CAREC Members Electricity Regulators Forum
2006 Studies Proposed for PPIAF Funding

NB: In addition to these two studies, there are three further studies being prepared with ADB funding.

A. Appropriate Pricing and Provision of Ancillary Services

-Participating Country: People's Republic of China

1. **Background.** Ancillary services are essential in a power grid for maintaining reliability and quality of power supply from the generators to consumers. Although commercial transactions have traditionally depended mainly on the price for capacity (kilowatt) and energy (kilowatt-hour), new electricity markets have further unbundled the costs to establish markets for ancillary services. Such markets allocate value to (i) frequency response services that enable supply to be at the designated frequency (50 Hertz), (ii) various types of reserve services that become available quickly and within 10 minutes (spinning, or quick start machines), or within 30 minutes (supplemental generation capacity or curtailable demand), (iii) reactive power and voltage control services that enable the supply voltage at the consumer end to remain within prescribed limits during high and low demand periods, and (iv) black start services that enable resumption of power supply following a system-wide power outage. The regulators need to ensure that the costs incurred in providing these services are also recovered from consumers through tariffs. Because all ancillary services are either commons goods or public goods[1], electricity markets will tend to under-provide them in the absence of suitable regulation.[2]

2. There is currently a debate occurring regarding the relative merits of command and control measures and pricing measures for ensuring the efficient provision of ancillary services. Under command and control mechanisms, the market operator (MO), supervised by the regulator, requires firms to provide a level of reserve capacity or reactive power, may designate a particular firm with responsibility for maintaining frequency control, and may also delegate a firm the responsibility for providing black-start services. Under a pricing approach, the market operator (again supervised by the regulator), either sets a price, or facilitates a market that sets a price, paid to voluntary providers of ancillary services.

3. There are two primary benefits of command and control approaches. First, the fact that the quantity of ancillary services provided is controlled directly, without the regulator/MO needing to make assumptions regarding how prices will translate into quantities provided, means that required standards of reliability can be easily maintained. Second, command and control systems are already in place, so maintaining them could ease the transition to market pricing. The primary benefit of pricing systems, is that they permit the lowest cost providers of ancillary services to meet service needs. One possibility, exploiting the benefits of each approach, is to mandate levels of ancillary services to be provided by firms (ensuring reliability), but to allow them to purchase these services from other firms (minimizing cost).

[1] The terms 'Public Good' may have different meanings in different context. Both 'Public Good' and 'Commons Good' are used here in Microeconomics terms. Thus, reactive power and reserve services are commons goods because they are rival but non-excludable. Frequency control and black-start services are public goods, because they are non-rival and non-excludable.

[2] There is some undue controversy regarding the question of under-provision of "power reliability", with some authors arguing (incorrectly) that consumers with the greatest willingness to pay for "power reliability" will ensure that an adequate level of reliability will be provided that all can enjoy. This argument may hold for those system requirements that are public goods, but will not hold for those elements that are commons goods. The error arises because power reliability is treated as a single public good, rather than as a combination of services, some of which are commons goods.

4. Peoples' Republic of China (PRC) is currently designing power markets and implementing them on a trial basis. PRC is currently experiencing a power shortage. Consequently, markets are not yet permitted to determine electricity prices, for fear that market prices would be extremely high. A boom in the construction of generation capacity is underway, and Asian Development Bank (ADB) staff forecast that the shortage will turn into a glut within two years, permitting markets to be introduced. Given the large size and rapid growth of the PRC electricity grid, as well as the instability inherent in a power shortage, ensuring that ancillary services are adequate to maintain system stability will be critical for markets to work.

5. **Objective**. The regulator and market operator can ensure that ancillary services are provided using various blends of market mechanisms and command-and-control mechanisms. The objective of this study will be to improve the capacity of the regulators to analyze the cost factors of the four types of ancillary services and outline a suggested package of these mechanisms for ensuring ancillary services provision with reasonable certainty and at low cost in the context of PRC plans for its power market.

6. **Consulting Requirements:** 3 months of domestic and 3 months of international consultant time will be required over a period of 6-8 months. Each consultant will be a proven expert in power sector economics, with demonstrated experience in the area of power markets in general. The domestic consultant will require a background in power engineering, and demonstrable and up to date knowledge of the PRC power sector, as well as obvious capacity to read and communicate on technical issues in both English and Chinese. The international consultant will have expertise in the design of ancillary services pricing in electricity markets, and in applied microeconomic theory, as well as a high capacity to write and communicate clearly in English on these subjects, each demonstrated through a solid record of empirical research and publication in peer-reviewed journals. The consultants will be hired through a firm.

7. **Standards of analysis:** The reports produced must conform to the highest professional standards. The reports must be presented in clear, grammatically correct English, suitable for translation into Chinese. All opinions must be clearly explained and explicitly backed by sound reasoning and reference to international experience. All source materials must be cited, and direct quotations from other sources are to be strictly minimized. The translation of the reports into Chinese must meet with the approval of the State Electricity Regulatory Commission (SERC). The emphasis will be on the logical integrity and clarity, rather than the numerical accuracy of the exercise. This particular limitation in expectations is reflected in the limited consultant time required. Generic sector experts without substantial expertise and experience in the area of ancillary services provision are strongly discouraged from applying.

8. **Scope.** The study will focus on a region of PRC covered by one power market. It will be carried out in six stages:

(i) The International consultant will collect information from about three electricity markets in other countries that have instituted proper systems for ensuring ancillary service provision. These countries will be selected to provide useful contrasts between different mechanisms for ancillary services provision. Such mechanisms should have been in operation for at least 2 years. The consultant will: explain the mechanisms utilized to ensure provision of the different ancillary services; explain which measures of the adequacy of ancillary services provision were used; provide the price and adequacy trends for these ancillary services; and indicate the success of the program and the contributing factors.

(ii) The international consultant will visit the PRC market and meet with the market operator, regulators, and affected firms. During this visit, the international consultant will acquaint themselves with all necessary details regarding the design of the future power market. The domestic consultant and the regulator will provide details regarding the country's power system and the measures of reliability and quality of power supply, during and subsequent to this visit.

(iii) The domestic consultant, with guidance of the international consultant, will analyze the grid related information to estimate the requirements for each of the ancillary services, as well as the technical and regulatory arrangements currently being utilized to ensure that these requirements are met.

(iv) The international consultant will use normative cost data to estimate the cost of providing the ancillary services given roughly plausible future demand conditions and the likely profile of generation and transmission capacity.

(v) The international consultant will prepare a proposal for how provision of these services could be induced in the context of PRC's market design, how costs of provision may be recovered from the consumers, and how the providers may be compensated. If regulated prices of ancillary services are involved, the regulator would provide preliminary estimates of the prices required.

(vi) The international consultant will present a final report in English, with a translation into Chinese. This will detail the findings of each of the preceding stages of the study. The main body of the final report will not exceed sixty pages, and will include explanations of all major methodological and economic points. Calculations and data can be confined to the appendices. Comments from the regulator and market operator will be secured and incorporated. The international consultant will conduct back to back visits to PRC and to the 2006 CMERF meeting to present findings. PRC regulators or the government will provide the venue for the dissemination meeting.

9. **Timing and Implementation:** ADB's East and Central Asia Department, Energy Division, will serve as the executing agency for the study, while PRC's State Electricity Regulatory Commision's (SERC), Policies and Regulation Department will be the implementing agency. Results to the case studies will be submitted to ADB and SERC within two months of project commencement. The draft final report is to be presented to ADB and SERC within six months of consultant contracting, with the final report to follow one month later. All reports will be provided in English and Chinese. At least one half of the consultants' fees will be paid only upon the executing agency's approval of the final report. At least one sixth of the fees will be paid only upon satisfactory completion of the final presentations of the study results.

10. **Consultant Selection Materials:** Alongside the standard selection materials, shortlisted international consulting firms will also be required to submit writing samples, written by the international economist. These papers will be utilized to assess the suitability of the proposed expert, and will be assessed on the basis of their relevance to the study topic, and the technical capacity of the proposed expert.

B. Risk sharing under power purchase agreements

-Participating Countries: Kazakhstan, The Kyrgyz Republic

11. **Background:** Attracting private investment, whether domestic or foreign, in power generation facilities has proven difficult in many developing countries. Private investors, in particular the banks financing private generation companies, are often wary of a wide variety of risks. These include: commercial risks (input and output price fluctuations, demand fluctuations

and breach of contract by private customers); regulatory risks (tariff inadequacy or regulatory prevention of actions against non-paying customers); political risks (prohibitions on repatriation of profits, seizure of assets, unreasonable taxes, breach of contract by public customers, and civil unrest); and risks of commercial discrimination (transmission or distribution companies prevent the firm from accessing consumers). Many of these risks (regulatory, political, and commercial discrimination), can and should be alleviated through regulatory, legal and structural reforms, although, given real constraints on the speed and depth of such reforms, investors seek further guarantees in the interim.

12. More problematically, potential investors inevitably seek guarantees against commercial risks as well, usually through take or pay contracts. This is economically undesirable because investors are well placed to manage and reduce the commercial risks, as well as to access international insurance markets. Also, the process of securing private investment is intended to harness the capacity of the market to determine the commercial viability of investments, and insulating investors from commercial risks eliminates this potential benefit to private sector involvement. Finally, governments that turn to private sector finance often do not have the liquidity to cover the commercial risks of these companies. These assurances would therefore be costly to governments/taxpayers, and the costs are usually passed on to consumers through higher rates.

13. Direct contracts with large consumers and independent distribution companies can be utilized to pass on some demand risks. Because large consumers and distribution companies are best placed to assess demand risk, the premiums they attach to it will be smaller than those attached by the investor in generation. Similarly, project developers tap insurance companies who can spread risks further and charge premiums that are lower than those the developer would require to bear the risk themselves..

14. For governments seeking private investment, arriving at a realistic assessment of how much of which types of risks investors/developers, insurance companies, independent distribution companies and large consumers would be willing to bear is often difficult, because each player overstates its degree of risk aversion as a negotiation strategy. Regulators, who are required to endorse such contracts, face a greater challenge if the agreements provide generous risk premiums. They therefore need to understand how much risk it is reasonable to expect each major player in the sector to bear, so that investments may be secured without shifting excessive risk premiums to the consumer/taxpayer.

15. **Outcome and Impact:** The study will improve regulators understanding of what appetite private investors, distribution companies and large consumers would have for various risks, and therefore how to allocate the risk of power sector investments in the fashion that minimizes the risk premiums that must be passed on to consumers. This would improve the design of PPAs.

16. **Consulting Requirements:** 2 months equivalent of intermittent domestic consultant time in each of the 2 participating countries, as well as 4 months of international consultant time will be required. The domestic consultants will each require a background in local business/financial practices, and demonstrable and up to date knowledge of their respective national power sectors, as well as obvious capacity to read and communicate on technical issues in both English and Russian. The international consultant will have experience in facilitating contracting to involve private capital in developing country power sectors. The methodology in this study is inherently subjective, so this experience will be crucial for the success of the study. As the emphasis is on assessing the potential balance of risk between different actors, and not in actually drafting legal documents, an expert with demonstrable

knowledge of the economic principles and experience of the financial considerations underlying these negotiations will be preferred to a legal expert. The international economist will also have training in applied microeconomics especially in the area of risk analysis, as well as a high capacity to write and communicate clearly in English on these subjects, demonstrated through a personal writing sample on the subject which will be submitted as part of their proposal. The consultants will be hired through a firm.

17. Up to three resource persons will also be invited to make presentations at the 2006 CMERF annual meeting, as indicated below.

18. **Standards of analysis:** The report produced must conform to the highest professional standards. It must be presented in clear, grammatically correct English, with an accurate and readable translation into Russian. Opinions must be clearly explained and explicitly backed by sound reasoning and reference to international experience. All source materials must be cited, and direct quotations from other sources are to be strictly minimized. The translation of the reports into Russian must meet with the approval of the regulators from participating countries. Generic sector experts without substantial expertise and experience in the negotiation of power purchase agreements are strongly discouraged from applying.

20. **Scope:** The study will involve five phases:

(i) The international consultant will read all relevant reports on the participating countries' power sectors and visit both countries in succession. The local consultants and regulators from each country will help the international consultant to produce a detailed written assessment of the different types of risks of investing in each participating country's power sector. This assessment will include coverage of each power sector's industry architecture and structure, prices, cash flow, currency convertibility and political circumstances, as well as the balance of payments position and the legal rights normally afforded to domestic and foreign private investors. The consulting firm will provide translations of these materials into Russian.

(ii) The International Consultant will prepare a thorough survey of the experiences of four developing/transitional countries with comparable power sectors that have negotiated power purchase agreements, to provide a baseline assessment of how much risk can be borne by investors, large consumers and commercial distribution companies in the environments documented in the previous phase. The samples should include power purchase agreements signed with both domestic and international investors, as well as at least one negotiation that ended in failure. The consulting firm will provide translations of these materials into Russian.

(iii) A plenary discussion will be held at the following CMERF meeting by the international consultant and up to three of the personnel actually involved in negotiating the most successful of the reviewed agreements from other countries. Discussions will focus on: how much risk might be borne by investors, large consumers and distribution companies in participating countries; any measures that can complement or be included in the PPA to reduce the risk premiums that each player would require; and the minimum risk premiums that each player would require to take on such risks. They will aim to clarify the scope of a Terms of Reference which could be given to a legal team to prepare a PPA.

(i) A final report will be written providing suggestions of how to minimize the risk premiums that must be borne by consumers in the countries participating in the study and including the analyses undertaken for the first and second phases of the study. It will also include a TOR which could be provided to a legal team to prepare a suitable draft PPA in each country.

(ii) If regulators in the two countries determine that there is sufficient interest in the relevant line ministries, the international consultant will visit the participating countries to present the study's findings. Regulators will work with their respective governments to organize workshops, and provide the venue and logistical requirements.

21. **Timing and Implementation:** ADB's East and Central Asia Department, Energy Division, will serve as the executing agency for the study. Phase (i) is to be completed within three months of consultant contracting. Phase (ii) will be completed and the translated drafts shared with regulators within six months of completion. Phase (iv) is to be completed no later than one month after the CMERF annual meeting. Phase (v), if it is requested, will be completed within two months after the CMERF annual meeting. Fees will be paid in five installments at the conclusion of each phase, according to a schedule negotiated during contracting. All outputs will be provided by the consulting firm in English and Russian.

22. **Consultant Selection Materials:** Alongside the standard selection materials, shortlisted international consulting firms will also be required to submit writing samples, written by the international economist. These papers will be utilized to assess the suitability of the proposed expert, and will be assessed on the basis of their relevance to the study topic, and the technical capacity of the proposed expert.