Power Sector—Analyzing The Transmission Pricing Policy by CERC And Its Impact on Competition

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Abstract:

Growth of Electricity sector of a country is very important for country’s development. Transmission services begin an intermediary product plays a very vital role in the sector.

Transmission is internationally considered a natural monopoly. It is to the credit of the Indian Policy planners that we have a central agency of planning of the grid which has led to regional grids and synchronization of all regional grids except southern grid. Such an integrated grid system doesn’t exist even in the USA. In 2009 CERC (The regulatory commission proposed the new pricing mechanism that is a hybrid method based point of connection (POC) mechanism. The transmission capacity is allocated on a non discriminate basis depending on amount of power flows and point of injection/drawl. Any new generation coming up has to first plan for evacuation of power to the grid and delivery of power through the transmission network to its consumers and need to coordinate with Central Transmission utility (Power grid). However, in the present scenario, no discrimination is there.
As far as setting up of transmission system, till recently it was the domain of power grid. However, now the sector has been opened to private participation wherein, private players can bid for construction of transmission projects. The paper analysis if impact of the new mechanism on competition and any anticompetitive issue that may arise near future.
INTRODUCTION

Electricity plays a vital role in achieving economic, social and environmental objectives of sustainable human development. Development of different sectors of economy is not possible without matching development of the electricity sector. In fact it has become essential ingredient for improving the quality of life and its absence is usually associated with poverty and poor quality of life.

The problem that India faces is that it is not an oil rich country and a major portion of the hydel power potential lies in earthquake prone areas. Also India is dependent on coal as its primary source of power and it will continue to be so, unless there are innovations in technology. The major concern about coal being the primary source of power is that it is extremely polluting during consumption as well as during extraction. Also coal reserves are not uniformly distributed across the country and are concentrated in certain regions. The shortfall in domestic production is met by imported coal which is very expensive. There is a strong demand for electricity in India and it is steadily growing with the country’s economic growth and rising consumerism. The Indian electricity market today offers one of the highest growth potential for private players.

The Indian Power Industry before independence was controlled firmly by the British. Then legal and policy framework was conducive to private ownership, with not much regulation with regard to operational safety. In line with the Industrial Policy Resolution of 1948, the government played a
dominant role in initiating and regulating development in key sectors of the economy which inter alia included the Indian Electricity Sector. It was embodied in the constitution, the principle that both the Central Government and the States should be able to legislate on power. Shortly after this, legislative authority was more formally divided in the Electricity Supply Act of 1948. The Act provided for the establishment of the Central Electricity Authority (CEA) and of State Electricity Boards (SEBs) which were to become the main agencies for supplying power throughout India. The SEBs were autonomous bodies responsible for the development and operation of generation, transmission and distribution in the “most economical and efficient way”. According to the CEA was to develop national plans and help formulate national power policy, to report the progress of the electricity supply industry, to provide technical assistance, to advise Central Government/State Government/Boards/generating company, act as arbitrator between State or Board or licensees, to train personnel in the sector, to promote research and, in general, to facilitate efficient power supply. Its role, however, was essentially advisory rather than executive. The Industrial Policy Resolution of 1956 reserved the generation and distribution of electricity almost exclusively for the states, letting, existing private licensees, however, to continue. This led to the gradual domination of the electricity sector by government enterprises. Amendment in 1976 enabled generation companies to be set up by the central and state governments resulting in the establishment of National Thermal Power Corporation Ltd. (NTPC Ltd.), National Hydro Power Corporation Ltd. (NHPC), North Eastern Electric Power Corporation Ltd. (NEEPCO), Mysore (now Karnataka) Power Corporation and Water & Power Consultancy Services (a consulting firm), etc. The development of the sector took place essentially through various public sector utilities – some under the central government and the
majority under the state governments – between them they accounted for more than 95% ownership.

Until the 1980s, electricity services in most developing countries of the world, as also in many developed countries of Europe, were delivered by state-owned monopolies. It was considered that monopolies were best suited to deliver electricity services, as they enjoyed economies of scale and scope. In India also reflecting the same sentiment, until 1991, the sector in the states was managed by one large, vertically integrated entity that generated, transmitted and distributed power, under the respective State Ministries of Power.

However, in many instances, the absence of competition led to poor quality of services, sub optimal utilization of resources, and little consideration for consumer interests. The inability of state-owned enterprises to deliver services in an efficient and cost-effective manner led to reassessment of the policies relating to the provision of services, and there was a growing perception that corporatization of the sectors could improve efficiencies, quality of service and improve the bottom-line. Taking cue from UK and the USA and developing countries like Argentina, Chile, Brazil, Philippines and Pakistan, the Indian government also commenced the restructuring of the Indian power sector which commenced with the unbundling, corporatization and privatization of Orissa power utility. The Indian power sector has witnessed significant changes since early 1990s. Beginning with allowing private investment in power generation in 1991, initiating regulatory reforms through Electricity Regulatory Commissions Act, 1998, the Indian government has enacted the Electricity Act, 2003 which seeks a paradigm shift.
STRUCTURE OF THE ELECTRICITY SUPPLY INDUSTRY

The Electricity Supply Industry comprises mainly of:

- Generation
- Transmission
- Distribution

The chart below can give an idea of the Industry:
POWER SECTOR REFORMS

The first reform phase began in 1991 with the introduction of Independent Power Producers (IPP) paradigm. Government initiated reform process due to the following reasons: (i) the ever-widening gap between the demand and availability of electricity, (ii) the poor technical and financial performance of the State Electricity Boards and (iii) inability of the Central and State Governments to finance and mobilize resources for generation capacity expansion projects, making third party investment in power sector imperative. The initial step in this direction has been the amendment of legislation governing the electricity sector in 1991. The Indian Electricity Act, 1910 and the Electricity (Supply) Act, 1948 were amended to attract private investment in power generation. The first policy statement of October 1991, titled the Government of India Resolution – Policy on Private Participation in Power Sector, through various initiatives like it allowed the private sector to “set up thermal projects, hydroelectric projects, and wind/solar energy projects of any size”. Generators were invited to submit unsolicited proposals to SEBs for the purpose, it allowed the private sector to “supply and distribute energy in a specified area, foreign ownership up to 100% was allowed, etc.

This facilitated the tapping of domestic and foreign capital markets, provided assured returns on investment and reduced legal hassles to allow the private investors to set-up generation capacities or operate as licensee in distribution segments, which were hitherto a monopoly of the SEBs. Private power initiative in generation banked on long-term power purchase agreements. However, the distribution was not privatized.
Having experienced success in restructuring the electricity industry in the Latin American countries, World Bank put forth power sector reforms as a necessary condition for future assistance to power sector in the recipient countries (Rajan, 2000). Therefore, at the urging of the World Bank, Orissa was the first state to enact, in 1996, comprehensive power sector reform act involving (1) an independent regulatory commission, (2) unbundling of the State Electricity Board (SEB) into separate generation, transmission and distribution entities, and (3) eventual privatization, particularly of distribution. The ‘Orissa Model’ was based on functional unbundling and corporatization of the SEB into generation, transmission and distribution companies. Subsequently the companies were privatized. The Orissa Electricity Regulatory Commission (OERC) was set-up under the Orissa Electricity Reforms Act 1995. Subsequently, Haryana and Andhra Pradesh followed suit but did not privatize the distribution companies. The main functions of State Electricity Regulatory Commission (SERC) include licensing for undertaking business in its jurisdiction and the setting of tariffs for Transmission and Distribution (T&D) businesses.

In 1995, these measures were further strengthened by a Mega Power Policy, whereby plants above 1000MW capacity would receive additional incentives in the form of a 10-year tax holiday anytime during the first fifteen years, exemption of customs duty for imports, reduced hassles for clearances, etc. This also provided for the setting up of Power Trading Corporation (PTC) to act as an intermediary between the private developers of mega projects and the SEBs. Though independent power producers (IPPs) evinced interest for adding generation capacity for about 95,000MW, only 6500MW was added during the eighth and ninth five-year plans (1992–2002) (WEC Report, 2002).
Further, out of a targeted capacity addition of 17,588 MW from the private sector during the ninth Five-year plan (1997–2002), a mere 5061 MW only materialized (GOI, 2002).

Central Electricity Regulatory Commission (CERC) was formed on 26 April 1999 and State Electricity Regulatory Commissions (SERCs) have been set up in twenty-five (25) States. Most of the States have initiated reform process and some have made substantial progress in restructuring of the power sector. The main functions of CERC include regulating tariffs of generating companies, owned or controlled by the Government of India and any other generating company catering to more than one state, and also tariffs for the inter-state transmission of electricity. Apart from this, significant steps taken by CERC include introduction of Availability Based Tariff (ABT), and Guidelines for transmission licensing, open access Regulations, Trading Regulations and fixing of trading margins, etc. ABT has been instrumental in bringing discipline to the grid by providing frequency linked incentives and disincentives. In the ABT, a two-part tariff is supplemented with a charge for Unscheduled Interchange (UI) for the supply and consumption of energy in variation from the pre-committed daily schedule and depending on grid frequency at that point of time. The regulatory changes have brought transparency to the tariff-making process. They have also led to the rationalization of distribution tariffs, thereby arresting increases of cross-subsidy in the system. Public hearings have been able to give voice to consumers in raising their concerns and contribute constructively to the regulatory process. In order to address the consumer complaints, SERCs have come up with a complaint-handling system.
THE ELECTRICITY ACT, 2003

Recognizing the need for the Reform process covering the entire facets of the electricity sector comprising generation, transmission and distribution to the consumers, a comprehensive Electricity Bill was drafted in 2000 following a wide consultative process. After a number of amendments, the bill finally sailed through the legislative process and was enacted on 10 June, 2003. It replaces the three existing legislations governing the power sector, namely Indian Electricity Act, 1910, the Electricity (Supply) Act, 1948 and the Electricity Regulatory Commissions Act, 1998. The Electricity Act, 2003 mandates that Regulatory Commissions shall regulate tariff and issue of licenses and that State Electricity Boards (SEBs) will no longer exist in the existing form and will be restructured into separate generation, transmission and distribution entities. Regulatory function has been taken away from the purview of the government. The Electricity Act, 2003 mandates licensee-free thermal generation, non-discriminatory open access of the transmission system and gradual implementation of open access in the distribution system which will pave way for creation of power market in India. The main provisions of the act are:

- De-licensing of thermal generation and captive generation (to generate electricity primarily for his own use and includes any co-operative society or association of persons for generating electricity primarily for use of members of such cooperative society or association),
- Open access in distribution to be introduced in phases,
- Provision for license-free generation and distribution in rural areas and provision for management of rural distribution by Panchayats, Cooperative Societies, non-government organizations, franchisees, etc,
• Non-discriminatory open access in transmission,
• Multiple licensing in distribution,
• Mandatory metering of all electricity supplies,
• Adoption of multi-year tariff principles,
• Provision for cross-subsidy surcharge on direct sale to consumers,
• Power Trading recognized as a distinct activity with ceilings on trading margins to be fixed by the Regulatory Commissions,
• Upfront payment of subsidies by the States and,
• Setting up of an Appellate Tribunal to hear appeals against the decisions of the CERC and the SERCs.

The Act is aimed at providing an investor friendly environment for potential developers in the power sector by removing administrative hurdles in the development of power projects and shall provide impetus to distribution reform to be undertaken in India. Provisions like de-licensing of thermal generation, open access and multiple licensing; no surcharge for captive generation shall be the basis for a competitive environment in the Indian power sector. Provisions of open access would be instrumental in the development of competitive power markets, and multiyear tariffs shall bring in necessary incentives for performance improvement and to reduce regulatory risk.
Introduction of competition is the main feature of the new legislation - non-discriminatory open access in transmission has introduced competition amongst the generators at the outset. This entails that the generators can choose any distributors and distributors their suppliers with the transmission wires providers obliged to give non-discriminatory open access for transmission of electricity from generator to supplier on payment of transmission charges which would lead to the emergence of the Multi Buyer Model (MBM) markets in the near future.

Competition on the distribution end had also been introduced by providing for open access in distribution and by allowing more than one licensee in the same area of the supply. Open access in distribution shall pave way for the consumer to have choice of supplier. The concept of have more than one licensee in same area shall also give the consumers choice to choose their supplier.

The following section will give an overview of the transmission sector in India:

**TRANSMISSION**

**Introduction**

Transmission of electricity is defined as the bulk transfer of power at high voltage (132KV and above) over long distances. Transfer of power from the generating station to the industrial, commercial or residential consumers is an important part of power generation. Typically power is transmitted from the power station to a substation in the vicinity of a populated area. A power transmission system is often referred to as a grid and consists of a fully connected network of transmission lines which act as transport arteries for power.
The grid consists of two types of infrastructures: high voltage transmission system for transporting power over long distances and the lower voltage distribution systems. High voltage minimizes electrical loses when power is transmitted over long distances but it is impractical over short distances. An efficient system for transmission of power over long distances is needed due the uneven distribution of exploitable energy resources across the country. This is seen by the abundance of coal in Bihar, Jharkhand, Orissa and West Bengal and the concentration of hydroelectric resources in Northern and North-eastern India. The result is that some regions do not have adequate resources for setting up power plants to meet their current and future requirements of power. The regional power grids are established to solve the problem of uneven distribution of power stations by having intra regional and inter regional power exchanges depending on the available supply and the load conditions. The surplus power is transferred to the deficit regions through the grid. The country has been divided into five regions for transmission systems, namely Northern Region, North Eastern Region, Eastern Region, Southern Region and Western Region. The regional grids interconnect transmission systems within each region. The formation of the national power grid is thus a step towards optimizing utilization of natural resources spread across the country and ensuring adequate power supply across all regions of the country.

Electric power is usually transmitted over long distances through over head transmission lines and underground lines are used in densely populated areas. Redundant paths and lines are provided so that power can be routed from any power plant to any load center through a variety of routes depending on the economics of transmission and the cost of power.
The predominant technology for electricity transmission has been alternating current (AC) technology. Besides AC, High Voltage Direct Current (HVDC) technology has also been used for interconnecting the regional grids across the country and for bulk transmission of power over long distances.

Historically the focus had always been on power generation and transmission and distribution had mostly been neglected. The Electricity Act, 2003 acted as a catalyst for the development of the transmission sector. Another driving factor for the rapid development of this sector was to achieve the transmission objectives of the 11\textsuperscript{th} five year plan and the ambitious plan of ‘Power for all’ by 2012, aiming at 200,000MW of power generation, which required for the rapid improvements in transmission capability. From the perspective of power generation projects, it is critical for project specific transmission projects to be set up before the commissioning of the plant to enable timely evacuation of power.

**THE STRUCTURE OF POWER TRANSMISSION IN INDIA**

India has two types of transmission companies - central transmission utility (CTU) and state transmission utilities (STU). The CTU is responsible for transmission between states and between regions and The STUs are responsible for transmission within states. The Power Grid Corporation of India is the central transmission utility and it own and operates 80\% of interstate transmission networks and accounts for 95\% of transformation capacity at the state level.
Power transmission even today is largely dominated by the government owned units, with very little participation from the private sector. It is essential to have greater participation from the private sector to achieve investment targets and overcome implementation challenges. The Electricity Act 2003 provided for greater participation of the private sector to increase network efficiency and it had provision for non-discriminatory open access to transmission and distribution systems. The Union power ministry and the Regulatory Commissions have made several efforts to improve private sector participation (PSP). These include issuance of guidelines for encouraging PSP (Private Sector participation) in the transmission sector; development of the national grid and large capacity dedicated transmission corridors; notification of competitive bidding guidelines and standard bidding documents for selection of private developers through tariff based bidding; streamlining of processes and bringing clarity to issues related to transmission; grant of connectivity regulations; open access regulations and new transmission pricing framework to alleviate the accumulation of zone access charges which is also called pan caking. As a result of these initiatives the transmission sector is now faring well on the PSP front with seven Central Sector and four state sector projects amounting to around INR 10,000\(^1\) crore awarded in the last three years. This framework has enabled increased private sector investment in this sector and it has also led to efficiency gains as, in most cases the prices offered by the private sector players were considerably lower than the estimated State utility price. With the recent notification of Ministry of Power regarding mandatory procurement of transmission services through competitive bidding, more projects are expected to be awarded through the PSP route.
**THE GROWTH OF POWER TRANSMISSION IN INDIA**

The transmission system in India was developed according to the growth in power generation capacity. The 220KV of transmission power was introduced in 1960 and another 400 KV was introduced in 1977. HVDC and HVDC bi-pole transmission was set in 1989 and 1990 respectively. The transmission line expanded from 52,034 ckm in the 6th five year plan to 221,549 ckm in the 11th five year plan (as on January 2010)\(^2\). The substation size increased from 46,621 MVA in the 5th five year plan to 303,637 MVA in the 11th five year plan \(^3\). The current inter regional transmission capacity is 22400 MW and the target that has been set for the 11th five year plan is 37700MW \(^3\). Around 20,700 MW \(^2\) of new inter-regional links have been planned for the 11th five year plan. The possibilities of linking India’s transmission system with neighboring countries like Bhutan, Nepal and Sri Lanka is also being explored. There are also plans to develop an undersea HVDC transmission link between Sri Lanka and India. Around INR 550 billion \(^3\) of investment is planned at the inter-state and intra-state levels to increase the inter region transfer capacity in the 11th five year plan.\(^1\)

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\(^1\) Power transmission, India's Energy Sector, 1200 kV power transmission line will set a benchmark for efficient power transfer Monday, December 13, 2010

\(^2\) Power Sector 2010, KPMG Report

\(^3\) Indian Power Sector
THE FOLLOWING TABLES GIVES THE EXISTING INTER-REGIONAL POWER TRANSFER CAPACITY (MW)
(TILL NOV '2010')

<table>
<thead>
<tr>
<th>Transmission capacity in MW</th>
</tr>
</thead>
<tbody>
<tr>
<td>EAST-NORTH</td>
</tr>
<tr>
<td>WEST-NORTH</td>
</tr>
<tr>
<td>EAST-WEST</td>
</tr>
<tr>
<td>EAST-SOUTH</td>
</tr>
<tr>
<td>WEST-SOUTH</td>
</tr>
<tr>
<td>EAST-NORTH EAST</td>
</tr>
<tr>
<td>Various 132KV inter-regional links</td>
</tr>
<tr>
<td>CUMULATIVE</td>
</tr>
</tbody>
</table>

(Source Ministry of Power)
THE FOLLOWING TABLE GIVES A PICTURE OF REGION-WISE AND VOLTAGE-WISE TRANSMISSION LINE AND CAPACITY (AS OF 30.9.2009)

<table>
<thead>
<tr>
<th>Voltage Level</th>
<th>NR-I</th>
<th>NR-II</th>
<th>ER-I</th>
<th>ER-II</th>
<th>WR-I</th>
<th>WR-II</th>
<th>SR-I</th>
<th>SR-II</th>
<th>NER</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>765 kV AC</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>703</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>703</td>
</tr>
<tr>
<td>765 kV (AC charged at 400 kV)</td>
<td>369</td>
<td>563</td>
<td>0</td>
<td>0</td>
<td>972</td>
<td>492</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2396</td>
</tr>
<tr>
<td>500 kV HVDC</td>
<td>1630</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2738</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4368</td>
</tr>
<tr>
<td>400 kV AC</td>
<td>11608</td>
<td>4203</td>
<td>4861</td>
<td>4695</td>
<td>5862</td>
<td>9539</td>
<td>7226</td>
<td>5851</td>
<td>1869</td>
<td>55713</td>
</tr>
<tr>
<td>220 kV AC</td>
<td>3000</td>
<td>1388</td>
<td>450</td>
<td>1080</td>
<td>205</td>
<td>939</td>
<td>0</td>
<td>366</td>
<td>551</td>
<td>7978</td>
</tr>
<tr>
<td>132 kV AC</td>
<td>58</td>
<td>110</td>
<td>95</td>
<td>327</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1765</td>
</tr>
<tr>
<td>66 kV AC</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>37</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>37</td>
</tr>
<tr>
<td>Total Kms.</td>
<td>16665</td>
<td>6263</td>
<td>5406</td>
<td>6138</td>
<td>7038</td>
<td>10970</td>
<td>9964</td>
<td>6217</td>
<td>4185</td>
<td>72845</td>
</tr>
</tbody>
</table>

(Source Ministry of Power)
THE FOLLOWING MAP GIVE A PICTURE OF EXISTING, APPROVED AND PLANNED TRANSMISSION NETWORK OF INDIA (400KV AND ABOVE UP TO 2011-2012)

(S(Source Ministry of Power)
Technology Trends in the Transmission Sector

The predominant technology for electricity transmission has been alternating current (AC) technology. Besides AC, High Voltage Direct Current (HVDC) technology has also been used for interconnecting the regional grids across the country and for bulk transmission of power over long distances. But there is an emerging shift towards Ultra High Voltage systems. The exiting 400KV lines can transfer up to 600MW of power, 800 KV lines will be capable of transferring 1200-2400MW of power whereas a 1200KV line will be capable of transferring 6000-8000 MW of power. With peak demand of power expected to rise by 500,000MW by 2027\(^3\), an additional 700,000MW of power generation capacity will be required. The challenge will be therefore to evacuate, transmit and distribute this power efficiently. Hence it is not surprising to see the shift towards Ultra high voltage systems. Work on India's first 800KV HVDC transmission line between Biswanath Chariyali-Agra and work has started on the 1200KV test station at Bina in Madhya Pradesh which is a joint venture between the Power Grid Corporation and 35 manufacturers to develop this technology indigenously. There is also a move towards setting up of smart grids which will help utilities detect, isolate and correct problems. An example for this is set by the Power Grid Corporation of India which has sensors on its transmission networks which gives readings every 15 minutes on key transmission parameters which is used to monitor systems and take corrective measures.
CHALLENGES FACING TRANSMISSION OF POWER IN INDIA

There are several challenges that face transmission of power in India. The first bottleneck is that the acquiring right of way (ROW) for constructing transmission lines is getting increasingly difficult with introduction of stringent environmental laws, especially in eco sensitive regions like the north-east, Chicken neck area, hilly areas in Jammu & Kashmir, Himachal Pradesh and the western ghats. This is a cause major concern as these regions have the major share of India’s hydro electric power generation potential. It is also becoming increasingly difficult and expensive to get people to part with the large tracts of land required to build the transmission lines. The second is regarding transmission and distribution loss which is around 28% and is amongst the highest in the world. The transmission losses are due to the energy dissipated in conductors and equipment used in transmission, transformation and sub-transmission. This problem can be solved by setting up smarts grids and setting up transmission super highways, which use ultra high voltage (800KV & 1200KV) to minimize transmission losses. The third is that with a planned investment of over INR 140,000 crore until 2017 in the sector, sooner or later project developers will face challenges in funding their projects due to issues of financial closure or credit limits. These investments would be only possible by attracting foreign direct investment and increase public-private partnerships in the sector. The fourth challenge is with regard to man power. The advent of new technologies is leading to challenges in sourcing and retaining trained and skilled man power during operation periods. The problem is made more acute by talent poaching by private firms in a sector which was earlier monopolized by the public sector. A solution is the adoption of Industrial Training
Institutes (ITIs) for developing appropriately skilled manpower for the industry. The fifth major challenge is that there is a need for a lot of inter-phasing between transmission lines and sub-stations. The sub-stations are largely owned, operated & maintained either by CTU or STUs. Increased PPPs with CTU / STUs will help in alleviating inter-phasing issues to a great extent.

NEW REGULATION POLICY ON SHARING OF TRANSMISSION CHARGES AND TRANSMISSION LOSSES

Indian power system is divided into five regional grids, viz., Northern, Western, Eastern, North-Eastern & Southern. A region consists of number of state owned utilities, which are also separate control areas within that region. The power plants set up by central government enterprises have allocations to the state utilities in a region. The backbone of transmission network in the country is provided by POWERGRID (Central Transmission Utility) which is primarily built to evacuate the power of central sector power plants and to inter-connect the state utility grids as well as regional grids. The interstate transmission system (ISTS) connects all central sector and inter-regional injection points with drawl points of the states similar to a LAN system with multiple computer nodes. The owner of state utility grid, i.e., State Electricity Board of each state acts as a State Transmission Utility (STU).

In October 1991 Eastern and the Northeastern regional grid were synchronized whereas in March 2002 West synchronized with the above mentioned regional grids through AC lines. In August 2006 north synchronized with central grid. So, now there are five regional grids and two frequencies. The rapidly increasing inter-regional capacity has caused a change in the nature of the ISTS within a short time. From a predominantly regional system it has a quickly evolved into a national transmission system.
The National Electricity Policy (NEP), requires that transmission charges, under these broad guidelines, can be determined on MW per circuit kilometer basis, zonal postage stamp basis, or some other pragmatic variant, the ultimate objective being to get the transmission system users (Designated ISTS Customers, DICs) to share the total transmission cost in proportion to their respective utilization of the transmission system.

**METHODOLOGIES FOR TRANSMISSION PRICING**

Like other commodity the buy or sell of electricity is now open for all in the Act 2003. In a market, determination of price for any service or commodity has significant importance to create competition among the sellers and the buyers of the service or commodity. Unlike any other commodity, the storage of electricity is not possible to a large extent. Once it is generated it should be transmitted simultaneously. In our country the demand is more than the supply so to increase generation the generators should be encouraged to take interest in the electricity market. They could be attracted by reasonable pricing and ensuring the return while protecting the consumers’ welfare. The pricing method should be sufficient to fulfill the following issues.

1. It should be non-discriminatory and the charges for transmission service for all generators are in a comparable manner.
2. The region wide transmission cost should be shared among the generators in the region in an equitable proportion. The transmission pricing and wheeling charge will reflect the effect of the generator on transmission facilities.
3. It should recover the fixed cost of transmission facilities.
4. It should encourage new generators to be established in area which serve to reduce the constraints over an interface.
5. There should be proper monitoring of loop flows within the region.
6. It should be beneficial in open access transmission system where the periodically updating of transmission system cost is needed for declaring market price. The method should be simple and fast so that the revision of the market price will not take much time.

In open access transmission system the pricing is a critical issue. The states in India are not agreed upon a common method for transmission pricing and wheeling charges. Same is also case in the international region. There are several methods of transmission pricing- such as postage stamp method; location based marginal pricing, contract path method. These methods have been tried in different countries.

In India till date allocation mechanism of sharing transmission charges and losses was based on regional postage stamp system / method in which all States in the Region are sharing the transmission charges and transmission losses on a Regional pooled basis, in the ratio of the quantum of power drawn through the Inter-State transmission system. The quantum of power drawn is calculated as the sum of entitlements (firm share plus share from unallocated quota of power in the Central Generating Stations) from Central Generating Stations and long-term contracts between sellers (which could be surplus States or IPPs) and buyers (which would normally always be States). This is the simplest form of transmission pricing, where no distinction is made between the transactions with regard to the power flow path, supply or delivery points, or the time when it takes place. Therefore, a transaction between two adjacent buses could end up paying equal to that between far off locations.
Also with the introduction of open access in transmission and distribution so in near future many new IPPs and bulk consumers are also being allowed to purchase power through open access from anywhere in India, even across Regions. The mechanism has served the needs of the system well. However, with the integration of the regional grids, and the objective of the policy and regulatory framework to provide access to sellers and buyers, an appropriate change in the pricing mechanism is required.

One of the problems in postage stamp method is that of “pan caking” of charges-Term used to describe stacking up of charges in a transmission system due to repeated application of charges for different regions. This can be understood with the following example cited below:

A generator (say “A Ltd.”) in Arunachal Pradesh (NER), willing to supply power in Maharashtra (WR). According to postage system, the total charges and total transmission losses of the system for each region is pooled and is spread over the users of the system on per MW basis. A Ltd. will have to bear the transmission losses and charges for three regions involved – namely NER-ER-WR (there is no direct link in NER-WR). While a local generator of WR may use owned dedicated line or may pay only one region charges for supply within the region. Thus, a generator in other region becomes grossly uncompetitive in the sellers region. If a State Transmission Utility (“STU”) network is also used, then charges and losses of such STU would further be loaded, which may vary widely among states. Moreover, if there is any system strengthening/up-gradation required to be carried out by PGCIL, cost of such system will be borne by the specific users for whom it has been created.
Thus there is an increase in the landed cost of power and also discouragement to inter regional exchange of power and also it is non-reflective of the network utilization. Also the actual displacement of power may be very small as against the underlying theory of assuming full displacement from injection to delivery point, due to many generators and consumers connected in between the two. The system worked well in pre-reforms era where there was only govt. owned agencies in both generation and demand and there were identifiable lines. With the reforms and private sector players coming in, the system, post 2012, would be a deeply meshed network, making it almost impossible and impractical to trace the destination to source and underlying routes. Also with reference to the literature an ideal transmission pricing mechanism should allow the power plant developers and customers to decide the optimal location of the power plant by comparing the costs of fuel transportation and the cost of electricity transmission. The transmission pricing mechanism based on ‘regional postage stamp’ was needed to be revised to suit the needs of the changes in the market structure and the policy framework. The beginning of the revised framework for sharing of transmission charges and losses lies in the National Electricity Policy (NEP), which mandates that the national tariff framework implemented should be sensitive to distance, direction and related to quantum of power flow(Para 7.2(1) Tariff Policy notified vide Govt. of India Ministry of Power Resolution No. No.23/2/2005-R&R (Vol.III) dated 6.1.2006). The ultimate objective being to get the transmission system users (Designated ISTS Customers, DICs) to share the total transmission cost in proportion to their respective utilization of the transmission system.
The overall tariff framework should be such as not to inhibit planned development/augmentation of the transmission system, but should discourage non-optimal transmission investment.

The CERC, after due consideration of the alternative methodologies for allocation of transmission charges and the comments received from various stakeholders has considered implementation of the Point of Connection (PoC) methodology based on a hybrid method, which brings together the strengths of both the Marginal Participation and the Average Participation Method discussed in the staff paper. Under this framework, any generator node is required to pay a single charge based on its location in the grid to gain access to any demand customer located anywhere in the country. Similarly, any demand node will also be required to pay just one charge and get access to any generator in the grid. This is based on load flow studies conducted for each node, one at a time. The same principle holds for transmission losses that a generator node or demand node has to bear.

Thus the new regulation on sharing of interstate transmission charges and losses laid down the methodology for sharing of transmission charges for the use of Inter-State Transmission System (ISTS) and transmission losses in the ISTS, in accordance with the National Electricity Policy and Tariff Policy. But they do not deal with the determination of Approved Transmission Charges (ATC) of the transmission licensees and mechanisms for computation of overall losses.

Determination of ATC and methodology of computation of overall losses shall be as per the regulations of the Commission from time to time. Also ISTS Charges and Losses shall be shared amongst the following categories of users who use the ISTS in accordance with these regulations:

(a) Power Station directly connected with the ISTS;
(b) State Electricity Boards / State Transmission Utilities / Distribution licensees using ISTS; and

(c) Any other bulk consumer directly connected with the ISTS.

The core of the regulation is The ISTS is treated as a single integrated “common-use” national network for use by all DICs (Designated ISTS Customers who would pay charges (or loss compensation) depending on where they are placed in the national network. For example, demand located near generation hubs would have relatively lesser charges or losses allocated to them. Also if the entire national network is frequency integrated, so national network is envisaged for the computation of charges and loss allocators. However as mentioned earlier there are five regional grids with two frequencies and till the Southern Region Operates in a separate frequency regime, the computations for NEW grid and SR grid would be undertaken independently. Also the sharing of transmission charges is not related to individual transactions which makes the transaction management (including on the trading platforms) much simpler.

As mentioned AC Load Flow based “Point of Connection (PoC)” charging methodology is used which will be the hybrid of the Marginal Participation and the Average Participation Methods.

As said the pricing mechanism must be able to capture the utilization and charge for the resources being utilized. Pricing of transmission services based on average or marginal utilization of the network branches is known as Average Participation or Marginal participation method respectively.
MARGINAL PARTICIPATION METHOD

It analyzes how the flow in the grid is modified when minor changes are introduced in the production or consumption of agent I. For each of the scenarios (for each season) the procedure can be considered as follows:

• Marginal Participation sensitivities $A_{ij}$ are obtained that represent how the flow in the line $j$ changes when the injection in bus $I$ is increased by 1 MW. The increase in 1 MW has to be compensated by a corresponding increase in load or generation at some other bus or buses—called Slack bus(es)

• Total participation for each agent are calculated as a product of its net injection by its marginal participation. If net injection is considered positive for generation and negative for demand, the total participation of any agent $I$ in line $j$ is $A_{ij}$ (generation$_i$ - demand$_i$).

• The cost of each line is allocated pro-rata to different agents according to their total participation in the corresponding line.

AVERAGE PARTICIPATION METHOD

This method works as follows:

• For every individual generator $i$, a number of physical paths are constructed, starting at the node where the producer injects the power into the grid, following through the lines as the power moves through the network, and finally reaching several of the loads in the system.

• Similar calculations are also performed for the demands, tracing upstream the energy consumed by a certain user, from the demand bus until some generators are reached.
• One such physical path is constructed for every producer and for every demand.

Various countries like United Kingdom, Norway (for transmission losses), Brazil, Columbia etc have implemented the Marginal Participation method. However there are very few international countries which have implemented Average Participation Method. If we talk about India the Hybrid Method is used where the role of Average Participation method is selection of slack buses. As the injection at each bus needs to be counter-balanced by a corresponding increase in demand at certain buses – called the slack buses. Similarly, an increase in demand at a load bus needs to be counter-balanced by a corresponding increase in generation at certain buses. The Marginal Participation Method is used to compute network utilization by injection / withdrawal at each node.

**REASON FOR ADOPTING HYBRID METHOD IS AS FOLLOW:**

A criticism of the approach was that it would not be prudent to assume that an increase in generation in one state (say Arunachal Pradesh) would impact demand in distant nodes (say Maharashtra). The hybrid approach addresses this criticism of the Marginal Participation method proposed originally. On the other hand, the Average Participation method tends to select buses which are geographically and electrically proximate. The hybrid approach uses the slack buses selected by the Average Participation Method but allocates the burden of transmission charges on various nodes using the Marginal Participation Method. This, thus, results in generators feeding “geographically and electrically proximate” demand first and then the demands which are “geographically and electrically distant”.

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In other words, generators are primarily linked with nearby demand first and only net imports or exports are linked with external nodes. Consideration of the Marginal Participation method for determination of the burden of transmission charges helps consider the burden of transmission charges of lines which may not be in the path (incidental flows) identified by the Average Participation Method but are identified to be affected by flows along the identified path. Further, from an efficient pricing standpoint, Marginal Participation Method helps relate the nodal charges with the marginal benefits provided by each line to the node being priced. Also in various studies revealed that the nodal transmission charges in the AP method have a higher variance. As compared to the range of transmission access charges in the Hybrid method (Rs 2.98 – 17.75 lakh / MW), the range in the AP method (Rs. 2.79 – 53.61 lakh / MW) is much higher.

So, using the above mechanism, the marginal participation factors for allocation of charges and losses to each node are computed.

Pricing Mechanism under the Selected Framework:

As mentioned earlier also that with the reference to international experience and looking at the past experience of Indian system, the Hybrid method- a hybrid of the average and marginal participation methods have been used for calculating transmission charges and transmission losses. The followings steps were followed in the implementation of the hybrid methodology:

- Data Acquisition
- Computation of Load Flows on the Basic Network
- Network Reduction
- Identification of Slack Node(s)
- Hybrid Methodology for the determination of transmission charges
• Hybrid Methodology for the determination of transmission losses
• Determination of Sharing of YTC and Losses
• Creation of Zones

Data Acquisition: in this step information on nodal generation, nodal demand, transmission circuits between these nodes and their electrical characteristics required for load flow analysis, the associated lengths of these transmission lines and its capacity, Yearly Transmission Charges (YTC) of each line, identification of a reference node(s). In case of nodal generation/demand information the Designated ISTS Customers (DICs) will provide forecast injection / withdrawal information (MW and MVAr (or an assumption about the power factor to be used)) at all the nodes or a group of nodes in a zone (identified a-priori by the Implementing Agency (IA) in the Network. “Typical” injection / withdrawal data for peak and other than peak periods for the peak and other than peak periods as defined in these regulations shall be provided to the Implementing Agency by the DICs for the following blocks of months April to June, July to September, October to November, December to February and March. Data on network supplied by CTU, owners of deemed ISTS transmission system and the DICs whose assets are being used or considered in the Basic network which includes data on bus data (like load bus plant bus, etc), generator data, branch data, etc.

For computation of transmission charges all the above information was provided to Implementing Agency (IA). For first two years NLDC is the Implementing Agency.

After this IA, run AC load flow on the basic networking using technical data provided by DICs, RLDCS, NLDC. The entire process of formation of the basic network and converges to load flow was validated by validation committee. Also network was truncated at 400kV level to reduce network.
The truncated network so obtained by IA by following the guideline mentioned by CERC is used for the implementation of the Marginal Participation methodology of transmission pricing. Truncation at the 400 kV level also allows relation of local generation and local demand and obtains a source (or a sink) for the net imports (or exports). In other words, state generators below 400 kV are primarily linked with state demand and only net imports or exports are linked with external nodes. The external (slack buses) for each node shall be found as follows:

a. For every node in a particular scenario, Average Participation method will be applied to each generation / load located in the state under consideration. Tracing from load to generator (or from generator to load), a set of generators (or loads) (including those outside the state) and their contribution to the load (generator) is determined for each load (generator) bus.

b. Using the above choice of slack buses for each generator and load bus, marginal participation of each generator and load in each transmission line is computed. The Hybrid Method analyzes how the flows in the grid are modified when minor changes are introduced in the production (or consumption) of agent \(i\), and it assumes that the relationship of the flow through line \(j\) with the behaviour of the agent \(i\) can be considered to be linear. For each of the considered blocks of months and peak and other than peak condition, the procedure can be described by CERC is followed to calculate transmission charges and transmission losses. Computation of transmission charges are as follows:

Marginal participation sensitivities are obtained that represents how much the flow through each network branch \(j\) increases when the injection/ withdrawal in a bus is increased by 1 MW. Flow variation in each network branch \(j\) incurred by 1 MW injection / withdrawal at each bus is computed for each scenario, \(e\). Once the flow variation in each line incurred by each agent and for every scenario is obtained, seasonal usage index is computed for each network user according to equation
given below. Only positive increments in the direction of the power flow in the base case are considered. Because it could be difficult to pay grid connected entities for being connected to the grid.

The seasonal index (for each block of months) is computed as:

\[ U_{e,i,l} = \left( |F_{ie}^l| - |F_{il}| \right) P_{ie}. \]

Where,

- \( U_{e,i,l} \) is the seasonal usage index in line \( l \) due to injection / withdrawal at node \( i \)
- \( F_{ie}^l \) is the flow in line \( l \) under scenario \( e \) under base case
- \( F_{il} \) is the flow in line \( l \) under scenario \( e \) due to injection / withdrawal of 1 MW at node
- \( P_{ie} \) is power dispatch / demand at bus \( i \) under scenario \( e \) under base case

The revenue requirement of each line is allocated pro-rata to the different agent

\[ \text{Cost Allocated}_{e,l} = \frac{U_{e,i,l}}{\sum_i U_{e,i,l}} \times C_l \]

Where,

- \( C_l \) is the Transmission Charge of the line – computed by attributing the Yearly Transmission Charge for the ISTS licensee to each line owned by it and to the block of month under consideration.

\( U_{e,i,l} = \) is the marginal participation factor

\( \sum U_{e,i,l} \)

On the other hand there will be a change in losses in the system (here the base case) because of an incremental injection or withdrawal at each node and this is termed as Marginal loss factor for that node which is computed as follows:
Marginal Loss Factor \( i \) = \( \frac{\partial \text{System Losses}}{\partial \text{Power generation / load at Node } i} = K_i \)

The selection of the slack buses for absorption (supply) of the incremental injection (withdrawal) using AP method.

The marginal loss factors are multiplied by the generation / demand at these nodes under base case, i.e.

\[
\begin{align*}
K_i \times P_i^g & \quad \text{for generation nodes} \\
K_j \times P_j^d & \quad \text{for demand nodes}
\end{align*}
\]

Where,

\( P_i^g \) is base case generation at node \( i \)
\( P_j^d \) is base case demand at node \( j \)

Where,

Loss Allocation Factor for generation and demand nodes are computed as:

\[
\begin{align*}
\frac{K_i \times P_i^g}{\sum_i K_i \times P_i^g + \sum_j K_j \times P_j^d} & \quad \text{for generation node } i \text{ and} \\
\frac{K_j \times P_j^d}{\sum_i K_i \times P_i^g + \sum_j K_j \times P_j^d} & \quad \text{for demand node } j
\end{align*}
\]
The Loss Allocators computed above are multiplied by the total system losses to allocate losses to each node in the system.

Treatment of HVDC lines: Flow on the HVDC line is regulated by power order and hence it remains constant for marginal change in load or generation. Hence, marginal participation of a HVDC line is zero. Thus, MP-method cannot directly recover cost of a HVDC line. Therefore, to evaluate utility of HVDC line for a load or a generator, the following methodology shall be applied:

a. Step 1: Evaluate the Transmission System charges (of AC network) for all loads and generators corresponding to base case which has all HVDC lines in service.

b. Step 2: Disconnect the HVDC line and again compute the new flows on the AC system. Hence, evaluate the new transmission system charges (of AC network) for all the loads and generators.

c. Step 3: Compute the difference between the Nodal Charges (unit – Rs) with and without HVDC line and identify nodes which benefit from the presence of the HVDC lines. Benefit is new (with disconnection) usage cost minus old (with HVDC) cost. If benefit is negative, it is set to zero. The cost of the HVDC line is then allocated to the nodes in proportion of the benefits they derive from its presence as computed above.

POC charges are then computed for 5 blocks of months and peak (generally 8 hrs) and other the peak conditions (16hrs). Representative blocks of months are April to June, July to September, October to November, December to February and March. Annual Average YTC of each line will then be attributed to peak and other than peak periods of each season. The annual average YTC (of each period in each season) of each line is attributed to the total change in flow in each line. Therefore the YTC is allocated to each agent in proportion of the change in the flow in network branch affected by that agent.
Transmission charges based on Hybrid Methodology in Rs/MW/Month and Rs/MW/hr at each node in each block of months will be computed. Loss Allocators and total loss shall also be computed along as discussed above.

The nodal transmission charges and loss allocators will be aggregated over zones determined based on the electrical and geographic proximity of the nodes, such that the difference between nodal charges of nodes being combined into a zone are within a logical range where zones shall contain relevant nodes with costs in the same range and also nodes with connectivity to thermal generators greater 1500 MW or hydro generators greater than 500 MW to be taken as separate zones. The transmission access charges shall be determined for each generation zone by computing the weighted average of nodal access charges at each generation node in this zone while multiple generation zones shall be considered in a state, for each state there shall be a single demand zone. This is essentially because, the interface of the CTU network with the State is usually at either 400 kV or 220 kV nodes which are generally owned by the state transmission utilities. The transmission bills by the CTU are generally raised on the STU or the SEBs where state utilities have not been unbundled. While the nodal charges for access by demand customers will be made available to the State Utilities, the manner of application within the state would be left to the state utilities. This may change when the states implement a ‘Point of Connection’ based transmission pricing mechanism.

The PoC charge of a zone shall be sum of Uniform charge and Zonal Charge in the proportion as specified by the Commission.

**Example: PoC Charge (PoC) = m * Uniform Charge (UC) + n *Zonal Charge (ZC) (hybrid method)**

Where m and n are the constants specified in the regulation which is 0.50 for initial two year.
The Uniform Charge component of PoC charge shall be calculated as follows:

\[ UC = \frac{\text{Total ARR}}{\text{Sum of Approved Injection} + \text{Sum of Approved Withdrawal}} \]

This shall be worked out separately for the NEW grid and SR grid till such time the grids are synchronized. Unless or otherwise revised by the Commission, PoC Charge shall comprise of 50% of Uniform Charge and 50% Zonal Charge. Also there is no differentiation in rates is proposed between the long term, medium term and short term users of the transmission system. However these would be accorded decreasing order of priority in event of system constraints.

The chart below shows the entire process for determination of transmission charges:
**BENEFITS OF NEW METHODOLOGY**

In the postage system which was used till date, all the grid users within a region, pay a uniform transmission charge and share transmission losses. This system is therefore not sensitive to the distance and the frequency at which the power is transmitted by the user. On, the other hand, new mechanism under which the transmission charges and losses among the grid users are allocated based on the actual utilization of the network by each user, taking into account the physical distance of power transmission and peak and off-peak hours of a day/ season (users only pay for point-to-point transmission of electricity). The following are few benefits of the new transmission pricing mechanism which is based on hybrid method.

Like other commodity the buy or sell of electricity is now open for all in the Act 2003. In a market, determination of price for any service or commodity has significant importance to create competition among the sellers and the buyers of the service or commodity. With the transmission pricing mechanism charges are indicated to provide a signal

- If the generation charges are high in a particular region and there is adequate transmission capability, adding generation there will reduce transmission charges.
- If the generation charges are high in a particular region and transmission system is operating close to capability, adding generation there may increase transmission charges.
Demand access charges in the vicinity of a generation hub are low (provided the demand nodes are connected directly with the generation hubs). A commercial contract which is against the direction of physical flow of power will invite lower transmission charges – e.g. commercial contract between a plan in UP-West and Maharashtra would invite 11.11 paise/kWh whereas, a commercial contract between a plant in Chattisgarh and Maharashtra would invite 19.30 pasie/kWh. In this example, the former contract will be against the direction of flow (which is generally from WR to NR), while in the latter case the power will flow along the direction of dominant flows in inter-state lines between Chattisgarh and Maharashtra.

- Earlier the transmission investments faced with the uncertainty in generation and also the cumbersome process of getting the Bulk Power Transmission Agreements (BPTAs) signed by all the expected beneficiaries of the transmission system. Under the new mechanism all the Designated ISTS Customers (DICs are default signatories to the Connection and Use of System Agreement (CUSA), which also requires these DICs to pay the point of connection charge, which covers the revenue of transmission licensees. This commercial arrangement would also facilitate financial closure of transmission investments.

The new mechanism would facilitate integration of electricity markets and enhance open access and competition by obviating the need for pan caking of transmission charges. For example: Suppose a transaction of power exchange of 1 MW takes place between a state in WR and a state in ER. In this case, postage stamp rates of both the regions need to be paid, i.e. (Rs.359+Rs.434=Rs.793).
In the table below that the maximum transmission cost paid by any state in WR is Rs.288.229. Similar rate would be paid by the ER constituent, but which would always be lesser than Rs.434. Hence, the transmission price paid by this type of contract would be lesser than (288.229 + 434.42 =722649).

**TABLE ON DETAIL ABOUT GENERATION AND LOADS AND CORRESPONDING POC RATES**

<table>
<thead>
<tr>
<th></th>
<th>GUJURAT (GU)</th>
<th>MADAYA PRADESH (MP)</th>
<th>MAHARASHTRA (MH)</th>
<th>CHANDIGARH (CH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>POC Tariff Generation (Rs/MW)</td>
<td>89.9527</td>
<td>270.352</td>
<td>101.815</td>
<td>288.229</td>
</tr>
<tr>
<td>POC Tariff Load (Rs/MW)</td>
<td>111.109</td>
<td>232.476</td>
<td>90.2563</td>
<td>149.286</td>
</tr>
</tbody>
</table>

- The National Electricity Policy requires the transmission charges to reflect network utilization. The Point of Connection tariffs are based on load flow analysis and capture utilization of each network element by the customers (through average and marginal participation method). So there is better utilization of resources which is a component in improving competition.

5The example is taken from Electricity Transmission Pricing: Tracing Based Point-of-Connection Tariff for Indian Power System Anjan Roy, A. R. Abhyankar, Student Member, IEEE
The hybrid method brings together the strengths of both the margin and average participation method. The distinction between generation and demand customers would provide siting signals to the DICs, through accurate transmission charges vis-à-vis. The current decision of generators is based on just the fuel transportation costs. With the implementation of the new transmission pricing mechanism – where transmission charges are locationally differentiated – the generators will have to take a view both on transmission costs of electricity and transportation costs of fuel. (An ideal pricing mechanism should include both of these)

The new framework will greatly facilitate fair and transparent competition for case-1 bids. Under the methodology which was followed till date, the case-1 bid processes were severely distorted because of pan caking, and this result in pit head / hydro plants not being competitive for inter-regional bids. The impact of pan caking is further amplified in such bid processes because of application of escalation factors to transmission charges over a 25 year period. The proposed methodology will remove such difficulty.

Coal which is the primary source of power is extremely polluting during consumption as well as during extraction and the reserves of fossil fuel is also limited. So government is taking various initiatives to promote the use of renewable resources for power generation. The new regulation facilitate solar based generation by allowing zero transmission access charge for use of ISTS and allocating no transmission loss to solar based generation. Solar power generators shall be benefited in event of use of the ISTS. Since such generation would normally be connected at 33 kV, the power generated by such generators would most likely be absorbed locally.
This would cause no / minimal use of 400 kV ISTS network and might also lead to reduction of losses in the 400 kV network by obviating the need for power from distant generators. Further, this is also aligned with the objectives of the Jawaharlal Nehru National Solar Mission which is “to establish India as a global leader in solar energy, by creating the policy conditions for its diffusion across the country as quickly as possible.” The cost of energy from solar based generation is in the range of Rs 14-18 / kWh and application of ISTS charges and losses would further reduce the acceptability of power generated from solar sources. This regulation encourages solar based generation.

In short we can say, the new mechanism is independent of the contract “path”. It is transparent as all the data used for computing the transmission charges are shared with the users leading to improvement in efficiency of pricing and which in turn will lead to more optimally utilization of transmission system. The transmission charge payable for any contract is known ex-ante and hence it can be considered while entering into a contract and this provide rational and economic logic for siting generation with respect to load(power withdrawn). Also the cost matrix is changing so there is reconfiguration of the market. It is therefore expected that generators from other regions would now have a level playing field in competitive biddings and in the open market, thus paving way for a broader, deeper and fair competition and also better management of congestion. Overall impact would be rationalization and convergence of tariff across country in long run.
TRANSMISSION SECTOR AND POSSIBLE COMPETITIVE ISSUES:

*Services according to competition act section 2(u) means* services of any description which is made available to potential users and includes the provision of services in connection with business of any industrial or commercial matters such as banking communication, education, financing, insurance, real estate transport, storage, material, processing, *supply of electrical or other energy*, boarding, construction, conveying of news or information and advertising.

*Transmission services* are intermediate product (generation-transmission – distribution) so it plays an important role between what is produced and how much is consumed. The hybrid method is not only simple to understand but easy to implement. The new mechanism is providing signals to users like if demand charges are high in a zone – it would be advantageous to add generation there, similarly for demand. New regulation pricing policy on the assessment was found to provide more *transparency by providing* as all the data used for computing the transmission charges are shared with the users leading to improvement in efficiency of pricing, which in turn will lead to more optimally utilization of transmission system, so there is a movement from opaque pricing mechanism towards transparent pricing mechanism. Also the new pricing policy is more predictable and it provides *rational and economic logic to the generator for siting generation with respect to load* as the transmission charge payable for any contract is known ex-ante.
Due to change in the process and method used for determination of transmission charges the cost matrix is changing leading to reconfiguration of market. On the assessment, generators from other regions would now have a level playing field in competitive biddings and in the open market, and as far as infrastructure is concern thus paving way for a broader, deeper and fair competition and also better management of congestion. So this attracts number of players like generators, distributors as well.

*As of now on the assessment we can’t focus any anticompetitive issues as such now but the following are the expected issues that have to be taken care of.*

As Indian electricity sector faces supply deficit it is important to see the conduct of various players vis-à-vis the consumers and see whether there are any agreements that will affect long term contracts.

- As the new transmission pricing policy is distance and most importantly direction sensitive so we can say sensitivity to information is very high. A little bit of asymmetric information would disturb the market equilibrium. Once it is shifted the things are very technical, so we need to bridge gap of asymmetric information if any. Failure on this front might lead to differentiation among players and will favor discrimination. It might bring vertical or horizontal arrangements (section 3(3) and 3(4) would apply then

- As the calculation of transmission charges is very technical so there is a need that there is fairness in measurement, so anything wrong might lead to disastrous results.

*So the sectoral regulator that is CERC should ensure that the above mentioned points are fulfilled and adhered to. Any failure in doing so requires an intervention and detailed analysis by the CCI*
Also being a natural monopoly CERC should ensure that there is no abuse of dominance and CCI should keep an eye this and will have to intervene if required (section 4).

Also as mentioned that the pricing policy is dependent on direction flow. A commercial contract which is against the direction of physical flow of power will invite lower transmission charges – e.g. commercial contract between a plant in UP-West and Maharashtra would invite 11.11 paise/kWh whereas, a commercial contract between a plant in Chattisgarh and Maharashtra would invite 19.30 paise/kWh. In this example, the former contract will be against the direction of flow (which is generally from WR to NR), while in the latter case the power will flow along the direction of dominant flows in inter-state lines between Chattisgarh and Maharashtra. So it should be seen that this transmitting firm doesn’t lead to anti competition in the region through discriminating pricing, misusing the opportunity.

These issues should be taken care of.
**Conclusion:**

Transmission is internationally considered a natural monopoly. It is to the credit of the Indian Policy planners that we have a central agency of planning of the grid which has led to regional grids and synchronization of all regional grids except southern grid. Such an integrated grid system does not even exit in USA. The transmission capacity is allocated on a non discriminate basis depending on amount of power flows and point of injection/withdrawal. The new pricing mechanism provides a movement from opaque to transparent system and it rational and economic logic to the generator for siting generation with respect to load. We expect that this mechanism will attract more players in the sector. But few issues should be taken care of.