting.

As of 1997, 37% of the urban population and 63% of the rural population was living under the poverty line in Latin America and the Caribbean. As mentioned above, the overall percentage is 44% of the total population. As these percentages are too great to be satisfactory, there is a need to develop public policy to reduce them. Without access to commercial energies, it will be difficult to incorporate many of these underprivileged into viable economic activities that will help them to move above the poverty line. Market forces by themselves will not manage it, and government intervention through transparent subsidies is considered necessary.

**Energy Infrastructure**

As of 1999, the installed capacity in electricity generation was 211.69GWe, of which more than half (119.74GWe) are hydro-based and 87.87 thermal power plants. The remainder are nuclear, geothermal and biomass-fuelled power plants.

Since natural gas as fuel was not fully utilised for electricity generation in the past decade, as in other parts of the world, combined-cycle gas-fuelled power plants have dominated the new installed capacity and the corresponding gas transport and distributions systems have been built. Refining capacity to produce oil products, mainly for the transport sector, is approximately enough to satisfy present demand. In 1999, this capacity was equivalent to 6.8 million barrels of oil per day.

If economic growth is the first priority in reducing poverty in the region, economic analysis indicates that sustained GDP high-growth annual rates are required (~5%) in order for significant poverty reduction to take place in the next decades. If this happens, electricity demand would be expected to grow one or two percentage points above the value of the economic growth rate, that is between 6% and 7%.

This high electricity demand growth-rate means, in gross terms, the duplication of the installed electricity generation capacity every 10 years, that is, for 2025 there should be something between 700GWe and 1,000GWe installed, of which between 500GWe and 800GWe will be new. At between US$600 and US$2,000 per kilowatt capital cost, depending on the technology (US$600 for combined-cycle gas turbine and US$2,000 for hydroelectric), the total investment required just for generation is in the range of US$1 trillion. Another similar amount will be required in transmission and distribution infrastructure. It should be noted that one would not expect that all new-generation capacity would be natural-gas fuelled.

As for oil-refining capacity, a scenario can be built on the premise that the demand for transport fuels will increase at a rate of 3% annually. That is, refining installed capacity will have to be duplicated in the period between 20 and 25 years – that is, an additional seven million barrels per day capacity should be built. At a cost of roughly US$15,000 per barrel for new installed capacity, something like US$100 billion will be required. Besides this investment, infrastructure for exploration, production, transport and distribution will be required, although perhaps not as much as for refining, due to the fact that the region is currently a net exporter of crude oil, which could be utilised internally.

This rough estimate of the required infrastructure and corresponding amounts of investment in the Latin America and Caribbean region shows that there are interesting opportunities for investors, even considering that maybe not all the energy infrastructure will be in the hands of the private sector, since, even with the reforms, there will probably remain some public participation.

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The New Renewable Energy Market – Main Characteristics

According to the most recent National Household Sample Survey1 (“the survey”), conducted nationwide by the Brazilian government, 25% of all rural households lack electricity. This means that at least eight million Brazilians in rural areas are without any kind of electric lighting in their homes. More importantly, there is only a remote short-term and medium-term possibility that their homes will be interconnected with the electric power system operated by the concession companies that distribute and sell electricity in their states.

In general, considering a daily income of less than US$1 per person as the basic indicator of poverty, these rural populations are extremely poor. According to the survey, 45% of the rural population and 23% of the total Brazilian population fall into this category. The highest levels of rural poverty are found in the north and north-east of the country – particularly the latter, where that figure is as high as 60%. Furthermore, this vast swath of the population also lacks other kinds of basic infrastructure, such as sewerage and connections to existing water supply and electric energy systems.

Thirty four per cent of the population earning less than US$1 per day do not have access to electric energy services, 86% are not connected to the water supply system and 47% lack sewerage.

Although this situation is less serious in urban areas, the same correlation occurs in that less-privileged individuals lack access to the basic infrastructure services of sewerage and connections to the main water-supply system. Nevertheless, with regard to public electric energy services, the urban situation is considerably different, with just 3% of the population without electricity. Figure 1 illustrates the regional distribution of the rural population that lacks access to these basic infrastructure services.

With specific regard to access to electric energy, it should be noted that the overwhelming majority of the rural population living in unserviced areas is concentrated in the northern and north-eastern regions of the country. In the Brazilian north-east, the most severe energy deficits are found in the states of Bahia and Ceará and electrification is virtually non-existent in the rural areas of northern Brazil. It should also be stressed that there is a strong correlation between the number of people living in unserviced rural households and the low average-income levels of the residents of those households.

Figure 3 illustrates that the largest concentration of unserviced households is in the same category as those with average annual incomes of less than one minimum monthly salary (the equivalent of US$75 per month, in February 2001). These statistics underestimate the actual number of households lacking electric energy, because all residences that are electrified in some way – even via highly precarious means – are considered to be getting electricity services, according to the standards used by the survey. Furthermore, the unserviced households in six northern states – Acre, Amapá, Amazonas, Pará, Rondônia and Roraima – are not included and these states are estimated to have the largest number of households lacking access to electric energy.

According to the results of a project conducted for ANEEL (Agência Nacional de Águas e Energia Elétrica) to identify the unserviced electric energy market in Brazil and individual states,2 the number of unserviced households in the country falls within a segment that is larger than that reported by the Pesquisa Nacional de Amostragem por Domicílio (PNAD) and smaller than the one considered unserviced by the electricity sector. Figure 4 shows the PNAD 1999 figures and the numbers reported by Eletrobrás that same year for the nation as a whole. Thus, the total number of people that do not have electric energy services is between 10 and 18 million.

According to the Energy Sector Management Assistance Programme’s (ESMAP’s) estimates:3 if ANEEL

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had not proposed this resolution on the universalisation of energy services, more than one million households would still be lacking electricity by 2005 in the states of Bahia, Ceará and Minas Gerais alone.

The Role of Access to Infrastructure in the Alleviation of Rural Poverty

At present, few credible studies have been conducted to determine the size of the potential non-conventional renewable energy market on a national, regional and state level. However, a number of methodically developed and accepted proposals from the standpoint of the electricity sector have determined, with reasonable accuracy, the size of the nationwide market that lacks electricity services and the segments of that market that could be served with non-conventional technologies.

Primarily conducted in the 1990s, this drive sought to identify not only these market niches, but also forms of management, real generating costs in US dollars per megawatt hour and the feasibility of supplying this market for businesses, considering the specific characteristics of these potential consumers.

The underlying conviction that, in a way, drove technicians and researchers to take on this challenge was the understanding that access to public electric energy services is a necessity and that, although this alone is not enough to alleviate rural poverty, it can help make a real improvement to the living conditions of millions of people who are now completely excluded - both economically and socially - from the results of national production.

ANEEL’s proposed resolution to universalise energy service falls within this perspective by requiring clearly defined goals and responsibilities to be implemented by the state concession companies. It is understood that privatisation without universal service has created a situation that cannot be resolved without the intervention of the conceding authority (government), thereby repaying a social debt that is widely recognised by the state.

The proposal for universalising energy service calls for all Brazilians to have access to public electric energy services, no matter where they live or how much energy their households potentially consume. In order to do this, the proposal has established that all concession companies must set service goals that will enable all rural households and properties in their respective concession areas to receive a regular supply of electric energy by 2005. A large percentage of the energy supplied to this new market should be generated by non-conventional sources as they are the least expensive and most appropriate alternatives for supplying the electrical loads typically associated with these potential energy users.

At present, negotiations of this process of establishing universal service are well advanced, following the public hearing held in October 2000 to discuss all of the main issues involving the interests of the concession companies, the conceding authority (represented by ANEEL) and consumers.

Despite the disagreements expressed at the public hearing by some of the concession companies regarding the proposed deadlines, and the arguments raised regarding legal considerations and the costs involved in meeting the required goals, all indications are that the ANEEL will regulate universal access to public electric

2. O Solano, T Mourindo, et al. (1999), Metodologia para Identificação do Mercado Não Atendido de Energia Elétrica, ANEEL Relatório Técnico 02/99/R2; UNIFACS, Universidade Salvador.
energy services in accordance with the terms of its original proposal. This means that electrification goals will be established and renewable sources will be included as alternatives sources of supply by concession companies when these sources prove to be the least expensive and most suitable alternatives.

In rural areas where electrification through interconnections with the power system is financially impossible, electricity could, in the short term, be supplied through alternative non-conventional energy sources.

Based on the experiences of some small farm co-operatives, expectations are that the farming activities typically found in these rural communities will also benefit from access to this kind of energy supply, as it has already worked a profound and qualitative change in the incomes and living conditions of the families served, particularly in regard to small-scale irrigation, electrified fences, significant increases in the productivity of sheep and goat raising and the cold storage of fish, among other applications.

The Bill goes further by proposing the compulsory purchase by concession companies of electric energy generated by non-conventional renewable sources, such as solar, wind, biomass and small hydroelectric plants. It also proposes the introduction of a new intrasectoral financing mechanism, the Energy Development Account, which is a fund to be established by the electricity sector to cover the deficits imposed on concession companies when servicing this new market. This mechanism is similar to the one now being used to electrify isolated communities in northern Brazil with groups of diesel generators (recently extended to include other non-conventional sources). The Bill is currently under analysis by the National Congress, and is expected to be signed by the president by the end of the year.

Once both legal instruments are established, electricity will improve rural areas by creating a positive impact on poverty alleviation. A substantial part of this provided infrastructure will be accredited to alternative sources, not only because of its relative low cost, but also due to the portfolio renewable standard.

Conclusions

It is widely recognised that the definition of poverty on the basis of strictly monetary standards – an average daily income of less than US$1 per person – should be used in context and in conjunction with other equally important variables to establish and maintain the wellbeing of individuals and communities.

Taking this, the most underprivileged people who lack access to public electric energy services live in rural areas, particularly concentrated in northern and north-eastern Brazil. In general, this poverty situation is also reflected by a lack of other basic infrastructure services, such as sanitation and water supply, which are strongly correlated to low household incomes.

These populations are extremely poor and their homes are scattered and far removed from interconnection points with the power system. There are consequently no short-term, or even medium-term, prospects of their being serviced by the state concession companies’ electricity systems. This is because the electrical loads to be provided are small and not very diversified, and they do not justify the investments required to install rural lines and systems.

The new regulations being proposed for the Brazilian electricity sector, which include the universalisation of service and the compulsory purchase of non-conventional renewable energy, will expand considerably the electric energy market to be supplied with alternative electric energy sources.

This will be achieved via positive combination of the new regulatory framework and opportunities to grow the basic infrastructure, thereby alleviating the extreme poverty suffered by millions of Brazilians living in the country’s rural areas. It also contributes to the reduction of migration to urban areas, where the rural underprivileged leave their environment seeking for better infrastructure and economic opportunities, and end up facing a different type of misery.
Delivering Electricity to the Rural Poor — The Changing Paradigm

a report by
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Introduction

Delivering electricity to the rural poor has been, and continues to be, a primary objective for governments throughout the developing world. Expanding electricity confers benefits of many kinds:

- economic – the growth in incomes resulting from increased employment opportunities as industries and agriculture develop, and increased time as fewer hours are used in obtaining basic necessities such as heat and light;

- social welfare – the increase in living standards resulting from better access to information through radios and televisions, better lighting and therefore time to learn, and the gains in health; and

- environmental – the reduction in deforestation and desertification, resulting from a switch to greater use of commercial energy.

However, despite these advantages and government commitment, in many countries, progress in expanding access to electricity, in particular in rural areas, remains slow. Access to electricity in Africa ranges from just 3% in Chad to about 40% in Côte d’Ivoire. While maximum levels of electrification are higher in Asia, there are still significant gaps, with large countries such as India only 50% electrified, and much of that at very low, undependable capacity. In addition, the poorest rural communities are invariably the last to be electrified. For example, despite its relatively high rate of electrification, while 99% of the top income quintile in Côte d’Ivoire have electrified houses, less than 1% of the bottom two quintiles are electrified. Similarly, high total electrification rates in Central and South America and the Caribbean conceal relatively low electrification of the poorest — well below 50% in most countries.

This article focuses on the problems of expanding rural electrification; the traditional response to these problems and the new paradigm that is emerging in turn, as traditional approaches fail to deliver the promised gains. In doing so, the experience of various countries is drawn on to illustrate how institutions are changing to better serve the objectives set.

The Rural Electrification Challenge

The overriding challenge in rural electrification is how to expand services when the unit costs of supply are higher than other areas and ability to pay is lower.

The high unit costs of rural electrification are driven by:

- the large capital costs of electrification;

- the relatively low load density in rural areas; and

- the generally higher proportion of domestic to total consumption in rural areas.

1. While these gains all potentially exist, there is little evidence on the degree to which they are realised in practice. Studies in Asia by The World Bank suggest that, generally, investments are only economically justified where a dynamic agricultural or rural industrial sector already exists. (The World Bank (1994), “Rural Electrification in Asia: A Review of Bank Experience”, OED Report 13291, Washington, DC).


3. While there is also an important need to address access to electricity of the urban underprivileged, the issues are slightly different and not considered in this article.

4. As an example, the cost of electricity for initial users of a new grid extension may be as high as US$0.80/kWh, (i.e. if the initial users must pay to establish their section of the network). (The World Bank, 1996, adjusted for inflation.)

5. The recognition that underprivileged communities have relatively low levels of electricity demand per consumer does not imply that their total energy requirements are reduced considerably compared with wealthier consumers. Instead, it is a recognition of the fact that electricity is not the least-cost manner of meeting demand for activities such as cooking and heating water, where biomass will remain least-cost in many cases.
At the same time as costs per connection and unit tend to be higher for rural consumers, their ability to pay is generally lower. This is only partly due to low levels of household income. Indeed, numerous studies have demonstrated a relatively high willingness to pay for electricity services among less privileged households. For example, rural and peri-urban households in Guinea pay about US$0.24 per 48/kWh for a combination of oil and batteries to meet their energy needs. Further evidence of willingness and ability to pay is provided in Figure 1.

Difficulties in the ability to pay of underprivileged households are in a large part related to the high upfront costs of electrical systems (whether connection to an existing grid or installation of small-scale generation) and an inability to access credit.

**Traditional Approaches**

The traditional approach to serving less-privileged consumers has relied on the extension of existing electricity grids by large state monopoly suppliers and prevention of entry by private providers. High unit costs are addressed through the use of subsidies — either paid directly by governments and donors or through cross-subsidies from urban areas and/or non-domestic consumers. Concerns over ability to pay are usually met by using cross-subsidies to consumers, maintaining tariffs below cost-reflective levels. For example, a 1994 World Bank survey of a number of Asian countries estimated average agricultural tariffs as ranging from 3% to 66% of long-run marginal costs. The situation has changed little since then.

Such approaches have proven successful in some countries. In Thailand, for instance, the proportion of electrified villages rose from 20% to 98% in a 20-year period. This was due largely to an extensive programme mainly funded from cross-subsidies between larger consumers and consumers in Bangkok to those in the remainder of Thailand delivered through differential bulk supply tariffs.

However, in most countries, traditional approaches have failed to deliver the desired expansion of services. Traditional approaches have failed for a number of reasons:

- a failure to involve local communities leading to systems that do not meet the needs of consumers — whether through poor design, over-specification, inappropriate technology or supporting institutions;
- a focus on investment rather than operations, leading to inadequate operations and maintenance, and poor quality of service;
- the inefficient use of subsidies that fail to target the appropriate groups;
- inadequate revenues that have proven insufficient to cover operating costs, let alone investments; and
- use of inappropriate technology, leading to systems that do not meet the ability of consumers to pay.

**The Emerging Alternatives**

Recognition of these failures of traditional approaches have led to the development of a new paradigm in rural electrification among governments, utilities and financing institutions. It emphasises:

- the decentralisation of decision-making to communities;
- the use of market mechanisms, both to supply energy and to carefully target subsidies; and
- a flexible approach to the types of technology and services that are put in place.

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7. The fact that a village is electrified does not mean that all residents have access to electricity. Depending on the country concerned, the definition of ‘electrified’ may merely mean that at least one pole on an electricity line is located in the territory of that village.
8. For example, lifetime blocks are often set above the level of service used by less-privileged households, leading to a disproportionate saving for wealthier households.
Its implementation is driven by changes in:

- market structures and institutional arrangements;
- models of ownership; and
- technologies.

The market structure and institutional arrangements will determine the incentives for rural electrification and the ability of new entrants to serve rural communities. New approaches emphasise the following:

- Supporting, rather than operating, role for government – across all reforming countries, governments are withdrawing from direct provision of services. They are using limited available resources to provide specific institutional support (e.g., helping community committees contract for supply), regulatory support (e.g., a proportion of funding for new regulatory institutions), and initial subsidies (e.g., subsidising connection charges, capital costs), (see Box 1).

- Decentralised contracting structures – the structure envisioned for rural electrification in Lesotho foresees local communities, with support from the central government, contracting for electricity and water services.

- Limited explicit regulatory intervention – the Ugandan Electricity Regulatory Authority will be able to delegate some of its powers to local communities, exempt small systems from licensing requirements or set simpler requirements set different quality standards and tariffs in consultation with the local communities and the Rural Electrification Unit (see Box 1).

- Limited exclusivity – to balance the need for revenue security while encouraging new entry exclusivity for distribution companies in Panama has been limited. They have exclusive rights only within 100m of the existing network; for distances of up to 300m, they have the right to match any offer from a new entrant; and no incumbent rights beyond 300m.

Alternative forms of ownership are an integral part of strategies to provide energy to the underprivileged. The alternatives include forms led by the private sector, co-operatives, local consumer associations, public-private joint ventures and local government.

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**Box 1: Ugandan Model**

**Background**

In 1997, the Government of Uganda began the implementation of a strategic plan to reform Uganda’s power sector. The rural electrification portion of the plan aims to achieve 300,000 new connections by 2010 using a combination of grid extensions, new mini-grids and alternative technologies.

**Institutions**

The Rural Electrification Unit (REU) will be responsible for the rural electrification programme. While officially part of a ministry, the REU will operate separately, with its own staff, budget and objectives. The reforms also create a regulatory agency, the Electricity Regulatory Authority (ERA). In recognition of the different characteristics of off-grid electrification, the ERA will be allowed to delegate some of these powers to local communities.

**Market**

The REU’s projects will be supported by a Rural Electrification Fund that will be used to provide subsidies to selected projects. Auctions will be held at regular intervals in different regions of the country at which communities and companies can propose projects and required subsidy levels. Funds will be granted based partly on a lowest subsidy approach in which providers submit bids and projects are ranked from least to greatest subsidy required. Funds are then provided, beginning with the project requiring the least subsidy, until available funds for the auction in question are exhausted.

**Targeting Subsidies**

Under this system, subsidies will only contribute to the capital cost of setting up the system. Consumers will still be responsible for paying the cost of the energy supplied to them – providing signals for productive efficiency and, through the auction process, a degree of allocative efficiency.
In many cases, the shift in emphasis from government provision to government support of private-sector provision is a recognition of the extensive role already played by the private sector. In Cambodia, where to date there has been no explicit government support, there are an estimated 600 private, small-scale rural electricity providers. A survey of a sample of providers indicated that the average provider has 192 customers and has a capacity of about 145kW. 9

The shift to government support of private initiatives is often focused on facilitating private-sector entry and providing targeted financial support. In Chile, local communities and private companies jointly submit projects to the regulatory commission, which then awards subsidies based on a range of criteria. This programme succeeded in increasing rural electrification about 50% of the rural population to about 75% over the six-year period from 1994, and aims to reach 100% by 2004.

Elsewhere, rural electrification has been supported through co-operative ventures that allow local communities to ensure supply meets their specific needs. In Bangladesh, the government programme to provide full electrification through a network of 70 co-operatives covering the country is well underway. Of the 70 co-operatives envisioned, 67 have been created and 57 are operational. These have added electrical supplies to about 20 million people and services are now expanding at a rate of 390,000 new connections per year. While extensive donor support has helped the programme, much of the implementation and training requirements for the co-operatives have been provided by overseas, especially American, co-operative associations.

Finally, alternative technologies focus on the use of non-traditional energy sources taking advantage of the physical characteristics of rural communities (e.g., high insolation or wind levels or availability of biomass by-products from agricultural activities). In many countries the private sector has been central to the delivery of such a system. In Kenya, private suppliers have been instrumental in delivering small solar systems to homes in rural areas.

Alternative technologies encompass not only generation but also systems that help the underprivileged better manage their cash flow. In many cases, inability to pay is related to the billing cycle, with customers receiving monthly or quarterly bills – consumers would be able to pay if billing was spread out over a longer period. In South Africa, innovative prepayment systems are being installed in some townships by private providers who have found that helping the underprivileged to manage their cash flow creates demand for electricity.

The success of the new approach will depend on the effective implementation of all three elements, rather than picking and choosing among them (e.g., using alternative technologies but failing to undertake appropriate market and regulatory reforms). In particular, it focuses on adapting the three elements outlined above to the needs of each individual community.

Conclusions

Traditional approaches to electrification have largely failed to provide electricity to significant portions of rural households in nearly all developing countries. New approaches are based on a recognition of the need to adopt a flexible approach to rural electrification – allowing local communities to express their demand for the type and quantity of electricity and the appropriate form of generation, minimum regulatory control and lack of exclusive arrangements. This new approach has led to successful electrification programmes in countries like Chile, and is being implemented in countries in Africa and Asia.

A final example, summarising the key elements of the new approach, is provided by rural electrification initiatives in Kenya, where more rural households now receive their electricity from photo-voltaic systems (PVS) bought from private providers than from the official Rural Electrification Programme.

The slow expansion of the grid, due to the poor financial performance of the state-owned utility, along with the flexibility of PVS (e.g., users can choose the size and cost of the PVS appropriate to their circumstances) has led to considerable rural demand for the systems. There are presently about eight private companies that supply the PVS market. While all are based in Nairobi, each company has agents in the rural areas who sell, install and maintain the systems. While the service provision has not been without problems, private providers have entered to meet demand, at affordable prices without support or, often equally important, too much hindrance from the government.

9. It is important to emphasise that decisions about institutional structure, regulation and ownership are interrelated. In particular, the form of regulation is critically dependent on choices about both the institutional arrangements and ownership – and all three depend on the ultimate objectives of the government involved.

In its most commonly used forms, such as electricity and oil, energy sources affect all crucial aspects of modern life, such as water pumping, heating and cooking, refrigeration, interior lighting and access to audiovisual activities, etc. Thus, the access to energy supply should be treated as an indirect but complete right. It should be an objective for society as a whole, and backed by the state as guarantor.

In a developing and semi-arid country such as Morocco, the right to the sources of energy hinges on basic issues, which include:

- deforestation control – wood-produced energy represents one-third of the national energy consumption, and such deforestation accelerates soil erosion and desertification;
- improvement of the condition of women in rural areas, where they have had to supply the home with both wood and domestic water;
- promoting agricultural mechanisation;
- water pumping for agriculture and human consumption; and
- higher school attendance and access to audiovisual facilities.

Morocco’s Global Rural Electrification Program (PERG) is destined to resolve these problems that are all the more pertinent in a nation currently without oil or gas resources, resulting in the cost of energy remaining high.

**Access to Energy in Today’s World**

The idea that access to oil products should occur in the framework of a market that is more or less efficiently regulated by the state has always existed. There are four concepts that are indicative of the state’s interest in regulating this market: price controls; easy tax revenues; restriction in the consumption of non-renewable energy – in Morocco’s case 100% imported; and environmental factors.

A highly competitive market assures that there is nationwide distribution and availability of these products. In the case of electricity, the fundamental concept is one of public service, focusing on the attainment of three objectives: generalisation of electrification; permanent electricity availability; and obtaining the best possible price per kilowatt hour (price/kWh).

Many countries in a similar situation to Morocco have so far successfully depended on government-controlled monopolies for the provision of electricity. This, in turn, gives rise to a single and overly rigid system of transportation and distribution. Three unfavourable factors have proven detrimental to the performance of state-owned electricity supply systems: refusal to practise realistic price levels for domestic consumption; poor service to users; and the generally inefficient and uneconomic management so often encountered in organisms not obliged to deal with a competitive market.

New thinking has confronted these issues of public service as a result of the vast on-going move towards globalisation. At once a practice and an ideology, globalisation leads to a specific discourse with regard to electrical energy. It concerns the creation of an electricity supply market and depending on market forces in order to meet the objectives of public service and to guarantee optimal performance of all the related components. Unfortunately, this process rules out any idea of subsidising general electrification since the market concept is based on the harmonious coexistence of competitive producers and solvent consumers. Injecting subsidies into energy supply for the underprivileged would penalise the energy requirements required by the productive forces subject to worldwide competition.

An ‘ultra-liberal’ solution therefore does not respond to the needs of a globalising economy where whole sectors of territory and population have still not been integrated into the global market. The ideologues of ultra-liberalism propose a two-track approach to energy supply: the creation of a market geared to the globalised section of the country; and a series of power supply microactivities generally linked to renewable sources of energy, primarily individual photo-voltaic techniques.

In this way, the transition is made from public energy supply, where society as a whole ensures the right of the citizen to electricity, to a system where the market
regulates the energy supply with the exception of the non-profitable elements. This in turn suggests photovoltaic energy as the primary method of electrification in rural areas of the country—an approach championed by two sectors of public opinion. On the one hand, the most vocal partisans of environmental protection contend that the world economy already consumes too much pollution-generating energy. They insist that the new markets of emerging countries should consume less polluting resources such as photovoltaic energy and other types of renewable sources. On the other hand, there are various schools of thought that traditionally refuse government-controlled projects, electrical supply being considered one of the most potent factors in state centralisation. Any segmentation of distribution or local type activity, in their eyes, is preferable to centralised control by a public service.

The problems of upstream resources are an extremely sensitive issue in Morocco in view of the effective monopoly for the refining and importation of oil products and the beginnings of a private monopoly in natural gas. The liberalisation of electricity production in such a context would be tantamount to handing over the electricity market to fuel supply monopolies and introducing economic factors contrary to the interests of the clients. Opening the national market to imports from the competitive market, through the development of international interconnections, constitutes a response to this situation.

**The Moroccan Solution**

 Barely one-third of the population currently has access to an electricity supply. The Moroccan solution, designed to accommodate the right to electricity supply, hinges on ideas imbued with the same sense of pragmatism.

In 2000, the privatisation of electrical production reached 65% and 75% for urban distribution. A third wind energy project for a total of 250MW is currently being developed, which places Morocco at the head of emerging nations in this area of technology. Another 180MW thermo-solar project is also being launched.

The governmental electricity board—Office National de l’Électricité (ONE)—remains as leading operator in this sector, entrusted with managing private production contracts, sole purchaser and transporter, electricity provider in rural areas and urban outskirts and the proposer of price rates. Based on sales, and in cooperation with the relevant local authorities, ONE subsidises the country’s electrification programme and provides pre-financing over five-year periods. In each of the past two years, approximately one million Moroccans have gained access to electricity supply through the network. PERG is one of the three largest such projects in the world.

ONE emphasises electrification by grid connection but also supports expansion of photovoltaic technology in areas not accessible to this network. It also accepts the principle of subsidising the initial equipment but ensures striking a good balance in rural operational and distribution costs.

ONE guarantees that consumer prices correctly reflect the true costs while maintaining a socially sensitive rate system for consumers of less than 100kWh per month, who represent 60% of households and only 10% of total electricity sales. To reach realistic price levels and lend support to the competitiveness of the Moroccan economy in the context of globalisation, domestic rates have remained frozen for five years and all efforts with regard to costs have been deployed in support of industrial rates, which have been lowered by 28% over the same period of time.

Morocco is developing and expanding international electrical interconnections to guide the Moroccan market into the Western Mediterranean competitive market. This market is marked by the co-existence of countries with energy resources, such as Algeria, and other nations representing large markets, such as Spain.

Direct access to competitive electricity supply reduces the risk of production monopoly in the domestic Moroccan market, these risks being aggravated by the presence of monopolies in the supply of fuel required for electricity output.

The Moroccan government is providing the conditions for the gradual liberalisation of the electricity market. Over the next five years, 15,000 industrial clients representing 60% of national consumption will be able to purchase their electricity through the national or international supply market. Four million domestic clients will remain connected to the rate system designed to protect the interests of low-income rural and urban populations through actions undertaken by ONE, the government’s chosen instrument in the area of electrical supply.

**Conclusion**

Far removed from fashions and ideological doctrines, Morocco is building its own vision of the right to electricity. There remains the strong presence of the state in the form of ONE, but its purely industrial role is diminishing. It is increasingly concerned with ensuring a healthy balance between the social demands, particularly electrification of the territory, and industrial demand, which is undergoing a process of liberalisation in order to provide all the advantages of a genuinely competitive market—a condition indispensable to integration into the general thrust towards globalisation.
Environmental and Social Dimensions of Energy Reforms

Why Energy Reforms are Necessary

In the developing world, people spend approximately 12% of their income on energy, which is about five times that of people living in developed countries.

Negative social and environmental impacts resulting from energy consumption need urgent attention in these countries, since the problems associated with energy use are more significant than they were in developed countries over 50 years ago. High levels of dust, soot and \( \text{SO}_x \) levels, resulting from the combustion of fossil fuels (especially low-quality lignite), are a serious problem.

The economic loss caused by negative environmental conditions amounts to approximately 6% of the gross national product in the developing world – an amount in excess of US$350 billion. While the scale of damages is debatable, it is certain that the economic cost of global warming will grow exponentially over the next 50 years.

Policy and decision-makers of the large emerging markets are aware of these facts. However, the increasing demand of the public for a better life, combined with limited available resources, forces them to make trade-offs between different combinations of options. This is the main reason to implement healthy energy reform programmes in these countries.

The Spectrum of the Energy Reforms

The spectrum of the energy reforms can be summarised as follows:

- Employment of market-based instruments – these cover part, or all, of the following options:
  - unbundling of production, transport and retail supply;
  - private sector participation in production/transport and retail;
  - building competitive markets for production and retail supply;
  - commercialisation of utility management, including cost recovery; and
- Introduction of institutional and regulatory measures – improve environmental management.
- Inter-fuel substitution – cleaner fuels and renewable energy sources.
- Improving power production/utilisation technologies and practices, such as clean coal technologies/low sulphur fuels.
- Increasing energy efficiency, especially on the demand side, and transport and distribution loss-reduction measures.

Energy reforms in the developing world, and especially in the large emerging markets, are introduced in order to provide the following benefits:

- safe energy production, transport and distribution;
- sufficient and continuous energy supply;
- right/affordable pricing;
- efficiency (efficient use in all sectors);
- state-of-the-art technologies in all phases of the energy chain; and
- environmentally compatible/socially acceptable utilisation.

The present trend in most of the large emerging markets is to implement some or all of the above-stated components in their energy reform programmes. Successful energy reforms have proven that the public or the state enterprises must assume the role of monitoring, regulating and auditing each step of the reform activities, i.e. planning, production, transportation, retail distribution and pricing, closely and effectively. It has been observed that the reforms that did not include and manage the social and environmental aspects carefully have not been successful.

Case Study – Turkey

Energy consumption in Turkey has been increasing at a rate of around 4.4% per annum, with the electricity
rate increasing by 8.5% over the last few decades. This rapid expansion of energy consumption has resulted in a wide range of issues having negative impact on the local and regional environment.

Projections indicate a quadruple increase of energy consumption by 2020, with hydroelectric and lignite power exhibiting the largest growth rates. Present, yet rather unrealistic, energy consumption expectations include the installation of a 43,000 megawatt (MW) capacity by 2010 and another 44,000 MW capacity by 2020. This means an average of 2,500 MW of new power generation capacity per year for the next 10 years. The ability to meet this demand is dictated by the building of 29 new lignite plants, 22 hard coal plants, 33 natural gas plants and 16 oil-powered thermal plants, as well as 32 new hydroelectricity plants and 10 nuclear power plants.

These ambitious and unrealistic expectations are responsible for both social and environmental 'corruption' in Turkey. Social corruption has started to become evident in energy sector investments. There are, for example, several legal cases against public sector employees who had responsibility for executing these investments.

On the environmental corruption side, the situation is even more disastrous. National Environmental Action Plan states that, between 1990 and 1996, over 15 million Turkish citizens (of a total population of about 65 million) living in urban areas (cities) were exposed to SO\textsubscript{2} and total suspended particle (TSP) levels that far exceeded (in some cases by three to six times) the World Health Organization's standards. The situation is worse for the Mugla region (on the Aegean coast) at the present time, due to the existing lignite-burning power plants.

If the investment predictions are to become a reality in Turkey, by 2020 there will be an immense energy-based pollution problem. For example, the resulting TSP, SO\textsubscript{2} and NO\textsubscript{2} emissions would triple their present values and reach 18 million tonnes, 3.5 million tonnes and 1.6 million tonnes respectively.

It is therefore imperative for Turkey (and for large emerging markets with similar characteristics) to put special emphasis into their energy reform programmes in an attempt to control and reduce the negative social and environmental impacts caused by the rapid growth of the energy sector.

Energy Reform Programme in Turkey

To mitigate the social and environmental impacts of the rapidly increasing energy consumption in Turkey, an energy reform programme has been in place since the mid-1980s, but with little success.

While the country's privatisation efforts in the energy sector (the most important component of the reform package) began over two decades ago, limited progress was achieved. This was mainly due to the lack of policies in the institutional and regulatory areas. Implemented policies had little emphasis on social and environmental aspects.

It must be highlighted that unrealistic consumption targets also have important negative impacts in implementing energy reforms. Unreliable data on the demand side (consumption) and the supply side cause serious problems in planning realistic reform programmes. It is, for example, clear from the case study for Turkey presented in this article that the demand (consumption) predictions are high and that they are impossible to achieve for 2010, and also for 2020.

This is one of the main reasons that inadequate investments in Turkey are made and is also the major cause for 'corruptive practices' in the country. Thus, correct demand-supply analysis and in-depth understanding of the social and environmental dimension of energy reforms are a prerequisite for a successful programme.

Conclusions

Social and environmental corruption can be avoided by implementation of energy reforms with environmental and social dimensions. These qualities have crucial importance in the healthy development of the large emerging markets.

It is obvious that financial instruments have the highest impact in the energy reforms. Subsidies in the energy sector must be avoided since they bring more negative burdens on social structure and on the environment.

Energy reforms covering unbundling and privatisation efforts, without putting sufficient emphasis on social and environmental issues, are likely to be unsuccessful in the long term.

Close monitoring and strict auditing of the reforms must be guaranteed in order to encourage the socially acceptable and environmentally sound applications.

Reliable supply/demand data is imperative in making the right choices in energy investments. History demonstrates that only by careful regulation and enforcement and by the necessary protection of the social structure and environment can energy reforms be successful.
Information Technology plus Energy Technology — A New Approach

a report by

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There is an ever-increasing demand for electricity in the developing world. Figures defining potential investment into new capacity should be welcomed by financiers, although to most they are still problematic. Grid-connected electrification is a dream that will not come true in a majority of countries and for the majority of villages in Africa, South-East Asia and Latin America. Considering modern technologies that are available today, which grant reliable access to electricity in efficient decentralised ways, it may not be the best available option either.

Modern methods take good care of potential growth and are flexible enough to adjust to new conditions, be it in the way of life or in the means of manufacturing goods. This article encourages not withholding the best technology from the poorer sector of the global population when alternatives to grid-connected electricity supply are available. It examines ways and means to speed up what has been a frustrating story of extremely slow progress and combines principles that might be regarded as contradictory — globalisation, decentralisation and decarbonisation.

The global energy market is generally split into two basic distinctions and distortions — one market that is environment-driven and another that is energy-driven.

The first mainly consists of the Organisation for Economic Co-operation and Development (OECD) countries that — with a few remarkable exceptions — would have rather large surplus capacities and little incentive for new investment were it not for reasons of environmental policies, in particular climate protection. The second comprises the developing world and the newly industrialised countries, the growth of which is sometimes severely handicapped by power shortages. Customers and mass consumers on the scale of the ‘Western household’ are scarce in these poorer countries, and political and legal frameworks are not sufficiently stable to stimulate the necessary investment.

To provide an even briefer characteristic of these two markets — in the environment-driven market, no new capacity is required as power is available in abundance, while in the energy-driven market, potential buyers for the product do not exist. The power market was, is and probably will be a political market. As phrased by The Economist: “The market is not a good master but a good servant.” It needs to be told by the policy shapers and by the political decision-makers what it should achieve. The market is as democratic as it is transparent, and will show to what cost any political target can be met. Any global strategy worth implementing in the energy sector must bear these basic distinctions in mind. There is a need to try to make the market work, providing electricity to everyone, globally, in a decentralised way, in a decarbonised form.

As we enter the information age — the knowledge-based society — links between people and continents, time and space, technologies and businesses are considered In information technology (IT) terms, time and space are a different phenomenon altogether.

For example, the west coast of the US can conduct business with the Indian east coast at any time. Day and night are rendered relatively meaningless.

The speed by which the World Wide Web operates was inconceivable just a few decades ago. The first general purpose electronic digital computer, built for the US Army in 1946 to calculate ballistic tables, weighed more than 30 tons and contained more than 17,000 vacuum tubes. Today’s computing devices become smaller and smarter by the hour. Over the past 40 years, global computing power has increased many times over. Today, the average family car contains more computing power than the mainframe computers used in the Apollo Space Program.

An economist at the University of California at Berkeley stated that: “IT and the Internet amplify brain power in the same way that the technologies of the industrial revolution amplified muscle power.”

The importance of electricity must be taken into account and realised. Without electrical power, there can be no e-mail. Electrons must be made to flow in order for e-commerce to flourish. There can be no modern mass communication without decent standards of electrification.
Figure 1: Installed Wind Capacity by 2020 (MW)

Figure 2: Annual Electricity Production from Wind Power (TWh/year)

Figure 3: Penetration of Wind Power by 2020 (% of electricity consumption)

It is thought that there is more than just common ground for the IT business and rural electrification in India and other places – there is common interest. There might also be new solutions emerging, which, in principle, means the creation of something entirely new from well-known components that are arbitrarily mixed with one another. The business principle corresponding with this scientific approach is commonly referred to as cross-selling and/or cross-over. A new approach is necessary for invoking both the scientific principle of emergence and the business principle of cross-selling – IT should be made to meet ET, or vice versa.

The G8 have voiced their concern over an increasing lagging behind of developing countries because of an increasing gap in the access to IT. The G8 nations have asked the International Energy Agency to create a strategy for rural electrification. There are two strategic issues and two global problems, for which solutions are urgently required. The author believes that one will not be accomplished without the other. The emergence of a new approach might lead to a new product, to a new implementation strategy and/or to new ways of financing.

The main barrier for investment in the above-mentioned sectors is the unreliability of the legal framework governing payback, or the complete lack of such. The customer may not be willing to pay up and is not being forced to, or the customer may have no particular interest in the new services offered or can see no use for electricity, as there is no option to make good personal use of it. Again, it is not a lack of funds, but the lack of a legal framework and/or economic incentive to pay for or to pay back that is causing permanent underinvestment in the energy sector in the developing world and the newly industrialised countries.

That very lack of investment into the energy sector is also the main barrier for investment into the IT sector. Barring people from access to the modern means of individual and/or collective mass communication is the major obstacle to growth. Various aid programmes are currently looking at both sectors separately. Assistance is granted in the form of direct subsidies – the most expensive form.

A quicker, cheaper, more efficient and effective approach is needed. The author suggests that investment into electricity-generating capacity is undertaken by the telephone or Internet service provider, or any similar business activity. The customer is then paying for the service, be it a mobile phone, the Internet or the use of a laptop. The bill would include a proportionate share of the investment into the electricity-generating capacity on top of the ‘telephone bill’. The services offered, the product being sold, is ‘electronic communication’.
Figure 4: Forecast for Wind Energy Development 2000–2004

Since 1949 RAFAKO Boiler Engineering Company has been serving the power industry with its complex offer including a wide range of boilers and environment protection equipment as well as modernisation, repairs and diagnostics of existing boiler plants. Major technologies offered include CFB, HRSG, supercritical boilers, and FGD plants based on the wet lime method. As an engineering company, RAFAKO S.A. is able to design, manufacture and deliver its products in accordance with major international regulations like ASME, PED, SNTL, BS and others. Employing 2000 people, the ISO 9001 and ISO 14001 certified company is one of the major suppliers of boiler pressure parts worldwide.
systems of various kinds are envisaged, such as wind-diesel systems, wind-solar systems or 'micro systems'. Taking into consideration the fact that simple mechanical processes are largely replaced by microelectronics, with nanotechnologies already on the horizon, any growth will involve going 'small and smart'.

Another advantage of the new approach is that microsystems require 'microlending', which is minimising the credit risk for any financier, or outbalancing the specific country risk that would normally increase the cost of borrowing considerably.

Positive experiences of most of the microlending schemes operated by the World Bank at present can also be drawn on. Minimising the cost of error has been referred to as the most challenging task of policy-making today, yet another element of the new digital age could be met with the following approach: "Combine the small efforts of the many with the large efforts of the few." Global loan facilities need to be tailored to meet this new approach. Guarantee facilities and counter-guarantees by the respective host states would further safeguard the prospective investments into 'electronic communication'.

There is an additional bonus to that sort of investment in that it is highly sustainable. Intrigenerational, as well as intergenerational, equity can thus be established as it had previously been called for. Renewable energy technologies — wind energy having been the most successful over the last decade — contribute positively to local wealth generation. They lower the burden on poor countries' import budgets as they are indigenous sources. The local content in the manufacturing, i.e. towers for wind turbines, is relatively high. As outlined in the Wind Force 10 report, a 10% share in electricity generation worldwide is possible. Carbon dioxide reduction, i.e. actively contributing to climate protection, is another, if not the most important of advantages of 'renewables' compared with fossil fuels.

Joint implementation — a new instrument elaborated under the Kyoto Protocol — could be proven as being a workable means of stimulating investment into clean energy technologies. Modern infrastructure is the key to health and growth, and to healthy growth. The information age and its global links can further that growth and create sustainable development if forces are combined and efforts joined. No additional funds are called for as they are not needed. IT needs to meet ET to create electronic communication.

Infrastructures and Innovation - The Metropolitan Bilbao Experience

a report by
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Introduction –
The City, a Core of Innovation

Innovation should be a characteristic feature of every city, since interaction among people still stands as the best way to encourage change. Economies in a creative environment exist, given that groupings of people sharing the same physical space encourage concentration of intelligence and fostering innovation. This collective intelligence implies continuous changes – from consumption habits to ways of speaking - whilst the city reinvents itself over and over. Urban innovation does not necessarily imply spectacular technological changes; it is more often the result of many small decisions made by anonymous people.

The collective intelligence of a city is greatly reinforced by communication. A revolution in communications is underway, that makes the existence of a global collective intelligence possible. This is due to the interaction of cities in the so-called network. Urban innovation forces technological change, which in turn forces the development of urban innovation. Nowadays, technological revolution is so intense that the breakthroughs expected in this century will be more promising than ever. What is being faced is the 'global city'.

The City –
Creative and Cultural Centre

There is an important emergence of creative and cultural industry, now transformed into the mass consumption sector. Seventy years ago a future was predicted where basic economic problems would be solved and people would be finally free to enjoy their leisure. We are fast approaching what was thought of as 'the future', and that situation will increasingly appear in advanced societies this century. Leisure is already transforming the economy given that cultural industry is taking on more and more force in terms of employment.

On the other hand, cities attend the convergence between artistic and technological creativity. These two fields have traditionally been managed separately by people of diverse education and preoccupations. Nowadays, new multimedia industries represent the link between culture and new communication technologies. This circumstance leads to a game in which everyone can take part, and where new sectors are located, once more, in cities. Moreover, the city has also turned into a tourist centre that manages its resources, including its historical heritage.

Facing New International Urban Trends

Most significant decisions are made by a number of 'world cities', meaning that smaller cities become more dependent on economic power. They will tend to become satellite cities and therefore compete for a part of these profits.

In this context, Bilbao, as with other medium-sized metropolitan areas, must face its position in the global community with a new perspective. In this sense, most of its inhabitants consider that the metropolis will retrieve its leadership in the European context, even though they almost unanimously agree that the revitalisation effort must be continued. Bilbao's industrial tradition remains a comparative advantage, but it is necessary to identify new advantages of being part of a major urban system. The best strategy must be adopted in order to secure a recognised position in a global context.

In addition, Bilbao should take advantage of the fact that it does not face the pressure of fast growth, as many Asian and Latin American metropolises do. Fast or slow growth can be considered as a strength or a weakness, depending on the financial resources available. Provided growth is not immediately necessary, all the available resources can be invested in improving the 'quality of the city'.

Welcoming a New Era

Bilbao and its metropolitan area have experienced an important revitalisation process, altering its inhabitants' quality of life. Most of the objectives of the Strategic Plan for the Revitalization of Metropolitan Bilbao have become a reality, and it is now time for new strategic thinking. The vigorous revitalisation process of the last decade has brought an optimistic outlook for the future. The challenge lies in capitalising on this
optimism and achievements. In issues related to urban planning, the environment and society, excellence must be pursued in order to build a world-class metropolis and emerge as a driving force in the new knowledge-based era. As the new economy opens up and the knowledge-based society rapidly takes hold, the potential for new opportunities will depend on developing those assets related to the capacity of people, and on the city’s ability to provide for its inhabitants.

In a study of advanced international models of urban strategy development, Bilbao Metropoli-30, with the participation of its 133 members and the support of 20 international experts, came up with a ‘blueprint’ for the success of Metropolitan Bilbao. After reflecting on strategy and considering the complex nature of international competition, they concluded that success – of the kind that ensures high growth rates, wealth creation, improved quality of life and worldwide recognition – lies in finding ideas and turning them into real products or services. In short, they agreed that the elements for Bilbao’s success are ideas and the people who know how to apply these ideas to create new opportunities, and capitalise on opportunities that will undoubtedly arise in the world market.

It was this conclusion that gave rise to a vision of Bilbao. For all involved, it has been necessary to build a city in which it is possible to live up to whatever ideals might be imposed. The vision for Bilbao is of a community capable of identifying and attracting good ideas and putting them to work for everyone. It is a community in which ideas germinate, are cultivated and flow freely. It welcomes dreams and is the perfect setting for imaginative people whose insights and ideas can be turned into projects.

The vision for Bilbao is ambitious, but it is neither a pipe dream nor a Utopian ideal and, if history is to be the judge, the vision is apt. A strong relationship exists between what needs to be done to achieve success today and what the city has shown itself capable of in the past. Bilbao’s 700-year history offers many examples, proving that it has been able to transform ideas into realities and capable of creating wealth. Bilbao has a tradition of using a vision of hope to exploit opportunities for economic growth or to recover from situations of economic decline.

**Pursuing the Vision – Keys to Strategy**

**Active and Committed Leadership**

The primary key to shaping the new Metropolitan Bilbao is an active and committed leadership. Leaders, who are responsible for turning dreams into reality, have a gift for recognising and attracting ideas. They take the most visionary opinions, the most advanced state of knowledge and, with the contribution of the entire community, put ideas into practice. Leaders are one of the most essential elements for transforming a metropolis and shaping a new future. Leaders see opportunities, bring about agreement and consensus, and mobilise the community along the chosen path.

The business sector produces leaders who are entrepreneurs, often acting with the conviction that the long-term welfare of their enterprises is closely linked to the welfare of the region. The public sector produces leaders representing society, as well as universities and non-governmental organisations. Leaders provide the incentive for the community to guide its own development. This promotes new social leadership in a ‘self-seeding’ process. Asset-rich places that have an active civil society and ties of trust and confidence give rise to leaders who bring the community together to work on other projects. This creates new assets. If the people of Bilbao can identify and promote leaders, and if they are united in giving them their trust and commitment, they possess one of the keys to transforming the city into their vision for the future.

Intense restructuring of economic, political, social and planning aspects of the city in the last ten years provides the clearest evidence that leaders are at work in Bilbao. In fact, great leaders are not foreign to the city. Throughout its history, it has known exceptional leaders and entrepreneurs who have forged the metropolis as it is today.

After suffering amid recession of the 1970s and 1980s, the Basque region is once again Spain’s leader in terms of growth. The credit goes to dynamic businessmen and women, who led the way forward from the difficult times of the recession and found renewed strength to build and shape an innovative business sector capable of creating wealth and improving lives. The public sector has also demonstrated great leadership with a high degree of social consensus. With its Strategic Plan for the Revitalization of
Metropolitan Bilbao, it has taken on numerous urban renewal projects, including new bridges, parks, Metro Bilbao, the underground railway system, the new terminal building at Bilbao Airport, the Bilbao port extension, the Euskalduna Conference and Concert Hall, the Maritime Museum and the Bilbao Guggenheim Museum. The impact of such revitalisation projects goes beyond the immediate benefits brought about by new construction. Revitalisation endows the city with sophistication and style. The spirit captures not only the people of Bilbao, but also the ever-growing number of visitors.

**People and Their Values**

The second strategic key to a city's revitalisation is its people. The international context of a global economy, rapid technological change, the growing importance of cities and the intensification of competition calls for emphasis on people and their values.

Today, the success or failure of a city depends on the people who live there. Only people can have new ideas, dream up plans and turn them into reality. The vision of Bilbao is fed by a human organisation comprised of people capable of visualising a future community, with ideas about how to design that future and with the expertise to put the ideas into practice. All citizens matter in the construction of the metropolitan community. All of those in Bilbao, regardless of their qualifications, status or life achievements, are indispensable elements of a common vision of the future.

To meet the overall commitment to people, it is important that professionals are identified and focused on for their leadership potential and expertise. Those who are highly qualified in the new technology that is shaping the evolution of the socio-economic framework in the global context must be cultivated. In Bilbao, the success of the open society and future vision depends not only on the city's professionals, but on attracting qualified people from other parts of the world to help build the future.

**Knowledge and Innovation**

Knowledge and innovation comprise the third key to the future vision of Metropolitan Bilbao. Knowledge is the seed for new ideas and innovation is the process of tapping ideas and applying them in ways that benefit the whole community. All sectors of society — individuals, businesses, institutions and all kinds of other organisations — feel the impact of innovation. For Bilbao to be a place where ideas become reality, it must have knowledgeable and innovative people.

Innovation is at the centre of all processes of revitalisation and metropolitan development. It means new ideas, new projects, new outlooks and aims. Without innovation, the range of possibilities and opportunities for development becomes far narrower.

To foster and maintain a process of growth and continued improvement in urban infrastructure and standards of living, new and innovative projects are essential. Advances in technology by themselves are not enough to ensure success. In order for all sectors of metropolitan society to flourish, a clear view of the needs of residents, companies, institutions and organisations is required. Innovation means anticipating those needs and knowing how to use technology to furnish them.

Five essential elements are required to generate innovation in a city. These are not links in a sequentially-ordered time chain, but are interacting ingredients that complement each other and work collectively to enhance the process. To foster innovation, a metropolis must:

- constantly monitor its internal and external environment for indications or inspirations for potential innovation;
- pursue projects and innovative elements that offer the most for the future, given the social characteristics of the city;
- equip itself with the knowledge that will enable efforts and resources to be channelled to put an option into practice once an option has been chosen;
- apply chosen projects in a way that contributes to the configuration of the city; and
- review successes and failures with an aim to acquiring knowledge from experience.

Metropolitan Bilbao is involved in a process of modernisation that has altered reality for the city's inhabitants. In just a few years, the city has transformed its productive organisation by incorporating more and better companies that provide advanced services. These, in combination with industry, are increasingly more innovative, and human resources are better qualified than ever. Town planning and public transportation have transformed Bilbao. Great effort has been made to improve the environment, and ambitious arts projects such as the Guggenheim Museum have reached deep into the soul of the city.

**Networking**

Networking is the fourth key to the future of Metropolitan Bilbao. In today's world, the success of
people, companies and institutions lies in connecting with a broader community. Advances in information technology have removed distance barriers and created a global knowledge base that stretches the imagination. The new, wide-ranging opportunities offered by the knowledge-based society can only be exploited if individuals join forces and create formal and informal networks to accelerate learning and strengthen the competitive edge. Networks offer a global perspective – and access to an unprecedented range of information.

For individuals, the Internet provides a gateway to a world with a more dynamic flow of information, and opportunities to work in groups that transcend geographical borders. For companies, networking is an essential tool that enables them to capitalise on potential opportunities that challenge their resources, but must be tackled if the companies are to compete in the world marketplace. For institutions – public and private – networking offers opportunities to expand their horizons and consolidate their leadership.

For maximum benefit, networking should bring together leadership and excellence. Networking should be embraced by all sectors involved in creating wealth, as a means of convincing potential competitors to become allies and generating synergy through the combination of resources and knowledge.

City Networks

City networks have made extraordinary progress in recent years and are woven into the core fabric of the principal cities of the world. They are becoming consolidated as important pressure groups that allow the city to be promoted in a more open and ambitious way. They represent instruments for the implementation of advanced technology, and they allow access to a greater amount of information and to the exchange of experience at all levels of city management, such as rendering services, efficiency and quality in management, and environment protection.

The metropolis of Bilbao is part of several outstanding networks. One example is Eurocities – which Bilbao currently heads – an association of the 99 most important metropolitan areas of Europe. Its aim is to strengthen the urban dimension of the process of integration in the community by launching innovative projects of common interest. The network exerts pressure on European institutions, and takes part in various European projects, in association with cities and organisations of other countries. A more informal type of networking comes from the development of physical communication networks, particularly airports and ports. For example, enlarging the Port of Bilbao and its airport are potential ways of broadening these informal networking connections.

Business Networks

Business networks are not new and the need for collaboration is widely acknowledged, as is the need to form strategic alliances to improve business competitiveness, particularly for small and medium-sized companies. They are important as a means to stimulate growth and help companies take advantage of new business opportunities. Business networks provide a way for global players to acquire regional knowledge and for local players to learn how to compete worldwide.

The emergence of local suppliers’ networks presents opportunities to attract the enormous purchasing power of large companies. Networking promotes the extension of the advantages that large companies enjoy to the wide network of small and medium-sized enterprises.

Companies in the Basque region are an increasing presence in export and international markets, and they are rapidly forming important networks and linkages in countries within Europe, Asia, South America and the US. Networking promotes collaborative projects in a broad range of fields and with numerous companies in all sectors.

Other Kinds of Networking

The potential for networking is not limited to city administrators and private enterprise, but exists for practically all public and private institutions. Networks are a powerful resource that can deliver all available worldwide resources on subjects relevant to any imaginable interest group or organisation. Networking promotes links between health centres at home and abroad, advancing the quality of health services in a way that is beyond the scope of individual centres. Networks and associations of local and regional development agencies, chambers of commerce and universities promote the exchange of ideas and experiences. Networks of municipal services such as libraries, information centres, home help services and civic centres, facilitate co-ordinated joint action.

Additionally, there are a large group of associations in the Basque region, examples of which include GARAPEN (Network of Regional Development Agencies) and EUDEL (Association of Basque Councils), which aim to join forces in the promotion of local development and to exchange experiences, with the goal of solving common problems, with Bilbao Metropoli-30 the overall manager of the revitalisation process of Metropolitan Bilbao. The group participates in some of the most active and prestigious networks concerned with city renewal.

The opportunity to benefit from networking and extend it to other fields – local, business or even...
individual — is tremendous, and its importance cannot be over-emphasised.

Quality of Life

Making an attractive city that enhances the quality of life for its inhabitants is the key to the Bilbao of the future. As an element that attracts qualified professional people, it is vital for the city’s competitiveness. Promoting the city’s appeal will generate wealth and sustained growth for the city. The promise of a high standard of living attracts qualified professionals who wish to work and live in a pleasant environment. They, in turn, are likely to generate additional revenue, which works to improve the standard of living for all residents, bringing full-circle the impact of the city’s appeal.

A city’s attractiveness has a physical and social dimension. Each involves a set of variables that shape the concept of quality of life. The physical aspects are integrated in urban and environmental renewal, and involve tangible assets such as infrastructure and aesthetic appeal. The social dimension, in one way or another, involves all fundamental aspects of this reflection on strategy.

The Guggenheim Museum Bilbao has placed Bilbao on the world map. It has greatly increased Bilbao’s quality of life, not only because of its international attracting power, but also because of the enormous impact it has had on the demeanour and outlook of the residents. It has restored a sense of civic pride that has been diminished since the difficult economic times brought about by the industrial recession of the 1980s. The museum project has laid the foundation for a new urban direction that is more in tune with the times. It has become a symbol of new direction and revitalisation, and for the people of Bilbao, represents the city they are building for the future.

The metropolis of Bilbao attracts domestic visitors as well as those from abroad. The city is attractive to its own inhabitants, whose standard of living has noticeably improved since the completion of the Guggenheim Museum. Leisure is of increasing importance in today’s society. This means that the role of cultural activities must be given more emphasis, and we should be working to meet society’s demand for more arts and culture. Cultural and leisure activities add an element of prestige that enriches quality of life.

Conclusion

People, Knowledge, Innovation — Bilbao’s New Strategy

Ten years ago, a plan to revitalise Bilbao was outlined, and public and private institutions committed themselves to seeing it through, working to fulfil the dreams and aspirations of the community. Today Bilbao is a changed city. The years of hard work have come to fruition. The differences can be seen and felt during a stroll along the city’s streets, and heard in its people’s conversations. Tomorrow looks even brighter for Bilbao, full of fresh opportunities.

The world in which we live is a changing world. Large cities, products of an industrial age, are giving way to a new kind of urban centre operating in a knowledge-based economy. Bilbao is positioned to be a leader in the new ‘society of knowledge’. A city must have some essential features if it is to move into the new era — quality of life, universal education, access to information and knowledge, integration into global networks, the capacity to generate and attract new ideas and to innovate. It must possess an involved and connected community; a focus on people, knowledge and innovation. There is confidence that Bilbao has all these key elements.

The new era has its demands. Either we are capable of creating knowledge or we must depend on the knowledge developed by others. Either we become part of the global community or we get left on the sidelines. To secure our place among the world-class metropolitan centres must be the first objective. Then comes the challenge of making Bilbao what is already called the best in the world.

To meet the challenge, we are working to develop a social architecture of innovation based on people and on strengthening their capacity to identify new opportunities, and to have vision and ideals. To create an environment that attracts people who love ideas. To turn dreams into reality. All this and nothing less is Bilbao’s answer to the challenges of the new era.
Reducing Bus Accidents and Sustaining Public Transport Services in the Developing World

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There are approximately 0.8 million road accident fatalities and 20 to 30 million people injured throughout the world annually, many resulting in long-term disabilities. Almost 70% of these occur in the developing or emerging world. While there is a general decline in the number of fatalities in industrialised countries, the opposite is true elsewhere. Compared with industrialised countries, considerably higher proportions of those injured in road accidents in the developing world consequently die from their injuries. Thus, not only is the proportion of people injured per vehicle very high, but also the death rate is higher in developing countries.

Countries throughout the developing world are characterised by rapid urbanisation, high growth rates in traffic and, consequently, congestion and decreasing regulation of public transport. The majority of the developing world’s inhabitants are dependent on public transport. The need for safe, efficient and effective public transport services is therefore essential to ensure adequate and affordable accessibility, for sustaining livelihoods, and rural and urban development.

From 1997 to 2000, a study, funded by the British government’s Department for International Development, was conducted into the extent and likely causes of bus accidents in five developing regions – the Indian state of Maharashtra, Nepal, Zimbabwe, Thailand and Tanzania. These were thought to be representative of a variety of public transport scenarios and transport environments throughout the developing world. Operating environment, vehicle condition and driver behaviour were also assessed. This article summarises the findings from each of the countries studied.

India

In 1998, there were 0.30 million reported accidents, leading to 76,732 fatalities, and over 0.32 million casualties in India. Due to the size of India and the high statistics, the study was restricted to the state of Maharashtra. During the period 1961 to 1996, the registered motor fleet in Maharashtra grew by over 40 times whilst the road network increased just 3.5 times. As a consequence, over the two decades between 1975 and 1995, the number of road accident fatalities increased by 282% and injuries by 220%. Data for 1995 showed that buses and trucks were involved in 35% of accidents; taxis, cars and jeeps in 32%; two-wheelers in 22% and other vehicles in 11%. Other data suggested that driver error was a major factor in the majority of accidents, with infrastructure deficiencies also a significant contributory factor.

The state-owned Public Bus Transport Corporation, which operates a fleet of around 70,000 buses, has been involved in 4,149 accidents with 688 fatalities. The company’s own investigations showed that their own drivers were at fault in approximately 50% of the accidents.

Nepal

By 1996 there were a total of 7,800 conventional buses and 2,752 minibuses operating in public transport services throughout Nepal. About 95% of buses are owned and operated by the private sector.

During the period July 1995 to June 1996, 479 serious bus accidents (14% of the total) resulted in 365 fatalities and 1,751 injured persons. The totals represented 39% of all road fatalities during the 12-month period and 60% of all road casualties. Bus accidents therefore represented a significant proportion of all road accidents, fatalities and injuries in Nepal.

The opinions of the various drivers, conductors, traffic police and passengers interviewed suggested that the same probable causes apply in Nepal as they do in India – and for the same reasons. Data from November 1996 to April 1998 suggested that driver error was the major factor in 74% of bus accidents; external factors in 18%; and vehicle condition in 8%. All agreed that a single factor was unlikely to cause an accident and that a combination of factors and causes was the likely explanation.

Surveys and inspection of vehicle condition noted that 65% of the buses had one or more faults in terms
of tyres, wheel fixings and front/rear lights, yet all had passed a vehicle fitness test and were legally fit to operate. The poor condition of the roads and associated infrastructure resulting from deficiencies in maintenance, alignment, traffic signs and safety features were all identified as possible causes of accidents. Even vehicles in adequate condition for use would have been at severe risk of accident due to the poor state of the roads.

**Tanzania**

The organisational structure of the bus industry in Tanzania can be broadly categorised into urban operations and long-distance operations, which includes rural services.

Urban operations comprise conventional buses and minibuses (*daladala*). The fleet of the state-run bus company, UDA (Usafiri Dar es Salaam), has dwindled and now comprises only a few minibuses. Privately owned *daladala* operate in almost all municipalities in the country and are generally capable of carrying up to 16 passengers. The *daladala* fleet has grown considerably since its legalisation in 1983. Methods of remunerating the *daladala* drivers encourage speeding, overtaking, poor parking and frequent vehicle stoppages to pick up or drop off passengers.

The operational environment for long-distance services has changed in recent years. Quantity and fare controls on routes have been liberalised, and entry into the industry is now very much dependent on the roadworthiness of the vehicle. The most common buses are 45 to 65-seaters. Driver turnover is high and, due to an increasing passenger fleet, buses compete for business by employing ‘toots’. It is alleged that buses race against each other in order to pick up passengers along the route. On the other hand, the competition for passengers has resulted in a few operators introducing semi-luxury and luxury coaches on selected routes to attract more passengers.

In total, conventional buses and *daladala* accounted for 24% of vehicles involved in accidents during 1997 and 1998, but generated 39% of fatalities and injuries. On average, each long-distance bus involved in a road accident resulted in five fatalities and 39 injuries, while the approximate unit fatalities and injuries for other vehicle classes were insignificant. Within the public transport sector, long-distance buses represented 1.3% of vehicles involved in accidents, yet generated 41% of fatalities and 45% of injuries.

The human factor is perceived to be the principal cause of bus accidents in Tanzania, with factors similar to those in Nepal. The contribution of human error in causing accidents is not only confined to drivers, as passengers and pedestrians also contribute to accidents. Passengers attempting to disembark from buses while in motion or distracting the attention of the driver are frequent major causes of bus accidents, as are other road users and pedestrians.

... [infrastructure] must be linked to an improvement in the safety of public transport provision in order that the poor may enjoy reasonable access and mobility.

**Zimbabwe**

The Zimbabwe United Passenger Company (ZUPCO), now wholly owned by the government, operates both conventional buses and minibuses on urban public transport services. There are also privately-operated commuter buses, introduced in 1993, consisting of various vehicle types and capacities that have been allowed to proliferate throughout the urban centres with few controls. Long-distance bus services (intercity and rural) are provided by ZUPCO and the private sector.

A total of 27,150 accidents, leading to 1,066 fatalities and 13,458 injured persons, was reported in Zimbabwe in 1992 and, by 1996, the totals had increased to 38,777, 1,205 and 18,070, respectively. Most bus accidents (and consequently injuries) occur in urban areas, while the majority of fatalities result from long-distance services due to the higher speeds of the latter – a result similar to that found in Tanzania.

Police statistics of bus accidents in 1996 showed that 58% of bus accidents were classified as blameworthy (i.e. human error) and led to 76% of bus fatalities and 75% of injuries. The most frequently quoted factors regarding driver behaviour included reckless driving, inattention, lack of judgement, speeding, driver fatigue and the use of unqualified and inexperienced drivers.
**Thailand**

The conventional public transport sector in Thailand comprises fixed and non-fixed routes (nationwide, mainly for tourists) with fixed routes defined as follows:

- urban, the bulk of which are operated in Bangkok and a handful of provinces (27%);
- intercity (23%); and
- rural services operated within provincial boundaries (50%).

The total conventional bus fleet in 1998 comprised 93,061 vehicles (0.5% of the total motor vehicle fleet), of which 94.5% were privately owned and operated. The industry is strictly regulated by the Department of Land Transport in terms of standards of buses, routes operated, timetables, fares, etc.

Accident numbers reached a peak in 1994 at 102,610 and fatalities and injuries in 1995 (16,727 and 50,718, respectively), since which time reductions have followed. According to police records, 74% of all accidents on the intercity and inter-district highways in 1997 were due to driver behaviour, with the remaining causes due to external and vehicle defects. During 1998, Thailand’s national newspapers reported major bus accidents resulting in 65 fatalities and 692 injuries, of which 50% constituted single-vehicle accidents.

Driver error was the overriding factor involving state-owned vehicles and this is likely to be replicated throughout the industry.

**Discussion**

In all five countries, road accidents are increasing over time. Overwhelmingly, driver behaviour is the major factor in bus accidents as in all road accidents.

Public transport vehicles appear to be involved in a higher proportion of accidents than their numbers warrant. However, this is principally because buses cover a high annual mileage through their daily and weekly duty cycles. Considering the number of passengers transported, a safety culture should be active and evident. It does not seem to be the case at the present time in the countries monitored for this study.

The need for high standards of driver behaviour and vehicles in Nepal, where nearly all of the public transport sector is privatised, is emphasised by the significantly higher severity of accidents, with a fatality rate twice as high, and an injury rate more than three times that of Tanzania. Some of this difference however, may be due to the difficult terrain over which buses are operated. Interestingly, Tanzania and Thailand appear to have similar fatality and accident rates, although the operating environments differ greatly.

In India, Zimbabwe and Tanzania, public transport services are increasingly being owned and operated by the private sector as liberalisation is encouraged. This has inevitably led to a private sector philosophy of maximising profit by minimising cost, rather than increasing efficiency, as in the case of Nepal. Driver behaviour appears to suffer under the auspices of liberalisation and low enforcement.

Although 95% of Thailand’s buses are privately owned, there is strong enforcement of bus regulations but not of driving standards. However, privatisation should not be seen as automatically leading to lower standards in the pursuit of profits. Some companies in operation see the opportunities to increase their profits by providing superior services and consequently safer ones.

**Recommendations**

The main recommendations for reducing bus accidents and sustaining public transport services in the developing world are:

- Improved driver training – the public driving test is often inadequate and should be backed up by specialised training, including refresher courses, perhaps operated by the private sector for the smaller operators.
- Medical requirements for drivers – this should include regular eyesight tests.
- Improved maintenance – the condition of the bus should be seen as a selling point and maintenance should not be seen as a necessary evil, to be carried out only when absolutely necessary and then only to those components or systems that are required to keep the bus mobile.
- Safety culture, which is absent in most areas of the industry. It is critical that it should be linked to other inputs such as national road safety councils, government departments, etc., as a joint effort is required by all road users to recognise and implement such a culture.

It does not matter how much the infrastructure is improved, it must be linked to an improvement in the safety of public transport provision in order that the poor may enjoy reasonable access and mobility.
Water-related Infrastructure Towards Recycling Society

a report by
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Introduction

The main target of urban water management and related infrastructure, i.e. creation of health-protecting living conditions in cities, was achieved by organising material flows that moved the residuals outside the living sphere of population. The main goal was to create habitable conditions in cities rather than protect the environment outside cities. In present society, which is aiming to be sustainable, the focus has changed. It is generally understood that the wellbeing of societies depends on the state of the environment and especially the state of water resources. However, it is also understood that the conservation and recycling of natural resources and used materials is a basic condition for the future sustainable society. It is doubtful if present infrastructure and management methods can fulfil these new goals.

In the industrialised world there are two parallel methods of fulfilling system conditions within urban water management. The first is to improve the function of the existing infrastructure and applied technologies. The second method is to develop new, basically different system solutions, infrastructure and management methods that are designed to fulfill sustainability system conditions, i.e. where the creation of circular material flows and conservative use of energy is an overarching target.

In future ‘recycling societies’, the same raw materials will be used many times over. Concepts such as ‘wastewater’ or ‘solid waste’ will disappear, because, in a sensible society of the future, these residuals will constitute new resources. Creation of a recycling society requires change of infrastructures and will not be without challenges and problems.

Drinking Water

As in most other European countries, water supply networks in Sweden cover all drinking water needs. The price of water is low and affordable for all. However, some problems for the future can be foreseen. The existing water pipes are close to the end of their lifetime. Corrosion of water pipes and the impact of chemicals result in the shortening of the previously expected lifetime of the pipes. The increasing use of new domestic, industrial and agricultural chemicals, medicines, hormones, pesticides and other substances not previously used, bring new risks of water contamination. New, recently-discovered problems denote an increase in water contamination by chemicals passing through the walls of the water pipes, increasing expenditure on repairs and construction of new pipes. As a consequence, the present high quality and low price of water cannot be guaranteed in the future, and a reduction in water consumption will become an economic necessity.

An additional reason to reduce water consumption is the need to decrease wastewater flow through wastewater networks and, thus, decrease the costs of wastewater treatment. One option to decrease water consumption in households is via the dissemination of information, influencing human habits. Technical options, such as the introduction of dual piping systems with multiple or quality-adjusted water uses, would require structural changes in houses and are less realistic for Swedish applications.

Pollution in a Drinking Water Context

Pollution of drinking water sources is not widely discussed in Sweden, but has been attracting debate recently in the US, where the United States Environmental Protection Agency has established a new Drinking Water Advisory Council to revise present routines and practices in water supply in order to eliminate existing serious risks. The Swedish assumption that there are no risks associated with drinking water in Sweden seems to be over-optimistic. Besides bacterial and viral water pollution, chemicals are used in an increasing number and variety in all aspects of society, constantly bringing new risks. Substances recently discussed in scientific circles include:

- Giardia and Cryptosporidium –this group of pollutants includes worms, parasites and protozoa. The greatest offenders are *Giardia lamblia* and *Cryptosporidium*, which cause diarrhoea, dehydration and intestinal disorders. Both parasites have recently been discussed in the US as 87% of the nation’s
water supply systems were found to contain these organisms. The bacteria are resistant to chlorine, and healthy people infected experience an illness similar to cholera that is difficult to cure. People with defective or vulnerable immune systems experience damage to the liver and respiratory system, with a mortality risk of 50%. There is no known drug that can cure cryptosporidiosis.

- Endocrine disruptors – i.e. substances present in some chemical products that damage the human body by mimicking the natural hormones. Damage may manifest itself in cancer, birth defects and different immunological failures. Substances such as herbicides and pesticides are examples of endocrine disruptors. Endocrine disruptors are carried by surface runoff and may enter water supply systems, having an effect even in undetectable concentrations.

- Chlorine and other disinfectants that are used in almost all households are known poisons, though short-term use is seldom connected to illness. During the chlorination process, chlorine combines with natural organic matter forming several carcinogenic agents, of which trihalomethanes (TTHMs) are most known. The use of TTHMs and their permissible levels in drinking water is regulated by environmental regulations. However these permissible levels are not necessarily safe, and it is possible that the use of TTHMs is associated with the increasing risk of bladder and rectal cancer. More than 2,000 drinking water contaminants have been detected in the US since 1974, with 190 known or suspected to cause adverse health effects. In total, 97 carcinogens, 82 mutagens and 23 tumour promoters have been detected in US drinking water.1

- Arsenic is present in low concentrations in sources of drinking water in several US states, and a number of scientists have raised the debate on this issue, stating that:

  “Lives will be saved if urinary arsenic is monitored and lowered in the same way as cholesterol and blood pressure is monitored and lowered. It may reduce sickness and death from heart attack, stroke, lung disease and cancer.”

To the author’s knowledge, there are no problems with the presence of arsenic in drinking water in Sweden, but it is not monitored as a matter of routine in all drinking-water sources. The incidence of arsenic and other rare pollutants from natural or anthropogenic sources may carry unnecessary health risks for the population in some areas of Sweden.

Stormwater

The technical structure of a city generates water. Material flows between the city and the surrounding rural areas – essential elements for all types of life within a river basin – are heavily affected in a quantitative and qualitative sense by the human activities in cities. The city influences the runoff pattern and the state of the ecological systems, not only within the city area but also in and around an entire river system. Chemical composition and physical properties of different types of water in urban areas are substantially different to those in rural areas. Compared with rainwater, stormwater contains many more particles and chemicals that are washed from the air and from urban surfaces by rainwater.

A stormwater system consists of pipes and conduits, overflow structures, detention structures and open channels designed to provide safe evacuation of stormwater from a city and from other constructions designed to manipulate flow pattern in a time- and-flow regime in the system outlet. All of these constructions require the use of natural resources and constant economic input. Possible changes in stormwater-related infrastructure should contribute to the creation of return loops, providing ways of retrieving resources deposited in stormwater streams and receiving waters.

Downstream, in some cases, riverbeds are covered with several metres of contaminated stormwater sludge that is gradually transported to the receiving coastal waters, affecting the marine environment. Thousands of tonnes of metals are bound up in the stormwater-generated sludge. As an example, in only a small river – the Höjëå – in the south of Sweden, 760 kg of copper, 1710 kg of zinc and 310 kg of lead is deposited over one year. Copper, zinc, cadmium (Cd), lead and nickel are of concern in stormwater runoff due to their potential for causing aquatic life toxicity.

Water-related infrastructure in urban areas, including stormwater systems, represents high economic value. It requires constant maintenance and repairs and large economical input in order to maintain its functionality. Main stormwater conduits are usually located along and under the streets. Every pipe breakage and subsequent repair causes a disturbance to traffic and becomes a source of irritation for residents. As many such facilities were constructed a long time ago, the large capital costs of construction do not influence the budget of the communities. The cost of new construction, maintenance and repairs will increase in the future. Some older parts of the stormwater systems are designed for when less-permeable surfaces existed. Intense rain in such areas causes frequent street and

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basement flooding, bringing economic losses for residents. These systems must be renovated in the near future, requiring new investment.

The leading ideas behind new stormwater management are based on the construction of a large number of small-scale detention and treatment facilities, usually used in integration, constructed to obtain delay and equalisation, and some treatment of stormwater. An additional aim is to improve aesthetic values of the city and to deliver recreational values via the introduction of park-like areas with open water surfaces and lush vegetation. It is understood that important benefits can be achieved by the use of open stormwater drainage, i.e. systems in which a proportion of stormwater is left on the surface where it can be attenuated, treated and possibly reused.

During the last 10 years, hundreds of stormwater conveyance and treatment facilities, based on these principles, have been constructed worldwide, and considerable experience exists in the operation of these facilities. Urban hydrologists have begun to understand treatment performance, know how to recognise key points, and how to identify and solve problems.

Some Swedish communities already routinely build local systems for the retrieval and reuse of stormwater in new housing areas. Consequent application of local treatment and the disposal of stormwater will influence the cities’ entire infrastructure. Stormwater may, in the future, constitute an important resource that is possible to reuse, either independently or together with ‘grey water’; for toilet flushing, irrigation in small-scale urban agriculture, or even for the production of drinking water. Rainwater that is collected from rooftops should be considered as a valuable resource, adequate for use in some domestic applications and not mixed with other residuals. Some of these ideas are already realised in ‘ecological villages’ in Sweden and in other, mainly European, countries.

New technical solutions used in stormwater management have not been proved on a long-term basis. It is not known if the investments, in a sense of monetary value as well as natural resources bound in these constructions, will not exceed the total environmental benefits. There is no environmentally-sound procedure on how to deal with the contaminated sedimentary sludge in the stormwater ponds and wetlands. As yet, there has been no attempt, nor infrastructure implemented, to retrieve and reuse metals and other substances deposited in ponds and urban streams. It is not known if the design of ponds, wetlands and ditches is done optimally, thereby diverting nutrients and metals away from stormwater. There is a need for further research in order to optimise stormwater constructions with respect to the design and minimisation of integrated environmental effects.

An increasing number of implemented local solutions in stormwater management is changing the city. Thus, integration of stormwater management is required at all spatial and temporal scales of urban and rural planning within a river basin. A new challenge is to develop methods for the recycling and use of stormwater in uses that demand a lesser quality, such as toilet flushing or irrigation of parks and local agriculture.

The most serious effects of stormwater release and emissions are on the aquatic habitat of the waters that are recipient to the stormwaters. The major effects of urban sediment include silting of spawning and food production areas and unstable bed conditions. Other major habitat destruction problems include rapidly-changing flows and the absence of refuge areas to protect the biota during flow changes. Removal of riparian vegetation can increase water temperature and create organic debris.

There is insufficient knowledge about the physical, chemical and biological processes occurring in stormwater ponds and wetlands to avoid mistakes being made in the design and operation. For example, it is understood that the major process for the initial removal of phosphorous in wetland systems is adsorption to the substrate. However, removal of phosphorous by plants may provide an irreversible storage mechanism, thus contributing to general phosphorous depletion. In the engineered wetland, the system is managed to provide a higher uptake than release rate. This requires an adequate knowledge of the removal mechanisms and hydraulics of the system. Since wetlands established for the purpose of stormwater treatment are seldom checked with respect to removal rate (due to the high costs of analysis) such wetlands may become saturated with phosphorous and do not either perform the intended task of removal or become a source of phosphorous in receiving waters.

Water-related infrastructure in urban areas represents great economic value, requiring constant economic input for maintenance in order to maintain its functionality. A new type of stormwater management, with surface storage, retention ponds and wetlands, must operate in a complex system together with existing traditional stormwater pipe systems, underground retention facilities and diverting structures. These old constructions must still be fully maintained to remain functional. As some stormwater flows have been diverted to open surface retention and treatment facilities such as ponds and wetlands, stormwater flow in conduits decreases, which may bring some operational problems, and total maintenance costs may increase in the future. As ponds and wetlands were only built during the last 10 years, costs of long-term maintenance and periodic reconstructions cannot be accurately assessed.
Sanitation

Around 95% of the Swedish population in permanent housing are served by water-borne sanitation and at least three-stage wastewater treatment. Sweden is somewhat unique with respect to sanitation coverage. There are several countries in Western Europe that do not have that kind of water sanitation coverage. This is certainly not the case in several other European countries and in the majority of developing countries. According to The World Bank statistics, about 94% of the world’s population lacks proper sanitation and 96% do not have access to wastewater treatment facilities. Of those that have access to sanitation, the majority are served with on-site sanitation, without the use of water for the disposal of effluent. Even several European countries do not have full coverage of wastewater treatment plants. For example, in 1995, only 52% of sewage in Belgium was treated. In Canada, only 66%, and in Latin America, only 2% of wastewater is treated. The problem with the present sanitation and wastewater management is that, even fully implemented, these systems are weak with respect to safe methods of achieving full recycling of anthropogenic nutrients to agricultural food production.

An attempt to develop a sanitation infrastructure with recycling ability is noticeable in the construction of urine-separating toilets. However, environmentally sound management of housing equipped with such sanitation requires environmental consciousness of all inhabitants, homeowners and administrative personnel involved. Management of residuals from such housing differs substantially from traditional management. It places new obligations on the users and local administration. The goal of urine-separating solutions – i.e. safe for both humans and the environment – recycling of sanitary nutrients in agriculture requires that environmental costs of processing and transporting residuals to agricultural areas will not exceed the benefits. The distance between the area from where urine is collected and where it is used is crucial to the economic outcome of using urine as a fertiliser.

Energy use and environmental pollution due to the transportation of urine bring environmental and economic risks that should be evaluated before a decision about the type of sanitation is made. Separate handling and agricultural use of sanitary residuals, urine and faeces generates potential health risks for all involved parties, and the Swedish population is not prepared to lower its hygienic standards. The entire issue of the safe recycling of human nutrients for agricultural purposes requires many infrastructural changes, including the development of new systems for the transportation of urine in such a way that it will not cause environmental damage. However, much is at stake because human urine is such a good fertiliser.

The urine of one person over the course of a year contains nutrients of approximately the following proportions: 5.6kg nitrogen, 0.5kg phosphorous, 1.0kg potassium. The proportions of these nutrients are similar to those present in many commercial fertilisers. Human urine, if stored in air-tight containers, does not lose its fertilising values if stored for up to one year.

Urine-separating toilets are installed in several hundred buildings in Sweden, in single-family houses, public buildings and blocks of residential flats. No adverse measurable effects on the health of residents were reported from any of the areas equipped with urine-separating sanitation. Risks due to the toxic potential of relatively unknown micropollutants present in human urine used as fertiliser were discussed within the NOVAQUATIS (Innovative Management of Anthropogenic Nutrients in Urban Water Management and Agriculture) Research Project. There is a risk that those micropollutants enter food chains, harm terrestrial ecosystems, or by leaching, end up in surface or groundwater.

Currently, there are no urine quality requirements either defined or required. A second problem may be connected to the long-term effects of using urine as a fertiliser. Since the practice of using urine has only been adopted in recent years, longer-term risks are not known. Houses equipped with separation sanitation do not need to be connected to the treatment plant and, as a result, fewer treatment plants will need to be used and built in the future, which may bring economic benefits.

Due to lack of experience, many technical errors were made in early applications of waterless sanitation in ecological villages. In spite of the fact that these mistakes have often led to poor levels of comfort, hygienic risks and the necessity to change equipment, a significant number of residents wanted to continue using local sanitary solutions. New residential housing equipped with alternative sanitation solutions is problem-free and well-accepted by the Swedish population.

Responses from 46 residents of a student house in Lund, where urine-separating toilets are installed, reveal that no particular problems were experienced in the daily use of these toilets. The only criticism was regarding the inadequate service, installation and maintenance of the toilets, resulting in an excessively high-flush water flow. However, this problem had no adverse effects on the possibility of using urine as a fertiliser because urine for use in agriculture must, in any event, be diluted with water.

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