*IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE)*
*e-ISSN: 2278-1676,p-ISSN: 2320-3331, Volume 13, Issue 3 Ver. III (May. – June. 2018), PP 34-40*
*www.iosrjournals.org*

# Open Access: The Multi-Licensee Tool In Emerging Indian Power Sector with Renewable Energy

Mohd.Imran[1], P. C.Kushwaha[2],A. P. S. Jadon[3], A. K.Dubey[4]
[1]*Assistant Engineer (Electrical Safety), Assistant Electrical Inspector, Govt. of Madhya Pradesh,Bhind, Madhya Pradesh, INDIA.*
[2]*Head (O&M), Shaktisteller Energy Solutions Pvt. Ltd.,Bhopal, Madhya Pradesh, INDIA.*
[3]*Deputy Chief Electrical Inspector, Govt. of Madhya Pradesh, Indore, Madhya Pradesh, INDIA.*
[4]*Joint Secretary of all India Electrical Inspectorate Federation, Deputy Chief Electrical Inspector,Govt. of Madhya Pradesh, Bhopal, Madhya Pradesh, INDIA.*
*Corresponding auther: Mohd.Imran*

***Abstract:*** *The objective of this article is to analyse the role of open access electricity market with growing renewable energy penetration for energy system development and welfare in developing economy. The hypothesis is that open access is a framework for development of power market for promoting competition in power sector to allow freedom for consumers (suppliers) to choose suppliers (consumers). The focal questions are related to incentives arising from the operational environment, their impact on existing power sector structure, and further research and development needs.The paper comprises current status of Indian power market, its future with increase of renewable energy generation and rise of electricity demand, role and challenges of open access in electricity market.*
***Keywords*** *– Open Access, Renewable Energy, Power Market*

---

Date of Submission: 06-06-2018 Date of acceptance: 24-06-2018

---

## I. Introduction

The Indian Power Sector has come a long way since independence. At present, India has fifth largest electrical generation capacity in world, while India is sixth largest in electrical energy consumption and still around 18% of India's population have no access to electrical energy [1],[2]. Now Indian government has taken Power for All (PFA) initiative to provide 24x7 electricity supplies to all consumers. To meet out the future demand, capacity addition is required in conventional and nonconventional power plant. Renewable Energy sector is now poised for a quantum jump as India has reset its Renewable Energy capacity addition target so as to have installed capacity of 175 GW by the end of 2022 [3]. As the cost of electricity from renewable energy (RE) sources has been decreasing, the amount of RE generation has been growing by leaps and bounds. Present installed RE based electricity generation capacity and its target by 2022 is shown in Table 1.

**Table 1.**RE based electricity generation present capacity and target by 2022[3].

| Source (RE) | Total Installed Capacity Present (MW) | Target for 2022 (MW) |
|---|---|---|
| Wind power | 32,715.37 | 60,000.00 |
| Solar power - Ground Mounted | 14,751.07 | 1,00,000.00 |
| Solar power – Rooftop | 823.64 | |
| Biomass power (Biomass & Gasification and Bagasse Cogeneration) | 8,181.70 | *10,000.00 |
| Waste-to-Power | 114.08 | |
| Small hydropower | 4,399.35 | 5,000.00 |
| TOTAL | 60,985.21 | 1,75,000.00 |

Activities in the Indian Power Sector especially in transmission and distribution have largely remained a natural monopoly. After independence the government, took upon itself the task of developing the Power market but that could not improve the financial condition especially in the case of distribution, or could effectively address the Power shortages and strength of transmission.Reforms like unbundling, privatization, commercialization and regulation in Indian power sector are mostly follow the World Bank model. Reformation in the Indian power sector commenced in 1991, when the Indian Economy underwent liberalisation, amendments were made in the existing acts;The Indian Electricity Act, 1910 and The Electricity (Supply) Act,

1948. The major purpose of making amendments in these laws as earlier made in 1910 and 1948 was to attract Private investments for capacity addition in generation and also diluting the monopoly of State Electricity Boards in phases. Thrust to the development of Indian Power Sector came in form of The Electricity Regulatory Commissions Act, 1998; which sought to delegate the role of government in matters pertaining to tariff regulations to independent regulatory commissions i.e., Central Electricity Regulatory Commission (CERC) andState Electricity Regulatory Commissions (SERCs) [4].

Finally it was The Electricity Act, 2003 (No. 36 of 2003) woven around a framework aimed to promote competition in power sector (generation, transmission, distribution and trading of power) and combined with the regulatory oversight, constitution of Central Electricity Authority, Regulatory Commissions and establishment of Appellate Tribunal and gave evolution to the concept of Open Access(OA). OA in Indian power sector allows the freedom to consumers as well as sellers for transection of energy. It breaks the monopolistic behaviour of DISCOMs and act as a portability tools in Energy sector. It introduces the interaction of private parties in the field of generation and distribution [4],[5].

With the increase of RE penetration and future demand, OA market can be solution to provide reliable and cost effective electrical energy to consumers. Several states have offered concessions in OA charges if the competitive supply is provided on RE. These concessions are provided in the form of reductions in CSS, transmission charges, or energy-banking charges. As a result of this RE based power through OA can be less expensive for consumers than power from conventional resources [4].

## II. Open Access In Indian Power Market

As per Electricity Act, 2003 Open Access has been defined under Section 42 (Sub Section 2) as follows:

"The non-discriminatory provision for the use of transmission lines or distribution system or associated facilities with such lines or system by any licensee or consumer or a person engaged in generation in accordance with the regulations specified by the Appropriate Commission [6]."

Provided that one (such OA shall be allowed on payment of CSS, surcharge) in addition to the charges for wheeling as may be and other charges as determined by the State Commission. To put simply, OA allows enabling of non-discriminatory sale/purchase of electric power/energy between two parties utilizing the system of an in- between (third party), and not blocking it on unreasonable grounds.Basically, OAis a framework for development of power sector market and for promoting competition; it is mandated to allow freedom for consumers (suppliers) to choose suppliers (consumer). It basically means that the buyer has the freedom of selecting the seller, and vice-versa [5].

### 2.1 Why OA is required?

The Power Sector round the globe has undergone various changes in its working as well as in its operational model. Following their successes in such transformations Indian Power Sector was propelled to bring in such transformation and OA is one such tool to put the Power Sector on the path of progress [7],[8].

The important reasons why OA is required in the Indian Power Sector are based on following benefits that are expected to accrue.

1. To increase/promote the competition.
   - The Power sector has for long remained a monopoly. It has been an obligation for a generating system to sign a BPTA (Bulk Purchase Transmission Agreement) and to adhere to connectivity conditions of the Transmission Company.
   - OA in this context grants right to the generating company, the non-discriminatory provision for use of Transmission & Distribution lines thus reducing the monopolistic nature of the electricity market and promoting competition at various level of Power Sector.
   - Competition in distribution sector is based on the concept of multiple licensees in the same area so that consumers have a choice to decide the source as per their need [8].
2. For changing and developing market structure.
   - Electricity Act 2003, aim to develop a full-fledged market of electricity and as such OA is one of the many tools to change & develop a competitive market and diluting its monopolistic nature power sector.
   - Development of competitive market will lead to competitive prices and service which will obviously be lesser than monopolistic price.

3. For optimum resource utilization.
   - OA led competitive environment can raise investment sentiments in the power sector and thus it can help network strengthening for better evacuation and distribution.
   - Power sector has been currently marred by ageing and in adequate –infrastructure. With competitive players active in the sector infrastructure and network connectivity can be developed as well as strengthened.
   - This will help route electricity from the area with surplus amount of electricity to the region of deficit.

4. Consumer friendly approach.

- OA makes Power Sector more consumer friendly in the sense that consumer will have choice for the retailer who in turn will not only compete on prices offered to the consumer but also on the facilities offered to him in form of better quality, a better plan or better reliability.
- Consumers who have requirement of more than 1 MW can directly source their requirements from generators, instead of contacting themselves to trader or distributor.

## III. Categorization Of Open Access

OA is categorized as the following depending upon the location of buying and selling entities and further sub-categorized depending on the duration of the access. Figure 1 shows the categorization of OA in Indian power market.

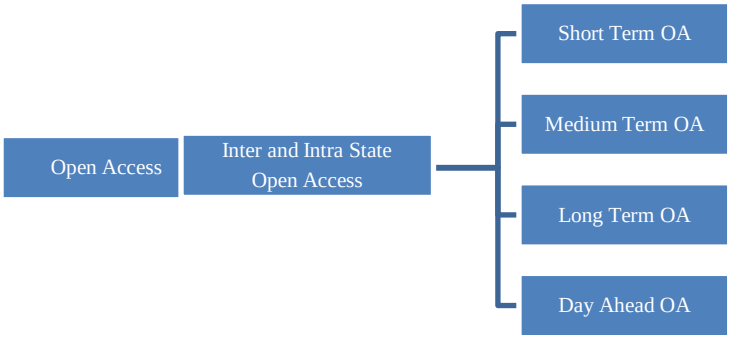


**Figure 1.**Categorization of OA[11].

3.1 Inter State OA.

When buying and selling entity belongs to different states, it falls in the category of Inter State OA. In this case CERC regulations are followed [9].

It is further categorized as:

a) Short Term Open Access (STOA): This is allowed for the period of less than a month (30 days).
b) Medium Term Open Access (MTOA): Itis allowed for a period of 3 months to 3 years.
c) Long Term Open Access (LTOA): Thisis allowed for a period of 12 years to 25 years.
d) Day Ahead OA: It is permitted on availability of surplus capacity in distribution Licensee's system. The application will be received within 2 days prior to date of scheduling but not later than 1500 hrs. of day immediately preceding the day of scheduling for day ahead transaction [10][11].

Note: If one requires OA for two months, then application for STOA should be re-applied before the expiry of first month.

3.2 Intra State OA.

When buying and selling entity belongs to same state, it refers to Intra State OA. In this case SERC regulations are followed [10][11].

It is further categorized as Short Term OA, Medium Term OA, Long Term OA, Day Ahead OA and the duration of which depends on the respective state OA regulations.

**Table 2.**Various section of Indian electricity act 2003 related with OA [6].

| **Section of EA 2003** | **Description** |
|---|---|
| Section 38 (2) (d) | Functions of CTU |
| Section 39 (2) (d) | Functions of STU |
| Section 42 | Duties of distribution licensee and OA |
| Section 43 | Duty to Supply on Request |
| Section 49 | Agreement with respect to supply or purchase of Electricity |
| Section 86 (1) (a) | Function of state commission |

Table 2, shows the various provisions to enable OA in Indian power market.

## IV. Structure Of Indian Power Market

The hierarchical structure of Indian power market is as shown in Table 3. In India, the key stakeholders are the large-scale producers, the transmission system operator (TSO), and the distribution companies (DISCOMs); where electricity retailers and wholesale market operators are separated.

**Table 3.**Power sector market structure of India [11][12].

| | |
|---|---|
| Concurrt Policy Making | • Central Government<br>• 29 State Government |
| Regulation | • Central Electricity Regulatory Commission<br>• State Electricity Regulatory Commissions |
| System Operator | • National Load Dispatch Center<br>• 5 Regional Load Dispatch Center<br>• 29 State Load Dispatch Center |
| Generation | • Central Generation Unit<br>• State Generation Unit<br>• CPP,IPP and Renewable Energy Unit |
| Transmission | • CTU<br>• STU<br>• IPTC |
| Distribution | • State Distribution companies<br>• Private Distribution companies |
| Market | • Bulk industrial consumer<br>• Bileteral market and power exchange<br>• Agriculture, industrial, domestic etc. consumers |

The Indian market model with OA is shown in Figure 2. This model is complicated with small differences between the states and multiple layers and parallel market places. Independent power producers and public sector generation companies are allowed to compete openly. However, almost 90% of the market comprises long-term bilateral purchase agreements, revealing the lack of true competition that is hindered by insufficient capacity for trading.A variety of distributed technologies; including flexible demand, distributed generation and energy storage with RE is going to change the consumption pattern of electricity and create new options to consumers [13]. Unfortunately, there is not any mechanism to integrate RE based microgrids or flexible generation and loads into this market model. Hence, redesign of the market to meet new electricity architectures is a key research challenge.

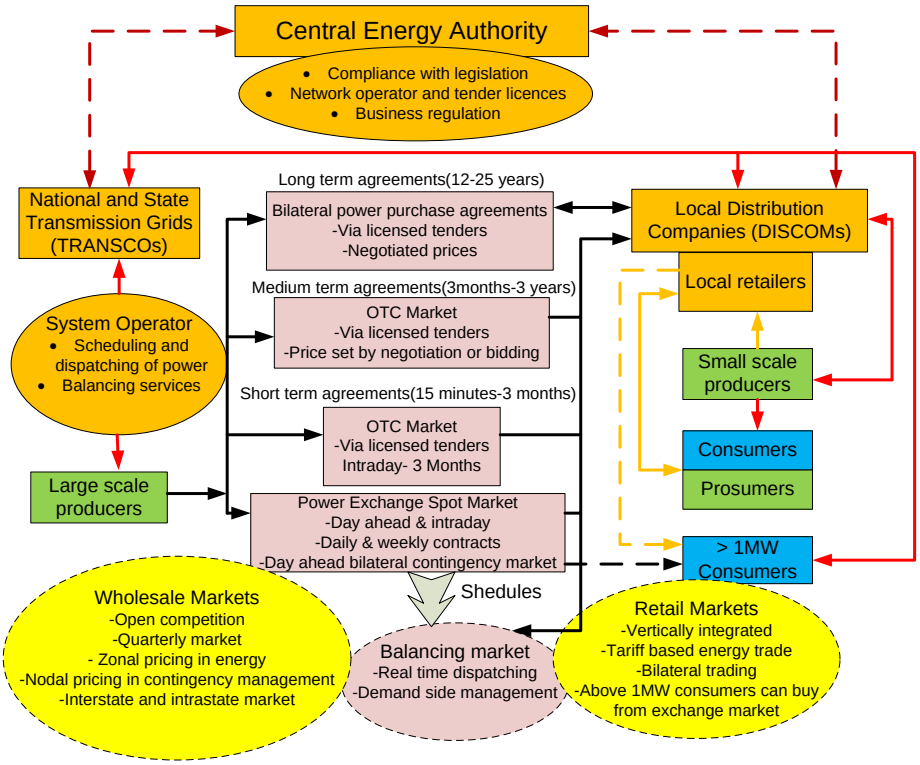


**Figure 2.**Indian electricity market model with OA[11],[12].

## V. Future Of Open Access In Indian Power Market

Indian Government has initiated Power for All (PFA) to provide 24x7 access of uninterruptable electricity for consumers by 2022. To achieve this target in future with increase in power demand, generation capacity should be increased. Power system structure should also need to improve for handle future power demand. Over the years, RE sector in India is emerging as a significant player, in the grid connected power generation capacity. It is well recognized that RE has to play a most important role in achieving energy security in the years ahead and be an integral part of the energy planning process. RE sector is now poised for a quantum jump as India has reset its RE capacity addition target so as to have installed capacity of 175 GW by end of 2022, in view of the significant RE potential in the India and commitment made by the investors/stakeholders [1],[10].

Electrical energy requirement and peak demand for the country (Utilities) has been worked out by aggregating the electrical energy requirement of all the States/Union Territories. Peak demand is calculated by assuming load factor. The forecast of electrical energy requirement and peak demand on all-India basis for the years 2016-17, 2021-22 and 2026-27 is given in Table 4.

**Table 4.**Electrical energy requirement and peak demand an all-India basis (Utilities)[10].

| Year | Electrical energy requirement in MU | CAGR of energy requirement % | Peak Demand in MW | CAGR of Peak demand in % |
|---|---|---|---|---|
| 2016-17 | 1230264 | - | 170950 | - |
| 2021-22 | 1748251 | 7.28 | 244753 | 7.44 |
| 2026-27 | 2335987 | 6.00 | 329998 | 6.15 |

The Compound annual growth rate (CAGR) of energy requirement for the period 2016-17 to 2021-22 will be around 7.28 %. While the actual growth in electrical energy requirement, during the period 2009-10 to 2015-16, was 5.02 %. To achieve desired energy requirement by 2022, it needs extra amount of funds. Total fund requirement for generation projects including RE during 2017-2022 is mentioned in Table 5.

**Table 5.**Requirement of fund for meet out the future demand[10].

| Details Fund requirement | INR (Crores) |
|---|---|
| During 2017 – 2022, for capacity of 72,495 MW conventional generation and 1,15,326 MW from RE Sources | 8,59,369 |
| Advance action for the period 2022-27 | 1,74,006 |
| Total fund requirement for Generation projects during 2017-2022 | 10,33,375 |

This fund is calculated on the basis of future demand that will rise by 2022. As the government has set the target for 100% electrification of all rural house hold by December 2018 and committed to power for all (24x7)uninterrupted supply to all household, industries, commercial etc. by 2022. These funds are including the cost of all type of conventional and non-conventional power project. Assumptions for estimating cost of power projects on the basis of market rate are shown in Table 6.

**Table 6.**Assumptions for estimating cost of power projects[14].

| Sr. No. | Type of Generation Project | Cost (Crore/MW) 2017-22 | Cost (Crore/MW) 2022-27 (20% escalation except for Solar, Biomass, Wind) |
|---|---|---|---|
| 1 | Coal + Lignite | 7 | - |
| 2 | Gas | 4 | - |
| 3 | Hydro | 10 | 12 |
| 4 | Solar | 5.5 | 5.5 |
| 5 | Wind | 6 | 6 |
| 6 | Biomass | 5.7 | 5.7 |
| 7 | SHP | 7 | 8.4 |
| 8 | Nuclear | 10 | 12 |

Private sectors contribution towards generation capacity addition has significantly increased during the $11^{th}$ five year plan period. They have contributed around 42% of the total capacity added during $11^{th}$ Plan and will add about 56% during $12^{th}$Plan [10]. If 50-40% of conventional and nonconventional plants are diverted to private site then the fund requirement would be drastically reduced and the burden of Government and DISCOMs will be less. By allowing OA, energy demand of large consumer can be fulfil easily. It can further reduce the financial burden to government and the same time goal of PFA can achieve in economical way.

To promote the RE some of the States are providing OA on a concessional rate [5]. In addition, in some states RE providers are not being paid regularly by DISCOMs making sale of RE-based power through OA an attractive alternative because of the greater certainty of payment. Together, these two factors are leading to increasing sale of RE-based power through OA. Generation from RE must be incentivized because of its

environmental benefits, and it is heartening to see rapid increases in the amount of RE in the generation mix. However, use of RE in OA transactions greatly exacerbates the problems with frequent switching because RE as in the case of solar provide only a limited supply in other word during the day time only so the special care and some reserve should be taken while taken the supply form such form of RE [7][9].

Net metering concept, for grid tied rooftop solar is introduced in many States which is a part of OA. In net metering consumer can supply his excess energy to DISCOM and take the supply when needed. At present OA is available only for large consumers (>1MW). In future, to increase competition OA facility should be given to small and medium scale industries where power demand is >100kW and also to small RE power producers.

## VI. Merits Of Open Access

There are various advantages of OAin power sector market.

6.1 OA allows multiple options for consumer to take the supply, it can increase the competition in state as well as country.

OA provides the flexibility to consumer to getting the supply at a competitive rate. This can increase the competition in between the state distribution company and private sector. As OA facility is provided on above 1 MW. Generally large industrial consumer comes above 1MW, which provide the 100 % realization of revenue and ask for uninterrupted supply.Due to OA, market is open for all state DISCOMs and private sectors, so that they can try to provide the quality supply at a competitive rate.

6.2 OA allows the maximum utilization of Transmission line and their associated facility.

Generally Power systems are design on the basis of future extension. In some of the state there is a less generation of electricity as per their demand and thus get the transmission line and their associative facility at 50-60% of their capacity. While the distribution line and their associated facilities are generally loaded at 90-100% of their capacity and thus make the mismanagement of power between the distribution and transmission line. By OA, consumers are free to use the distribution line, transmission line and their associated facility by giving the charges as per rules made by CERC and SERC and thus allow the optimum utilization of transmission line and their associated facility.

6.3OA can provide the open platform for RE(like solar, wind etc.).

In some of the state there is a wide chance of generation of electricity by Renewable source like wind, solar, etc. Still major electricity has been produced by thermal power plants or by other conventional methods. The stock of conventional fuels is limited and can get exhausted in future. So we have to go for nonconventional source of energy like: solar, wind and other form of natural energy. By OA market RE plants i.e., solar, wind, etc. can be set in any state or within the state and they can transmit or trade the power.

## VII. Drawbacks Of Open Access

There are some downsides in OA power market.

7.1 Need of transmission system and their associated facility to take optimum utilization of OA.

To transmit the power from one place to another place adequate strength of transmission line and their associated facility are required otherwise system would be overloaded.

7.2 Frequent switching of Load.

Whenever unscheduled shut down occur in producer side then consumer will shift to the state distribution utility, this would be a major problem with OA. Strict regulatory actions should be taken in this case to avoid the frequent switching of load.

7.3 Power Mismanagement.

Power mismanagement in the system happens mainly due to the mismatch in supply and demand, but many time it has been seen that this problem was created due taking of undue advantages, flawed market design and inconsistent rules. This aspect is mainly termed as Gaming. In the OA, problem arises when electrical energy demand is more than supply or vice- versa. This problem is widening when there is lack capacity of generation (MW) in state and healthy quantity of OA consumer. Also, when OA consumers bid for power in the open market, bidding rates are generally lower than that of the HT tariff. If there bid was cleared then only OA consumers purchase power, but if the bid was not clear, it leads to alarming signals to DISCOM. Now, the OA consumers will drawl energy from DISCOM, for which the DISCOM is not ready, as they have not taken this demand in its day ahead scheduling. To meet out this demand DISCOM will have to overdraw power from grid and it will lead to power mismanagement in the state grid. Another condition may also arises when the utilities take account of OA consumer energy in their account in day-ahead forecasting of power, but consumers do not consume energy from them and it take energy from the open market by OA through bid process. This situation will lead to the power mismanagement in the system [15].

7.4 Revenue Loss.

Due to OA agreement and open market scenario, consumer purchase power from open market by OA. It will lead to revenue loss to the DISCOMs. As the OA consumers are mostly of large industry/commercial consumer and they are having a 100% realization in terms of revenue. As also from above discussion stated in part (7.3) due to gaming by the OA consumer DISCOMs will have to over drawl and again get the revenue loss [15].

## VIII. Conclusions

Every consumer wants reliable, good quality and cost effective electricity.OA can give consumers many options and freedom to choose their desirable energy. Curranty, OA is available only for large consumers (>1MW). In future, to increase competition, OA facility should be given to small and medium scale consumersand also to small RE power producers. To promote RE based generation, there should be proper mechanism to integrate RE based microgrids or flexible generation and loads in existing market model. Hence, redesign of the market to meet new electricity architectures is a key research challenge.OA market can reduce the burden on government in terms of finance by increasing installation of RE plants.OA can act as a multi-licensee portable tool for consumersto take the supply from open market at a compatible rate.

## References


[1]. "Welcome to Government of India | Ministry of Power", Powermin.nic.in, 2017. [Online]. Available: http://powermin.nic.in

[2]. "Draft National Policy on RE based Mini/Micro grids", mnre.gov.in, June 2016. [Online]. Available: http://mnre.gov.in/file-manager/UserFiles/draft-national-Mini_Micro-Grid-Policy.pdf

[3]. "Ministry of New and Renewable Energy", Mnre.gov.in, 2017. [Online]. Available: http://www.mnre.gov.in

[4]. A.Kumar,"Comparative analysis of viability of open access in major Indian states", Summer Internship Report,MaharshiDayanandUniversity,Rohtak,August2013.[Online].Available:http://npti.in/Download/MBAInternshipProject/Regulatory/17_ANKUR%20KUMAR/17_ANKUR_PDF.pdf

[5]. N. Rawat, "Framework and Issues Related to Open Access", Summer Internship Report, MaharshiDayanand University, Rohtak,August2012.[Online].Available:http://npti.in/Download/MBAInternshipProject/Transmission/29naman%20rawat/29_Naman%20Rawat_A.pdf

[6]. "The Electricity Act, 2003", India. [Online] Available: http://www.cercind.gov.in/Act-with-amendment.pdf

[7]. D. Singh, "Newer challenges for open access in electricity: need for refinements in the regulations," Brookings India Impact series no. 042017-02. April 2017. [Online]. Available: https://www.brookings.edu/wp-content/uploads/2017/04/open-access_ds_042017.pdf

[8]. A. Singh, "Cross-border Trading and Regional Power Markets: Prospects for South Asia", 28-30 July, 2014. [Online]. Available:http://www.iitk.ac.in/ime/anoops/IEX%20Training-2014/IITK%20-%20PPTs%20-%202014/Day-3/3%20-%20Anoop%20Singh%20-%20Cross-border%20Trading%20and%20Regional%20Power%20Markets%20-%20Prospects%20for%20South%20Asia%20-%202014.pdf

[9]. CERC finalizes new Open Access Regulations for Inter-State Transmission",Central Electricity Regulatory Commission, January 2008. [Online]. Available:http://www.cercind.gov.in/09012008/Transmission-2008.pdf

[10]. "DraftNationalElectricityPlan(Volume1)Generation",December2016.[Online].Available:http://www.cea.nic.in/reports/committee/nep/nep_dec.pdf

[11]. "Central Electricity Regulatory Commission", Cercind.org, 2017. [Online]. Available: http://www.cercind.org

[12]. "POWERGRID | A Government of India Enterprise | A Navratna Company", Powergridindia.com, 2017. [Online]. Available: http://www.powergridindia.com

[13]. I. Perez-Arriaga, J. Jenkins and C. Batlle, "A regulatory framework for an evolving electricity sector: Highlights of the MIT utility of the future study", Economics of Energy & Environmental Policy, vol. 6, no. 1, 2017.

[14]. "Indian Energy Exchange", Iexindia.com, 2017. [Online]. Available: https://www.iexindia.com

[15]. S. K. Parashar, A. K. Bansal, M. P. Sharma, G. Sharma, "Issue Related To an Open Access of Power Mechanism to Distribution Utilities in an Indian Scenario -A Case Study", IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE), vol. 3, pp.21-26, Nov-Dec. 2012.


Mohd.Imran "Open Access: The Multi-Licensee Tool In Emerging Indian Power Sector with Renewable Energy "IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE) 13.3 (2018): 34-40.