Working Paper No. 231

Trade in Energy Services: GATS and India

Arpita Mukherjee
Ramneet Goswami

January 2009

INDIAN COUNCIL FOR RESEARCH ON INTERNATIONAL ECONOMIC RELATIONS

Contents

List of Tables

List of Figures

Foreword

With liberalization and privatization, energy services is now an important component of international trade and trade agreements. This study, sponsored by the Department of Commerce, Government of India, examines India's prospects of liberalizing energy services within the WTO framework, identifies barriers to trade and recommends possible negotiating strategies for the government in the on-going Doha Round. The study comes out with specific policy recommendations which, if implemented, would strengthen the global competitiveness of this sector and enable India to meet the challenges and opportunities arising from trade liberalization under the GATS.

Although extensive research has been conducted on the energy sector of India, there are hardly any studies on India's trade potential in energy services. This study aims to fill that lacuna. The study found that India has both export and import interest in energy services and we are facing various barriers in markets of export interest. Therefore, India should offensively push for liberalizing this sector in the Doha Round.

Given the importance of energy for the growth of the economy and trade policies, I am hopeful that this paper will provide significant inputs to policy makers, negotiators, industry and academicians working toward realizing the potential of this sector.

(Rajiv Kumar)
Director & Chief Executive

January 28, 2009

Abstract

Energy plays a vital role in the development of any economy and given its unequal distribution trade in energy, especially fossil fuels, is an important component of international trade. In the past, due to its public good characteristics, energy-related services were mostly supplied by the government. With liberalization and globalization the sector underwent significant transformation. Many new services developed and large multinationals emerged which increased global trade in energy services. Energy services is now an important component of all trade agreements.

In the above context, this paper examines India's opportunities and constraints to trade in energy services within the GATS framework. The study found that India has the capability of exporting high-skilled manpower at competitive prices but is facing various market access, discriminatory and regulatory barriers in markets of export interest. With the entry of energy-producing countries such as Saudi Arabia into the WTO, the Doha negotiations provide an important platform to offensively push for liberalization in this sector. India needs foreign investment, technical know-how and international best practices in energy. The country has progressively liberalized this sector and there are no major entry barriers. However, India has not been successful in attracting large foreign investment and technology. This is due to various domestic barriers which make it difficult to set up a competitive operation. The study lists the reform measures which will help the sector become globally competitive, protect the interests of consumers and meet the energy needs of society. Since this sector is sensitive and is closely monitored by governments across the world, government-to-government collaborations would ease the entry process for Indian companies in foreign markets, diversify our energy resource base and improve energy security.

JEL Classification: *F13, F14, L71, L72, L94, L95, Q4*
Keywords: *GATS, Energy, Trade, India & the WTO*

Acknowledgements

The authors are grateful to Rajiv Kumar, Director and Chief Executive, ICRIER, for giving them the opportunity to work on this project and for his valuable comments. This study was sponsored by the Department of Commerce, Government of India. The authors would like to thank Amit Yadav and Sonia Pant of the Department of Commerce for their useful comments. Thanks are due to Shrawan Nigam, Senior Consultant, ICRIER, Krishan Gupta, Counsellor, Permanent Mission of India, Geneva, and Sumanta Chaudhuri, Head, WBIIDC, for their comments and feedback. The Petroleum Federation of India (PetroFed), its member companies and other industry experts have helped in improving our understanding of this sector. The contribution of Aditi Mody, Former Consultant, ICRIER and R Vasudevan, Former Secretary, Ministry of Power, Government of India, is acknowledged. Renu Gupta, our copyeditor, deserves a special mention.

Abbreviations

AERB	Atomic Energy Regulatory Board
APEC	Asia-Pacific Economic Cooperation
APM	Administrative Pricing Mechanism
ASEAN	Association of Southeast Asian Nations
BG	British Gas
BOOT	Build-Operate-Own-Transfer
BOT	Build-Operate-Transfer
BPCL	Bharat Petroleum Corporation Limited
BWR	Boiling Water Reactors
CASE	Commission for Additional Sources of Energy
CEA	Central Electricity Authority
CERC	Central Electricity Regulatory Commission
CESC	Calcutta Electricity Supply Company
CIL	Coal India Limited
CIS	Commonwealth of Independent States
CMPDI	Central Mine Planning and Design Institute Limited
CNG	Compressed Natural Gas
CPC	Central Product Classification
CSS	Contractual Service Suppliers
DAE	Department of Atomic Energy
DGH	Directorate General of Hydrocarbons
DIPP	Department of Industrial Policy and Promotion
DNES	Department of Non-conventional Energy Sources
E&P	Exploration and Production
EC	European Community
ECT	Energy Charter Treaty
ENT	Economic Needs Test
ERCs	Electricity Regulatory Commissions
ESI	Energy Security Initiative
EU	European Union
EWG	Energy Working Group
FBRs	Fast Breeder Reactors
FDI	Foreign Direct Investment
FIPB	Foreign Investment Promotion Board
FOC	Foreign Oil Company
GAIL	Gas Authority of India Limited
GATS	General Agreement on Trade in Services
GATT	General Agreement on Tariffs and Trade
GCC	Gulf Cooperation Council
HPCL	Hindustan Petroleum Corporation Limited
IAEA	International Atomic Energy Agency
IOCL	Indian Oil Corporation Limited
IP	Independent Professional
IPPs	Independent Power Producers
IREDA	Indian Renewable Energy Development Agency
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LWRs	Light Water Reactors

MFN	Most Favored Nation
MNRE	Ministry of New and Renewable Energy
MoEF	Ministry of Environment and Forests
MoPNG	Ministry of Petroleum and Natural Gas
NAMA	Non-Agriculture Market Access
NAPIMS	National Petroleum Investment and Management Services
NCDC	National Coal Development Corporation
NELP	New Exploration Licensing Policy
NEP	National Electricity Policy
NHPC	National Hydroelectric Power Corporation
NLCL	Neyveli Lignite Corporation Limited
NOCs	National Oil Companies
NPCIL	Nuclear Power Corporation of India Limited
NPT	Non-Proliferation Treaty
NTPC	National Thermal Power Corporation
OECD	Organisation for Economic Co-operation and Development
OIL	Oil India Limited
ONGC	Oil and Natural Gas Corporation Limited
OPEC	Organization of Petroleum Exporting Countries
PFBR	Prototype Fast Breeder Reactor
PHWR	Pressurized Heavy Water Reactor
PNGRB	Petroleum and Natural Gas Regulatory Board
PPAs	Power Purchase Agreements
PSAs	Product Sharing Agreements
PSCs	Production Sharing Contracts
PSEs	Public Sector Enterprises
PSUs	Public Sector Undertakings
R&D	Research and Development
RAPS	Rajasthan Atomic Power Station
RETs	Renewable Energy Technologies
RIL	Reliance Industries Limited
RTAs	Regional Trade Agreements
SAARC	South Asia Association for Regional Cooperation
SCCL	Singareni Collieries Company Limited
SEBs	State Electricity Boards
SERC	State Electricity Regulatory Commission
SHP	Small Hydro Power
SPV	Solar Photo Voltaic
TAPI	Turkmenistan-Afghanistan-Pakistan-India
TAPS	Tarapur Atomic Power Station
UAE	United Arab Emirates
UK	United Kingdom
UNCPC	United Nations Central Product Classification
UNCTAD	United Nations Conference on Trade and Development
USO	Universal Service Obligations
USTR	United States Trade Representative
WTO	World Trade Organization

Units

Units	Full Form	Remarks
BkWh	Billion Kilowatt Hours	
Bt	Billion Tonne	10^9 Tonne
MMSCMD	Million metric standard cubic metres per day	
MMT	Million metric tonne	
Mt	Million tonne	10^6 Tonne
Mtoe	Million tonnes of Oil Equivalent	
MW	Mega Watt	10^6 Watt or 10^3 kW
Quadrillion Btu	British Thermal Unit	10^{16} Traditional British Units
TCM	Trillion Cubic Metres	10^{12} m^3
TWH	Terawatt Hour	

Introduction

Energy plays a vital and pervasive role in all national economies. It determines the quality of our lives and is one of the most important drivers of economic development. The provision of adequate, affordable and reliable energy services is essential for economic welfare, eradication of poverty, infrastructure development, growth of health services, commerce, communication and other economic activities. In fact, energy availability and consumption have become so important that the magnitude of energy consumed per capita is one of the key indicators of modernization and progress of a country.

In the past, due to its public good characteristics, energy-related services were mostly supplied by state-owned monopolies and the involvement of the private sector was limited. Since the 1990s, the sector has undergone substantial reforms and liberalization in many countries, including India, and now private players have an important role in the growth and development of this sector. Privatization led to the emergence of global players in energy services and enhanced trade in energy services.

The Uruguay Round, for the first time, brought services into the multilateral trading system. The General Agreement on Trade in Services (GATS), which came into force in January 1995, established rules and disciplines governing trade in services. The Agreement aims at progressive liberalization of trade in services through successive rounds of negotiations. Energy is one of the services covered under the GATS. In the Uruguay Round, many countries were in the process of liberalizing this sector and, as a consequence, it witnessed limited liberalization. The second round of GATS negotiations – the Doha Round – is ongoing. As a member of the World Trade Organization (WTO), India is actively engaged in the negotiations.

This paper examines the prospects of liberalizing trade in energy services within the GATS framework. Specifically, it examines India's opportunities and constraints to trade in energy services, recommends possible negotiating strategies for the government in the Doha Round and suggests reforms that would strengthen the global competitiveness of the sector.

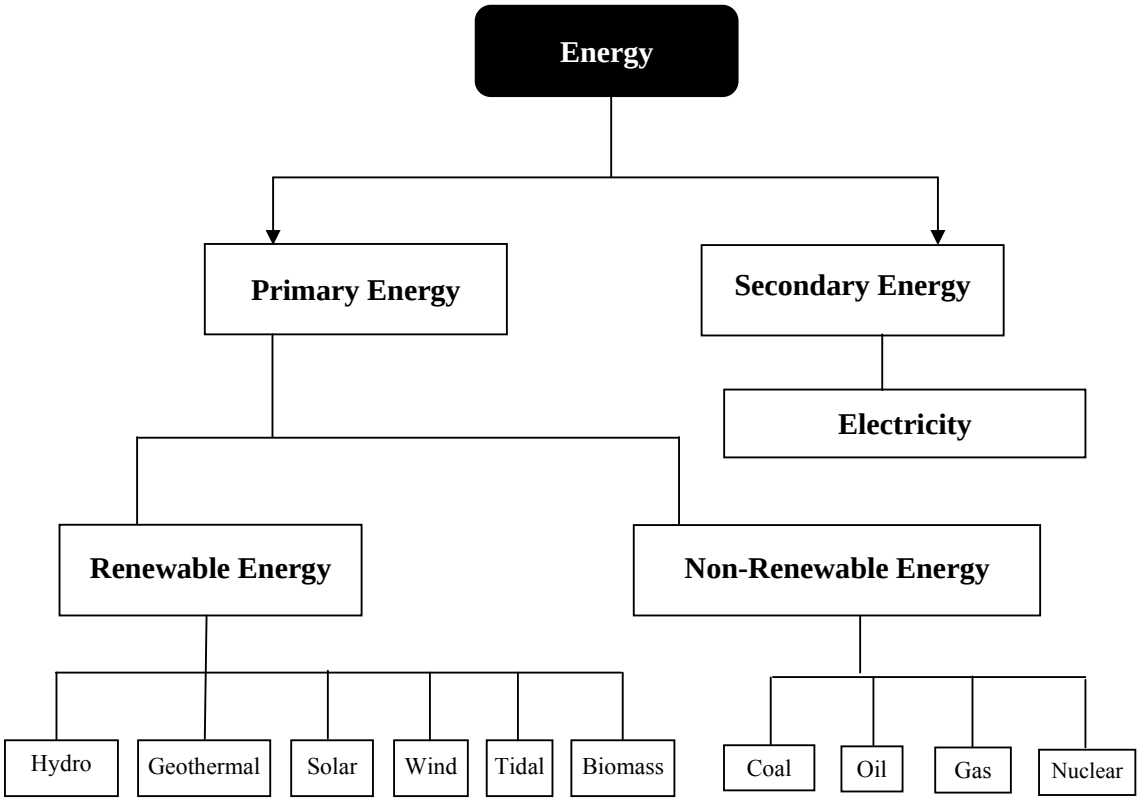
The structure of the paper is as follows: Section 1 discusses the classification and coverage of energy services under the GATS. Section 2 analyzes recent trends and developments in this sector globally, highlighting the liberalization process, trade in energy services and trade barriers. Section 3 provides a brief overview of the Indian energy services sector, emphasizing the liberalization process and domestic and external barriers to India's trade in this sector. Section 4 analyzes the commitments in this sector during the Uruguay Round. It also discusses the developments in the Doha Round, emphasizing India's negotiating strategies. Specifically, it highlights the requests of India's trading partners and India's possible response to such requests. It also discusses the possible demands which India can make on its trading partners for removal of entry barriers in markets of export interest. Section 5 discusses regulatory and other reforms which will not only improve productivity and efficiency in this sector, but also enable the country to meet the challenges and opportunities arising from trade liberalization under the GATS. The last section draws the main conclusions of the study.

1. Classification and Coverage of Energy Services

Energy can be broadly classified under two categories: Primary Energy and Secondary Energy. Primary energy is contained in raw/fossil fuels such as coal, oil, and natural gas and

can be further divided into Renewable or Non-renewable. Secondary energy is the more useable form to which primary energy may be converted, such as electricity from gas or coal. The classification of energy is shown in Figure 1.

Figure 1: Classification of Energy



One major problem in defining energy services is that there is no clear distinction between energy goods and services. This is because the energy sector has traditionally been dominated by state-owned vertically integrated utilities which performed all energy-related activities, namely, production, transmission and distribution. Some energy products such as oil and solid fuels, which can be easily stored, are considered as goods, while others such as electricity have characteristics of both goods and services[1]. During the Uruguay Round (1986-94), it was decided that production of primary and secondary energy will be covered under the General Agreement on Tariffs and Trade (GATT), and transmission and distribution of energy services will be subject to GATS rules. A broad framework of GATS is given in Appendix A. The majority of global energy services were not covered by specific commitments under GATS. Services such as construction, engineering, and consulting services which intervene in the energy value added chain (from production to resale to consumers) were defined as energy-related services rather than energy services.[2]

During the Uruguay Round, WTO member countries drew up a list of services (MTN.GNS/W/120)[3] from the United Nations Provisional Central Product Classification

[1]Electricity may be considered as a good in the sense that it is manufactured through the process of materially transforming fuels into electrons and a service in the sense that it cannot be stored and must be produced and consumed simultaneously.
[2] For details see WTO (9 September 1998).
[3]WTO (1991).

(UNCPC) for the purpose of negotiations. The WTO Services Sectoral Classification List (known as "W/120") covered 12 service sectors and over 150 sub-sectors. However, it does not have a separate comprehensive category for energy services. Important energy services (transport, distribution, construction, consulting, engineering, etc.) are covered by the respective horizontal categories, while some energy-related services are listed as separate sub-sectors. For instance, services incidental to mining and services incidental to energy distribution are classified under 'Other Business Services', and pipeline transportation is covered under 'Transport services'. One of the reasons for the poor coverage of energy services in the W/120 is that the UNCPC, from which it is drawn, also does not list energy services as a separate category. However, under each broad category, there is a corresponding CPC number for energy services. For instance, CPC 632 relates to non-food retailing services under which CPC 63297 covers retail sales of fuel oil, bottled gas, coal and wood. Given the complexities of classification, countries have to be careful in scheduling commitments. It is also important to note that after the Uruguay Round, the coverage of energy services in the UNCPC has undergone changes in line with developments in this sector. For instance, in CPC Version 1.0, new services, such as electricity distribution services (69110) and gas distribution services through mains (69120), have been included.

Given the evolutionary nature of this sector and its inadequate coverage in the W/120, classification of this sector has been widely debated since the beginning of the Doha Round. The debate largely centered around two issues: (a) whether energy services should be classified as one sector or should different parts of it be classified under relevant sectors (transport, distribution, etc.), and (b) what constitutes a comprehensive coverage of this sector. A number of negotiating proposals submitted to the WTO (for instance, by the United States of America[4], European Community[5], Japan[6], Cuba[7] and Venezuela[8]) have raised the classification issue. Some proposals, for instance, that of the EC, USA and Venezuela, provided various alternative classifications of energy services for the purpose of discussion and consultation in the WTO.

In the initial and revised offers, while making commitments, countries have not classified energy as a separate sector. In the plurilateral request, the requesting countries provided a comprehensive coverage of the sector. Based on this and W/120, the coverage of energy services is shown in Table 1.1.

Table 1.1: Coverage of Energy Services

W/120	CPC No.	Description
1.A.e	8672	Engineering services
1.A.f	8673	Integrated engineering services
1.C.a	85103	Research and experimental development services on natural sciences and engineering and technology for casting, metal, machinery, electricity, communications, vessels, aircraft, civil engineering, construction, information, etc.
1.F.c	86509	Management consulting services
1.F.d	86601	Services related to management consulting
1.F.e	8676 (partial)	Technical testing and analysis services

[4]WTO (18 December 2000).
[5]WTO (23 March 2001).
[6]WTO (4 October 2001).
[7] WTO (22 March 2002).
[8]WTO (29 March 2001), (15 October 2001), and (4 June 2003).

W/120	CPC No.	Description
1.F.h	883	Services incidental to mining[(a)]
	5115	Site preparation work for mining
1.F.j	887	Services incidental to energy distribution
1.F.m	8675 (partial)	Related scientific and technical consulting services
1.F.n	8861-8866 (partial)	Maintenance and repair of fabricated metal products, machinery and equipment, and electrical machinery (excluding maritime vessels, aircraft or other transport equipment)
3.B	5134-5136	Construction work for civil engineering for long-distance pipelines, for local pipelines, for mining
3.E	518	Renting services related to equipment for construction or demolition of buildings or civil engineering works, with operator
4.A	62113	Commission agents services – sales of fuels on a fee or contract basis
4.B	62271	Wholesale trade in services of solid, liquid and gaseous fuels and related products (excluding electricity and town gas)
4.C	63297	Retailing services of fuel oil, bottled gas, coal and wood
11.G.a	7131	Pipeline transportation of fuels

Source: Compiled by the authors from WTO (1991) and www.commerce.nic.in
Notes: (a) Services incidental to mining cover services such as drilling services, derrick building, repair and dismantling services, oil and gas well casings cementing services, which are rendered on a fee or contract basis at oil and gas fields.

2. Global Overview

Energy is one of the largest sectors in the world economy, with a turnover of at least US$2 trillion a year.[9] The total investment requirement for energy-supply infrastructure worldwide is estimated at US$16 trillion over the next three decades.[10] The world's leading energy consuming countries in 2007 are given in Table 2.1 below.

Table 2.1: World Leading Primary Energy Consuming Countries in 2007

Rank	Country	Consumption (Mtoe)	Percentage share
1	USA	2361.4	21.3
2	China	1863.4	16.8
3	Russia	692.0	6.2
4	Japan	517.5	4.7
5	India	404.4	3.6
Total		**11099.3**	**52.6**

Source: Complied from Primary Energy – Consumption (pp. 40), BP[11] (2008).
Note: In BP (2008), Primary energy comprises only commercially traded fuels such as coal, oil and gas (excludes wind, geothermal, solar energy, wood fuel and animal waste).

The total world energy consumption is projected to increase at an average rate of 1.6 per cent per year from 2005 to 2030 (Table 2.2).

[9]UNCTAD (2003).
[10]International Energy Agency (2003).
[11]Formerly known as British Petroleum.

Table 2.2: World Energy Consumption (2005-2030)

Consumption (units)	2005	2010	2020	2030	Average annual per cent change
Total Energy (Quadrillion Btu)	462.2	512.5	608.4	694.7	1.6
Coal (Quadrillion Btu)	122.5	140.2	171.7	202.2	2.0
Liquids (million barrels oil equivalent per day)	83.6	89.2	101.3	112.5	1.2
Gas (trillion cubic feet)	103.7	115.7	141.1	158.0	1.7
Nuclear energy (BkWh)	2626	2747	3283	3754	1.4
Hydroelectricity and other renewable (Quadrillion Btu)	35.5	42.0	49.3	59.0	2.1

Source: Compiled from Table A1 (pp. 95), Table A5 (pp. 100), Table A6 (pp. 101), Table A7 (pp. 102), Table A8 (pp. 103) and Table A9 (pp. 104), Energy Information Administration (2008).
Note: Liquids include petroleum-derived fuels and non-petroleum-derived fuels, such as ethanol and bio diesel, coal-to-liquids, gas-to-liquids petroleum coke, natural gas liquids, crude oil consumed as a fuel and liquid hydrogen.

The production of energy has also increased to keep pace with increasing demand. The production of the three important fossil fuels, namely, coal, gas and oil have increased by around 37 per cent, 32 per cent and 12 per cent, respectively during the period 1997-2007.[12] Access to and availability of energy, however, varies among regions and countries. The one billion people in the industrialized countries consume nearly 60 per cent of the total energy supply, whereas the five billion people living in developing countries consume the remaining 40 per cent.[13] Some countries have very large quantities of energy reserves and are called energy-rich countries, while others have small domestic reserves and are dependent on trade to meet their energy requirements. For instance, the US, China, India and Russia are rich in coal reserves, while Saudi Arabia, Iran, Iraq and Kuwait are rich in oil reserves. Countries such as France, South Korea and Vietnam have very small amounts of energy reserves.

Coal is one of the most important sources of primary energy and is also used for electricity generation. It has the most widely distributed reserves among fossil fuels. Although coal deposits are found in almost all regions of the world, commercially significant coal reserves are found only in the Asia Pacific, Europe and North America. The top five countries with the largest coal reserves in 2007 are given in Table 2.3.

Table 2.3: Countries with Largest Coal Reserves in 2007

Rank	Country	Reserves (Bt)	Percentage share
1	USA	242.7	28.6
2	Russia	157.0	18.5
3	China	114.5	13.5
4	Australia	76.6	9.0
5	India	56.5	6.7
Total		**847.5**	**76.3**

Source: Compiled from Coal - Proved Reserves (pp. 32), BP (2008).

[12]BP (2008).
[13]UNCTAD (2003).

The top five coal producing and consuming countries in 2007 are given in Tables 2.4 and 2.5, respectively. Among developing countries, India and China were among the top coal producing and consuming countries.

Table 2.4: Five Largest Coal Producing Countries in 2007

Rank	Country	Production (Mtoe)	Percentage share
1	China	1289.6	41.1
2	USA	587.2	18.7
3	Australia	215.4	6.9
4	India	181.0	5.8
5	South Africa	151.8	4.8
Total		**3135.6**	**77.3**

Source: Compiled from Coal – Production (pp. 34), BP (2008).

Table 2.5: Five Largest Coal Consuming Countries in 2007

Rank	Country	Consumption (Mtoe)	Percentage share
1	China	1311.4	41.3
2	USA	573.7	18.1
3	India	208.0	6.5
4	Japan	125.3	3.9
5	South Africa	97.7	3.1
Total		**3177.5**	**72.9**

Source: Compiled from Coal – Consumption (pp. 35), BP (2008).

About 58 per cent of the world's oil reserves are in the Middle East[14] countries. Countries with the highest oil reserves in 2007 are given in Table 2.6.

Table 2.6: Countries with Largest Oil Reserves in 2007

Rank	Country	Reserves (Bt)	Percentage share
1	Saudi Arabia	36.3	21.3
2	Iran	19.0	11.2
3	Iraq	15.5	9.3
4	Kuwait	14.0	8.2
5	United Arab Emirates (UAE)	13.0	7.9
23	India	0.7	0.4
Total		**168.6**	**57.9**

Source: Compiled from Oil – Proved Reserves (pp. 6), BP (2008).
Note: The relative position of India is given for comparison.

[14]Bahrain, Egypt, Iran, Iraq, Israel, Jordon, Kuwait, Lebanon, Palestinian territories, Oman, Qatar, Saudi Arabia, Sudan, Syrian Arab Republic, the UAE and Yemen.

Table 2.7 and Table 2.8 list the world's largest oil producing and consuming countries, respectively in 2007.

Table 2.7: Five Largest Oil Producing Countries in 2007

Rank	Country	Production (Mt)	Percentage share
1	Saudi Arabia	493.1	12.6
2	Russia	491.3	12.6
3	USA	311.5	8.0
4	Iran	212.1	5.4
5	China	186.7	4.8
23	India	37.3	1.0
Total		**3905.9**	**43.4**

Source: Compiled from Oil – Production (pp. 9),BP (2008).
Note: The relative position of India is given for comparison.

Table 2.8: Five Largest Oil Consuming Countries in 2007

Rank	Country	Consumption (Mt)	Percentage Share
1	USA	943.1	23.9
2	China	368.0	9.3
3	Japan	228.9	5.8
4	India	128.5	3.3
5	Russia	125.9	3.2
Total		**3952.8**	**45.5**

Source: Compiled from Oil – Consumption (pp. 12), BP (2008).

Natural gas has been discovered on all continents except Antarctica. The world's largest gas reserves in 2007 are given in Table 2.9. More than two-third of the natural gas reserves are located in Russia and the Middle East**.** The leading gas producing and consuming countries in 2007 are given in Tables 2.10 and 2.11, respectively.

Table 2.9: Countries with Largest Natural Gas Reserves in 2007

Rank	Country	Reserves (Tcm)	Percentage share
1	Russia	44.6	25.2
2	Iran	27.8	15.7
3	Qatar	25.6	14.4
4	Saudi Arabia	7.2	4.0
5	USA	6.0	3.4
26	India	1.1	0.6
Total		**177.4**	**62.7**

Source: Compiled from Natural Gas – Proved Reserves (pp. 22), BP (2008).
Note: The relative position of India is given for comparison.

Table 2.10: Five Largest Natural Gas Producing Countries in 2007

Rank	Country	Production (Mtoe)	Percentage Share
1	Russia	546.7	20.6
2	USA	499.4	18.8
3	Canada	165.3	6.2
4	Iran	100.7	3.8
5	Norway	80.7	3.0
24	India	27.2	1.0
Total		**2654.1**	**52.4**

Source: Compiled from Natural Gas – Production (pp. 25) BP (2008).
Note: The relative position of India is given for comparison.

Table 2.11: Five Largest Natural Gas Consuming Countries in 2007

Rank	Country	Consumption (Mtoe)	Percentage share
1	USA	595.7	22.6
2	Russia	394.9	15.0
3	Iran	100.7	3.8
4	Canada	84.6	3.2
5	United Kingdom (UK)	82.3	3.1
17	India	36.2	1.4
Total		**2637.7**	**47.7**

Source: Compiled from Natural Gas – Consumption (pp. 28) BP (2008).
Note: The relative position of India is given for comparison.

Renewable energy uses resources that are constantly replaced and, compared to fossil fuels, are usually less polluting and environment friendly. They help to mitigate the risk due to fluctuations in oil prices and are important for ensuring energy security. Some renewables such as biomass have become the cheapest options for stand-alone and off-grid applications, especially in developing countries. Renewable energy also contributes significantly to employment and, therefore, meets development objectives.

Renewables are the third most important source of electricity generation after coal and gas. In 2007, global investments in construction of renewable energy production facilities grew around 30 per cent to $71 billion (Germany $14 billion, China $12.9 billion and the US $10 billion). Construction of wind power plants had the highest (47 per cent) share of investment, followed by solar panels at 30 per cent. In 2007, renewable energy constituted around 1.5 per cent of the global electricity generation compared to 1.2 per cent in 2006. Europe and Japan are the leaders in renewable technology which is supported by generous government incentives.[15] Hydropower is the most important among renewable sources of electricity. The world's largest hydroelectricity consuming countries in 2007 are given in Table 2.12.

[15] BP (2008).

Table 2.12: Five Largest Hydroelectricity Consuming Countries in 2007

Rank	Country	Consumption (TWh)	Percentage share
1	China	482.9	15.4
2	Brazil	371.5	11.9
3	Canada	368.2	11.7
4	USA	250.2	8.0
5	Russia	179.0	5.7
7	India	122.4	3.9
Total		**3134.3**	**52.7**

Source: BP (2008).
Note: The relative position of India is given for comparison.

Although globally geothermal, wind and solar electricity generation is low (approximately one per cent), for some countries these are important sources of electricity generation. For instance, in Denmark around 20 per cent of the total electricity and in Spain and Germany 10 per cent and 7 per cent of the total electricity is generated by wind, while geothermal sources account for approximately one-fifth of the total electricity generated in the Philippines, Kenya and Iceland.[16] In Germany, 14 per cent of the total electricity generated is from renewable sources.[17]

Globally wind energy has become a mainstream energy source and an important player in the world's energy markets, and it now contributes to the energy mix in more than 70 countries across the globe. In 2006, the installed capacity of wind energy was 74,051 MW which increased to 93,864 MW in 2007.[18] The top five countries in terms of installed capacity were Germany, the US, Spain, India and China (Table 2.13).

Table 2.13: Five Largest Installed Wind Power Capacities in 2007

Rank	Country	Consumption (MW)	Percentage share
1	Germany	22,247	23.7
2	USA	16,818	17.9
3	Spain	15,145	16.1
4	India	7,845	8.4
5	China	5,906	6.3
Total		**93,864**	**72.4**

Source: Global Wind Energy Council (2008).

Nuclear energy is a clean and efficient way of generating electricity. It has distinct advantages over fossil fuels – it is environment-friendly, safe, reliable and affordable. Uranium – the fuel for generating nuclear energy – is virtually unlimited (considering both geological and technological aspects). In 2007, Australia had the world's largest uranium reserves (23 per cent) followed by Kazakhstan (15 per cent), Russia (10 per cent), Canada (8 per cent), South Africa (8 per cent) and USA (6 per cent).[19] In spite of Australia's huge reserves, Canada is the largest exporter of uranium ore and the world's largest, low-cost uranium producer, accounting for 23 per cent of the world's uranium production.[20]

[16]BP (2008).
[17]http://en.wikipedia.org/wiki/Renewable_energy_in_Germany
[18] Global Wind Energy Council (2008).
[19]World Nuclear Association (2008a).
[20]World Nuclear Association (2008c).

Nuclear energy accounts for almost 20 per cent of the electricity production in the world. The largest nuclear electricity generating and consuming countries in 2007 are given in Tables 2.14 and 2.15, respectively. At present, the US has the largest number of nuclear reactors (104) followed by France (59), Japan (55), Russia (31) and South Korea (20).[21] These five countries account for around 61 per cent of the world's total nuclear reactors. Countries with large numbers of nuclear reactors, especially the US, Japan and France, are the main supporters of nuclear energy as an alternative to fossil fuel to reduce environmental damage. Developing countries with low reserve/production of oil and natural gas, such as India and China, are looking at nuclear energy as an alternative to fossil fuel for electricity generation.

Table 2.14: Five Largest Nuclear Electricity Generating Countries in 2007

Rank	Country	Generation (TWh)	Percentage Share
1	USA	807.0	30.9
2	France	420.1	16.1
3	Japan	267.3	10.2
4	Russia	148.0	5.7
5	South Korea	136.6	5.2
18	India	15.8	0.6
Total		**2608**	**68.2**

Source: World Nuclear Association (2008b).
Note: The relative position of India is given for comparison.

Table 2.15: Five Largest Nuclear Energy Consuming Countries in 2007

Rank	Country	Production (TWh)	Percentage Share
1	USA	848.9	30.9
2	France	440.4	16.0
3	Japan	279.0	10.1
4	Russia	159.8	5.8
5	South Korea	142.9	5.2
18	India	17.8	0.6
Total		**2748.9**	**68.0**

Source: Compiled from Nuclear Energy: Consumption (pp. 36), BP (2008).
Note: The relative position of India is given for comparison.

The top five electricity generating and consuming countries in 2007 are given in Tables 2.16 and 2.17.

Table 2.16: Five Largest Electricity Generating Countries in 2007

Rank	Country	Production (TWh)	Percentage Share
1	USA	4367.9	22.0
2	China	3277.7	16.5
3	Japan	1160.0	5.8
4	Russia	1014.9	5.1
5	India	774.7	3.9
Total		**19894.8**	**53.3**

Source: BP (2008).

[21]World Nuclear Association (2008e).

Table 2.17: Five Largest Electricity Consuming Countries in 2007

Rank	Country	Consumption (TWh)	Percentage Share
1	USA	3,717.0	23.0
2	China	2,494.0	15.4
3	Russia	940.0	5.8
4	Japan	906.2	5.6
5	India	587.9	3.6
Total		**16180**	**53.4**

Source: http://www.photius.com/rankings/economy/electricity_consumption_2007_0.html

There is an uneven distribution of energy resources, production and consumption across countries. This enhances the scope for trade, and trade in energy is playing a significant role in the world economy. The world's top energy exporting and importing countries for coal, oil and natural gas [pipeline and Liquefied Natural Gas (LNG)] are given in Tables B1, B2, B3 and B4, respectively in Appendix B. These tables show that some developing countries are among the top ten exporters: for example, China and South Africa in the case of coal.

A number of developing countries such as Brazil, China, India, Malaysia and South Africa have large domestic markets and significant export potential for renewables. Focus on renewable energy can help developing countries such as India to reduce their dependence on fossil fuels. It also has the potential to increase agriculture-based exports of biofuels such as ethanol and vegetable oils.

2.1 Market Structure and Liberalization

Prior to the 1990s, energy-related services were mostly supplied by state-owned vertically integrated monopolies. The natural monopoly of the state was justified on the grounds of public service obligations[22] and the high costs of setting up infrastructure were met by charging monopolistic rents and practising cross-subsidization. Often energy was sold on the basis of long-term contracts with prices that were relatively stable, leaving little margin for trade and competition. This resulted in sizable economic welfare losses for countries that could not secure the most competitively priced energy to drive their economies.

With economic development and globalization, the demand for energy increased and countries realized the need for investment in infrastructure. Governments of many countries did not have the funds to make the requisite investments and monopoly-induced inefficiencies became more prominent. In the 1990s, a large number of countries started initiating reforms to improve the efficiency, productivity and competitiveness of this sector. In fact, energy is one of the sectors which witnessed significant privatization in the 1990s with a global value of property transfers estimated at US$37 billion in 1996, corresponding to around one-fourth of all privatization exercises carried out during that time.[23] In many cases the process began with privatization of some or all state-owned energy companies. An important component of the reforms was allowing private/foreign investment in energy utilities in order to foster greater access, more competition and diversity of suppliers. Some countries established new market rules designed to increase competition and provide consumers with greater flexibility in meeting their energy needs. Between 1990 and 1999, 76

[22]The state was expected to be the guarantor of supply, meeting the energy needs of the most vulnerable groups of the population.
[23]Gabriele, A (2004).

developing countries including Indonesia, Philippines, India and Chinese Taipei introduced private participation in energy (electricity and natural gas transmission and distribution). These countries awarded the private sector more than 700 energy projects, representing investments of almost US$187 billion. Foreign capital was a major source of funds.[24]

Although privatization was across the globe, the process was not uniform. Countries such as Argentina, the UK, Chile and New Zealand auctioned off energy companies (oil, gas and electricity) directly to the public through a bidding process – thereby allowing the market to determine the value of these companies. In Chile, first the electricity distribution companies were privatized and then electricity-generating companies were opened for foreign investment, while in Russia the government restructured the coal sector and opened it to foreign investors in 1993.

Liberalization and privatization led to outsourcing of services on a competitive basis. It provided opportunities for energy trade in open markets and fixed long-term contracts gave way to shorter-term contracts linked to spot and futures markets. These resulted in the creation of new intermediaries – brokers[25] and marketers[26] to facilitate transactions between buyers and sellers. Such intermediaries are common in countries such as Norway, Australia and New Zealand.[27] As energy trading increased, more innovative pricing options and financial instruments developed to manage price risk over time. Together, the structural changes increased the international role of energy services to support increasingly competitive physical markets for oil, gas, electricity and other energy products.

Foreign investment is an important component of the liberalization process. When five state electricity distribution companies in the Australian State of Victoria were auctioned off, all were purchased, at least in part, by US companies.[28] In the UK too, US-based companies acquired eight out of twelve privatized electricity distribution companies.[29] In Argentina, companies from Chile[30] and the US constitute almost all foreign investment in electricity, oil and gas companies. The extent and the mode of foreign participation varied across countries. Build-Operate-Transfer (BOT)[31] became a popular means of attracting foreign investment in countries such as Japan, Chinese Taipei, Malaysia and Hong Kong. Others, such as Canada

[24]Izaguirre, A.K. (2000).

[25]Brokers take commission from buyers and sellers for their services such as price determination and bill settlement services.

[26]Marketers take physical positions in the market, usually by building a portfolio of assets which may include oil fields, gas reserves, gas storage, pipeline capacity, and power plants, or by purchasing and reselling energy products from other providers. They are licensed by the government but their prices are not regulated by the government. They offer a wide range of contract terms that can be tailored to specific customer needs.

[27]Evans, P.C. (2002).

[28]http://www.itcilo.it/english/actrav/telearn/global/ilo/frame/energyun.htm

[29] For instance, Midlands Electricity was purchased by General Public Utilities and Cinergy, and Seaboard was purchased by Central and South West of Dallas, Texas. Southern Western Electricity was purchased by Southern Company of Atlanta, Georgia. (http://www.eia.doe.gov/emeu/pgem/ch5b.html)

[30] The Chilean companies (all of which are primarily electricity companies) are Chilgener, Chilquinta, Enersis and National Electric of Chile and the US Companies are Amoco, Enron, Cinergy, CMS Energy, Dominion Resources, Duke Power Entergy Corp, Houston Industries, Northeast utilities and Southwestern Public Service. (http://www.itcilo.it/english/actrav/telearn/global/ilo/frame/energyun.htm)

[31]BOT is a form of project financing, wherein a private entity receives a fee from the public sector to finance, design, construct and operate a power plant for a specified period, after which ownership is transferred back to the public sector. This is commonly used by the public sector to tap the private sector for large capital projects.

and New Zealand, used the Build-Operate-Own-Transfer (BOOT) mode to attract foreign investment.[32]

Liberalization allowed alternative providers to enter the market to supply services such as metering, billing, maintenance, repair, installation, and upgrading activities for oil, gas and electricity services. Privatization and regulatory reforms made it possible for companies to switch quickly between fuels and bundle energy services in innovative ways. For instance, oil and gas companies can now own electric plants; and electric utilities can have stakes in gas pipelines. An increasing number of utility companies, oil companies and energy equipment manufacturers started building on their respective competencies to supply energy services on a more integrated basis. The companies are now competing to provide a full range of energy asset and energy facilities management services which benefit both customers and companies. Customers benefit since they are able to purchase a range of fuels and equipment combined with supporting services at a lower cost from a single supplier and this made the companies particularly successful with large industrial and commercial customers. The process of deregulation in network industries (telecommunications, electricity, gas, transportation, etc.) led to new types of regulations (independent regulators), pricing mechanisms and market structures. The regulators imposed Universal Service Obligations (USOs)[33] which forced energy utilities to supply service in a continuous manner, to meet the needs of all customers, and provide it at the minimum possible price.

The growth of integrated service providers led to specialization. Some energy companies gravitated toward asset-based strategies focusing on energy manufacturing and energy delivery. Others focused on energy trading. The industry also witnessed mergers and acquisitions as companies tried to optimize their mix of goods and services. In the US, 22 mergers, worth US$56 billion, were announced between 1997 and 1999. Similar trends were visible in the European energy companies. Cross-border mergers and acquisitions also increased. In the electricity sector alone these transactions increased from US$20 billion in 1996 to US$38 billion in 1999.[34] Mergers and acquisitions and the growth of large players have raised concerns about anti-competitive practices.

The liberalization process in different sub-sectors is given below.

2.1.1 Coal

The structure of the coal industry has undergone considerable changes – from being a state-owned monopoly catering to the domestic market to an internationally competitive sector. Till the 1970s, isolated national producers dominated the coal industry. The oil crises in 1973 and 1979 initiated a series of reforms leading to rapid development of the international coal market. Many countries in Latin America, Africa, Eastern Europe and Central Asia introduced reforms in mining services in order to attract private sector investment in exploration and production (E&P) activities. With the opening up of the sector for foreign competition, governments started reducing subsidies and multinational corporations such as Anglo American, BHP Billiton, CONSOL Energy Inc., RAG Group and Rio Tinto with specializations in key activities (such as mining) entered this sector, gradually replacing the local coal producers. For instance, in Russia until 1993, the majority of the coal industry was state-owned and private producers accounted for less than 10 per cent of total

[32]BOOT is the same as BOT, except that instead of receiving a fee for operation, the private entity receives a net income from the asset.
[33]To provide a legal obligation to serve all customers, including those that may not be commercially attractive.
[34]Evans, P.C. (2002).

production. By the end of 2001, privately-owned Russian coal companies produced around 77 per cent of the industry's output.[35]

Even though the government still plays an important role in mining operations in many large coal-producing countries such as China, India and Poland, the sector is gradually undergoing changes. For instance, in China big coal companies are restructuring themselves by getting listed on stock markets or establishing joint ventures with foreign companies.[36]

2.1.2 Oil

The oil industry too was dominated by large vertically integrated state-owned companies engaged in the extraction, refining and distribution of oil products and mainly catering to the domestic market in a non-competitive environment. The government controlled the industry by setting prices and volume limits for production. The restructuring process began in the early 1990s. The nature and extent of liberalization varied across countries. In Russia, the process involved both the creation of a domestic (and largely privately-owned) industry out of the former state-owned monopolies and the opening up of the Russian oil sector to foreign investors. In Eastern Europe, privatization has largely been concentrated in the downstream segment with several countries allowing foreign companies to invest only in petroleum refining, marketing and operation. Many global petroleum giants, such as British Petroleum, Eni (Italy), Petro Canada, Repsol (Spain) and Total (France), underwent transitions from being state-owned to public companies.[37]

Deregulation and privatization increased competition in the international market and expanded efforts in the exploration and exploitation of oil fields. It also led to a number of mergers and acquisitions.[38]

Most of the large, vertically integrated multinationals that dominate the oil sector contract out specialized services such as consultancy services to independent consultancy companies, leading to the development of specialized consultancy firms in this sector. For instance, Edinburgh Petroleum Services (UK) provides consulting services and engineering services to the world's largest oil producing companies.

2.1.3 Natural Gas

Traditionally, the gas industry was dominated by large state-owned companies which integrated all functions including production, pipeline transportation, trading and supply, and distribution of gas. The key features of the reforms in this segment are open-access[39], unbundling[40] and vertical integration[41]. The US was the pioneer in reforms and, in 1985, it

[35]Artemiev, I, and M. Haney (2002).

[36] For example, Shenhua Group Corporation Limited, China's largest coal company, is going in for such joint ventures.

[37]A company which is owned by the public through shares and listed on a stock exchange and traded on the open market (widely accessible to all investors/consumers). It can raise funds and capital through the sale of stocks and convertible bonds.

[38] In 2001, Chevron Corporation merged with Texaco to form Chevron Texaco. In May 2005, it discontinued with Texaco and in August 2005 it merged with Unocal Corporation (Union Oil Company of California).

[39]A natural gas utility which made its transmission facilities, storage facilities, or distribution facilities available to all natural gas suppliers, transmission services providers, distribution services providers, and customers on a non-discriminatory and comparable basis.

[40]The separation of natural gas supply (production, wholesale and retailing) from pipeline transportation. Prior to the unbundling the pipeline companies could restrict competition in the wholesale gas market through non-

introduced an open-access system to the pipelines. The government created a competitive wholesale gas market by deregulating wholesale gas prices and unbundling the supply of natural gas from transportation on interstate pipelines. Flexibility in pipeline transportation services was introduced by allowing resale of firm transportation contracts in a secondary market.[42] This led to increased competition, price transparency and lower end-user prices. In the UK, the process of liberalization began in 1986 with the privatization of British Gas (BG), a single state-owned monopoly functioning in all sub-sectors such as exploration, transmission and distribution. At the same time, the government also separated the gas market into three major segments – the wholesale market[43], the contract market[44] and the tariff market[45]. The government opened the wholesale and contract gas markets which permitted large consumers to contract for natural gas directly with producers, and also allowed independent gas shippers, traders, and suppliers to arrange gas supplies for large consumers in order to create competition in wholesale supply. The tariff market remained closed to competition, and BG continued to be the sole supplier of natural gas to small consumers. In addition to liberalization, BG was re-organized and divided into two companies, namely, Centrica, which took charge of gas production, gas trading and sales, and BG Plc., which was responsible for gas transportation, storage, and international E&P. Subsequently, in 1999, BG was restructured again and the BG Group became the parent company with indirect holding in BG Transco.[46] Among developing countries, Argentina reformed the gas industry by vertically unbundling and deregulating the wholesale gas market.

The liberalization process changed a market characterized by the dominance of a few service providers to one with multiple service providers. This created new opportunities for private sector participation, with the greatest business opportunities arising in the competitive segments of production and marketing. Consumers now have a wide range of choices. They can choose their suppliers, tariffs, services and payment options.

Liberalization and reforms led to an increase in efficiency and greater production. Due to competition, the prices for natural gas came down in many countries. For example, in the UK, during 1990-2000 prices declined by more than 20 per cent, while in Australia prices fell by 22 per cent and 11 per cent for the industrial and residential segments, respectively during 1997-98.[47] However, this trend was not noticeable in all countries and, in some market-based economies, prices were higher than those under a government-subsidized regime. For example, in Argentina the removal of natural gas price controls and the introduction of competition resulted in a 15 per cent increase in prices during 1993-95.[48]

Liberalization and reforms also led to the emergence of markets in other segments such as natural gas storage, metering and meter installation, and system balancing.

---

price measures such as low-quality transportation services. Unbundling eliminated this distortion and created a level playing field for all participants in the natural gas market.

[41]This is a style of ownership and control. Vertically integrated companies are united through a hierarchy and share a common owner. Usually each member of the hierarchy produces a different product or service, and the products combine to satisfy a common need.

[42]Juris, A (1998).

[43]In which gas is traded between producers, traders, British Gas and independent suppliers.

[44]Where gas is supplied to large consumers by British Gas or independent suppliers.

[45]Where gas is supplied to small consumers (with annual consumption below the threshold for large consumers) by BG.

[46]Gastech (2003).

[47]UNCTAD (2003).

[48]International Energy Agency (1999).

2.1.4 Renewable Energy

The need to invest in renewable energy was strongly felt after the oil crises of 1973 and 1979. This sector is more suitable for private investment since it is less sensitive to scale economies and more decentralized. Governments of many countries including Germany, Japan, Netherlands, the UK and the US, are actively encouraging private investment in this sector by providing various fiscal incentives, subsidies, and support for third-party financing, and by having dedicated R&D funding. Large multinationals such as BP and Shell specializing in fossil fuels have entered this segment. Shell has invested in renewables in many developing countries including Brazil, India, Kazakhstan, Pakistan, Sri Lanka, Turkmenistan, Uzbekistan and Zimbabwe.

2.1.5 Nuclear Energy

Due to security concerns, governments of many countries play an active role in developing nuclear energy technologies and in dealing with issues such as long-term viability and expansion of nuclear electricity, the need for reduction of nuclear wastes, and safety and performance of electricity generations. The general trend in the past decade, however, has been to move nuclear generation and fuel cycle companies from government ownership to investor ownership. Companies which have made such transitions include the US Enrichment Corporation (USA), British Energy (UK) and Endesa (Spain). In the US, out of the 104 operable nuclear reactors, only nine are owned and operated by the government while 95 are owned and operated by private players.[49]

2.1.6 Electricity

Until 1990, most countries (with the exception of a few such as the US and Japan) had vertically integrated, state-owned utilities that owned the bulk of the generation capacity, transmission and distribution facilities. This monopoly was justified on the grounds of requirement of huge investment for setting up large electricity plants, economies of scale, long gestation periods and USOs among others. Chile was one of the first countries to liberalize its electricity market in 1982. The Chilean electricity sector was vertically separated into three basic business units – generation, transmission and distribution. A new regulatory framework and a wholesale electricity trading mechanism were put in place to encourage competition. The liberalization had a positive effect on installed capacity, efficiency, quality of service and supply. It is referred to as a successful example of electricity liberalization in a developing country and motivated numerous countries to follow it during the 1990s. Most Latin American countries including Brazil, Bolivia, Colombia and Peru have been influenced by the Chilean liberalization and adopted the same approach.

The UK was the first developed country to privatize its electricity industry in 1990, which was in turn a part of the overall privatization process that the UK was undergoing. Electricity was among the last and more controversial sectors to be privatized (privatization of gas happened in 1986). An important component of the reform was the creation of a national wholesale electricity pool[50] and in this the UK registered new ground in electricity

[49] http://www.nea.fr/html/general/profiles/usa.html

[50] The Electricity Pool defines market trading rules and procedures. The Pool facilitates a competitive bidding process between generators and establishes the preferred generation merit order, and, similarly, it also facilitates the mechanisms to support competition in supply, where customers can choose their supplier. Currently, these pools are in operation in many countries including the UK (England and Wales), Norway, Australia, Spain, Canada (Alberta), Chile and Argentina.

reforms. Although many nations have privatized their electricity industries since the 1990s (or are currently undertaking such efforts), the UK's electricity privatization effort has been among the world's most ambitious and path-breaking. Several countries have followed the UK experience as a policy guide in their own electricity restructuring, privatization, and regulatory reforms. For instance, Norway, Argentina and Australia have adopted variations of the UK model. Among other European nations, Hungary too adopted an ambitious privatization program in 1991; the state-owned electricity companies were privatized and foreign participation in electricity companies were allowed. Other countries to privatize include the Czech Republic, Poland and Russia. In Asia, countries such as India, China, Indonesia, Malaysia, Pakistan and Nepal introduced private participation in electricity mainly through private financing of new generation capacity in the form of Independent Power Producers (IPPs).[51]

Liberalized markets have provided new opportunities for private-sector firms to compete in the development and construction of energy infrastructure around the world. IPPs are now an important means of expanding generation capacity, introducing competition into the generation business, and transferring some risks from the public sector to the private sector. It also provided opportunities for private sector firms to enter into wholesale electricity trading arrangements, electricity pools, brokering of electricity, and other energy products.

The liberalization experience shows that most countries are willing to introduce competition in the generation and the distribution sector, while retaining some control over the transmission network (infrastructure). On the other hand, post-liberalization, low-cost and small-scale generation units were allowed to produce electricity closer to end-users to reduce the reliance on transmission and distribution networks. Liberalization also resulted in a growing convergence of petroleum-related activities and electricity-related activities, due to significant improvements in the efficiency of gas-fired electricity generation units. Moreover, in many countries such as the UK, natural gas deregulation was accompanied by deregulation of electricity.

The privatization process brought about a shift from a market characterized by a few service providers and captive customers to one with an array of choices and participants. This, in turn, created a number of new opportunities in competitive segments of production and marketing. In the UK, in the decade following electricity privatization, from seven vertically integrated regional monopolies there were 42 generation companies and 29 licensed marketers.[52]

Competition enabled consumers to choose their service providers on the basis of price and quality. In the UK, competitive marketing was introduced in three stages: to large consumers in 1990, to medium-sized consumers in 1994, and to domestic consumers in 1998. By 2000, nearly 81 per cent of large consumers and 38 per cent of residential consumers had switched to a new electricity marketer.[53]

---

[51]An IPP is a privately-owned power producer. IPPs are recognized as an important means of expanding generation capacity, introducing competition into the generation business, and transferring some risks from the public sector to the private sector. They are often the first private investors in a power market dominated by state-owned power utilities and they can enter the wholesale power market under any of the market structures.

[52]UNCTAD (2003).

[53]UNCTAD (2003).

The impact of privatization varied across countries. In some countries, such as the UK, Sweden, Germany, New Zealand and Argentina, electricity prices fell due to the expansion of third-party access to networks, and the establishment and operation of electricity spot markets. This led to a noticeable improvement in service quality and the number of interruptions (fault-related) decreased. There have been a few cases where liberalization has been less successful/or has failed. For instance, in California, the liberalization process was not well-conceived and the deregulated market was not allowed to work properly. It resulted in an increase in wholesale prices of electricity. The widespread black-outs in North America, Italy and Scandinavia in 2003 are examples of failures of electricity liberalization.

On the whole, the liberalization process has been successful in some countries while it failed in others. The failures have largely been attributed to the lack of an appropriate regulatory regime to support the liberalization and restructuring. In the case of energy services, liberalization can confer benefits if it is accompanied by a strong regulatory framework which is transparent and ensures access and affordability of services, quality standards and prevents anti-competitive behaviors. Since energy has traditionally been treated as a public good, the fees do not always reflect the cost, and government-owned monopolies have often met their public service obligations through cross-subsidizations. Charging cost-reflective tariffs has been one of the most controversial aspects of the liberalization process. Sometimes, liberalization is resisted by the incumbent providers because they feel that the new entrants would cherry-pick the market and leave them saddled with the costs of meeting various social obligations. The private sector, on the other hand, is facing several problems such as access to government-owned networks and cost-based pricing.

Although privatization is an important component of reform, simply changing ownership from the government to the private sector may not foster competition if the new company retains the structure and dominant position of the old government entity. A strong independent regulator is essential for private players to compete and to protect the interests of consumers from anti-competitive suppliers. Markets in many developing countries are still evolving and they lack adequate regulatory agencies and competition authorities.

2.2 Trade in Energy Services

Liberalization and privatization created new services associated with energy production, distribution and transmission and enhanced trade in energy services. Trade in energy services takes place through all the four modes of trade as specified under the GATS, namely, Mode 1 (cross-border trade), Mode 2 (consumption abroad), Mode 3 (commercial presence) and Mode 4 (movement of natural persons). Trade through Mode 1 covers cross-border interconnection of electricity grids, transportation of oil and gas through pipelines, providing energy-related consultancy services on the Internet, and on-line trading and brokering services, among others. Trade through Mode 2 includes services such as use of machineries in a foreign country and sending people abroad for training. With liberalization, Mode 3 has become an important mode of trade. It involves the establishment of presence in a foreign country. In developing countries FDI inflows (Mode 3) can play a crucial role in building infrastructure and facilitating transfer of technology. Mode 4 covers the temporary movement of skilled professionals to deliver technical and managerial services, as well as the temporary movement of semi-skilled and unskilled personnel for construction and upgrading of facilities and grids.

Gas is normally traded across neighboring countries through high-pressure pipeline networks. Cross-border trade in gas via pipelines is found in North America (between Canada

and the USA) and in Europe (between Russia and members of the EU). As shown in Table B3 in Appendix B the main gas (via pipeline) exporting countries in 2007 were Russia, Canada, Norway, Netherlands and Algeria. The main gas importing countries were USA, Germany, Italy, France and Turkey. Due to the high cost of building networks, barriers to third-party access and other technical barriers, gas is also traded in the form of LNG mainly through maritime transport. In 2007, most LNG trade took place in the Asia-Pacific region with Indonesia, Malaysia and Qatar being the main exporters, while Japan was the main importing country, which traded with Middle East countries (Oman, Qatar and the UAE) and with Asia-Pacific countries such as Australia, Indonesia, Malaysia and Brunei Darussalam.

Cross-border trade in electricity depends on the existence of interconnections between national electricity grids. It is common among EU member countries. The US is an importer of electricity from Canada and Mexico. In Asia, interconnections exist between some countries such as Thailand and Laos, and Indonesia and Singapore and trade occurs through Mode 1.

With liberalization and unbundling of national energy markets, trade through Mode 3 has increased. Privatization opened enormous opportunities for foreign investment through IPPs, BOT and joint ventures among others. Although the majority of international players are from the developed countries while developing countries provide the main markets, companies from developing countries such as Saudi Aramco (Saudi Arabia) and ONGC Videsh Limited (OVL) (India) have established a global presence.

Some multinationals offer a variety of services across different energy segments while others have specialized in particular services or particular segments. For example, Shell (Netherlands), which operates in 130 countries (including Canada, USA, Iran, Saudi Arabia, Pakistan, India, Japan and China), is engaged in five core businesses – Exploration and Production (E&P), petroleum refining, downstream gas and electricity, chemicals, and renewables. It also provides consultancy, technical services and R&D services to the energy industry. BG Group (UK) specializes in natural gas and operates in approximately 20 countries including the UK, Kazakhstan, Norway, Argentina, Brazil, Canada, the US, Israel, India and Malaysia. Chevron Corporation (USA) which operates in approximately 180 countries including Canada, China, India, Russia, Angola, Algeria, Australia, Kazakhstan, Belgium, France, Brazil, Argentina, the UAE and Saudi Arabia, is engaged in different activities such as E&P, refining, marketing, pipelines, electricity generation and mining. International Power Plc (UK) is a global electricity generation company with 37 power stations in 18 countries including Australia, the US, the UK, Italy, Turkey, Oman, Saudi Arabia, the UAE, Indonesia, Malaysia and Pakistan.

Liberalization and globalization have increased the possibilities of providing energy-related consultancy services. Companies now tend to outsource certain energy services and some companies have specialized in energy-related consultancy services. For instance, Barlow Jonker (Australia) offers advisory and information services to coal and energy industries internationally. Edinburgh Petroleum Services (UK) provides consulting services to the world's major oil producing areas and has offices in Edinburgh, Dubai, the US, Mexico, Malaysia and China. Developing countries (such as India) which have comparative advantages in the supply of high-skilled manpower at competitive prices can create a niche for themselves in providing such consultancy services.

Given the importance of energy in economic development, this is one of the key sectors in the on-going Doha Round of multilateral negotiations and in bilateral and regional

agreements. Countries have formed groupings, treaties, cartels, etc. to accord preferential treatment to selected trading partners and gain from trade in energy. Some of these are discussed in Appendix C.

2.3 Trade Barriers

There are various barriers to trade in energy services. These can be classified as under:

2.3.1 Barriers in accessing a foreign market or market access barriers
2.3.2 Discriminatory or national treatment barriers
2.3.3 Regulatory barriers
2.3.4 Other barriers

2.3.1 Market Access Barriers

Restrictive business practices by incumbent monopolies are major barriers to cross-border trade. When some countries have liberalized while others have a monopolistic regime, cross-border supply of gas and electricity are restricted due to lack of third-party access. Unfair, discretionary and high transmission/transit[54] fees restrict cross-border trade. There are numerous disputes on transit fees between the Russian Federation and Ukraine, which is known as the main transit route for Russian gas. Requirements of local presence for providing services, residency and registration requirements also affect trade in this sector. For instance, in Russia a foreign company should have a legal establishment for offering cross-border services.[55]

Foreign ownership restriction is the most common restriction under Mode 3. Some countries do not allow foreign investment in certain segments of energy while others allow it only partially. Several countries restrict or completely bar oil companies from engaging in downstream gasoline and other retail marketing. In Kuwait, foreign firms are not allowed to invest in the upstream petroleum sector, but can only invest in petrochemical joint ventures. Foreign Direct Investment (FDI) up to 100 per cent is only allowed in electricity projects. In Sri Lanka, FDI only up to 40 per cent is allowed in mining and primary processing of non-renewable national resources. Countries have also imposed local incorporation and/or joint venture requirements. In Nigeria, investment in the petroleum sector is limited to existing joint ventures or Production Sharing Agreements (PSAs).[56]

Some countries such as Malaysia have imposed the requirement of having a local board of directors for establishing commercial presence, while others have a strict quota for locals. For example, in Nigeria, foreign oil and gas companies must hire Nigerian workers. Certain management positions can be filled by expatriates with the approval of the National Petroleum Investment and Management Services (NAPIMS) agency; however, each oil company has to negotiate its expatriate worker allotment with NAPIMS.

[54]Transit fees are a kind of royalty or license fee which are usually paid by one country to other country for accessing services which are forwarded by a third country.
[55]American Chamber of Commerce in Russia (2006).
[56]PSAs are among the most common types of contractual arrangements for petroleum exploration and development. Under a PSA, the state as the owner of mineral resources engages a foreign oil company (FOC) as a contractor to provide technical and financial services for exploration and development operations. The state is traditionally represented by the government or one of its agencies, such as the national oil company (NOC). The FOC acquires an entitlement to a stipulated share of the oil produced as a reward for the risk taken and services rendered. The state, however, remains the owner of the petroleum produced, subject only to the contractor's entitlement to its share of production.

Barriers to cross-country temporary movement of service providers include rigid work permit and visa regimes (USA, Iran), requirement to employ locals (Nigeria, Qatar), mandatory requirements to have local sponsors (Kuwait, Qatar, Oman), commercial presence requirements (Oman), non-recognition of professional qualifications (China, the EU and the US), difficulties in getting multiple-entry visas [some Gulf Cooperation Council (GCC)[57] countries] and/or extending the period of stay. In addition, countries have imposed various other barriers such as an economic needs test (ENTs) and labor market tests, minimum wage requirements, requirements to contribute to social security and preferences for certain categories of people (Muslims in Saudi Arabia).

2.3.2 Discriminatory or National Treatment related Barriers

Government procurement is one of the main barriers to trade in energy services. In some countries, there are limitations on foreign capital participation in procurement bids. In others, the government gives subsidized prices and tax benefits to local firms, which foreign companies cannot avail. In Malaysia, preference is given to Bumiputras (Ethnic Malays), foreign firms do not have the same opportunities as some local companies to compete for contracts and, in most cases, foreign firms are required to take on a local partner before their bids are considered. In China, it is difficult for foreign firms to obtain licenses for offering construction services and they have to get project-by-project clearances; they also face bidding restrictions. Chinese engineering and architectural firms have to approve and stamp all drawings prior to construction.[58] In Kuwait, foreign companies cannot sell directly to the government or participate in public tenders except through a local agent and the government prescribes a 10 per cent price advantage for local firms in government tenders which are not available to foreign firms. In Brazil, federal, state and municipal governments, as well as related agencies and companies, in general follow a "buy national" policy which imposes a restriction on foreign players. In Russia, there is a Central Bank restriction on medium-term loans (more than 180 days) of hard currency for the purchase of imported inputs.[59]

Non–transparent government procedures and lack of sufficient access to procurement, pricing and other information can be a trade barrier. In China, foreign firms engaging in oil exploration often face barriers related to lack of access to prime exploration areas and updated prices. In the case of electric utilities, US companies have pointed out that Japanese utilities reject registration applications by foreign suppliers because foreign companies are not consumers of electricity generated by Japanese utilities.[60]

In some countries, such as Kenya, branches of foreign companies have to pay higher taxes than local companies. In Indonesia, there is an additional withholding tax of 20 per cent on the post-tax income of foreign companies.

Many companies participating in the energy market are wholly or partially government-owned. This provides scope for direct or indirect government involvement in investment and commercial decisions which, in some circumstances, act as a barrier to trade. In several uranium-producing countries, including Canada, France, Gabon and Niger, there are various levels of state involvement in uranium mining companies (in Canada this was reduced in 1994). Although all these companies operate as commercial entities, the state can and sometimes does give direct and indirect subsidies. In the uranium producing countries of the former Soviet Union (principally Russia, Kazakhstan and Uzbekistan), which have recently

[57]Member countries are Saudi Arabia, Kuwait, Bahrain, Qatar, the UAE, Oman and Yemen.
[58]USTR (2006).
[59]USTR (2006).
[60]USTR (2006).

accounted for about one-quarter of world uranium production, governments retain a significant stake in uranium mining companies. A similar situation exists in China and countries in Central and Eastern Europe.

2.3.3 Regulatory Barriers

Energy is a highly regulated sector. Some of the regulations are imposed to protect important policy objectives such as health and safety, universal service obligations, consumer and environmental protection. Although regulatory barriers are usually applicable to both domestic and foreign firms, they may affect foreign firms more adversely. The cost of setting up energy infrastructure is high and, therefore, access to infrastructure is essential for setting up a successful operation. The monopolistic transmission companies often restrict third-party access to competitors from generation, supply and distribution division in cases where the third-party access is not regulated. Delays in getting approvals (in countries such as Nigeria[61]) and requirement of multiple clearances can act as barriers to trade. In Indonesia, every business entity or permanent establishment can get only one contract area; if a company wants to have more than one contract area, it has to establish a separate legal entity for each contract area.[62] Since the sector had been under public monopolies, even after liberalization, governments often tend to protect the interests of the monopolies. Although many countries have introduced independent regulators, they have not always been successful. For instance, in Germany the regulatory framework proved inadequate to bring network prices down to internationally comparable levels.[63] Non-transparent and evolving regulations in countries, such as Russia and China, create uncertain business environments. Trade is restricted by restrictions on imports of equipment and tools needed for production or maintenance services.

Trade in energy services is subject to various regulations related to the environment and safety. Non-transparent regulations concerning environmental permits and pipeline access in countries, such as Russia, act as a barrier to trade.[64] The environmental policies of the EU place barriers on coal usage through measures such as the Large Combustion Plants Directive (2001/80/EC)[65] and the EU Greenhouse Gas Emission Trading Scheme[66] at the individual Member State level. Production, transformation and disposal of nuclear fuel are subject to strict safety and environmental regulations in many countries including most EU countries. While some of these regulations are necessary, they increase the cost of investment.

2.3.4 Other Barriers

A major barrier to cross-border trade in electricity and gas even among neighboring countries is differences in technical standards. In the case of electricity, cross-border trade is affected by the lack of interconnection between national electricity grids. In 2002, the European Council agreed that all Member states must have interconnection equivalent to at least 10 per cent of their national consumption. This has not happened so far.[67] Geographical distance is also a barrier to cross-border trade in electricity and gas.

---

[61]USTR (2006).
[62]Information was provided during the survey and is also mentioned in USTR (2006).
[63]For details see OECD (2006).
[64]USTR (2006).
[65]This directive applies to combustion plants with a thermal output greater than 50 MW. http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/l_309/l_30920011127en00010021.pdf
[66]http://ec.europa.eu/environment/climat/emission.htm
[67]WTO (February 2007).

Rivalries/political differences between nations or between sub-national groups, different political systems, political interference, time-to-time sanctions from the government, internal disunity toward the energy policy goals, and emphasis on national energy self-sufficiency often act as barriers to trade in energy. For instance, the oil dispute between Russia and Belarus, after the two countries imposed oil levies against each other, adversely affected the oil sectors of Germany, Poland, Hungary, Slovakia and the Czech Republic since Russia is the sole oil supplier to these countries.[68]

There are various other barriers to trade in energy services such as corruption[69], language[70] and weak legal framework. Electricity is treated as a public good and is often subsidized. Moreover, it is stolen in large amounts in many developing and transition economies. Private companies face a situation where they cannot collect reasonable tariffs and avoid loss by theft. This deters investment.[71]

3. Overview of Indian Energy Sector

India is both a major energy producer and consumer. India currently ranks as the world's seventh largest energy producer, accounting for about 2.5 per cent of the world's total annual energy production. In 2007, it was the fifth largest energy consuming country, using around 3.6 per cent of the world's total annual energy consumption (Table 2.1). In the past few years, India has emerged as a major economy in the world through a sustained Gross Domestic Product (GDP) growth of around 8 per cent. The high level of growth and increase in economic activities created greater demand for energy. Along with China, India is now driving the energy market of not only Asia, but the world as a whole. As demand for energy continues to outstrip production at home, India has emerged as a major importer of energy, either through trade or investment in countries rich in fossil fuels.

India's primary fuel consumption across different commercial fuels is given in Table 3.1 and the consumption projections are given in Table 3.2. The projections over the 25-year period (2005-2030) show that there will be an average annual increase of 2.9 per cent in India's energy consumption which is much above the global average of 1.6 per cent (as shown in Table 3.2). If the consumption projection is compared with the primary energy production (as shown in Table 3.3), there is a demand-supply gap in certain key sectors such as oil and gas. Although the projections vary across different studies, they all emphasize the demand-supply gap. For instance, a Planning Commission report[72] pointed out that under various scenarios, with an 8 per cent GDP growth rate the import dependence for energy in 2031-32 could range between 29 to 59 per cent with oil imports ranging between 90-93 per cent. Another report by the Planning Commission[73] pointed out that in future domestic gas production would meet around 20 per cent of the total demand and the rest would be met by imports.

While the domestic production of crude oil has stagnated around 31-33 MMT per year for the past few years, the demand has been steadily increasing. The total consumption of

[68]BBC News, 'Russia oil row hits Europe supply', 8 January 2007, http://news.bbc.co.uk/2/hi/business/6240473.stm

[69]Corruption is a problem in some countries such as Kenya and Indonesia. Companies often have to pay irregular fees to obtain the required permits or licences, and government awards of contracts and concessions are based on personal relationships (USTR, 2006).

[70]In Algeria, all foreign companies have to submit their official documents in French (USTR, 2006).

[71]For details see Walde, T.W. and A.J. Gunst (2003).

[72]Planning Commission (2006).

[73]Planning Commission (2002).

petroleum products grew at the rate of 5.7 per cent per annum between 1980-81 and 2003-04.[74] Consequently, India's dependence on imported crude oil has been rising and, in 2006-07, it was over 77 per cent of the domestic requirement. During the year, India imported 99.41 MMT of crude oil.[75] This growing import dependence not only raises supply risks, but also makes the economy susceptible to market risks. Similarly, there is a mismatch between demand and domestic production of natural gas. Against a total demand of 118 million metric standard cubic meters per day (MMSCMD), the supply of natural gas was only 80 MMSCMD in 2006-07, a shortfall of 28 MMSCMD.[76]

Per capita consumption of energy in India is one of the lowest in the world.[77] Even today a large number of people in the rural areas depend on traditional sources of energy, such as firewood, animal dung and biomass. Those who have access to electricity also suffer from shortages and poor quality of supply. To meet the rising demand, India needs to invest in energy-efficient technologies, in sub-sectors such as renewable energy which use resources that are in abundant supply, and improve the transmission and distribution efficiency in the electricity sector. Given that India is a net importer of energy and energy security is key to sustainable economic development, energy services is becoming an important sector in India's international engagements.

Table 3.1: India's Primary Energy Consumption by fuel in 2007

Fuel	Consumption (Mtoe)	Percentage share
Coal	208.0	51.4
Oil	128.5	31.8
Gas	36.2	9.0
Renewable (Hydro)	27.7	6.8
Nuclear Energy	4.0	1.0
Total	**404.4**	**100**

Source: Compiled from Primary Energy: Consumption by fuel (pp. 41), BP (2008).

Table 3.2: Indian Energy Consumption (2005-2030)

Consumption (units)	2005	2010	2020	2030	Average annual per cent change
Total Energy (Quadrillion Btu)	16.2	19.4	26.6	33.2	2.9
Coal (Quadrillion Btu)	8.6	9.9	12.9	15.5	2.4
Liquids (million barrels oil equivalent per day)	2.4	2.7	3.8	4.9	2.8
Gas (trillion cubic feet)	1.3	1.8	2.9	3.9	4.6
Nuclear energy (BkWh)	16	37	104	149	9.4
Hydroelectricity and other renewable (Quadrillion btu)	1.1	1.5	1.6	1.9	2.4

Source: Compiled from Table A1 (pp. 95), Table A5 (pp. 100), Table A6 (pp. 101), Table A7 (pp. 102), Table A8 (pp. 103) and Table A9 (pp. 104), Energy Information Administration (2008).
Note: Liquids include petroleum-derived fuels and non-petroleum-derived fuels, such as ethanol and bio diesel, coal-to-liquids, gas-to-liquids petroleum coke, natural gas liquids, crude oil consumed as a fuel and liquid hydrogen.

[74] Planning Commission (2006).
[75] http://www.assocham.org/events/recent/event_189/Gokul-Chaudhri-BMR.pdf
[76] http://in.rediff.com/money/2007/mar/22energy.htm
[77] Planning Commission (2006).

Table 3.3: Indian Energy Production (2005-2030)

Production (units)	2005	2010	2020	2030	Average annual per cent change
Liquids (million barrels oil equivalent per day)	0.8	1.1	1.2	1.3	1.8
Gas (trillion cubic feet)	1.1	1.5	2.4	2.9	4.1
Total Generating Capacity (GW)	138	201	296	398	4.3
Installed coal-fired Generating Capacity (GW)	79	96	140	173	3.2
Installed liquid-fired Generating Capacity (GW)	6	7	6	6	0.1
Installed natural gas-fired Generating Capacity (GW)	15	37	78	133	9.1
Installed hydroelectric and other renewable Generating Capacity (GW)	53	56	57	66	0.8
Installed nuclear Generating Capacity (GW)	3	5	14	20	8.2

Source: Compiled from Table 5 (pp. 41), Table G1 (pp. 207), Table H1 (pp.229), Table H2 (pp.230), Table H3 (pp.231), Table H4 (pp. 232), Table H5 (pp. 233), and Table H6 (pp. 234), Energy Information Administration (2008).
Note: Liquids include petroleum-derived fuels and non-petroleum-derived fuels, such as ethanol and bio diesel, coal-to-liquids, gas-to-liquids petroleum coke, natural gas liquids, crude oil consumed as a fuel and liquid hydrogen.

Among different sub-sectors of energy, coal is the most abundant fossil fuel in India. It accounted for almost 51 per cent of the primary fuel consumption in 2007 (Table 3.1). In the same year, India was the third largest coal consuming and fourth largest coal producing country in the world (see Tables 2.4 and 2.5). It was the fifth largest country in terms of coal reserves, accounting for 6.7 per cent of world's total reserves (Table 2.3). Coal is primarily located in the states of Bihar, West Bengal and Madhya Pradesh. Around 75 per cent of domestic coal production is consumed by the electricity sector.[78]

Oil and gas together comprised around 41 per cent of India's primary energy consumption in 2007 (Table 3.1). Although India has a low reserve of oil and gas (see Tables 2.6 and 2.9), it ranked as the fourth largest oil consuming country and accounted for around 3.3 per cent of the world's total oil consumption in 2007 (Table 2.8). India ranked relatively low (17th) among natural gas consumers in 2007 (Table 2.11). Given its low domestic production and high domestic consumption, India is a net importer of oil and gas. India was the fifth largest oil importer in 2006 (Table B2 in Appendix B). India is also the seventh largest importer of natural gas (LNG) in 2007 (Table B4 in Appendix B). In the same year, India ranked fifth in oil refining capacity with 3.4 per cent of the world's refining capacity. The Reliance Petroleum Refinery at Jamnagar is the world's largest single stream refinery. India is increasing its share in the global refining capacity and this is likely to improve with the completion of the second Reliance refinery in Gujarat with a capacity of 5,80,000 barrels per day.

[78] http://www.indiacore.com/coal.html

India is the leading country in Asia and one of the leading countries in the world in generating electricity through renewable energy sources. The country is abundantly endowed with renewable energy in the form of solar, wind, hydro and bio-energy and has significant potential for generation of electricity from renewable energy sources. Renewable energy would not only reduce India's dependence on imported fuels but is also environment friendly. Additionally, some forms of renewable energy such as biomass electricity production and ethanol motor fuel can create rural employment. Renewable energy sources contribute 5 per cent of the total electricity generating capacity.[79] Wind has the highest share among renewable energy sources. Wind energy generates around 3 per cent of all electricity produced in India. In 2007, India ranked fourth among the wind energy producing countries of the world (Table 2.13).

India was the seventh largest hydroelectricity generating country in the world in 2007 (Table 2.12). There has been a continuous increase in the installed capacity of hydroelectric stations in India, which is presently 35,209 MW (Table 3.4). Small hydro projects can play a critical role in improving the overall energy scenario of India, particularly in remote and inaccessible areas. It is estimated that India's small hydro power potential is around 15,000 MW. The government is encouraging the development of small hydro projects by the private sector in various states such as Andhra Pradesh, Haryana, Himachal Pradesh, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. So far, 523 small hydro power projects with an aggregate installed capacity of 1705 MW have been installed and 205 projects with an aggregate capacity of 479 MW are under implementation. Fifteen states have announced policies to attract private sector entrepreneurs to set up such projects.[80]

Biomass has always been an important source of energy in India. It is used by 90 per cent of rural households as domestic fuel.[81] It is also used as an industrial fuel by small industries in the unorganized sector and cottage industries. Biomass along with dung cakes accounts for almost a third of India's total primary energy consumption.[82] Solar energy can be exploited to meet the ever-increasing requirement of energy in India. Its suitability for decentralized applications and its environment-friendly nature make it an attractive option to supplement the energy supply from other sources. Solar energy has a huge potential in India, but much of its potential is yet to be used.

India has the capability to design, build, operate and maintain nuclear power plants, manufacture all associated equipments and components and produce the required nuclear fuel and special materials.[83] However, the country has a very small amount (only 1 per cent) of the world's total uranium reserves[84] and, moreover, this uranium is extracted from very low quality ore which makes Indian nuclear fuel two to three times more expensive than international supplies.[85] Hence, although the country ranked ninth in terms of number of nuclear reactors (17 nuclear reactors)[86], it ranked much lower (18th) in terms of nuclear electricity production and consumption in 2007 (see Tables 2.14 and 2.15). As India has 12

[79] http://mnes.nic.in/booklets/Book7-e.pdf
[80] http://mnes.nic.in/booklets/Book7-e.pdf
[81] http://www.indg.in/rural-energy/rural-energy/sources-of-energy/re-basics-src-bio
[82] Planning Commission (2006).
[83] Nuclear Power Corporation of India Limited (1997).
[84] World Nuclear Association (2008a).
[85] Planning Commission (2006).
[86] World Nuclear Association (2008c).

per cent of the world's total thorium reserves,[87] it is in the process of developing technology to utilize thorium as a nuclear fuel.

The electricity sector has grown substantially since Independence. From an installed capacity of 1362 MW in 1947, it has reached 141,079.8 MW in 2007-2008.[88] With economic development, the demand for electricity is growing at a fast pace. In 2007, India was the fifth largest electricity generating as well as consuming country (see Tables 2.16 and 2.17). Fuel-wise installed capacity in 2007-08 is given in Table 3.4 below. Despite the growth in the installed capacity, the per capita consumption of electricity in India is only 606 kWh compared to the global average of 2429 kWh.[89] A Planning Commission report[90] pointed out that although the installed capacity for electricity generation has tripled over the past 20 years, the total demand for electricity is expected to increase by another 3.5 times in the next two decades, even under a best-case scenario that envisions intensified efforts to modernize electric plants, improve transmission and distribution efficiency, and adopt more efficient generation technologies.

Table 3.4: India's Fuel-Wise Installed Capacity in 2007-08

Fuel	Installed Capacity (MW)	Percentage share
Thermal	90895.8	64.4
Coal	75002.4	
Gas	14691.7	
Oil/Diesel	1201.8	
Hydro	35208.8	25.0
Renewable Energy Sources*	10855.2	7.7
Nuclear	4120.00	2.9
Total	**141079.8**	**100.0**

Source: Region-wise installed capacity, all-India installed capacity (in MW) of power stations located in the regions of main land and islands, Statement I, pp. 188, Ministry of Power (2008).
*Note: *Renewable energy sources include small hydro projects, biomass gasifiers, biomass power, urban and industrial waste power and wind energy.*

3.1 Market Structure and Liberalization

Over the years, the Indian energy sector has been regulated and owned by government agencies and organizations. The basic institutional structure comprises a nodal ministry at the centre for each sub-sector (which is a primary agency for policy formulation and support in decision-making), state-level nodal agencies, public sector undertakings (PSUs) and technical and research institutions. The organizational framework of the union government and related governmental agencies in the energy sector is given in Appendix D. A multitude of ministries, organizations, and agencies are vested with various functions geared toward ensuring sustainable energy development. The Parliamentary Committee on Energy and the Energy Policy Division of the Planning Commission are also involved in policy-making.

At the time of Independence, India had poor infrastructure in energy production and supply. Per capita consumption of energy was low and access to energy was inadequate. The

[87]World Nuclear Association (2008e).
[88]Ministry of Power (2008).
[89]KPMG (2007).
[90]Planning Commission (2002).

economy was dependent on non-commercial sources of energy to meet household requirements, and on animal and human energy in the case of agriculture and transport. At that time, the commercial energy sector was regulated entirely by the government.

After many years of pursuing economic policies based on import substitution and state ownership of key industries, the government embarked on a series of economic reforms in the mid-1990s and introduced new policies which allowed private participation in the coal, oil, gas and electricity sectors. The sector-wise market structure and liberalization is discussed below.

3.1.1 Coal

As per the Indian constitution, the responsibility to regulate coal mines and mineral development is with both the central and state governments. The Ministry of Coal is the apex body at the Centre. The sector is dominated by public monopolies – Coal India Limited (CIL), Neyveli Lignite Corporation Limited (NLCL) and Singareni Collieries Company Limited (SCCL) (see Appendix D). CIL controls over 84 per cent and SCCL controls only 9 per cent of the total coal production. NLCL controls around 73 per cent of total lignite production.

Coal mining began as early as 1774. In the initial stages, mining was predominantly done by the private sector and pricing was market-driven. After Independence, the government implemented several legal and institutional changes in the coal sector. In 1956, the National Coal Development Corporation (NCDC) was created to carry out coal mining. The sector was progressively nationalized in two phases during 1971-73. In the first phase (1971-72) coking coal mines were nationalized and in the second phase (1973-74) non-coking coal mines were nationalized. This was followed by the enactment of the Coal Mines (Nationalisation) Act, 1973.

The primary reason for nationalization was to ensure a scientific approach to exploration and exploitation of coal deposits with due attention to safety, conservation and environmental aspects, while accelerating production levels through substantial investment so as to reduce India's dependence on oil. However, this objective was not realized. The country continued to face shortages in the supply of coking coal, the quality of thermal coal deteriorated over the years, and there were only marginal improvements in productivity.

The first step toward liberalization was taken in 1976, when the Coal Mines (Nationalization) Act, 1973 was amended to allow captive coal mining by private companies engaged in the production of iron and steel. With the liberalization of the economy in the 1990s, the coal market was slowly liberalized and subsidies of the state-owned mining companies have been reduced. In June, 1993 the Coal Mines (Nationalization) Act, 1973 was further amended to allow captive coal mining in the private sector for electricity generation, washing of coal obtained from a mine and other end uses as notified by the Central Government from time to time. By these amendments, private companies were allowed to enter into joint ventures with existing coal companies and foreign investment was allowed in captive coal mining projects linked to electricity plants and other specific end-uses on a case-by-case basis.

In 1997, the subsidiaries of CIL were restructured as financially independent competing units.[91] The prices of coking and higher-quality steam coal (quality grades A to C) were deregulated in 1996. In 2000, the Colliery Control Order, 1946 was replaced by the Colliery Control Order, 2000 which fully deregulated coal pricing. This allowed coal producing companies (CIL and SCCL) to fix their own prices and revise the same.[92]

The coal sector has been one of the few sectors which witnessed limited liberalization. The sector is dominated by PSUs and foreign/private players are only allowed to invest in captive coal mining. At present, there is a Screening Committee constituted of members from the Ministry of Coal and other ministries (such as railways, electricity and steel), the concerned state government, and the concerned coal subsidiary of CIL, among others that decides the allocation of captive coal blocks.

3.1.2 Oil and Gas

The Indian oil and gas sector is regulated by the Ministry of Petroleum and Natural Gas (MoPNG) and is dominated by PSUs. The Directorate General of Hydrocarbons (DGH) advises the government on all policy matters related to the upstream[93] segment while a Petroleum and Natural Gas Regulatory Board (PNGRB) has been set up under the PNGRB Act, 2006 to regulate the downstream[94] segment. Around 85 per cent of total crude oil production and 76 per cent of the total natural gas production are still in the hands of PSUs.[95] The share of the private sector is gradually increasing. For instance, during 2006-07, oil and gas discoveries were dominated by private/joint ventures such as Cairn Energy India Limited and Reliance Industries Limited (RIL).[96] The refining segment is also dominated by National Oil Companies (NOCs), such as Indian Oil Corporation Limited (IOCL) at 32 per cent, Hindustan Petroleum Corporation Limited (HPCL) at 9 per cent, and Bharat Petroleum Corporation Limited (BPCL) at 13 per cent, and their subsidiaries.[97] Among private players, RIL has a 22 per cent share in the refining segment.[98] The retailing segment is dominated by NOCs (98 per cent), which have one of the strongest and largest distribution networks. There were 36,921 retail outlets in April 2008, of which the share of NOCs was 93 per cent.[99] In the natural gas segment, the Gas Authority of India Limited (GAIL) is the dominant player with a market share of 78 per cent in the gas transmission business and 70 per cent in the gas marketing business.[100] In the retail segment of natural gas, the company has key joint ventures such as the Mahanagar Gas Limited (a joint venture between British Gas and the government of Maharashtra) in Mumbai and Indraprastha Gas Limited (a joint venture between Bharat Petroleum Corporation Limited and the government of Delhi) in Delhi.

---

[91] International Energy Agency (2002a)

[92] In December 2004, CIL introduced e-auctions to allow traders and consumers to bid for their requirements from preferred sources, thus, bypassing the black market in coal and transferring the premium from those sales to the coal companies. However, the bulk of coal was still sold to the power sector at regulated rates well below those prevailing in the auction market. Based on this contention, in December, 2006 the Supreme Court of India considered e-auctions unconstitutional and banned CIL from undertaking this activity. Nevertheless, CIL has introduced a new on-line booking system, that is, e-booking on a first-come first-served basis.

[93] Upstream activities cover E&P.

[94] Downstream activities cover refining and managing distribution and marketing (processing, storage and transportation).

[95] Calculated from Table 10 (pp.11), Ministry of Petroleum and Natural Gas (2008).

[96] http://www.petrodril.com/major_discoveries.htm

[97] PPAC (2008)

[98] PPAC (2008)

[99] Ministry of Petroleum and Natural Gas (2008) and PPAC (2008)

[100] http://gail.nic.in/gailnewsite/businesses/gastransmission.html

Prior to Independence, the Indian oil industry was controlled by a few Anglo-American companies which maintained their dominance till the end of the 1950s. The Industrial Policy Resolution of 1948 and 1956 brought this sector under direct government control and reserved the future development of the oil industry to PSUs. Consequently, the NOCs, namely, ONGC and Oil India Limited (OIL) monopolized the upstream segment. In 1976, the government nationalized the refining and marketing sector and introduced regulatory controls on production, import, distribution and pricing.

The first step toward liberalization was in 1979 when the government introduced private participation in the upstream segment by providing licenses. Different sedimentary basins were offered to foreign oil companies for E&P. Better basins with liberal terms were offered in successive rounds.[101] At the same time, in the refining segment, the government allowed Indian private companies – initially as a joint venture partner with a public sector refining company.[102]

In 1992, the government offered contracts for 18 discovered fields to companies such as Enrol Oil and Gas Company, Command Petroleum, Videocon Petroleum Limited, Ravva Oil Private Limited and RIL. These, however, did not lead to much investment as the exploration activities were initiated only in a few (15 per cent) potential oil-bearing areas and there were delays in awards of contracts. To facilitate the inflow of technology and generate investment, the government introduced the New Exploration Licensing Policy (NELP) in 1997. Under this policy, interested parties could bid directly without the mandatory participation of NOCs and carried interest[103] of the Government/NOCs. ONGC and OIL were required to compete to obtain oil blocks instead of getting them on a nomination basis as had been the case in the past. Various other incentives were given to encourage private investment, such as seven years of income tax holiday from the commencement of commercial production and abolition of customs duties on import of equipment for exploration operations. The companies were also given the freedom to market gas within the country. So far, six rounds of NELP have been completed and a total of 162 (onshore and offshore) blocks have been awarded. Of these, 37 blocks have been awarded to 25 foreign companies including British Gas (UK), Cairn Energy & Premier Oil (UK), Canoro and Niko (Canada), ENI (Italy), Gazprom (Russia), Geopetrol (France) and Santos (Australia).[104] The seventh round was also closed for bidding in April 2008, in which 21 foreign companies and 75 Indian companies participated.[105]

In June 1998, the Government de-licensed the refining sector. Private refineries have been permitted to import crude oil without an import license for actual use in their own refineries and refineries could be set up without specific government permission subject to other statutory requirements. After the de-licensing, RIL set up India's first privately-owned refinery in 1999, which is one of the major contributing factors behind the enhancement of refining capacity.

[101] For example, in the third round of bidding (1986), where a few major foreign companies participated, the government exempted them from paying any royalty.
[102] http://www.indiaresource.org/issues/energycc/2003/globpetroleumindust.html
[103] Carried interest was exercised by the NOCs only after commercial discovery. In pre-NELP rounds, NOCs had the right to take up to 40 per cent share in all offered blocks (mandatory 10 per cent at the beginning and 30 per cent after commercial discovery).
[104] http://petroleum.nic.in/speeches/08-01-2008.doc; http://www.pcra.org/English/general/Profile%20-07.pdf
[105] India Infoline (2008)

A key regulatory development in the marketing sector took place in 2002, wherein marketing of transportation fuels, such as motor sprit, high-speed diesel and aviation turbine fuel was opened to the private sector. However, this segment continues to be dominated by NOCs, and private players including Reliance, Essar and Shell have only 19 per cent market share.[106]

In 1997, the Administrative Pricing Mechanism (APM) was dismantled in a phased manner. In April 2002, petroleum products imports were liberalized, and APM for all petroleum products other than LPG and superior kerosene oil was eliminated.[107] However, the government continued to decide the retail price of petrol and diesel.

In April 2006, the PNGRB Act, 2006 was enacted and an independent regulator in the downstream sector was set up in October 2007. In December 2006, the government also notified the 'Policy for Development of Natural Gas Pipelines and City or Local Gas Distribution Networks' to provide a framework for the future growth of pipeline infrastructure in the country and to promote investment from both the public and private sectors in natural gas pipelines and city or local natural gas distribution networks.[108]

3.1.3 Renewable Energy

The oil shocks of the 1970s led to an increase in crude oil prices and raised concerns about energy security. India started to seriously focus on new and renewable sources of energy for sustainable development and energy security. In 1981, the government established a Commission for Additional Sources of Energy (CASE) in the Department of Science and Technology, along the lines of the Space and Atomic Energy Commissions. In 1982, CASE was incorporated in the newly created Department of Non-Conventional Energy Sources (DNES), which in 1992 became a full-fledged Ministry, namely, the Ministry of Non-Conventional Energy Sources (MNES). The name was subsequently changed to Ministry of New and Renewable Energy (MNRE) in 2006. India is the only country in the world which has a separate and dedicated ministry for developing and promoting non-conventional energy sources.

Although Renewable Energy Technologies (RETs), such as biogas plants and improved cooking stoves existed as early as the 1940s, renewable energy programs started only after the creation of CASE. The early programs were initiated with a target-oriented supply-push approach and were driven by direct subsidies from the government. They focused on the development, dissemination and demonstration of various RETs. Even though this policy was successful in creating a fairly large and diversified manufacturing base, it did not lead to commercialization due to various reasons such as subsidies, low reliability of the devices, lack of remunerative tariffs for RET-generated electricity, and lack of consumer-desired features (in terms of the services and financial commitments) in the design and sales package.

With liberalization in the 1990s, there was a shift from financial to fiscal incentives and the renewable energy programs focused on commercialization and greater involvement of the private sector. The Ministry was restructured in 1993 into sectoral groups of (a) rural energy, (b) urban/industrial energy, and (c) electricity generation. Through the restructuring, the emphasis shifted towards policies, planning and institutional linkages to promote RETs

[106] Ministry of Petroleum and Natural Gas (2008).
[107] Oil companies can now take independent decisions based on competitive conditions to set their prices for petroleum products. Thus, public sector oil companies have to face a competitive marketing environment.
[108] Ministry of Petroleum and Natural Gas (2006).

within each sector. Three technologies – wind electricity, small hydroelectricity and solar photovoltaic electricity – were targeted for commercialization under a set of revolving funds created from international finance, mainly from the World Bank. The management of this task was entrusted to the Indian Renewable Energy Development Agency (IREDA), an autonomous financial institution created in 1987 under the MNRE. Direct subsidies on various RET programs were either removed or drastically reduced, and several fiscal incentives were provided to users as well as manufacturers. Private players were encouraged to invest in RETs by taking advantage of the fiscal benefits such as accelerated depreciation, sales tax and import duty exemptions, reasonable buy-back rates and waiving of industrial clearance for setting up a renewable energy industry. By the end of the 1990s, this strategy appeared successful as more than 80 per cent of energy from renewables was generated by the private sector.[109] With this multi-pronged strategy, by the beginning of 1998 India developed the world's largest Solar Photo Voltaic (SPV) lighting program, the fourth largest wind electricity program, and the second largest biogas and improved stove programs.

Although the government has taken various measures to encourage investment in research, design and development related to renewable energy, renewable energy deployment has outpaced such efforts. The Ministry has evolved a policy of supporting R&D with the close involvement of the industrial sector. The government believes that the involvement of the business and scientific and technical community is a prerequisite for the development of renewable energy technologies, products and services at par with international standards and in a manner so as to arrive at an optimal fuel-mix (the focus is to reduce dependence on liquid, gaseous and solid fossil fuels).

3.1.4 Nuclear Energy

The nuclear energy sector is sensitive and, therefore, it is highly regulated. The Department of Atomic Energy (DAE) is an independent department under the direct charge of the Prime Minister and the Atomic Energy Regulation Board (AERB) is the regulatory body for nuclear energy. The DAE has set up a number of associated or subsidiary organizations (see Appendix D for details).

The Atomic Energy Act was passed on April 15, 1948 and the Atomic Energy Commission was constituted on August 10, 1948 for the development and utilization of atomic energy for peaceful purposes. In 1954, the DAE was formed to encompass research, technology development and commercial reactor operations. In 1957, the Atomic Energy Commission started the Atomic Energy Establishment at Trombay (near Mumbai) which was renamed the Bhabha Atomic Research Centre in 1967. Subsequently, the government passed the Atomic Energy Act, 1962 which emphasized the control and use of atomic energy for the welfare of Indians and for other peaceful uses. It also allowed only government-owned enterprises to be involved in the nuclear sector.

To attain energy security through the use of nuclear energy, in 1954 India launched a three-stage nuclear electricity program, consisting of setting up Pressurized Heavy Water Reactors (PHWRs) in the first stage, Fast Breeder Test Reactors (FBTRs) utilizing a uranium-plutonium fuel in the second stage, and Breeder Reactors utilizing thorium fuel in the third stage. At present, 15 such reactors are under operation, three are under construction, and several others have been planned (Tables E1 and E2 in Appendix E). One FBTR has been operating at the Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam since

[109]Guru, S. (2002).

1985. India is in the process of developing technology to use thorium as a nuclear fuel. An Advanced Heavy Water Reactor (AHWR) is being developed at the Bhabha Atomic Research Centre (BARC) to expedite transition to thorium-based systems.[110]

3.1.5 Electricity

As per the Constitution of India, electricity is covered under the concurrent list and is administered by both the central and state governments. The Constitution has, however, given supremacy to central legislation. At the Centre, the apex body is the Ministry of Power (MoP). In most states there are State Electricity Boards (SEBs) (see Appendix D).

After Independence, most of the electricity sector was nationalized. The Electricity (Supply) Act, 1948 was enacted to provide the framework for governance of the electricity sector and it led to the establishment of SEBs as monolithic state-owned entities responsible for generation, transmission and distribution of electricity. In 1975, the National Thermal Power Corporation (NTPC) and National Hydroelectric Power Corporation (NHPC) were created to boost electricity generation. In 1989, the Power Grid Corporation of India Limited was established to manage the transmission system.

In 1991, the central government opened electricity generation to foreign/private investment and encouraged the establishment of Independent Power Producers (IPP) projects. Enron in Maharashtra, AES in Orissa, GVK and Spectrum in Andhra Pradesh, and Essar in Gujarat are examples of such projects. The government also offered concessions such as 100 per cent ownership, long-term purchase agreement and assured profits (as high as 32 per cent post-tax return on equity every year in the currency of investment). After 1995, competitive bidding was allowed for acquiring new capacity (that is, IPPs).

As most SEBs were making huge financial losses, the setting up of an independent, autonomous and accountable regulatory structure at the centre and state levels became essential. In 1998, the government passed the Electricity Regulatory Commission Act to establish independent regulatory bodies or commissions at the central and state levels. The Central Electricity Regulatory Commission (CERC) was established in August 1998. At present, around 23[111] states have constituted the State Electricity Regulatory Commission (SERC).

On June 10, 2003 the government introduced the Electricity Act, 2003 repealing earlier legislations – the Indian Electricity Act 1910, the Electricity (Supply) Act 1948, and the Electricity Regulatory Commissions Act 1998. This comprehensive Act, which became effective in June 2005, aimed to promote competition, rationalize tariffs, and provide a transparent regulatory environment. It provided various measures such as de-licensing of generation, freedom of captive generation, unbundling of SEBs to promote competition and non-discriminatory open-access was introduced in the transmission system. The Act also made it mandatory to set up an Electricity Regulatory Commission (ERC) in states.

In consonance with the provisions of this Act, the government notified the National Electricity Policy (NEP) in February 2005 to accelerate development of the electricity sector by providing supply of electricity to all areas and protecting the interests of consumers and

[110] DAE (2008)

[111] Andhra Pradesh, Assam, Bihar, Chattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttrakhand, Uttar Pradesh and West Bengal.

other stakeholders keeping in view the availability of energy resources and technology to exploit these resources. It meant to provide policy guidance to the ERCs in the discharge of their functions and to the Central Electricity Authority (CEA) for preparation of the National Electricity Plan. In addition, in 2006 the government notified the Tariff Policy to ensure availability of electricity to consumers at reasonable and competitive rates and promote competition, efficiency in operations and improvement in quality of supply, among others. On March 31, 2008 the government amended the Tariff Policy, and since then 23 states[112] have issued their first tariff orders and 21 states[113] have issued open-access regulations. To promote electricity trading, 12 states[114] have already issued intra-state trading regulations. As of July 2008, CERC has awarded inter-state trading licenses to 31 companies.[115]

3.2 FDI in the Energy Sector

Energy services, which were once under public monopoly, have been gradually liberalized since the early 1990s. One of the important components of liberalization was to allow FDI in different segments. It was believed that allowing FDI would lead to the inflow of finance, technical know-how, skills and best management practices. The current FDI regime for different sub-sectors is discussed below.

In the coal sector, FDI up to 100 per cent is only allowed in captive mining of coal and lignite, subject to the provisions of the Coal Mines (Nationalization) Act, 1973. FDI up to 100 per cent is allowed for setting up coal processing plants, subject to the condition that the company will not do coal mining and will not sell washed/sized coal from its coal processing plants in the open market and shall supply the washed/sized coal to those parties who are supplying raw coal to coal processing plants for washing/sizing. In all the cases, FDI is allowed up to 50 per cent through the automatic route, subject to the condition that such investment shall not exceed 49 per cent of the equity of a PSU.

In the oil and gas sector, 100 per cent FDI is allowed in exploration subject to the exploration policy. In the refining segment, 100 per cent FDI is allowed and foreign companies are not required to take any clearances from the Foreign Investment Promotion Board (FIPB); they only have to notify the Reserve Bank of India, but in case the project is taken up along with a PSU, 49 per cent FDI is allowed with the approval of the FIPB. For the marketing of petroleum products, 100 per cent FDI is allowed through the automatic route, subject to sectoral regulations issued by the Ministry of Petroleum and Natural Gas (details given in Table 3.2.1). For petroleum products pipelines, 100 per cent FDI is allowed through

[112] Andhra Pradesh, Assam, Bihar, Chattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Meghalaya, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh, Uttrakhand and West Bengal.

[113] Andhra Pradesh, Assam, Bihar, Chattisgarh, Delhi, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, Uttrakhand, West Bengal and Tripura (draft).

[114] Andhra Pradesh, Assam, Delhi, Gujarat, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Punjab and Rajasthan.

[115] Tata Power Trading Company Ltd., Adani Enterprises Ltd., PTC India Ltd., Reliance Energy Trading Ltd., Vinergy International Pvt. Ltd., NTPC, Lanco Electric Utility Ltd., MMTC Ltd., DLF Power Ltd., Jindal Steel and Power Ltd., Sarda Energy and Minerals Ltd., GMR Energy Ltd., Karam Chand Thapar and Bros Ltd., Subhash Kabini Power Corporation Ltd., Special Blasts Ltd., Maheshwary Ispat Ltd., Instinct advertisement and Marketing Ltd., Essar Electric Power Development Corporation Ltd., Suryachakra Power Corporation Ltd., JSW Power Trading Company Ltd., BGR Energy Systems Ltd., Malaxmi Energy Trading Pvt. Ltd., Visa Power Ltd., Kalyani Power Development Pvt. Ltd., Patni Projects Pvt. Ltd., Ispat Energy Ltd., Sri Balaji Biomass Power Pvt. Ltd., Vandana Global Ltd., Vandana Vidhyut Ltd., Indrajit Power Technology Pvt. Ltd. and Adhunik Alloys and Power Ltd.

the automatic route, while the same is allowed for natural gas or LNG pipelines with the approval of the FIPB.

In the renewable energy sector, up to 74 per cent foreign equity is allowed through a joint venture with Indian partners for financial and/or technical collaboration through the automatic route and 100 per cent foreign investment is allowed with the approval of the FIPB. Foreign investors can also set up a liaison office in India, and the government is encouraging foreign investors to set up renewable energy-based electricity generation projects on a build-own-and-operate basis.

In the electricity sector, 100 per cent FDI is allowed in generation, transmission, distribution and electricity trading subject to the provisions of the Electricity Act, 2003.

In the nuclear energy sector, 74 per cent FDI is allowed for mining and mineral separation (through FIPB approval and subject to guidelines issued by the DAE), value addition and integrated projects (through joint ventures with central/state PSUs in which equity holding of at least one PSU is not less than 26 per cent). In exceptional cases, FDI beyond 74 per cent is permitted subject to clearance by the Atomic Energy Commission before FIPB approval.

The FDI regime by sub-sectors is given below.

Table 3.2.1: FDI Regime across different Energy Services

W/120	CPC No.	Description	FDI Regime
1.A.e	8672	Engineering services	No cap and entry through automatic route
1.A.f	8673	Integrated engineering services	No cap and entry through automatic route
1.C.a	85103	Research and experimental development services on natural sciences and engineering and technology for casting, metal, machinery, electricity, communications, vessels, aircraft, civil engineering, construction, information, etc.	No cap and entry through automatic route
1.F.c	86509	Management consulting services	No cap and entry through automatic route
1.F.d	86601	Services related to management consulting	No cap and entry through automatic route
1.F.e	8676 (partial)	Technical testing and analysis services	No cap and entry through automatic route
1.F.h	883	Services incidental to mining	No cap and entry through automatic route
	5115	Site preparation work for mining	No cap and entry through automatic route
1.F.j	887	Services incidental to energy distribution	No cap and entry through automatic route

1.F.m	8675 (partial)	Related scientific and technical consulting services	No cap and entry through automatic route
1.F.n	8861-8866 (partial)	Maintenance and repair of fabricated metal products, machinery equipment, and electrical machinery (excluding maritime vessels, aircraft or other transport equipment)	No cap and entry through automatic route
3.B	5134-5136	Construction work for civil engineering for long-distance pipelines, for local pipelines, for construction of mining	No cap and entry through automatic route
3.E	518	Renting services related to equipment for construction or demolition of buildings or civil engineering works with operator	No cap and entry through automatic route
4.A	62113	Commission Agents Services – Sales on a fee or contract basis of fuels	No cap and entry through RBI (FEMA) route and subject to the regulations of Ministry of Petroleum and Natural Gas, if any
4.B	62271	Wholesale trade services of solid, liquid and gaseous fuels and related products (excluding electricity and town gas)	No cap and entry through FIPB route and subject to the regulations of Ministry of Petroleum and Natural Gas, if any
4.C	63297	Retailing services of fuel oil, bottled gas, coal and wood	No cap and entry through automatic route for petroleum and natural gas subject to a minimum investment of Rs. 2000 crore (US$ 450 million) in exploration and production or refining or pipelines or terminals and other conditions as laid down by the Ministry of Petroleum and Natural Gas. Retail marketing of coal in the open market is not allowed by foreign companies and foreign investment in Indian companies setting up or operating power projects as well as coal mines is only allowed for captive mining in such projects. Private Indian companies engaged in exploration or mining of coal are also allowed foreign equity up to 100 per cent through automatic route for captive consumption (for production of iron, steel and cement) only.
11.G.a	7131	Pipeline transportation of fuels	Petroleum pipeline: No cap and entry through automatic route. Natural gas/LNG pipeline: No cap and entry through the approval of the FIPB.

Source: Compiled by the authors from WTO (1991), Plurilateral Request (http://www.commerce.nic.in/), DIPP (2005), DIPP (2006), DIPP (2008b) and Ministry of Petroleum and Natural Gas (2002) and http://www.investmentcommission.in/sector.htm.

Overall, the energy sector has undergone significant liberalization since the 1990s and, as a result, it is one of the important sectors in terms of FDI inflows. Table 3.2.2 shows that electricity and oil refinery ranked fifth in attracting the highest FDI inflows between April 2000 and March 2008. Table 3.2.3 shows the FDI inflows for the previous financial year.

Table 3.2.2: Top Ten Sectors in terms of FDI Inflows (April 2000 - March 2008)

Ranks	Sector	Amount of FDI inflow (US$ million)	Percentage with total inflows
1	Services sector (financial and non-financial)	13058	22.64
2	Computer software and hardware	7277	13.07
3	Telecommunications (radio paging, cellular mobile, basic telephone services)	3842	6.81
4	Construction activities (including roads and highways)	3163	5.44
5	Housing and real estate	2711	4.54
6	Automobile industry	2237	4.01
7	Power	2205	3.91
8	Petroleum and natural gas	1981	3.35
9	Metallurgical industries	1762	2.99
10	Chemicals (other than fertilizers)	1385	2.50

Source: DIPP (2008a).

Table 3.2.3: Top Ten Sectors in terms of FDI Inflows (April 2007 - March 2008)

Ranks	Sector	Amount of FDI inflow (US$ million)	Percentage with total inflows
1	Services sector (financial and non-financial)	6615	26.91
2	Housing and real estate	2179	8.87
3	Construction activities (including roads and highways)	1743	7.09
4	Petroleum and natural gas	1427	5.81
5	Computer software and hardware	1410	5.74
6	Telecommunications (radio paging, cellular mobile, basic telephone services)	1261	5.13
7	Metallurgical industries	1177	4.79
8	Power	967	3.93
9	Automobile industry	675	2.75
10	Chemicals (other than fertilizers)	229	0.93

Source: DIPP (2008a).

3.3 Trade in Energy Services

Economic growth, liberalization and globalization affected India's trade in energy in various ways. On the one hand, domestic demand is outstripping the production and, as a consequence, more than 25 per cent of primary energy needs are met through imports mainly in the form of crude oil and natural gas. On the other hand, new services associated with energy production, distribution and transmission are coming up in which Indian companies have global competitiveness. With the availability of skilled manpower at competitive prices, India is capable of providing consultancy services in global markets, and foreign companies are setting up outsourcing units and R&D centers in India. India needs foreign investment, technology and skills. Indian companies are venturing into international markets for E&P, etc. The government is also encouraging Indian companies to acquire equity stakes abroad. Thus, India has both export and import interests in energy services and this is now one of the core sectors in India's multilateral, regional and bilateral engagements. India's trade and foreign collaborations across different sub-sectors of energy services is given below.

3.3.1 Coal

Although FDI is only allowed in captive coal mining and the sector is dominated by PSUs, India needs foreign technology in areas such as in situ gasification, clean coal technologies, liquefaction of coal[116] and R&D. At present, foreign companies offer various consultancy services such as feasibility studies, geological interpretation, reserve evaluation, surface and underground mine planning and design, and overall mine evaluation for investment and divestment purposes, among others. For instance, Norwest Corporation (USA), an International Mining Consultant, was awarded a five-year contract to provide management consulting and engineering services to the first private sector coal mine in India, the Sarshatali Mine, owned by CESC.[117] Wardell Armstrong (UK), the international mining and environmental consultancy company, is exporting its modern coal technologies to Indian companies. It offers multi-disciplined consultancy services in mining, engineering, health and safety, geology, project management, surveying, civil and structural engineering and land reclamation, among others. Rock Mechanics Technology (UK) did a major project for Western Coalfields Limited in which it designed and introduced an advanced technology rock-bolt support system for a new section of Tandsi Colliery.[118] There is scope for even south-south collaboration in this sub-sector; India needs technology for the liquefaction of coal and South Africa leads the world in this technology based on the Sasol process.

To bring in modern technologies for underground and opencast mining, bilateral funds for import of equipment, foreign financial assistance/investment and skill development and training of Indian personnel, the Indian government has Joint Working Groups on coal with advanced coal-producing countries such as France, Germany, Russia, Canada, Australia and Poland. In 1994, a Joint Working Group was also constituted for bilateral cooperation between the Indian and Chinese coal industries. Meetings of the Indo-China Joint Working Group are held alternately in India and China every year. To date, China has supplied three longwall equipments for Balrampur, Rajendra and New Kumda, and an agreement was signed with China in 2001 for the development of the Short Longwall project.[119] Many countries

[116]Coal liquefaction is a process that converts coal from a solid state into liquid fuels, usually to provide substitutes for petroleum products

[117]http://www.worldcoal.com/Coal/CL_consultants_norwest.htm

[118] http://www.worldcoal.com/Coal/CL_consultants_rock.htm

[119]Ministry of Coal (2002).

have expressed an interest in investing or entering into technical collaboration with India in this sub-sector; for instance, Australia has expressed an interest in investing in coal mining in India and has invited Indian companies to explore investment opportunities in Australia.

The Central Mine Planning and Design Institute Limited (CMPDI),[120] India's largest consultancy organization in this sub-sector, has offered consultancy services to international consultancy companies such as International Management Consultant Limited (UK), Montan Consulting GmbH (Germany), Rheinbraun (Germany) and DMT GmbH (Germany). India has the potential to offer coal-related consultancy services. Indian companies are also investing abroad. NTPC signed a Memorandum of Agreement with the Ceylon Electricity Board on December 29, 2006 to set up a coal-based power plant in Trincomalee (Sri Lanka) through a 50:50 joint venture.[121] CIL has submitted a proposal to the Finance Ministry to set up a new subsidiary, Coal India Videsh Limited, for acquisition of coal blocks through joint ventures and has identified countries such as Australia, South Africa, Indonesia, Mozambique, Zimbabwe and Russia as prospective destinations for initiating such ventures.[122]

3.3.2 Oil and Gas

To mitigate the demand-supply gap in the oil and gas sector, the government is encouraging Indian companies to invest abroad through acquisition, strategic alliances, joint ventures and subsidiaries, and foreign companies are invited to invest in India. Strategic partnerships are encouraged for acquiring global best technologies and management practices and skill upgrading. In certain segments, such as E&P, India needs foreign technical know-how.

Many foreign companies have invested in the E&P segment in India. For instance, Cairn Energy (UK) is engaged in E&P and operating in three regions – eastern, western and northern India. Conoro Resources Limited (Canada) has two exploration blocks in Assam. Hardy Oil and Gas Plc. (UK) is involved in various E&P ventures in India. Niko Resources (Canada) has Production Sharing Contracts (PSCs) for five fields (Hazira, Bhandut, Cambay, Matar and Sabarmati); it also holds 100 per cent share in the onshore block in Surat (Gujarat) and 10 per cent share in two offshore blocks**.** Premier Oil India (a subsidiary of Premier Oil Plc, UK), has a 10 per cent share in the development of the Ratna field (Mumbai) and holds a 14.5 per cent share in well-drilling projects in Assam. In the sixth round of NELP, some new foreign companies such as NaftoGaz (Ukraine), Santos (Australia), Tap Oil Limited (Australia), Total (France) and EOG Resources (Texas) also made bids for exploration blocks.[123]

To date, Shell has the largest FDI inflow (of around US$1 billion) and is the only foreign company which has a retail licence for fuels in India. It is engaged in the LNG, LPG, lubricants, bitumen and solar energy segments in India. It has multiple subsidiary companies such as Shell India Marketing Private Limited, Bharat Shell Limited,[124] Pennzoil Quaker

[120]CMPDI is engaged in exploration, project planning, detailed designing of systems and sub-systems, coordination and integration of applied R&D, absorption of new techniques of coal mining, beneficiation and utilization of coal, perspective planning and environment-related services.
[121]www.ntpc.co.in
[122]The Financial Express, 'Proposal to set up Coal Videsh Limited shot down', 30 November 2007, http://www.financialexpress.com/news/Proposal-to-set-up-Coal-Videsh-Ltd-shot-down/244967/
[123]http://www.petroleumbazaar.com/articles/article28.htm
[124]Joint venture between Shell and Bharat Petroleum.

State India Limited, Shell Hazira Gas Private Limited, Shell Gas (LPG) India Private Limited and Shell Bitumen India Private Limited. Some foreign companies have invested in petroleum products such as lubricants. For instance, BP has a 71 per cent stake in Castrol India Limited – the largest Indian private lubricant company. Exxon Mobile Lubricants Private Limited (a subsidiary company of Exxon Mobile, USA) is also dealing in lubricants.

In the refining sector, PSUs are entering into foreign collaborations. Saudi Aramco (Saudi Arabia), the world's largest oil producing company, is likely to pick up a 26 per cent stake in IOCL's Paradeep refinery. Saudi Aramco is also examining investment possibilities in ONGC's Kakinada refinery project (Andhra Pradesh), and in HPCL's Visakhapatnam refinery. Both companies are negotiating commercial terms for the equity arrangement with Saudi Aramco.[125] Total SA, the French petroleum major, entered into an MoU (on October 18, 2007) with HPCL, OIL, GAIL India and Mittal Steel for a feasibility study for setting up a refinery-cum-petrochemical complex at Visakhapatnam in Andhra Pradesh. The project would set up a joint venture company, with the three government-owned companies holding less than 51 per cent.[126]

In gas, Gaz de France (France) has a 10 per cent stake in India's Petronet LNG Limited. OAO Gazprom (Russia) holds a 50 per cent stake in a block in a consortium with GAIL. BG India (a subsidiary of BG Group Plc., UK) has a 30 per cent share in two offshore fields, namely, Tapti and Panna/Mukta, 65 per cent controlling stake in Gujarat Gas Company Limited, and a 49.7 per cent stake in Mahanagar Gas Limited. Elf Gas India Limited (a subsidiary of Total) operates the LPG storage facility at Mangalore.

Among Indian companies, ONGC Videsh Limited (a subsidiary of ONGC) made huge international investments abroad through acquisitions of E&P (37 blocks) assets in countries such as Brazil, Cuba, Colombia, Libya, Myanmar, Nigeria, Russia and in some Middle East countries (Egypt, Iran, Iraq, Sudan and Qatar). It also has subsidiary companies, namely, ONGC Nile Ganga in Sudan, ONGC Narmada and ONGC Bonny Brahmaputra Limited in Nigeria. BPCL signed a farm-in-agreement to acquire a 20 per cent participating share in one block in Australia. IOCL has retail outlets in Sri Lanka and Mauritius through wholly-owned subsidiaries, namely, Lanka IOC Limited and Indian Oil (Mauritius) Limited, respectively. It provides expertise in the areas of refining, marketing, transportation, training and R&D to several countries such as Sri Lanka, Kuwait, Bahrain, Iraq, Abu Dhabi, Tanzania, Algeria, Nigeria, Nepal, Malaysia and Zambia. RIL is planning to invest in a refinery in Yemen with an initial capacity to process over 50,000 barrels of crude oil per day.[127]

GAIL has established a presence in compressed natural gas (CNG) and city gas sectors in Egypt through equity participation in three Egyptian companies – Fayum Gas Company, Shell CNGE and National Gas Company. It also has an equity stake in China Gas Holding to explore opportunities in the CNG sector in China. It has a stake in three E&P blocks in Myanmar and one block in Oman and has a wholly-owned subsidiary company, GAIL Global (Singapore) Pte. Limited in Singapore. An MoU was signed between NTPC and the Ministry of Energy, Nigeria on May 22, 2007 at Abuja (Nigeria), under which the Nigerian Ministry

[125] http://www.petroleumbazaar.com/articles/article6.htm
[126] http://sify.com/finance/fullstory.php?id=14545491
[127] The Economic Times, 'RIL to set up refinery, retailing ops in Yemen', 17 Jan 2007, http://economictimes.indiatimes.com/News/News_By_Company/Companies_A-Z/R_Companies_/RIL_to_set_up_refinery_retailing_ops_in_Yemen/rssarticleshow/1233684.cms

will provide around 3 million tonnes per annum of LNG to NTPC on a long-term basis at a reasonable price and also help NTPC to participate in bidding for gas blocks.[128]

With the competitive advantage in the supply of high-skilled English-speaking manpower, Indian companies are providing consultancy services to international clients. For example, Petroleum India International, a consortium of eight[129] large Indian oil companies, provides technical and management services in upstream and downstream segments to GCC countries and other countries such as Malaysia, Nigeria, Ethiopia, Canada, Sudan, Iraq and Syria. Engineers India Limited has been providing engineering consultancy to GCC countries for more than 10 years which includes basic design, detailed engineering, managing contract services, project management services, environmental impact assessment studies and technical assistance. The company has offices in different countries such as the UK (London), the UAE (Abu Dhabi), Kuwait, Qatar, Malaysia and Australia.

India needs to import gas, and countries such as Iran, Myanmar and Turkmenistan have gas reserves which far exceed their domestic requirements. Cross-border trade through pipelines is an important mode for importing gas from these countries. Talks on setting up cross-country pipelines are ongoing. Some of the important pipelines under discussion include the Iran-Pakistan-India gas pipeline (talks began in 1994 but due to political tensions between India and Pakistan and the dispute between Iran and India regarding gas prices, there have been delays and difficulties in its implementation) and the Turkmenistan-Afghanistan-Pakistan-India gas pipeline (an MoU was signed between Turkmenistan, Afghanistan and Pakistan, and India has now joined this project. This pipeline project offers the possibility of an alternative source of gas supply from Turkmenistan to India).[130]

3.3.3 Renewable Energy

The government is encouraging foreign investment in renewable energy and there is scope for Indian companies to invest abroad especially in neighboring countries. In the hydro electricity sector, there have been several successful collaborations between India, Bhutan and Nepal. Most of these projects have been initiated at the government level. Cooperation in hydro-electricity between Bhutan and India started with the signing of the Jaldhaka agreement in 1961; the Jaldhaka Hydel Power Station is located in the district of Darjeeling (West Bengal) near the Bhutan border and supplies electricity to West Bengal.[131] The Chukha Hydroelectric Project of Bhutan was entirely funded by the Government of India and around 70 per cent of the power generated by this project is exported to India; this is a unique example of successful collaboration between two countries. Other projects such as the Tala Hydro-electric Project and Kurichhu Hydro-electric Project in eastern Bhutan have also been implemented by the Government of India. In these projects civil engineering and construction work is done by Indian companies (both PSUs and private companies) such as Hindustan Construction Company, Bharat Heavy Electricals Limited, Larsen & Toubro, Gammon (India) and Jaypee Group. The Government of India and Government of Bhutan have signed MoUs for three more projects, namely, Punatsangchhu Hydro Electric Project (Stage I), Punatsangchhu Hydro Electric Project-II and Mangdechu Hydro Electric Project. An

[128] http://www.ntpcindia.com/companyperformance/message_to_shareholders.shtml

[129] BPCL, HPCL, Kochi Refineries Limited, Bongaigaon Refineries and Petrochemicals Limited, IBP Company Limited, Engineers India Limited, Chennai Petroleum Corporation Limited and Indian Petro Chemicals Limited.

[130] Iran Daily, 'India Approves TAPI Pipeline', 20 May 2006, http://www.iran-daily.com/1385/2566/html/index.htm

[131] West Bengal State Electricity Board (2005).

implementation agreement for the Punatsangchhu Hydro Electric Project (Stage I) was signed on July 28, 2007 between the governments of India and Bhutan.[132]

In Nepal, four hydroelectric projects – Pokhra, Trisuli, Western Gandak and Devighat – have already been implemented with financial and technical assistance from the Government of India. Other major multi-purpose projects – Karnali, Pancheshwar and Saptakosi – are under discussion. The power trade agreement between Nepal and India (1997) allows private sector participation in electricity generation in both countries. In 2007, the GMR Group was the first Indian private company to establish a presence in Nepal's hydropower sector when it bought an 80 per cent stake in the Nepali hydropower company, Himtal Hydropower.[133] In January 2008, the Government of Nepal awarded the Upper Karnali project to GMR Energy Limited. The company signed an MoU on January 27, 2008 according to which it would provide 12 per cent free electricity and 27 per cent free equity in the project to Nepal.[134] Arun III, which is proposed to be located in the Sankhuwasabha District of Nepal, was awarded to Sutlej Jal Vidyut Nigam Limited (SJVNL). According to the MoU, signed on March 2, 2008[135], SJNVL will provide 21.9 per cent electricity to Nepal free of charge, pay 7.5 per cent of its total income as royalty, and pay 0.5 per cent export tax to the Nepali Government.[136]

Myanmar has huge potential for hydro electricity generation (about 100,000 MW, of which about 39,720 MW has been identified for development). India is assisting Myanmar in the development of this potential. Design and engineering work of the Sedawyagi Hydro electric Project (25 MW) was undertaken in India. The Tamanthi hydro electric project has been identified as a mutually beneficial project for both India and Myanmar. The Government of India has also provided technical assistance to the Government of Afghanistan for the development of three projects – Kajakai Power Project, Lower Helmand Valley Development Project and Khanabad Hydro Electric Project. India is presently extending assistance to the Government of Afghanistan for reconstruction/rehabilitation and completion of the Salma Dam Multipurpose Project. The work of executing the project has been entrusted to WAPCOS. Indian companies such as the Central Electricity Authority (CEA), Central Water Commission (CWC) and Central Soil and Materials Research Station (CSMRS) are providing services such as assessment and rehabilitation, detailed design and engineering, project management, testing, and commissioning of the project.[137]

Among foreign companies in India, Snowy Mountains Engineering Corporation (India) Private Limited, a wholly-owned subsidiary company of SMEC (Australia) offers consultancy services such as feasibility studies, detailed engineering design and review, preparation of detailed project reports, advisory services, and training and transfer of technology for hydroelectric projects, power projects and wind projects. Its subsidiary, SMEC West Seti Hydro-electric Corporation Limited, has signed an MoU with PTC India Limited for the West Seti hydropower plant in Nepal for the purchase of electricity.[138]

---

[132] http://www.cea.nic.in/hydro/Cooperation%20with%20Neighbouring%20Countries.pdf (31st July 2008); http://www.eoithimphu.org/mega.html; and http://www.bhutannewsonline.com/hydro_electricity.html

[133] The Economic Times, 'Stuck in India, GMR Energy Forays into Nepal', 26 September 2008, http://economictimes.indiatimes.com/News_by_Industry/GMR_Energy_forays_into_Nepal/articleshow/3531029.cms

[134] http://www.stockwatch.in/nepali-govt-puts-300-mw-upper-karnali-project-gmr-s-pocket-2196

[135] http://sjvn.nic.in/projects/projects_arun.asp

[136] http://www.cea.nic.in/hydro/Cooperation%20with%20Neighbouring%20Countries.pdf (31st July 2008)

[137] http://www.cea.nic.in/hydro/Cooperation%20with%20Neighbouring%20Countries.pdf (31st July 2008)

[138] http://www.smec.com.au/media/latest/hydro.htm

Some foreign companies have invested in solar energy either through joint ventures or on a project-to-project basis. One important joint venture is Tata BP Solar India Limited, which is a joint venture of Tata Power (India) and BP Solar (UK). The company has set up a manufacturing facility in Bangalore which is one of the largest manufacturing facilities for SPV systems and solar thermal products in India. It not only caters to the domestic market, but also exports to various countries in the SAARC (South Asia Association for Regional Cooperation)[139] region, the US and Australia, among others. Shell Solar India Private Limited (a subsidiary of Shell) is actively engaged in partnerships with rural banks such as Vysya Bank, Syndicate Bank, Canara Bank and the Nethravathi Grameen Bank to facilitate finance options in rural areas.

As India is one of the largest wind power generating countries in the world, some foreign investors have shown an interest in this sector. For example, Vestas Wind System (Denmark), the world's leading producer of high-tech wind power systems, has a subsidiary company, Vestas Wind Technology India Private Limited, in India. Its core businesses are development, manufacture, sale, marketing and maintenance of wind power systems.[140] Gamesa Corporation Technology (Spain), the third-largest wind-turbine maker supplied 10 wind turbines worth €3.5 million to India.[141] Suzlon Energy Limited, India's leading manufacturer of wind turbines, has established a presence in over 40 locations around the world including Australia, China, Europe, New Zealand, South Korea and the US. It has design and R&D facilities in Germany and the Netherlands. It is also in the process of acquiring companies abroad; in 2006, it acquired Hansen Transmissions (Belgium), which specializes in gearboxes for wind turbines for US$565 million;[142] and in 2007, it acquired a controlling stake in Germany's REpower for US$1.6 billion.[143]

Indian companies and the MNRE provide consultancy services in international markets. The key services provided by the MNRE include resource assessment, policy and program formulation, development of mechanisms for program implementation and monitoring, feasibility studies, detailed projects reports and R&D services in different areas of renewable energy to countries such as Cuba, Morocco, Sri Lanka, Bhutan and Namibia.[144]

3.3.4 Nuclear Energy

In the past, there were collaborations with countries such as the US, Canada and Russia in setting up nuclear reactors. India needs foreign investment and technical know-how in areas such as the use of thorium in nuclear power. The country also needs to import uranium.

In 2005, India and the US agreed to enter into a nuclear energy cooperation agreement. After this, other countries such as the UK, Canada, France and Russia have extended support for greater cooperation in the field of nuclear energy. The US, UK and Canada have relaxed controls on export of technology to India, though staying within the Nuclear Suppliers Group (NSG) guidelines.

---

[139] SAARC is an economic and political organization of eight South Asian countries. It was established by seven countries namely India, Pakistan, Bangladesh, Sri Lanka, Nepal, Maldives and Bhutan on December 8, 1985. On April 3, 2007 Afghanistan became the latest member country to join SAARC at the 14th summit in New Delhi.

[140] http://www.vestas.com/vestas/global/en/

[141] The Tribute, 'Turbines for India', 4 February 2005, http://www.tribuneindia.com/2005/20050204/biz.htm, and http://www.gamesa.es/gamesa/index.html

[142] http://www.renewableenergyaccess.com/rea/partner/story?id=44380

[143] http://www.suzlon.com/

[144] http://www.mnes.nic.in

In December 2006, the US Congress passed the United States-India Peaceful Atomic Energy Cooperation Act under which the US will provide access to civilian nuclear technology and nuclear fuel in exchange for IAEA safeguards on civilian Indian nuclear reactors. On August 3, 2007 both countries released the full text of the 123 Agreement.[145] On July 9, 2008 India formally submitted the safeguards agreement[146] to the IAEA, which was approved by the IAEA on August 1, 2008. After this, the US approached the NSG to grant a waiver to India to commence civilian nuclear trade. The 45-nation NSG granted the waiver to India on September 6, 2008 allowing it to access civilian nuclear technology and fuel from other countries. The implementation of this waiver makes India the only known country with nuclear weapons which is not a party to the Non-Proliferation Treaty (NPT) but is still allowed to carry out nuclear commerce with the rest of the world. The US House of Representatives passed the bill on September 28, 2008. On October 1, 2008, the US Senate also approved the civilian nuclear agreement allowing India to purchase nuclear fuel and technology from the US. On October 8, 2008, US President George W. Bush signed the legislation on the Indo-US nuclear deal, approved by the US Congress, into law, called the United States-India Nuclear Cooperation Approval and Non-Proliferation Enhancement Act, and on the other side, the agreement was signed by India on October 10, 2008.[147]

Scrapping 34 years of nuclear trade isolation, India and France entered into a new era of bilateral ties on September 30, 2008 by signing a landmark agreement on civil nuclear cooperation that includes supply of reactors and atomic fuel, which is known as 'the Indo-France Nuclear Cooperation Agreement'. With this pact, France became the first country to enter into a formal understating with India after the NSG granted a vital exemption to India enabling it to conduct global nuclear trade. With this agreement, India and France will embark on other areas of cooperation like nuclear safety, radiation and environment protection and nuclear fuel cycle management.[148]

Russia also expressed an interest in cooperating with India in peaceful nuclear energy. During the visit of Russian President Vladimir Putin in January 2007, India and Russia agreed to enhance civilian nuclear energy cooperation for strengthening India's energy security. The two countries have signed a "memorandum of intent" to build four more nuclear reactors in Kundankulam (Tamil Nadu) and build more reactors at new sites under IAEA safeguards. There is already an inter-governmental agreement between India and Russia for cooperation in setting up 2x1,000 megawatts electrical Light Water Reactors (LWRs) at Kudankulam (Tamil Nadu). Russia will also supply low-enriched uranium to India's Tarapur Atomic Power Plant in Maharashtra.[149]

India has been a member of the Board of Governors of the IAEA since its inception and has taken active part in policy management and programs of the agency. As a part of that, India offers training facilities, fellowships, scientific visits, etc. to foreign scientists and provides the services of its scientists for expert assignments to other countries, both through the IAEA and to countries with which we have entered into bilateral agreements for cooperation in the field of peaceful uses of atomic energy.

---

[145] Section 123 of the US Atomic Energy Act, 1954 establishes an agreement for cooperation as a prerequisite for nuclear deals between the US and any other country. Such an agreement is called a 123 Agreement.

[146] Text of India-IAEA Safeguards Agreement http://www.isis-online.org/publications/southasia/India_IAEA_safeguards.pdf)

[147] http://en.wikipedia.org/wiki/United_States-India_Peaceful_Atomic_Energy_Cooperation_Act

[148] http://www.newstrackindia.com/newsdetails/20438; http://www.indianexpress.com/news/india-france-ink-nuclear-deal-first-after-nsg-waiver/368048/

[149] Cybercast News Service, 'Russia Offers Nuclear Supplies to India', March 17, 2006 http://www.cnsnews.com/ViewForeignBureaus.asp?Page=/ForeignBureaus/archive/200603/FOR20060317a.html

3.3.5 Electricity

In India, foreign companies are primarily involved in electricity generation. They also offer consultancy and other services on a project-by-project basis. Bechtel (USA) has a strong presence in the engineering segment and offers engineering, procurement, construction and support services to diverse projects in India. CLP Power Asia (China) owns a power project in Gujarat. Doosan Heavy Industries and Construction Company (South Korea) signed a US$370 million contract with NTPC to build three steam power plants in Sipat and Chattisgarh by early 2009. Marubeni Corporation (Japan) has a 26 per cent equity stake in the PPN Power Generation Company Limited in Tamil Nadu;[150] it also holds a stake in the proposed coal-based BPL power project in Andhra Pradesh. Public Service Electric and Gas Company (USA) operates the 330 MW combined-cycle electric generating facility in Pillaiperumalnallur (Tamil Nadu); the plant operates as a base load facility and sells electricity to the state-owned Tamil Nadu State Electricity Board under a 30-year PPA.

There are some joint ventures with foreign companies in consultancy services. For instance, L&T-Sargent & Lundy (L&T-S&L)[151] – a joint venture company of Larsen and Toubro Limited (India) and Sargent & Lundy (USA) – provides consultancy services in the electricity sector from the concept stage to commissioning of thermal power plants, cogeneration plants, combined cycle power plants and associated fields.

Among Indian companies, NTPC is offering services such as feasibility studies, engineering services, planning services, and training services in coal, oil and gas fired power plants to various countries including the US, Sweden, France, Syria, the UAE, Oman, Nepal, Japan, Saudi Arabia, Malaysia, Australia, Tanzania and the Philippines.

3.4 Trade Barriers

This section discusses the domestic and external constraints on India's trade in energy services. The barriers have been identified based on discussions with companies which are operating in different segments of energy services or plan to operate in the future.

3.4.1 Domestic Barriers

The Indian energy sector is presently facing multiple challenges. Domestic demand far exceeds domestic supply and the expansion of production has been at a slow pace. There is a need for technological upgrading and investment and, in spite of progressive liberalization since the 1990s, there has been limited private/foreign investment. The sector continues to be dominated by the public sector and faces monopoly-induced inefficiencies. Since the sector is highly regulated, there are bureaucratic delays in getting approvals. Often it takes a long time to initiate regulatory reforms. For instance, it took four years to ratify the PNGRB Act, 2006. As different sub-sectors of energy are under different ministries/departments, they are often regulated separately rather than in an integrated manner. Moreover, many sub-sectors such as mining are jointly regulated by central and state governments. All of these create conflicts of interest, delays in decision making and result in requirements of multiple clearances. The lack of coordination between planning and implementing agencies, lack of a comprehensive energy policy and weak corporate governance are major barriers to long-term private/foreign investment in this sector.

[150] The Hindu Business Line, 'El Paso Sells Stake in PPN Power to Promoter', September 1, 2005, http://www.blonnet.com/2005/09/01/stories/2005090102650200.htm

[151] http://www.lntenc.com/lntenc/services/engineering/power.jsp

3.4.1.1 Coal

Although India has one of the largest coal reserves in the world, the quality of coal is deteriorating progressively. Indian coal has a high ash content and is low in calorific value. The sector is dominated by PSUs which have outdated/outmoded technologies. The lack of technical know-how and the high-labor component in underground operations and the use of obsolete techniques due to their low cost are some reasons for the lower productivity of coal mines. As opencast[152] mines are generally cheaper to operate than underground mines, neither domestic nor foreign investors are willing to invest in new underground mines. At present, it takes around eight years to develop coal mines, and this long gestation period together with the requirement of large investment makes it non-viable for private investment. Companies pointed out that delays in the approval process range between 4 to 7 years. The major part of the delay is in getting clearance from the Ministry of Environment and Forests (MoEF). The CIL board can only approve projects up to Rs.100 crore and projects above Rs. 100 crore have to be approved by the government, which causes the delay.

Inadequate geological data, the high price of such data and the government's conservative approach in assessing the economic feasibility of new projects make the sector less attractive for private investment. Even to expand the existing mining capacities, companies face various problems including bureaucratic delays, difficulties in acquisition of land and associated problem of rehabilitation. Since foreign investment is only allowed in captive coal mining and that too with restrictions on sale in the open market and there are other restrictions, foreign investors have not shown much interest in investing in this sector.

Since the sector is dominated by PSUs, there is limited scope for competition and, therefore, limited incentive for improving productivity and efficiency. Private/foreign companies pointed out that in the absence of an independent regulator, PSUs not only have a major stake in the prices but also have a preferential position in getting licenses and mining leases. Private/foreign companies further pointed out that captive coal fields are allocated through a Steering Committee and not on a competitive basis. They have raised concerns about the lack of transparency in the block allocation procedure.

Although India has a supply of high-skilled manpower, this sector suffers from specific skill shortages. On the other hand, some government companies, including CIL, are overstaffed, which lowers productivity. The inadequate logistic infrastructure (port, road, railways, etc.) increases the cost of transportation, resulting in the high price of coal, which makes it uncompetitive in international markets.

The Coal Mines Nationalisation (Amendment) Bill, 2000, which was introduced in Parliament to bring suitable legislation amendments to permit private sector entry into the coal sector, is still pending.

3.4.1.2 Oil and Gas

While foreign/private companies are encouraged to invest in the upstream segment, they face various barriers. Both private Indian and foreign companies pointed out that the bidding process for exploration of new blocks is very time consuming. For example, the sixth round of NELP took a year for the entire process from the announcement to the allotment of blocks.

[152]Opencast mining is a method of extracting coal from an open pit. It is used when deposits of commercially-used coal are found near the surface.

Wildlife sanctuaries, national parks, coral reefs and areas of biosphere sensitivity are excluded from the activities of E&P by the MoEF even though these areas may have high potential. There is a requirement of multiple clearances from different ministries/departments/bodies (such as environmental clearance from the MoEF and State Pollution Control Boards, and naval clearances from the Indian Navy/Ministry of Defence for deployment of vessels/offshore rigs) which further increases delays. Companies require more than 70 clearances for exploration and over 20 clearances for marketing. These clearances are not only time consuming but also lead to delays in the establishment of assets. The aggregate time spent by marketing companies on obtaining these clearances ranges from around 3 to 4 years, the estimated time required to set up one retail outlet is 6 to 8 months, and the period required by the Navy/Ministry of Defence for clearance is 120 days.

Both foreign and private companies pointed out that it is extremely difficult to set up operations in the downstream segment, especially retailing which is dominated by PSUs. They argued that although APM in the oil sector is said to have been eliminated, the government continues to control the prices of automotive fuels, LPG, and a large part of domestic natural gas and kerosene. The government also frequently interferes in fixing the price of crude oil as well as petroleum products at the retail level. The government provides subsidies on LPG and kerosene to PSUs which is not available to private players. There is no competition at the refinery or retail end. There are differential custom duties, excise duties and central levies on crude oil and petroleum products and these duties are high. State levies are also high and they also vary across different states.

Despite the presence of domestic and foreign players in the refining segment, there is no real competition in this sector other than in some products such as lubricants. The minimum investment requirement of Rs. 2 billion crore is also an entry barrier in the retailing segment which discourages foreign players from entering this segment. There is a lack of a common carrier principle in the distribution and marketing segment.

In the gas sector, the multiplicity of prices is a major barrier. On the one hand, gas from the nominated blocks is marketed at APM prices determined by the government and, on the other hand, domestic gas procured from NELP blocks is sold at prices determined on the basis of production sharing contracts and prevailing market conditions. In the case of LNG, which is imported under an Open General Licence, prices are determined on a contract-to-contract basis. This pricing system has slowed down investments in the laying of transmission pipelines. Moreover, there is no transparent and regulatory framework for setting up transmission pipelines. Setting up of pipeline infrastructure is capital intensive and involves a high initial cost. Therefore, it deters investment if appropriate incentives are not given.

DGH, which oversees the allocation and exploitation of oil and gas reserves and enforces profit sharing with E&P companies, does not work independently and the government handles all regulatory issues.

Indian companies (both PSUs and private) pointed out that they lack certain technical know-how and skills. Although many of them have entered into collaborative ventures with renowned international companies, there is hardly any technology transfer. Moreover, international players are keen to appoint individual consultants instead of giving the entire consultancy project to an Indian company. There is a shortage of skills in this sector, especially engineers. India has an abundance of engineers, but many of them lack the requisite skills and there is a shortage of the specialized expertise needed in this sector. In fact, Indian companies often depend on foreign geologists and other specialists.

3.4.1.3 Renewable Energy

One major barrier to investment in the renewable energy sector, especially in hydro and wind power segments, is the lack of availability of land for energy generation as other competing land uses dominate and there are social issues such as rehabilitation of displaced occupants of the land. This causes delays in project implementation. The environmental clearance process is time consuming. The cost of setting up of the projects is high and returns are uncertain. For instance, wind power projects currently deliver only about 17 per cent of the capacity factor on an average and many hydro-electric projects face cost over-runs.[153] With the present level of technology, solar electricity produced through the photovoltaic conversion route is 4-5 times more expensive than the electricity obtained from conventional fossil fuels.[154] Small hydro-electric projects are often located in remote areas and, therefore, require high investments in transmission and distribution which add to the costs. Although the government gives various incentives in this sector, they are not sufficient. Due to the lack of clear policy guidelines, the incentives provided by the government are often misallocated; for instance, sometimes the government-granted investment subsidy for biomass gasifiers is used to obtain subsidized diesel engine pump sets or diesel engine gensets. Many financial institutes are not keen to fund renewable energy projects and only a few provide micro-credit at the grassroots level (to local bodies) for projects such as biomass. Most banks and financial institutions and even IREDA (which was set up specifically to fund RETs) have cumbersome/long procedures for giving financial assistance. Lack of information on the viability of the technology restricts investment. For example, the SPV system is not directly associated with revenue generation and restrains financing institutions from venturing into the solar lighting business. Lack of funds makes it difficult to upgrade and maintain equipment and to set up an efficient consumer service infrastructure.

Lack of coordination between the states, local bodies and centre often makes the projects unviable. The projects are often planned at the central level and implemented at local levels. Some of the state-level plans do not have adequate allocation for renewables and there is no uniform policy across states and between the centre and states with respect to third-party sale, wheeling[155] charges and buy-back of power, among others. Delays in signing of the Project Development Agreements and PPAs with the SEBs are major barriers in this sector. Information regarding renewable energy projects and technologies is not readily available.

3.4.1.4 Nuclear energy

The main barriers to the growth of the nuclear energy sector include the availability of raw material (uranium), finance and technical know-how. India's uranium reserves are of low grade and the cost of the fuel is almost five times compared to international prices.[156] The sector requires huge investments. Around 20-25 per cent of the country's R&D spending is on nuclear research.[157] The sector is highly regulated and, therefore, there is limited scope for private investment.

---

[153] Planning Commission (2006).

[154] http://ecoworld.com/features/2007/05/15/indias-solar-power/

[155] The transfer of electricity between utility companies, especially through the networks of one company on behalf of others.

[156] Planning Commission, 2006.

[157] http://www.ccnr.org/third_world_nukes.html

3.4.1.5 Electricity

Electricity is an important input and its price affects the productivity, efficiency and global competitiveness of allied sectors such as manufacturing and services. Based on purchasing power parity, Indian consumers pay one of the highest prices for electricity. At present, consumers buy electricity from single monopoly suppliers. As long as this non-competitive environment persists, consumers may not get quality supply at reasonable rates. Also, there is cross-subsidization between different sectors, such as the agriculture sector and households, and industry and commercial users. While the purpose of subsidies is to provide electricity to the "needy" who cannot afford to pay the market price, these are often given in an ad-hoc manner rather than on the basis of need. For instance, the electricity subsidy does not discriminate between poor and rich farmers; farmers in most states face zero marginal cost of electricity and this encourages misuse and results in allied problems such as ground water depletion.

The electricity sector is dominated by large state monopolies and there are various monopoly-induced inefficiencies. The electricity utilities suffer from very high network losses. Although there has been an increase in generation capacities, the transmission and distribution network is still underdeveloped. Inadequate investment in transmission and distribution, lack of proper distribution planning, metering, theft, non-billing, incorrect billing, inefficiency in collection, defaulters, etc. result in an average loss of over 40 per cent in transmission and distribution. Moreover, inefficient networks make it difficult to distribute electricity from surplus to deficit areas. Due to irregularities and the poor quality of supply, industrial and commercial establishments not only have to pay a high price but also invest in their own 24x7 captive backups.

Since the sector is dominated by PSUs, the government often tends to protect its interests. There is, at present, no level playing field between PSUs owned by the central government and others. These PSUs get guaranteed post-tax returns of 14-16 per cent with full payment backed by the government, but private generating companies are not entitled to these assured post-tax returns. The SEBs are financially sick[158] and are unable to meet their investment needs or attract private capital. Their day-to-day operations are closely monitored by the state governments and they lack corporate management. Foreign investors have faced various problems in their dealings with SEBs. For instance, Electricite de France (France), Cogentrix Energy Inc (USA), Bayernwerk (Germany), Vereinigte Elektrizitätswerke Westfalen (Germany) and Daewoo Power India Limited (a subsidiary of Korea's Daewoo Corporation) have withdrawn from different projects as the SEBs were unable to provide security of payments. A similar situation occurred in the case of the Dabhol Power Project (Maharashtra) in which Enron Corporation, the American energy giant, had a majority stake.[159]

The other reason for withdrawing investment is the low returns in comparison to other international markets. Private and foreign companies have also referred to the lack of clarity in government policies, discretion and political interference as reasons for withdrawals or not making investments. For instance, in 1999, three bidders – Siemens Power Generation (Germany), Vereinigte Elektrizitätswerke Westfalen (Germany) and Public Sector Enterprise Group (USA) – withdrew from the bidding process for the Pipavav Mega Project (2000 MW)

[158] Due to huge subsidies to certain sections of consumers such as farmers and domestic users, and high transmission and distribution losses.

[159] http://www.atimes.com/reports/CA13Ai01.html

due to lack of policy clarity.[160] They also pointed out that they do not have adequate access to data on resource and cost allocation. Lack of transparency not only leads to technical inefficiencies but also corruption. There are significant bureaucratic delays in getting clearances and in signing crucial agreements such as PPA, Implementation Agreement and Fuel Supply Agreement. For example, Electricite de France, Europe's largest electricity company, withdrew as the co-promoter of the Bhadrawati Power Project (1082 MW) in Maharashtra due to long delays in getting clearances and lack of payment guarantees. In the case of the Hirma Thermal Power project in Orissa, the foreign promoter, Mirant Asia Pacific Limited, withdrew on the grounds that several key agreements such as the Fuel Supply Agreement, Implementation Agreement, and Transmission Services Agreement had not been met.

The Electricity Act, 2003 introduced various measures such as power trading, open-access, and unbundling of SEBs. It also permits setting up of captive and group captive power plants without clearances of the distribution utility to encourage private sector investments. However, privatization of the distribution system has taken place only in some states such as Orissa, Delhi, Maharashtra, Gujarat, Uttar Pradesh and in some parts of West Bengal. Although most states have issued open access regulations, very few applications have been received for obtaining open access because consumers have to pay high cross-subsidy surcharges, unreasonable transmission charges and wheeling charges. Similarly, in the case of trading, only 3 per cent of the gross electricity generated in the country is being traded.

The cost of borrowing is very high. Most private sector projects tend to source the debt portion of their funds in overseas markets because of the substantially higher nominal interest rates. Financial institutions are more willing to fund projects that are backed by state guarantees.

In the transmission segment, information regarding transmission capacity is not widely available to all players and the cross-subsidy surcharge is currently very high. The other barriers are incumbent service providers, lack of adequate infrastructure, lack of political will to reform and heavy regulation of fuel markets. Non-availability of coal at competitive prices and its quality also act as barriers to investment in thermal electricity generation. The price of coal, together with transportation costs, increases electricity tariffs.

3.4.2 External Barriers

Indian companies face various barriers in the international market and some of them are listed in Section 2.4.

India has a comparative advantage in the supply of high-skilled manpower at competitive rates. Restrictions on the temporary movement of people adversely affect trade in this sector. It is extremely difficult to get work permits and visas for countries such as the US, Iran, Indonesia, Bahrain and Qatar and the process is time consuming. Sometimes visas are rejected without a valid reason. In Iran, business visas are given for only one month, which is a problem for persons going for exploration, which are long-term projects. In some Middle East countries such as Qatar, it is difficult to get multiple-entry visas. Many countries, especially developed countries, do not recognize Indian professional degrees and/or their work experience. Moreover, in the US, many qualification-related restrictions are imposed at

[160] http://www.iimahd.ernet.in/~morris/iir01/iir6.pdf

the state level. In some countries in the Middle East, it is difficult to change jobs or employers; to change jobs, a "No Objection Certificate" from the current employer is required. Professionals staying for short durations have to make social security payments in countries such as Iran and the US. Most Indian nationals do not have statutory recognition in other countries (for example, Sri Lanka) and cannot sign documents presented to government institutions or regulatory bodies. Many countries have imposed ENTs and labor market tests. For instance, in Indonesia, foreign experts are only allowed if the company can prove that the required skill/knowledge is not available locally.

Indian companies are keen to establish a presence abroad and the government is encouraging them to do so. However, there are various barriers to Mode 3 trade. Apart from FDI restrictions, many countries (including the UAE, Iran, Qatar, Oman and Bahrain) have a mandatory requirement to have local sponsors/agents; these are sometimes sleeping partners who appropriate a large share of the profits. In some countries (for example, Saudi Arabia and Oman) the condition of local employment acts as a major barrier since the right skills are not often available and, if available, they are more expensive and less productive than Indians. Countries such as Iran have local content requirements, while others (for instance, Malaysia) have local incorporation requirements. In some countries such as Oman, there is high customs duty on the import of equipment. To operate as an international engineering company in Qatar, it is mandatory to obtain a commercial registration. In many countries, regulations change frequently or are non-transparent, while in others, in the case of disputes, the legal framework in biased in favor of locals. In countries such as Australia and some EU countries, there is a stringent imposition of standards and local safety and environmental practices. Some countries such as Indonesia have imposed withholding tax on repatriation of income.

Lack of information about the bidding process, bid documents in local languages and the requirement to know local languages, problems of sending staff due to security reasons (the Middle East, Afghanistan, etc.), and the requirement for only locals to participate in the tendering process are other barriers to trade in energy services. In the energy sector, there are large vertically integrated global players. These companies have higher levels of specialization and technical expertise and offer significant competition to Indian companies. In the Middle East there is a preference for companies from developed countries – especially the EU and the US. There are only a few Indian banks abroad which offer loan facilities and domestic interest rates are high. Moreover, Indian companies often find it difficult to raise finance in international market through other sources.

Although there is significant potential for cross-border trade in electricity and gas (through pipelines), it is currently limited because of border disputes, conflicts of interest among neighboring countries, security issues, pricing issues, lack of clear concepts on electricity sharing, issues of third-party access and transmission fees. In recent years, India and its neighboring countries have been trying to resolve some of these issues. The limited financial resources of the SAARC member countries also restrict the process of regional cooperation in energy. Apart from these, other concerns, such as environment concerns, prevent cross-border trade. For instance, the Manas Multipurpose Hydroelectric Project (2800 MW) between India and Bhutan was not cleared because of environmental objections by the Government of Bhutan.

With the multiplicity of bilateral and regional agreements, countries are giving preference to companies from countries with which they have these agreements. India is not a part of any major trading bloc and is not a party to some important treaties, and this has

adversely affected India's trade in energy services. For instance, India has not signed the NPT and this affected the development of civil nuclear energy until recently.

4. General Agreement on Trade in Services - GATS

4.1 Uruguay Round of Negotiations

The Uruguay Round (1986–94) was the first round of multilateral negotiations in services. In that round only a few countries undertook commitments in energy and energy-related services because there was no clear sectoral classification. Moreover, energy services have traditionally been dominated by state-owned vertically integrated utilities and countries were undergoing a liberalization process. Since the regulatory regimes were evolving in many countries, it was difficult for them to undertake commitments. Countries were also concerned about the potential effects of GATS on the ability of the government to ensure adequate provision of energy services to the public (that is how they could meet their universal service obligations once a commitment is made in the WTO).

The countries which undertook commitments in different sub-sectors of energy services are given in Table 4.1. Overall, the commitments were restrictive. For instance, among the eight members that undertook commitments in services incidental to energy distribution, Australia only committed for consultancy services, leaving the core distribution and transmission services unbound (no commitments). Among the 33 members that undertook commitments in services incidental to mining, 11 commitments were limited to advisory or consulting services.

Members have also undertaken commitments in other service sectors such as engineering services, integrated engineering services, R&D services, management consulting services, services related to management consulting, technical testing and analysis services, related scientific and technical consulting services, and general construction work for civil engineering and distribution services (commission agent, wholesale and retail services) which have implications for trade in energy services. Within these energy-related services some members have undertaken partial commitments. For instance, Pakistan only gave commitments in hydel electricity under engineering services.

Table 4.1: Commitments in the Uruguay Round

Sub-Sectors	Countries
Services incidental to mining	33 members including Argentina, Australia, Canada, Colombia, Dominican Republic, EC, Finland, Hungary, Israel, Korea, Pakistan, Poland, South Africa, Sweden, Switzerland, Thailand, Turkey, USA, Venezuela and Zambia made commitments.
Services incidental to energy distribution	Only 8 countries – Australia, Dominican Republic, Gambia, Hungary, Nicaragua, Sierra Leone, Slovenia and USA – undertook commitments.
Engineering services	Antigua & Barbuda, Argentina, Australia, Brazil, Canada, Chile, Cuba, Czech Republic, Dominican Republic, EC, El Salvador, Finland, Guyana, Hungary, Iceland, Indonesia, India, Israel, Jamaica, Kuwait, Malaysia, New Zealand, Netherlands, Norway, Pakistan, Peru, Poland, Romania, Singapore, Slovak Republic, South Africa, Swaziland, Sweden, Switzerland, Thailand, Turkey, USA and Venezuela

Sub-Sectors	Countries
Integrated engineering services	Australia, Austria, Canada, Czech Republic, Dominican Republic, EC, Finland, Guyana, Hungary, Iceland, Indonesia, Israel, Korea, Kuwait, Malaysia, Norway, Pakistan, Slovak Republic, South Africa, Swaziland, Sweden, Switzerland, Thailand, USA and Venezuela
R&D services on engineering and technology	Antigua & Barbuda, Austria, Dominican Republic, Hungary, Iceland, Kuwait, Pakistan, Slovak Republic and Switzerland
Management consulting services	Argentina, Australia, Austria, Brazil, Canada, Chile, Colombia, Cuba, Czech Republic, Dominican Republic, EC, Finland, Hong Kong-China, Hungary, Iceland, Israel, Japan, Jamaica, Korea, Kuwait, Malaysia, Morocco, Mexico, Netherlands, Norway, Poland, Romania, Slovak Republic, South Africa, Swaziland, Sweden, Switzerland, Thailand, Turkey, Uruguay, USA and Venezuela
Services related to management consulting	Australia, Austria, Brazil, Canada, Czech Republic, EC, Finland, Iceland, Japan, Kuwait, Norway, Romania, South Africa, Slovak Republic, Sweden, Switzerland, Uruguay and USA
Technical testing and analysis services	Austria, Canada, Dominican Republic, EC, Finland, Gabon, Hungary, Iceland, Indonesia, India, Kuwait, Malaysia, Norway, Pakistan, South Africa, Swaziland, Switzerland, Thailand and Zambia
Related scientific and technical consulting	Australia, Austria, Canada, Czech Republic, Dominican Republic, EC, Finland, Hungary, Iceland, Israel, Jamaica, Korea, Kuwait, Namibia, Norway, Slovak Republic, South Africa, Sweden, Switzerland and USA
General construction work for civil engineering	46 countries including Australia, Austria, Brazil, Canada, Colombia, Cuba, Czech Republic, Dominican Republic, EC, Finland, Ghana, Indonesia, India, Japan, Korea, Kuwait, Malaysia, Morocco, New Zealand, Norway, Poland, Romania, Slovak Republic, South Africa, Sweden, Switzerland, Thailand, Turkey, USA, Venezuela and Zambia undertook commitments.
Installation and construction work	Cote 'd' Ivoire
Commission Agents' services	Countries such as Australia, Austria, Brazil, Canada, EC, Finland, Iceland, Japan, Korea, Kuwait, New Zealand, Romania, Sweden, Switzerland, Thailand and USA
Wholesale trade services	30 countries including Argentina, Australia, Austria, Canada, Czech Republic, EC, Finland, Hungary, Iceland, Japan, Korea, Kuwait, Mexico, New Zealand, Norway, Peru, Poland, Romania, Slovak Republic, South Africa, Sweden, Switzerland and USA undertook commitments.
Retailing services	29 countries including Argentina, Australia, Austria, Brazil, Canada, Chile, Czech Republic, EC, Finland, Hungary, Iceland, Japan, Korea, Kuwait, Mexico, New Zealand, Norway, Poland, Romania, Slovak Republic, South Africa, Sweden, Switzerland and USA undertook commitments.
Pipeline transportation of fuels	Only 3 countries, namely, Australia, Hungary and New Zealand undertook commitments.

Source: Compiled by Authors from WTO (September 9, 1998) and WTO (April 15, 1994).

In the Uruguay Round, most of the countries (both developed and developing) have not imposed limitations/restrictions on market access and national treatment in Modes 1 and 2. A number of countries have imposed market access limitations in Mode 3 – which is an

important mode for trade in this sector. Some commonly listed market access limitations include restrictions on foreign equity participation, nationality and residency requirements, restrictions on type of legal entity and authorization requirements. For instance, Malaysia offered partial commitments in management consulting services covering advisory, guidance and operational assistance services concerning management of the transmission of non-conventional energy, imposing the restriction that market access would only be allowed through a locally-incorporated joint venture with Malaysian individuals or Malaysian-controlled corporations or both and there should be at least 30 per cent Bumiputra shareholding in the joint venture. Sierra Leone imposed a joint venture requirement for other business services, while Egypt only allowed commercial presence through joint venture in long-distance pipelines and electricity lines, gas fitting construction work and installation work. Hungary imposed the limitation that pipeline transportation services should be provided through a contract of concession granted by the state or the local authority. Some countries imposed limitations on national treatment. For example, in Indonesia, the Indonesian participant in a joint operation must be a member of the Indonesian Consultant Association. Countries such as the US (in pipeline transportation), Venezuela (in distribution and marketing of petroleum and petroleum products, advisory services and exchange of technology) and Indonesia (preferential treatment to ASEAN contractors in government-funded construction projects) undertook MFN exemptions.

India made commitments in sectors/sub-sectors such as engineering services, R&D services (these included heat, light electromagnetism, and astronomy but excluded atomic energy and related matters and engineering and technology including applied science and technology for casting metal, machinery, electricity, etc.), technical testing and analysis services, and construction work for civil engineering. By mode, India did not undertake commitments in Modes 1 and 2 and undertook partial commitments in Mode 3 – 51 per cent foreign equity only with local incorporation. Commitments in Mode 4 were to the extent stated in the horizontal schedule.

4.1 Doha Round of Negotiations

Article XIX of the GATS states that Members should enter into successive rounds of negotiations to progressively achieve higher levels of liberalization, the first of such rounds to begin not later than five years from the entry into force of the WTO Agreement which was January 1, 1995. Accordingly, services negotiations were launched in January 2000 and were known as the GATS 2000 negotiations. These negotiations were subsumed in the wider round under the Doha Ministerial Declaration of November 2001 and are an integral part of the ongoing round.

Since the beginning of this round, countries/regional groups such as the EC[161], US[162], Norway[163], Venezuela[164], Japan[165], Chile[166] and Cuba[167] have submitted negotiating proposals on energy services which focused on the coverage of this sector, classification and definitional issues. For an energy service provider, there are various practical problems associated with fragmented and non-exhaustive classification. Since energy services

[161]WTO (23 March 2001).
[162]WTO (18 Dec. 2000).
[163]WTO (21 March 2001).
[164]WTO (29 March 2001), and WTO (4 June 2003).
[165]WTO (4 October 2001).
[166]WTO (14 May 2001).
[167]WTO (22 March 2002).

constitute a chain of interrelated activities, an energy service supplier may need market access in a number of relevant service sectors to adequately provide the service. The proposals varied in their content but had some common elements. They are based on the assumption that improved market access in the energy service sector can have beneficial effects for all countries. They stressed that negotiations on the liberalization of the energy service sector should not address the issue of ownership of natural resources; they recognized that energy would continue to be regulated to ensure the achievement of public goals; and they acknowledged that since the countries are in different phases of regulatory development, their commitment would reflect the levels of existing market reforms.[168]

The US and Norway proposals called for the development of a Reference Paper along the lines of the Reference Paper on Basic Telecommunications. The Japanese proposal also referred to the need for a multilateral framework for domestic regulations to ensure a competitive environment, and non-discriminatory, fair and transparent access to networks. In this sector there is need for a strong regulatory framework to guarantee effective market access. Many academic studies emphasized the need for additional commitments in the energy sector as in the case of telecommunications. For instance, Evans (2002) argued that to secure pro-competitive regulatory reforms, third-party access to essential facilities (including gas pipelines, electric power transmission and other essential energy infrastructure), market transparency (including real-time access to information on prices, transmission capacity, congestion and upcoming demand), competition safeguards and an independent regulator are basic requirements in any agreement on energy services. It is important to note that as of now restrictive business practices by incumbent operators are subject to Article VIII (monopolies and exclusive services suppliers) and Article IX (business practices) of GATS. These rules are applicable only in cases where the members have undertaken specific commitments.

Another important issue in the context of the negotiations is what areas should be exempted from the GATS disciplines. The initial proposal by the EC[169] argued for the need to exempt nuclear energy. The US and Venezuela proposed the exclusion of ownership of publicly-owned natural resources. Many countries have raised concerns about how to address safety and security issues and ensure the nation's sovereignty over natural resources. Article XIV bis of GATS deals with Security Exceptions. It includes among security exceptions Members' action to protect essential security interests "relating to fissionable and fusionable materials or the materials from which they are derived". It is, however, not clear how this would affect international trade in nuclear energy.

Since the beginning of the Doha Round, countries in favor of enhanced GATS commitments in the energy sector have emphasized that multilateral commitments can create momentum for further domestic reforms and enable developing countries to attract much needed investment since it provides a credible signal that the government is committed to reforms. They have also argued that GATS provides considerable flexibility to developing countries to undertake commitments in line with their reform process and governments would retain their rights to regulate.

The Doha Round negotiations were initially based on a request-offer approach,[170] that is, each country made bilateral requests to its trading partners to remove barriers in areas of its export interest but commitments will be multilateral. The date for submitting requests was June 30, 2002, the initial offer was March 31, 2003, and the revised offer was May 31, 2005.

[168]UNCTAD (2003).
[169]WTO (9 September 1998).
[170]Plurilateral negotiations began only after the Hong Kong Ministerial.

Accordingly, WTO members made bilateral requests to their trading partners in areas of export interest. Since requests were confidential and only addressed to the member concerned, it is difficult to make an assessment of the requests. Overall, the requests were very ambitious and called for substantial liberalization.

India received requests from around 27 countries (including all major developed and developing countries) and the requests of countries such as Brazil, Australia, the US, the EC, Canada, Norway, Poland, Japan and Switzerland covered energy services. The majority of the requests called for widening the sectoral coverage and undertaking full commitments under market access and national treatment for Modes 1, 2 and 3.[171] Some countries (such as Canada for scientific and technical consulting services and services incidental to mining) focused on binding the existing regime. In its horizontal request, Japan pointed out that there should be uniform laws and regulations across the country. Further, Japan requested lower tariffs on imported tools and equipment and for the local content requirement on such tools/equipment to be eliminated. Many countries have referred to transparency in the tendering procedures. India did not make a request in this sector.

An analysis of the initial and revised offers show that some WTO members including the US, EU, Brazil, Canada and India have broadened their commitments both in terms of sectoral coverage and extent of openness. For instance, in its revised offer of August 2005, India undertook commitments in new sub-sectors such as integrated engineering services, management consulting services and services incidental to energy distribution excluding energy trading and load dispatch functions. The US for the first time offered commitments in pipeline transportation of fuels. The EU broadened the sectoral coverage to include sub-sectors such as related scientific and technical consulting, services incidental to energy distribution, and advisory and consulting services related to mining. Canada offered to undertake commitments in a wide range of new areas, such as engineering services, integrated engineering services, management consultancy services and technical and testing analysis.

Countries also offered to widen their commitments by mode of delivery, especially in Modes 1, 2 and 3. For instance, under Mode 3 India offered to remove the 51 per cent restriction on foreign equity; instead, foreign investors have been allowed to enter through local incorporation and subject to the condition that in the case of foreign investors having a prior collaboration in that specific service sector in India, FIPB approval would be required. India also offered to undertake full commitments in Modes 1 and 2 under market access and national treatment for selected sectors/sub-sectors, such as engineering services and integrated engineering services, management consulting services, technical testing and analysis services, and general construction work for civil engineering. Some of these sectors were either not covered in the Uruguay Round or commitments were left unbound. A comparison of India's Uruguay Round commitments and revised offer is given in Table F1 of Appendix F. Table F1 shows substantial improvements in India's revised offer in energy services compared to its Uruguay Round commitments. In the Uruguay Round, Brazil imposed the condition that for market access in services related to management consulting, companies must register with the Regional Council of Administrators. This was removed in the Doha Round offers. Some countries such as Pakistan increased the foreign shareholding limits in their offers.

[171]Commitments in Mode 4 can be as per the horizontal schedule.

Although countries offered to broaden their commitments both in terms of sectoral coverage and modes of delivery, there are still many barriers to trade in energy services. For instance, in China, cooperation with Chinese professional organizations is required for certain engineering services. In Brazil, foreign service suppliers are required to form a "consorcio" for commercial presence in engineering services with Brazilian service suppliers, where the latter would maintain the leadership. In Canada, there are citizenship and residency requirements in related scientific and technical consulting services under Mode 1. In Malaysia, engineering services may be supplied only by natural persons and there is a joint venture requirement with Bumiputras in certain services such as management consulting services, technical testing and analysis and general construction work for civil engineering. Pakistan offered foreign investment in engineering services for hydel electricity only; foreign equity in engineering consulting companies has been limited to a maximum of 50 per cent. The US and Canada have imposed various state-level restrictions. The EU's offer is full of restrictions. For instance, all major players except countries such as Austria, the Czech Republic, Estonia and Lithuania have kept Mode 1 unbound for exploration services in the sub-sector – related scientific and technical consulting. All Member States except Hungary, Latvia, Lithuania and Slovenia kept Modes 1, 2 and 3 unbound for services incidental to energy distribution. Hungary's offer in this sub-sector is limited to consultancy services while Slovenia stated that commitments in services incidental to energy distribution is limited to gas and that public utility exists and concession rights can be granted to private operators established in the country.

Countries such as Nepal, Israel, Turkey, Oman, Saudi Arabia and Armenia, which acceded to the WTO after the Uruguay Round, undertook liberalization commitments across different energy and energy-related services in their accession schedules, indicating that this is an important sector for future negotiations. Among the major energy producing countries, Saudi Arabia offered full commitments in sectors/sub-sectors such as R&D services, management consulting services, technical testing and analysis, pipeline transportation and services incidental to mining under Modes 1, 2 and 3 for both market access and national treatment, and imposed a foreign equity limit of 75 per cent for engineering and integrated engineering services and an equity limit of 50 per cent (which would increase to 75 per cent after 3 years) in wholesale trade and retailing. Oman offered full market access and national treatment commitments in most sub-sectors, the major exception being pipeline transportation.

The progress of GATS negotiations prior to the Hong Kong Ministerial was slow. Many WTO members had not submitted their initial/revised offers and many of the offers that were submitted did not reflect the unilateral liberalization that the countries had undertaken since the Uruguay Round. The Hong Kong Ministerial Declaration outlined the need to intensify negotiations toward achieving meaningful liberalization. Annex C of the Hong Kong Ministerial Declaration pointed out that in order to achieve a higher level of liberalization, members should undertake commitments at the existing level of market access on a non-discriminatory basis across sectors of interest to trading partners for Modes 1 and 2. It also requested members to remove the existing requirement of commercial presence for offering services under Modes 1 and 2. In Mode 3, members were requested to undertake commitments to enhance the level of foreign equity participation, remove or substantially reduce ENTs, and allow greater flexibility in the type of legal entity. In Mode 4, members were asked to undertake new or improved commitments on (a) Contractual Service Suppliers (CSS) and Independent Professionals (IP) delinked from commercial presence and (b) Intra-corporate Transferees and Business Visitors. Annex C also pointed out that members should

remove or substantially reduce MFN exemptions and clarify the remaining MFN exemptions in terms of scope of application and duration.

Annex C pointed out that in order to expedite the negotiations, in addition to the request-offer approach, members can enter into plurilateral negotiations in accordance with the principle of GATS and the Guidelines and Procedures for Negotiations on Trade in Services. The timeline for submitting the plurilateral requests was February 28, 2006 and for the revised offer it was July 31, 2006. Around 35 WTO member countries participated in the negotiations. Plurilateral requests were made in 16 sectors, all 4 modes and in MFN exemptions.

India was a recipient of the plurilateral request in energy services. The EC coordinated the request which was sent along with countries such as Australia, Canada, Japan, Norway, Saudi Arabia, Korea, Separate Customs Territory of Taiwan, Penghu, Kinmen & Matsu, Singapore and the US to around 23 countries. Apart from India, countries such as Brazil, Argentina, China, Malaysia, Qatar and South Africa received the request. The requesting members pointed out the importance of liberalizing energy services and emphasized that the request has been made with due respect for national policy objectives and the level of development of individual WTO members, both overall and in individual sectors. The request is neutral with respect to energy sources, technology and whether services are offered onshore or offshore. It acknowledges the right of WTO members to regulate services and introduce new regulations in future, but stresses that regulatory measures, which are important in the energy sector, must be clearly defined, transparent and non-discriminatory. The request does not cover ownership of energy resources.

Since energy services constitute a closely interrelated set of activities, the requesting countries drew up a detailed list of energy and related sectors/sub-sectors where they wanted targeted countries to undertake commitments for meaningful liberalization of energy services. The list does not cover all energy services but only those in which the co-sponsors share common interests. This is listed in Table 4.2.1.

The Doha Round of negotiations were temporarily suspended on July 24, 2006 after the talks in agriculture (market access and domestic support) and non-agriculture market access (NAMA) between six major members – Australia, Brazil, India, Japan, the EU and US – broke down on July 23, 2006. Hence, the revised offers were not tabled on July 31, 2006. The negotiations have resumed on February 7, 2007 and are ongoing.

Compared to the bilateral requests received by India in energy services, the plurilateral request was more focused. As shown in Table 4.2.2 below, the plurilateral request concentrated on removal of specific barriers to trade across different modes of service delivery rather than asking for full commitments in Modes 1, 2 and 3 as was the case in the bilateral requests. Six bilateral market access clusters and four plurilateral meetings on energy services were held between April 2006 and September 2007. The discussions focused on clarification of doubts, sharing of information, addressing sensitivities related to this sector and some indication of the potential offers. Although India's revised offer shows significant improvement over the Uruguay Round commitments, it is much below what the demandeurs want in the plurilateral request. Specifically, India's revised offer does not cover sectors/sub-sectors such as services incidental to mining, site preparation work for mining, commission agents' services, wholesale trade services and retailing services for energy and pipeline transportation of fuels. India did not offer to bind the existing regime for certain sub-sectors (see Table F2 of Appendix F and Table 3.2.1 for details). The revised offer of some

co-sponsors including the EC, which is the coordinator in this sector, is very restrictive and in the plurilateral negotiations the co-sponsors are deemed recipients, that is, they should be willing to liberalize what they ask for.

Table 4.2.1: Sectoral Coverage in Plurilateral Request

W/120	CPC No.	Description
1.A.e-f	8672-8673	Engineering services and integrated engineering services
1.F.c-d	865-866	Management consulting services and services related to management consulting
1.F.e	8676 (partial)	Technical testing and analysis services (excluding services related to medical devices and food products)
1.F.h	883	Services incidental to mining
	5115	Site preparation work for mining
1.F.m	8675 (partial)	Related scientific and technical consulting services
1.F.n	8861-8866 (partial)	Maintenance and repair of fabricated metal products, machinery and equipment, and electrical machinery (excluding maritime vessels, aircraft or other transport equipment)
3.B	5134-5136	Construction work for civil engineering for long-distance pipelines, for local pipelines, for construction of mining
3.E	518	Renting services related to equipment for construction or demolition of buildings or civil engineering works with operator
4.B	62271	Wholesale trade services of solid, liquid and gaseous fuels and related products (excluding electricity and town gas)
4.C	63297	Retailing services of fuel oil, bottled gas, coal and wood

Table 4.2.2 : Plurilateral Requests across Different Modes in Energy Services

Modes	Requests
Mode 1	• Substantial reduction of market access limitations • Removal of existing requirement of commercial presence
Mode 2	• Make commitments whenever technically feasible
Mode 3	• Removal or substantial reduction of foreign equity limitations • Substantial elimination of joint ventures and joint operations requirements for foreign service suppliers • Removal or substantial reduction of ENTs • Elimination of discriminatory licensing procedures
Mode 4	• Make commitments in accordance with Paragraph 1(d) of Annex C of the Hong Kong Ministerial Declaration • No general exclusion of energy services from horizontal commitments • In Mode 4 the US is not a requesting member but a deemed recipient

4.3 India's Negotiating Strategy

With liberalization, trade in energy services has become an important component of India's trade in services and FDI inflows. India needs foreign investment, technical know-how and best management practices in the energy sector to sustain the high rate of growth. Indian companies are venturing into international markets. India has a comparative advantage in providing energy-related consultancy services. Collaboration with internationally-renowned companies would not only make the domestic industry globally competitive but also enable it to establish a presence in third-country markets. In the domestic market, the sector is undergoing various changes. Reforms are ongoing and the industry is not fully competitive. In the Uruguay Round, some important countries such as Oman and Saudi Arabia were not members of the WTO; they have acceded to the WTO in recent years. All these factors will determine India's negotiating strategy in the Doha Round.

In the Uruguay Round, India made limited commitments in energy services. In the revised offer of August 2005, there was substantial improvement in commitments both in terms of sectoral coverage and modes of delivery. Since the sector has been unilaterally liberalized (Table 3.2.1) it would not be difficult for India to meet the plurilateral request in many sub-sectors listed in Table 4.2.1. For instance, India has already offered to bind the unilateral regime for engineering services (CPC 8672), integrated engineering services (CPC 8673), R&D services on natural science and engineering (CPC 85013), management consulting services (CPC 86509), services related to management consulting (CPC 86601), technical testing and analysis services (CPC 8676 partial), services incidental to energy distribution (CPC 887), construction work for civil engineering for long-distance pipelines, local pipelines and mining (CPC 5134-5136) and renting services related to equipment for construction or demolition of buildings or civil engineering works with operator (CPC 518). Although in the revised offer India did not offer to make commitments in sub-sectors such as services incidental to mining and site preparation work for mining, related scientific and technical consulting services, maintenance and repair of fabricated metal products, these sub-sectors are unilaterally open (Table 3.2.1) and there would not be any major problems in scheduling them. Indian companies pointed out that they need foreign technology and finance in sub-sectors such as services incidental to mining and the government may consider scheduling it subject to existing regulations. In scientific and technical consultancy, India with a strong knowledge base can be an R&D center for global energy players. It may be difficult for India to schedule commitments in sub-sectors such as retailing services since the regulatory regime is evolving, the market is not fully competitive and there are various regulatory restrictions (some are discussed in Section 3.2). Stakeholders have pointed out that it may be difficult for India to undertake commitments in Mode 1 in pipeline transportation services due to security concerns and sensitivity issues. At present, FDI in wholesale trade services of solid, liquid and gaseous fuels and related products (excluding electricity and town gas) (CPC 62271) and commission agents' services – sales on a fee or contract basis of fuels (CPC 622113) – is not allowed. Stakeholders also pointed out that since India's revised offer is already very liberal compared to that of even developed countries such as the EU, India should bargain for greater market access and removal of discriminatory barriers in markets of export interest and especially in Modes 4 and 1. The actual market access barriers in India are much lower than many of its trading partners and, hence, India should offensively push for greater market access both in the WTO and in its bilateral agreements with regional blocks such as the GCC, ASEAN and the EU.

India has the potential of offering consultancy services in the energy sector in a wide range of markets including the Middle East, East Asian countries, neighboring countries and

even developed countries such as the UK, the US and Germany. These are largely offered on a project-by-project basis and often do not require physical presence. Mode 4 is an important mode of trade in this sub-sector. As discussed earlier, Indian professionals face various barriers related to market access, national treatment and domestic regulations in markets of export interest. Countries have hardly scheduled any sector-specific Mode 4 commitments in energy services and the horizontal offers are restricted to business visitors and intra-corporate transferees. India is the coordinator of the plurilateral request in Mode 4, which was made to a group of developed countries from a group of developing countries. The plurilateral request sought new improved commitments in CSS and IP that were delinked from commercial presence. It also clarified definitions and categories of CSS/IP for which commitments have been requested. The list of sectors/sub-sectors for CSS/IP covered energy-related sectors such as engineering, services, integrated engineering services, R&D services, management consulting services, and technical testing and analysis services in which India has an export interest. The target group of developed countries has been asked to remove or substantially reduce Economic Needs Tests (ENTs). It stated that wage parity should not be a precondition for entry and the duration of stay should be one year or for the duration of the contract (if longer) with the provision of renewal. It referred to transparency in Mode 4 commitments.

It is important to note that although the list of sub-sectors for CSS/IP in the plurilateral request is quite exclusive, the request is only addressed to a few developed countries. Indian service providers frequently travel to developing countries (either in their individual capacity or through their companies) as consultants on a project-to-project basis and face various barriers related to Mode 4 in those markets. The plurilateral request does not address the barriers in developing country markets. India should bilaterally negotiate with important countries such as Bahrain, Oman, Qatar, Saudi Arabia, China, Sri Lanka and Indonesia for removal of barriers to trade through Mode 4 in energy services. In many markets, especially the Middle East, individuals and companies face problems getting multiple-entry visas even for business visitors; India should discuss this bilaterally. Lack of information and transparency in the bidding process is a problem in many developing countries. The barriers faced by Indian service providers in developed country markets are different from those in developing countries. Unlike developed countries where recognition of professionals is a major barrier, Indian service providers in GCC markets do not face such barriers. The condition of local employment in countries such as Oman and Saudi Arabia and the condition that foreign experts will only be allowed if required skills are not available locally (in countries such as Indonesia) act as a major barrier to Mode 4 trade. In countries such as Kuwait, Qatar and Oman there is a mandatory requirement to have local sponsors, and both independent professional and companies face various problems with the local sponsor. Although developed countries, such as the EU, have offered to broaden commitments for business visitors and intra-corporate transferees, a large part of the movement in this sector is in the form of CSS/IP which is not covered in their revised offer. These issues should be raised in the ongoing round. Apart from horizontal commitments, India should ensure sector-specific commitments in energy services.

As of date, India's cross-border trade in electricity and gas (through pipelines) with neighboring countries is very limited. Issues related to such cross-border trade can be resolved at a regional level through harmonization of grids, and resolving pricing and security issues. Until these issues are resolved, India may not be ready to undertake a commitment in the pipeline transportation of fuels. Even developed countries have imposed several restrictions on pipeline transportation of fuels. For instance, the US has imposed a citizenship requirement for providing services under Mode 3, while all EU Members States kept Mode 1

unbound for pipeline transportation, which is the most important mode for trade in this sub-sector.

India has a comparative advantage in providing consultancy services on the Internet, especially in trade with developed countries. India is the coordinator of a plurilateral request in Modes 1 and 2 in the WTO. This request was submitted along with countries such as Chile, Mexico, Pakistan, Singapore and Switzerland to around 20 developed and developing countries including the US, the EU, Canada, Korea and Malaysia. The requesting group of countries provided a list of sectors/sub-sectors in which they would want their trading partners to undertake full market access and national treatment commitments. The list is quite exhaustive and covers all sectors/sub-sectors of India's interest in consultancy services. Commitments were sought at a two-digit level for certain sectors, such as computer-related services, to take into account technological developments. Members have been requested to make commitments in a way that reflects commercially meaningful opportunities. Members have also been asked to take full national treatment commitments and remove the requirements of commercial presence, citizenship and residency for market access. In the revised offer, among developed countries, the US did not offer to make any commitments in R&D services even though many US companies are outsourcing such services to countries such as India. Mode 1 in the revised offer of the EU is full of restrictions and the levels of commitments differ across the 27 EU Member States. For instance, Portugal and Italy kept Mode 1 unbound for engineering services and integrated engineering services; countries such as Austria and Hungary have kept Mode 1 unbound for R&D services; and new members such as the Czech Republic, Cyprus and the Slovak Republic have kept Mode 1 unbound across a wide range of sub-sectors such as technical testing and analysis services, and advisory and consulting services related to mining. In Canada, to supply engineering and integrated engineering services through Mode 1, the person has to be a permanent resident in British Columbia, Alberta, Ontario and New Brunswick. Many developing countries have not offered commitments in Mode 1. For instance, in its initial offer Brazil kept Modes 1 and 2 unbound across a wide range of sub-sectors including engineering services, management consulting services and technical testing and analysis services. In its initial offer Bahrain mentioned that commercial presence is required for offering engineering service through Mode 1. India should push for removal of such barriers and for greater market access in Mode 1 in both plurilateral and bilateral negotiations.

Many Indian companies are exploring the possibilities of establishing a presence in international markets and are facing various barriers to trade through Mode 3. These include FDI restrictions, joint venture requirements, local sponsor requirements, local content requirements, registration requirements, and requirements to employ locals. Specifically, in the revised offer Malaysia has imposed a Mode 3 barrier that engineering services can only be supplied by a natural person and that, for multidisciplinary practices, foreign equity up to a maximum of 10 per cent for joint ventures by professionals who are registered in the country will be permitted. Countries such as China and Pakistan have joint venture requirements, while countries such as Kuwait have FDI restrictions. Many of these countries are recipients of the plurilateral request in energy. India should also bilaterally request these countries to remove Mode 3 barriers.

India is a co-sponsor of a plurilateral request in architecture, engineering and integrated engineering services. Canada is the coordinator and the request has been made along with 14 countries including the EU, the US, Australia, and Japan to 24 countries. The request calls for the removal of specific restrictions across different modes of services. Some of the co-sponsors, including the EU and Canada, have also listed some of these restrictions in their

revised offer for specific countries and provinces, respectively. Since the demandeurs are deemed recipients, it will be interesting to see how they meet the request.

Although countries are liberalizing the energy sector, the regulatory regimes are evolving and this creates an uncertain trade environment. Moreover, regulations are not often transparent. While Indian companies have raised the issue of non-transparent regulations in markets of export interest, many companies, especially from developed countries have pointed out that the India should have transparent regulation in this sector. In the WTO, India is pushing for developing discipline on domestic regulation with regard to qualifications, licensing procedures, etc. On the other hand, developed countries, such as the US, are pushing for transparency in domestic regulations. India needs to address regulatory issues through domestic reforms.

Even though market access barriers are being gradually reduced, foreign companies face various discriminatory and regulation-related barriers in the Indian market and due to this the sector is not getting the required FDI. India should implement domestic reforms and then bind the regime in the WTO. Since the sector is sensitive, it would be difficult for India to make forward-looking commitments in the current round. However, given that India has substantially liberalized this sector, it should aggressively push for greater market access in countries of export interest.

5. Reforms

This section discusses regulatory and other reforms which will not only improve the productivity, efficiency and global competitiveness of the energy services sector, but also enable India to gain from liberalization undertaken unilaterally and in the WTO.

India cannot deliver sustained economic growth without access to adequate energy. The energy intensity of the country's growth is falling and is now almost half of what it used to be in the early 1970s. India is facing formidable challenges in meeting its energy needs and providing clean, convenient and reliable energy for all. It has been estimated that the energy sector requires investments of US$120-150 billion over the next five years to sustain the current economic growth (8-10 per cent).[172] If the GDP continues to grow at around 8-9 per cent, the energy demand will grow at 4.5-5.5 per cent. There is a need for private/foreign investment to complement public sector investment in meeting this requirement and to bring in the required skills, technologies and best management practices. To ensure energy security, it is not only important to increase domestic productivity and efficiency, but also to enhance the share of the country in global energy business. The current reserves of fossil fuels are limited and Indian companies are exploring opportunities to invest abroad. For this, they have to be globally competitive.

Even though the sector has been unilaterally liberalized, the country has not been successful in attracting much-needed private/foreign investment due to the barriers listed in Section 3.4. The purpose of reform is to ensure a competitive investment environment at home on the one hand, and to protect the interests of consumers and provide access to the poor and needy on the other. The reforms should also enable the sector to become globally competitive.

[172]KPMG (2007).

The energy sector has long been under public monopoly and, therefore, suffers from monopoly-induced inefficiencies. Even with the entry of private players, often the interests of PSUs are protected, resulting in a non-competitive business environment. To make the regulations transparent and accountable, there should be independent regulators. Some sub-sectors such as electricity (Central Electricity Regulatory Commission) and atomic energy (Atomic Energy Regulatory Board) already have regulators, while others such as coal need independent regulators. Since the different sub-sectors are interlinked, it is debatable whether each of them should have separate regulators or whether a few regulators can regulate the interlinked sub-sectors. Globally, countries are at different stages in setting up their regulatory frameworks. While some such as Bangladesh (Bangladesh Energy Regulatory Commission)[173], Canada (National Energy Board)[174] and South Africa (National Energy Regulator)[175] have a single regulator for the energy sector as a whole, others such as the US (the Federal Energy Regulator for electricity, gas and oil and Nuclear Regulatory Commission for the nuclear sector)[176], the UK (The Office of Gas and Electricity Markets for the electricity and gas sectors)[177] and France (Commission de regulation de l'energie for the electricity and gas sectors)[178] have regulators for specific sub-sectors. The regulatory regimes of different countries should be studied and then India should develop its own regulatory framework. To ensure competition and a transparent business environment, the regulator should be independent and have authority to issue licences.

The Indian energy sector is regulated by a large number of ministries/department at the centre and state level and each narrowly focuses on the sub-segment which it regulates. Given that the sectors are interlinked, there should be a comprehensive integrated national energy policy for the overall development of the sector and for meeting the common objective of energy security. The sub-sectors must be regulated in a consistent manner. There should be more inter-ministerial coordination. For instance, the Ministry of Coal should cooperate with the MoP for the development of mines, power project construction and transport facilities development. Inter-ministerial coordination is also needed to streamline the approval process and reduce bureaucratic delays. The respective energy ministries should work together with the MoEF, Ministry of Defence and State Pollution Boards in allocating new projects, so that environmental concerns are addressed at the very beginning, which will reduce delays and uncertainty.

PSUs face a variety of problems. They lack corporate governance, the decision-making process is long and cumbersome, and many of them, in spite of being overstaffed, do not have the required skills. The PSUs should be given more independence, encouraged to run like corporate entities, and made accountable for their profits-losses.

There is an urgent need to upgrade the energy infrastructure in terms of setting up an efficient transmission and distribution network in electricity, cross-country pipelines for gas transportation, and rail, road and port infrastructure for transportation of coal. Setting up transmission networks or pipelines requires huge investments and the gestation period is long. Since it is not economically viable to multiply such infrastructure, it is important to identify and prioritize such investments and develop them through public-private

[173] http://www.berc.org.bd/index.html
[174] http://www.neb.gc.ca/index_e.html
[175] http://www.ner.org.za/
[176] http://www.ferc.gov/about/about.asp
[177] http://www.ofgem.gov.uk/Pages/OfgemHome.aspx
[178] http://www.reckon.co.uk/tags/cre

partnerships. The government should come up with innovative public-private partnership models that will encourage the private sector to participate.

Since energy is a scarce resource, it is necessary to improve overall efficiency in its usage particularly in electricity generation, transmission, distribution and end-use. The government can encourage the industry to design more energy-efficient products through incentives and then disseminate information about these products to consumers. Energy efficiency can be improved by setting up minimum energy efficiency standards which are applicable to manufacturers of energy products. State and central governments can encourage energy-saving infrastructures (green buildings, etc.) through appropriate incentives.

High and multiple taxes and variation in taxes between states and across different energy sub-sectors affect India's global competitiveness. This distorts the relative prices of fuels and encourages investment in those which get the maximum tax benefits. The central and state taxes on commercial energy supplies should be rationalized and should be neutral to fuel choices and investment decisions. There should be a uniform low customs duty on all imports for energy projects, investments and supplies. Incentives given by the government should be similar for each energy sub-sector and any tax concession or duty exemption should be available to all sub-sectors.

To encourage private investments, investors should be given the freedom to act commercially and earn reasonable returns, while compensating the community for the use of its resources and ensuring that environment and social issues are managed well. The bidding process should be transparent. For instance, coal blocks can be allocated to the private sector on a competitive basis. Many sub-sectors do not have effective price competition. Rational pricing of energy supplies, especially in the case of coal and oil, will encourage private investments. In India, the electricity generation segment has been liberalized, while the input market for coal (both in terms of availability and pricing) is still controlled by the government; this restricts private investment. There is a need for appropriate regulation to ensure non-discriminatory access to incumbent facilities. There should be a clear and stable policy framework, which will encourage private investment. Clarity is required in matters related to pricing of energy products, market structure, cross-border investments, government incentives and subsidy administration.

India's growing dependency on imports of oil and gas increases the uncertainties regarding availability of commercial energy at affordable prices. Like all energy importing countries, India needs to focus on alternative fuels and non-traditional sources, such as bio-diesel and ethanol. For instance, bio-diesel from non-edible oils such as Jatropha, Karank and Mahua can be a substitute for diesel; ethanol is used in Brazil as a fuel for cars. These alternative fuels will not only reduce our dependence on imports but are also environment-friendly.

R&D is critical for augmenting India's energy resources to meet long-term energy needs and attain energy independence. It is important to focus on R&D in energy-efficient technologies such as liquefaction of coal, hydrogen technology and gas hydrates. As of date, a large part of the R&D expenses are met by the government. The private sector should be encouraged to invest in R&D through financial incentives such as an annual allocation of funds and income-tax benefits. A virtual network of energy research institutions, such as the laboratories of the Council of Scientific and Industrial Research, Department of Science and Technology, Department of Biotechnology and the private sector should be created to assist in pooling resources and exploiting synergies through well-coordinated and directed research

for identified technologies. Indian companies pointed out that they have gained little through international collaborations as foreign companies are not very keen to disseminate their technologies. Foreign collaborations initiated by the government should focus on transfer of technology. Foreign companies can also be encouraged to set up R&D centers in India and this will, in turn, lead to skill upgrading and technology transfer. India should collaborate with other countries in R& D related to energy. For instance, countries such as Canada, the US and the UK are already focusing on the use of hydrogen as an alternative fuel and collaboration with these countries will be beneficial. However, a comprehensive study on the technology used, available resources, costs, etc. is necessary prior to entering into any collaborative arrangement with foreign countries.

Although India has an abundance of high-skilled manpower, there is a shortage of specific skills, especially specialists and engineers. Both private and government companies have raised concerns about the quality of engineers. There is a need to identify the specific skills that are in short supply and invest in education and training institutes for developing the skill base. There should be some uniformity in the standard of engineers from different institutions and this should be pegged to international standards. India should also enter into collaborations with academic and training institutes abroad to improve the quality of its manpower. India is a provisional member of the Washington Accord, which allows easier movement of engineers among its member countries. Indian should implement standards needed by this organization, which will facilitate the movement of engineers from India to countries such as the US and the UK.

The government should enter into alliances/partnership/collaboration with important countries such as Malaysia, Indonesia, Russia and Myanmar to diversify the energy supply base and improve long-term energy security. For instance, Kazakhstan has abundant deposits of coal, oil and gas, but it depends on external finances to develop its resource base. India can enter into a collaborative venture with this country and Indian companies can invest there. India should diversify oil imports by looking beyond the Middle East to other countries such as Malaysia, Indonesia and Russia. At present, India's trade with neighbors such as Afghanistan, Bangladesh, Bhutan, China, Pakistan, Myanmar, Nepal and Sri Lanka is limited. It is important to focus on reducing regional conflicts and political tension to enhance trade, which is mutually beneficial. India can benefit by importing electricity and gas from these neighboring countries. The power systems of India-Nepal and India-Bhutan have been interconnected at various points but there is also scope for interconnections with Bangladesh. It is important to convince Bangladesh that interconnection of power grids would be beneficial for both countries and then start the pending projects. If India's relationship with Pakistan improves, there are possibilities of interconnection of grids with Pakistan. Tajikistan ranks eighth in the world in hydro power; there is scope for construction of new stations as well as rehabilitation and modernization of existing stations in this country. Tajikistan has signed agreements with Russia and Iran for completion of the hydro projects.[179] Government-to-government collaboration will facilitate the entry of Indian companies into that market.

Cross-country gas pipelines are the most cost-effective way to transport gas from the source to demand centers and India needs to work together with its neighboring countries on this. The private sector in the concerned countries should be involved in these investments as this is likely to reduce political tensions. India, with its strong political ties with Russia and the Commonwealth of Independent States (CIS)[180], can consider setting up gas-to-liquid

[179] http://www.tjus.org/prezentatsiya_Zaripova_eng.pdf

[180] CIS is the international organization consisting of 11 member countries – Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Ukraine and Uzbekistan.

plants in CIS countries under long-term arrangements, wherein India gets a share of the liquids produced. India should consider signing the Energy Charter Treaty (see Appendix C for details) which may obviate the need for separate multilateral agreements for various projects to import gas through pipelines from Iran, Turkmenistan and Myanmar.[181]

Given that the sector is open, India should aggressively negotiate for the removal of barriers in markets of export interest in the WTO and in its bilateral/regional agreements. Countries such as China have an aggressive international strategy. China entered Sudan in a big way by investing in the social sector. Since oil and gas deals are not always market driven and aid, government-to-government collaborations and partnering in development play a key role in getting international projects, the Indian government should partner with PSUs and private companies in their endeavors abroad. Instead of competing among themselves, Indian companies should be encouraged to bid in a consortium in international markets. Since E&P projects have a long gestation period, while taking investment decisions abroad, companies, especially PSUs, should focus on future returns rather than the current rate of return. In international markets, Indian and Chinese companies have complementary skills. As of date, they are competing and this has affected our business opportunities. Indian companies may explore the possibilities of joint bidding/collaborations/strategic partnership with Chinese companies in international markets.

In addition there is a need for sector specific reforms which are given below.

5.1 Coal

In the coal sector, productivity can increase by restructuring the existing PSUs, encouraging them to implement corporate governance, giving them autonomy and making them accountable. The public sector company, CIL, is in need of organizational transformation in order to gradually align its operating costs to international standards. The mining costs of CIL are at least 35 per cent higher than those of leading coal-exporting countries such as Australia, Indonesia and South Africa. To match international productivity levels, CIL should invest in new technologies, improve the planning process and execution of projects, institutionalize a comprehensive risk management framework by allowing competition among mining subsidiaries of CIL and encourage joint ventures with the world's leading companies in coal mining. PSUs should have the freedom to outsource certain mining operations and/or enter into joint ventures with private/foreign companies. In fact, PSUs alone will not be able to meet the future demand for coal; hence, private/foreign investment should be allowed in non-captive mines. The approval process should be simple and streamlined, and the approval limit of the CIL Board should be raised from Rs 100 crore. The price of coal should vary with quality and its calorific content.

The logistics infrastructure (such as ports and railways) is poorly managed and congested. In order to increase freight capacity from the coal-producing regions to the demand centers in the northern and central parts of the country, it is necessary for the Indian Railways to expand capacity. Special freight corridors are required to raise speeds, cut costs and increase the system's reliability. An investment of US$15-20 billion is required toward creating new freight corridors and integrating them with existing rail operations.[182] The private sector can play an important role in investment and management of these infrastructures.

[181] http://www.teriin.org/pub/articles/art8.pdf
[182] KPMG (2007).

There should be new regulations which support a free market and allow the formation of joint ventures or other alliances. Since the sector is politically sensitive, the government should work with different stakeholders to arrive at a consensus and overcome strong opposition from political and business groups within the sector.

The growth of the coal sector is restricted by outdated regulations. The Coal Mines (Nationalisation) Amendment Bill, 2000 which is still pending in Parliament should be passed as it will allow private sector participation in commercial coal mining. The Land Acquisition Act, 1984 should be amended to make it easier for private players to acquire land for mining. The government should facilitate trading and marketing of coal by removing it from the list of essential commodities. The government should also notify the new technologies such as in situ coal gasification and coal liquefaction as end-uses under the current captive consumption policy, which will encourage private players to invest in the development of these technologies.

5.2 Oil and Gas

Only one-third of the potential oil-bearing areas have been explored so far. Some geologists predict vast amounts of undiscovered oil in India. Exploration efforts in the oil and gas sector should be doubled. In view of the rising demand-supply gap in both crude oil and gas, there is an urgent need to increase public and private investments, especially in the E&P segment. Many companies have pulled out of this segment due to delays in awards of blocks. The government should fix a time limit for allocating/awarding the blocks in NELP rounds. Delays in getting approvals should be minimized and the number of clearances required should be brought down to a maximum of five.

Instead of a piecemeal approach to reforms, this sector requires a comprehensive reform package which includes pricing, regulations, industry structure and subsidies. Full price competition at the refinery gate and at the retail level for all petroleum products should be pursued. The pricing mechanism for petroleum products on import parity basis should be replaced by a trade parity basis; for instance, products for which India is a net exporter/ importer over a specified time period should have export/import parity prices. There is also a need for investment to upgrade existing refineries and expand the retail network. The process of subsidization of kerosene and LPG should be re-examined. It should be transparent and directed only at the targeted beneficiaries. Subsidies on these products should be charged directly to the budget and not loaded on the oil companies.

The price of gas should be determined on a cost-plus basis by an independent regulator and there should be consistency in gas prices. There should be a clear and transparent framework for setting up the transmission pipelines. The Government should encourage foreign/private companies to invest in the pipeline infrastructure by giving them some incentives. To use cheap natural gas under long-term arrangements (25-30 years), India should set up captive fertilizers and/or gas liquefaction facilities in foreign countries.

On the upstream side, DGH should be made an independent regulator.

5.3 Renewable Energy

Renewable energy can help reduce India's dependence on imports and it is also environment friendly. Renewables can be used for space heating, cooling, water pumping, cooking and for almost any end-use that is currently met by fossil fuels. India has the

potential to develop renewable energy, but this requires careful planning and advance technology. The government should create a database of information on renewable energy projects, highlighting the costs and benefits of such projects. An annual renewable energy report should be published providing details of actual performance of different renewable technologies at the state and national levels. Information on any system that receives government support should be made publicly available. It is essential to ensure that independent assessment of performance is done for all renewable projects that receive government funding. This will help in tracking programs, avoiding repetition of mistakes and providing mid-course corrections.

Currently India utilizes only 17 per cent of its hydro power potential, which is much lower than countries such as Norway (58 per cent), Canada (41 per cent) and Brazil (31 per cent).[183] As there is vast potential for the development of SHP projects, the government should encourage the private sector to invest in these projects. Hydro power stations are better than thermal power stations in terms of life-cycle costs, recurring fuel costs and environmental costs, and grid economy; therefore, the government should emphasize the development of new hydro power projects. Projects are delayed because of the long time taken to acquire land, difficulty in obtaining clearances and issues related to rehabilitation and resettlement. To resolve these issues, new projects should initially be taken by government-owned companies for activities such as conducting investigations, updating detailed project reports, obtaining the necessary clearances and executing pre-construction work. After the completion of these stages, the projects should be offered to the private sector for execution either on a 'standalone' basis or for joint venture participation with state-owned companies. As of now, hydro projects are funded by the government, but private financial institutes should be encouraged to fund these projects. The government should make available data on hydro potential sites and this should be updated from time to time.

India's water storage capacity is one of the lowest in the world. Its capacity is 207 m^3/capita, compared to 1964 m^3/capita and 1111 m^3/capita in the US and China, respectively.[184] The government should market the irrigation and flood control benefits of hydro-electric projects. The focus should be on developing small environment-friendly hydropower projects (the relocation costs, etc. of such projects are lower). Overall, the government should come up with an appropriate hydro-thermal mix for future electricity generation.

There should be a long-term development strategy which has an appropriate mix of different technologies for meeting multiple objectives. Some renewable energy projects are more technology intensive than others; some can provide rural employment, while others require highly skilled workers.

There is a need for greater coordination between the MNRE and other Ministries/ Departments such as the MoEF, MoP, Ministry of Tribal Affairs and Ministry of External Affairs for the development of renewable energy programs. For instance, coordination with the MoEF will reduce delays in getting environmental clearances. The implementation of renewable energy projects such as bio-fuel, wind diesel, and biomass gasification are often at the grassroots level and require more active involvement of local bodies such as Panchayats. To spread awareness about the benefits of renewable energy and encourage investment in this

[183] http://www.upcl.org/Energy-conservation-DSM.pdf
[184] Planning Commission (2006).

sector, the government should set up an institutional network of policy makers, private investors, banks/financial institutes, global players and researchers.

Renewable energy development policies should be integrated with national developmental policies and it must be ensured that the targets set and the measures undertaken for promotion of RETs are in line with the overall developmental priorities. There should be a set of uniform and consistent policies for renewable energy promotion and development across states and this should be integrated with central policies and targets. The policies should clearly outline issues related to guaranteed purchase, third-party sales, wheeling charges, banking charges and other issues. There is an urgent need to ensure the stability of the policy regime over a period of time. Frequent changes in policies will deter investment.

Various measures can be taken by the government to increase the use of renewable energy. It may be locally available through a centralized system. The government should emphasize outcomes rather than outlays. All price subsidies should be linked to outcomes. The production of bio-diesel can be encouraged by allowing private oil companies to take the lead in developing large-scale plantations directly through contract farming with individual farmers, self-help groups, rural cooperatives and panchayats. Up to 100 per cent tax rebate can be provided for investments made in plantations and bio-diesel processing through Tradable Tax Rebate Certificates.

At present, the duration of loans for renewable projects (wind power, hydro projects, biomass, etc.) is for a maximum period of 12 years. Government and financial institutions should provide long-term finances/loans for at least 20 years. Financial institutes should be encouraged to set up venture capital funds for renewable energy projects and have innovative investment schemes. The government should encourage financial institutes to invest in rural areas by making them aware of the technology, the merits of venturing in the projects and about revenue generation in investing in renewable projects. There should be collaboration between rural banks, cooperative societies, and cooperative banks for financial incentives. Finance should be made available at reasonable interest rates.

Renewable energy should be an important sector in the government's international engagements. The government should identify countries with which India can enter into collaborative arrangements for sharing of technology and international best practices, implementing joint schemes, and providing training and capacity building.

5.4 Nuclear Energy

India needs technical know-how in the nuclear energy sector. With the recent signing of agreements with the US and France, this sector is likely to benefit in terms of inflow of technology and it would also give the country access to uranium. Foreign collaboration enhances the opportunities for private participation not only in nuclear power generation but also in areas such as waste management. Collaborative ventures with foreign/private players in R&D for the use of thorium in generating nuclear electricity will be beneficial for the country. The government should seriously consider amending the law to facilitate private participation in non-strategic components of the nuclear power program. The government can allow private players to work in a joint venture with NPCIL to set up and operate the nuclear power plants.

5.5 Electricity

In the electricity sector there is limited coordination between different states, which hampers the distribution of electricity from surplus states to deficit states. There is a need for greater centre-state and state-state coordination. As SEBs are not performing well, the Centre can make the states accountable for the performance of their public electricity system. The Centre can also encourage the states through various ways, such as providing additional financial incentives to better-performing states on the basis of a transparent set of criteria. On the other hand, states can reduce transmission and distribution losses by implementing measures such as enforcement of stringent laws to clamp down on non-paying consumers, efficient billing process, appropriate vigilance, improving maintenance services and differentiating between technical and non-technical losses. As huge investment is needed in the transmission and distribution networks, the government should encourage private players to invest in them.

The government should reduce cross-subsidization, and minimal entitlements should be given to users. Consumption in excess of the minimum should be charged at full cost of supply. This will not only reduce misuse but also help revive the financial health of SEBs.

An important issue in the electricity sector is connectivity in rural and remote areas. Since the private sector would not find it a lucrative investment, the government needs to look at different models adopted by other countries to meet this universal service obligation and then derive a model that is best suited to the country.

Although, the Electricity Act, 2003 introduced several measures such as de-licensed generation, trading, open access in transmission and distribution, multiple distribution licensee and unbundling of SEBs to make the sector more competitive, there are some important pending issues such as availability of pricing of transmission capacity, financial viability of SEBs, fuel supply and end-user tariffs which should be addressed for developing an efficient electricity market. An independent planning/regulatory body for inter-state transmission networks is needed to ensure proper development of such networks. Information regarding network availability should be available to all players. To encourage open access, it is necessary for each state to identify congestion points in the transmission network. The focus should be on the development of India as a single energy market.

At present, in the electricity sector, there is a single supplier which limits the choice available to consumers. Like the telecommunications sector, there should be a choice between a few service suppliers in this sector. It will improve the service quality and competition will bring down the prices.

The efficiencies of coal power plants should improve. This can be done by using better quality coal, technological upgrading and implementing best management practices. For environmental reasons, power stations should be located at pit-heads; this will also reduce the high cost associated with transportation of coal. The private sector should be encouraged to invest in captive plants and the use of existing captive production capacity should be maximized. There should be a payment security mechanism for private players.

Electricity trade among neighboring countries can only succeed after harmonization of national grid codes and establishing cross-border tariffs and other surcharges. India should try to come to an agreement with its neighbors on interconnection of power grids by resolving these issues.

Conclusion

Given the unequal distribution of resources, energy has always been an important component of the goods trade. With liberalization and reforms, many services associated with energy production, transmission and distribution have developed in which companies even from developing countries have established a global presence. With globalization and increase in trade in energy services, it has now become an important component of international/regional/bilateral agreements.

The study found that although the sector underwent significant liberalization in the past two decades, there are various barriers to trade which need to be addressed in the WTO. In the Uruguay Round, the sector witnessed limited liberalization since many countries were in the process of liberalizing, regulatory regimes were evolving and energy services did not have comprehensive coverage in the W/120. From the beginning of this round, many WTO member countries have been pushing for greater liberalization in this sector. Post-Uruguay Round, important energy-producing countries, such as Saudi Arabia and Oman, acceded to the WTO, while others, such as Russia, are in the process of acceding. The entry of these countries has increased the importance of seeking multilateral commitments in this sector.

India has both export and import interests in energy services. India needs foreign investment, technical know-how and international management best practices. Given the availability of high-skilled manpower at competitive prices, India has the potential of providing energy-related consultancy services both through cross-border supply (Mode 1) and movement of persons (Mode 4). Since the domestic availability of fossil fuel is limited, Indian companies are exploring the possibilities of investing abroad. The study found that they are facing various market access, discriminatory and regulatory barriers in countries of export interest. India, on the other hand, offered to substantially liberalize this sector in its revised offer (August 2005). The study pointed out that since the unilateral regime is liberal, it would not be difficult for India to make further improvements in the revised offer. However, any improvement in commitments should be in return for greater market access in Modes 4 and 1. It recommended that India should offensively push for liberalization commitments in this sector, both in the WTO and in its bilateral/regional agreements. It also pointed out that it would be difficult for India to undertake commitments in certain sub-sectors, such as pipeline transportation and retailing, since the domestic regime is evolving and due to security concerns and sensitivity. It argued that in sensitive sectors such as energy, unilateral liberalization should precede multilateral commitments.

Although India was the coordinator of the plurilateral request in Mode 4, the request did not cover developing countries with which India has trade interests in this sector. The study lists some countries with whom India needs to negotiate bilaterally for greater market access. The study found that in Mode 1, even many developed countries have imposed significant barriers. It also found that the revised offers of co-sponsors of the plurilateral request in energy are fairly restrictive.

Although there are no major entry barriers, India has not been successful in attracting foreign investment in this sector. The study identifies the barriers and lists reform measures which are essential to make the sector globally competitive and enable the country to gain from liberalization undertaken unilaterally or under the WTO. It is not important to merely change ownership from public to private. The purpose of the reforms is to ensure a regulatory framework which will allow the private sector to operate in a competitive environment, protecting the interests of consumers and meeting the energy needs of society. New models

of private-public partnership, greater inter-ministerial coordination and centre-state and state-state coordination will improve productivity and efficiency.

Across the world, governments play an active role in development and trade in energy. Government-to-government collaborations would ease the process of entry of Indian companies into international markets. The Indian government and private sector should together identify countries of trade interest, and the government should enhance collaboration with these countries. This will not only diversify the energy supply base but also improve energy security. India has trade complementarities with other South Asian countries and cooperation in energy is important for the development of this region as a whole.

Bibliography

Artemiev, I, and M. Haney (2002), *The privatization of the Russian coal industry: policies and processes in the transformation of a major industry*, Policy Research Working Paper 2820, World Bank, Washington, D.C.

Evans, P.C. (2002), *Liberalizing global trade in energy services*, American Enterprise Institute, AEI Press.

Gabriele, A. (2004), *Policy alternatives in reforming power utilities in developing countries: a critical survey*, Discussion Paper No. 168, UNCTAD http://www.unctad.org/en/docs/osgdp20042_en.pdf

Gastech (2003), *Natural gas transmission system operators in the USA, UK, and Australia*, March 2003, Energy International Inc./Gastec Technology BV Report No. 02-1119-BR0022-V3.

Ghosh, D., P.R. Shukla, A. Garg, and P.V. Ramana (2001), *Renewable energy strategies for Indian power sector*, Occasional Paper No. 3/2001, Centre de Sciences Humaines (CSH).

Guru, S. (2002), *Renewable energy sources in India: is it viable?*, Working Paper, Julian Simon Centre for Policy Research, Liberty Institute, New Delhi.

Izaguirre, A.K. (2000), *Private participation in energy*, Public Policy Journal, Note No. 154, World Bank Group, Washington D.C.

Juris, A. (1998), *Competition in the Natural Gas Industry*, Public Policy for the Private Sector, Note No. 137, pp. 1-8, World Bank Group, Washington D.C.

Nag, B. (2004), *Issue related to India's energy trading with Central Asian countries*, Discussion Paper 69/2004, Research and Information System for Developing Countries (RIS), New Delhi.

Singhania K. (2003), Investment Opportunity in India's Upstream Oil and Gas Sector, *OGEL*, Volume I, Issue 2,. http://www.gasandoil.com/ogel/

Walde, T.W. and A.J. Gunst (2003), *International energy trade and access to energy networks*, Chapter 5, Energy and Environmental Services – Negotiating Objectives and Development Priorities, UNCTAD.

Ministry Reports/Reports/Other

American Chamber of Commerce in Russia (2006), *Current Russian Legislative Regulation of Direct Foreign Investments*, Dec 2006, http://www.amcham.ru/doing_business/investment_issues/fdi_in_russia

ASEAN (2004), *ASEAN Plan of Action for Energy Cooperation (APAEC) 2004-2009*, July 2004, Philippines, http://www.aseansec.org/pdf/APAEC0409.pdf

BP (2008), *Statistical Review of World Energy 2008*, June 2008, http://www.bp.com

DAE (2008), *Long Term Vision of Department of Atomic Energy*, Government of India.

DIPP (2005), *Investing in India: A comprehensive Manual for Foreign Direct Investment Policy and Procedures*, November 2005, Ministry of Commerce and Industry.

DIPP (2008a), *Fact Sheet on FDI from August 1991 to March 2008*, Ministry of Commerce and Industry, Government of India. http://www.dipp.nic.in/fdi_statistics/india_fdi_March2008.pdf

DIPP (2008b), *Consolidated Policy on Foreign Direct Investment*, Press Note 7 (2008), 16th June 2008, Ministry of Commerce and Industry, Government of India. http://siadipp.nic.in/policy/changes.htm

Energy Information Administration (2008), *International Energy Outlook - 2008*, September 2008, US Department of Energy, USA, http://www.eia.doe.gov/oiaf/ieo/

Global Wind Energy Council (2008), *Global Wind Report – 2007,* May 2008, Belgium, http://www.gwec.net/

India Brand Equity Foundation (2007), *Oil and Gas*, October 2007, http://www.ibef.org/download/oilandgas_16May_08.pdf

International Energy Agency (1999), *Regulator Reform in Argentina's Natural Gas Sector*, France.

International Energy Agency (2002a), *Coal in the Energy Supply of India*, France.

International Energy Agency (2002b), *Electricity in India*, France.

International Energy Agency (2003), *World Energy Investment Outlook – 2003 Insights*, Hiroyuki Kato, October 2003, Beijing, http://www.iea.org/Textbase/work/2003/beijing/6WEIO.pdf

International Energy Agency (2003), *World Energy Investment Outlook – 2003 Insights*, Hiroyuki Kato, October 2003, Beijing, http://www.iea.org/Textbase/work/2003/beijing/6WEIO.pdf

International Energy Agency (2008), *Key World Energy Statistics 2008*, France.

India Infoline (2008), *Oil and Gas Newsletter*, 30 June to 5 July 2008, http://www.indiainfoline.com/content/rep/Sector_Newsletters/2008/7/872008/O&G_050708.pdf

KPMG (2007), *India Energy Outlook 2007*, http://www.in.kpmg.com

Ministry of Coal (2002), *Annual Report 2001-02*, Government of India.

Ministry of Coal (2005), *The Expert Committee Report on Road Map for Coal Sector Reforms – Part I*, Government of India.

Ministry of Coal (2007), *Annual Report 2006-07*, Government of India.

Ministry of Commerce and Industry (2006), *Foreign Direct Policy 2006*, April 2006, Government of India.

Ministry of Petroleum and Natural Gas (2002), *Marketing Regulation 2002*, March 2002, Government of India.

Ministry of Petroleum and Natural Gas (2006), *Policy for Development of Natural Gas Pipelines and City or Local Natural Gas Distribution Networks*, Government of India, http://petroleum.nic.in/policy%20of%20pipelines.pdf

Ministry of Petroleum and Natural Gas (2008), *Basic Statistics on Petroleum and Natural Gas*, Government of India, http://petroleum.nic.in/petstat.pdf

Ministry of Power (2008), *Annual Report 2007-08*, Government of India.

Nuclear Power Corporation of India (1997), Towards an Energy Independent India', Dr. R. Chidambaram, *Nu-Power*, Vol. 11, No. 1-3, 1997, http://www.npcil.nic.in

OECD (2006), *Liberalizing Network Infrastructure Services and the GATS*, OECD Trade Policy Working Paper No. 34, 22 May 2006.

PPAC (2008), *Statistics on Indian Petroleum Industry (Historical)*, Ministry of Petroleum and Natural Gas, Government of India, http://www.ppac.org.in/basic-statistics_hist_0506.htm

Planning Commission (2002), *India Vision – 2020*, Government of India.

Planning Commission (2006), *Integrated Energy Policy - Report of the Expert Committee*, August 2006, Government of India.

UNCTAD (2003), *Energy and Environmental Services – Negotiating Objectives and Development Priorities*, Geneva.

USTR (2006), *National Trade Estimate Report on Foreign Trade Barriers*, USA http://www.ustr.gov/Document_Library/Reports_Publications/2006/2006_NTE_Report/Section_Index.html

USTR (2007), *National Trade Estimate Report on Foreign Trade Barriers*, USA http://www.ustr.gov/Document_Library/Reports_Publications/2007/2007_NTE_Report/Section_Index.html

West Bengal State Electricity Board (2005), *Annual Report 2004-05*.

World Nuclear Association (2008a), *Supply of Uranium*, Information Papers, June 2008, http://www.world-nuclear.org/info/inf75.html

World Nuclear Association (2008b), *Nuclear Share Figures 1996-2007*, Information Papers, June 2008, http://www.world-nuclear.org/info/nshare.html

World Nuclear Association (2008c), *Uranium Production Figures - 1998-2007*, Information Papers, July 2008, http://www.world-nuclear.org/info/uprod.html

World Nuclear Association (2007d), *Thorium*, Information Papers, July 2008, http://www.world-nuclear.org

World Nuclear Association (2008e), *World Nuclear Power Reactors 2007-08 and Uranium Requirements*, September 2008, http://www.world-nuclear.org/info/reactors.html

WTO (1991), *Services Sectoral Classification List (MTN.GNS/W/120)*, 10 July 1991, http://www.wto.org/english/tratop_e/serv_e/mtn_gns_w_120_e.doc

WTO (15 April 1994), *Schedule of Specific Commitments – Antigua and Barbuda, Argentina, Australia, Austria, Brazil, Canada, Chile, Colombia, Cote D'Ivoire, Cuba, Czech Republic, Dominican Republic, El Salvador, EC, Finland, Gabon, Guyana, Hungary, Iceland, India, Indonesia, Israel, Jamaica, Japan, Korea, Kuwait, Malaysia, Netherlands, Norway, Pakistan, Peru, Poland, Romania, Slovak Republic, South Africa, Swaziland, Sweden, Switzerland, Thailand, Turkey, USA, Uruguay, Venezuela and Zambia*.

WTO (9 September 1998), *Energy Services - Background Note by the Secretariat, S/C/W/52*.

WTO (18 December 2000), *Communication from the USA*, S/CSS/W24.

WTO (21 March 2001), *Communication from Norway*, S/CSS/W/59.

WTO (23 March 2001), *Communication from the European Communities and their Member States*, S/CSS/W/60.

WTO (29 March 2001), *Communication from Venezuela*, S/CSS/W/69; (15 October 2001), S/CSS/W/69/Add.1; and (4 June 2003), S/CSS/W/69/Add.2.

WTO (14 May 2001), *Communication from Chile*, S/CSS/W/88.

WTO (4 October 2001), *Communication from Japan*, S/CSS/W/42/Suppl.3.

WTO (22 March 2002), *Communication from Cuba*, S/CSS/W/144.

WTO (12 January 2004), *India - Conditional Initial Offer*, TN/S/O/IND, and (24 August 2005), 'Revised Offer', TN/S/O/IND/Rev.1.

WTO (May 2007), *Trade Policy Review, EC*, Report by the Secretariat, http://www.wto.org/english/tratop_e/tpr_e/tp283_e.htm

Newspapers

BBC News, 'Russia oil row hits Europe supply', 8 January 2007, http://news.bbc.co.uk/2/hi/business/6240473.stm,

Cybercast News Service, 'Russia Offers Nuclear Supplies to India', March 17 2006 http://www.cnsnews.com/ViewForeignBureaus.asp?Page=/ForeignBureaus/archive/200603/FOR20060317a.html

Iran Daily, 'India Approves TAPI Pipeline', 20 May 2006, http://www.iran-daily.com/1385/2566/html/index.htm

The Economic Times, 'RIL to set up refinery, retailing ops in Yemen', 17 Jan 2007, http://economictimes.indiatimes.com/News/News_By_Company/Companies_A-Z/R_Companies_/RIL_to_set_up_refinery_retailing_ops_in_Yemen/rssarticleshow/1233684.cms

The Economic Times,' Stuck in India, GMR Energy Forays into Nepal', 26 September 2008, http://economictimes.indiatimes.com/News_by_Industry/GMR_Energy_forays_into_Nepal/articleshow/3531029.cms

The Financial Express, 'Proposal to set up Coal Videsh Limited shot down', 30 November 2007, http://www.financialexpress.com/news/Proposal-to-set-up-Coal-Videsh-Ltd-shot-down/244967/

The Hindu Business Line, 'El Paso Sells Stake in PPN Power to Promoter', 1 September 2005, http://www.blonnet.com/2005/09/01/stories/2005090102650200.htm

The Hindu Business Line, 'HPCL in talks with Total for Vizag Project', 19 January 2007, http://www.blonnet.com/2007/01/19/stories/2007011905261300.htm

The Hindu Business Line, 'India Agrees to Price Formula for Iran Gas Pipeline Project, 7 February 2007, http://www.thehindubusinessline.com/2007/02/07/stories/2007020702811000.htm

The Tribute, 'Turbines for India', 4 February 2005, http://www.tribuneindia.com/2005/20050204/biz.htm

Websites

http://www.apec.org
http://www.aseansec.org
http://www.assocham.org/events/recent/event_189/Gokul-Chaudhri-BMR.pdf
http://www.atimes.com/reports/CA13Ai01.html
http://www.bg-group.com/index.html
http://www.bg-india.com/
http://www.bp.com
http://www.berc.org.bd/index.html
http://www.bhutannewsonline.com/hydro_electricity.html
http://www.cairn-energy.plc.uk/
http://www.ccnr.org/third_world_nukes.html
http://www.cmpdi.nic.in/
http://www.coal.nic.in/
http://www.commerce.nic.in/
http://www.cslforum.org/india.htm
http://www.cea.nic.in/hydro/Cooperation%20with%20Neighbouring%20Countries.pdf
http://www.dae.gov.in/
http://ec.europa.eu/environment/climat/emission.htm
http://www.eoithimphu.org/mega.html

http://en.wikipedia.org/wiki/United_States-India_Peaceful_Atomic_Energy_Cooperation_Act
http://ecoworld.com/features/2007/05/15/indias-solar-power/
http://www.eia.doe.gov/emeu/pgem/ch5b.html
http://en.wikipedia.org/wiki/Renewable_energy_in_Germany
http://www.engineersindia.com/index.html
http://www.eni.it/home/home_en.html
http://www.encharter.org
http://www.epsedin.co.uk
http://europa.eu.int/eur-lex/pri/en/oj/dat/2001/l_309/l_30920011127en00010021.pdf
http://ec.europa.eu/environment/climat/emission.htm
http://www.ewg.apec.org
http://www.ferc.gov/about/about.asp
http://www.gamesa.es/gamesa/index.html
http://gail.nic.in/gailnewsite/businesses/gastransmission.html
http://www.gwec.net/uploads/media/07-02_PR_Global_Statistics_2006.pdf
http://www.indiacore.com/coal.html
http://in.rediff.com/money/2007/mar/22energy.htm
http://www.indiaresource.org/issues/energycc/2003/globpetroleumindust.html
https://www.indianoiltenders.com/iocl/about.asp
http://www.indg.in/rural-energy/rural-energy/sources-of-energy/re-basics-src-bio
http://www.iocl.com
http://www.investmentcommission.in/sector.htm
http://www.indianexpress.com/news/india-france-ink-nuclear-deal-first-after-nsg-waiver/368048/
http://www.iimahd.ernet.in/~morris/iir01/iir6.pdf
http://www.itcilo.it/english/actrav/telearn/global/ilo/frame/energyun.htm
http://www.lntenc.com/lntenc/services/engineering/power.jsp
http://mnes.nic.in/booklets/Book7-e.pdf
http://mnes.nic.in/booklets/Book2-e.pdf
http://mnes.nic.in/shp40com.htm
http://www.nea.fr/html/general/profiles/usa.html
http://www.ner.org.za/
http://nextbigfuture.com/2008/09/breeder-reactors-uranium-from-phosphate.html
http://www.nikoresources.com/
http://www.neb.gc.ca/index_e.html
http://www.newstrackindia.com/newsdetails/20438;
http://www.npcil.nic.in/PlantsInOperation.asp
http://www.ntpcindia.com/companyperformance/message_to_shareholders.shtml
http://www.ofgem.gov.uk/Pages/OfgemHome.aspx
http://www.ongcindia.com
http://www.ongcvidesh.com
http://www.opec.org/home/
http://www.pcra.org/English/general/Profile%20-07.pdf
http://www.petrodril.com/major_discoveries.htm
http://www.petroleum.nic.in/
http://petroleum.nic.in/speeches/08-01-2008.doc
http://www.petroleumbazaar.com/articles/article28.htm
http://www.petroleumbazaar.com/articles/article6.htm
http://www.planningcommission.gov.in
http://www.powermin.nic.in

http://powermin.nic.in/indian_electricity_scenario/blue%20print/accelerating_developement.htm
http://www.photius.com/rankings/economy/electricity_consumption_2007_0.html
http://www.ppac.org.in
http://www.reckon.co.uk/tags/cre
http://www.renewingindia.org/
http://www.renewableenergyaccess.com/rea/partner/story?id=44380
http://www.rmtltd.com/
http://www.saag.org/%5Cpapers19%5Cpaper1822.html
http://www.saudiaramco.com/bvsm/JSP/home.jsp
http://www.shell.com
http://sify.com/finance/fullstory.php?id=14545491
http://sify.com/finance/fullstory.php?id=14545491
http://sjvn.nic.in/projects/projects_arun.asp
http://www.smec.com.au/india/
http://www.smec.com.au/media/latest/hydro.htm
http://www.stockwatch.in/nepali-govt-puts-300-mw-upper-karnali-project-gmr-s-pocket-2196
http://www.suzlon.com
http://www.tjus.org/prezentatsiya_Zaripova_eng.pdf
http://www.teriin.org/pub/articles/art8.pdf
http://www.total.com
http://www.tve.org/ho/doc.cfm?aid=1678&lang=English
http://uk.reuters.com/investing/quotes/keyDevelopments?symbol=601088.SS
http://www.upcl.org/Energy-conservation-DSM.pdf
http://www.vestas.com/vestas/global/en/
http://www.windpowerindia.com/newsdetailer.html#bkmark2
http://www.worldcoal.com/Coal/CL_consultants_norwest.htm
http://www.worldcoal.com/Coal/CL_consultants_rock.htm
http://www.wto.org

Appendix A

Brief Overview of GATS

GATS, established in the Uruguay Round, is the first ever set of multilateral, legally enforceable rules governing trade in services. The main aim of GATS is to progressively liberalize trade and investment in services through periodic rounds of negotiations.

Under GATS, services are traded in four different modes:

- **Mode 1**: "Cross-Border Supply of Services" refers to the delivery of services across countries such as the cross-country movement of passengers and freight, electronic delivery of information and data among others.
- **Mode 2**: "Consumption Abroad" refers to the physical movement of the consumer of the service to the location where the service is provided and consumed.
- **Mode 3**: "Commercial Presence" refers to the establishment of foreign affiliates and subsidiaries of foreign service companies, joint ventures, partnerships, representative offices and branches. It is analogous to FDI in services.
- **Mode 4**: "Presence of Natural Persons" refers to natural persons who are themselves service suppliers, as well as natural persons who are employees of service suppliers temporarily present in the other member's market to provide services.

In Modes 1 and 2 the service supplier is not present within the territory of the member, while in Modes 3 and 4 the service supplier is present within the territory of the member.

The GATS contains two sorts of provisions. The first are general obligations, some of which apply to all service sectors (for example, Most Favored Nation (MFN) and Transparency) and some only to scheduled specific commitments (for example, Article XI: Payments and Transfers). The second are specific commitments, which are negotiated undertakings particular to each GATS signatory.

Under the MFN Treatment (Article II), a member is obliged to provide to another Member treatment which is no less favorable than that which it provides to any other country, whether a member or not (that is, if a WTO member Country offers a certain privilege to any other country, whether it be a member or not, it has to extend the same treatment to all WTO member countries). However, GATS allowed member countries to undertake exemptions to this clause, in their initial commitments in the Uruguay Round, subject to review.

The clause on Transparency (Article III) requires each member country to publish all measures of general applications which pertain to or affect the operation of the Agreement. Countries are also required to publish international agreements pertaining to or affecting trade in services. In other words, the Council of Trade in Services will have to be informed— at least annually—of the introduction of any new laws or any changes to existing laws, regulations and administrative guidelines. WTO member countries can make requests regarding specific information which the concerned country will have to provide promptly.

The GATS aims to progressively liberalize service trade under the four modes of service supply. For each mode a country can impose two types of restrictions (limitations): market access and/or national treatment. A country is said to have imposed a market access restriction if it does not allow (or partially allows with some restrictions) foreign service

providers to enter and operate in domestic market. A national treatment restriction exists when foreign services or service providers are allowed to enter the market but are treated less favorably than domestic service providers. During the successive rounds of negotiations, member countries negotiate and undertake commitments to liberalize market access and/or national treatment in specific sectors in what is known as Sectoral Schedule of Commitments and across all or several sectors in the Horizontal Schedule of Commitments. Both the sectoral and horizontal schedules have to be read together to understand the extent and nature of commitments undertaken in a particular sector. Thus, market access and national treatment are negotiated obligations. It is possible for countries not to grant full market access and deny national treatment by putting limitations and conditions on market access and conditions and qualifications on national treatment in particular sectors/sub-sectors. This is done by recording such limitations and qualifications in the commitment schedules under market access and national treatment columns. In its schedule a country is said to have made a "Full" commitment in a particular mode/sector if there are no restrictions on market access or national treatment. A country is said to have made "Partial" commitment if the commitment is subject to some restrictions on market access or national treatment. If a country does not make any commitment to liberalize a particular sector or mode of supply and retains the right to impose restrictions in the future, then it is said to have kept the sector/mode "Unbound". It is expected that successive rounds of negotiations will secure further liberalization by adding more sectors to a country's schedule and removing limitations and qualifications, if any, in sectors/sub-sectors already in the schedule. This is done mode-wise for each sector/sub-sector. It is also possible for countries to make commitments which are outside the scope of market access and national treatment as defined in the GATS. These are called Additional Commitments (Article XVIII). This provides scope for making commitments in such regulatory areas as licensing, qualifications and standards applicable to services.

The GATS covers all services except those supplied in the exercise of government authority. It follows a positive list approach which indicates that there is no a priori exclusion of any service sector and that countries are free to choose the service sectors/sub-sectors and modes within those sectors/sub-sectors for scheduling commitments.

Appendix B

Table B 1: World's Top Coal Exporters and Importers in 2007

(million tonnes)

Rank	Exporter	Exports	Importer	Imports
1	Australia	244	Japan	182
2	Indonesia	202	Korea	88
3	Russia	100	Chinese Taipei	69
4	South Africa	67	India	54
4	Colombia	67	UK	50
6	China	54	China	48
7	USA	53	Germany	46
8	Canada	30	USA	33
9	Vietnam	30	Italy	25
10	Kazakhstan	23	Spain	24
	World	**917**	**World**	**892**

Source: Extracted from pp. 15, International Energy Agency (2008).

Table B 2: World's Top Oil Exporters and Importers in 2006

(million tonnes)

Rank	Exporter	Exports	Importer	Imports
1	Saudi Arabia	358	USA	587
2	Russia	248	Japan	203
3	Iran	130	China	145
4	Nigeria	119	Korea	120
5	Norway	109	India	111
6	UAE	106	Germany	110
7	Mexico	99	Italy	94
8	Canada	93	France	82
9	Venezuela	89	Spain	61
10	Kuwait	88	UK	59
	World	**2203**	**World**	**2285**

Source: Extracted from pp. 11, International Energy Agency (2008).

Table B 3: World Top Natural Gas Exporters and Importers (*via* Pipeline) in 2007

(billion cubic meters)

Rank	Exporter	Exports	Importer	Imports
1	Russia	147.5	USA	108.9
2	Canada	107.3	Germany	83.7
3	Norway	86.0	Italy	72.4
4	Netherlands	50.1	France	33.8
5	Algeria	34.0	Turkey	30.6
6	USA	22.0	UK	28.0
7	Germany	16.4	Belgium	19.3
8	Other Europe and Eurasia	10.8	Netherlands	18.9
9	Bolivia	11.7	Canada	13.2
10	UK	10.4	Spain	11.0

Source: Extracted from Trade Movements 2007 by Pipeline (pp. 30), BP(2008).

Table B 4: World Top Natural Gas Exporters and Importers (LNG) in 2007

(billion cubic meters)

Rank	Exporter	Exports	Importer	Imports
1	Qatar	38.5	Japan	88.8
2	Malaysia	29.8	South Korea	34.4
3	Indonesia	27.7	Spain	24.2
4	Algeria	24.7	USA	21.8
5	Nigeria	21.2	France	13.0
6	Australia	20.2	Chinese Taipei	10.9
7	Trinidad & Tobago	18.2	India	10.0
8	Egypt	13.6	Turkey	6.0
9	Oman	12.2	China	3.9
10	Brunei	9.4	Belgium	3.2

Source: Extracted from Trade Movements 2007-Liquefied Natural Gas (LNG)(pp.30), BP(2008).

Appendix C

Grouping, Regional Agreements and Treaties in Energy

1. The European Single Energy market

The EU is an energy-intensive economy. The European Commission has developed frameworks for a single European energy market in sectors such as gas and electricity. The first stage of the Commission program was completed in 1992 with the adoption of Directives on transit of electricity (90/547/EEC) and natural gas (91/296/EEC), and on price transparency in these sectors. In the next stages the Commission aimed at interconnecting the national markets in electricity and gas sectors by introducing common rules on market opening and competition. The EC also came up with policies which assured the security of energy supply and aimed at achieving environmentally sustainable, clean and efficient energy supply and use. The EU facilitates competition with funding to connect isolated networks and improve cross-border interconnections, both within the EU and with supplier countries. All suppliers have guarantees under single energy market rules that they can have access to the distribution grid and pipeline networks of other EU countries with fair access charges. On October 25, 2005 the Energy Community Treaty was signed between the EC and nine south-east European countries, constituting the largest internal market for electricity and gas in the world.[185]

2. Energy Charter Treaty (ECT)

The Energy Charter Treaty (ECT) [186], which was signed in 1994 and entered into force in 1998, provides a multilateral framework of rules governing energy cooperation. The fundamental aim of the ECT is to strengthen the Rule of Law on energy issues, by creating a level playing field of rules to be observed by all participating governments, thus minimizing the risks associated with energy-related investments and trade. The Treaty's provisions focus on five broad areas: the protection and promotion of foreign energy investments (based on the extension of national treatment, or most favored nation treatment, whichever is more favorable); free trade in energy materials, products and energy-related equipment, based on WTO rules; freedom of energy transit through pipelines and grids; reducing the negative environmental impact of the energy cycle through improving energy efficiency; and mechanisms for the resolution of state-to-state or investor-to-state disputes.[187] The provisions on investment apply to any investment of an investor of another ECT contracting party associated with an "economic activity in the energy services", including exploration, extraction, refining, production, transmission, distribution and marketing. Economic activities in the energy services also include such services as construction of energy facilities, prospecting, consulting, management and design and activities aimed at improving energy

[185]The nine countries are Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Albania, the FYR of Macedonia, Romania, Bulgaria, and Kosovo (WTO, February 2007).

[186]To date the Treaty has been signed or acceded to by 52 states including Albania, Armenia, Austria, Australia*, Azerbaijan, Belarus*, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, the Czech Republic, Cyprus, Denmark, Estonia, the EC, Finland, France, Georgia, Germany, Greece, Hungary, Iceland*, Ireland, Italy, Japan, Kazakhstan, Kyrgyzstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Mongolia, the Netherlands, Norway*, Poland, Portugal, Republic of Macedonia, Romania, Russian Federation*, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tajikistan, Turkey, Turkmenistan, Ukraine, Uzbekistan, and the UK. * denotes states in which ratification of the Energy Charter Treaty is still pending.

[187]http://www.encharter.org

efficiency.[188] The ECT also includes a number of provisions on environmental aspects of the energy sector. The ECT encourages cooperation in the modernization of energy transport facilities and generally to facilitate the smooth operation (including interconnection) of such facilities in the case of pipelines.

3. Organization of Petroleum Exporting Countries (OPEC)

The Organization of the Petroleum Exporting Countries (OPEC)[189] is a cartel formed by five countries – Iran, Iraq, Kuwait, Saudi Arabia and Venezuela – in 1960 to protest against the international oil market dominated multinational companies, the 'Seven Sisters'.[190] Currently, OPEC has around two-thirds of the world's oil reserves, and, in 2006, produced 43 per cent of world's crude oil production.[191] OPEC member countries supply about 40 per cent of the world's crude oil and 16 per cent of its natural gas. The principal objective of this organization is to coordinate and unify petroleum policies among member countries and to stabilize prices in international oil markets, and to provide an efficient economic and regular supply of petroleum to consuming countries. Unlike many other cartels, OPEC has been successful in increasing the price of oil for extended periods. OPEC decisions have considerable influence on international oil prices. For example, in the 1973 energy crisis, it refused to ship oil to western countries that had supported Israel in the Yom Kippur War with Egypt and Syria. This refusal caused a fourfold increase in the price of oil, which lasted five months and this price hike caused inflation in oil-importing countries. In 1999, with the cooperation of non-OPEC oil-exporting nations, OPEC raised prices by cutting production. Twice a year, or more often if required, the Oil and Energy Ministers of OPEC members meet to determine production quotas aimed at optimizing world oil prices, given demand and supply conditions.

4. Asia-Pacific Economic Cooperation (APEC)

Asia-Pacific Economic Cooperation (APEC) is a regional organization made up of 21 member countries such as Australia, Brunei Darussalam, Canada, Chile, People's Republic of China, Hong Kong (China), Chinese Taipei, Indonesia, Japan, Republic of Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, Philippines, Russia, Singapore, Thailand, the US and Vietnam. It is designed to promote cooperation and growth as well as the liberalization and facilitation of trade and investment within the Asia-Pacific region. Accounting for around 60 per cent of world energy demand, the APEC region is a net energy importer. Some APEC member countries (such as China, Indonesia, Japan, Thailand and Vietnam) are the largest coal producers in the world.[192] APEC created the Energy Working Group (EWG) in 1990, to enhance energy cooperation between APEC members. The EWG is engaged in reducing regulatory, institutional and procedural impediments to trade and investment in energy infrastructure and is also engaged in a range of activities directed at the facilitation of efficient and environmentally sound energy technologies. The EWG is assisted in its work by five Expert Groups, namely, Expert Group on Clean Fossil Energy, Expert Group on Efficiency and Conservation, Expert Group on Energy Data and Analysis, Expert Group on New and Renewable Energy Technologies and Expert Group on Minerals, Energy

[188]WTO (9 September 1998).
[189]Now OPEC member countries are Algeria, Angola, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the UAE and Venezuela.
[190]Standard Oil of New Jersey, Standard Company of New York, Standard Company of California, Texaco, Gulf, Shell, and BP, mostly owned by the United States, British and Dutch nationals.
[191]BP (2007).
[192]BP (2007).

Exploration and Development. The latest APEC Energy Ministers Meeting was held in Australia in May 2007. The discussion focused on improving energy efficiency and support for the development and deployment of cleaner and more efficient energy technologies. In 2001, EWG developed the APEC Energy Security Initiative (ESI) that comprises a series of short-term measures to respond to temporary energy supply disruptions, and longer-term policy responses to address the broader challenges facing the region's energy supply. In October 2003, APEC Economic Leaders endorsed an Implementation Plan and an APEC Action Plan as mechanisms to accelerate implementation and further enhance the ESI. In November 2004, APEC Economic Leaders endorsed the Comprehensive Action Initiative recognizing the need for strengthening the ESI under the themes of energy security, sustainable development and common prosperity. The EWG has been actively implementing its commitments under Energy for Sustainable Development through a range of projects and activities, and has agreed to incorporate sustainable development principles into the development and implementation of all EWG projects. In recognizing the link between sustainable development and energy security, the EWG has recognized a number of EWG activities that support the implementation of both the APEC ESI and Energy for Sustainable Development. [193]

5. Gulf Cooperation Council (GCC)

The Gulf Cooperation Council (GCC) is a regional organization which was formed on May 1981 by six Middle East countries – Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the UAE – to enhance economic, political, and social cooperation among these states, unite countries with common historical social and cultural ties, strengthen ties between their citizens and safeguard their common interests. In 2006, these countries accounted for about 40 per cent of the world's proven oil reserves and 23 per cent of the proven global natural gas reserves.[194] The Unified Economic Agreement (1981) and the New Economic Agreement (2001) highlight the different areas where member countries have agreed to enhance their economic ties, in which energy is one of the areas. In this sector, the agreement states that member states should coordinate their policies with regard to all aspects of the oil industry and adopt a common position vis-à-vis rest of the world and in international and specialized organizations.

6. Association of Southeast Asian Nations (ASEAN)

Energy has played a vital role in moving the Association of Southeast Asian Nation (ASEAN)[195] countries toward economic integration and members have actively pursued cooperation for the full utilization of their energy potential. ASEAN has vast reserves of coal (46 billion tons) and it is the most abundant energy resource. The region also has 22 billion barrels of oil and 227 trillion cubic feet of natural gas and also has 234 gigawatts of hydroelectricity and 20 gigawatts of geothermal capacity.[196] ASEAN has promoted several initiatives in the field of energy cooperation, including an Agreement on Energy Cooperation (1986), an Agreement on Petroleum Security (1986) and an ASEAN Plan of Action on Energy Cooperation (2004-2009). In 2004, the ASEAN Plan of Action on Energy Cooperation (2004-2009), a strategic plan, was also formulated which covered six cooperation programs such as the Trans-ASEAN Power Grid, Trans-ASEAN Gas Pipeline,

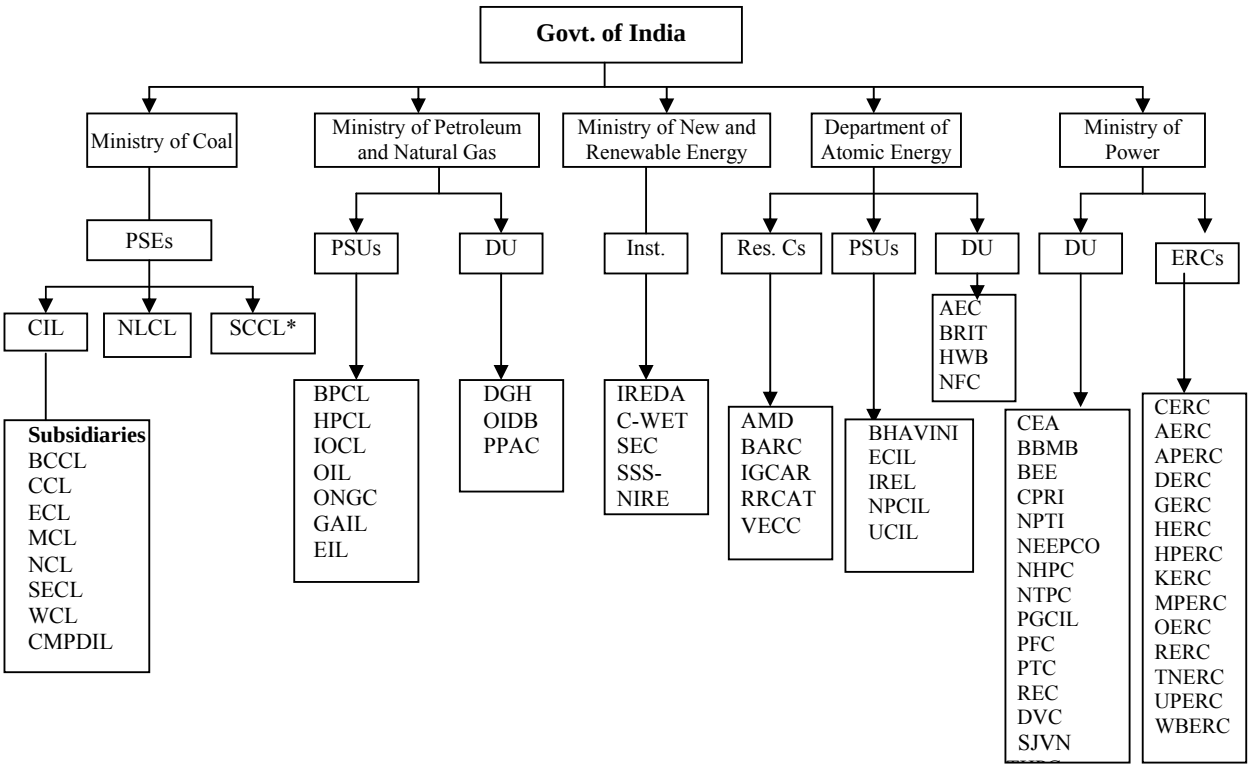
[193] http://www.apec.org and http://www.ewg.apec.org
[194] BP (2007).
[195] Established in 1967, member countries are Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam.
[196] ASEAN (2004).

Coal, Energy Efficiency and Conservation, Renewable Energy Development, and Energy Policy and Planning but greater importance is given to two projects – Trans-ASEAN Power Grid and Trans-ASEAN Gas Pipeline. In July 2002, the Ministers signed the Memorandum of Understanding on the Trans-ASEAN Gas Pipeline Project.

In order to bring the region closer to important bilateral and multilateral partners, various cooperation activities have been undertaken to pave the way for enhanced regional cooperation with the EU, Australia, Japan, China and Korea.

Appendix D

Figure 2: Organizational Structure of Government: Energy Sector



Note : *SCCL : A joint sector undertaking of the Government of Andhra Pradesh and Government of India (51:49), PSEs – Public Sector Enterprises; DU : Departmental Undertakings, Inst. : Institutions; Res. Cs : Research Centres, ERCs : Electricity Regulatory Commissions, RC : Regulatory Commission

CIL	Coal India Limited	SEC	Solar Energy Centre	PGCIL	Power Grid Corporation of India
NLCL	Neyveli Lignite Corporation Limited	SSS-NIRE	Sardar Swaran Singh National Institute of Renewable Energy	PFC	Power Finance Corporation of India
SCCL	Singareni Collieries Company Limited	AMD	Atomic Minerals Directorate for Exploration and Research	PTC	Power Trading Corporation of India
BCCL	Bharat Coking Coal Limited	BARC	Bhabha Atomic Research Centre	REC	Rural Electrification Corporation
CCL	Central Coalfields Limited	IGCAR	Indira Gandhi Centre for Atomic Research	BBMB	Bhakra Beas Management Board
ECL	Eastern Coalfields Limited	RRCAT	Raja Ramanna Centre for Advanced Technology	DVC	Damodar Valley Corporation
MCL	Mahanadi Coalfields Limited	VECC	Variable Energy Cyclotron Centre	SJVN	Satluj Jal Vidyut Nigam
NCL	Northern Coalfields Limited	BHAVINI	Bhartiya Nabhikiya Vidyut Nigam Limited	THPC	Tehri Hydro Development Corporation
SECL	South Eastern Coalfields Limited	ECIL	Electronics Corporation of India Limited	CERC	Central Electricity RC
WCL	Western Coalfields Limited	IREL	Indian Rare Earths Limited	AERC	Assam Electricity RC
CMPDIL	Central Mine Planning & Design Institute Limited	NPCIL	Nuclear Power Corp. of India Limited	APERC	Andhra Pradesh Electricity RC
BPCL	Bharat Petroleum Corporation Limited	UCIL	Uranium Corporation of India Limited	DERC	Delhi Electricity RC
HPCL	Hindustan Petroleum Corporation Limited	AEC	Atomic Energy Commission	GERC	Gujarat Electricity RC
IOCL	Indian Oil Corporation Limited	BRIT	Board of Radiation and Isotope Technology	HERC	Haryana Electricity RC
OIL	Oil India Limited	HWB	Heavy Water Board	HPERC	Himachal Pradesh Electricity RC
ONGC	Oil and Natural Gas Corporation	NFC	Nuclear Fuel Complex	KERC	Karnataka Electricity RC
GAIL	Gas Authority of India Limited	CEA	Central Electricity Authority	MPERC	Madhya Pradesh Electricity RC
EIL	Engineers India Limited	BEE	Bureau of Energy Efficiency	OERC	Orissa Electricity RC
DGH	Directorate General of Hydrocarbons	CPRI	Central Power Research Institute	RERC	Rajasthan Electricity RC
OIDB	Oil Industry Development Board	NPTI	National Power Training Institute	TNERC	Tamil Nadu Electricity RC
PPAC	Petroleum Planning and Analysis Cell	NEEPCO	North-Eastern Electric Power Corporation	UPERC	Uttar Pradesh Electricity RC
C-WET	Centre for Wind Energy Technology	NHPC	National Hydroelectric Power Corporation	WBERC	West Bengal Electricity RC
IREDA	Indian Renewable Energy Development Agency	NTPC	National Thermal Power Corporation		

1. Coal

The Ministry of Coal is the primary body, which is responsible for policy formulation with regard to development and exploitation of coal and lignite. The Ministry has three Public Sector Enterprises (PSEs) – CIL, NLCL and SCCL (a joint venture between the Government of Andhra Pradesh (51 per cent) and the Central Government (49 per cent)) under its administrative control. The CIL is the apex body for exploration, production, and distribution of coal and for implementing policy guidelines of the Ministry. It has seven production subsidiaries – Bharat Coking Coal Limited, Central Coalfields Limited, Eastern Coalfields Limited, Mahanadi Coalfields Limited, Northern Coalfields Limited, South-Eastern Coalfields Limited and Western Coalfields Limited. The eighth subsidiary is CMPDI, which provides technical and consultancy services to these production subsidiaries.

2. Oil and Gas

The Indian oil and gas sector is under the purview of MoPNG which oversees the entire chain of activities in the oil industry, including E&P of crude oil and natural gas, refining, distribution, and marketing of petroleum products and natural gas, exports, imports and conservation of petroleum products. The three key organizations under its administrative control are DGH[197], Oil Industry Development Board[198] and Petroleum Planning and Analysis Cell.[199] The MoPNG has set up a number of organizations to facilitate delivery of its various functions. The E&P is primarily undertaken by two PSUs – ONGC and OIL. The refining and marketing segment is mainly done by three NOCs – BPCL, IOCL and HPCL – and their subsidiaries. Distribution and marketing of gas is done mainly by GAIL. Engineers India Limited also comes under MoPNG, which provides engineering and related technical services for petroleum refineries and other industrial projects

3. Renewable Energy

MNRE is the primary agency, which is responsible for the development and policy implementation of renewable energy. In order to provide concessional financial support to the renewable energy sector, the Ministry has set up a financial institution - IREDA. Centre for Wind Energy Technology, Solar Energy Centre and Sardar Swaran Singh National Institute of Renewable Energy are the other institutions under the Ministry for R&D, technology development, testing and certification. Various renewable energy projects and programs are implemented through a country-wide implementation network, consisting of state nodal departments, state nodal agencies, autonomous organizations, NGOs, R&D institutions, financial institutions and private entrepreneurs.

4. Nuclear Energy

DAE is under the direct charge of the Prime Minister and is responsible for the execution of the nuclear program. The Atomic Energy Commission, also working under DAE, is responsible for the formulation of policies and programs. The DAE has set up a number of associated or subsidiary organizations which includes five research centers, five PSUs and three department undertakings. The five research centers are Atomic Minerals

[197]Supervises the activities of companies in the upstream oil and gas sector and oversees efficient utilization of gas fields.
[198]Provides financial and other assistance for the development of the oil industry.
[199]Responsible for analyzing trends in international oil markets and domestic prices, forecasting and evaluating petroleum import and export trends and also administering subsidies in LPG.

Directorate for Exploration and Research, Bhabha Atomic Research Centre, Indira Gandhi Centre for Atomic Research, Raja Rammana Centre for Advanced Technology and Variable Energy Cyclotron Centre. The five PSUs are Bhartiya Nabhikiya Vidyut Nigam Limited[200], Electronics Corporation of India[201], Indian Rare Earth Limited, NPCIL[202] and Uranium Corporation of India Limited.[203] The three department undertakings include the Board of Radiation and Isotope Technology, Heavy Water Board (in charge of the many plants that produce heavy water) and the Nuclear Fuel Complex (manufactures the fuel for the nuclear reactors).

5. Electricity

At the Centre, the MoP is responsible for perspective planning, monitoring, and implementation of power projects. Central generating utilities, transmission utilities, policy bodies and research institutions help the Ministry. The CEA assists the MoP in all technical and economic matters. The institutes working under the MoP are the Bureau of Energy Efficiency, Central Power Research Institute and National Power Training Institute. The construction and operation of generation and transmission projects are undertaken by central sector power corporations such as North Eastern Electric Power Corporation, NHPC and NTPC and Power Grid Corporation of India Limited[204]. The Power Finance Corporation provides term-finance to projects in the power sector, while the Rural Electrification Corporation funds programs on rural electrification. PTC India Limited is the dominant public sector organization involved in power trading. The other autonomous organizations under MoP are Bhakra Beas Management Board, Damodar Valley Corporation, Satluj Jal Vidyut Nigam and Tehri Hydro Development Corporation. There are also many Electricity Regulatory Commissions working at central and state levels, for instance, CERC at the central level and Assam Electricity Regulatory Commission and Andhra Pradesh Electricity Regulatory Commission at the state level. SEBs, constituted by the state governments, work at the state level.

[200]Responsible for setting up fast/breeder reactors.
[201]Responsible for reactor control and instrumentation.
[202]Responsible for designing, constructing and operating the nuclear power plants.
[203]Responsible for mining and processing uranium.
[204]Responsible for all existing and future transmission projects in the central sector and also for the formation of the National Power Grid.

Appendix E

Table E 1: India's Nuclear Reactors in Operation

No.	Name	Type	Capacity (MWe)	Date of Commercial Operation
1	TAPS-1, Tarapur, Maharashtra	BWR	160	28 Oct 1969
2	TAPS-2, Tarapur, Maharashtra	BWR	160	28 Oct. 1969
3	RAPS-1, Rawatbhata, Rajasthan	PHWR	100	16 Dec. 1973
4	RAPS-2, Rawatbhata, Rajasthan	PHWR	200	01 April 1981
5	MAPS-1, Kalpakkam, Tamil Nadu	PHWR	220	27 Jan. 1984
6	MAPS-2, Kalpakkam, Tamil Nadu	PHWR	220	21 March 1986
7	NAPS-1, Narora, Uttar Pradesh	PHWR	220	01 Jan. 1991
8	NAPS-2, Narora, Uttar Pradesh	PHWR	220	01 July 1992
9	KAPS-1, Kakrapar, Gujarat	PHWR	220	06 March 1993
10	KAPS-2, Kakrapar, Gujarat	PHWR	220	01 Sept. 1995
11	KAIGA-1, Kaiga, Karnataka	PHWR	220	16 Nov. 2000
12	KAIGA-2, Kaiga, Karnataka	PHWR	220	16 March. 2000
13	RAPS-3, Rawatbhata, Rajasthan	PHWR	220	01 July 2000
14	RAPS-4, Rawatbhata, Rajasthan	PHWR	220	23 Dec. 2000
15	TAPS-4, Tarapur, Maharashtra	PHWR	540	12 Sept. 2005
16	TAPS-3, Tarapur, Maharashtra	PHWR	540	18 Aug 2006
17	KAIGA-3, Kaiga, Karnataka	PHWR	220	06 May 2007
Total			**4120**	

Source: Nuclear Power Corporation of India, http://www.npcil.nic.in/main/AllProjectOperationDisplay.aspx

Table E 2: India's Nuclear Reactors under Construction

No.	Name	Type	Capacity (MWe)	Expected Commercial Operation
1	KAIGA-4, Kaiga, Karnataka	PHWR	220	March 2009
2	RAPS-5, Rawatbhata, Rajasthan	PHWR	220	Feb. 2009
3	RAPS-6, Rawatbhata, Rajasthan	PHWR	220	June 2009
4	Kundankulam-1	PWR (VVER)	1000	August 2009
5	Kundankulam-2	PWR (VVER)	1000	May 2010

Source: Nuclear Power Corporation of India, http://www.npcil.nic.in/main/ProjectConstructionStatus.aspx
Note: PWR – Pressurized Water Reactor.

Appendix F

Table F 1: Comparison of India's Commitments in Uruguay Round and Revised Offer

W/120	CPC No.	Description	Uruguay Round	Revised Offer
1.A.e	8672	Engineering services	M1, M2: Unbound for MA and NT M3: Only through incorporation with 51 per cent foreign equity for MA and None for NT M4: Unbound except as in HC for MA and NT	M1, M2: None for MA and NT M3: None except establishment only through incorporation and FIPB route required in case of prior collaboration in that specific service sector, for MA, and None for NT M4: Unbound except as in HC for MA and NT
1.A.f	8673	Integrated engineering services	No Commitment	M1, M2: None for MA and NT M3: None except establishment only through incorporation and FIPB route required in case of prior collaboration in that specific service sector, for MA, and None for NT M4: Unbound except as in HC for MA and NT
1.C.a	85103	Research and experimental development services on natural sciences and engineering and technology for casting, metal, machinery, electricity, communications, vessels, aircraft, civil engineering, construction, information, etc.	M1: Unbound for MA and NT M2: Unbound* for MA and NT M3: Only through incorporation with 51 per cent foreign equity for MA, and None for NT M4: Unbound except as in HC for MA and NT	M1: Unbound for MA and NT M2: Unbound* for MA and NT M3: None except establishment only through incorporation and FIPB route required in case of prior collaboration in that specific service sector, for MA, and None for NT M4: Unbound except as in HC for MA and NT
1.F.c	86509	Management consulting services	No Commitment	M1, M2: None for MA and NT M3: None, except FIPB route required in case of prior collaboration in that specific service sector, FIPB route required for MA, None for NT M4: Unbound except as in HC for MA and NT
1.F.d	86601	Services related to management consulting	No Commitment	M1, M2: None for MA and NT M3: None, except FIPB route required in case of prior collaboration in that specific service sector, FIPB route

W/120	CPC No.	Description	Uruguay Round	Revised Offer
				required for MA, None for NT M4: Unbound except as in HC for MA and NT
1.F.e	8676 (partial)	Technical testing and analysis services	M1, M2: Unbound for MA and NT M3: Only through incorporation with 51 per cent foreign equity for MA, and None for NT M4: Unbound except as in HC for MA and NT	M1, M2: None for MA and NT M3: None except establishment only through incorporation and FIPB route required in case of prior collaboration in that specific service sector, for MA, and None for NT M4: Unbound except as in HC for MA and NT
1.F.j	887	Services incidental to energy distribution**	No Commitment	M1, M2: None for MA and NT M3: None, except FIPB route required in case of prior collaboration in that specific service sector, FIPB route required for MA, None for NT M4: Unbound except as in HC for MA and NT
3.B	5134-5136	Construction work for civil engineering for long-distance pipelines, for local pipelines, for construction of mining	M1, M2: Unbound* for MA and NT M3: Only through incorporation with 51 per cent foreign equity for MA, and None for NT M4: Unbound except as in HC for MA and NT	M1, M2: None for MA and NT M3: None except establishment only through incorporation and FIPB route required in case of prior collaboration in that specific service sector, for MA, and None for NT M4: Unbound except as in HC for MA and NT
3.E	518	Renting services related to equipment for construction or demolition of buildings or civil engineering works with operator	No commitment	M1, M2: None for MA and NT M3: None except establishment only through incorporation and FIPB route required in case of prior collaboration in that specific service sector, for MA, and None for NT M4: Unbound except as in HC for MA and NT

Source: Compiled by the authors from India's Uruguay Round Schedule (GATS/SC/42) and India's Revised Offer (TN/S/O/IND/Rev.1.)

Notes: MA is Market Access, NT is National Treatment and HC is Horizontal Commitments.

** Unbound due to lack of technical feasibility.*

*** In the Revised offer, energy trading and load dispatch functions were excluded.*

Table F 2: Sub-sectors in which India did not make Offer

1.F.h	883	Services incidental to mining
	5115	Site preparation work for mining
1.F.m	8675 (partial)	Related scientific and technical consulting services
1.F.n	8861-8866 (partial)	Maintenance and repair of fabricated metal products, machinery and equipment, and electrical machinery (excluding maritime vessels, aircraft or other transport equipment)
4.A	62113	Commission Agents Services – Sales on a fee or contract basis of fuels
4.B	62271	Wholesale trade services of solid, liquid and gaseous fuels and related products (excluding electricity and town gas)
4.C	63297	Retailing services of fuel oil, bottled gas, coal and wood
11.G.a	7131	Pipeline transportation of fuels

LATEST ICRIER'S WORKING PAPERS

NO.	TITLE	AUTHOR	YEAR
230	THE MISSING MIDDLE	ANNE O. KRUEGER	JANUARY 2008
229	WHAT CAN BE LEARNED ABOUT THE ECONOMIES OF CHINA AND INDIA FROM PURCHASING POWER COMPARISONS?	ALAN HESTON	DECEMBER 2008
228	THE COST COMPETITIVENESS OF MANUFACTURING IN CHINA AND INDIA: AN INDUSTRY AND REGIONAL PERSPECTIVE	BART VAN ARK ABDUL AZEEZ ERUMBAN VIVIAN CHEN UTSAV KUMAR	DECEMBER 2008
227	EMERGING THROUGH TECHNOLOGICAL CAPABILITY: AN OVERVIEW OF INDIA'S TECHNOLOGICAL TRAJECTORY	AMIT SHOVON RAY	NOVEMBER 2008
226	THE CHINESE EXPORT BUNDLES: PATTERNS, PUZZLES AND POSSIBLE EXPLANATIONS	ZHI WANG SHANG-JIN WEI	NOVEMBER 2008
225	INDIA'S MACROECONOMIC PERFORMANCE AND POLICIES SINCE 2000	SHANKAR ACHARYA	OCTOBER 2008
224	DECONSTRUCTING CHINA'S AND INDIA'S GROWTH: THE ROLE OF FINANCIAL POLICIES	JAHANGIR AZIZ	OCTOBER 2008
223	POLLUTION ACROSS CHINESE PROVINCES	CATHERINE YAP CO FANYING KONG SHUANGLIN LIN	SEPTEMBER 2008
222	IMPACT OF ORGANIZED RETAILING ON THE UNORGANIZED SECTOR	MATHEW JOSEPH NIRUPAMA SOUNDARARAJAN MANISHA GUPTA SANGHAMITRA SAHU	SEPTEMBER 2008
221	CHINA AND INDIA: A TALE OF TWO TRADE INTEGRATION APPROACHES	PRZEMYSLAW KOWALSKI	AUGUST 2008

About ICRIER

ICRIER – established in August 1981 – is an autonomous, policy-oriented, not-for-profit research institute. We have nurtured our cherished autonomy by establishing an endowment fund, income from which enables us pursue our priority research agenda. ICRIER's office is located in the prime institutional complex of India Habitat Centre, New Delhi. The focus of our work is to support India's interface with the global economy.

ICRIER's founding Chairman was Dr. K.B. Lall who led the organization since its inception till 1992 when he handed over the Chairmanship to Mr. R.N. Malhotra (1992-1996). He was followed by Dr. I.G. Patel who remained Chairman from 1997 to 2005 until his demise in July 2005. ICRIER's current Chairperson is **Dr. Isher Judge Ahluwalia.**

Amongst ICRIER's founding members are: Dr. Manmohan Singh, Dr. C. Rangarajan, Dr. M.S. Swaminathan, Dr. Jagdish Bhagwati, Dr. R. J. Chelliah, Mr. M. Dubey and Dr. Deepak Nayyar.

ICRIER conducts thematic research in the following six thrust areas:

- Trade, Openness, Restructuring and Competitiveness
- WTO-Related Issues
- Regional and Bilateral Issues
- Financial Liberalization and Integration
- Macro-economic Management in an Open Economy
- Strategic Aspects of India's External Relations

To effectively disseminate the research findings, ICRIER organises workshops/ seminars/ conferences to bring together policy makers, academicians, Union Cabinet Ministers, Members of Parliament, senior industry representatives and media persons to try and create a more informed understanding on issues of major policy interest. ICRIER invites distinguished scholars and policy makers from around the world to deliver public lectures on economic themes of interest to contemporary India.

ICRIER's highly qualified **in-house team** of researchers includes several Ph.Ds from reputed Indian and foreign universities. At present the in-house team has 25 Senior Economists and 26 Research Associates/Assistants. In addition, ICRIER encourages external researchers to work on specific assignments and maintains a network of external consultants. At present we have 23 External Consultants working on various projects. The team is led by **Dr. Rajiv Kumar**, D.Phil in Economics from Oxford University and Ph.D from Lucknow University.