Republic of India
Policy Notes - Indian Power Sector

1. Approach to financial sustainability of distribution business.
2. International Experience on Coal Imports and Mitigation of Market Risk

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SASDE
SOUTH ASIA
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1. Approach to financial sustainability of distribution business focusing on
   (i) What's worked well in Distribution,
   (ii) Experience sharing of rural load segregation in states, and
   (iii) Improving access to electricity.
Are We Staring At An Impending Financial Crisis in the Indian Power Sector?

This note lays out the implications for the financial sector and budget of the huge and increasing losses of Indian Distribution Companies (DisComs) and presents potential approaches to address the issue.

1. Challenges in the Sector
   • There are huge shortages of power: 350 million people lack access to electricity and those with access suffer supply interruptions and have high coping costs (60 percent of firms rely on captive/back-up generation).
   • The sector is constrained in addressing the shortage of power because of: (i) the fragile finances of the distribution sub-sector resulting from 30% system losses and a shortfall of Rs. 1.10 per unit of electricity supplied, and (ii) delays in bringing new generation online, largely on account of environmental/land acquisition constraints, but exacerbated by uncertainties on imported coal and limited availability of domestic coal.¹ The payment uncertainty associated with weak DisCom finances has also reduced the incentive to invest in new generation, contributing to further constrain in supply.
   • Sector reform remains incomplete: utility governance is weak and regulatory mechanisms do not function well, with annual tariff increases not being implemented despite existing legal provisions. Competition to supply large retail consumers has not yet materialized.

2. Current Financial Sector Exposure to the Power Sector
   • At end FY12, financial sector exposure to the power sector² amounted to Rs. 477,200 crores ($106b³) or 6.1 percent of GDP.⁴ More than 65 percent of this exposure is to public sector financial institutions (such as PFC, REC, SBI, PNB, etc.) and 53 percent (or Rs. 252,000 crores, $56 billion) is accounted for by new generation projects under the 11th plan.⁵
   • Annual financial losses (i.e. profit after tax) of DisComs were Rs. 61,500 crores in 2009-10.⁶ State governments provided a ‘subsidy’ payment of Rs. 19,074 crores, bringing net DisCom losses (profit after tax on a subsidy received basis) down to Rs. 42,414 crores.⁷
   • As a result, accumulated power sector losses at the state level had risen to Rs. 122,412 crores in 2009/10,⁸ or 1.87 percent of GDP. Assuming continued uncovered losses of Rs. 40,000 crores for

¹ The current policy of managing domestic coal supply through coal linkages, e-auctions, tie-ups with commercial miners, etc., is still expected to lead to a supply shortfall of 36% in the XIIth Plan. The option of international sourcing of coal through acquisition of coal mines abroad and through fuel supply agreements has exposed generators to the risk of changes in international law and tax structures, which they are not able to manage.
² This covers generation, transmission and distribution – and borrowing by state utilities, central utilities and private power producers/suppliers as well as private investment in power transmission and distribution.
³ At Rs. 45/$.
⁴ Mercados, quoting a Goldman Sachs report. This estimate is understated to the extent it does not include external commercial borrowing by corporate entities, private equity exposure, or investments in the power sector by insurance or pension funds.
⁵ The total generation capacity of 80 GW originally planned to be commissioned under the 11th Plan amounts to an investment funding requirement of $80b. Assuming a 70:30 debt equity ratio (for Central, State and Private sector plants), this implies debt of $56b (which amounts to 53% of $106b).
⁶ Income Expenditure and Profitability for Utilities selling directly to consumers during 2009-10 (Source: PFC).
⁷ Profit after tax on subsidy booked basis is Rs.27,488 crore loss, showing the significant difference between subsidy received and booked.
2010/11, total sector accumulated losses in 2010-11 would amount to Rs. 162,412 crores ($36b, or 2 percent of GDP).9

- The five states with the highest distribution losses in 2009/10 were Rajasthan, Tamil Nadu, Uttar Pradesh (UP), Andhra and Haryana. Tamil Nadu, UP, Rajasthan, Punjab and Madhya Pradesh (MP) account for 74 percent of accumulated DisCom losses.
- Financial institutions are now unwilling to extend working capital loans to utilities in UP, Tamil Nadu, Rajasthan, Punjab and Haryana. As a result, DisComs have been resorting to load shedding, even though power is available, since they cannot pay for the power they need to supply.10

3. Potential Fiscal Implications

- Problems in the power sector have clear fiscal ramifications because the bulk of lending to the sector is by state owned financial institutions (which are, arguably, ‘too big to fail’). The fiscal burden additionally includes Government subsidy payments for supply of power below the cost of generation.11
- The involvement of private sector lenders means there is now greater pressure on the Government to compensate them for losses due to the poor performance of the sector. The fact that many generators (the central generation companies like NTPC, NHPC; private power producers such as Reliance, GMR, Tata, etc.) and financial intermediaries lending to the sector (PFC, REC, ICICI, SBI, IDFC, etc.) are listed on the stock market also means that broad market sentiment could be negatively impacted by failures of even a few firms and financial institutions, with wider repercussions for the economy.

4. Policy Actions for Bringing State Utilities Back to Financial Sustainability

The most urgent need is to address the problem of financial distress of the utilities, while using the crisis as leverage to implement regulatory and governance reforms that will be essential to the longer-term sustainability of any short-term actions agreed by the utilities.

- Focus on the seven states that are responsible for more than 75% of current accumulated financial losses. The Government of India may want to prepare a framework that allows each state to propose its own tariff and efficiency reform actions to attain full cost recovery over a specified period of time. The framework/scheme should be optional to states, where the consolidated set of policy and management actions that could reduce financial losses in the short term would require sustained and strong political commitment to reform. Achievement of objectives such as higher cost recovery require the political determination at the state level to treat power as a commercial good and break the local patronage nexus between employees and local politicians. The plan for states that opt to join the scheme (say up to 4), could include measures such as innovative private sector participation in distribution, institutional accountability models under state ownership like mandatory compliance with corporate governance codes and partial listing on stock exchanges (with employee stock options), etc., leading to full cost recovery within a defined time frame. These measures would need to be supplemented by a package of strategic technical assistance, institutional development and focused investment to help the DisComs reduce their distribution losses. Active forums to promote

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10 There is an irony here as Load Disptach data show that on specific days more than 10 GW of thermal power stations with variable cost of around 3 cents/ unit are shut down due to limited off-take by credit strapped state utilities, while more than 20 GW of diesel based captive capacity with running cost of 30 cents/ unit continues to be operational in private sector as a coping strategy.
11 This is exacerbated when new power capacity comes on-line because old plants tend to be heavily depreciated.
learning on state reforms across states should also be established (for lessons on state reforms over
the last two decades, refer to Annex 1).

- A Government of India-led framework for comprehensive and sustainable financial restructuring of
  the utilities in distress may incorporate the following principles/actions:

  (i) Ensure that accumulated liabilities are neither transferred to a third party in total, nor
      shifted to a future date through the issuance of bonds for the entire accumulated liability. Instead,
      annual assistance in servicing transition financing should be linked to milestone-
      based demonstrated achievements on pre-defined parameters. In essence, continued
      cooperation between the RBI, Ministry of Finance and Ministry of Power would be
      required to ensure hard budget constraints for non-performing utilities in the future.

  (ii) Require fair and transparent financial contributions from all stakeholders, including both
       the state and the financial institutions that have been complicit in creating the current
       situation.

  (iii) Institutionalize a facilitative legal and regulatory framework for robust monitoring and
       evaluation (comprising existing institutions like Forum of Regulator representatives and
       credible sector experts), with the power to release annual incentives or penalize non-
       compliance.

  (iv) Establish performance accountability and incentive mechanisms for DisCom management
       and employees that give them a stake in the success of reforms, and

  (v) Allow flexibility for mid-course correction.

- All efforts at the DisCom and policy level would need to be accompanied by key regulatory
  interventions. These would need to include:

  (i) Mandated timely, periodic tariff reviews and adjustments;

  (ii) Incentivized introduction of retail supply competition through open access;

  (iii) Measures to ensure greater autonomy in the appointment, finances and functioning of
        Regulatory Commissions;

  (iv) Strategies for ring-fencing the rural/agricultural sector from the urban sector, including a
        transparent subsidy mechanism that states would adhere to. The segregation of rural from
        urban loads (refer to Annex 2 for details) would permit the utility to control agricultural
        consumption and create incentives to improve service across the board.12

Actions to reform DisComs would need to be accompanied by efforts to expand coverage. An
option to be considered is the development of a centre of excellence on rural power supply to
develop alternative policy and implementation models for providing electricity to the 350
million Indians who lack access (refer to Annex 3 for details) and pilot models for the delivery
of subsidies to farmers.

12 The near universal factor in states with maximum financial distress in distribution is that 50-70% of power
generated is not paid for (system losses and agricultural consumption), implying need for political dialogue to go
beyond tariff increase and pursue separate strategies for rural and urban areas.
Annex 1: Key Directions for Distribution Reforms in the Power Sector in India

The process of reform in the Indian power sector began in the early 1990s with a few State Governments enacting legislation to reform and restructure their State Electricity Boards (SEBs) in an effort to improve performance by enhancing accountability. Starting with Orissa in 1995, followed by Haryana, Andhra Pradesh, Rajasthan, Uttar Pradesh, Karnataka, Delhi and Madhya Pradesh, most states have now restructured their SEBs. The Electricity Act, passed in 2003, required the unbundling of SEBs and separation of the trading function from transmission and system operation, allowed open access, and encouraged competition in the sector. Despite these efforts the distribution segment has continued to perform below potential almost across the board. Significant exceptions exist, however, and this note summarizes key lessons from the experience across states and identifies directions for the future, underlining how one size does not fit all. Since power is a concurrent subject, and states play the main role in distribution, GoI may want to focus on developing a framework that creates incentives for good performance and ensures accountability.

Learning from Indian state reforms

- **Political resolution to treat electricity as a commercial good for most consumers, rather than a public good with corresponding entitlement rights:** At the ground level in most states, corporatization and unbundling have not been effective in treating power as a commercial activity that needs to be paid for. Where political executives at the state level have seen the power sector strategy as a vehicle to assist industrialization and a way to break the patronage nexus between employees and local politicians, while undertaking strategic communication campaigns on treating power as a commercial activity, results in distribution efficiency have been positive. Reforms in Gujarat, West Bengal (from 2005 to 2010) and AP (from 1999 to 2005) and private sector participation in Delhi and Bhiwandi (Maharashtra) provide evidence to this effect.

- **Internal organizational change.** A variety of models have shown promise - privatization in the case of Delhi, a franchise model in Bhiwandi, State-Owned Enterprises (SOEs) in Gujarat and West Bengal. In all cases internal organizational reforms, including increased managerial autonomy, were undertaken and realistic business plans implemented with appropriate investments credible time-bound measures to improve service standards, and incentives for efficiency improvement.

- **Strengthened corporate governance.** Establishing robust accountability and governance structures, for example along the lines of the requirements for publicly listed companies, is essential to the sustainability of reform. Without this, and without consequences for non-performance, most DisComs slip back into their old operational ways soon after restructuring.

- **Ring-fenced power supply to agriculture.** Any successful distribution reform will also need to explicitly compensate DisComs for the power that is not paid for. In the states with maximum financial distress in distribution 50-70% of power generated is not paid for (due to system losses--both commercial and technical--and free power supply to agriculture, which are often clubbed together). This underlines the need to go beyond tariff increases alone and pursue separate strategies to supply rural and urban areas.

- **Good data.** Even 15 years after reforms were initiated, utility operational and financial data remain unreliable. In the absence of quality baseline data, regulators often set tariffs on a normative basis, which does not reflect true costs, results in systematic failure by DisComs to achieve performance targets, and makes implementation of incentive schemes more difficult.

An analysis of the reform experience in Latin America also shows that two models of distribution reforms have been successful: (i) privatization with performance-based regulation involving multi-year tariffs (applied for
periods of four to six years at a time) and the establishment of service quality standards with close monitoring of compliance; or (ii) state-owned enterprises with strengthened corporate governance frameworks (for example, CEMIG in Brazil).

**Going forward**

Drawing on the lessons of experience, some key elements of any reform strategy for various stakeholders are presented below. It is clear that DisCom losses result from a combination of factors with multiple responsibilities. To be sustainable, any resolution must involve all agencies, share the burden of adjustment among all responsible, and be coordinated by the centre. Implementation of the reform strategy would need to be monitored regularly, for example by a standing committee which could include the RBI, Ministry of Finance, Ministry of Power and CERC.

**Government of India**

(i) **Incentivize utility performance.** Utilities would be required to formulate a turnaround/reform program that is bankable and that has clear, monitorable, targets which would be agreed upfront with the Ministry of Power (MoP), lenders, and the State Government. With this in place, GoI could support states which achieve their annual specified targets with (a) concessional financing and/or (b) low-cost power from the unallocated power of CPSUs. For example, state utilities could be provided financing on the basis of metered sales. To ensure that states do not relapse into “business as usual”, potential disincentives could be a reduction in their allocations of central power supply (as was done in 2001) and central fuel supplies, downgrades by FIs, and, perhaps, even a cut in central devolutions. Accumulated liabilities or transition financing should not be transferred in their entirety to any third party (such as a Special Purpose Vehicle) or to a future date through a financial instrument (such as bonds). *Ensuring a continued hard budget constraints for non-performing utilities is a critical policy requirement.*

(ii) **Improve corporate governance.** Greater operational autonomy of DisComs should be balanced by monitoring and accountability mechanisms:

a. Discoms could be required to adopt the corporate governance framework mandated by the Department of Public Enterprises for CPSUs.

b. The boards of utilities could be professionalized by bringing in professionals as independent directors. “Performance agreements” or MoUs between the State Governments and their utilities could hold the board and management personally accountable for achieving targets in their Performance Agreements. Utility management could be given greater autonomy in HR.

c. Accounting practices could be standardized, e.g., to follow current accounting standards (ICAI), and timely finalization of accounts required.

**State Governments**

State Governments would need to sign an MoU with financiers, the MoP, and MoF to commit to the actions laid out below, with the understanding that failure to implement the agreement would result in pre-specified penalties as described above (such as curtailments in power allocation, financing, and central devolutions).

(i) **Measure and pay for power to the agriculture sector.** Utilities should ring-fence the power supplied to agriculture (e.g., by rural load segregation) and establish a transparent mechanisms to determine and administer subsidies for power to agriculture. *State Governments need to be held accountable by the centre for timely delivery of the subsidies required.* Experience shows that, in mixed-load distribution utilities, success comes from focusing first on improving service to the urban and high-paying segment and only then on economically
weaker consumers (this approach was followed successfully in Buenos Aires and other Latin American cities). Controlling supply to agriculture will permit DisComs to focus on limiting non-technical losses and providing good service to the 20% of customers who deliver 80% of revenues. It would also ensure the political sustainability of reforms by permitting DisComs to provide quality power to rural areas.

(ii) **Implement structural and organizational changes in DisComs.** State Governments could explore a mix of models, including innovative private sector participation strategies, building on the successful loss reduction experience of the Delhi operators and Bhiwandi franchisees. Internal organizational reforms to enhance accountability, particularly in SOEs, would need to accompany the financial restructuring and business plan so that it is more than a mere transfer scheme. Autonomy could be granted by invoking a Corporate Governance code (such as that of Central PSUs), mandating partial listing on stock exchanges within pre-defined time frames, or by forming a panel of external experts mandated to monitor performance of the board.

(iii) **Strengthen skills and capacity of utility officials.** Discoms have not invested enough in human resource development. Skill shortages exist across the spectrum—technical, information technology, regulation, finance and accounting—since recruitment has been restricted for 15 years, with the average age of employees now about 50 years. Managerial talent is also becoming scarce since private entities in the sector have been able to attract experienced managers away from state companies. The average tenure of management in state utilities is less than 2 years. While R-APDRP provides support on IT aspects, it needs to be supplemented with performance-based human resource regimes that institutionalize performance improvement and through the creation of Centers of Excellence to act as resource centers for best practice and skills development.

**Central Electricity Regulatory Commission and Forum of Regulators**

(i) **Enhance regulatory efficiency.** Efforts need to be made to strengthen state regulators in terms of their autonomy, institutional capacity, efficiency, and accountability. This would include:

   a. Implementing organizational changes related to the selection and appointment of the Chairman and members, funding arrangements that are independent of state legislature decisions, ensuring there is a critical mass of staff and skills in-house by institutionalizing a national cadre of officers interested in developing a career on regulation, and establishing accountability mechanisms so that the regulatory agency is able to play the role of referee between the utility, investors, and consumers.
   b. Holding the regulator accountable for timely and periodic tariff reviews and adjustments, the promotion of competition through open access, etc.

(ii) **Self-regulation.** Develop a code of conduct or performance metrics for regulators that the FOR would endorse and that CERC would monitor and enforce.

(iii) **Data.** Require accurate data collection, record keeping and preparation of timely accounts by DisComs following standards established by the GoI. Require timely publication of audited accounts.
Annex 2: Lighting Rural India - Experience of Rural Load Segregation in Select States

Key Messages:

- Rural Load Segregation can be done in multiple ways and there is no “One Size Fits All” model for universal application in the states. A detailed assessment study during the conceptualization phase is needed for each state to identify appropriate models given state-specific parameters such as the extent of agricultural metering, current loss levels, geographic spread, etc.

- Rural load segregation is essentially a hardware investment, but to effectively make the schemes economically and financially viable and to better measure and control agricultural consumption, institutional measures (such as use of Automated Metering Infrastructure[this is not institutional], developing Management Information System and hiring skilled people to manage new data centres) need to be put in place.

- An evaluation of existing rural feeder segregation schemes indicates that, while the quality of supply has improved in rural area across the board, financial viability has not been achieved. The financial and economic viability of a scheme is a function of (i) effective planning to determine the optimum model for feeder segregation in a specific state, (ii) monitoring and evaluation (with variations of public and private sector involvement), (iii) integration of the scheme with cross-sectoral and institutional strengthening measures. No state regulator is currently using data from segregated feeders to fix targets for agricultural consumption and corresponding subsidy levels, even in states with completed rural load segregation.

- As an immediate next step, a Centre of Excellence could be set up at the Government of India level to: (i) assess feasibility options for rural load segregation models in different states with high agricultural consumption; (ii) evaluate opportunities for synergies with interventions on irrigation, microfinance and agriculture modernization; and (iii) recommend measures to improve data quality standards for policy and regulatory decisions on agricultural supply and subsidy delivery.

1. Traditionally, power supply to agriculture in India has been heavily subsidized since irrigated agriculture was at the heart of the Green Revolution. Electricity tariffs for farmers amount to less than 10 percent of the cost of supply. Typically, farmers pay a flat rate per unit of horsepower per pump; the actual level of power use is not metered or recorded. This lack of information on usage means that the amount of power consumed on a specific feeder13 cannot be disaggregated into the amount used by agriculture, by rural non-farm users or, indeed, the amount that is lost on account of technical inefficiencies or that is unaccounted for because it is stolen.

2. In the absence of metering and with (almost) free supply, there is no incentive for conservation or controlled use of power by rural users. Also, high reported transmission and distribution losses14 in the

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13 A "feeder" is a 11kV electricity network emanating from a 33kV or higher voltage electricity substation used for supplying electricity to end consumers.
system (currently estimated at 35 percent) basically camouflage theft. The magnitude of the power subsidy for the agricultural sector in some states is twice the budgetary annual spending on health or rural development. Empirical evidence suggests that it is primarily large farmers who have gained from this subsidy policy; most small and marginal farmers lack access to electricity and depend on rain-fed agriculture. State utilities seek to limit the supply of power to agriculture (to 6-8 hours in a day, often during the night) in an effort to control wasteful consumption in an environment of chronic shortages. However, this constrains productive economic activities by non-agricultural consumers on the feeder.

3. It is in this context that several states in India have undertaken programs of rural load segregation that separate power supply to rural non-agricultural consumers from supply for irrigation, thereby separating paid and nominally-paid loads. Through this mechanism, utilities have attempted to measure and limit the amount of power supplied for free for irrigation, while ensuring that rural non-agricultural consumers receive better quality supply for longer periods. Seven states have initiated rural load segregation schemes -- Andhra Pradesh (AP), Gujarat, Haryana, Punjab, Karnataka, Maharashtra, and Rajasthan, with the earliest attempt being made in AP in 2001.

4. A study was conducted to assess the experience of states in rural feeder segregation with a view to informing the implementation of the schemes more broadly. This note summarizes the findings of the study for the project conceptualization (design), execution, and evaluation stages, with details on financial and economic cost benefits analysis of the schemes discussed subsequently.

5. Key findings on the ‘conceptualization’ (design) stage:

- The approach to load segregation followed in a given state is context-specific with respect to political thinking, regulatory practices, and state of the power sector. In Haryana, for example, the power sector was faced with the problem of high distribution losses (around 30 percent), whereas in Rajasthan the load segregation work was a part of the integrated Feeder Renovation Program (FRP). In Gujarat groundwater issues were also addressed along with feeder segregation within an integrated approach for rural development.
- The primary objective common to all states in the study was socioeconomic development through ensured supply hours to agriculture and non-agriculture consumers in rural areas.
- The technical approach to carrying out load segregation varied across states. Rajasthan and Haryana undertook load segregation through virtual (single-phase supply for rural households) and physical (three-phase supply for rural household usage) modes respectively, whereas AP and Gujarat both undertook virtual segregation of loads in the initial phase and then due to various reasons shifted to physical segregation.
- Baseline data collection and analysis was not undertaken in any state before embarking on rural load segregation.
- The cost of load segregation varies across states depending on the technical approach and whether it is a standalone program or part of an integrated program.

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6. Key findings on the ‘execution’ stage:

- The state government or distribution utilities were the project owner,\(^{16}\) with no separate or specific institutional framework being put in place for execution of the scheme.
- All states except Haryana decided to undertake a pilot before initiating a state-wide rollout of load segregation.
- None of the schemes included components on data measurement and management information systems such as Remote Meter Reading or Automated Meter Infrastructure to capture online metering data.

7. Key findings on the ‘evaluation’ stage:

- Attention to Monitoring and Evaluation and outcomes was negligible in all states. Even after five years of completion of the scheme in Gujarat and about four years in Rajasthan, summary reports of agricultural consumption based on segregated load data are not prepared regularly for management decision-making.

8. The experiences of Gujarat and Rajasthan were studied in detail to verify the prevailing perceptions regarding rural load segregation. The table below discusses each perception based on the quantitative and qualitative information gathered from the two states.

### Summary table of perceptions and observations and lessons from the study

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<th>S.No</th>
<th>Perception</th>
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<tr>
<td></td>
<td>Observations and Lessons from the Study</td>
<td>Gujarat</td>
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<td>Rajasthan</td>
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<tr>
<td>1</td>
<td>Segregation of loads is the only solution to provide 24x7 supply to rural non-agriculture loads</td>
<td>Segregation -- either virtual or physical -- has both financial and human resource requirements. It is required only under the socio-political scenario where metering of agriculture loads is not possible. Where metering is possible (and there exists a group of farmers who are willing to bear the costs associated with reliable and assured power supply(^{17})) reliable Information Communication Technology (ICT)-based metering solutions such as AMI(^{18}) are available.</td>
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<td>2</td>
<td>Load segregation results in the creation of additional infrastructure (new feeders, additional transformers, etc.)</td>
<td>The existing infrastructure is aged and overloaded, requiring augmentation irrespective of segregation. Initially the new segregated assets created may not be optimally loaded but, given the healthy growth rate in demand of 6-7% per annum across consumer categories, the infrastructure would be fully utilized in a few years.</td>
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\(^{16}\) Defined as the stakeholder who is the scheme originator and owns it through the implementation phase.

\(^{17}\) In Gujarat, the utilities have received requests from some potato cultivators who are willing to pay commercial rates for assured and longer supply hours.

\(^{18}\) AMI is a system that uses two-way communication and back-end software applications with energy meters to measure, collect, analyze and control energy usage in the system on a real-time or near real-time basis. It is very effective in communicating and implementing supply rosters and dealing with detection of unauthorized consumption, thus reducing losses. AMI systems can be designed to perform a wide range of functions like energy audit, distribution network management, implement varying tariffs for consumers connected on the same feeder etc. They provide accurate data to the utility, can reduce billing cycles, improve consumer satisfaction by providing information on real time basis and perform a whole host of other functions. The technology is now mature and is commercially available at reasonable costs.
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<td>Gujarat</td>
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<td>3</td>
<td>Agriculture consumption would not be reduced post segregation leading to no reduction in T&amp;D loss levels</td>
<td>Post RLSS, accounting of agriculture consumption improved at the sub-division level. But the estimation of agriculture consumption for the state, in utility and regulatory accounts, even after 5 years of rural load segregation, continues to be based on earlier estimates and not on data captured from rural load segregation.</td>
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<td>4</td>
<td>Post segregation the booking, allocation and delivery of subsidies would be transparent</td>
<td>Subsidy booking and allocation has been on a rising trend in the states included in this study, except Gujarat, where there is a fixed subsidy allocation by the state government. Overall, the impact of load segregation on agriculture subsidies could not be established owing to the absence of a feeder information data collection system agreed with the regulator.</td>
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<td>5</td>
<td>Load segregation brings in financial benefits through loss reduction, revenue improvement and improved load factor</td>
<td>Strengthening of agriculture accounting led to loss restatement and subsequent loss reductions at the sub-division level.</td>
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<td>6</td>
<td>Socioeconomic benefits in rural areas through improved livelihoods and income, improved health and education outcome</td>
<td>A primary survey conducted for this study established considerable socioeconomic benefits, though the exact contribution of RLSS cannot be quantified. But even if just 5% of the increase in income could be attributed to rural load segregation, the economic return would still be a strong 15%. The linkage between power subsidies and agricultural growth was outside the scope of the study, but at a macro level over the last five years agricultural growth in Gujarat has been impressive in spite of limited subsidies and power supply, while increased agricultural consumption and consequent higher financial losses in Rajasthan do not seem to have translated into commensurately higher agricultural GSDP.</td>
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<td>7</td>
<td>Load segregation would lead to an improvement in service standards in rural areas</td>
<td>Load segregation has resulted in an improvement in supply hours to rural areas. Supply expansion is also constrained by generation capacity.</td>
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<td>8</td>
<td>Investments were based on baseline data of agricultural consumption and Monitoring and Evaluation (M&amp;E) systems were put in place</td>
<td>Baseline data such as the existing loss levels, agriculture consumption, connected load, number of consumers, number of functional feeders were not collected by the DisComs or third party agencies.</td>
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<td>9</td>
<td>Feeder segregation is a one-time activity/investment</td>
<td>Feeder segregation is a continuous activity. New connections need to be continuously monitored and discipline enforced, as otherwise the segregated agriculture a feeder may again get converted into a non-agriculture feeder over time.</td>
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<td>10</td>
<td>Feeder segregation is a viable substitute for agriculture metering</td>
<td>Metering of agricultural consumers is essential for consumer-specific consumption monitoring and the use of alternative subsidy delivery mechanisms. Consumer metering for agricultural farmers alone will not lead to the provision of 24 hours of supply to rural non-agricultural load consumers unless farmers are willing to pay cost-reflective rates beyond their allocated quota of power. Thus, feeder segregation is necessary but by itself it is not a sufficient tool for a more transparent allocation of subsidies to agricultural farmers unless supported by an effective M&amp;E system.</td>
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</table>
9. The primary objectives of increasing quality and quantity of power supply for non-agricultural consumption in rural areas seem to have been met, though the schemes have had mixed results on the financial status of DisComs. Gujarat has managed to control subsidies and financial losses, while overall financial losses and subsidies continue to increase in Rajasthan. The socioeconomic impacts of the feeder segregation schemes on excessive groundwater extraction with higher agricultural power consumption post segregation and the benefits of increased agricultural GDP would also need to be assessed in subsequent phases of the study for an integrated analysis of the rural feeder segregation schemes.

10. Further, the study has shown that a standard rural load segregation approach or rural load segregation in isolation is unlikely to meet the strategic objectives of different states. Ideally, a robust distribution infrastructure (with adequate HT:LT ratio) with 100% remote consumer meter reading would be the right approach to deliver power supply in rural areas to consumers with diverse needs. This is also supported by previous studies conducted by the Planning Commission, which advocated metering for each agricultural consumer with subsidies limited to specified initial units of consumption. Load segregation through either virtual or physical means may be a second-best option given the current institutional and socio-political constraints, under which it is difficult to meter all agricultural connection, monitor supply remotely, and maintain the infrastructure. Feeder segregation would need to be carried out in state-specific ways. The study highlights need for an intensive effort during the conceptualization and design phases to understand state-specific issues and design an appropriate scheme.

11. To maximise the benefits accrued from load segregation, a feedered segregation scheme would need to be accompanied by institutional and governance reforms at the utility level. Feeder meters compatible with remote reading are already installed in most sub-stations. It is necessary to automatically collect the data acquired by these meters and analyze it. For this, a data monitoring centre could be set up with to manage and disseminate the data provided by the data acquisition system. Feeder segregation provides the hardware for a system that is capable of delivering differentiated service to agricultural farmers and non-agricultural rural consumption, along with management decision-making tools for effective monitoring, but the outcome in terms of better quality of supply and sustainable operations is a function of software elements. These relate to the simultaneous and integrated application of organizational changes, accountability systems, and use of information technology. Similar lessons have emerged from the implementation of the Accelerated Power Development and Reform Program (APDRP) central scheme, where improved data quality through institutional changes in DisComs and use of information technology were identified as precursor to large-scale investments.
A Centre of Excellence on managing rural energy could be considered to assist in the conceptualization, execution, monitoring and evaluation phase of feeder segregation programs. Rural feeder segregation schemes would need to lead over time to more transparent and efficient forms of subsidy delivery to farmers. Sectoral efforts to remedy the adverse effects of the energy-groundwater-agriculture nexus have mitigated sector-level impacts but cannot solve the underlying problems responsible for distortions across multiple sectors. The problem can be addressed only through a comprehensive multi-sectoral approach, which will need to be politically acceptable. Options are being explored in Karnataka and Punjab to replace the existing indirect delivery of farm power subsidies by a system of direct delivery to farmers that will: (a) make more power available to farmers on demand without in any way reducing their existing benefit of free or subsidized power; (b) accelerate the pace of agricultural growth and diversification; (c) generate powerful incentives for improving the efficiency of power as well as groundwater use in agriculture; (d) support accurate energy accounting, auditing and monitoring within the utility and thereby promote greater business orientation in the power utility management; and (e) reduce leakages of subsidy.
Annex 3: Power For All: The Access Challenge in India

India’s rural electrification (RE) program is facing tremendous challenges and opportunities. India’s challenge is unique: no other country has faced the onerous task of providing a commercial service to so many people who may not be able to pay its total cost. The total investment required to achieve universal access to electricity by 2030 is estimated at $9 billion per year or 0.9% of India’s GDP in 2008. But India also has the opportunity to transform many lives and raise people's productive abilities to contribute to the economy.

India’s rural electrification efforts are supported by the flagship Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) that begun in 2005. In spite of the impressive achievements of 95% village electrification, universal access, at 70%, is still distant. This policy brief examines some good practices in rural electrification in that might help to bring service to India's 350 million people without electricity and improve service for those who already have it. The successful programs examined are in Bangladesh, Chile, Lao PDR, the Philippines, Thailand, Tunisia, and Vietnam. They are presented in the spirit of providing suggestions to improve service delivery in rural India.

A. India’s access story so far: impressive achievements but still a way to go

About 45 million households or 203 million people in the past decade have been connected. The new consumers are primarily located in rural areas where electricity access rates jumped from 48 percent in 2000 to 60 percent in 2008. Access has expanded across income levels. The gain in the poorest quintile was 9 percentage points. Bihar, West Bengal, and Andhra Pradesh are success stories in expanding access, accounting for 30% of the growth in new connections.

India’s electrification challenge is confined to rural areas, poorest population, and selected states. About 95% percent of the unserved (328 million people) live in rural areas. More than two-thirds belong to the lowest 40 percent of the income ladder. About 83 percent of the unserved population is located in the states of Uttar Pradesh, Bihar, West Bengal, Rajasthan, and Orissa.

The demand for power in many rural markets is not being met, and even in areas where grid supply is accessible consumers continue to be under-served. About 75 percent of households in rural areas have electricity outages for at least 4 hours per day, and about one-fifth have only intermittent supply for most of the day. Bihar and UP, which are the states that are the farthest behind in coverage, are also the ones that face the highest hours of outage in a day. Unreliable electricity service results in continued kerosene use. Recent analysis shows that this is the single most important reason why village electrification has not automatically translated into household connectivity.

B. Recommendation 1: Facilitate effective planning and implementation of rural electrification projects

An effective implementing agency is one of the most basic requirements to manage the relatively complex business of large-scale grid-based electrification. A variety of approaches have been successful: a separate rural electrification authority (Bangladesh); setting up rural electric cooperatives (Costa Rica); allocating rural electrification to a department of the national distribution company.

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(Thailand); or delegating it to the regional offices of the utility (Tunisia). The only private sector experience is in Chile, where a subsidy fund for rural extension was developed to encourage private sector utilities to extend service to rural areas. There are common factors behind the models that have worked well: (i) leadership of the program vested with a single strong entity, with a stable and long-tenure management backed by an institutionally capable team; (ii) clearly established roles and responsibilities; and (iii) technical capacity to support the supply chain of contractors and small service providers. The agency needs to be complemented by a critical mass of project developers, consultants, and installers, who must be available in sufficient quantity and quality for the success of a large-scale effort. For India, this suggests the creation of centres of excellence to build the skills of local project developers and contractors.

**Grid extension and off-grid options are not mutually exclusive and could be implemented in parallel and, under specific conditions, in sequence.** The rural electrification program needs to be guided by a transparent long-term multiyear vision aimed at coordinating grid/off-grid efforts and should be supported by studies on the optimization of technology options and a grid/off-grid comparative economic analysis, and publicly disclosed market studies on ability and willingness to pay. Grid extension is often the cheapest way to connect new users located not too far from existing networks and is relatively easy to implement. India, under the RGGVY, has proceeded on this path at a steady state. Off-grid electrification is applicable in remote areas unlikely to be connected to the grid in the foreseeable future. Off-grid technologies such as solar home systems may be economic and financially attractive under conditions of very low incomes and very low consumption, since they are available at lower costs for small amounts of consumption. For India, this implies a more coordinated approach between the Ministry of Power and the Ministry of New and Renewable Energy on coordinating grid- and off-grid-based RE schemes.

**Decentralization of planning and implementation process is critical, by involving local communities and Small and Medium Enterprises (SMEs).** Institutional constraints in rural supply are often localized and hence need local solutions. Involving local communities from the start can help improve design (Peru, Vietnam), gain local support (Bangladesh), mobilize contributions in cash or in kind (Nepal, Thailand), and increase local ownership, contributing to operational sustainability. Similarly, SMEs have a particularly important role to play in remote areas that distribution utilities find difficult to cover. This role can take the form of maintenance and customer service provision in rural low-voltage systems (Vietnam) and off-grid systems (Peru), or as contractors in the construction of small-scale rural grids. In India, decentralization could involve a more active role of Panchayati Raj institutions (PRI) in the planning and execution of RE schemes.

**Customized design standards and low-cost technologies should be incorporated.** Many countries have been successful in reducing construction costs using technical standards adapted to rural demand patterns. In Costa Rica, the Philippines and Bangladesh, adoption of the well-proven single-phase distribution systems, used in the US rural electrification program of the 1930s, brought major savings. Where the main use of electricity is expected to be for lights and small appliances, typical of many rural areas, there is no reason to apply the design standards used for much more heavily loaded urban systems. Although consumption normally grows, this is usually at a slow pace and, provided the necessary design provisions are made, systems can be upgraded relatively cheaply later.

**C. Recommendation 2: Provide reliable power supply and monitor the quality of service**

**Dedicated generating capacity can be set aside for rural consumers.** Increasing access for the poor, particularly at subsistence level of consumption, is likely to impose a relatively minimal requirement of additional generation capacity. The expansion of access to 45 million households has accounted for only
17% of the incremental capacity installed over the past decade. The generating capacity available for universal access has to increase not only to provide for the unserved but also to improve reliability for currently served rural consumers. There has to be dedicated generation capacity, decided at the central level, which needs to be allocated for rural consumers. For India, this could mean allocating new pit head-based coal stations or central sector hydro stations to serving newly electrified homes. The other options are to manage the current capacity shortages by a transparent system of scheduled load shedding which can be publicly announced using media outlets and to strengthen the transmission and distribution infrastructure to increase the amount of energy that can actually be delivered.

The regulator has to effectively monitor the quality of service standards. A mechanism of subsidy payments to Distribution Companies effectively linked to compliance with clearly defined quality parameters for technical and costumer services may help. The absence of such a mechanism may introduce distortions into the incentive system, as DisComs would tend to reduce investment and operating costs as rural electrification is not perceived as a commercial business. This monitoring role of the regulators can also be outsourced to third-party agents. For India, a careful balance is required between effective monitoring by regulators and allowing space for the development of innovative models by private sector providers.

D. Recommendation 3: Pursue operating cost recovery principles to ensure long-term sustainability

Sustainable access means not only providing the village infrastructure but also the connections. Conditions should be such to enable people to continue to maintain their connections and pay their monthly dues while providing incentives to the DisComs to service these consumers. Bill collection from rural consumers is a priority, no matter how small the bill. In India, prepaid meters can be used to facilitate monthly payment for power by poor households and reduce utilities’ commercial risk. A system of tariffs and subsidies is required to complement—but not replace—the limited contribution of rural consumers and ensure the sustainability of the service. Of the three types of costs—capital, connection, and operations—typically, the capital costs of investments are completely subsidized (in India as well). Connection costs have often proved to be a barrier, so subsidizing them in a selected or geographically targeted way or spreading them out over a period of time are options. Output-based subsidy mechanisms can also be used, as in Ethiopia where a payment per connection is made to the DisCom upon verification by a third-party agent. Based on international experience, states in India could evaluate a targeted subsidy on connection charges for Below Poverty Line consumers and test output-based subsidy models.

Viability gap funding-based concessions to the private sector for expansion and operation of electricity services in rural areas can be explored. Such concessions could be awarded on a competitive basis, with a minimum assured supply from the discoms. The viability gap funding could either be decided upfront on capital costs through an auction process or provided based on the actual number of connections given under an output-based aid mechanism. Similarly, operating subsidies could be provided based on metered consumption by the consumers. Such an approach would allow faster expansion and sustained operation of rural electricity services.

Cross-subsidies, used to balance the limited ability to pay of rural consumers, need to be non-distortionary to the discom’s incentive structure. Rural consumers are not perceived as ‘paying’ consumers. This leads to the well-documented vicious circle of poor performance in rural areas and of mistrust between consumers and the discoms, which means resistance to higher prices. Recent analysis shows that 85% of rural consumers can afford to pay up to Rs 90 a month, which would cover a minimum level of consumption and would not be above 5% of their household budget. This implies that the tariffs for rural consumers can be set at or near operating cost recovery levels. Further, the current system of
cross-subsidies tends to benefit the non-poor. First, the poor tend to live in areas where access to electricity is much lower. Second, they also tend to have lower connection rates to the network when there is access in the area in which they live. Existing consumption subsidies for electricity appear to be less targeted than a number of other government transfers for the poor such as Sampoorna Grameen Rozgar Yojana (SGRY) and Rashtriya Swasthya Bima Yojana (RSBY).

**An integrated rural development agenda that offers electricity in a bundle of complementary services can ensure productive use.** The experience of several countries, including Bangladesh and Thailand, suggests that promotion of and capacity building for productive uses of electricity in rural areas can increase the productivity of rural businesses, enable a more efficient use of the supply infrastructure, and improve the revenues of distribution companies, thereby enhancing the economics of electrification. The "complementary services" identified in many studies as facilitating productive uses of electricity and business development are access to affordable microfinance, access to information and knowledge (education, training, business development services, dissemination campaigns, available and qualified human resources), access to markets (access to raw materials, sufficient demand for the product or service, complementary infrastructure such as roads or ICT), availability of equipment and tools (sufficient stock), and appropriate legal and regulatory frameworks (property rights, contract enforcement, tax incentives, etc).
2. International Experience on Coal Imports and Mitigation of Market Risk (experience of major fuel importing countries of China and Japan).
SUMMARY: International Experience on Coal Imports and Mitigation of Market Risks

India’s coal shortage crisis has many aspects, ranging across the value chain—inefficient domestic production, evolving global industry structure and rapidly increasing demand from new and upcoming power plants. This note focuses on coal imports and looks at the experiences of China and Japan that also import a significant share of their steam coal needs. The coal import volumes are approximately equal for these two countries, but vastly different in the share of total coal demand (more than 99% in Japan, 4.3% in China).

Three broad questions are addressed:

1. **What is the institutional set-up for import of coal in these countries? Is there a single aggregator/importer or several? What has been the evolution of this set-up?**

Japan and China have both moved from aggregator-based models to disaggregated individual importer models. China was a net coal exporter as recently as 2009, but has become the biggest coal importer in 2012. China’s imports are necessitated by transportation bottlenecks between the producing regions and major load centers, often rendering imports from countries like Indonesia and Australia more economical. Its state-owned coal companies, Shenhua Group, China Coal, China Minmetals and Shanxi Coal, which together also produce more than a billion tons of coal a year, are the prime importers and exporters. However, the electricity power generation companies are now increasingly directly importing from around the world, under the “Two Markets, Two Resources” diversification strategy. Japan, which started closing domestic coal mines in the 1960s and now relies on imports for more than 99% of its coal needs, diversified types of contracts and negotiation methods from an aggregated amount of purchase led by a leading company to independent negotiation and competitive bidding as each buyer became big enough to have negotiating power. The terms of contracts also vary from 1-3 years for aiming for more flexibility, to 10-15 years for seeking more stability. Detailed experiences over the years of both these countries are available in the Annexes.

2. **How is the price variation in international coal markets passed on to domestic consumers in these countries?**

Both countries allow pass-through of price variation in international coal prices, although through different mechanisms and to different extents. China’s National Development and Reform Commission (NDRC) introduced a policy in 2004 on “Coal and Electricity Price Co-Move” which mandates pass through of coal price increases under some circumstances. When the average coal price increases by more than 5% within a period of six months, 70% of the increase is passed through to the end-users through increase in grid tariffs, while the remaining 30% is absorbed by the power producers. However, several other political economy factors affect the determination of power tariffs in each of the provinces, guided by the principles of economic growth and social stability, and implementation of the centrally-issued directives depends on local and provincial decision makers. Recently, electricity tariff increases did not match the rapid increase of coal price resulting in large deficits for power generators. However, it should be noted that China’s position as the world’s largest producer and largest importer of coal provides it unique flexibility in price arbitrage in internationally traded coal. Domestic and international coal trade co-exists, with supply choices driven by the goal of cost minimization for the individual power companies, where China could absorb 15-20% of the internationally traded coal or none.

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In the case of Japan, the variability in the cost of imported steam coal is passed on to consumers through a fuel price adjustment system. The weighted average fuel prices for coal, LNG and oil for the most recent three months are reflected in electricity tariffs two months later, subject to a maximum increase of 50%. This maximum of 50% helps prevent excessive increases in tariffs. The electricity amendment system has been rigorously applied in Japan since it was introduced in 1996 (while the fuel price pass-through in China has never been fully implemented). It is imperative that some cost pass-through is to be allowed to prevent building-up massive deficits by generators using coal, while ensuring incentives for generators for efficient procurement of coal.

3. **How have supply and price risks in the international coal market been hedged in Japan?**

In order to avoid supply and price risks in the international coal market, Japan has been diversifying steam coal import sources geographically. Therefore, if a problem occurs in a country and/or region, Japan could shift import sources to other countries/regions. Although qualities of imported steam coal from different countries vary, Japanese utility companies have been installing coal thermal generation facilities that accept different coal qualities. Japanese electric power companies also have been investing upstream in the fuel supply chain, such as in concessions for new sites of fuel development and coal transportation vessels. See Annex I for details.
Annex 1: Japan Case Study

1. Electricity Sector

As of 2010, total generation capacity in Japan was 243,870 MW, with 1,006 TWh of electricity generated (refer to Figure 1 and Figure 3). In the Japanese electricity sector, the government (the Ministry of Economy, Trade and Industry—METI) plays a regulatory role, while most power facilities (including generation facilities) are owned by ten vertically integrated private electric power companies, which have regional monopolies. Wholesale companies, including Independent Power Producers (IPPs) and a former government-owned company (privatized as J-Power in 2004), had 36,520 MW of generation capacity (15% of the total) as of 2009 (refer to Figure 2). Forty-four percent of this generation capacity (or 16,090 MW) is coal thermal. The former government-owned company pioneered power generation using imported coal to diversify fuels after the oil crisis when, as a national strategy, Japan built most of its imported coal-fired power plants.

2. Coal Thermal Power

The percentage of electricity generated by coal thermal has been constant since 2005 at approximately 25% (refer to Figure 3). The generation capacity of coal thermal power is 38,870 MW (or 16% of total generation capacity in the country) and 251 TWh of electricity (or 25% of total electricity) was generated by using coal in 2010. According to the plan in place before the nuclear crisis triggered by the North-East Japan Earthquake of March 2011, both generation capacity and electricity generated by coal were expected to be reduced by 13% and 20% respectively by 2030 (refer to Figure 1 and Figure 3).

3. Coal Supply

More than 99% of coal is imported. The total volume of imported steam coal was 129 million ton (Mt) in 2010 (refer to Figure 4). The majority of coal is imported from Australia (85.9 Mt or 66.6%), followed by Indonesia (21.5 Mt or 16.7%), Russia (10.2 Mt or 7.9%), PR China (6.3 Mt or 4.3%), Canada (2.7 Mt or 2.1%), Vietnam (1.6 Mt or 1.2%), and the US (0.4 Mt or 0.3%). Japan diversifies steam coal import sources quite well in terms of geography. The price of imported steam coal increased in 2008, but then gradually declined, from US$125.5 in 2008 to US$107.8 in 2010 for coal from Australia (refer to Figure 5). Prices rose again suddenly to US$129.85/t in the first quarter of 2011 due to the heavy rain which hit Queensland, Australia. Even after the increase, electricity generated by coal has been stable: approximately 250 TWh (or 25% of total electricity generated) after 2008 (refer to Figure 3).

Although policies to limit coal exports and meet domestic coal needs first have been implemented by some coal-producing countries including South Africa, PR China, Vietnam and Indonesia, there are many other coal-producing countries that have export capacities including Australia, the US and Canada. Australia is planning to charge taxes on exports of coal and iron ore as well as domestic production: this may result in pushing the price of coal up by US$20-25 per ton, but the taxes could be absorbed in the current high international price so as to remain competitive with coal from other exporting countries and other fuels (i.e. LNG), since the production cost is far below the price. Coal mine potential exists in developing nations including Botswana, Mongolia, Zimbabwe, and Mozambique. Investments in these countries will accelerate if the international price of coal remains high. Since the qualities of imported coal vary across different sources, Japanese importers specify acceptable qualities of steam coal (such as heat contents and percentage of water, ash, volatile matter, and fixed carbon) in contract documents and execute sample quality tests at exporting and importing ports. In addition, Japanese utility companies have been installing coal thermal generation facilities that accept wide coal qualities.
4. Coal Procurement Methods & Prices

Approximately 80% of coal used by Japanese power utilities, the former government-owned company, and IPPs is imported based on long-term purchase contracts (mostly 1 to 3 years for power utilities and 10 to 15 years for the former government-owned company). Although long-term contracts are less flexible to adjust to coal demand fluctuations, they used to be the best way power utilities had to secure fixed amounts of coal supply for their base load. Electric power companies used to determine the necessary amount of fuels according to their demand forecast and generation/supply plans over the long term. Then, according to their fuel needs (including coal), electric power companies would either establish a negotiation group to exercise bargaining power or make purchase orders through Japanese trading companies. A leading company of the group or a trading company, which power companies soon eliminated to avoid overhead charges, would aggregate the amount of coal necessary to supply electric power companies over the long term and sign contracts with foreign exporters. To secure the necessary amount of coal, some electric power companies and the former government-owned company invested in mining concession/development to reduce vulnerability to international market fluctuations. The spot price of coal is determined by market principles/mechanisms. Abnormal weather, such as torrential rainfall and huge snowfall in major coal-producing countries, including Australia, Indonesia, and China, led to coal production stagnating in 2007. The rapid increase in coal imports by India and China after 2006 resulted in a further substantial rise in the spot price (refer to Figure 6), until the global financing crisis in September 2008, when prices fell again.

From the 1980s to the mid 1990s, the price of steam coal was determined as an agreed-upon price (or a benchmark price) based on discussion between a coal exporter and a consortium (or a Japanese trading company). The FOB coal price was settled by adjusting a benchmark price based on energy contents. After the 1990s, each electric power company started holding direct and individual negotiations with coal exporters and set individual contract prices. To hedge the market risks, electric power companies also started investing upstream of the fuel supply chain, such as in fuel development concessions, and owning or having exclusive right of use of coal transportation vessels. After 1999, competitive bidding also started for annual contracts of coal procurement. Currently, imports are taking place through a mixture of 1) long-term contracts (10 – 15 years), 2) short-term contracts (1 – 3 years), and 3) annual competitive bidding.

5. Electricity Tariff Adjustment System based on Fuel Cost Variation

The cost of imported steam coal is passed on to electricity customers through a fuel price adjustment system introduced in 1996. The weighted average fuel price (including coal, LNG, and oil) for the most recent three months is reflected in the customer’s electricity tariff two months later. The amount of the monthly electricity tariff increase due to the fuel price adjustment system is limited to 50%, although there is no lower bound for tariff reductions in the system.

As a result of this price adjustment system, monthly tariff charged to customers fluctuate over time, from a low of 6,051 Yen (or US$78) to a high of 7,206 Yen (or US$92) for a standard household consuming 290 kWh monthly with a 30A contract.

Comparing by unit energy content (or US$/MMBtu), the price of imported steam coal (US$4.5/MMBtu) is still approximately one fifth of that of crude oil (US$22/MMBtu) and slightly more than a fourth of the price of Liquid Natural Gas (US$16/MMBtu); while getting more expensive, imported steam coal is still much cheaper than other fuels.

6. Government Support

The Japan Bank for International Cooperation (JBIC) provides concessional loans to coal/minerals companies in developing nations under the condition that coal (mainly coking coal) and other minerals be supplied to Japanese...
companies over the long term. For example, JBIC and Mitsui-Sumitomo Bank co-financed a US$150 million loan to the Vietnam National Coal Mineral Industries Group (VINACOMIN, 100% owned by the Vietnamese Government) in March 2010 with the condition that anthracite coal be supplied over the long term to JFE Steal and Sumitomo Materials. VINACOMIN can utilize the loan for its coking coal mine development/expansion and for transportation infrastructure, among others.

The Japanese government has been strategically supporting natural resources exporting countries to strengthen bilateral relationships and secure the necessary amount of natural resources (such as oil, coal, LNG, iron ore, copper ore, and other metals/minerals). Supply chains have been established using grant funds and concessional loans. Over the last decade, JBIC has provided a total of 5,400 billion yen (or US$65 billion) in loans to natural resources exporting countries around the world.

7. Effects of Unplanned Fuel Demand on LNG Import Price after the North-East Japan Earthquake

Japan needed to increase the volume of imported LNG volume by 12.2% (78 Mt in total) after the North-East Japan Earthquake in March 2011, to substitute LNG thermal generation for nuclear power. As this demand spike was unexpected (or unplanned) in the international market, Japanese importers ended up spending 4,777 billion yen (or approximately US$60 billion), 37.5% more compared to the previous year. In other words, Japanese importers paid approximately 23% more (on average) to purchase LNG in 2011 than in 2010. As a result, the Japanese trade balance fell into deficit in 2011 for the first time since 1980. Fortunately the international LNG market has been in supply surplus due to cancellation of US imports, as the US shale gas supply has increased rapidly and the US does not need to import LNG. As long as the price remains at the current very low levels, US gas can profitably be exported to Asian Pacific markets as LNG.

![Figure 1: Power Generation Capacity in Japan (10 Electric Power Companies + IPPs)](source: Federation of Electric Power Companies in Japan Info Base & TEPCO Illustrated 2009)
Source: Federation of Electric Power Companies in Japan Info Base & TEPCO Illustrated 2009

**Figure 2: Power Generation Capacity in Japan (IPPs Only)**

**Figure 3: Generated Electricity in Japan (10 Electric Power Companies + IPPs)**
**Figure 4: Steam Coal Imported Volume by Origin**

**Figure 5: Imported Steam Coal Price (CIF) by Origin**

**Figure 6: Long-Term Contract Price and Spot Price**
Annex 2: CHINA

1. Institutional Setup of the Electricity Sector and Thermal Coal Procurement
Coal increasingly dominates China’s electricity generation system. Coal’s share of electricity generation capacity has grown steadily, from 69% in 1980, to 78% in 2007. The absolute amount of coal-fired capacity grew at an average annual growth rate of more than 12% between 2000 and 2007, from 238 to 554 GW. In spite of this rapid growth, China’s per-capita electricity generation capacity is comparatively low (0.5 kilowatts per person in 2007). Japan’s per capita generation capacity, for example, was 1.9 kW per person in 2007.

As shown in the graph below, average on-grid electricity tariffs moved along with the rise in coal prices from 1980 to the mid 1990s. The coal market opened up at the end of 2002, and controls on coal prices were released. The market saw an exponential increase in the price of coal. Electricity tariffs, however, having remained under full government regulation, were not allowed to rise with soaring fuel costs and increased slightly above the change in CPI. The control on electricity prices brought substantial pressure to power producers, and the government made subsequent efforts to establish a linkage between coal prices and electricity tariffs.

![Graph showing price changes in coal, electricity, and general CPI for China](image)

**Figure 1: Price changes in coal, electricity and general CPI for China**

However, the “Coal and Electricity Prices’ Co-Movement”, which is a government administrative measure to relieve the pressure of rising coal prices on power generators, is a strong planning approach, and its implementation has been arbitrary and not fully predictable or transparent, as discussed below.

2. Political Economy Pressures and Varying Tariffs
China regards its economic reform as a step-by-step process that is gradual, with adequate trials and references to international experiences. Social stability and economic development are considered the prerequisites for all of the reform measures to be implemented. Even when electricity tariffs are raised within the supply chain, retail tariffs have rarely been touched, partly for fear of stoking inflationary pressures. With bulk power tariffs capped at a fixed rate by Beijing, while thermal coal prices are deregulated, many thermal power plants have been incurring huge losses especially

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21 In 2004, the National Development and Reform Commission established a policy stipulating the adjustment of electricity prices if average coal prices fluctuate more than 5% within 6 months. In practice, however, electricity prices were not allowed to rise in spite of rapidly increasing coal prices starting in 2007. To avoid exacerbating inflation and its social and economic impacts, the cap on electricity prices (retail tariffs) was implemented to control the consumer price index.
over the past two years, as the surge in steam coal prices has far outpaced the meager power price hikes allowed by the government.

3. **Historical Context of Deregulation in the Coal Sector**

With different paces of economic reform, conflicts between the power and coal industries have occurred over the course of development. In response to increasingly strong demand for coal, in 1985, coal production was separated into two parts: in-plan coal and out-of-plan coal (jihua ni and jihua wai). The prices and volumes of the former were determined by the central government, and the latter were left to the local governments and mines after fulfilling quotas set by the central government. The two-tier coal prices were applied to coal via these two production schemes. Prices for out-of-plan coal were allowed to be determined by the market, which was normally higher than the in-plan coal that was regulated by the government. This two-tier pricing policy did contribute to a rapid expansion of coal production and helped relieve the pressure on coal supply, thanks to the proliferation of many local small- and medium-sized coal mines. As coal supply became abundant, reform in the coal industry progressed, and the coal market was further deregulated in 1994.

To protect the power industry and maintain a low electricity tariff, the prices of coal sold to power plants (within-plan coal) were deliberately kept low. When coal prices fluctuated in the market and electricity prices remained unchanged, the conflicts between these two industries were inevitable. The low coal price policy for within-plan coal protected the power producers but at the expense of the coal industry. As a result, the coal industry became one of the largest loss-makers, and in 1993, it received nearly six billion RMB in subsidies.

While relative tariff levels vary by region (see graph further below) a prevailing trend is relatively low catalogue tariffs for residential, industrial, chemical, agricultural and irrigation users and higher tariffs for non-residential lighting and commercial users. Additionally, time-of-day tariffs also vary between different user classes. For example, residential and irrigation users are exempt from the time-of-day tariffs while heavy industry, chemical plants and agriculture users face significantly lower tariffs. The disparity between controlled electricity prices and more market-oriented coal prices has created cost incentives for generators to maintain low coal inventories, thereby rendering them vulnerable to supply disruptions.

4. **Varying fortunes of utilities: From Shortfalls to Windfalls**

China Electricity Council statistics show that all together, the power plants operated by the country's five major thermal power generation groups - China Huaneng Group, China Datang Corp, China Guodian Corp, China Huadian Corp and China Power Investment Corp - lost 7.46 billion yuan in the first seven months of 2011, 8.27 billion yuan more than the same period in 2010. In July 2011 alone, they lost 980 million yuan. The Council said that rising coal prices were the main reason for the losses and the situation was becoming more serious.

However, the situation is vastly different for the two state-owned power transmission and distribution companies (grid companies). State Grid, which runs power transmission and distribution networks in 26 of China's 31 provinces, aims to achieve 62 billion yuan ($9.84 billion) in gross profit in 2012, up 16 percent, according to the China Securities Journal. It plans to boost investments in China's power grids to 2.55 trillion yuan ($390.63 billion) in the coming five-year plan, up 68 percent from the preceding period. China's cash-flush state-owned grid companies are going on a buying spree abroad, scooping up bargains with virtually no political opposition as Europe looks to reduce its debts.

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22 A quarter of Portugal's power grid operator, REN, will be sold to China's State Grid Corp for 387 million Euros ($507.82 million), part of a wave of privatizations Lisbon has to carry out under the terms of its 78-billion-euro European Union/International Monetary Fund bailout loan. China's foray into the overseas power sector began in 2009 when the Philippines sold a 25-year license to a consortium led by China State Grid to run its
Hydro generation companies are not suffering either: The China Three Gorges Project Corp, operator of the world's largest hydropower project, also agreed last December to pay 2.7 billion Euros ($3.54 billion) for a 21 percent stake in the Energias de Portugal (EDP) utility and hopes to cooperate with EDP in further acquisitions and expansion in eastern Europe and South America.

5. The Politics of Regulation and Central vs. Provincial Control

China's national regulatory system is mismatched with the electricity sector's provincial character, and the national-provincial dichotomy has created frequent conflict between the central government and provincial governments, sometimes acting as an obstacle to the implementation of national policies. China's efforts to shut down small, inefficient power plants illustrate how central-provincial tensions can thwart national policy. Facing a surplus in generating capacity during the Asian financial crisis of the late 1990s, China's central government slowed power plant approvals and began requiring provincial governments to shut down small, inefficient, and highly polluting power plants. Shandong Province, however, had only recently faced electricity shortages and decided to risk disobeying Beijing. Between 2000 and 2003, Shandong built 5 GW of small, coal-fired power plants. As the Chinese economy began to pick up in 2003 and demand for electricity surged, other provinces found themselves without enough generating capacity. Shandong, however, had capacity to spare. By 2005, Shandong had become China's largest industrial province, and other provinces were sending teams to "study" the Shandong model.

The consequence of these institutional shortcomings is an electricity sector with powerful, entrenched monopolies, tension between different levels of government, a strong reliance on negotiated settlements rather than rule-based decisions, and a lack of regulatory oversight and transparency. The full cost-of-service model never took hold in China. As shown in the first of the two figures below, on average, on-grid tariffs in East and South China have been consistently higher than for poorer inland and western regions. In 2008, average on-grid electricity tariffs in East China were roughly 60% higher than those in the Northwest. Net imports shot up when domestic coal became too expensive due to transportation hurdles for transfer of coal from the North and West to the consumption centers.

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power network. At $3.95 billion, it was the Southeast Asian nation's biggest privatization deal. The State Grid, China's biggest electrical utility, has already bought seven grid operators in Brazil for $1.7 billion.
6. **Transportation Bottlenecks: Implications for the Coal Economy**

Within China’s coal-dominated energy system, domestic transportation has emerged as the largest bottleneck for coal industry growth and is likely to remain a constraint to further expansion. Transporting coal to users has overloaded the train system and dramatically increased truck use, also correspondingly raising transportation oil demand. Growing international imports have helped to offset domestic transport bottlenecks, making it the biggest importer in a short term, overtaking Japan. In the long term, import demand is likely to exceed 200 million tons by 2025, significantly impacting regional and international markets.

The NDRC said it would strengthen its supervision of coal prices and launch a special inspection campaign for major coal-producing provinces and regions. In late 2011, the NDRC and the Ministry of Railways sent a joint inspection team to review contracts related to thermal coal supplies to China’s key coal-producing regions of Shanxi, Shaanxi and Inner Mongolia. NDRC also met with managers of major coal companies, including the country’s largest coal producers China Shenhua and China Coal, and instructed them to stabilize the thermal coal market.

State-controlled contract prices for thermal coal, which is sold directly to power plants by coal producers, have remained almost unchanged since last year. Prices currently stand at 570 yuan per metric ton although supply is very limited. Prices for regular coal, however, have risen to 837 yuan per metric ton, creating great pressure for coal producers to raise the prices of thermal coal. In addition, imported coal prices also soared in 2011, adding pressure to the domestic coal market, where many analysts predict further hikes amid increasing electricity demand and decreased supplies of hydropower due to a lingering drought in the middle and lower reaches of the Yangtze River.

7. **Two Resources, Two Markets: Creating the World’s Biggest Arbitrage market**

The NDRC has urged coal producers to increase production while strengthening its inspection of coal prices. The transportation bottlenecks with attendant supply constraints have led the NDRC to rapidly deregulate and open the coal market. NDRC encourages state and private coal and power companies to adopt a “Two Resources, Two Markets” strategy of importing coal when the economics justifies that. This opening of the coal sector for all players has led to an improvement in coal supply through the market. Entire mine complexes in exporters like Australia are being created for

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23 The Institute of China Coal Economy of the Central University of Finance and Economy has estimated that coal traders buy one ton of coal for about 400 yuan ($62) in coal mines in Erdos, the Inner Mongolia autonomous region, which is a major coal producer in China, and the unit price increases to as much as 900 yuan to 1,000 yuan when the coal is sold to power plants in Shanghai. China needs to resolve coal transportation obstacles to help deliver coal from the north to the south and the west to the east. Otherwise, the high logistical costs will never be eased, based on research conducted by the Institute.

the Chinese market, on long term contract basis, for individual power companies. With large import capacities at its ports and domestic production of more than a billion tons, China can now play the role of the world’s biggest coal arbitrager. It can buy 15-20% of the globally traded coal or none of it, providing it immense market power and thereby controlling the global coal price, which would also affect other major importers like India.

8. The Proposed Way Forward
A government report issued in early March 2012 stated that China would work on a pricing reform for power, whereby it would implement tiered electricity tariffs for residential users to "better reflect" the price of coal. The main agency involved in policy making for the energy sector, the National Development and Reform Commission (NDRC) also released a draft plan for a graduated tariff mechanism on residential-use power to curb “irrational consumption”. The mechanism was announced last year and is being tried out in several selected provinces. The mechanism will for the first time divide residential power tariffs into three levels: those for basic needs, for normal and reasonable demand, and for high living quality needs. The NDRC also said qualified low-income families may get 10-15 kWh free electricity every month, which is equivalent to an annual fee rebate of 60-90 yuan per household.
Bibliography

- Edward Lehman, 2009, *Electricity Regulation in 34 Jurisdictions* (Lehman, Lee and Xu)
- Aden, Fridley, Zheng: *China’s Coal—Demand, Constraints and Externalities*, July 2009, Lawrence Berkeley National Laboratory
- Moritz Paulus and Johannes Truby: *How do Chinese Bulk Energy Transport Decisions affect the Global Steam Coal Market?* Institute of Energy Economics, University of Cologne, Germany
- Paulus, Truby, Growitsch, *Nations as Strategic Players in Global Commodity Markets—Evidence from World Coal Trade*, Institute of Energy Economics at the University of Cologne, June 2011