Energy Policies in India

Presentation at New Delhi - LAMP

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Current Energy Use

Primary energy consumption in KToE

- **Industry**: 101068, 50%
- **Transport**: 62368, 31%
- **Other (Resi, comm, agri, others)**: 37396, 19%

Source: MOSPI, 2019
Sector-wise Energy Consumption

Sector-wise Energy Consumption (KToe)

- Industry: 97,880.11, 18%
- Transport: 307,493.33, 58%
- Residential: 18,435.77, 3%
- Commercial and public services: 52,296.54, 10%
- Agricultural and forestry: 50,329.94, 9%
- Non-specified (other): 8,358.09, 2%
- Non-specified (other): 52,296.54, 10%

Source: MOSPI, 2019
Primary energy supply source

Total primary energy supply (KToe)

- Coal: 526,864.64 KToe
- Crude Oil: 261,750.99 KToe
- Oil Products: 54,388.32 KToe
- Natural Gas: 9,993.20 KToe
- Nuclear: 10,859.31 KToe
- Hydro: 8,969.80 KToe
- Solar, Wind, Others: 100,000.00 KToe
- Electricity: 200,000.00 KToe
- Total: 600,000.00 KToe

Source: MOSPI, 2019
**Trends in Electricity Consumption (GWh)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Consumption (GWh)</th>
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<td>2008-09</td>
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<td>2009-10</td>
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<td>2010-11</td>
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**Growth rate of 2017-18 over 2016-17(%)**: 6.51%

**CAGR 2008-09 to 2017-18(%)**: 7.39%

Total consumption in 2017-18 = 11,30,244 GWh

Source: MOSPI, 2019
INSTALLED GENERATING CAPACITY
STATEWISE/MODEWISE
Including allocated shares in Joint and Central Sector
(As on 31.03.2018, Figures in MW)

[Map not be scale]

All India Capacity: 3,440.0239 MW

[Map showing various states with installed generation capacity values in MW]
Source-wise Installed Capacity of Grid Interactive RE as of 2018 (MW)

- Wind Power: 34,986.35 MW
- Solar Power: 24,312.60 MW
- Total: 73,351.81 MW
Renewable Energy Targets

- As per the Paris Accord on Climate Change, India made a pledge that by 2030, 40% of installed power generation capacity shall be based on clean sources,
- It was determined that 175 GW of renewable energy capacity will be installed by 2022.
- A total of 82,588 MW is the installed capacity sourced through renewables as of Sept 2019.
Structure of the Energy Sector

- Federal state structure- Joint responsibility of central and state governments.
- Departments playing a key role in the power sector:

<table>
<thead>
<tr>
<th>Key Departments</th>
<th>Roles and Responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ministry of Power (MoP)</td>
<td>Responsible for planning, policy formulation, administration and enactment of legislations for thermal and hydropower generation, transmission and distribution.</td>
</tr>
<tr>
<td>Central Electricity Authority (CEA)</td>
<td>Advising the government on matters including the national electricity policy and any technical matters relating to generation, transmission and distribution of electricity; Specifying grid standards for O&amp;M of transmission lines</td>
</tr>
<tr>
<td>Central Electricity Regulatory Commission (CERC)</td>
<td>Two main regulatory bodies that govern the power sector. Formed for the protection and promotion of consumer interest, fair competition, transparency, between players, through tariff fixation, etc keeping in view the interest of both the supplier and the beneficiary.</td>
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<tr>
<td>State Electricity Regulatory Commission (SERC)</td>
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</tr>
<tr>
<td>Ministry of Petroleum and Natural Gas</td>
<td>To formulate conducive policies and provide effective regulatory framework for the growth of hydrocarbon sector; promote fuel conservation, clean &amp; green fuels and development of alternative energy sources</td>
</tr>
</tbody>
</table>
Key Stakeholders

Regulators
- Central Electricity Regulatory Commission (CERC)
  Regulates tariffs of central generating stations & interstate generation, transmission, and supply
- State Electricity Regulatory Commission (SERC)
  Determines bulk and retail tariffs charged to consumers & regulates operations of intrastate transmission

State Power Ministry

Ministry of New and Renewable Energy (MNRE)

Various technology specific institutions (e.g. SECI)

Ministry of Power (MoP)

MoP sets energy and electrification policies

Transmission utility ↔ DISCOMs (distributors) ↔ On-grid power generators

Consumers

Various state and rural banks

Financiers invest in / subsidize projects across the market

Public financial institutions – IREDA and REC

Investors

Donors

Electricity
Payment

Source: Dalberg, 2017:23
Key Stakeholders

Source: Anantaram, 2010
Electricity Act 2003

- Objective: to introduce competition, protect consumer’s interests and provide power for all.
- Provides for National Electricity Policy, Rural Electrification
- Consolidated the laws relating to the generation, transmission, distribution, trade and use of electricity.
- Key implications:
  - Open access in transmission
  - Phased open access in distribution
  - Mandatory SERCs
  - License free generation and distribution
  - Regional/national electricity market
  - Independent system operator
  - Performance based regulation
  - Power trading
  - Mandatory metering and stringent penalties for theft of electricity
Generation:
- Electricity Act (2003) increased private participation by de-licensing generation.
- Liberalised captive power generation. Captive units could thus sell their surplus power to customers of their choice.
- Resulted in competition among generators

Transmission:
- Generators have open access to transmission and distribution lines
- Therefore, choice to choose customer/ efficient transfer of power
- Power Grid, a central transmission utility, could provide open access at the national level, while state transmission utilities could do the same in states.

Distribution:
- Permitting more than one distribution license in the same area to increase competition among licensees, thus reducing losses
- Distribution franchisees introduced under the 2003 Act, under which a distribution licensee could distribute electricity through another player within the distribution area
- Stringent penalties for power theft
- Transparent subsidy management
Key changes

• National Tariff Policy (2006) –
  • Ensure electricity to consumers at competitive rates, promote transparency and competition in the sector, and ensure financial viability of the electricity sector
  • Renewable Purchase Obligations (RPO)- distribution companies, captive power plants and other large electricity consumers are bound to meet RPOs by purchasing a certain percentage of their requirements from renewable energy sources.

• National Electricity Policy
  • Demand Side Management- utilities are looking for accelerated deployment of end use energy efficiency in the different consumer segments and its effective utilisation
Ownership

• Power sector offers a wide scope for private investment by a change of ownership of existing assets or green field investment in generation, transmission or distribution assets.

• The private power policy formulated in 1991 allowed private and foreign investment in the generation and distribution of electricity.

• Private investors were offered a 16 % return on equity, which was further incentivised in the case of higher efficiency levels in terms of Plant Load Factor (PLF).

• Boosting competition among players.
State-wise ARR Overview

ARR (INR Millions)

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<th>State</th>
<th>Utilities</th>
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<td>Maharashtra</td>
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<td>Maharashtra State</td>
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<tr>
<td>Electricity Distribution</td>
<td>AEQUS SEZ</td>
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<td>Company Limited</td>
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Source: Latest open access (cross-subsidy) surcharge order published on the websites of various state distribution utilities.

Note: kWh = kilowatt-hour; Rs = Indian rupees.
Utilities debt

- The utilities have piled up more than 4 trillion rupees ($58 billion) of debt as they were forced to sell electricity at subsidized rates to farmers and poor households.
- They depend on commercial users for revenue to maintain financial health.
- Under such circumstances, retailers may cut purchases, leaving power plants running below capacity.
Aggregate Losses (Subsidy Received Basis) – All Utilities

The losses on subsidy received basis on an aggregate basis for all utilities increased from Rs. 45,382 Crs. in 2009-10 to Rs. 53,986 Crs. in 2010-11 and to Rs. 67,006 Crs. in 2011-12.
Real-time data tracking portals by govt

- DEEP Portal by MOP
- UDAY Dashboard
- Saubhagya Dashboard
Market reforms - trends
Development of Market Reforms

- Reforming India’s Energy Market: Towards Centralised Production
- Re-Designing Real Time Electricity Market in India and its draft amendments.
- Re-Designing Ancillary Services Mechanism in India
- Market Based Economic Dispatch of Electricity: Re-designing of Day-Ahead Market (DAM) in India
- Pilot on Security Constrained Economic Dispatch (SECD) of Inter-State Generating Stations (ISGS) Pan India and it’s extension.
Present Market Design

- India follows a decentralized, multilateral and coordinated model for scheduling and dispatch of electricity.
- Around 90% of a Discom’s power procurement portfolio consists of long-term physical contracts from which they self-schedule on a day-ahead horizon.
- Power exchanges only contribute to around 4% of the total electricity transactions.
- Imbalances in real-time are managed through ‘right to recall’, Deviation Settlement Mechanism (DSM), Ancillary Services (AS) and intra-day transactions either bilaterally or through PXs.

Source: Based on the data from the MMC Report of CERC (2016-17)
Key Issues (1/2)

- Self-scheduling by Discoms in silos leads to sub-optimal utilization of low-cost generation capacities.
- There is no platform or framework to allow Discom’s to identify cheaper generation outside their own portfolio.
- Since the variable cost of the self-scheduled generation is unknown, the true system marginal cost remains undiscovered.
- Lack of flexibility arises due to smaller balancing areas. This affects a Discom’s ability to meet diurnal / seasonal demand and adjust to the variations in the net load.

Source: CERC Analysis
Key Issues (2/2)

- ‘Right to recall’ disregards the schedule and takes away the opportunity from the generators to participate in the intra-day markets for their URS.
- Furthermore, although DSM and AS are not designed to manage real-time imbalances, they are heavily relied upon for such services.
- Absence of ‘gate closure’ also creates a hurdle in optimizing system operations during real-time.
- Lastly, AS are not comprehensively defined in terms quantum and duration of reserves, flexibility attributes etc. Therefore, this makes it difficult for the system operator to utilize these services efficiently and several issues from above further add to it.
Proposed Market Reforms (1/4)

Market Based Economic Dispatch

- A day-ahead market whose objective is to - “meet system load by dispatching least-cost generation mix while ensuring that security of the grid is maintained”.

1. **Scheduling and Dispatch (System Operations)**
   1. Buyers and Sellers would submit bids/offers to the market which will be optimized to schedule and dispatch resources accordingly at a market clearing price (MCP)
   2. Low-cost resources will be utilized efficiently and the true system marginal cost will be discovered.

2. **Settlement of Contracts (Market Operations)**
   1. All buyers and sellers will make/receive payments at the MCP for the generation scheduled.
   2. In case of existing contracts being dispatched by the market, the stakeholders of the contract will settle separately through *Bilateral Contract Settlement (BCS)*.
   3. BCS will ensure that both parties are hedged against the volatility of the market clearing price and the terms of their existing contract is honored.
   4. This would effectively separate the physical and financial aspect of the contract and allow the system operations to be optimized without any contractual constraints.
Proposed Market Reforms (2/4)

Market Based Economic Dispatch

Consider a discom and a generator with a Contracted Price (VC) of Rs. 3 / kWh

If the Market Clearing Price (MCP) is Rs 4 / kWh,
- discom pays to pool/Market Operator (MO) Rs 4 / kWh
- Generator receives Rs 4/kWh from pool/MO
- Generator refunds discom 1 Re/kWh.

Discoms would be hedged against any increase in the market clearing price through BCS

For demand which is met out side of existing contracts, discoms would pay MCP.

Source: CERC Staff Analysis
Proposed Market Reforms (3/4)

Real-Time Market

- A pool-based auction for an intra-day market on hourly basis.
- Gate closure to take place 60mins before the delivery period.
- Settlement to take place at an uniform clearing price for the incremental / decremental energy generated or consumed.
Proposed Market Reforms (4/4)

Ancillary Services Mechanism

- AS to be procured through competitive market based approach from all power plants (currently proposed for tertiary services)
- Bids for AS will be co-optimized with day-ahead and real-time markets based on the demand for reserves put forth by the concerned load dispatch center.

Market linked Deviation Settlement Mechanism (DSM)

- DSM mechanism to be linked with the daily average ACP discovered in the exchange.
- Currently, the charges are capped at Rs. 8/kWh but can be revised later on.
- This makes DSM a more punitive mechanism which punishes buyers and sellers from leaning onto the grid for power
- Prices can be further linked to 15-min market prices in the future.
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