Modernizing China's Oil And Gas Sector:

Structure Reform and Regulation

Consolidated Joint Report of the World Bank and the Institute of Economic System and Management

November 20, 2000

CONTENTS

Preface i
Executive Summary iii
Chapter 1: A Sector in Transition: China's Oil and Gas Sector Moving to a Market Economy 1
1.1 Background 1
1.1.1 Sector Change and Legal Framework 3
1.2 Barriers to a Successful Transition 4
1.3 Policy Objectives 6
1.4 Key Areas for Comprehensive Reforms 7
1.5 Guidelines for Reform and Phased Implementation 8
Chapter 2: Creating a Competitive Sector Structure 10
2.1 Overview and Objectives 10
2.2 Corporate Governance and Ownership 11
2.3 Increased Upstream Exploration and Development 11
2.3.1 Access to Petroleum Mineral Rights 11
2.3.2 Access to Markets 13
2.3.3 Introduction of Market Forces: Crude Oil Pricing, Allocation, and Competition 15
2.4 Increased Downstream Oil Efficiency 166
2.5 Increased Downstream Gas Market Penetration 19
Chapter 3: Regulatory Reform: Promoting Transparency, Investment, and Competition 24
3.1 Role of Regulation 24
3.1.1 The Nature of the Regulatory Body 25
3.1.2 Need for Regulatory Change 25
3.1.3 Scope and Depth of New-Style Regulation 26
3.2 Regulatory Framework: Principles to Drive Investment 27
3.2.1 Separation of Regulation from Policymaking 27
3.2.2 Independent Regulatory Decisionmaking 28
3.2.3 Removal of Policy and Regulatory Responsibilities from SOEs 29
3.2.4 Transparent Regulation 29
3.2.5 A Sound Legal Framework 29
3.3 Proposals and Objectives for Sector Regulation 31
3.3.1 Organizational Options 31
3.3.2 Policy Issues to Be addressed 32
3.4 Transition Period 34
3.4.1 Organization and Relationships in the Transition Period 36
3.4.2 Required Studies to Prepare for Regulatory Change 38
3.5 Conclusions on Regulatory Reform 39
Chapter 4: Summary: Challenges and Phased Implementation 41
4.1 Major Challenges 41
4.2 Need for Transition and Legal Framework 41
4.3 Making a Start: Regulation of the Downstream Gas Industry 42

4.4 Implementation and Road Map 43

Annexes

1 List of Experts that Participated in the Work Group Meetings
2 A Comparative Analysis of the Upstream Fiscal Terms for China
3 Market Opening and Security of Oil Supply
4 "Qualification" or "Certification" of Participants in Oil and Gas Operations
5 A Comprehensive Listing of Proposed Regulatory Activity
6 Environmental Regulation
7 International Cases of Structural and Regulatory Reform

Tables

1.1 Primary Energy Production and Consumption, 1990–99 (mtoe)
3.1 Regulatory Areas during Transition, 2000–05
3.2 Regulatory Areas after Markets Are Functioning, Post 2005
4.1 An Illustrative Five-Year Road Map: Policy, Structure, Regulation, and Legislation

Figures

1.1 Changing Structure of Primary Energy Consumption
1.2 Growing Import Supply Gap

Boxes

2.1 Sector Reform Actions: Access to Petroleum Mineral Rights
2.2 Sector Reform Actions: Access to Markets
2.3 Sector Reform Actions: Pricing, Allocation, and Competition
2.4 Increased Downstream Efficiency
2.5 Increased Downstream Gas Penetration
3.1 Principles of Independent Regulation
3.2 Summary of Organizational Actions for 2000

ACRONYMS AND ABBREVIATIONS

AEUB	Alberta Energy and Utilities Board
CNOOC	China National Offshore Oil Company
CNPC	China National Petroleum Company
E&D	Exploration and development
EU	European Union
GOC	Government of China
IOC	International oil company
IPO	Initial public offering
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
MOPI	Ministry of Petroleum Industry
OECD	Organization for Economic Co-operation and Development
OLADE	Organization of Latin American Energy
R/P	Reserves-to-production ratio
PSC	Production-sharing contract
SAPCI	State Administration for Petroleum and Chemical Industries
SEPA	State Environmental Protection Administration
SINOCHEM	China Chemical Industry Import/Export Corporation
SINOPEC	China Oil and Petrochemicals Company
SOE	State-owned enterprise
SDPC	State Development Planning Commission
TOR	Terms of reference
WTO	World Trade Organization

UNITS OF MEASURE

Bcm	Billion cubic meters
b/d	Barrels per day
mtce	Million tons of coal equivalent
mtoe	Million tons of oil equivalent

PREFACE

This is a joint report prepared by the World Bank and the Institute of Economic System and Management, the State Council Office for Restructuring the Economic System, People's Republic of China.

With a view to promoting the research on the regulatory framework for the Chinese oil and gas sector, energy experts from the World Bank and its Chinese counterpart team, whose core membership was drawn from the Institute, formed the joint working group. In addition to experts from the Institute, officials and experts from the Ministry of Land and Resources, State Administration for Petroleum and Chemical Industry, PetroChina Company Limited, China Oil and Petrochemicals Company (SINOPEC), and the China National Offshore Oil Company (CNOOC) also participated in the joint work. As well, there was participation, where necessary, by government officials and experts relevant to oil and gas matters.

The World Bank energy experts made three visits to Beijing in September and November–December 1999 and in April 2000, during which the Chinese members from the joint group worked closely with the World Bank experts.

Three reports were drafted during the first two missions. They were carefully reviewed by the Chinese counterparts who then recommended corrections. The World Bank experts modified these reports according to the Chinese counterparts' opinions. It was on this basis that the final report was drafted and completed jointly by the Word Bank and the Institute.

The working staff of the World Bank highly commended the Chinese counterparts' work; the Institute was most appreciative of the World Bank experts' effort, ingenuity, and efficiency. At the same time the two sides are sincerely appreciative of the active cooperation of all other parties concerned. The feedback and comments provided by experts from these institutions were very helpful and resulted in improvements to the report. At the same time, it is recognized that the points of view expressed in this report may not be consistent with the opinions of all of the different institutions that were consulted.

List of the Joint Working Group

Group Leaders:
World Bank:
Noureddine Berrah Task Team Leader, Energy Program Coordinator, World Bank

Institute:
Chen Li Executive Deputy Director

Members:
World Bank:

Bent Svensson	Lead Energy Economist
Elaine Sun	Energy Program Coordinator, World Bank, Beijing
Ralf Dickel	Sr. Gas Specialist
Roland Priddle	Consultant
Tom Houston	Consultant
Peter N. Cameron	Consultant
Robert McManus	Consultant
Dean Girdis	Consultant

Institute of Economic System and Management, Office of Restructuring the State Council:

Huan Guoyu	Office Director, Professor
He Xiaoming	Professor
Li Xiaodong	Associate Professor
Wang Jianmei	Deputy Division Chief
Gao Shiji	Associate Professor

Ministry of Land and Resources

Che Changbo	Director, Department of Geological Exploration

State Administration for Petroleum and Chemical Industries (SAPCI):

Liu Yan	Division Chief, Petroleum Division, Planning Department

China National Petroleum Company (CNPC):

Jiang Lixin	Deputy Economist General, Secretariat of the Board of Directors

SINOPEC:

Zhang Xuzhi	Team leader of Strategic Research Team
Fang Zhongyu	Team member of Strategic Research Team

China National Offshore Oil Company (CNOOC):

Liang Zhili	Advisor, Legal Department
Zhou Shengwei	Division chief, Office for Restructuring the Economic System

The list of experts who participated in the Working Group meetings is attached as Annex 1.

EXECUTIVE SUMMARY

THEME I: Much progress has been achieved in restructuring the oil and gas sector but the piecemeal and administered market approach has now reached its limits.

1. In China's coal-based economy, oil meets about 20 percent of primary energy consumption needs and natural gas about 2 percent. The energy sector has grown rapidly, but is still relatively underdeveloped. Thus, per capita consumption is low by international standards (0.9 tons oil equivalent, compared with 4.0 for Western Europe, but 0.6 for the rest of Asia) and so is the share of fluid fuels (oil and gas together), which is well over 50 percent for many developed economies.

2. Oil production, mostly from northern China, of about 160 million tons annually, supplies some 80 percent of national requirements, but imports are now growing rapidly because of an accelerating shortfall against domestic consumption. Gas production has been rising more than oil, but despite the Government of China's (GOC's) stated objective of raising it to 6 percent by 2010, the share of gas in the energy balance is still very low, even compared with neighboring East Asian countries that use imported liquefied natural gas (LNG). The reserves-to-production ratio (R/P) for oil (14) suggests a lack of effective upstream investment. The ratio for gas (40) is rather high, compared with industrial consuming countries, denoting insufficient investment in downstream market development.

3. Much progress has been made in areas such as oil production, the development of national technical capability, oil products exports, and the ability to attract foreign capital through production-sharing contracts (PSCs). The petroleum industry faces major challenges, however, in terms of outdated technologies, inherited non-core investments, overstaffing, weak management, and deteriorating infrastructures. These weaknesses reinforce concerns about increasing net oil imports, inefficiencies throughout the system, and the disappointing state of gas development.

4. Important energy reforms have already been initiated by the GOC. They have involved (a) rationalizing of oil and gas pricing to improve the financial situation of the national oil companies, encourage exploration, and increase the share of gas; (b) initiating the separation of government and enterprise functions; (c) the creation in 1982 of the China National Offshore Oil Company (CNOOC) to foster offshore oil and gas exploration; (d) restructuring in 1998 of the two major national companies, China National Petroleum Company (CNPC) and China Oil and Petrochemicals Company (SINOPEC), into two large, new, competing, vertically integrated entities; and (e) making initial public offerings (IPOs) of a proportion of the shares of the national companies, starting with the CNPC in April 2000 and SINOPEC in October, with CNOOC expected to follow in 2001 after a failed listing in 1999. The listing process will encourage efficiencies by clearly separating core from non-core and social activities and ensuring that management concentrate on core businesses and profit maximization.

5. The GOC, however, recognizes that the existing piecemeal and administered approach to reform, based in part on "mimicking" the market system, has probably reached its limits. The government therefore intends to embark on a comprehensive restructuring to gradually open the sector to market forces and, in parallel, to create a comprehensive modern regulatory framework for oil and gas.

THEME II: Major obstacles exist to sector restructuring and regulatory change.

6. Upstream, the geographical division of exploration areas through three major Chinese companies is restricting the competition between Chinese companies operating in the sector. The administration of exploration licenses is deficient in promoting competition. For example, awarding mineral licenses to Chinese companies through bidding process is not applied today in China, and strict terms for extending licenses are not in place. Restrictions on PSC partners' ability to engage in oil and gas trading contribute to reducing the interest of potential entrants. Further improvement of fiscal terms is needed. The decision whether to cooperate with foreign partners rests solely with the Chinese companies. All these problems mean that petroleum resources are not being exposed to the full range of exploration ideas and technologies.

7. Downstream, competition in refining and wholesale operations is limited to CNPC and SINOPEC, retail activities are not fully open to competition, and there are government controls on crude oil and oil products import, export, and pricing.

8. Regulatory obstacles exist, such as the wide diffusion and overlap of responsibilities, and regulation of some important areas is not in place. Some important regulatory functions of SOEs have not been transferred to the relevant government agencies. These obstacles discourage investors, especially foreign ones, are harmful to the consumer and public interest, and jeopardize the GOC's efforts to attract private funds to the sector.

9. The current oil and gas legal framework is deficient: there is no comprehensive oil and gas law; no proper regulatory framework for the sector; authority therefore tends to be provided by regulations rather than by laws; and there are cases of important gaps, as well as overlaps, in government responsibilities for the sector. These deficiencies must be remedied to create the conditions for orderly development, encouraging private investment and protecting the public interest.

10. Overall, these structural, regulatory, and legal obstacles hamper resource development, foster inefficiencies, burden the consumer with additional costs, and frustrate sound development of China's economy.

THEME III: A new wave of reforms is needed to improve the governance of the sector, increase competition, and develop modern regulation.

11. Against the background of the transition from a planned economy to a socialist market economy, the GOC aims to create the environment for an efficient petroleum industry to help meet the energy needs of modern China and establish the conditions for Chinese oil and gas companies to develop into world class businesses that can compete successfully as the sector opens.

Principles and Objectives for Reform

12. Reform will be guided by principles that include the following:

(a) making optimum use of China's petroleum resources;
(b) separating government and enterprise functions;
(c) bringing competitive pressures to bear on all sector participants to improve efficiency;
(d) attracting foreign investment;
(e) developing modern regulation; and
(f) providing a comprehensive national legal framework for the sector.

13. The objectives of reform are:

(a) upstream oil and gas: increased exploration and development (E&D);
(b) downstream oil: greater industry efficiency;
(c) gas penetration: raising the share of natural gas to 6 percent by 2010; and
(d) the creation of a modern regulatory framework consistent with a market-based petroleum industry.

Concepts Underlying Structural and Regulatory Change

14. Policy concepts to guide further initiatives include the introduction wherever possible of competitive forces; the light-handed regulation of natural monopolies, such as pipelines and gas distribution systems; and change taking place in a phased progression.

15. The case for market opening is strong. It brings to bear investment, management skills, and technology from all sources; it disciplines the various actors by competition rather than by regulation; and it will make best use of all available resources while also strengthening Chinese companies. This is the model followed for the oil and gas sectors of the leading international economies.

16. With regulatory reform, policymakers will determine the broad policy environment for the sector. Independent regulators will make decisions in specific cases, ultimately concentrating on dealing with dominant market positions and being guided by international standards for technical regulation of health, safety, and environmental protection. The regulatory transition needs to be implemented in a comprehensive, careful, and timely way to achieve the objectives sought by the government.

17. A pragmatic and flexible five-year transition (2001–2005, coincident with the 10th Plan) is proposed for both structural and regulatory change. The proposed transition recognizes the sweeping governmental, administrative, corporate, managerial, and behavioral changes to be faced; takes account of reforms in other areas of the economy, especially the country accession to the World Trade Organization (WTO); and recognizes the long lead times needed to develop and implement the proposed regulatory reforms and the challenges facing the national companies to adjust to the new competitive environment.

THEME IV: Reforming the sector to increase openness and foster competition.

18. Sector reform is designed to achieve the three broad objectives of increased E&D in the upstream, greater downstream efficiency in the oil sector, and accelerated gas penetration.

19. More, but orderly, competition should be gradually introduced to the upstream industry to achieve faster and more efficient resource development. Easing entry would ensure increased involvement of the international oil companies (IOCs) to attract capital and new technologies. Submission of the Chinese companies to competitive pressures and their exposure to and cooperation with international investors would increase their efficiency and improve their competitive ability. The main policy instrument will remain the use of PSCs under competitive fiscal terms.

20. Steps to increase E&D, to be taken in succession, are a review, and if necessary adjustment, of fiscal terms; removal of geographical constraints on the Chinese companies; an increase in exploration areas available for PSC bidding; strict enforcement of and more demanding exploration license terms for the national companies; and independently managed, competitive issuance of new PSCs.

21. Greater IOC presence will be encouraged by improving market access for PSC oil and gas under the control of the IOCs. Thus, in stages, PSC partners should be allowed to market profit gas, then oil, directly; they should be permitted to invest in pipelines; and they should eventually have nondiscriminatory access to all pipelines, regardless of ownership.

22. Crude oil market opening steps are study of the impact of removing crude oil refinery allocations and pricing approvals (with cap prices, if required, during the transition period); eventual discontinuance of refinery gate price approvals; and then the phaseout of import quotas and licenses.

23. Opening of the crude oil market is needed to further unleash competitive forces, but it may result in both greater exports and imports of oil (although net imports will be moderated by greater E&D). Such a development could enhance existing GOC policy concerns about security of the civilian oil supply. This issue has been addressed in the Organisation for Economic Co-operation and Development (OECD) countries by diversifying total energy supply, diversifying oil supply sources, involving competing suppliers, and giving them freedom to obtain oil from any source and to access adequate foreign exchange.

24. A start to greater downstream efficiency in the oil sector was the increased competition resulting from the creation of the CNPC and SINOPEC. The downstream sector, however, has not yet achieved the efficiency gains that must be obtained by the second wave of sector reforms. Additional capital from both Chinese and IOC sources must be mobilized. In addition to capital, IOCs can bring new management skills and improved technology to the sector. Municipal enterprises should be corporatized and pilot projects created to give Chinese companies first-hand experience of fair open market competition, which is stipulated in the WTO accession. By the end of the transition, the

whole downstream should be fully open to capital, technology, and entrepreneurship from all sources.

25. Decisions, to be implemented according to a carefully planned transition, are to study oil and gas taxation, to permit investment by Chinese and joint venture (JV) companies in wholesale products markets, to replace government benchmark pricing with maximum prices for products, to open competition for qualified Chinese companies and IOCs on a pilot project basis in wholesale and retail markets, to accelerate corporatization of municipal enterprises, to remove restrictions on foreign majority participation in retail activities, and finally to open the whole sector to international trade and investment.

26. As to gas penetration, China's gas endowment is underdeveloped and its share of the nation's energy supply is small compared with those of the advanced economies, even to ones dependent on imports of gas. The objective of a 6 percent energy market share by 2010 is a major commitment and can be exceeded in the long term.

27. Achieving this ambitious target, equivalent to expanding the sector by an amount equal to the size of the Italian gas industry, will require increased investment in all segments of the industry and the removal of remaining obstacles to a functioning gas market, including gas quotas and pricing distortions, the CNPC's quasi monopoly on wholesale trading, and inadequate remuneration of transmission services.

28. The gas distribution sector will have an important part to play in achieving the 6 percent target. Attention needs to be given to distribution system planning and to corporatization with a view to improved financing, more aggressive marketing, and addressing the problems of inadequate margins.

29. In conclusion on sector reform, the proposed program would result in strengthened and modernized oil and gas sectors with diversified ownership and operation in an environment where trade flows and prices would predominantly be determined by the market leading to economic efficiency and optimal allocation and use of resources.

THEME V: Developing a modern oil and gas regulatory system.

30. There is a broad international consensus that the policy role of government must be distinguished from its regulatory responsibilities and that the enterprises should not be involved in either. The policy role deals with broad issues relating to security of supply; resource management; competitive fiscal terms; definition of market operation; control of pipeline and other natural monopolies; the definition of regulatory principles for health, safety and environmental protection; and dealing with the sector's social issues.

31. The regulatory framework addresses three principal areas: mineral resource management and related fiscal matters; technical regulation for health, safety, and the environment; and economic regulation of natural monopolies. In each area, it may be necessary for regulators to "qualify" or "certify" operators as to their fitness to take part in oil and gas activities, having regard, for instance, to their technical and financial viability.

32. Regulatory reform is a necessary counterpart of structural modernization and will enable achievement of structural reform objectives. China has the opportunity to make a fresh start in this field and create a modern, efficient, and effective oil and gas regulatory structure. This reform will require the creation of a level regulatory playing field, administered by an independent commission or commissions that will take over environmental, technical, operational, economic regulatory, and permitting functions from a number of different existing agencies.

33. Particular attention should be given to incorporating responsibilities for health, safety, the environment, and technical regulation, including sound petroleum reservoir management, to serve the public interest of China. Project approvals will require the development of environmental assessment and review processes that distinguish appropriately between routine and more complex projects. The regulator in these areas will set technical and environmental standards, regulate the exploitation of subsurface resources to avoid waste, and establish procedures for public consultation and for inspection and compliance. In the area of economic regulation, the regulator will monitor the development of competitive oil and gas markets and deal effectively with natural monopolies.

34. The new regulatory culture will provide transparency in terms of the requirements to be met and the processes for their implementation. This will create an environment of fairness that, together with stability, is another important quality of modern oil and gas regulation.

35. In terms of objectives, by the end of 2005, the GOC should have put in place a fair, stable, comprehensive, and permanent regulatory structure for the oil and gas industry implemented by separate permanent up- and downstream regulatory commissions, to recognize differences in the composition of the sectors and in their regulatory needs and processes.

36. There is a series of implementation tasks to be carried out to achieve these objectives. These tasks include studies of existing regulation; decisions on the transition actions needed; and agreement on programs of further work, such as the development of a regulatory framework for gas development in China. Operational tasks to be dealt with include the modernization of pipeline rate design and the provision of pipeline open access. Implementation of the new regulatory structure involves first the mapping of existing regulation, then the definition of regulatory policies in each of the three main areas of activity, decisions as to related regulatory techniques, and the design and processes of legislative implementation. In parallel with this, the design of the regulatory organizations needs attention in terms of responsibilities, structure, relationships, authority, and resourcing.

37. In conclusion on regulatory reform, completion of these tasks by the end of the transition will equip China with a thoroughly modern regulatory regime responding to high international standards, potentially superior to that of some of the advanced countries.

THEME VI: Challenges of the transition and phased implementation.

38. Numerous tasks have to be undertaken, during a pragmatic and flexible five-year transition, to achieve the objectives of sector reform and the creation of new-style regulation for oil and gas. Their completion will pose major challenges for the GOC. Among the most difficult to overcome will be the need to change mentalities and behaviors. Much stress will be put on the whole system, but the potential gains far outweigh the risks. A flourishing, market-oriented oil and gas sector will improve the oil supply balance; increase gas penetration; reduce atmospheric pollution; bring in new capital, entrepreneurship, and technology; create high-value employment; and serve consumers better in terms of service and pricing.

39. The transition is specially important in terms of the time-consuming creation of the new legislation. A modern legal and regulatory framework for the upstream will attract foreign investment to the development of hydrocarbon resources. Downstream the framework will particularly affect the gas industry, defining the areas for regulation and the responsibilities of the agency responsible for oversight of it.

40. In this connection, an obvious area to start implementation of new-style regulation is the downstream gas industry, from which it could be extended to other areas in subsequent phases. The absence of a regulatory framework for downstream gas hinders this segment's development. Much preparatory work has been undertaken toward remedying this deficiency, and more is planned. The stage is therefore set for a demonstration project in modern regulation for this component of the oil and gas sector.

41. The following abridged five-year "road map" for policy, structure, regulation, and legislation respecting the oil and gas sector summarizes the foregoing proposals.

Road Map for Policy, Structure, and Legislation				
Year	*Policy*	*Structure*	*Regulation*	*Legislation*
2000	Policy statement: Restructure sector. Modernize regulation. Policy directive: Consolidate regulatory processes.	**Oil** Review fiscal, licensing, PSCs. Extention of license Study taxation and pricing. Study impact of removing refinery allocations and prices. Study phaseout of import quotas and licensing. **Gas** Study phaseout of in- and out-Plan pricing. **Oil and Gas** Study pipeline open access and rate making.	Study development of terms of Reference (TOR) for research on structural and regulatory change. Identify responsibility for regulatory implementation. Create regulatory "road map" of existing processes. Create interim regulatory organization. Study monitoring and reporting on regulation and market development.	Legal staff work on legal instruments for regulation. Prepare inventory and analysis of petroleum legislation and regulation.
2001	Policy decisions: Remove crude oil allocations and import restrictions. Phase out and unify in- and out-Plan prices for gas. Policy directive: Targets for PSC blocks to be licensed.	**Oil** Chinese companies utilize their right to explore. Introduce imports quotas for nonstate companies. Set up a scheme to remove import quotas and licensing. Allow Chinese and JV companies to invest and operate in wholesale oil products markets. Introduce maximum retail prices for gasoline and diesel. **Gas** Phase out in-Plan gas allocations to extent possible. Extend market-oriented prices to all new gas projects. Chinese and PSC companies to sell gas directly to consumers. Encourage negotiated gas prices for new projects. Promote market planning and development. **Oil and Gas** Increase exploration blocks available for licensing for PSCs. Enforce terms for extension of exploration licenses and increase the cost of holding them. Make new and existing blocks eligible for PSCs.	Regulatory decisions on pipeline rates and access to support oil and gas marketing by PSC partners (effective 2002–03). Remove regulatory and policy functions from state-owned enterprises (SOEs) and return policy function to the GOC. Initiate monitoring and reporting on structure and regulatory changes and market behavior. Begin study and decision making on regulatory policy (complete early 2002). Begin study and decision making on regulatory techniques (complete late 2002).	Assess use of existing legal instruments and needed changes. Assess need for legislative changes; initiate if necessary. Legal staff tracks legislative implications. Legal staff tracks legal drafting needed.

Road Map for Policy, Structure and Legislation, (continued)

Year	*Policy*	*Structure*	*Regulation*	*Legislation*
2002	No new policy statements or decisions required. Policy level receives briefing on progress in sector structure and regulatory reform.	**Oil** Remaining approval of crude oil refinery gate prices eliminated. Chinese and PSC companies sell profit oil directly. Pilot projects for liberalization of products begin. **Oil and Gas** Allow foreign investors to own a majority interest in pipelines. Introduce a regulated open-access pipeline regime.	Complete study and decision making on regulatory policy. Complete study and decision making on regulatory techniques. Interim regulatory organization continues oversight of transition to competitive products markets, progress of other structural and regulatory change	Legal staff to track legal drafting needed; initiates work as policy and technical work is approved. Completion of technical regulations proceeds while Petroleum Law is drafted.
2003	Issuance of revised and final policies on oil and gas pricing.	**Oil** Remove restrictions on foreign majority participation in retail gasoline and diesel. and allow foreign companies to own majority interest in refineries.	*No new initiatives* Interim regulatory organization has achieved high degree of cooperation and coordination. Interim regulation system is functioning effectively in supporting structural changes.	Regulations freeing up oil and gas commodity markets. Legal staff completes work on regulations.
2004	Policy decision, following formal review, as to whether to complete regulatory reform.		Interim regulatory organization completes formal review. Responsibility center reviewed by State Council.	Completion of all regulatory drafting. Positive State Council decision authorizes any necessary work on laws.
2005	No further policy decisions required. National People's Congress approval; new law-making required.	**Oil** Removal of crude oil import quotas and licensing. Reduce product import tariffs. Eliminate import-export quotas and product licensing system. Eliminate all economic controls on investment in all sectors. Accelerate corporatization of municipal enterprises in the wholesale market, and integrate with a program of share listings. Remove import quotes and licensing. Introduce bidding for new exploration blocks by Chinese companies.	Concentrate all regulatory functions and activity under interim regulatory organization. Period of intensive staff training and cooperation. Up- and downstream regulatory commissions appointed and organized; absorb functions of interim regulatory organization.	Legal drafting is continued and completed. New legal structure is enacted by the National People's Congress and other lawmaking authorities, as appropriate.

CHAPTER 1:

A SECTOR IN TRANSITION: CHINA'S OIL AND GAS SECTOR MOVING TO A MARKET ECONOMY

1.1 Background

China's energy sector has become the second largest in the world. In 1999 the country's primary commercial energy production and consumption amounted to 1100 and to 1,220 mtce, respectively. Despite a slower growth during the last decade, coal remains the dominant source of energy, accounting for about 67.1 percent in 1999 compared with 76.2 percent in 1990 (see Table 1.1 and Figure 1.1).[1]

Oil production grew 2.2 percent per annum during 1990–97, but stagnated at around 230 mtce (154 mtoe) in 1998 and 1999. Primary energy consumption of oil increased at the higher annual rate of 8 percent during the same period, reaching 286 mtce (192 mtoe). The country became a net oil importer in 1993. Net imports of crude oil and products increased to about 43.81 million ton in 1999, about 22% of the primary oil consumption

Gas production and consumption increased at a modest pace of 5.7 percent in the 1990s to about 35.9 mtce (25.2 Bcm). The share of gas in the commercial primary energy consumption increased only slightly during 1990–99 from approximately 2.1 to 2.8 percent, despite the government's stated objectives, since the early 1990s, to increase gas penetration.

China's reserves-to-production ratios (R/P) for oil and gas highlight the weaknesses of the sector. A low R/P of about 14 for oil potentially indicates insufficient investment in E&D (primarily an upstream issue), whereas the high R/P of about 40 for gas points to a low rate of resource mobilization and stagnation of gas market penetration (primarily a downstream issue). To be more specific on the oil side of the issue, rising imports are indicative of the industry's failure to boost production in step with rising domestic requirements because of a lack of innovative exploration ideas, outdated technology to increase recovery ratios in producing fields, and shortage of investment funds to bring new fields into production.

[1] Source: *China Statistical Yearbook 1991–2000*.

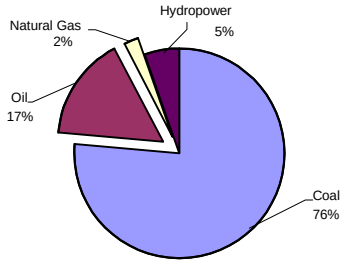
Table 1.1 Primary Energy Production and Consumption, 1990-1999 (mtce)

Coal remains dominant despite a steady decline of its share from 1990 to 1999 . . .

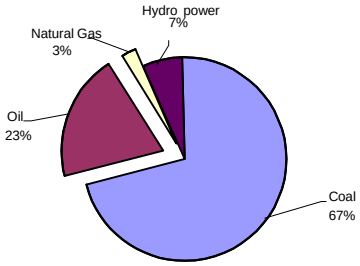
	Production				Consumption			
Energy Sources	1990	%	1999	%	1990	%	1999	%
Coal	771.1	*74.2*	750.2	*68.2*	752.1	*76.2*	818.6	*67.1*
Oil	197.4	*19.0*	229.9	*20.9*	163.8	*16.6*	285.5	*23.4*
Natural Gas	20.8	*2.0*	34.1	*3.1*	20.4	*2.1*	34.2	*2.8*
Hydropower	49.9	*4.8*	85.5	*7.8*	50.3	5.1	81.7	6.7
TOTAL	1039.2	*100.0*	1100.0	*100.0*	987.0	*100.0*	1220.0	*100.0*

Figure 1.1 Changing Structure of Primary Energy Consumption

. . . oil share slightly increased from 1990-1999 and gas share stagnated . . .



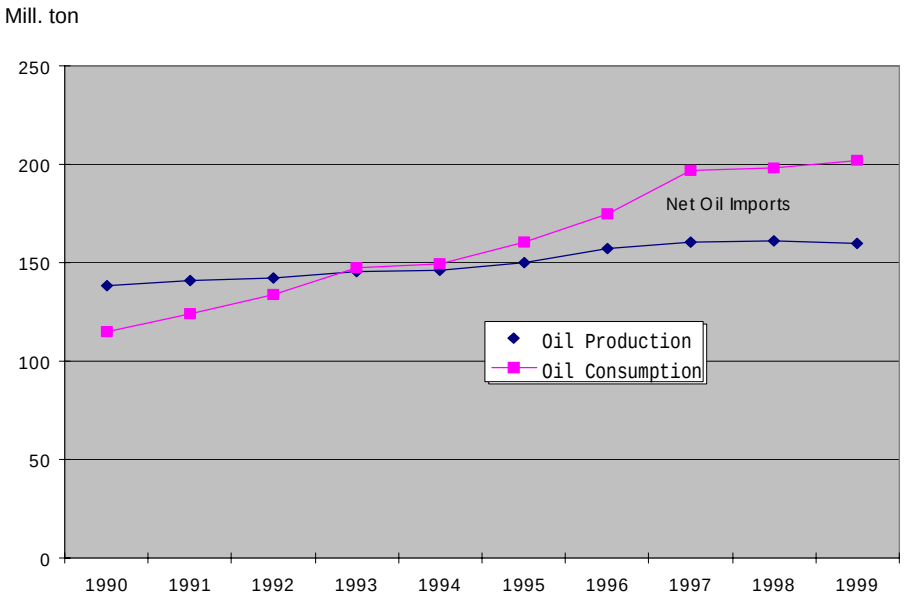
1990 Oil and Gas Consumption



1999 Oil and Gas Consumption

Figure 1.2 Growing Oil Import Supply Gap

. . .and oil imports increased significantly.



1.1.1 Sector Change and Legal Framework

The organization of the oil and gas sector in China has been in a state of continuous change, especially during the last two decades. From 1949 to 1955, the oil and gas sector was under the control of the Bureau of the Petroleum Industry in the Ministry of Fuel. In 1955 the bureau was elevated to the Ministry of Petroleum Industry (MOPI), which oversaw all aspects of hydrocarbon exploration, development, and transportation. In 1970 MOPI was merged with the Ministry of Coal and Ministry of Chemical Industry; these ministries were split again in 1975.

In 1988 MOPI was dissolved. Simultaneously the CNPC was created to exercise MOPI's former operational roles. It also acquired some of that ministry's policy functions. A new Ministry of Energy (MOE) took over MOPI's former administrative responsibilities, as well as those policy functions that had not gone to the CNPC.

In 1994 the MOE in turn was eliminated. Most of its functions were acquired by the State Development Planning Commission (SDPC), but some of the policy responsibilities went to the CNPC which, partly because of its strength in personnel resources, continues to exercise a policy role.

Until 1998 the CNPC was in charge of almost all the onshore petroleum exploration and development activities in China, including negotiations and administration of agreements with international oil companies through its subsidiary, the China Oil and Natural Gas Exploration and Development Corporation. The China National Offshore Oil Corporation (CNOOC), created in 1981, was responsible for virtually all the offshore petroleum operations. The Ministry of Geology was in charge of geological work. The Petrochemical Corporation of China (SINOPEC), established in 1983, was responsible for most petroleum refining and petrochemical production based on liquid petroleum feedstocks. The Ministry of Chemical Industry (MCI) is responsible for most petrochemical plants using natural gas and coal as feedstocks. The China Chemical Industry Import/Export Corporation (SINOCHEM) is in charge of oil and products trading.

Starting in 1998, the government initiated another major change in the sector structure and corporate governance of the state companies operating in the sector through (a) restructuring the state oil and gas assets to transform the CNPC and SINOPEC into two vertically integrated companies; (b) separating the core business of the CNPC and SINOPEC from non-core businesses and social services and transferring the core services to newly incorporated entities, PetroChina Company Ltd. and China Petroleum &Chemical Corporation Ltd. and finally, (c) making initial public offerings (IPOs) for PetroChina Ltd.and SINOPEC). These IPOs are based on a government decision to allow minority foreign shareholding in the major state-owned entities operating in the sector. The process started slowly. The successful IPO of 10 percent of the shares of PetroChina, Ltd. and SINOPEC Ltd. indicate the strong but cautious interest of international oil companies (IOCs) and financial markets in China's oil and gas sector. Preparation for an IOP of CNOOC Ltd. is ongoing.

Finally, significant steps have been taken to gradually bring oil and gas prices up to market levels. Domestic crude oil and products are now linked to international prices, and gas prices have been increased to levels close to and, sometimes, above long-run marginal costs. However, the necessary linkage to gas competitiveness with other fuels was not ensured.

The GOC's approach to sector change and reform outlined above can be characterized as a piecemeal one. The problems stemming from this approach, and from the legal and regulatory deficiencies identified in the balance of this section, are further discussed in section 1.2.

The current oil and gas legal framework in China is deficient. Thus,

(a) There is no comprehensive oil and gas law.
(b) Similarly, there is no comprehensive regulatory framework for the sector.
(c) For the most part, authority is provided by regulations rather than by laws.
(d) There are, in some important cases, gaps and, in other cases, overlaps in the coverage of these regulations.

The overall effect is that the existing regulatory framework is fragmented, responsibility is dispersed between different centers, and there are clear overlaps in responsibilities.

For the long-term successful development of the sector, an oil and gas law for both upstream and downstream will be required. Many countries have found that the orderly development of the oil and gas sector is facilitated by a sector-specific law whose purpose is to create the conditions necessary for private investment while safeguarding the public interest. (A relevant example is China's Electricity Law.) However, new laws take a long time to develop, and their content is difficult to foresee, particularly in the case when a new natural gas sector is developing rapidly. Given the fast track the government has taken in the sector, such laws will need to be developed in tandem with the implementation of regulations and development of the sector.

1.2 Barriers to a Successful Transition

Despite the progress achieved during the last two decades, major problems are still impeding the development of the sector and its efficient operation. This report focuses on two prerequisites to a successful transition to further market orientation and increased efficiency in the sector: the creation of a competitive business environment and the introduction of modern regulation. From the standpoint of that focus, key challenges and problems include the following:

Challenges

(a) Oil production growth has been outpaced by domestic demand growth. This has resulted in rising imports since 1992, despite China's favorable petroleum resource potential. Domestic oil demand is expected to continue to grow significantly. Each

percentage point growth in petroleum demand would require a supply increase of about 2 million tons in the year 2000 and of about 5 million in the year 2010.

(b) Gas consumption has not increased its share of final energy consumption. Gas penetration has increased from only 2 percent in 1990 to 2.8 percent in 1999, despite the declared government policy to increase gas penetration in the energy balance to 6 percent by 2010. Even if primary energy consumption increased by only 2 percent annually in the coming decade (compared with 4 percent recently), achieving the government's target of 6 percent gas penetration by 2010 would require an additional 60 Bcm of gas to be consumed. This is equivalent to adding the whole Italian gas industry in one decade. Development of a market of this size in China would require the completion of five gas projects of the capacity of the planned West–East pipeline.

Key Problems That Present Barriers

(c) Government roles of policymaking and regulation are still not clearly separated from its ownership and governance roles. Specifically, policy and regulatory functions are widely diffused and interwoven. The "command and control" approach to regulation is still pervasive. And within the existing system, there is insufficient attention to human health, safety, and environmental protection.

(d) The state-owned enterprises (SOEs) retain policy and regulatory functions. SOEs, listed (or about to be listed) on the stock exchange, are still exercising functions that can lead to conflict-of-interest situations and discriminatory practices against possible competitors.

(e) Governance of the SOEs is not being appropriately implemented. Seventeen years after the enactment of the Company Law and several corporate restructurings, governance of most, if not all, state-owned companies is still not properly exercised through their boards of directors and articles of association (charters). Interference in management decisions by government agencies and holding (mother) companies has continued after incorporation of the business entities and, in some cases, even after their listing in national and international stock markets, which has reduced management autonomy and weakened accountability.

(f) The sector is inefficient. Inefficiencies are a result of (i) relatively outdated technologies, partly because of insufficient innovation; (ii) corporate structures that have inherited non-core investments ("side businesses") rather than aggressive investment in innovation and core exploration and production businesses; (iii) overstaffing stemming from the SOEs' perceived social obligations and overstaffing in the core petroleum business; (iv) the weakness of management processes and corporate governance; and (v) underutilization and deterioration of the existing infrastructure because of unsafe operational procedures and inadequate maintenance.

(g) Allocation of some gas volumes and structured gas prices are among the most important impediments to the optimal use of gas resources. More importantly, they act as disincentives to the mobilization of financial resources required for sector development.

Problems of the Piecemeal Approach

The persistence of these problems and the partial achievement (and in some cases the failure to achieve) the government 's stated objectives for the sector stem mainly from the piecemeal approach to reform. Examples include the following:

(a) Restructuring, corporatization, and commercialization of SOEs has taken place without the necessary parallel development of a competitive framework and of independent regulation. This has created major conflicts of interest. For example, profit-oriented operators are still entrusted the responsibility of designing and enforcing operating and safety standards; new entrants to the sector have to associate with state-owned companies that have dominant market positions and that exercise regulatory powers. Additionally, there are market power situations that discouraged new entrants and tend to discourage foreign investments in the sector.

(b) Conflict-of-interest situations are becoming more apparent after the decision to link the three major companies to international equity markets.

(c) Increased gas prices, without phasing out the gas allocation system and improving the pricing structure to reflect supply costs have failed to provide adequate incentives to increase and rationalize the gas supply and consumption.

(d) Regulation remains deficient, with responsibilities dispersed and overlapping, a lack of effective regulation in some important areas, the retention of regulatory responsibilities by SOEs, and the continued absence of a unified legal system that provides adequate transparency.

If not addressed, these problems could jeopardize the future development of the sector and, more importantly, limit the ability of the Chinese operators to compete in the more open environment defined by the terms agreed to by the government for China's accession to the World Trade Organization (WTO).

1.3 Policy Objectives

This report seeks to address these challenges and problems, provide reform concepts and to achieve the broad policy objectives established by the government for reform of the sector, which are as follows:

1. Make optimal use of China's petroleum resources. Given the extent of the country's petroleum resources, increased E&D could create the capacity to reduce the rapid rise in China's net oil imports and temper any concerns the GOC may have about foreign exchange costs and the security of imported oil supply. Greater E&D would as well contribute to increase gas supply and diversify the country's energy mix.

2. Remove the regulatory functions from the SOEs and create a clear, modern regulatory framework. This will be obtained through two fundamental actions:

(a) Removing all policy and regulatory functions from the operations of the SOEs. This will enable them to focus further on the profitability of business operations, thus reducing overstaffing and high operating costs.
(b) Creating a new legal system to provide a proper basis in law for comprehensive oil and gas regulation.

3. Bring competitive pressures to bear on the SOEs and other sector participants to improve efficiency. Competitive forces, rather than government control and direction, are the proven means to make best use of all available resources. The management of SOEs will be improved and their capital better employed, and they will be transformed into the world-class companies that they need to be to survive and prosper in the long term.

4. Attract foreign investment. The GOC's aim is to leverage the technical and financial resources of skilled foreign companies to invest in both the upstream and downstream oil and gas sector. Such investment can be attracted through their expanded participation in PSCs, through investments in pipelines and other infrastructure, and by continued IPOs of shares in the main SOEs.

5. Increase gas penetration. The GOC has a publicly stated objective to increase the share of natural gas in the energy balance from the present 2 percent to 6 percent by 2010. Increased gas penetration will reduce coal's dominance, thereby mitigating the adverse environmental impacts of coal use, especially on health (reduction of particulate emissions) and agriculture (reduce acid rain).

1.4 Key Areas for Comprehensive Reforms

Comprehensive sector reform is a critical element necessary to meet the government's policy objectives set out in section 1.3. The piecemeal approach is not working, and the policy objectives are in danger of not being met. International experience in developed and developing countries shows that increased reliance on market forces, combined with proper government oversight of the sector, leads to increased economic efficiency and attracts the investment and entrepreneurship needed to develop oil and gas resources to meet the country's needs. The reforms must be integrated and focused on the following:

(a) Sector structure—meaning conditions under which qualified enterprises can enter and make investments in all segments of the oil and gas sector and subsequently carry out activities, such as producing, selling, buying, importing, and exporting.

(b) New style regulation—meaning government control and direction of business enterprise activities that are not subject to adequate disciplining by competitive forces. The activities in question are typically health, safety, and environmental protection, sound petroleum reservoir management and regulation of natural

monopolies, such as pipelines and gas distribution systems, particularly in terms of prices and rights of access to services.

The oil and gas sectors of most leading industrial economies are based on the principle of open, functioning markets. The beneficial effects of market opening on petroleum development have been demonstrated in recent years in such countries as Argentina, Bolivia, and Canada. International organizations like the EU, the International Energy Agency, and the Organization of Latin American Energy (OLADE) all endorse open market oil and gas policies.

In countries where oil and gas sectors are closed or highly controlled, industry efficiency is low and supply costs are high, leading to excessive consumer prices and an unnecessary drain on the government budget; SOEs' commercial objectives may be subordinated to government policy considerations; labor forces are bloated; environmental management is often substandard; technology is outmoded; "best practices" in engineering design and operations are not consistently instituted; some resource development opportunities, particularly for gas, may be neglected; petroleum reservoir practices are usually less than optimal; domestic oil products specifications fall short of international norms; and the quality of retail service is inferior.

In all reforming countries, as former public enterprises become subject to market competition and have to demonstrate profitability, pressures increase on their management to cut costs in such areas as environmental protection and to take advantage of any remaining dominant market positions that they may have. This tendency is developing in China. It must be offset by vigilant, independent regulation to protect the public interest.

A broad international consensus is developing as to the appropriate functions of governments in relation to the oil and gas sector when market principles are implemented. Regulatory responsibilities should not be exercised by SOEs, and regulation should be properly separated from the government's policymaking functions. This will increase the public's confidence, create a "level playing field" for enterprises of all kinds, and help improve the investment climate.

1.5 Guidelines for Reform and Phased Implementation

Two basic principles are proposed to guide the process of further reform, and they are applied in Chapters 2 and 3:

(a) Sector structure: Progressively greater reliance must to placed on market forces and the gradual opening of the sector to trade and investment to achieve optimal use of human and material resources and greater productivity.

Market opening and reliance on competitive forces will (a) allow and invite investment, enterprise, and technology from all sources, domestic and foreign, to take part in the development of all phases of the oil and gas industry; and (b) put pressure on all participants, newcomers as well as incumbents, to invest and operate efficiently and minimize costs to the benefits of consumers, thereby

reducing the need for administrative interference. Chinese companies will benefit from being exposed to international competition through a gradual market opening. Both theory and practice show that functioning markets are the best means of fostering investment, making most efficient and rational use of resources, strengthening successful corporations, and at the same time safeguarding consumer interests.

(b) Regulation: The aim must be to create a modern framework in which economic regulation protects the government and consumers from the misuse of monopoly powers and technical regulation is carried out to high international standards.

The transition from a planned economy to a socialist market economy does not mean the end of government intervention. Rather it means a shift from all-pervasive intervention to more selective and focused intervention to serve the public interest and provide an environment for fair market competition. New-style regulation requires first the separation within government of the function of regulation from the function of policymaking and the creation of new regulatory institutions. Second, it involves a change in emphasis of regulation. Thus, as functioning markets develop for oil and gas, market-intervention regulation will diminish and eventually disappear. Where markets do not work because of the presence of natural monopolies like pipelines and gas distribution systems, new-style economic regulation will be put in place to prevent the abuse of dominant positions and encourage the functioning of markets for the commodities that flow over those pipelines. In the area of technical regulation, high and uniform international standards will be applied by the new regulatory institutions. In all respects, the public interest will therefore be safeguarded by competition in some markets; by the regulation of monopoly where markets do not work; and by the protection of health, safety, and the environment where competitive pressures do not necessarily work to secure sound practices.

A flexible and pragmatic transition is required that recognizes the extent of the needed changes and, in many cases, their link to the macroeconomic situation; the initial adaptation difficulties that will be faced; the importance of maintaining the pressure for change; and at the same time, the wisdom of adopting a phased approach that includes a program of further studies and embodies decision points as progress is made toward the final goals. Reforms must be synchronized with China's international commitments, but not limited by them. A five-year transition period is proposed (2001–05), coincident with the 10^{th} Plan.

CHAPTER 2:

CREATING A COMPETITIVE SECTOR STRUCTURE

2.1 Overview and Objectives

China has taken the first steps toward restructuring its oil and gas industry. The restructuring of the CNPC and SINOPEC and IPOs for PetroChina Ltd. and SINOPEC Ltd. and others are examples of moving toward a more market-oriented approach.

Some progress has therefore been achieved, but it has been slow relative to certain other sectors, such as telecommunications. Much therefore remains to be done, and the pace of reform should be speeded up. Key issues that oil and gas sector reform must deal with include the following:

(a) insufficient levels of E&D exploration;

(b) production and supply inefficiencies;

(c) lack of competition, particularly in onshore exploration and in the downstream sector, both gas and oil;

(d) traditional sector regulation that limits competition; and

(e) inadequate market development and penetration of natural gas.

To adequately address these issues and reach the GOC's related policy objectives identified in section 1.3, structural changes based on market principles are recommended that will progressively increase competition and achieve the following objectives:

(a) increased upstream exploration and development;
(b) greater efficiency in the downstream oil sector; and
(c) increased gas market development and penetration.

First, to move in the direction of a market economy and to create functioning markets in the upstream sector, a prerequisite is to foster competition by increasing the number of oil and gas suppliers. At the moment, for example, crude oil can only be put on the Chinese market by the Chinese companies presently producing alone or in conjunction with their foreign PSC partners and by the Chinese companies allowed to import under licenses. This is not a sound basis for a competitive crude oil market.

Second, to increase investments in E&D from existing and new companies, greater infusion of foreign capital, technology and expertise should be sought and broader access

to petroleum mineral rights provided. At the same time, the upstream fiscal system should be reviewed to verify that it remains internationally competitive for all current and prospective players.

Third, all SOEs and other companies need access to markets to sell their products, whether they are crude oil, oil products, or natural gas. Over time, the remaining government controls on prices and volumes will therefore have to be phased out.

2.2 Corporate Governance and Ownership

The current role of China's dominant oil and gas companies will change with the transition to a competitive market. Areas that could be affected include ownership structures as a result of public listings; new management, which may be brought in to deal with the challenges of competition; and implementation of future policy, which will have its effects.

With the advent of an open market, competition, and greater participation by foreign investors, pressure will be increased on existing players in the oil and gas business to improve their operating performance. The pressure will lead to greater accountability that will help foster change. Corporate decision making styles are likely to move toward decentralized and performance-based decision making. Corporate governance properly carried out by independent boards of directors should reduce the degree of government influence on and interference with day-to-day operations. Government agencies should focus on setting policies, ensuring the operation of a fair competitive market, and managing the government's assets in the sector through boards of directors. Difficult behavioral changes will have to take place on the part of the government and the enterprises, but without them, progress toward functioning markets will be impeded, and associated efficiency gains will be forgone.

2.3 Increased Upstream Exploration and Development

By increasing upstream competition, there will be more rapid and efficient petroleum resource development. A first step would be to increase the activity levels in the sector by better harnessing the capital, technology, and entrepreneurship of the IOCs. At the same time, the Chinese companies could be made stronger both by the action of competitive forces and by productive relationships with IOCs. Three areas need to be addressed to achieve this: better access by qualified companies to petroleum mineral rights, access to markets, and pricing and allocation reform.

2.3.1 Access to Petroleum Mineral Rights

Minerals licensing policy, including the conditions for licensees to enter into PSCs, along with E&D fiscal terms, is the most effective policy instrument to promote increased exploration activity by the IOCs. Today SOEs apply to the Ministry of Land and Resources for E&D licenses and receive them on a "first come, first served" basis, unless the acreage is reserved for other purposes. The SOE then decides whether to explore on its own or to cooperate with an IOC under a PSC. IOCs are only allowed to

participate in exploration and production under PSCs. Only 5 percent of onshore acreage, but most of the offshore, is under PSCs.

At present, it is too easy for incumbents to obtain license extensions, and the cost of holding large blocks of exploration rights is low.

The disadvantages of current mineral rights licensing system include: market competition mechanism is not introduced into the process of obtaining licenses, and the current practice of extending licenses does not give the licensees an incentive to explore effectively. Reform in this area is thus necessary.

Strict enforcement of exploration license terms is required, together with an increase in the costs of holding the licenses. The intent of this step is to improve the relinquishment process to ensure that licensed areas that are not ranked highly by one company are made available to others that may see the prospects differently. The result should be an accelerated and more efficient development of petroleum resources.

As the first step toward increasing competition within the sector in an orderly manner, Chinese E&D companies must utilize their rights to explore throughout the country. Exploration blocks should be obtained through bidding processes. A more aggressive petroleum mineral rights licensing policy should be implemented concurrent with greater and more orderly competition among Chinese companies. This policy should allow the Chinese companies to compete in the upstream industry without any geographical limitation; maximize the amount of mineral rights available for exploration; accelerate the turnover of already-licensed mineral rights; and, to the extent possible, encourage an increase in the proportion of all rights available for PSCs.

Second, foreign capital, technology and expertise should be leveraged. This is a proven approach used effectively to open markets that previously had "closed" oil and gas economies. Worldwide experience over many decades has demonstrated that the best way to find and develop oil and gas reserves is to allow a wide range of exploration ideas and engineering expertise to be applied to the basic raw material, namely, mineral rights in petroleum prospective areas. The IOCs are valuable vehicles for such ideas and engineering practices. When they are allowed access to petroleum jurisdictions where SOEs were previously dominant, they can often by their own activities bring about dramatic changes in the rate and efficiency of oil and gas development. At the same time, their presence can act as a valuable stimulus to the incumbents, both by the action of competition and also by the "demonstration effects" that the IOCs may foster.

Third, the percentage of exploration and production blocks for PSCs should be increased when possible. PSCs should be promoted by increasing the relinquishment of acreage underutilized by SOEs and should be awarded competitively. PSCs have worked well in China and are well understood by the government and by the IOCs. This model can be used in the future, but a competitive bidding procedure should be introduced. Until a bidding procedure is developed for all companies, Chinese companies can continue to receive new exploration blocks according to the current procedures. Under a competitive bidding process for PSCs, after a block is awarded to a Chinese company, the agency responsible for administering petroleum mineral rights would call for bids

from all interested parties for a PSC on that block. The basis for selection of the PSC partner would be the highest bid in a combination of work commitments and profit sharing. The successful PSC bidder would then carry out its work commitment, exploring for and, if successful, developing hydrocarbons on the block. The purposes of this step are first, to manage the awarding of PSCs independently of the SOEs; second, to increase the number of PSCs; and third, to bring other qualified Chinese companies, as well as IOCs, into the exploration effort. The principal constraint to effective use of this policy instrument today is that most prospective petroleum areas are under license, and significant new areas are not expected to be added to the exploration pool through the relinquishment process during the next several years.

Last, to encourage IOC investment, fiscal terms should be competitive and periodically reviewed to ensure that the underlying fiscal systems for all players remains internationally competitive and that they are consistently applied to all enterprises. If deficiencies are revealed, for example in regard to overall competitiveness or in relation to natural gas development, they should be corrected (refer to Annex 2). The recommendations are summarized in Boxes 2.1–2.5 and in Table 4.1.

Box 2.1: Sector Reform Actions: Access to Petroleum Mineral Rights

The following actions are proposed to improve access to mineral rights and increase exploration:

- Review fiscal terms to assess their international competitiveness and effectiveness to achieve the objective of greater E&D (to be carried out immediately).
- Initially ensure that the three Chinese E&D companies utilize their right to explore anywhere in China, including onshore or offshore (from 2001).
- Increase the number of exploration areas available for the bidding and award of PSCs, and offer more prospective exploration rights (from 2001).
- Strictly enforce the terms for extension of exploration licenses, and increase the cost of holding licenses (from 2002 or as soon as possible).
- Make all new and relinquished exploration blocks eligible for PSCs through annual competitive rounds (starting in 2001) managed by an independent agency that has the authority to sign the PSC.
- Ultimately consider introducing the practice of allocating new exploration blocks among the Chinese companies by some form of bidding.

2.3.2 Access to Markets

A greater upstream presence by IOCs will help to attain the objective of increased E&D activities. However, IOCs will be more ready to enter into PSCs if they have access to markets. This is of particular importance in gas-prone areas because the commercialization of gas requires strong marketing efforts. The companies would be helped in this direction if they can market their share of oil and gas production directly, and if they can be sure of having access to the needed pipeline capacity, either by using

others' transmission pipelines or building their own. Presently PSC gas can only be marketed by the SOE or by the SOE in conjunction with the PSC partners. This presents a serious disincentive to gas exploration and development by IOCs. Arrangements that allow all partners to decide independently how they market jointly produced gas are the international norm. Each partner can then maximize the value of its share of production. If this were possible in China, there would be greater IOC interest in PSCs, particularly in gas-prone areas, and more vigorous and successful subsequent marketing efforts.

In regard to gas, the IOCs have very broad and varied experience worldwide in development and marketing by investing in pipelines, by innovative arrangements with consumers and, in some cases, by building and owning gas-fired electricity generation. This is known as the creation of a natural gas "value chain." Conversely, the IOCs are not interested in leaving their gas marketing, and the associated revenue stream, in the hands of other parties. If the conditions are created for the IOCs to market their profit gas directly, they will approach gas exploration more confidently, and their efforts, if successful, could entrain important further benefits for China's energy economy by way of more rapid gas market development and associated investment.

Foreign PSC partners should be allowed to invest and have majority interests in pipelines to increase the attraction of PSC arrangements to the IOCs, especially in regard to PSCs in gas-prone areas. However, producer-owned pipelines will require special attention. They will of course be subject to regulation to ensure that access to their services is equally open to all parties, that their rates are reasonable, and that there is no abuse of monopoly powers by their owner(s). For regulatory and taxation reasons, pipelines that are owned by other corporations, including by petroleum producers, should be constituted as independent legal entities with separate management and accounting (or, as a minimum, be constituted as separate profit centers of the producing companies). This step has in a sense been anticipated in the July 12, 2000, announcement of the West–East Gas Pipeline Project that opened the possibility of foreign investment in the project.

Where pipelines already exist, all producers, including PSC partners, who have rights to market oil and gas directly, must have access to each other's pipelines. This was historically a significant problem in the development of the North American oil and gas market. It was overcome by regulatory measures to enforce open pipeline access for all potential shippers. This had a profound effect on the development particularly of efficient, expanding markets for natural gas. Allowing all producers, including foreign PSC partners, access on a nondiscriminatory basis to oil and gas pipelines regardless of the ownership of those lines will release the same potential in China. Open access pipelines must transport a fully fungible gas commodity. They therefore have to state and enforce stringent rules for the quality of gas to be accepted into their systems. Both the pipeline and its shippers are therefore vigilant about the quality issue. In an open access regime, this kind of policing would deal with the current problem.[2]

[2] Open access will therefore provide a solution to the present regional problem of producers introducing off-specification gas to the transmission pipelines.

In regard to crude oil, the same issues apply, but perhaps to a lesser degree. This is because at the present stage of China's petroleum development, crude oil markets are more homogeneous and transparent than gas markets, and some transportation infrastructure is in place (pipelines and rail). The case for IOCs being allowed to sell their crude oil directly relates more to the beneficial effects that should follow in terms of bringing supplies from more sources and greater competition in the refinery crude oil market than the incentive for IOCs to engage more vigorously in upstream operations. Allowing foreign PSC partners to market oil on an equal footing with the three Chinese E&D companies would have positive effects in two areas. First, it would help establish a competitive upstream market with consequent efficiencies stemming from economically optimal crude oil allocation. Second, it would encourage IOCs' E&D activities by ensuring that they will be able to compete for domestic crude oil markets on a level playing field with the SOEs.

Box 2.2: Sector Reform Actions: Access to Markets

The following actions are proposed to improve the access of oil and gas producers to markets:

- Allow foreign PSC partners to market profit gas directly, at prices established through buyer-seller negotiations (2001).
- Allow foreign PSC partners to market profit oil on an equal footing with the three Chinese E&D companies (2002).
- Allow foreign PSC partners to invest and have majority interests in pipelines (2002).
- Grant foreign PSC partners access on a nondiscriminatory basis to oil and gas pipelines regardless of the ownership of those lines (2002).

2.3.3 Introduction of Market Forces: Crude Oil Pricing, Allocation, and Competition

Although crude oil and products pricing mechanism has been reformed and prices are now related to international market levels, regulations and accepted practices still constrain commercial activities of oil market players at present. This control system prevents the SOEs from acting in completely commercial ways. To achieve a fully functioning market for crude oil and to gain the benefits of the competitive forces that it will unleash therefore requires further reform of the pricing mechanism, phasing out of the import licensing system, and of any other government interventions in the crude oil market that adversely affect the companies' commercial decisions.

Refinery gate prices of crude oils are determined under indicative inter-company agreements on crude oil supply, coordinated by the government, and linked to world levels. In the event that the companies cannot reach agreement, coordination of these pricing arrangements would be provided by the SDPC, which is also responsible for indicative regulation of retail gasoline and diesel prices. Although allocations of crude oil volumes between the companies are not enforced, regulations give government agencies

the right to do so. These actual or potential measures present regulatory obstacles in the transition to a fully functioning market. They will therefore have to be phased out to achieve market efficiencies.

A phaseout of the crude oil import licensing system would create an environment that would help suppliers and buyers to negotiate market prices for domestic crude oil. The result would be a fully rational utilization of oil supplies. During the phase out of crude oil pricing controls, three issues need to be addressed: the units of measurement (volume or weight?), the premiums or discounts to be applied, and the provisions for quality adjustments reflecting such matters as density and sulfur content. A phase out, required under China's WTO agreements, would progressively enlarge the refiners' supply options. Pressures would be created to negotiate prices for domestic crude oils that would fully reflect international prices for similar qualities. Such pricing would be in the interest of both sellers and buyers: both sets of actors would be able to take their own optimizing decisions. In the case of buyers, this would extend to the refinery level. This has become an almost universal practice in the refining industries of the industrial countries. However, it will take time for China's refining sector to make the investments needed to take advantage of the new feedstock sourcing flexibility, as well as to become competitive against imported products. A study should precede the introduction.

Security of Oil Supply

China has become a significant net oil importer and is likely to remain so, although import growth could be moderated by greater and more successful E&D. Moreover, if controls on oil exports, imports, and prices are removed, both exports and imports may increase. This could enhance any existing policy concerns on the part of the GOC about the security of oil supply for civilian needs. Such concerns will have to be understood better before specific prescriptions can be put forward. However, as an aid to perspective on the GOC's concerns and possible means to deal with them, some observations are provided in Annex 3.

Box 2.3: Sector Reform Actions: Pricing, Allocation, and Competition

The following actions are proposed to phase out government price-setting and quotas:

- To achieve market efficiency, the SDPC will not retain the right to interfere with prices agreed between companies or otherwise intervene in inter-company matters respecting crude oil prices;
- Import quotas and licensing systems for crude oil will be phased out on a predetermined schedule (starting in 2001 and finishing in 2005).

2.4 Increased Downstream Oil Efficiency

The 1998 industry restructuring is resulting in increased competition in the downstream oil sector as the CNPC and SINOPEC start to compete for markets throughout the country. The downstream sector, however, has not achieved the efficiency gains that could be obtained by a second wave of sector reforms. Nor could it achieve such gains, because the presence of a duopoly is usually insufficient to create a functioning market. It is therefore both desirable and necessary to create the conditions for more competitors to take part in the market. The recommendations in the "road map" (see Table 4.1) aim at introducing supply from more players in the market to achieve the potential advantages from competition. By the end of the transition, the whole downstream sector, including oil refining, importing, and storage, would be fully open to capital, technology, and entrepreneurship from all sources, both Chinese and foreign.

The downstream oil sector presents opportunities for smaller companies in the wholesale end of the business. Chinese capital should be mobilized and opportunities created for IOC participation through JVs in the wholesale segment (import terminals, storage, transport, and distribution). The IOCs can bring additional capital, management skills, and improved technology, including the opportunity for technology transfer to Chinese companies. In this, as in other parts of the petroleum sector, the IOCs can be expected to introduce high standards of environmental, safety, and health protection.

In retail gasoline and diesel activities, restrictions on foreign majority participation should be removed to progressively enhance competition with the CNPC and SINOPEC in the retail sector. It is understood that the two companies are taking over smaller, privately owned retail outlets. If competition is to be effective and associated consumer benefits achieved, there would have to be rather large numbers of retail outlets carrying the brands of foreign companies. Typically they seek substantial representation that would support their infrastructure costs and make advertising, brand recognition, and other consumer relations activities worthwhile. It will be necessary to award a sufficient number of licenses, including sufficient retail stations allowed per license, to ensure a fully competitive environment in the retail gasoline business. The results could include job creation, the introduction of modern technologies, and marketing and improved service from both the incumbent suppliers and new entrants to the retail sector.

In the refining sector, the competition will mainly come from the opening of the market for product imports. As well, the refinery sector should also be open for Chinese and foreign investments for rehabilitation and grassroots refineries when the current overcapacity disappears. This would introduce more suppliers of products to the retail sector and allow new investors in the retail sector to rely on their own supply sources.

To provide Chinese companies with first-hand experience of open market competition, pilot projects for qualified Chinese oil companies and IOCs to operate in wholesale and retail markets should be initiated. Such projects should be put in place in two regions. The intent would be to provide Chinese companies such experience well in advance of the full downstream opening.

In regard to taxes and to price setting, as a first step a study is needed of taxation on oil and gas products (including liquefied petroleum gas (LPG)) to examine both the effects and the fiscal revenue potential of the taxation instrument. The purpose of the

study is to analyze the impact of such taxation on the structure of energy consumption and of the incorporation of environmental constraints.

SDPC setting of oil products prices, as long as it is retained, should relate to maximum prices. The purpose is to remove a potential administrative obstacle to the working of competitive markets: benchmark prices tend to discourage the development of price competition. Many countries that practice price-setting of oil products apply maximum prices. Competition is then free to drive prices below these maximums to the benefit of the consumer. This will support the ultimate objective of creating a functioning market. Maximum prices for oil products should continue to be linked to international levels. Adjustments to these prices should take place at the same time as adjustments to crude oil prices under the remaining regulation to ensure that changes are made in step with each other. This would avoid causing undesirable fluctuations in refinery margins caused by changing the products' prices less frequently than those for crude oil. This would enable consumers to benefit from fair competition between products suppliers while still retaining the desired consumer protection effects in those sectors and regions where competition does not yet properly discipline selling prices.

Municipal enterprises currently have an important role in the downstream sector. They will need to function in a more competitive environment. An important preparatory step that should be accelerated is corporatization of such enterprises and share issuance. It appears that progress on corporatizing municipal storage, distribution, and retail enterprises has been uneven and is not far advanced. More rapid progress is needed to enable the enterprises to attain competitiveness by the time the IOCs fully enter the market at the end of the transition. In this way, an important element of Chinese investment and entrepreneurship can hopefully be sustained, thereby making a contribution to overall market competition.

The agreement between China and the United States for China's accession to the WTO provides for the removal of import quotas for oil products no later than 2005 and allows foreign companies to engage in wholesale and retail trade in crude oils and oil products by that date. The EU agreement sets out crude oil and product import quotas for nonstate companies, starting in the accession year for around 25 percent of current imports of crude oil and products. A fully functioning downstream market will require the reduction of oil products import tariffs and the phaseout of import and export quotas. As well, all investment restrictions in the wholesale and retail petroleum businesses will have to be removed after a transition period that gives domestic refiners time to adjust and achieve international competitive standing. The recommendations in the "road map" (Table 4.1) provides for a transition to accomplish this already-agreed opening.

The progressive and eventually complete opening of the sector to investors, Chinese or foreign, necessarily raises the issue of the conditions for entry. In many countries, it is established practice for the government or a responsible agency to set out requirements that must be met by entities wishing to take part in certain petroleum activities. The requirements might relate to such matters as business incorporation, under predefined conditions; financial capability; and technical fitness to carry out oil and gas operations. To promote orderly competition, make the best use of natural resources and protect the public interest, it is a legitimate governmental function of the GOC to

determine and implement such requirements, always provided they are not used as a mechanism to limit competition, for example to protect SOEs. The matter of "qualification" or "certification" of participants in oil and gas operations, as a regulatory function, is referred to in Chapter 3 and is elaborated in Annex 4.

Box 2.4: Increased Downstream Efficiency

The following actions (shown in chronological order) are proposed to increase the efficiency in the downstream oil sector:

- Undertake a study of oil and gas products taxation and, to the extent relevant, prices and margins in the oil distribution trade (preparatory year).
- Allow the SDPC to establish maximum prices for oil products to replace the existing system (from the beginning of 2001).
- Allow Chinese and Chinese-foreign JVs to invest and operate in wholesale products markets (beginning in 2001).
- Introduce crude oil and oil product import quotas for nonstate companies (2001).
- Set up a scheme to gradually remove product import quotas and the licensing system (2001).
- Allow qualified Chinese companies and IOCs to operate, on a pilot project basis, in wholesale and retail products markets in two regions (from 2002).
- Remove restrictions (from 2003) on foreign majority participation in retail gasoline and diesel activities, and issue licenses in significant numbers.
- Allow foreign companies to own majority interest in refineries (2003).
- Accelerate and integrate the process of corporatizing municipal enterprises in the wholesale market with a program of listing shares in these enterprises (by 2005).
- Reduce oil product import tariffs, eliminate import and export quotas and the licensing system (2005), and allow investors, both domestic and foreign, to operate in all sectors of the Chinese oil and gas sector (from the end of 2005).

2.5 Increased Downstream Gas Market Penetration

Gas has high value in specialized applications and provides the basis for the new energy conversion technologies of gas turbine co-generation and combined cycle electric generation. It can contribute importantly to meeting the nation's large and growing needs for low-polluting energy forms. In some sectors, gas can be successfully marketed as the environmentally friendly, modern fuel. In North America gas provides nearly 30 percent of primary energy, in all of Europe gas provides about 20 percent, and even in Japan, totally dependent on imports, the proportion is 12 percent.

The GOC's objective is to increase the share of gas in China's energy supply to 6 percent within 10 years. It will mean going from an annual consumption of some 20 Bcm today to around 80 Bcm a decade hence (for comparison, 80 Bcm is the size of Germany's 1999 consumption). The commercialization of such large new gas volumes over a rather short period will be a major challenge. Given the potential to increase the rate of utilization of domestic reserves, to increase those reserves, and to import gas from overseas as LNG and also from Russia by pipeline, the objective appears entirely feasible from a standpoint of adequacy of supply. Indeed, it would be reasonable to think in terms of much exceeding the 6 percent figure in the long term.

To achieve even the 6 percent level, however, will require increased investment in existing production, more gas-oriented E&D, much capital spending on new and enlarged pipelines and distribution systems, and the removal of remaining obstacles to a functioning gas market. The steps that are described below aim at helping create the necessary policy conditions for these things to happen.

The allocation of about one-quarter of natural gas supplies at low "in-Plan" prices distorts price signals to producers and consumers, and it has discouraged new supply and prevented rational and efficient use of gas resources. Since the early 1990s, the GOC has reduced the volumes under the in-Plan and increased the volumes under the out-Plan each year. The allocations should therefore continue to be phased out. As to concerns about adjustment, consideration should be given to the fertilizer plants that benefit from low "in-Plan" gas prices instead receiving direct government monetary subsidies. Such subsidies would have to be financially justifiable in terms of fertilizer industry economics and phased out over five years.

The existing 10 percent negotiating flexibility in "out-Plan" gas prices is a step in the right direction, but market orientation of pricing needs to be further strengthened to allow all out-Plan prices to be freely negotiated. Today, many new projects are negotiated between buyers and sellers and do not fall under the in-Plan and out-Plan categories. Pipelines in the Tu-Ha Region in Western China are examples of such new projects. This will confirm and ensure the market orientation of all new gas development at the same time that prices and volumes in existing developments are being phased into a competitive environment. It will provide a clear signal of the GOC's long-term policy and will give an immediate incentive for gas development. Competition in the gas market and proper market functioning will develop gradually as the number of suppliers and buyers increases.

In the initial stages of competitive market development, it may be necessary for the GOC, directly or through a regulatory agency, to provide guidance on how market principles should be applied in situations where sellers and buyers are not able to agree on prices and other terms. These are necessary conditions for making best use of an *existing* flow of gas to market and to provide correct price signals to gas producers, to ensure economically sound allocation of supplies to markets and to give incentives to gas development.[3]

[3] SDPC regulation of ex-refinery prices of light fuel oil to the fertilizer industry must be similarly phased out for essentially the same reasons.

It is understood that the CNPC had "exclusivity" for wholesale gas transactions, and de facto it still dominates gas trade through ownership of most pipelines. To encourage E&D of natural gas, producers of all kinds—SOEs and PSC contractors—should be allowed to market gas from their discoveries directly to consumers, such as power plants and industries. As well, they should have access to transportation on existing pipelines and be allowed to invest in new gas pipelines.

Current gas pipeline rate design may frequently be a simple flat charge per volume transported. This is an out-of-date approach: it puts too much business risk on the pipeline, probably raises financing costs, and does not give the shipper an incentive to achieve high year-round load factors. More modern rate designs can encourage aggressive gas marketing and should therefore receive careful study.

The foregoing steps constitute a suite of measures to support the GOC's 6 percent gas penetration target for 2010. Achievement of the 6 percent target will require a much more vigorous development than heretofore of domestic resources and probably the import of natural gas, some of which is already planned, as well. The agreement with the United States for China's WTO accession provides for the elimination of the natural gas import tariff from 2002.

The policy and regulatory measures identified will need to be further refined. The planning of major pipeline projects required to achieve an 80 Bcm gas market will have to be identified, at least in conceptual terms. A start has of course been made with the announcement of the West–East Pipeline Project. And careful monitoring will be required of progress toward the 6 percent target, accompanied by a preparedness to examine and introduce further supportive steps if the ones set out here prove insufficient to the challenge.

The urban gas distribution sector has several problems that need to be solved to increase gas penetration. Most important, the gas market planning should be promoted and developed based on the competitiveness of gas vis-à-vis other fuels. Secondly, gas distribution systems should be progressively corporatized and thereby liberated from the control and constraints of the municipal governments that own them. This will enable the distribution business to engage in a more active marketing, arrange its own financing, and address the problem of inadequate distribution margins because of the current pricing of gas. This should release an entrepreneurial spirit to help achieve the government's policy objectives for greater gas penetration in the energy sector.

Analyses of other Options Considered

The alternative to creating the conditions for private enterprises to develop and take part in the major supply projects that China will need is to commission one SOE or a group of SOEs to undertake at least some of the needed projects. Although there is nothing to prevent PetroChina from developing large new supply projects by itself, it should *not* be required to do so as an element of GOC policy for the following reasons:

(a) The announcement of the West East Pipeline Project suggests that it is the GOC's intention that such projects should be undertaken with private sector foreign cooperation.
(b) It would not accord with the principle of "allowing SOE managers to manage."
(c) It would be contrary to the expectations of investors in the PetroChina IPO.
(d) It would likely strain the financial resources of the SOEs and prevent them from undertaking other projects that might, in the judgment of their management, be more profitable.

The alternative to allowing IOCs to market gas directly through access to existing pipelines or investments in new gas pipelines is to retain a strong role for a state entity (which could be a component of the CNPC) to act as a single national buyer and wholesale seller of natural gas. It would be required to treat all suppliers and buyers in a nondiscriminatory manner and to seek to optimize the business by obtaining the best prices for both suppliers and buyers. This is somewhat the former European model exemplified today by Gaz de France. It is *not* recommended for the following reasons:

(a) The competitive market approach will yield superior results for both suppliers and buyers in terms of timing, pricing, and expansion.
(b) Funding of investments would be difficult, which would slow gas development.
(c) This model has been or is being abandoned in the most industrial countries.

Conclusion on Policy Options

This consideration of policy options therefore finds them to be deficient. Therefore, no major alternative course of action is available. Gas penetration must be achieved by fostering the development of competitive markets and encouraging the participation of IOCs in the various gas businesses. Conversely, there is a need to recognize both the limited role for the state in the sector and the fact that the state has other and broader responsibilities in terms, for example, of establishing macroeconomic policy and dealing with national social security issues.

Consideration of Measures to Supplement the Working of Competitive Markets

Although the measures identified, together with enhanced E&D, will create a much more favorable environment for gas penetration than presently exists, no assurance exists that they will be sufficient to secure the targeted gas penetration. Supplemental measures may therefore be required to support the marketing of gas (and may anyway be desirable in their own right because they would help reduce environmental costs). These include the following:

(a) tightening emission controls in respect of all fuels, particularly in urban areas;
(b) taxing the use of high-sulfur fuels, at least in areas where atmospheric pollution is a particular concern;
(c) phasing out the use of coal for commercial and industrial use (except electricity generation) where natural gas service is available;
(d) providing loans and grants toward the capital cost of gas conversion in some public and residential sectors; and

(e) ensuring that other energy policies, for example regarding electricity generation, do not present obstacles for gas penetration.

The rate of gas penetration must be carefully monitored against the target. Government authorities should track the planning and development of gas supply, transportation, distribution, and conversion projects by the enterprises. Actions along the above lines should be carefully studied and, if they are found acceptable, promptly initiated if the rate of project development falls short of what is needed to achieve the 6 percent goal by 2010.

Box 2.5: Increased Downstream Gas Penetration

The following actions are proposed to achieve the goal of increased gas market penetration:

- Study how to further phase out in- and out-Plan prices (2000).
- Phase out the allocation of gas volumes and phase out (2001) the use of in-Plan prices.
- Create and refine the conditions for private enterprises to take part in the development of gas mega-projects (2000 onwards).
- Promote market planning and development based on the competitiveness of gas vis-à-vis other fuels (2001).
- Study, and bring to a state of readiness, supplemental measures to support gas marketing (2001).
- Provide open access to new and existing gas pipelines (2002, see Box 2.2).
    - For new projects, gas prices should be negotiated between buyers and sellers (2001).

CHAPTER 3:

REGULATORY REFORM: PROMOTING TRANSPARENCY, INVESTMENT, AND COMPETITION

3.1 Role of Regulation

Regulation is recognized as an essential function in a modern petroleum economy, and governments dedicate substantial resources to it. For example, the U.S. Minerals Management Service, which regulates all aspects of oil and gas in the federal offshore area, mostly in the Gulf of Mexico, has 1,800 employees. The Alberta Energy and Utilities Board (AEUB), which was established in 1937 as the Oil and Gas Conservation Board of Alberta, employs about 650 people and has an annual budget of some $40 million. As a result of the 1995 merger into the AEUB of the province's Public Utilities Board, which dated from 1915, the AEUB is now responsible for technical and economic regulation of the whole oil and gas (and electricity) industry in Canada's major petroleum-producing province.

The scope of regulation is broad: it covers a whole range of activities from the approval of geological and geophysical exploration programs to the operation of gas distribution networks serving households. Regulation can start with the initiation of projects and extend to their eventual abandonment, facilities removal, and cleanup. It is important to take note of the range, nature, and purpose of oil and gas regulation in making decisions on the structure, staffing, and resourcing of oil and gas regulatory organizations.

Regulations are an essential component of the oil and gas legal framework. Some are issued by the government, and some by the regulator using the authority the government has given it. In either case, the purpose is to provide the necessary detailed interpretation and application of the basic oil and gas law (which is pending in China) to specific industry and sector situations. Both the regulator and the industry are then bound by these regulations. Because they are created by government orders or by orders of the regulator, they may also be changed in a similar way and are therefore less stable than primary laws, but more flexible. Proper drafting and implementation of regulations will guide development of the oil and gas sector and will serve as the basis to promote investment by IOCs.

3.1.1 The Nature of the Regulatory Body

The modernized regulation of China's oil and gas sector would be designed with the approval of its politicians and implemented by a new agency situated within the overall government structure. That regulatory body's activity would be comprehensive in scope (see section 3.1.3), separated from the oil and gas policy function (section 3.2.1) and, insofar as specific decisionmaking is concerned, independent of that function (section 3.2.2 and Box 3.1). Its rules and processes would be publicly known, responding to the principle of transparency (section 3.2.4) and would be grounded in a new legal framework (section 3.2.5). There are options for the structure of the regulatory body (section 3.3.1) and policy issues respecting its functioning need to be addressed (section 3.3.2), although the powers to take discretionary (as opposed to administrative) decisions should be entrusted to a small group of well-qualified commission members who are appointed with security of tenure for staggered terms of, say, three to five years, subject to strict conflict-of-interest guidelines, supported by an expert staff and provided with adequate resources. A senior minister would be the contact point for the regulatory body at the State Council level: he would be knowledgeable about its activities, budget, and the like, and would publicly communicate general policy direction to the agency's head, but would not interfere in its decisionmaking in individual cases.

3.1.2 Need for Regulatory Change

As was noted earlier, significant emphasis is now being placed on the need for a coherent gas policy with accompanying gas regulations. If the ambitious plans for gas are to be realized (meeting a target of 6 percent in the fuel mix by 2010), the need for clear policy decisions and related regulations is urgent. The regulations and their implementation must be soundly based, fair, and transparent. This will help create a level playing field for investors. It will help bring about a market conducive to attaining the government's policy goals, partly by attracting foreign investment, which is a key driver in developing the sector.

Presently no coherent regulatory framework exists for China's oil and gas industry. As a result of this deficiency, there is no clear mechanism for guiding development of the sector. The harm has touched domestic and foreign companies alike and threatens to slow much-needed growth of the sector. By implementing a program of regulatory reform, carried out in tandem with the program of sector structure reform as described in Chapter 2, future development can be promoted.

The case for regulatory reform was briefly reviewed in Chapter 1 in the context of examining the general case for comprehensive reform. The particular case for new-style regulation is presented in the following sections. The essential argument is that regulation carried over from a centrally planned economy cannot serve the needs of a socialist market economy for the following reasons:

(a) Old style regulation is not compatible with the development of market forces. Certain remaining controls—for example, on oil and gas prices, on the flows of these

commodities, and on investments by enterprises—discourage the working of market forces and prevent the managers of enterprises from acting in the best interests of the business owners. Therefore, to bring about sector opening, these controls must be adjusted and eliminated.

(b) Old-style regulation did not pay adequately attention to health, safety, and environmental protection. Existing regulation in the fields of human health, safety, and environmental protection, even where it is adequate, is not comprehensively enforced under the old-style regulatory paradigm. Therefore, a high international standard of technical regulation needs to be introduced and fairly implemented by an independent authority.

(c) There are "gaps" in old style regulation. There are areas where the state has a legitimate role, but which are not covered by old-style regulation. One of them is the oversight of oil and gas-producing operations to prevent waste of the state-owned resources where there is poor reservoir management or unnecessary flaring of gas. Another area is the regulation of pipelines to ensure that they provide access to any qualified parties that wish to have their oil and gas transported.

(d) The institutions for sound regulation are lacking. Since old-style regulation is diffused within government, parts of several ministries and agencies have oil and gas regulatory responsibilities. Conversely, there is no organization where regulation of this sector can be based and no provision for coordination of present regulatory activities affecting the sector.

(e) Old-style regulatory processes are not transparent. Regulatory processes carried over from the era of central planning cannot satisfy the standards required of new-style regulation. For example, they are often not properly separated from the policy function of government; the SOEs may retain a role in them; they lack transparency; and they do not ensure that decisions in individual cases will be free from political interference.

The situation presented by old-style regulation is unacceptable in the long term and must be corrected by a program of regulatory reform if a positive market environment is to be created. Like sector structure reform, this program should be carried out in accordance with the principle of a flexible and pragmatic transition. Regulatory reform is a necessary counterpart of structural reform, supporting and facilitating it. Regulatory reform therefore has to be synchronized with structural reform.

3.1.3 Scope and Depth of New-Style Regulation

New-style regulation answers the question, "What is needed to create a regulatory environment conducive to a competitive, market-based petroleum industry?" New-style regulation means "government control and direction of those activities of business enterprises that are not subject to publicly acceptable disciplining by competitive forces as market opening takes place."

Broadly, four areas of activity requiring regulation are not adequately covered by market forces. These include the following:

1. Technical regulation involving mainly engineering skills and including health, safety, environmental protection, and petroleum reservoir management.

2. Economic regulation of prices, and access and quality of service, typically for natural monopolies, such as pipelines and gas distribution systems.

In addition, two other responsibilities may be placed on the oil and gas regulator:

3. Mineral resources and fiscal includes the administrative functions related to the management of petroleum mineral resources, leasing rights to explore and produce them, the collection of production royalties and similar revenues for the state, and maintenance and provision of appropriate access to the related data inventory.

4. Qualification of participants in oil and gas operations to ensure their technical, financial, and administrative fitness (again, refer to Annex 4).

A comprehensive listing of proposed regulatory activity is set out in Annex 5, and further detail on issues of environmental regulation is presented in Annex 6.

3.2 Regulatory Framework: Principles to Drive Investment

Five principles should be applied in developing a new oil and gas regulatory framework for China:

(a) separation of regulation from policymaking,
(b) independent regulatory decisionmaking,
(c) removal of policy and regulatory responsibilities from SOEs,
(d) transparent regulation, and
(e) a sound legal framework.

After the implementation of a regulatory framework based on these principles, a "new regulatory culture" will emerge and be characterized by even-handed application of regulation to all enterprises and stability and predictability of decisionmaking. This means that all parties affected can expect the same basic regulatory approach to remain in place for a long time, which will assist in business planning, whereas predictability means that regulators, when dealing with similar factual circumstances, will take essentially similar decisions, thereby increasing business confidence.

3.2.1 Separation of Regulation from Policymaking

Historically comprehensive control of an enterprise's activities was a key feature of a centrally planned economy. In this model, the policy and regulatory functions were merged. In the changing conditions of the increasingly dynamic socialist market economy, however, an enterprise's activities are increasingly controlled by the market. Those that are not controlled by the market are subject to independent regulation. The critical policy lever is no longer the approval of specific investments and activities. Instead it is the determination of the broad policy environment in which particular sectors, as well as the economy as a whole, function.

The policy role regarding oil and gas in a socialist market economy relates mainly to the following kinds of issues:

(a) long-term security of supply;
(b) management of domestic resources;
(c) ensuring the fair operation of markets;
(d) creating a favorable environment for foreign investment; and
(e) sector employment and social welfare issues.

In each of these cases, policies and policy principles are defined by government. Their implementation is, to a large extent, carried out by some form of independent regulation. To effectively achieve this, however, the two functions must be organizationally separate. The policymaker cannot make regulatory decisions affecting individual enterprises. The regulator does not have a role in developing broad policies, even though it takes account of them in its own specific decisionmaking.

3.2.2 Independent Regulatory Decisionmaking

Regulatory decisions should be taken only by the regulator, with regard to the broad policy environment, which should otherwise act independently of the policy side of government. In some jurisdictions, however, the policymaker retains veto power over very important decisions of the regulator, such as whether to allow large imports or exports of gas or the construction of major pipelines.

Other features and requirements for independent regulation include the following:

(a) Enterprises should not be able to improperly influence the regulator.
(b) There should be high, mandated standards of regulatory behavior.
(c) There should be security of tenure for the regulator to reduce fear of job loss if decisions taken are unpopular with enterprises or with government.
(d) "Fees-for-service" or levies on industry activity, paid to the regulator to assure it has the necessary human and financial resources to adequately fulfill its responsibilities as opposed to being financed by the government budget.

Independent regulation carried out under these conditions produces several benefits. For the public, it will increase confidence, for instance, that environmental regulation and the control of monopolies is not subject to outside influence. For the

enterprise, it will improve the investment climate by helping create a level playing field for all participants.

Box 3.1 provides a summary of the key principles of independent regulation.

3.2.3 Removal of Policy and Regulatory Responsibilities from SOEs

The commercial playing field will not be level as long as the SOEs have regulatory responsibilities, whether to self-regulate or to regulate competitors, and have a role in policymaking. Policy development is the exclusive preserve of government policymakers. Self-regulation, however conscientiously carried out, holds the potential for abuse. It is unacceptable for SOEs to have any role in regulating competitors. And, again, the managements of SOEs must be freed up to concentrate on commercial activities. The solution is to remove any policymaking or advisory functions from the SOEs and to transfer remaining regulatory functions to a national regulatory body as soon as possible.

3.2.4 Transparent Regulation

"Regulatory transparency" means that the regulated entity and parties who have a legitimate interest in its regulation should know all the rules and processes under which regulation will be carried out. Unless commercial secrets are involved, the facts in any disputed cases should be made public, together with the regulator's decision and the reasons for it.

An example of transparent regulation would be the public filing of an application for a new gas pipeline transmission rate. Any parties who wanted to support or oppose the application would have to do the same. If a hearing were required to examine these filings and hear arguments about them, it too would be public. And the regulator's decision would be taken on the basis of that evidence and those arguments. The reasons for its decision would be published. The regulator will as well report annually to the public on its activities.

Transparency, like independence, is an important factor that will develop confidence on the part of enterprises and other stakeholders that the system is fair. It will as well contribute to the attributes of consistency and stability in decisionmaking that are hallmarks of good regulation.

3.2.5 A Sound Legal Framework

For new-style regulation to succeed, a legal framework is required, compatible with the features of a socialist market economy, and which will establish and reinforce the regulatory system.

Box 3.1: Principles of Independent Regulation

It is important for the regulator to make discretionary decisions, such as on pipeline rates and access terms, solely on the basis of the facts of each case, as presented by the applicant and interested parties. A "discretionary decision" is generally one in which the decisionmaker can choose among alternatives. For example, different rates of return on investment by a pipeline company may determine the prices of the commodity or services related to it. It contrasts with an "administrative decision," which is made on the basis of whether an applicant has complied with a predetermined list of mainly factual criteria or conditions.

Independence in discretionary decisionmaking is important to investors in and users of regulated facilities. It assures them that covert pressures from any quarter will not influence decisions in specific cases, political or commercial. This is an important confidence-building factor in the regulated utility industry. To maintain independence, the regulator should not receive instructions from the policy side of government, and all communications and evidence put before the regulator should be public. The eventual decision should demonstrably be made only on the basis of that public information.

Independence is also secured through the appointment of the regulator for a fixed term (three to seven years) and by meeting the costs of regulation through fees-for-service or levies on industry activity (pipeline throughputs, for example), so that the regulator is not dependent on government budgetary decisions.

An independent regulator may still be subject to influence from government policy. It is considered acceptable, indeed desirable, for the regulator to take note of the government's policy statements, whether they relate to the economy at large or to the regulated sector specifically. Canada provides two examples of this. First, in the early 1980s, during a period of rapid inflation, the government announced that it wanted all its decisionmaking agencies to put government-prescribed ceilings on price increases for all products whose prices were regulated. Those ceilings were taken into account by the energy regulator in pricing decisions. Second, in 1985, the government announced a change in national energy policy that henceforth was to be market-oriented, rather than command-and-control. The energy regulator responded by removing oil controls, allowing gas producers greater access to export markets, and requiring pipelines to grant access to third parties, so that individual sellers and buyers of gas could deal with each other directly.

A properly designed legal framework will give the policymaker proper supervisory powers over the regulator while at the same time giving the regulator independence in dealing with individual cases. It will make broad provisions for transparency of regulatory processes, and it will provide appropriately for appeals from regulatory decisions flowing from those processes. The various levels of government—State Council, the regulator, and provincial authorities—will be suitably equipped with all the legal instruments needed to make modern regulation work.

The legal framework is required to give permanence and certainty to new-style regulation. Conversely, it will make it clear that old-style regulation will not be revived. These are additional factors that will increase the confidence of the public and of investors, which are addressed below.

International Regulatory Best Practices

To provide some perspective on the content and results of modern oil and gas regulation, examples are provided in Annex 5 of international best practices of structural and regulatory reform. They relate to countries that, in the last 10–15 years, have achieved successful and productive sector restructuring involving the introduction of new regulation or, in the case of Canada, the adaptation of existing regulation to new policy objectives.

3.3 Proposals and Objectives for Sector Regulation

The final objective by the end of 2005 is to achieve a fair, comprehensive and permanent oil and gas regulatory structure for both the up- and downstream petroleum industries. This will provide the following:

(a) efficient petroleum mineral resource administration and related fiscal management;
(b) high standards of technical regulation from the standpoints of sound engineering practices and of health, safety, and the environmental protection;
(c) effective economic regulation of monopolies in regard to their rates, services, and capital projects;
(d) monitoring of the operation of markets for competitive behaviors; and
(e) fair qualification of enterprises wishing to take part in sector activities.

Transparent processes should be instituted that provide comprehensive information for all parties affected by regulation and regular reporting to the government and public on regulatory activities and their results. This new regulation will both facilitate and support sector structure change.

3.3.1 Organizational Options

One option is to create separate up- and downstream regulatory commissions ("the regulatory commissions") from the end of 2005. The specific functions of such a structure are listed in Annex 7. Establishing separate commissions is recommended for a number of considerations:

(a) Industry segments are differently organized and will eventually be composed of largely different companies.
(b) Regulation of the downstream has a much larger discretionary component.
(c) Different types of public processes will be required, and those processes are likely to be significantly different up- and downstream.
(d) The technical-regulatory requirements of the segments call for different technical and managerial skill sets.
(e) The government, as owner and lessor of the mineral resources, has a beneficial interest in the way these rights are managed, which is fundamentally different from its interest in regulation of the downstream industry.

A second option would be to have one regulatory commission with two "deputy regulators" dealing with the up- and downstream.

3.3.2 Policy Issues to Be addressed

No matter which option is selected, there are several important broad policy issues that will need to be addressed, for example, the following:

(a) the extent of the commission's (or commissions') jurisdiction, in terms of the areas of activity set out in Annex 2, for example, who should be responsible for administering petroleum mineral rights;
(b) the degree to which the commission(s) should be allowed to exercise discretion in matters of regulatory policy, for example, whether it should be the commission(s) or the policymakers who will decide which consumers will be allowed to choose their own gas suppliers;
(c) the extent to which the commission(s) should be autonomous in regulatory decisionmaking in specific cases, for example, whether they should be allowed to authorize large new investments without any recourse to the policy side of government;
(d) the provisions for the policy side of government to communicate with the commission(s), for example, to convey to the commission(s) generic energy, oil, or gas policy advice without interfering or appearing to interfere in decisionmaking in specific cases;
(e) the arrangements for appeals from decisions of the commission(s), for example, what decisions could be appealed, on what grounds, and to what level, inside and outside the commission(s);
(f) the relationship between the new regulatory commissions and existing agencies that have exercised elements of the responsibilities that are to come under the commission(s); and
(g) the question of delegation of authority to the regional, provincial, or municipal levels, an issue that is important enough to require separate discussion here.

Delegation of Regulation below the National Level

Administrative structures already exist, particularly in respect of aspects of gas industry technical standards and commercial arrangements, at the provincial and municipal levels. On the one hand, these structures and the people who run them are experienced, adapted to local conditions, and familiar with the entities subject to their oversight, such as urban gas distribution systems. On the other hand, this form of administrative control has, broadly described, been unduly responsive to local social and political conditions, resulting in the distribution enterprises' being compelled to operate noncommercially and prevented from properly playing their important role in an expanding national gas industry.

In a number of federal states, such as Australia, Canada, Russia, and the United States, the constitutional division of powers gives the state or provincial governments responsibility for economic activities that are wholly within their boundaries. As a result, in these countries, intrastate oil and gas activities are regulated at that level. This means activities, such as oil and gas well drilling and gas distribution. The federal (national) government's responsibilities relate to such activities as offshore oil and gas and gas transmission systems that cross state boundaries. In most cases, state or provincial regulation is longstanding (see, for example, the reference to the AEUB under section 3.1.1) and is carried out responsibly. Quite apart from the constitutional division of powers aspect, there is much to be said for the local regulation of activities that are purely local in character.

China, however, is not a federal state. Moreover, the indications are that local administrative control of natural gas has not been carried out well, and the local authorities have not been responsive to existing central direction, for example, SDPC's price directives. We, therefore, cannot be optimistic that the changes required by new-style regulation will be readily acknowledged or adopted by existing local administrations. If foreign corporations are going to invest in new gas distribution businesses, a field that is now open to them, they will have more confidence in the stability and fairness of a national regulator than of a provincial or municipal one.

The matter of downward delegation of regulatory authority in China is clearly politically sensitive and administratively complex. It therefore requires further study. However, if delegation takes place, then as a minimum the regional, provincial, or municipal levels should be required by law to observe national standards for regulatory processes and national guidelines in such areas as return on investment. Unless this is done, the country's urban gas distribution systems will not be able to fulfill their important role in fostering penetration of the energy market by natural gas.

Technical Regulation Should Become More Vertical

Today, the administration of technical regulation of all kinds is dispersed among several agencies and the SOEs. In the future, the administration of technical regulation of all kinds will be concentrated rather than, as at present, dispersed among several agencies and the SOEs. It will be carried out objectively, with efficient enforcement, to high international standards. Key aspects include the following:

(a) The State Environmental Protection Administration (SEPA) will continue to set environmental standards on a national level.
(b) Oil and gas regulation will generally be provided through a "single window" national regulator. This means that the regulator normally can approve all phases of an oil and gas project.
(c) Potential conflicts between the single regulatory authority's sector-specific "vertical" regulation standards and generic "horizontal" regulation can be eliminated by careful definition of jurisdictions, by definition of tasks within those jurisdictions and, where appropriate, by giving the oil and gas regulator

the authority to implement the standards set by the "horizontal" regulator.

(d) For example, oil and gas industry sulfur emissions, handling and disposal of dangerous chemicals, and the use of radioactive materials would be regulated, directly or indirectly, by the responsible "horizontal" regulators. Gas flaring, return of produced water to predetermined geological formations, and cleanup of well sites, all of which are activities peculiar to the oil and gas industry, would be handled by the "vertical" regulator.

(e) Even where standards are developed by another agency, efficiency gains can be achieved if the specialized sector regulator is authorized to implement them, thereby maintaining the "single window" concept.

(f) Where appropriate, administration of regulations will be carried out at a regional or provincial level, but always on the basis of national standards for regulatory requirements and processes, including enforcement.

Authority to grant licenses to one agency will increase the effectiveness of the regulatory system. SEPA still has an important role to play. In addition, a "one window" approach provides more efficient regulation than a regulatory structure where responsibilities are dispersed among many agencies

Economic Regulation Should Diminish over Time

Economic regulation of the oil and gas sector will diminish during the transition as many existing controls are removed and prices and flows of oil and gas become regulated by the working of competitive market forces. At the same time, modernized regulation will be introduced in those parts of the sector where regulation is needed as a substitute for competition. This will facilitate and encourage the working of competitive markets for oil and natural gas, particularly the latter, as commodities.

3.4 Transition Period

Tables 3.1 and 3.2 present a short summary of implementation tasks for regulation both during the transition period of 2000–05 and thereafter. There are two major differences between the pre- and postregulatory environment: the change from granting import and export licenses to a monitoring-only approach, and current regulation of oil and gas price tariffs for upstream products will be eliminated by 2005.

Table 3.1: Regulatory Areas during Transition, 2000–05

Activity	*Mineral rights and fiscal*	*Imports and exports*	*Prices and tariffs*	*Service standards*	*Major project approval*	*Technical*
*Upstream**						
Oil	Yes	License	Yes		Yes	Yes
Gas	Yes	License	Yes		Yes	Yes
*Downstream**						
Pipelines			Yes	Access	Yes	Yes
Refineries					Yes	Yes
Distribution						
Gas			Yes	Yes	Franchise	Yes
Oil retail		License	Yes		Local	Yes

Note: Blank cells indicate "not applicable."

Table 3.2: Regulatory Areas after Markets Are Functioning, Post 2005

Activity	*Mineral rights and fiscal*	*Imports and exports*	*Prices and tariffs*	*Service standards*	*Major project approval*	*Technical*
*Upstream**						
Oil	Yes	Monitor	No		Yes	Yes
Gas	Yes	Monitor	No		Yes	Yes
*Downstream**						
Pipelines			Yes	Access	Yes	Yes
Refineries					Yes	Yes
Distribution						
Gas			Yes**	Yes	Franchise	Yes
Oil retail		Monitor	No		Local	Yes

* "Upstream" includes exploration, production, gathering and processing or purification. "Downstream" includes all activities beyond the gas processing plant and beyond the entry point of the trunk crude oil pipeline.
**Distribution tariff, not gas selling prices.
Note: Blank cells indicate "not applicable."

In the following sections, the specific tasks to be completed during the period 2000–05 are presented.

3.4.1 Organization and Relationships in the Transition Period

Decision is needed on the responsibility focus for the implementation of the new sector and regulatory structure. This responsibility area includes confirming and, where necessary, adjusting the implementation agenda, as well as overseeing all studies, recommendations, monitoring, and interim regulatory operations.

The first, vital, organizational step is to authorize an "Reform Bureau", to be given both the responsibility and the authority of a "change champion", taking the senior decision making and oversight functions for both structural and regulatory change in the oil and gas sector. The Director of this Bureau has the responsibility to report to the State Council. To ensure that the Director of this organization takes an unbiased approach to such matters as organizational design and staffing, it would be made clear from the outset that he or she would not occupy a senior position in the future commission(s).

Organizational Structure

It is necessary to create an interim regulatory organization to provide for the coordination, according to new objectives, of existing regulation during the transition (for example, oil products price regulation) and for the implementation of new regulation (for example, provision of open-access pipeline transportation). This organization should probably also be responsible for monitoring and reporting on the progress of regulatory and structural change.

It would not be feasible to immediately create a new permanent regulatory organization. To do so, the legal and administrative task would be large and time-consuming, and the expenditure of time and resources might be at the expense of time devoted to initiating practical regulatory reform.

The preferred approach is to have the "chief interim regulator," with deputies for the up- and downstream, empowered to do this job. The chief interim regulator would, under this concept, be completely in charge of managing regulatory change at all levels. He would be responsible for obtaining the cooperation of departments and agencies in the transition process, and he would report to the Director of the Reform Bureau. Staffing of the interim regulatory organization is clearly a vitally important issue. Whether or not the chief interim regulator idea is pursued, a dedicated, enthusiastic group of people needs to staff the work of regulatory change. This "core team," which might report through deputies for the up- and downstream, would receive immediate training including, for its legal staff, an understanding of current laws and regulations for oil and gas. Initially comprising perhaps 15 professionals, the team would be carefully selected from the cooperating departments and agencies. Periodically its size and training needs would be reviewed and any changes promptly acted upon.

If the concept of interim regulation under a chief interim regulator is adopted, it will be vitally important for it to succeed. A significant failure in this transitional instrument for regulatory reform could prejudice the whole program and jeopardize the

chances of successful implementation of the permanent regulatory commissions. Careful attention will therefore need to be given to ensuring the conditions for success, including particularly the matters of providing proper authority to enable the chief interim regulator to discharge his functions, and adequate resources to do so.

Organizational Relationships

Carefully selected interdepartmental and interagency relationships for the functioning of the interim regulatory organization will have to be in place. Therefore, for each area of regulatory activity, transitional contact ministries and agencies must be identified. The choice of ministries and agencies will have to be designed to cover regulatory activities that will eventually be abandoned, as well as new ones. The recommended permanent regulatory commissions should be authorized, empowered, organized, staffed, and resourced, and be functioning by the end of the transition.

Those components of the SOEs that have been responsible for aspects of technical regulation (the "institutes") will have to be organizationally divided from the SOEs and given an independent status. Ultimately their functions and staff should be transferred to the permanent regulatory commission(s).

Responsibility for Developing the Permanent Regulatory Scheme

Consideration should be given to the question where to focus the task of developing the permanent regulatory scheme. This would involve policy, techniques, legislation, and organization. It could be made a responsibility of the interim regulatory organization (containing a growing body of information and expertise, but also engaged with ongoing regulation), or it could be given to a separate organization, not having ongoing operational responsibilities. Box 3.2 and Table 4.1 summarize the recommendations.

Box 3.2: Summary of Organizational Actions for 2000

Key actions include the following:

- Ministerial and vice ministerial Director of the Reform Bureau should be identified for market structure and regulatory reform.
- A "chief interim regulator," together with deputies for the up- and downstream, should be selected and empowered.
- A multidisciplinary "core ream" should be selected to support the interim regulator, reporting through the two deputies, and should receive immediate training including, for its legal staff, an understanding of current laws and regulations for oil and gas regulation.
- Transitional contact ministries and agencies should be identified for each area of regulatory activity to be carried out in the transition.
    - Appropriate steps should be taken to put in place a process to continuously review, appraise, and report to the policy level on the progress of the transition and experience with interim regulation. (2001)

3.4.2 Required Studies to Prepare for Regulatory Change

A suite of studies needs to be pursued and completed at an early stage in the regulatory transition. They will therefore be carried out in advance of the work on implementation of the permanent regulatory structure. They include the following studies:

1. Recommended changes to existing regulation. This includes aspects of upstream technical operational and environmental regulation by intermediaries ("the institutes") that have been separated from the SOEs.

2. Inventorying and mapping of the existing regulatory structure.

3. Relationship with other organizations. In respect of both the interim and the permanent organizations, studies will have to be undertaken and decisions made in regard to such matters as the following:

(a) positioning within the structure of the GOC;
(b) definition of their relationships with other departments and agencies, including SOEs and organizations presently affiliated with the SOEs (the "institutes");
(c) authority (what they can do and to whom);
(d) internal structure, in a broad sense (detailed organization should be left to the respective managements);
(e) staffing in terms of the numbers and where these staffs will be obtained;
(f) available resources and the means to provide those resources (for example, charging of fees for regulatory services provided, levies on the production of regulated entities such as pipelines); and
(g) appropriate division of regulatory responsibilities between different levels of government (central, provincial, and local).

4. Definition of the regulatory policies for each of the four main areas of regulation. For example, as to mineral resources licensing, should it be a mechanical process or discretionary? In the area of technical regulation, is it to be "prescriptive" or "objectives related?" In regard to economic regulation, should pipeline rates be determined by a "price cap" methodology or by some kind of cost-of-service approach? As to "qualification," how should the principal criteria for taking part in petroleum activities be defined?

5. Identification of the basic regulatory techniques. Corresponding with certain regulatory policy decisions, how-to decisions will be required. For example, if technical regulation is to be prescriptive, how are the relevant standards to be developed and what use should be made of international standards (API, ISO)? If pipeline rates are to be determined by the cost-of-service approach, what data need to be collected and in what form to provide the accounting basis for this kind of regulation? In regard to both

regulatory policies and regulatory techniques, consideration has to be given to mobilizing resources to assist the above decision processes.

6. Design of and processes for legislative implementation. As to legislative design, decisions will be needed on the degree to which regulation should be embodied in laws (that are difficult to change) or regulations (that can be changed more easily, thereby providing "flexibility") and on the regulation-making power that is to be retained by the policymaker compared to the powers to make regulations that are granted to the regulator. Consideration will also need to be given to the extent to which existing legal authorities can be adapted to meet new regulatory needs as compared to the desirability of making a "fresh start" with entirely new legislation.

Once these studies are complete, arrangements will be needed for the legal "tracking" of regulatory reform activities and for legislative drafting instructions stemming from them. The creation and enactment of legislation presents a complex set of tasks that will have to start in the preparatory year with the briefing and familiarization for the legal staff of the interim regulatory organization. By 2005, all the laws, regulations, guidelines, and any other instruments necessary to fully implement the objectives of regulatory reform, including the establishment of the permanent up- and downstream regulatory commissions and including as well legislation to amend or revoke existing statutes, must be drafted and enacted.

3.5 Conclusions on Regulatory Reform

When the regulatory reform tasks have all been accomplished in an integrated manner at the end of the transition period, the GOC and the country's important oil and gas sector will be equipped with a thoroughly modern regulatory regime designed to a high international standard. In fact, to the extent that the regime is established on first principles and built up as an integrated whole, it could be superior to the regimes of some other industrial countries that reflect mutations taking place over many decades. Creation of this regime is both a necessary condition for successful structural reform and a means to support such reform.

In summary, key areas to address include the following:

(a) Elimination of old and inappropriate regulation is critical. Current regulations pertain to a planned economy approach, whereas China is in the midst of a conversion to a socialist market economy.

(b) Recognition of three distinct types of regulation, mineral rights and fiscal, technical, and economic. Each must be addressed individually.

(c) Separation of regulation from policymaking is essential. By doing so, conflicting objectives of government policy and the free hand of market development will be eliminated.

(d) New-style regulation must be independent and transparent. No SOEs should be involved in regulation because of the potential conflict of interest, and transparent decision making must exist so that IOUs fully understand the process and rationale.

(e) A sound legal framework is needed. The legal structure that will support the required regulations and laws must be clear and coherent, and must adhere to international best practices.

CHAPTER 4:

SUMMARY: CHALLENGES AND PHASED IMPLEMENTATION

4.1 Major Challenges

Sector reform and regulation are the principal issues for the oil and gas sector and will be deciding factors in achieving a fully functioning competitive market. Based on the objectives for sector reform and new-style regulation of the oil and gas sector, numerous operational tasks must be completed to achieve those objectives. These tasks present formidable challenges in such areas as government organization, staffing, and the design and development of specific elements of regulation. To accomplish this, the GOC will need to confront major challenges, recognize the need for transition, and implement a logical "road map" for future actions. GOC recognizes that the reform needs to be implemented with WTO agreement in mind, but with due concern for the current sector structure and operations.

The transition from a command-and-control approach to a more market-based approach is a tremendous challenge with many potential pitfalls. Careful planning and a phased implementation, with provision for further studies and for specific decision points along the way, will go far toward reducing the margin for errors. Probably the most difficult challenge to overcome will be the need to change mentalities and behaviors. Business managers used to a government-controlled sector have to adapt to a different set of market dynamics and be inspired by performance and results. Rather than focusing on central planning and control of the economy, government officials will get their job satisfaction from setting general frameworks, from discouraging antimarket behaviors, and encouraging market-based efficiencies, and then from monitoring the results.

All this will put a lot of stress on the whole system. Change will therefore not be accomplished without difficulties, but the potential gains are of great importance for China and far outweigh the risks. Compared to a "business as usual" case, the oil supply balance will be improved, the contribution of gas will be increased, atmospheric pollution will be reduced, new capital and entrepreneurship—bringing with them new technologies—will flow into the sector from China and abroad, high-value new employment will be created, and all classes of consumers will be better served in terms of quality and price. In the light of these favorable prospects, it will be well worthwhile to deal with the challenges and accept the risks posed by the transition.

4.2 Need for Transition and Legal Framework

The introduction of a market-based approach cannot be accomplished overnight. Transition will have to be phased. The creation of new legislation is a key activity for the transition: when approved by the State Council, it can be implemented on a temporary basis during the transition. However, the legal and administrative task is large and time-

consuming and should not delay sector reform and regulatory change. Nevertheless, actions must be initiated on the introduction of laws giving the legal basis for oil and gas activities and regulation in the sector. Such laws are the foundation and basis for the legal framework and will act to secure and complement regulations. The GOC will have to promulgate laws in which the elements of the new policy and regulatory framework are established that include the following goals:

(a) Upstream to establish a modern legal and regulatory framework for the petroleum sector and its regulation, enabling China to attract domestic and foreign investment to develop the hydrocarbon reserves.
(b) Downstream to state the objectives for development of the gas industry and for competition in the transmission, distribution, and sales of gas; which parts of the industry to be subject to continuing regulatory oversight; and the composition, authority, and activity of the agency responsible for the oversight.

This would help create an environment of regulatory stability. The law then would establish the policy framework governing the gas industry.

4.3 Making a Start: Regulation of the Downstream Gas Industry

A start to implementation of new-style regulation needs to be made. An obvious area is downstream gas regulation, focusing first on long-distance gas transmission and second on bringing national standards for rational regulation to urban gas distribution.

Announcement of the West–East Pipeline Project in July 2000 highlighted, for potential investors, the prospect of oil and gas sector development but also the fact that there is presently no specific downstream gas regulation. The gas industry requires a regulatory framework and its absence hinders investment and development in a sector, important parts of which have just been opened up to foreign enterprise.

Considerable preparatory work for modern regulation of downstream gas is now being undertaken by the World Bank, in close consultation with Chinese counterparts. This "Study on the Implementation of the Regulatory Framework for China's Downstream Gas Sector" draws on the Joint Report and relates to such areas as the responsibilities of the regulator, regulatory principles, regulatory techniques, and arrangements for the transition period. Terms of reference (TOR) are under discussion for a second study that would encompass regulatory organization, procedures, and the drafting of a gas law.

This work sets the stage for early establishment of those components of the interim regulatory organization that would be concerned with downstream gas. Consideration should be given to establishing the interim downstream gas regulatory organization as early as 2001. Such a "demonstration project" in modern regulation would clearly signal the government's intention to follow up on the Joint Report. It could properly be linked in part with the West–East project. Operationally it would provide a very specific invterface for the further work being undertaken by the World Bank and the

Chinese Working Group. Also, it should be designed so as not to fragment sector regulation, but rather to pave the way for the creation of the comprehensive downstream oil and gas regulatory organization.

4.4 Implementation and Road Map

The following "road map" (Table 4.1) serves as a guide and summary of key actions that should be taken.

Table 4.1: An Illustrative Five-Year Road Map: Policy, Structure, Regulation, and Legislation

Year	*Policy*	*Structure*	*Regulation*	*Legislation*
2000: preparatory year	Policy statement: Restructure sector. Modernize regulation. Policy directive: Regulatory processes to be consolidated in "one window" approach.	**Oil** Review fiscal, licensing, PSCs, extension of license. Study taxation and pricing, of oil products. Study impact of removing remaining refinery allocations of crude oil and prices for crude oil and retail prices for oil products. Study the phaseout of import quotas and licensing system for crude oil and products. **Gas** Study phaseout of in- and out-Plan pricing. **Oil and Gas** Study pipeline open-access and rate-making.	Study development of detailed TOR for further research on structural and regulatory change (continuing process). Authorize Director of the Reform Bureau for regulatory structure implementation. Create regulatory "road map" of existing processes. Create interim regulatory organization, decisions on: locus, relationships; authority; structure; staffing; training: Identify and empower "chief interim regulator" and a "core team?" Study how to monitor and report on structure and regulatory change and market development.	Legal staff of interim regulatory organization works on comprehensive understanding of all current legal instruments for regulation. Prepares inventory and analysis of current petroleum legislation and regulation.

Year	*Policy*	*Structure*	*Regulation*	*Legislation*
2001: transition starts	Policy decisions issued: • Remove crude oil allocations and import restrictions. • Phase out and unify in- and out-Plan prices for gas. Policy directive: Targets for PSC blocks to be licensed.	**Oil** Chinese E&D companies utilize their right to explore both onshore and offshore. Introduce crude oil and oil product import quotas for nonstate companies. Set up a scheme to gradually remove crude oil and product import quotas and licensing system (completed by 2005). Allow Chinese companies and JVs to invest and operate in wholesale oil products markets. Introduce maximum retail prices for gasoline and diesel. **Gas** Phase out in-Plan gas allocations to extent possible. Extend the system of more market-oriented prices to all new gas projects, and promote market planning and development based on the competitiveness of gas vis-à-vis other fuels. Chinese and PSC companies to sell gas directly to consumers. **Oil and Gas** Increase the pool of exploration blocks available for licensing through a more aggressive land licensing policy: allow the Chinese companies to compete in the upstream industry without any geographical limitation, and promote transfer of exploration blocks to companies with different exploration ideas • To increase the number of exploration license areas available for bidding and award of PSCs and to offer prospective exploration land. • That the terms for extension of exploration licenses be strictly enforced and the cost of holding licenses be increased. • That all new and relinquished exploration blocks be	Regulatory decisions on pipeline rates and access to enable and support oil and gas marketing by PSC partners (to become effective 2002–03). Remove regulatory and policy functions from SOEs, constitute regulatory functions separately for transfer to interim then final regulatory organization, return policy function to GOC. Initiate monitoring and reporting on structure and regulatory changes and market behavior (continuing). Start study and decision making about regulatory policy, involving use of working groups (complete early 2002) Start study and decision making on regulatory techniques pursuant to policy decisions (complete late 2002).	Check whether can use existing legal instruments or need changes; initiate if necessary. Check whether need legislative changes; initiate if necessary. Legal staff tracks legislative implications. Legal staff tracks legal drafting that will be needed.

		available for PSCs, initially through annual competitive rounds.		

Year	*Policy*	*Structure*	*Regulation*	*Legislation*
2002: second transi-tion year	No new policy statements or decisions required. Policy level receives periodic briefings on progress in industry structure and regulatory reform.	**Oil** Any remaining approval of crude oil refinery gate prices eliminated. Chinese and PSC companies sell profit oil directly to customers. Pilot projects for products liberalization begin. **Oil and Gas** Allow foreign investors to own a majority interest in pipelines. Introduce a regulated open-access pipeline regime.	Complete study and decision making on regulatory policy. Complete study and decision making on regulatory techniques (economic; land and fiscal; technical; and health, safety, and environment). Interim regulatory organization continues oversight of transition to competitive products markets, progress of other structural and regulatory change.	Legal staff tracks legal drafting that will be needed; initiates drafting as policy and technical work is completed and approved. Formulation of technical regulations proceeds even while policy-level consideration is being given to its legal setting, for example, a "petroleum law" for China.
2003: third transi-tion year	Issuance of revised and final policies on oil and gas pricing.	**Oil** Remove restrictions on foreign majority participation in retail gasoline and diesel, and allow foreign companies to own majority interest in refineries.	**Consolidation year: no new initiatives** Interim regulatory organization has achieved high degree of cooperation and coordination with contact agencies, interim regulation system is functioning effectively in support of changes in industry structure, successfully overseeing competitive products market transition, providing periodic reports and assessments to policy level. Size and capability of interim regulatory organization staff continuously reviewed and adjusted, training continues, including of staff in contact agencies.	Development of regulations freeing up oil and gas commodity markets. Legal staff continues and completes work on regulations that embody and give effect to decisions on regulatory techniques.

Year	*Policy*	*Structure*	*Regulation*	*Legislation*
2004: formal review year	Policy decision, following formal review, on whether to complete regulatory reform, set up commissions.		Interim regulatory organization completes formal review of regulatory reform program. Responsibility center(s) receives review and forwards to State Council for discussion and decision.	Completion of all regulatory drafting. Positive State Council decision authorizes any necessary work on new laws.
2005: comple-tion year	No further policy decisions required. National People's Congress approval. New lawmaking required.	**Oil** Complete removal of crude oil import quotas and licensing system. Reduce product import tariffs, and eliminate import-export quotas and product licensing system and all economic controls on investment in any oil and gas business sectors—upstream, midstream, and downstream. Accelerate corporatization of municipal enterprises in the wholesale market, and integrate with a program of share listings (by 2005). Introduce bidding for new exploration blocks by Chinese companies.	All regulatory functions and activity concentrated under interim regulatory organization, all staff now co-located (first months). Period of intensive staff training and cooperation in new quarters. Up- and downstream regulatory commissions appointed, organized, and absorb functions.	Legal drafting is continued and completed. The new legal structure is enacted by the National People's Congress and other lawmaking authorities as appropriate.

Annexes

1. List of Experts that Participated in the Work Group Meetings

2. A Comparative Analysis of the Upstream Fiscal Terms for China

3. Market Opening and Security of Oil Supply

4. “Qualification” or “Certification” of Participants in Oil and Gas Operations

5. A Comprehensive Listing of Proposed Regulatory Activity

6. Environmental Regulation

7. International Cases of Structural and Regulatory Reform

Annex 1: List of Experts that Participated in the Work Group Meetings

An Fengquan	Planning Institute, SINOPEC, Senior Engineer
Cai Jingyong	Investment Banking Department, CICC, General Manager
Che Changbo	Prospecting Department Administration of State Land Resources, Division Chief
Chen Fanghong	Planning Department, CNPC, Deputy Division Chief
Chen Zhanjie	Laws and Regulations Department, Administration of State Land Resources, Senior Engineer
Fang Fenglei	CICC, Deputy Executive Officer
Feng Fei	Industry Department Development Research Center, State Council, Deputy Department Chief
Gan Zangchun	Laws and Regulations, Department Administration, State Land Resources, Deputy Chief
He Jia	Laws and Regulations, SAPCI, Deputy Division Chief
He Junxiong	International and National Taxation Department State Taxation Administration, Deputy Division Chief
Huang Taihe	SCRES, Deputy Director
Hu Bingjun	Financial Department, CNPC
He Chang	Offshore Region Management Department, CNOOC, Engineer
Li Jian	Comprehensive Division, Taxation System and Rules Department, MOF
Li Jiaqiang	Research Institute of Economic Technology, SINOPEC, Senior Engineer
Ling Jiang	Laws and Regulations Department, SEPA, Division Chief
Li Runsheng	Laws and Regulations Department, SAPCI, Deputy Chief
Liu Bin	Reserve Department, Administration of Land Resources, Deputy Division Chief
Liu Jingsheng	Investment Banking, CICC, Deputy General Manager
Liu Xianfa	Laws and Regulations Department, SAPCI, Deputy Division Chief
Liu Xiaowei	Investment Baking, CICC, Deputy General Manager
Ma Shenyuan	Planning Department, SAPCI, Deputy Division Chief
Man Rui	Development Research Department, CNPC, Deputy Division Chief
Mu Guangfeng	Supervision and Management Department, SEPA, Deputy Department Chief
Nie Lei	Development Strategic Research Team, SINOPEC, Economist
Niu Yubin	Price Department, SDPC
Peng Jianqin	Information Research Center, CNPC, Professor
Shi Xingchun	Economic and Information Research Center, CNPC, Deputy Director
Su Weixing	Laws and Regulations, Administration of Land Resources, Division Chief
Tang Zhengguo	Reserve Department Administration of Land Resources, Sector Chief
Wang Baocheng	Planning Department, SDPC
Wang Zhonghua	Planning Department, SDPC

Xiang Ze	Price and Taxation Division, Financial Department, CNPC, Division Chief
Xu Dian	International Price Taxation Department, State Taxation Administration, Division Chief
Xiu Tao	Taxation System and Rules Department, MOF, Deputy Division Chief
Yang Dan	Investment Banking, CICC, Manager
Yang Huijie	Financial Department PetroChina Ltd.
Yang Jiwu	Environment Department, CNOOC
Yang Xiaoyi	Safety and Environment Protection Office, CNOOC, Engineer
Yang Rue	Investment Banking, CICC, Assistant Manager
Rao Yishan	Quality, Safety and Environment Department, CNPC Senior Engineer
Yuan Qingdan	Policy Research, Office, SEPA, Sector Chief
Zhan Kun	Safety and Environment Bureau, SINOPEC, Deputy Director
Zhang Xuzhi	Development Strategic Research Team, SINOPEC, Bureau Chief
Zhang Yuqing	Economic Projection Department, SDPC, Deputy Division Chief
Zhao Xiaohui	Consulting Firm, SINOPEC
Zheng Biying	Safety and Environment Protection Office, CNOOC, Division Chief
Zhou Jiangang	Economic and Research Center, CNPC
Zhu Yu	Planning Institute, SINOPEC, President

Annex 2: A Comparative Analysis of the Upstream Fiscal Terms for China

Introduction

1. This report was prepared by Dr. Pedro van Meurs at the request of the World Bank to provide an economic rating of the Chinese upstream petroleum fiscal terms and propose some modifications to these terms as a result of the partial listing of CNOOC and CNPC.[1]

Economic Framework

2. The comparative analysis was based on offshore costs and production data, regardless of whether terms applied to the onshore or the offshore. This was to provide for a common reference and framework on a worldwide basis. The analysis was for oil only and compared 284 upstream petroleum terms. Other factors, such as geological, political and regulatory differences between the countries and jurisdictions were not included.

Costs and Production: Offshore Fields

Water Depth

3. Fields were assumed to be in less than 200 meters of water.

Field Sizes

4. Three oil field sizes were used for the economic analysis, as follows:

- 300 million barrels (bbl)
- 150 million barrels
- 75 million barrels

Number of Producing Wells

5. Crucial to the economics of the project was the number of wells that would be required for oil production. It was assumed that the oil fields would have the following number of wells:

- 300 million barrels: 10 wells
- 150 million barrels: 12 wells
- 75 million barrels: 14 wells

6. The number of wells increases as the fields become smaller. This is normally not the case. Normally larger fields have a large number of wells. However, by inverting the range, a wider diversity of possible production and cost structures can be evaluated. This means that the scenarios range from rather poor small fields to rather prolific large fields and provide a good comparison of economic results and fiscal systems.

[1] The analyses was done before the partial listing of Sinopec.

Maximum Production Levels and Field Life

7. It was assumed that the fields would be produced over a short life, with relatively high maximum production levels. Today, this is the most common way of producing oil. The following table shows the maximum production levels and field lives that are used:

Field size (barrels of oil)	*Maximum production (bopd)*	*Field life (years)*
300 million	100,000	15
150 million	55,000	12
75 million	35,000	10

Offshore Economic Framework

Costs

8. The cost assumptions used in the analysis are shown in Box 1:

Box 1: Cost Assumptions

Geophysical costs. Geophysical costs were estimated at $5 million during the first year of the cash flow.

Exploration well costs. It was assumed that the exploration well would cost $25 million on the basis of a floating drilling platform in shallow waters.

Delineation well costs. It was assumed that one delineation well would be required for the small fields, two wells would be required for the medium-sized fields, and three wells for the large fields. The costs were assumed to be $20 million per well.

Platforms and facilities. The platform and facilities costs were estimated in a general manner because it was not possible to consider specific designs or layouts of the field. The total platform and facilities costs for the six fields in less than 200 meters of water were estimated as follows:

- 300 million barrels: $440 million
- 150 million barrels: $320 million
- 75 million barrels: $200 million

Investments were typically assumed to take place over a two-year period.

Platform wells. Platform wells were assumed to cost $10 million.

Operating costs. The fixed operating costs were assumed to be $8 million per year for the small fields, $11 million per year for the medium-sized fields, and $14 million per year for the large fields.

The variable costs were assumed to be the following:

- For the small fields: $4 per barrel
- For the medium-sized fields: $3.50 per barrel
- For the large fields: $3 per barrel

Overall Cost Analysis

9. The total costs were summarized on a per-barrel basis in the following table to make them comparable to other international data.

Field size (barrels of oil)	*Capital costs per bbl ($/bbl)*	*Operating costs per bbl ($/bbl)*	*Total costs per bbl ($/bbl)*
300 million	2.11	3.70	5.81
150 million	3.42	4.38	7.80
75 million	5.24	5.07	10.31

bbl = barrel.

Prices

10. The future oil price is subject to considerable uncertainty. The price was assumed to be $21 per barrel.

11. The oil prices apply to prices at the delivery point of the production platform into a tanker.

Escalation

12. All investment and operating costs, as well as oil prices, were escalated at 3 percent per year.

Timing

13. For all cases it was assumed that the exploration phase would take two years and would include a seismic program and the first exploration well. Subsequently, a two-year delineation and appraisal phase followed with the drilling of delineation wells and follow-up seismic surveys. Then, a two-year construction phase would start, with development drilling and production to start in the second year of this period (the sixth year of the cash flow). Finally, additional drilling and increases in production follow until maximum production has been reached.

Financing

14. All fields were analyzed before financing because companies would typically analyze exploration projects this way. After a commercial discovery has been declared, however, financing of development would be possible.

Total Cash Flows

15. In summary, the economic results of the various cases in constant U.S. dollars are the following:

Cases *Field size (barrels)*	*Gross revenues ($ million)*	*Capital costs ($ million)*	*Operating costs ($ million)*	*Divisible income ($ million)*	*Rate of return (%)*	*NPV at 10% ($ million)*
300 million	6,300	633	1,110	4,557	50.2	1,499
150 million	3,150	513	657	1,980	42.0	694
75 million	1,575	393	380	802	30.8	266
Project	614	122	126	367	27.3	111

NPV = net present value.

16. The table shows a wide variation between the fields in terms of gross revenues received and capital and operating costs. The "divisible income" is the difference between the revenues and the costs. It is called divisible income because this is the income that will be divided between the government and the company.

17. "Project" refers to the economics of the exploration project, taking into account geological risk. The geological risk was estimated as follows:

- Probability of a dry hole: 80 percent
- Probability of a small discovery: 7 percent
- Probability of an average discovery: 10 percent
- Probability of a large discovery: 3 percent

18. Based on the revenues, costs, and risks assumed above, the prospects for the Project are rather profitable before any government take of a 27 percent rate of return.

Stand-Alone and Incremental Analyses
19. Two types of analysis can be carried out:

- Stand-alone analysis
- Incremental analysis

20. "Stand-alone" analysis means the analysis of a project on the assumption that it is the first and only project that an investor is carrying out in a particular country and in a particular contract area. This has important implications for the calculation of corporate income taxes and other fiscal instruments.

21. "Incremental analysis" means the analysis of a project on the assumption that there is already an "ongoing" operation. For instance, an oil field is already producing and there is already taxable income. In this case, the investment in a new exploration well results directly in a tax deduction or results in the immediate recovery in the form of additional cost oil. In other words the "net cost" of the investment is less than the total costs.

22. The rating is based on stand-alone analysis.

Yardsticks for Profitability and Risk Analysis
23. For simplicity a single yardstick for comparison was used—the rate of return for the individual cases and risked rate of return for the project.

24. *Rate of Return (ROR).* This is the cash flow rate of return. The rate of return is on total capital. The rate of return indicates the profitability of the investment.

25. *Risked Rate of Return*. The project is the rate of return of the weighted average cash flow.

Economic Rating

Fiscal Systems Used

26. In total, 284 fiscal systems around the world were used for comparison with the Chinese terms. Three sets of Chinese terms were used:

- Offshore terms
- Onshore regular terms
- Onshore frontier terms

27. In addition, an alternative for the offshore terms was also rated. In total, therefore, the rating in table 1 includes 285 fiscal systems.

28. Onshore terms for the continental United States and Canada were not included in the analysis, because these terms apply to rather different economic situations of usually very low cost operations. However, the offshore U.S. and Canadian terms were included.

Chinese Fiscal Terms

29. The Chinese terms applied in the analysis are summarized in this section.

China Offshore Terms

Bonuses	Signature bonus: $0.25 million; $0.50 million upon selection of development area.
Rentals and Fees	None (paid by CNOOC).
VAT and Royalties	5 percent VAT. Royalties: Sliding scale: 0 percent up to 1 million t/yr, 4 percent up to 1.5 million t/yr, 6 percent up to 2 million t/yr, 8 percent up to 3 million t/yr, 10 percent up to 4 million t/yr, and 12.5 percent over 4 million t/yr.
Cost Oil	Cost oil limit 62.5 percent of gross production. Royalty under cost oil limit is deducted first. Operational costs next, exploration and development costs last. Deemed interest of 9 percent for development costs.
Income Tax	Income tax 30 percent plus 3 percent local tax for a total rate of 33 percent. Exploration costs expensed. Development and facilities depreciated over 6 years straight line.
Profit Oil	Eight-step sliding scale: government share of profit oil from 8 percent to 75 percent (assumed).
Participation	CNOOC has option to participate for 51 percent in each commercial discovery.
Profit Share	None.
Other	Tax consolidation (not applicable for stand-alone analyses).
Legal Framework of Fiscal Terms:	
Negotiability	Profit oil split negotiable.
Stability	All terms fixed in contract, except corporate income tax.

China Onshore—Regular terms	
Bonuses	Signature bonus of $1 million, not recoverable.
Rentals and Fees	None.
VAT	5 percent VAT.
Royalties	Sliding scale: 0 percent up to 0.5 million t/yr, 2 percent for 0.5 to 1.0 million t/yr, 4 percent for 1.0 to 1.5 million t/yr, 6 percent for 1.5 to 2 million t/yr, 8 percent for 2 to 3 million t/yr, 10 percent for 3 to 4 million t/yr, and 12.5 percent over 4 million t/yr.
Income Tax	Income tax 30 percent plus 3 percent local tax for a total rate of 33 percent. Exploration costs expensed. Development and facilities depreciated over 6 years straight line.
Cost Oil	Cost oil limit 60 percent of gross production.[2] Exploration costs recovered first. Operational costs next and development costs last. Deemed interest of 9 percent. Royalty deducted separately from the remaining 40 percent.
Profit Oil	Eight-step sliding scale: Government share of profit oil from 5 percent to 60 percent (assumed).
Participation	Petrochina has the option to participate for 51 percent in each commercial discovery.
Profit share	None.
Legal Framework of Fiscal Terms:	
Negotiability	Profit oil split negotiable.
Stability	All terms fixed in contract, except corporate income tax.

[2] Assumption used for calculations. Contracts without maximum cost oil limit may exist.

China Onshore Terms for Qinhai Province,
Tibet and Xinjiang Uigur Autonomous Regions

Assumed Fiscal Terms:	Onshore Second Round, February 1994, with 1995 Royalty Incentives; See WPA95-I, p. 522; PW96, p. 106, VMA info.
Bonuses	Signature bonus of $1 million, not recoverable.
VAT	5 percent VAT.
Rentals and Fees	None.
Royalties	Sliding scale: 0 percent up to 1 million t/yr, 4 percent for 1 to 1.5 million t/yr, 6 percent for 1.5 to 2 million t/yr, 8 percent for 2 to 3 million t/yr, 10 percent for 3 to 4 million t/yr, and 12.5 percent over 4 million t/yr.
Income Tax	Income tax 30 percent plus 3 percent local tax for a total rate of 33 percent. Exploration costs expensed. Development and facilities depreciated over 6 years straight line.
Cost Oil	Cost oil limit 60 percent of gross production. Exploration costs recovered first. Operational costs next and development costs last. Deemed interest of 9 percent. Royalty deducted separately from the remaining 40 percent.
Profit Oil	Eight-step sliding scale: Government share of profit oil from 5 percent to 60 percent (assumed).
Participation	State option to participate for 51 percent in each commercial discovery.
Profit share	None.
Legal Framework of Fiscal Terms:	
Negotiability	Profit oil split negotiable.
Stability	All terms fixed in contract, except corporate income tax.

30. The profit oil sliding scales for offshore and onshore are biddable items. The assumed scale is not based on any specific contract:

Profit splits (bopd)	*Offshore (%)*	*Onshore (%)*
Up to 10,000	8	5
10,000–20,000	10	8
20,000–40,000	12	12
40,000–60,000	20	25
60,000–100,000	27	30
100,000–150,000	40	40
150,000–200,000	65	50
Over 200,000	75	60

31. The rating of the Chinese system, shown in the next section, depends to a considerable decree on the profit oil splits that are being assumed. The scales assumed in this comparative analysis are relatively attractive and do not necessarily reflect the average terms that were concluded so far.

Results of the Worldwide Rating

32. Table 1 in the attachment provide for the worldwide rating of the Chinese offshore terms, onshore regular terms, and onshore frontier terms.

33. The worldwide rating of the offshore fiscal terms is shown in the following table:

75 million bbl	*150 million bbl*	*300 million bbl*	*Project*
Ranking:			
111—Onshore fontier	112—Onshore front	115—Offshore	141—Onshore front
122—Onshore regular	115—Offshore	116—Onshore front	146—Offshore
123—Offshore	116—Regular	123—Regular	149—Regular

It can be seen how the Offshore field rates slightly below the onshore fields for the small fields and slightly above the onshore fields for the large field. This is because of the profit oil sliding scale.

34. The fields rate approximately the same on a worldwide basis regardless of the field size. This is because of the generally neutral nature of the fiscal terms. The overall level among 285 fiscal systems is relatively favorable for the three “no-risk” field sizes. In all cases, the fiscal systems rate somewhat better than the average of 142.

35. The Project, however, rates around the worldwide average.

36. The relatively poorer rating of the Project is entirely because of the 51 percent

carried interest. This carried interest harms the exploration economics considerably because 51 percent of the cash flow is earned by CNOOC/Petrochina after a discovery.

37. This means that in general, the overall structure of the Chinese model contracts permit, in principle, achievement of fiscal terms that are average on a worldwide basis, depending on the sliding scale that is offered during the bids. However, the structure also is inherently unfavorable from an exploration point of view.

Possible New Contract

Listing of State-Owned Enterprises

38. The successful initial public offering (IPO) for PetroChina listing 10 percent of CNPC's shares in core domestic assets and the prospects for listings of CNOOC and Sinopec create no specific problems with respect to the existing production sharing contracts (PSC).

39. From the prospectuses of the three major Chinese companies it is understood that IOCs can only undertake offshore E&D activities in China through a PSC with these companies. In the reorganization in preparation for the listing of public shares, the three major Chinese companies' commercial rights in all existing and future PSCs were transferred to the Listed companies. The Listed companies, however, do not have the capacity to enter into PSCs directly with foreign enterprises under existing Chinese law. Accordingly, the parent companies will continue to enter into PSCs, but after signing a contract, they will immediately assign to the Listed companies all their commercial and operational rights.

40. The parent companies will retain all its administrative functions—including organization of international bidding, award, and assignment of PSCs—receive any signature bonuses, approve any extensions of the period for the completion of appraisal work, and submit plans and reports to the government. The Listed companies, however, will receive the rights, benefits, and obligations regarding the implementation of PSCs. It is understood that the Listed companies carry the cost, receive the profit oil and gas, and retain the right to take up to a 51 percent participating interest in the development of any oil and gas field after the PSC partner has undertaken the exploration costs. The public share offering of PetroChina included a similar reorganization of CNPC with regard to PSCs.

41. As part of the listing, the government will receive full value for the carried interest of CNOOC and the profit oil.

42. As an example, Canada went through a similar process with the privatization of PetroCanada. PetroCanada also owned carried interests in the frontier areas, such as in the Hibernia field as a result of previous legislation. With the privatization, this carried interest was maintained, and it flowed to the private investor. In Canada, however, PetroCanada was treated as any other oil company once the privatization process had started.

43. In China, the issuance of new blocks raises an issue, since the prospectus indicates that the listed CNOOC will continue to receive the carried interest on new blocks and profit oil. A severe conflict of interest could be the result of the practice of giving partially listed companies a carried interest and profit oil from new blocks that are being negotiated by the government-owned parent company.

Possible New PSC

44. The carried interest option is widely used in many countries in the first phase of petroleum development to transfer technology and management skills to national or state companies. However, it poses a special issue because it harms the exploration economics considerably, since the investor carries the exploration costs and only receives 49 percent of the revenues. The following example shows how much profit oil shares can be increased if the carried interest option is substituted by a profit oil share in future bidding rounds. It would considerably enhance the interest in exploration because the removal of the carried interest improves the exploration economics.

45. The following table shows the new profit oil splits that were used in calculating an illustrative example of changed terms:

Profit splits (bopd)	*Offshore-old (%)*	*Offshore-new (%)*
Up to 10,000	8	30
10,000–20,000	10	35
20,000–40,000	12	40
40,000–60,000	20	45
60,000–100,000	27	50
100,000–150,000	40	55
150,000–200,000	65	75
Over 200,000	75	85

46. These new splits, together with the removal of the carried interest, create a more progressive fiscal system that is much more attractive to explorers, as can be seen from the resulting new rating. The new rating is as follows:

75 million bbl	*150 million bbl*	*300 million bbl*	*Project*
Ranking:			
107—New PSC	112—Onshore frontier	115—Offshore	108—New PSC
111—Onshore frontier	115—Offshore	116—Onshore frontier	141—Onshore frontier
122—Onshore regular	116—Onshore regular	123—Onshore regular	146—Offshore
123—Offshore	119—New PSC	133—New PSC	149—Onshoreregular

47. It can be seen how the new PSC would be more attractive for the small fields, but tougher for the larger fields because the fiscal system is now more progressive. At the same time, the Project now rates considerably better than before, making the exploration much more attractive.

Conclusion

48. The comparative analyses of China's offshore terms for petroleum show that their attractiveness is about average compared with a worldwide rating of around 280 fiscal systems. The government has recently taken initiatives to improve the attractiveness of the fiscal terms for investors. Local procurement of goods and services, for instance, will allow additional income tax deductions to foreign investors. This will mainly affect the development of oil and gas onshore. The government is also considering further changes to improve the fiscal terms.

49. However, more fundamental changes in the fiscal and contractual system for petroleum E&D may be required to ensure its competitiveness. A question is whether the PSC structure is sustainable in the long term, in particular if larger shares of the companies are being offered to private shareholders. The transfer of the state's right to profit oil and of the carried interest option for future contracts to a partly private company will result in part of the economic rent being transferred to private parties.

50. Further work in the area of fiscal systems and their legal and contractual framework would be required. This work should include options for increasing the competitiveness of the Chinese fiscal system for petroleum, analysis of options for petroleum contracts with foreign investors as a supplement to PSCs, and how to improve the transparency and timing of the bid award process.

Table 1: Worldwide Rating of Fiscal Regimes

75 million barrels			*150 million barrels*			*300 million barrels*			*Project*		
Rank	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*
1	No Gov. Take Spreadsheet	0.347	1	No Gov. Take Spreadsheet	0.463	1	No Gov. Take Spreadsheet	0.547	1	No Gov. Take Spreadsheet	0.312
2	Svalbard	0.301	2	Svalbard	0.416	2	Svalbard	0.501	2	Svalbard	0.28
3	Ireland-off-frt	0.292	3	Arg-T del Fuego	0.405	3	Arg-T del Fuego	0.491	3	Arg-T del Fuego	0.272
4	Ireland-off-dp	0.292	4	Palau	0.403	4	Palau	0.489	4	Palau	0.272
5	Ireland-off-sh	0.291	5	Ireland-off-frt	0.397	5	Ireland-off-frt	0.479	5	Ireland-off-frt	0.264
6	Lebanon-on	0.291	6	Ireland-off-dp	0.397	6	Ireland-off-dp	0.479	6	Ireland-off-dp	0.264
7	Arg-T del Fuego	0.291	7	Ireland-off-sh	0.397	7	Ireland-off-sh	0.479	7	Ireland-off-sh	0.264
8	Palau	0.289	8	Lebanon-on	0.388	8	Lebanon-on	0.465	8	Lebanon-on	0.26
9	St Pierre&Miq	0.274	9	St Pierre&Miq	0.378	9	Bahamas	0.46	9	Bahamas	0.252
10	Bahamas	0.264	10	Bahamas	0.376	10	St Pierre&Miq	0.459	10	St Pierre&Miq	0.247
11	UK-off	0.264	11	Kaz-OOC	0.367	11	UK-off	0.447	11	UK-off	0.241
12	Kaz-OOC	0.261	12	UK-off	0.366	12	Kaz-OOC	0.435	12	Kaz-OOC	0.241
13	Nicaragua	0.258	13	Nicaragua	0.356	13	Port-off-dp	0.434	13	Nicaragua	0.234
14	Port-off-dp	0.255	14	Port-off-dp	0.356	14	Nicaragua	0.434	14	Port-off-dp	0.232
15	OCS-GOM>800m	0.254	15	Chad	0.354	15	Moldova	0.43	15	Mongolia	0.232
16	Chad	0.253	16	Mongolia	0.352	16	Chad	0.429	16	Moldova	0.229
17	Bioko-off-sh	0.251	17	Paraguay	0.348	17	Paraguay	0.429	17	Chad	0.228
18	Israel-off	0.249	18	Israel-off	0.348	18	Israel-off	0.427	18	Cyprus	0.226
19	Israel-on	0.249	19	Israel-on	0.348	19	Israel-on	0.427	19	Sweden	0.226
20	Sweden	0.247	20	OCS-GOM>800m	0.345	20	Cyprus	0.425	20	Paraguay	0.225
21	OCS-GOM<800m	0.247	21	Sweden	0.344	21	Sweden	0.424	21	Puerto Rico	0.225
22	Paraguay	0.247	22	Puerto Rico	0.343	22	Puerto Rico	0.423	22	Uruguay	0.224
23	Puerto Rico	0.245	23	Cyprus	0.342	23	Uruguay	0.421	23	Israel-off	0.223
24	Mongolia	0.245	24	Moldova	0.341	24	Mongolia	0.419	24	Israel-on	0.223
25	Denm-gen-4thR	0.243	25	Uruguay	0.339	25	UK-N Ireland	0.419	25	UK-N Ireland	0.223
26	Greece	0.241	26	UK-N Ireland	0.338	26	Falkland Isl	0.416	26	Falkland Isl	0.221
27	Cyprus	0.238	27	Bioko-off-sh	0.337	27	OCS-GOM>800m	0.415	27	Austria-new	0.218
28	Uruguay	0.237	28	Greece	0.337	28	Greenland	0.414	28	Germany-off	0.217
29	UK-N Ireland	0.236	29	Falkland Isl	0.336	29	Croatia	0.413	29	Greece	0.216
30	Falkland Isl	0.234	30	OCS-GOM<800m	0.335	30	Austria-new	0.409	30	Italy-off	0.213

Contd..

75 million barrels			*150 million barrels*			*300 million barrels*			*Project*		
Rank	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*
31	Greenland	0.234	31	Greenland	0.333	31	Greece	0.409	31	Port-on	0.213
32	Port-off-sh	0.234	32	Croatia	0.33	32	OCS-GOM<800m	0.407	32	Port-off-sh	0.212
33	Port-on	0.233	33	Austria-new	0.328	33	Germany-off	0.407	33	Bioko-off-sh	0.212
34	Pak-on-Zone1	0.231	34	Port-on	0.328	34	Italy-off	0.406	34	Argentina-gen	0.212
35	Qatar-restated	0.231	35	Port-off-sh	0.328	35	Port-on	0.405	35	Greenland	0.211
36	Austria-new	0.23	36	Kaz-Oryx	0.326	36	Port-off-sh	0.403	36	Poland-on-gen	0.211
37	Kaz-Oryx	0.23	37	Germany-off	0.326	37	Poland-on-gen	0.403	37	Pak-on-Zone1	0.21
38	Madagascar	0.229	38	Italy-off	0.325	38	France	0.403	38	Jamaica	0.209
39	Moldova	0.227	39	Pak-on-Zone1	0.324	39	Argentina-gen	0.403	39	Kaz-Oryx	0.208
40	Guyana-off	0.227	40	Poland-on-gen	0.323	40	Belize	0.402	40	OCS-GOM>800m	0.208
41	Nova Scotia-off	0.226	41	Belize	0.321	41	Pak-on-Zone1	0.402	41	France	0.208
42	Italy-off	0.226	42	France	0.321	42	Jamaica	0.401	42	Belize	0.208
43	Germany-off	0.226	43	Madagascar	0.32	43	Fiji	0.394	43	Madagascar	0.207
44	Poland-on-gen	0.225	44	Argentina-gen	0.319	44	Kaz-Oryx	0.393	44	Fiji	0.207
45	Peru-off-Z-29	0.224	45	Jamaica	0.319	45	Peru-off-Z-29	0.392	45	Pak-off-dp	0.205
46	Belize	0.223	46	Guyana-off	0.317	46	Hungary	0.391	46	Peru-off-Z-29	0.205
47	Pak-off-dp	0.222	47	Pak-off-dp	0.317	47	Pak-on-Zone2	0.39	47	Hungary	0.203
48	Pak-on-Zone2	0.222	48	Peru-off-Z-29	0.316	48	Switzerland	0.39	48	Dominican Rep	0.203
49	France	0.22	49	Nova Scotia-off	0.314	49	Madagascar	0.39	49	Guyana-off	0.203
50	Newf-off-gen	0.22	50	Pak-on-Zone2	0.314	50	Bioko-off-sh	0.389	50	OCS-GOM<800m	0.202
51	Jamaica	0.219	51	Dominican Rep	0.312	51	New Zealand	0.389	51	Costa Rica	0.201
52	Eritrea-min	0.219	52	Fiji	0.312	52	Costa Rica	0.389	52	Switzerland	0.201
53	Argentina-gen	0.218	53	Hungary	0.312	53	Mauritius	0.388	53	Mauritius	0.201
54	Croatia	0.218	54	Eritrea-min	0.31	54	Pak-off-dp	0.387	54	Nova Scotia-off	0.201
55	Pak-off-sh	0.217	55	Pak-off-sh	0.309	55	Eritrea-min	0.387	55	Eritrea-min	0.2
56	South Africa	0.217	56	Barbados	0.309	56	Nova Scotia-off	0.386	56	Barbados	0.2
57	Barbados	0.216	57	Switzerland	0.309	57	Barbados	0.386	57	Pak-on-Zone2	0.199
58	Austr-off-gen	0.216	58	China-Taiwan	0.307	58	Dominican Rep	0.385	58	China-Taiwan	0.198
59	Timor Gap-ZOCB	0.216	59	OCS-GOM<400m	0.307	59	Niger	0.385	59	Pak-off-sh	0.198
60	OCS-GOM<400m	0.215	60	Mauritius	0.305	60	OCS-GOM<400m	0.382	60	Schleswig Holst	0.196
61	Dominican Rep	0.215	61	Niger	0.304	61	China-Taiwan	0.381	61	Haiti	0.196
62	Hungary	0.214	62	Costa Rica	0.303	62	Guyana-off	0.38	62	C Afr Rep	0.193
63	Senegal	0.214	63	Pak-on-Zone3	0.303	63	Pak-on-Zone3	0.379	63	Czech Rep	0.192
64	Fiji	0.213	64	Senegal	0.302	64	Haiti	0.378	64	Lower Saxony	0.192

75 million barrels			*150 million barrels*			*300 million barrels*			*Project*		
Rank	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*
65	Pak-on-Zone3	0.212	65	C Afr Rep	0.3	65	C Afr Rep	0.377	65	Niger	0.192
66	New Zealand	0.21	66	Qatar-restated	0.3	66	Schleswig Holst	0.375	66	Maldives	0.191
67	Canada-NWTerr	0.209	67	Haiti	0.3	67	Pak-off-sh	0.375	67	Philipp-off-dp	0.19
68	China-Taiwan	0.209	68	Denm-gen-4thR	0.298	68	Senegal	0.374	68	Ecuador-min	0.19
69	Philipp-off-dp	0.209	69	South Africa	0.297	69	Czech Rep	0.374	69	Pak-on-Zone3	0.188
70	Switzerland	0.207	70	Philipp-off-dp	0.297	70	Maldives	0.371	70	Senegal	0.188
71	Zambia	0.207	71	Schleswig Holst	0.296	71	Philipp-off-dp	0.37	71	Croatia	0.188
72	C Afr Rep	0.207	72	Tanz-Rukwa	0.295	72	Lower Saxony	0.369	72	Qatar-restated	0.185
73	Nig-off>1000m	0.206	73	Nig-off>1000m	0.294	73	OCS-GOM<200m	0.368	73	Turkey	0.185
74	Mauritius	0.205	74	Austr-off-gen	0.294	74	Nig-off>1000m	0.368	74	Japan	0.185
75	Tanz-Rukwa	0.205	75	Timor Gap-ZOCB	0.294	75	Lithuania	0.366	75	Denm-gen-4thR	0.185
76	Tanz-mdl	0.205	76	Zambia	0.293	76	Zambia	0.364	76	Tanz-Rukwa	0.185
77	Newfoundland-on	0.204	77	Newf-off-gen	0.292	77	Viet-off-dp	0.362	77	Austr-off-gen	0.183
78	Tanz-Texaco	0.204	78	Ecuador-min	0.291	78	Japan	0.362	78	Timor Gap-ZOCB	0.183
79	Uganda-mdl	0.204	79	Czech Rep	0.291	79	South Africa	0.361	79	OCS-GOM<400m	0.183
80	Schleswig Holst	0.2	80	Maldives	0.29	80	Turkey	0.36	80	Nig-off>1000m	0.183
81	Costa Rica	0.2	81	Lower Saxony	0.29	81	Ecuador-min	0.36	81	New Zealand	0.182
82	Guat-97r-15	0.198	82	OCS-GOM<200m	0.289	82	Timor Gap-ZOCB	0.36	82	Zambia	0.181
83	Niger	0.198	83	Viet-off-dp	0.286	83	Austr-off-gen	0.36	83	Lithuania	0.181
84	Namibia	0.196	84	Tanz-mdl	0.286	84	Nig-off<1000m	0.356	84	Viet-off-dp	0.18
85	New S Wales	0.195	85	Turkey	0.285	85	Viet-off-sh	0.354	85	Philipp-off-sh	0.18
86	SaoTome&Princ	0.195	86	Newfoundland-on	0.285	86	Newfoundland-on	0.354	86	Newf-off-gen	0.18
87	Ecuador-min	0.195	87	Japan	0.284	87	Peru-on-mdl	0.352	87	Newfoundland-on	0.178
88	Lower Saxony	0.194	88	Nig-off<1000m	0.282	88	Newf-off-gen	0.352	88	Tanz-mdl	0.177
89	Nig-off<1000m	0.194	89	Lithuania	0.281	89	Mali	0.352	89	Peru-on-mdl	0.176
90	Viet-off-dp	0.194	90	Tunisia-frt	0.28	90	Tunisia-frt	0.352	90	Slovakia	0.175
91	Turkey	0.193	91	SaoTome&Princ	0.28	91	Philipp-off-sh	0.352	91	Viet-off-sh	0.175
92	Japan	0.193	92	Viet-off-sh	0.279	92	SaoTome&Princ	0.351	92	Nig-off<1000m	0.174
93	Maldives	0.192	93	Tanz-Texaco	0.279	93	Slovakia	0.35	93	Tunisia-frt	0.174
94	OCS-GOM<200m	0.192	94	Tunisia-gen	0.278	94	Ras Al-Khaimah	0.35	94	OCS-GOM<200m	0.173
95	Kenya	0.192	95	Guat-97r-15	0.278	95	Tunisia-gen	0.349	95	Guat-97r-15	0.173
96	Haiti	0.192	96	Kenya	0.278	96	Tanz-Rukwa	0.347	96	Cote dIv-off-dp	0.173
97	Tunisia-frt	0.191	97	Canada-NWTerr	0.278	97	Sierra Leone	0.344	97	SaoTome&Princ	0.173
98	Tunisia-gen	0.191	98	Peru-on-mdl	0.277	98	Nig-off<800m	0.343	98	Tunisia-gen	0.172

75 million barrels			*150 million barrels*			*300 million barrels*			*Project*		
Rank	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*
99	Czech Rep	0.191	99	Philipp-off-sh	0.276	99	Italy-on	0.342	99	South Africa	0.17
100	Peru-on-mdl	0.19	100	Mali	0.274	100	Korea-South	0.342	100	Kenya	0.169
101	Newf-Hibernia	0.189	101	Namibia	0.272	101	Peru-on-Camisea	0.339	101	Neth Antilles	0.169
102	India-psc-nocar	0.189	102	Cote dIv-off-dp	0.27	102	Denm-gen-4thR	0.338	102	Mali	0.169
103	Philipp-off-sh	0.188	103	Nig-off<800m	0.269	103	Togo	0.335	103	Bangladesh	0.168
104	Somalia	0.188	104	Togo	0.269	104	Qatar-restated	0.335	104	Sierra Leone	0.168
105	Togo	0.187	105	Malay-off-dp	0.269	105	Tanz-mdl	0.335	105	Tanz-Texaco	0.168
106	Viet-off-sh	0.187	106	Ras Al-Khaimah	0.268	106	Algeria-min	0.335	106	Italy-on	0.167
107	**China-NewPSC**	**0.186**	107	India-psc-nocar	0.268	107	Kenya	0.334	107	Peru-on-Camisea	0.167
108	Rus-KomiRep-psc	0.185	108	Slovakia	0.268	108	Alb-oil sands	0.334	**108**	**China-NewPSC**	**0.167**
109	Nig-off<800m	0.182	109	Peru-on-Camisea	0.267	109	India-psc-nocar	0.332	109	Togo	0.166
110	Nova Scotia-off	0.182	110	Bangladesh	0.266	110	Guat-97r-15	0.332	110	Nig-off<800m	0.165
111	**China-Ons-Frontier**	0.182	111	Sierra Leone	0.265	111	Bangladesh	0.331	111	Namibia	0.165
112	S Australia	0.181	112	**China-Onsh-Frontier**	0.265	112	Nig-off<500m	0.33	112	Canada-NWTerr	0.164
113	Austr-N-Terr	0.181	113	Neth Antilles	0.264	113	Cote dIv-off-dp	0.329	113	New S Wales	0.162
114	Queensland	0.181	114	Italy-on	0.263	114	Namibia	0.329	114	India-psc-nocar	0.161
115	Victoria	0.181	**115**	**China-off**	**0.263**	**115**	**China-off**	**0.328**	115	Gambia	0.16
116	Albania-on-93r	0.181	116	**China-Ons-Reg**	0.262	116	**China - Onsh- Front**	0.328	116	Tonga	0.16
117	Mali	0.181	117	Nova Scotia-off	0.261	117	Kaz-Elf-Temir	0.327	117	Korea-North	0.16
118	Bangladesh	0.18	118	Korea-North	0.26	118	Tonga	0.327	118	Malay-off-dp	0.159
119	Malay-off-dp	0.18	**119**	**China-NewPSC**	**0.258**	119	Panama	0.327	119	Nova Scotia-off	0.158
120	Peru-on-Camisea	0.18	120	New S Wales	0.258	120	Suriname	0.326	120	Suriname	0.157
121	Lithuania	0.18	121	Korea-South	0.257	121	Tanz-Texaco	0.326	121	Nig-off<500m	0.156
122	**China-Ons Reg**	0.179	122	New Zealand	0.257	122	Albania-off-new	0.326	122	Albania-off-new	0.153
123	**China-off**	**0.178**	123	Nig-off<500m	0.256	123	**China-Onsh-Gen**	0.325	123	Albania-on-93r	0.153
124	Neth Antilles	0.177	124	Albania-on-93r	0.255	124	Nova Scotia-off	0.325	124	Kaz-Elf-Temir	0.152
125	Alb-oil sands	0.176	125	Algeria-min	0.255	125	Malay-off-dp	0.325	125	Jordan	0.151
126	Korea-North	0.176	126	Morocco-off-dp	0.255	126	Gambia	0.324	126	Cambodia-on-gen	0.151
127	Morocco-off-dp	0.176	127	Albania-off-new	0.254	127	Morocco-off-dp	0.323	127	S Australia	0.15
128	Cote dIv-off-dp	0.176	128	Gambia	0.254	128	Neth Antilles	0.323	128	Austr-N-Terr	0.15
129	Morocco-off-sh	0.175	129	Morocco-off-sh	0.252	129	Albania-on-93r	0.322	129	Queensland	0.15
130	Cambodia-on-gen	0.174	130	Uganda-mdl	0.251	130	Korea-North	0.319	130	Victoria	0.15
131	Sierra Leone	0.174	131	Cambodia-on-gen	0.251	131	Morocco-off-sh	0.319	131	Burundi	0.149
132	Italy-on	0.173	132	Burundi	0.25	132	New S Wales	0.316	132	Panama	0.148
133	Gambia	0.172	133	Kaz-Elf-Temir	0.249	**133**	**China-NewPSC**	**0.314**	133	Alb-oil sands	0.148
134	Tasmania	0.171	134	Tonga	0.248	134	Nig-off<200m	0.314	134	Zaire	0.147

75 million barrels			*150 million barrels*			*300 million barrels*			*Project*		
Rank	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*
135	Liberia	0.17	135	India-psc-carry	0.247	135	Zaire	0.313	135	Eg-Med-BG	0.146
136	Albania-off-new	0.17	136	Somalia	0.246	136	JDA	0.313	136	Somalia	0.146
137	Ras Al-Khaimah	0.17	137	Suriname	0.246	137	India-psc-carry	0.312	137	Ras Al-Khaimah	0.146
138	Slovakia	0.17	138	Jordan	0.243	138	Turkmenistan	0.31	138	Ecuador-Triton	0.145
139	W Australia	0.169	139	Newf-Hibernia	0.242	139	Burundi	0.31	139	JDA	0.145
140	Nig-off<500m	0.169	140	S Australia	0.242	140	Jordan	0.309	140	Nig-off<200m	0.144
141	India-psc-carry	0.168	141	Austr-N-Terr	0.242	141	Ecuador-Triton	0.309	141	**China-Ons-Front**	0.143
142	Burundi	0.165	142	Queensland	0.242	142	Ukraine-96r	0.306	142	Tasmania	0.142
143	Cambodia-Prem	0.161	143	Victoria	0.242	143	Guinea	0.306	143	Lebanon-off	0.142
144	Algeria-min	0.161	144	Zaire	0.241	144	Cambodia-on-gen	0.302	144	Ukraine-96r	0.142
145	Thai-off-dp	0.16	145	Turkmenistan	0.241	145	Sicily	0.302	145	Guinea	0.141
146	PNG-gen	0.16	146	JDA	0.24	146	Congo-Kitina	0.301	**146**	**China-off**	**0.141**
147	Ukraine-96r	0.16	147	Nig-off<200m	0.24	147	Eg-Med-BG	0.3	147	W Australia	0.141
148	Ethiopia	0.159	148	Panama	0.239	148	S Australia	0.3	148	Turkmenistan	0.14
149	Korea-South	0.158	149	Ukraine-96r	0.239	149	Austr-N-Terr	0.3	149	**China-Onsh-Gen**	0.139
150	Tonga	0.158	150	Eg-Med-BG	0.236	150	Queensland	0.3	150	Uganda-mdl	0.139
151	Nepal-Shell	0.157	151	Ethiopia	0.235	151	Victoria	0.3	151	Ethiopia	0.139
152	Turkmenistan	0.157	152	Liberia	0.234	152	Kyrgyzstan-psc	0.299	152	Sicily	0.138
153	Bolivia-new-ntr	0.155	153	Cambodia-Prem	0.233	153	Ukraine-Krymg	0.299	153	Cambodia-Prem	0.138
154	Bolivia-new-trd	0.155	154	Lebanon-off	0.232	154	Bolivia-new-ntr	0.297	154	Bolivia-new-ntr	0.138
155	Dubai	0.155	155	Tasmania	0.231	155	Bolivia-new-trd	0.297	155	Bolivia-new-trd	0.138
156	Yem-Nimir	0.154	156	Guinea	0.23	156	T&T-on-gen	0.296	156	Korea-South	0.138
157	Nig-off<200m	0.153	157	Congo-Kitina	0.23	157	Brunei-off>10ml	0.295	157	Newf-Hibernia	0.138
158	Suriname	0.153	158	Bolivia-new-ntr	0.23	158	Somalia	0.294	158	Morocco-off-dp	0.138
159	Ghana	0.153	159	Bolivia-new-trd	0.23	159	Ajman-Scimitar	0.293	159	Algeria-min	0.137
160	Jordan	0.152	160	W Australia	0.229	160	Uzbekistan	0.293	160	Kyrgyzstan-psc	0.137
161	JDA	0.152	161	Rus-KomiRep-psc	0.228	161	Ethiopia	0.29	161	Ukraine-Krymg	0.136
162	Cayman Isl	0.151	162	Nepal-mdl	0.228	162	Romania	0.289	162	Nepal-mdl	0.136
163	Nepal-mdl	0.149	163	Ecuador-Triton	0.226	163	Bulgaria-off-dp	0.288	163	T&T-on-gen	0.136
164	Lebanon-off	0.148	164	Guat-97r-30	0.224	164	Brunei-off<10ml	0.288	164	Morocco-off-sh	0.135
165	Eg-Med-BG	0.147	165	Nepal-Shell	0.224	165	Tasmania	0.288	165	Congo-Kitina	0.135
166	Congo-gen	0.146	166	Ukraine-Krymg	0.224	166	Canada-NWTerr	0.288	166	Uzbekistan	0.134
167	Uzbekistan	0.145	167	Ghana	0.224	167	Lebanon-off	0.287	167	Ghana	0.134
168	T&T-off-sh-psc	0.145	168	Alb-oil sands	0.224	168	Br Virgin isl	0.287	168	Guat-97r-30	0.134
169	Zaire	0.144	169	Cayman Isl	0.223	169	Nepal-mdl	0.287	169	Rus-KomiRep-psc	0.132
170	Congo-Kitina	0.144	170	Sicily	0.222	170	Fujairah	0.286	170	Ajman-Scimitar	0.132

75 million barrels			*150 million barrels*			*300 million barrels*			*Project*		
Rank	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*
171	Guat-97r-30	0.143	171	Mozambique	0.222	171	W Australia	0.286	171	Nepal-Shell	0.132
172	Mozambique	0.143	172	Uzbekistan	0.222	172	Cambodia-Prem	0.285	172	Mozambique	0.132
173	Kaz-Elf-Temir	0.142	173	Brunei-off>10ml	0.22	173	Laos	0.285	173	Benin	0.131
174	Ukraine-Krymg	0.14	174	Ajman-Scimitar	0.22	174	Benin	0.284	174	India-psc-carry	0.13
175	Benin	0.138	175	Kyrgyzstan-psc	0.22	175	Ghana	0.283	175	Thai-off-dp	0.129
176	Seychelles	0.138	176	T&T-on-gen	0.219	176	Col-trd	0.282	176	Laos	0.128
177	Ajman-Scimitar	0.137	177	Thai-off-dp	0.216	177	Liberia	0.281	177	Chile	0.128
178	Netherlands-95	0.136	178	Bulgaria-off-dp	0.216	178	Uganda-mdl	0.279	178	Bulgaria-off-dp	0.126
179	Guinea	0.135	179	Benin	0.215	179	Brunei-ons	0.279	179	Liberia	0.126
180	Sudan-new	0.135	180	PNG-gen	0.214	180	Seychelles	0.279	180	Seychelles	0.124
181	Indon-PreT-frt	0.135	181	Yem-Nimir	0.214	181	Guat-97r-30	0.278	181	Timor Gap-ZOCA	0.123
182	Indon-eor-frt	0.135	182	Brunei-off<10ml	0.213	182	Cayman Isl	0.278	182	Congo-gen	0.123
183	T&T-on-gen	0.134	183	Congo-gen	0.212	183	Chile	0.278	183	Dubai	0.123
184	Brunei-off>10ml	0.134	184	Br Virgin isl	0.21	184	Mozambique	0.276	184	Cameroon-Other	0.117
185	Panama	0.133	185	Fujairah	0.21	185	Cameroon-Other	0.276	185	Cayman Isl	0.116
186	Sicily	0.133	186	Seychelles	0.21	186	Dubai	0.275	186	T&T-off-sh-psc	0.116
187	Libya	0.132	187	Timor Gap-ZOCA	0.209	187	Rus-KomiRep-psc	0.274	187	Indon-eor-frt	0.114
188	Timor Gap-ZOCA	0.132	188	Laos	0.208	188	Rus-on-Elf	0.273	188	PNG-gen	0.114
189	Bulgaria-off-dp	0.131	189	Cameroon-Other	0.206	189	PNG-gen	0.272	189	Eg-Med-Teikoku	0.113
190	Ecuador-Triton	0.131	190	Chile	0.206	190	Timor Gap-ZOCA	0.271	190	Indon-PreT-frt	0.112
191	Thai-off-sh	0.128	191	T&T-off-sh-psc	0.206	191	Nepal-Shell	0.269	191	Guinea Bissao	0.11
192	Netherlands-old	0.127	192	Netherlands-95	0.205	192	Netherlands-95	0.267	192	Netherlands-95	0.107
193	Brunei-off<10ml	0.127	193	Dubai	0.204	193	Indon-eor-frt	0.266	193	Sudan-old	0.107
194	Sudan-old	0.126	194	Brunei-ons	0.204	194	Bolivia-gen-old	0.265	194	Bioko-old	0.105
195	Cameroon-Other	0.126	195	Indon-eor-frt	0.203	195	Rus-gen-jv	0.264	195	Viet-psc-Oxy	0.104
196	Indon-off>1500m	0.125	196	Romania	0.203	196	Rus-gen-jv-1997	0.261	196	Brunei-off>10ml	0.103
197	Br Virgin isl	0.124	197	Indon-PreT-frt	0.201	197	T&T-off-sh-psc	0.259	197	Romania	0.103
198	Fujairah	0.123	198	Libya	0.201	198	Umm Al-Qaiwan	0.259	198	Libya	0.102
199	Azerbaijan-AIOC	0.121	199	Col-trd	0.2	199	Yem-Nimir	0.258	199	Col-trd	0.102
200	Chile	0.121	200	Rus-on-Elf	0.197	200	Azerbaijan-AdPt	0.258	200	Fujairah	0.102
201	Brunei-ons	0.118	201	Sudan-old	0.196	201	Newf-Hibernia	0.258	201	Congo-Nkossa	0.101
202	Indon-PreTert	0.117	202	Netherlands-old	0.195	202	Indon-PreT-frt	0.258	202	Bolivia-gen-old	0.101
203	Guinea Bissao	0.117	203	Eg-Med-Teikoku	0.194	203	Guinea Bissao	0.257	203	Indon-off>1500m	0.1
204	Azerbaijan-AdPt	0.117	204	Guinea Bissao	0.193	204	Congo-gen	0.256	204	Thai-off-sh	0.099
205	Col-mdl-95	0.117	205	Azerbaijan-AIOC	0.192	205	Netherlands-old	0.255	205	Br Virgin isl	0.098
206	Eg-Med-Teikoku	0.115	206	Myanmar-on-Amoc	0.191	206	Thai-off-dp	0.254	206	Congo-PNGF	0.098

75 million barrels			*150 million barrels*			*300 million barrels*			*Project*		
Rank	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*
207	Thai-on-Khorat	0.112	207	Sudan-new	0.188	207	India-Enron	0.253	207	Sudan-new	0.098
208	Abu Dhabi-Nom	0.112	208	India-Enron	0.187	208	Congo-Nkossa	0.252	208	Myanmar-on-Amoc	0.098
209	Azerbaijan-Rfac	0.109	209	Azerbaijan-AdPt	0.187	209	Bioko-old	0.251	209	Cote dIv-off-sh	0.098
210	Nor-Barents Sea	0.108	210	Indon-off>1500m	0.186	210	Cameroon-RdR	0.249	210	Cameroon-RdR	0.098
211	Nor-North Sea	0.108	211	Congo-Nkossa	0.186	211	Viet-psc-Oxy	0.249	211	Brunei-off<10ml	0.098
212	India-Enron	0.107	212	Viet-psc-Oxy	0.185	212	Eg-Med-Teikoku	0.247	212	Nor-Barents Sea	0.097
213	Col-trd	0.106	213	Azerbaijan-Rfac	0.185	213	Myanmar-on-Amoc	0.247	213	Nor-North Sea	0.097
214	Congo-Nkossa	0.106	214	Umm Al-Qaiwan	0.183	214	Azerbaijan-Rfac	0.246	214	Yem-Nimir	0.097
215	Cameroon-RdR	0.106	215	Rus-Sakhalin2	0.182	215	Azerbaijan-AIOC	0.246	215	Oman-psc	0.097
216	Oman-psc	0.105	216	Cameroon-RdR	0.181	216	Congo-PNGF	0.242	216	Rus-on-Elf	0.094
217	Kyrgyzstan-psc	0.104	217	Bioko-old	0.18	217	Nor-Barents Sea	0.241	217	Netherlands-old	0.094
218	Cote dIv-off-sh	0.102	218	Rus-gen-jv	0.179	218	Nor-North Sea	0.241	218	Indon-PreTert	0.094
219	Romania	0.099	219	Indon-PreTert	0.178	219	T&T-off-gen	0.241	219	T&T-off-gen	0.093
220	Umm Al-Qaiwan	0.099	220	Nor-Barents Sea	0.176	220	Indon-off>1500m	0.238	220	Eg-GOS-Apache	0.091
221	Rus-Sakhalin2	0.096	221	Nor-North Sea	0.176	221	Libya	0.238	221	Brunei-ons	0.091
222	Thai-on-C	0.096	222	Thai-off-sh	0.176	222	Sudan-old	0.235	222	Rus-Sakhalin2	0.09
223	Rus-on-Elf	0.093	223	Rus-gen-jv-1997	0.175	223	Yem-BP	0.235	223	Eg-on-Teikoku	0.088
224	Laos	0.093	224	Oman-psc	0.173	224	Oman-psc	0.234	224	Thai-on-Khorat	0.088
225	Rus-gen-jv	0.093	225	Congo-PNGF	0.172	225	Abu Dhabi-Nom	0.234	225	Georgia	0.087
226	Georgia	0.092	226	Cote dIv-off-sh	0.171	226	Viet-psc-Lasmo	0.231	226	Yem-BP	0.085
227	Viet-psc-Oxy	0.091	227	Col-mdl-95	0.17	227	Indon-PreTert	0.23	227	Rus-gen-jv-1997	0.083
228	Gab-off-sh-psc	0.091	228	Eg-GOS-Apache	0.165	228	Rus-Sakhalin2	0.23	228	Rus-gen-jv	0.083
229	Yem-Revised	0.089	229	Viet-psc-Lasmo	0.164	229	Col-mdl-95	0.226	229	Indon-marg-frt	0.082
230	Indon-marg-frt	0.088	230	Abu Dhabi-Nom	0.164	230	Yem-Revised	0.224	230	Eg-GOS-Repsol	0.082
231	Congo-PNGF	0.088	231	Yem-Revised	0.164	231	Thai-off-sh	0.222	231	India-Enron	0.081
232	Indon-94-inc	0.088	232	Bolivia-gen-old	0.162	232	Indon-94-inc	0.222	232	Eg-Med-Amoco	0.081
233	Eg-GOS-Apache	0.087	233	Eg-on-Teikoku	0.162	233	Indon-marg-frt	0.222	233	Indon-94-inc	0.081
234	Eg-on-Teikoku	0.086	234	T&T-off-gen	0.161	234	Sudan-new	0.221	234	Viet-psc-Lasmo	0.08
235	Rus-gen-jv-1997	0.084	235	Myanmar-on-mdl	0.161	235	Georgia	0.22	235	Eg-on-Shell	0.079
236	Ven-Paria E	0.082	236	Thai-on-Khorat	0.16	236	Eg-GOS-Apache	0.22	236	Eg-on-Mobil	0.079
237	Angola-off-mdl	0.081	237	Gab-off-sh-psc	0.156	237	Myanmar-on-mdl	0.219	237	Umm Al-Qaiwan	0.078
238	Thai-Gulf	0.08	238	Indon-94-inc	0.156	238	Honduras	0.216	238	Gab-off-sh-psc	0.077
239	Myanmar-on-Amoc	0.08	239	Indon-marg-frt	0.155	239	El Salvador	0.215	239	Thai-on-C	0.077
240	Nig-Inland	0.079	240	Georgia	0.155	240	Nig-Inland	0.215	240	Azerbaijan-AdPt	0.076
241	T&T-off-gen	0.078	241	Myanmar-on-Yuk	0.155	241	Eg-on-Teikoku	0.215	241	Myanmar-on-mdl	0.076
242	Eg-GOS-Repsol	0.077	242	Eg-Med-Amoco	0.154	242	Eg-on-Mobil	0.213	242	Myanmar-on-Yuk	0.076

75 million barrels			*150 million barrels*			*300 million barrels*			*Project*		
Rank	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*
243	Eg-Med-Amoco	0.077	243	Yem-BP	0.153	243	Albania-off-old	0.213	243	Eg-on-IEOC	0.075
244	Bioko-old	0.077	244	Eg-GOS-Repsol	0.152	244	Myanmar-on-Yuk	0.213	244	Nig-Inland	0.075
245	Rus-gen-psc	0.074	245	Eg-on-Mobil	0.151	245	Eg-on-Shell	0.212	245	Albania-off-old	0.075
246	Albania-off-old	0.072	246	Eg-on-Shell	0.151	246	Cote dIv-off-sh	0.211	246	Col-mdl-95	0.073
247	Bahrain	0.071	247	Nig-Inland	0.148	247	Thai-on-Khorat	0.21	247	Yem-Revised	0.07
248	Eg-on-IEOC	0.07	248	Albania-off-old	0.146	248	Eg-Med-Amoco	0.207	248	Honduras	0.07
249	Eg-on-Shell	0.07	249	Thai-on-C	0.146	249	Eg-GOS-Repsol	0.205	249	Eg-on-Marathon	0.068
250	Indon-marg	0.063	250	Eg-on-IEOC	0.143	250	Yugosl-Serbia	0.205	250	Thai-Gulf	0.067
251	Nig-Niger Delta	0.059	251	Thai-Gulf	0.135	251	Eg-on-Marathon	0.205	251	Ven-Paria E	0.064
252	Aruba	0.058	252	Rus-gen-psc	0.135	252	Gab-off-sh-psc	0.201	252	Abu Dhabi-Nom	0.064
253	Viet-psc-Lasmo	0.057	253	Honduras	0.131	253	Thai-on-C	0.201	253	El Salvador	0.062
254	Myanmar-on-mdl	0.052	254	Eg-on-Marathon	0.13	254	Kaz-Tengiz	0.199	254	Bahrain	0.061
255	Sharjah	0.046	255	Bahrain	0.128	255	Eg-on-IEOC	0.198	255	Indon-marg	0.057
256	Eg-on-Mobil	0.046	256	Indon-marg	0.125	256	Yem-Exxon	0.196	256	Nig-Niger Delta	0.052
257	Ven-Delta C	0.045	257	Yugosl-Serbia	0.121	257	Thai-Gulf	0.195	257	Yem-Exxon	0.049
258	Myanmar-on-Yuk	0.043	258	Nig-Niger Delta	0.12	258	Peru-on-BL-52	0.192	258	Peru-on-BL-52	0.049
259	Malay-off-sh	0.042	259	Ven-Paria E	0.119	259	Rus-gen-psc	0.19	259	Kaz-Tengiz	0.047
260	Honduras	0.04	260	Sharjah	0.113	260	Indon-marg	0.188	260	Rus-gen-psc	0.041
261	Bolivia-gen-old	0.039	261	El Salvador	0.111	261	Bahrain	0.187	261	Aruba	0.041
262	Indon-conv	0.038	262	Yem-Exxon	0.109	262	Nig-Niger Delta	0.183	262	Yugosl-Serbia	0.04
263	Ven-Guanare	0.035	263	Kaz-Tengiz	0.107	263	Sharjah	0.179	263	Azerbaijan-Rfac	0.039
264	Yem-BP	0.031	264	Aruba	0.106	264	Yem-Crescent	0.164	264	Ven-Delta C	0.037
265	Yugosl-Serbia	0.025	265	Angola-off-mdl	0.103	265	Algeria-psc-gen	0.163	265	Azerbaijan-AIOC	0.036
266	Neutr Zone-on	0.024	266	Peru-on-BL-52	0.103	266	Ven-Paria E	0.155	266	Algeria-psc-gen	0.034
267	Algeria-psc	0.023	267	Algeria-psc-gen	0.097	267	Indon-conv	0.151	267	Indon-conv	0.031
268	Ven-Paria W	0.023	268	Indon-conv	0.092	268	Qatar-mdl	0.149	268	Ven-Guanare	0.031
269	Algeria-psc-gen	0.016	269	Ven-Delta C	0.083	269	Aruba	0.149	269	Angola-off-mdl	0.03
270	Neutr Zone-off	0.012	270	Algeria-psc	0.083	270	Algeria-psc	0.142	270	Qatar-mdl	0.027
271	Eg-on-Marathon	0.01	271	Qatar-mdl	0.081	271	Neutr Zone-on	0.141	271	Algeria-psc	0.027
272	Peru-on-BL-52	0.01	272	Neutr Zone-on	0.078	272	Yem-Norsk Hydro	0.138	272	Yem-Crescent	0.024
273	Kaz-Tengiz	0.006	273	Viet-psc-BHP	0.075	273	Viet-psc-BHP	0.137	273	Neutr Zone-on	0.022
274	Yem-Oxy	0	274	Ven-Guanare	0.074	274	Angola-off-mdl	0.126	274	Sharjah	0.009
275	El Salvador	0	275	Malay-off-sh	0.074	275	Syria-psc-mdl	0.123	275	Malay-off-sh	0.007
276	Qatar-mdl	0	276	Yem-Crescent	0.069	276	Ven-Delta C	0.123	276	Ven-Paria W	0.006
277	Viet-psc-BHP	0	277	Ven-Paria W	0.064	277	Malay-off-sh	0.12	277	Ven-La Ceiba	0
278	Yem-Crescent	0	278	Neutr Zone-off	0.06	278	Neutr Zone-off	0.119	278	Iran	0

75 million barrels			*150 million barrels*			*300 million barrels*			*Project*	
Rank	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*	*Rank*	*Name*	*ROR*
279	Yem-Norsk Hydro	0	279	Ven-La Ceiba	0.034	279	Ven-Guanare	0.118	279	Ven-Gpiche	0
280	Ven-La Ceiba	0	280	Ven-Gpiche	0.033	280	Yem-Oxy	0.118	280	Yem-Oxy	0
281	Syria-psc-mdl	0	281	Yem-Norsk Hydro	0.027	281	Ven-Paria W	0.109	281	Neutr Zone-off	0
282	Iran	0	282	Syria-psc-mdl	0.018	282	Syria-Unocal	0.096	282	Syria-psc-mdl	0
283	Ven-Gpiche	0	283	Iran	0.007	283	Ven-La Ceiba	0.083	283	Syria-Unocal	0
284	Syria-Unocal	0	284	Yem-Oxy	0.004	284	Ven-Gpiche	0.082	284	Viet-psc-BHP	0
285	Yem-Exxon	0	285	Syria-Unocal	0	285	Iran	0.079	285	Yem-Norsk Hydro	0

Annex 3: Market Opening and Security of Oil Supply

The government has policy concerns about the adequacy of oil storage to meet civilian and national security needs in situations where some regions of the country may become more import-dependent, for example, if market forces dictate that more Chinese crude oil should be exported and more of the refiners' requirements be met by imports. National security needs for oil products must be dealt with as part of defense and energy policies, which is something outside the scope of the present report. Concerns about security of the civilian oil supply will have to be better understood before specific prescriptions can be put forward. However, as an aid to perspective on the government's concerns and possible means dealing with them, we offer the following observations.

Global security of oil supply is seen as having greatly improved in the past 20 years, as a result of such factors as the greater geographical dispersion of sources of supply, the presence of the International Energy Agency (IEA) and the existence of the U.S. Strategic Petroleum Reserve (SPR). This improvement was demonstrated during the Iraq-Kuwait crisis in 1990–91: oil supplies were adequately maintained and prices remained at acceptable levels, despite the loss of about 4 million barrels a day of exports, a volume deficit that would have caused severe difficulties for the world economy had it taken place in the 1970s. The existence of the IEA and the SPR arguably benefits all users of imported oil, not just the IEA countries.

The progressive liberalization of China's oil imports and exports is likely to increase its dependence on gross imports (the absolute volume of imports). On the other hand, net imports (imports minus exports) are more likely to increase less than they would under a "business as usual" case. Nevertheless it is understandable that prospectively larger gross imports would raise policy concerns in China, just as they have done in other countries. At the same time, those concerns have to be seen in the context of the Chinese economy where the share of oil in the energy mix and the share of imports in that component will remain much less than that of Europe or the United States (both about 40 percent oil, more than half of which is imported).

As a generalization, the current dominant policy thinking among the industrial countries is that security of energy supply is best assured by having a varied mix of energy sources, in which the oil component is fed from a diversity of sources by a mix of suppliers competing vigorously against each other and where there are no restrictions, for example, in terms of access to foreign currency, on the suppliers' ability to make full use of international sources of supply. This is consistent with the proposals for the reform of sector's structure and with the view expressed in this report that the best way to improve China's oil supply is to increase E&D, partly by greater IOC participation.

The International Energy Program (IEP) was signed by 16 countries in 1974 and the IEA was formed. The IEA currently has 24 member countries. The countries participating in the IEP agreement have committed themselves to maintaining emergency oil reserves

equivalent to at least 90 days of net oil imports, having ready a program of oil demand restraint, and participating in oil allocation through IEP emergency measures. Net exporting countries do not have stockholding obligations under IEP with the exception of member countries of the European Union. The countries have different types of stockholding systems: 14 countries have only company stocks (compulsory and commercial stocks), 2 countries have company and government stocks (United States and Japan), 6 countries have company and agency stocks (with cost sharing arrangements), and 2 countries have a mix of all three types of stocks.

Whether stocks are held by the government or by the oil companies, though, this is an expensive way of providing some security of civilian oil supply. It is therefore a question for discussion whether China can afford the "luxury" of an oil security stockpile, whether financed publicly or imposed as an additional cost of operations on the commercial sector and therefore having to be recovered in market prices.

Another approach is for companies from an important dependent country to develop overseas sources of equity or "owned" crude oil production, with a view to those supplies then being dedicated to that country's domestic market. Japan has done this in the past through its national company's operations in the Kuwait-Saudi Neutral Zone. We understand that CNPC's share of the Sudan Greater Nile Project oil production is imported to China. This approach may make sense where the cost of developing the foreign sources is demonstrably cheaper than that of domestic oil, where any potential penalties—such as oil quality in relation to domestic refinery configurations—are properly accounted for, and where there is real confidence in the security of the source in question. The stream of deemed "secure" imports would of course have to be established in non-emergency conditions, rather than be diverted from other markets in times of crisis. And any costs that this approach imposes on the operating company would have to be made explicit and be offset by the government, especially if the company were a state-owned enterprise (SOE) in the course of privatization.

A approach related to that described in the previous paragraph involves some kind of state-to-state trading. The concept is to enter into arrangements with a foreign country, directly or more likely with its state company, which is deemed to provide a "secure" supply source, and to establish a dedicated stream of oil from that source to the importing jurisdiction. This approach may make sense in some circumstances, but it appears to be less widely used than was the case in the supply crisis atmosphere of the 1970s and early 1980s when arrangements with the state companies of exporting countries were seen as potentially key elements in providing supply security. The approach can entail many issues, such pricing, quality, transportation, scheduling, and allocation of these imports among users. These issues tend to become more difficult to deal with to the extent that markets in the importing jurisdiction are being opened up to competition and when state companies are partially or fully listed on the stock exchange.

Finally, consideration has been given in some countries to mandating that a proportion of oil-using equipment should have dual fuel capability, to enable oil use to be curtailed in an emergency. While this is technically feasible, for instance, in electricity generation, it too imposes the cost burdens of such equipment and of the "standby" alternative fuel supply

capability. Our sense is that fuel-switching capability for security reasons has diminished and that where such equipment is installed now, it has more to do with taking advantage of fuel market price opportunities than with security of supply.

Annex 4: "Qualification" or "Certification" of Participants in Oil and Gas Operations

1. It is established practice in many countries for the government or the responsible agency to set out requirements that must be met by companies wishing to take part in certain petroleum activities.

2. The purpose, generally speaking, is to ensure that the intending participant is qualified to carry out the activity. "Qualification" may relate to financial or technical capability, or both, and may also require reference to demonstrated experience and success in the same activity elsewhere.

3. A balance clearly needs to be struck between, on the one hand, the desirability of having qualified operators and, on the other hand, of having many companies active in the various fields of activity to derive the benefits of competitive markets.

4. Also, qualification should be based on identifiable, objective criteria and the government or its agency should have little or no discretion to decide whether a bidder meets those criteria.

5. Examples of qualifying criteria include the following:

- Business incorporation under some predefined conditions, and identification of key staff and directors.
- Financial capability: the demonstration of a certain net worth in the most recent audited financial statements.
- Technical capability: the achievement of certain defined production volumes in relevant petroleum operations elsewhere.

6. Examples of activities where "qualification" or "certification" might be required are the following:

- Exploration and development operations, particularly offshore.
- Construction and operation of major facilities, such as processing plants, long-distance pipelines, or liquefied natural gas (LNG) terminals.
- Participation in energy commodity markets (natural gas), and serving small customers in those markets.

7. "Qualification" or "certification" by government authorities of operators in certain businesses needs to be distinguished from the following:

- Qualification by industry participants of contractors or business partners, again on the basis of financial or, more often, technical capability. This is a matter between private

parties. For example, an oil company might have a set of criteria the drilling contractors would have to meet to bid on drilling work for that company.

- The application of standards by government authorities to all participants in a sector. For example, a regulatory agency might require that certain standards of product handling and of equipment be met to take part in the LPG business (standards for propane cylinders). This is a very common type of regulation affecting businesses of all kinds. The important point is that standards should be applied and enforced equally on all parties.

Standards and "Unfair competition"

8. At least two cases of "unfairness" came to the attention of the working group in this general context:

- Unfair competition in the retail gasoline market from stations that do not meet industry standards. The solution lies in the area of enforcement.
- Well drilling by third parties on the margins of oil or gas fields operated by state-owned enterprises (SOEs) under license from the state, resulting in the SOEs' oil or gas being in effect "stolen" by these operators. The solution lies in the area of regulation and enforcement: every well should have an approval before drilling starts, and approvals should only be given where the entity drilling the well has proper title to the mineral rights.

Annex 5: A Comprehensive Listing of Proposed Regulatory Activity

Upstream[3]

Mineral Rights and Fiscal Management

1. Creating a geographical reference scheme for all petroleum-prospective areas.
2. Maintaining a bank of information as to which petroleum mineral rights are under license, to whom, and for what period.[4]
3. Providing access for bona fide oil and gas operators to mineral rights that are not under license, for purposes of exploration, development and production of their petroleum resources, on such terms as the Government of China may from time to time determine.
4. Monitoring that the licenses are maintained in good standing by the lessees, for example, by their observing all the terms of the respective license.
5. Where the petroleum mineral rights is accessed by a production-sharing contract, supervising the terms of and performance under such a contract.
6. Administering all issues relating to surface rights that are affected by oil and gas operations, including the arbitration of disputes between surface rights owners and oil and gas lessees (in the alternative, this regulatory activity could be dealt with by independent mediation or arbitration boards established specifically for the purpose).

Fiscal

7. Maintaining a comprehensive system for accounting of production, reinjection, sale and other disposal of all oil, gas, gas liquids, sulfur, and other fluids produced.
8. Assessing and collecting royalties and all other revenues associated with the use of the license, by applying such royalties and other fiscal imposts as the Government of China may from time to time determine.

Technical—Engineering Related

9. Dealing with applications to carry out all activities and put in place all plant and facilities that have to do with upstream oil and gas, such as exploration, appraisal, development, offshore structures, gathering pipelines, field processing of oil and gas, enhanced recovery schemes, and eventual abandonment and removal of such equipment and clean-up of sites where plant and facilities had been installed.[5]

---

[3] The term "upstream" denotes all activity upstream of the points at which processed clean oil moves into the pipeline, which takes it to refinery markets, or marketable pipeline gas leaves the processing plant.

[4] The term "license" is used in relation to the upstream industry to denote any vehicle by which the Government of China provides access to petroleum rights for purposes of exploring and developing their petroleum resources.

[5] By "deal with" is meant receive, consider, and either approve, approve with conditions, recommend reapplication, or reject.

10. Monitoring and administering all subsurface reservoir management and production schemes and practices to ensure the conservation and maximum recovery of petroleum from the reservoir.
11. Monitoring, inspecting, auditing, and ensuring compliance with all requirements for the construction and operation of all plant and facilities.
12. Maintaining a bank of information about China's petroleum resources and reserves in the form of geological geophysical and engineering data from government agencies and from oil and gas operators and making these data publicly available after any prescribed confidentiality periods.
13. Administering all issues related to subsurface production and ownership disputes that might arise between oil and gas producers.

Upstream and Downstream[6]

Technical—Health, Safety and Environment

14. Developing and enforcing all environmental, safety, and labor standards, rules, and regulations that are specific to the oil and gas industry, for example, environmental, in regard to environmental impact assessment, facility siting, air, water and solid waste discharges; design standards for pollution control equipment and for public and worker safety, in regard to well control, pipelines and distribution systems; and worker safety, in regard to all work site hazards.
15. Carrying out auditing, inspection, and collection of environmental and operational data to ensure compliance with standards and license requirements.
16. Investigating accidents, including equipment failures, that have or could affect public, worker or environmental safety, to determine whether the accident or failure was related to a deficiency in the design or application of the regulations.
17. Collecting and maintaining data on the location and status of wells, pipelines, and other facilities.

Downstream

Technical

18. Dealing with all technical, including environmental, aspects of applications for the development, beyond the oil or gas field, of pipeline and other facilities intended to bring oil to refinery markets and gas to final consumers, therefore including long-distance pipelines for oil and gas and distribution systems for gas.

Economic—Monopolies: Rates and Service

19. Setting or approving rates and all other service conditions of oil and gas pipelines.
20. Setting or approving rates and all other service conditions of gas distribution systems.
21. Carrying out all the information gathering, storage, and manipulation activities required to set or approve such rates, including, for example, maintaining, according to a uniform system of accounting, a comprehensive data series on the investments,

[6] "Downstream" means all activities not included in "upstream." See footnote 1.

depreciation, original and depreciated rates bases of the regulated entities to provide a basis for determination of their costs of service or a benchmark for the application of other forms of economic regulation such as price caps.

22. Performing audits and inspections to ensure that only approved rates are being charged and that services are being properly provided in relation to approved standards.
23. Dealing with complaints by users of the regulated pipelines and distribution systems as to rates charged and services provided.

Economic—Monopolies: Project Approval

24. Receiving and ruling on applications for approval of significant capital expenditures by regulated enterprises, including applications for the right to take lands owned by others for rights of way that are found by the regulator to be required in the public interest.
25. Receiving and ruling on applications for franchises for gas distribution systems.
26. Establishing and applying criteria for gas distribution systems to be extended or improved to provide service to a previously unserviced area or client.

Process and Information Transparency: Upstream and Downstream, Technical and Economic

27. Processes that, while safeguarding state and commercial secrets, provide comprehensive information about the information requirements and procedures to obtain all the approvals referred to above about compliance required, about the rights of applicants for approvals, and the rights of persons and organization that may wish to support or oppose the grant of those approvals, and about the rights and responsibilities of successful applicants.
28. Processes that, while safeguarding state and commercial secrets, provide for regular reporting to government and to the public on the results of all the regulator activity set out in the foregoing in terms both of data and narratives.

Annex 6: Environmental Regulation

1. This annex focuses on the aspects of technical regulation related to worker safety, public safety, environmental protection, engineering and environmental standard setting, operational practices, and operational compliance of oil and gas enterprises.[7]

2. The joint working group identified the need to examine the role of technical, environmental, and public and worker safety issues with respect to recommendations regarding change to China's oil and gas regulatory framework. The working group recognizes the importance of effective environmental and safety regulatory systems in achieving worker safety and environmental policy objectives as established by the government. In addition, transparent, timely, and efficient operational regulatory processes consistently administered by an independent regulator are critical to ensuring that competitive markets exist. Environmental regulatory functions (similar to economic regulation objectives) can provide a "level playing field" for competitors in resourcing programs necessary to achieve the required level of compliance to environmental and safety standards. Failure to establish these regulatory structures will inevitably lead to a competitive market structure in which the least environmentally responsible enterprises achieve the largest economic advantage. This system penalizes the responsible operator and rewards the worst operator.

3. This annex on environmental regulation sets out to achieve the following objectives:

    - To describe the typical functions of a "modern" framework for environmental, safety, and technical regulation of the petroleum industry.
    - To describe the existing oil and gas environmental regulatory framework in China, including environmental standards, environmental impact assessment, and worker and public safety.
    - To identify issues with the current Chinese environmental regulatory framework.
    - To provide recommendations on the establishment of new regulatory structures and functions.

[7] For the purposes of this report, "technical regulation" includes all regulations pertaining to environmental standards, discharge standards, remediation and reclamation requirements, good petroleum operational standards, engineering design standards, geological and reservoir management regulations, public safety requirements, worker safety standards, and other regulatory requirements normally associated with petroleum industry development and operations.

Methodology and Limitations of Report

4. The background, analysis, and issues with China's environmental processes contained in this report are based on interviews with representatives of several Chinese state government agencies and oil and gas companies, as well as a review of selected available literature on China's environmental regulatory processes during a two-week mission to Beijing in April 2000. The findings were presented to and discussed with the joint working group, along with international best practice in these areas. The findings are preliminary because additional information on ambient and discharge standards and further interviews with regional and local environmental organizations would be necessary to confirm the findings.

Health-Safety-Environmental (HSE) and Technical Regulatory Responsibilities

5. The primary function of a modern regulatory framework is to ensure that resources are developed and marketed in the "public interest" (that is, in a manner that maximizes the benefits of these activities to the public). Ensuring that unwanted effects of resource development to the physical and social environment are minimized is an important component of these regulatory responsibilities. To achieve this goal for China's petroleum industry, a number of environmental and technical or operational regulatory functions must be exercised on behalf of the government. These functions and a rationale for including them as responsibilities within the proposed new approach to regulation of China's petroleum industry are described in the following paragraphs.

Environmental Screening, Environmental Impact Assessment, and Permitting Processes for Petroleum Construction Projects

6. Environmental screening and environmental assessment of proposed construction activities (such as drilling a well, conducting seismic appraisal, or constructing pipelines or processing facilities) are important tools for regulatory permitting processes. The regulatory purpose of conducting these reviews is to
   - examine project alternatives;
   - ensure that possible prevention and mitigation of adverse environmental impacts have been incorporated into project plans, where possible; and
   - determine whether a proposed construction project should be permitted to proceed with construction and operation, proceed with modifications, or be rejected.

7. Modern petroleum regulators have generally developed screening criteria and processes to determine the appropriate extent and type of environmental assessment required. Project proposals are screened or categorized to separate routine activities (for which environmental effects can be mitigated and managed through compliance with standards, codes, and guidelines) from more complex projects likely to have significant adverse environmental impacts and require more

specific and focused regulatory scrutiny. Complex projects are determined by location (that is, activities in environmentally or socially sensitive areas), scale (larger projects can have broader environmental or social effects), or uniqueness (projects that are unique or utilizing unknown technologies). In many regulatory jurisdictions, the environmental assessment function is a shared responsibility between the petroleum regulator and a national (that is, government) or provincial level ministry with environmental assessment responsibilities. State environmental assessment processes supplement the petroleum regulators' responsibility by conducting more formal environmental assessment review processes for "mega" projects that may have national environmental, social, or economic policy considerations. In these situations, petroleum "mega" projects would be required to get an environmental assessment certificate before proceeding through the more detailed permitting processes. In China's context, the formal Environmental Impact Assessment (EIA) review process for major petroleum projects could be jointly conducted by the new petroleum regulatory agency and the State Environmental Protection Administration (SEPA).

8. Developing specific screening criteria and designing appropriate regulatory review processes for routine and more complex environmental reviews promotes efficiency in the permitting process and focuses regulatory resources where the most environmental benefits can be achieved.

Technical and Environmental Standard Setting

9. The regulator in a modern regulatory framework prescribes engineering and environmental standards for the design of drilling programs, pipelines, and field production and processing facilities. Good design ensures that environmental standards are achieved and environmental exceedences or accidents causing environmental damage or creating public safety risks in facilities operations are thereby avoided. Where accidents, incidents, or failures occur and result in environmental damage or risks to the public or workers, the regulator will conduct investigations to identify the cause. Findings from such investigations will be published and utilized to improve design standards, regulations, and/or create improved operating practices, as appropriate.

Regulation of Subsurface Production and Reservoir Management Schemes

10. The regulator in a modern regulatory framework oversees the exploitation of resources in a manner that ensures that the public interest is protected during the production phase of petroleum development. This objective is accomplished through such means as establishing the maximum production allowable and permitting reservoir development schemes with the objective of maximizing the volume of oil or gas ultimately recovered. The regulator also provides mechanisms to ensure fair access to resources where more than one enterprise is producing from the same oil or gas field or reservoir.

Public Consultation

11. It is now commonplace for regulators to require enterprises or companies proposing to construct projects to review these plans with regional and local authorities and the various publics who might be affected by them. The issues identified during public consultations and recommendations stemming from them are considered by the regulator in making a decision as to whether or not to allow activities to proceed.

Inspection and Compliance

12. A modern regulatory framework must have the organizational capacity and the legal authority to inspect petroleum activities and operations to ensure that they are in compliance with standards and permit requirements, as well as to initiate enforcement actions where standards are not being met. Modern regulatory practices are to establish routine monitoring information, which operators must provide to demonstrate their compliance. Monitoring activities are supplemented by routine audits and on-site inspections to ensure that monitoring data are accurate and that design and operations standards are being adhered to.

Public Safety

13. Regulatory assessment and permitting, technical standard setting, and compliance and enforcement efforts must ensure that petroleum developments do not create unacceptable risks to the safety of people living near these facilities (sour gas wells, pipelines, and field processing plants). By using modern technical design standards and establishing emergency response planning requirements and procedures, the regulator will maintain the highest possible levels of public safety.

Worker Safety

14. Regulatory responsibilities also include establishing acceptable practices designed to ensure the safety of workers in the construction and operation of petroleum facilities. These responsibilities include operability assessment of facility design, review, and specification of operating procedures, and inspection of construction and operating sites to ensure that worker safety standards are maintained. Compliance with worker safety regulatory requirements is the responsibility of the enterprise. The regulator maintains the authority to establish such standards, enforce them, and prosecute companies under the law where standards are not adhered to.

China's Current Regulatory Design and Framework

15. Based on the mission's preliminary review of China's existing environmental regulatory system[8], it is clear that the structural elements of a comprehensive

[8] Woodrow Wilson International Center for Scholars. 26 Nov. 1996. *The Environment in China: An Overview*. http://ecsp.si.edu/ecsplib.nsf/451f9216. Retrieved April 24, 2000. .

regulatory framework are in place. SEPA is the primary environmental regulator of China's petroleum industry. Reporting to China's State Council, SEPA administers a comprehensive set of guidelines, laws, regulations, and standards to achieve environmental objectives in a wide spectrum of areas of responsibility. China's environmental regulatory processes benefit from strong technical competencies in areas such as environmental assessment, standard setting, and the environmental sciences.

Legal Framework for Environmental Regulation in China

16. Since 1979 China has established a comprehensive environmental legal framework, including the adoption of six national environmental protection laws, all of which would have some application to oil and gas activities:[9]

- Environmental Protection Law
- Marine Environmental Protection Law
- Law for Prevention and Treatment of Ambient Air Pollution
- Law for Prevention and Treatment of Water Pollution
- Law for Prevention and Treatment of Solid Waste
- Law for Noise Prevention and Treatment
- Regulation on Natural Preservation Area
- Regulations of Environmental Management on Construction Project

17. In addition, a number of other elements of China's environmental protection framework have been developed, some of which have direct application to oil and gas activities:

- 28 administrative regulations including "Regulations of GOC on the Administration of Environmental Protection in the Exploration and Development of Off-Shore Petroleum";
- 65 sectoral administrative regulations on environment protection (56 promulgated by SEPA; 9 by the State Marine Administration);
- 3 special regulations on offshore oil development;
- more than 100 labor standards (industrial hygiene); and
- more than 900 environment protection regulations issued by local environmental departments of local governments.

World Bank, Environment, Human Resources and Urban Development Division, East Asia and Pacific Regional Office, Report No. 9669-CHA. April 1992. "China Environmental Strategy Paper, Volume I: Main Report and Volume II: Annexes."

World Resources Institute. January 2000. *Laws and Policies to Protect the Environment and Health.* http://www.wri.org/wr-98-99/prc2laws.htm. Retrieved April 2000.

Xiamen Environmental Protection Bureau. 1996. *Environmental Regulations.* http://chinavista.com/xiamen/invest/env-reg.html. Retrieved April 2000.

[9] State Administration of Petroleum and Chemical Industries presentation, April 17, 2000.

18. Administratively, environmental regulatory responsibilities and programs are delivered through state and provincial environmental protection agencies (EPAs), and prefectural (municipal) environmental protection bureaus (EPBs). This process primarily applies to onshore activities. Offshore petroleum development activities are regulated principally by the State Ocean Maritime Bureau, which oversees permitting, standard setting (by the state setting the marine standards), and monitoring responsibilities (in association with SEPA and a number of other offshore regulatory agencies).

19. China's legal and administrative framework establishes an environmental regulatory management system based on pollution discharge fees, the "Three Synchronizes," and Environmental Impact Assessment.

Pollution Discharge Fees

20. In the past in China, discharges of emissions in excess of established discharge standards are not treated as legal violations. Article 18 of China's Environmental Protection Law states that where limits are exceeded, "a compensation fee shall be charged according to the quantity and concentration of the pollutants released."[10] Based on the "polluter pays" principle, China's local EPBs administer a system of effluent fees for permitted discharges and levy fines when these discharge permit levels are exceeded. Effluent discharge fees are collected by local EPBs and redistributed to enterprises for funding pollution reduction or abatement initiatives. Up to 80 percent of these funds can be used to assist enterprises in the installation of pollution control equipment. The remaining 20 percent are used to fund local EPB scientific and promotion activities. Fines for exceeding discharge limits are transmitted to the national government. On September 1, 2000, the "Law for Prevention and Treatment of Ambient Air Pollution" came into force. This new legislation will treat emission discharges in excess of standards as violations, and polluters will be subject to appropriate legal liabilities or remedies.

The Three Synchronizes

21. The Three Synchronizes requires that environmental protection measures be incorporated into all new projects at the project planning, design, and implementation or operation phases. These steps are utilized to promote the reduction of pollution through incorporating pollution prevention planning into the conceptual planning and design, during construction, and when facilities go into operation.[11]

---

[10] Dasgupta et al. 1997. Dasgupta, Susmita, and Manul Huq, and David Wheeler. Feb. 1997. *Bending the Rules: Discretionary Pollution Control in China*. http://www.worldbank.org/nipr/work_paper/1761/index.htm. Retrieved April 2000.

[11] China Environmental Strategy Paper, 1992; Discussions with SOE representatives, April 19, 2000.

Environmental Impact Assessment

22. The other mainstay of China's environmental regulatory framework is the environmental assessment process. Environmental assessment requirements vary under Chinese law depending on the severity of impacts associated with proposed new project construction, expansion, or modifications. Detailed environmental impact statements (EISs) are required for large projects (generally costing more than RMB 200 million) that generally require state environment department approval. For projects with light or very small impacts, a more simplified process requiring completion of environmental impact forms is required (environment impact reports (forms) are approved by local EPBs and are required for projects costing less than RMB 200 million.[12]

23. On behalf of the enterprise, a "certified organization," designated by the local EPB, prepares an EIS outline for the project. This outline is then reviewed for approval by the appropriate responsible government agency. Following approval of the outline, the detailed EIS is prepared and submitted, with the proposed project design, for approval. Following acceptance of the EIS and approval of the project, the EIS is utilized to monitor the project during the construction phase and to provide structure at the startup phase when pollution control equipment is tested for acceptance or approval to operate.

Environmental and Technical Standards and Discharge Permits

24. National environmental ambient and technical pollution discharge standards are established by SEPA. National standards developed by SEPA are submitted to the Standardization Law and Environment Protection Law for review and approval. Currently, 360 national environmental standards have been established by SEPA. National standards are supplemented by many local environmental standards.

25. Provincial, prefectural (municipal) EPBs formulate local standards that usually could only be more stringent than those set nationally. EPBs report to local village or county governments. Local EPBs are responsible for establishing permitted emission levels for regulated discharges and monitoring the permitted enterprises for compliance.

Issues or Concerns with the Current Chinese Environmental Regulatory System

26. The following observations, based primarily on interviews with state agencies and enterprise representatives associated with or familiar with China's environmental technical regulatory framework, were discussed with the working group.

---

[12]. *China Environmental Review:* Quarterly newsletter for China Environment, Health http://www.environmental-expert.com/magazine/aer/china/summer/article2.htm. Retrieved April 2000.

Complexity of the Environmental Framework

27. A number of observations were made on the complexity of China's environmental and technical regulatory processes. These comments include concerns that in some cases, the EIA and technical standards were some times applied inconsistently to different enterprises. There is a perception that standards and expectations are higher for "richer" and larger enterprises, and conversely that requirements are applied less stringently to smaller, less profitable enterprises.

28. The structural nature of the current multilevel SEPA regulatory framework that relies on state, provincial, county, or local EPAs and EPBs to review environmental impact statements, set standards, monitor for compliance, and collect discharge fees and assign discharge fines creates significant opportunities for inconsistent application of requirements.

Overlapping Jurisdictional Responsibilities

29. In some instances, more than one level of environmental regulatory authorities provincial, prefectural (municipal) conducted on-site inspections of the same facility.

Multiple Agency Jurisdictions

30. For offshore developments, multiagency jurisdictional issues and overlaps were identified as concerns. When components of offshore developments (such as a pipeline or processing facilities) come onshore, the jurisdiction for these project components changes. The onshore components of offshore projects require conducting separate environmental assessments. This results in one assessment process for the offshore and one for the onshore facilities. Different regulatory authorities administer these environmental assessment review processes. In addition, a number of other agencies also have some type of regulatory jurisdiction for marine or coastal environments and must be included in EIS reviews. Coordinating reviews under these circumstances is very challenging to enterprises attempting to acquire project approvals through multijurisdictional and complex regulatory processes associated with these types of developments.

31. Amendments to the "Marine Environmental Protection Law" promulgated on April 1, 2000, appear to consolidate onshore components of offshore oil and gas exploration and development with the State Marine Administration. However, environmental issues associated with the onshore anciliary facilities associated with offshore developments (such as pipelines and production facilities) must still be submitted to SEPA for review and approval.

Standard Setting for Petroleum Developments

32. Several participants observed that regulatory agencies (primarily SEPA) did not have sufficient resources to develop strong technical expertise in petroleum development issues. Consequently, sometimes standards were set or regulatory changes made that were difficult or impossible for SOEs to comply with.

33. A very limited review of ambient air quality standards (total suspended particles, SO2, NOx, CO, and ozone) and surface water (pH, chemical oxygen demand, biological oxygen demand, and petroleum) was conducted. The standards reviewed were abstracted from a 1994 report.[13] The mission was unable to confirm that these standards are currently in effect. Moreover, the system in China of creating differing ambient concentration and pollutant discharge standards (air and water), depending on the nature of the receiving environment, makes it difficult to directly compare standards with those typically used internationally. Because EPBs set more stringent local standards, it cannot be assumed that the 1994 national standards reviewed by the author would be those that would apply to petroleum enterprise activities.

34. A more detailed comparison of standards should be undertaken by selecting a sample of petroleum activities and facilities and directly comparing the applicable ambient and discharge standards with similar facilities in other regulatory jurisdictions. This analysis would enable a more meaningful comparison between China's environmental standards applicable to oil and gas development, and other internationally recognized standards.

Implementation of Environmental Standards and Policies at the Local Level

35. Interviews with SEPA, SAPCI, and oil and gas companies suggest that the issue of implementation (inspection and monitoring for compliance with discharge standards and operating requirements) by local EPBs is the most important one facing achieving government environmental policy objectives. The local conflict and pressures to enhance local employment and economic development and the complexity and vagueness of standards in legislation leads to a situation where negotiated resolutions are sometimes achieved outside of strict compliance to environmental regulatory requirements.

36. The oil and gas sector is characterized by a large number of construction projects, including well drilling (for example, in 1998, CNCP drilled more than 8,000 wells), pipelines, and field production facilities, such as oil batteries, dehydration facilities, and pipeline tie-ins. The large number of projects and their geographically disparate locations make effective inspection and monitoring activities a challenge for regulators. Large processing facilities (refineries, chemical plants, natural gas processing facilities) that are amenable to more frequent monitoring and inspection are important sources of local employment and taxation. It would appear that the reporting relationship of EPBs to local communities creates significant pressures to avoid enforcement actions that would result in reduced operating capacity or closure of these facilities because of the associated employment and taxation impacts to local communities.

[13] DHV Consultants BV and CH2M HILL International LTD. and COPIA Beijing. 28 Nov. 1994. Hubei Urban Environmental Project Industrial Pollution Control Component, "Action Plan and Feasibility Assistance", Phase 1, *Volume I, Main Report*

Recommendations

37. It is recommended that the working group include environmental, worker and public safety, and technical regulation as part of the regulatory responsibilities incorporated in the creation of new, modern regulatory frameworks for the upstream and downstream petroleum sectors.

38. The new upstream and downstream regulatory agencies have the following responsibilities:

- environmental, worker, and public safety;
- responsibility for resource conservation through sound reservoir management techniques;
- technical standards for accepted petroleum operating and engineering design;
- data collection and archiving; and
- environmental and technical review of all applications (with the exception of large projects that might have national environmental or social impact considerations) for onshore and offshore projects and associated infrastructure.

39. These upstream and downstream regulatory agencies have the authority to convene inquiries for decision making on projects or for the review of operational policy issues.

40. Funding should be derived for operating these new regulatory agencies through a levy on oil and gas production or throughput, as well as on direct fees for services rendered.

41. The new regulators should be established as a national agencies with regional offices reporting to and funded by the national central agency offices.

Rationale for Consolidating Upstream and Downstream Regulatory Authorities

42. Objectives of regulatory reform in China's petroleum industry should include enhancing the effectiveness of the current regulatory system. Creation of a petroleum regulator that broadly consolidates environmental, technical, fiscal, economic, and mineral administrative responsibilities creates an opportunity to improve the sector's environmental performance and enhance programs for worker and public safety.

43. By establishing a state-level regulatory organization with regional offices and agencies reporting to and being fully funded by the state central headquarters, a more consistent set of regulatory review processes and technical and environmental standards could be developed and implemented. Regional offices reporting to the central office could be expected to conduct and apply consistent regulatory compliance monitoring and enforcement actions. Establishing a consistent set of environmental standards and applying them uniformly to all enterprises with petroleum-related operations is one of the key aspects of creating a level playing field and ensuring that all participants compete equally.

44. Effective and efficient exercise of environmental, worker and public safety regulatory responsibilities requires development of strong technical knowledge of engineering design issues, construction practices, operating problems, and other factors that may lead to future environmental and safety problems. Consolidating these technical and environmental assessment capabilities in the creation of an upstream and downstream regulator is consistent with regulatory trends toward creation of "one window" regulatory agencies. The "one window" regulatory approach provides important advantages over regulatory structures where authorities and responsibilities are dispersed among many government departments or agencies with various approval or regulating functions.

45. Consolidating environmental, public, and worker safety regulatory authorities and responsibilities (along with mineral resources, fiscal, and economic regulatory functions) allows the regulator to create a more focused organizational mandate and administrative structure. A comprehensive structure enables the regulator to deliver a higher level of regulatory service to clients while requiring fewer human and financial resources. A focused "one window" regulatory mandate facilitates the development of a technically sophisticated regulatory workforce. This engineering, environmental, and operating expertise can be engaged to support a variety of other regulatory functions.

46. A technically competent regulator is better able to translate the government's health, safety, and environmental policy goals into standards, regulations, and inspection processes to ensure their implementation throughout China's petroleum industry (onshore or offshore). Upstream and downstream petroleum regulators could be most effectively organized with a strong "head office" and "regional offices" located in regions where petroleum resources are being developed. Regional offices should be funded fully by the central office so that no conflict of interest occurs in the implementation of enforcement of environmental, public safety, or worker safety mandates. This structure is necessary to ensure that the regulatory organization is not unduly influenced by local employment concerns or taxation issues where enforcement actions could result in the curtailment or shutdown of facilities that are not able to meet required operating standards.

Further Studies and Next Steps

47. The current environmental regulatory structure for petroleum development in China is very complex. The implementation of more modern regulatory structures will require a number of further studies and initiatives as part of this transition process:

A. Inventory existing technical and environmental legislation.
B. Create a current regulatory roadmap.
C. Draft legislation and regulations.
D. Develop a regulatory business process design.
E. Develop an organizational design.

A. Inventory Existing Technical and Environmental Legislation

48. Compile an inventory of environmental and safety legislation, policy, guidelines, and standards administered by various Chinese government agencies overseeing petroleum development (onshore and offshore). Areas of overlapping, conflicting, or unclear jurisdictional responsibilities should be identified.

B. Create a Current Regulatory Roadmap

49. Prepare a regulatory roadmap that describes and documents the existing processes for environmental assessment and licensing, standard setting, establishment of worker safety standards, monitoring, enforcement, and technical engineering. Areas of overlapping jurisdictional responsibilities and gaps should be highlighted.

C. Draft Legislation and Regulations

50. New upstream and downstream regulatory responsibilities will involve the development and adoption of new legislation by the government. Specific HSE and technical regulatory responsibilities should be included in this legislation (as determined by the government). Legislative drafting instructions should be prepared by a working group of technically competent representatives from appropriate government agencies, enterprises (SOEs, IOCs) and potentially, environmental NGOs.

51. Following the preparation of new legislation, drafting of HSE and technical regulations should be initiated. Regulations drafting should be done in reference to the legislative gaps and overlaps identified in the initial legal review (task 1). A review of legislation and regulation used by other internationally recognized “one window” regulatory agencies should be used to complete this task.

D. Develop a Regulatory Business Process Design

52. Having defined the goals, objectives, and expected outcomes through legislative and regulatory drafting, regulatory business processes to achieve these objectives can be developed.

E. Develop an Organizational Design

53. Following the design of specific business processes, detailed organizational design, skill requirements, and staffing issues associated with delivering the HSE and technical regulatory functions would be completed. These business processes may currently be delivered by other agencies (identified in steps A and B). In these instances, personnel from these organizations may be able to relocate to the new regulatory organizational structures created to regulate the upstream and downstream petroleum industries.

Annex 7: International Cases of Structural and Regulatory Reform

1. The working group asked the Bank to provide international examples of oil and gas sector reform and regulation. This annex includes experience from six countries Argentina, Brazil, Bolivia, Canada, Poland, UK. The working group, however asked for more in depth information about oil and gas sector reform and regulation and background information about the situation in different countries leading up to the reform process. The Bank has provided the Working group with the following reports for background information and in depth studies:

Specific Country Experience

Canada—Structural Reforms Succeeds after State Management of the Oil and Gas Economy Is Abandoned

2. *State Management:* From 1973 onwards, Canada pursued policies directed towards energy self-sufficiency, tried to separate itself from international markets, adopted a "national" pricing policy and discriminated against foreign investment. Heavy new taxes were placed on producers. The prices of oil and gas in almost all transactions were regulated. Controlled prices encouraged consumption and discouraged production. Export prices were regulated at above-market levels. Wastefully uneconomic flows of oil were established across the country.

3. The results were disastrous: oil and gas production fell; oil exports were almost eliminated; export gas markets were badly damaged; industry investment slowed; development projects were abandoned; foreign companies sold out and left the country; and political relations between producing and consuming regions and interests became tense.

4. *Structural Reforms:* In 1984 a new government decided to introduce market-oriented policies across the sector, taxes were reduced and regulators took account of these policies in their decisions. Despite a deteriorating international pricing environment, investment flowed back into the industry, markets improved and producer-consumer tensions were eliminated. Regulation now is "light-handed" and oriented towards facilitating market solutions. Oil output is up 30% and the country is a large net exporter. Gas production has more than doubled, exports have nearly quadrupled and Canada is the world's second largest exporter. Oil and gas projects, abandoned in the 80's, are alive again. And domestic consumer prices of oil and gas are among the lowest in the world.

Privatization in Bolivia

5. Before privatization of Bolivia's state-owned oil and gas company, YPFB, the company's production was gradually declining, the sales price for its gas exports to Argentina was dropping, and its exploration effort was declining in intensity. Moreover, YPFB was being financially squeezed by overtaxing, and the government was interfering in its day-to-day operations. Morale in the company was low.

6. This was the context in which the government decided to undertake reform. Its objectives were to redefine its role in the sector by irreversibly transferring ownership of the YPFB companies to the private sector and adult citizens; maximize private investment in the hydrocarbon sector; maximize the value of shares before privatization; enhance competition, promote efficiency, and further deregulation; protect consumers and the environment through regulation; and strengthen its policymaking capacity.

7. After extensive reviews of institutional options, the government decided to establish two exploration and production companies, and a pipeline company to operate all pipelines. The "residual" company remains in state hands. It contracts for services (such as drilling and seismic analyses), refines and distributes petroleum products, enters into concession contracts with private companies, and functions as natural gas aggregator to ensure fulfillment of the gas export contract with Brazil. A regulatory agency has been set up for both the upstream and the downstream sector.

8. In 1997 the government privatized the two exploration and production companies and the pipeline company. Some 25 companies participated in the bidding, and the three winning bids exceeded US$800 million.

Argentina—Regulation as State Industries Have Been Privatized

9. Argentina is the most developed and liberalized gas market in Latin America and one of the most developed in the world. In 1996, there were 5.2 million consumers (including 4.998 million residential) consuming 26.9 billion cubic meters.

10. In the 1980s the State controlled most of the economy. In 1989, 117 state owned enterprises accounted for about 50% of GNP, and 30% of them were subsidized by the state. By the end of 1994, most of these had been privatized and the total value of the privatized companies reached $26.9 billion. Until privatization in late 1992, the entire oil and gas industry was state owned. Upstream oil and gas exploration and production was under the control of the state company Yacimientos Petroleos Fiscales (YPF) and natural gas transportation and distribution was under the control of another state company, a subsidiary of YPF, Gas del Estado (GdE).

11. In late 1992 the entire gas network was restructured into two transportation companies (one for the north and one for the south) and eight distribution companies, which were then privatized. Foreign companies were invited to tender to buy these companies in joint ventures with local companies. There were strict rules preventing investors gaining ownership of both transportation and distribution companies or of more than one distribution company in each group. This led to a competitive market with a wide range of foreign investors who brought much-needed investment into the Argentine gas industry. The main foreign ownership in the Argentine gas industry (all in partnership with local Argentine companies) following privatization is as follows:

Transportation

- Transportadora de Gas del Norte (TGN, northern transport system)—TransCanada PipeLines, Canada;
- Transportadora de Gas del Sur (southern transport company)—Enron, USA.

Distribution

- Metrogas (central Buenos Aires)—British Gas, UK;
- Gas Natural BAN (north Buenos Aires)—Gas Natural of Spain;
- Camuzzi Gas Pampeana (south Buenos Aires and Buenos Aires province)—Camuzzi (Italian gas distribution company).

12. The Natural Gas Act of 1992 is the natural gas regulatory framework. The intention is to encourage competition in all sectors of the gas industry but it recognizes that this is difficult to achieve at the transportation and distribution stages, and so regulation is needed. There is an open access regime, the state is excluded from providing services and the only private companies may transport and distribute gas. The Gas Act also set the conditions for gas exports and imports and the creation of the Natural Gas Regulatory Entity (Enargas). The government's stated objective is for a light handed regulatory regime with minimal intervention in normal commercial operations. Prices are set according to the "RPI minus X" system and reviewed every five years by Enargas.* Distribution companies may adjust their prices automatically if there is a change in inflation, the price of gas, and the transportation charge or in the tax regime. It is important to note that restructuring, privatization and the establishment of modern regulation took place simultaneously. This meant that investors knew in advance the rules that would govern their operations in the country.

*In "RPI minus X", prices are escalated by the retail price index (RPI) minus an efficiency factor ("X") prescribed periodically by the regulator.

Legal Frameworks for the Gas Industry

13. In **Brazil** the primary law regulating the gas sector is the 1997 Hydrocarbon Law, intended to dismantle the monopoly of Petrobras in oil and gas activities. The law has broad coverage, defining the conditions for exploration and development concessions for oil and gas, refining and transport of petroleum products, and the import and transport of natural gas. The law obligates energy enterprises to provide negotiated third-party access to oil and gas pipelines, establishes the Hydrocarbon Sector Regulatory Agency (ANP) to oversee the introduction of competition, and stipulates that the prices of petroleum products and natural gas must be freed within three years after its passage. The ANP has been formed but is not yet fully staffed or functional, and the body of regulation under which the energy sector will function is being formulated. The distribution segment, however, is covered by the Concession Law for Public Services of 1995, which requires that all concessions for public services be awarded through competitive bidding. Brazil has also separate regulatory apparatus for distribution at level of each state.

14. In **Poland** two key energy acts regulate activities in the gas sector. The Geological and Mining Law of 1994 sets out the principles and procedures for granting concessions for oil and gas exploration and production. And the Energy Law of 1997 sets out the principles for developing competition in energy networks, including gas, heat, and electricity. The Energy Law obligates energy enterprises whose business is transmission and distribution to provide transmission services (open access) for domestic energy producers, establishes the Energy Sector Regulatory Agency (ERA) to oversee the development of competition in the sector, and states that natural gas tariffs will be fixed by the Ministry of Finance for up to two years after passage of the law, or until December 1999. Although the ERA has been formed, it is not yet fully functional, and the body of regulation that will govern the energy sector is being written.

How to Develop Gas Markets

15. To develop gas markets, the following factors are essential:

- Competitive price at the wellhead. This is worked out by calculating back from the end user price necessary to compete against other fuels;
- A large (anchor) customer, such as a power station to provide a large high-utilization load from the start. Taking environmental costs into account, gas is likely to be competitive against new coal fired power generations in some regions of China;
- Considerable investment in distribution;
- Proactive market strategies, and
- Exclusivity for the gas distributor for a fixed period of time.

Two examples of how gas distribution has been introduced and expanded

Northern Ireland: How to Build a Gas Market

16. Northern Ireland is a part of the United Kingdom and has been without the benefit of natural gas until very recently. The development of the gas market started with the privatization of Ballylumford power station by British Gas in 1993. This was a 1,000 MW high sulphur fuel oil-burning plant and was environmentally damaging. British Gas converted it to natural gas, which was completed at the end of 1996. A pipeline company was set up (Premier Transco) to supply gas to the power station. On the back of the power plant sales, a distribution company was also set up (Phoenix Natural Gas). In both of these companies, British Gas (now BG plc) was the major developer but in both cases it brought in US investors for their particular expertise.

17. In 1997, Phoenix began to develop a gas distribution market within the Greater Belfast area (the main city of Northern Ireland). In order to encourage the development of the network, exclusivity was granted for fixed periods of time. There is exclusivity of transportation along the distribution network for 20 years (until 2016), and for selling gas to customers for eight years (to 2004), except that for large customers (those consuming over 75,000 therms, 204,000 cubic meters) the exclusivity is for just three years. Gas is bought under a 10 year long term contract.

18. Phoenix Natural Gas also had to provide a development plan, which is part of the license. This divides the area into 15 districts and gives a target for new connections in specified years of the plan. The network must be built such that 90% of customers can be easily connected.

São Paulo, Brazil: How to Build a Gas Market

19. Comgás distributes around 1.2 bcm/year of natural gas to 250,000 residential and several hundred industrial customers in São Paulo, Brazil. Demand is forecast to grow dramatically, by an extra 2.9 bcm/year over the next few years. In 1997, the local State government brought Shell in as a strategic investor with a 20% stake. In 1999, Comgás was fully privatized and Shell and BG plc in consortium acquired the company in a public tender for just short of $1 billion (one of the highest priced utility sales in the world).

20. The privatization is in the form of a concession (BG and Shell have the right to operate the company for a time after which it reverts to the State) for 30 years. There is complete exclusivity on the pipeline network for the whole 30-year period, also for sales to residential and commercial customers. For industrial and power generation customers (large users), there is exclusivity of sales for 12 years. Comgás is given tough targets for laying distribution pipes each year.

21. The price to end users is a combination of the pass through of gas costs and transportation charges (that is the charge for transporting gas from the international source in Bolivia). These two elements are bought as a bundled service at the City Gate from Petrobras (the Brazilian Federal state monopoly upstream oil and gas and transportation company) under a long-term contract. Comgás may contract for additional gas supplies from other producers.

Great Britain—Regulation as State Industries Have Been Privatized

22. Great Britain is totally self-sufficient in gas and consumed 85.8 billion cubic meters in 1997. After the end of World War 2, many privately owned utility companies were nationalized and brought under direct state control. The intention of this was to protect individuals from exploitation, either on safety or price grounds. It was believed that the gas industry was a natural monopoly and that therefore the public interest would be better served by having such industries in public rather than private hands.

23. The Gas Act of 1948 brought together and nationalized the 1,046 private and municipal gas companies then operating in Great Britain. This resulted in the creation of 12 Regional Gas Boards and the formation of the Gas Council. The newly formed Regional Gas Boards operated as separate statutory bodies and controlled everything related to gas supply. The gas supplied was initially “town gas”, but after the award of exploration licenses under the provisions of the Continental Shelf Act of 1964, substantial reserves of natural gas were found in the North Sea.

24. Following the decision to use natural rather than town gas, all gas appliances throughout Great Britain had to be converted to use natural gas. Additional gas terminals also had to be built on the East coast and a high-pressure gas transportation system had to be constructed. The gas industry structure also had to be reorganized, so the Gas Act of 1972 renamed the Gas Council as British Gas Corporation and this then assumed control of the 12 Regional Gas Boards.

25. British Gas was privatized by public sale in December 1986 and sale proceeds were £7.9 billion (approximately $13 billion). British Gas was sold as a vertically integrated company and the industry was later restructured, mostly during the 1990s. The restructuring process was a very painful one for the company and its employees. It involved several referrals to the Monopolies and Mergers Commission (the government antimonopoly organization), a new Gas Act (in 1995) and the eventual division of British Gas into two completely separate listed companies (BG plc owning the transportation network and international assets, and Centrica with the right to supply gas to customers).

26. The current structure of the gas industry consists of gas producers (over 100), gas shippers and gas suppliers (about 40) and open access gas transporters (virtually the whole transportation and distribution network is owned by BG Transco, although there are six other very small local distribution companies).

27. Gas prices are made up of three elements: the production cost, the transportation cost and the tariff price. The last two are regulated. The tariff price is price capped according to the RPI minus X formula. Centrica had an exclusivity of supply to those customers consuming fewer than 2,500 therms a year but from 1998, competition was extended to all customers. This makes the UK the most liberalized and competitive gas market in the world (the same also applies to electricity). In contrast to the Argentinean case above, the British authorities made the mistake of restructuring after privatization, a painful process that affected investor confidence.