

**Study of Capacity Building of the  
Electricity Regulatory Agency (SERC) ,  
P.R. China**

State Electricity Regulatory Commission, P.R.China

Ministry of Finance, P.R. China

World Bank

This report (discussion paper) presents the results of a sector analysis and research that is published to encourage discussion and comment within the electricity regulation and power market-oriented reform, as consultation references for policy making in China, and for dissemination to parties interested in sector reform in other countries.

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# Preface

As one of projects listed in the Technical Cooperation Projects in Phase 4 supported by the World Bank to China, the Project of Study on Capacity Building of the State Electricity Regulatory Agency, P.R. China has been financed by the World Bank, and under fund supervision by the Ministry of Finance of China, it has been carried into execution by the State Electricity Regulatory Commission of China (SERC).

Through international public bid organized by SERC, the Ministry of Finance of China, and the World Bank in compliance with relevant requirements of the Ministry of Finance of China and provisions of purchase guidance of the World Bank, the Consortium established between NERA (National Economic Research Associates Inc) as the Leading Consultant, and CIECC (China International Engineering Consulting Corporation) and Norton Rose Law Firm, both as the Sub-Consultants, has been awarded the contract to provide consulting service for the Project. The contract became effective in May 2004.

After an intensive process of investigations into the electricity industry of China as well as research and discussion with staffs from SERC, relevant governmental organizations and various electricity enterprises over a lengthy period of time, the Consortium has submitted preliminary report, mid-term report and initial version of final report at relevant stage of the project. And SERC has convened meetings at each stage to conduct full discussion of the received reports and put forward proposals for further revisions.

As part of the work scheduled in the Project, an international forum on Power Reform and the Capacity Building of China Electricity Regulatory Agency was held by SERC, the Ministry of Finance and the World Bank in Beijing on September 19~20, 2006. The forum has been proved to be very successful, where the Project results was introduced, and many

well-known experts and scholars were invited from native and abroad and delivered speeches and their comments, all of which aroused great interests among participants from relevant governmental organizations and the electricity industry. After the forum, the Consortium has finalized its report and submitted it to SERC.

In order to enable our dear readers to have a full view of the project results, to better refer to foreign experiences in electricity power reform and regulatory practices, and to explore in depth the key issues involved in the power reform and electricity regulation in China, SERC, the Ministry of Finance of China and the World Bank has decided to co-publish the final bilingual English-Chinese report of the Project.

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# Contents

<b>Acknowledgements</b> .....	115
<b>Abbreviations and Acronyms</b> .....	116
<b>Executive Summary</b> .....	118
<b>Chapter 1 Introduction</b> .....	128
1.1 Background to the Study.....	128
1.2 Key Issues to be Solved for Capacity Building of the Electricity Regulatory Institutions of China.....	131
1.3 Structure of This Report.....	132
<b>Chapter 2 The Purpose, Role and Functions of Regulation</b> .....	133
2.1 Purpose of Electricity Regulation.....	133
2.1.1 Why Regulate Anything.....	133
2.1.2 Why Should We Implement Professional Regulation in the Electricity Sector.....	134
2.2 Entities to be Subjected to Electricity Regulation.....	135
2.3 Three Key Areas of Electricity Regulation.....	136
2.3.1 Prices.....	136
2.3.2 Quality.....	137
2.3.3 Investment.....	138
2.4 Targets and Principles of Electricity Regulation—Balancing Various Interests.....	138
2.4.1 Consumers’ Interests.....	138
2.4.2 Utility Investors’ Interests.....	139
2.4.3 Government’s Legitimate Policy Interests.....	139
2.5 Design of Effective Regulation—International Experience.....	139

2.5.1	High Level Objectives	139
2.5.2	Independence	140
2.5.3	Funding	141
2.5.4	Central or Local Regulation	142
2.5.5	Governance	142
2.5.6	Standard Processes	143
2.5.7	Areas of Regulation of the Regulatory Institutions	143
2.5.8	Major Functions of Regulatory Institutions	144
2.6	Extent of the Regulatory Body's—Whether It is Limited to the Electricity Sector	144
<b>Chapter 3</b>	<b>Allocation of Electricity Regulatory Responsibilities in China</b>	<b>146</b>
3.1	Review of Current Situation	146
3.1.1	The Power Sector Reform Working Group	146
3.1.2	The National Development and Reform Commission	147
3.1.3	The Ministry of Finance	147
3.1.4	Provincial Economic and Trade Commissions	147
3.1.5	The State-owned Assets Supervision and Administration Commission (SASAC)	148
3.2	Current Problems of the Functional Distribution of Electricity Regulation in China	148
3.2.1	Policy Making and Regulatory Function are Confused	148
3.2.2	Planning Approvals and Investment Supervision Functions are Confused	149
3.2.3	Tariff Regulation Functions are not Allocated Properly	149
3.3	International Examples of Relevant Issues	149
3.3.1	International Examples of Horizontal Allocation of Regulatory Function	149
3.3.2	International Examples of Vertical Distribution of Regulatory Functions	150
3.4	Recommendations for Horizontal Allocations of the Electricity Regulation Functions in China	150
3.4.1	Create an Energy Policy-making Function in China	150
3.4.2	Establish Responsibilities for Investment Regulation	151
3.4.3	Gradually Adjust the Allocation of Electricity Tariff and Cost	

Regulation Functions	152
3.4.4 Coordinate Anti-trust (Competition Policy) Responsibilities	152
3.4.5 Clarify Responsibility for Technical and Quality Regulation	153
3.5 Recommendations for the Vertical Allocation of Regulatory Powers in China	153
3.5.1 The Importance of the Vertical Distribution of Regulatory Power in China	153
3.5.2 Concrete Suggestions for the Vertical Allocation of Regulatory Powers in China	154
<b>Chapter 4 Basic Methods for Electricity Sector Regulation</b>	<b>156</b>
4.1 Tariff Regulation in Economic Regulation	156
4.1.1 The Importance of Tariff Regulation in Economic Regulation	156
4.1.2 Key Features of a “Good” Tariff Regime	157
4.1.3 Basic Methods of Electricity Price Regulation	157
4.1.4 Principal Methodologies	158
4.1.5 Types of Tariff and Their Regulation	160
4.2 Quality Regulation	161
4.3 Investment Regulation	163
4.3.1 Investment Regulation for Electricity Generation	163
4.3.2 Transmission and Distribution Investment	164
4.3.3 Agreed Investment Criteria and Obligations	164
4.3.4 Suggestions for a Coordination Mechanism for the Existing System Planning and Investment Regulation in China	165
4.4 Licensing of Operations of Electricity Sector Entities	166
4.4.1 Licenses Can be Short or Comprehensive	166
4.4.2 Licensing is Specific to the Activity	167
4.4.3 Exemptions and Exceptions	168
4.4.4 Processes for Issuing, Amending and Revoking Licences	169
4.4.5 Common Core Conditions	170
4.4.6 Specific Conditions for Different License Types	171
4.5 Regulation of State-owned Electricity Sector Utilities	172

4.5.1	Difficulties in Regulating State-owned Enterprises	173
4.5.2	Specific Methods for Regulation of State-owned Electricity Enterprises	173
<b>Chapter 5</b>	<b>Establishment and Regulation of Competitive Electricity Markets</b>	<b>175</b>
5.1	Some Models for Electricity Sector Structure	176
5.1.1	Model 1 : Vertically Integrated Monopoly	176
5.1.2	Model 2 : Single Buyer	177
5.1.3	Model 3: Wholesale (Generation) Competition	177
5.1.4	Model 4: Retail Competition	178
5.2	Model 2—Regulation of Single Buyers	179
5.2.1	The Role of the Regulator in Model 2	179
5.2.2	The Grid Company in a Single Buyer Model	180
5.2.3	Procurement of Generation in the Single Buyer Model	180
5.2.4	Dispatching Generating Plant in a Single Buyer Model	181
5.3	Regulatory Issues in Model 3—Wholesale Competition	182
5.3.1	The Role of the Regulator in Model 3	182
5.3.2	Regulating the Trading Arrangements (the market rules) in Model 3	184
5.3.3	Promoting Competition in the Generating Markets in Model 3	184
5.3.4	Generation Investments and “Capacity Payments”: Models 1 and 3	185
5.4	Responsibilities for the Supply/Demand Balance in Models 2 and 3	189
5.4.1	Investment Regulation in Model 2	189
5.4.2	Investment Regulation in Model 3	189
<b>Chapter 6</b>	<b>Capacity Building for SERC in the Near-term</b>	<b>191</b>
6.1	Speed up Electricity Sector Reform	191
6.2	Energetically Promote Construction of Regional Electric Electricity Markets	191
6.3	Focus on Regulating Markets and Protecting Customers as the Key Near-term Areas of Work	191
6.4	Further Development of the Legal Framework for Electricity Regulation	195
6.5	Strengthen Cooperation with Relevant Departments of the Government and Jointly Execute Relevant Regulatory Tasks	196
6.6	Improve and Implement Measures on Electricity Regulation Fee Collection	197

6.7	Urgent Need for Establishment of SERC at Regional, Provincial, and Local Levels	197
6.8	Apply for Authority to Regulate State-owned Electricity Enterprises through Specific Methods	198
6.9	Improve Communication Channels with Other Government Agencies, and with Regulatory Bodies in China and Worldwide	198
6.10	Strengthen Personnel Training, and Establish Regulations for the Behaviour of Personnel	199
<b>Appendix A International Comparisons of Regulatory Bodies and Practices</b>		<b>201</b>
A.1	Case Study 1 : Tariff Setting Powers and Regulatory Independence	211
A.2	Case Study 2: The Vertical Split of Regulatory Authority — India, the United States and Russia	216
<b>Appendix B Detailed Review of the Current Situation in the Chinese Electricity Sector</b>		<b>227</b>
B.1	Overview of the Sector	227
B.2	Reform Plans	230
B.3	Progress with Unbundling	231
B.3.1	Generation	232
B.3.2	Transmission	232
B.3.3	Distribution	235
B.4	Electricity Tariffs	235
B.4.1	The Current Tariff Position	235
B.4.2	Price Regulation Powers and Procedures	237
B.5	The Electricity Sector Context	238
B.6	Plans for Development of Trading Arrangements	239
B.7	Progress to Date	240
B.7.1	System Operation	240
B.7.2	Electricity Trading	241
B.7.3	Retail Competition	242
B.8	Regulation of the Regional Sectors and the Market Arrangements	242
<b>Appendix C Elaboration of Key Features of Effective Regulation</b>		<b>244</b>
C.1	Clarity of Roles and Objectives	244

C.2	Autonomy	245
C.3	Accountability	245
C.4	Participation	246
C.5	Transparency	246
C.6	Predictability	246
C.7	Proper Regulatory Capacity	247
<b>References</b>		<b>248</b>

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## Abbreviations and Acronyms

AER	Australian Energy Regulator
ANEEL	Agência Nacional de Energia Elétrica, Brazil
BETA	British Electricity Trading Arrangements, that superceded NETA and now apply to England, Scotland, and Wales
BST	Bulk Supply Tariff
CERC	Central Electricity Regulatory Commission, India
CNE	National Energy Commission, Spain
Distco	Distribution Company
DoE	Department of Energy, USA
ENRE	Ente Nacional Regulador de la Electricidad, Argentina
EPACT	Energy Policy Act, USA
ETC	Economic and Trade Commission, PRC
FEK	Federal Energy Commission, Russia
FERC	Federal Energy Regulatory Commission, USA
FPA	Federal Power Act 1935, USA
GNP	Gross National Product
Gridco	Grid Company
GW	Giga Watt
IPP	Independent Power Producer
kWh	Kilo Watt Hour
LSE	Load Serving Entity
MME	Ministry of Mines and Energy, Brazil
MO	Market Operator
MOF	Ministry of Finance, PRC
MW	Mega Watt
NARUC	National Association of Regulatory Utility Commissioners, USA
NDRC	National Reform and Development Commission, PRC
NEM	National Electricity Market, Australia
NETA	New Electricity Trading Arrangements, previously applying to England and Wales
NVE	Norwegian Water Resources and Energy Directorate, Norway
OFGEM	Office of Gas and Electricity Markets, United Kingdom
PJM	An accepted abbreviation for the electricity market operating in the Pennsylvania, New Jersey and Maryland area of the USA.

PPA	Power Purchase Agreement
PRC	Peoples Republic of China
PSRWG	Power Sector Reform Working Group, PRC
PUC	Public Utility Commission, USA
PUHCA	Public Utility Holding Company Act, USA
REK	Regional Energy Commission, Russia
RoR	Rate of Return
RTO	Regional Transmission Organisation, USA
SASAC	State-owned Assets Supervision and Administration Commission, PRC
SC	State Council, PRC
SERC	State Electricity Regulatory Commission of China
SGC	State Grid Company, PRC
SO	System Operator
SOE	State Owned Enterprise
SPC	State Power Corporation, PRC
UK	United Kingdom
USA	United States of America

# Executive Summary

## Introduction

This Report has been prepared as the final part of the work under NERA's contract for Capacity Building of the Electricity Regulatory Agency (SERC), P.R. China (a Technical Cooperation Project supported by the World Bank). It has been prepared through an intensive process of research, discussion, and drafting in close collaboration with SERC and other agencies. The team of foreign experts has worked closely with local experts and SERC staff in its preparation. The research carried out has examined both the conditions in China and also regulatory practices in other countries.

In the past 20 years, China has made great achievements in its electricity sector. As the second largest electricity sector in the world, the Chinese electricity sector has undergone impressive growth. Total installed generating capacity exceeded 500 GW by the end of 2005; in 2005 China added over 66 GW of new installed capacity, and the national electricity production was 2474.7 billion kWh (an increase of 12.3% on a year-on-year basis). China's electricity system has also undergone major reforms: ownership of most of the electricity plants has been separated from electricity grids; the central generation assets and electric network assets have been restructured; regional electricity markets are being developed; and a professional electricity regulatory institution has been established. The core objectives of this electricity system reform of China are to promote the role of the market in the development and operation of the electricity sector, and to apply effective economic regulation to the electricity sector.

However, despite these achievements and progress, the current position of China's electricity sector is not wholly satisfactory: low levels of efficiency in the sector have become an outstanding problem relative to the sustainable development of economy and society; conflicts between electricity sector development, resource use, and the environment are more and more evident; electricity supply facilities are poorly equipped, with low reliability of electricity supply and poor service quality; policy and administrative mechanisms are lagging behind the reform, and electricity supply cannot reach an efficient and harmonious codevelopment with the economy and society. All these impact on the rational adjustment of the electricity sector structure and on the health and sustainable development of the entire economy.

Based on our research we believe that, in order to improve significantly the performance of the electricity sector in China, it is necessary to achieve substantial progress in respect of

the introduction of market disciplines, enterprise reform, and the introduction of modern regulation as soon as possible. This Report focuses on the core issue of the creation of modern regulation, that is how to improve the capacity of the electricity regulatory institutions in China from both internal and external perspectives. As part of that work, this Report also conducts an in-depth research on the issue of the establishment and regulation of a competitive electricity market in China.

## **Purpose, Role and Functions of Electricity Regulation**

The focus of this Report is on economic regulation, that is regulation of prices and other commercial terms, investment, and service quality. Chapter 2 of the Report sets the scene for considering and introducing electricity sector economic regulation by discussing the basic principles behind it, and presenting an extensive review of relevant international experience. An initial issue, given that China is moving away from a system of almost complete price control by governments towards a market economy, is why it is necessary to institute economic regulation at all? This Chapter addresses this basic issue by examining the central purpose and function of economic regulation in the electricity sector. To achieve that purpose, it is necessary to balance the interests of consumers, the utility investors, and the government.

The interests of consumers are best ensured by obtaining reliable supplies at the least cost. Consumers' interests are not best served solely by low prices, if it is to the detriment of the future reliability of supplies of electricity. Utility investors will be seeking to maximize the profit from their investment, but are also interested in stability and certainty in the market. Governments may have policy issues for the electricity sector such as rural electrification, security of supply or reducing emissions. The regulator has a role in balancing legitimate government policy issues, while ensuring that the other stake holders are not harmed.

Competitive markets can provide efficient production levels, minimum cost, adequate supplies, and high quality of service. In contrast, monopolies are able to raise prices, reduce output and compromise quality and service, and that is why it is generally considered economically desirable to avoid monopolies where possible, and to regulate them where they are unavoidable. The negative effects of monopoly can then be reduced to the minimum.

There are three main reasons why it may be important to introduce economic regulation in a sector:

- (1) Control the behavior of “natural monopolies”, in order to prevent the monopoly enterprises from raising the prices at will while reducing the electricity supply services.
- (2) Promote fair and efficient competition.
- (3) Promote the public interest.

Fundamentally speaking, a powerful regulatory system is not in contradiction with the

concept of deregulation. The regulatory system places emphasis on regulatory effectiveness, while deregulation pays more attention to reducing the sphere of micro-interference and exerting the fundamental roles of market allocation of resources. In fact, both international practice and research findings prove that, as part of strong government, regulation is an important guarantee of economic development whether in developed countries or in developing countries.

In general, regulation is a system designed to solve market failures and limitations. The electricity regulatory institutions play a role of regulating the price, investment and service where monopoly enterprises provide services; and also approve the market designs and price-setting mechanisms and monitor the efficient operation of the market when there is competition.

The electricity sector is a key network sector where problems of monopoly have been found to arise, and so is a sector to which regulation is commonly applied. In addition, other characteristics of the electricity sector make it necessary for the execution of professional regulation.

Regulatory actions are usually based on regulating prices, quality and investment. Where companies are natural monopolies, such as transmission networks, the regulator generally sets the prices; where companies operate in potentially competitive activities, such as generation or retail supply, the regulator will try to establish competition so that the interaction of supply and demand can be left to set prices. This Report deals separately with each of these areas in more detail. Quality regulation is also important because, where incentives are placed to cut costs, monopoly businesses may respond by reducing quality rather than improving efficiency.

Electricity tariff regulation should not be confused with economic macro-regulation. In fact, electricity tariff regulation has essential differences from economic macro regulation in terms of its subjects, targets and measures.

## **Reasonable Allocation of Electricity Regulatory Responsibilities in China**

Chapter 3 examines the allocation of responsibilities for electricity sector regulation in China. Currently in China, these responsibilities are split between a number of different organisations, and the regulatory powers of each of them is lacking in clear definition. That is an obvious difficulty at present. The National Development and Reform Commission (NDRC) is responsible for planning and price regulation. The Ministry of Finance has some decision-making powers relating to certain financial rules and cost standards; and the State-owned Assets Supervision and Administration Commission exercises a supervisory role over state-owned enterprises, in particular in appointing and supervising senior executives.

The existing distribution of regulatory functions for the electricity sector in China is

inefficient and inconsistent, mainly in the following aspects:

- (1) First, policymaking and regulatory functions are mixed.
- (2) Second, planning approvals and investment supervision functions are confused.
- (3) Third, tariff regulation functions are not allocated effectively.

In the light of these problems, we have reviewed relevant international experience and developed recommendations for improvement. On this basis, we recommend that a new Electricity Law be introduced that provides a clear and consistent definitions of responsibilities. This redefinition of responsibilities should include the following points:

(1) An electricity sector policy-making entity, like Ministry of Energy, should be established in China as soon as possible, based probably on the restructuring of the existing institutions including the Bureau for Energy and Department of Price of NDRC and some other institutions.

(2) SERC's roles and powers should be clearly defined, and it should be given the responsibility for the full range of regulatory responsibilities.

(3) There should be gradual adjustment of the responsibilities for tariff setting, so that they are progressively transferred to SERC from NDRC.

(4) Significant antitrust (competition policy) responsibilities should also be allocated to SERC, and if necessary a special antitrust institution should be set up to work in collaboration with SERC.

(5) SERC should have the prime responsibility for setting technical and quality regulation issues.

(6) SERC should be able to establish the regional, provincial, and branch offices with high efficiency, so that it can carry out necessary regulatory responsibilities at the local level.

We suggest that the Ministry of Finance should be responsible for specifying general financial rules, accounting rules and cost standards for all sectors, and SERC should have the responsibility for developing specific rules and standards for electricity sector within MOF's general rules and standards, and for ensuring that these rules are observed by electricity companies.

It should be emphasised that bringing tariff regulation and cost regulation together is critical for the development of effective economic regulation. The current situation in China, where the responsibilities are split between NDRC and MOF, who are carrying tariff regulation and cost regulation into execution separately, should be changed as soon as feasible. We recommend that the responsibility for these functions should be unified and assigned to SERC.

We also suggest that, with the expansion of natural gas consumption and its growing impacts on the development of economic society, China could take account of this

international experience, in particular from Britain and the United States, and consider integration of the regulatory mechanisms respectively for the electricity sector and the natural gas sector, so as gradually to develop a more comprehensive energy regulatory body.

## **Basic Methods of Electricity Sector Regulation**

The tasks of regulating monopolies and regulating markets go together, and we believe SERC should carry out both functions for the electricity sector. Only by this means can the transparency, predictability and efficiency of electricity sector regulatory operations be realized.

There are extensive natural monopolies in transmission and distribution in the electricity sector, and SERC should be responsible for licensing and regulation, including setting prices for these companies and implementing quality and investment regulation. Chapter 4 deals in detail with regulatory mechanisms for natural monopoly sectors that may be adopted by SERC, and discusses different approaches. For example, there are different approaches to calculating costs and setting tariffs, but we emphasise that in all cases the rules should be transparent, consistent and predictable. In addition, the rules should have incentives for efficiency in operations and investment decisions, as well as a reasonable prospect of cost recovery for the monopoly.

In this context of price regulation, we believe that there is an important distinction to be made between the role of setting the price policy and methodology, and the role of calculating and enforcing the prices. We have recommended that, in the long term, the function of setting price policy and methodology should be borne by the government's macro section, while the function of calculating and enforcing the prices should be borne by SERC. SERC should have primary responsibility for implementing price regulation, but the key methodologies and transitional tariffs could be developed jointly by NDRC and SERC (and any other relevant ministries or agencies involved in the reform process).

In addition to regulating prices, regulators have an important role in regulating other aspects of the monopoly's service such as quality (technical and customer service), investment and system planning and licensing. The Report emphasises that in each of these areas, SERC should play the major role. The Report also discusses various mechanisms and approaches to be adopted by SERC for the electricity sector regulation.

## **Establishment and Regulation of Competitive Electricity Markets**

Chapter 5 focuses on the issue of regulation in competitive areas. The Report emphasizes that the regulation function should be suitable for the specific structures and characteristics of the electricity sector. In competitive areas of the electricity sector the regulator still has an important role to play. We recommend in the Report that in all the areas where the

competition mechanism could be introduced, SERC should play an important role in competition design, promotion, development and realization. It should be ensured that markets are effectively designed, there is freedom of entry for new generators, transmission and distribution access is non-discriminatory, and investigations are conducted on complaints about competitors' behaviour.

Chapter 5 describes four basic models of the electricity sector structure, which are vertically integrated monopoly, single buyer, wholesale competition, and retail competition, and we also put emphasis on the regulatory issues with different market models. The four basic models are differentiated by how much monopoly is retained.

The role of the regulator will depend on the competitive model chosen, which can vary from limited competition where the only competition is to build new generation under contract, to a single buyer, through to full competition where generation and retail are competitive and only transmission and distribution remain as monopoly activities. In addition, the role of the regulator will vary with the speed of the reform process. In Chapter 5 we review the characteristics of the different market models relevant to China, and review their implications for regulation. Our general recommendation is that China should aim to achieve as soon as possible the transition of regional electricity markets from a single buyer model to a wholesale competition model, and create genuine regional electricity markets with multiple sellers and multiple buyers. Research on the proper positioning of the electricity market operator should also be speeded up, and the issue of property system reform should be addressed, to facilitate the creation of fair and effective wholesale competition in the electricity market.

Whichever market model is chosen, the regulator will have a very important role in the design of the trading arrangements or market rules. According to international experience, we would expect the grid company to design the rules, which would then be ratified by SERC. As China has such diverse electricity markets, not all regions need to follow the same model of competition (single buyer, wholesale competition etc) simultaneously, but we suggest that where the same model is applied, then the same rules should also apply. The wider development of electricity markets in the USA and Europe has been hampered by divergent market rules being put in place in different states or countries. FERC (the USA federal regulator) has finally adopted a standard design based on the PJM market, but Europe continues to allow widely differing arrangements under the terms of the electricity directives.

### **Capacity Building in the Near-Term**

It is likely to be a lengthy process to build the long-term capacity of electricity regulatory institutions in China and solve its present issues. However, it may need further time still to achieve the targets for regulation of the sector in the long term. Meanwhile, and in parallel

with the longer-term efforts, SERC should further improve and strengthen the capacity building in the near-term. This is as important as the long-term capacity building, and it will affect the relevant parties' understanding of the practical value of SERC. From our perspective, this capacity building in the near-term includes two principal aspects, improving external conditions, and building internal capabilities, and these should be identified and performed in accordance with their importance and urgency and the existing conditions and capabilities. In Chapter 6 we discuss the specific near-term steps that we believe should be carried out in parallel with the longer-term changes, and these are summarized below.

(1) Speed up electricity sector reform.

Promoting the market-oriented electricity sector reform is the most fundamental prerequisite to improving the capacity of electricity regulatory institutions in China. In the situation where electricity sector reform has slowed down, it would be hard to set up a modern electricity regulatory system, and it would probably be impossible to execute effectively many of the standard regulatory functions.

As an important element of this, we suggest that there should be clear objectives and a timetable given to the Power Sector Reform Working Group (PSRWG), to continue and develop the reform process.

It is also suggested that PSRWG should use the opportunity while the imbalance between supply and demand is easing to strengthen its leading position, improve its coordination with other departments, speed up the decision-making process and promote electricity sector reforms. The office of PSRWG should be given clearer objectives and a stronger capability to speed up the implementation of reform decisions.

It should be pointed out that in any market economy countries or regions, electricity sector reform has been regarded by the party in power and by government as an important political decision, and has thus received direction from, and has been promoted by, senior political leaders or their authorized senior decision-makers. The importance and complexity of the electricity reforms in China is no less than in the other countries that have carried out successful electricity reforms. Therefore, although China has now entered into a period favourable for electricity reform, we still have to suggest, based on international experience and the real situation in China, that for securing the progress, strength and expected success of the electricity sector reform, the PSRWG should be given strong support from the senior leadership group, and that the work of the PSRWG should be directed and promoted by them or by a leading decision-maker authorised by them in a timely manner.

We also suggest that the electricity sector reform in the near-term should speed up the execution of separating non-core businesses of the grid companies, so as to avoid cross subsidization and connected transactions, to create an electricity market basic platform, and to promote competent market-based entities. It should set and implement separate transmission

and distribution system tariffs, speed up the work on allowing large consumers to buy directly from generators (differentiated by size or voltage level and by other groupings). Alongside this, the reform should pursue research on separating the electricity transmission and distribution functions so as to achieve as soon as possible the transition of regional electricity markets from a single buyer model to a wholesale competition model, and create genuine regional electricity markets with multiple sellers and multiple buyers.

(2) Energetically promote construction of regional electricity markets.

SERC should energetically promote construction of regional electricity markets, gradually exerting the fundamental roles of market allocation of resources, and promote and create new electricity sector control and regulation systems that are suitable for a market economy system. The new system would combine macro-control, market regulation and effective supervision to improve effectiveness and techniques for the regulation of the electricity sector. In this way, electricity sector regulatory capacity will be gradually improved along with the development of electricity markets. In a sense, that is a fundamental work to be done.

(3) Focus on regulating markets and protecting customers as the key near-term areas of work.

In the present situation, if SERC wants to have a clear impact on the sector, then we suggest that SERC put regulating markets and protecting customers as its key short-term areas of work, to obtain acceptance and support from all sectors of society. SERC therefore needs as soon as possible to place emphasis on market regulation and on its function as the protector of public interests and users' interests. It should look for opportunities to implement several big cases that have major impacts in respect of regulating markets and protecting customers. In order to deter potential violators and encourage customers to rely on SERC to defend their rights, violators could be punished by way of "naming on bulletin" or being named in newspapers, in addition to other economic punishment.

(4) Pursue further development of the legal framework for electricity regulation.

The existing Electricity Law and other regulations are far from sufficient for SERC to be able to become an effective national regulator. As a first priority, SERC should therefore work to speed up the amendment of the Electricity Law, confirm the lawful duties and powers of the electricity regulatory institutions in the new law, and then revise the administrative regulations such as the regulations on electricity regulation according to this new law.

(5) Strengthen cooperation with relevant departments of the government and jointly execute relevant regulatory tasks.

In the present situation, SERC may only carry out some areas of regulation in conjunction with other responsible departments. It is therefore important for SERC to strengthen cooperation with the relevant departments of the government (mainly the NDRC), or even to assist the NDRC, to meet the needs of implementing the functions of regional electricity market building, regulating

electricity market behaviour, and protecting customer interests. SERC may perform efficiently and play important roles during this cooperation, and gradually reform traditional approval processes so as to improve functional allocation problems. There are not many staffs in these other relevant departments of government to perform electricity regulation functions, and the numbers are insufficient to perform these roles adequately. In this circumstance, it is useful to both sides that SERC should strengthen its cooperation with those other departments.

Of course, even though SERC may be given the responsibility for major functions in the future, such as electricity price regulation, investment regulation, etc, the separation of administration and regulation between macro-departments of government and SERC means that other macro departments would still play an important role. SERC should therefore also strengthen its communications with those other governmental departments according to the requirements of the work. However, in the current circumstance, this cooperation is a pragmatic measure that is necessary and important.

(6) Improve and implement measures on electricity regulation fee collection.

The key source of income for regulatory institutions is often regulation fees collected from the electricity enterprises themselves. This form of funding complies with the principle of costs being covered by the responsible parties, and is common practice in other market economy countries because of its fairness and efficiency. However, at present, many of the administrative expenses of SERC have no stable source of income to cover them, which is clearly problematic. SERC (and other relevant departments of the government) should fully understand the need to establish a system of electricity regulatory fees. The earlier it is put into effect, the more beneficial it will be for the execution of regulatory tasks, and the less damage it is likely to cause to the image of the government.

(7) Urgently establish SERC at regional, provincial, and local levels.

One of the current key problems that prevent the improvement of electricity regulation capacity in China is that there are no basic regulatory institutions in place to execute and fulfil many regulatory tasks (e.g. service quality and customer protection). This greatly reduces the overall effectiveness of the sector regulation. One of the important tasks for short-term regulatory capacity building is therefore to identify and execute a reasonable structure of branch institutions as soon as possible.

Early work should focus on the framework of subordinate institutions of SERC, i.e. to set up the basic unified organizations able effectively to execute regulatory instructions.

In addition, current staffing levels are obviously not enough for SERC to execute its regulatory functions effectively. We provide detailed descriptions of relevant international experience in this respect in Appendix A, with tabulated data useful for reference.

The report concludes that there needs to be a large increase in staff for electricity regulation. However, each level of institution has to follow the principle of “better few than

worse”. What needs to be particularly emphasized is that the increase of SERC personnel that is needed would not add substantially to the total numbers of government personnel. As some functions are transferred from other departments of the government to SERC, the additional personnel for SERC may come from these departments.

(8) Apply for authority to regulate state-owned electricity enterprises through specific methods.

It is quite common for regulatory organizations to have to regulate state-owned enterprises within the electricity sector in China. However, for the reasons discussed in Chapter 4 of the Report, specific mechanisms are required to regulate these entities effectively. We therefore recommend that SERC apply to the State Council for authority to use the specific range of measures proposed in Chapter 4 to enable effective regulation of the relevant state-owned electricity enterprises by SERC.

(9) Keep well informed about electricity enterprises and establish mechanisms for effective communication and exchange with external entities.

To establish and maintain good relations with other bodies and to improve understanding of its role, SERC should have more robust mechanisms of communication and exchange with external entities. This applies to entities within the electricity sector, in other regulated sectors in China, and to relevant international organizations.

(10) Strengthen personnel training, and establish regulations for the behaviour of personnel.

As electricity regulation measures and methods are different from most traditional administrative and management activities, a programme of standard personnel training is far from adequate to enable SERC staff to execute their functions effectively. Its personnel should be equipped with modern regulatory ideas relevant to the market economy and wide-ranging and systematic professional regulatory knowledge. So we suggest that SERC should design and implement a more comprehensive training programme.

Important aspects that need to be considered in respect of personnel recruitment and training are that SERC must try hard to avoid appointing unsuitable personnel, and that it should cultivate professional ethics into its personnel through establishing proper regulations on behaviour.

# Chapter 1 Introduction

## 1.1 Background to the Study

This Report has been prepared as the final part of the work under NERA's contract for Capacity Building of the Electricity Regulatory Agency (SERC), P.R. China (Sub-project A12 of Technical Cooperation Project (04) supported by the World Bank). Earlier written deliverables under this project have included the preparation of a number of Issues Papers, a Mid-term Report and a Policy Paper, but much of that material is not repeated here. This Report has been prepared through an intensive process of research, discussion and drafting in close collaboration with SERC. The team of foreign experts has worked closely with local experts and SERC staff in its preparation. The research carried out has examined both the conditions in China and also regulatory practices in other countries.

In the past 20 years, China has made great achievements in its electricity sector. The installed electricity capacity and annual electricity production have remained the second in the world for ten consecutive years (installed capacity exceeding 5000 GW by the end of 2005). In 2005, China added 66 GW of new installed capacity, with a national electricity production of nearly 2474.7 billion kWh (an increase of 12.3% on a year-on-year basis). China is expected to maintain a high rate of increase of both demand and production for a very long period in the future (see Appendix B of this report for more detailed information).

China's electricity system is quite clearly undergoing great changes. The Plan for the Reform of the Electricity System (referred to as Document No.5 in this Report) promulgated by the State Council of China in 2002 set an important milestone. A new series of electricity sector reforms have been carried out in accordance with this Document No 5. Major reform measures have been executed to separate electricity plants from electricity grids, to restructure the central generation assets and electric network assets, to construct regional electricity markets, and to set up professional electricity regulatory institutions. The core objectives of this electricity system reform of China are to promote the role of the market in the development and operation of the electricity sector, and to apply effective economic regulation to the electricity sector.

China has achieved great progress in the reform of the electricity regulatory system. It has set up a professional electricity regulatory institution—the State Electricity Regulatory Commission (SERC)—with modern regulatory practices being adopted rapidly and relevant regulations gradually being established. The initial arrangements for electricity markets have

been put into practice, and there has also been great progress in the development of regulatory branch offices.

However, despite these achievements and progress, the current position of China's electricity sector is not wholly satisfactory, for the reasons described below:

**Low Electricity Sector Efficiency.** China has a serious problem of high investment needs, high consumption and low efficiency in its electricity sector. Currently, the average coal consumption per kWh in China is reported still to be 50g of standard coal higher than that in developed countries, and the line loss rate is 2 to 3 percentage points higher than developed countries. The water consumption rate of thermal-electricity plants per kWh is around 40% higher than developed country levels, while the labour productivity of major electricity enterprises is less than one third of the developed country level. In addition, there are still widespread problems of overlapping of core and supplementary functions of the electricity enterprises. All these factors result in costs being difficult to calculate clearly and to control effectively, cross subsidization and connected transactions are unavoidable, and so all these factors have resulted in low levels of efficiency.

**Poor Electricity Generation Mix.** The total installed electric capacity by the end of 2005 in China, broken down between thermal-electricity generation, hydro-electricity generation and nuclear-electricity generation, were respectively 384 GW, 116 GW and 6.85 GW, i.e. about 75.6%, 22.9% and 1.35% respectively. Non-fossil energy resources such as nuclear electricity, wind electricity, and solar electricity accounted for a very small proportion of the total. Within thermal-electricity generation capacity, there are 150 GW of coal-fired generation units smaller than 135 MW that have high coal consumption and cause severe pollution, accounting for approximately 30% of the country's total installed capacity. Such a structure of generating capacity creates conflicts between electricity sector development, resource use, and the environment.

Electricity supply facilities are poorly equipped, with low reliability of electricity supply and poor service quality. Electricity supply facilities in smaller urban areas and rural towns in China are particularly poorly equipped. The electricity supply service is often operated without any competition or necessary regulation, and this results in low reliability of electricity supply and poor service quality.

**Erratic policy and administrative mechanisms.** Preparation of electricity laws and regulations is lagging behind reform, sector planning and industrial policy making are weak. The development of the electricity sector is alternating between situations where electricity supply is sometimes subject to serious shortages and then in surplus, so that it cannot develop efficiently and in harmony with the economy and society. All these factors impact on the health and sustainable development of the economy and the rational adjustment of the electricity sector structure.

Based on our review, we believe that these problems have three major causes:

(1) Market involvement in the electricity sector is low. The low level of private sector or market involvement in the electricity sector structure causes conflicts with the regulatory mechanism. Despite an unbundled sector structure, with many separate entities in the generation sector, much of the regulatory mechanism is still under the centralized control of the government. It has therefore been inevitable that a severe imbalance of the electricity supply and demand has occurred. In general, the development and management of the electricity sector in China have depended on traditional government political measures. External market pressures encountered by the enterprises have been weak, and there has been little obvious motivation to promote internal reform or to explore the potential to improve service quality.

(2) Reforms of electricity sector enterprises have not been executed in full. Electricity enterprises in China are mainly state owned, and so lack the understanding or incentive to lower costs and increase efficiency. There has been no significant progress in the reform of state-owned enterprises generally so far. The electricity sector also has the same problems such as lack of vigour, waste of resources, short-term behaviour, neglect of responsibilities etc., that have occurred in other industries because the reforms have not been fully executed.

(3) Modern electricity regulation based on the market economy has not yet been effectively implemented. China has carried out major investments with the introduction of commercialisation in its electricity sector, but most electricity enterprises are still state owned, and are in effect part of the administrative system. Enterprises' behaviour is to some extent or even significantly distorted. Effective electricity sector regulation is not only necessary, but also needs to be far more sophisticated and tough than other industries. However, China has not yet carried out effective economic regulation to its electricity sector. After the restructuring of government administration and the electricity sector restructuring, the former management system has been broken up, while a new regulatory structure has not yet taken its place. The regulatory structure has not been systematically designed and revised because of problems with the existing division of responsibilities between the present institutions. The government has not yet exercised its combined regulatory powers, and the problems of absence of regulation and the need to update it have not yet been effectively settled. Thus, in addition to introducing the competitive mechanism into electricity system reform of China, the government should also revise and improve its capacity to regulate electricity investment, cost, and price and service quality in appropriate ways. In relative terms, it has now become even more urgent to establish modern electricity regulatory arrangements.

In order to improve significantly the performance of the electricity sector in China, it is necessary to achieve practical changes in respect of introducing market discipline, enterprise reform, and the introduction of modern regulation, as soon as possible. This report will focus on the core issue for the creation of modern regulation, that is how to improve the capacity of

electricity regulatory institutions in China.

## **1.2 Key Issues to be Solved for Capacity Building of the Electricity Regulatory Institutions of China**

As mentioned above, China has set up a new professional electricity regulatory institution—SERC—but, so far, SERC has not been charged with the functions and powers that are appropriate for regulating a large electricity sector and the rapidly growing electricity market. Building of SERC's fundamental capacity needs to be further strengthened. There are both external and internal factors contributing to SERC's deficiencies in regulatory powers, and these include:

(1) The idea of modern regulation has not been widely accepted. Regulation based on the principles of a market economy is still a new concept in China, and it is easy for people to confuse this with direct control of the planned economy. It needs a process for all parties concerned (including government, enterprises and customers) to update their knowledge.

(2) Relevant legislation, especially legislation relating to electricity sector regulation, is relatively immature. In particular, the absence of a new Electricity Law means that SERC has still not been given the necessary legal duties and so does not command the necessary authority with the regulated enterprises.

(3) The problem of allocation of responsibilities between SERC and other governmental subdivisions is being resolved only very slowly. SERC was set up as a professional regulator. However, the core functions of electricity regulation have not so far been allocated to SERC. This not only severely limits the capacity of SERC to regulate the electricity sector effectively, but also intensifies the functional overlaps and conflicts between government institutions. The result is that the government institutions as a whole are prevented from executing their regulatory powers efficiently.

(4) The vertical organizational system within SERC is also still relatively undeveloped. The vertical division of functions and numbers of personnel are far from being adequate for the specific situation of a country like China that has a vast geographical spread, a large population, and a huge electricity system with a large and diverse sphere of electricity services. The unbalanced pattern of regional electricity sector development and the uneven reform progress further complicate the issue. This results in a situation where some necessary aspects of regulation are absent, while at the same time conflict of regulatory functions occur because of horizontal overlaps of powers.

(5) Regulations and implementation programs that are necessary for the execution of regulatory functions are not in position. Compared with some of the traditional approaches to administrative management, modern economic regulation needs to be based on clear legislation and associated rules. For all these reasons, it is very difficult at present for SERC to design a

scientific, reasonable, and effective electricity regulatory framework and program. Without this clear legislative framework and clear rules, effective regulation of the electricity sector will be out of the question, and the public will not understand the essential differences between the SERC and the administrative government departments previously responsible for the sector.

(6) The personnel structure and quality within SERC also present problems for the execution of the key regulatory tasks. Experience from other countries indicates that it is extremely important for electricity regulatory institutions to strengthen their organizational structure and build their capabilities so as to obtain trust from the government, investors and consumers, and gain respect from other interested parties. For many practical reasons (for example the large income differences between SERC staff and staff in the regulated state-owned electricity enterprises, and the fact that regulatory functions are not well defined), the electricity regulatory institutions are in a relatively inferior position in terms of attracting high quality and talented staff within the electricity sector, compared with large state-owned electricity enterprises.

The potential solutions of these six problems are the primary focus here in terms of regulatory capacity building.

### **1.3 Structure of This Report**

This report is divided into six Chapters and three Appendixes. The Chapters are divided as follows:

Chapter 1 is this Introduction.

Chapter 2 discusses some basic issues of economic regulation, including the main contents of economic regulation, why we should regulate the electricity sector, who should regulate and what should be regulated, etc..

Chapter 3 presents suggestions on the long-term functional divisions of the government in capacity building and suggests what new functions are required and what functions need to be transferred from other institutions to SERC.

Chapter 4 expands in detail on how to regulate the natural monopoly areas of the electricity sector.

Chapter 5 discusses further how to perform regulation in competitive electricity markets.

Chapter 6 then makes suggestions on the near-term capacity building of the electricity regulatory institutions in China.

The contents of the three Appendixes are:

Appendix A provides an introduction and commentary on the regulatory mechanisms of the electricity sectors in nine countries, including the U.S.A. Russia, and Britain.

Appendix B provides a review of the development situation of the electricity sector in China.

Appendix C discusses some of the basic characteristics of effective regulation.

## **Chapter 2 The Purpose, Role and Functions of Regulation**

It is important to emphasise that we are referring in this study to economic regulation. In this context “economic” regulation means regulation of prices and other commercial terms, investment, and service quality, as opposed to the rules for safety, or for land use, or for environmental aspects. These other issues, of safety regulation, and land use and environmental regulation, are not within the scope of this study.

### **2.1 Purpose of Electricity Regulation**

The central purpose of electricity regulation is to achieve economic and technical efficiency in the sector, to control the price of electricity, and to improve the electricity supply quality and service quality. Given that China is moving away from a system of almost complete price control towards a market economy, where the prices of products are determined by the “market”, and not by the government, why institute economic regulation at this time? What is it supposed to do? This Chapter of the Report attempts to answer these questions.

#### **2.1.1 Why Regulate Anything**

There is wide-spread agreement that, in general, competitive markets can provide efficient production levels, minimum cost, adequate supplies, and high quality of service. In contrast, monopolies are able to raise prices, reduce output and compromise quality; and that is why it is generally considered economically desirable to avoid monopolies where possible, and to regulate them where they are unavoidable. The negative effects of monopoly can then be reduced to the minimum.

(1) There are three main reasons why it may be important to introduce economic regulation in a sector:

(2) First, is the need to control the behaviour of “natural monopolies”, in order to prevent the monopoly enterprises from raising the prices at will while reducing the quality of electricity supply and service.

(3) Second, is the need to promote fair competition. It may be that, for various reasons, a sector performs badly even if it is not a natural monopoly and is supposedly competitive. The specific technological and economic features of the specific industries make it quite hard both

to introduce competition (especially where the market structure and competition model are also unique), and also to stop a sector from becoming remonopolised. In this case, professional regulation is needed to construct a platform for competition, to regulate market operation and to promote fair and effective competition. The regulatory requirements of such a competitive sector are discussed in the Chapter 5.

(4) Third, is to promote the public interest. If a particular sector is heavily clothed with the public interest, the government needs to require it to behave in certain ways to further particular policy goals. The telecommunications industry, for example, is so important for the efficient functioning of a modern economy and for economic development that most governments feel the need to stay close to the industry's activities. These issues could be dealt with by an anti-monopoly body, together with a Ministry of Communications, a Ministry of Finance, and a Ministry of Economic Development, meeting together to ensure coordination. However, most countries have chosen to establish a separate regulator, independent of the industry and of the various departments of government, to concentrate on the needs of the industry and to balance the various interests.

Fundamentally speaking, a powerful regulatory system is not in contradiction with the concept of deregulation. The regulatory system places emphasis on regulatory effectiveness, while deregulation pays more attention to reducing the sphere of micro-interference and exerting the fundamental roles of market allocation of resources. In fact, both international practice and research findings prove that, as part of strong government, regulation is an important guarantee of economic development regardless of whether it is in developed countries or in developing countries.

### **2.1.2 Why Should We Implement Professional Regulation in the Electricity Sector**

The electricity sector is a key network activity where problems of monopoly have been found to arise, and so is a sector to which regulation is commonly applied. In addition, other characteristics of the electricity sector make it necessary for the execution of professional regulation:

(1) The electricity sector is the base for modern material civilization. The safety, price, quality (including service quality) and so on of the electricity sector have a major impact on the general development of the economy.

(2) The electricity sector needs to strengthen its electricity transmission grid and distribution systems, and these require large investment projects, strong management, and major capital expenditures. The transmission and distribution activities of the electricity sector are natural monopolies, and their prices, investment and service quality have to be regulated.

(3) The electricity sector is a tightly integrated and complex system, in which the

separate activities of generation, transmission, distribution and sales are connected to achieve safe and effective operation. Therefore, even though a competitive mechanism may be introduced into electricity generation and electricity sales, and their prices and investments need not be regulated, the competitive model must be in compliance with the requirements of safety and efficiency of the whole system due to their close and complex technical connections with electricity transmission and distribution. So even after competition is introduced into electricity generation and electricity sales, some form of regulation is still needed on these the transmission and distribution activities to guarantee the effective operation of the electricity market.

(4) The electricity market is characterised by instantaneous balance and technical complexity. It has greater technical complexity than other commodity exchange markets. And because the electricity market is special in its competition model and its operation method, it has to be designed, monitored, and controlled in a way that recognises the special characteristics of the electricity sector.

The role of the regulator depends upon the degree of competition in the sector, and needs to be adjusted constantly. In monopoly sectors the regulator generally controls prices and investment, and determines the acceptable service quality. In the competitive sectors the market sets the price, and the price induces the investment—the regulator’s role is to approve the trading arrangements and monitor the workings of the market, to ensure that competition is maintained. In general, regulation is a system designed to solve market failures and limitations. The electricity regulatory institutions play a role of regulating the price, investment and service where monopoly enterprises provide services; and to approve and monitor the market designs and mechanisms (by which the price is set) when there is competition.

All of these circumstances apply as much in China as in most other countries, and there is therefore no doubt in our view that regulation of the electricity sector is an important and justifiable requirement.

When viewed from the perspectives of government and the whole society, the electricity sector’s requirements for professional regulation are very clear, but what needs to be emphasised is that regulatory reform in China must be firmly rooted in the market-oriented economic reform process. The first and foremost task is to deepen the reform so that competition and market forces will be empowered wherever possible, and unleashed from tight government control. Construction of the regulation system should therefore be in compliance with a competitive electricity market and diversification of the electricity sector entities.

## **2.2 Entities to be Subjected to Electricity Regulation**

All the entities operating in the electricity sector should normally be subject to some form of regulation. They will all need to be licensed, and they will all need to agree to abide

by the rules set up to ensure coordination in the sector. These entities should be required to meet certain minimum conditions set out by the Regulator in order to do business at all. Chapter 4 elaborates the aspects of their activities that should be regulated, but in essence this will be prices, quality, and investment for the monopoly or not fully competitive elements.

## **2.3 Three Key Areas of Electricity Regulation**

As noted above, the objective of regulation is to control the activities of utilities where there is natural monopoly or inadequate competition, so as to balance the interests of the consumer, the utility investors, and the government. In carrying this out, regulatory actions are usually based on exercising controls in three main areas of activity of a utility: Prices, Quality and Investment. Investment regulation originates from the requirements for price control.

### **2.3.1 Prices**

In the monopoly activities, control of prices is the basic rationale for economic regulation, and in most other countries the regulator is in charge of setting tariffs. The methodologies for tariff regulation are quite complex, and are left to Chapter 4. In China at present the regulator does not have tariff regulation authority. Nonetheless, we should assume that regulatory organizations finally obtain the authority to determine the price, or it is the necessary process for regulatory organizations to propose material suggestions to obtain approvals of price policy departments, or will work closely with the agency that does set the tariffs. In any event, the principles of setting “just and reasonable tariffs” need to be part of the expertise of the staff of SERC.

Economic regulation needs to ensure that prices are as low as is consistent with the functioning of a reasonably efficient utility, and this can be achieved by giving incentives to the utility to operate as efficiently as possible. It is important to emphasise here that consumers’ interests are not simply a matter of obtaining electricity at low prices. In the electricity sector, a regulator’s role in relation to price varies across the sector:

(1) If the service is provided by a monopoly, the regulator must control the prices directly.

(2) If a service is provided in a competitive market, the regulator must ensure that the market is free of distortion or monopoly practices.

As China is still in the process of system transition, there are inevitably impacts from the old system to people’s understanding of electricity tariff regulation. For instance, people confuse electricity tariff regulation with economic macro-regulation. In fact, electricity tariff regulation has essential differences from economic macro regulation in subjects, targets, and measures:

(1) Subjects are different. Macro regulation focuses on the regulation of economic aggregates, while electricity tariff regulation only deals with the electricity sector or some of its enterprises.

(2) Targets are different. Macro regulation is in pursuit of macro-economic stability while electricity tariff regulation focuses on the balancing of interest between the electricity sector producers and consumers, so as to improve the distribution efficiency of the electricity sector resources.

(3) Measures are different. The main measures of macro regulation are currency and fiscal policies, and these policies impact on all economic subjects. The main measure of electricity tariff regulation is the determination of relevant regulations according to which encouragement for performance improvement and penalisation of inefficient or anticompetitive behaviour can be imposed.

(4) Knowledge structure and special skills are different. Macro regulation requires that policy makers have relevant macro-economic knowledge and relevant skills on finance, taxation and currency policies, etc.. But for electricity sector tariff regulation, regulatory organizations require detailed technical knowledge and analytical capability on micro-economics, accounting, laws and the relevant industries.

### **2.3.2 Quality**

If the price is controlled, profits will fall, and monopolies will generally attempt to find ways to reduce costs somewhere, to maintain their profitability. The first sources of cost reduction are usually reductions in maintenance of physical plant, staffing and services. These cost reductions mean that reliability suffers. The customers cannot choose a more reliable supplier, since we are dealing with a monopoly. So there is no necessary market pressure for enterprises, and competition cannot help improve the service quality. So, as part of the responsibility to regulate the price, the regulator must also ensure that quality is maintained. These efforts to ensure good quality will mean collecting data on quality, setting quality standards, and disciplining those companies that fail to deliver acceptable quality.

In the electricity sector, the term quality covers a range of issues, and needs to take account both of technical quality (including voltage and frequency stability and absence of supply interruptions) and of quality of service (including promptness and accuracy of billing, and responsiveness to requests for service calls and complaints). Detailed issues of quality are dealt with in more detail in sub-section 4.2.

As a whole, regulatory focus on quality is therefore important for two reasons:

(1) Because certain aspects of the sector are natural monopolies, there may be a natural tendency for electricity companies not to respond to quality issues as would be the case in a

competitive market, and regulation needs to compensate for this.

(2) In addition, some forms of price regulation provide incentives to utilities to improve efficiency and cut costs, and these efficiency pressures can lead to declining quality, which needs to be counter balanced by quality regulation.

### **2.3.3 Investment**

As recent events in China have shown, availability of reliable supplies of electricity is of vital importance, and consumers' true long-term interests are best met by regulation that ensures an efficient balance between supply and demand. In particular, this means prices that are sufficiently remunerative to provide incentives to investors to invest in capacity adequate to meet demand. An important outcome of regulation should be incentives for the required investment in the sector. At the same time, this investment should be carried out efficiently and only to the extent that it is required to meet the needs of consumers. This means that regulation should also be able to intervene where investment is excessive and likely to operate to the detriment of consumers:

(1) If the service is provided by a monopoly, the regulator must control the investment by establishing that there is a need for it.

(2) If a service is provided in a competitive market, the regulator must ensure that the market is free of distortion or monopoly practices, which would tend to reduce investment to efficient levels.

These three key areas or prices, quality and investment will be discussed in detail in Chapter 4, regarding to how to apply general economic regulation principles to electricity sector reform practice in China.

## **2.4 Targets and Principles of Electricity Regulation—Balancing Various Interests**

It is common to describe the general objective of regulation as being to balance the interests of the three main groups of stakeholders, which are consumers, utility investors and government. Our assumption is that this would be true in China. In addition, in the case of China we believe that there may be other interests that need to be balanced, particularly between the different localities.

### **2.4.1 Consumers' Interests**

The main interest of the customers is in obtaining reliable supplies at minimum costs, and this emphasises the need for low prices and good quality. It is, however, important to emphasise that we should take into account the long-term interests of consumers. For example, in the short term prices can be kept low by reducing the funds invested in new facilities, and this will give consumers short-term benefits. However, this would not be in the long-term

interests of consumers because it would lead to inadequate supplies and poor quality. A regulator therefore needs to strike a balance between the short-term and long-term requirements. Sometimes in China, customers would rather obtain stable electricity supply at a higher price than have to cope with electricity shortages at a lower price.

#### **2.4.2 Utility Investors' Interests**

Investors will naturally be interested in maximising their profits, and a regulator needs to balance this against the desire of consumers for low prices. It is also important to emphasise that investors are generally not just looking for the highest possible profits, they are also very interested in stability and certainty. If a regulator can achieve a stable and predictable regulatory environment, the investor will see the sector as low risk, and that generally means that it is willing to accept a lower rate of profit, which is beneficial to consumers. A regulator therefore needs to have regard to both the return and risks for investors.

#### **2.4.3 Government's Legitimate Policy Interests**

Governments clearly have legitimate policy interests in the electricity sector, and may wish to pursue certain policy objectives, such as reducing emissions, increasing the extent of rural electrification, or ensuring low cost supplies to certain types of consumers. However, governments frequently use the electric sector to meet the needs of macro-economic policy (for example, necessary tariff increases are postponed because of inflationary considerations). The task of the regulator is to strike a balance in allowing the government to achieve its legitimate policy objectives, without unduly harming the interests of the other stakeholders.

### **2.5 Design of Effective Regulation—International Experience**

China is systematically designing regulatory institutions in this sector for the first time. There is considerable agreement among international regulatory specialists about the key general features of good regulatory design, both at the level of overarching concepts and at the practical level of procedures and methodologies. Additional detail on these aspects of typical regulatory institutions for a number of electricity sector regulatory bodies including Great Britain, the United States, Australia, Norway, Russia, Brazil, Argentina and India can be found in Appendix A of this report.

#### **2.5.1 High Level Objectives**

High level, conceptual, design issues include the fundamental questions of roles and objectives, independence, accountability etc. Should the agency be secretive or open? How much participation should it encourage, or should it just issue rules? There is significant international experience of how these choices affect the effectiveness of regulation. For example, there is close agreement between what is stated in a 1998 NERA report to the Asian

Development Bank and a recent survey for the World Bank by Kessides (2003), and on this basis we have identified the following criteria that we believe define good regulation:

- (1) Clarity of roles and objectives.
- (2) Autonomy or independence.
- (3) Accountability.
- (4) Participation of stakeholders.
- (5) Transparency of process and decision making.
- (6) Predictability.
- (7) Adequate resources, particularly professional staff.

Since these features are central to the issues and recommendations presented in this report, the features are elaborated in more detail in Appendix C. But probably the most important points to emphasise here are, ①that the regulatory body needs to have clear authority for sector regulation, independent from day-to-day interference by other government agencies; ②that the regulatory body must have clear and transparent methodologies to follow in its regulatory activities, so that private-sector investors will have confidence in its actions.

### **2.5.2 Independence**

Countries with mature market economies generally pay more attention to the issues of a regulator's independence. This is because regulation experience in these countries shows that reliability of the regulatory institutions plays a very important role in attracting investment into a regulated utility sector. It is the quality of regulation that impacts to a large degree on the companies' investment decision-making processes. It is recognised that if governmental organisations apply improper pressure on the sector regulation institutions and impact on the development or implementation of their regulation, then regulatory organizations will lose their independence and reputation. Major systematic factors that impact on the independence of regulatory organizations are:

(1) Whether the policy targets and regulation targets are clearly defined. Lack of clarity will probably cause unpredictable problems for regulatory institutions (the international experience on this issue will be discussed in detail in the next part). Lack of clarity will undoubtedly cause severe problems for investors.

(2) Whether sources of funding for the regulatory institutions are likely to impact their actions. It is therefore a very important question to decide who will actually fund the regulator and who will approve the regulator's budget. It is widely agreed that independence of regulatory institutions should be built on the base of comparatively independent sources of regulatory funding.

(3) Methods of appointment and removal of the senior personnel of the regulatory

institutions. It is a crucial issue who will appoint the head (or heads) of the regulatory institutions, and what are the appointer's rights of termination. This issue can clearly impact on the conduct of regulatory institutions.

Data in Appendix A indicates that British laws strictly define the functions of the electricity and natural gas regulatory organization, OFGEM, and relevant governmental departments, so that the regulatory institution is able to resist inappropriate pressure from other government subdivisions. The situation is similar in Australia, Spain, and Brazil.

In the United States, although it is part of the Department of Energy (DoE) the functions of the Federal Energy Regulatory Commission (FERC) are clearly legally defined. FERC ensures that prices in the electricity sector are “just and reasonable” either by controlling the prices of monopoly elements, or by supervising the markets that establish prices in the competitive parts. In practice the DoE virtually never intervenes in FERC procedures or decisions.

In Norway, even though it is an arm of the Ministry, the regulatory institution NVE enjoys very large independence in law and in its actual execution of the regulatory process.

In Russia, deficiencies in regulation cause many problems, as the independence of regulatory institutions is not guaranteed in law or in practice. Partly because of these problems, potential investors have been inhibited in committing investment funds, or have sought a risk premium. This result is not good for either the utilities or the government. It is very hard in these circumstances to provide correct incentives unless relevant reforms are carried out.

### 2.5.3 Funding

Details of the organisational structures, funding and other organisational aspects of the regulatory bodies vary by country in a way that reflects the specific circumstances in those countries.

We can see from the examples reviewed in Appendix A<sup>①</sup> that regulatory institutions in Norway, Australia and Russia all rely on governmental finance. Those in Britain, the United States, Spain, Brazil and Argentina collect their revenues mainly from the regulated enterprises<sup>②</sup>, while expenses of Indian regulatory organizations partially come from governmental appropriation funds and partially from enterprises. However, regardless whether funding is notionally from a normal governmental budget or from enterprises, these countries all strictly follow established programs for collection of revenues and budgeting of expenses. Budgets of the regulatory institutions have to be approved by the relevant government processes, and

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① See Table A.2 in Appendix A of this report.

② Though in the case of the UK, the revenue flows via the Treasury (Finance Ministry).

their expenditures have to go through relevant auditing processes.

The key role of establishing a sound legal basis for the regulatory body's revenue is as follows:

(1) To guarantee that decision-making and fundamental operation of regulatory institutions cannot be interfered with and impacted by withholding of revenues.

(2) To guarantee its annual revenue, and provide financial stability, so as to be able to attract talented professionals to the organisation and obtain necessary consulting services or information.

(3) Because it is seen as fairer and more efficient, to focus revenue collection directly on the responsible parties (i.e. electricity enterprises), rather than all tax payers.

The sources of the electricity regulator's revenues, in principle, can include all electricity enterprises, such as electricity plants and electricity grid companies.

#### **2.5.4 Central or Local Regulation**

Our review of the areas of responsibility and powers of the regulatory bodies in Appendix A indicates that in most cases the regulatory bodies (whether federal or local) have the full range of regulatory powers for the sector<sup>①</sup>. It is only in the case of Russia that the regulatory organizations are to a substantial degree subservient to the government.

As regards the split of responsibilities between Federal and local level, review of a sample of countries<sup>②</sup> shows that:

(1) In five cases (i.e. Argentina, Brazil, England Spain and Norway) the bodies operate on a single national level<sup>③</sup>, with no vertical allocation of responsibilities—these reflect the centralized governmental organisations in each case.

(2) In four cases (i.e. Australia, India, Russia and USA) there are separate federal and local regulatory entities, again reflecting the political organization in each case. In all cases, the federal level bodies are organisationally quite distinct from the local level bodies; broadly, in all cases the main regulatory powers remain at the local level; and the federal level bodies mainly have responsibilities for inter-regional issues, and for setting or recommending general policy.

#### **2.5.5 Governance**

As regards the senior managements of the regulatory organisations, the regulatory

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① See Table A.3 in Appendix A of this report.

② See Table A.4 in Appendix A of this report.

③ Brazil represents a partial exception, in that ANEEL has a number of agreements with local bodies to carry out some regulatory functions on its behalf.

systems of the countries surveyed are characterized as follows:

(1) In eight out of the nine cases, the organisation is headed by a committee of members, ranging from 3 up to 15, and that in at least seven of the cases the positions of members are protected by security of tenure of at least 5 years, as a means of protecting their independence;

(2) In all cases the members are appointed by government, in some cases in the form of the President and in other by government Ministers.

(3) In most cases, no specific qualifications are required of members, though in some cases general qualifications are specified, in terms of experience or capability in a range of relevant areas, such as engineering, law, or commerce.

(4) In most cases, the members have some form of protection from dismissal, for example in terms of dismissal having to be approved by Parliament or justified only on very narrowly defined grounds of incapacity or misbehaviour.

#### **2.5.6 Standard Processes**

In terms of decision making processes and rights of appeal by the regulated entities, our review indicates:

(1) In general there are few specific restrictions on processes, and the regulatory bodies have authority to set out their own rules of procedures, though in some cases some basic principles or general administrative procedures are specified.

(2) In most cases there is a formal route specified for appeals against the decisions of the regulatory bodies, in some cases to the Courts and in others through appeal to the Minister or to some form of designated tribunal.

#### **2.5.7 Areas of Regulation of the Regulatory Institutions**

For all the countries surveyed, the regulatory bodies have responsibilities for the regulation of all parts of the electricity sector. That means that their regulatory responsibilities cover:

- (1) Transmission.
- (2) System operation.
- (3) Market operation.
- (4) Distribution.
- (5) Retail supply.
- (6) Generation.

The form of regulation that should be applied to a vertically integrated sector with little or no competition differs from the regulation that needs to be applied to a disintegrated sector with extensive competition. However, the standard international practice is that, even though

there are some competitive markets and different activities within the electricity sector have different regulatory requirements, one regulatory institution is still be in charge of regulation across all the activities.

The different approaches that are appropriate to the regulation of these different parts of the electricity sector are discussed in Chapter 4, where we refer to international experience in a number of relevant countries.

### **2.5.8 Major Functions of Regulatory Institutions**

We have also addressed the question of what kind of functions do overseas electricity regulatory institutions have? We have found through our analysis that:

(1) All have extensive price regulatory powers, though in some cases this is shared between the federal and local levels of regulation.

(2) All have indirect powers of regulation over investment, though generally this is through their powers to control prices and regulate quality rather than through specific powers of regulation over individual investment decisions.

(3) In all cases, except the Russian federal level regulator, the organisations have at least some powers in respect of quality regulation.

From a sector regulation perspective, it is more effective to balance the interests of the various parties and promote industrial development through a process where the electricity regulatory institutions are responsible for unified economic regulation of all the activities in the electricity sector.

## **2.6 Extent of the Regulatory Body's—Whether It is Limited to the Electricity Sector**

Internationally, there are different models of regulation over the network industries and public utilities, such as unified regulation of several sub-sectors by a single regulatory entity, and separate regulation of individual sub-sectors by different regulatory entities. However, taking account of the common characteristics of the public utilities and networks within the sphere of energy regulation, energy regulatory institutions in many countries regulate the electricity sector, the natural gas sector, and in some cases the oil and district heat sectors. This combined regulation of the energy sector benefits from synergies and staff are able to share knowledge and skills in the solution of similar regulatory issues.

In the nine surveyed countries, there are 6 countries whose regulatory authorities carry out regulation in more than one area of the energy sector. Only Argentina, Brazil, and India have individual regulatory organizations for regulation of the electricity sector. Reviewing the history, one can find that Britain set up separate regulatory organizations to supervise the electricity sector and the natural gas sector during the original privatisation and reform of

state-owned enterprises in the 1990's. But, after 2000, the electricity and natural gas regulatory institutions were combined to create the Office of Gas and Electricity Markets (OFGEM).

It is suggested that along with the expansion of natural gas consumption and its growing impacts on the development of economic society, China may take account of this international experience, in particular from Britain and the United States, and consider integration of the electricity and natural gas regulatory mechanisms, so as gradually to develop a more comprehensive energy regulatory body.

Appendix A of this report contains the analysis of international experience and examples of electricity regulation. It emphasizes and discusses the differences between various regulatory mechanisms, including independence of regulatory institutions, horizontal distribution of regulatory powers, and comparisons between centralised regulation and decentralised regulation. Appendix A also describes the regulatory performance of different regulatory modes in various regulatory spheres.

## **Chapter 3 Allocation of Electricity Regulatory Responsibilities in China**

### **3.1 Review of Current Situation**

Aside from SERC, there are now many government organizations in China that have some responsibility for electricity regulation. However, their powers and methods of approach are different, and in this chapter we review each body and the overall situation. We will first comment on each of these organizations and their impacts on electricity regulation. It will be seen from this review that a key difficulty with the present arrangements is the lack of clearly defined regulatory powers in the hands of a single regulatory entity. Based on experience in other countries, there is no doubt that the present diffuse and unclear allocation of regulatory powers is potentially a major obstacle for private-sector investors when considering entry to the sector.

#### **3.1.1 The Power Sector Reform Working Group**

The Power Sector Reform Working Group (PSRWG) was established by the State Council in 2001, and the members of the PSRWG were drawn from many government departments. The PSRWG and its role were specified in the State Council Document No.5.

After the SERC was founded, the membership of PSRWG changed. The Director of the National Development and Reform Commission (NDRC) is now the group leader. SERC's Vice Chairman plays the role of office director of PSRWG, while the PSRWG's office is established in the SERC's premises. This arrangement of separating the group leader and the office director of the same working group to different departments may have implications for the efficiency of policy making and execution.

Though the office of PSRWG is now established in SERC, it seems that SERC does not play a dominant role in the reform of the electricity system. Besides designing the electricity market, SERC is not responsible for designing or leading the reform process, or for its general implementation, or for price regulation.

The PSRWG does not seem to have been active recently. It is unclear whether there will be further changes to the organizations leading the reform, but regardless whether there are new arrangements or not, it is clear that the constitution and functions of the leading organization in the reform of the electricity sector will fundamentally impact the capacity building of electricity regulation institutions in China.

### **3.1.2 The National Development and Reform Commission**

The NDRC was formed by a reorganization in 2003, and is responsible for regulation and control of macro-economy. But in contrast with most other countries, China does not have a department of energy or similar department that is in charge of the energy industry. The Energy Bureau and Pricing Department of NDRC mainly performs this function. With respect to the electricity sector, the Energy Bureau is charged with the work of long-term development planning. It approves all major investment projects, be it in generation or in transmission. NDRC also performs some other functions that in other countries are executed by the Department of Energy (or similar specialist policy organisations), including the making of general energy policies of China, forecasting demand, providing directive suggestions for energy selection, etc.

NDRC also has responsibilities as a micro-economic regulatory agency. The Department of Prices of NDRC dominates pricing issues in electricity sector reform and approves the prices that can be charged and revenues that can be received by generation companies and grid companies.

### **3.1.3 The Ministry of Finance**

We understand that in some matters, for example certain financial rules and cost standards for electric enterprises, the Ministry of Finance (MOF) has decision-making powers relating to the electricity sector. Potentially this could mean there is some partial overlapping of some of the roles that should be solely in the hands of the SERC. However, MOF has wide-ranging responsibilities across all sectors of the Chinese economy, so that it is limited in the extent to which it can focus on issues specific to the electricity sector. We recommend that this partial overlapping of responsibilities should be addressed, for example by MOF-SERC joint work to improve co-ordination and co-operation relating to the electricity sector.

### **3.1.4 Provincial Economic and Trade Commissions**

The State Economic and Trade Commission was reorganized as the State-owned Assets Supervision and Administration Commission (SASAC) of the State Council in 2003, but many provinces continue to have Economic and Trade Commissions (ETCs) that provide a local sector supervision and co-ordination role.

In practice, in some respects the ETCs appear to be carrying out many of the functions of a local regulatory agency. One of the reasons for this is because SERC has not yet rolled out its provincial and local office program. SERC is established in only a small number of provinces, and as construction of SERC regulation offices at city/county level is not yet anticipated, the ETCs are filling the gap. In the longer term, as more SERC Provincial and local offices become established, there will be a major potential conflict—assuming that the

ETCs continue to have some role for the electricity sector at provincial and local level.

### **3.1.5 The State-owned Assets Supervision and Administration Commission (SASAC)**

SASAC is a recently established Commission in 2003, which exercises ownership responsibilities over state-owned enterprises (SOEs). SASAC's functions include the supervision of the performance of SOEs, the appointment and removal of senior executives, setting out auditing requirements, approval of key decisions, etc.

As most enterprises operating in the electricity sector in China are SOEs (this includes all grid companies), the role of SASAC could be important for SERC and these two organizations may have different opinions over issues of enterprises mergers and acquisitions, performance evaluation, appointment and removal of high-level management staff, and so on.

## **3.2 Current Problems of the Functional Distribution of Electricity Regulation in China**

The existing distribution of regulatory functions for the electricity sector in China appears inefficient and inconsistent at present. The main inconsistencies and their consequences are discussed below.

### **3.2.1 Policy Making and Regulatory Function are Confused**

Most countries have a Ministry of Energy (or equivalent), which is responsible for making high-level policy decisions on electricity sector and market structure, including the degree of competition in the sector. These agencies are usually also responsible for fuel use and generation mix, the provision of forecasts and market analysis, and for energy and environmental trade-offs and guidelines, etc. The Ministry also gives policy guidance to the regulatory agency, e.g. on issues such as the desired pace of liberalisation, and subsidy and tariff policy.

For countries that now have separate electricity regulatory agencies, some of the quasi-regulatory functions that Ministries carried out in the past normally go to the regulatory agency (e.g. licensing, tariff regulation, quality regulation, etc). However, in some countries, the relevant Ministry maintains the responsibility for setting regulatory methodologies.

China has set up specific responsible electricity regulatory agencies, but there is no equivalent comprehensive policy-making entity for energy or electricity. NDRC seems to be responsible for the making of policies for the energy or electricity sectors. At the same time, it carries out some core functions of the electricity regulation agency, such as the key regulatory function of electricity pricing, so its policy establishment capacity is obviously impacted. The consequence is that there is a very confused boundary between policy and regulation as reflected in:

(1) The capacity for making macro policies for the electricity sector and for sector planning activities is seriously weakened.

(2) The overlap in regulatory functions between SERC and NDRC will inevitably reduce

regulatory efficiency.

### **3.2.2 Planning Approvals and Investment Supervision Functions are Confused**

In China, there is no “Ministry” which is responsible for making policy for the sector beyond the limited NDRC function. Similarly, the grid companies do not seem to have the clear responsibility either for planning or for implementing system expansion plans. NDRC is more concerned with approvals of individual investment projects than system expansion plans. It is responsible to approve investment for specific projects; the latter involves much detailed analysis, which will of course occupy much of its attention. In fact, in China investment approval for specific projects is often regarded as a major part of regulation because of its direct connection with users’ interest such as electricity sector costs, system reliability, etc.

Even after the establishment of SERC with specific responsibilities for electricity sector regulation, NDRC still handles both planning approvals and specific approvals of investment plans. This has confused regulatory roles, and has meant that NDRC can neither manage the planning nor exert its own functions of project approval effectively due to the unavoidable inconsistency between general investment supervision objectives and the specific issues and targets in the sphere of electricity sector regulation.

### **3.2.3 Tariff Regulation Functions are not Allocated Properly**

Though a specific electricity sector regulation institution has been established in China, in the form of SERC, this institution can only provide suggestions in most cases in respect of tariff regulation. NDRC maintains almost all the regulation powers over the regulation.

In many countries, relevant Ministries (often including the Ministry of Finance) are involved, jointly with the regulator, in constructing tariff making methodologies. This is particularly helpful in countries where new regulatory agencies are being established. But in these countries, concrete decision-making on tariff regulation is usually performed by regulatory organizations that have specific responsibilities in this area. As mentioned above, tariff regulation is the core of regulation in respect of monopolistic electricity enterprises regulation. It is logically inconceivable that the specific responsible regulatory organizations would have no decision-making power over tariff regulation. So, it is natural that China has encountered misunderstandings over regulation, and that disputes regarding the present operations continue. Splitting the responsibility for carrying out price regulation and other related activities runs contrary to the general rules of administrative system design, for example the need to avoid functional overlapping and to define responsibilities clearly.

### **3.3 International Examples of Relevant Issues**

#### **3.3.1 International Examples of Horizontal Allocation of Regulatory Function**

In most countries with mature market economies, there are electricity regulation institutions that are either set up within relevant departments of the government, or are separately established as electricity sector regulators, or are established jointly with energy or other public utility regulation organizations as multi-utility regulators. The precise arrangements are often related to country-specific factors such as political framework, land area, social and cultural traditions, and the reform progress of the electricity sector. But no matter what the precise set-up arrangements are, there is one common point to emphasise: all the functions of regulation are generally covered by the same institution, especially the core functions such as electricity tariff regulation. There are generally no other regulatory institutions to share the responsibility.

#### **3.3.2 International Examples of Vertical Distribution of Regulatory Functions**

In several of the countries that we surveyed, including the US and India, there are federal constitutions, and the regulatory bodies are divided on federal/state lines. Thus, for example, in the USA there is the coexistence of two distinct levels of electricity regulatory bodies: a federal regulator the Federal Energy Regulatory Commission (FERC) and state regulators (the Public Utility Commissions). This relationship has developed over a long period, and the Energy Policy Act (EPACT) of 1992 further clarified the relationship between FERC and state Public Utilities Commissions. Under the Act, FERC has complete jurisdiction over the inter-state wholesale electricity marketplace, while electricity competition at the state level would remain within the jurisdiction of the various state public utilities commissions.

Similarly, in accordance with stipulations of the constitution, India also defines the federal and inter-state regulatory functions. In 2003, India changed its electricity sector law to set up a central regulation commission, in addition to state commissions. It separated functions of electricity sector policies, electricity tariff policies and electricity sector planning between the two level regulation organizations. These cases indicate that, along with the existing federalism, every state government has obvious power to decide on the development of interior industries within the state. In Russia, central coordination of this issue seems very prominent. How to coordinate vertical power decentralization would become very important in China, as China does not have a federal constitution.

### **3.4 Recommendations for Horizontal Allocations of the Electricity Regulation Functions in China**

In the light of the discussion earlier in this Chapter, in this section we put forward a number of preliminary recommendations for the allocation of electricity sector regulatory

responsibilities in China.

### **3.4.1 Create an Energy Policy-making Function in China**

A specialist electricity sector policy-making entity should be established in China as soon as possible, after all factors to be taken into consideration and overall plans have been made. This entity should be based probably on the restructuring of the existing institutions, including the Bureau for Energy and Department of Prices of NDRC and other relevant institutions. This new policy-making entity should concentrate on:

(1) Establishing relevant policies and development strategy and planning, for sustainable development of the energy sector in China.

(2) Ensuring the security of primary energy supplies and fuel diversity in generation.

(3) Coordinating the development of the electricity sector and primary energy sources such as coal, oil and gas.

(4) Drafting relevant electricity sector regulations, and establishing relevant policies directing electricity regulations such as electricity tariff policy, etc.

It is important to emphasise that this institution should not be both a maker of policy and a practical implementer of the regulation that results.

As long as they are compatible with normal practice in China, a number of different organization forms would be possible for this policy-making institution. But the basic principle should be to centralize regulatory functions, separate administration and regulation functions, and define relative responsibilities clearly.

### **3.4.2 Establish Responsibilities for Investment Regulation**

Currently, the overall responsibility for new investment in the sector rests with NDRC, and we suggest that this needs to be remedied with the establishment of a proper “Ministry” policy-making entity with which SERC and the regional network companies (who are also currently the electricity purchase companies) can interact. In this way, these responsibilities should be more clearly established, and such a coordination mechanism of investment regulation responsibilities is spelled out in more detail in Chapter 4. In particular, we recommend that SERC’s roles and powers in this are be clearly defined. We would recommend that SERC be given the responsibility for:

(1) Defining electricity grid enterprises’ responsibilities in their exclusive areas, requiring that they should provide safe and reliable infrastructure and relevant service standards to the users.

(2) Requiring the regulated enterprises to set up reasonable forecasting, planning, and execution programs, so that they can execute their functions in the way that is in compliance with development targets and the demands of the economy.

(3) Regulating investment expenses of the regulated enterprises, so as to ensure efficiency, and to avoid unnecessary cost increases.

(4) Imposing responsibility for procurement of adequate electricity where relevant, and monitoring the procurement process.

(5) Enforcing the implementation of these investment obligations by other means if necessary.

### **3.4.3 Gradually Adjust the Allocation of Electricity Tariff and Cost Regulation Functions**

As mentioned above, electricity tariff and cost regulation is a core component of electricity regulation, and tariff regulation should not be within the sphere of macro-economy policy and control. China has established specific responsible electricity sector regulatory institutions, and tariff regulation functions shall obviously be the responsibility of SERC, in order to normalise and rationalise the distribution of government functions.

We also understand that the complete transfer of tariff regulation functions is not just an issue between the NDRC and SERC. It may also involve some adjustment to the whole government administrative system of China, including some specific electricity sector cost responsibilities exercised by MOF. In consequence a considered and careful transition process is needed. As the overall economic reform proceeds, the relevant government department (which is currently NDRC) should gradually give up its role of making individual and detailed pricing decisions in the electricity sector, and instead take the role of developing high-level policy on pricing issues. As this takes place, SERC should gradually take over the primary responsibility for price regulation in the electricity sector.

In a situation where SERC assumes major responsibilities for electricity tariff regulation in the longer term, we would also recommend that in the shorter term the key methodologies and price transition paths be developed jointly by SERC with NRDC (and any new Ministry function) and other relevant Ministries or other agencies involved in the reform process, including the proposed Steering Group.

MOF has been, and should continue to be, responsible for specifying general financial rules, accounting rules and cost standards for all companies; and the SERC should make detailed cost standards and rules for the electricity sector within MOF's general rules and standards, and be responsible for supervising their implementation by electricity enterprises. This means that SERC should have the responsibility for:

(1) Ensuring that these general rules are observed by electricity companies; and

(2) Developing and enforcing any specific rules for electricity enterprises within MOF's general rules and standards.

It should be emphasised that bringing tariff regulation and cost regulation together is critical for the development of effective economic regulation. The current situation in China,

where the responsibilities are split between NDRC and MOF, who are carrying tariff regulation and cost regulation into execution separately, is very unsatisfactory and should be changed as soon as feasible. We recommend that the responsibility for these functions should be unified and assigned to SERC.

#### **3.4.4 Coordinate Anti-trust (Competition Policy) Responsibilities**

If a specialist competition body is created, SERC should coordinate with it in respect of the electricity sector, and operate within general competition policy guidelines.

But the electricity sector operates within a closely integrated framework, so after establishing a competitive electricity market, SERC shall not only supervise the monopolistic enterprises, but also continue to carry out a leading function in respect of competition policy across the electricity sector:

(1) For the potentially competitive activities (generation and retail supply), SERC should safeguard the orderly transition to a competitive electricity market by developing rules to prevent the abuse of market power by any companies.

(2) SERC should also be authorized to play a leading role in dealing with mergers and acquisitions among electricity enterprises. For instance, SERC could play a leading role in joint handling of such cases with the relevant competition supervisory authorities.

#### **3.4.5 Clarify Responsibility for Technical and Quality Regulation**

At present there is no particular controversy about the responsibility for technical and quality regulation. However, the absence at present of service quality regulation is a very serious omission, and this is an opportunity for SERC to exercise an important new function, allowing it the opportunity to build up a positive image and realize its value within a relatively short time. SERC should establish relevant regulations as soon as possible, and at the same time build up an open program of technical and quality regulation that electricity enterprises and customers can participate in.

### **3.5 Recommendations for the Vertical Allocation of Regulatory Powers in China**

#### **3.5.1 The Importance of the Vertical Distribution of Regulatory Power in China**

It can be seen from the international experience surveyed in Chapter 2 and Appendix B that in other countries there is generally a clear division of powers between central and local supervisory organizations in federalist countries. Viewed in the context of China, the most basic regulatory tasks, especially the electricity distribution and sales regulation tasks, cannot be completed by SERC and its six regional agencies under present conditions because:

(1) China is a very large and geographically diverse country, and the electricity sector's

scale and economic size are very large. It is clear that it would be impossible to exercise effective control from a central office and six regional agencies, and a more comprehensive range of offices spread around the country is therefore essential.

(2) China has very sharp differences between regions. Different regional electricity enterprises operate in different conditions. It is therefore necessary to authorize local regulatory institutions with responsibilities so as to be able to adjust measures to local conditions.

(3) Electricity distribution (including electricity sales at present) is a monopolistic operation. The price, reliability of supply, electricity quality, service quality etc. of the electricity sector are all in need of effective regulation. These matters all apply on a local basis, often across more remote cities and counties. Some specific regulatory functions are currently split among government departments at county level. Even though their regulatory methods and measures often fail to meet the needs of modern regulation in a market-oriented economic system, sometimes through a complete failure to regulate, this emphasises the need for local offices. With improved procedures and SERC local offices, the results of electricity sector regulation will eventually be apparent in the outcome of this process in these local areas. As organized at present, SERC and its regional agencies (even through provincial regulatory organizations) are generally too remote from consumers to be able to help with these matters.

**3.5.2 Concrete Suggestions for the Vertical Allocation of Regulatory Powers in China**

Figure 3.1 shows an outline of our proposed outline for the vertical allocation of electricity regulatory institutions in China, involving four levels, that is the Head Office, Regional Offices, Provincial Offices and City and County offices.

The Local Offices at City and County level envisaged in Figure 3.1 would help execute and strengthen the regulation of local electricity enterprises. Considering Chinese circumstances, these local offices are important given the large geographic and demographic size of Provinces. In addition, their existence should ensure that SERC has adequate representation at local level. These local offices can, in our view, be relatively small and might typically have between 3 and 5 suitably qualified and experienced staff members per office.



**Figure 3.1 Proposed General Framework for SERC Offices**

We emphasize that, in following the above or other similar structures, SERC should invite regional and provincial regulatory organizations to participate extensively in an open discussion program and process when it formulates general regulatory methods, regulatory frameworks, and market regulations.

It will be important that the detailed allocation of functions reflects the specific

circumstances region by region, and province by province. Thus, for example, in regions where a regional electricity market is in operation or under active design, the regional office would take the lead in the regulation of the market and the transmission system. In other cases where there is no regional electricity market, the regional office would have a smaller role, probably limited to establishing policies and guidelines. In these cases, it would be the provincial offices that would play a more leading role in the regulation of local markets and provincial transmission system.

The scope of the activities of provincial offices would also be affected by the existence of provincial electricity markets. Where a province-level market exists, the provincial office would handle its regulation, subject to national policy and guidelines.

In general, electricity sales regulation would be overseen at the provincial level, subject to national guidelines. Implementation could be at the provincial level, but generally is probably more efficiently carried out at the local level. Similarly, much of the detailed implementation of quality regulation would be carried out at the local level.

For the transition period, the proposed detailed allocation of functions is illustrated in Figure 3.2.

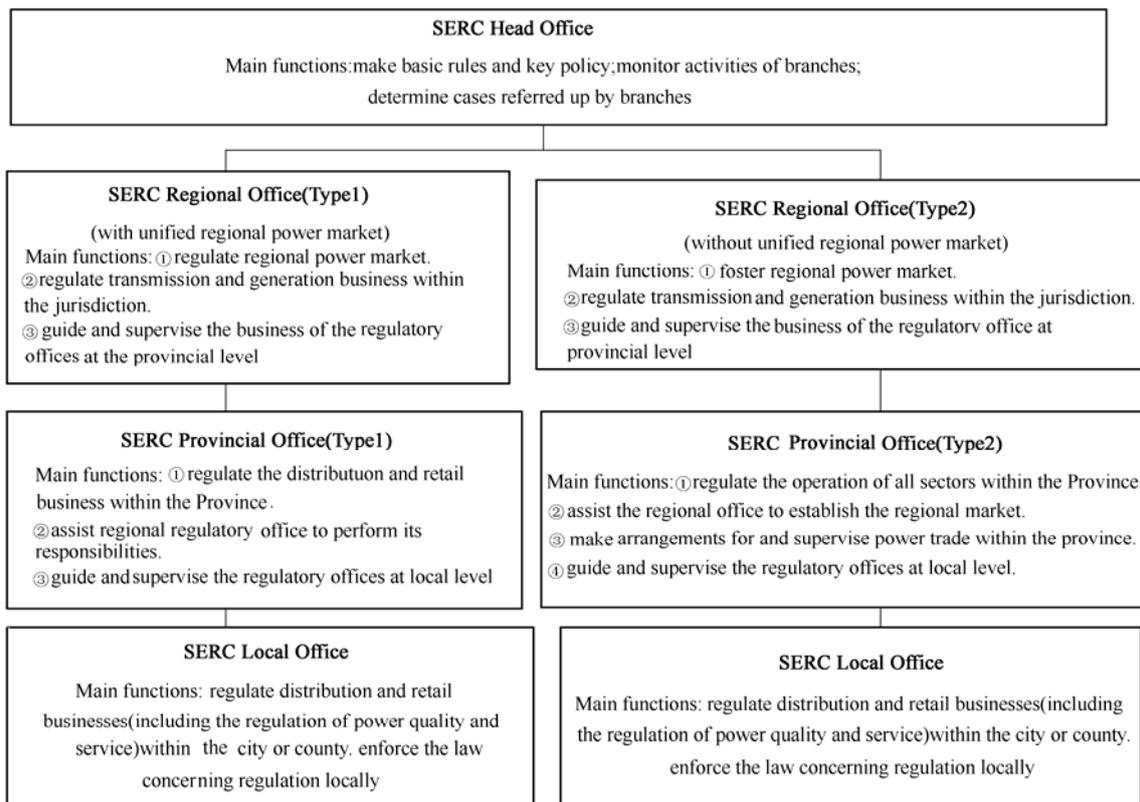


Figure 3.2 Proposed Detailed Allocation of Functions

## **Chapter 4 Basic Methods for Electricity Sector Regulation**

After discussing what regulation is, what is to be regulated, and who will execute regulation, we now turn to the issue of how to regulate. Regulation of the monopolistic parts of the sector and promotion of competition are really quite different activities, and it is convenient to separate the discussions of them. In this Chapter 4 we describe the main approaches that are suitable for regulation of the monopoly activities, including price control (or tariff regulation), licensing of businesses, quality and investment regulation, and also the special problems of regulating a state-owned enterprise. Chapter 5 discusses the role of the regulator in the competitive activities.

In this discussion of methodologies, it is again important to emphasise the point made in previous Chapters about the need for clarity and consistency. Potential private sector investors need to see regulatory processes that are transparent and predictable, and that provide a reasonable opportunity to make a return on investments. A single national agency like SERC, equipped with suitable regulatory mechanisms, can provide this transparency and predictability.

### **4.1 Tariff Regulation in Economic Regulation**

#### **4.1.1 The Importance of Tariff Regulation in Economic Regulation**

One of the basic functions of prices is to guide reasonable and efficient allocation of resources. However, companies with monopoly positions, and especially those which sell a product that has become an essential commodity, can obtain excessive profit by way of excessive prices, or allow costs to increase to unreasonable levels, causing waste. This results in efficiency declining, and in an inefficient allocation of resources, with an increased burden to customers. That was the initial impetus for regulation of electricity prices all over the world to restrain the monopoly power of the utilities.

However, tariff regulation does not mean “the lower the better”. Since the electricity sector is so large and important, retail electricity prices are sometimes controlled by the government at too low a level, in order to restrain inflation. This can starve the sector of investment funds, and lead to shortages. The position that has emerged is that tariffs should not be constrained by political considerations, nor left to the monopolist, but that they should

be based on cost to achieve reasonable and efficient allocation of resources.

#### 4.1.2 Key Features of a “Good” Tariff Regime

Tariff regulation is the source of funds for the sector. It is fundamental to the commercial viability of a electricity sector and to protecting consumers’ interests. Even where private generators participate on the basis of Power Purchase Agreements (PPAs), tariff regulation is vital for investor confidence, as it will affect the viability of the PPA purchaser. “Good” tariff regulation is therefore vital in promoting the confidence of investors and consumers in the regulatory arrangements, and its key features are.

(1) Transparency, consistency, and predictability are the primary features of successful tariff regimes. Long-term investors need to know that they can expect reasonable regulation of tariffs in the long term. That requires transparency of process and a guarantee of consistently reasonable behaviour. It is particularly important to avoid the possibility of arbitrary or opportunistic behaviour by the regulator. Ideally there should be a legal requirement that tariff regulation processes are to be conducted transparently and according to clearly specified rules. There may be a trade-off with flexibility, but in establishing initial confidence in the regulatory regime, transparency of process is important.

(2) The right to reasonable cost recovery. Investors have a right to expect cost recovery, providing they operate efficiently and reasonably, and so it is important to establish this right to reasonable cost recovery in a way that cannot easily be over-turned. At the same time, there needs to be clear powers on the part of SERC to disallow any costs that are found to be unreasonable. Ideally, this right would be made clear either in the law, or in the licence, providing the licence cannot be easily changed.

(3) “Incentive compatible” . Use of incentives for efficiency should be part of the mandate of the regulator: It should be the regulator’s responsibility to ensure that in establishing tariffs or regulating quality, the rules are “incentive compatible” (by this we mean that the incentives that are imposed on the sector by the tariff regulation encourage efficient behaviour).

#### 4.1.3 Basic Methods of Electricity Price Regulation

Tariff regulation is divided into two distinct aspects: regulation of average electricity price levels (total income), and the structure of electricity prices:

The level of the tariff (the average revenue per kWh) is crucial to the financial viability of the companies. It is what enables the criterion of “reasonable cost recovery” to be met. The average revenue per kWh multiplied by total sales of kWh is the total company revenue: in setting the tariffs the determination of total allowable revenue is the first step (in the USA this is known as the “revenue requirement”). It is usually determined by the utility’s asset base,

the depreciation and rate of return that the utility is allowed to earn on this asset base, and its reasonable operating costs. If the utility is allowed to recover this revenue requirement then it will be viable and will be able to invest and grow. If the overall level of the tariff is too low, it will induce wasteful consumption; if it is too high it will impede economic growth.

The tariff structure is also important to a utility, but for different reasons. Once the total amount of money in the revenue requirement is set, it has to be allocated to different customers and different services. The components of the tariff are called the tariff structure. Just as the overall tariff should reflect cost, the components of the tariff should reflect the component costs, and particularly the marginal or incremental cost—the amount that additional amounts of this particular service will cost. This is what makes tariffs incentive compatible and efficient. For example:

(1) The retail tariff should be structured by voltage level, since it costs less to provide electricity at a higher voltage, to encourage high voltage connections.

(2) It should be differentiated by time of use to reflect cost differences between peak hours and low use hours, to encourage off-peak use.

(3) The transmission tariff should reflect the marginal cost of using the transmission system (congestion and losses) as well as the cost of building the system. This leads to “locational energy prices” that are a big incentive to use the transmission system efficiently.

A number of different tariff structures may all be quite capable of allowing recovery of the utility’s revenue requirement, and to that extent the structure may seem of secondary concern to the utility. But even where the tariffs allow full revenue recovery, if the components of the tariff structure are not cost reflective then important distortions are introduced.

#### **4.1.4 Principal Methodologies**

There are two principal methodologies of tariff regulation that are widely recognised as competing approaches to the problem of determining a utility’s permitted revenue:

(1) Rate of Return Regulation (RoR).

(2) Price Cap or Performance Based Regulation.

These are described in turn in this section, where we conclude that a combination approach is optimal. In both cases, the question of tariff structure needs to be dealt with separately.

##### **4.1.4.1 Rate of Return Regulation**

The traditional US framework for setting electricity prices is RoR regulation, which is sometimes referred to as cost-plus regulation because the regulated entity is able to collect from its customers all its prudently incurred costs plus a regulated return on its prudent investment. In general, this method sets the total allowed revenues (or revenue requirement)

of the utility according to the following formula:

$$RR = [RB \times RoR] + E_D + E_{O\&M} + T$$

Where:

$RR$  = the total annual revenue requirement of the utility;

$RB$  = the rate base (required investment) of the utility;

$RoR$  = the allowed rate of return (debt and equity) on investment;

$E_D$  = annual depreciation expense;

$E_{O\&M}$  = annual operation & maintenance (O&M) expense;

$T$  = annual taxes paid by the utility.

Under this general framework, the utility has the burden of proving to the regulatory body's satisfaction that each proposed element of the revenue requirement formula is a prudently incurred cost required to serve the public's electricity needs. For example, investments made in capital plant must be shown to be "prudent" and to be "used and useful" in the provision of electric service, in order to be included in the  $RB$  term. Similarly, individual operating expense items (including purchased electricity costs) must be shown to be prudent and necessary for the provision of service in order to be included in the  $E_{O\&M}$  term.

The revenue requirements of the regulated company are set based upon the values for the terms in the formula during a Test Year, usually a past year adjusted for known and measurable changes so as to reflect conditions expected to prevail during the time the proposed tariff will be in effect.

There are several advantages of RoR regulation:

(1) This approach fixes prices based upon a "test" year and they are unchangeable until the next tariff review. After prices are set, the regulated entity's actual rate of return will vary, depending upon variations in costs and sales, and upon the company's ability to control those costs which can be controlled.

(2) And as a result of the first, there is some incentive for the utility to minimize costs between tariff reviews, as this will increase its profits for the period before the next review. This incentive will be higher the longer the period between those proceedings.

(3) Non-economic goals (from the electricity sector point of view), such as price relief for some categories of consumers, are easiest to meet using this system.

(4) The hearings on tariff changes provide consumers with frequent forums to present their views regarding the performance of the regulated utility.

This approach also has several disadvantages:

(1) Its cost-plus nature blunts the incentive for the utility to minimize cost in the long run. There is a tendency to "gold plate" investments, and make them more expensive than they need to be. One utility executive explained "I even get a rate of return on my office desk, so

of course I have a very nice desk”.

(2) If the allowed rate-of-return is less than the actual cost of capital then there will be a disincentive for the utility to build plant which is essential, and vice versa.

(3) Because the regulated firm may worry that high performance may lead to more strict regulation of profit, its incentive will be distorted, i.e. a ratchet effect lowers incentives to perform well.

(4) There can be fairly high administrative costs associated with frequent regulatory scrutiny of all utility costs in this system, and the hearings can be time-consuming.

These disadvantages can be minimized when RoR regulation is combined with elements of the UK-style Price Cap Regulation (sometimes called Performance Based Regulation or PBR).

#### **4.1.4.2 Price Cap or Performance-Based Regulation**

Price Cap is a modification of RoR regulation, and many variants on it have been adopted in different jurisdictions. Under a Price Cap system, the period between regulatory reviews (sometimes known as “regulatory lag”) is extended, in order to provide better incentives for the regulated entity. At pre-set intervals (3~10 years), baseline rates are reset using Rate of Return principles. Between these baseline tariff cases, tariffs are adjusted based on specific formulae that include as variables measures of the utility’s performance, cost indexes, etc. Price Cap seeks to eliminate some of the regulator command and control aspects of Rate of Return regulation and substitute for it a system of incentives or penalties for performance based on de-linking costs and prices for a longer period.

An advantage of a good Price Cap regime is that a definite incentive for cost minimisation, and improving service quality can be built into the system. Secondly, an effective Price Cap system may reduce the need for frequent tariff filings which would lead to reduced administrative costs.

#### **4.1.5 Types of Tariff and Their Regulation**

Based on experience abroad it is possible to identify four distinct tariff components that are typically regulated:

##### **1. Generation Tariffs**

(1) Generation tariffs such as those that exist in China are relatively rare. Where electricity markets exist there are no generation tariffs, but market prices which ideally are not subject to regulation. Buyers are the final consumers or Distribution companies; sellers are the generation companies.

(2) If there is a single buyer there are usually Power Purchase Agreements (buyer is the single buyer, sellers are the generators) which are long-term contracts; these may have different prices depending on when they were made. The prices are usually determined by a competition (auction, or public bidding) for the PPAs. The regulator would monitor and

approve the fairness of the auctions.

## 2. Bulk Supply Tariffs

There is often a separate bulk supply tariff (BST). The seller is the single buyer, and the buyers are the distribution entities or large consumers. The BST should reflect the costs of meeting the purchaser's load. Because the BST is generally charged by a monopoly single buyer, it is normal for it to be regulated. The BST may or may not include the transmission cost, but the general principle of regulation is that the BST should allow the reasonable costs of the single buyer to be recovered in the BST.

## 3. Transmission Tariffs

Where there is a competitive generation market, and so there is open access to the transmission system, separate transmission tariffs must be charged for the use of the transmission system. But even if the generation markets are not competitive, the transmission companies need revenues of their own; they need a tariff which can be charged to the distribution companies and to the generators. The structure of transmission tariffs differs widely from country to country, as different methodologies are applied to reflect the type of market in operation and other specific circumstances in the country. On the other hand, there is a much greater convergence of views on the general approach to determining allowed revenues, based on the approach to operating costs and capital costs that has been described above. What differs from country to country is whether rate of return regulation or price cap regulation is applied.

## 4. Distribution Tariffs

There are some similarities between transmission tariffs and distribution tariffs in the way that allowed revenues are often determined, but there is more convergence of view on the structure of the distribution tariffs. As with transmission revenues, there is significant convergence of views on the general approach to determining allowed revenues, based on the approach to operating costs and capital costs that has been described above, with differences from country to country is whether rate of return regulation or price cap is applied. As with transmission, in circumstances where there is no open access, it will not be necessary for a separate tariff to be charged to the customers, but the costs of distribution must be measured and incorporated into the final price.

## 5. Retail Tariffs

Retail tariffs, that is tariffs charged to final consumers, are a combination of the components of cost incurred by the distribution company i.e. generation, transmission, and distribution costs. Providing all the external costs incurred have already been subject to price regulation at some point, then the norm would be to allow the costs to be passed through, regulation to end users.

## 4.2 Quality Regulation

As noted earlier, when prices are subject to regulation there will likely be a tendency for quality to decline, as a way of reducing costs. This likely effect is clear and generally accepted by specialists in regulation, and it is therefore recognised that the regulation of price needs to go hand in hand with quality regulation. In competitive industries, competition based on quality is usually one of the main elements of competition. In natural monopolistic conditions, there is almost no market pressure for enterprises to maintain high product and service quality; price control will encourage the network sector to reduce costs, and this can be achieved by way of quality reduction.

Price regulation therefore makes no sense if there is no requirement for quality. In this section we discuss the nature of the measures that are typically applied, and also the institutional framework that might be used to apply it.

In the electricity sector, quality is a multi-faceted issue, and needs to take account both of technical quality and of quality of service. To ensure that the interests of customers are protected, a range of measures are likely to be necessary, and these are outlined below.

(1) Technical quality. The imposition of two sets of measures is commonly used to ensure technical quality, that is:

1) Planning standards and investment obligations in respect of transmission, distribution, and generation to ensure that new capacity is planned and installed to a minimum standard.

2) Operating codes, and in particular the introduction of a Grid and Distribution Codes, that require the systems to be operated in ways that are aimed to ensure certain minimum standards of operation and maintenance, including the technical specification of the supply to final consumers.

(2) Service quality. Here it is common to impose minimum standards of service to consumers in such matters such as interruptions, time to connect new service etc. Three sets of quality measures are commonly applied by regulatory bodies:

1) Overall service standards: These are service standards that are specified in terms of the overall level of service, rather than the service to specific consumers. Such a measure might, for example, specify a maximum level of consumer interruptions in terms of lost load. Failure to achieve these standards could be punished by financial penalties, through reductions in the utility's allowed revenues.

2) Guaranteed service standards: these specify the standards that individual consumers can expect, for example in terms of maximum length of interruption on any occasion. Because these apply to individual consumers, it is possible to provide for penalties, in the form of compensation payments to individual consumers for failure to meet the standards.

3) Codes of practice: these can be applied to a range of matter, for example in respect of

complaints handling procedures, rules governing disconnections, or services that must be offered to special consumer groups.

Though in the case of the overall service standards and the guaranteed service standards we mentioned the possible use of different types of financial penalties or compensation payments, care needs to be taken in the application of such measures. The principal objective is to achieve a satisfactory standard of service, and if a utility is penalised to an excessive extent these penalties may prevent the utility from being able to invest to make improvements in service.

### (3) Obligations to Serve.

The third issue regarding quality is service obligations. In some countries there are “universal service obligations”, where all consumers within a utility’s service area have a right to receive a connection or supply if they require it. Depending on the characteristics of the sector, such an obligation might or might not be appropriate. In the case of China it will be necessary to consider the extent to which such obligations can be applied.

## **4.3 Investment Regulation**

### **4.3.1 Investment Regulation for Electricity Generation**

The issues of who should decide about investment in generation are much more contentious than those in Transmission and Distribution, and practices vary widely across the world. In vertically-integrated systems, the norm has been to specify generation planning standards that are aimed to achieve certain standards of security, and the utility will be expected to comply with such standards. Standards of this sort would also commonly apply where there is a single buyer arrangement. In countries where generation competition has been introduced, practice varies widely. For example, in the UK decisions about the quantity and type of generation investment are left wholly to market forces and no other measures are applied to either incentivise or limit the quantity of new generation investment. In other areas, for example parts of the US, concerns about adequacy of generation investment have led to the introduction of generation capacity requirements being imposed on the so-called “load serving entities”, that is retailers.

In those parts of China (if any) where generation is still run as a monopoly, the planning and approval considerations outlined in this report for transmission and distribution will apply. In the competitive cases the issues surrounding capacity requirements or capacity payments are considered in the Chapter 5. But the main point about investment approvals for generation can be briefly raised here.

(1) In the fully competitive case there will still be a need for generators to sign up to technical standards and to agree to follow the rules of the market (the trading arrangements).

(2) The generators will still need to be licensed, so that if they fail to obey the rules their licenses to operate can be revoked.

(3) They may also need to get siting approvals, environmental permits and so on.

But in the competitive case there should be no need for analysis of financial viability of investment. The existence of competitive markets should ensure that generators enter the market if they think they can make a profit; it should ensure that quality is maintained, and that expenditures are not excessive. However, this involves ensuring that the pricing mechanisms in the trading arrangements are capable of doing the job of signalling the need for investment. This also raises the issue of “capacity payments”, which we discuss this further in the next chapter.

#### **4.3.2 Transmission and Distribution Investment**

In principle, Transmission and Distribution investment could be competitive, but it turns out to be very complicated to do so. The centralised approach to network expansion is still used more or less everywhere.

Typically, the procedure for regulating investment in other countries will be that the system operator or network owner (often with the regulator) draws up a set of rules for identifying, evaluating, building and charging for required new facilities that are necessary in the public interest. In the UK, transmission planning standards are imposed on the transmission utility, and the investment programme that those standards require are recognised in the price regulation that is imposed. Similar systems apply in many other countries. In Argentina, private investors may build transmission lines; in the USA several have been proposed and one line has actually been built, although privately built lines are not expected to be a major trend. In each case the regulator has to be heavily involved with the expansion plans and pricing.

There are two separate aspects to the regulation of investment in these network areas: the process of deciding what investments are necessary, and the process of approving specific investment proposals. Since we have discussed the investment approval process in Chapter 3, here we concentrate only on the process of deciding what is needed.

#### **4.3.3 Agreed Investment Criteria and Obligations**

It is desirable to establish a clear regulatory approach towards the investment programme of the monopoly utilities and the obligations they must meet. Because they are natural monopolies, an underlying assumption is that it will be necessary to apply performance standards to the operation of the networks, to ensure that customers receive an adequate standard of service. Such an approach could consist of:

(1) The performance standards, which might be set up as allowable hours of outage, or

deviations from a frequency band, or voltage limits. There would be obligations on the transmission and distribution companies and specified in their comprehensive licenses (which would allow for different standards in different regions, according to the type of terrain and the extent of electrification).

(2) In this new more market-orientated environment it is also important to ensure that there is effective coordination between generation and transmission investment decisions. If investors in generation are able to make their own decisions about timing and location of new plants, it is important that grid companies are given obligations to respond to the requirements of these investors and provide the necessary transmission infrastructure.

However, these obligations and performance standards alone may not be sufficient to ensure adequate investment, and they may need to be supplemented with regulation of investment plans, to ensure adequate investment. This will require:

(1) Agreed planning methodologies and technical standards that should be followed in the development of the system.

(2) An agreed source of macro-economic assumptions about the rate of economic growth in the economy as a whole and by region, and the course of interest rates and inflation.

(3) An agreed evaluation methodology to be followed in determining whether specific investments should be proceeded with. The methodology might take the form of a standard cost-benefit analysis that evaluates the proposed additions by the amount of outage they avoid and the savings in fuel costs through the reduction of congestion and line losses. The problems that may arise are those of identifying and verifying which investments are cost effective and should be undertaken, and also of deciding how to allocate the costs to the market participants.

(4) Following from the above, a regularly updated and agreed investment program and plan.

(5) Implementation of the plan, with investment approvals for specific elements as they are prepared.

#### **4.3.4 Suggestions for a Coordination Mechanism for the Existing System Planning and Investment Regulation in China**

Based on the practical situation of China, we suggest that it would be appropriate to introduce the following work division and approach to coordination for system planning and investment regulation:

(1) As it is responsible for electricity system security, decision-making powers for security levels and the required investments should belong to SERC, though this needs to be

carried out in consultation with NDRC.

(2) Obligations and performance standards should be developed by SERC in conjunction with the licenses.

(3) Macro-economic forecasts developed by NDRC would be used in the drawing up of electricity development plans.

(4) The grid companies to continue to draw up electricity system development plans, based on macro-economic forecasts developed by NDRC.

(5) The Government energy administrative department in charge would be responsible for final approvals of electricity development planning, including listening to views from other industries and governmental subdivisions.

(6) Once approved in accordance with this process, implementation of the network development plans would be the clear responsibility of the electricity enterprises, under the oversight of SERC.

#### **4.4 Licensing of Operations of Electricity Sector Entities**

Licensing of all operations of electricity sector entities is a common tool for enabling a regulator to control the entry and exit of participants in the sector, and to control their behaviour. It gives the regulator a powerful enforcement tool because:

(1) No entity can function legally in the sector without a license, and that can only be granted by the regulator; and Failure to comply with the conditions would mean revocation of the license by the regulator.

(2) This approach should normally be sufficient to enforce compliance from the entity. There is no doubt that the regulator, as the entity responsible for the sector, should have the ultimate authority over the issue of licenses, and that is the commonest approach internationally.

(3) In some cases there may be an administrative requirement that the license formally be issued by a government department (for example in Greece), but even in such cases it is still important that the regulator retains control over the content, issuing, and enforcement of the licenses.

Their use is not universal, however, and, for example in the USA where private sector utilities have been regulated for many decades, general legislative powers rather than licensing are used as the means of exerting regulatory control.

In China, SERC's power to issue licenses has been defined in Electricity Regulations and documents of the State Council. There are a series of questions to consider on the design of a license system in this way, and we will discuss these questions here and propose suggestions.

#### 4.4.1 Licenses Can be Short or Comprehensive

There are two main options for the form of licenses: “Short licenses” or “Comprehensive licenses”.

(1) Option 1. “Short licenses” are no more than a page or two, and simply grant the licensee general rights, these rights being subject to substantive conditions that will be specified in other relevant regulatory documents, such as secondary laws, regulations, rules, etc., such as a condition to comply with all sector codes;

(2) Option 2. “Comprehensive licences” contain most or all of these substantive conditions that will apply to the particular licensee; these are likely to be lengthy documents, particularly in some cases. The most important of these specific conditions is the tariff determination for a particular company—in a comprehensive licence the prices the company is permitted to charge are part of the license; in a short license these prices appear elsewhere. But the licenses will also contain references to specific duties not imposed on other companies, etc..

Internationally, Option 2, the Comprehensive License, is the more common choice of regulators, and it has the significant advantage that it brings together in a single document the terms that apply, so adding to the transparency of the system. We recommend that Option 2 should be followed in the case of China. If this option is followed, we recommend that SERC start work on the development of “model” licenses that would be used in each of the main sub-sectors. Examples are of common core conditions and specific conditions are given later in this section.

#### 4.4.2 Licensing is Specific to the Activity

An important distinction is between the different licensing processes that need to operate in the natural monopoly sectors (transmission and distribution), compared to the potentially-competitive sectors (retailing and generation). The content of licenses will differ between sectors, and it is therefore recommended that licensing should apply separately to the following four sectors:

(1) Generation—this type of licensing would be relatively light-handed, and ideally the licenses should be offered to any qualified company wishing to enter, in order to facilitate competition.

(2) Transmission—this type of license would be substantially different from generation licenses, as (i) the issue of transmission is likely to be limited to the incumbent companies, with no new entry, and (ii) there would need to be very tight regulatory controls, including price and quality regulation conditions. The transmission license normally covers such issues as:

1) Duty to offer definite terms for connection and use of the licensee’s system—this will

be a necessary obligation to ensure competition in generation;

2) Grid Code Preparation—if it is anticipated that a grid code will be in place to regulate the use of the transmission system, then provisions will be needed to set out the process for preparation and modification of a Code. (Note for other licensees there will also need to be a requirement for the licensees to comply with the Code in so far as it is applicable to the license holder).

3) System planning and security arrangements: provisions need to be made for the planning, development and operation of the licensee's system which should comply with given system and security standards. This needs to make clear responsibility for the expansion and development of the transmission system.

(3) Distribution—this type of license would have some similarities to the transmission license, in that this also is a natural monopoly function, and (i) the issue of distribution licenses is likely to be limited to the incumbent companies, and (ii) there would need to be very tight regulatory controls, including price and quality regulation conditions. However, in the case of distribution there will need to be more extensive conditions dealing with customer service and other matters.

(4) Retailing—in the longer term, this type of licensing could also be relatively light-handed, with licenses available to any qualified company wishing to enter, in order to facilitate competition. However, in the short and medium term this light-handed approach will not be appropriate, with only limited competition being possible.

Where a company covers more than one of these sub-sectors, it will need to be issued with separate licenses or a combined license covering the sub-sectors separately. For instance, in the UK the electricity distribution and retail license were originally combined in a single license for electricity supply, but with increasing unbundling these have now been separated into separate licences.

#### **4.4.3 Exemptions and Exceptions**

In most countries where licensing applies, there are some exemptions from the normal licensing provisions. Specific examples of where exemptions could be granted include:

(1) The supply of electricity in multi-occupancy buildings where the building owner resells electricity only to tenants.

(2) Very small generators (for example less than 1 MW capacity) that sell only to a local licensed distribution entity, could be exempted from the normal licensing rules.

(3) Generators that produce only for consumption within their own premises could, subject to size limits, be defined as exempt from generation licence requirements. In this case, larger size limits could apply (for example 50 MW or 100 MW), providing they do not sell to

the system, or operate in a way that affects the system adversely.

The need to grant exemptions can be very important in order to avoid a regulator being overwhelmed with large numbers of small licence applications that would not be cost effective to process or enforce. To retain flexibility, we would not recommend that the details of the exemptions themselves be specified in the law.

However, these exemptions could be handled by:

Option 1: Giving certain discretion to the SERC to grant exemptions where it considers it desirable to do so (within a very broadly defined framework).

Option 2: In the Electricity Law empowering the relevant government entity to make an “exemption regulation” or rules on licensing, in which the scope for granting of exemptions by the SERC in strictly defined and limited circumstances.

In general, there are arguments in favour of keeping regulatory discretion to a minimum, which would favour Option 2. The Electricity Law should say clearly what activities need to be regulated (and hence licensed) and should specify the conditions for exemptions to be granted.

#### **4.4.4 Processes for Issuing, Amending and Revoking Licences**

In the interests of transparent and predictable regulation, it is important that the processes for issuing, amending, and revoking licences be clearly set out, and be as open as possible. For example, for issuing licences, the process should as far as possible set out the following, ideally in detailed rules made under the Electricity Law:

(1) Application criteria and requirements—these could require the applicant to fill in a detailed application form with details of its sector experience, financial status (audited accounts) and corporate information (at the least), etc.

(2) An application process that is clear, structured and public, indicated by:

1) Publication of the application, for example, in sector press or national/local newspapers.

2) Consultation with the sector (either by way of inviting comments or by open hearings) by the Regulatory Commission for a given time period after submission of an application.

3) Giving notice of the decision to grant a license or withholding the granting of the license with reasons.

(3) A common scale of fees to be levied in all cases should also be published.

Similarly, the Regulator should have the power to amend conditions of licenses as necessary and in accordance with the provisions of the law and regulations where it is in the public interest to amend them.

There should be rules relating to license amendments that are evenly balanced, so as to allow the licenses to be amended where required but also to provide a degree of protection for

the licensee from arbitrary changes. Licenses can normally be amended either at the request of the licensee, or at the instigation of the Regulator.

Where the licensee puts forward a proposal to amend a license, the Regulator should have a duty to consider it and reply within a definite timescale. Or, the Regulator can begin the process of amendment. In either case, whoever is the instigator; the Regulator should be obliged to publish notice of its intention to amend a specified licence, and should be obliged to consider representations made within a specified time by any person. The consideration should in all cases be in accordance with the regulator's procedures (preferably involving a public hearing) and the regulator should publish its decision, with explanations.

#### **4.4.5 Common Core Conditions**

Though licenses differ for different types of entity, there are a number of common core conditions that will be found in all licences, such as:

(1) Scope—this condition would refer to the activities which the licensee is authorized to conduct, and the geographic area in which it may be conducted.

(2) Duration of the license—this is an important issue, as in general it will be desirable for the term to be long enough to provide some commercial certainty for the licensee, and for renewal to be permitted either automatically or subject to a detailed review, or by means of a reapplication procedure.

(3) Modification and revocation—if appropriate, this would refer to the SERC's powers to modify or revoke the licence.

(4) Provision of information to the SERC—as the SERC will have an important monitoring role to ensure that license holders comply with the terms of their licenses, it should be made clear in a licence condition that the licensee must provide any information to the SERC requested, subject to any necessary confidentiality conditions.

(5) Separate accounts for separate businesses—it is important that electricity licensees are subject to a requirement for total separation of accounts in order to avoid discrimination, cross-subsidization and “inter-dependability” of the businesses. This condition would reiterate that where a licensee operates in more than one sub-sector of the electricity sector (that is transmission, distribution, generation or retail), separate accounting information must be prepared and submitted. These accounts must also be separate from any accounts for activities in other non-energy or non-regulated areas.

(6) Prohibition of cross subsidy—it also needs to be made explicit that the licensee must ensure that there is no cross-subsidy between the licensed activity and any other activity of the licensee, whether or not regulated.

(7) Licence Fees—if that is an appropriate means of funding SERC then there will need to be a condition regarding levies or fees on licensees.

(8) Assignment/transfer/change of control—the licence will need to ensure that the licensee has an obligation to notify the SERC and seek approval for assignment/transfer of licenses or change of control of the utility following a merger or a corporate acquisition.

(9) Disposal of assets—to ensure continuity of service, it is likely to be desirable to forbid the disposal of significant assets without prior approval of the Regulatory Commission. A suitable threshold will need to be inserted here, in order to allow reasonable commercial freedom and avoid undue bureaucracy.

(10) Obligation to comply with sector Codes—this would impose a general obligation to comply with relevant sector Codes, for example Grid or Market Code that is in operation.

If the license is a comprehensive license as we have suggested, it will also have substantive sections, including a pricing section specific to the company. A monopoly company's licence may contain its tariff, including specific numbers.

#### **4.4.6 Specific Conditions for Different License Types**

In addition to the general conditions that we have described above, a range of different specific conditions would be relevant to different types of licenses, and below we summarize these by main license type.

(1) Distribution License. Because of the importance of distribution in the impact that it has on final consumers, it is normal for extensive license conditions to apply to distribution licensees:

1) Price Control. Price controls are inevitable for a distribution utility, and this condition would need to define how the price controls apply to the structure of tariffs and the level of prices, and possibly set out the powers of the regulator with regard to approving prices. We would also envisage that there would be a prohibition on price discrimination, subject to any policy requirements issued by the Government.

2) Subsidies. This would define the circumstances in which subsidies could be permitted. For example, the law could provide for the Government to request subsidies in certain cases, subject to it covering the costs to ensure that the company's profitability is not affected. This condition would elaborate the procedure where the company is required to provide subsidies in its prices for supply of electricity.

3) Obligation to Connect. This would deal with the exact extent of the obligations on the enterprise to provide new connections, including the procedure where the government requires the company to undertake rural electrification or other non-remunerative activities.

4) Social Obligations. This needs to spell out the process where any significant social obligations are to be imposed. In the meantime, it is necessary to clarify the compensation mechanism.

5) Quality of Service Provisions. This needs to spell out the process for developing and

imposing any supply or customer service standards. This would include compliant handling processes.

6) System Operation and Supply Security Standards. In order to ensure adequate security and supply standards, this condition would deal with the licensee's day-to-day operation of the system, short-term and long-term system planning, and maintenance of system stability and supply quality.

(2) Transmission license. Additional conditions are important for the transmission licensee, and we envisage that typically the additional areas to be addressed in such licenses would be:

1) Transmission System Development and Connections: This needs to make clear responsibility for the expansion and development of the transmission system, and the process for dealing with requests for new connections.

2) Permitted Revenues for Use of System and Connection to System. The price control applying to this company will be in respect of the bulk supply tariff, which will need to cover all costs including transmission costs. It will therefore be important to establish a procedure under which the licensee's revenue requirement for the transmission activity is determined.

3) Transmission System Security Standards and Quality of Service. This will cover planning, developing, operating, and maintaining the transmission system, establishing criteria by which the performance of the transmission system and quality of service may be measured, and reporting.

(3) Bulk Supply License. For a bulk supplier like a regional transmission company, we would envisage that the main additional conditions would be:

1) Obligation to Supply. This would deal with the obligation to ensure that demand from customers can be satisfied, and as part of this ensuring that the licensee undertakes, in collaboration with all other Permit holders which it is obliged to supply, operational planning and longer term planning which may be necessary to ensure that demand can be met.

2) Economic Purchasing. This would deal with the obligation to conduct its purchasing activities with generators so as to ensure that its requirements for electricity are satisfied in the most economical way possible. In particular, this would be aimed to ensure that wherever possible such purchasing shall be through competitive procurement in accordance with the requirements of the regulator.

3) Bulk Supply Tariff. This will deal with the regulation of the bulk supply tariff.

(4) Generation license. Whether it is in a market environment or in a single buyer environment, a generation license will generally contain little beyond the general conditions that have been outlined above.

(5) Other License Types. Depending on the circumstances, there may be other licence

types, for example:

1) A Market Operator license, though in some circumstances this would be combined with the transmission system operator license.

2) A Retail license for an entity that does not operate any system but only supplies to final consumers.

## **4.5 Regulation of State-owned Electricity Sector Utilities**

As mentioned above, both the origin of economic regulation, and the practical situations in most countries today, indicate that the subjects of economic regulation are mainly intended to be private infrastructure enterprises. In principle, regulatory organizations should and can fairly treat both public and private enterprises. However, state-owned enterprises are likely to show different responses to the same regulatory measures because of the different incentive mechanisms that exist in each.

### **4.5.1 Difficulties in Regulating State-owned Enterprises**

Regulatory control mechanisms generally exert their influence through economic incentives and restrictions. Private enterprises hope to maximize their profit. This assumption is the basis for much modern economics; it is the logical base for the idea that competition can improve efficiency and make better use of resources, and justifies the introduction of a market economy. In principle, regulatory institutions may affect a company's profit by way of tariff regulation, or financial penalties to encourage and restrict enterprises to operate in a planned way. This is because private-sector utilities would generally respond to actions by regulatory organizations so as to maximize their profitability under the conditions imposed on them.

However, state-owned companies may not be so interested in profit maximisation, and their managers may be more interested in pursuing other behaviour or targets, for example:

(1) Using resources and finance inefficiently, and allowing unreasonable cost increases.

(2) Adopting short-term behaviour, neglecting long-term targets.

(3) Undertaking "blind" or unremunerative investment, artificially enlarging the company without strengthening it financially.

(4) As public-sector company managers are only subject to appointment and removal from officials at a superior level (rather than shareholders), they may pay excessive attention to the operation of the appointment and removal processes, neglecting enterprises' efficiency and the proper supervision of the enterprises they work in.

These special problems of state-owned enterprises have happened in several other countries. Of course, it does not mean that state-owned public enterprises are not in need of regulation. But that if there is no intention or possibility of privatising these state-owned

enterprises, then we must recognize that regulatory institutions will be hindered, both in the authority they can exercise and in the regulatory results that they can achieve.

#### **4.5.2 Specific Methods for Regulation of State-owned Electricity Enterprises**

Such problems with state-owned enterprises may also mean that it is not enough to consider regulatory methods offered by standard textbooks. We must take some other measures in accordance with the specific circumstances of the state-owned enterprises, i.e.:

(1) Cost or other parameters could be “benchmarked” in order to try to achieve efficiency improvements, or to limit the extent of cost recovery, rather than imposing straightforward profit incentives to improve efficiency. These measures are effective when it is hard to audit on state-owned enterprises cost, especially when connected transactions of some state-owned electricity enterprises are concealed.

(2) Publicize in bulletin and the press those enterprises that violate the regulations. In general circumstances, company managers of state-owned enterprises pay more attention to their own reputation than to economic punishment. So such measures can be executed effectively to affect the behaviour of enterprises. Its efficient use may also directly impact appointment and removals of company managers and may be very effective.

(3) Specify the qualification of high-level management staff in regulated state-owned enterprises and participate in their appointment. Viewed from the point of evaluating professional capacity and operation performance, regulatory institutions may directly recognize what kind of people are suitable for advanced management positions of regulated enterprises, and more directly understand managerial capacity, professional capacity and operation performance of relative staff. So we suggest regulatory institutions should approve the minimum qualifications of the advanced management staff in regulated enterprises whose management staff is appointed from superior level. For instance, appointment programs of advanced management staff in regulated electricity enterprises may be defined closely in compliance with requirements relating to the required level of competence of appointees. This can be done in consultation with the relevant supervisory institutions.

(4) Regulation of the income level of high-level management staff in regulated state-owned enterprises. As stipulated in Chapter 2, the targets and principles of regulation are usually defined as balancing interests of three major parties, which are users, public utility investors (state-owned enterprises of course includes its operator) and government. In tariff and cost regulation, regulatory institutions should place limits on regulated state-owned electricity enterprises’ personnel, especially the maximum incomes of high-level management staff, in order to control costs, prevent customers from unreasonable expenses, and balance the interests of the operators and users of electricity enterprises.

At the current stage, it is inevitable for state-owned enterprises to be the major subjects

of electricity regulation in China. However, from a long-term point of view, it will be important to introduce multi-component (including private) investment into the electricity sector, optimize electricity enterprises and investment structure, and achieve greater diversification. This will allow the exercise of electricity regulation to the fullest extent, and improve efficiency and service levels of the electricity sector in the longer term.

## Chapter 5 Establishment and Regulation of Competitive Electricity Markets

The job of the regulator depends upon the structure of the sector—whether it has elements of competition or is a complete monopoly. To some extent in the medium term, and to a larger extent in the long term, it may be possible to introduce competition into the electricity sector in China, and this will likely be on similar lines to the development of competition in other countries. Regulation of monopoly sectors is discussed in the previous chapter, but in this section we consider the types of detailed regulatory approaches that are necessary to deal effectively with the generating sector that is potentially competitive.

Where competition can be introduced, as in the generation sector, the importance of transparent and predictable regulation is even greater. In these circumstances, investors will face a combination of both market and regulatory risks, and the regulatory body needs to operate in a way that maintains an acceptable degree of risk, without removing the incentive for efficient operation. A single regulatory entity, like SERC, operating under a set of transparent and predictable rules, has the greatest chance of achieving this.

The regulator may also need to advise the decision-making body on the speed of reforms, and how much competition should be introduced—these are issues not covered in this paper, where we consider only the regulatory requirements of each model. However, there does seem to be in China a conviction that competition cannot be introduced in the face of shortages. This is not really correct. Argentina introduced competition in the sector in the face of massive shortages. In doing so it solved the shortage problem quite fast: plants became more efficient and more available; less was wasted, and new plants were constructed. The fear in China is that if there are shortages, prices will rise and there will be public unrest; this is a reasonable fear. However, the way to solve the problem of excessively high bills is by using Vesting Contracts<sup>❶</sup> that set the price of a base amount of output at the historic level, while paying more (market prices) for the increases in output. This encourages additional output from the existing plants, and retains the incentives to operate efficiently, and to add capacity, but keeps the final average prices down.

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❶ The details of Vesting Contracts are not covered in this paper.

## 5.1 Some Models for Electricity Sector Structure

There are four basic models of sector structure, differentiated by how competitive they are and much monopoly is retained. All the models assume continued monopoly over transmission, distribution wires, and system operations. The regulator has to regulate these monopoly elements as described in the previous chapter no matter what happens to the generation. But the different models imply different trading arrangements, different procedures for purchasing electricity and for controlling prices, and different amounts of attention to competitive behaviour in the sector. There is gradually increasing competition in these four models, and the extent of monopoly gradually grows smaller.

The four different models of competition (which were originally developed by NERA in connection with the Chinese Electricity Sector Reforms) have been extensively discussed elsewhere<sup>①</sup> Here we describe them briefly and concentrate on the regulatory implications of each. The four models progressively expand the extent of competition, and they each have their merits and difficulties.

### 5.1.1 Model 1: Vertically Integrated Monopoly

Model 1 is a monopoly of the kind that existed in China before 1985, with all the functions of the sector integrated into one company. In Model 1 there are no competitive generators, and the two main variants of the model are illustrated in Figure 5.1. All functions in the sector are “bundled” together, and regulated. This model served the sector well for 100 years, and is still the model in existence in most places. Since the whole sector is run as one or more monopolies (one per area) the relevant techniques of regulation have been discussed in the previous chapter. In this chapter we will give more attention to regulatory techniques required by the alternative models.

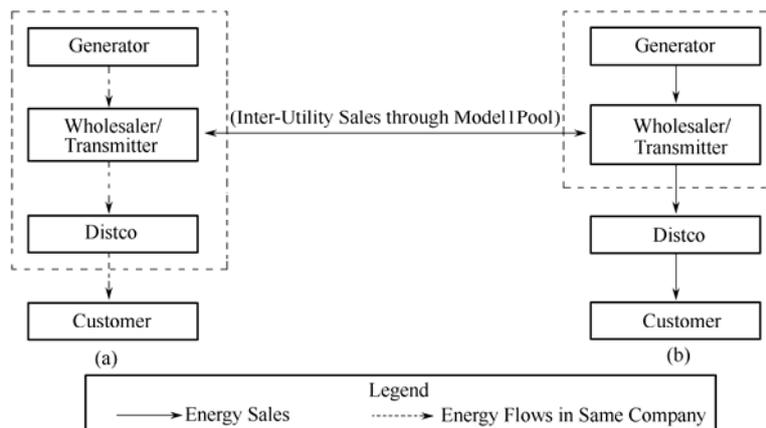


Figure 5.1 Model 1: Vertical Integrated Monopoly

① Sally Hunt and Graham Shuttleworth, *Competition and Choice in Electricity* Wiley 1996 and Sally Hunt *Making Competition Work in Electricity*, Wiley 2002, available in Chinese from the World Bank.

(a)Vertical in tegration; (b)Separate Retailer/Distributor

5.1.2 Model 2: Single Buyer

In this model, only one entity in any area is permitted to buy from the competing generators, and this is illustrated in Figure 5.2.

China used to be an example of the “integrated version” of model 2, with the provincial companies purchasing from competing generators, and also owning their own generation. This causes conflicts of interests. The recent reforms separated the transmission, and made the grid companies the single buyer. At present in China, therefore, the “disaggregated version” is the standard model—the single purchaser in each region is now the grid company, and there are many sellers.

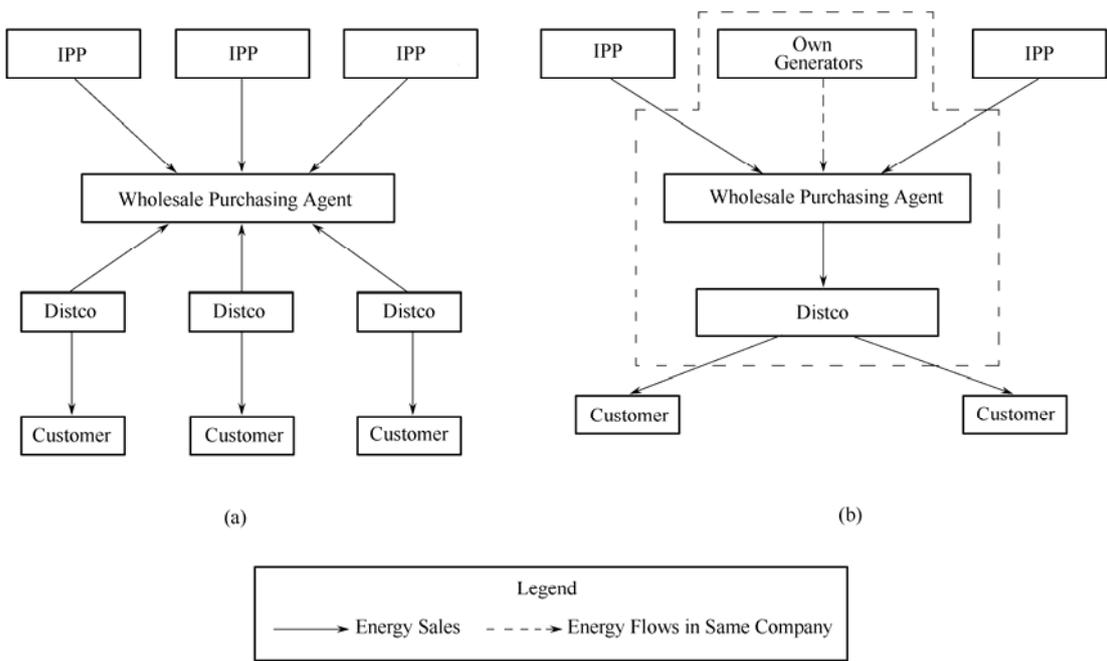


Figure 5.2 Model 2: Single Buyer

(a)Disaggregated Version(Northern Ireland) ; (b)Integrated Version(US and PURPA)

The approach to regulation of tariffs is different in model 2 compared to model 1, as the generation costs are determined by contracts. For model 2, these generation costs are passed through, and the transmission, distribution, and retail tariffs are subject to regulation.

5.1.3 Model 3: Wholesale (Generation) Competition

Model 3 allows distribution companies and large customers to purchase from competing generators, as is shown in Figure 5.3. This has been the model adopted in almost all countries that have introduced competition (except the USA) either as a transition or as the planned destination.

In this case, as Figure 5.3 shows, the main focus is on regulation of the transmission and

distribution tariffs, and regulation of market behaviour, including contracting. The regulator also sets retail tariffs, based on these combined costs.

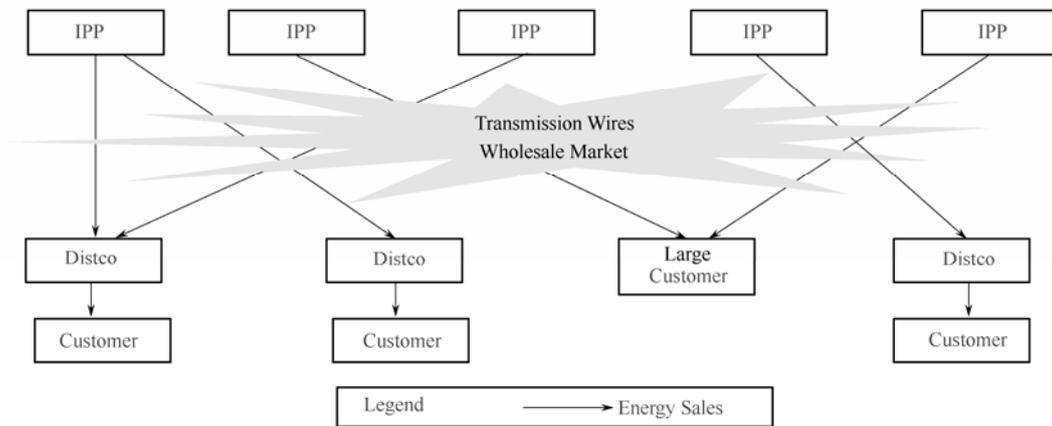


Figure 5.3 Model 3: Wholesale Competition

#### 5.1.4 Model 4: Retail Competition

Model 4 permits small customers, as well as large customers, to choose their suppliers; so a competing generator can sell to anyone, although small customers usually buy through aggregators or retailers, as is shown in Figure 5.4. Model 4 is known in the USA. as “retail access” or “customer choice”. It is the model now in place in the UK, New Zealand, Australia, Argentina, Norway, Sweden, Spain, Alberta, and many states of the USA.

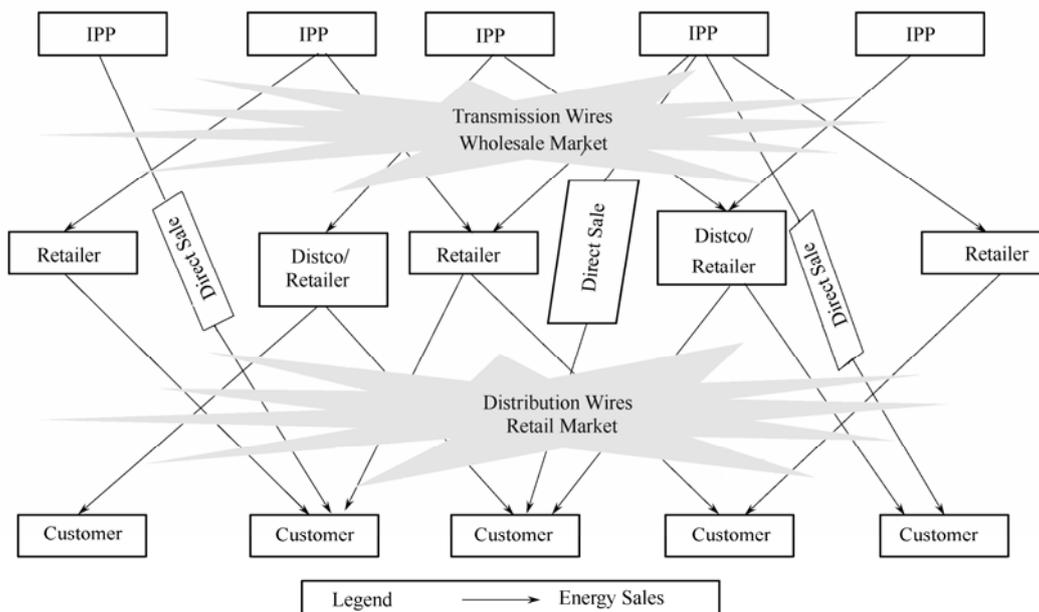


Figure 5.4 Model 4: Retail Competition

Model 4 requires the same wholesale trading arrangements and competitive wholesale

markets as Model 3. The main additional requirements in Model 4 are the settlement process, meter reading and billing, which are greatly expanded from Model 3, and education of millions of customers. These are expensive and complicated. Although many of the developed countries have instituted Model 4, there have been substantial operational problems.

The electricity sector in China has basically achieved “separate plants from grid”, and there is no evidence indicating that China would use model 4 in the foreseeable future. As for the regulatory requirements of model 1 and model 4, we will not develop their regulatory aspects in detail in this document, as they have been further elaborated in Making Competition Work in Electricity (S. Hunt 2002). As noted above, model 2 is the active system in China at present, and model 3 is the system that may be widely performed in the next phase of restructuring. We will therefore focus on the discussion of regulation in models 2 and 3.

## 5.2 Model 2—Regulation of Single Buyers

The Single Buyer model is being followed in many countries, in Asia particularly, as a first step to liberalization and as a way of attracting investment by Independent Power Producers or IPPs. China has been following this model for nearly 20 years. The defining feature is that IPPs may only sell to the single buyer (in China’s case, the grid company in each region), which still have a complete monopoly over all further sales. The single buyer model is a limited form of competition. It is only competition to build plants and operate them. Since there is only one buyer, the generating contracts have to cover all the output and the entire life of the plant, since there is no other buyer to take any extra un-contracted output.

### 5.2.1 The Role of the Regulator in Model 2

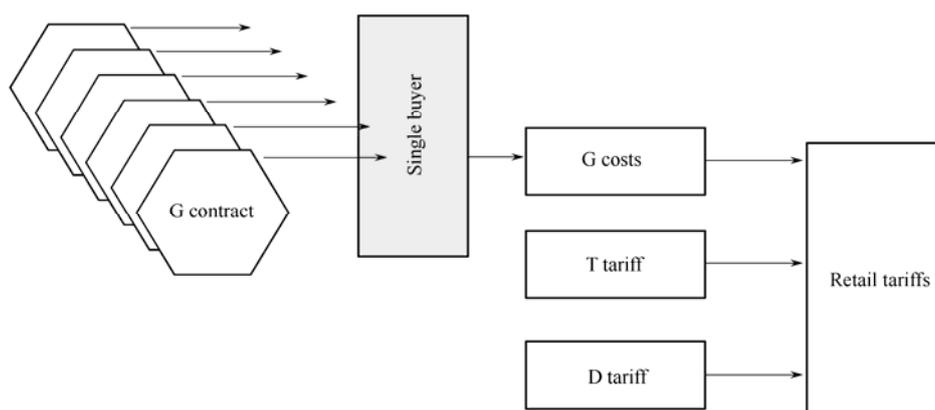


Figure 5.5 Tariff Regulation with Model 2, with separate transmission and/or distribution

In the case of Model 2, the main focus of the regulator is in the following areas:

- (1) Setting the tariffs for the transmission and distribution monopolies.
- (2) Minimising the generation costs by approving the single buyer contracts:
  - 1) Form of the contract—for example, two-part contracts, life of plant;

- 2) Methods of contracting—in particular the competitive bidding process;
- 3) Conditions of the contracts—for example conditions on merit order despatch.
- (3) Requiring Grid companies to publish investment forecasts.
- (4) Setting retail price by way of adding purchase contract cost of electricity generation and electricity transmission and electricity distribution costs.
- (5) Monitoring quality.

In Model 2 the regulator still controls prices and costs for the monopoly elements (transmission and distribution) but also has to oversee the contracting process for generation.

### **5.2.2 The Grid Company in a Single Buyer Model**

Model 2 has one really important new player compared to model 1—the single buyer. But it also has a grid company separated from the generation, to avoid conflicts in the dispatching of plant. Where the grid company is also the single buyer, as in China at present, it is a very powerful entity, and may have conflicts of interest. It has three major functions, and some conflicts may arise in all of them:

- (1) Purchasing of generation (as single buyer).
- (2) Scheduling (in advance) and dispatching plants (in real time).
- (3) Investing in the transmission grid and running it as a business.

Also, some generating plants in China are still owned by the Grid Companies (Gridcos), which is a serious conflict of interest.

These functions should be kept operationally separate. Further unbundling of some of the regional grid companies' activities would go some way to addressing these problems, but effective regulation will also be important in all these areas. They should have separate accounts and separate sources of revenue.

### **5.2.3 Procurement of Generation in the Single Buyer Model**

In China, each regional grid company is the “single buyer” for its region and procures generation under contract. However, the process used by the Gridcos is not a competitive one, and generators are in effect offered a tariff. This tariff is not cost reflective and is not efficient, and so it seriously distorts procurement.

There is extensive international experience to show how the procurement function should be carried out efficiently (and also to show the mistakes that should be avoided). The utility that is the single buyer should remain responsible for carrying out the procurement, but the processes followed should be specified by the regulator, and the regulator should oversee the whole activity.

The key elements of an efficient competitive procurement programme that SERC could implement would be as follows:

(1) Each single buyer would be required by SERC to undertake regular demand forecasting and generation planning exercises, to verify the future needs for new generating capacity. These planning exercises should be approved by SERC and the responsible national departments, and would be carried out under the supervision of SERC. Procurement of new generation would only be permitted where the planning exercise indicated a need.

(2) The procurement process to be followed would be specified by SERC, and this would cover matters such as timetable for procurement, advertising of opportunities, form of bidding documents, issuing of documentation, treatment of bids, contact with bidders or potential bidders, negotiations, etc.

(3) The form of generation contract to be used would be subject to the agreement of SERC, and this would be a standard format that would apply to all bidders.

(4) The methodology for evaluation of bids would be agreed with SERC and pre-specified so that it is transparent to all bidders. The evaluation itself would be carried out according to processes agreed with SERC.

(5) Contract award could only be made providing the SERC confirms that the processes have been correctly followed.

Evidence from other jurisdictions (e.g. the USA and Thailand) show that a properly run procurement process can produce very good results in terms of low cost generation. On the other hand, some experience, for example in India and some other Asian countries, shows that failure to follow such competitive procedures often results in slow and ineffective procurement at high prices. We recommend that SERC, as sector regulator, should take the lead role in this.

#### **5.2.4 Dispatching Generating Plant in a Single Buyer Model**

The work of the dispatch operator is crucial to the efficient functioning of the electricity system, and to the development of competition. The dispatch in China now is not based on Merit Order, for various reasons. If it had been, the transition both to the single buyer and to the more competitive models would be much easier. Competitive markets induce merit order dispatch: less competitive markets rely on the regulator to require it. Model 2 should dispatch the contracts in merit order, and should therefore write the contracts in the two part form that specifies the fuel cost.

Merit order is the order of short run costs; plants should be dispatched with the lowest cost plants running the longest number of hours. It has been known for decades that this method ensures lowest cost operation for plants already built. Together with investment criteria that ensure minimum-cost expansion, the sector can achieve maximum efficiency.

We recommend that merit order dispatch be instituted as soon as possible.

The regulator should ensure that scheduling and dispatch is carried out on a non-discriminatory basis. Dispatch rules and procedures need to be subject to approval by the regulator, and operations subject to review, particularly in the event of disputes about dispatch decisions. Such measures are of particular importance in circumstances where the utility carrying out dispatch is also the owner of generating plants.

As mentioned above, China has not executed dispatch on a least-cost basis up to now. Objectively there are several limits to this being implemented at present:

(1) Government plans to arrange the pattern of electricity generation, and define annual contract electricity generation for each electricity plant and electricity price;

(2) The electricity price for plants connected to the grid is basically a single price established by the government, and there is no mechanism to encourage electricity purchasing institutions to dispatch in accordance with the merit order of the electricity plants;

(3) Government has set a unified electricity price for any electricity produced beyond the basic contract electricity production. This lacks any incentive for electricity generation plants to improve availability in times of high demand.

### **5.3 Regulatory Issues in Model 3 —Wholesale Competition**

Model 3 permits (indeed requires) distribution companies (Distcos) to purchase from a competitive generating sector; the grid company is no longer the single buyer in the area – a sufficient number of distribution companies should be created to enable competitive purchasing.

Model 3 allows larger customers to choose their suppliers. All small customers have little or no “customer choice” or retail access (whereas Model 4 permits all customers a choice of supplier), and are still supplied by monopoly electricity distribution companies. The Distco in Model 3 might purchase all its needs at wholesale or it might own some of its own generation. If it purchases at wholesale it should be required to purchase at minimum cost.

In this type of competitive model, trading can take place on a variety of bases, including trade in electricity futures. Such trading allows the opportunity for purchasers and sellers to hedge their price risks over a range of time horizons, if they wish. Such markets, if properly regulated, can increase the efficiency of electricity markets generally, and improve the information available about market price trends.

#### **5.3.1 The Role of the Regulator in Model 3**

In the Model 3 case, the main activities of the regulator will be:

- (1) Setting the tariffs for the transmission and distribution monopolies.
- (2) Controlling the generation costs by ensuring the market is competitive:

- 1) Control of market power;
- 2) Freedom of entry for generators;
- 3) Demand response;
- 4) Market monitoring.

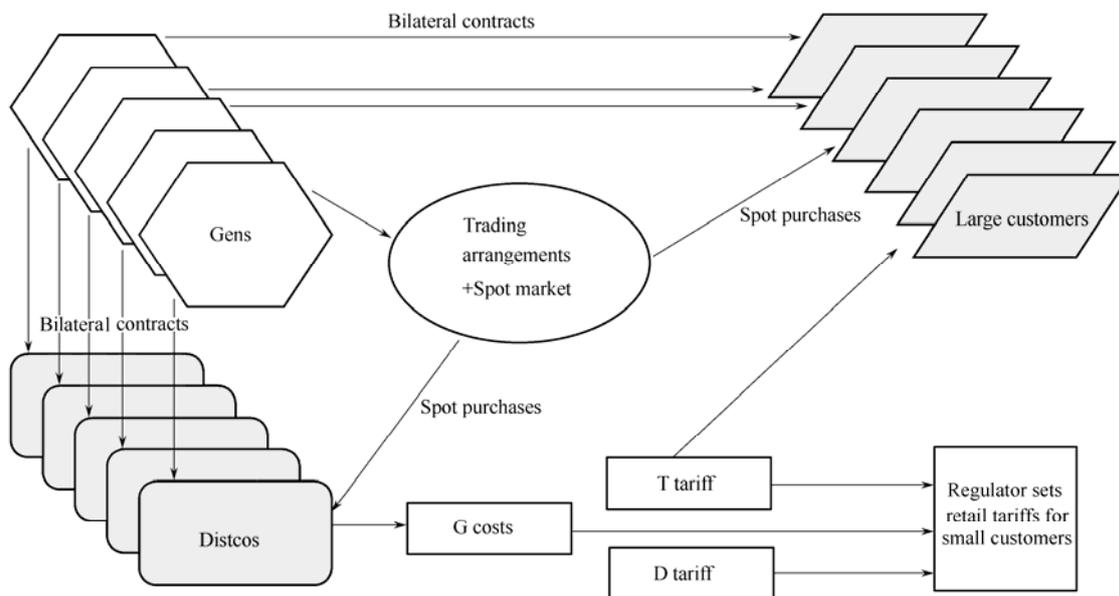


Figure 5.6 Tariff Regulation with Model 3

- (3) Requiring Gridcos to publish investment needs and forecasts.
- (4) Requiring Gridcos to invest in transmission.
- (5) Requiring Distcos to purchase electricity at minimum cost – eg contractual auctions and spot purchases.
- (6) Setting retail prices for small customers, based on transmission and distribution costs and market prices of generation.
- (7) Monitoring quality.

Document No.5 (2002) envisaged the development of competitive wholesale markets. As the sector develops, the regulator would continue to have to play a lead role to ensure effective competition. Once again, evidence from other countries indicates that effective regulatory oversight and control is essential to ensure that competition functions correctly. On the basis of experience elsewhere, the functions that SERC would need to carry out are as follows:

- (1) Ensuring competitive markets—many suppliers, many buyers, supply response and demand responsiveness.
- (2) Regulating the trading arrangements (the market rules).

- (3) Overseeing the grid company's investments and the transmission business model.
- (4) Overseeing the competitive procurement of electricity by the Distcos.

These are developed in more detail below.

### 5.3.2 Regulating the Trading Arrangements (the market rules) in Model 3

This is necessary to ensure that the trading arrangements are efficient and non-discriminatory. The trading arrangements (market rules) should be drafted by the grid companies, in consultation with relevant parties, and be subject to the final approval of SERC.

Not all provinces or regions of China need to follow the same model of competition (monopoly, single buyer, wholesale competition etc). But it would be very useful to have identical trading arrangements for those areas that do go to Model 3. In fact it would be useful for SERC to develop a standard design for trading arrangements. Both Europe and the United States encouraged local design of trading arrangements, which in both cases prevented a wider market developing. FERC, the USA federal regulator, finally adopted a standard design, based on the PJM model, but has not been able to insist on its adoption.

SERC must also oversee the operation of the trading arrangements, and have powers to intervene and require changes to the rules where that is necessary; no changes should be made to the rules without SERC approval.

For example, the rules may have some elements designed with hydro plants in mind—these can be run with little advanced notice, so do not need day-ahead markets, in fact the market can be run by an auctioneer in real time, as in Norway. But coal plants are much slower to start up, and have substantial costs of doing so; they need to know if they will be called upon or not. This would lead to a need for day-ahead markets. The regulator must be able to insist on this, for fair competition.

International experience shows the importance of the regulatory body having adequate powers over the trading arrangements to ensure that they are efficient and non-discriminatory. In particular, in the UK the original England and Wales Pool operated under a set of Pool Rules that turned out to have some problems, but which were not under the control of OFGEM. This meant that OFGEM was powerless to make the changes that it considered necessary to have the trading arrangements (the Pool) operating more efficiently. Finally, the Pool was largely revised by means of changing the legislation and introducing new trade arrangements (NETA)<sup>①</sup>. If the original Pool Rules had been more under the control of OFGEM, it is possible that much of the upheaval could have been avoided.

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① The NETA arrangements originally applied only to England and Wales and have now been superseded by the British Electricity Trading Arrangements (BETA), which include Scotland.

### 5.3.3 Promoting Competition in the Generating Markets in Model 3

If the regulatory body is to cease setting the prices for the generating sector, it must ensure that the markets that set the prices are competitive. This involves having many generators, many purchasers, and both buyers and sellers need to be able to react to prices. They also need to be able to get the product from generators to buyers over a transmission and distribution system that allows non-discriminatory access.

(1) Ensuring freedom of entry for generators. The generators should respond to prices by entering the market when the price is high. It is essential for an efficiently functioning generation market that generators are able to enter reasonably freely and on non-discriminatory terms. SERC would need to ensure that the licensing and other requirements can allow this, and in particular that they do not discriminate against new entrants.

Also the grid company should be required to publish annually a rolling multi-year load forecast showing its view of how much electricity will be required, area by area, and its best information as to where new plants are being built or planned, and where new transmission is planned. This enables potential competitors to have as much information as incumbents.

(2) Guaranteeing service conditions for non-discriminatory electricity transmission and distribution grids. This would include ensuring that rules are established for the granting of generator connections and system access: Rules for, and monitoring of, system maintenance and operation, to ensure that generators are not discriminated against; Regulating the tariffs and other terms and conditions for transmission and distribution connection and use, to ensure they are non-discriminatory. Accounting rules for transmission and distribution utilities, and in particular the establishment of separate accounting, to ensure that there are no cross-subsidies between generation, transmission, and distribution.

(3) Supervising market behaviour. SERC will need to monitor the behaviour of the market participants (including the market operator) to ensure that there is no anti-competitive behaviour by them. Where the number of competing generators is small, there will inevitably be suspicions that anti-competitive behaviour will take place, and careful monitoring and supervision will be necessary. This would probably have to include:

1) powers for regular collection of bidding data, price data, and profitability data from the participants and the market operator, to look for evidence of anti-competitive behaviour;

2) SERC should have the right to collect the information, although there is always some question as to whether publishing the information simply makes collusion easier.

Where the market operator also has interests in other parts of the sector, in particular generation or supply, strong regulatory action will be necessary to avoid problems arising from conflicts of interest. Ideally, complete separation of market operation from any such interests should be the aim, to avoid any conflicts from arising. Strong enforcement powers

would also be essential to eliminate anti-competitive behaviour where it occurs. Experience suggests that the only lasting solution to such behaviour can be to enforce the sale of some capacity to other participants, to reduce the degree of ownership concentration in the market. However, this will require very strong regulatory powers.

#### **5.3.4 Generation Investments and “Capacity Payments”: Models 1 and 3**

China’s move to a socialist market economy has been able to take advantage of the power of prices to do the job of signalling investment. The theory of generation markets is the same: where they function effectively and price is allowed to reflect the balance between supply and demand, it is possible to rely on the price mechanism alone to deliver adequate capacity and acceptable reliability. However, this does mean having some mechanism for large customers at least to know the spot price and be able to respond to it; they should have hourly meters and pay hourly spot prices for consumption above their contracts. They should be able to sell back contracted electricity at the spot price, which helps relieve shortages. In the long term, this could operate in China. However, allowing these markets to do the work of inducing investment means that prices must be allowed to fluctuate. This means that prices of contracts between generators and large customers must be freely negotiated, and the contracts must be enforceable; and that spot market prices may sometimes be very high or very low. This volatility in the spot market is essential, because it balances supply and demand.

Some generation markets operate in a way that is consistent with the model of electricity markets in which market prices for energy fluctuate to reflect the level of spare capacity. This means there are periods of high energy prices during capacity shortages, providing the opportunity for the capacity costs of plants to be recovered. For this to work it is essential that the market price be set with customer participation—the distribution companies and large customers should be fitted with hourly metering and should be able to save money by not consuming when prices are high.

Though such a market model is theoretically correct, and would work where circumstances are suitable, in many cases in practice there are significant concerns that this market mechanism may not work efficiently, and that sufficient generation investment may not be forthcoming:

(1) Where prices are subject to regulation, prices may not be allowed to change sufficiently to provide the necessary market incentives.

(2) Investors may be concerned about high levels of regulatory or political risk, especially where markets or regulatory arrangements are relatively new and untried.

(3) Even where price signals would result in adequate generating capacity in the long term, short-term price fluctuations and outages caused by temporary shortages may be judged

as unacceptable by policy makers.

(4) Reliability is something shared by all consumers on a system, as in practice it is not possible to discriminate between consumers when interruptions are necessary as a result of inadequate capacity, unless there is adequate hourly metering allowing customers to disconnect themselves when the prices are high.

(5) In the circumstances of many electricity systems, the consumer price does not work effectively to reflect consumers' preferences or to allocate the available capacity.

For these reasons, in practice policy makers often think that there should be some specific mechanism that will help to ensure an adequate capacity margin. Generally, where such mechanisms have been introduced it has been for reasons of ensuring reliability of supplies and/or to avoid some of the price volatility that comes with capacity shortages, or because decision makers have convinced themselves that widespread hourly metering is too complicated.

Broadly, three types of approach are adopted in practice to ensure sufficient generating capacity:

- (1) Capacity payments incorporated into the spot market price.
- (2) Capacity obligations.
- (3) Contracts for capacity.

All three options can be found operating in practice in different countries, and a number of variations of each exist in. Below we discuss the main features of each type of mechanism.

#### **5.3.4.1 Generation Capacity Payments Incorporated into the Spot Market Price**

In this approach, the market itself incorporates arrangements for making payments to plants that are despatched or available, in addition to the payments for energy provided. Schemes vary, but in general the features of this type of mechanism are that:

(1) The price rises, and can rise quite high when capacity is tight. That is the point—to encourage generators to get their plants back on line.

(2) There is some mechanism for preventing it from rising too high—establish upper price limit by using actual response or simulated response of users.

1) In early schemes in the UK, Australia, Argentina and other places, the simulated customer response was approximated by a price cap set at the Value of Lost Load, (what the last customer would have been willing to pay) as determined by the regulator. A regulatory price cap below the Value of Lost Load is virtually useless.

2) Actual response of consumers. A better scheme is for the maximum price to be set directly at what the last customer is willing to pay, by means of actual customer bids; this is being incorporated in the PJM and New York markets. This requires hourly metering of at least the large customers.

If there is no actual or simulated customer response there has to be an alternative

“capacity obligation” or “capacity contract”. California went naked into reforms, with no customer response, actual or simulated, no capacity obligation, no capacity contracts, no nothing. And as a result the prices rose by a factor of 10 when there was a shortage. This was a disaster, and scared everyone; but it does not have to happen.

#### **5.3.4.2 Generation Capacity Obligations**

A number of markets (for example PJM, New York, and Ontario) operate schemes where all entities selling electricity to consumers (the so called Load Serving Entities or LSEs) must be able to demonstrate that they have contracted for sufficient capacity to meet their consumers’ loads. This means that all LSEs must own or contract for plant, Penalties for failure to meet the obligations, if set at above the level of new plant capacity costs, should ensure that the plant will be built.

Unfortunately, the requirement to have enough contracts to cover load applies to future demand; in January the LSEs show they have enough contracts to cover next July’s expected requirements. But this does not actually prevent them from running short next July. Especially in a place like China with growing load, the “Capacity requirement” may look good but it will actually do nothing. If the requirement were an hourly requirement, to show that the LSE had contracted sufficient to meet the actual demand, then the price of short term contracts would rise to the level of the penalty. If the penalty were set at the Value of Lost Load, we would be back to relying on a simulated price.

In our view it would be far better to develop markets with demand responsiveness than to rely on “capacity requirements.” PJM and New York are both moving this way.

#### **5.3.4.3 Contracts for Required Generation Capacity**

In arrangements of this sort an appropriate entity, such as the System Operator, the market Operator, or a key utility, organises a tender under which bids for the provision of new capacity are invited and contracts granted on the basis of the lowest bids received. Until recently, the only available examples of such an approach were of short-term contracting, for example in Australia. However, recent uncertainties in electricity markets internationally, and the need to make provision for transitional risks, have seen the development of schemes of this type in a number of situations, in particular Ireland and Greece.

While a mechanism of this sort involves the signing of long-term contracts (typically 10 to 12 years), in general the “stranding” of the contracts is avoided by the System Operator (SO) or Market Operator (MO) being the counterpart. In most jurisdictions, the SO or MO is able to ensure that the costs are recovered by means of surcharge on all consumers.

The potential benefits of this contracts approach are:

(1) Predictable. By calling for tenders for specific quantities of new investment, and ensuring the technical qualifications of bidders, the necessary new capacity can be achieved over an appropriate timescale.

(2) Focused on new entry. The scheme can be limited to new entrant generators, and this limits the cost of the scheme as payments to existing generators can be avoided.

However, such schemes can destroy the market entirely by ensuring long term over-capacity and low market prices. A Model 2 market, where the grid company was explicitly responsible for purchasing, and all contract costs were passed on to customers would be preferable to a partially competitive Model 3 market where a quasi government organisation could act as an irresponsible competitor.

## **5.4 Responsibilities for the Supply/Demand Balance in Models 2 and 3**

If the government is responsible for ensuring supply/demand balance in a planned economy, who is responsible in a market economy? The answer of course is the markets. The price mechanism is what is supposed to elicit supply and ration demand, and it does do efficiently in hundreds and thousands of markets all the time. However, electricity markets are more complex than most markets, and there is always a concern on the part of government that there will be shortages while the markets adjust.

Problems of new investment commonly arise in new or transitional electricity markets, and a range of mechanisms have been developed to deal with this. But so far, it seems that there is no doubt about China's interest in investing to construct new electricity generation plants. Indeed, it appears that up to now interest in investment in generation capacity has been very strong, with investors wishing to proceed with more capacity than the authorities were willing to authorise. On the other hand, virtually all those investors are publicly-owned companies, and it may be that private-sector investors would not be so enthusiastic. It may therefore be that in the long term consideration will need to be given to transitional capacity mechanisms that could be adopted.

### **5.4.1 Investment Regulation in Model 2**

Based on practice elsewhere, the long-term arrangements for regulating investment in the sector in the current Model 2 phase are likely to be that:

(1) Planning for the required generation capacity would be carried out by the relevant grid company, based on macro-economic forecasts produced by NDRC.

(2) Approval of the plans would be carried out by SERC, in collaboration with NDRC.

(3) Implementation would also be the responsibility of the grid company, under the supervision of SERC.

(4) New capacity is brought in on the basis of competitive tendering for new contracts, the tendering to be carried by the purchaser (in China, the Gridcos) on the basis of procedures specified by SERC, under the supervision of SERC; The grid company specifies where it

wants the plants on the basis of its internal computations of transmission costs.

(5) These PPA contracts would survive the transition to Model 3; they might be sold to new owners (large companies), but would be bid into the market by the owners, either the grid companies or the purchasers of the contracts.

#### **5.4.2 Investment Regulation in Model 3**

In this model, the mechanisms to be implemented for ensuring adequate investment in generation would be likely to differ. In the more market-orientated environment that is expected to exist in the longer term, it is important to ensure that there is effective coordination between generation and transmission investment decisions.

(1) From a long-term view, the ideal model is that the market will determine the capacity needed by the system. But it would be necessary to consider what, if any, “capacity mechanism” is required in the trading arrangements to provide assurances that there will be adequate generating capacity.

(2) In Model 3 the most difficult planning problem is for the grid companies to be able to work out how much capacity they will need, if the generators do not have to follow a central plan for generating stations. Ideally, the generating companies should have to pay whatever it costs to connect them to the grid, plus all costs of reinforcing the grid that are attributable to the new generating plant. But this is not always easy to ascertain, because of the electrical interactions of all the generators on the grid.

(3) This problem has been solved in different ways in different places. In most places the grid companies publish a 3, 5, or 7 year forecast of what they expect the increases will be in generation, together with estimates of how much it would cost to provide new transmission to various places on the grid. The grid company is obliged to quote specific connection prices to new generators, at the request of the generators. The quotes must be based on verifiable costs, and the regulator has to approve.

## **Chapter 6 Capacity Building for SERC in the Near-term**

In the earlier chapters we have placed particular emphasis on the long-term capacity building of electricity regulatory institutions in China and its relevant issues. However, it is likely to be a lengthy process to solve these issues and it may need further time still to achieve the targets for regulation in the long term. Meanwhile, and in parallel with the longer-term efforts, SERC should further improve and strengthen the capacity building in the near-term. This is as important as the long-term capacity building, and it will affect the relevant parties' understanding of the practical value of SERC. From our perspective, this capacity building in the near-term includes two principal aspects, improving external conditions, and building internal capabilities, and these should be identified and performed in accordance with their importance and urgency and the existing conditions and capabilities. We have emphasised the properties of good regulation elsewhere in this report, and even in the near term SERC should be working towards establishing its credibility as a regulatory body that will have clear authority for sector regulation, independent from day-to-day interference by other government agencies, and that will follow clear and transparent methodologies in its regulatory activities.

Here we discuss specific near-term steps that we believe should be carried out, in parallel with the longer-term changes.

### **6.1 Speed up Electricity Sector Reform**

Promoting the market-oriented electricity sector reform is the most fundamental prerequisite to improving the capacity of electricity regulatory institutions in China. As was mentioned above, an integral part of electricity sector reform is to establish a modern regulatory system in China. In the situation where electricity sector reform has slowed down, it would be hard to set up a modern electricity regulatory system, and it would probably be impossible to execute effectively any of the standard regulatory functions. For instance, if the non-core businesses are not separated from the core businesses, it would be difficult to execute regulations on electricity transmission and distribution costs, and therefore impossible to set up precise and reasonable regulatory mechanisms on electricity transmission and distribution prices. If the transformation of government functions lags behind, it would be hard to harmonize the work of electricity regulatory institutions and other government departments.

The current progress status of the electricity reform in China seems less than satisfactory, and is currently in a logjam situation, with reform measures half completed. Based on our understanding of the position, there are many reasons for this situation, but a key reason appears to be that China has been suffering severe nation-wide electricity shortages during the past few years. This has diverted attention from the electricity reform process and, in the circumstances of China, this has made pursuing reform more difficult. In addition, the present institutional arrangements, including the organization and work of the Power Sector Reform Working Group (PSRWG), are in many respects inconsistent and not ideal.

We also suggest that there should be clear terms of reference given to the PSRWG, which is formed by representatives from government departments and other institutions. These terms of reference could include:

(1) Setting up an overall plan for electricity sector reform, and ensuring that the plan should be not only a general plan, but also a detailed practical schedule with a clear reform time table.

(2) Making timely reports and suggestions to the State Council on the progress achieved and the main problems encountered in further reform.

(3) Responsibility for the drafting of the new Electricity Law within a clearly defined timeframe.

It is also suggested that the PSRWG should seize the opportunity while the imbalance between supply and demand is easing to strengthen its leading position and to improve its coordination with other departments. This would speed up the decision-making process, and make a major contribution to the promotion of electricity sector reforms. To help accomplish these goals, the office of PSRWG should be given clearer objectives and a stronger capability. This would help it carry out its responsibilities for electricity sector reform design and implementation.

It should be pointed out that in any market economy countries or regions, electricity sector reform has been regarded by the party in power and by government as an important political decision, and has thus received attention from, and has been promoted by, senior political leaders or their authorized senior decision-makers. The importance and complexity of the electricity reforms in China are no less than those in the other countries that have carried out successful electricity reforms. Therefore, although China has now entered into a period favourable for electricity reform, we still have to suggest, based on international experience and the real situation in China, that the PSRWG should be given strong support from the senior leadership group, and that the work of the PSRWG should be directed by them or by a leading decision maker authorised by them.

Finally, we also suggest that the electricity sector reform in the near term should speed up the execution of separating non-core businesses of the grid companies, so as to avoid cross

subsidization and connected transactions, to create an electricity market basic platform, and to promote competent market-based entities. It should:

- (1) Set and implement separate transmission and distribution system tariffs.
- (2) Speed up the work on allowing large consumers to buy directly from generators (starting with the largest users) through the development and implementation of open and regulated open access transmission arrangements.
- (3) Pursue research on separating the electricity transmission and distribution functions.

At the same time, work should continue so as to achieve as soon as possible the transition of regional electricity markets from a single buyer model to a wholesale competition model, and create genuine regional electricity markets with multiple sellers and multiple buyers. Research on the proper positioning of the electricity market operator should also be speeded up, and the issue of property system reform should be addressed, to facilitate the creation of fair and effective wholesale competition in the electricity market.

## **6.2 Energetically Promote Construction of Regional Electric Electricity Markets**

Electricity market reform is a wide-ranging and integrated project. International experience indicates that it includes not only the adjustment of the organizational structures and property structures of electricity enterprises, but also evolution away from the model where the government manages the electricity sector. China has learnt from international experience and decided to set up a reform strategy for regional electricity markets, taking account of its own actual situation.

Establishing regional electricity markets will be an effective measure for China to optimize electricity resources allocation and improve electricity sector efficiency. It would strongly promote the transition of the management functions of the government, to adapt to the market economy and improve the government's capability of managing the electricity sector in the market economy. So, SERC should energetically promote construction of regional electricity markets, gradually extending the role of markets on resource allocation, and promote and create new electricity sector regulation systems that are suitable for a market economy system. The new system would combine macro-control, market regulation, and effective supervision to improve effectiveness and techniques for the regulation of the electricity sector. In this way, electricity sector regulatory capacity will be gradually improved along with the development of electricity markets.

## **6.3 Focus on Regulating Markets and Protecting Customers as the Key Near-term Areas of Work**

If there are no significant changes to the present electricity sector and allocation of

functions among the government entities, then SERC will be greatly restrained in exerting its functions. However, this does not mean that SERC cannot make a valuable contribution. The establishment of new electricity regulatory institutions is fully in compliance with the normal evolutionary pattern of electricity sector reform, and meets the development and reform requirements of the electricity sector in China. SERC should try hard to obtain acceptance and support from all sectors of society. This is the historical responsibility for SERC leaders and its staff.

In the present situation, if SERC wants to have a clear impact on the sector, then we suggest that SERC puts regulating markets and protecting customers as its key short-term areas of work, to obtain acceptance and support from all sectors of society. We suggest this because:

(1) Regulating markets is the basic function authorized by the State Council to SERC. Well-operated electricity markets are extremely important for guaranteeing the stable operation of the electricity system and maintaining the legitimate interest of market participants and customers. As the plants and electricity grids are initially separated, the grid enterprises and generation enterprises are separate entities with different interests. The former internal problems become external, and previously-hidden contradictions become apparent. It is urgent for regulatory organizations to solve these problems, harmonize relationships between entities, and regulate market behaviour.

(2) Protecting customers is in fact one of the basic functions of regulatory organizations. Though the function of regulatory organizations is to balance the interests of various parties, customers are often in a disadvantageous position in comparison with regulated electricity enterprises. Regulatory organizations must therefore offer special protection to the customers' interest. So, regarding protecting customers as a key work area may usefully be combined with SERC's longer-term development.

(3) Electricity sector customers in China are in urgent need of protection. As above mentioned, the Chinese electricity sector has relatively poor service quality. Since the removal of the special administration department of the government electricity sector—the Ministry of Power Industry—the issue of electricity supply service quality has basically been in a regulatory vacuum.

(4) It is easy to understand the positive meanings of regulating markets and protecting customers. They are likely to have major impacts and it is relatively easy for all sectors of society to understand the characteristics of the regulatory institutions and their valuable effect.

So, SERC needs as soon as possible to place emphasis on market regulation and on its function as the protector of users' interests. It should look for opportunities to implement

several big cases that have major impacts in respect of regulating markets and protecting customers. Since its establishment, as we know, SERC has taken some important measures in respect of regulating the electricity generation market and dispatching order, etc., which are in accordance with the reform requirements and have achieved good effects. This progress needs to be maintained, and extended to protect customers of the electricity sector as soon as possible. As a means of raising its profile with consumers, and in order to deter potential violators and encourage customers to rely on SERC to defend their rights, violators could be punished by way of “naming on bulletin” or being named in newspapers, in addition to other economic punishment.

#### **6.4 Further Development of the Legal Framework for Electricity Regulation**

With the authorization in Document No.5 from the State Council, SERC has promulgated a number of relevant regulations since 2003 such as:

- Basic Rules for Electricity Market Operation;
- Rules on Regulating Electricity Markets;
- Functional instructive rules for Technical Support System of the Electricity Market;
- Guideline on Regional Electricity Market building;
- Rules for Promoting Open, Fair, Just Dispatching;
- Suggestions for the Management of Operation of Electricity Generation Plants connected and synchronized with the grid;
- Model Contract to Purchase Electricity;
- Model Agreement for Electricity Generation Plants connected and synchronized with the grid and for Dispatching;
- Tentative rules for Direct Pilot Purchase of Electricity Users from Electricity Generation Enterprises.

However, these regulations are far from sufficient for SERC to be able to complete its mission, and SERC needs to take further action.

First, as noted above, SERC should work to speed up the amendment of the Law of Electric Power, confirm the lawful duties and powers of the electricity regulatory institutions in the new law, and then revise the administrative regulations such as Regulations on electricity regulation according to this law. The amended Law of Electric Power needs to emphasize the following features:

(1) Establishment of electricity regulatory institutions, including the definition of their constitution, their general and specific legal powers and responsibilities, and their capacities for making relevant regulations and other laws.

(2) Determining the relationship between the electricity regulatory institutions and the new government department for energy policy making.

(3) Defining a new electricity sector framework, including sector structure, market structure, and the basic rights and obligations of the various relevant subjects.

Second, SERC needs to build up a number of additional regulatory rules as soon as possible, including the following:

- (1) General regulation procedures for SERC.
- (2) Advisory procedures for regulatory decision-making.
- (3) License procedures, licence models, etc..
- (4) Approval procedures for implementation of market rules, including market governance and transparency.
- (5) Price regulation procedures, including regulations on accounts, cost standards, regulations for information request standards, and price monitoring programs.
- (6) Rules for the procedures for electricity purchase, including standard contracts.
- (7) Service quality regulation rules, including complaint handling procedures.
- (8) Regulations or stipulations for investment regulation and system planning.

## **6.5 Strengthen Cooperation with Relevant Departments of the Government and Jointly Execute Relevant Regulatory Tasks**

As above mentioned, up to now SERC has not been authorized with the major regulatory functions of electricity price regulation, investment regulation, etc. These functions still remain in other departments of the government. SERC only has general rights to make proposals, as a subordinate entity in these aspects. But this does not mean that SERC has no useful role in these areas. It is still important for SERC to strengthen cooperation with relevant departments of the government (mainly the NDRC), to meet the needs of implementing the functions of regional electricity market building, supervising electricity market order, and protecting customer interests. SERC may perform efficiently and play important roles during this cooperation, and gradually reform traditional approval processes in practice and so improve functional allocation problems. As we understand it, there are not many staff in these other relevant departments of government to perform electricity regulation functions, and the numbers are insufficient to perform these roles adequately. In this circumstance, it is useful to both sides that SERC should strengthen its cooperation with those other departments.

Of course, even though SERC may be given the responsibility for major functions in the future, such as electricity price regulation, investment regulation, etc., macro-departments of government would still play a role on the basis of the separation of administration and regulation. SERC should therefore also strengthen its communications with those governmental departments according to the requirements of the work. However, in the current

circumstance, this cooperation is a pragmatic measure that is necessary and important.

## **6.6 Improve and Implement Measures on Electricity Regulation Fee Collection**

As mentioned earlier, the key source of income for regulatory institutions is often the electricity enterprises themselves. It complies with the principle of costs being covered by the responsible parties, and is common practice in other market economy countries because of its fairness and efficiency. However, it is clear that this method for collecting electricity regulation fees in China is at a preliminary level and it will be hard to implement. In the meantime, many of the administrative expenses of SERC (e.g. construction expenses for regional electricity markets) have no stable source of income to cover them. If this situation continues, it may produce problems of non performance, or some expenses may have to be covered indirectly by enterprises or other governmental departments. Either outcome would cause lasting damage to SERC in its role of implementing electricity reforms, and it may also damage the image of SERC or perhaps the government as a whole in the eyes of the public.

SERC (and other relevant departments of the government) should therefore fully understand the need to establish a system of electricity regulatory fees. The earlier it is put into effect, the more beneficial it will be for the execution of regulatory tasks, and the less damage it is likely to cause to the image of electricity sector regulation.

## **6.7 Urgent Need for Establishment of SERC at Regional, Provincial and Local Levels**

One of the current problems that prevent the improvement of electricity regulation capacity in China is that there are no basic regulatory mechanisms in place to execute and fulfil key regulatory tasks (e.g. customer protection and service quality). This greatly reduces the overall effectiveness of the sector regulation. Obviously, branch offices of SERC should not only exist at the regional level as regional bureau, but also in provinces. There must be a complete organization system of electricity regulation at provincial and lower levels, so as to guarantee effective and efficient regulation and the smooth promotion of electricity sector reform. One of the important tasks for short-term regulatory capacity building is therefore to deal with disputes on this matter, and to identify and execute a reasonable structure of branch institutions as soon as possible.

Early work should focus on the framework of subordinate institutions of SERC, i.e. to set up the basic unified organizations able effectively to execute regulatory instructions. In addition, current staffing levels are obviously not enough for SERC to execute its regulatory functions effectively. We provide detailed descriptions of relevant international experience

in Appendix A, but the following data is useful for reference:

(1) In Britain, OFGEM has about 300 personnel. It is responsible for supervision of both the electricity sector and natural gas. It is an independent office, and the scale of the electricity sector it supervises is only about as big as a medium-sized province in China.

(2) In the United States, the Federal Energy Regulatory Commission (FERC) alone has more than 1200 personnel. FERC covers the whole energy sector and has 5 regional offices. However, its responsibilities are largely limited to inter-state matters, and each state has a public utility commission to carry out detailed regulation of utility industries like the electricity sector within their state boundaries.

This supports the conclusion that there needs to be a large increase in staffing for electricity regulation. At the same time, each level of institution has to follow the principle of “better few than worse”. What needs to be emphasized is that the increase of SERC personnel would not necessarily add substantially to the total numbers of government personnel. As some functions are transferred from other departments of the government to SERC, the additional personnel for SERC may come from these departments.

## **6.8 Apply for Authority to Regulate State-owned Electricity Enterprises through Specific Methods**

As discussed in Section 4.5 of Chapter 4, it is not uncommon for regulatory organizations to regulate state-owned enterprises within the electricity sector. However, for the reasons discussed in Section 4.5, specific mechanisms are required to regulate these entities effectively, principally because of the different incentives that operate on them. We therefore recommend that SERC applies to the State Council for authority to use the specific range of measures proposed in Section 4.5.2 to enable effective regulation of the relevant state-owned electricity enterprises by SERC.

## **6.9 Improve Communication Channels with Other Government Agencies, and with Regulatory Bodies in China and Worldwide**

Electricity regulatory institutions are relatively new in China, and at the same time SERC is different from most current governmental entities. One of its basic functions is to settle various complicated disputes over interests. SERC must therefore have more robust mechanisms of communication and exchange with external entities, to establish good relations with other bodies and improve understanding of its role. In particular, we recommend that it should:

(1) Make full use of available electricity sector information, and strengthen the communication of sector information with the outside world;

(2) Invite or arrange domestic and overseas experts to make detailed research on electricity sector reform and regulation;

(3) Consider publication of an Annual Report on China Electricity Regulation, in order to improve transparency of regulatory activities and help SERC to promote its role and policies;

(4) Strengthen communication and cooperation with government and the relevant departments at various levels to win support and collaboration;

(5) Actively propose important policy recommendations to the State Council on the promotion of electricity sector reform, and improve its ability to promote policy making;

(6) Set up regular communication with overseas electricity regulatory institutions, to learn about their successful experiences and avoid their mistakes;

(7) Set up regular communication with other regulatory authorities responsible for regulation of domestic sectors such as telecom, stocks, banks, insurance companies, etc.. The problems, experience, and lessons they have encountered or dealt with will have many common characteristics and so will also be helpful to SERC's development.

## **6.10 Strengthen Personnel Training, and Establish Regulations for the Behaviour of Personnel**

SERC has carried out a lot of staff training since its establishment, such as inviting some leaders and relevant experts to take seminars, and arranging for some personnel to study or visit aboard. These play an active function in helping the personnel to understand the work of electricity regulation as rapidly as possible.

As electricity regulation measures and methods are different from most traditional administrative and management activities, a programme of standard personnel training is far from adequate to enable SERC staff to execute their functions effectively. Its personnel should be equipped with modern regulatory ideas relevant to the market economy, and wide-ranging professional knowledge. So we suggest that SERC should design and implement a more comprehensive training programme, including training in:

(1) Modern economics, especially the basic theory of regulated economics.

(2) Laws, especially the basic theory of economic and legislation.

(3) Standard theory and techniques of project evaluation and management of enterprise finance.

(4) Technical knowledge relating to electricity regulation.

(5) Public relations theory and practice.

(6) Experience and lessons from other countries that earlier carried out electricity sector reform.

In some areas of the public sector in China, there exist some problems of poor work quality and deficiencies in standards of behaviour, in terms of public service and other matters. If SERC wants to fulfil its functions and achieve the trust of electricity companies and the public, it is important for SERC to avoid being tainted by these bad practices. So, important aspects that need to be considered in respect of personnel recruitment and training are that: SERC must try hard to avoid appointing unsuitable personnel; and it should cultivate professional ethics into its personnel through establishing proper regulations on behaviour so as to inspire SERC staff to behave competently and prevent SERC staff from developing the undesirable trends that can possibly occur in this respect.

## Appendix A International Comparisons of Regulatory Bodies and Practices

In this Appendix we present an international comparison of the electricity sector regulatory arrangements in nine different countries. This is presented partly in table format, comparing specific data and characteristics, and partly in case study format, looking at two specific aspects of regulation:

- (1) Tariff setting powers and the degree of regulatory independence; and
- (2) The vertical split of regulatory authority in those cases where the country is organized on a federal basis.

Conclusions based on the data presented in this Appendix are contained in the relevant parts of the main report.

**Table A.1 (1) Fundamentals of Regulatory Bodies**

Country	Great Britain	Norway	Russia (Federal)	Spain
Name of Body	Gas and Electricity Markets Authority (GEMA), responsible for the Office of Gas and Electricity Markets (OFGEM)	Norwegian Water Resources and Energy Directorate (NVE)	Federal Tariffs Service (previously called and still often referred to as the FEK—the Federal Energy Commission)	National Energy Commission (CNE)
Date Established	1989 (as OFFER)	1921, competences were last modified in 1990	1995 as the Federal Energy Commission (FEK)	Created in 1998 as “Commission for the National Electricity System”, was later renamed “National Commission for the Electricity System” and later, when its powers were expanded to include the gas sector was renamed “National Commission for Energy”
Number of Members	Minimum 3 Members, currently 15 Members	One	Maximum 7 (one board for each regulated natural monopoly)	9 Members (in addition to a non-voting Secretary)
Term of Office	Maximum 5 years	6 years, renewable once	Not defined	6 years (to reduce coincidence with elections calendar cycle and maximise independence of the commission), renewable once (renewals are staggered with half of the board being reconsidered every three years)

续表 A.1 (1)

Country	Great Britain	Norway	Russia (Federal)	Spain
Required Qualifications	No specific requirements	No specific requirements	Not defined	Recognized technical and professional competence
Members Appointed by	Department for Trade and Industry	Proposed by the Ministry of Petroleum and Energy and appointed by the King	Government of the Russian Federation appoints and removes the Head and Deputies of the FTS	Proposed by the Minister of Industry. Appointed through a Government decree, after appearance in Congress
Grounds for removal	Only incapacity or misbehaviour	Established by the Civil Service Act 1983 (section 2) : below two years of service, a civil servant in Norway (such as the Director General of NVE ) “may be dismissed when there are proper grounds for doing so” and after two years of service, he “may be dismissed if as a result of illness he is permanently unfit to carry out his duties in a satisfactory manner, if he no longer has the qualifications that are necessary for the post, if for other reasons he is permanently unfit for the post”	Not defined	Permanent incapacity, incompatibility, legal offence, serious non-compliance with its functions. In addition, they can be dismissed by the Government after a reasoned request by the Industry Minister
Salary levels of Senior Officials	Not available	Not available	Not available	Not available
Degree of Independence from Government	Subject to Parliamentary oversight, but no significant control by Government Departments	NVE is subordinated to the Ministry of Petroleum and Energy. NVE’s decisions are reviewed by the Ministry	Very little - The head of the FTS bears the personal responsibility for performance of the powers assigned to it by the government and the realisation of state policy in the sectors	Formally independent. The Ministry is responsible for monitoring the efficacy of the Commission

Table A.1 (2) Fundamentals of Regulatory Bodies

Country	United States (Federal)	Australia (Federal)	Brazil	Argentina	India (Federal)
Name of Body	Federal Energy Regulatory Commission (FERC)	Australian Energy Regulator (AER) . NB: the AER is a constituent part of the Australian Competition and Consumer Commission (ACCC)	Agência Nacional de Energia Elétrica (ANEEL)	Ente Nacional Regulador de la Electricidad (ENRE)	Central Electricity Regulatory Commission (CERC)
Date Established	October 1 1977 (substituting the Federal Power Commission, FPC, which was established in 1920)	The AER commenced operations in July 2005	1996 (by means of Law 9427 of 26 December 1996) , as a substitute of the National Department of Waters and Electric Power	1991 ( Law 24065, creating ENRE , was approved in December 1991)	July, 1998

续表 A.1 (2)

Country	United States (Federal)	Australia (Federal)	Brazil	Argentina	India (Federal)
Number of Members	Up to five commissioners (only four)	Three	ANEEL is managed by a collegiate Board of Directors, composed of the Director-General and four other directors, among them, the Director-Ombudsman. The executive functions of ANEEL are under the responsibility of twenty superintendents. The <del>Office General</del> the Agency in legal matters	5 members: a president, a vice-president and three commissioners	Five ( 5 ) , consisting of a <del>Chairman</del> and four other Members including the Chairman, Central Electricity Authority as the ex-officio Member
Term of Office	5 years	Up to five years	4 years	5 years, but can be reelected for an indefinite term	Maximum 5 years
Required Qualifications	No specific requirements, it is only stated that "the Chairman and members of the Commission <del>should be</del> in-who, by demonstrated ability, background, training, or experience, are specially qualified to assess fairly the needs and concerns of all interests affected by Federal energy	No specific qualifications. One member must be a Commissioner of the ACCC	No specific requirements	No specific requirements. To be defined by the Energy Secretary of the Government each time a member of the Board has to be appointed (Decree 1398/92)	Having experience in any of engineering, law, <del>economic science</del> , management/sitting or retired judge of Supreme Court or Chief Justice of High Court
Members Appointed by	Appointed by the President of the United States with the advice and consent of the Senate	Two of the members are to be recommended for appointment by Ministers representing each of the States and Territories that have elected to be subject to the jurisdiction of the AER, the third is to be recommended for appointment by the Chair of the ACCC	Presidente da República (but previously approved by Brazilian Senate)	In the case of the President, Vice-president and first commissioner, public election by a Selection Committee including representatives of the sector. The other two <del>commissioners</del> are appointed by the Consejo Federal de la Energia, after the approval of a Parliamentary Commission	Central Govt on recommendations of selection committee headed by Member of Planning Commission in <del>Energy</del> sector, as per Act

续表 A.1 (2)

Country	United States (Federal)	Australia (Federal)	Brazil	Argentina	India (Federal)
Grounds for removal	May be removed by the President only for inefficiency, neglect of duty, or malfeasance in office	Incapacity or misbehaviour; Bankruptcy; Failure to comply with disclosure of interest requirements; Full-time members are not to take paid employment outside the AER; Part-time members are not to take paid employment in conflict with their responsibilities at the AER	Misbehaviour, failure to fulfill his duties, criminal conviction	Only by justified decision of the Government approved by a Parliamentary Commission	Insolvency, incapacity, convicted of offence involving moral turpitude, abusing his position, guilty of proved misbehaviour, having financial or other interests prejudicing his actions
Salary levels of Members/Senior Officials	The Chairman of FERC is compensated at level III and other members at level IV, as stated in the US Code Title 5	Not available. Subject to decisions of the Remuneration Tribunal	Not available	The remuneration of the members of the board is established by Government Decree	As prescribed by Central Government from time to time
Degree of Independence from Government	Independent. There is no review of FERC's decisions by the President or Congress	Independent Not subject to ministerial or political intervention	ANEEL is a semiautonomous government organisation which depends on the Ministry of Mines and Energy (MME). In particular, ANEEL enjoys financial independence, autonomy of its management and independent decision-making process based on technical issues	ENRE is and independent institution inside the Energy Department of the Economics Minister. However, it is subject to auditing by the Economics Minister and the Sindicato General de la Nación, which depends directly from the Government	No significant control by Government Departments, except policy guidelines and budgetary allocations

**Table A.2 (1) Organisation of Regulatory Bodies**

Country	England and Wales	Norway	Russia (Federal)	Spain
Source of Funding	Licence fees and other income from Licensees, but subject to Parliamentary approval	State funding	Government Budget	Service fees paid out of energy tariff entities as a percentage defined by the government
Organisational Structure (refer to organigrams)	See Figure A.2	See Figure A.4	See Figure A.5	See Figure A.8
Annual Budget	£37.3 million in 2003~2004	kr 228 million (aprox. \$32 million) in year 2003	Not available	2004 Financial Statements Revenue: € 22.1 million Costs: €14.3 million
Number of Employees	291 in 2003~2004	414 in year 2004	Approximately 200 for Energy – other sectors unknown	178 (at 31-12-2004)
State/Provincial Offices? (see Table A.4)	1 regional office, in Scotland	NVE is based in Oslo and has 5 regional offices in Tønsberg, Hamar, Førde, Trondheim and Narvik	Each local area (around 80 “oblasts” or regions) of the Russian Federation has its own Regional Energy Commission (REK) which regulates end-user tariffs within its region	Based exclusively in Madrid. However, consideration is being given to moving the CNE’s central offices to northern Spain
Decision Making Processes	No specific requirements for proceedings, and GEMA can decide	NVE has to follow the process detailed in the Public Administration Act (Chapters III and IV)	Undefined	Allowed to establish its own procedural rules
Appeals Procedures	Appeals limited to reference to the independent Competition Commission and judicial review	Appeals against NVE’s decisions are submitted to the Ministry of Petroleum and Energy. In addition, NVE’s decisions are subject to judicial review	The Antimonopoly Service is likely theoretical route, but in practice such issues are dealt with through the political process	Appeals to be made before the Minister

**Table A.2 (2) Organisation of Regulatory Bodies**

Country	United States (Federal)	Australia (Federal)	Brazil	Argentina	India (Federal)
Source of Funding	Annual charges and filing fees levied on the regulated companies. Budget has to be approved by Congress	Federal funding	ANEEL is mainly funded by a charge applied on generation, transmission and distribution companies (this charge amounts to 0.5% of the annual benefits of each utility) Other sources of funding are government’s budget transferences, sales of publications and other material, financial operations’ returns, other contracts’ revenues, and sales of tangible assets)	Mainly from an inspection and control tax that generators, distributors and transmission companies must pay the regulator each year (other sources of funding are subsidies and donations; fines and confiscations; interests and revenues from own resources). Budget has to be approved by Congress	Grants & loans made by the Central Govt., and fees and <del>and from</del> licensees, but subject to Parliamentary approval
Organisational Structure (refer to organigrams)	See Figure A.3	Divided into three groups, see Figure A.10	See Figure A.9	See Figure A.6	See Figure A.7

s)

Country	United States (Federal)	Australia (Federal)	Brazil	Argentina	India (Federal)
Annual Budget	2003 (actual): \$190 million; 2004 (estimate): \$204 million; 2005 (request): \$210 million	A\$12.3 million in 2006~2007	In 2004, ANEEL's budget amounted to 219040668 R\$ (74852687US \$) The budget of ANEEL and its execution are public ANEEL has to publish annually a report to the Federal Court of Accounts showing that its administration has been transparent (this report is called Annual Rendering of Accounts)	\$ 23 million in 2002	Around £0.6 million
Number of Employees	2003 (actual): 1214; 2004 (estimate): 1250; 2005 (request): 1280	Funded for 77 permanent positions in 2006~2007	Not available	151 in 2002 (out of which two tiers are technical staff)	68 during 2003~2004
State/Provincial Offices? (see also Table A.4)	5 regional offices in Atlanta, Chicago, New York, Portland and San Francisco	Head office: located in Melbourne. Other offices are located in <del>Atlanta, Chicago, New York, Portland and San Francisco</del> and Brisbane	ANEEL does not have state/provincial offices, but it is in the process of decentralizing some of its powers and operations, by signing Cooperation Agreements with regional regulatory agencies	There are provincial regulatory institutions (currently 13 plus 4 being developed)	Only one office at headquarters in New Delhi, India. No regional or other office
Decision Making Processes	FERC is authorized to establish such procedural and administrative rules as are necessary to the exercise of its functions	Currently, decisions required the unanimous agreement of the members present and voting. However, it is intended that the AER voting rule will change to a requirement for simple majority decisions when the AER assumes responsibility for national regulation of distribution and retailing in January 2007	ANEEL decides its own procedures, by means of Resolutions. However, several general principles are established as follows: lawfulness, impersonality, morality, publicity, procedural efficiency; It has to be noted also that for the Board of Directors of ANEEL to meet, at least three directors (including the Director-General or its legal substitute) have to be present. The decisions of the Board of Directors need the agreement of at least three members	Some very broad principles of processes are set by Law 24065	Through proceedings and written orders
Appeals Procedures	Judicial review (U.S. Courts of Appeals and Supreme Court)	Decisions are subject to judicial review. Decisions on gas are also subject to merits review under the gas pipelines law. There is also likely to be merits review for electricity in future, under a proposed new administrative rule	Any administrative appeal to a decision by ANEEL has to be forwarded to ANEEL itself, which has powers to annul and revoke its own decisions. The decision by ANEEL's board exhausts the administrative stage. However, this does not prevent any agent from resorting to the courts, even before the submission of an administrative appeal. It is remarkable that ANEEL has defined several quality standards for services provided to customers (in compliance with Presidential Decree 3507, of June 13, 2000, which sets directives for the establishment of quality standards and of a permanent process of quality evaluation of services delivered by governmental organizations at the national level)	ENRE's decisions are subject to the following controls: (i) Administrative control (appeal to the Energy Department); (ii) Judicial control (appeal to the Cámara Nacional de Apelaciones); (iii) Ombudsman's appeal. The ombudsman can ask, on his own initiative or at the request of one of the parties, for the investigation of any act, fact or failure to act of ENRE, that may represent an illegitimate, defective, irregular or abusive exercise of ENRE's rights	Appeals to the "Appella <del>ibunal</del> for Electricity", limited against the orders of the <del>adjudicating</del> <del>tribunal</del> or the Central Commission, under the Act

Table A.3 (1)

## Organisation of Regulatory Bodies

Country	England and Wales	Norway	Russia (Federal)	Spain
Sectors Regulated	Electricity and natural gas	Water and energy	Electricity; Thermal Energy (district heat) ; Natural Gas; Oil Pipelines; Railway Transportation; Ports & Airports; Ice-breaking services; Post; Telecommunications and certain other prod-	Electricity, natural and liquefied petroleum gases and oil
Types of Entities Regulated	Mainly Private Sector companies, but also State-owned nuclear generator	Entities mostly owned by local and /or regional authorities	Natural monopolies, which in general are still majority state-owned companies	Private entities
Range of Electricity Responsibilities	Responsible for regulation of : generation (including system operation ) , distribution, and supply sector	Mainly network regulation and licensing of electric utilities. In addition, NVE monitors the country's energy systems, including generation, sales, transmission and energy use; and assesses future needs in the generation and transmission system	Responsible for regulation of : generation (including system operation), distribution, and supply sector	Advisory body for the Government, competition supervision, settlement of the regulated costs of the electricity system, technical inspection, arbitration between energy sector parties, ring-fencing supervisory body for regulated entities
Price Regulation Powers	Yes, full authority on prices	Yes, NVE sets income limits for distribution companies and approves their tariffs	A wide range of electricity prices and charges are regulated, including generation tariffs, tariffs for system operation, market services, ancillary services, transmission, and limits for retail tariffs	No, although it is compulsory for the CNE to draft a non-binding decision of each tariff proposal. European Commission requires national regulators to define the tariffs or at least the tariff methodology. However, this requirement has not yet been transposed into Spanish legislation
Authority over Market Design	Yes, full powers over NETA	Only setting guidelines for system operation	No — this is the responsibility of the Government. The State-controlled electricity company (RAO UESR) is leading electricity market design, but the Ministry of Economic Development & Trade (MEDT) has policy oversight	No, although non-binding decisions by CNE are required in most issues
Investment Regulation Powers	Indirectly through price regulation	Indirectly through price regulation	In so far as tariffs are based on budgeted cash costs — including any investment requirement	No, although non-binding decision by CNE is required in the energy planning process
Quality Regulation Powers	Yes	Yes (new regulations on quality of service to enter into force in January 2005)	In practice— No	No, but it monitors quality of service

**Table A.3 (2) Organisation of Regulatory Bodies**

Country	United States (Federal)	Australia (Federal)	Brazil	Argentina	India (Federal)
Sectors Regulated	Natural gas, oil and electricity	Wholesale electricity market and electricity transmission networks in the National Electricity Market (NEM); transmission networks and enforcing the gas access code in all jurisdictions except Western Australia; AER assumes responsibility for national regulation of <del>distribution</del> January 2007	Only electricity	Electricity	Electricity
Types of Entities Regulated	Private entities (FERC has only limited jurisdiction over entities owned by the public sector)	Both Private Sector and State-owned companies	Concession companies, both private and state-owned (Brazil used to have a state-owned system, which is being progressively privatised over the last years)	Concession companies, all of which are privately owned	Generating Companies owned by Central Govt plus those having <del>concession</del> scheme for more than one state, and Inter-state Transmission Utilities
Range of Electricity Sector Responsibilities	FERC regulates interstate electricity transmission, the sale of electricity for resale and mergers	Electricity and gas access pricing and transmission revenue regulatory decisions; service standards; guidelines for ring-fencing; promulgating the regulation test for <del>electricity</del> ; enforcing the National Electricity Law and Rules and the Gas Pipelines Access Law and Gas Code	Its powers and responsibilities are: to regulate and supervise the generation, transmission, distribution and commercialization of electric power, addressing the complaints from agents and consumers; to mediate conflicting interests among agents of the <del>electricity sector</del> and <del>between the</del> nt, permit and authorize electricity facilities and services; to <del>promote fair</del> ensure the quality of services; to enforce investment by agents; to <del>participate among</del> the operators and to ensure universal access to services	Tariff setting; regulation on security, technical aspects, measurement and <del>billing</del> , connexion issues, quality of service; antitrust regulation; concession assignment; fines	Responsible essentially for regulation of tariff of Central Generating Companies and Inter-state <del>Transmission Utilities</del> <del>and</del> issue <del>trading</del>

续表 A.3 (2)

Country	United States (Federal)	Australia (Federal)	Brazil	Argentina	India (Federal)
Price Regulation Powers	On transmission prices	Yes, responsible for electricity and gas access pricing and transmission revenue regulatory decisions	Yes, as stated by ANEEL itself, ANEEL "is responsibility to establish electricity rates ensure payment of a fair price by end-consumers, as well as to ensure the economic-financial health of the distribution concessionaire so it may offer a service with the necessary quality, reliability and	Yes, ENRE sets maximum transmission and distribution prices	Yes, full authority on prices
Authority over Market Design	Yes, FERC has complete jurisdiction over the wholesale electricity marketplace	No. This is the responsibility of the Ministerial Council on Energy (MCE) and/or the Australian Energy Market Commission (AEMC is responsible for rulemaking)	Only in the framework of MME's general guidelines [ANEEL elements the general policy decisions of the Ministry of Mines and Energy (MME)], and the stipulations of the electricity sector regulations	No	Market design determined by Electricity Act. Time and phases of introduction to be decided by Commission
Investment Regulation Powers	Indirectly through price regulation	Yes, through promulgating the regulatory test for transmission investment referred to Electricity Rules and disputes regarding regulatory test assessments. Also approves gas transmission investments under the Gas Code	Indirectly through price regulation, concession bids (for generation, transmission, and distribution) and concession contract terms	Indirectly through price regulation	Indirectly through price regulation
Quality Regulation Powers	Together with North American Electric Reliability Council (NERC)	Yes, under the service incentive regime in revenue cap determinations. Some technical standards are the responsibility of state regulatory agencies	Yes, ANEEL sets quality of service standards for the electricity sector and supervises its fulfilment	Yes	Yes

**Table A.4**

**Vertical Allocation of Regulatory Responsibilities**

Country	United States		Russia		Australia		India	
	Federal Level	Local Level	Federal Level	Local Level	Federal Level	Local Level	Central Level	Local Level
Central/Local Organisational Link	Department of Energy and Federal Energy Regulatory Commission(FERC)	State Public Utility Commissions	The Federal body is established by the Federal Government and has powers to set bounds on the tariffs set by Regional Energy Commissions	There is a Regional Energy Commission(REK)for each local area("oblast" or region)of the Russian Federation	Australian Energy Regulator (AER)	State regulatory agencies	Central Commission is established by the Central Government and has no direct links to State Commissions	These are established by State Governments, and are not subject to control or oversight by the Central Commission
Level of Local Organisations	Below the Federal level are the State organisations	No relevant entities below the State level, though some states have more than one entity	Single organisation with no local representation	Exist only at Oblast level, with no offices or representation at more local levels	Single Federal body	State level, with no lower level bodies	Single organisation with no local representation	Exist only at State level, with no offices or representation at more local levels
Central/Local Allocation of Responsibilities (prices, investment, etc.)	FERC regulates interstate transmission, sale of electricity for resale and mergers	State public utility commissions regulate generation, distribution, service and prices to end-users, transmission siting, and environmental concerns	Responsible for: transmission tariffs where lines cross regional boundaries; generator tariffs for so-called "Federal stations" (typically very large condensing stations)plus nuclear stations and major hydro stations; setting limits (typically on the % increase)on end-user tariffs that REKs can set	Responsible for end-user tariffs that can be charged by integrated regional electricity companies (Energos)	Economic regulation	Technical standards, safety, metering, distribution and retail geographical service areas, service reliability and performance standards, special requirements for small customers	Responsible for regulation of tariff of Generating Companies owned by Central Govt plus those having composite generation scheme for more than one State and Inter-state Transmission Utilities, issue of licenses for transmission & trading, specify Grid Code and standards of performance – no jurisdiction within States except in matters relating to inter-state transfer of electricity	Full responsibility for all regulatory matters within States
Relative Staff Numbers	1250 (year 2004)	Depends on each State (some States have more than one PUC). Some examples are: Colorado PUC, 95 employees; Maine PUC, 61 employees; New Hampshire PUC, 73 employees; Idaho PUC, 49 employees; Texas PUC, 210 employees; Oregon PUC, 124 employees	Approximately 200	Approximately 5	Funded for 77 permanent positions in 2006~2007	Yet to be determined. AER only assumes responsibility for national regulation of distribution and retailing in January 2007(until then, these are the responsibility of the State regulatory agencies and the relevant staff have not transferred)	68	Varies from state to state; but in the range of 75 ~ 100



## A.1 Case Study 1: Tariff Setting Powers and Regulatory Independence

In this case study we consider, with reference to these regulatory bodies studied here, the issue of independence of the regulator from other governmental organizations in its tariff setting role.

### ➤ The Need for Regulatory Independence in Tariff Setting

The new institutional economics and the examples of regulatory regimes around the world have emphasised the importance of regulatory credibility and reputation to ensure private investment in monopoly industries. Governments have great difficulty to issue credible statements because of their multiple opposing political economy objectives.

Companies invest under a set of rules that are may change because of the pressures on governments to use their control over regulated sectors to achieve industrial, employment or social objectives when the need arises. Anticipating this opportunistic behaviour, private utilities will likely invest less than is optimal or demand high-risk premiums. The result is bad for the companies and bad for the government, but this temptation is unlikely to provide the right incentives unless complemented by some reform.

Countries react to the credibility problem in two different ( and sometimes complementary ) ways. They may resort to:

- (1) Institutional reform.
- (2) Entering into long-term contractual arrangements.

Long-term contracts tend to specify the obligations of the investor in terms of quality, coverage, investment plans and the remuneration expected from the fulfillment of these obligations. These contracts are usually signed with the host state directly and tend to be subject to international arbitration.

The main difficulty of these contracts is that they tend inevitably to be incomplete. Predicting every single future contingency is not possible especially in contractual relationships that may last a long time. As a result, forced contract renegotiations are a real possibility and when the rules to conduct them are not clear the scope for opportunistic behaviour from either party could reduce the effectiveness of long-term contracts.

Even when contracts are part of the regulatory framework, some countries resort to the creation of independent regulatory commissions. These institutions tend to solve the commitment problem by reducing the link between elected politicians and the electricity sector. By contraposition to long-term contracts, analysts refer to these reforms as the creation of implicit contracts between consumer, companies, government and the regulatory commission.

The main virtue of an independent regulatory commission is that it is detached from the

political process and can take decisions that are not affected by political considerations. But even the regulatory process is unlikely to completely eliminate the discretionary nature of regulatory decisions, and with tariff setting in particular it is necessary to create a properly specified and transparent framework to reduce the exercise of this discretion. The independence and autonomy achieved by the regulator needs to be complemented with a set of rules that constrain its behaviour.

Tables A.2 (1) and A.2 (2) show that in most of the countries surveyed the regulatory entities have full responsibility for tariff regulation. The cases of electricity distribution in Norway and Argentina and the federal regulation of transmission tariffs in the US, presented below, have been chosen as three particularly interesting examples of the existence of ( more or less )independent regulators in charge of price setting in order to overcome the problem of governmental inconsistency. We also review the cases of India and Russia. In the Indian case, despite the existence of legal powers, the state regulatory commissions have struggled to exercise their independent tariff setting powers. In the Russian case, the regulatory entities have no legal powers to carry out tariff regulation. The following paragraphs include a brief description of the process of tariff setting of each of the regulators considered, making special reference to the degree of discretion that the regulator enjoys in setting revenues and tariffs.

### ➤ **Distribution Tariff Setting in Norway—The Role of NVE**

In Norway, distribution tariffs are set by the independent regulator, Norwegian Water Resources and Energy Administration (NVE) , in order to reduce the possibility of political discretion. As stated by NVE itself, its main responsibility is “to ensure that tariffs for transmission of electricity reflect the cost of efficient operation and maintenance of the network and of investments in the network”.

This involves two main activities. First, NVE determines revenue caps to ensure efficient development of the grid and reasonable charges for customers. Second, the regulator determines the framework within which the tariffs must be developed.

NVE regulates around two hundred network companies. The regulator enjoys a high degree of discretion in the way tariffs are established, since the legislation does not include any provision in relation to the type of regulation (cost-of-service versus price or revenue cap) , the length of the regulatory period, or the allowed return of invested capital.

The remuneration of the grid activities has evolved through two clear phases: a cost of service system between 1992 and 1997 and an incentive based system of regulation implemented in January of that year (1997~2001) and maintained with few changes for the period 2002~2006. Grid companies operate under concession from the government and are

required to allow access to their network at tariffs set by the regulator.

NVE determines a revenue cap for each grid company, based on factors that influence costs in the area served, such as climate, topography and settlement patterns. The company's income must not be higher than a figure determined by NVE. Revenue caps are set for a minimum of five years and are corrected annually for inflation.

The revenue formula depends on the actual level of costs of each utility and on individual efficiency requirements (based on benchmarked efficiency measurements). The more efficient grid companies are only required to achieve the general efficiency requirement, while less efficient companies must also achieve individual requirements.

The revenue cap is increased annually by a factor equivalent to half the percentage increase in energy supplied. The formula is intended to encourage grid companies to operate more efficiently, and to consider alternatives to investments in increased transmission capacity. A reduction in the quantity of energy supplied does not result in a reduction in the revenue cap.

### ➤ **Distribution Tariff Setting in Argentina—The Role of ENRE**

In Argentina, the Ente Nacional Regulador de la Electricidad (ENRE) is the independent agency in charge of establishing maximum regulated electricity prices for each of the distribution and transmission companies in the country. Theoretically, tariffs should be established every 5 years (with the exception of the first regulatory period, which was foreseen to last 10 years), and are part of the concession contracts signed by the distribution companies.

ENRE enjoys a low degree of discretion in the regulation of distribution companies, because Law 24065 establishes the length of the regulatory period, the allowed rate of return and provides that remuneration of regulated companies will include an efficiency correction factor.

The first regulatory period ended in September 2002 for distribution companies Edenor and Edesur and in December 2000 for Edelap, and the revision (including the submission of a proposal for the review of tariffs by the distributors to ENRE, seeking for approval) was initiated months before.

In May 2000, ENRE communicated (by means of Resolution No.265) the timetable of the proposed revision. Other steps conducted in order to develop the tariff revision for the period 2002~2007 were ① the hiring by ENRE of a group of independent consultants to provide the regulator with an alternative proposal of distribution tariffs, that would be used together with the distributor's proposal for the definitive resolution; ② the development of certain methodological aspects and certain issues related to tariff setting; ③ the establishment of the criteria that the distributors should follow in their tariff proposals.

However, due to the economic crisis Argentina was suffering, the Economy Minister issued in 2002 Resolution No. 38, by which it required the regulators to interrupt any tariff revision process.

Therefore, even if the regulation in Argentina assigns ENRE, as independent regulator, the power to define electricity distribution tariffs, and the legislation limits its discretion, the regulator is not completely free from the interference of the government.

### ➤ **Transmission Tariff Setting in the US — The Role of FERC**

As established by the Department of Energy's (DOE) Organization Act 1977, FERC regulates the remuneration of inter-state transmission companies. However, the Act does not set the method of regulation, the length of the regulatory period nor the allowed return allowed for the invested capital.

The US legislation does not even establish the difference between “transmission” and “distribution” companies. The distinction between transmission and distribution companies was officially set by means of FERC Order 888, approved in 1996. Before its approval, transmission companies were normally defined only in terms of their nominal voltage. With Order 888, FERC developed a series of tests (the Seven Factor Test) to use in the determination of what facilities historically classified as transmission facilities could be reclassified as local distribution facilities and therefore subject to the jurisdiction of the state.

Therefore, FERC seems to have a high degree of discretion in setting transmission revenues, however, precedents and an open process of consultation and public hearings reduce uncertainty for regulated companies.

Transmission owners in the US have traditionally been subject to cost of service regulation and are allowed a certain return on equity in the form of a regional transmission tariff, determined by FERC. In some circumstances there is in addition a state jurisdictional component of that tariff set by state regulatory commissions.

FERC has approval responsibility for transmission rate schedule for individual transmission companies but also for regional transmission organizations (RTOs) . Transmission companies and RTOs present their proposals to FERC for their approval. Transmission companies also propose the validity period of the proposed tariffs, even in cases when the process of creation of RTOs lead to several companies asking for shorter periods for transitional purposes.

The regulation of transmission revenues has been modified in recent years, although its basis is still the Policy on Transmission Pricing issued in 1994 by FERC. The main changes were designed by FERC to achieve open access non-discriminatory transmission tariffs (FERC Order 888, which also permits public utilities to seek recovery of stranded costs

associated with providing open access) and to encourage the creation of RTOs (FERC Orders 888 and 2000) .

### ➤ **Tariff Setting Powers and Regulatory Independence in India**

The electricity sector in India is currently regulated under “The Electricity Act, 2003”. This Act stipulated that there should be a Central Electricity Regulatory Commission and State Electricity Regulatory Commissions in each state. There is also provision for Joint Commissions between two or more Governments of States, where the states want it; or between Central Government, in respect of one or more Union territories, and one or more Governments of States.

With regard to tariff setting, the Electricity Act., 2003 mandates that the Central Government shall prepare a Tariff Policy in consultation with the State Governments and the Central Electricity Authority. The law also requires that the Central Electricity Regulatory Commission shall advise the Central Government on the Tariff Policy.

The Act specifically mentions that tariffs be set according to the national tariff policy and allows a multi-year tariff principle. It emphasizes that the tariffs should progressively reflect the cost of service and that cross-subsidies have to be eliminated in a specified time frame. It also seeks to encourage generation of electricity from renewable sources of energy.

With regard to tariff setting, the Central Electricity Regulatory Commission has the following powers:

(1) To regulate the tariff of generating companies owned or controlled by the Central Government.

(2) To regulate the tariff of generating companies other than those owned or controlled by the Central Government specified in clause (1), if such generating companies enter into or otherwise have a composite scheme for generation and sale of electricity in more than one State.

(3) To determine tariff for inter-State transmission of electricity.

Correspondingly, the State Electricity Regulatory Commissions have the following powers with regard to tariff setting:

(1) Determine the tariff for generation, supply, transmission and wheeling of electricity, wholesale, bulk or retail, as the case may be, within the State: Providing that where open access has been permitted to a category of consumers, the State Commission shall determine only the wheeling charges and surcharge thereon, if any, for the said category of consumers;

(2) Regulate electricity purchase and procurement process of distribution licensees including the price at which electricity shall be procured from the generating companies or licensees or from other sources through agreements for purchase of electricity for distribution and supply within the State.

Subject to the national tariff policy and the policy guidelines issued by Central and State

Governments from time to time, the Central and State Electricity Regulatory Commissions have full independence on tariff setting.

### ➤ **Tariff Setting Powers and Regulatory Independence in Russia**

In contrast to most of the other examples given, in Russia, there is no “independent regulation”. Tariffs are effectively controlled by the Government, and this lack of independence of tariff setting in Russia, is seen as a major weakness of the system, as tariffs remain a political issue. The Ministry of Economic Development & Trade continues to exercise strong control over the level of all tariffs as an important part of its management of the economy.

In practice, therefore, the FTS (FEK) and the REKs are limited to determining and applying detailed methodologies to calculate the precise tariffs.

## **A.2 Case Study 2: The Vertical Split of Regulatory Authority—India, the United States and Russia**

In this set of cases studies, we look at how regulatory responsibilities and powers are split vertically in three of the cases where there is a federal system. In Tables A.1 to A.4 we also review a fourth case where there is a federal form of government, Australia. However, the regulatory arrangements there are in the process of transition with greater powers now allocated to the centre, and it is not therefore reviewed here in detail.

### ➤ **The Indian Case—Federal and State Structure**

During the year 2003, the Indian Parliament passed a new Act, the Electricity Act, 2003. This Act combined all the five or six existing Acts relating to electricity sector in India, in force at that time.

The Electricity Act, 2003 envisages a co-ordinated approach towards the development of the Indian electricity system. At the highest level, the Central Government is required to specify the national electricity policy and national tariff policy, and the Central Electricity Authority is required to specify the national electricity plan. The national electricity policy and the national electricity plan broadly decide the sources of electricity generation keeping in view overall optimum resource realisation, environmental concerns, etc. The Act envisages establishment of a Central Commission and State Commissions in each State, who will discharge their functions according to the above electricity policy, tariff policy and electricity plan. The regulatory commissions are expected to promote efficiency, economy, competition and investment in the electricity sector in a transparent manner and formulate a rational tariff structure for different components of the electricity sector.

Central Electricity Regulatory Commission: The Central Commission was set up in July 1998. It functions in a quasi-judicial manner, and has the powers of civil courts. The Central

Commission has the responsibility to discharge the following functions:

(1) To regulate the tariff of generating companies owned or controlled by the Central Government.

(2) To regulate the tariff of generating companies other than those owned or controlled by the Central Government specified in clause (1) , if such generating companies enter into or otherwise have a composite scheme for generation and sale of electricity in more than one State.

(3) To regulate the inter-State transmission of electricity.

(4) To determine tariff for inter-State transmission of electricity.

(5) To issue licenses to persons to function as transmission licensee and electricity trader with respect to their inter-State operations.

(6) To adjudicate upon disputes involving generating companies or transmission licensee in regard to matters connected with clauses (1) to (4) above and to refer any dispute for arbitration.

(7) To levy fees for the purposes of the Act.

(8) To specify Grid Code having regard to Grid Standards.

(9) To specify and enforce the standards with respect to quality, continuity and reliability of service by licensees.

(10) To fix the trading margin in the inter-State trading of electricity, if considered, necessary.

The Central Commission also advises the Central Government on ① formulation of national electricity policy and tariff policy; ② promotion of competition, efficiency and economy in activities of the electricity sector; ③ promotion of investment in electricity sector.

State Electricity Regulatory Commissions: Most of the states in India, totalling to 28, have already set up State Electricity Regulatory Commissions. For smaller States and Union Territories, the Act formulates establishment of a Joint Commission for more than one States or between one or more States and Union Territories.

These Commissions now assume most of the roles that the earlier State Governments were exercising on the State Electricity Boards, except formulation of policy guidelines. The State Commissions are required to perform the following functions:

(1) Determine the tariff for generation, supply, transmission and wheeling of electricity, wholesale, bulk or retail, as the case may be, within the State: Providing that where open access has been permitted to a category of consumers, the State Commission shall determine only the wheeling charges and surcharge thereon, if any, for the said category of consumers.

(2) Regulate electricity purchase and procurement process of distribution licensees including the price at which electricity shall be procured from the generating companies or licensees or from other sources through agreements for purchase of electricity for distribution and supply within the State.

(3) Facilitate intra-state transmission and wheeling of electricity.

(4) Issue licences to persons seeking to act as transmission licensees, distribution licensees and electricity traders with respect to their operations within the State.

(5) Promote cogeneration and generation of electricity from renewable sources of energy by providing suitable measures for connectivity with the grid and sale of electricity to any person, and also specify, for purchase of electricity from such sources, a percentage of the total consumption of electricity in the area of a distribution license.

(6) Adjudicate upon the disputes between the licensees, and generating companies and to refer any dispute for arbitration.

(7) Levy fee for the purposes of the Act.

(8) Specify State Grid Code consistent with the National Grid Code.

(9) Specify or enforce standards with respect to quality, continuity and reliability of service by licensees.

(10) Fix the trading margin in the intra-State trading of electricity, if considered, necessary.

The State Commissions also advise the State Governments on: ① promotion of competition, efficiency and economy in activities of the electricity sector; ② promotion of investment in electricity sector; ③ reorganization and restructuring of electricity sector in the State; ④ matters concerning generation, transmission, distribution and trading of electricity or any other matter referred to the State Commission by that Government.

The Vertical Split of Regulatory Authority between the centre and states, as described above, is quite relevant to the political structure in India, and is seen as sensible.

### ➤ **The Case of the US — Vertical Organisation Structure**

The United States has a federal constitution, and as such, some of the powers of the States that form part of the Federation have been delegated into a higher supra-state organisation. This is the case of some aspects of the regulation of utilities in general and of electricity sector companies in particular.

The Public Utility Holding Company Act (PUHCA) and the Federal Power Act (FPA) of 1935 established a regime of regulating electric utilities that gave specific and separate powers to the states and the federal government.

This fact leads to the coexistence of two levels of electricity regulator bodies: a federal

regulator (FERC) and state regulators (the Public Utility Commissions).

The current structure of the regulation of electricity utilities in the US is a consequence of the developments of regulation that occurred during the last two centuries: state regulatory commissions began to develop in the 1830s and increased in number and power in the 1870s. These commissions combined legislative, judicial and administrative authorities and made possible a more comprehensive and flexible regulation of public utilities. The number of state commissions grew rapidly after 1907 and by 1920 more than two-thirds of the states had created regulatory commissions.

The Public Utility Commissions of each state have joined to form the National Association of Regulatory Utility Commissioners (NARUC), as a non-profit organisation whose objectives are “the advancement of commission regulation through the study and discussion of subjects concerning the operation and supervision of public utilities and carriers, the promotion of uniformity of regulation of public utilities and carriers by the several commissions, the promotion of coordinated action by the commissions of the several States to protect the common interests of the people with respect to the regulation of public utilities and carriers, and the promotion of cooperation of the commissions of the several States with each other and with the Federal commissions represented in the Association” (article II, NARUC Constitution). Therefore, the NARUC is not a regulatory body, but a think-tank and a coordination organisation.

The first federal commission with regulatory powers was the Interstate Commerce Commission, established in 1887. Federal regulation was expanded in the 1930s when much of the regulatory responsibility shifted from the states to the federal government. In 1935 the Federal Power Commission, now the Federal Energy Regulatory Commission, was empowered to regulate interstate sales of electricity, and in 1938 it was expanded to govern the regulation of interstate natural gas sales.

In most cases, the federal government regulates the transmission of goods and services between states or regions, while the state or local agencies regulate the flow of goods and services within the state. In some instances, the distinction is also made between retail and wholesale pricing such as in the case of FERC, which regulates the wholesale rates of electricity, while the state and local agencies regulate the retail rates.

The division of powers in electricity regulation.

FERC regulates interstate transmission, sale of electricity for resale and mergers, while state public utility commissions regulate generation, distribution, service and prices to end-users, transmission siting and environmental concerns.

The functions of the federal regulator are listed in the Department of Energy's (DOE) Organization Act.1977, which creates FERC, and in particular in section 7172 (Jurisdiction of

Commission). This article refers to other regulations, such as the Federal Power Act (FPA) 1935 for the case of transmission pricing, which provides that “it is declared that the business of transmitting and selling electric energy for ultimate distribution to the public is affected with a public interest, and that Federal regulation of matters relating to generation to the extent provided and of that part of such business which consists of the transmission of electric energy in interstate commerce and the sale of such energy at wholesale in interstate commerce is necessary in the public interest, such Federal regulation, however, to extend only to those matters which are not subject to regulation by the States” (FPA Declaration of Policy).

The DOE Act also defines the relationships between the federal regulator and the states’ regulators. In particular, it establishes that “whenever any proposed action by the Department conflicts with the energy plan of any State, the Department shall give due consideration to the needs of such State, and where practicable, shall attempt to resolve such conflict through consultations with appropriate State officials. Nothing [...] shall affect the authority of any State over matters exclusively within its jurisdiction” (DOE Act 1977, Declaration of Findings and Purposes).

The Energy Policy Act (EPACT) of 1992 further clarified the relationship between the Federal Energy Regulatory Commission and state public utilities commissions. Under the Act, FERC would have complete jurisdiction over the wholesale electricity marketplace while electricity competition at the retail level would remain within the jurisdiction of the state public utilities commissions.

In relation to mergers, the powers of FERC are shared with the Department of Justice and the Federal Trade Commission.

The relations between both levels of regulation of the electricity sector in the US, federal and state, are summarised in the following figure.

### ➤ **The Russian Case — Federal and Local Structures**

In Russia, the Federal Tariffs Service (previously the Federal Energy Commission – FEK) is responsible for regulating all inter-region and cross-region tariffs – transmission lines, generator tariffs for so-called “Federal stations” (typically very large condensing stations) plus nuclear stations and major hydro stations. It also establishes limits (to apply policy objectives) on the end-user tariffs that the Regional Energy Commissions (REKs) can set.

The REKs set the end-user tariffs that can be charged by integrated (generation, distribution and supply) regional electricity companies (called Energos). The capability and objectivity of REKs varies significantly between regions, but all REKs are subjected to conflicting pressures:

- (1) From the Energos, the pressure is to increase tariffs to cover costs – especially in

view of the recent significant increases in fuel costs;

(2) From the Regional Government, the pressure is to keep tariffs for the population low for social and political reasons;

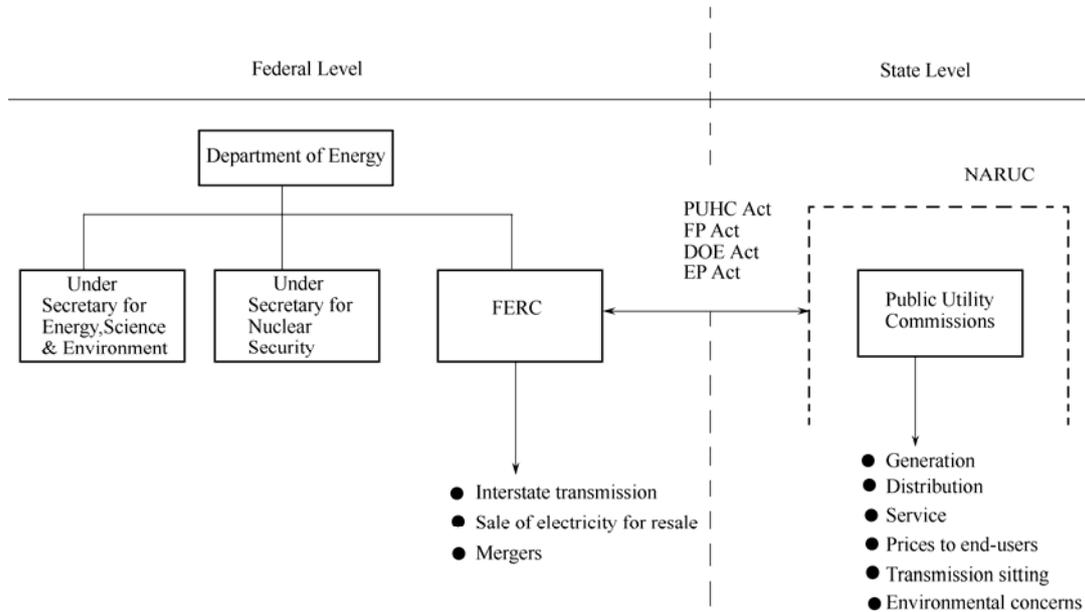


Figure A.1 The Vertical Split of Electricity Regulators in the US

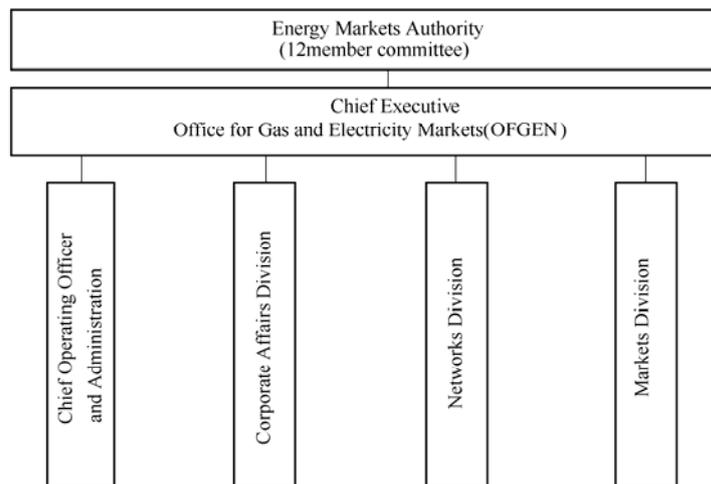


Figure A.2 Organisation Chart of OFGEM, Great Britain

(Source: Ofgem's web page)

(3) From local industries, the pressure is to reduce the level of cross-subsidies and hence their tariffs.

The level of cross-subsidy in Russia is very substantial, and is likely to prove to be the greatest obstacle to electricity sector reform. There are estimates that in some cases the tariffs for the population need to increase by 6 times, in order to cover costs.

Larger industrial consumers are moving away from buying their electricity from the regional Energos, and are either buying direct from the Federal Wholesale market or are building their auto-generation plant — especially if they have a requirement for process steam. The level of auto-generation construction would be even greater if more gas supply could be assured. As a consequence of this shift in the buying pattern of industrial consumers, the regional Energos are finding it more and more difficult to cover their costs and the REKs are having to face up to economic realities.

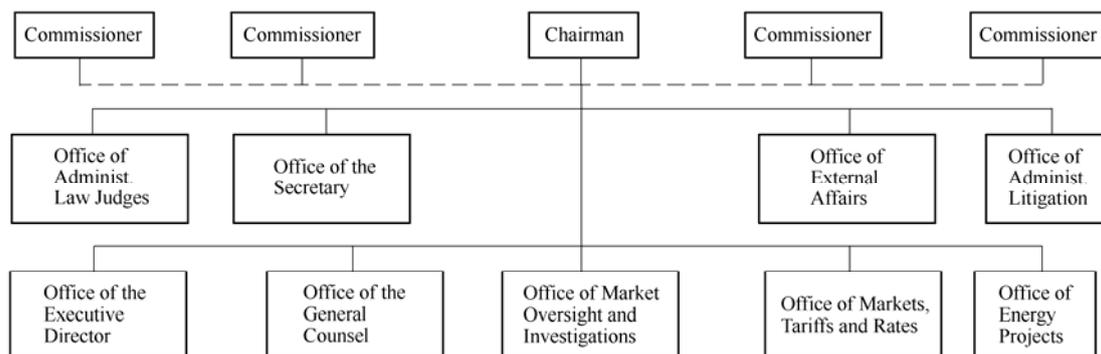


Figure A.3 Organisation Chart of FERC, USA

(Source: FERC’s web page)

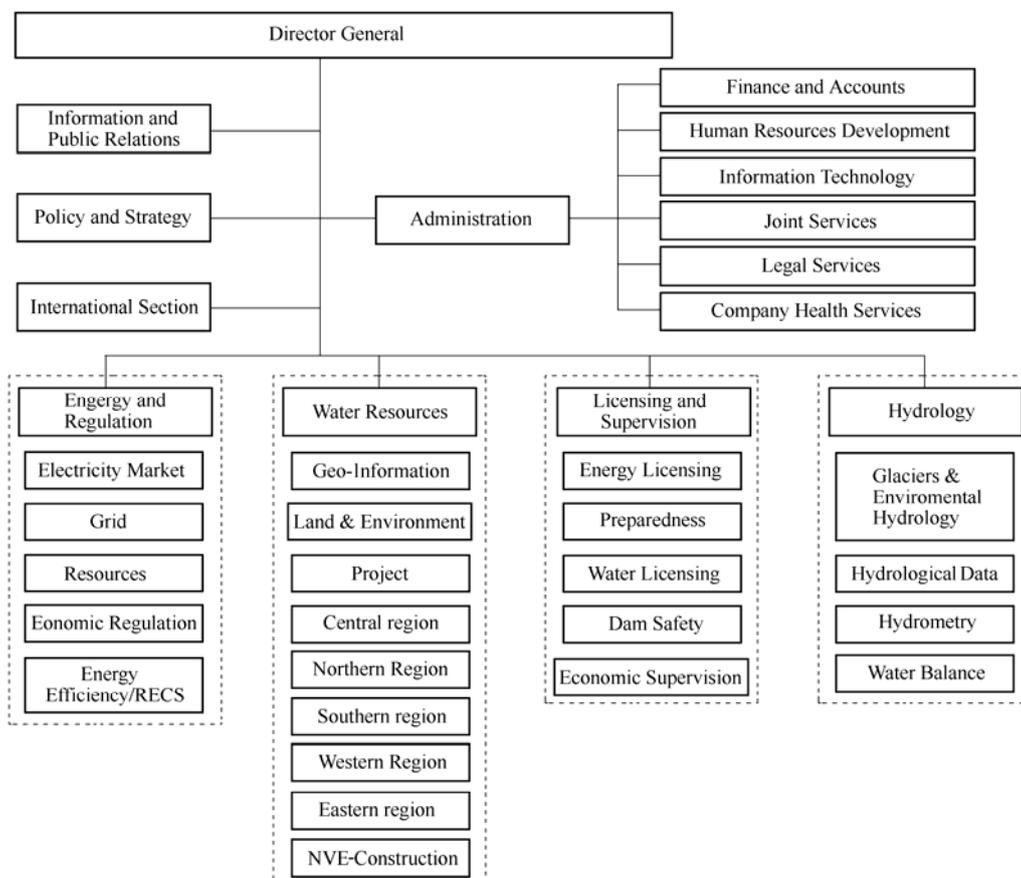


Figure A.4 Organisation Chart of NVE, Norway

(Source: NVE's web page)

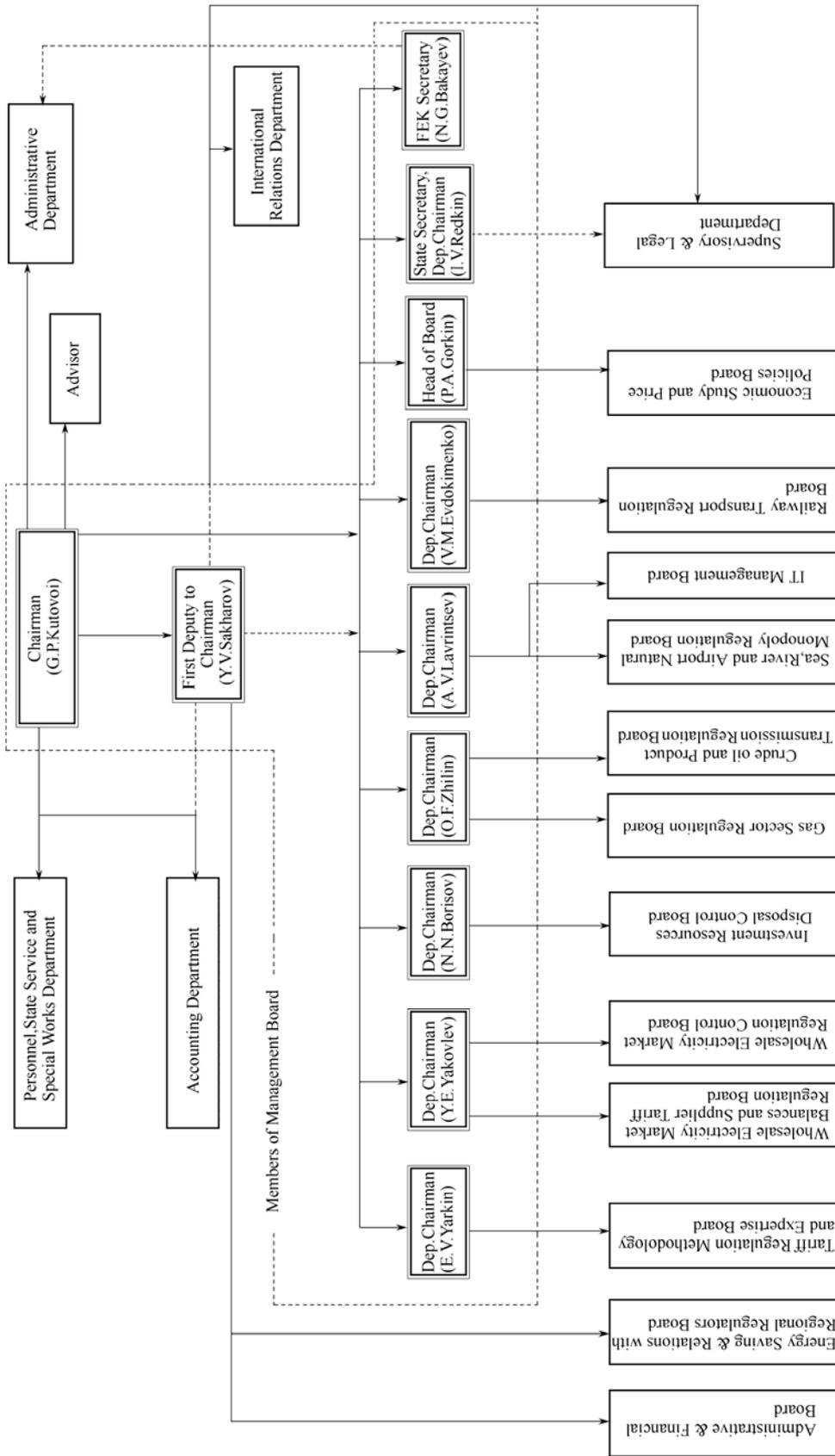


Figure A.5 Organisation Chart of FTS, Russia



In the short term, the establishment of the REKs has made it much more difficult to apply centrally determined policies on tariff reform, in particular removing cross-subsidies. In the longer term, the REKs are expected to play a key role in educating the local population on the need for tariffs to cover costs – and potentially in supporting the implementation of the social support mechanisms necessary to accompany tariff reform.

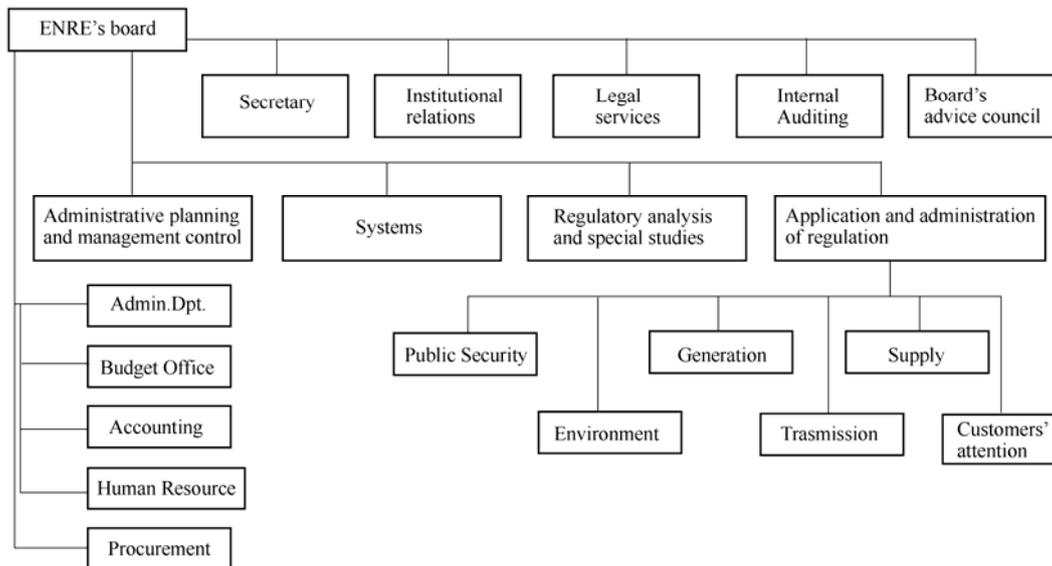


Figure A.6 Organisation Chart of ENRE, Argentina

(Source: ENRE's web page)

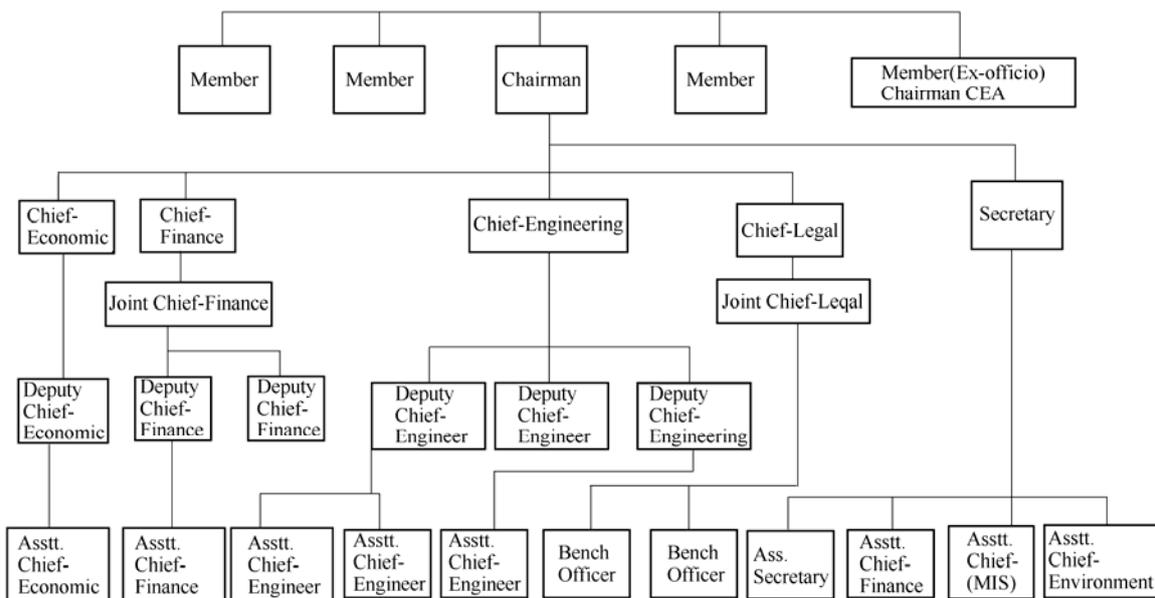


Figure A.7 Organisation Chart of CERC, India

(Source: CERC's web page)

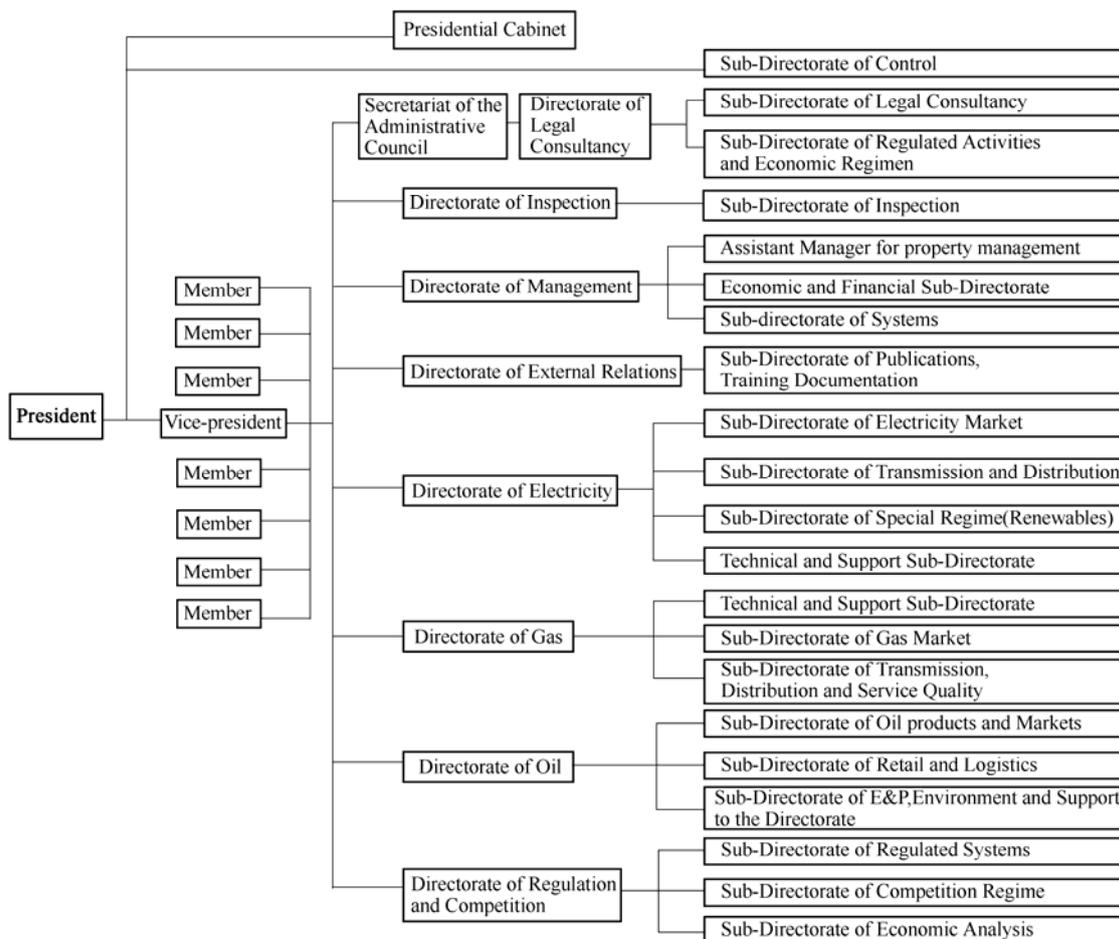


Figure A.8 Organisation Chart of CNE, Spain

(Source: CNE’s web page)

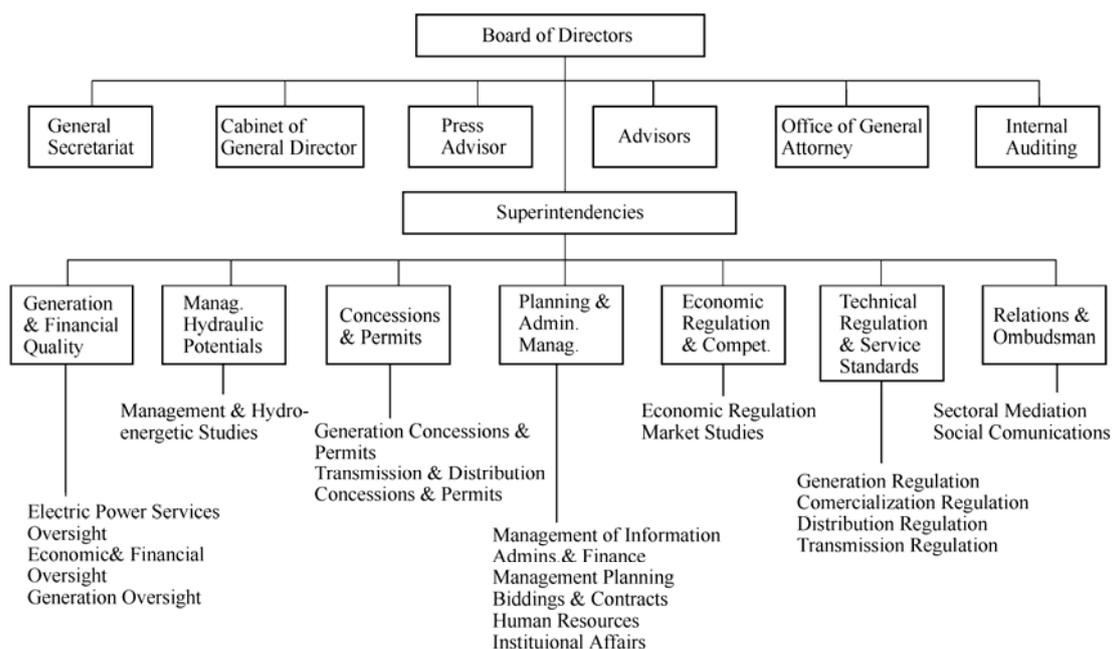
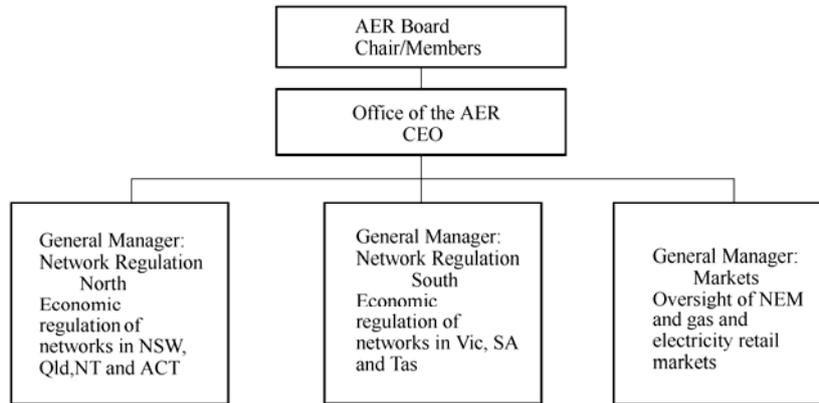


Figure A.9 Organisation Chart of ANEEL, Brazil

(Source: NERA elaboration from ANEEL’s web page)



**Figure A.10 Organisation Chart of AER, Australia**

(Source: AER's web site)

## Appendix B Detailed Review of the Current Situation in the Chinese Electricity Sector

### B.1 Overview of the Sector

Recent decades have seen very substantial growth in energy use and electricity use in China, and this is expected to continue, as Table B.1 shows.

**Table B.1 Primary Energy Demand in China** (Unit: Mtoe)

Energy type	Year				
	1971	2002	2010	2030	2002 ~ 2030
Coal	192	713	904	1354	2.3%
Oil	43	247	375	636	3.4%
Gas	3	36	59	158	5.4%
Nuclear	0	7	21	73	9.0%
Hydro	3	25	33	63	3.4%
Biomass and waste	164	216	227	236	0.3%
Other renewables	0	0	5	20	-
Total	405	1242	1622	2539	2.6%

Source: International Energy Agency (IEA) : World Energy Outlook 2004, Paris, 2004, table 8.6, p. 264.

Growth in electricity generation capacity has also shown substantial growth, as Table B.2 shows for the recent period. Table B.3 shows the breakdown of the generating capacity, both by region and by fuel type, for 2005.

**Table B.2 Generation Capacity by Fuel Type** (Unit : 10 thousand kW)

Energy type	Year						
	1999	2000	2001	2002	2003	2004	2005
Hydro	7297	7935	8301	8607	9490	10524	11650
Thermal	22343	23751	25301	26555	28977	32948	38413
Nuclear	210	210	210	447	619	684	685
Others	0	36	37	48	55	82	93

Total	29877	31932	33849	35657	39141	44239	50814
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Source: CIECC.

**Table B.3** Total Installed Capacity ( 2005 ) (Unit: 10 thousand kW)

Region	Total	Hydro-power	Thermal-power	Nuclear-power	Others
<b>Total</b>	50847	11652	38414	685	96
<b>North China Grid</b>	9320	275	9043	0	2
Beijing	492	106	384	0	2
Tianjin	617	1	616	0	0
Hebei	2187	85	2102	0	0
Shanxi	2298	78	2220	0	0
Shandong	3726	5	3721	0	0
<b>North East China Grid</b>	5625	660	4935	0	30
Liaoning	1757	140	1602	0	15
Jiling	1026	377	639	0	10
Heilongjiang	1252	85	1162	0	5
Inner Mongolia	1590	58	1532	0	0
<b>East China Grid</b>	12303	1599	10382	307	15
Shanghai	1302	0	1302	0	0
Jiangsu	4326	14	4306	0	6
Zhejiang	3749	701	2738	307	3
Anhui	1189	74	1115	0	0
Fujian	1737	810	921	0	6
<b>Central China Grid</b>	10793	4770	6022	0	1
Henan	2848	256	2592	0	0
Hubei	2747	1795	951	0	1
Hunan	1498	780	718	0	0
Jiangxi	900	280	620	0	0
Sichuan	2296	1495	801	0	0
Chongqing	504	164	340	0	0
<b>North West Grid</b>	3667	1198	2438	0	31
Shanxi	1072	188	884	0	0
Gansu	985	395	576	0	14
Qinghai	531	442	89	0	0
Ningxia	422	37	381	0	4
Xinjiang	657	136	508	0	13
<b>South China Grid</b>	9095	3109	5591	378	17
Guangdong	4800	873	3533	378	16
Guangxi	1075	592	483	0	0
Yunnan	1320	861	459	0	0
Guizhou	1688	725	963	0	0
Hainan	212	58	153	0	1

Other ( Tibet,etc )	44	41	3	0	0
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Note: All data from other reliable resources.

Source: CIECC.

The growth in the sector is expected to continue, and Table B.4 provides a recent forecast of the expected growth in total generation and in the mix. Table B.5 provides a corresponding forecast in terms of generating capacity.

**Table B.4 Forecast: Electricity-Generation Mix in China (Unit: TWh)**

Energy type	Year				
	1971	2002	2010	2030	2002 ~ 2030
Coal	98	1293	2030	2910	4035
Oil	16	50	59	65	53
Gas	0	17	55	196	315
Nuclear	0	25	82	180	280
Hydro	30	288	383	578	734
Biomass and Waste	0	2	31	58	84
Other renewables	0	0	13	31	72
Total	144	1675	2653	4018	5573

Source: International Energy Agency (IEA) : World Energy Outlook 2004, Paris, 2004, table 8.7, p. 268.

In parallel with the growth in generating capacity, transmission capacity has also grown, and Table B.5 shows the breakdown on capacity in 2004. But in comparison with 2004 the totals for 2005 were: 500kV, 62866km; 330kV, 13059km; and 220kV, 177617 km; plus 141km of 750kV line.

**Table B.5 Transmission Lines in 2005 (Unit:km)**

	Total	750kV	500kV	330kV	220kV	110kV (including 66kV)	35kV
<b>Total</b>	973596	141	62866	13059	177617	339587	380327
<b>North China Grid</b>	154714		11826		30732	45645	66512
Beijing	8000		896		2208	2721	2176
Tianjin	7394		524		1727	2136	3007
Hebei	50363		4064		9188	15798	21313
Shanxi	33425		3062		6635	10118	13610
Shandong	55532		3279		10975	14872	26406
<b>North-east China Grid</b>	126600		8546		33709	68360	15985
Liaoning	34037		2923		9295	21794	25
Jilin	23125		1213		6752	15086	76
Heilongjiang	35616		1999		7941	13975	11701
Inner Mongolia	33822		2411		9722	17505	4183
<b>East China Grid</b>	162149		13525		34962	45988	67674
Shanghai	7125		577		2201	725	3622
Jiangsu	56784		6335		12591	15923	21935
Zhejiang	37847		3696		8661	11661	13829

Anhui	32141		1566		6213	8144	16218
Fujian	28252		1351		5297	9535	12070
<b>Central China Grid</b>	233028		13568	50	41423	74642	103344
Henan	43618		2057	50	8392	14171	18948

续表 B.5

	Total	750kV	500kV	330kV	220kV	110kV (including 66kV)	35kV
Hubei	41922		4629		7634	13524	16134
Hunan	50232		1913		8304	16119	23896
Jiangxi	26166		704		5185	8064	12211
Sichuan	19487		1279		3417	6597	8194
Chongqing	51603		2986		8490	16167	23961
<b>North-west Grid</b>	112575	141		13009	7162	42481	49782
Shanxi	27935			4557	825	12152	10401
Gansu	33765	128		4955	1189	11511	15983
Qinghai	10323	13		2227		4688	3395
Ningxia	8898			1270	1838	3207	2582
Xinjiang	31654				3310	10923	17421
<b>South China Grid</b>	172984		7639		29429	60811	75105
Guangdong	49246		3575		11550	22270	11851
Guangxi	38117		644		5996	8864	22613
Yunnan	46417		1880		5415	14132	24990
Guizhou	33239		1539		5194	13195	13311
Hainan	5965				1274	2350	2340
<b>Tibet</b>	3584					1660	1924
<b>Trans-region</b>	7961		7762		200		

Source: CIECC.

Taking together these overview data on the Chinese electricity sector, it is clear that the sector is in technical terms one of the leading electricity sectors in the world, but also faces major expansion and the need for very substantial capital investment. This situation further emphasises the need for efficient legal, institutional, and regulatory arrangements.

## B.2 Reform Plans

The State Council Notification on Power Sector Reform Document No5, 2002, provided for the setting up of the SERC, and also laid out the guiding principles and objectives of the reform. The main structural elements of the proposed reforms in the plan are:

(1) Separation of generation from the network activities — this has been completed at the state level, with the separation of generation assets owned by former State Power Corporation from network activities to create independent generating company. The grid

company still owns or held the share of some regulating electricity plants, such as hydro-electricity plant, pump storage electricity plant. These electricity plants will not participate in the bidding market at present.

(2) Generation assets owned by the State Power Corporation (SPC) to be separated in 4~5 generation companies, with the condition that the share of installed capacity in the hands of each generation company should not generally exceed 20% within each regional electricity system - this has been completed.

(3) A state grid company (to be wholly state owned) will be established and become the owner of the SPC grid assets, and the SPC will be dismissed. It will be responsible for inter-regional trading and for operation and development of inter-regional grids—the creation of this new company has been completed.

(4) Six regional grid companies will be established (corresponding to the six regions mentioned in section 1 above) as joint stock companies, with responsibility for ownership, maintenance, and operation of the grid assets in their regions. The provincial companies will become branches or subsidiaries of the regional companies — this has been completed. The regional grid companies presently have not been established as joint stock companies; five of them now are solely owned by the State Grid Company (SGC) , and will be reformed to joint stock companies in the future.

(5) The regional grid companies will be responsible for development and operation of regional grids, dispatch, and fostering of electricity markets—this development has been started, but much work remains to be done especially on creation of regional electricity markets.

(6) The regional grid companies will be permitted to own distribution assets during the 10<sup>th</sup> plan period, but will be required to achieve accounting separation between transmission and distribution—this remains to be done, with little if any progress in development of accounting separation.

(7) That after completion of other reform measures, the separation of transmission from distribution should be gradually piloted and implemented, and competition introduced at the retail level - this remains to be done.

(8) Electricity trading centres will be established within the jurisdiction of the regional grid companies, and generators will be expected to bid to be dispatched—this remains to be done.

The Plan document also specified that the national grid company, the regional grid companies, and electricity generation companies should be established within about one year. The SGC, China Southern Grid Company (CSG), and the electricity generation companies were established in Dec 2002. The other regional grid companies were established in 2003.

### **B.3 Progress with Unbundling**

As noted above, the four main structural separations envisaged for the near term have been completed:

- (1) Separation of transmission from generation.
- (2) Creation of a State grid company to promote inter-regional trading.
- (3) Priority of regions over provinces — six regional grid companies now created.
- (4) Five national generating companies.

Plans are underway for the eventual separation of distribution assets. A pilot is envisaged to test consumer choice for large consumers; however the development of electricity markets and bidding systems is still in a demonstration stage.

Although all the new generation and grid companies have been created, they all remain majority state owned and under the direct ownership and control of the State-owned Asset Supervision and Administration Commission (SASAC), which is currently responsible for 189 large State-owned Companies, including SGC and the five electricity generating groups.

#### **B.3.1 Generation**

Five generating groups have been established out of the State owned electricity plants, including Huaneng Power Group, Datang Power Group, Huadian Power Group, Guodian Power Group, and China Power Investment Group. The generating capacity controlled by these companies is around 32GW, more or less. This is less than half of all generating plant in China, the rest being controlled by more than 40 generating investment companies owned by local governments, and more than 30 companies with the stock market listings, as well as foreign investment companies and private companies. Most of the generating companies are Limited Liability Companies and Joint Stock Limited Companies with diversified investors. It is stated in “Electricity law” that the government encourages, and inducts domestic and foreign economy organizations and individuals to invest in generation and establish generating companies according to the law. At present, the generation owned by non-state-owned companies is understood to be about 8% of total capacity.

#### **B.3.2 Transmission**

Six regional electricity grid companies have now been established, for Northern China, North eastern China, Eastern China<sup>①</sup>, Central China, Southern China, and North-western China, as envisaged in the Plan. All except the Southern Grid Company are subsidiaries of the State Grid Company; the Southern Grid Company remains a separate state-owned enterprise. The characteristics of these regional companies are summarised at the end of this sub-section. Tibet’s electricity company now is an independent company, but the SGC is responsible for its operation on behalf of the owners. It is clear therefore that there has been

significant separation of transmission from generation.

At present, the provincial grid company remains as the single buyer to purchase electricity from the generators within the province and other provincial grid companies. On regional electricity markets, the regional grid company and the provincial companies are all purchasers. This puts the grid company in the position of being the scheduling and dispatch agent, as well as the purchaser of electricity. These two functions need to be separated, since there is an intrinsic conflict of interest.

The (Regional) Grid companies we visited during our Inception visit complained that they have no separate source of revenue, other than the difference between what they purchase (at the grid tariff) and what they sell (at the retail tariff rate). Clearly they need a cost-based transmission tariff.

Under each regional grid company (and owned and controlled by the respective regional grid companies) there are a number of provincial electricity companies which own and operate the transmission lines. The law guarantees open access to the transmission wires, but virtually nobody takes advantage of this provision at present. In the trial project for the big consumers to purchase electricity from generator that is under way at present, the problem of the access to transmission wires and related price has been raised.

### ➤ Northern China

Within this area there is mainly thermal generation, and the grid consists of two parts: Northern China region and Shandong. The main load centres are located in Beijing, Tianjin and Tangshan city. Shandong is an isolated provincial grid with pure thermal generation and maintains its own supply and demand balance without any energy trade with other areas. In the region, the Northern China grid is made up Beijing–Tianjin–Tangshan grids, Shan’xi provincial grid, Southern Hebei grid and western Mongolia grid hooking up to the 500kV main electricity grid skeleton.

The Beijing–Tianjin–Tangshan grid is a 500kV circuits grid centred on Beijing–Tianjin, and it interconnects Shan’xi provincial grid, Southern Hebei grid, and western Mongolia grid.

### ➤ North-eastern China

The North-eastern regional electricity grid includes Liaoning, Jilin and Heilongjiang provincial grids, and eastern Mongolia grid with load center located south of the region. The main energy flows in the grid are from west to east, and from north to south. The North-eastern regional grid is interconnected with the Northern regional grid, with transfers of

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① East China is the biggest power grid with 96970 MW Generation capacity by the end of 2004. In fact it is probably the largest power grid in the world.

energy mainly occurring from the former to the latter.

### ➤ **Eastern China**

There are five provincial electricity grids in the Eastern China region:

- (1) Jiangsu ;
- (2) Zhejiang ;
- (3) An' hui ;
- (4) Fujian ;
- (5) Shanghai provincial (city).

Its supply area covers the most developed region in China and load focuses on the Changjiang River Delta area. The Eastern regional electricity grid has a strong main skeleton, with two circuits looking like a figure“8”at 500 kV level completed in 2002, which hooked up the Central China regional electricity grid by Gezhouba and the Three-gorges transmission projects. Yangcheng electricity plant in Shanxi outside of the region is connected to the grid through a HVDC link through which it delivers energy to the region.

### ➤ **Central China**

This regional company includes the Central China electricity grid and Sichuan–Chongqing electricity grid. Henan, Hubei, Hunan and Jiangxi provincial electricity grids are part of the Central China electricity grid. The Sichuan–Chongqing electricity grid is connected with the Central China HVAC grid via the Three-Gorges transmission project. There is a larger proportion of hydro generating plant than in other regions, and it exports electricity to Eastern and Southern China from the Gezhouba Hydro Plant.

The Central China regional electricity grid has been connected up with Southern China regional electricity grid and enhanced interconnection with Eastern China because of the Three-Gorges transmission project.

### ➤ **Southern China**

The Southern China regional electricity grid is linked with Hong Kong and Macao, and includes five provincial grids:

- (1) Guangdong ;
- (2) Guangxi ;
- (3) Guizhou ;
- (4) Yunnan ;
- (5) Hainan.

Hainan is still isolated from the main grid, but the other four are connected to the grid. The main load centres are located in the Zhujiang River delta in the region and energy flows from the west to Guangdong by two HVAC circuits and a HVDC circuit. Exports are expected to reach 7000 MW by the end of 2005.

### ➤ **North-western China**

The North-western regional electricity grid is made up Shanxi, Gansu, Qinghai, Ningxia and Xinjiang provincial grids. There is substantial thermal generation in the eastern part of the grid, and hydro in west, and together these form an integrated electricity system.

#### **B.3.3 Distribution**

The provincial electricity companies continue to operate their local transmission and distribution networks, and remain responsible for supplying electricity to the end consumers through their branch local companies. They have monopolies over distribution and electricity sales within those areas. This is based on the provisions of the 1996 Electricity Law.

There has been no progress towards the physical separation of the distribution activities from transmission activities in the provinces, though accounting separation is to be introduced gradually. We understand that the Ministry of Finance is currently studying the accounting rules for the allocation of costs, but that no official document about it has yet been issued.

There are no provisions for third-party access on distribution networks, and distributors have no obligations to provide system service to others. This will need to be changed if retail competition is ever introduced for customers below the transmission level.

## **B.4 Electricity Tariffs**

### **B.4.1 The Current Tariff Position**

#### **B.4.1.1 Generator Tariffs**

Currently, all the generators connected to the grid sell their energy at a “tariff” that is determined by the pricing authorities, generally at the time the plant was built. Originally, these tariffs were set on the basis of:

- (1) A single per-kWh price for the plant’s output, based on a minimum number of operating hours for the plant, over which fixed costs would be recovered;
- (2) Depreciation of capital costs over a relatively short timescale, with the tariffs then reduced at the end of that time.

Historically, these tariffs have come to be regarded as equivalent to “contracts” for the lives of the plant. However, over the last few years, there have been two changes to these basic arrangements and these appear to diminish the reliance that can be placed on the tariffs as quasi-contracts:

(1) For new generators, the assumed plant life has been lengthened, so that capital costs are recovered over a longer period;

(2) In some cases the tariffs for existing plants have been increased to reflect the significant rise in the price of coal;

(3) Because the shortage has resulted in increased running hours, ad hoc price adjustments were applied for output above the minimum hours level.

More recently, the NDRC has promulgated a new pricing document (understood to be dated 15 June 2004) that changes the basis for new generator prices, unifies the price for the new capacity in the regional grid, and set up one standard of price for each province. It is still based on the concept of “normal” generating hours for each plant, but specifically provides for a lower price for output above those hours, based on plant marginal costs.

Alongside these tariff arrangements, newly-developing trading arrangements mean that generators have a further potential source of revenue, other than selling direct to the regional grid company. There is no specific provision for these revenues in the arrangements existing up to now, though it is understood that these trading arrangements (for example in the case of the East China monthly market) effectively impose a price cap on bids by generators.

Regarding actual tariff levels, different tariffs applied for different types of generators, the 2005 figures being:

- (1) Nuclear generators had an average tariff of around 0.41 yuan/kWh.
- (2) Thermal generators had an average tariff of around 0.36 yuan/kWh.
- (3) Hydro generators had an average tariff of around 0.30 yuan/kWh.

#### **B.4.1.2 End User (Retail) Tariffs**

The average retail tariff across the country was 0.50 yuan/kWh in 2005, with a tendency for higher tariffs in the east and lower in the west. Examples of the different tariffs that applied in different provinces in 2005 are:

(1) The average end-user tariffs in Hainan, Shanghai, and Guangdong are relatively higher than other provinces, and reach above 0.6 yuan/kWh.

(2) The average end-user tariffs in Guizhou and Qinghai are relative lower than other provinces, at around 0.35 yuan/kWh.

Even within provinces, retail prices varied significantly between different categories of consumer. For example, in 2002 the averages for different customer categories were:

- (1) Commercial 0.7 yuan/kWh.
- (2) Non-residential lighting 0.6 yuan/kWh.
- (3) Non-general industry 0.45 yuan/kWh.
- (4) Residential, and large industrial 0.4 yuan/kWh.

(5) Agriculture 0.33 yuan/kWh.

(6) Irrigation and drainage consumers in poor counties 0.16 yuan/kWh.

On the basis of this data, it seems clear that the prices for residential, agricultural, and irrigation and drainage consumers are somewhat lower than could be justified on the basis of costs. There are, in effect, cross subsidies between user classes. Other features of these retail tariffs are:

(1) At present, there exist time-of-day tariffs for the larger consumers in some area, but time-of-day tariffs have not been in operation more broadly. Neither is there any pricing based specifically on interruptability of supplies;

(2) There is no provision for any retail prices to change in response to the pricing signals that arise from the developing trading arrangements.

#### **B.4.1.3 Use of Grid System Tariffs**

Up to now there are no specific use of system tariffs in use, either for the transmission or the distribution systems. In effect the grid “tariff” is the residual revenue that is left from receipts from sales to consumers after payments to generators have been made. Overall, we understand that the effect of these tariffs means that, in 2002, generating companies received around 66%, and the grid companies 34% of total revenues. It was generally agreed by the companies we spoke to that these arrangements yield revenues that are not adequate to operate and maintain the current system, and do not provide adequate revenues for system expansion.

#### **B.4.1.4 Expectations on Future Pricing Structures**

The general trends in pricing that are expected in the near term (that is within the next 12 months) are:

(1) Generation price tariffs are expected to continue to rise to some degree, with differences between provinces, due to the recent rapid increase in demand and continuing high prices of fuel, especially coal;

(2) The average level of the retail tariff will go up, though with variations by different seasons and different hours. This is because in the past the generating cost occupied a larger portion of the retail price, while the portion for grid was limited, but this is now expected to change on the basis of new policy on tariffs that will allow grid company profits to increase;

(3) The structure of retail tariffs is also expected to change, as part of a policy to make major adjustments to bring consumer prices more into line with costs.

For the longer term, officials from NDRC told us that they envisage that the change to a government determined capacity price and a market determined energy price is intended only for the transition. In the longer term, both elements could be determined by the market.

## **B.4.2 Price Regulation Powers and Procedures**

The existing Price laws of the PRC specify that the governmental price department of the State Council (SC) is the legal agency primarily responsible for price management and supervision. Consistent with this, it is clear from several parts of Doc 7 that SERC has a relatively limited role in price regulation, and details of this were given in Issues Paper 5.

### **B.4.2.1 The Price Approval Process**

The National Development & Reform Commission (NDRC) has been responsible up to now for setting, checking, ratifying and establishing electricity price, as well as looking over and inspecting the implementation of electricity price. Its responsibilities on electricity price regulation have included checking and ratifying the generation price, checking and ratifying the provincial list sale price, and checking and ratifying all electric add-ons and construction fund.

This NDRC regulation operates through a tiered system where:

- (1) In general the enterprise would submit the price application to the local pricing bureau, which would co-ordinate it and pass it to the upper level pricing bureau for approval.
- (2) The provincial pricing bureau would apply to the NDRC for approval.

As noted in Issues Paper 5, the State Electricity Regulatory Commission (SERC) may:

- (1) Give its suggestion on electricity pricing adjustment to governmental price management department.
- (2) Supervise and inspect the related electricity price for enforcement purposes.

It is understood that there is a plan of pricing reform that has been prepared and approved by the State Council, but so far only the retail price components are implemented. It is also understood that it is the responsibility of NDRC to carry out this implementation.

### **B.4.2.2 Process Issues**

On our current understanding of the situation with regard to price regulation powers and processes, there seem some significant inconsistencies with the existing price regulation arrangements, in that:

- (1) The NDRC continues to have the lead responsibility for pricing in the electricity sector, although it is not a regulatory organisation that specialises in electricity sector issues;
- (2) SERC has other responsibilities for which pricing is a key issue, and where its inability to make decisions on pricing could introduce serious difficulties in exercising these other responsibilities.

## **B.5 The Electricity Sector Context**

In considering the development of markets and competition, it is important to emphasise

the current context of the electricity sector. In the last few years, China faced a serious electricity shortage. The gap between supply and demand continued to widen, so that in 2004 the shortage of electricity was much more serious than in 2003.

The gap between supply and demand in 2004 is estimated to be 30 GW at the peak period in summer, and about 26 provinces were expected to experience electricity shortages. Because of this situation, we understand that the government believes that bid-based markets would inevitably lead to high generation prices; if the retail price were not allowed to increase, the grid company, as single buyer, would be bankrupt (as happened in California). If the price increases were passed to customers, this would not be fair, and the generators would just get rich. This means that the electricity shortage became a significant obstacle for the implementation of electricity sector reform.

We were, however, assured several times by different groups that the shortages are mainly due to bad planning decisions in central government. This occurred in the period 1997~1999, when GNP growth faltered and the State Planning Department decide to reduce the expansion of thermal generating capacity. Excess generating capacity at that time, along with contracts or tariff arrangements that guaranteed 5000 hours running, led to a policy of encouraging consumer expenditures on electricity-using equipment. So as soon as the GNP growth resumed, shortages became evident. We were also told that availability of capital for investment is not the problem — metaphors referring to new plants being like “mushrooms” and “Bamboo shoots” indicate how fast new plants are springing up all over east China. We were told that generators think the approval procedure should be simplified and the process should be speeded up. But because the provincial governments prefer that the generation capacity should be invested and constructed by the larger electricity companies with abundant construction and operation experience on large units, at the moment most new capacity is invested by the State-owned generating companies or the listed stock companies controlled by them. There are very few private investors participating in the market, though some are involved indirectly by purchasing the share of the listed stock companies. Because the market rules are not clear and there exists some uncertainty over future policy, there few foreign investors participating in the market.

## **B.6 Plans for Development of Trading Arrangements**

As noted above, the State Council’s reform plan envisaged the development of trading arrangements<sup>①</sup> as part of the reform:

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① Note that when we refer to trading arrangements we refer to short-term arrangements for trading of physical electricity. We use the term market arrangements to refer to the wider set of arrangements that includes contracting for electricity (both physical and financial) and for sales direct to consumers.

(1) At the state level, the state grid company would be responsible for inter-region trading. In many ways this is the most important current activity, since moving large quantities of electricity from one region to another, at a fair price, is most likely to increase the overall efficiency of the electric system;

(2) At the regional level, trading arrangements would be under the auspices of the regional grid companies; The market model of regional electricity market is under examination, and SERC is responsible for deciding the market model taking account of the detailed feature of the regional system.

(3) That generators will bid for dispatch, that trading would be developed around dispatch centers, and that this will be developed under the auspices of the regional grid companies.

(4) The price paid to the generators (the “on grid price”) would include two kinds of arrangements, in one arrangement price consists of a government-determined fixed capacity price and a market determined energy price; and with the other kind of arrangement there is single energy price.

(5) That by the end of the 10<sup>th</sup> plan period (that is the end of 2005) , the main generation companies in each region should participate in bidding for dispatch.

SERC has issued a document entitled “Instructions for Establishing Regional Electricity Markets”; also there are demonstration bidding systems in place in East China and in North Eastern China, operating simulations on a monthly basis, but without settlement and without dispatching based on the schedule produced by bidding system.

It seems to us that there is some confusion about the role of these “markets” (which in our terminology we refer to as “trading arrangements”) and how they should interact with the generator tariffs, and with the dispatch. It is also not clear whether their role is being integrated with the other structural things that need to be done to make a market workable such as demand responsiveness, problems of free entry to the market, and so on. There is also confusion as to how the price in these trading arrangements would relate to the tariffs.

## **B.7 Progress to Date**

In this section, we review our understanding of the current situation with the development of electricity trading. We begin first with system operation and then with operation of the trading arrangements.

### **B.7.1 System Operation**

In general, the State Grid Company is responsible for system operation on a nation-wide basis, except in the Southern electricity system, in which the Southern grid company is responsible for the system operation. Thus, it is the state grid company that acts as system

operator and the single buyer. It operates the grid, and is responsible scheduling and dispatching, as well as purchase and sale of electricity.

As noted above, under each regional grid company, there are several provincial electricity companies who own and operate the transmission lines and distribution networks.

In the aspect system operation, “the Regulation of net work dispatching and management” which was issued in 1993, sets out the power and duties of the dispatching centres, central and provincial government, related generation companies and grid companies, as well as consumers. The main principle of dispatching in these regulations is called “integrated management, operated in five levels”. This means there are five levels of dispatching centre, with their own ranges, powers, and duties, including state level, regional level, provincial level, city level and county level.

In practice, the dispatching centre creates a schedule based on the load forecast and the amount of generation allocated to the generators by the government (the provincial economic and trading commissions). There has never been a general principle of merit order dispatch (dispatch in order of unit marginal costs) in China, although it is almost universal elsewhere. It is not clear quite what is being optimised by the system schedulers, or how the allocation of generator hours is arrived at.

At present, most of the generators have signed contracts with the grid company called “Agreement on connection to the grid”. In this contract, there are some terms to stipulate the obligations for the generators to follow the instructions of the grid operator. In general, there are no other code or rules in respect of dispatch procedures, other than the 1993 Regulations and the connection agreement, though each regional and provincial electricity system has its own dispatching rules.

## **B.7.2 Electricity Trading**

At the present time, electricity trading in China is mainly carried out under the direction of the government. This means that the government approves the prices and allocates the amount of generation among generators. Only some trading involving small quantities of energy takes place, and this is on the basis of bilateral negotiation, mainly in the form of trading between two provincial electricity companies. No special treatment is given to the issues of transmission losses or ancillary services.

However, SERC is now developing regional electricity markets, and two regional electricity markets, the North-eastern China and the Eastern China regional markets are under simulation this year. These arrangements are described in more detail below.

### **B.7.2.1 Trading within Provinces**

At present, most of the trading that takes place is between the generators and the provincial electricity companies, which act as single buyers and own most of transmission and

part of distribution grids within the province. Basically the yearly and monthly amounts of the trades are determined by the provincial government (the economic and trade commissions), and the daily schedule of generation is made by the provincial electricity company in a way consistent with the limit.

#### **B.7.2.2 Trading between Provinces**

Usually the electricity trading between provinces is arranged by the relevant provincial electricity companies and the regional grid company. Inter-regional trading is arranged by the relevant regional grid company and the state grid company. Up to now, there are only a few generators that sell electricity outside their own regions, and this needs the approval from the (NDRC). But the planned development of major projects in the west will involve enormous increases in inter regional flows, as the Three Gorges Dam already has.

#### **B.7.2.3 Prices, Periods, and Meters**

At present, the prices for trading need the approval from the relevant pricing bureau. In the planned regional markets, it is expected that the trading arrangement would be organized through centralised bidding and despatch arrangements.

Most of the existing electricity trading takes place on a yearly or monthly basis, with a very small part of electricity trading on an hourly basis in some regions. We understand that this hourly trading is mainly trading between provincial electricity companies, and some trading between regional electricity companies, who negotiate such trading within short time scales according to their needs. The newly established regional electricity market in the East and North-east are still under simulation, with no daily bidding or actual settlement.

#### **B.7.2.4 The Proposed Trading Arrangements in the Eastern and North-eastern Regions**

It is understood that for the competitive electricity markets (trading arrangements) planned to be established in the Eastern and North-eastern regions the current simulation is on the basis of monthly bidding, and that the generators would be equipped with hourly meters to support the market operation. It is also understood that the trading arrangement would take account of constraints in the transmission grid. That means that plants that would be constrained on or constrained off for special locational reasons would be dealt with specially within the trading arrangements.

It is also understood that in the planned regional electricity markets, the impact of transmission losses would be considered when arranging the trades based on bidding prices, and that there would be loss factors to take account of these.

For ancillary services, it is understood from SERC Document No.21 that in the proposed new arrangements these would fall into two categories: obligatory services that must be provided by the generators; and commercial services that are provided in return for cost recover or payment of a "market" price.

### **B.7.3 Retail Competition**

At present, no choice of supplier is available for consumers, SERC and NDRC recently issued a document“Temporary management rules for the big consumers purchase electricity from generators directly”.This stated some general principles and goals for pilot projects of this sort, but contained no detailed plan for the progress. A pilot project with a single large customer is planned to begin in Jilin province.

## **B.8 Regulation of the Regional Sectors and the Market Arrangements**

It is clear from what was noted earlier, that SERC now has the central responsibility for regulation of electricity markets throughout China. Specifically, under State Council Document No.5, SERC has responsibility for:

(1) Developing wholesale markets, including for drawing-up the overall development plans for electricity markets, proposing market designs for regional electricity exchanges, and deciding electricity exchange arrangements.

(2) Monitoring electricity market operations to ensure orderly and fair competition, regulating transmission, distribution and non-competitive generation businesses.

(3) Issuing business licenses for companies operating in the electricity sector.

SERC’s Document No.21 is an important start to this process, as it sets out the basic framework for regional market development.

The main limit on SERC’s existing regulatory powers is in respect of pricing. Under existing laws, it is the government pricing authority (NDRC) that determines tariffs, though SERC has responsibility for reviewing tariff levels and proposing tariff adjustments. The SERC does, however, have specific responsibility for deciding fees and charges for ancillary services.

## Appendix C Elaboration of Key Features of Effective Regulation

As noted on Chapter 2, there is considerable agreement among specialists on the subject of the key features of good regulation. For example, there is close agreement between what is stated in a 1998 NERA report to the Asian Development Bank<sup>①</sup> and a recent survey for the World Bank by Kessides (2003), and on this basis we have identified the following criteria that we believe define good regulation:

- (1) Clarity of roles and objectives.
- (2) Autonomy or independence.
- (3) Accountability.
- (4) Participation.
- (5) Transparency.
- (6) Predictability.
- (7) Proper regulatory capacity<sup>②</sup>.

We discuss each of these criteria in turn below.

### C.1 Clarity of Roles and Objectives

This refers to the extent to which the responsibilities of the regulatory agency are clearly separated from those of policy-making bodies and from regulated companies. It includes issues such as:

- (1) Does the regulator have a coherent mandate?
- (2) Are the responsibilities of the regulatory agency clearly separated from those of policy making bodies and from regulated companies?
- (3) Whether and how far the primary legislation (e.g. the Electricity Act) sets out a clear definition of the regulator's functions and duties.
- (4) How much power does the regulator have to enforce decisions?

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① See also J.Stern and S.Holder, (1999) "Regulatory governance: criteria for assessing the performance of regulatory systems. An application to infrastructure industries in the developing countries of Asia", Utilities Policy, Vol. 8, pp.33-50.

② The term "capacity" refers to the volume of resources, particularly staff and professional staff available to the regulatory agency.

(5) If not, whether these functions and duties are formally set out in legal instruments and/or other documents.

(6) How clear it is on which issues the regulator has an advisory role (e.g. to the Minister) rather than a decision making role?

(7) Whether there are any functions carried out jointly, or any that are ambiguous, between the regulator and those of the relevant Minister (s).

(8) Whether the legislation establishes unambiguously which entity is responsible for what regulatory functions.

## **C.2 Autonomy**

This relates primarily to the degree of formal independence of the regulatory body and covers issues such as:

(1) What the relationship is between the regulatory body and the government e.g. whether the regulator is:

- 1) A separate division of a Ministry;
- 2) A body independent of any Ministries;
- 3) A body independent of government, or some other.

(2) How the decision making members of the regulatory body (e.g. commissioners, chairmen, board members, etc.) are appointed?

(3) Whether and how decision making members of the regulatory body can be dismissed?

(4) How the regulatory body is financed and who has to approve the funding?

## **C.3 Accountability**

This relates primarily to the formal audit, reporting and appeals processes faced by the regulatory agency such as:

(1) Whether there is a formal mechanism for regulated firms (or other parties) to challenge regulatory decisions?

(2) Whether there is also a legal right of redress to the law courts e.g. over abuse of process by the regulatory agency?

(3) To whom the regulatory body is formally accountable (e.g. to government, parliament, courts)?

(4) Whether the regulator has to answer questions before parliament?

(5) Whether the regulator can be dismissed for failing to fulfil his duties?

(6) Whether there is a facility for judicial review under primary law?

## **C.4 Participation**

This covers the degree to which parties with a legitimate interest in the outcome of regulatory decisions (e.g. regulated firms, large and small consumers, investors, etc.) are involved in the regulatory decision making process before and after the regulator makes its decisions. This covers issues such as:

(1) Whether and how far the regulator formally involves regulated firms, other industry firms, consumers and others on:

- 1) Major decisions;
- 2) The proposed approach to taking major decisions.

(2) Whether the regulatory agency makes public the consultation responses (either in full or in a summary of responses)?

(3) Whether the regulator comments publicly on points made in consultation responses, and how (if at all) the consultation responses affected the final decision?

(4) Whether there are any other indications of whether or not consultation responses influence the final decision?

(5) Whether there are other ways sector participants (including firms and consumers) are involved in regulatory decision making and processes?

## **C.5 Transparency**

This relates primarily to the openness of the regulatory process and covers issues such as:

(1) Whether major regulatory documents (e.g. licences) are in the public domain?

(2) Whether the regulator publishes major decisions (and advice)?

(3) Whether the regulator publishes the reasoning behind major decisions?

(4) Whether, if decisions/reasons are published, this is compulsory (e.g. a legal requirement to justify decisions) or just voluntary?

(5) Whether, if decisions/reasons are not published, participants (such as the regulated firms) are told of the reasons for major decisions?

(6) Whether the regulatory agency holds public meetings either in consultation over regulatory decisions and/or for the taking of regulatory decisions?

(7) Whether firms or other parties can comment (or even challenge) decisions through informal channels (such as direct representations to Ministers, or through the media)?

## **C.6 Predictability**

This relates primarily to the degree of understanding between the regulatory agency and

other parties on the regulator's duties, approach and decision making process. It covers issues such as:

- (1) How easy/difficult it is to change the regulator's functions and duties.
- (2) How easy/difficult it is to change key regulatory documents (e.g. licences, authorisations, franchise contracts, etc.).
- (3) The extent to which regulatory principles (e.g., on the procedural approach to tariff reviews, the definition of the rate base or the rate of return which a firm should be allowed to earn) are set out formally in published documents.
- (4) Whether and how far the regulator's decisions demonstrate a consistent approach?
- (5) Whether there is a published timetable of regulatory events every year (e.g. set out in a forward plan issued by the regulatory agency).
- (6) The extent to which regulatory arrangements in the electricity sector are part of a coherent approach (i.e. echoed in other infrastructure sectors such as telecoms and railways) and to what extent are they *ad hoc* (i.e. different in institutional structure from other infrastructure sectors).

Other issues that are important for effective regulatory governance are:

- (1) Information and reporting requirements, and effective powers of regulators to demand information from regulated entities.
- (2) The importance of clearly defined procedures, public consultation and submissions from interested parties, and open hearings.
- (3) The need for strong enforcement powers.

## **C.7 Proper Regulatory Capacity**

This relates to the following matters:

- (1) Is there an adequate regulatory budget?
- (2) Is there competitive pay for regulatory staff?
- (3) What ability does the regulator have to outsource some technical work to external experts and take other necessary actions?

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