# ENERGY FOR ALL®

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## TILA INTERNATIONAL ENERGY CONFERENCE, 2018


Organized by
Dr. Gopal Energy Foundation®

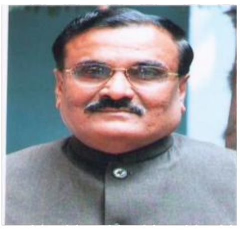
CONVENER
**Sh. Raj Singh Niranjan**
Advocate - Supreme Court & Appellate Tribunal of Electricity,
Legal Adviser, International Solar Alliance.


Subros

## ORGANIZING COMMITTEE, INTERNATIONAL ENERGY CONFERENCE

**Mr. Raj Singh Niranjan**
Convener
3rd TILA International Energy Conference 2018
Counsel for Govt. of India-Supreme Court

**Dr. Rajni Patel**
Co-Convener
3rd TILA International Energy Conference 2018



**Dr. Vijay Singh, IAS (Retired)**
Co-Convener
3rd TILA International Energy Conference 2018

- **Dr. (Col.) S.N. Katiyar, Co-Convener [Across India]**
  Coordinator –Govt. of India & State Government
- **Ms. Anjali Chauhan Co-Convener [Mumbai]**
  Coordinator –Petroleum & Energy Gas
- **Mr. Myron Yeo, Co-Convener[ Singapore]**
  Director of woods and prints
- **Mr. Sibongakonke Dawn Keswa(South Africa)**
  Youth Influencer & Motivational Speaker, Johansburg
- **Mr. Nusrat Malik Munir (Mauritious)**
  Founder/Director, Regenesis Ltd.
- **Charlie Martial NGOUNOU (Uaounde, Cameroon)**
  Founder, XUXXEX Group Consulting (ltd)
- **Mr. Eligbelo Begakoma Felix, Co-Convener [Kinshasa, Kongo]**
  CEO Administrative, Gerant, Fonderie Durable DU Kongo
- **Sh. Subrahmanyam Pulipaka, Co- Convener**
  Co-Founder & CEO, Soreva
- **Sh. Himanshu Pathak, Co-Convener [Bhopal]**
  Coordinator – New & Renewable Energy
- **Sh. Ashok Aneja, Director (Co-Convener)**
  Director (Accounts & Finance)
- **Sh. Ramesh Tiwari,** Secretary General Dr.Gopal Energy Foundation and Secretary to the Organising Committee.

DR. GOPAL ENERGY FOUNDATION
Energy For All! ऊर्जा सबके लिए!

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Jasola District Center, New Delhi-110025, INDIA
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Ref No. D-GEF/A/63A

**ABOUT D-GEF**

- Dr. Gopal Energy Foundation (D-GEF) is a non-profit premier organization enabling energy Revolution by serving the International Community in the disciplines of power, Petroleum, Gas, Coal, Nuclear and Renewable Energy Sector, with motto of "Energy for all" founded on 15th April 2015 with its corporate office at New Delhi, INDIA.

**D-GEF INITIATIVES**

**International Conference on Energy (ICE)**

- International Conference on Energy (ICE) is a flagship, annual event of D-GEF. The Energy conference organized by D-GEF on its foundation day (15th April) was attended by 500 plus delegates from across the world.

**Skill Development & Capacity Development in Energy Regulations**

- **Electricity Laws- Online Certificate Course** – D-GEF Certificate Courses on Electricity Laws is highly recommended for Law/Management/Engineering Students, Professionals (Lawyers/CA/CS), Professors, Experts Managers/Engineers who are working in Energy PSU's and Private Energy Companies or anyone who wants to excel in Electricity Laws. This course is primarily based on Electricity Act – 2003.
- Certificate course on Energy Arbitration, Environment Laws, Contract Management in Energy Sector, Solar Policy & Law in India, Petroleum Laws, Coal Laws, Nuclear Energy Laws shall be shortly started.

**D-GEF Services to Energy Companies for doing business in India & CSR for Energy Companies**

- D-GEF is your partner in all stages of business development , from formulating entry strategies to setting up local offices and communicating your expansion to core markets. Services at a glance are (1) Business Partner Search (2) Market Research (3) Credit Checks (4) Investment in India (5) Recruitment Services (6) PAN Card application & support for Tax returns (7) GST application and support for returns (8) Business Delegation Services (9) B2B Match making services (10)Corporate & Cultural Events (11) Special business events in India and abroad (12) media and Public relations (13) value added services such as Legal Services, Translation services , Marketing & Advertising, trade fair services , Visas, Clean technologies, environment, renewable energies, CSR, Senior Expert Services, Publications, Training.
- A data base of Independent directors/Women Directors with expertise in Energy sector to enable energy companies to appoint Independent/Women Director in compliance of companies Act – 2013.
- D-GEF is willing to take over the CSR activities of Energy Companies for better monitoring & implementation of projects.

**TILA Energy Moot Court Competition**

- It is proposed to organize Energy Moot Court Competition every year on 2nd October to bring in awareness about Energy Laws amongst the Law candidates across the World.

**Training/Workshop for capacity building in Energy Sector**

- In house Training/Workshop in the corporate office/on site is provided by expert faculty.
- Many customized courses are conducted for capacity building

**Publications of Technical Documents & Journal**

- **"*Energy for all!*"** ® ISBN Registered, conference book is published annually containing articles & research papers from Leading Experts, faculty and researchers from premier Management / Law and Engineering Institutions like IITs/National Law Schools/IIMs etc.
- **Conference outcome book** is published every year recommending reforms in Energy Sector to achieve the goal of Energy for all.
- **Guide to Electricity Laws in India** authored by Sh. Raj Singh Niranjan, Energy Law Expert is available through D-GEF.
- **Energy Law Journal (ELJ)** containing all Acts/Rules/Regulations/important notifications and
- **Energy Law Reporter (ELR)** containing all judgments of SERC/JERC/CERC/APTEL/Sec 125 Appeal in Supreme Court is proposed to be published.

**International Energy Arbitration Centre (IEAC) New Delhi**

- IEAC, New Delhi aims to become world largest Institutional Arbitration Centre for energy companies.
- Negotiation, Mediation, Conciliation, & Arbitration facility is provided through experts in energy sector.

*For more information, visit www.dgef.in*
*Look forward to hearing from you.*


| | | | |
|---|---|---|---|
| Sh. Raj Singh Niranjan, Convener 9810070075 rsn@tlaindia.org | Dr. Rajni Patel, Co-Convener 9818043057 rajni@tlaindia.org | Dr. Vijay Singh, President Ex- IAS, Former Commissioner & Principal Secretary info@tlaindia.org | Sh. R.K.Tiwary Secretary General 08860635075 secretary@tlaindia.org |

# ENERGY FOR ALL

3rd TILA INTERNATIONAL ENERGY
CONFERENCE, 2018

सत्यमेव जयते

**Government of Tripura**

**Convener**
Mr. Raj Singh Niranjan
Energy Law Expert

**Knowledge Partner**
**Trans India Law Associates**
Advocates and Legal Consultants

Organized by
**Dr. Gopal Energy Foundation**
D-GEF Secretariat, JA-120, DLF Tower- A,
Jasola District Centre,
NEW DELHI-110025

Government of Tripura

# TICE 3

## TILA INTERNATIONAL ENERGY CONFERENCE 2018

Venue – Silver Oak, India Habitat Centre, New Delhi-110 003, INDIA
Date –Monday, 16th April 2018
Time 8.30 Hrs to 16.30 Hrs

Tentative/Invited /Confirmed

## ***CONFERENCE AGENDA***

**Theme- "Energy Revolution in India"-The way forward**

**08:30 hr. 09:30Registration**

| | |
|---|---|
| **09:30-10:30 hrs.** | **Inaugural Session** |
| Session I<br>Government/ Policy Makers Speak &Inaugral Session | Inaugration by Chief Guest, of art Exhibition of paintings by Children on Energy Conservation under the direction/Mentoring of Dr. AmritKapoor, PhD Arts.<br><br>Presenting of Bouquet to the Hon'ble Chief Guest/s & Lighting of lamp.<br><br>National Anthem |
| **Welcome Address& Annual Report of Dr. Gopal Energy Foundation** | **Sh.Raj Singh Niranjan,**<br><br>Convener, TILA International Energy Conference, 2018<br><br>• *Release of Conference book/Knowledge Papers "Energy for all"®*<br>• *Award to Meritorious Candidates of* ***Electricity Laws-online Certificate*** |

***Course.***

- *Release of Brochure of* ***TICE IV 2019 to be held on 15th April 2019 at New Delhi.***

| | |
|---|---|
| **Key note address by Guest of Honour** | **Sh. K.S. Popli**<br>Chairman & Managing Director,<br>Indian Renewable Energy Development Agency Ltd. |
| **Key note address by Guest of Honour** | **Prof. Sofia Oliveira Pais**<br>Professor, Portuguese Catholic University Europe |
| **Key note address by Guest of Honour** | **Mr. Pranav Mehta,**<br>Chairman- Elect, Global Solar Council and Founder Chairman, NSEFI |
| **Key note address by Guest of Honour** | **Mr. Charlie Martial NGOUNOU**<br>(Uaounde, Cameroon)<br>Founder, XUXXEX Group Consulting (ltd) |
| **Address by Guest of Honour** | **Sh. Ismail Ali Khan**<br>Chairperson,<br>Telangana State Electricity Regulatory Commission |
| **Address by Chairperson of the Conference** | **Sh. Suresh Kumar Agarwal**<br>Chairperson,<br>Uttar Pradesh Electricity Regulatory Commission |
| **Address by President of the Conference** | **Sh. Subhash Kumar**<br>Chairperson,<br>Uttarakhand Electricity Regulatory Commission |
| **Address by Chief Guest** | **Sh. UpendraTripathy,**<br>H.E. Director General,<br>International Solar Alliance (ISA) |
| **Special Address by** | **Justice Surendra Kumar,**<br>Former Member,<br>Appellate Tribunal of Electricity(APTEL) |

**10:30- 11:00 hrsNetworking Tea Break**

| | |
|---|---|
| **11:00 – 13:00 hrs** | **International Initiatives For Energy Revolution:** |
| **Session – A ( Sub-Theme)** | Way forward to mobilize & utilize US $1000 BILLION through ISA for investment & deployment of Solar Energy across the world. |

*__Objective__: With the advent of international emphasis on clean energy oriented generation growth, this panel will outline what it takes to provide the last mile energy access in a sustainable and cost effective manner. Consisting of people from international, bilateral and multilateral organizations this panel helps us decoding the flow of resources into their initiatives.*

***Discussion**:*

1. *What's the path for attaining energy sustainability and completely eradicating energy poverty?*
2. *Role of multilateral organizations like ISA, IRENA, IEA in this process?*
3. *India's leadership at ISA, how mutually beneficial it is to the developing countries?*
4. *What's the way forward to mobilize resources and funds for this energy revolution?*
5. *How can private sector companies involve, contribute or be engaged in the dialogue?*

**Panelists/Speakers**

**Mr. Pranav Mehta,**
Chairman- Elect, Global Solar Council and Founder Chairman, NSEFI

**Ms. Anjuli Chandra**
Hon'ble member of Punjab Electricity Commission

**Prof. Sofia Oliveira Pais**
Professor, Portuguese Catholic University Europe (Paper Presenter)

**Prof. B. K.Choudhury** Phd IIT
Fellow IEI & AEI Professer , Depatment of Energy Management **,**Secretary -Energy Club, IISWBM (Paper presenter)

**Dr. Arun Kumar Tripathy**
Director Genral
National Institute of Solar Energy

**Sh. Ashish Swaroop**
Chief Operating Officer
Skeiron Renewable Ltd,
Pune

**Sh. Pedro Ivo Ferraz Da Silva,**
Head of the Energy, Environment and

| | | |
|---|---|---|
| | | Science& Technology Section, Embassy of Brazil inNew Delhi<br><br>**Shri Aishwarya Kachhal**<br>Co-Chair,<br>Harvard Business Alumni Angel Limited.<br><br>**Sh. Leon Toh**<br>Director<br>Damson Group (Singapore)<br><br>*Interaction with Delegates / Question Answer session* |
| **13:00- 13:30 hrs** | **Lunch Break** | |
| **13:30-15:00 hrs.** | | **<u>National Initiatives for Energy Revolution:</u>** |
| **Session - B(Sub-Theme)** | | *Challenges for the scheme PradhanMantriSahajBijliHarGharYojna "Saubhagya". Encouraging Green Energy (Solar/Wind/Bio Mass/Biogas) for Agri-Business/Food Parks/Cold Storage.*<br><br>***Objective:*** *India is leading the 21st Century's energy revolution, However, there are unaddressed issues in Indian energy scenario which hamper this progress of energy sustainability. With new initiatives like SAUBHAGYA, solar rooftop subsidy, this panel will drive into the key elements that contribute to the growth and effective implementation of such programs in Indian RE sector*<br>*****In Smart City projects / or in metros : Need to have solar rooftop buses : How to build it/ take it forward***<br>****** What is intelligent solar power lights ? how to take it forward in smart cities***<br><br>***Discussion:***<br>*1. What is the way ahead for achieving 175 GW RE target?*<br>*2. Can last mile connectivity with RE integration be implemented effectively?*<br>*3. How to overcome the existing challenges of quality infrastructure?*<br>*4. How can an integrated Solar/Wind/Bio-fuel grid cater to the existing needs?* |

| | |
|---|---|
| **Panelists/ Speakers** | **Sh. Dharmendra Gangwar**<br>Additional secretary, Ministry of food processing industry govt. of India**.**<br><br>**Sh. A. K. Das**<br>Hon'ble member of Odisha Electricity Regulatory Commission<br><br>**Sh. R.K. Choudhary**<br>Hon'ble member of Bihar Electricity Regulatory Commission<br><br>**Sh. P. K Aggarwal,**<br>Director (Market & Operations), POSOCO.<br><br>**Shri Agrim Kaushal,**<br>Economic Advisor & CVO<br>Ministry of New & Renewal Energy, Govt. of India.<br><br>*Interaction with Delegates /Question AnswerSession* |
| **15:00-15:40 hrs.**<br>**Session - C(Sub-Theme)** | **State Initiatives for Energy Revolution:**<br>*Strategy for Encouraging massive investment in 'Waste to energy' & Bio- Mass Energy.*<br><br>**Objective:** Since electricity is a concurrent matter, the involvement and contribution of state governments will be a critical element for the successful proliferation of Renewable energy sources.When we emphasize of last mile connectivity, it becomes equally important that these state nodal agencies be involved in the distribution process. This panel will discuss on the plan of action from the State Nodal Agencies for their state own targets and insights from their experience on what are the bottlenecks for implementation.<br>** **Small waste to energy plants at various locations within city ?** Any case studies ? How to take it forward<br>** **Waste to fertiliser :** wet waste at wards level . How feasible ?<br>**Waste segregation at source .** |
| **Panelists/Speakers** | **Sh. A.B. Agarwal**<br>Former Chairman, Bhakra Beas<br><br>**Sh. P. Uday Kumar,**<br>Director, NSIC |

**Sh. Rakesh Kumar**
Sr. Consultant, International Solar Alliance
Former Director, Solar Energy Corporation OfIndia (SECI)

**Sh Rajesh Kumar Mediratta**
Director (Business Development)
Indian Energy Exchange (IEX)

**Sh. Rajiv Agarwal**,
Secretary,
Indian Captive Power Producers Association

**Sh. Amit Singh**
Associate Head, Dept. of Banking and International Law, University of Petroleum and Energy Studies (UPES)

**Sh. LalitAmbastha**
Managing Partner
Patent Wire

**Shri Akshat Sinha**
Alliance School of Law, Bangaluru, Karnataka, (Paper Presenter)

**Valedictory Address & Presentation of Awards to Team organizing Team**

**Dr. Vijay Singh, IAS (Retd),**
Former Principal Secretary ,
Govt. of Madhya Pradesh.

**Sh. G.P.Patel,**
Director, CBIP,
Former ExecutiveDirector, NHPC Ltd
Former CMD of UJVNL Govt. of Uttarakhand
& CED of NHDC Ltd

**Sh. S.P. Singh**
OSD, Member, Railway (Traction)
Ministry of Railways

**Concluding Remark/ Conference wrap up / Vote of Thanks**

**Mr. Ashok Aneja, Partner (Banking& Finance), Trans India Law Associates**

Announcement of venue/theme and date of Next Conference.

* Invited and Confirmed Speakers/ Panelist

**16:00 -16:30 hrs. Networking Tea**

## ORGANIZING COMMITTEE, INTERNATIONAL ENERGY CONFERENCE

1. **Sh.Raj Singh Niranjan, Convener @9810070075, rsn@tlaindia.org**
   Coordinator – Power
2. **Dr.(Ms.) Rajni Patel, Co- Convener [New Delhi]**
   Coordinator – Conference Administration
3. **Dr. Vijay Singh IAS (R), Co-Convener [Across India]**
   Coordinator – Public Sector Undertaking
4. **Dr (Col.) S.N.Katiyar, Co-Convener [Across India]**
   Coordinator –Govt. of India & State Government
5. **Ms. Anjali Chauhan Co-Convener [Mumbai]**
   Coordinator –Petroleum & Energy Gas
6. **Mr. Myron Yeo, Co-Convener[ Singapore]**
   Director of woods and prints
7. **Mr. Sibongakonke Dawn Keswa(South Africa)**
   Youth Influencer & Motivational Speaker, Johansburg
8. **Nusrat Malik Munir (Mauritious)**
   Founder/Director, Regenesis Ltd.
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   Founder, XUXXEX Group Consulting (ltd)
10. **Mr. EligbeloBegakoma Felix, Co-Convener [Kinshasa, Kongo]**
   CEO Administrative, Gerant, Fonderie Durable DU Kongo
11. **Sh. SubrahmanyamPulipaka, Co- Convener**
   Co-Founder & CEO, Soreva
12. **Sh. HimanshuPathak, Co-Convener [Bhopal]**
   Coordinator – New & Renewable Energy
13. **Sh. Ashok Aneja, Director (Co-Convener)**
   Director (Banking& Finance), Trans India Law Associates
14. **Sh.RameshTiwari,**SecretaryGeneral, Dr.Gopal Energy Foundation and Secretary to the Organising Committee.
   Mobile No. 08860635075, secretary@tlaindia.org

**Master of Ceremony**

| **SESSION** | **MASTER OF CEREMONY** |
|---|---|
| Inaugral Session | Mr. Subramanyam, Soreva |
| Theme A- | Shashank Shekhar Rai, Principal Associate, TILA, ISA Project |
| Theme B- | CS KirtiDureja |
| Theme C- | Sh Arafat Siddqui Sr. Associate, TILA, Anantpur/ Hyderabad Office |
| Veledictory Session , Appriciation of the Team and Vote of Thanks | Mr. Ashok Aneja, Director (Banking and Finance) |

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**ENERGY DELEGATES AT TILA INTERNATIONAL ENERGY CONFERENCE 2018**

**Dear Professional Colleagues**

We thank you for your support and Best Wishes for the International Conference 2018. As desired, we are glad to share with you the first list of Confirmed/Invited Delegates.

**LIST OF DELEGATES 3RD TILA INTERNATIONAL ENERGY CONFERNCE 2018**

1. Sh. Amrik Singh, Chief Engineer (Electrical), **CVPP, Jammu & Kashmir**
2. Sh. Rajesh Ojha, Sr. Manager (Civil), **CVPP, Jammu & Kashmir**
3. Sh. Chandrakant Mani, Dy. Manager (Civil), **CVPP, Jammu & Kashmir**
4. Sh. Prashant Singh, Engg. (EE), **RITES Limited (Railway Energy Management Company Limited)**
5. Sh. R.N.Sinde, GM(EE) WR, **Airport Authority of India**
6. Sh. K.B.Dhamale, DGM (EE)SR, **Airport Authority of India**
7. Sh. Prem Prasad, **Airport Authority of India**
8. Sh. M.P.Tiwari, **Airport Authority of India**
9. Sh. Atul Shrinet, Engg. (EE), **RITES Limited (Railway Energy Management Company Limited)**
10. Sh. Vipul Rathi, Manager (Civil), **NHDC Limited**
11. Sh. Ashwani Sood, DGM**, Himachal Pradesh Power Corporation Limited (HPPCL)**
12. Sh. Stian Jonsgard, Dirc. of Investment, **Damson Capital, Singapore**
13. Sh. C.S. Mandal, **Engineers India Ltd.**
14. Ms. Mamta Mandal, Legal Head **Engineers & Country Head, India.**
15. Prof. Tara Prasad Sapkota, Dean, **Tribhuvan University, Nepan**
16. Sh. Bargav Ravisankar, Manager, **Rightfocus Advisory Private Limited**
17. Sh. Stenneth Numol, First Secretary, **Papua New Guinea High Commission**
18. Sh. Marcus Lim, Co-Founder & Managing Director, **Ecosoftt**, **Singapore**
19. Sh. Vijay Barthwal, Consultant, **Energy Cost Optimixation**
20. Sh. Abhishek Kumar, Legal Counsel, **Huawei Telecommunications (India) Company Private Limited**
21. Justice Surendra Kumar, Former Judicial Member, **Appellate Tribunal For Electricity**
22. Sh. Atul K. Gangwar (CEO), **Sway Techno Solutions Private Limited**
23. Sh. PRABHAT Verma, DGM-Marketing & Sales, Power Service Division, **Doosan Power Systems India Pvt Ltd.**
24. Mr. Manu Bishnoi, Director, **JLTM Energy India Pvt. Ltd.**
25. Mr. Nitin Mittal, Founder & CEO, **Climate Care**

26. Mr. D.K. Bajaj, Director, **D M Systems Pvt. Ltd**
27. Ms. Manu Goel, Director, **Novarch**
28. Mr. Nishant Goel, Director, **Novarch**
29. Ms. Francesca Datola, Second Secretary, **Embassy of Italy**
30. Mr. Milan Dostal, commercial Economic Counselor, **Embassy of the Czech**
31. John Martin Thomas, **Talesun Solar Switzerland**
32. Sh R. K. Choudhary, Hon'ble member, **Bihar Electricity Regulatory Commission**
33. Sh A. K. Das, Hon'ble member, **Odisha Electricity Regulatory Commission**
34. Sh. K. S. Popli, Chairman & Managing Director, **Indian Renewable Energy Development Agency Ltd.**
35. Sh. Ismail Ali Khan, Chairperson, **Telangana State Electricity Regulatory Commission**
36. Sh. Suresh Kumar Agarwal, Chairperson, **Uttar Pradesh Electricity Regulatory Commission**
37. Sh. Pradeep Kumar Pujari, Chair Person, **CERC,Ministry Of Power**
38. Sh. Upendra Tripathy, H.E. Director General, **International Solar Alliance**.
39. Ms. Sofia Oliveira Pais, Professor EU University, **Portugal**
40. Sh. Rakesh Kumar, Sr. Consultant**, International Solar Alliance** , Former Director, **Solar Energy Corporation of India (SECI)**
41. Sh. Pedro Ivo Ferraz Da Silva, Head of the Energy, Environment and Science & Technology Section, **Embassy of Brazil in New Delhi**
42. Ms. Mahua Mukherjee, Programme Ambassador, **Interntional Solar Alliance**
43. Sh. Pranav Mehta, Chairman- Elect,**Global Solar Council, Washington, D.C.**
44. Sh. P. Uday Kumar, Director, **National Small Industries Corporation,**
45. Sh. Dharmendra Gangwar, Additional secretary, **Ministry of food Processing Industry Govt. of India.**
46. Sh. Rajeev Sharma, CMD, **Power FinanceCorporation of India**
47. Sh. Ashok Haldia, MD and CEO, **PTC India Financial Services.**
48. Sh. Ashish Swaroop, Chief Operating Officer, **Skeiron Renewable Ltd**, **Pune**
49. Sh. P. K Aggarwal, Director (Market & Operations), **POSOCO.**
50. Sh. Charlie Martial NGOUNOU, (Uaounde, **Cameroon, Africa)** , Founder, XUXXEX Group Consulting (ltd)
51. Sh. Nic U. Iqbal, **Nippon I-Clean Solutions Pvt. Ltd.**
52. Sh. Leon Toh, Director, **Damson Group (Singapore)**
53. Sh. Lalit Ambastha, Owner, **Patent Wire**
54. Sh Rajesh Kumar Mediratta, Director (Business Development), **Indian Energy Exchange (IEX)**
55. Sh. Amit Singh, Associate Head, **Dept. of Banking and International Law, University of Petroleum and Energy Studies (UPES)**

56. Prof. Binoy Choudhary, Department of Energy Management Assistant Director - AEE & Secretary -Energy Club, **IISWBM, Kolkata**
57. Sh. A.B. Agarwal, Former Chairman, **Bhakra Beas Management Board (BBMB)**
58. Sh. Rajiv Agarwal, Secretary, **Indian Captive Power Producers Association**
59. Sh. Vijay Kumar Chadalavada, Managing Director, **SWAN Environmental Pvt. Ltd., Hyderabad**
60. Sh. Raghav Chauhan, School of Law, **Galgotias University, Greater Noida**
61. Ms. Swati Vishan, School of Law, **Galgotias University, Greater Noida**
62. Sh. Rajiv Kumar Jha, School of Law, **Galgotias University, Greater Noida**
63. Ms. Pushti Dublish, School of Law, **Galgotias University, Greater Noida**
64. Ms. Archana Upadhyay, School of Law, **Galgotias University, Greater Noida**
65. Ms. Soniya Kumari,
66. Sh. Mohim Roy, School of Law, **Galgotias University, Greater Noida**
67. Sh. Bushra Malik, School of Law, **Galgotias University, Greater Noida**
68. Sh. Gurkirat Singh, School of Law, **Galgotias University, Greater Noida**
69. Sh. Gyaneshwar Singh, **Pusa Institute of Technology**
70. Sh. Harsh Jain, **Amity University**
71. Sh. Ansul Varma, **Banasthali Vidyapith, Rajasthan**
72. Ms. Vatshala Bhushan, **Banasthali Vidyapith, Rajasthan**
73. Ms. Khyati, **Banasthali Vidyapith, Rajasthan**
74. Ms. Disha Litauriya, **Banasthali Vidyapith, Rajasthan**
75. Ms. Aditi Prasad, **Banasthali Vidyapith, Rajasthan**
76. Ms. Rashmi Singh Rana,HOD, **Banasthali Vidyapith, Rajasthan**
77. Sh. S. Gopalakrishnan,Placement Officer, **Banasthali Vidyapith, Rajasthan**
78. Sh. Priyanshu Kumar, Sr. Manager, Business Development, **InfralineEnergy**
79. Sh. Parth Chaudhary, Associate, Business Development, **InfralineEnergy**
80. Sh. Krishnandan Kumar Singh, Sr. Analyst, Renewal Energy, **InfralineEnergy**
81. Dr. S. C. Sharma, Advisor, Renewal Energy, **InfralineEnergy**
82. Sh. Atul Gupta, AVP-Finance, **Jakson Ltd.**
83. Sh. Rajiv Rautary, **Jakson Ltd.**
84. Sh. Dhruva Ballal, **CII**
85. Sh. Jayant Parival, **Adani Group, Ahmedabad, Gujarat**
86. Sh. Barun Kumar, **IISWBM, West Bengal**
87. Dr. Rahul Walawalkar, **CES Ltd.**
88. Sh. K. Umamaheshwaran, **Ecotechenergy**
89. Sh. Raghav Agarwal, **Rotosol Solar**

90. Sh. Aman Pal Singh,Professor**, Guru Gobin Singh University**
91. Sh. Jon R. Larson, Economic Officer, **U.S. Consulate Ho Chi Minh City**
92. Sh. Kanti Prasad, Director, **Mount Him Integrated Projects & Services Pvt. Ltd.**
93. Sh. Gaurav Kumar Arora, General Counsel & Company Secretary, **Huawei Telecommunication Pvt. Ltd**
94. Ms. Ritu Singh, Vice President, **International Business Premier Solar Systems Pvt. Ltd.**
95. Sh. Tanmay Pawale, Project Manager, **Arcor India Energy Systems Pvt. Ltd., Turkey**
96. Sh. V P Pandey, Consumer Grievance Redressal Forum, **TATA Power**
97. Dr. Priyanka Singh, **Amity Unversity**
98. Ms. Uma Mishra, Legal Head, **Vulcan Express Pvt. Ltd.**
99. Sh. Rajeev Grover, **HLS Asia Ltd.**
100. Ms. Anjali Chauhan, Founder, **Maxima Steel, Mumbai**
101. Sh. Rohit Sharma, **North Delhi Power Ltd.**
102. Sh. Rahul Pandey, **National Power Training Institute (NPTI)**
103. Sh. Lamba, **Cebntral Board of Irrigation &Power**
104. Sh. Ashok Haldia, MD, **PTC India Financial Services Ltd.**
105. Sh. Ram Kumar Niranjan, Project Officer, **Uttar Pradesh New & Renewal Energy Development (UPNEDA)**
106. Sh. Kanwar Singh, **SJVN Ltd.**
107. Ms. Sumedha Nidhi, **NSEFI**
108. Sh. Y. K. Jain, **NSEFI**
109. Officer, **Power Finance Corporation Limited**
110. Officer, **Power Finance Corporation Limited**
111. Shri Partha Sen, Finance, **CERC**
112. Dr. Vijay Singh, Patron, Ex-IAS, President, **Dr. Gopal Energy Foundation**
113. Sh. O. P. Trikha, Ex- Executive Director, **Steel Authority of India Ltd.**
114. Sh. Ashish Garg, COO, **Adani Group, Ahmedabad.**
115. Sh. Ashish Swaroop, COO, **Skeiron Renewal Energy Pvt. Ltd.**
116. Sh. Anoop Khatry, Legal Head, **Suzlon Energy Ltd.**
117. Sh. Dilip Kumar Patel, General Manager, **Suzlon Wind Energy Ltd.**
118. Sh. Deepak Tibrewal, Company Secretary, **Artson Engineering Limited**
119. Sh. Brajesh Anand, Chief Counsel, India Legal & Compliance, **Andritz India Pvt. Ltd., Austria**
120. Sh. Nitin Kapoor, Managing Director, **Elyzium Technologies Pvt. Ltd.**
121. Sh. Devansh Jain, Director, **Inox Wind Energizing INDIA**
122. Sh. Pardeep Agarwal, **Australia**
123. Ms. Amaya Singh, Partner, **Lex Orbis**
124. Sh. D. K. Jain, General Manager, Encharge NRLDC), **POSOCO**
125. Sh. P.K. Agarwal, Director (Marketing & Operations), **POSOCO**
126. Sh. Arvind Kumar Mishra, **Mangdechhu Hydro-Electric Project , Bhutan**

127. Sh. Shubash kumar , Chairperson, **Uttarakhand Electricity Regulatory Commission**
128. Mr. Aiora, Trade Advisor, **Embassy of Spain**
129. Sh. Vijay Khera, **HLS Asia**
130. Sh. S Saheb Rahman, **ICRA India**
131. Sh. Durgesh Jaiswal, **ICRA Online**
132. Sh. Vimal Kishore,**Head- Legal, Compliance & Company Secretary, Liberty General Insurance Limited**
133. Sh. Ashish Lakhtakia, Legal Department, **Reliance Nippon Life Insurance Co. Ltd.**
134. Sh. Anhsul Vyas, Deputy. Gen. Manager (legal), Reliance Mutual fund, **Reliance Nippon Life Asset Management Limited**
135. Sh. Ajit Gupta, Managing Director, **Rapid Engineering Co. Pvt. Ltd.**
136. Sh. Manish Vij, Chief Executive Officer, **Smile Vun Group**
137. Ms. Linda Hawke, Publisher, **Diplomatist Magazine**
138. Ms. Kanchi Batra, Business Editor, **Diplomatist Magazine**
139. Sh. Kartikeya Narain Sharma, Head - Growth & Strategy, **Sunsure Energy Pvt. Ltd.**
140. Sh. Kartikeya Narain Sharma, Head - Growth & Strategy, **Sunsure Energy Pvt. Ltd.**
141. Sh. Rajiv Kulshreshtha, **Sunsure Energy Pvt. Ltd.**
142. Sh. Gaurav Chandra, Manager Social Innovations and partnerships, **Hindustan Ecosoftt Pvt. Ltd.**
143. Sh. Piyush Asija, Company Secretary & Sr. Manager Legal, **TCNS Clothing**
144. Sh. D. K. Bajaj, Cyber Security, **D M Systems Pvt. Ltd.**
145. Sh. Shshil Sharma, Computer Spares, **Parts Baba**
146. Ms. Meenal Malhotra, Sports Gym-wear, **Level International**
147. Sh. Sunil Mehra, Women's Wear, **Campari Exports Pvt. Ltd.**
148. Sh. Sushil Kapoor, Security Manpower, **Elyzium Securitech Pvt. Ltd.**
149. Sh. Nitin hans, Office Furniture, **Classy Furniture**
150. Sh. Vasudev Gupta, Metal Fabricators, **B.A. Fabricators & Engineers Pvt. Ltd.**
151. Sh. Anshul Garg, CCTV, **Thinking Technologies**
152. Sh. Gurvir Singh, PVC Panels, **Top Exports**
153. Sh. Alok Bansal, Commercial Interiors, **SPAN Furnishers Pvt. Ltd.**
154. Sh. Gagan Sood, Fire Safety, **Tech Tree Inc**
155. Sh. Rajeev Gupta, Modular Kitchen, **Tanya Construction & Interior Pvt. Ltd.**
156. Sh. Vidur Aggarwal,n OOffcer Printer, **Vee Kay Industries**
157. Sh. Karan Verma, Investment Banking, **Faad Network Pvt. Ltd.**
158. Ms. Kirti Dureja, Compnay Secretary, **Kirti Dureja & Co.**
159. Sh. Sachin Sinha, Chartered Accountant, **Prakash Sachin & Co.**
160. Sh. Vivek Sharma, Product Certification, **Alps consultants**
161. Sh. Saurabh Karan Dev Singh, **Civil Litigation Lawyer**
162. Ms. Rashi Sinha, Corporate Trainer, **The Yellow Car Company**
163. Sh. Anil Sharma, Physiotherapist, **The Physicare**

164. Sh. Amitesh Singh, Corporate Gifts, **Bharat Advertisers**
165. Sh. Bharat Sheth, General Insurance, **B.A. Associates**
166. Sh. Neeru Kaushik, Travel Inbound**, Visit India Tours**
167. Sh. Amita Sood, Frozen Desserts, **Letz Roll**
168. Sh. Tarun Jain, Jeweller, **Tarun Jain Fine Jeweller**
169. Ms. Vrinda Arora, Graphics Design, **Paper Town**
170. Sh. Dushyant Rastori, Advocate & Patent Authority, **R.K. Dewan & Co.**
171. Sh. G. Prem Kumar, DGM- Land, **Suzlon Energy Ltd.**
172. Sh. Jaya Prakash, Sr. General Manager, **Suzlon Energy Ltd.**
173. Sh. V. K. Narula, Senior AGM, **Air India.**
174. Sh. Rakesh Seth, Director, **International Consultaning Professionals' Insitutute.**
175. Sh. Shaikh Jeelani, Legal Manger, **Suzlon Gujarat Wind Park Ltd.**
176. Sh. Devanshu Gupta, **Advocate**
177. Ms. Shrithi Bali, **Amity University**
178. Dr (Col.) S.N.Katiyar, Co-Convener [Across India], **Coordinator –Govt. of India & State Government**
179. Ms. Anjali Chauhan Co-Convener **Coordinator –Petroleum & Energy Gas, [Mumbai]**
180. Mr. Myron Yeo, Co-Convener **Director of woods and prints, [Singapore]**
181. Mr. Sibongakonke Dawn Keswa(South Africa), **Youth Influencer & Motivational Speaker, Johansburg**
182. Nusrat Malik Munir (Mauritious), Founder/Director, **Regenesis Ltd.**
183. Mr. Eligbelo Begakoma Felix, Co-Convener [Kinshasa, **Kongo**], CEO Administrative, Gerant, **Fonderie Durable DU, Kong**
184. Sh. Subrahmanyam Pulipaka, Co- Convener, Co-Founder & CEO, **Soreva**
185. Sh. Himanshu Pathak, Co-Convener, Coordinator – New & Renewable Energy, **Bhopal**
186. Sh. Ashok Aneja, Director (Co-Convener), Director (Banking& Finance), **Dr. Gopal Energy Foundation**

# *TABLE OF CONTENTS*

***I- TENTATIVE CONCLAVE AGENDA***

***II-CONFIRMED/ INVITED DELEGATES***

# PART - A

# MESSAGES

“May the Sun bring you new energy by day,

May the moon softly restore you by night,

May the rain wash away your worries,

May the breeze blow new strength into your being,

May you walk gently through the world and know its beauty all the days of your life.”

- Apache Blessing

The Prime Minister
State of Kuwait

رئيس مجلس الوزراء
دولة الكويت

سعادة الدكتور/ راجنى باتيل
رئيس مؤسسة غوبال للطاقة

تحية طيبة وبعد،،،

تلقينا ببالغ الشكر والتقدير رسالتكم الكريمة التى تضمنت دعوتنا للمشاركة في المؤتمر السنوي الثالث للطاقة والمزمع عقده في مدينة نيودلهي بتاريخ 16 أبريل 2018 .

ويسعدنا أن ننتهز هذه الفرصة لنعرب لكم عن تمنياتنا بنجاح فعاليات المؤتمر في تحقيق أهدافه المرجوة منه ، مؤكدين موقف دولة الكويت الداعم لأهداف المؤتمر الذي يحمل عنوان " ثورة الطاقة في الهند " ومشاركتها الفعالة لكم ولدول العالم في تحقيق تلك الأهداف .

نكرر شكرنا املين لكم دوام الصحة والعافية، وللقائمين على المؤتمر التوفيق والسداد وللعلاقات التاريخية الوثيقة بين دولة الكويت وجمهورية الهند الصديقة المزيد من التطور والنماء .

مع أطيب التمنيات ،،،

جابر المبارك الحمد الصباح

رئيس مجلس الوزراء
دولة الكويت

الكويت في : 09 رجب 1439 هـ
الموافق : 26 مارس 2018م

Embassy of the State of Kuwait
New Delhi

سفارة دولة الكويت
نيودلهي

Unofficial Translation

Mrs. Dr. Rajni Patel
President of Dr. Gopal
Energy Foundation

Greetings..

We have received with great appreciation your kind invitation letter to participate in the Third Annual Energy Conference being held in New Delhi on April 16, 2018.

We are pleased to avail of this opportunity to express our best wishes for the success of the events of the Conference to achieve its goal, assuring the State of Kuwait's support to the objectives of the conference entitled: "Energy Revolution in India" and active participation of the countries of the world to achieve those objectives.

We extend once again our thanks to you, wishing you the best for your health and well being and success to the organizers of the conference and further progress and development of the strong historical relations between the State of Kuwait and the friendly Republic of India.

Sheikh Jaber Al-Mubarak Al-Hamad Al-Sabah,
Prime Minister of the State of Kuwait

Tel: (0091- 11) 24100791 / 2 / 3, Fax: (0091- 11) 26873516 - 5-A, SHANTIPATH, CHANAKYAPURI, NEW DELHI - 110021
E-mail: kuwait_new_delhi@mofa.gov.kw

ПАТЕНТНО ВЕДОМСТВО НА РЕПУБЛИКА БЪЛГАРИЯ
Гр. София 1040, бул. „Г. М. Димитров" 52Б, тел.02/ 9701321,
факс – 02/ 8735 258

ПАТЕНТНО ВЕДОМСТВО НА РЕПУБЛИКА БЪЛГАРИЯ
Изх. номер 93-11-129 Дата 13.02.18
BULGARIAN PATENT OFFICE

**DR. RAJNI PATEL**
**PRESIDENT**
**D-GEF**

**Dear Dr. Patel,**

On behalf of the Patent Office of the Republic of Bulgaria (BPO), please accept my respect for your endeavours, devoted to the organization of the 3rd TILA INTERNATIONAL ENERGY CONFERENCE, to be held in April 2018, and your best efforts to summon good ideas from all over the world for the sake of our future and that of our children.

More changes have occurred in the global energy sector in the past decade compared to the 100 years prior. Now, to work for the new technologies and for the future of the clean energy is crucial for the proper development of the energy market worldwide.

I wish you every success in your work and fruitful debates at the conference.

I believe that the new initiatives brought to life at the forum can contribute to the bright and safe future of many people on Earth.

Kind regards,

**Petko Nikolov, PhD**
**President of BPO**

1

अनुप्रिया पटेल
Anupriya Patel

सत्यमेव जयते

स्वास्थ्य एवं परिवार कल्याण राज्य मंत्री
भारत सरकार
MINISTER OF STATE FOR
HEALTH & FAMILY WELFARE
GOVERNMENT OF INDIA

## MESSAGE

I am happy to know that Dr. Gopal Energy Foundation **(D-GEF)** in association with Trans India Law Associates **(TILA)** under the Guidance of Energy Law Expert Shri Raj Singh Niranjan is organizing the **3rd Tila International Energy Conference, 2018** at New Delhi on 16th April, 2018. The conference aims to bring all the stakeholders on a single platform to discuss the existing Government initiatives, policies, cull out innovative ideas, suggest potential measures in wholesome implementation of Government objectives.

As I was told that the theme of the conference is **"Energy Revolution in India".** Obviously, energy for all is fundamental to achieve the universal objective of Sustainable Development. The Government is striving hard in contemplating energy access and ensuring energy security to its people.

I wish success of the **3rd Tila International Energy Conference, 2018.**

**(Anupriya Patel)**

निर्माण भवन, नई दिल्ली-110 011
Nirman Bhavan, New Delh-110 011
कैम्प कार्यालय : भरुहना चौराहा (पुरानी हीरो हौंडा एजेंसी के सामने), मिर्जापुर-231001 (उ.प्र.) फोन 05442-220133
आवासीय कार्यालय : सी-I/16, पंडारा पार्क, नई दिल्ली-110003 फोन: 011-23782610
E-mail:officeanupriyapatel@gmail.com

सत्यमेव जयते

# Vijay Rupani

apro/Jm/2018/02/07/dt

Chief Minister, Gujarat State

Dt. 07/02/2018

## MESSAGE

***"Every act of energy conservation is more than just common sense; I tell you it is an act of patriotism"***

\- ***Jimmy Carter***

The Indian philosophy of practical life has always preached to utilize the natural resources, but never to exploit them for the selfish motives. This is what is happening today for satisfying the blind greed for the development, growth and modernization. Now is the time to wake up and transform our greed to the wisdom.

I am happy to learn that the **Dr. Gopal Energy Foundation** (DGEF) is hosting its **3rd Annual Rolling Conference** with a sharp focus on **"Energy Revolution in India (Urja Kranti)"** at **New Delhi** on **1st April, 2018**. I, hereby, extend my heartiest best wishes to **DGEF** for hosting such an event of vital importance, and also to the participants for a successful event. I am sure the **Souvenir** being published to commemorate the event will be an eye-opener.

**(Vijay Rupani)**

To,
**Dr. Rajnibhai Patel,** *President*,
Dr. Gopal Energy Foundation,
JA-120, DLF Tower-A,
Jasola District Center,
New Delhi-110025.
Email: rajni@tlaindia.org

No.– O – संदेश /CM–1/2018

**Yogi Adityanath**

CHIEF MINISTER
UTTAR PRADESH

Dated : 06-02-2018

## Message

I am happy to know that Dr. Gopal Energy Foundation is organising its 3rd Anuual Rolling Conference on the theme 'Energy Revolution in India' on 16th April, 2018 in New Delhi.

The Government of Uttar Pradesh is committed to providing quality and cheap power for the development of agriculture, industries and all other sectors. To fulfil With this objective it has signed '24x7 Power for All' MOU with Government of India which will fulfil the energy needs of the people. Beside, Our Government is also making serious efforts for facilitating sustainable generation of green and quality power through Renewable and New Energy Sources.

I am confident that the deliberations during the Conference would be beneficial and the event would be successful in achieving its objectives.

My best wishes for the entire endeavour.

**( Yogi Adityanath )**

Lal Bahadur Shastri Bhawan, Lucknow

S.K. Agarwal
Chairman

UPERC

Ref:UPERC:Chairman:006

Dated: 16 FEB, 2018

Dear Dr. Rajni Patel,

I thank you for your letter No. DGEF/B50/10/37 dated 7.2.18 inviting me to the 3rd TILA International Energy Conference. In this letter you have mentioned that a knowledge paper will also be issued on this occasion.

I feel that circulation of the knowledge paper on the occasion of such conferences is very useful and enables the participants to carry useful information with them.

I would like to convey my good wishes for the success of this conference and also for the knowledge paper, which would be of great use for the participants.

With regards,

Yours Sincerely,

( S.K. AGARWAL )

Dr. Rajni Patel,
President D-GEF,
Dr. Gopal Energy Foundation (D-GEF),
D-GEF Secretariat, JA-120,
DLF Tower-A, Jasola District Centre,
New Delhi-110025.

Uttar Pradesh Electricity Regulatory Commission
2nd Floor, Kisan Mandi Bhawan, Vibhuti Khand, Gomti Nagar, Lko. - 226 010 • Tel. : 0522-2720427, Fax : 0522-2720423
e-mail : chairman@uperc.org, Website : www.uperc.org

**ASSOCIATION OF ELECTRONIC INDUSTRIES IN SINGAPORE**
9 Jurong Town Hall Road #03-03, TA Hub, Singapore 609431
Tel: 67761880, Fax: 67760238, Web: www.aeis.org.sg, Email: info@aeis.org.sg

**MESSAGE**

It is a great initiative taken by **Dr. Gopal Energy Foundation** by organizing **TILA International Energy Conference on 16th April 2018**, in New Delhi, INDIA.

I express my warm greetings and heartiest congratulations for the success of this event. The efforts are highly appreciable for enhancing the knowledge and scope in Energy Sector on the theme: **"Energy Revolution In India (Urja Kranti)"**. This will go a long way in encouraging investments in India in the Energy Sector and contribute to Energy Security of the nation.

Ronnie Wong
Chief Operating Officer
**Association of Electronic Industries in Singapore**

**Sh. Raj Singh Niranjan**
Convener
TILA International Energy Conference
TILA Suite, JA-120,
DLF Tower- A, Jasola District Centre,
**NEW DELHI-110025**

GOGLA sends its warm greetings on the occasion of the 3rd **TILA international conference**, organized by the **Dr. Gopal Energy Foundation** on the 16th of April 2018, in New Delhi, India. As the voice of the off-grid solar lighting and electrification sector, GOGLA is honored and delighted to associate with this event, which is recognizing and bringing to the fore the importance of *Energy for All*.

Access to energy and energy security transform lives. It improves health and education, creates jobs and income opportunities and helps consumers save money. It is with this goal in mind that GOGLA supports its members to build sustainable markets, to deliver high-quality and affordable products and services to as many households, businesses and communities as possible.

The TILA conference supports this mission by convening all stakeholders on a single platform, sparking conversation and pushing the discussion forward.

We wish the organizing team and all delegates a successful and fruitful event.

**Viraj Gada**

GOGLA India Regional Representative

Mumbai, India

Ref. No. : DGEF-B50-22-09 5th April, 2018

## *CONVENER'S MESSAGE*

"Electricity is not a matter of life and death.
It's a lot more important than that."

The power sector of a nation heavily influences its economical growth. In the current ongoing energy crisis around the world, the bottleneck in the supply of power keeps growing significantly. Thus, a call for energy revolution is imminent. Our collaborated effort is a necessity to achieve such a revolution. I invite you all to join me in taking these first steps towards a sustainable tomorrow.

'Energy for All' offers the surge needed by a nation to progress, develope and evolve. Today India's maximum population is facing a deficiency in power, ie – Energy Poverty. Realizing this sense of urgency, the Government of India is taking numerous initiatives to improve the electricity facility in India.

Let us all play a crucial part in this war against Energy poverty.

The main theme of The 3rd TILA International Energy Conference 2018 is **"Energy Revolution in India" (Urja Kranti)**

Accordingly, The Conference is carefully divided into four major Sub-themes –

**Theme A – International Initiatives for Energy Revolution** – way forward to mobilize and utilize US $ 1000 BILLION through ISA for investment & deployment of Solar Energy across the world.

**Theme B – National Initiatives for Energy Revolution** – Implementation Challenges for the scheme Pradhan Mantri Sahaj Bijli Har ghar Yojna "Saubhagya". Encouraging Green Energy ( Solar / Wind / Biogas / Bio Mass ) for Agri-Business / Food Parks / Cold Storage.

**Theme C – State Initiatives for Energy Revolution** – Strategy for Encouraging massive investment in " Waste to Energy" and Bio-Mass Energy.

**Theme D – Role and action plan by Regulatory Authorities/ Government / CPSUs / SPUs / Private Sectors / Individuals** – "To provide clean, affordable and quality energy for all".

I am sure this initiative of Trans India Law Associates will go the destined way in curbing the Energy deficiency and stir up the process of Government actions.

I would like to thank you all for sparing your valuable time to be a part of this vital Conference. Your well wishes coupled with your already immense contributions further strengthens our resolve to work for this great nation.

TRANS-INDIA LAW ASSOCIATES Advocates & Legal Consultants NEW DELHI

Raj Singh Niranjan

**(Raj Singh Niranjan)**
Convener
TILA International Energy Conference, 2018
Legal Adviser - International Solar Alliance
rsn@tlaindia.org
9810070075

# PART - B

# International Initiatives for Energy Revolution

"We have a single mission:

To protect and hand on the planet to the next generation"

- Francois Hollande
President of France

# *“EU - India Clean Energy Partnership: The opportunity to exchange views and experiences”*

***Sofia Oliveira Pais***

*Professor of Law (Universidade Católica Portuguesa); Jean Monnet Chair*[1]

## *1.Introduction. Clean energy in a changing world.*

The partnership between EU and India on clean energy is becoming a major issue as the world is going through the most significant energy transformation since industrial revolution. In this new scenario renewable energy is the key to an efficient and sustainable environment. More than 150 countries have developed policies to promote clean energy investment. In this context it is worth highlight the India-EU Partnership on Clean Energy, which was agreed between European leaders and the Prime Minister Modi in 2016. This Partnership has a work program covering priorities areas such as renewable energy, energy efficiency and energy security. Regarding renewable energy, EU aims to improve the share of that energy in the Europe, which should fulfil at least 20% of its total energy needs by 2020. On the other hand, Indian government is also pushing for energy efficiency and renewable energy targets that are quite ambitious but apparently possible.

The aim of this very brief presentation is to point out the main areas for India and the European Union to work together in order to assure clean energy in the future, after recalling briefly the main advantages of renewable energy sources and some difficulties of the EU energy policy.

## *2. Main advantages of renewable energy sources*

Renewable energy sources are usually defined as those energy sources that are automatically replenished. In the EU, the concept of “renewable energy sources” has been defined in several legal acts, namely in the Directive 2009/28/EC on the Promotion of the Use of Energy from Renewable Sources.[2] Article 2 of the Directive explains that “energy from renewable sources’ means energy from renewable non-fossil sources, namely wind, solar, aerothermal,

[1]Paper presented at the 3rd TILA International Energy Conference, 16.4.2018, New Delhi.

[2]JO L 140/16, 5.6.2009.

geothermal, hydrothermal and ocean energy, hydropower, biomass, landfill gas, sewage treatment plant gas and biogases".

There are many benefits of renewable energy use and they revolve around the fact that they are : (1) environmentally friendly; they are safe and clean to use when compared to fossil fuels; (2) they are sustainable, promoting independence from forms of energy non renewable; in other words, they allow independence from countries that control price and availability of non renewable energy sources; (3) they can be cheap sources of energy and can be stored with low operating cost; it is expected that the price of renewable energies will continue to go down with technology improvements; (4) they can increase energy efficiency, namely if they are part of daily life(for instance solar panels can be placed on the roof of a family home), and promote decentralization (in fact, the EU Directive highlights that decentralisation has many advantages as the utilisation of local energy sources, increasing the local security of energy supply, diminishing transport distances and reducing energy transmission losses, as well as creating local jobs)[3].

There are, however, also some minor disadvantages of renewable energy sources, namely: (1) they might involve high initial cost and not every form of renewable energy is commercially viable; in fact, renewables often require subsidies to make them affordable, which can conflict with other public policies, like competition goals; (2) they are not suitable for all climates; (3) they might be difficult to transport or store and are not always the most efficient energy source (for instance, coal may offer more energy per unit) .

In conclusion, the use of renewable energy sources may experience some difficulties. Nevertheless, these obstacles are very much outweighed by the advantages of using renewable energy sources. In addition, with the development of new technologies, and the improvement of the existing ones, it is highly likely that in the near future there will be solutions to these issues.

## *3. The EU renewable energy policy and its potential conflicts with European competition goals and the internal market*

Although the benefits of the use of renewable energy sources are nowadays widely spread, in the EU a common energy policy and the promotion of renewable energy sources are recent goals[4]. On the one hand, although energy issues are a shared competence between the EU and

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[3]Points 6 and 7 of the Directive cit. On 30 November 2016, the Commission published a proposal for a revised Renewable Energy Directive to make the EU a global leader in these matters.

[4]On this topic see, Rafael Leal-Arcas - Andrew Filis,"Legal Aspects of the Promotion of Renewable Energy within the EU and in Relation to the EU's Obligation in the WTO", *RELP 2014/1,* 2-25 and Cosmo Graham, "New

the Member States (article 4 TFUE), certain aspects are of the exclusive competence of the EU (for instance, if they are related to the internal market or EU competition policy). On the other hand, EU energy policy only recently has become a priority. In fact, the first policy proposal -Energy for a Changing World- was published by the European Commission on January 10, 2007. And it was only on 22 January 2014 that the Commission proposed the energy and climate objectives to be met by 2030 in the Communication 'A policy Framework for climate and energy in the period from 2020 to 2030' (the 2030 Framework)[5]. The three pillars of the 2030 Framework are: "i) a reduction in greenhouse gas emissions by 40% relative to the 1990 level; ii) an EU-wide binding target for renewable energy of at least 27%; iii) renewed ambitions for energy efficiency policies; and iv) a new governance system and a set of new indicators to ensure a competitive and secure energy system"[6].

Concerning, specifically, renewable energy the most relevant EU secondary legislation is the Directive 2009, which encourages Member States to promote the use of that sources. Article 3(1) of the Directive provides, that, by 2020, at least 20% of the EU's gross energy consumption be met by renewable sources, and Article 3(4) decides that, by 2020, at least 10% of each Member State's energy needs for transport be fulfilled from renewable sources. Under Article 4 "each Member State shall adopt a national renewable energy action plan", which "shall set out Member States' national targets for the share of energy from renewable sources consumed in transport, electricity and heating and cooling in 2020, taking into account the effects of other policy measures relating to energy efficiency on final consumption of energy, and adequate measures to be taken to achieve those national overall targets".

On the other hand, the Directive provides few guidelines concerning national schemes of support for renewable energy sources. Under the Directive support scheme include "any instrument, scheme or mechanism applied by a Member State or a group of Member States, that promotes the use of energy from renewable sources by reducing the cost of that energy, increasing the price at which it can be sold, or increasing, by means of a renewable energy obligation or otherwise, the volume of such energy purchased. This includes, but is not restricted to, investment aid, tax exemptions or reductions, tax refunds, renewable energy obligations, support schemes including those using green certificates, and direct price support schemes including feed-in tariffs and premium payments"[7]. These national schemes have to

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Challenges in Energy Efficiency in the European Union: a Consumer Perspective",*University of Leicester School of Law Research Paper* No. 17-02 ,1-23.

[5]JO C 200/2, 28.6.2014.
[6]Paragraph 4, 2030 Framework cit.
[7] Article 2(k) of the Renewable Energy Directive.

be assessed under the general rules on state aid (article 107-109 Treaty on the Functioning of the European Union, hereinafter TFUE or Treaty) and the Comunication from the Commission - Guidelines on State aid for environmental protection and energy 2014-2020[8]. Article 107(1) of the Treaty lays down the principle that State aid is prohibited. However, State aid may be compatible with the internal market under Articles 107(2) and (3) of the Treaty. As the European Commission has highlighted "the Europe 2020 strategy put forward the 'Resource Efficient Europe' as one of the seven flagship initiatives[9]"; therefore, "the objectives of a secure, affordable and sustainable energy market will be undermined unless electricity grids are upgraded, obsolete plants are replaced by competitive and cleaner alternatives and energy is used more efficiently throughout the whole energy chain" (paragrapg 8). In order to attain these goals, the Guidelines on State aid for environmental protection and energy 2014-2020 sets out the conditions under which aid for energy and environment may be considered compatible with the internal market under Article 107(3)(c) of the Treaty. Its main goals are: "(a) to foster sustainable, smart and inclusive growth in a competitive internal market; (b) to focus Commission ex ante scrutiny on cases with the biggest impact on the internal market while strengthening the cooperation with Member States in State aid enforcement; (c) to streamline the rules and provide for faster decisions"[10].

In other words, in the energy sector, and specifically regarding renewable energy sources, public intervention is considered necessary to compensate market and regulatory failures. On the other hand, Member States should keep in mind that EU State Aid rules shall apply, which means that national schemes considered state aid need to be notified to the European Commission (and authorized, unless specific rules apply)[11] before their application. In fact, they will be prohibited if the four conditions, laid down in Article 107(1) TFEU, are met: there is an intervention by the State or through State resources, the intervention be liable to affect trade between Member States, it confers a selective advantage on the beneficiary and distorts or threaten to distort competition[12] (, and of 19 December 2013. The Commission decision's can, then, be appealed to the Court of Justice of the European Union (CJEU).

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[8]JO C 200/1, 28.6.2014.

[9]The flagship initiative aims to create a framework for policies to support the shift towards a resource-efficient and low-carbon economy, see paragraph 5, Guidelines cit.

[10]Paragraph 11, Guidelines cit.

[11]See for instance theCommission Regulation (EU) No 1407/2013 of 18 December 2013 on the application of Articles 107 and 108 of the Treaty on the Functioning of the European Union to *de minimis* aid, JO L 351/1, 24.12.2013. Concerning the role the National Competition Authorities in this context, see Manuel F. Campos 2017. "What Role for National Competition Authorities after 60 Years of EU State Aid Control? – The Case of the Portuguese Competition Authority", in *60 Years of EU Competition Law – Stocktaking and Future Prospects* , ed. Roberto Mastroianni e Amedeo Arena , 141 - 157.

[12]Judgments of 17 March 1993, *Sloman Neptun*, C-72/91 and C-73/91, ECLI:EU:C:1993:97, paragraph 18.

A recent case illustrating these concerns is the Court of Justice decision of 13 September 2017, ENEA S.A. v Prezes Urzędu Regulacji Energety [13]. In this case, the Supreme Court of Poland requested for a preliminary ruling concerning the interpretation of Article 107(1) TFEU and Article 108(3) TFEU. The request was made in proceedings between ENEA S.A. (a company which produces and sells electricity and is wholly owned by the Polish State) and the Prezes Urzędu Regulacji Energetyki (president of the Office for the regulation of energy in Poland; 'URE') concerning the imposition of a financial penalty on ENEA for breach of its obligation to purchase electricity produced by cogeneration with the production of heat from energy sources connected to the network and situated in the Republic of Poland. In fact, for a certain period (2003 to 2007), the Polish Law on energy provided for a support scheme for electricity produced by cogeneration, by imposing, to undertakings selling electricity to end users, a quota obligation to purchase electricity produced by cogeneration. The main question asked by of the National Court was whether the obligation, placed both on public and private undertakings, to purchase electricity produced by cogeneration, as laid down in the Polish law, should be considered state aid[14] . The Court of Justice answered that in order to assess whether a measure is attributable to the State, it is necessary not only that public authorities were involved in the adoption of that measure (this condition was met, as the obligation at issue in the main proceedings, to supply electricity produced by cogeneration, was imposed by the Polish Law on energy), but also that the aid is granted directly by the State or "by public or private bodies established or designated by the State with a view to administering the aid"[15]. This condition is not met if the "private undertakings, are not appointed by the State to manage a State resource, but are merely bound by an obligation to purchase using their own financial resources"[16]. The Court concluded, on the one hand, that the "the supply undertakings were not appointed by the State to manage a State resource, but were funding a purchase obligation imposed on them by having recourse to their own financial resources". On the other hand, as regards the argument that the majority

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[13] Judgment of 13 September 2017, ENEA S.A. v Prezes Urzędu Regulacji Energetyki, C-329/15, ECLI:EU:C:2017:671. See also Nevin Alija, 2017, "SUPPORT SCHEMES IN RENEWABLE ENERGY- Commentary to Judgment of the Court (Fifth Chamber) of 13 September 2017, ENEA S.A. v Prezes Urzędu Regulacji Energetyki*", Market and Competition Law Review, Vol 2-1.*

[14] It should be pointed out that "ENEA was bound to sell to end users a minimum quota of electricity produced by cogeneration, either by producing such electricity itself or by purchasing it from third party producers" and in this latter case, "the purchase price of electricity produced by cogeneration was to be set by mutual agreement between the undertaking subject to the purchase obligation and the producer of such electricity" (no. 12, Case cit.)

[15]Paragraph 23.
[16]Paragraph 26.

of undertakings bound by the purchase obligation were public undertakings and therefore that obligation could be regarded as being financed through State resources, the Court of Justice held that “the resources of public undertakings may be regarded as State resources where the State is capable, by exercising its dominant influence over such undertakings, of directing the use of their resources in order to finance advantages to the benefit of other undertakings “[17], which was not the case, so the obligation imposed by the Polih Law did not fall under the prohibition of article 107 (1) TFUE.

In conclusion, in the EU, renewable energy policy implementation may sometimes involve some tension with the EU’s competition goals. Member States are, therefore, advised to take into account the case law of the Court of Justice in this matters as well as the European Commission Guidelines on State aid for environmental protection, when they intervene in the market to pursue environmental objectives. It is important to strike the right balance between a clean and sustainable European policy energy and the further development of the internal market.

## *4. Collaboration with third countries: the EU-India Partnership on clean energy.*

Cooperation between Member States,to help them meet their renewable energy targets, is one of the main goals of the EU energy policy. Another one is to improve energy cooperation with third countries. The EU-India partnership on clean energy is certainly one of the most important achievements in the last years.

As the President of the European Commission, Jean-Claude Juncker, said, in the “EU - India Summit: strengthening our strategic partnership and moving forward with our common agenda” that took place in Brussels, on 6 October 2017: “We are [India and EU] the world's two largest democracies. We are two of the world's biggest economies. We share the same values and the belief in freedom, equality, tolerance and the rule of law. (…)We agreed that we should take our trading relationship to the next level. It is high time for a Free Trade Agreement between India and the EU.(...) Today's Summit is an important step in the right direction (…)”.[18]

In this Summit, the leaders of EU and India adopted a Joint Statement on Clean Energy and Climate Change[19], showing their shared responsibility and determination to take the lead in

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[17]Paragraph 31.

[18] See http://europa.eu/rapid/press-release_IP-17-3728_en.htm (30.3.2018). In fact, “EU is India's largest trading partner, whilst India is the EU's 9th largest partner” , cf. op.cit.loc.cit.

[19] Seehttps://ec.europa.eu/clima/sites/clima/files/news/20171006_statement_en.pdf (30.3.2018)

global efforts to mitigate the effects of climate change. Both sides confirmed their commitments under the Paris Agreement and agreed to worktogether with all stakeholders to combat climate change, implement the 2030 Agenda for Sustainable Development and encourage global low greenhouse gas emissions.

Concerning bilateral cooperation, the EU and India will further strengthen their cooperation in the following areas[20]:

- EU and India will strengthen their cooperation in the frame of International Solar Alliance, namely through training activities and disseminating best practices for solar deployment;

-EU and India will promote dialogue with working groups and events on areas of mutual interest;

-EU and India agree to cooperate "on the formulation of mid-century, long-term low greenhouse gas emission development strategies through regular technical dialogues including mitigation and adaptation solutions, capacity-building and climate legislation", and "on increased energy efficiency of products and industrial processes" and in buildings"[21].

-EU and India agree to improve cooperation regarding "solar parks and smart grid demonstrations, the EU and India will further cooperate on the smart integration of renewable energy in the electricity system, including the enabling policy and regulatory aspects".

-EU and India will continue their cooperation in view of the cost-effective development of offshore wind in India, and the European Investment Bank will play a relevant role in that process.

Finally, the EU and India reaffirmed their intention to continue the implementation of the Partnership agreed in the 13th Summit that took place in Brussels on 30 March 2016[22]. In this Summit the EU and India decided to improve their cooperation to fight climate change and adopted the 'Joint Declaration between the EU and India on a Clean Energy and Climate Partnership'[23] and the 'Joint Declaration by the European Union and the Republic of India on Indo-European Water Partnership' .

The 'Joint Declaration between the EU and India on a Clean Energy and Climate Partnership is essential to the implementation of the Paris Agreement. It intends to reinforce energy cooperation, mainly on renewable energy sources, promote clean energy generation and

[20]Op. cit.loc.cit.
[21]Op.cit.loc.cit.
[22]See http://europa.eu/rapid/press-release_IP-16-1142_en.htm (30.3.2018)
[23]See https://www.consilium.europa.eu/media/23673/20160330-joint-declaration-energy-climate.pdf (30.3.2017).

increased energy efficiency.[24] Seven areas of cooperation were highlighted in the Joint Declaration:

-the establishment of a Clean Energy and Climate Partnership, bringing together relevant stakeholders, EU Member States, European and Indian institutions, businesses and civil society;

-to exchange views on policy and regulatory approaches, as well as on governance and best practices, in the field of clean energy, taking into account the existing experience of EU and India in these matters;

-to continue the joint activities on energy efficiency in buildings and renewable energy sources, including solar energy and offshore wind energy , clean coal technologies, nuclear fusion and energy security, as well as the cooperation aiming at increasing access to modern energy;

-to exchange views on implementing the INDC's and related mitigation and adaptation initiatives;

-to develop EU-India cooperation on smart grids and work together with India to implement the goals of the International Solar Alliance, Mission Innovation.

-to promote access to clean energy and climate friendly technologies;

- to cooperate in the context of the Montreal Protocol[25].

To sum up, as Mr. Tomasz Kozlowski, Ambassador of the European Union to India, said "EU and India has had an energy policy level dialogue in place since many years, and renewable energy, energy efficiency and energy security are clearly identified priorities"[26].

## *Conclusion*

[24]Note however that "the Joint Declaration is not intended to create any legal or financial obligations under domestic or international law in respect of either side". Cf. V, op.cit. loc.cit.

[25]Montreal Protocol on substances that deplete the ozone layer in view of the 2015 Dubai Pathway on hydrofluorocarbons (HFCs), see http://ozone.unep.org/en/treaties-and-decisions/montreal-protocol-substances-deplete-ozone-layer (30.3.2017).

[26] Speech by H.E. Mr.Tomasz Kozlowski, Ambassador of the European Union to India at the India-EU Clean Energy and Climate Conclave, 7 September 2017, https://eeas.europa.eu/delegations/india/32098/india-eu-clean-energy-and-climate-conclave-september-2017_en (30.3.2017).

In conclusion, to promote the use of renewable energy sources is one of the main goals of EU energy policy. As the EU Renewable Energy Directive highlights that aim need to be attained from inside the EU – promoting cooperation between the Member States along the lines of the EU energy policy and the goal to promote the internal market - and from outside the EU, namely through the implementation of joint projects with third countries. The partnership between India and the EU is particularly relevant because of its significance and impact. It intends to facilitate policy dialogue, share views, experiences, best practices and business solutions, improve joint research and innovation and develop financing models for clean energy . It represents a further step to achieve the common European and Indian goal of an efficient and sustainable environment with the use of renewable energy.

# ***International Solar Alliance, Scaling Solar Applications-***

# ***Development of user interactive application tool to assess the solar potential inISA member countries, methodology to SWPS Calculator***

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***Abstract***

With the era of human development and industrialization there is an increasing demand for green electricity source, increasing global efforts to reduce $CO_2$ emissions. Despite the promising efforts, only a small share of electricity is currently produced globally from solar power. ISA or the International Solar Alliance is an alliance of 121 solar resource rich countries lying fully or partially between the Tropics of Cancer and Capricorn. ISA become a full-fledged Intergovernmental Treaty Based Organization registered under Article 102 of the United Nations Charter. This paper presents an insight to ISA programme on Scaling Solar Application for Agricultural Use. The demand aggregation of various ISA nations can help in considerable decrease in price of SWPS (Solar Water Pumping Systems). ISA understands that demand aggregation requires effective communication approach and tools for the smooth movement of this goal. They presently follow questionnaire based approach to collect the details on general and technical backgrounds, which is sent through respective NFPs (National Focal Points) in ISA nations. The questionnaire is appraised by member nations and facilitates first-hand information. The aim is to help underdeveloped or developing countries to pace up economic and social growth. African nations are encouraged because of their high solar potential, a study is made in this paper on their aquifer characteristics. On basis of this study and NASA meteorological data a software called SWPS CALCULATOR is developed in MATLAB Platform. In this app users are asked to fill the

basic information like water demand and population to be served and user get an option of pump system optimization.

Keywords: ISA, PV, SWPS Calculator

## *1. Introduction*

In order to help countries realize the importance of tapping solar energy, it is crucial to reveal the solar potential. This paper discuss a brief methodology for SWPS CALCULATOR which is developed in MATLAB platform, such tool can act as first-hand measure to assess the solar water pumping system.

## *2. International Solar Alliance*

ISA or the International Solar Alliance is an alliance of 121 solar resource rich countries lying fully or partially between the Tropics of Cancer and Capricorn. ISA become a full-fledged Intergovernmental Treaty Based Organization registered under Article 102 of the United Nations Charter. Mr. Narendra Modi, Honorable Prime Minister of India and Mr. Francois Hollande, Honorable President of France launched the ISA in the presence of Mr. Ban Ki Moon, the Former Secretary General of the United Nations.

Currently, the ISA has three programmes in place namely Scaling Solar Applications for Agricultural Use (SSAAU), Affordable Finance at Scale and Scaling Solar Mini-grids. The first two programmes intend to promote various solar applications for agricultural use and provide finance at attractive rates. The affordable finance programme aims to mitigate risk in solar project financing and making solar projects bankable. The third programme aims at reorganizing ISA Island States and identified areas in member States with no grid or limited grid connectivity, to promote universal energy access by 2025 through introduction and promotion of mini-grids. Now ISA is going for its next program on Scaling Solar Rooftop.

## *3. Solar Radiation*

Understanding solar resource is crucial for the development of solar energy applications. In particular for the solar power sector, Photovoltaic (PV) technologies typically require an analysison Global Horizontal Irradiation (GHI) and Global Tilted Irradiation (GTI), i.e. solar radiation received by the surface of photovoltaic modules).To account for location specific TMY data it involves mathematical modeling of solar radiation and air temperature.

- **Solar radiation model:** takes into account attenuation factors due to atmosphere, solar resource parameters are calculated with inputs from geostationary satellites and meteorological models. Clear sky irradiance is calculated using Clear sky model (absence of cloud), considering position of Sun, effect of altitude, aerosols, water vapor and ozone. And then data from geostationary satellites are used to quantify attenuation effect of clouds (Cloud index calculation).This helps in fetching all sky irradiance. Primary Global Horizontal irradiance (GHI) with the help of other models helps in calculation of Direct (DNI), Diffused (DIF) and Tilt radiation (GTI).

- **Air temperature model**: Besides solar radiation, air temperature and consequently thetemperature of PV modules, have the most relevance for the solar electricity simulation.In addition, wind speed, wind direction, relative humidity and other parameters are alsoimportant.

These data are available with different pricing schemes from Solar TMY data vendors. For this paper NASA meteorological data is used which is free and available at their website.

## *4. Solar Water Pumping System*

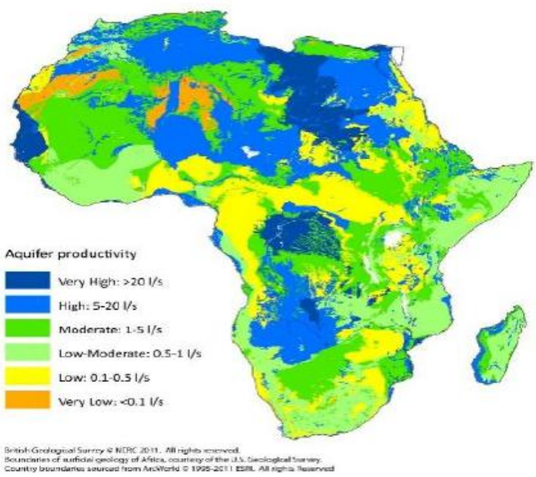
Water pumping is a fast growing and needed application for photovoltaic power systems. A low maintenance PV powered water system can bring health and prosperity to remote villages by aiding irrigation water requirements and drinking water for all. This paper will focus on direct coupled solar powered water pumping system. These system output water in proportion to available solar insulation. They pump more water during summer months, typically when more water is needed, and avoid the need of batteries and regulators.

## *5. Water Pumping System Nomenclature*

- **Flow:** The rate at which water is delivered by the pump, usually measured inlitres/second or cubic meter per hour minute.
- **Volume:**The total amount of water needed daily. Usually given in cubic meters/day.
- **Suction Head:** Vertical distance from surface of water to centre of pump whenpump is located above water. There is no suction head for submerged pump.
- **Discharge Head:** Vertical distance from centre of pump to surface of storage tank,water or point of free discharge.
- **Static Head:** Vertical distance from surface of water to surface of storage tank wateror point of free discharge. **Static Head = Suction Head + Discharge Head**
- **Friction Head:** There is a loss of energy as water moves through a pipe. Thesmaller the pipe diameter and the faster the flow, greater the loss. Also fittings, valvesand

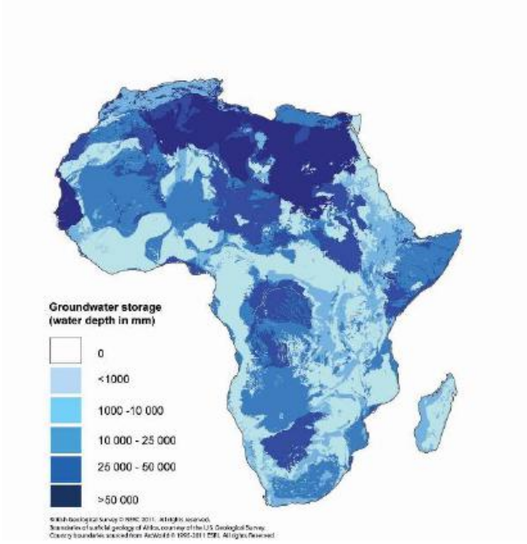
bents contribute friction which opposes water flow. The table of loss coefficients isprovided by equipment suppliers. These tables provide friction loss factors for fittings,elbows, as well as different pipe types (steel, plastic, copper) and for different diameters.

- **Draw Down:** When the pump draws water from the well, the level of the surface maydrop depending upon the ability of the surrounding earth to replenish the well. The higherthe pumping rate, the greater the draw down.
- **Total Dynamic Head**: The final total head for which the pump must be able todeliver at the desired rate of pumping, including all previous heads.**Total Dynamic Head = Static Head + Friction Head + Draw Down**
- **Groundwater Productivity:** The groundwater productivity map indicates what borehole yields can reasonably be expected in different hydro-geological units.



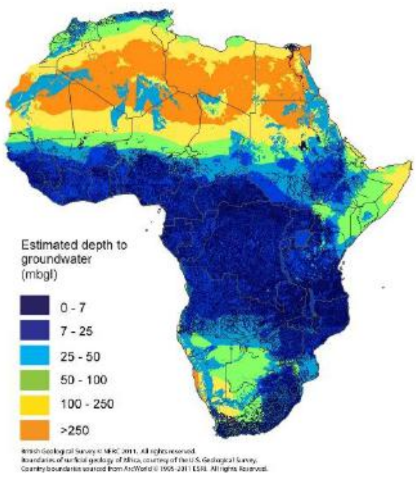

## *Africa Aquifer Characteristics*

- **Groundwater storage:** Groundwater storage is estimated by combining the saturated aquifer thickness and effective porosity of aquifers across Africa.



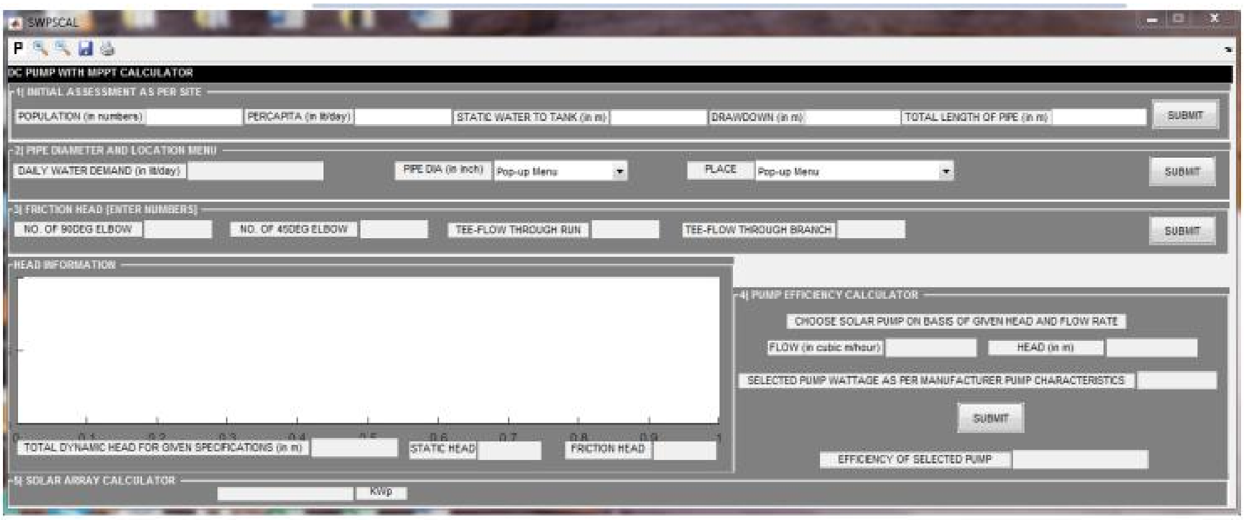

## *Africa Groundwater Storage Characteristics*

- **Depth to Groundwater:** Depth to groundwater was assigned according to rainfall and aquifer type, as well as proximity to rivers.




## *7SWPS Calculator Design*

A software for initial level assessment is programmed and designed in MATLAB during this work, this software can help



calculate size of water pumping system (including Pipe Diameter selection, Water pump selection for maximum efficiency, solar array size and analysis for different pipe diameter size to reduce friction head).

## *6. SWPS Calculator Working*

**STEP 1:** User has to fill initial site assessment data involving population size, per-capita water requirement, static water level difference and pipe length,

**STEP 2:** By the selection of location software in backend fetch solar radiation details of the site,

**STEP 3:** User will fill details like elbow, Tee joints to consider equivalent friction head,

**STEP 4:** Head information part displays Friction heads for various available pump diameters, helping to choose optimum one to reduce friction loss,

**STEP 5:** Also user can choose efficient pump and corresponding solar array size.

## *7. Results and Conclusion*

Various programmes of International solar alliance are focused on development of solar infrastructure in countries lying between Tropical of Cancer and Tropic of Capricorn.Development of SWPS (Solar Water Pumping System) Calculator is a step forward to involve and attract nations which are yet not contributing in ISA programmeswith their demand numbers for solar water pumps. Since the calculator covers all aspects of solar water pump design with also considering energy efficiency as a feature, it is an integrated approach of design.

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# ***Critical Appraisal of Civil Nuclear Liability Damages Act, 2010 In Conformity with International Conventions***

***Abstract***

*India is a demographically and geographically rich and diverse country. It has a sizeable young population (65% of Indian population is under 35 years of age) which promises a high demographic dividend for the economic growth of the country. This fact, along with the blessing of enormous natural resources that India possesses could project India right into a consistent economic growth trajectory. For this the Indian Government has launched the Make in India scheme along with other attempts to increase Ease of Business to attract foreign direct investment and urge foreign players to invest in projects in India. This in turn would increase our GDP leading to better prospects. However for these projects to work and produce industrial growth and infrastructural development we need energy. The traditional sources of energy are often found inadequate to fulfill the demand of the project investments made today, so modern scientific developments are underway to fulfill such demand. Nuclear energy is one such development and such is enjoying focus from authorities and corporations alike.*

*It is imperative to note here that two of the most important international law elements, i.e., the Non Proliferation Treaty as well as the Nuclear Suppliers Group are not in India's favor. India has not accepted the Non Proliferation Treaty due to its discriminatory nature against developing countries and is not accepted in the Nuclear Suppliers Group in spite of unbridled US support. Also, the* ***CIVIL NUCLEAR LIABILITY DAMAGES ACT[27], 2010,*** *India's national civil nuclear liability law has been challenged by the international community of not being in conformity with the Paris Convention of 1960 (PC), the Vienna Convention of 1963 (VC) and the Convention on Supplementary Compensation of 1997 (CSC) and lacking in several aspects.*

*Keeping in perspective these realities about India's nuclear liability law regime, it is difficult to project that the dream of Nuclear Energy being a driving force in achieving the desired industrial growth and infrastructural development for India is farfetched. Therefore this Research Paper will attempt to clarify the laws in question, analyze the facts from both the sides and then try to come up with a possible situation. This paper is divided into five parts.*

[27] Hereinafter referred to as 'The Act'

*The first part discusses about the internationally accepted principles of civil nuclear liability. Second Part will explain the history and the Legislators intent while drafting Civil Nuclear Damages Act , 2010. The third part will discuss about the Objective and provision of CNLD act with its conformity with CRC convention India has signed. The Fourth part will discuss about section 17 and 46 and its conformity with CRC convention signed and ratified by India. The fifth part includes the Conclusion of the paper.*

***By Akshat Sinha***

### *Internationally Accepted Principles of Civil Nuclear Liability*

International Nuclear Liability laws can be grouped broadly in to the OECD (Organization for Economic Cooperation and Development) Paris Convention, 1960 and the IAEA's Vienna convention

The Vienna convention comprising mostly of Eastern European nations whereas, western European countries are a party to the Paris Convention, 1963. The Vienna convention comprising mostly of Eastern European nations whereas, western European countries are a party to the Paris Convention.

Both the conventions evolved through various stages and were amended in order to suit the current liability needs. Though these liabilities regimes have differing provisions, they hold a few principles in common like

- Strict liability of the nuclear operator
- Exclusive liability of the operator of a nuclear installation
- Compensation without discrimination based on nationality, domicile or residence
- Mandatory financial coverage of the operator's liability
- Exclusive jurisdiction (only courts of the State in which the nuclear accident occurs have jurisdiction)
- Limitation of liability in amount and in time.

The Paris Convention has very limited scope that is, it is only limited to territory of the contracting party according to Article 2 of the convention, except if mentioned in the legislation of the state of the contracting party. The convention allows very limited time of ten years for the victim of nuclear damage to claim compensation. The Liability amount in the Paris convention is limited, to five to fifteen million Special Drawing Rights (SDR). SDR refers to the asset or the account of the International monetary fund which is used by member countries. Paris Convention allows for carriage of material through maritime international laws which allows innocent passage in time of distress which is not so in the case of the Vienna Convention. The Paris convention also does not explain the word damage in article 1 of list of definitions.

The 1986 Chernobyl accident led to release of radioactive material into the atmosphere and its spread regardless of geographical boundaries. The incident impacted surrounding countries like Belarus, Ukraine and the United Kingdom. Former Soviet Union was not a party to any of the international Civil Nuclear Liability Conventions and had not notified its neighboring states about the mishap. Therefore, it could not benefit from the compensation arrangements of the liability regimes. The Chernobyl accident stood a testimony to the fact that a nuclear accident does not recognise geographical boundaries and would affect non-contracting states as well.

Post the Chernobyl incident, there was need felt for a regime that was viable to bring about a balance between the two regimes that is the Paris convention (1960) and the Vienna convention (1963). As not all the countries were a party to either of the conventions. It was essential to amend these laws in order to increase the liability compensation, the scope of damage and unite the nations under an umbrella of a single liability regime. As a result there was a Joint Protocol signed in 1988. The 1988 Joint protocol provided a link between the two conventions so that the parties to both the conventions have a benefit of compensation. The joint Protocol after it came in to force in 1992 and enabled those members who were a party to it benefit from both the conventions. Consequently the Vienna convention was amended in 1997 and Parris convention in 2004.[28]

## *History of the enactment of The CNLD Act, 2010:*

India began forays into the sphere of Nuclear Energy soon after independence in late 1950s. It all began with the first nuclear power plant with two Boiling Water Reactors (BWR) of 210 MWe each, which was constructed on turnkey basis with General Electric (US) and went operative in 1969. Subsequently India collaborated with Canada in constructing two Pressurized Heavy Water Reactors (PHWR) of 220MWe each, but the collaboration was terminated due to India conducting a Peaceful Nuclear Explosion (PNE) in 1974. This sparked concerns across the international community and sanctions and denials were imposed that resulted in the isolation of India from international trade in nuclear technology, materials and fuel. Subsequent to this non cooperative stance from its international counterparts, India has been indigenously constructing PHWRs. Currently 21 reactors (18 PHWRs) with a cumulative installed capacity of 5780 MWe are under operation with an enviable record of safety. India not only has competence in building reactors indigenously but also builds and manages the entire fuel cycle activities. India in this period also took several steps promoting nuclear power with the most primary one being indemnifying all suppliers of all risks, a move inspired by what the US did after the enactment of Price Anderson Act, 1957.

The sanctions and denials imposed upon India unnecessarily after the first Peaceful Nuclear Explosion (PNE) in 1974 continued till 2005 when India and USA came together and after a

28 Summaiya Khan, International Civil Nuclear Liability Regime and India: A Comparative Assessment, 2015

series of negotiations took place finally culminating into the 2008 Indo-USA deal. To put this deal to fruition and ensuring maximum benefits out of the same as well draw from the Nuclear Suppliers Group waiver which allowed India access to international nuclear trade and commerce, India had to fulfill the prerequisite of being part of one of the international conventions on civil nuclear liability. It is also important to note here that although India had sustained a nuclear energy regime in face of international hostility, the Indo-US deal was a huge turning point for the same as it projected the nuclear energy regime to better measures[29].

India out of all decided to go for Convention on Supplementary Compensation, 1997 for which the enactment of a national law on the same subject became imperative.

The enactment of this legislation although crucial to the nuclear energy regime in India was highly contentious.

Once the draft bill was tabled in the parliament, the members therein put forth serious concerns about the provisions and ends of the bill. This was justified and necessary especially after the experience of the Bhopal Gas Tragedy which wasn't just menacing in the environmental damage and the loss and suffering of human life but also challenging due to the legal struggle both in India and abroad with Union Carbide for damages and rightful compensation to the victims of the tragedy.

To address these issues raised by the members of Parliament, as is the procedure, a parliamentary committee under Ministry of Science and Technology was set up to deliberate upon the concerns raised and address them and put up the revised bill again to be tabled in the Parliament. This was followed up and the bill finally received Presidential assent and became an Act in 2010. Thus the Civil Nuclear Liability Damages Act, 2010 came into existence.

### *Objectives and provisions of Civil Nuclear Liability Damages Act, 2010:*

The objectives of the Act are enumerated below[30]:

1. Strict (no fault) liability[31] imposed on the operator

2. Legal channeling of the liability to the operator

3. Limitation of liability in terms of cost and time

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[29]http://www.world-nuclear.org/info/Safety-and-Security/Safety-of-Plants/Liability-for-Nuclear-Damage/.

[30]Bharadwaj, Anshu, Subramanium, Rajgopal and Krishnan, L.V. *Nuclear Power in India : The Road Ahead.* 2008.

[31]Strict liability means that the victim is relieved from proving fault.

4. Insurance for financial security of the operator as prescribed by the Act

5. Establish exclusive jurisdiction of a single court.

Upon perusal of the above objectives we find that the objectives have been formulated keeping two essential streams of thought in perspective, the first one being protection of the victim in wake of a mishap and the second, providing protection both legal and financial as far as achievable in the light of natural justice to ensure the promotion of nuclear energy as well. This first stream of thought behind the objective emanates from the aftermath and experience of *Bhopal Gas Tragedy* and ensures that if history repeats itself the hardship and sufferings can be reduced to a minimum as far as feasible. The second stream of thought behind the objective emanates from the need of India to achieve economic growth, industrial growth and infrastructural development which is again something that cannot be compromised upon. The objective of having a single court to address the grievances arising is also a move to serve both victim and operator and ensure a hassle free process which ultimately serves both streams of thought.

The CLNDA, 2010 consists of seven chapters and 49 sections. These chapters deal with Preliminary provisions, Liability for Nuclear Damage, Claims Commissioner, Claims and Awards, Nuclear Damage Claims Commission, Offences and Penalties as well as Miscellaneous provisions. The major challenge surrounding the CLNDA, 2010 is the need to ensure its conformity with the CSC, 1997 to actually reap the international benefits of nuclear trade as well as win the desired membership of NSG[32]. It has been a cause of international concern that the provisions of CLNDA especially Sections 17(b) and 46 are contrary to international principles accepted and nuclear liability as under the CSC, 1997. To explore this claim, there needs to be a perusal between the provisions of both CLNDA, 2010 and CSC, 1997.

## *Section 17 Of CLNDA, 2010 As Against Article 10 Of Csc, 1997*

*Section 17 provides Operator's right of recourse. –*

The operator of the nuclear installation, after paying the compensation for nuclear damage in accordance with section 6, shall have a right of recourse where--

a. such right is expressly provided for in a contract in writing;

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[32]**Lok Sabha Secretariat, New Delhi.** Committee on Subordinate Legislation. 27th Report on The Civil Liability for Nuclear Damage Rules, 2011.

b. the nuclear incident has resulted as a consequence of an act of supplier or his employee, which includes supply of equipment or material with patent or latent defects or sub-standard services;

c. the nuclear incident has resulted from the act of commission or omission of an individual done with the intent to cause nuclear damage.

One of the major points of international concern has been the variance in the provisions of CLNDA, 2010 and CSC, 1997 on the subject of right to recourse. To establish this right to recourse we need to first grapple upon Section 6 of CLNDA, 2010 and Article 4 of CSC, 1997 which deals with the onus of Liability, its limits and amount.

Both Section 6 and Article 4 are in conformity with the liability to be established to the operator in figures of Special Drawing Rights. Although CSC provides limits for the liability amount to the operator as well as the installation state, it authorizes the latter to put on lower limits of liability amount provided that in no event shall any amount so established be less than 5 million SDRs, and provided that the Installation State ensures that public funds shall be made available up to the amount established in the article to compensate nuclear damage. The only point of difference here arises with the power of the Government to revise these liability limits irrespective of the international law on the same. This creates discomfort and uncertainty in the international community on the same issue of arbitrary power vested in the government which would in turn affect these international players of nuclear energy trade.

The difference then occurs in the right to recourse as under Section 17 of CLNDA, 2010 as against Article 10 of CSC, 1997 wherein under CSC the right to recourse is available only when the same prescribed in writing or as against an individual if the nuclear incident has resulted from an act or omission done by such individual with intent to cause damage. These two provisions are concurrent with Section 17(a) and 17(c) of CLNDA, 2010 but the dispute arises as a result of extension of this right to recourse of the operator against the supplier given under Section 17(b) of CLNDA, 2010. This has caused major grievances as this ensures that the operator in India, i.e. Nuclear Power Corporation of India Ltd (NPCIL), a public sector undertaking of Government of India can exercise this right against nuclear suppliers which is not possible under CSC, 1997[33].

Whereas ,Section 17(b) appreciates and draws lessons from historical incidents such as the Bhopal Gas Tragedy of 1984 for which defective parts of the nuclear plant were partly

[33] *Critical Analysis of the Indian Civil Nuclear Liability Act, 2010.* **Tigadi, Rohan.** s.l. : Social Science Research Network, 2012.

responsible. The paltry compensation that the victims were finally bestowed with was a result of by gaps in the legal framework supported by an extraordinarily recalcitrant state machinery. However, to disguise this as an Indian experience would defeat the purpose—accidents such as Three Mile Island which occurred partially due to shortcomings on the part of suppliers. In a more recent incident forged quality certificates were detected for parts supplied to nuclear plants in South Korea. That Section 17(b) incentivises supplier safety and reduces the probability of a recurrence of such instances is equally undeniable as much as it is vital.

However in pursuing the safety of supply and liability of supplier, Section 17(b) tries to balance liability to be imposed by suppliers .To address this, Rule 24 of the CLND Rules dilutes the right of recourse conferred by Section 17(b) by limiting compensation payable by suppliers to a specified amount and for a specified time period and provides that :

1. *A contract referred to in clause (a) of section 17 of the Act shall include a provision for right of recourse for not less than the extent of the operator's liability or the value of the contract itself, whichever is less*

*2. The provision of the right of recourse referred to in sub-rule (1) shall be for the duration of initial license issued under the Atomic Energy rules, 2004 or the product liability period, whichever is longer.*

The product liability period is defined as: "The period for which the supplier has taken liability for patent or latent defects or sub-standard services under a contract".

The provisions of the CLNDA, 2010 read with the rules of 2011 raise quite a few contentions and can also be ambiguous in determining liability if a dispute so arises. There are a series of concerns that arise:

1. The contingency of Section 17(b) on Section 17(a) as a result of the aforementioned provisions create concerns because one, it makes reference to "product liability" which is the period for which the supplier has taken liability for patent or latent defects or sub-standard services under a contract. Hence it essentially refers that once the said limit expires the liability of the supplier ceases which destroys the recourse provided under Section 17(b).

2. The duration of initial license referred to in Rule 24(2) is five years, there is difficulty in determining how the period commencing from date of supply to commencement of first license period is covered. There can be different variation of the same which remains critically unclear. Independently under Section 17(b)

the liability would extend to minimum 40 years, the design life of the reactor. If the plant life is extended to 60 or 80 years the liability would also extend correspondingly.

The suppliers are wary of this provision as the liability subsequent and in course of the plant life is the responsibility of the operator as it is their prerogative to ensure that the parameters for the safe and effective functioning of the plant are sufficed.

***Possible Solution for this issue :***

- The CSC allows countries to make reservations to certain provisions in treaties despite being signatories to them. India, taking advantage of the same could make a reservation to Article 10 of the Annexure to the CSC. Since it satisfies the requisite criteria for making a valid reservation under the Vienna Convention on the Law of Treaties application of the same can be done away with.
- Article XV of the CSC implies that the rights and obligations of nation States under public international law are co-existent and independent from the application of the CSC. The "polluter pays principle" is one of the major ones used extensively in cases of environmental damage both on a domestic and international level. The principle operates in a way through which compensation can be recovered from a polluting entity for the environmental harm it causes.

***Section 46 of CLNDA, 2010 with no Corresponding Provision under CSC, 1997*** Section 46 provides, "*The provisions of this Act shall be in addition to, and not in derogation of,any other law for the time being in force, and nothing contained herein shall exempt the operator from any proceeding which might, apart from this Act, be instituted against such operator*.[34]"

There are various incidences of this provision with implications both on the operator which can in turn extend to the supplier and other links down the supply chain as well. This provision makes it possible for the operator to be sued in addition to the liabilities under this Act, also for any other proceedings which may be instituted for other laws like the Law of Torts and Constitutional Law. This provides a sot of unlimited horizon of liability on the operator as well as the suppliers, sub-suppliers and other actors in the functioning of the plant.

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[34]http://lawmin.nic.in/ld/regionallanguages/THE%20CIVIL%20LIABILITY%20OF%20NUCLEAR%20DAMAGE%20ACT,2010.%20(38%20OF2010).pdf

This has been a bone of contention for multiple reasons; firstly, there is no corresponding provision or rather independence to the installation state under CSC, 1997; secondly, this makes international players apprehensive of unlimited liability, burden of lawsuits and never ending litigation. This is detrimental for India in achieving the desired economic growth, industrial growth and infrastructural development it envisages.

## *Conclusion*

### *National Interests vs. International Obligations*

It is imperative to conclude however that although the international community looks at the above mentioned provisions of CLNDA, 2010 with trepidation, it is vital and relevant to the situation in India. India had to face the terrible Bhopal Gas Tragedy which was the result of defects in the functioning and design basics of the operations of the nuclear plant and at the same time on one hand had to battle coping with environmental damage and biological mutations, human lives lost and devastated on one hand with the tedious legal struggle both India and abroad on the other hand. The latter prolonged the misery and in the end did not provide satisfactory results with the case even been sent to the US Supreme Court to no avail. It was a major loss to India both domestically and internationally. The lessons learnt from that tragedy reflect in these provisions.

Clause 17(b) is to ensure that in case of faulty supplies the operator in India, i.e. Nuclear Power Corporation of India Ltd (NPCIL) is not made to bear the burden and justice is ensured. The Attorney General of India has opined that "*The failure to provide for and have recourse against the supplier would ultimately impact public funds. This is a serious policy issue and is ordinarily a matter for government to decide.*[35]" This although unacceptable by suppliers as being not in conformity is still vital to the Indian limitations.

Clause 46 on the other hand is to ensure that there is faster delivery of justice, however, this provision in the opinion of the author contains ambiguity as the phrase "any other law" has not been specified and leaves and exceptionally wide ambit. Furthermore, since the Claims Commissioner and other officials are appointed by the Government and at the same time the operator is an entity of the government, fairness and justice remains a question of doubt.

[35]**Venkatesan, J.** *Opinion on Liability waiver based on legality, says Attorney General.* New Delhi : The Hindu, 2013.

# ***Strategies for Renewable Energy Market***

"During 2016, ACCIONA (Spanish conglomerate group dedicated to the development and management of infrastructure) **avoided the emission of 14.8 million tonnes of CO2**, thanks to its activity in renewable energies. By the end of 2016, ACCIONA had 8.961 MW in installed renewable energy and a total production of 20.830 GWh."

As public awareness of the environment and the need for its conservation increases, the demand for renewable energy sources also rises and the good news is that the market is now experiencing significant growth. This trend is reinforced by the United Nation's Millennium Goal Number 7, which pursues ecological sustainability through the global reduction of CO2, specifically regulated in the Kyoto Protocol guidelines for reduction of emissions by the industrial states.

Due to this call for lower greenhouse gas emissions, the market for renewable energy is currently undergoing a revolution, most notably throughout Europe, where member states are experiencing the ambitious and mandatory targets imposed on them in the "EU Directive on Renewable Energy". By 2020 20% of energy consumed must be generated from renewable sources. Hence the transportation sector must reach a minimum of 10% by itself!

This directive makes allowances for the different rates of development throughout the member states by specifying individual targets for each nation, ranging from 10% in Malta to 49% in Sweden. The member states aim to achieve these targets through incentive programs, coupled with financial benefits in the form of grants. While Germany, for example, focuses on a feed-in tariff, Sweden has opted for tradable environment certificates.

The rapidly rising crude oil and gas prices provide a further incentive for local authorities, businesses and private individuals to turn to renewable energy sources. It is not only the lower prices which appear attractive but also the independence from major suppliers and the market forces behind those frequent price fluctuations.

By - ***Sm. Shadab Ali***

The obvious consequence from the above regulations and targets is high potential for growth on the renewable energy stage. The share of total energy consumption attributed to renewable sources is therefore expected to rise considerably throughout the world over the coming years.

Scientists from the universities of Stanford and Davis have drawn up a schedule for an emission-free world by 2030, in which they estimate that the global change to renewable energy will cost around 100.000 billion US $.

## *Market Entry – The Pre-Requisite of any Successful Business*

Even the potential of this market offers companies immense scope for success, it is not without its numerous risks. The seemingly inexhaustible capacity of the renewable energy playing field has attracted a myriad of companies, thus continually increasing the competitive pressure on this market.

It is therefore essential that new players gain an edge over the competition with innovative and high performance products, plus a sophisticated and stringent marketing strategy.

Perfect Example: The Bavarian company agnion Technologies GmbH aims to carve out a long-term niche for itself in this market. As the agnion CEO Dr. Mey explains: “The trailblazing agnion technology stands for a breakthrough in energy market decentralization!” agnion Technologies develops and produces cutting-edge systems for generation of decentralized regenerative energy from bio mass sources. Established in 2007, the company has taken the innovative Heatpipe-Reformer designed by the Munich Technical University and developed it to market maturity.

The company enjoys the support of renowned national and international investors, including Kleiner Perkins Caufield & Byers, Wellington Partners Venture Capital and Munich Venture

Partners, who feature in companies such as Google and Amazon or support the Frauenhofer Institut with venture capital.

“The confidence of these prestigious investors reassures us of the unique nature of our technology”, Dr. Kröner, COO of agnion, explains. “Our patented liquid metal heat pipe achieves more effective and efficient combustion than comparable systems. Indeed, the Heatpipe-Reformer is the only combustion solution world-wide that can produce heat, electricity and BioSNG (substitute for natural gas) on a small scale (0.5 – 5 MW). This gives us a significant edge over the competition."

However, since the management at agnion know that unique technology alone is not enough to automatically earn hard cash, the time had come in summer 2010 to compile a smart market entry strategy which would successfully launch their product in the market. The joint mission of the project team was to identify the best means by which to position the Heatpipe-Reformer so that it could establish itself on the market as rapidly and successfully as possible. To this purpose, agnion pursued a clearly structured market entry strategy:

1. Definition of overall target – vision and mission
2. Definition of target markets – markets with the most potential for product
3. Development of product, sales and marketing strategy – tackling the target markets
4. Compilation of action plan – measures for strategy implementation

## *Vision and Mission – A Clear Focus*

Vision gives our lives and our businesses meaning and value! Companies need clearly defined targets to focus on, to motivate staff and give their work a sense of value. The corporate vision can therefore be defined as the company's general principle or the driving force behind any entrepreneurial activities.

It should form the foundation for any strategies or activities and must always be clarified before strategies are developed. John Naisbitt, an American forecaster, defined the corporate vision as "a clear image of what you want to achieve." The vision drives the mission, which forms the global task that a company sets itself and which permeates all its activities: market, products,organization, processes, systems. agnion Technologies defines its vision and mission as follows:

**Vision:**

"To bring about breakthrough energy market decentralization!"

**Mission:**

"We will achieve our vision as follows:

A clearly structured market entry strategy for target markets, products, sales and marketing, A market-oriented product in relation to costs, performance, service and financing, A high-performance and well-functioning value chain and effective organization in relation to structures, processes and competencies.”

***Target Markets – Pinpointing Potential***

After the management has defined the strategy framework, the next step is to level the path towards realization of the goal. Before we plan specific measures, we consider which markets we want to address. Our aim is to align our activities as precisely as possible to these markets”.

The selection of target markets depends on two main factors: the activity on the market, meaning its attractiveness for the company, and how the company itself fits into the market. This leads to four evaluation parameters

| | Target market region | Target market costumer group |
|---|---|---|
| Market attractiveness | Market volume, market growth, price levels, market entry barriers, competitive situation | Market volume, market growth, market entry barriers, competitive situation |
| Fit for market | Distance, language, current corporate status (reputation, presence, references, turnover) | Needs of individual customer group vs. Fulfillment of needs trough the product / company |

**Table 1**
Source: Tefen, 2010

To save time and effort, a quality-based preselection of the markets was made. The relevant data is then collected for these. According to reports, we probably needed the most time for this stage. Although we will frequently experience trouble accessing the required data, we will persevere because we know how strategically important the market selection is, for any company. The data is analyzed and evaluated using developed scoring model. Market attractiveness will be measured by more than 10 parameters, including:

- Conditions facilitating renewable energy
- Degree to which “EU Directive on RenewableEnergy” is fulfilled
- Market potential of bio mass power plants.
- Grant options for renewable energy sources etc.
- Economic and biogeographic conditions
- Proportion of forest in country
- Bio mass prices in relevant country

- etc.

The “fit for market” factor in the individual regions relies on other criteria, including:

- Average output of biomass power plants
- Geographic location
- Language barriers
- etc.

The final result produced will give a diagram that shows which regions are the most interesting for the company. In this case, the priority lies with Austria, Germany, Italy and Switzerland. Austria and Germany show a high level of maturity in their legislation and regulation favoring renewable energies. Another important fact is that there is no language barrier. Switzerland comes up with the same “fit for market” factor as Germany and Austria but with lower market attractiveness. Italy’s market attractiveness lies between Germany and Austria, the agnion “fit for market” factor is lower.

According to this data, when it comes to Italy, we will mainly focus on the South Tyrolean region for the initial sales phase. Due to the language and the distance to Munich, this part of Italy comes up with a high agnion ‘fit for market’ factor.”

### *Product, Sales and Marketing Strategies – Tackling Target Markets*

After defining the target markets, realization plans need to be drawn up in the form of a product, sales and marketing strategy.
Let us come back to the example.

The product strategy focussed first on the design characteristics or features of the main product, this being the Heatpipe-Reformer. Two of the many attributes developed to ensure the best possible benefit for the customer included the optimum size of the Heatpipe-Reformer and the types of bio mass it can process. Attention was also paid to auxiliary products either requested by the customers or deemed by agnion to be ideal for boosting sales of the main product. One example of this was a financing concept. Funding is often the make or break criterion when it comes to striking a deal for major investment such as an energy generation system.

Eike Liekweg defined the main criteria for the sales strategy, “We first need to decide which markets we are approaching with direct and indirect methods and then align our organization to this.” The advantage of the direct channel for agnion is the customer proximity. Regular feedback enables products to be continually optimized, leading to greater customer satisfaction and higher turnover.

The indirect approach to other markets keeps the sales force streamlined and flexible, while reducing costs.

The challenge is to decide which method brings the most benefit for the company in each market. The following questions helped to align the sales organization:

- Which regions will have company sales offices?
- Where will we have our own sales representative but no fixed branch?
- Which sales partners support us in the regions without a physical presence there and what are the conditions that they require?

When defining its marketing strategy, agnion took advice and support from external specialists but contributed actively to the process itself. agnion staff ascertained the specific needs of its customers in 20 individual telephone interviews. The aim was to find out precisely what their customers wanted, in order to increase the chances of success that their product would have on the market. Marketing materials and activities must therefore reflect the customer’s own benefit arguments. The interviews also helped to define the overriding marketing messages that the company was to use.

### *Strategy Realization – Ready For Action*

The last step in the market entry strategy is to plan the actual implementation. agnion translated its strategy into action using the “Strategy Map” tool:

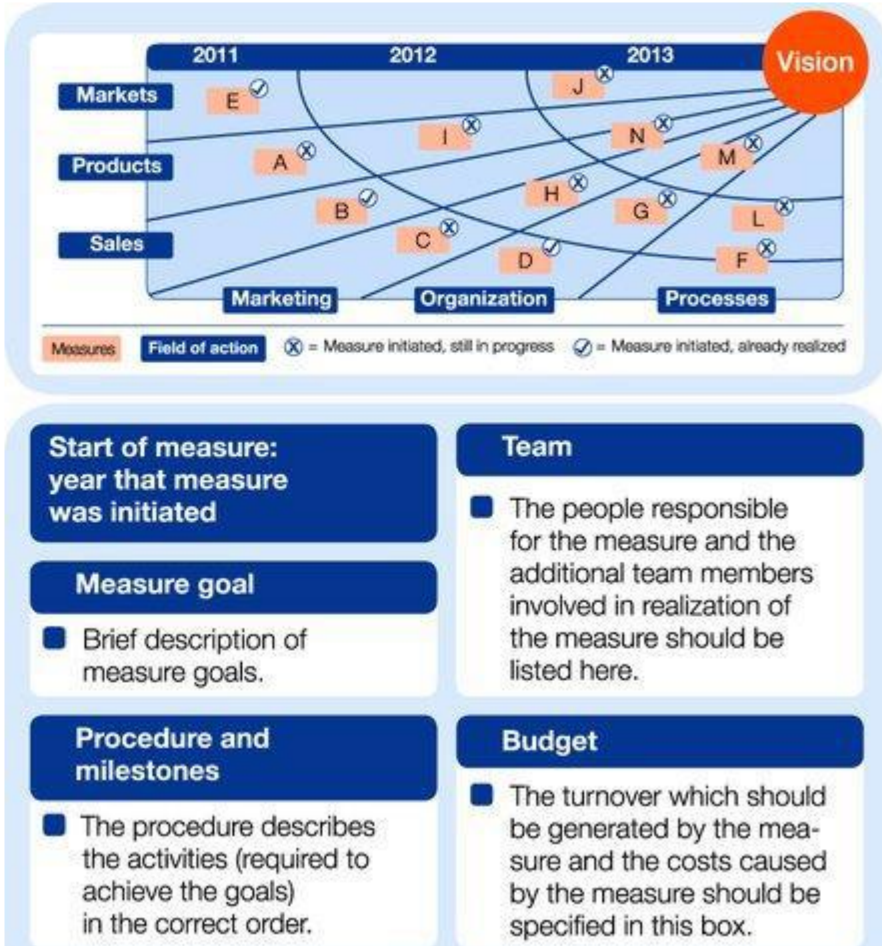


**Diagram 4** Source: Tefen, 2010

The "Strategy Map" helps to integrate and organize the defined measures along a time line. As Dr. Mey explains, "We defined a total of 40 measures. However, to realize them, we needed to be more specific. We need to set a fixed target, procedure, milestones, responsibilities and budget for each measure. The staff involved in individual measures is then given a detailed measure sheet explaining their work." Controlling process ensure continual monitoring of the measure realization.

Since a strategy defines a common goal and a joint journey towards this goal, agnion wanted to ensure that all its staff were informed about and understand the new market entry concept. A joint weekend in the idyllic Bavarian countryside provided the ideal backdrop for the company to step out of hectic day-to-day operations and reflect on the joint vision and their commitment towards it.

Whether you’re marketing hydropower, geothermal energy, or solar electrical energy, what is crucial is building a marketing plan that your customers will like. The very best method to do that by creating content for your consumers that helps inform, notify, and raise their interest in your renewable energy services. As you may know, this new technique is known as Content Marketing and Inbound Marketing.

Taking the Inbound Marketing approach allows you draw in website visitors naturally, convert them into certified leads, and then turn them into pleased customers for years to come.

# PART - C

# National Initiatives for Energy Revolution

“Solar Power is not about fashion, it’s about Survival.”

- Sir Norman Forster

TED Talks

# ***Energy Policies of India – A General Sub-Study***


### *Abstract*

India's Energy (Electricity) outlook from fossil fuels sources ( about 70% of India's electricity generation capacity ), particularly in the coal, oil and gas sector, point out to a very high dependence on imported raw materials. By 2030, India's dependence on energy imports is expected to exceed 53% of the country's total energy consumption. In 2009-10, the country imported 159.26 million tons of crude oil which amounts to 80% of its domestic crude oil consumption. At present, 31% of the country's total imports are oil imports.On the other hand, the prospect of obtaining energy from renewable energy sources has a positive outlook due to abundant availability of such resources in various parts of the country. Out of all these sustainable resources, solar, wind and biomass energy are some of the fields where past and present development have already witnessed major achievement. The major advancements have greatly helped develop the local economy of the nation. Solar energy in particular, from a recent governmental policy ( Saubhagya – Pradhan Mantri Sahaj Bijli Har Ghar Yojna ), has gained the momentum as one of the most important sources of energy for the country. The Indian Government has adopted an Integrated Energy Policy (IEP) document gives a roadmap to develop energy supply options and increased sustainable exploitation of renewable energy. The Indian Government has amended the National Tariff Policy for Electricity for the promotion of renewable energy in January, 2006.

The Paper presents the *Integrated Energy Policy of India*, the various Policies and Schemes adopted by the Indian Government for the promotion of renewable energy- *Saubhagya Yojna, Rewa Mega Solar Energy Project, Deen Dayal Upadhyaya Gram Jyoti Yojna*, International Policies of India *(India – U.S. GTG)* , Environmental concerns related to the generation of energy.



*Key-Words*: India, Energy, Policy, Fossil Fuels, Development, Solar Energy, Sustainable exploitation.



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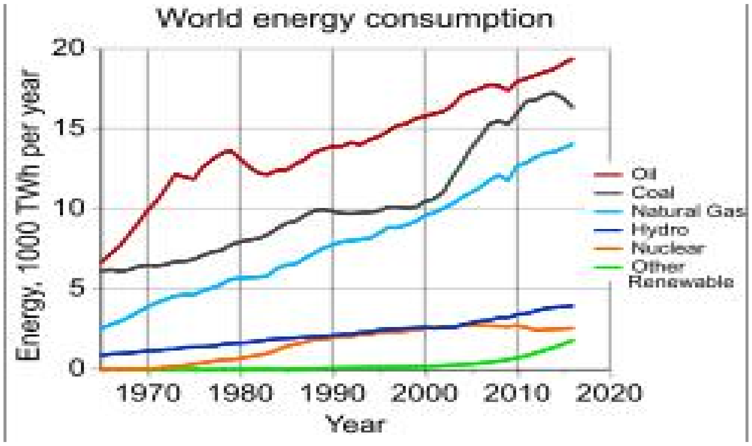
## *Introduction*

The environmental impact of the energy industry is diverse. Energy has been harnessed for millennia. Initially it was with the use of fire for light, heat, cooking and for safety, and its use can be traced back at least 1.9 million years. In recent years there has been a trend towards the increased commercialization of various renewable energy sources. Consumption of fossil fuel resources leads to global warming and climate change. In most parts of the world little effort is being made to slow these changes. If the *peak oil theory* proves true, and more explorations of viable alternative energy sources are made, our impact could be less hostile to our environment. Rapidly advancing technologies can achieve a transition of energy generation, water and waste management, and food production towards better environmental and energy usage practices using methods of systems ecology and industrial ecology.




## *Integrated Energy Policy in India*

The *Manmohan Singh* government had launched an Integrated Energy Policy in mid 2000s. That policy envisaged an energy mix that focused on augmenting the domestic energy resource base and increasing efficiency while strategizing India's stakes in energy assets overseas. The broad vision behind the *Integrated Energy Policy* was to reliably meet the demand for energy services of all sectors including the lifeline energy needs of vulnerable households in all parts of the country with safe, clean and convenient energy at the least cost. In further to it, *NITI chairman Arvind Panagariya* had renounced that NITI would soon launch an Integrated Energy Policy under NITI Ayog.

These are the major aims of an Integrated Energy Policy.

- Reduce Energy Requirements
- Expand Resource Base in both conventional and unconventional areas and both renewable and non-renewable sources.
- Build *Strategic Oil Reserve (SOR)*
- Implement Power Sector Reforms
- Increase efficency in fossil fuels consumption
- Independent regulation to achieve competitive efficiency
- Reduction in cost of Power
- Boosting Energy Related R&D
- Exploring Waste to Energy Potentials

***Why there is a need of an Integrated Policy?***There is a need to provide clean, safe and convenient form of energy to all sectors in an economically viable manner. To achieve this objective India needs to expand its energy base by exploring all possible energy resources whether conventional or non conventional. Along with this India needs to pursue such strategies which manages demand side problems and promote conservation of coal and petroleum with a focus on increasing energy efficiency which shall remain India's most important concerns regarding energy security till 2030.

***What should be the Energy Priorities for India?***Achieving energy security, first and foremost requires development goals in rural areas where poverty condition are currently the greatest. This will require greater access and improved energy services as a means to reach education, health, water and other goals in these rural areas. Expanding energy services is a means to generate increased employment and income generating opportunities- and is therefore a pre- requisite to increased value adding activities in rural areas. For the policy – maker helping create a sustainable energy pathway will require broad social consensus around the strategic choices of economic, environmental and social development. Depending on their current state of development and priorities, India is likely to pursue different paths towards a variety of sustainable development options. It will require different policy mixes, likely incorporating fiscal, regulatory and research and development efforts. Transparency, stakeholder involvement and institutional flexibility will be the key ingredients for any set of decisions.

## *Pradhan Mantri Sahaj Bijli Har Ghar Yojana–"Saubhagya"*

*Pradhan Mantri Sahaj Bijli Har Ghar Yojana – '**Saubhagya'***a new scheme was launched by *Narendra Modi ji, theHon'ble Prime Minister, on 25th September 2017*. Under Saubhagya, free electricity connections to all households (both Above Poverty Line and poor families) in rural areas and poor families in urban areas will be provided. There are around 4 Crore un-electrified households in the country and they are targeted for providing electricity connections by December 2018. *Rural Electrification Corporation (REC)* has been designated as its nodal agency for the Saubhagya scheme.

To expedite and monitor the electrification process under Saubhagya a web portal *(www.saubhagya.gov.in)* was launched by *Shri R.K. Singh, Minister of State (IC) for Power and New & Renewable Energy on 16th November 2017*. The Saubhagya web portal has been designed and developed to disseminate information about the Household Electrification Status (State, District, Village wise), Household Progress as on date, State Wise Target vs Achieved, Monthly Electrification Progress, etc.

Under the Saubhagya scheme, DISCOMs are to organize camps in villages/cluster of villages to facilitate on-the-spot filling up of application forms including release of electricity connections to households. DISCOMs/Power Department are to adopt innovative mechanism through dedicated web-portal/Mobile App for collection/consolidation of application form in electronic mode and also capturing process of release of electricity connections. The details of consumers' viz., Name and Aadhar number/Mobile number/Bank account/Driving License/Voter ID etc., as available would be collected by the DISCOMs.

***Scope of the Scheme:***

- Providing last mile connectivity and electricity connections to all un-electrified households in rural areas.
- Providing Solar Photovoltaic (SPV) based standalone system for un-electrified households located in remote and inaccessible villages/habitations, where grid extension is not feasible or cost-effective.

- Providing last mile connectivity and electricity connections to all remaining economically poor un-electrified households in urban areas. Non-poor urban households are excluded from this scheme.

***Salient Features of Saubhagya are:***

- All DISCOMs including Private Sector DISCOMs, State Power Departments and RE Cooperative Societies shall be eligible for financial assistance under the scheme in line with DDUGJY.
- The prospective beneficiary households for free electricity connections under the scheme would be identified using SECC 2011 data. However, un-electrified households not covered under SECC data would also be provided electricity connections under the scheme on payment of Rs. 500 which shall be recovered by DISCOMs in 10 installments through electricity bill.
- The electricity connections to un-electrified households include provision of service line cable, energy meter including pre-paid/smart meter, single point wiring. LED lamps and associated accessories in line with technical specifications and construction standard.
- In case of un-electrified households located in remote and inaccessible areas, power packs of 200 to 300 Wp(with battery bank) with a maximum of 5 LED lights, 1 DC Fan, 1 DC power plug etc. may be provided along with the provision of Repair and Maintenance (R&M) for 5 years.
- The details of consumers viz, Name and Aadhar number/ Mobile number/ Bank account/ Driving License/Voter ID etc., as available would be collected by the DISCOMs.
- The defaulters whose connections have been disconnected should not be given benefit of the scheme. However, the utilities may consider settlement of old dues and reconnection as per norms.

***The funding structure of Saubhagya is as under:***

| Agency | Nature of support | Quantum of support (%) | |
|---|---|---|---|
| | | Other than Special Category States | Special Category States |
| Govt of India | Grant | 60 | 85 |
| Utility/State Contribution | Own Fund | 10 | 5 |
| Loan (FIs/ Banks) | Loan | 30 | 10 |
| Additional Grant from GOI on achievement of prescribed milestones | Grant | 50% of total loan component(30%) i.e 15% | 50% of total loan component(10%) i.e 5% |
| Maximum Grant by GOI (including additional grant on achievement of prescribed milestones) | Grant | 75% | 90% |

## *Deen Dayal Upadhyaya Gram Jyoti Yojna*

***Deen Dayal Upadhyaya Gram Jyoti Yojana ( DDUGJY )*** is a Government of India scheme designed to provide continuous power supply to rural India. It was launched in 2015 by *Shri Piyush Goyal, from the Union Cabinet*, chaired by the *Hon'ble Prime Minister Shri Narendra Modi*. The government plans to invest *₹756 billion (US$12 billion)* for rural electrification under this scheme. The scheme will replace the existing *Rajiv Gandhi Grameen Vidyutikaran Yojana ( RGGVY ).*

The DDUGJY scheme will enable to initiate much awaited reforms in the rural areas. It focuses on feeder separation (rural households & agricultural) and strengthening of sub-transmission & distribution infrastructure including metering at all levels in rural areas. This will help in providing round the clock power to rural households and adequate power to agricultural consumers .The earlier scheme for rural electrification viz. Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) has been subsumed in the new scheme as its rural electrification component.

The Ministry of Power has launched a new app, *GARV-II app* to provide real-time data of all six lakh villages of the country. The app is envisaged to ensure transparency in the implementation of rural electrification programme. The new app will also enable the citizens to participate in the developmental works and can give their feedback and inputs related to the rural electrification programme. The participation of Citizens will enable public scrutiny of the rural electrification programmes. In addition, the village-wise works sanctioned under Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) has been mapped to scrutinize the progress of work carried out under the project in each village

The deadline for the Centre's rural electrification programme is *May 2018*.

***Scheme -***

Ministry of Power, Government of India has launched *Deen Dayal Upadhyaya Gram Jyoti Yojana* for rural areas having following objectives:

1. To provide electrification to all villages
2. Feeder separation to ensure sufficient power to farmers and regular supply to other consumers
3. Improvement of Sub-transmission and distribution network to improve the quality and reliability of the supply
4. Metering to reduce the losses

***Benefits –***

- All villages and households shall be electrified
- Increase in agriculture yield
- Business of Small and household enterprises shall grow resulting in new avenues for employment
- Improvement in Health, Education, Banking (ATM) services
- Improvement in accessibility to radio, telephone, television, internet and mobile etc.
- Betterment in social security due to availability of electricity
- Accessibility of electricity to schools, panchayats, hospitals and police stations etc.
- Rural areas shall get increased opportunities for comprehensive development.

## *Rewa Mega Solar Project*

The World Bank has agreed to provide loan to develop internal transmission arrangements of the upcoming Rewa Ultra Mega Solar project in Madhya Pradesh. Rewa Ultra Mega Solar is a proposed solar park spread over an area of 1,590 acres (6.4 km2) in the Gurh tehsil of Rewa district of Madhya Pradesh. The project is expected to be commissioned with 750 MW capacity by the end of 2018. Rewa Ultra Mega Solar Limited (RUMSL), the implementing agency of the project, is a 50:50 joint venture between the Madhya Pradesh Urja Vikash Nigam Limited (MPUVNL) and the Solar Energy Corporation of India (SECI). Internal infrastructure for the project is developed by the RUMSL. The World Bank has agreed to provide loan to develop internal transmission arrangements of the Rewa project. It will provide 25 per cent of the loan amount under its Clean Technology Fund, where the money will be provided at an interest rate of only 0.25 per cent. This would be the first solar power project of the country to receive a loan under CTF. 24% of power generated from the park will be sold to the Delhi Metro Rail Corporation, and the remaining to Madhya Pradesh state utility, M.P. Power Management Company Ltd.

## *USA – India Bilateral Program 'Greening the Grid'*

Sh. Piyush Goyal, the Union Minister of Power, released the first part of the study " Pathways to Integrate 175 gigawatts of Renewable Energy into India's Electricity grid."

The study, developed under the US – India bilateral program "Greening the Grid", confirms the technical and economic viability of integrating 175 gigawatts (GW) of renewable energy into India's power grid by 2022, and identifies future course of actions that are favorable or such integration. The government of India in 2015 had set the ambitious target of adding 100 GW of solar energy and 60 GW of wind energy into the country's energy mix.

***Background –***

USAID has a long-standing collaboration with the Government of India in the area of energy.

*The US agency for International Development ( USAID)* announced five new partnerships in 2016, four of which are with the government of India, to expand US – India cooperation on clean energy, environment and climate change. First among these new partnerships is USAID's commitment to work with the *Bangalore power utility BESCOM and the US based company, Innovari,* to launch the first grid integration pilot under the *"Greening the Grid (GTG) initiative"*. GTG is a joint USAID and Ministry of power initiative to strengthen India's power gid to manage large-scale integration of renewable energy. India aims to provide 24/7 power to all Indian households by 2022 by adding and integrating 175 gigawatts of renewable energy into the national grid.

Under the next partnership, *the Ministry of New and Renewable Energy (MNRE)* and USAID agreed to expand their solar rooftop program to an additional eight states and 15 utilities. During the first phase of the program, the USAID and MNRE supported the states of Rajasthan, Karnataka and Madhya Pradesh to introduce appropriate net-metering policies and regulations, and provided technical assistance to the state distribution utilities implementing solar rooftop programs. In the expanded program, USAID will also partner with MNRE to train 5000 utility engineers and 1000 bankers and entrepreneurs on installation and operation best practices for solar rooftop systems.

During the US India Joint Workshop Group on Combating Climate Change, USAID announced its collaboration with *the Forest Survey of India (FSI) under the Ministry of Environment*, Forest and Climate change to strengthen the latter's capacity to better predict forest fires, use high resolution satellite imagery for forest resources assessment, and develop protocols for strengthening forest inventory. USAID is partnering with the University of Chicago to support the efforts of the Government of India and Gujarat State pollution Control Board to pilot a market instrument designed to reduce costs for industrial plants to comply with regulatory limits on emissions.

***Highlights of the Report –***

The report resolves many questions about how India's electricity grid can manage the variability and uncertainty of adding large amounts of renewable energy into the grid.

The results demonstrate that power system balancing with 100 GW solar and 60 GW wind is achievable at 15-minute operational timescales with minimal reduction in renewable energy output. India's current coal dominated power system has the inherent flexibility to accommodate the variability associated with the targeted renewable energy capacities.

***Some of the key operational impacts that came out of the report were –***

1) Large - scale benefits of fuel savings and reduced emissions due to increased renewable energy production

2) Existing fast ramping infrastructure is sufficient to maintain grid balance

3) In post 175 GW clean energy scenario, coal plants operating at part capacity will need suitable incentives for flexibility.

The study also evaluates the value of strategies to better integrate renewable energy and demonstrates the importance of policy and market planning.

A multi institutional team from India's Power System Operation Corporation ( POSOCO) and the U.S. Department of Energy's National Renewable Energy Laboratory (NREL) and Lawrence Berkeley National Laboratory ( LBNL) produced the report using advanced weather and power system modeling, under the leadership of Ministry of Power and the U.S Agency for International Development (USAID) with co-sponsorship from the Energy Sector Management Assistance Program (ESMAP) and the 21st Century Power Partnership.

## *World's Largest Solar Park in India*

*Kurnool Ultra Mega Solar Park is a solar park spread over a total area of 5,932.32 acres (24.0072 km2) in Panyam mandal of Kurnool district, Andhra Pradesh.* The project is being implemented by the *Andhra Pradesh Solar Power Corporation Private Limited (APSPCL)*, a joint venture of the *Solar Energy Corporation of India, Andhra Pradesh Power Generation Corporation and the New & Renewable Energy Development Corporation of Andhra Pradesh Ltd.* The park was built at an investment of around *₹7,000 crore (US$1.1 billion)* by solar power developers and the Central and State governments.Solar power developers invested ₹6,000 crore (US$930 million), while the remaining ₹1,000 crore (US$160 million) was funded by APSPCL supported by a ₹200 crore (US$31 million) grant from the Union Government.With more than 900 MW of the 1,000 MW already commissioned, and the rest expected to be ready soon, the Kurnool Ultra Solar Park has become the largest single location solar project.With a capacity of 1,000 MW, it has already outpaced the *648 MW solar park developed by the Adani group in Tamil Nadu* and the *550 MW Topaz Solar Park in California*.The project is located about 280 km from Hyderabad and is developed under the *Ministry of Renewable Energy's Solar Parks* *scheme*. The park has been set up by the *Andhra Pradesh Solar Power Corporation Limited (APSPCL*), a joint venture company where in 50 per cent equity is held by *Solar Energy Corporation of India (SECI),* 41 per cent by AP Genco and 9 per cent by *Non-conventional Energy Development Corporation of Andhra Pradesh (NREDCAP).*

## *Conclusion*

The *Energy Revolution* demonstrates how the world can get from where we are now, to where we need to be in terms of phasing out fossil fuels, cutting CO2 while ensuring *energy security*. This includes illustrating how the world's carbon emissions from the energy and transport sectors alone can peak by 2015 and be cut by over 80 percent by 2050. This phase-out of fossil fuels offers substantial other benefits such as independence from world market fossil fuel prices as well as the creation of millions of new green jobs.

In India, because our energy infrastructure is not fully developed as yet, we have the opportunity to make the right choices today. We can choose between abundantly available renewable and sustainable energy that is the way the world is going to be powered in the future or the old, dirty energy technologies that will drive India's dependence on foreign countries for supply of fuel, whether it is nuclear, coal or oil.

In an effort to bring about this revolution, *Greenpeace India* is working to promote *Decentralized Renewable Energy (DRE)*. Decentralized energy systems are based on the idea that energy doesn't have to be generated in one giant centre and then transported long distances. It can be generated near the place it is needed, and often under the control of the people who will use it.

As decentralized energy system serves people locally, it will necessarily be smaller than the huge power stations in a centralized system. Renewable energy technologies are ideally suited to this type of small-scale energy generation and have the advantage that they won't pollute the air, water and land of the people who live nearby. Renewable energy technologies also don't generate greenhouse gases and therefore won't exacerbate climate change.

In India, where the vast size of the country and the huge power deficits mean that most people – particularly those in rural areas – can't rely on their electricity supply, DRE systems are particularly relevant. The beauty of operating on such a small scale means that the energy supply can be designed to exactly suit the needs of the community it serves.

Depending on the natural resources available, people can choose to capture solar power, wind power, the power of moving water using micro-hydro technology, or a combination of all of three. There are many other forms of renewable energy present in the world too, and we're getting better at capturing them. Systems can be isolated – these are called 'stand-alone' – or can even be connected to the main electricity grid – these are called 'grid interactive'. Grid interactive systems have the advantage that the owners of the system can actually sell power to the grid if they generate excess, creating another source of income for them, or draw extra power if they find they ever need more.

Examples of DRE systems are cropping up all over India. In Bihar, over one lakh people are using electricity made from waste rice husk. In Ladakh, tribal communities are processing their farm produces with machines powered by micro-hydro. In Karnataka, villagers are cooking food on clean gas flames produced by cow manure.

टीएचडीसी इंडिया लिमिटेड

THDC INDIA LIMITED

# ***National Initiatives for Energy Revolution***


### *Abstract*

The society in which we live and breathe is in an ever changing mode, either it's the way we live changes or our conventional methods which change. The only constant thing was energy which is been and will be used for eons, although it keeps on modifying itself providing better, stable and a friendly approach towards achieving the desired goals, earlier the mode of generation of electricity were limited i.e. not eco friendly and also perishable but with the growing time we as a society is looking towards other mechanism for generation of energy like solar energy, wind energy, bio mass energy biogas energy, and for a country like India which have all these natural resources in abundance we have still lacked in providing electricity to all across the country. This research article focuses upon the new scheme which purpose is to provide electricity at a subsidised rate to those who still cannot afford it. Pradhan Mantri Sahaj Bijli Har Ghar Yojna "Saubhagya". The challenges with implementation of this scheme, also this article focuses upon encouraging green energy in India for Agriculture business, cold storage, food parks etc;



***Keywords:*** Energy, Saubhagya



***By Aman Tolwani***

### *Introduction*

Energy is an essential input for social and economic development our government is fully indulged in providing adequate power to meet the objectives of economic developments and to strive towards making quality of life of people of rural areas. The increasing demand of power requires additional increase in funds, huge investments for creating additional capacity of generation, transmission and distribution. Ever since independence it has been the goal of policy makers to provide electricity to every household every village in our country, in time we had stumbled upon many roadblocks many other issues which in some way or other has delayed or slowed down the pace of our goal.Over the years many schemes were launched which aimed at distributing electricity to every household in our country, few attained a tad bit of a success, few failed miserably and few were left with their files only.

Of the world's 1.3 billion people who live without access to power, a quarter, about 300 million live in rural India in states such as Bihar. Indian leaders say that the huge challenge of extending electric service to its citizens is a hard reality that the country must continue to increase its fossil fuel consumption, meaning therefore a threefold increase in greenhouse gas emissions by 2030, according to some estimates.

Satish Paswan, 35, a farmer who sold a bit of his family's land to purchase a solar panel and light a few months ago for about $88. Wished only that his five children could do their homework.

"We feel very ashamed and bad that other neighboring villages are enjoying power facility and we don't have it," Paswan said. "Whenever a small leader or a big leader belonging to the ruling party comes here, they promise their first priority is to provide electricity to the villages. But they have never fulfilled that promise."[36]

Over the years with schemes kept on changing following the ruling governments, in 2014 new government came in power govern our country and since then India has seen a major growth in various sectors, be it jobs or communication or international relations, India has seen light of day in almost every sector. While coming to the end of year 2017, Prime Minister Shri Narendra

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[36] The Washington Post, Annie Gowen, **India's huge need for electricity is a problem for the planet, November 6, 2015** https://www.washingtonpost.com/world/asia_pacific/indias-huge-need-for-electricity-is-a-problem-for-the-planet/2015/11/06/a9e004e6-622d-11e5-8475-781cc9851652_story.html?utm_term=.2d5dfae657c2

Modi Ji launched a scheme for providing electricity in utmost 4 Crore household across the country, It aims to provide universal household electrification in many parts of the country at an overall cost of Rs 16,320 crore, in which the division of funding is as follows:

- 60% Government of India grant
- 10% Utilities/State contribution
- 30% loans.

The name of the scheme is Pradhan Mantri Sahaj Bijli Har Ghar Yojna or Saubhagya launched in September 2017, the scheme is a part of Union Government's Pradhan Mantri Kaushal Vikas Yojana (PMKVY). The sole purpose of this scheme is to provide electricity in all household of rural India, to provide Solar Photovoltic (SPV) based standalone electricity system where grid extension is not feasible, provide electricity to poor urban household in country which are still un-electrified. In all, to provide electricity to such households which cannot afford electricity at present rate or due to present circumstances.

To expedite and monitor the electrification process under Saubhagya a web portal (www.saubhagya.gov.in) was launched by Shri R.K. Singh, Minister of State (IC) for Power and New & Renewable Energy on 16thNovember 2017. The Saubhagya web portal has been designed and developed to disseminate information about the village wise Household Electrification Status across the country.[37] Under the Saubhagya scheme, DISCOMs will organize camps in villages/cluster of villages to facilitate on-the-spot filling up of application forms including release of electricity connections to households. DISCOMs/Power Departments will also adopt innovative mechanisms like dedicated web-portal/Mobile App for collection/consolidation of application form in electronic mode and also capturing process of release of electricity connections. The details of consumers like Name, Address and Identification proof as available (Aadhar number/Mobile number/Bank account/Driving License/Voter ID etc.) would be collected by the DISCOMs.[38]

### *Features of Subhagya scheme:*

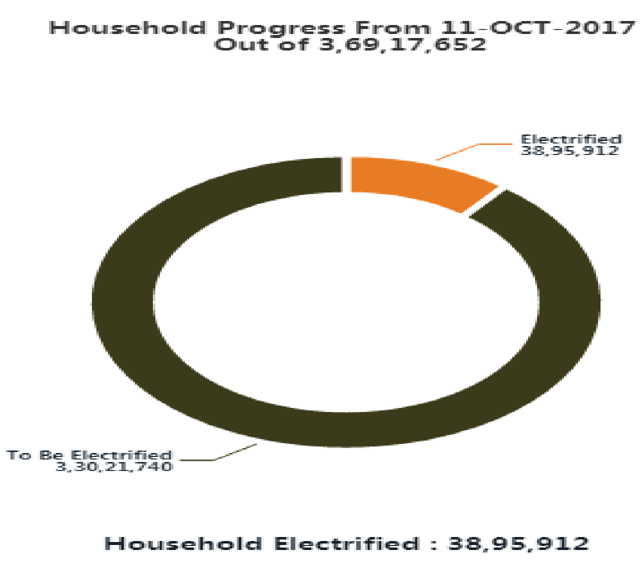
All DISCOMs including Private Sector DISCOMs, State Power Departments and RE Cooperative Societies might be qualified for financial help under the scheme in accordance with

[37] www.saubhagya.gov.in
[38] Ibid., at pt 2

DDUGJY. The forthcoming recipient households with the expectation of complimentary electricity associations under the scheme would be distinguished utilizing SECC 2011 information. Notwithstanding, un-electrified households not secured under SECC information would likewise be given electricity associations under the scheme on installment of Rs. 500 which might be recouped by DISCOMs in 10 portions through electricity charge. The electricity associations with un-electrified households incorporate arrangement of administration line link, vitality meter including paid ahead of time/savvy meter, single point wiring. Driven lights and connected extras in accordance with specialized determinations and development standard. If there should be an occurrence of un-electrified households situated in remote and out of reach regions, power packs of 200 to 300 Wp(with battery bank) with a maximum of 5 LED lights, 1 DC Fan, 1 DC power plug and so forth might be furnished alongside the arrangement of Repair and Maintenance (R&M) for a long time. The points of interest of customers viz, Name and Aadhar number/Mobile number/Bank account/Driving License/Voter ID and so on., as accessible would be gathered by the DISCOMs. The defaulters whose associations have been disengaged ought not be given advantage of the scheme. Be that as it may, the utilities may think about settlement of old duty and re connection according to standards.

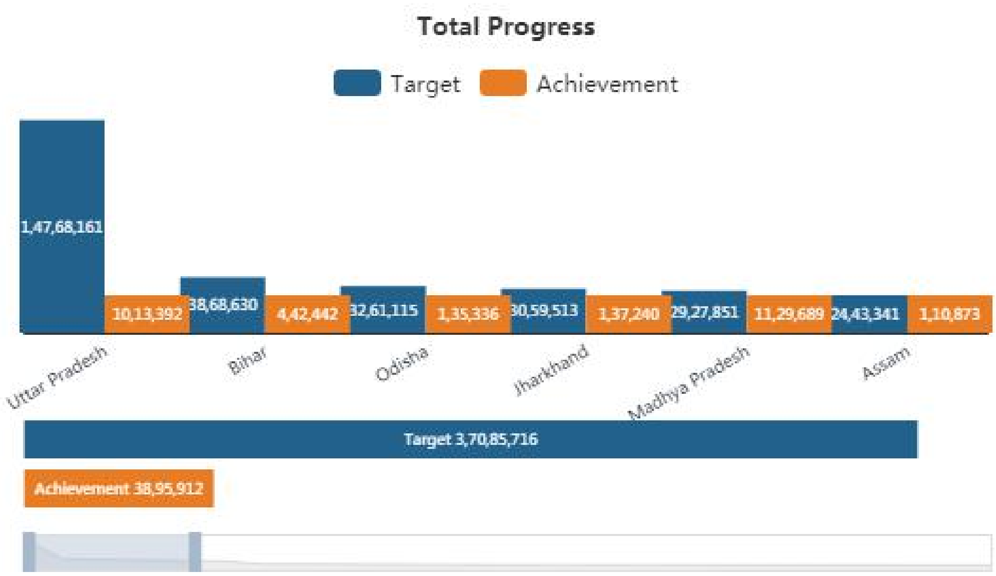
Citizens can track progress of the scheme by visiting www.saubhagya.gov.in (Saubhagya portal)

***Progress report***



The above pie chart indicates as to number of households which are electrified (38,95,912) since 11th October 2017 till date and the number of households which are yet to be electrified.


The above diagram indicates the achievements of Saubhagya scheme month wise from the month of October 2017 till the latest month of March 2018, the orange bar indicates towards the achievement as to number of houses which are electrified up till this point under this scheme. One good thing about the scheme is that, till now they haven't set any target limit, otherwise people starts comparing as to what they have achieved in their span of time, without considering the factors which might have hampered the process, so it's a good thing that they are just covering as much of household as they can without worrying about the said target limit.



The above diagram contains two bars, the blue bar was the target limit set in each state and the orange bar stating the achievements so far, so now we know that Uttar Pradesh needs to be electrified the most, so more man power will be employed there and that the state will take more time to get fully electrified as compared to other states.

***Funding of Saubhagya***

| **Agency** | **Nature of support** | **Quantum of support (%)** | |
|---|---|---|---|
| | | **Other than Special Category States** | **Special Category States** |
| Govt of India | Grant | 60 | 85 |
| Utility/State Contribution | Own Fund | 10 | 5 |
| Loan (FIs/ Banks) | Loan | 30 | 10 |
| **Additional Grant** from GOI on achievement of prescribed milestones | Grant | 50% of total loan component(30%) i.e 15% | 50% of total loan component(10%) i.e 5% |
| **Maximum Grant by GOI (including additional grant on achievement of prescribed milestones)** | **Grant** | **75%** | **90%** |

Saubhagya was acquainted with compensate for the drawbacks of prior schemes that considered a town electrified in the event that it had fundamental dissemination framework to supply electricity to every single open place (schools, clinics, group focuses and so forth) and just 10 for each penny of households. The plan lays accentuation on giving energy access to unelectrified households, though, its forerunners, the Deen Dayal Upadhyaya Grameen Kaushalya Yojana (DDU-GKY) and Integrated Power Development Scheme (IPDS) were principally engaged at enhancing framework.

Sabyasachi Majumdar, Senior Vice President at ratings agency ICRA has this to say, "The thrust towards ensuring electricity access to all rural households under Saubhagya & DUGJY schemes is likely to provide a boost in energy demand to some extent, apart from improving the quality of life for rural households. Further, the mechanism proposed to buy surplus solar energy from solar pumps by distribution utilities as well as push for deployment of solar energy under smart city programme would facilitate solar capacity addition, given the improved tariff competitiveness of solar energy"[39]

The eligibility for free electricity will be identified through Caste Census of 2011. The Rural Electrification Corporation Limited (REC) has been appointed as the nodal agency for the implementation of the Saubhagya scheme.

### *Issues with the Scheme*

***Awareness*** **-** Absence of knowledge spread is a huge impediment to accomplishing round the clock electricity for all. Recipients at times comprehend the motivating forces made accessible to them and electricity suppliers can't viably strategise for proficient supply administration because of absence of field data. Through knowledge scattering camps, contribution of gram panchayats and open organizations, Saubhagya means to build mindfulness and encourage spot applications and additionally streamline documentation, conveyance of bills and revenue collection.

***DISCOMS are an impediment*** **-** The scheme neglects to boost DISCOMS to give continuous quality services. This is in spite of the constructive connection between's solid electricity and an expansion in electricity use and individuals' ability to pay, as apparent the nation over. Also, it

[39] Economic Times, Sudheer Singh, **Budget 2018: Positive impact on power sector, Saubhagya to boost demand, February 1, 2018** https://energy.economictimes.indiatimes.com/news/power/budget-2018-positive-impact-on-power-sector-saubhagya-to-boost-demand/62742057

neglects to prepare its intended interest group to cooperate and take an interest in information feedback loops, fundamental for refining their electricity supply.

The scheme discusses empowering individuals and achieving financial improvement, which is frequently repeated by the Prime Minister. Nonetheless, it doesn't energize miniaturized scale endeavors or pay creating openings that could enable customers to bear the cost of their electricity utilization. Not representing the family unit's powerlessness to pay elevates a current bottleneck in electricity services. Defaulters, who have lost their electricity associations due to non instalment, have not been suited inside the scheme. The scheme ought to give them financing arrangements that enable them to pay off their duty and win back electricity rights.

If there should arise an occurrence of non-fruition under Saubhagya, remaining un-electrified towns will overflow to DDU-GKY. Specialists anticipate that the last couple of houses will receive rewards of electricity just by 2021-2022. The genuine progress or disappointment of India's zap system may be obvious in Census 2021.

***Encouraging Green Energy for Agriculture Business*** **-** The land of India is embedded with various gifts from mother nature, like winds flowing, abundant solar energy, bio mass energy and agriculture being the backbone of our country all these naturally occurring resources can provide a large boost to our country's Agri based business.

India's geographical advantage makes solar-powered water pumps an excellent alternative to diesel powered pumps in particular. Studies estimate India's potential for solar PV water pumps for irrigation to be 9 million to 70 million pump sets[40] says Vikas Dawra. India's geographical advantage makes solar powered water pumps a viable alternative to diesel powered pumps in particular. India's potential for solar powered water pumps for irrigation to be 9 million to 70 million pump sets.

Solar pumps can improve the financial health of State Electricity Board (SEB) by reducing subsidised power to farmers and eliminating capital expense to connect farms to grid which is estimated to be ₹1.7 lakh per connection.

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[40] The Hindu, Vikas Dawra, Renewable Energy: Best bet for farm factors, June 17, 2015 https://www.thehindubusinessline.com/news/variety/renewable-energy-best-bet-for-farm-sector/article7322489.ece

The upfront capital cost of solar powered pumps is higher than traditional pump, a lucrative payback economics of 3-5 years is possible given the high operating cost for diesel pumps.

Indian government led by the Ministry of New & Renewable Energy (MNRE) has placed a substantial emphasis on further penetration of solar PV power pumps with a vision to replace existing 26 million pumps with more efficient solar power pumps.

In the Union Budget, the Finance Minister announced a ₹ 415 crore for installing 100,000 solar powered pump sets. In November 2014, the government launched a programme for promoting 30,000 solar pumping systems per year for the purpose of irrigation.

The programme will be implemented alongside state governments. MNRE will provide a subsidy of 30 per cent (maximum amount is capped per category of pump) and loan at 5 per cent with an additional subsidy from state governments.

Rajasthan has been a pioneer in promoting solar water pumps, and offers an additional subsidy of 56 per cent over and above the MNRE subsidy, which means that the solar water pump owner gets 86 per cent subsidy in total.

In Tamil Nadu, a total of 80 per cent subsidy is provided, whereas in Punjab, the total subsidy comes to about 70 per cent. Maharashtra has recently proposed a plan to provide 5 lakh solar pumps to farmers and is in the process of formalizing the program.

In spite of favourable macro economic and government support, solar power pumps have still lagged considerably vis-a-vis diesel power pump addition. Total installed solar pumps are merely 25,000 vis-a-vis 10 mn installed diesel pumps.

Firstly, solar power pumps have a substantially higher capex vis-a-vis diesel pumps. With limited capability of upfront payment, the market is heavily dependent on government subsidies. While subsidies are in place, it is typically very difficult to make use of these payments (especially the state portion)

Secondly, the solar pumps are not portable unlike diesel pumps. Movable pumps protect from theft and can be easily rented out. Lastly, diesel pumps have a higher degree of user confidence vis-a-vis solar pumps which have limited track record.

### *Recommended action*

We believe solar pumps provide an exceptional opportunity to not only improve the productivity of farm lands but also substantially improve the energy security of the nation and reduce the subsidy bill. However, in order to realise the utmost potential, several steps need to be taken. Firstly, heavily subsidised model is not feasible in the long run.

Pay per use model would enable shared usage of solar pump infrastructure by multiple farmers. This will result in deeper penetration amongst marginal farms and maximum utilization of the system resulting in lower payback period. This model has worked quite well in rural micro and mini grid installations in India.

Support could be provided to these entrepreneurs via soft loans. Subsidies could be better utilized in undertaking R&D efforts to reduce the initial capex of these products which would be more productive in the long run

Secondly, no power cost in solar powered pumps, poses the risk of over usage by farmers, resulting in wastage and affecting the water table. Pay per use model stated above could assist in reducing the wastage. Further usage of solar pumps should be accompanied by efficient mechanisms such as drip irrigation and water storage facility – most of the subsidy schemes have already included this as a requirement

Further, a strong local ecosystem needs to be created to promote and provide cost effective O&M solutions for the system. This will not only assist in cost effective maintenance of the system but will also increase rural employment

Finally, educational and promotional campaigns to explain the economical and social impacts of solar pumps vis-a-vis traditional pumps would be critical to increase the penetration and acceptability of the products amongst farmers.

# ***Electricity Arbitration in India: Current Challenges & the way forward***


### *Abstract*

This century has seen rapid growth in the electricity sector in India with investment increasing substantially. To support electricity sector reforms in India, a strong legal framework by way of the Electricity Act, 2003 was enacted. It deals with various matters relating to generation, transmission, distribution, trading and use of electricity. This Act permits private participation in generation, transmission and distribution of electricity.

Dispute resolution being a major concern for private investment in infrastructure, this article seeks to examine the mechanisms available under the various state and central legislations, regulations and industry practices in an attempt to put forth suggestions for improving their efficacy. Disputes mean delay and delay in turn would mean escalation of costs. Particularly, for a private investor it implies loss of earnings from the resources having utilization otherwise. An efficient dispute resolution mechanism thus holds significance, in attracting private investors to partner with the government. This paper aims to study the current challenges faced legal provisions to drive electricity demand, promoting retail competition and tariff slab rationalization to drive manufacturing.



***Keywords:*** Electricity, Arbitration, Power, Reforms, Dispute Resolution



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## *Introduction*

Since the beginning of this century, India has seen a rapid growth in its Electricity Sector.[41] According to the International Energy Agency[42] since the year 2000, India has contributed for around 10% of the increase in energy demand worldwide. India's energy demand has almost doubled in this time frame, pushing India's share in global demand up to 5.7% in 2013 from 4.4% at the beginning of the century. The provision of electricity is critical to India's energy and economic outlook and is a major area of uncertainty for the future. According to BP Statistical Review of World Energy 2017[43], India holds a 5.6% share in the global electricity generation.

The rapid growth of the electricity sector has not only led to policy and regulatory reforms, but also in a paradigm shift in the legal regime that governs this sector. Reforms in the Electricity Sector also include statutory mechanisms for efficiently resolving disputes among generation, transmission and distribution companies. Last year, the NITI Aayog came up with the Draft National Energy Policy 2017 encompassing four important objectives - *Access at affordable prices, Improved security and Independence, Greater Sustainability, and Economic Growth.*[44] The Draft Policy, inter alia, recommended some revolutionary reforms such as the opening up of the entire power sector value chain to private investment in order to create an efficient electricity market. On September 2017, the Prime Minister of India launched a new scheme Pradhan Mantri Sahaj Bijli Har Ghar Yojana –"Saubhagya" to ensure electrification of all willing households in the country in rural as well as urban areas by 31st December 2018.

## *The Historical Background*

To keep up with the growth and investment in India's electricity sector and to a push for policy and regulatory reforms, the Parliament enacted the new Electricity Act, 2003. The aim of this

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41 According to the Energy Statistics 2017 published by the Central Statistics Office Ministry Of Statistics And Programme Implementation Government Of India, the total generation of electricity in India was 6,70,654GWh in 2006-2007 which increased to 11,67,584 GWh in the year 2015-2016, and the Compound Annual Growth Rate (CAGR) for Gross Generation of Electricity the period of 2005-2006 to 2015-16 was 5.70 %

42 INTERNATIONAL ENERGY AGENCY. (2015). India Energy Outlook - World Energy Outlook. Paris, Organisation for Economic Co-operation and Development.

43 BRITISH PETROLEUM COMPANY. (2017). BP Statistical Review of World Energy. London, British Petroleum Co.

44 NITI AYOG. (2017) Draft National Electricity Policy. Delhi, Government of India.

Act is to push the sector onto a trajectory of sound commercial growth and to enable the States and the Centre to move in harmony and coordination[45].

The Electricity Act, 2003 is *"An Act to consolidate the laws relating to generation, transmission, distribution, trading and use of electricity and generally for taking measures conducive to development of electricity industry, promoting competition therein, protecting interest of consumers and supply of electricity to all areas, rationalization of electricity tariff, ensuring transparent policies regarding subsidies, promotion of efficient and environmentally benign policies, constitution of Central Electricity Authority, Regulatory Commissions and establishment of Appellate Tribunal and for matters connected therewith or incidental thereto."*[46]

The Electricity Act, 2003 came into effect on 10th June 2003. It repealed the three existing laws that governed this sector previously.[47] The Electricity Act, 2003 is a comprehensive legislation which was passed to deal with various matters relating to generation, transmission, distribution, trading and use of electricity. The Act aimed at taking measures to advance the electricity industry through promotion of competition and protection of the interests of consumer in terms of supply and rationalization of tariff.  It also encouraged larger private participation of the Private Sector in electricity generation. The 2003 Act also constituted the Central Electricity Authority[48], Regulatory Commissions (Central[49] and State[50]) and established the Appellate Tribunal for Electricity (APTEL)[51]. It empowered the Central and State Electricity Regulatory Commissions to take over the role of Central Electricity Authority with certain additional powers/responsibilities. It also provides that the State Electricity Regulatory Commissions shall be guided by any determination by the Central Electricity Regulatory Commission, the National Electricity Policy, the National Electricity Plan and the Tariff Policy[52]. The CERC and SERCs along with the APTEL form the mechanism of dispute resolution under the Electricity Act, 2003. It is based on the 'expert adjudication' approach of Dispute Resolution, which included adjudication by quasi-judicial bodies comprising of technical and legal experts with a provision

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45 Power Ministry, Government of India.

46 Long title of the Electricity Act, 2003.

47 Vide Section 185 of the 2003 Act, the Electricity Act, 1910; the Electricity (Supply) Act, 1948; and the Electricity Regulatory Commission Act, 1998 stood repealed.

48 Section 70 of Electricity Act, 2003.

49 Section 76 of Electricity Act, 2003.

50 Section 82 of Electricity Act, 2003.

51 Section 110 of Electricity Act, 2003.

52 Section 86(4) of Electricity Act, 2003.

for appeal to a multi-disciplinary appellate body.[53] The Hon'ble Supreme Court in the case of *U.P. Power Corporation Ltd v. NTPC Ltd & Ors*[54] ruled in favor of 'expert adjudication' approach of dispute resolution.

***The Controversy Arises:****Gujarat Urja Vikas Nigam vs. Essar Power Ltd.*[55]

In 2008, the Hon'ble Supreme Court of India came across an important issue of contractions and conflicts in the Electricity Act, 2003 and the Arbitration and Conciliation Act, 1996. To understand the controversy better, a brief perusal of facts is necessary. The appellant GUVN**,** a generating company was supplying electricity to the respondent Essar Power Ltd ('Essar'), a licensee. A dispute arose between these parties under the Electricity Supply Contract. While attempting to resolve the dispute in accordance to the arbitration agreement under the contract, the parties could not agree upon a sole arbitrator. While, GUVN approached the electricity regulator to refer the dispute to arbitration under the Electricity Act, Essar Power approached the Hon'ble High Court of Gujarat for the appointment of an arbitrator under the Arbitration Act. The High Court appointed Essar Power's choice of arbitrator as the sole arbitrator. GUVN in appeal before the Supreme Court challenged the appointment of the sole arbitrator.

The issue to be adjudicated by the Hon'ble Supreme Court was whether the provisions for resolution of dispute contained in the Electricity Act, 2003 prevailed over Section 11 of the Arbitration and Conciliation Act, 1996.

More specifically, Section 86 of the Electricity Act, 2003 lays down the functions of the State Commission. Sub Section (f) of Section 86(1) provides an important function to the State Commission, to adjudicate upon the disputes between licensees and generating companies and to refer any dispute for arbitration.

The issue before the Supreme Court was that whether Section 86(1)(f) of the Electricity Act, 2003 would have an overriding effect on Section 11 of the Arbitration and Conciliation Act, 1996 which provides for appointment of an arbitrator. To put it simply, the question before the Hon'ble Supreme Court was that between the two acts, which governs the appointment of arbitrators in the case of disputes arising under the Electricity Act. The Supreme Court held that since the Electricity Act is a special legislation, it must override Section 11 of the Arbitration

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[53] Rethinking Dispute Resolution in Public–Private Partnerships for Infrastructure Development in India (Harisankar K.S. and Sreeparvathy G) Journal of Infrastructure Development 5(1) 21–32

[54] Uttar Pradesh Power Corporation Ltd. Vs. NTPC Ltd. & Ors., (2009) 6 S.C.C. 235.

[55] Gujarat Urja Vikas Nigam vs. Essar Power Ltd., (2008) 4 S.C.C. 755.

&Conciliation Act, 1996 which is the general provision for appointment of arbitrator. Therefore, the Court held that in all matters of dispute between distribution licensees and power generators, the electricity regulatory commissions have exclusive jurisdiction to either decide the dispute or refer it to arbitration by nominating an arbitrator, vide their power under Section 86(1)(f). It was further held that since the Electricity Act came into effect from 10th June 2003, any dispute between a licensee and a generator after this date can only be resolved by the concerned regulator or by arbitrators appointed by it. Harmoniously construing the Electricity Act, 2003 and the Arbitration and Conciliation Act, 1996, only the State Regulatory Commission or the Central Regulatory Commission (as the case may be) or arbitrator/arbitrators nominated by it can adjudicate disputes between licensees and generating companies. This would also apply to disputes falling outside the scope of clauses (*a*) to (*e*) and (*g*) to (*k*) of Section 86(1), since Section 86(1)(*f*) contains no restrictions on the nature of the disputes.

***The Controversy continues***

In the GUVN ruling[56], the Supreme Court did not prescribe any guidelines to keep a check on the conduct of Commission and was of the opinion that the Commission have complete discretion whether to decide the dispute under the Electricity Act, 2003 or to refer it to arbitration, conferring them with an exclusive jurisdiction. There was always an apprehension of abuse of discretion, and no safeguard against it. This controversy was finally laid to rest by the Supreme Court in the case of *Tamil Nadu Generation and Distribution Corporation Ltd. vs. PPN Power Generation Company Private Ltd*[57], where it was clarified that the power of the Commission to refer the dispute for arbitration has to be exercised reasonably and not arbitrarily. It was further held that the Appellate Tribunal for Electricity (APTEL) being the fora for first appeals under the Electricity Act could hear appeals deciding whether the decision of the regulator suffered from arbitrariness, unreasonableness or perversity.

## *Issues in the current regime*

***Effect on Party Autonomy* -** Arbitration law, worldwide, lays on the fundamental principle of party autonomy i.e., the freedom of parties to devise mechanisms for resolution of their disputes through contracts and subjecting them to mandatory rules of public policy. Party autonomy permits parties to select the law governing that contract along with the pre-determining jurisdiction for reference of the dispute. It underlies the principle of freedom of contracts, resulting in a globally accepted doctrine of the choice of law. The Indian Arbitration and

[56] Supra at note 15 .

[57] T. N. Generation & Distribution Corporation Ltd. vs. PPN Power Gen. Co. Private Limited, (2014) 11 S.C.C. 53.

Conciliation Act, 1996 recognizes the principle of party autonomy in the choice of procedure.[58] This means that if a particular procedure is prescribed in the arbitration agreement which the parties have agreed to, that has to be generally resorted to. It is because of this reason, as a normal practice, the court will insist the parties to adhere to the procedure to which they have agreed upon.[59]

There exists a lack of literature in India on party autonomy which necessitated the Supreme Court in *Andhra Bank Ltd. v. R. Srinivasan*[60] to fall back to English jurisprudence and precedents to decide on the point of law. Further, the Supreme Court in *VoestalpineSchienen GmbH Vs. Delhi Metro Rail Corporation Ltd*.[61] has held that the Indian Arbitration Act is based on the three main principles of arbitration law viz. (i) speedy, inexpensive and fair trial by an impartial tribunal; (ii) party autonomy; and (iii) minimum court intervention.[62]

Generally, all provisions of the Arbitration & Conciliation Act, 1996 are subjected to the agreement arrived at between the parties for identifying various substantive and procedural aspects in the arbitration proceedings, thus giving precedence to party autonomy. Some provisions of the Act reflecting the same are:

- Section 5 - Extent of judicial intervention: Notwithstanding anything contained in any other law for the time being in force, in matters governed by this Part, no judicial authority shall intervene except where so provided in this Part. There exists a handful go instances where judicial interference is allowed for instance appointment of arbitrators, where the parties‘ envisaged method for the same fails[63]; or ruling on whether the mandate of the arbitrator stands terminated due to inability to perform his functions or failure to proceed without undue delay[64]; assistance in taking evidence[65].

- Arbitration settlement (Sections 7-9): The arbitration settlement is central element which displays the autonomy of the parties. Disputes bypass jurisdiction of the civil courts through an arbitration agreement. An arbitration agreement, both in the form of an

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58SVG Molasses Co BV v. Mysore Mercantile Co Ltd 2007 (9) S.C.A.L.E. 89, para 11.
59 Voestalpine Schienen GmbH v. Delhi Metro Rail Corporation Ltd , (2017) 4 S.C.C. 665, paragraph 16.
60 Andhra Bank Ltd. v. R. Srinivasan, A.I.R. 1962 S.C. 232.
61 Supra at Note 19, Para 14-15.
62 Deptt. of Economics, Policy and Development of the City of Moscow v. Bankers Trust Co., (2004) 4 All. E.R. 746.
63 Section 11, Arbitration & Conciliation Act, 1996.
64Section 14(2), Arbitration & Conciliation Act, 1996.
65Section 27, Arbitration & Conciliation Act, 1996.

arbitration clause or the form of a submission settlement, reflects the will and intention of the parties.

- Arbitration Tribunal (Sections 10-15): The principle permits the parties to appoint any person who has requisite expertise as arbitrators. Furthermore, the powers and responsibilities of the arbitrators are determined by way of autonomy in arbitration.

- Location of Arbitration (Section 20): Parties to arbitration are at liberty to select the seat of arbitration.

- Section 29A - Section 29A has been introduced to fix the issue of lengthy arbitral proceedings, and to ensure that party autonomy is still maintained and that parties to the arbitration have the freedom to decide to extend the arbitration proceedings till whenever is required.

The Hon'ble Supreme Court in *Gujarat Urja Vikas Nigam Ltd. vs. Essar Power Ltd.*[66], however, failed to take into account the principle of party autonomy, by holing at Paras 35 and 59 that:

*"35. It is well settled that where a statute provides for a thing to be done in a particular manner, then it has to be done in that manner, and in no other manner, [vide Chandra Kishore Jha vs. Mahavir Prasad, (1999) 8 SCC 266: AIR 1999 SC 3558 (para 12), Dhananjaya Reddy vs. State of Karnataka,(2001) 4 SCC 9: 2001 State Commission(Cri) 652: AIR 2001 SC 1512 (para 22), etc. Section 86(1)(f) provides a special manner of making references to an arbitrator in disputes between a licensee and a generating company. Hence by implication all other methods are barred.*

*59… Hence on harmonious construction of the provisions of the Electricity Act, 2003 and the Arbitration and Conciliation Act, 1996 we are of the opinion that whenever there is a dispute between a licensee and the generating companies only the State Commission or Central Commission (as the case may be) or arbitrator (or arbitrators) nominated by it can resolve such a dispute, whereas all other disputes (unless there is some other provision in the Electricity Act, 2003) would be decided in accordance with Section 11 of the Arbitration and Conciliation Act, 1996. This is also evident from Section 158 of the Electricity Act, 2003. However, except for Section 11 all other provisions of the Arbitration and Conciliation Act, 1996 will apply to*

[66] Supra at Note 15.

*arbitrations under Section 86(1)(f) of the Electricity Act, 2003 (unless there is a conflicting provision in the Electricity Act, 2003, in which case such provision will prevail.)"*

The principle of party autonomy is not merely the foundation of the Indian Arbitration and Conciliation Act 1996, but it is in-fact the essence of any arbitration, domestic or international. The interpretation given by the Supreme Court overriding Section 11 of the 1996 Act, is not merely in contravention of the freedom of choice in arbitration, but it is against the whole and sole basis of party autonomy in the following ways:

(i) Increased Judicial Intervention - The power to refer any dispute to arbitration under Section 86 of the Electricity Act 2003, lies with the State Commission. If the State Commission in its discretion fails to honour the arbitration agreement so entered into by the parties, the State Commission itself will adjudicate upon the dispute. An appeal from such a decision would lie under Section 111 of the Act, to Appellate Tribunal for Electricity. Similarly, an appeal from the decision of the Appellate Authority would then lie under Section 125 of the Act to the Supreme Court. This engages the parties to the dispute in an endless cycle of litigation before the courts, exactly against the intention of the parties while entering into the arbitration agreement. The Supreme Court in the *Essar case*, relying on Sections 86(1)(f) and 158 of the Electricity Act, 2003 had taken the view that Section 11 of the Arbitration and Conciliation Act, 1996, would not apply at all. This interpretation whittles down the effect of Sections 5 and 8 of the Arbitration and Conciliation Act, 1996. Invalidating the application of Section 11 of the Arbitration and Conciliation Act 1996, has paved the way for greater and wider judicial intervention and has made it a rule, rather than an exception, for electricity disputes. This is against the basic idea of contractual freedom and renders the whole object of entering into an arbitration agreement redundant.

(ii) Lengthy Disposal of Electricity Disputes - Speedy conclusion of arbitration proceedings hardly needs to be emphasised.[67] The first and paramount principle underlying the 1996 Act is "fair, speedy and inexpensive trial by an Arbitral Tribunal". Unnecessary delay or expense would frustrate the very purpose of arbitration.[68] Keeping in mind the intention of the parties to enter into arbitration agreements, and also considering the lengthy procedure of adjudication before the civil courts, failure of referring the dispute to Arbitration would lead to

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[67] Supra at Note 19, Para 14.
[68] Supra at Note 19, Para 16.

lengthy litigations and procedures. This is against the very idea of speedy disposal of cases through arbitration.

(iii) Unilateral Arbitration clause - A unilateral arbitration clause refers to a clause allowing only one party under the arbitration agreement, to initiate and invoke the arbitration. Courts in Italy, Singapore, UK, and Spain have upheld such clauses as valid, while those in Bulgaria, France, Dubai, Russia, and Poland have struck down such unilateral clauses. Pertaining to electricity disputes in India, the interpretation given to Section 86 of the Electricity Act and Section 11 of the Arbitration Act, by the Supreme Court, the arbitration agreements which were negotiated equally, are now reduced to unequal, unilateral clauses. In India, generally, the grounds upon which unilateral arbitration clauses have been successfully challenged before the courts are – *lack of mutuality, public policy, and restraint of a party's right to legal proceedings*. Few decisions addressing the validity of unilateral option clauses by the Delhi , Calcutta and Madras High Courts (HC) are given as below:

A. In *Bhartia Cutler Hammer v. AVN Tubes*[69], the Delhi HC held that a party could not have an exclusive right to initiate arbitration as the Indian Arbitration and Conciliation Act, 1996. There must be a mutual arbitration agreement between the parties, and an opportunity for bilateral invocation. Even if the parties express consent to such a clause, it would not be a valid arbitration agreement.

B. In *Emmsons International Ltd. v. Metal Distributors*[70], the Delhi HC arrived at the same conclusion as in Bhartia Cutler, but gave a different reasoning. The court Tok the view that such unilateral option clauses were void as they restrained one party's recourse to legal proceedings, in contravention of Section 28 of the Indian Contract Act, 1872. The court noted additionally, that a unilateral clause would be void for being contrary to the public policy of India.

C. In *Lucent Technology v. ICICI Bank*[71], the Delhi HC held a unilateral option clause to be invalid. The court relied on both *Bhartia Cutler* and *Emmsons International* and invoked Section 28 of the Indian Contract Act, 1872, implying that the party's right to recourse through legal proceedings had been infringed.

[69] 1995 (33) D.R.J. 672.
[70] 2005 (80) D.R.J. 256.
[71] 2009 SCC OnLine Del. 3213.

D. Alternatively, the Madras HC in *Castrol India Ltd. v. Apex Tooling Solutions*[72] observed as a general principle that arbitration clauses need not necessarily have mutuality.

E. Similarly, the Calcutta High Court has consistently upheld unilateral arbitration clauses. In *Kedarnath Atmaram v. Kesoram Cotton Mill*[73], it held that unilateral option clauses would be valid as long as the conditions of *"prior knowledge and consent of both parties"* was met. In 2002, the Court's decision in *S&D Securities v. Union of India*[74], traced the evolution of English jurisprudence in this regard and finally upheld the validity of such clauses.

Thus, the High Courts remain divided on this issue, and in absence of a ruling of the Supreme Court classifying the dichotomy or a provision to this effect in the Arbitration and Conciliation Act 1996, it cannot be assumed that unilateral arbitration clauses fall within the purview of the said Act. Consequently, only giving the power to the Central/State Commission to refer electricity disputes for arbitration, and taking away the autonomy given to parties under the Arbitration Act, cannot be said to be in line with contemporary law and order.

(iv) Derogation from principles of impartiality and independence - The Supreme Court in the *Voestalpine* case[75] reproduced and relied upon the 246th Report of the Law Commission:

*"…57. The balance between procedural fairness and binding nature of these contracts, appears to have been tilted in favor of the latter by the Supreme Court, and the Commission believes the present position of law is far from satisfactory. Since the principles of impartiality and independence cannot be discarded at any stage of the proceedings, specifically at the stage of constitution of the arbitral tribunal, it would be incongruous to say that party autonomy can be exercised in complete disregard of these principles-even if the same has been agreed prior to the disputes having arisen between the parties.*[76] *The concept of party autonomy cannot be stretched to a point where it negates the very basis of having impartial and independent adjudicators for resolution of disputes. In fact, when the party appointing an adjudicator is the State, the duty to appoint an impartial and independent adjudicator is that much more onerous-and the right to*

72 (2015) 1 L.W. 961 (D.B.).

73 1949 SCC OnLine 382.

74 (2005) 124 Comp. Cas. 340.

75 Supra at Note 19.

76 Law Commission of India in its Report No. 246 in August, 2004, para 57; also in Voestalpine Schienen GmbH Vs. Delhi Metro Rail Corporation Ltd, supra at Note 19.

*natural justice cannot be said to have been waived only on the basis of a "prior" agreement between the parties at the time of the contract and before arising of the disputes.*

*21. Independence and impartiality are two different concepts. An arbitrator may be independent and yet, lack impartiality, or vice versa. Impartiality, as is well accepted, is a more subjective concept as compared to independence. Independence, which is more an objective concept, may, thus, be more straightforwardly ascertained by the parties at the outset of the arbitration proceedings in light of the circumstances disclosed by the arbitrator, while partiality will more likely surface during the arbitration proceedings."*

The Supreme Court in this case, deleted certain clauses of the Arbitration Agreement which interfered with the tenets of impartiality and independence of the Arbitral Tribunal. The recent decisions of *S.P. Singla Constructions v. Delhi Metro Rail Corporation*[77] and *BCL Secure Premises v. Metro Railway*[78], reiterate the view of this view of the Supreme Court.

According to the Supreme Court in *Essar case,* as on para 29, the State Commission alone has power to arbitrate/adjudicate the dispute either itself or by appointing an arbitrator. This is in clear violation of the requisites of impartial and independence because either the State Commission will itself arbitrate upon the dispute or it will refer the dispute to the arbitrator favouring it and its agencies. The right to appoint or have a say in the constitution of the arbitral tribunal is one of the main foundations of arbitration, which has been taken away from the other party by way of this judgment, only for electricity disputes. Such an interpretation has made it very convenient for partial and biased arbitrations to take over the stage in electricity disputes.

The rights of the parties to enter into Arbitration agreements has thus been curtailed for those engaged in commercial electricity contracts. Thus, the question to be ascertained by the Supreme Court is even though Electricity Act can override the Arbitration Act by virtue of being a special legislation, but can the Electricity Act override the basic principle of party autonomy in arbitration?

***An arbitration clause is a separate agreement in itself* -** The position with respect to whether an arbitration agreement contained in a contract is separable is settled law and the separability

[77]2017 SCC OnLine Del. 10689.
[78]2017 SCC OnLine Cal. 9449.

doctrine is respected by all courts.[79] The Supreme Court in several judgments including *Reva Electric Car Co. Pvt Ltd.* v. *Green Mobil*[80] and *Today Homes and Infrastructure Pvt. Ltd.* v. *Ludhiana Improvement Trust*[81]*and Enercon v Enercon*[82] has held that there exists a fundamental nature of the separability presumption in contracts having arbitration clauses.

Further, the Supreme Court of India in the recent case of *Ashapura Mine-Chem Ltd* v. *GujaratMineral Development Corporation*[83] addressed the issue of separability and survival of an arbitration clause contained in a Memorandum of Understanding and concluded that the arbitration agreement in the MoU was valid as it constitutes a stand-alone agreement independent from its underlying contract. The court found that irrespective of whether the MoU fructified into a full-fledged agreement, the parties had agreed to subject all disputes, arising out of and in connection to the MoU, to arbitration. Such an agreement would constitute a separate and independent agreement in itself.

When we apply this settled law to the present controversy, it is evident that the arbitration clause in an agreement, including a Power Purchase Agreement for Electricity, would invariably be governed by the 1996 Act, being separate and distinct from the underlying contract therein. It cannot be subjected to and governed by any other law, which is applicable to the other provisions in the underlying contract. Thus, the holding of the Supreme Court in the Essar case at para 58, that except for Section 11 all other provisions of the Arbitration and Conciliation Act, 1996 will apply to arbitrations under Section 86(1)(f) of the Electricity Act, 2003 (unless there is a conflicting provision in the Electricity Act, 2003, in which case such provision will prevail.), is inherently erroneous. The Court cannot simply pick and choose which sections of the 1996 Act would be applicable to the Electricity Act. There must be provision for this selected application under the Arbitration Act, 1996 on electricity disputes. In absence thereof, it cannot be construed that the interpretation of the Supreme Court in the Essar case is actually harmonious and within the tenets of principles of statutory interpretation.

***The interpretation given to Section 86(1)(f) of the Electricity Act 2003, is inherently wrong and faulty***

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79 2014 (5) S.C.C. 1.

80 Today Homes and Infrastructure Pvt. Ltd. v. Ludhiana Improvement Trust, 2014 (5) S.C.C. 68.

81 Reva Electric Car Co. Pvt Ltd. v. Green Mobil, 2012(2) S.C.C. 93.

82Supra at Note 39.

83 2015 (5) S.C.A.L.E. 379.

(i) Section 86(1)(f) of the Electricity Act, 2003 confers limited jurisdiction

Section 86(1)(*f*) is not meant to govern all disputes between the generating companies and the licensees. This is evident from the similar power vested in the Central Commission under Section 79(1)(*f*). The Central Commission can adjudicate disputes involving generating companies or transmission licensees on matters connected with clauses (*a*) to (*d*) of Section 79(1) and can refer any such disputes for arbitration within its discretion. Despite the fact that this limitation is not specifically contained in Section 86(1)(*f*), both the sections must be read together to identify that only those disputes connected to the functions performed by the State Commission under the remaining clauses of Section 86(1) are covered under clause (*f*) of this section. If Section 86(1)(*f*) is read with the rest of the Act, in its entirety, it no longer remains the special provision for all disputes between the generating companies and the licensees. This is in-fact strengthened when Section 86(1)(*f*) is read with Section 158. Section 158 does not rule out the possibility of a separate arbitration agreement for resolution of contractual disputes, and is triggered only when the Commission decides to refer a matter to arbitration.

(ii) Applicability of Sections 5 and 8 of the Arbitration and Conciliation Act, 1996

The Arbitration and Conciliation Act, 1996 restricts through section 5, the intervention by any judicial authority in matters within the ambit of Part I of the Act to situations specifically provided for in that part. Section 8 requires that any judicial authority when faced with a dispute being the subject of an arbitration agreement is to be referred by the parties to arbitration. Both these provisions would invariably be applicable to any judicial authority, whether it is the State Commission under the Electricity Act, 2003 performing an adjudicatory function or any other court/statutory body created under any other Act. However, the Supreme Court in the *Essar* judgment has failed to consider the above.

It is also important to note that the Electricity Act, 2003 does not contain any bar on arbitration proceedings. It only reflects jurisdictional bar in Section 145 mandating no civil court to have the jurisdiction to entertain any suit or proceeding in respect of any matter which an adjudicating officer appointed under the Electricity Act, 2003 is empowered to adjudicate upon. It thus makes it clear that there exists no statutory bar on arbitration proceedings conducted under the Arbitration and Conciliation Act, 1996. Only in cases where the Commission itself refers the dispute for arbitration under Section 86(1)(*f*) , would Section 158 become applicable. With respect to other cases, the Commission would have to refer the dispute for arbitration by virtue of Section 5 read with Section 8 of the Arbitration and Conciliation Act, 1996. In all such cases, the arbitrator would be appointed under Section 11 of the Arbitration and Conciliation Act, 1996.

## *Way Forward*

India's electricity sector in the present regime is reaching new heights.In the recent years, the Government of India has undertaken large projects and policy initiatives to make electricity accessible to all. The Draft National Energy Policy 2017 and the Pradhan Mantri Sahaj Bijli Har Ghar Yojana – "Saubhagya" for electrification of households. The Electricity Act, 2003 permits private participation in generation, transmission and distribution of electricity.

Resolution of disputes being a major concern for private investment in infrastructure. Disputes mean delay and delay in turn would mean escalation of costs; and for a private investor it would mean loss of earnings from the resources which he could have utilised otherwise. Efficacy of dispute resolution mechanism thus holds significance, in attracting private investors to partner with the government.

Though the ruling of the Hon'ble Supreme Court in GUVN vs. Essar[84], solved the prevalent repugnancy in the Electricity Act, 2003 and the Arbitration and Conciliation Act, 1996, but it opened doors for new controversies. This judgment has severe implications for PPAs entered into between the State Electricity Boards and licensees and virtually brings a slowdown in the dispute resolution mechanism of Arbitration voluntarily chosen by the parties to the PPA due to its features of speedy disposal, less costs, and party autonomy. Parliament could also consider inserting a proviso to Section 158 clarifying that if the matter is referred to arbitration by virtue of any agreement entered into between licensees and the State Electricity Boards, the Arbitration and Conciliation Act, 1996 would govern all aspects of such arbitration. Moreover, merely one party i.e. the generating party should not be given the right to refer the dispute to arbitration and appoint the arbitrator(s). The contractual freedom and equal rights refuted in the agreement must be respected, and judicial intervention must take a back-seat. Thus, the regime in its present forms hinders basic principles of arbitration and contact equity and it is strongly felt that in order to make arbitrations in the electricity sector work, the judgment of the Hon'ble Supreme Court need to be reconsidered.

[84]Supra at Note 15.

# ***Energy Revolution In India 2017:An Analysis***


### *Abstract*

As India is in the early stage of major transformation & expanding its economy in the sector of the energy revolution, where it can empower itself and support its 1.3 billion people. India is moving the country in many areas of global interaction to relish its goal to reduces CO2 emission by 2022 .This paper focuses on commitment and accomplishments of Shri Narendra Modi at Paris Climate Change Submit 2015, Where he cobbled together with International Solar Alliance of over 120 nations, situated between the two tropics .He fulfilled his woe to produce 20 GW of solar energy by 2022, which he achieved four years ahead of its target. Despite the fact that India being third largest consumer of electricity, where 450 million ceiling fans are in use and 40 million sold each year, but 240 million people still have no legal electricity connection and significant sources are non- renewable resources mainly coal. This paper tries to find the emptiness and anomalies that are further faced by our Indian Government and appreciates the achievement of conscious choice of India to use cleaner energy to fuel its nations growth and progress.It also appreciates the uncompromising commitment to mitigate climate change by all possible ways like Several schemes like UJALA programme, Biogas Energy and Saubhagya scheme.



***Keyword:*** Energy revolution; Paris Climate Change Submit 2015 ; International Solar Alliance; Green energy; Solar energy ;UJALA ;SAUBHAGYA, Biogas Energy



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## *Introduction*

Energy Revolution is a  phenomenon that maps the path towards the clean and sustainable resource utilisation; it is distinction to the point where the world stands today regarding effective energy creation and utilisation and where the world wants to be in future. It is wholly about methods of weeding out fosill fuel and cutting on CO2 emission but ensuring the ENERGY SECURITY. India being a developing Nation where the  energy Infrastructure is still in developing phase, so India  is provided with full flexibility to settle upon best option between Non-Renewal Resources and Easily available Renewal resources. The first option is the dirty technology, for which it has to be dependent on other nation whether it be oil, coal or nuclear and the other one is a form of Sustainable energy which is a nature's gift to India ,being a tropical Country receiving sunlight for almost  300 days a year. This paper analyses the energy revolution from its early process to till date. It majorly focus on how India has shifted to Cleaner Energy Generation from its conventional methods.

## *History*

From the beginning of human life on planet earth, the human being is being extra ambitious & has a more significant extent of temptation to make their life simpler and hassle-free. This is the critical force is driving them from the first task of burning wood for heating to diabolical creation of human history, i.e. Nuclear Energy. At the same pace from its long success journey of maximising the best of earth resources humans are supraliminal to preserve and enjoy the luxurious gift of nature, and they don't want any interruption to the same. This is evident from when the environment protection and utilisation have started pitching its land, it was in September 1972, when the first conference on Human Environment was held in Stockholm. The seeds of concern that spurted in 1872 have started germinating, is in its full swing after Paris Climate change agreement, 2015. As various developed and especially developing country like India has been adamant about saving the environment and bring the great Energy REVOLUTION in the country .But at the same time these developing countries denied to sacrifice with their economic growth as against anything.

The time travel of energy Revolution in Human history:

**1,000 BC**: Israilians discovered the advantage of harnessing fire.

**400 BC:** Inhabitants of northeastern China began burning coal for heating and cooking purposes. This popularised coal among other populations such as the Romans and Northern Native Americans.

**347 BC:** Ancient Greeks and Romans built water wheels in streams and rivers to capture the energy to be used not only as a power source but for irrigation as well.

**1,000:** Chinese discovered oil wells and utilized extensive bamboo pipelines to extract and transport it as a resource for lighting and heating.

**The 1700's:** Coal began to replace other energy sources such as wind and water, and quickly became the main source of energy around the world.

**The 1820's:** The first natural gas well was drilled in Fredonia, NY.

**The 1830's**: The electric generator, motor and relay were developed based off of Michael Faraday's discovery of electromagnetism.

**The 1850's:** The first petroleum rush occurred when the initial commercial oil well was drilled in Titusville, Pennsylvania

**The 1860's:** Fearing that fossil fuels may eventually run out, Augustine Mouchot believed that burning coal could be replaced by the sun's heat. He developed the first solar-powered system to produce steam to operate industrial machinery.

**1939:** The process of nuclear fission was discovered in Germany.

**1950:** first nuclear power plants began operating in Shippingport, Pennsylvania and Obninsk, USSR.

**1978**: he world's first solar-powered village was constructed at the Papago Indian Reservation in Schuchuli, Arizona.

**1997:** General Motors released over 1,000 electric cars (the EV1).

**2000's:** As the U.S. made significant efforts to support hydrogen fuel development, wind energy, solar power, biofuels, and energy grid upgrades, a number of catastrophic events transpired. [85]

### *Timeline of India Energy Evolution(Electricity)*

***Pre –Independence Period -*** The concept of electricity first came out with Britishers during the colonial period in India. They electrified the major cities, office centres and ports. PW Fluery & Co. used light bulbs to demonstrate electricity on the streets of Calcutta in 1879. Kilburn and

[85] Sarah Battaglia, *Evolution of Energy: From Torches to Solar Panels*,EC,(Feb.12,2013), http://www.theenergycollective.com/sbattaglia/185031/evolution-energy-torches-solar-panels.

Co., which later became Calcutta Electricity Supply Co., electrified Harrison Road (renamed MG Road) in Calcutta in 1889. This was the first street to have electric light bulbs in India. The Electricity Act of India was framed in 1910. It allowed private companies to generate and supply electricity. By the early 1900s, trams replaced horse driven carriages; ceiling fans replaced hand-held punkahs(hand fans), and gas lights were becoming obsolete. This ensured the success of CESC. Electric power was introduced in India 10 years after it was introduced in London and 17 years after that in New York. It was charged at one rupee per unit, which was comparable to the price in London.

## *Early Power System*

There were few initial Power stations set up in different parts of India.some of them were:

***Darjeeling Power Station*** **-** Sidrabong Power station was the first hydel generating station was set up in Darjeeling with a capacity of 130kW. It generated power at 83.3 cycles per second. This power station was commissioned in 1896 to supply power to the Darjeeling tea plantations. Set up in Darjeeling with a capacity of 130kW. It generated power at 83.3 cycles per second. This power station was commissioned in 1896 to supply power to the Darjeeling tea plantations.

***Calcutta Electricity Supply Company*** **-** The Emambagh Power Station was the first thermal power station in India. It was commissioned by the Calcutta Electricity Supply Co. It supplied commercial loads in and around Calcutta from 1899. To meet the growing demand, underground cables were laid by tunnelling the Hoogly in 1929. The tunnels connected the Southern generating stations and the Botanical gardens in Calcutta.

***Sivasamudram Power Station*** **-** Sivasamudram Power Station. It was commissioned under the Cauvery Power Scheme (1902), by the Mysore government, mainly to supply power to the Kolar gold mines. In addition to the gold mines, it provided power to Bangalore and the Madras Presidency. The initial capacity was 4500kW. The capacity was upgraded by later installations, and by the eighth installation, the capacity was around 56,000h.p. It used impulse turbines coupled to GE alternators.

***Tata Trio Of Water Plants*** **-** The Tata hydro-electric power supply companies harnessed the rainfall on the Bhore Ghat between Bombay and Pune for electrification of the Bombay Presidency. Tata Hydro-electric Power Supply Co., the first of these companies, utilised the monsoon precipitation collected in three lakes. It was formed in 1911 and had a capacity of 48,000 kW. The power station was located at Khopoli.

The largest member of the trio, called the Tata Power Co., was built in Bhira in 1927 and had a generating capacity of 87,500 kW. It was also named the Nila - Mula River Project. It had head-works at Mulshi and was located away from the railway line, near the coast.

The Khopoli and Bhivpuri power plants were electrically tied both at the generating end and the receiving end. The Tata Power Co.'s generating station in Bhira was linked to the Khopoli station making the three concerns work in close co-operation sharing the load in Bombay.

***Power Stations In Northern India (Jammu And Kashmir)*** **-** Jammu and Kashmir, the northernmost state of India, had two major generating stations, the Jammu power plant and the Mohora water power plant. The Jammu Power Plant, built on the river Chenab, was commissioned for use in 1909. The Mohora Station, built on the river Jhelum, also became functional in the year 1909 and supplied power at 30000 V and 25 cycles per second through duplicate H.T. lines. The voltage could be stepped up to 60 kV if the load increased considerably.

***Pykara Power Station*** **-** The Pykara power station of the Nilgiris was set up in 1933 with an installed capacity of 6.65MW. The power for the construction of the power station was obtained from the Glen - Morgan Scheme (1929) which had a capacity of 15000hp. The Pykara power station supplied power to the towns in southern India. It had three Escher Wyss Impulse turbines coupled to Metro - Vick alternators. The capacity of this power station was 6250kW at ordinary power factor.[86]

***Post-independence*** **-** The development of electricity power after Independence started with SEBs AND DEVELOPMENTS UNDER THE FIVE YEAR PLANS .The evolution of the power sector in India began in 1948 when the Electricity Supply Act was passed. This marked the beginning of functioning of State Electricity Boards (SEBs). These SEBs were autonomous in that they could step up the generation capacity as well as transmission and distribution in their respective states. The Act also gave the Boards the autonomy for optimal utilisation of resources

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[86]Sandhya Madan,Swetha Manimuthu ,S. Thiruvengadam, History of electric power in India (1890 – 1990),IEEE,http://ieeexplore.ieee.org/document/4510263/?anchor=references.

in their states. Under this act, the Central Electricity Authority was formed for operating the generating facilities at the Central level.

In 1950, a system of Five Year plans for the economic development of the country was envisaged. This was the beginning of the planned development of electric power. On 31.12.1950, the total installed capacity was only 1713MW, more than half the capacity being supplied by thermal power plants. The private sector then controlled 630/0 of generation while the rest was under public sector. In about 48 years the installed capacity has increased almost 52 times.

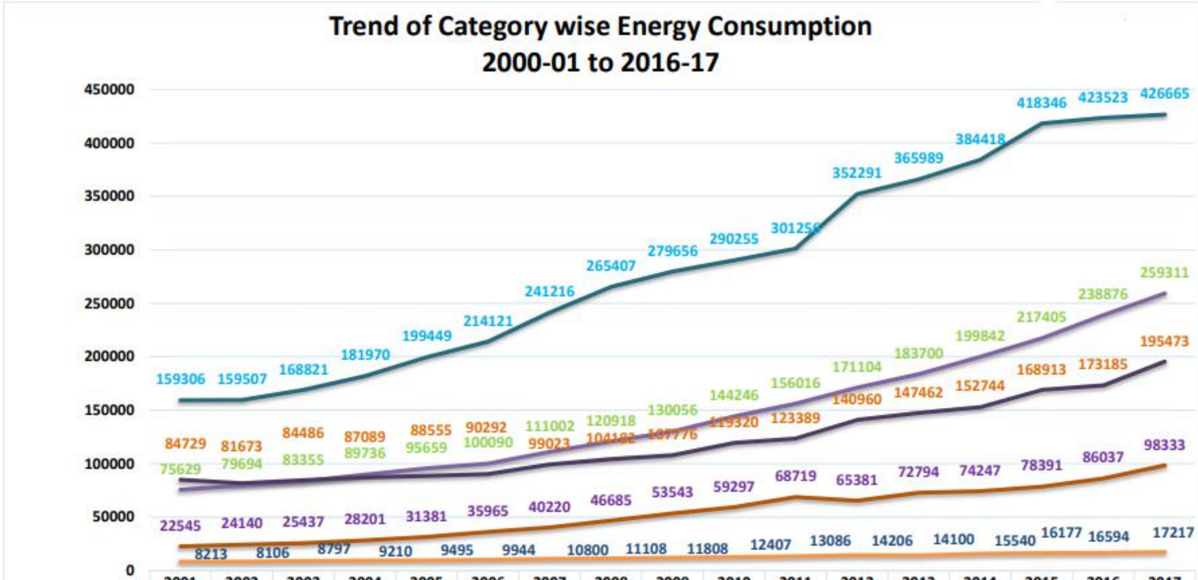
The SEBs, although responsible for the development of power generation and distribution systems, was not able to meet the growing electricity demands, which were characterised by frequent power cuts. To improve the efficiency, central sector generating agencies were established in the mid-seventies. After the Fifth Five-Year Plan (1974–79), the Government of India was involved in supplementing the efforts of the State Government in the transmission of electricity. This led to the setting up of central sector generating agencies that would help develop coal and hydroelectric resources in the country.

The Electricity Supply Act was amended in 1976 leading to the establishment of NTPC (National Thermal Power Corporation), NHPC (National Hydro-Electric Power Corporation), and NPCIL (Nuclear Power Corporation of India Limited.

## *Electricity Demand in India*

Since India is a developing country, a home to 1.3 billion, who is world's third largest consumer of electricity. Due to which there is the high emission of greenhouse gases which in return contribute to Global warming and increase in 2-degrees Celsius temperature. India will have to take immediate measures to curb it.

Below is the graph which depicts the energy growth consumption pattern of the country and the changes in the fold that has taken place over the recent years.




| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Domestic | 75629 | 79694 | 83355 | 89736 | 95659 | 100090 | 111002 | 120918 | 130056 | 144246 | 156016 | 171104 | 183700 | 199842 | 217405 | 238876 | 259311 |
| Commercial | 22545 | 24140 | 25437 | 28201 | 31381 | 35965 | 40220 | 46685 | 53543 | 59297 | 68719 | 65381 | 72794 | 74247 | 78391 | 86037 | 98333 |
| Industrial | 159306 | 159507 | 168821 | 181970 | 199449 | 214121 | 241216 | 265407 | 279656 | 290255 | 301256 | 352291 | 365989 | 384418 | 418346 | 423523 | 426665 |
| Agriculture | 84729 | 81673 | 84486 | 87089 | 88555 | 90292 | 99023 | 104182 | 107776 | 119320 | 123389 | 140960 | 147462 | 152744 | 168913 | 173185 | 195473 |
| Traction | 8213 | 8106 | 8797 | 9210 | 9495 | 9944 | 10800 | 11108 | 11808 | 12407 | 13086 | 14206 | 14100 | 15540 | 16177 | 16594 | 17217 |

### *Why shall India switch to cleaner fuel over cheap fuel like Coal?*

As India is one of the major countries due to its population and a huge economy that whose energy policy directly matters to global energy markets and the fight against climate change. India's 1.3bn people consume three times less energy per capita than the global average and six times less than the European average. Also, India accounts for world's third largest CO2 emission to the world. Therefore, there lies a huge responsibility for India to think for Global Planet rather than solely for itself. Moreover, this responsibility on the shoulders of the country is not charitable rather. If it succeeds in this, its economic ambitions will rise – the economy is currently growing at 7% to 8% per year, and once it succeeds, India will be a driver of the growth in global energy consumption.The kind of energy it consumes will be of significance to global CO2 emissions growth.

Moreover, it can become self-sufficient in its energy generation and can save on electricity imports from various countries like Bhutan.

## *Major events that paved way to Energy Relovution in India and Motivated India for cleaner fuel.*

***Paris Agreement*** - The Paris agreement, formally known as the Conference of Parties (CoP) protocol on combating climate change, is the world's first comprehensive regime on tackling the phenomenon within the United Nations Framework Convention on Climate Change (UNFCCC), its legally binding global climate deal.It was adopted by 195 countries in Paris in December 2015.

The regime will take effect after it is ratified by at least 55 countries responsible for 55% of global emissions. So far, 61 countries, not including India, have already ratified the treaty, and the emissions threshold currently stands at around 47%.

***Aim:*** The agreement aims at a global action plan to put the world on track to avoid dangerous climate change by minimising the global warming to scale below 2°Celsius. The agreement is due to enter into force in 2020.

***Role of India:*** India becomes significant in ratifying the agreement since :

- India accounts for over 4% of global emissions and is crucial for crossing the threshold mark of 55%.
- India is world's third largest greenhouse gas emitter, so India entering in the deal will help the agreement to be closer to reality
- The world's top two polluters—the US and China —that together account for 40% of global carbon emissions have already ratified the document.

***Compliance:*** Once the 55% barrier is crossed, the climate regime will become legally binding on all signatories after 30 days.

***India's Commitment:*** India is firmly committed to global Energy revolution which is evident from the following major commitments made by India at Paris Climate Change Agreement:

India has set a goal to take the edge off its carbon emission intensity - emission per unit of GDP - by 33-35% from 2005 levels over 15 years. It aims at producing 40% of its installed electricity capacity by 2030 from non-fossil fuels.

This would mean India will have to shift significantly from coal-based power generation to renewable energy sources. It will have to produce 100 gigawatts from solar, 60 gigawatts from wind, 10 gigawatts from biomass and 5 gigawatts from small hydropower by 2022.

Another commitment under the treaty requires India to increase its forest cover by five million hectares along with an improvement in the quality of green cover of an equal measure by 2030.At the same time India is not ready to compromise with its economic growth being a developing country.so there lies some point of divergence from the agendas of Paris Agreement.

***Points of divergence of India:*** India has not agreed to cap or cut its carbon emissions outright like some countries, maintaining that the burden of fighting climate change cannot be put on the shoulders of the poor after decades of industrial development by the rich nations.

Instead, it says it will hike its use of green energy and reduce its emissions relative to its gross domestic product by up to 35 percent by 2030 from 2005 levels — meaning emissions will continue to grow but at a slower rate.

India has announced plans to quadruple its renewable power capacity to 175 gigawatts by 2022 as part of the government's plan to supply electricity to every household.It also seeks to add 100 gigawatts of photo-voltaic capacity, 60 gigawatts of wind power, 10 gigawatts of biomass and five gigawatts of hydro projects.

India, which relies heavily on coal-fired power plants for electricity, argues that stricter emissions targets would compromise efforts to boost living standards of more than a quarter of its 1.2 billion population which lives in poverty.

***International Solar Alliances(Isa) -*** On June 30, 2016, the institution signed an agreement with the International Solar Alliance (ISA), consisting of 121 countries led by India, to collaborate on increasing solar energy use around the world and mobilise $1 trillion in investments by 2030.

***About:*** The International Solar Alliance is a collaboration of a platform for cooperation among sun-rich countries lying fully or partially between the Tropics of Cancer and Capricorn who are seeking to massively ramp up solar energy, thereby helping to bend the global greenhouse emissions curve while providing clean and cheap energy.

***Aim:*** This collaboration aims at reducing the cost of finance and cost of technology for the immediate deployment of competitive solar generation, storage and for technologies to be adopted to countries' individual needs and to mobilise billions of dollars for solar.

***The Initiative:*** This initiative was launched at the UN Climate Change Conference in Paris by the end of 2015 by the President of France and the Prime Minister of India.

***Five Key Focus Areas*** - This collaboration aims to achieve these following objectives:

- To enhance the prosperity by promoting solar technologies, new business models and investment in the solar sector.
- To encourage solar applications by formulating projects and programmes.
- To reduce the cost of capital by developing innovative financial mechanisms.
- To build a shared knowledge e-Portal
- facilitate capacity building for promotion and absorption of solar technologies and R&D among member countries

***Progress so Far:*** 19 countries have ratified, and 48 countries have signed the ISA Framework.

***ISA Countries Commitments:*** They have made a following commitments to lead the progress:

- They will explore innovative financing mechanisms that can generate a sustainable market for the deployment of cost-effective solar technologies, along with constructive policy initiatives to catalyse public and private investments with an ultimate aim to reduce the cost of solar projects in developing countries.

- These nations will also facilitate joint 'research and development' efforts among member states and other stakeholders to develop an appropriate business models, cost-effective standards, innovative technical applications, equipment and storage designs to readjust members' climatic conditions and to achieve clean and low-cost operations under the agenda.

They will also consider off-grid solar applications to cater to the energy requirements of poorer and remote communities and to facilitate awareness and skills enhancement of local communities while monitoring and maintenance of solar technologies in the member countries.

To leverage and emphasise the essential characteristics and strengths of solar energy in their national energy plans and strategies and to assist in the implementation of solar strategies.

To ensure better implementation of the schemes ISA presently has four ongoing programmes 1.Scaling Solar Mini Grids Affordable Finance at Scale,

2.Scaling Solar Applications for Agricultural Use,

3. Affordable Finance at Scale,

4. Scaling of Solar Rooftop to cater the needs of solar energy in specific areas.

## *Role Of PPF In ISA*

The PPF will provide consultancy support on a grant basis to requesting governments for project formulation. It is a demand-responsive mechanism and a quick access facility to address priority needs of requesting governments.
The PPF fills the capacity gap in identifying a need, conceiving a project and preparing a proper proposal.

Meanwhile, India said that it would set up a Project Preparation Facility (PPF) to assist its development partner countries towards the preparation of viable projects that can be considered for concessions financing under Lines of Credit.

## *How is India important player in ISA?*

Apart from being a founding member, India plays a significant role in the alliance regarding being a host as well as a significant contributor to the achievement of the target. The ISA is the first international body that will have a secretariat in India. India, with a mark to produce 100 GW of solar energy by 2022, would account for a tenth of ISA's goal. "India will produce 175 GW electricity from renewable sources by 2022 and 100 GW will be from solar energy," Mr Modi said, addressing the ISA.
According to the ISA official reports:

"Distribution of 28 crores LED bulbs in three years has saved $2 billion and 4 GW of electricity. India will also provide 500 training slots for ISA member-countries and start a solar tech mission to lead R&D." This report points out the importance of India in International solar Alliance.

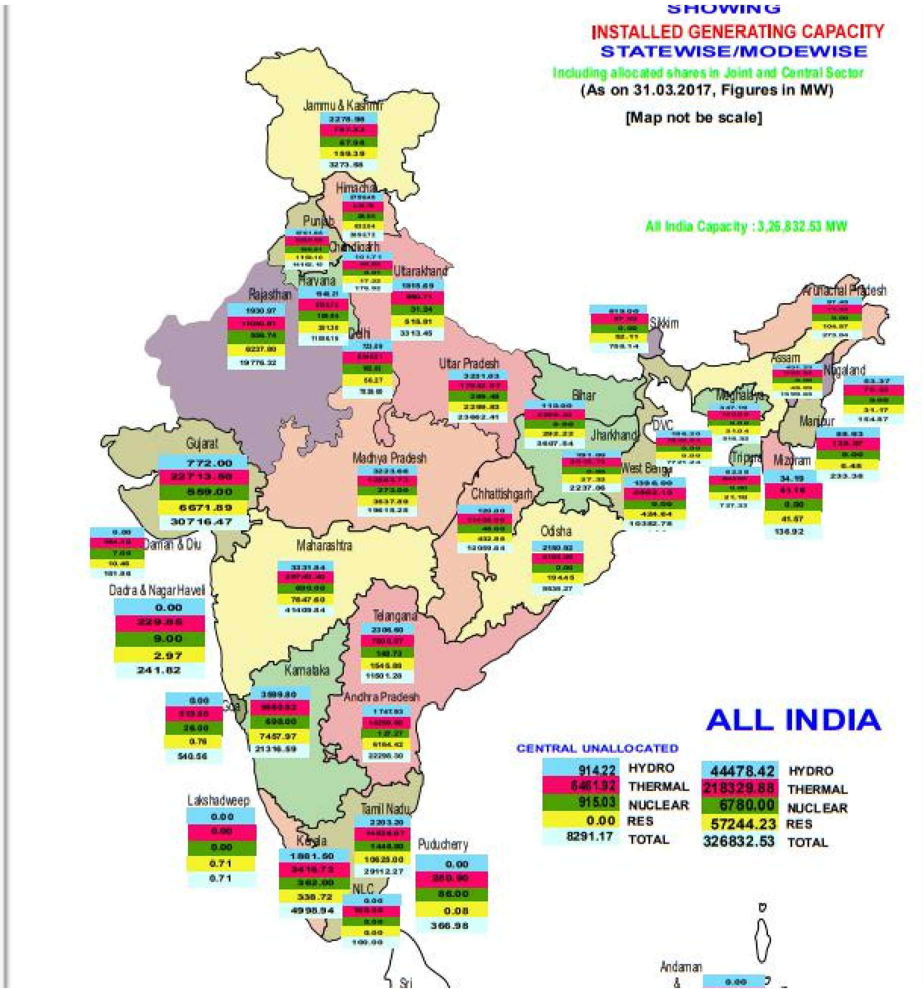
***Indian Contribution To IS :*** The central government will set up a $350-million solar development fund to contribute ISA Funding. In addition, to it, nine companies and banks have agreed to develop and finance various solar projects, which include a $1-billion partnership corpus of NTPC and CLP India to the ISA.

- 13 projects worth $143 million are funded under the line of credit provided by India.

  - India has announced about 27 proposed projects at the founding conference of International Solar Alliance, which entail funding of $1.4 billion.

***India's aim*:** 175 gigawatts of installed renewable energy capacity well before 2020.

After India being a party to these two major events, there has been a tremendous effort made by India to stick to its commitments. Let's discover track the journey of India from major coal-dependent for its energy production to switching to Renewable Energy.




***Shift in modes of Energy Generation:*** During recent years India has witnessed a gradual shift in energy generation modes. There are incremental shift and encouragement in choosing and enhancing the Solar Energy of India and taking the advantage of its geographical location

India has launched the world's largest renewable energy expansion programme and which aim at achieving 175 GW capacity of energy by 2022. The country is piloting national actions plans to dwell by its duty under the Paris Agreement to keep the rising temperatures of the Earth well below 2 degree Celsius. In India two states namely; Tamil Nadu and Rajasthan have become leading in the renewable energy sector by generating electricity using wind farms. However, Rajasthan tops the list for solar and wind energy with a total installation capacity of more than 3,000 Megawatts.

Indian projects like electrifying Rural India is also converged on using clean energy. The darker side of this shift is that coal electricity in India does not see a cut-off. One of the biggest coal plants in Asia, the Mundra Thermal Power Plant in Gujarat seeks to import coal from Australia.However, Government of India has launched several schemes for better implementation of “**CLEANER ENERGY”** GENERATION. Some of the prominent ones are:

1. ***Ujala Scheme***

***Objectives:*** to promote efficient lighting, enhance awareness on using efficient equipment which reduces electricity bills and helps preserve the environment.

***Targets:*** Following are the target set by Indian Government:

- ✓ Target to distribute 770 million LEDs by March 2019 across 100 cities
- ✓ Aims to rectify India's high cost of electrification and the increased emissions from inefficient lighting, amidst the backdrop of electricity demand witnessing a 5-fold increase over the coming years.
- ✓ Expected to increase annual energy savings up to - 105 bn KWh
- ✓ Expected to reduce peak load up to - 20,000 MW
- ✓ Expected to reduce Annually estimated greenhouse gas up to - 79 million tonnes of CO2 [87]

***Implementing Agency:***The Electricity Distribution Company and Energy Efficiency Services Limited (EESL) a public sector body of Government of India are implementing the programme.

***Mechanical Working of the scheme:*** Distribute 20W LED tube lights and BEE 5-star rated energy efficient fans to the consumers. We are distributing 20W LED tube lights that are 50% more energy efficient than conventional 40W tube lights and are available for Rs. 220/- per tube, as against the market price of Rs. 400-600. We have also revolutionised the fan market in India by providing energy efficient fans under the UJALA scheme that come with a BEE 5 Star rating. These ceiling fans are rated 30% more energy efficient than conventional fans and are priced at Rs. 1200/- per fan.

87

***Major Strength of this scheme:*** The cost is kept affordable as UJALA's LED bulbs cost only 50 INR, and it allows the consumers to buy them for an initial payment of 10 INR, and where the balance is paid through the consumer's electricity bills in equal monthly instalments of 10 INR.

2. ***Saubhagya Scheme***

***Launching Date***: 25th September 2017

***Investment*** : Rs.16,320 crore

***About:*** Pradhan Mantri Sahaj Bijli Har Ghar Yojana – 'Saubhagya' a new scheme was launched by the Hon'ble Prime Minister on 25th September 2017.Under Saubhagya Scheme free electricity connections are provided to all households (both APL and poor families) in rural areas and poor families in urban areas. There are around 4 Crore un-electrified households in the country, and which are targeted for providing electricity connections by December 2018.

***Working Mechanism:*** The Saubhagya scheme includes electricity connections to households from the nearest electricity pole, installation of a power meter, wiring for a single light point with LED bulb and a mobile charging point. Households located in remote areas are to be provided with solar power packs of 200 to 300 Watt, battery back with 5 LED lights, one fan, one power plug along with repair and maintenance for five years.

***Salient Features of Saubhagya are:***

- ✓ All DISCOMs including Private Sector DISCOMs, State Power Departments and RE Cooperative Societies shall be eligible for financial assistance under the scheme in line with DDUGJY.
- ✓ The prospective beneficiary households for free electricity connections under the scheme would be identified using SECC 2011 data. However, un-electrified households not covered under SECC data would also be provided electricity connections under the scheme on payment of Rs. 500 which shall be recovered by DISCOMs in 10 instalments through electricity bill.
- ✓ The electricity connections to un-electrified households include provision of service line cable, energy meter including pre-paid/smart meter, single point wiring. LED lamps and associated accessories in line with technical specifications and construction standard.

- ✓ In case of un-electrified households located in remote and inaccessible areas, power packs of 200 to 300 Wp(with battery bank) with a maximum of 5 LED lights, 1 DC Fan, 1 DC power plug etc. may be provided along with the provision of Repair and Maintenance (R&M) for five years.
- ✓ The details of consumers viz, Name and Aadhar number/ Mobile number/ Bank account/ Driving License/Voter ID etc., as available would be collected by the DISCOMs.
- ✓ The defaulters whose connections have been disconnected should not be given a benefit of the scheme. However, the utilities may consider the settlement of old dues and reconnection as per norms.[88]

***The scope of the Scheme:***

- ✓ Providing last mile connectivity and electricity connections to all un-electrified households in rural areas.
- ✓ Providing Solar Photovoltaic (SPV) based standalone system for un-electrified households located in remote and inaccessible villages/habitations, where grid extension is not feasible or cost-effective.
- ✓ Providing last mile connectivity and electricity connections to all remaining economically poor un-electrified households in urban areas. Non-poor urban households are excluded from this scheme

## *Government Efforts*

Government has been instrumental to achieve its golden commitment towards its local and global people. Following are few major steps taken by government to bring the commitment to reality:

Indian Government has allotted over Rs 5,020 crore ($790 million) for the expansion of various renewable energy technologies and other activities of the Ministry of New & Renewable Energy (MNRE) for the financial year 2018-19.

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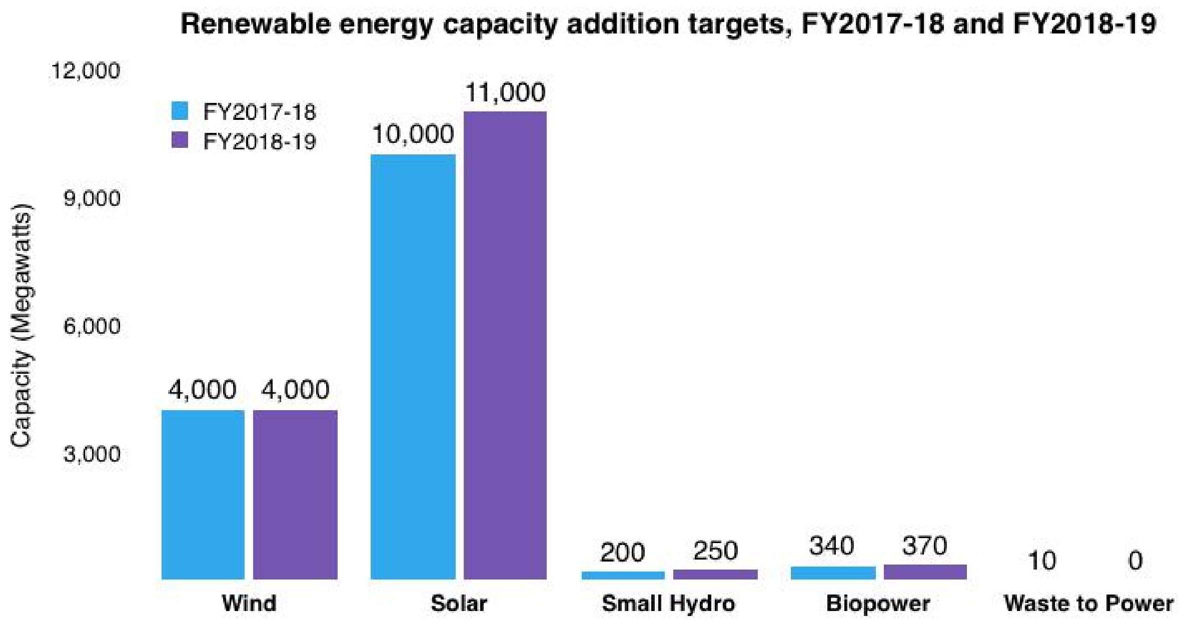
[88] Accessed at official website of REC, http://www.recindia.nic.in/saubhagya

Indian Government has set a high target to increase its addition energy production targets for the year 2018-19.MNRE has set a target for commission 15.62 gigawatts of new renewable energy capacity in the financial year 2018-19. The targeted capacity addition is 7.3% higher than the capacity addition target set for the fiscal year 2017-18.




***Solar Energy:*** The MNRE targets the addition of 11 gigawatts of solar power capacity, up from 9 gigawatts in FY2017-18.The largest allocation, of Rs 2,045 crore ($321 million), has been provided for capacity addition in the solar power sector, i.e. to add 11 gigawatts of capacity. Rs 848 crore ($133 million) have been earmarked for 200 megawatts of solar lighting devices and 20 megawatts of solar thermal applications.

***Wind Energy:*** The capacity addition target in the wind energy sector remains unchanged at 4 giga-watts

***Hydro Technology:*** The MNRE targets for small hydro technology has been increased from 200 megawatts to 250 megawatts

***Bio-power:*** The bio-power capacity addition has also been increased marginally from 340 megawatts to 370 megawatts.

***Green Energy Corridors:*** A very important allocation of Rs 600 crore ($94 million) has been made for implementation of 3,000 circuit kilometres of transmission lines across eight states rich in renewable energy resources. These transmission lines will be used solely to transmit electricity generated from renewable energy projects.

***Green Bonds:*** The Indian Renewable Energy Development Agency (IREDA) will receive Rs 128 crore ($20 million) for payment of interest on green bonds it plans to issue over the course of the financial year.[89]

## *Government Achievements*

Following are the achievements made by Indian Government while pursuing its goal:

- ✓ India's largest cluster of renewable energy mini-grids, developed under the Rockefeller Foundation's innovative Smart Power for Rural Development programme, has powered more than 110 villages and illuminated the lives of 40,000 people.

- ✓ In villages touched by the Smart Power for Rural Development programme, energy access has enabled enterprising Indians to raise their local economy by $18.50 per capita — accounting for an increase in economic productivity and the value of benefits to health, environment and social well-being.

- ✓ Micro-enterprises have reported a 13% average increase in monthly revenues, and there is evidence that business is growing: 11% of businesses reported some form of expansion, and 7% of them are entirely new, established as a result of gaining access to energy. [90]

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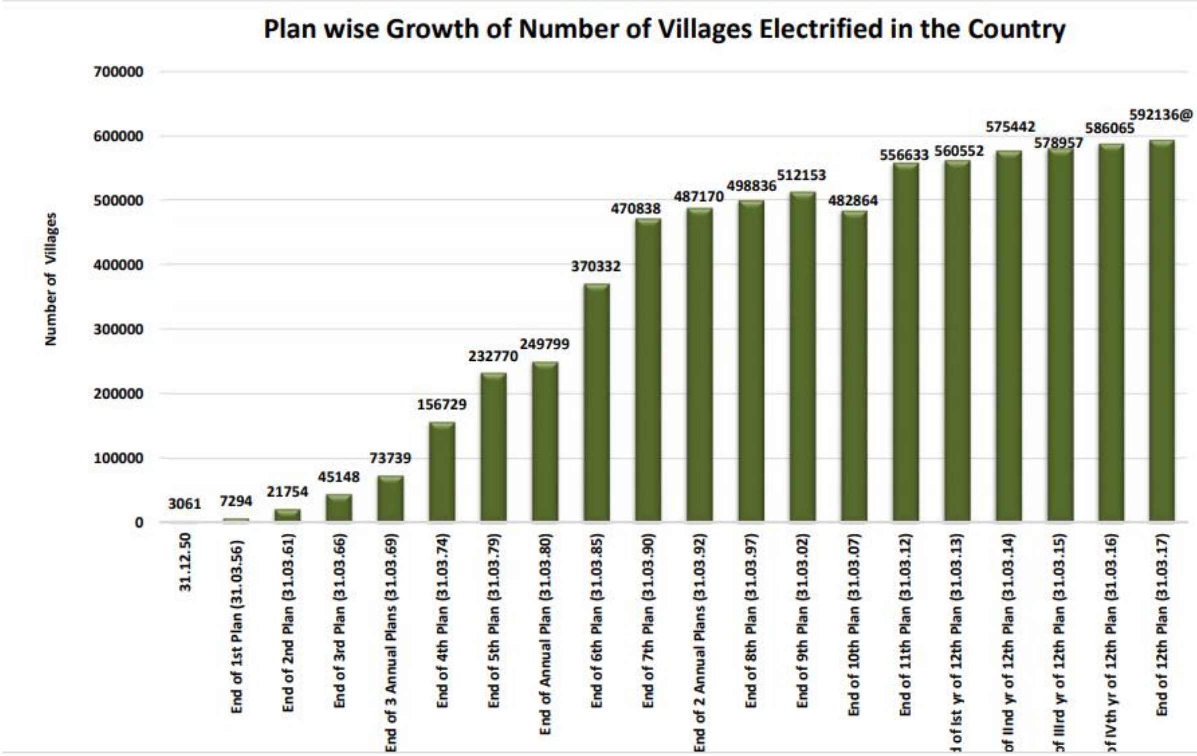
[89] https://cleantechnica.com/2018/02/07/india-aims-add-15-6-gigawatts-renewable-energy-capacity-2018-19/

[90] https://blogs.economictimes.indiatimes.com/et-commentary/how-india-can-rally-the-world-around-a-renewable-energy-revolution/




- ✓ The findings show that over 13,500 of more than 18,450 villages have been electrified as of May 2017. Solar and wind energy have a record low tariff. In 2016-17, the net capacity addition of renewable power exceeded that of conventional power for the first time.

- ✓ The installed capacity of renewable energy sources was 31,692.14MW in 2014 and, as of March 2017, the power sector saw an installed capacity of 57,260.2MW of renewable energy sources — an 80% increase over three years. In 2013 and 2014, the supply gap regarding available energy and peak demand stood at 4.2% and 4.5% respectively and had since decreased to 0.7% and 1.6% respectively in 2016 and 2017. In 2015, both solar and wind energy accounted for 3.5% of power generation in India. A successful transition of the ongoing energy program would mean the production of solar and wind power would quadruple by 2022.

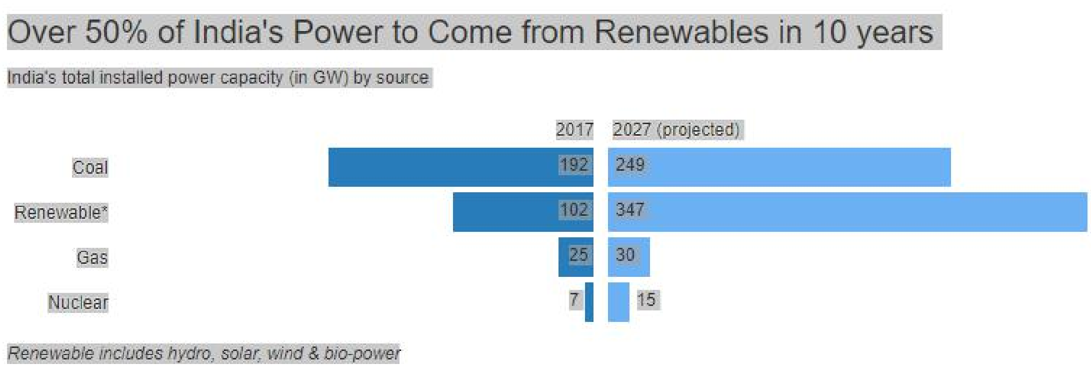
Already, in 2017 India had crossed 20 GW of solar energy which is the highest growth, almost 140%, in this sector. Renewable energy capacity in India increased from 39 GW to 63 GW during the last two years. To effectively use energy saving devices and to supplement solar energy generation, India has distributed 28 crores LED bulbs in the last three years which have helped save USD 2 billion and 4 GW of electricity, according to PM Modi.

✓ An Indian Union territory Diu became the first state to be fully solar powered by over 100% solar power generation.

## *Challenges faced by India Government in Execution*

❖ ***Limited Land Availability***: India has taken a smart initiative to deal with lack of land availability due to its huge population.Although Solar power requires large tracts of land to set up giant mirrors and lenses. So, in addition to its solar parks, India is installing solar panels on rooftops and floating solar platforms on rivers and other bodies of water

❖ ***India's Greenhouse Gas Emissions:*** which is predicted to keep increasing at least until 2030 but India is not giving up as its working hard –to change with serious energy efficiency measures.It is evident from the below data:




As a result of competition, higher production and low input cost the solar energy price has dipped to a reasonably low level in comparison to power from other traditional sources. The manufacturers and producers have concerned due to recent imposition of 5% tax apart from enhanced duties on imported photovoltaic cells and panels. In addition cost competitiveness & high transmission and distribution losses, focus of manufacture of PV cells to export markets rather than local, availability of land, complex subsidy structure, storage batteries, multiple government agencies, financing, technologies, low expenditure on R&D etc., pose significant constraints on achieving solar power generation on the desired scale.

A case in point is an invention of a SOLAR TREE by one of the labs of Council of Scientific and Industrial Research which is far more efficient and requires less space due to its vertical design like a tree. But the technology has still not been commercialised for some reason. Such gaps and issues need to be dealt with on priority.

- India is also faced with external constraints and disputes from solar panel producing countries. In 2013, and recently yet again, USA complained to the WTO that India's solar programme created an unfair advantage and barriers against the import of US made solar panels through domestic content requirement in violation of its treaty obligations under global trading rules.

## *Conclusion:*

Renewables have the potential to meet supply when peak demand necessitates it. The reform is vital for India's energy security, and both the government and its citizens must play an active role in paving the way for renewable energy. The important aspects of optimum resource utilization, its accessibility and affordability to low-income groups will play a crucial role in bringing a clean energy revolution. A higher degree of reliability with efficiency, hi-tech solutions and low operation and maintenance costs are required. To bring on robust change, the authorities concerned with this vital assignment can look to the less-tapped avenues of tidal energy, hydropower and biomass, biogas and geothermal energy.

It is time now to move from a fossil fuel-driven energy economy to a clean and renewable energy economy, making solar energy an essential aspect of national energy needs. India must aggressively pursue its efforts in nuclear energy, providing a particular emphasis on safety. The avenues for clean energy are still in a nascent phase across the country, but its use is growing. If the plans and policies are properly executed, then India could undoubtedly lead the way toward meaningful and long-lasting progress.

# ***Revolution Of Energy In India***

Power Sector in India has grown significantly since independence. The total power generating capacity of (utilities & non utilities) has increased from meagre 1362 MW in 1947 to 267 GW at the end of March, 2015 due to the revolutions taken by the country. Not only this there is an expected 8% increase in the power consumption till 2020.

## *Schemes and Measures taken for Revolution Of Energy in India*

***1. ISA Initiative to utilise us $1 trillion for Solar Energy Development -*** Member states at the founding conference of the International Solar Alliance (ISA) on Sunday pledged to pursue an increased share of solar energy in their overall power consumption thereby realising the huge potential the sector offers to create jobs and empowering poorer communities.Launched by Prime Minister Narendra Modi and then French President Francois Hollande at the Paris climate summit in 2015, the ISA was conceived as a coalition of solar resource-rich countries to address their special energy needs and provide a platform to collaborate.

***2. "Saubhagya" Pradhan Mantri Sahaj Bijli Har Ghar Yojna -*** The Prime Minister Shri Narendra Modi has launched a new scheme Pradhan Mantri Sahaj Bijli Har Ghar Yojana – "Saubhagya" to ensure electrification of all willing households in the country in rural as well as urban areas here today.

The total outlay of the project is Rs. 16, 320 crore while the Gross Budgetary Support (GBS) is Rs. 12,320 crore. The outlay for the rural households is Rs. 14,025 crore while the GBS is Rs. 10,587.50 crore. For the urban households the outlay is Rs. 2,295 crore while GBS is Rs. 1,732.50 crore. The Government of India will provide largely funds for the Scheme to all States/UTs.

***Mahak Gandhi and Sagar Juneja***

## *Energy forAll*

We use it almost every second, every minute, of everyday, of every year, electricity.

From turning on the lights to , working transportation , from warming purposes to cooling things , from being utilized for assembling procedures to being connected to exchanging and trading practices.

Indeed, even in business structures the application ranges from fueling restorative, security, and fire concealment gear; controlling lifts and elevators; and running cooking and clothing hardware.

The non-building uses of electricity include water supply services, sewage treatment facilities, telecommunications equipment, and outdoor and public street lighting.

India is the fourth-biggest and largest electricity purchaser on the planet, trailing just the United States, China, and Russia. In 2012 India had the tenth-biggest economy on the planet as estimated in 2012 U.S. dollars (changed over at official trade rates), and the third biggest economy on the planet when GDP is balanced for expansion and acquiring power. This inflation balanced GDP has raised to more than 7% every year since 2000, despite the fact that it eased back to a little more than 5% in 2012 as indicated by the Indian Central Statistical Organization.

India along with China is projected to account for lion’s share of Asia’s energy demand growth through 2035. India's vitality approach is centered around securing satisfactory energy assets to meet the developing requests of its economy.

Essential vitality utilization dramatically increased in the vicinity of 1990 and 2011. India's reliance on imported energy resources and its conflicting energy sector reform may make it hard to fulfill rising interest.

India’s power sector is not only limited to the electricity consumption but includes the following also :

Coal is India's essential wellspring of vitality; the power division represents over 70% of coal utilization. India has the world's fifth-biggest coal reserves.

India was the fourth biggest buyer of oil and petroleum items on the planet in 2011, after the United States, China, and Japan. India depends vigorously on imported crude oil, generally from the Middle East.

India has 211 gigawatts of installed electric limit, generally in coal operated plants. Due to lacking fuel supply, the nation experiences a deficiency of power age, prompting intentional power outages.

India has 20 operational nuclear reactors, with seven more under development; as power demand keeps on developing, India intends to expand its nuclear offer of share to 25%, up from 4% as in 2011.

India turned into the world's 6th biggest melted gaseous petrol shipper in 2011.

Rural zones in India depend vigorously on traditional biomass, as they need access to other vitality supplies. As per the 2011 India statistics, over 80% of country families utilize traditional biomass (counting kindling and yield buildup) as the essential fuel for cooking, appeared differently in relation to 22% of urban families.

Subsequently we perceive how wellsprings of energy scale from customary sources, for example, coal, lignite, flammable gas, oil, hydro and nuclear energy to suitable non-ordinary sources, for example, wind, sun oriented, and horticultural and residential waste.

## *Growth of power sector in India:*

India has moved up 73 spots to rank 26th in the World Bank's list of electricity accessibility in 2017, according to Mr.Piyush Goyal, Minister of State (Independent Charge) for Power, Coal, Renewable Energy and Mines, Government of India.

Hydro and thermal power stations were established prior to Independence. In 1897, the first hydroelectric station heralded the beginning of power generation in India.

Coal began its journey in the early 1899 and was all set to outlay a power sector reformation. Despite shortfalls in midway, the coal sector post-Independence, under the aegis of the government, ramped up capacity.

Ignition of coal discharges gases (oxides of nitrogen, sulfur and powder) that are perilous to lives and the air. While trying to differentiate the vitality portfolio, a 40 megawatt (MW) nuclear reactor was created by the exploration reactor agreement marked in 1956.

APSARA, Asia's first nuclear reactor reinforced India's improvement in the power area at that point. As of now, India has 21 nuclear reactors in seven nuclear power plants, with an introduced limit of 5,780MW.

Along with all this the government of India took initiatives like setting up of committees such as REC, which came into existence back in July 1969, due to critical draught situation faced by India in the late sixties. REC was set up in July 1969, in the setting of a basic dry season circumstance confronting India in the late sixties. The organization's underlying mandate was primarily to help State Electricity Boards invigorate pump-sets over to the nation to support farming and beat the devastating effect of three progressive years of lacking rainstorm

. The organization additionally gave back to quicken the pace of provincial jolt in the general setting of arranged projects for expanded horticultural generation. Other than fund, REC likewise offered assessing, consultancy, specialized help and observing of undertakings, to help State Electricity Boards/Power Utilities, Rural Electric Cooperatives and other such establishments.

On 2 July 1998, recognizing the needs for reforms in the electricity sector nationwide, the Central government of India moved forward to enact the Electricity Regulatory Commission Act of 1998,which mandated the creation of the Central Electricity Regulation Commission with the charge of setting the tariff of centrally owned or controlled generation companies.

Apart from CERC, the act also introduced a provision for the states to create the State Electricity Regulation Commission (SERC) along with the power to set the tariffs without having to enact separate state laws. CERC was instituted primarily to regulate the tariff of Power Generating companies owned or controlled by the government of India, and any other generating company which has a composite scheme for power generation and interstate transmission of energy, including tariffs of generating companies.

The energy policy of India is to a great extent characterized by the nation's expanding vitality shortfall and expanded spotlight on creating elective wellsprings of energy,particularly nuclear, sun powered and wind energy.

The National Action Plan on Climate Change implemented in 2008 emphasised the role of energy efficiency and Jawaharlal Nehru National Solar Mission. In addition, key initiatives such as, National Wind Mission and National Biofuel Policy has created the much needed traction to enhance the process of decarbonisation.

### *Development of Solar Energy:*

- In 2004, around 80,000 of the country's towns still did not have power; of them, 18,000 couldn't be charged by broadening the regular network. An objective of energizing 5,000 such towns was set for the 2002– 2007 Five-Year Plan.
- By 2004 more than 2,700 towns and villas were charged, fundamentally with solar based photovoltic frameworks. The advancement of this inexpensive and modest sunlight based innovation is viewed as a potential option.
- Therefore an initiative called as INTERNATIONAL SOLAR ALLIANCE was first proposed by Indian Prime Minister Narendra Modi in a speech in November 2015 at Wembley Stadium.
- The alliance is also called International Agency for Solar Policy and Application. The emphasis is on SOLAR based power use.
- The collusion has been conferred $1 tn as venture, and it is focused on making the expenses of sunlight based power more moderate for remote and unavailable groups. The organization together will underwrite India in accomplishing its objective of creating 100GW of sun powered energy and 175GW of sustainable power source by 2022.
- To encourage the same, the Indian government has devoted 5 acres of land of land in the NISE grounds for the future home office and a whole of $1.75 billion has been added to fund the working of a grounds in addition to meeting the consumptions of the initial 5 years.
- India has likewise begun an aspiring KUSUM solar plan (Kisan Urja Suraksha Evam Utthaan Mahaabhiyan) that is fundamentally gone for ranchers to empower them to move towards solar homestead water pumps and utilize desolate land for producing solar energy to have additional pay. The aggregate cost of the limits under this plan is required

to be Rs 1.4 lakh crore. Prior, a sponsorship of 30% was given to agriculturists however under the KUSUM plot, an endowment of 60% will be given to ranchers.

- The Interim Director General, ISA, Upendra Tripathy, told BusinessLine (The Hindu) that the organization together plans to offer 12-year and a half's cooperation to officers whose positions are identical to India's Joint Secretaries'.The intention is that people from abroad can learn about solar energy resources in Indian universities.. The thought is to offer 20 such fellowships. ISA has likewise chosen to train various professionals to wind up 'Master Solar Mechanics', in this way upgrading the accessibility of great job chances in the next level.
- Another opinion glided was the point of reusing degraded land by setting up solar plants on them, yet the idea of coordinated effort with the Land Degradation Neutrality Fund (of United Nation's Combat Desertification Campaign; the infant of UNCCD) isn't clear yet. This is on the grounds that the LDN Fund, which has a corpus of $300 million, is considerably less than what solar energy advancement requirements for debased land-solar recovery.
- The Alliance is likewise helping participating nations build up their own particular solar approaches and is due to hold a National Focal Point Conclave of agents from member countries. The second NFP Conclave held in Delhi on March 10, 2018, intended to create guides for Solar Energy Programs of individual ISA part nations.
- The nations should bolster each other in innovative work and in addition other abnormal state exercises. The World Bank will have a noteworthy part in preparing more than US $1000 billion in speculations that will be required by 2030, to meet ISA's objectives for the enormous organization of reasonable sun powered vitality.

## *National Initiatives for increasing accessibility to Power:*

- The Government of India has recognized power sector as a key sector of focus so as to promote sustainable growth. Some drives by the Government of India to boost the Indian power sector are:

- The companies under the solar power industry in India, specifically the ones involved in the operation and maintenance (O&M) of solar power plants have welcomed the Government of India's move to introduce regulations for operating drones by February 2017.

- Over 280 million LED globules were circulated to consumers in India by Energy Efficiency Services Limited (EESL) under Unnati Jyoti by Affordable LEDs for All (UJALA) as on December 19, 2017 and 524.3 million LED knobs were sold by private players till October 2017.

- The Union and state governments have consented to implement the Direct Benefit Transfer (DBT) scheme in the power sector for better focusing of sponsorships, according to Mr Raj Kumar Singh, Minister of State for Power (Independent Charge).

- All the states and union territories of India are on board to satisfy the Government of India's vision of guaranteeing 24x7 affordable and quality power for all by March 2019, expressed Mr Raj Kumar Singh, Union Minister of State (IC) for Power and New and Renewable Energy, Government of India.

### *Pradhan Mantri Saubhagya Yojna:*

- The Prime Minister, Shri Narendra Modi addressing at the launch of the Pradhan Mantri Saubhagya Yojana, at Deendayal Urja Bhawan, in New Delhi on September 25, 2017.
- This Saubhagya Yojna’s aim is to provide energy access to all by last mile connectivity and electricity connections to all remaining un-electrified households in rural as well as urban areas to achieve universal household electrification in the country.

- The electricity connection to households include release of electricity connections by drawing a service cable from the nearest pole to the household premise, installation of energy meter, wiring for a single light point with LED bulb and a mobile charging point. In case the electricity pole is not available nearby from household for drawing service cable, the erection of additional pole along with conductor and associated accessories shall also be covered under the scheme.

- The total outlay of the project is Rs. 16, 320 crore while the Gross Budgetary Support (GBS) is Rs. 12,320 crore. The outlay for the rural households is Rs. 14,025 crore while the GBS is Rs. 10,587.50 crore. For the urban households the outlay is Rs. 2,295 crore while GBS is Rs. 1,732.50 crore. The Government of India will provide largely funds for the Scheme to all States/UTs.

- The scheme is propelled on the occasion of the birth centennial celebration of Pandit Deen Dayal Upadhyaya on 25th September. Scheme aims to accomplish 24x7 power for all by 2019 by providing power connection to every household across the country. Scheme will provide endowment on equipment, for example, transformers, wires and meters.

- For simple and quickened implementation of the Scheme , modern technology shall be utilized for household review by utilizing Mobile App. Recipients shall be distinguished and their application for power connection along with candidate photograph and character proof shall be enrolled on spot. The Gram Panchayat/Public institutions in the country territories may be authorized to collect application forms along with complete documentation, disseminate bills and collect income in consultation with the Panchayat Raj Institutions and Urban Local Bodies. The Rural Electrification Corporation Limited (REC) will remain the nodal office for the operationalisation of the scheme throughout the country.

### *Green Energy Growth in the Country*

- Indiatgenerated 10.2 Billion Units (BUs) of electricity in June from green energy sources including solar, wind, biomasstandtsmall hydro -- 26 per cent more than 8.1 BUs of renewabletenergy generated in the same month last year and 17 per cent more than 8.6 Bus generated in the previous month (May 2017), research and ratings agency India Ratings said in a report.
- The Government of India, along with dynamic support from its nationals, has kick-started a revolution in energy efficiency by introducing versatile and replicable demand side management activities. The country has not only settled a comprehensive policy for energy efficiency – National Mission for Enhanced Energy Efficiency (NMEEE),

however has also executed effective demand side management programs for consumers and municipal corporations to accomplish overall energy reserve funds while gradually mitigating the impact of climate change.

- The Modi government has set an ambitious focus of setting up 175 Gigawatt of renewable power limit by end 2022. This incorporates 60 GW from wind, 100 GW from solar, 10 GW from biomass and 5 GW from small hydro.

### *Waste to Energy and Biomass Energy:*

- With serious concern globally and in India on the utilization of fossil energizes, it is important for India to begin utilizing renewable energy sources. India is the seventh biggest country in the world spreading over 328 million hectares and amply bestowed with renewable sources of energy. Among the renewable energy sources, biomass assumes a crucial role especially in provincial zones, as it constitutes the major energy source to majority of households in India. Biomass energy is the utilization of organic matter present and can be used for various applications.
- India produces about 450-500 million tonnes of biomass per year. Biomass provides 32% of all the primary energy use in the country at present.
- It is estimated that the potential in the short term for power from biomass in India varies from about 18,000 MW, when the scope of biomass is as traditionally defined, to a high of about 50,000 MW if one were to expand the scope of definition of biomass.
- The current share of biofuels in total fuel consumption is extremely low and is confined mainly to 5% blending of ethanol in gasoline, which the government has made mandatory in 10 states.
- Currently, biodiesel is not sold on the Indian fuel market, but the government plans to meet 20% of the country's diesel requirements by 2020 using biodiesel.
- Plants like Jatropha curcas, Neem, Mahua and other wild plants are identified as the potential sources for biodiesel production in India.

- There are about 63 million ha waste land in the country, out of which about 40 million ha area can be developed by undertaking plantations of Jatropha. India uses several incentive schemes to induce villagers to rehabilitate waste lands through the cultivation of Jatropha.
- The Indian government is targeting a Jatropha plantation area of 11.2 million ha by 2012.

### *Government incentives and Subsidies for Biomass Energy Production*

- The Ministry of New and Renewable Energy (MNRE) provides Central Financial Assistance (CFA) in the form of capital subsidy and financial incentives to the biomass energy projects in India. CFA is allotted to the projects on the basis of installed capacity, energy generation mode and its application etc. Financial support will be made available selectively through a transparent and competitive procedure.
- Mr Ashvini Kumar, Managing Director, Solar Energy Corporation of India (SECI), outlined Government of India's plan to tender 750 MW of solar capacity, along with offering deals covering four GW of wind capacity during FY 2017-18.

### *Waste – to - Energy Initiative:*

- Waste-to-energy is different from solar (or wind) as it essentially aims to reduce the colossal amount of solid wastes accumulating in cities and towns all over India. In addition to managing wastes, waste-to-energy has the added advantage of producing power which can be used to meet rapidly increasing energy requirements of urban India. In my opinion, waste-to-energy sector has attracted renewed interest in the last couple of years due to Swachch Bharat Mission, though government’s heavy focus on solar power has impacted the development of waste-to-energy as well as biomass energy sectors.
- Nowadays, advanced thermal technologies like MBT, thermal depolymerisation, gasification, pyrolysis and plasma gasification are hogging limelight, mainly due to better energy efficiency, high conversion rates and less emissions. Incineration is still the most popular waste-to-energy technology, though there are serious emission concerns in developing countries as many project developers try to cut down costs by going for less efficient air pollution control system.

- Waste-to-energy projects, be it in India or any other developing country, is plagued by NIMBY (not-in-my-backyard) effect. The general attitude towards waste-to-energy is that of indifference resulting in lukewarm public participation and community engagement in such projects.

India’s waste-to-energy sector, which kicked off in 1987, is still searching for a successful role model, even after tens of millions of dollars of investment. In recent years, many ambitious waste-to-energy projects have been established or are being planned in different parts of the country, and it is hoped that things will brighten up in the coming years.

### ***Role and Action Plans for a better tomorrow:***

- The Government of India is committed to increased use of clean energy sources and is already undertaking various large-scale sustainable power projects and promoting green energy heavily.
- In addition, renewable energy has the potential to create many employment opportunities at all levels, especially in rural areas. The Ministry of New and Renewable Energy (MNRE) has set an ambitious target to set up renewable energy capacities to the tune of 175 GW by 2022 of which about 100 GW is planned for solar, 60 for wind and other for hydro, bio among other. India will need investments of around US$ 125 billion to reach this target.

- It is expected that by the year 2040, around 49 per cent of the total electricity will be generated by the renewable energy, as more efficient batteries will be used to store electricity which will further cut the solar energy cost by 66 per cent as compared to the current cost. Use of renewables in place of coal will save India Rs 54,000 crore (US$ 8.43 billion) annually.

- The Government of India has released its roadmap to achieve 175 GW capacity in renewable energy by 2022, which includes 100 GW of solar power and 60 GW of wind power.The Union Government of India is preparing a 'rent a roof' policy for supporting its target of generating 40 gigawatts (GW) of power through solar rooftop projects by 2022.

- India’s installed solar power capacity reached 14,771.69 as of September 2017.
- The government’s immediate goal is to generate two trillion units (kilowatt hours) of energy by 2019. This means doubling the current production capacity to provide 24x7electricity for residential, industrial, commercial and agriculture use. A total of 16,064 villages out of 18,452 un-electrified villages in India have been electrified up to December 2017 as part of the target to electrify all villages by May 1, 2018.
- The Government of India is taking a number of steps and initiatives like 10-year tax exemption for solar energy projects, etc., in order to achieve India's ambitious renewable energy targets of adding 175 GW of renewable energy, including addition of 100 GW of solar power, by the year 2022. The government has also sought to restart the stalled hydro power projects and increase the wind energy production target to 60 GW by 2022 from the current 20 GW.
- Initiatives taken by the Energy Efficiency Services (EESL) have resulted in energy savings of 37 billion kWh and reduction in greenhouse gas (GHG) emissions by 30 million tonnes.
- The Union and state governments have agreed to implement the Direct Benefit Transfer (DBT) scheme in the electricity sector for better targeting of subsidies, according to Mr Raj Kumar Singh, Minister of State for Power (Independent Charge).
- A total of 26.3 million households which are below poverty line (BPL) have been electrified under the Rural Electrification component of Deen Dayal Upadhyay Gram Jyoti Yojana (DDUGJY), according to the Ministry of Power, Government of India.
- The crisis arising from cancellation of 214 coal blocks by Hon’ble Supreme Court was turned into an opportunity through transparent e-auctions, all of whose proceeds go to States especially the less developed States in East India.
- Besides PSUs, several state-level corporations are there which accounts for about 41.10% of overall generation , such as Jharkhand State Electricity Board

(JSEB), Maharashtra State Electricity Board (MSEB), Kerala State Electricity Board (KSEB), in Gujarat (MGVCL, PGVCL, DGVCL, UGVCL four distribution Companies and one controlling body GUVNL, and one generation company GSEC), are also involved in the generation and intra-state distribution of electricity.

- Other than PSUs and state level corporations, private sector enterprises also play a major role in generation, transmission and distribution, about 29.11%(61409.24MW) of total installed capacity is generated by private sector.
- The PowerGrid Corporation of India is responsible for the inter-state transmission of electricity and the development of national grid.

## *Conclusion*

It is difficult to forget that one of the largest power outage in our history happened in India in July 2012, leaving 62 crore people in darkness. Such darkness engulfed the nation, even as more than 24,000 MW of generation capacity lay idle due to lack of fuel like coal and gas. The entire sector reached a vicious cycle of inaction and policy paralysis with surplus generation capacity and massive unutilized investments at one end while large power cuts for the consumer on the other end.

From then on a lot of changes were incorporated along with change in approach by the government which were:

- Reliable power
- Quality power
- Optimum power cost
- Commercial viability of power industry
- Power for all
- Rural electrification and subsidisation .

### *Strategies*

- Power Generation Strategy with focus on low cost generation, optimization of capacity utilization, controlling the input cost, optimisation of fuel mix, Technology upgradation and utilization of Non Conventional energy sources
- Transmission Strategy with focus on development of National Grid including Interstate connections, Technology upgradation & optimization of transmission cost.
- Distribution strategy to achieve Distribution Reforms with focus on System upgradation, loss reduction, theft control, consumer service orientation, quality power supply commercialization, Decentralized distributed generation and supply for rural areas.
- Regulation Strategy aimed at protecting Consumer interests and making the sector commercially viable.
- Financing Strategy to generate resources for required growth of the power sector.
- Conservation Strategy to optimise the utilization of electricity with focus on Demand Side management, Load management and Technology upgradation to provide energy efficient equipment / gadgets.
- Communication Strategy for political consensus with media support to enhance the general public awareness.,

### *Rural electrification*

Jharkhand, Bihar, Uttar Pradesh, Orissa, Uttaranchal, Madhya Pradesh etc are some of the states where significant number (more than 10%) of villages are yet to be electrified.

- Number of Villages (1991 Census) – **593,732**
- Villages Electrified (31/08/2010) – **503,924**
- Village level Electrification % – **84.9%**

Hence the government's aim "To provide clean, affordable and quality energy for all" may not just remain a goal if each one of us puts in our 100% support and coordinate with the schemes and policies for a better tomorrow so that not only us but the coming generations also are able to enjoy a sustainable quality of life .

# ***National Initiatives For Energy Revolution***

In India, since our energy infrastructure is not intimately originated as yet, we have the opportunity to make the right alternative today.

### *Pradhan Mantri Sahajn Bijli Har Ghar Yojna "Saubhagya":-*

The aspiration of the 'Saubhagya' is to provide energy access to all by utmost mile connectivity and electricity connections to all remaining un-electrified households in rural as well as urban areas to effectuate universal household electrification in the country.

The Rural Electrification Corporation Limited (REC) will endure the nodal agency for the workable of the scheme throughout the country.

The expected outcome of the Scheme is as follows:

- Environmental ameliorate by substitution of Kerosene for lighting purposes
- Enhancement of education services
- Better health assistance
- Enhanced connectivity through radio, television, mobiles, etc.
- Intensify economic activities and jobs
- Improved quality of life precisely for women

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## *Introduction*

In India, since our vitality foundation isn't personally begun up 'til now, we have the chance to make the correct assistant today. Power age from sustainable sources is progressively perceived to play an imperative title for the achievement of an assortment of essential and auxiliary vitality strategy aim, for example, improve decent variety and security of vitality supply, consumption of neighborhood poison and worldwide ozone-harming substance outflows, territorial and country advancement, and misuse of scope for cultivating social union, esteem expansion and business age at the nearby and local level. This foundation the arrangement of the vitality emergency on the sensible usage of inexhaustible the sustainable power source assets, for example, biomass, sun-powered, wind, geothermal and sea tidal vitality. This paper surveys the sustainable power source abstract of India and in addition extrapolates the future improvement in India, where the monstrous size of the nation and the tremendous slippage control imply that the vast majority – strikingly those in provincial territories – can't depend on their power supply, DRE frameworks are astoundingly applicable. The magnificence of working on such little scale implies that the vitality supply can be a plot to precisely suit the requirements of the group it serves.

Contingent upon the normal assets reachable, humanity can assign to secure sun based power, wind control, the energy of moving water utilizing small scale hydro innovation, or a mix of all of three. There are various elective types of sustainable power source exhibit on the planet as well, and we're showing signs of improvement at catching them. Frameworks can be detached – these are called 'remain solitary' – or can even be associated with the principle power network – these are called 'lattice intuitive'. Matrix intelligent frameworks have the preferred standpoint that the proprietors of the framework can really pitch energy to the network on the off chance that they produce abundance, making another wellspring of pay for them, or draw additional power in the event that they discover they ever require more.

## *Current Situation*

India has propelled the world's biggest sustainable power source development program and means to accomplish 175 GW limit of vitality by 2022. The nation is taking national activities intends to comply with its obligation under the Paris Agreement to keep the rising temperatures of the Earth well beneath 2 degree Celsius. Tamil Nadu and Rajasthan are driving the sustainable power source segment by creating power utilizing wind ranches. Rajasthan tops the rundown for sunlight based and twist vitality with an aggregate establishment limit of in excess of 3,000 Megawatts.

### *Public Sector Initiatives*

The general population part endeavors in India have been contributing significantly in financial and social improvement for the country since origin. A MoU between Ministry of New and Renewable Energy and Ministry of Petroleum and Natural Gas (MoPNG) has been marked to enhance vitality security alongside clean vitality advancement through interests in expansive sun powered, wind and other sustainable power source extends by creating two uncommon reason vehicles (SPV) (MNRE, 2009). The SPVs will be shaped with cooperation from PSUs under MoPNG and under MNRE which are ONGCL, IOCL, OIL, GAIL, BPCL and HPCL and EIL (Engineers India Ltd), SECI (Solar Energy Corporation of India) and IREDA (Indian Renewable Energy Development Agency). In an activity of Ministry of Heavy Industries and Public Industries, Ministry of New and Renewable Energy and Ministry of Power, BHEL, SECI, Sambhar Salts Limited, Power Grid Corporation, Sutlej Jalvidyut Nigam Limited and Rajasthan Electronics and Instruments Limited have marked a MoU in Jan, 2014 for setting up of a ultra-mega sun oriented power venture with add up to limit of 4000 MW at Sambhar in Rajasthan on BOO premise (Barpatragohain, 2015). OIL had introduced a 54 MW wind cultivate and another 13.6 MW in Rajasthan which were viably associated with the state power lattice. OIL has setup two 100 kW sun based power plants in Rajasthan and Assam (Barpatragohain, 2015). Furthermore, OIL has additionally taken up a 5 MW sun based power plant in Rajasthan. ONGC has setup the ONGC Energy Center (OEC) for look into in substitute vitality sources to create moderate clean vitality answers for commercialization and is at present chipping away at execution of sun oriented warm dish-stirling motor framework in the Solar Energy Center at Gurgaon (Barpatragohain, 2015). ONGC is to setup a sun oriented power plant of 1 MW to provide food energy to its office and settlement in Rajahmundry. IOCL has introduced a 5 MW sun oriented power venture in Rajasthan and a 21 MW wind control venture in Gujarat and another 48.3 MW wind control venture is under usage in Andhra Pradesh. IOCL has setup a JV organization with NPCIL to set up a 1400 MW atomic power plants at in Rajasthan with Pressurized Heavy Water Based Reactor (PHWR) innovation and is required to be finished by 2017. NPCIL has consented to joint wander arrangement with National Thermal Power Corporation Limited, National Aluminum Company Limited, to setup a JVC for atomic power undertaking to bridle and create atomic vitality for producing power on a business premise. ONGC is investigating speculation openings in the atomic power age area in relationship with the NPCIL. Likewise, ONGC has embraced an exhaustive program for investigation for uranium in the sedimentary bowls of India.

### *Government endeavor and achievement*

The administration has taken a few measures to spread mindfulness for sun powered and wind vitality frameworks. These incorporate production of book, magazine, arranging workshop and class, and so forth. Worldwide Wind Day has been celebrating since, 2007 to make mindfulness and accomplishments in wind vitality segments. Service of New and Renewable Energy (MNRE), 2009 is the main service of its kind, totally devoted toward sustainable power source. MNRE is executing Remote Village Electrification (RVE) Program to give budgetary help utilizing sustainable power sources incorporating sun powered vitality in remote zones towns where power framework augmentation isn't discovered possible by the state governments (MNRE, 2009). The arranged introduce limit amid twelfth arrangement period was at first settled at 18,500 MW. Nonetheless, the new government has chosen for limit expansion with aspiring breeze vitality age of 10,000 MW consistently to decrease reliance on imported energizes (Barpatragohain, 2015). In perspective of that, MNRE, makers of wind turbine (IWTMA) and different partners will together examination the lattice accessibility in six states for extra establishment of wind control every year. The current assembling limit of twist turbines in India is 9500 MW with arrangement of further extension (Barpatragohain, 2015). Likewise, India can draw in more interests in twist area by settling issues like power clearing and buy commitments with the state utilities. C-WET has started a pilot venture for seaward breeze control age as a team with ONGC and the European Union Consortium (MNRE, 2009). The Ministry is giving budgetary impetuses to the establishment of both off-lattice and network associated sunlight based power plants through different plans. These incorporate particular tax, age based motivating forces, quickened devaluation, concessional/zero extract and traditions obligations, and so on. MNRE is likewise actualizing off-framework and decentralized sun oriented applications conspire under JNNSM for establishment of sun based power plants in different parts of the nation. Service of Power is executing Decentralized Distributed Generation (DDG) conspire for both customary and sustainable power hotspots for towns where charge of matrix network isn't possible. Both under the DDG plan and RVE program, the legislature gives 90% appropriation of the task cost. Under the DDG plot, the adjust 10% activities cost can be masterminded by the executing office or from any monetary establishments and for RVE ventures the adjust 10% can be financed from the state governments (MNRE, 2009). Under off-matrix and decentralized sun oriented applications conspire, the Ministry gives 30% capital appropriation to establishment of sun powered water radiators all in all classification States and 60% capital sponsorship in exceptional class states (North Eastern States, Sikkim, Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Lakshadweep and Andaman and Nicobar Islands). For establishment of sun based photovoltaic lighting frameworks, 30% capital appropriation (Max Rs.135/ - per watt crest) is conceded relying on limit and design. Government has likewise endorsed 48 urban communities to create as of "Sun powered City" for decrease of least 10% of anticipated request in ordinary vitality inside five years by misusing extra sustainable power sources and vitality proficiency measures (Barpatragohain, 2015). The plans under RVE program for financially savvy sunlight based power lighting answers for rustic populace have huge effect on lamp oil sponsorship bill and illuminating around 47% of the nation populace will rely upon such store accessibility. Under the offgrid and decentralized sun based applications plot, MNRE gives 30% capital sponsorship to establishment of sun oriented power plants and 90% for government associations of extraordinary class states. The legislature has propelled a plan to energize establishment of sun powered water radiators by setting focuses in staged way (Barpatragohain, 2015). The stage I of the Mission has been finished and accomplishment is 100%. The aggregate focus for stage II (2013e2017) and stage III (2017e2022) are set as 15 Million sq m and 20 Million sq m individually. The legislature has proposed a program for establishment of one lakh sun based pumps for water system and drinking water purposes the nation over. An aggregate number of 11,626 sun based pumps have just been introduced in the nation till 31/03/2014 and a sum of 14,788.45 lakh rupees have been authorized for sun oriented pumps under "Off matrix and Decentralized Solar Applications" conspire in 12 states (Barpatragohain, 2015; MNRE, 2009). The administration is empowering establishment of sun oriented road lights under off-framework and decentralized sunlight based applications plot with 30% capital endowment. The Ministry gives 90% capital appropriation to government associations for establishment of sun oriented road lights in unique class states. An aggregate of 274,679 sun based road lights have been introduced in different areas of the nation. Lattice associated sun powered power plants of 2596 MW total limit has been charged amid the most recent three years the nation over (Barpatragohain, 2015). The limit of plants dispatched under focal plans and states activities is 896 MW in 2011e2012, 754 MW in 2012e2013 and 946 MW in 2013e2014. An objective for abuse of matrix associated sunlight based power limit of 20,000 MW by 2022 of every three stages has been set under the National Solar Mission (NSM) with limits of 1000 MW in stage I (till 2013), 9000 MW in stage II (2013e2017), and 10,000 MW in stage III (2017e2022) (Barpatragohain, 2015). According to MNRE, an aggregate limit of 1686 MW of framework associated sunlight based power plants was dispatched toward the finish of NSM stage I, and a further limit of 1000 MW has been included amid NSM stage II till 30.06.2014. A portion of the regular strategy and administrative deterrents like land securing and resettlement, acquiring condition and timberland clearances have postponed significant ventures in vitality division (Palit, 2003; McKinsey, 2008). The Ministry of Environment has facilitated the Green Rules through warnings in Aug, 2014, for mining, streets, power and water system ventures and other mechanical parts (Barpatragohain, 2015). It has loose a couple of directions identified with condition, woodland and ancestral rights.

***Saubhagyaa***

## *Pradhan Mantri Sahaj Bijli Har Ghar Yojana– "Saubhagya"*

Pradhan Mantri Sahaj Bijli Har Ghar Yojana – 'Saubhagya' another plan was propelled by the Hon'ble Prime Minister on 25th September 2017. Under Saubhagya free power associations with all families (both APL and poor families) in country territories and poor families in urban zones will be given. There are around 4 Crore un-energized family units in the nation and they are focused for giving power associations by December 2018. Provincial Electrification Corporation (REC) has been assigned as its nodal office for the Saubhagya plot.

Under the Saubhagya conspire, DISCOMs will likewise sort out camps in towns/group of towns to encourage on-the-spot topping off of utilization shapes including arrival of power associations with family units. DISCOMs/Power Department will likewise receive inventive system through committed web-based interface/Mobile App for gathering/combination of use frame in electronic mode and furthermore catching procedure of arrival of power associations. The points of interest of customers' viz., Name and Aadhar number/Mobile number/Bank account/Driving License/Voter ID and so on., as accessible would be gathered by the DISCOMs.

Extent of the Scheme:

- Providing last mile availability and power associations with all un-energized family units in country regions.
- Providing Solar Photovoltaic (SPV) based independent framework for un-energized families situated in remote and out of reach towns/residences, where matrix expansion isn't doable or financially savvy.
- Providing last mile network and power associations with all outstanding financially poor un-jolted family units in urban territories. Non-poor urban family units are avoided from this plan.

***Notable Features of Saubhagya are:***

- All DISCOMs including Private Sector DISCOMs, State Power Departments and RE Cooperative Societies might be qualified for budgetary help under the plan in accordance with DDUGJY.
- The forthcoming recipient families with the expectation of complimentary power associations under the plan would be distinguished utilizing SECC 2011 information. In any case, un-charged family units not secured under SECC information would likewise be given power associations under the plan on installment of Rs. 500 which might be recouped by DISCOMs in 10 portions through power charge.
- The power associations with un-zapped families incorporate arrangement of administration line link, vitality meter including paid ahead of time/keen meter, single point wiring. Driven lights and connected frill in accordance with specialized determinations and development standard.
- In instance of un-energized families situated in remote and out of reach regions, control packs of 200 to 300 Wp(with battery bank) with a most extreme of 5 LED lights, 1 DC Fan, 1 DC control plug and so on might be furnished alongside the arrangement of Repair and Maintenance (R&M) for a long time.
- The points of interest of shoppers viz, Name and Aadhar number/Mobile number/Bank account/Driving License/Voter ID and so on., as accessible would be gathered by the DISCOMs.

•	The defaulters whose associations have been detached ought not be given advantage of the plan. Notwithstanding, the utilities may think about settlement of old duty and reconnection according to standards.

Due to the expansion in oil costs, particularly after the oil emergency in 1973 and the Gulf War in 1991, topographically decreased accessibility of oil, and the inconvenience of more stringent legislative controls on deplete outflows, analysts have considered elective fills and elective arrangement strategies (Durgun and Sahin, 2007). At the point when oil cost are low the elective vitality turns out to be less wanted, yet when oil cost increment, interchange vitality like sun based power, and wind control turn out to be great contrasting options to oil and gas. As, India is intensely reliant on non-renewable energy sources, import of unrefined has constrained India to pay out an enormous measure of outside money. Any unanticipated import emergency may drive the country to the edge of catastrophe. As vitality request has been developing relentlessly with financial development rate and regardless of whether India keeps up a normal development rate of around 6% in the coming years, the current assets will be feeling the squeeze and request supply hole both in modern and local divisions may cause intense vitality shortage. Other than helping the nation to accomplish vitality security sustaining sustainable power source shapes additionally have positive effect in diminishing ozone harming substance outflow. To be naturally generous, vitality administrations must be furnished with low ecological effects and low ozone harming substance (GHG) discharges. Be that as it may, 85% of current essential vitality driving worldwide economies originates from the burning of non-renewable energy sources and utilization of petroleum derivatives represents 56.6% of all anthropogenic GHG outflows (Rogner et al., 2007). To keep up both a practical economy that is fit for giving basic merchandise and ventures to the residents of both created and creating nations, and to keep up a strong worldwide atmosphere framework, requires a noteworthy move in how vitality is delivered and used. More we support and utilize sustainable power source assets, less will be the utilization of petroleum products. In this manner it will help in alleviating atmosphere changes. The arrangement creators, ventures, clients and different partners ought not see interchange vitality as a substitute for vitality generation just, yet should vision as a piece of procedure in accomplishing 'supportable and comprehensive development' to make India Energy Independent. Research, advancement, generation and exhibition have been done energetically in India to locate an achievable answer for the enduring issue of energy deficiency for as long as three decades. There is a critical requirement for progress from ordinary oil based vitality framework to sustainable asset based frameworks. India has acquired use of an assortment of sustainable power source advances for use in various areas.

# ***Decentralized Renewable Energy Options***


### *Abstract*

Electricity is essential for economic and social development of a region. Dependence on the fossil fuel resources for electricity generation is eroding the resources at faster rate apart from large scale pollution of land, water and air environment. Electric energy generation from renewable energy resources (wind and solar) plays a pivotal role in the region's development, while combating global warming through the reduction of greenhouse gas (GHG) emissions. The current communication explores the potential of available renewable energy resources in Western Ghats with undulating terrains and relatively good vegetation cover. Most taluks in the Western Ghats region with solar insolation >5 kWh/m2 and hilly terrain experiencing wind >3 m/s are most suited to decentralized electricity interventions, which would ensure livelihood prospects through availability of electricity throughout the year. Sufficient land is available as the estimate indicate about 1-2% of current wasteland is adequate to deploy decentralized electricity generation for meeting the current electricity demand. High wind power density can meet peak power deficiency in the states of WG region. Seasonal variability analysis of solar insolation and wind speeds across taluks gives the insight to generation scheduling and optimum grid operation. Decentralized energy generation using available wind and solar energy resources can meet the regional demand by reducing the transmission losses and stress on central grid.

The government support and encouragement for decentralized rooftop generation using solar PV would significantly contribute to meet the present and future electricity demand of the region. A generation based incentive (GBI) would encourage decentralized electricity generation at individual rooftops. Some of the other initiatives to be taken are 1) solar public and road lighting, 2) RE based generation in government organizations and infrastructure, 3) implementation of solar rooftop generation in existing govt. building and financial encourage for the same. Switching over to RE technologies would also help in bringing down GHG emission and pressure on dwindling stock of fossil fuels.



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## *Introduction*

Electricity plays a pivotal role in the development of any sector of the society or the region. Electric energy supply, its quality and reliability is significantly associated with the regional development. Sustained supply of electricity influences human comfort, commercial and industrial development. On the other hand, fossil fuel based electricity generation with the emissions of greenhouse gases (GHGs) is the significant contributor to the environmental pollution and global warming. Pollution of the region not only affects the local life, but also aids the global phenomenon such as increment in the earth surface temperature, acid rains, diseases related to heart and skin, large scale pollution of water resources, increment in the sea water level due to melting of glaciers and icebergs etc.

Demand for electricity has been increasing due to rapid urbanization and industrialization with globalization and relaxation in Indian market. Coupled with these, rural electrification has widened the supply demand gap, necessitating exploration for viable energy alternatives. Majority of Indian population (about 65%) resides in rural areas where the average electricity supply is as low as 8-10 hours per day. The provision of reliable electricity promotes rural development through employment prospects while alleviating poverty and drudgery. The growing environmental concerns against fossil fuel based mega power projects with strong resistance from local public necessitates environment friendly alternatives. Thermal and nuclear power plants require lot of water for cooling and as a heat exchanging media apart from demand for land [11]. Hydro power plants make irreversible landscape changes in the region, submerging huge land (forest, agricultural fields, habitats etc.) and also severely alters the environmental flow of the river. Supply of electricity to remote load centers often results in higher transmission and distribution (T & D) losses with lower energy efficiency and revenue loss.

This emphasizes the need for novel sustainable technologies based on renewable resources harvested at decentralized level and efficient distribution through micro grids. Exploiting locally available renewable energy resources to meet the regional electricity demand is being attempted in many regions. Hybrid systems through integration of local energy resources is a feasible technique to address the seasonal variability and ensure the reliable energy supply. Grid connected micro grid seems viable option as many federal governments have opted the payback tariff for supplying to the grid. Rural electrification is yet to gain momentum evident from the absence of electricity supply in more than 74,00,000 households of 32,000 villages, where nano generation is viable. This would also make the last consumer of the central grid ladder, an energy generator (Nano generation), while increasing the decentralized renewable energy interception. This necessitates the design of a model for un-electrified households, mostly in economically poor vicinity to meet the basic lighting demand. These individual houses act as Nano generating units, which can be inter connected and scaled up. The proposed Nano generating units are independent of grid connection, since the load serving capability is limited to a house or cluster of few homes and mostly connected to DC load.

Though renewable energy sources are widely available, they are intermittent and variable in nature. The potential assessment of available RE sources is essential, prior to installation of generation plants. Solar energy is one of the widely available energy source which can be directly converted to electricity using photo-voltaic (PV) cells. Photoelectric effect is the phenomenon which generates electricity (electrons), when solar radiations fall on PV cells. Number of PV cells are connected in series and/or parallel to meet output requirement (Voltage and current). External circuit will be connected to the end user/loads through inverters (to convert DC to AC), transformers (to maintain required voltage level) and security (circuit breakers, fuses, surge arrestors, isolators etc.) components. Solar energy can also be used for thermal applications and electricity is produced through steam turbines. Solar cookers, dryers, water heaters, concentrated solar power (CSP) plants are some of the examples of thermal energy utilization. However, PV cells produce electricity from solar radiations which is more convenient for installation and which is also user friendly.

Wind is being used for mechanical applications such as water pumping, grinding etc. Innovation of electricity generation boosted up the wind turbine installation to generate electricity, all over the world. Currently, more than 200 GW of power is being generated from wind across the globe, which is the leading RE resource. Winds are generated due to the rotation of the earth and temperature gradient in the atmosphere. Energy generation from wind is highly unpredictable which depends on potential variability, wind speed, etc. Since the output power of the wind turbine directly proportional to the cube of the wind velocity, any variation in wind speed will cause power output deviation. Drastic changes in the output will create stress on transmission lines due to stranded loads. This also decreases the plant load factor leading to lesser electric energy supply. To avoid transmission line stressing and to keep the load connected to the grid, forecasting of available wind potential is essential in order schedule the generation. This necessitates the potential assessment of available wind resource which also will help in plant installation planning and optimized scheduling of electricity generation. Forecasting of wind speed requires extensive mathematical (probabilistic approach) modeling. High potential areas assessed from spatial data will promise certain number of high wind speed days which decreases the complexity of prediction.

The present study deals with the available wind and solar energy potential assessment of taluks in the Western Ghats, one among 35 biodiversity hotspots in the world. Western Ghats (WG) is a repository of diverse endemic flora and fauna and also receives higher solar insolation for about 300 days in a year. The high altitude taluks in the region experience greater wind speed which are the high wind energy potential areas. Taluks in the planes and northern region of Western Ghats (WG) receives higher insolation which encourages the solar power plant installation. Seasonal variability across the taluks and seasons have been analyzed, which helps in optimizing the generation and selecting the best location for plant installation. Wind energy potential compliments the lower solar insolation during monsoon in the region. This ensures the reliable electricity generation throughout the year by hybridizing the energy resources.

Further, two systems are modeled in the study, which includes, a Nano electricity generating system for supplying a typical load of an un-electrified household and a hybrid system for village electrification. Earlier studies focused on rural electrification through renewable energy resources, decentralized energy generation, optimization of locally available energy resources, etc. [22-24]. Researchers have also proposed integrated energy systems and regional integrated energy plan which analyses the energy consumption pattern to provide viable sustained solutions [25, 26]. However, there are only few studies to address the un-electrified household energy issue (Nano level electricity generation) while mitigating the environmental pollution and grid dependency. The present study deals with electricity generation at the farthest end of distribution side, i.e. generation at the household, which eventually creates the building block to achieve energy independence. However, the model can also address the rural electrification in more environmental friendly way, while keeping the base load of the grid unchanged. The hybrid model using solar, wind and bio-energy, is simulated using HOMER platform to meet the village electricity load. The results are optimized for grid connected hybrid micro grid, with the sensitivity analysis of payback tariff. The probable reduction in emission is computed while the reliability of the system and minimum cost of electricity generation are optimized. Since the system is connected to the grid, energy storing devices are excluded which reduces the capital cost. Load data used are the real time data obtained by local electricity supply company (HESCOM grid), excluding industrial consumptions. The model is technically feasible, economically viable and environmental friendly with the scope for replication in all un-electrified and/or electrified villages depending on the resource availability. Reliability and better power quality is noticed with the decentralized system integrating locally available renewable energy resources, which also reduces the demand on the regional grid.

***Materials and methods*** - Study area: Western Ghats comprising of undulating terrain is located in the western part of India, along the coast, from Kanyakumari to Tapti valley covering about 1,490 km and spreads over 1,29,037 km2 area in Kerala, Karnataka, Goa, Maharashtra and Gujarat states. Taluks wise solar and wind energy potential analysis is carried for the Western Ghats region to analyse the seasonal variability and to identify the locations with high potential suitable for exploitation.

***Renewable Energy Potential Expedition*** **-** Spatio-temporal data are used for energy potential assessment using open source GIS platform, which also gives the seasonal and geographical variability of the energy resources. Long term data sets acquired from NASA SSE and Climate Research Unit (CRU) are reliable and depicts the seasonal variability which are closely correlated with ground measurement.

## *Conclusion*

GHG emissions of fossil fuel based centralized large-scale power plants (thermal, etc.) have resulted in serious environmental contamination apart from increasing carbon footprint. Decentralized generation (DG) using locally available RE resources with micro-grid are viable options to reduce the T and D losses and meet the regional electricity demand. It also optimizes locally available RE sources, stabilizes the voltage, improves power quality, remote area electrification, reduces pollution and hybridization of RE sources would promise a reliable supply of electricity. Taluks in the Western Ghats region receive higher solar insolation (> 5.5 kWh/m2/d) and also wind (2- 3 m/s) suitable for decentralized applications. Electricity harvesting by exploiting available renewable energy potential could also help the preservation of biodiversity of the region. A small fraction of available wasteland (1-3%) in each state is sufficient to meet the present electricity demand using SPV installation. Available wind power density shows that, peak demand deficiency can be met with wind power potential of the region.

# ***Electricity Regulation in India.***


### *Abstract*

**Central Electricity Regulatory Commission** (**CERC**), a key regulator of power sector in India, is a statutory body functioning with quasi-judicial status under sec – 76 of the Electricity Act 2003. CERC was initially constituted on 24 July 1998 under the Ministry of Power's Electricity Regulatory Commissions Act, 1998 for rationalization of electricity tariffs, transparent policies regarding subsidies, promotion of efficient and environmentally benign policies, and for matters connected Electricity Tariff regulation. CERC was instituted primarily to regulate the tariff of Power Generating companies owned or controlled by the government of India, and any other generating company which has a composite scheme for power generation and interstate transmission of energy, including tariffs of generating companies.



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## *Introduction*

The installed capacity of power plants increased from 1,713 MW in 1950 to about 211,766 MW by December 2012. A robust inter-state and inter-regional transmission system has evolved over decades, which facilitates widespread reach of power across the country.

The per capita consumption of electricity also increased from about 15 kWh in 1950 to about 814 kWh in 2011. About 90% of the villages in India have electricity. Although there has been substantial growth in generation, transmission and distribution capacity over the last sixty years, growth in demand for power has always exceeded generation capacity. The per capita electricity consumption in India is 24% of the world's average, and 35% and 28% of China and Brazil respectively.

## *Recent trends in the electricity sector*

The power sector continues to endeavor to provide adequate power, within the realms of sustainable development principles, to fuel the growing economy. Currently, the main issues include:

- ***Fuel shortage (domestic coal)*** - Coal production has not been keeping pace with the increasing demand of the electricity sector, mainly due to various delays in the development of coal mines in India. Due to this coal shortage, Coal India Limited (CIL) through its operating subsidiaries had not been issuing/signing letters of assurances/fuel supply agreements (FSAs) to power plant developers for supply of coal. The Ministry of Coal (MoC) therefore directed CIL to sign FSAs with power plants to supply a minimum annual contracted quantity of coal of at least 80%. It was also necessary to import coal due to the shortage. However, some FSAs have been signed although certain issues continue to need resolving.

- ***Pooled pricing of coal*** **-** Pooled pricing of coal (domestic and imported) is necessary as the production of domestic coal is not adequate for the coal requirements of power plants (both existing and planned). The Central Electricity Authority (CEA) and CIL therefore propose to prepare a scheme of coal price pooling to be considered by the Ministry of Power (MoP).

- ***Renegotiation of bid route purchase power agreements (PPAs) due to imported coal cost* -** Due to recent changes in the international coal market (specifically Indonesia), the prices of coal have substantially increased. This increase in fuel prices has substantially impacted the tariff initially bid by the project developers for coastal power plants in India (run on imported coal). Following this unexpected change, certain project developers have asked the Central Electricity Regulatory Commission (CERC) to intervene and approve a revised tariff for their power plants.

- ***Environmental clearance and land related issues* -** Land allocation issues and obtaining environmental clearance for their projects continue to be issues for power project developers.

- ***Tariff rationalization* -** In a recent order, the Appellate Tribunal for Electricity (APTEL) issued directions to the State Electricity Regulatory Commissions (SERCs) to ensure that state distribution utilities file tariff petitions for annual review of tariffs. This order was consequent to a *suo moto* action taken by the APTEL (an action taken by the APTEL on its own initiative) following a letter received from the Mop. Most SERCs have therefore asked electricity distribution companies to file tariff petitions for increase of tariffs. In cases where the distribution companies had not filed tariff petitions for tariff increases, the SERCs have passed *suo moto* orders for increasing distribution companies' tariffs.

- ***Distribution reforms* -** The MoP identified the poor financial health of the distribution utilities in India as a major issue to be addressed to get the power sector back on track. Based on a high level panel report (popularly known as the Dr Shunglu Committee report), the government is considering schemes for financial restructuring of state distribution companies.

## *Transmission and Distribution of Electricity in India Regulation, Investment and Efficiency*

Adequate investment in capacity and efficient working of transmission and distribution systems in developing economies with high growth of electricity demand are important objectives. Market oriented reform processes are required both for the creation of capacity and for electricity as a product. This invariably requires unbundling of transmission and distribution capacities from generation capacities. In this context alternative governance structures need to be explored. Concretely there has to be major emphasis on development of mechanisms of moving from State owned centralized planned and public sector owned electricity utility systems to public private partnership models for transmission and distribution. Transparency and different bidding procedures are essential during the transition. Overarching legislative back up to the process and the influence of political interest groups which arise including the need to protect the interests of small consumers and backward regions in a public utility is a policy management challenge in the larger context in which the transition takes place. Examples of the political process of successful management of the newer legislation for PPPs in developing economies are not that many and need analysis as best practice cases. Regulatory mechanisms including the rules for open access, the development of availability tariffs for inter regional transmission and time of the day and spatially differentiated pricing systems for distribution of energy in large federal countries are discussed in the policy literature but not that many successful examples are there. Examples generated from the literature generated by forward looking regulators and legal case literature, need attention. Resistance to such „efficient‟ systems, both at the level of regulators finding cost plus systems more convenient, parastatals taking refuge in „practical‟ alternatives, but in fact possibly increasing their monopoly power, need to be focused to show the ongoing nature of the problem. The importance of such systems for interregional grids across national borders and the superiority of rule based systems as compared to Bismarck an diplomatic negotiations needs exploration. Problems of technical management of efficient transmission and distribution systems and in particular of integrating decentralized generation through mini hydel, wind or photovoltaic sustainable generation mechanisms with grids are of interest. Case studies of captive and backup 2 generation capacities with spot trading electricity markets through real time provide a backdrop for this analysis. Financing systems, including viability gap funding in PPPs, both in unbundling reform and in project execution when regional or equity considerations become important in politically acceptable solutions requires work. Newer financial products for funding and risk mitigation which work need to be outlined. In addition to the national level, the integration of such systems with reform at the global level, including the OECD and G20 requires to be explored to integrate state of the art practice in the reform process.

Reforms and Governance It is obvious that in recent years considerable advance has been made in unbundling the system and involving private players and economic incentives and disincentives in electricity markets. But its weaknesses in terms of performance have been noted and while the islands of change are now more than best practice cases, the momentum needs acceleration. Very recently the Planning Commission has the following critical assessment. A robust trading system is very important for a free and fair competitive electricity market operation. Though most of the supplies of electricity are under long term contracts, electricity is also traded on a short term basis. The volume of such trading has increased substantially and trades are occurring at very high prices. The Unscheduled Interchanges (UI) mechanism, meant to ensure grid discipline (described above: author's insert), is being used by many state power utilities as a trading platform and this is one of the reasons for trading at high rates. Trading of power at high rates has a distortion effect since state utilities are paying very high prices for such purchased power and not reflecting this in the tariff charged to consumers. This will lead to large financial losses which will have negative consequences on the sector. This problem needs to be tackled by state 12 governments on a priority basis. Ideally, surplus power available with merchant plants should be sold to large consumers via open access. However, the open access provision in the Electricity Act has not been effectively operationalised."(GOI, 2010, p.328) Why does India like many other developing countries find it difficult to cover the last mile in accelerated reform? This is not a technical problem alone since the best practice cases have been listed and more examples will follow. Examination of recent history and structures show the basic forces at play. There are examples of governance managed for change and the other way around. It is important to analyze these in larger systemic terms rather than technical matters alone. Reform to be enduring will have to be at both technical and political levels. According to Subrahmanian, "..by 1996, the Government of India (GOI) realized that their generation tariff policy was flawed and similar problems needed to be avoided in the case of transmission. The central government, in parallel, was working out the technical feasibility of amending the act to allow private investments in the transmission sector." The original Transmission Bill was introduced in 1996 was seen through a Parliamentary Committee which was very cautious, particularly on private agents running an energy grid. The problems were political and since they were not resolved, the technical solutions don't work. The Left had genuine concerns on public control of energy wheeling in privately constructed systems and they were fully met in a period of almost a year. There were no short cuts in these issues and the quick fix comes unstuck. A The Opposition MP Jag Mohan chaired the Parliamentary Committee which patiently and laboriously saw through these objections, supported by the present author as Power Minister. Finally the Bill was approved by the Parliamentary Committee unanimously, which later led to support for reform oriented provisions in legislation and practice and finally in the Electricity Act, 2003. Based on this policy success foreign investment in transmission was possible. Private investment in transmission, power trading and other features were to follow. There were however problems created in this process and the momentum dried up. Contrast this with legislative attempts at fixing a minimum price for delivered power, the failure here leading to high AT&C losses listed above. This has been a vexed question for almost a decade and yet no one has seriously commented on the political failures, as shown by legislative glitches. The original legislation for the CERC had two essential features in it. It for the first time laid down that a minimum price of one and a quarter rupee per unit of electricity will have to be paid by law. Second it said that the decisions of the CERC would be mandatory. The author's predecessor was not allowed by Parliament to table the Bill, since it was genuinely controversial. On 14 August 1997, as Power Minister the author tabled the Draft Bill in the Lok Sabha. The successor Government, we believe wrongly and I said this to the then Power Minister, the late Kumaramangalam, who was a friend, instead of politically managing the Bill brought out an administrative Ordinance, which was a ditto copy of the act introduced in Parliament on 14 August 1997. Two Chief Ministers, Mr. Badal of the agriculturally rich State of Punjab and Madam Jayalalita of Tamil Nadu, important parts of the then NDA coalition protested in public on the minimum power rate and the mandatory powers of the CERC .K. Subrahmanin notes" The Tamil Nadu government had opposed the 50 paise concept even during Alagh's tenure, and wanted this condition to be dropped." (p.60). The Ordinance was crippled and the vagueness continued in all subsequent legislation, including in the Electricity Bill and leads to the outcomes 13 even today. This month the Planning Commission notes" Under the provision of the Act, the power tariff for all categories of consumers was supposed to be brought within 20 per cent of the average cost of supply. This has not happen. A great deal of effort is required for revision of agriculture tariff and timely payment of committed subsidy by the States to ensure healthy power utilities."(GOI, 2010, p.328)

Technology Advances in transmission technologies in India including a large HVDC system have been noted. Technical losses of interregional transfer of power are low and globally comparable. More recently Power Grid Corporation of India Ltd (PGCIL) has established a 1200-kV National Test Station for developing the technology for transmitting power at 1200 kV. As noted in the best practice cases description earlier there are substantial applications of information technology n managing transmission and distribution reform. The Planning

Commission has recently stated;‟ Application of Geographical Information System (GIS) and effective Management Information System (MIS) can help in carrying out load demand/supply analysis and demand forecasting; improve network planning and execution skills; identifying the high AT&C loss level areas and improved billing and revenue collection. MIS would facilitate quick decision making and improve governance of the distribution sector both in terms of operational and financial performance. This will lead to improved customer services and overall reduction in service costs of the utility.(GOI,2010,p.334). The Accelerated Power Development & Reform Programme aims to strengthen sub-T&D networks, thus reducing the aggregate technical & commercial (AT&C) losses. Complete feeder metering has been achieved in twenty states. In a first of its kind project in the world, the 17 Karnataka Power Transmission Corporation Ltd (KPTCL) has attempted to strengthen its power networks and the constituent distribution utilities, for a consumer base of almost 16 million An integrated Scada solution will include monitoring 867 T&D stations with one million input/output points across Karnataka from a single control room in real time in Bangalore. The project will help KPTCL manage distributed generation from independent power producers), non-conventional energy producers and mini hydel plants in the KPTCL grid. A significant step in the direction of making the grid smart, this project will also help reduce line losses, voltage irregularities and energy billing. The idea of open access was introduced for the first time in India by the Electricity Act of 2003, which had assigned the deadline of January 27, 2009, for grant of open access to all consumers with electricity requirements of above one Mw. The idea was to introduce more competition in transmission and distribution and enhance efficiencies in power supply for consumers. While applications seeking open access for over 25,950 Mw have been given till date, implementation has been only for 7,400 Mw. That too largely for captive power, according to the latest data from the Forum of Regulators, a government body consisting of heads of state power regulators and that of Central Electricity Regulatory Commission. India has a good record in energy efficiency

## *Financing*

The certain method of mobilizing finance is to hasten the reform process. A beginning has been made to provide the institutional mechanism for power trading. A few States have introduced mechanisms for those who pay to get electricity from relatively assured sources. But the basic issues of free power and financial viability still remain. If this is not solved other short run fixes like guarantees, escrowing local or regional revenue sources, special funding mechanisms have a limit. A more complex issue is the lumpy nature of energy investments. This creates viability problems for financial institutions in terms of prudential norms. For example if a long term financing system is not in place, a power system may exceed prudential norms for lending to a sector or a group of companies. While the viability of the loan needs scrutiny these kinds of limits may need examination at government or central bank levels. In India, there has been see saw in this matter leading to some uncertainty but at present such norms are relaxed. Long term lending institutions and infrastructure development funding institutions are another solution. Global assistance to viable reform programs is another. Equity Access to energy in rural areas is a major issue. While 85 percent of Indian villages are electrified in some areas progress is lower. According to the Planning Commission there is clearly a very slow progress in providing connections to BPL (Below Poverty Line) households (38.3 per cent). A number of habitations in the villages however remain uncovered." (GOI, 2010 ,p.327) .

## *Conclusion*

The Indian experience suggests: First the need to experiment with alternative administrative and bidding procedures in the unbundling process of transmission and distribution from centralized electricity systems. In the Indian case a system of bidding on targets of reducing AT&C losses in a phased manner, with share of equity awarded to the lowest bidder (in terms of AT&C losses) seems to have worked better than say a tariff based system with an incentive thrown in. Second there is a need to move away from cost plus pricing in transmission and distribution at the earliest. It may be noted that the AT&C loss minimization strategy is a variant of a long term marginal cost pricing strategy advocated by Indian experts. Third a transparent regulating system and the infrastructure of transmission and distribution needs to be set up at the earliest and the Indian experience are helpful in terms of such structures in a large democratic federal country. The Central and State Electricity Regulatory commissions and the Appellate Tribunal for Electricity (ATE), SEBs disaggregated into Generation, Transmission and Distribution Companies, various policies like the National Electricity Policy, Tariff Policy, Rural Electrification Policy mandated by the Act, along with Rules and Regulations have to be in place. Trading licenses have to be issued, power trading has to commence. National Grid Code and State Grid Codes have to be notified. Only then unresolved problems can be taken up. Fourth the Indian experience brings out the need to persist with reform ideas at the highest political levels. The successes of private transmission and availability tariffs in the initial stages and later problems underline this. These aspects need to be integrated in case studies of reform, which in turn have implications for negotiating reform packages. Fifth technological improvement packages, say as in open access programs need to be accelerated anyway and the Indian experience shows that while the important issues lie in the reform and unbundling package, the technical packages have a usefulness of their own . Sixth equity aspects need to be embedded in the program of reform, recognizing fully well the difficulties in a structured subsidization policy.

***Power Point Presentation on Improving Plants Performance by TOC in Power Plants***

*by Sh. Vijay Kumar Chadalavada,*
*Managing Director, SWAN Environmental Pvt. Ltd.*


## WHAT IS TOC?

- **Total Organic Carbon or Total Organic Content (TOC) is a measurement of the amount of organic carbon present in different matrix.**
- **TOC is an index of "*The amount of Organic Substances*" in the water Typical Index that shows "WATER QUALITY".**
- **Total organic carbon (TOC) is a non-specific test, which means TOC will not determine which particular compounds are present (most samples are complex mixtures which contain thousands of different organic carbon compounds). Instead, TOC will inform the user of the sum of all organic carbon within those compounds.**

## TOC IN VARIOUS WATERS

1. **SOURCE WATER**
2. **PROCESS WATER**
3. **WASTE WATER**

## SOURCE WATER IN POWER PLANTS

Power plants need plenty of water that may come from ground water, surface water (rivers, ponds, lakes, sea water, rain water).

Source water quality is changing rapidly and getting more polluted and seasonally getting effected due to raise in pollution with various point source (man-made) and non point source (decay of naturally occurring organic matter) pollutants. The organic pollutants are either in suspended/ insoluble or soluble form.

By monitoring TOC level one can plan their water treatment devices maintenance schedules depending upon the TOC load.

Some plants who like to use recycled water (from waste water). TOC measurement is helpful to determine the reuse of recycled water.

## SOURCE WATER IN POWER PLANTS

### River Water/ Pond/ Lakes Water:

Power plant depend on river water/pond/ lakes water as explained river water quality will change based on upstream activity/ seasonal effects. So TOC is excellent parameter to understand source water quality .

In South Korea the Ambient Water Quality Standards of Rivers – Living Environment is categorized into 7 types. The TOC limits have been set for each type

Similarly for Lakes also the Ambient Water Quality Standards of Lakes – Living Environment is categorized into 7 types. The TOC limits have been set for each type

## Ambient Water quality can be classified based on TOC Limits :

| Grade | TOC (mg/L) - Rivers | TOC (mg/L) - Lakes |
|---|---|---|
| Ia. Very Good | < /= 2 | < /= 2 |
| Ib. Good | < / = 3 | < / = 3 |
| II. Somewhat Good | < / = 4 | < / = 4 |
| III. Average | < / = 5 | < / = 5 |
| IV. Somewhat Poor | < / = 6 | < / = 6 |
| V. Poor | < / = 8 | < / = 8 |
| VI. Very Poor | > 8 | > 8 |

## SOURCE WATER IN POWER PLANTS

**Ground Water:** Determination of TOC in ground water can provide valuable diagnostic evidence of extent of good quality ground water availability.

**Rain Water:** If Rainwater are collected and used for ground water recharge or for direct use then TOC in the collected rain water will tell the quality of it - whether it can be used directly or recycled before use.

**Sea Water:** Some plants are using the sea water extensively for cooling tower purpose. TOC is one of parameter used to determine the quality of sea water or for any organic spills in cooling water.

## PROCESS WATER

**RAW WATER**

**DM WATER**

**RO WATER**

**DESALINATION WATER**

## TOC MONITORING IN WATER TREATMENT PROCESS

**Number of processes are available depending upon the source water quality. To name them like Chemical treatment / Lime softening, dual media filtration, carbon adsorption, conventional RO membranes and Ion exchange resin polishing (By DM Plants, RO Plants, Desalination Plants, MF Plants).**

**All the water treatment involves removal of TOC either in suspended / soluble / insoluble forms.**

**TOC of raw water plays important role in the extent of coagulation & softening process.**

| Source-water TOC (mg/L) | Source-water alkalinity, mg/L, as $CaCO_3$ | | |
|---|---|---|---|
| | 0 – 60 | > 60 – 120 | > 120 |
| > 2.0 – 4.0 | 35.0 % | 25.0 % | 15.0 % |
| > 4.0 – 8.0 | 45.0 % | 35.0 % | 25.0 % |
| > 8.0 | 50.0 % | 40.0 % | 30.0 % |

## TOC MONITORING IN WATER TREATMENT PROCESS

**Suspended & Insoluble matter can be removed by coagulation and filtration leaving Soluble and colloidal species in the supernatant water. The soluble can be removed using Organic scavengers with resigns, charcoal tower filters or Membrane filtration systems.**

**Organic scavengers are designed based on flow rate and organic concentration in the water. Care should be taken to avoid rapid fouling of the Ion Exchange resin or membranes or Charcoal towers. Resins are selected to resist the organic fouling based on TOC value of water. If the fouling occurs then it is often irreversible and prevention is better than curing.**

**TOC is good indicator and identify where organics are getting through, whether from membrane failure, Deterioration of Adsorbents such As Chelate, resin & activate carbon used in water treatment plant for timely replacement or maintenance of the same.**

## TOC MEASURING LOCATIONS IN RO PLANT

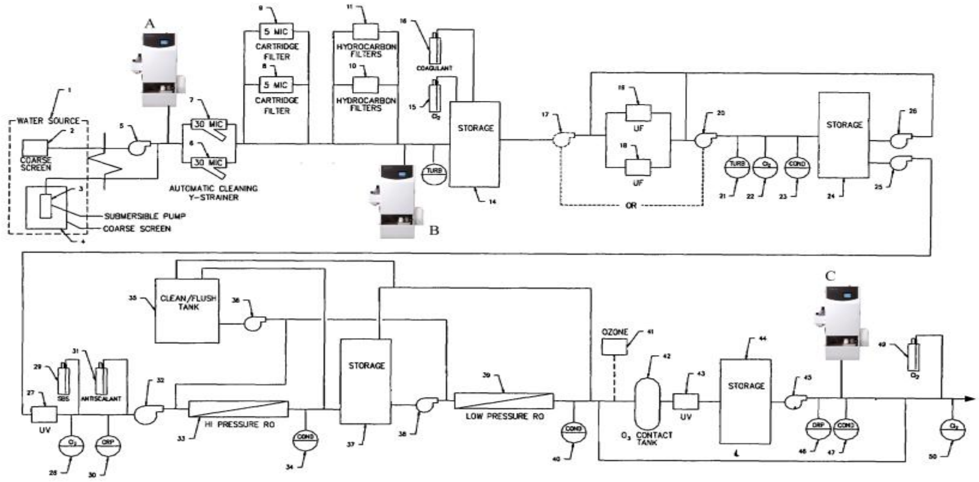
**<u>At the influent stage</u>**
**To estimate load on the plant and to take proactive action**

**<u>After hydrocarbon filters.</u>**
**Determines the need for adsorptive media in hydrocarbon filters**
**To find out the reduction in TOC level as compared to the TOC level at influent stage. Early detection to prevent organic fouling of RO membrane and there by preventing costly replacement of RO membrane.**

**<u>At the effluent stage before chlorine injection</u>**
**To determine the efficiency and effectiveness of the plant**
**To possibly avoid formation of DBP (Disinfection By Products like Tri Halo Methane**

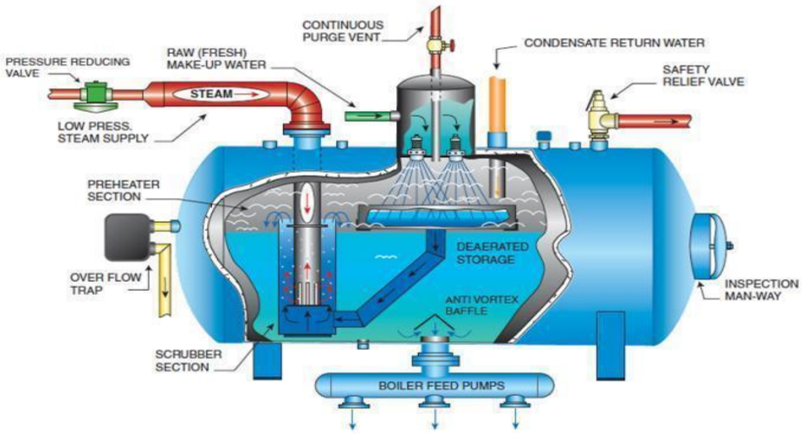
## TOC MONITORING IN RO PLANTS

## TOC MEASURING LOCATIONS IN RO PLANT



## PROCESS WATER

**BOILER FEED WATER / MAKE-UP WATER/ RETURN CONDENSED WATER /**



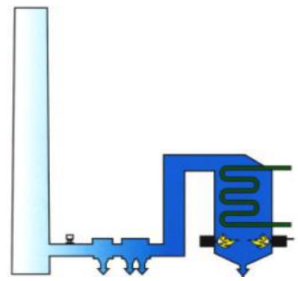

## TOC MONITORING FOR BOILER WATER

**Major sources of organic chemicals letting in Steam:**

**1.Natural Organic Matter (NOM) which consist of organic chemicals that pass through the pretreatment equipment and wind up in boiler feed water and steam. Research revealed that a seasonal influence on the TOC concentration and composition in make up water after mixed bed.**
**2. If the source water contains Trihalomethanes (THM) , 80% of THM passes through the water treatment and find the way into the steam and forms into halides.**
**3.The resins used in the treatment plants may go through chemical/physical breakdown and fine particles can find their way into steam. Fouling formed in polishers resins can also mix with steam.**
**4.Treatment Chemicals such as inorganic acids which may contain organic acids are added to the feed water that volatilize into the steam.**
**5.Spillage of the Lubricants used at high pressure rotating equipment may also mix with steam.**

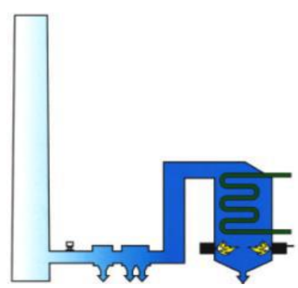
## TOC MONITORING FOR BOILER WATER

- It is well known that the accumulated Organic chemicals in pre-treatment are decomposed letting into the water/steam cycle that create anionic species ( acetate, formate and $CO_2$ ) in condensate will contribute to cation conductivity, their presence make it difficult for the operator to know if contaminants such as chloride or sulfate are in steam.
- The presence of organics under high temperature and pressure, are oxidized to form corrosive organic acids and carbonic acid. An increase in organic acids can severely damage ion exchange resins, mixed beds and demineralization tanks and Polishers, boilers, turbines, etc...
- Corrosion in boiler systems can quickly result in tube failure and plant shutdown.



## TOC MONITORING FOR BOILER WATER

- The TOC concentration limit is very low e.g. 0.1 to 0.5 mg/L.
- For coal-fired power plants, Eskom's Water Chemistry guidelines gave TOC target as 100 ppb and limit value as 250 ppb at mixed bed outflow.
- The boiler feed water limits given in 1999 by VGB Power tech e.V. was 200 ppb
- The boiler feed water limits given by EPRI (Electrical Power Research Institute) was 100 ppb



# TOC MONITORING FOR BOILER WATER

Republic of South Africa

Papers

105
CYCLODEXTRIN NANOSPONGES IN THE REMOVAL OF ORGANIC MATTER TO PRODUCE ULTRAPURE WATER FOR POWER GENERATION

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ABSTRACT

*The water treatment processes employed by coal fired power stations do not completely remove most of the natural organics (volatile component) from the feed water used for power generation. Currently, polyaluminium chloride, polyelectrolyte and ion exchange resins are used to treat water at power stations. The effectiveness of water-insoluble cyclodextrin (CD) polymers in the removal of natural organics (volatile component), dissolved organic carbon (DOC) and total organic carbon (TOC) from water collected at a specific power plant is reported. Results obtained from this study show that, despite the usage of the treatment processes, natural organic species emanating from raw water still persist throughout the stages of the water treatment process. The polymers on the other hand demonstrated the ability to remove dissolved organic carbon (DOC) from raw water by as much as 84%, whilst TOC removal was relatively low.*

*Keywords: Organic pollutants, Dissolved organic carbon (DOC), Total organic carbon (TOC), cyclodextrin polymers, coagulants, ion-exchange resin*

INTRODUCTION

The presence of organic pollutants in raw water is a major concern for a number of power plants and industries requiring ultrapure water such as pharmaceutical and electronics sectors (Maughan et al. 2000). Power stations in South Africa not being an exception, generally acquire their water from neighbouring surface water sources. This water normally contains inorganic salts as well as natural organic matter (NOM). The concentration levels of organics depend very much on the catchment, soil properties and other industrial and agricultural activities in the area. Seasonal variations are also a key factor as they also contribute to the level of organics in water. As per Eskom's chemistry guidelines, water specifications illustrated in **Table 1** have to be adhered to (Gericke, 2002).

**Table 1**: Demineralisation water specifications for coal fired power stations measured at the mixed bed outlet (Gericke, 2002)

| Parameter | Target | Limit |
|---|---|---|
| Turbidity (FTU) | < 0.1 | 0.2 |
| Specific conductivity (µs/CM@25°C) | <0.08 | 0.1 |
| Sodium (ppb as $Na^+$) | <1 | 2 |
| Silica (ppb as $SiO_2$) | ALARA | 10 |
| Chloride (ppb as $Cl^-$) | <1 | 2 |
| Sulphate (ppb as $SO_4^-$) | <1 | 2 |
| TOC | 100 | 200 |

Key
**ALARA**: As Low As Reasonably Achievable

On entering the boilers (**Figure 1**), these organic impurities can be decomposed to short chain organic acids and carbon dioxide through thermo-hydraulic processes (540°C 18 MPa) (Aspden et al. 2002). The newly formed acids can cause a decrease in the pH of the boiler water depending on the level of contamination, which in turn can impact negatively on the steam quality.

To alleviate this problem Eskom, the electricity generating utility in South Africa has developed a strategy which is aimed at producing water with reduced organic load. The approach in this strategy entails reducing organic loading in the water through the conventional treatment process employed. These conventional treatment processes which have now been adopted by all power stations, involve coagulation and flocculation of raw water followed by clarification, sand filtration and demineralisation. (Aspden *et al.* 2000). These processes are illustrated in **Figure 1**.


# TOC MONITORING FOR BOILER WATER


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Germany

**Differences in the Composition of Organic Impurities in Ground and Surface Waters: Consequences for the Preparation of Boiler Feed Water – Ref. #112**


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**1. Introduction**

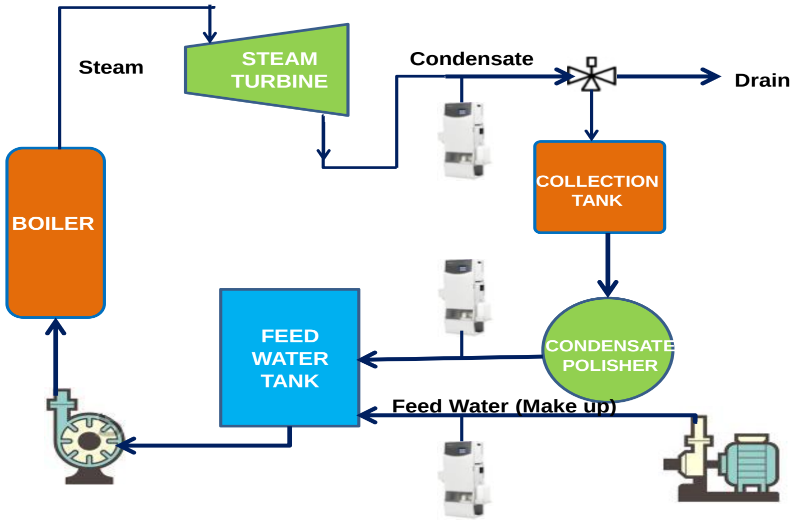
It is generally accepted that current limits for total organic carbon (TOC) in the pharmaceutical industry (500 ppb) and semiconductor industry (10-25 ppb) should be regarded as precautionary measures and do not necessarily reflect true scientific evidence. For the power industry the situation is different. Here, recommended TOC-limits for boiler feed waters (in 1999: VGB: 200 ppb, EPRI: 100 ppb) are based on scientific and empirical data. The oxidation of, say, 50 ppb TOC to carbon dioxide in the water/steam cycle will increase steam condensate conductivity by 0.48 µS/cm (values may depend on literature source, here [1]), a value which is not acceptable as it desensitises the detection of leaks in cooling water heat exchangers. Apart from this indirect effect of TOC there is also evidence for direct negative effects of TOC on steel materials. Even small amounts of organic acids, which are produced as intermediates in the TOC oxidation process, may locally lower the pH down to levels [2] where erosion corrosion of boiler tubes can take place. It was also found that carbon is enriched in stress corrosion cracks of turbine materials [3].
The present paper will discuss the "TOC-issue" in boiler feed water preparation. Most of the results can be applied also to other industries, e.g. semiconductor, chemical or pharmaceutical.

**2. Analysis of Organics in Natural and Demineralised Waters**

Let us assume an analytical instrument could identify all individual organic compounds in natural or processed waters. To what benefit could this be? It would take weeks to read the report and data interpretation would be a futile task. Even the most sophisticated instrumentation today is far away from being able to produce such data. It is regarded satisfactory if total values organics are obtained. Typical parameters for the-characterisation of organics are TOC, COD, BOD, permanganate consumption, spectral absorbance and emittance, AOX and trihalomethanes.
Such total values are not satisfactory at all. What is needed is more information on the qualitative composition of organics, namely NOM (Natural organic Matter). The problem is that NOM is non-volatile (purging of analyte is impossible), NOM is hydrophilic (enrichment by adsorption is not possible), NOM is labile (pre-concentration is not possible), and finally, NOM is generally present in very small concentrations only.
A relatively new analytical technique, called LC-OCD (Liquid Chromatography - Organic Carbon Detection) gives both quantitative and qualitative information on NOM. Quantification is based on carbon mass determination (like TOC) and qualitative analysis is based on a gel chromatographic separation technique [4]. For LC-OCD, only 10 millilitres of sample volume is required and measuring time is about 2 hours.
After several years of systematic and empirical work we are able to identify the following 6 classes of organic compounds: Humics (including molecular weight and aromatic properties), "building blocks" (natural decay products of humics), high-molecular weight polysaccharides, free organic acids, low-molecular weight neutrals, and natural hydrophobic compounds [5, 6, 7].

1

## KEY LOCATIONS FOR TOC MONITORING IN BOILER WATER CIRCUIT

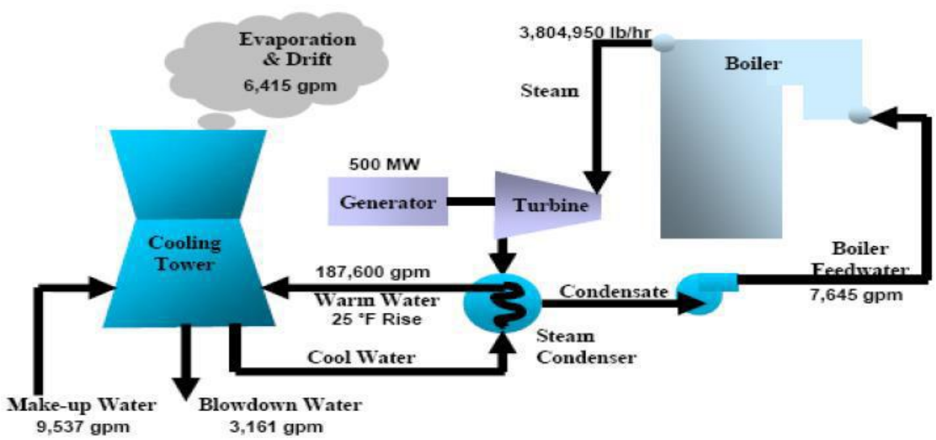



## BENEFITS OF TOC MEASUREMENT

- Monitoring of feed water for elevated organic levels
- Detection of leaks at the heat exchangers of the boiler system
- Improved system efficiency
- Reduced system downtime due to corrosion
- Boiler protection
- Water reuse optimization
- Energy optimization
- Chemical/Additive cost reduction
- Make up water cost reduction
- Waste Water Treatment Plant cost reduction

## TOC MONITORING IN POWER PLANT COOLING TOWERS

## PROCESS FLOW SCHEMATIC FOR WET RECIRCULATING COOLING WATER SYSTEM




gpm – gallons per minute
(3.784 litres per minute)

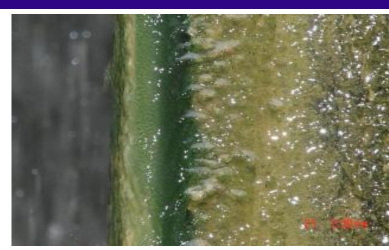
## TOC MONITORING IN COOLING TOWER

The source water for cooling tower ( Raw water, Clarified water, Filtered water, Soft water, Sea water, Treated Waste Water or Recycled water ).

- Higher the TOC concentration of the cooling water, the greater the risk for increased biological fouling.
- The bio film can lead to Microbiologically Influenced Corrosion (MIC) and cause localized metal loss.
- Algae and fungal mats can impede water flow, cause an unsightly appearance, and damage wood and tower structures.
- Biofilms are more insulating than most common scales, are 4 times more insulating than CaCO3 scale!

## ROLE OF ORGANICS IN CW SYSTEM

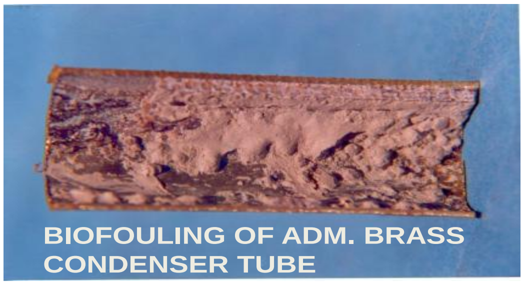
Eutrefication of reservoir



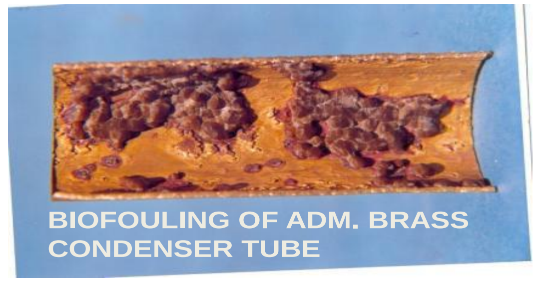
Thick Algae on CT


Severe foaming at CW Pump and in CW Foreway due to organic contamination

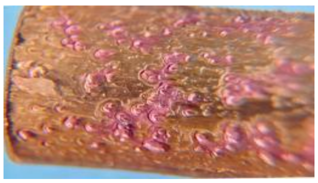
## CASES OF CORROSION IN CONDENSER TUBES



BIOFOULING OF ADM. BRASS CONDENSER TUBE

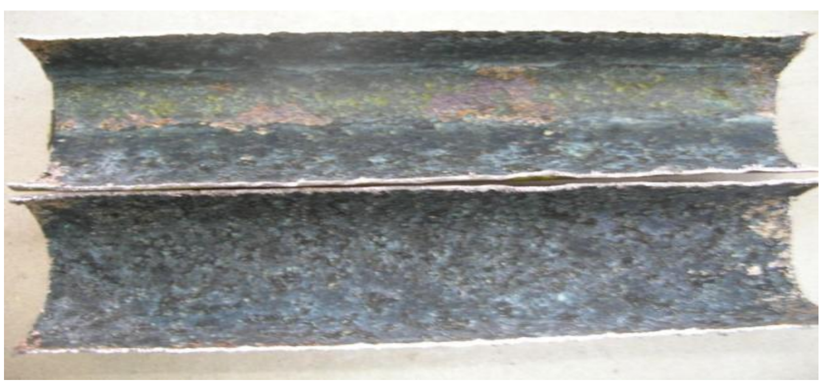


BIOFOULING OF ADM. BRASS CONDENSER TUBE



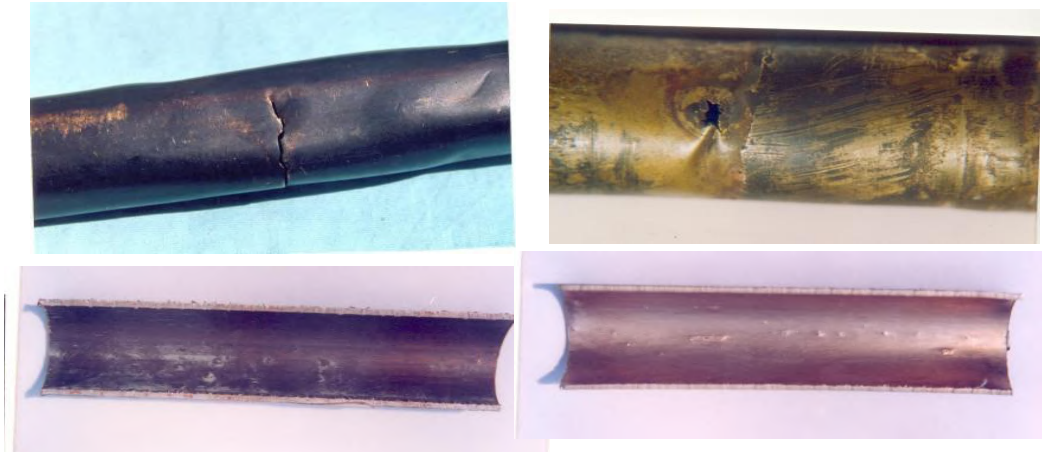
**MIC OF ADM. BRASS CONDENSER TUBES**
**CASES OF CORROSION IN CONDENSER TUBES**

## CASES OF CORROSION IN CONDENSER TUBES



**BIOFOULING OF Cu/Ni CONDENSER TUBES**

## CASES OF CORROSION IN CONDENSER TUBES



CORROSION OF CONDENSER TUBE WITH HIGH ORGANIC WATER

## BIOFILMS

- Biofilms are more insulating than most common scales
- Reduce heat transfer efficiency
- Increase dP across heat exchangers & reduce flow
- Health risks (legionella)

| Foulant | Thermal Conductivity |
|---|---|
| $CaCO_3$ | 1.3-1.7 |
| $CaSO_4$ | 1.3 |
| $CaPO_4$ | 1.5 |
| $MgPO_4$ | 1.3 |
| Fe Oxide | 1.7 |
| Biofilm | 0.4 |

**Common biofilms are 4 times more insulating than $CaCO_3$ scale!**

## TOC MONITORING IN COOLING TOWER

- <u>Texas Natural Resource Conservation Commission (TNRCC).</u> This permit required the plant to monitor its cooling water system for benzene and total organic carbon (TOC) concentrations in the return cooling water.
- Plant should install Online TOC analyser in the common cooling-water return header to detect early HyderoCarbon (HC) leakage.
- During cooling water system start-up, verification can be done for any leakage using TOC parameter. If the TOC in the makeup/raw water is 10 ppm, with 7 tower cycles operation, the maximum background TOC in the recirculating cooling water should be about 70 ppm or less.
- Any substantial increase in TOC concentration could be due to hydrocarbon leakage from process equipment.

## TOC MONITORING IN COOLING TOWER

### Typical Monitoring Data for Cooling Towers

**Weekly Analytical Data for Outfall**

| BOD | TSS | TOC | VOC | Residual Chlorine | pH |
|---|---|---|---|---|---|
| 6.72 mg/L | 5.47 mg | 54.21 mg/L | ND | 0.138 mg/L | 7.35 |

**Daily Analytical Data for Cooling Tower Blowdown**

| TOC | VOC | Residual Chlorine | pH |
|---|---|---|---|
| 70 – 80 mg/L | ND | 0.2–0.4 ppm | 7.2–7.8 |

ND = Not Detectable

# TOC MONITORING IN COOLING TOWER

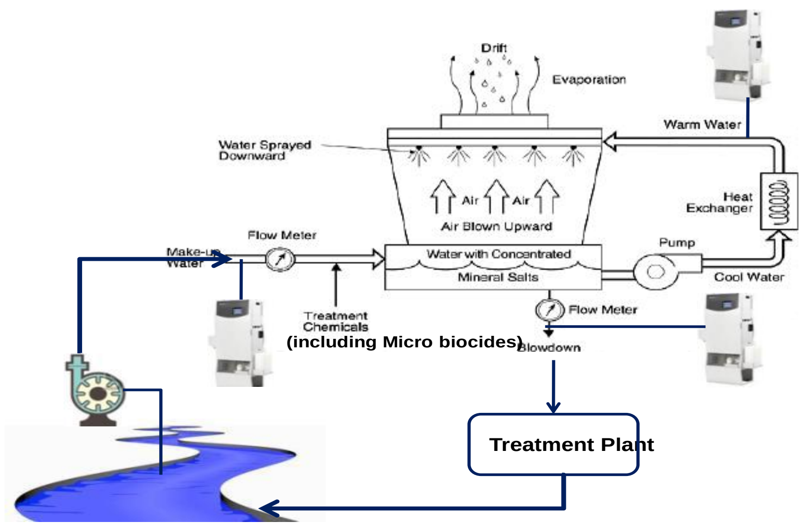
USA


Cooling Towers

Monitor Cooling Towers for Environmental Compliance

Establish an effective monitoring program by following these recommended practices.

# TOC MONITORING LOCATIONS IN COOLING TOWER

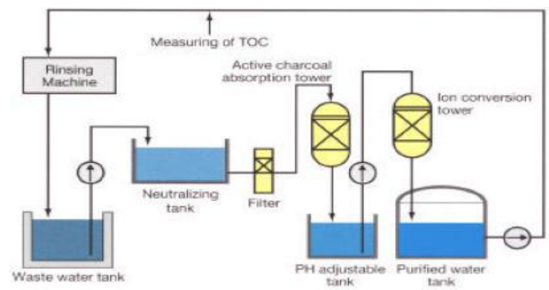



## PROCESS WATER

**WASHING WATER / RECYCLED WATER**

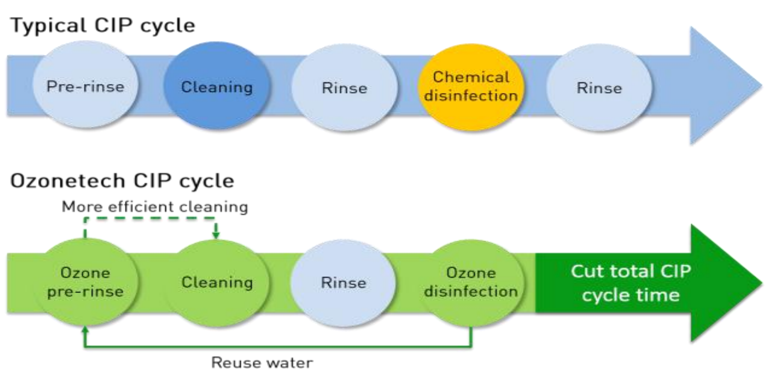
**Management of Collected Reusable water in a water network washing System using TOC monitoring :**

**When a water network is been Restarted after maintenance work On the rinsing system etc the point Where usable water quality level Has been reached can be quickly Determined If TOC management is used. So start up time can be minimized.**



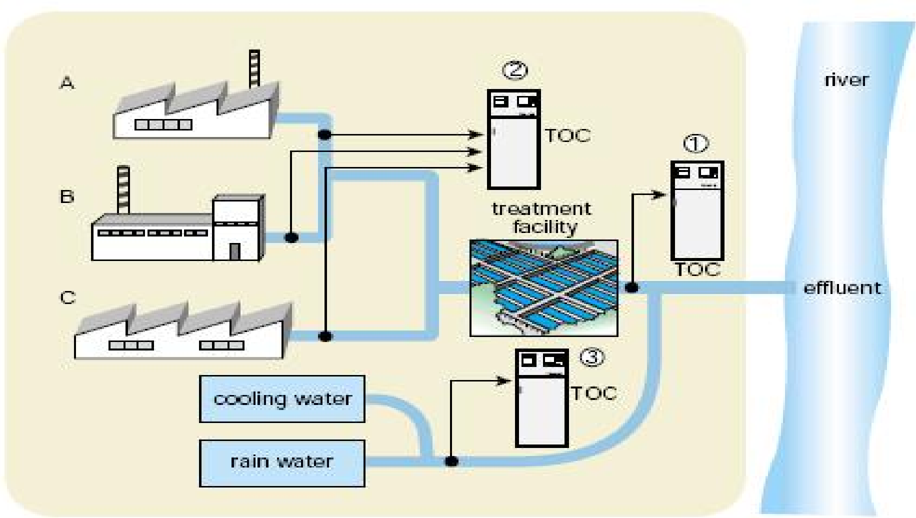

## PROCESS WATER – Clean-In-Place (CIP)

**TOC Can be used to validate and verify the effectiveness of cleaning operation as per customers GMP. ( Clean – In – Place) CIP is an automated cleaning process in wide verity of pharmaceuticals, chemical & food plants.**

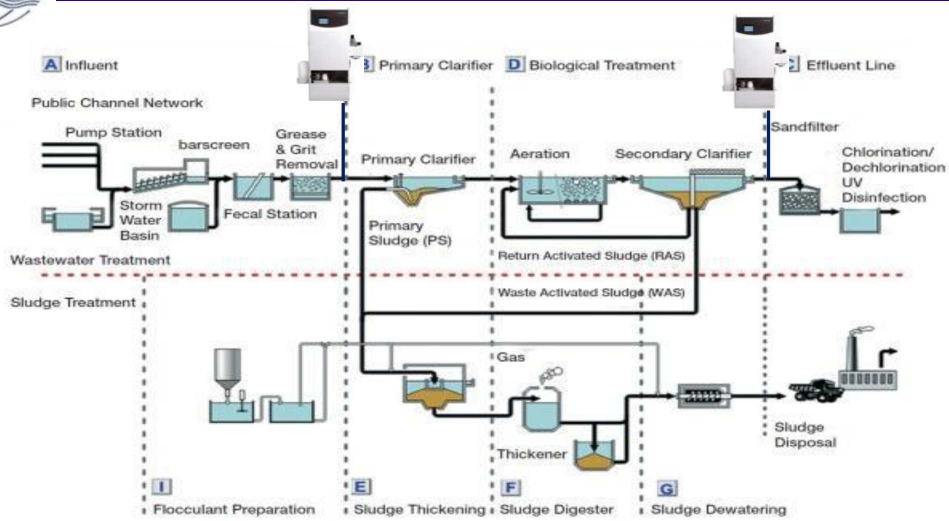



## TOC MONITORING IN WASTE WATER PLANTS

## UPSTREAM & DOWNSTREAM MONITORING



## TOC MONITORING IN WASTE WATER TREATMENT PLANT




## TOC HELPS IN WASTE WATER TREATMENT PERFORMANCE

**Waste water management in Accordance with ISO 14001 using On-line TOC Analyzer:**

**To discharge clean water ( water with less Environmental Impact) in rivers etc, it is necessary to reinforce controls and Management of waste water Treatment.**

**When there is a sudden increase in the pollutant Concentration due to an accident immediate action such as stopping Influents supply. To the treatment facility can be taken to prevent environmental pollution.**

- **Reduction of waste water Treatment Agents.**
- **Deterioration time of Adsorbents such as Chelate, resin & activated carbon can be specified.**

## TERMINOLOGY

TOC : Total Organic Carbon
TC : Total Carbon
IC : Inorganic Carbon
POC : Purgeable Organic Carbon
NPOC : Non Purgeable Organic Carbon
DOC : Dissolved Organic Carbon
SPOC : Suspended Particulate Organic Carbon

## PRINCIPLES OF TOC MEASURMENTS

**Two methods are available for measuring TOC**

- ☞ Difference Method
- ☞ Additional Method

**Based on the customer Requirement and Application choose the correct Method**

## PRINCIPLES OF TOC MEASURMENTS

**Difference Method :**

**TOC = TC – IC**

**TC measurement:**

**- TC is Oxidized to $CO_2$ using 680° C catalytic combustion**

**- $CO_2$ is detected with NDIR**

**IC measurement:**

**- IC is converted to CO2 by acidifying the sample**

**- $CO_2$ is liberated from the acidified sample by gas purging and measured with NDIR detector**

## PRINCIPLES OF TOC MEASURMENTS

**Additional Method :**

**TOC = NPOC + POC**

**NPOC measurement:**

**- Sample is injected after removing the IC by Acidification/Sparging and measured as NPOC**

**POC measurement:**

**-POC released from sample during Sparging is oxidized to $CO_2$ and detected with NDIR**

## MEASURING TECHNOLOGIES FOR TOC

**TOC Analyzers are classified based on Oxidation / Detection method**

- **High Temperature combustion Oxidation (900$^{O}$C – 950$^{O}$C ) NDIR (Non Dispersive Infrared) detection**
- **680$^{O}$C Catalytic Combustion Oxidation / NDIR detection – Invented by Shimadzu**
- **Wet Chemical Oxidation (UV+Persulfate or HOT Persulfate) NDIR Detection**
- **UV – Irradiation Oxidation / Conductivity Detection**

## MEASURING TECHNOLOGIES FOR TOC

**The key point about TOC is the efficiency to Oxidize Hard to decompose insoluble and macromolecular organic Compounds, not just the easily decomposed, low molecular weight organic compounds.**

**Catalytic Combustion method has high performance to oxidize the sample. (This method can oxidize and detect almost all organic substance)**

## TECHNOLOGIES

**The following are the most suitable technologies for process water application in Power plants:**

**1. High Temperature Catalytic Combustion with NDIR detection ( Based on reference methods ASTM 5310B, EN 1484, etc..)**

**2. UV Persulfate Oxidation with NDIR detection ( Based on reference methods ASTM 5310C, EN 1484 , etc.. )**

**The above two technologies will allow more reasonable suppliers to participate in tender.**

## TECHNOLOGIES

**UV Oxidation with Conductivity detection for TOC measurement CANNOT cover all process water applications in power plants.**

**Measurement of TOC in the steam-water cycle is not as simple as in makeup water samples. Most cycle chemistry treatments raise the pH with ammonia to a range near 9. If the sample were run directly through the direct UV oxidation TOC instrument, the carbon dioxide produced by organics oxidation would be neutralized by the ammonia, and the conductivity would not increase, and TOC could not be determined.**

**Compounds containing halogen, nitrogen, sulfur, phosphorus and ionic organic substances (R-COOH) would result in inaccurate TOC value using UV/conductivity based analyzer.**

**Interference from other gas generated from oxidation process like O2, pH and temperature fluctuations will result in wrong results of TOC using UV/conductivity based TOC analyzers.**

## TECHNOLOGIES

**UV Oxidation with Conductivity detection for TOC measurement CANNOT cover all process water applications in power plants.**

**In boiler feed water circuit during boiler operation, chemicals like (Hydrazine, Tri Sodium Phosphate etc.,) are dosed for removal of DO (Dissolved Oxygen), Silica etc., from boiler water. Addition of such chemicals (mostly inorganic), as per our understanding is likely to increase conductivity of the boiler water.**

**In such scenario, TOC measurement, which is based on conductivity detection, will be erratic as the presence of these inorganics, which interfere the measurement of TOC, are likely to contribute to the value of conductivity. During changes in the value of TOC in the water, it may be difficult to figure out if such changes are due to changes in TOC content or due to presence of inorganic in boiler water due to continuous addition of special treatment chemicals.**

## OUR SOLUTIONS – SHIMADZU TOC ANALYSERS

**ONLINE TOC ANALYSER**


**LAB TOC ANALYSER**

## LINE UP ( MAIN UNIT )

**High sensitivity model**
**TOC-LCSH/CPH**

**Regular sensitivity model**
**TOC-LCSN/CPN**

TOC-LCSH

TOC-LCPH

TOC-LCSN

TOC-LCPN

- **C : Combustion**
- **S : Standalone,**
- **H : High Sensitivity,**

**P : PC controlled**
**N : Normal Sensitivity**

## THE MEANING OF "TOP" LEVEL

- **Satisfying both of…**
  - **The strongest oxidation performance with 680°C catalytic combustion method**
  - **The highest sensitivity (as combustion TOC) that can measure even a pharmaceutical water: Detection limit 4µg/L**
- **Adaptive for several kind of "TOC" measurement**
  - **Direct method (NPOC)**
  - **TOC, containing volatile contents (TC-IC, NPOC+POC*)**
  - **TN*, Solid sample*, Gaseous sample*** *:option
- **Adaptive for several sample aspect**
  - **Sample with strong acid or alkali ➔ Auto dilution capability**
  - **Sample contains inorganic salt ➔ High salt sample kit, and so on…**

**This is SHIMADAZU TOC**

## KEY FEATURES

| Items | TOC-L C*H | TOC-L C*N |
|---|---|---|
| **Measurement Method** | 680°C Catalytic Combustion – non dispersive infrared (NDIR) method | |
| **Measured Items** | TC,IC,TOC (=TC-IC), NPOC Optional: POC, TOC (=NPOC+POC), TN | |
| **Measurement Range** | TC: 0-30,000mg/L IC: 0-35,000mg/L<br>TN: 0-10,000mg/L POC: 0-500mg/L | TC: 0-30,000mg/L IC: 0-3,000mg/L<br>TN: 0-10,000mg/L POC: 0-500mg/L |
| **Detection Limit** | TC, IC: 4µg/L TN: 5µg/L | TC: 50µg/L IC:4µg/L TN: 20µg/L |
| **Reproducibility** | TC, IC, NPOC: CV 1.5 % max.<br>or +-4 µg/L, whichever is larger<br>TN: CV 3.0 % max. or +-5 µg/L,<br>whichever is larger | TC, NPOC: CV 1.5 % max.<br>or +-50 µg/L, whichever is larger<br>IC: CV 1.5 % max. or +-4 µg/L,<br>whichever is larger<br>TN: CV 3.0 % max. or +-20 µg/L,<br>whichever is larger |
| **Dilution** | Dilution rate of 2 – 50 times (automatic sample dilution by syringe pump) Dilution Accuracy: +-2 % max (2 – 20x), +-5 % max. (21 – 50x) | |
| **Gas Used** | High purity air (CO, CO2, HC content: Each 1 ppm max., dew point: -50°C max)<br>Optional: use of nitrogen gas (Not possible in the TN measurement).<br>For C*N model, optional use of pressurized gas | |
| **Power Supply** | 100 - 240 VAC, 600 VA (Permitted range: 90 - 264 VAC) | |
| **Ambient Temperature** | 5 - 35°C | |

## TOC – L : MAIN UNIT

**-New Options-**

- **Combustion Tube for High Salt Samples**
  - **For seawater (cooling water), effluent of chemical industry, etc…**
  - **The high-salt sample combustion tube kit is an option that reduces the tedious maintenance required when measuring seawater and other samples containing large amounts of salt (more than 3 % salt).**
  - **It allows measuring 40 µL injections of seawater samples about 2500 times.**
  - **High-Salt Sample Combustion Tube Kit requires B-Type Halogen Scrubber.**

## TOC – L : MAIN UNIT

-New Options-

- B-type halogen scrubber
  - To save the detector unit from chloride that is included in the sample (ex: Sea water)
  - Newly designed and optimized for Lab-TOC

| | |
|---|---|
| Applicable Samples | Seawater or other samples containing salt (max about 3 % salt concentration) |
| Detection Limit | TC: 60 μg/L, IC: 4 μg/L, TN: 30 μg/L |
| Sample Injection Volume | TC: 10 to 150 μL<br>IC: 10 to 2,000 μL variable (TOC-LCPH/CSH)<br>10 to 4,500 μL variable (TOC-LCPN/CSN) |
| Reproducibility | CV 3 % max. |

## TOC – L : MAIN UNIT

-New Options-

- Small amount sample Kit
  - Using the smaller syringe (500μl)
  - Needle injection like TOC 5000A
  - Only 5mL sample is required for NPOC - 3times repetition (150μL for each, External sparging kit is required)
  - Only 8mL sample is required for TC-IC – 3times repetition
  - By combining with 9mL vial, measurements of small sample volumes can be automated
  - NPOC-sparged at ASI-L

## TOC – L : MAIN UNIT

**Option: ASI-L**

Designed for easy vial operation during the sample run

- Improving parallel motion to improve the throughput
- Vials
  - 9mL -93
  - 24mL -93
  - 40mL -68
- Options
  - Magnetic stirrer (for 24mL/40mL)
  - Septum and Cap (for 24mL/40mL)


## TOC – L : MAIN UNIT

**Option: OCT-L**

- New design and new 8-port valve

  = For 1-2 hours Automation =
- The container that the customer uses daily can be use directly
  - Can reduce the times of the sample transfer from container to container
    ➔ Avoiding the contamination
- Maximum 2 units can be installed (16 samples)


SWAN ENVIRONMENTAL


# THANKS FOR SAVING THE COST BY TOC

# PART - D

# Role & Action Plan by Electricity Regulatory Authorities/ Private Individuals

"We are the first generation to be able to end poverty, and the last generation that can take steps to avoid the worst impacts of climate change. Future generations will judge us harshly if we fail to uphold our moral and historical responsibilities"

- Ban Ki-moon
Secretary General
United Nations

# ***Interests or Institutions: Anti Dumping Measures on Solar Imports***

***-Srishti Thukral***[91]


### *Abstract*

*This paper provides a summary of some of the key elements of a study into the nature of objection to application of Anti Dumping duty. The future of the energy sector will be determined by the complex interplay of many social, political and economic factors. Yet, the law will also have an important influence on whether energy use becomes more sustainable. The law will either facilitate or, conversely, obstruct the adaptation to a sustainable energy future. With the Indian government taking a strong stand against imports in the renewable sector; it is to be believed that power developers should be protected against any impact. Figuratively, auctions of solar projects are facing the heat of the decision. At a practical perspective, Anti dumping duty would not help the country in long run as the additional duty shall increase solar power tariffs and reduce demand for solar power from discoms who are the ultimate buyer of this electricity. The paper describes a key risk area and provides that such duties if levied should be exempt from projects already under construction or awarded. The research was framed within a wider rhetorical analysis of a sample of texts from government policy documents, developer's stance, opposition campaign land local and national media reports, to provide a fascinating overview of the devices and rhetoric employed on all sides of what is a public conflict over the issue in stand. The conclusions and recommendations of this research sit firmly within the ethos of sustainable development and a level playing field for the domestic market proponents but more specifically within the need to put social sustainability on an equal footing with the publicly accepted environmental and economic aspects of Renewable Energy Infrastructure and imports facilitating Solar Planning."*


[91] B.A.LL.B. (Hons.), V Year, Damodaram Sanjivayya National Law University, Visakhapatnam.

## *Introduction*

With an average of 300 sunny days a year and high solar insolation, India has the capability of producing 5,000 trillion kilowatts of clean energy annually.[92] The potential to lead the way in the solar power space, in addressing domestic energy requirements and as a supplier of equipment to other countries is immense."

"The Jawaharlal Nehru National Solar Mission (JNNSM), launched in 2010, set an ambitious target of deploying 20,000 MW of grid-connected (including rooftop installations) and 2,000 MW of off-grid solar power by 2022 in three phases.

The JNNSM Phase II policy document has declared Phase I (up to 2013) a success story, with encouraging response from project developers.[93] A new World Bank report [94]attests this and states that the JNNSM Phase I is "well-poised to make India a global leader in the development of solar power", and that it has been "instrumental in bringing down the cost of solar power to a level that is competitive across the world".

However, almost all of the solar power projects of Phase I were "ground-mounted utility scale grid-connected systems".Large-scale solar projects are space intensive.[95] "A 1,000 MW plant may require nearly10,000 acres of contiguous land". With a high population density, land required for solar projects will be hard to come by in India.[96] And this is where rooftop projects can fill the gap. Rooftop projects also improve productivity as transmission and distribution losses are reduced, and they require a low gestation time.[97]

JNNSM Phase II (2013- 2017) aims to deploy 1,000 MW of grid-connected and off-grid rooftop solar projects.

To achieve a nationwide impact through solar power, particular attention will need to be given to small-scale solar applications, including rooftop projects. These projects will require continuous

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[92] Ministry of New and Renewable Energy (2012): "Jawaharlal Nehru National Solar Mission Phase II – Policy Document", available at http://mnre.gov.in/file-manager/UserFiles/draft-jnnsmpd-2.pdf.
[93] Ibid.
[94] The World Bank (2013): "Paving the Way for a Transformational Future: Lessons from JNNSM Phase 1", available at http://www.esmap.org/sites/esmap.org/files/ESMAP.
[95] Nampoothiri, Madhavan (2013): "Small is the new big – The Indian solar rooftop revolution", RESolve Energy Consultants, 30 April, available at http://www.re-solve.in/perspectives-and-insights/small-is-the-new-big-the-indian-rooftop-revolution/ , (viewed 10 March 2018).
[96] Venkatasubramanian, K.V. (2013): "Looking Skyward", The Statesman, 8 January, available at, http://www.cseindia.org/userfiles/Solar-%20Story-1.pdf (viewed 20 February 2018).
[97] Sindhura (2013): "Solar Policies for Rooftop Projects in India", Efficient Carbon blog, 1 March, available at http://efficientcarbon.com/blog/solar-policies-for-rooftop-projects-in-india (viewed 10 March 2018).

support and evaluation from the Ministry of New and Renewable Energy (MNRE) and the states. The bigger focus on large utility-scale projects is because these projects are easier to monitor and allow for achieving policy targets on time for policy makers.[98] Rooftop solar projects pose quite" "few challenges which need to be addressed before solar panels on roofs across India become a common sight.

## *The Indian Solar Revolution*

### *Solar space market*

As of October 2013, India's total installed capacity reached 2,100 MW from a mere 17.8 MW in early 2010. Of this, grid-connected solar capacity amounted to 1,969 MW and off-grid systems accounted for 131 MW.[99]The Indian solar market is estimated to reach US$2.05 billion in 2015, up from US$1.05 billion in 2012, according to an analysis by Frost and Sullivan.[100]

The JNNSM has been effective in bringing down the cost of solar power in India. A tariff of Rs 17 per kW hour was fixed by the regulator when the solar mission was launched in January 2010.Over the course of two years, the tariff reduced dramatically from Rs 17 per kWh to Rs 10.8 in November 2010 and further to Rs 7.49 per kWh in December 2011.

Rooftop Solar Power

Grid-connected : The Rooftop Photovoltaic (PV) and small Solar Power Generation Programme (RPSSGP) scheme (under JNNSM) aims to encourage states to set up small solar grid-connected projects. This endeavor will help "create a database of performance of solar plants under different climatic and grid conditions". RPSSGP is a generation based incentive (GBI) scheme and the projects are connected to the grid at voltage levels below 33 kV.

Interestingly though, a Centre for Science and Environment report states that "almost all projects under the RPSSGP are actually ground-based".

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98 Ministry of New and Renewable Energy (2012): "Jawaharlal Nehru National Solar Mission Phase II – Policy Document", available at http://mnre.gov.in/file-manager/UserFiles/draft-jnnsmpd-2.pdf(viewed 15 March 2018).

99 Press Information Bureau (2013): "Government of India, Promotion of Solar Energy", 17 December, available at http://pib.nic.in/newsite/PrintRelease.aspx?relid=101914 (viewed 19 February 2018).

100 Frost & Sullivan (2013): "Government Impetus to Energize Indian Market for Chemicals and Materials Used in Photovoltaics", 13 March , available at http://www.frost.com/prod/servlet/press-release.pag?docid=275246392 .

A good example of an off-grid solar project would be the micro grid executed by Mera Gao Power (a USAID-backed enterprise) in Damdampurawa village, Sitapur district, Uttar Pradesh in early 2013. Each household in the village was provided two LED lights and one mobile-charging point at Rs 25 per week (works for seven hours every evening) and a one-time setup" "cost of Rs 40 was charged. The roof of a sturdy house was chosen to install the two solar panels and battery (two panels can serve up to 50 households). The project brought a vast improvement to the life of the villagers.[101]

***States and the Domestic Consumer Space***

In the domestic consumer space, a typical house solar installation of 1KW power costs about Rs1.7 lakh with the battery costing approximately Rs 60,000 to Rs 70,000. The battery needs to be changed every five years.Many states now have their own solar policies with Kerala, Tamil Nadu, Gujarat and Karnataka investing significant allocation to rooftop projects directed at households.

***Challenges and Looking Forward***

Policy barriers: A report by World Bank in 2010 pointed out certain policy and regulatory barriers as key impediments to solar power development in India. Based on interviews with developers in the solar power space, it cited a lack of clarity in guidelines as a hindrance. For the domestic consumer, a tedious approval process to obtain subsidy,and the presence of multiple partners (MNRE, state implementation agency, project developer) makes installation a cumbersome task.[102]

There have also been administrative issues because of the "proliferation of different solar programmes".Currently there are, at least, "three programmes with similar mandates and overlapping areas of operation" among off-grid projects in rural areas .[103] These include programmes by the MNRE and Ministry of Power, which differ in their view of the type of decentralised energy sources to be used and the permanency of the off-grid system. The result is

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[101] Da Costa, Anna (2013): "TBI Photo Essay: Mera Gao Power – Providing A Brighter Future, Two Solar Panels At A Time, 6 February", available at http://www.thebetterindia.com/6726/tbi-photo-essay-mera-gao-power-providing-a-brighter-future-two-solar-panels-at-a-time/2/ (viewed 15 February 2018).

[102] Goel, Sandeep (2012): "Rooftop Solar Energy - Opportunities and Challenges", Renewable Watch, 29 August .

[103] Tyagi, Shivansh (2012): "Is the Indian grid ready for expansion to renewable energy?" Bridge to India, 1 August, available at http://www.bridgetoindia.com/is-the-indian-grid-ready-for-expansion-to-renewable-energy/.

that "no single entity is fully aware of villages being electrified through various decentralized energy programmes across the country"."

"For the domestic consumer, rural and urban, a single point of contact from financing to installing to operating to maintaining is required for the smooth implementation of the solar project.

Operational issues: The power grid in India has been known to have severe stability problems with major grid collapses. Solar power, being more erratic than conventional power, poses an important challenge to grid stability. With multiple small solar projects connected to the grid, there is a possibility that the electricity network can become imbalanced.As the number of these projects increase, it will be vital to monitor grid stability for its sustainability.[104]

Costs, financing and conventional energy sources: Even with subsidies, the installation cost of a domestic solar system at present remains high for most consumers in India. However, solar PV power is now cheaper than diesel generated power. "The MNRE anticipates solar power achieving grid parity by 2017-18 and parity with coal-based thermal power by 2025, but this recognises that cost trajectory will depend upon on the scale of global deployment and technology development and transfer".Ultimately, the growth of solar power in India is closely tied to the cost of conventional energy power. As solar power costs turn more competitive, demand from consumers will naturally push supply in the domestic segment.[105]

At present, the market has different types of solar devices of varying quality, including poor quality imported products. JNNSM Phase II has plans both for developing "star rating systems" and standards for components used in solar systems. Also, all roof types may not be suitable for installation and may require refurbishment.[106]

[104] Nampoothiri, Madhavan (2013): "Solar in India breaches the 2 GW barrier; Wind sector continues to stagnate", RESolve Energy Consultants, 21 October http://www.re-solve.in/perspectives-and-insights/solar-in-india-breachs-the-2-gw-barrier-wind-sector-continues-to-stagnate/ .
[105] Ministry of New and Renewable Energy (2013): "Jawaharlal Nehru National Solar Mission Phase II – Policy Document", December 2012, available at http://www.re-solve.in/perspectives-and-insights/small-is-the-new-big-the-indian-rooftop-revolution/, (viewed 16 January 2018).
[106] Nampoothiri, Madhavan (2013): "Solar in India breaches the 2 GW barrier; Wind sector continues to stagnate", RESolve Energy Consultants, 21 October http://www.re-solve.in/perspectives-and-insights/solar-in-india-breachs-the-2-gw-barrier-wind-sector-continues-to-stagnate/ .

### *Manufacturing Aspect*

One of the major challenges with ramping up solar in India is the limited manufacturing capacity available. Solar PV system has two broad elements—solar panels or modules (assembled from" an array of solar cells),"and the balance of the system (inverters, batteries, etc).12 Solar manufacturing is an integrated process involving multiple stages. For instance, silicon-based PV technology has four sequential stages—silicon refining, wafer fabrication, cell production, and module assembly (Wolfe 2013). In India solar manufacturing is extremely fragmented lacking vertical integration; it is specifically sparse in the upstream of module assembly (Sharda 2015). As per the latest research by Green Tech Media, India has only 0.9GW and 2.1GW of cell and module manufacturing, respectively (Anand 2015). This is low given the yearly installation requirement of 13–14GW for the next seven years in order to reach 100GW by 2022.

India's National Manufacturing Policy (Ministry of Commerce and Industry 2011) had recognised solar as a sector of strategic significance. However, the solar manufacturing policy in India has not been effective enough. Forty percent of solar cell manufacturers have closed down and overall industry capacity utilisation is as low as 21% (Energetica India 2015). According to the MNRE (2014), in June 2014 the cell and module manufacturing capacity of the country was 1.22GW and 2.35GW, respectively, of which only 0.24GW and 0.66GW were operational. This situation is attributed to falling global prices coupled with the lack of cost competitiveness of Indian solar industry arising out of relatively insufficient government support, the smaller size plants, and limited access to raw materials (Energetica India 2015).13 The latest data indicate that in 2014, India imported 74% of the modules and until August 2015 the corresponding figure was 78% (Bridge to India 2015c).[107]

Compared to the global leaders in solar like Germany, the US and China, solar industry in India is new and the related technology development is low (Dutta 2012; Sharda 2015). India can potentially innovate and leapfrog into next generation of cell technology and improve efficiency in balance of system (ORF 2015). However, innovations ecosystem needs consistent support. In the last four years, the reports on global trend in renewable energy investments indicate that India's research and development stands at $0.6 billion, which is 14 times less than that of the US or China, and 23 times less than that of Europe (UNEP 2012–2015). In the same time period

[107] Energetica India (2015): "Solar Manufacturing in India: A KMPG Report," *Power Generation Magazine*, Energetica India, No 47, pp 42–44.

research and development as a share of new investments in renewable sector is 1.7% in India; the corresponding figures for China, Europe, and the US are 3.1%, 4.1% and 5.0%, respectively" "(UNEP 2012–15). Moreover, unlike the global leaders in solar, India does not have a culture of strong industry–academia research collaborations. The National Centre for Photovoltaic Research and Education housed at the Indian Institute of Technology (IIT) Bombay and the ONGC Energy Centre's pan-IIT collaborations (ORF 2015) are rare examples, given the size of -innovation need in the country.[108]

India has less leeway in cell and module manufacturing in the near future as the global market is dominated by a very few big players. It has a better level playing field in module assembly and manufacturing of the balance of the system (ORF 2015). A Global Technology Watch Group study by the National Institute of Advanced Studies in collaboration with DCCC, GERMI, and IIT Delhi suggests that to accelerate learning and innovation India can follow both the Chinese model of allowing manufacturing by foreign companies and the US model of international partnership projects (NIAS 2015). The ORF (2015) report on R&D and local manufacturing in solar PV emphasises the German strategy of quality in niche areas to export to the other developing countries of the South. The non-manufacturing sector (installation, system integration, and operation and maintenance) in solar PV is of prime importance in the Indian context as it will be instrumental in job creation in the long run.

India has moved in the right direction in terms of initiating certain policy instruments, including providing accelerated depreciation, local content requirement, renewable purchase obligations, renewable generation obligations, bundling of conventional and renewable electricity, etc. But certainly to achieve installed capacity of 100GW in seven years, there are other challenges to overcome such as financing, off take of power, storage, and grid-management.

### *The Anti - Dumping Duty Dilemma*

The domestic manufacturers have been struggling because of their inability to compete on price with Chinese manufacturers. Most of them have sub-scale capacities, high cost base and are completely reliant on imported technology and raw materials. Imposition of ADD or provisional

[108] Inntersolar (2015): India Added 1.1 GW Solar Capacity during the 2014-15 Financial Year—MNRE for Press, News, http://www.intersolar.in/en/for-press/news/industry-news/india-added-11.

duty exceeding 10% shall enable them to price at profitable levels and increase production. But the key issue for the sector is whether Indian or other manufacturers would be able to use "the "opportunity afforded by duties to make investments and create a thriving, competitive module manufacturing sector in India. There is a huge gulf between the scale and technological or operational capability of Indian and Chinese manufacturers. Moreover, the Chinese manufacturers have been expanding internationally to counter threat from trade barriers. Canadian Solar, Jinko, Trina, JA Solar and Talesun are some of the notable names to set up manufacturing facilities in Indonesia, South Korea, South Africa and Thailand precisely for such purposes. They should be able to circumvent duties, at least partly, by routing exports from these manufacturing bases, in turn mitigating the negative and positive impact on developers and manufacturers respectively. We believe that trade barriers alone will fail to achieve their target to promote domestic manufacturing unless they are backed up by other policy reforms to improve competitiveness of Indian manufacturing.[109]

Indian Solar Manufacturer's Association (ISMA) has appealed in June 2017 for the third time in five years, to the Directorate General of Anti-Dumping (DGAD), to impose anti-dumping duty on solar panels. This time the application is against China, Malaysia and Taiwan. The first two instances of such appeal were in 2012 and 2014, respectively. In 2012, DGAD recommended anti-dumping duty on solar panels imported from China, Malaysia and USA after a complaint from domestic manufacturers. However, the duty wasn't applied by the Ministry of Finance.[110] Later in 2014, two simultaneous complaints were filed with DGAD and Directorate General of Safeguards (DGS) of Ministry of finance. The complaint was eventually dropped post reassurance, by the government, of future business opportunities for domestic players.

## *Ripple of Distress In The Domestic Market*

India's total imports of 'Photovoltaic cells' (HS code 8541) in 2016 were USD 3,637.41 million[111], 84.5% of which were imported from China. India's imports from China, Taiwan and Malaysia combined have grown from USD 523.73 million in 2012 to USD 3022.38 million in 2016, showing a compound annual growth rate (CAGR) of 55.99 per cent. Imports from China"

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109 Dutta, S (2016): "Developing India's Solar Power Sector: Potentials and Challenges (Part 2 of 2)," Re-Volt, Commentary from Worldwatch's climate and energy team, World Watch Institute, 23 October.

110 Mishra, S (2017): "A Comprehensive Study and Analysis of Power Sector Value Chain in India," *Management & Marketing Challenges for the Knowledge Society*, Vol 8, No 1, pp 25–40.

111 ITC Trade Map database.

"alone have increased 4.5 times [112]from 2012 to 2015. India's total export in 2016 for HS code 8541 was USD 159.69 million, a low 4 per cent of total imports. This ratio says something about India's dependence on imports for solar cells.[113]

### *Previous Cases in Perspective-*

Two precious developments are important for the current discourse. In 2012, a DGAD enquiry was initiated for imports from Malaysia, USA, Chinese Taipei and China PR. [114]After a thorough investigation by May 2014, it was established by the authority that material injury was caused to domestic industry due to imports at lower than normal value of the products. The authority also noted in their investigation that with anti-dumping duties imposed by the US and EU on Chinese solar panels, its dumping in Indian market can possibly increase. Booming domestic demand would add to the imports. Duties in the range of USD 0.11/watt to USD 0.81/watt were recommended to be imposed. However, the authority also recognized that the cost of solar power production will rise by Rs. 1.6 crore per Mw if anti-dumping duties are imposed on solar panel imports. Finally, the duties were not imposed.[115]

Simultaneous to the investigation was another development. India imposed 'Domestic Content Requirement (DCR)' on solar cells and modules in the first phase of national solar mission. Later, DCR was extended to thin film technologies. US strategically timed its response and in 2013, complained in the WTO against India's DCR policy. India, in defence used the 'government procurement' clause that permits a deviation from national treatment obligation under the WTO agreement. In 2013 itself, WTO ruled against Canada's DCR policy in a case petitioned by the EU and Japan. Expectedly, India lost the case. Later in 2016, India's appeal against the verdict was also rejected by the Appellate Body of the WTO. But in this entire process, India gained four years' time to comply with WTO's expected verdict."

"These two cases bring to light the dilemma that policymakers face while deciding on whether or not to favour the domestic manufacturers. It appears that India should use the clauses that provide for upholding domestic interests; a more fundamental dilemma is if India wants to do so.

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[112] See, http://www.tpci.in/blogs/indias-growing-demand-for-solar-panels-import-substitution-or-optimality (Last Accessed : 27th February 2018 )

[113] Nathan, H S K (2014): "Solar Energy for Rural Electricity in India: A Misplaced Emphasis," *Economic & Political Weekly*, Vol XLIX, No 50, pp 60–67.

[114] Refer , Case No.- 14/5/12, Initiation, DGAD, Department of Commerce, GOI

[115] Refer , Case No.- 14/5/12, Final Findings, DGAD, Department of Commerce, GOI

## *Case of European Union (EU) and United States (US)-*

The EU recently justified an anti-dumping duty of 47.7 per cent on Chinese solar exports imposed in 2013, post a two year long enquiry into the matter. The investigation revealed that Chinese exporters were selling solar panels at less than market values. A similar finding was made by the US Department of Commerce, following which tariff duties of up to 165.04 per cent were imposed on crystalline silicon photovoltaic solar imports from China and Taiwan.

### *Conflict of Interests-*

With the National Solar Mission's targets revised five folds upward in June 2015, the government was and still is in a fix to impose such a duty. It's a clear case of conflicting multiple objectives. The mission aims at 'reducing the cost of solar power generation' along with 'domestic production of critical components and products'- a clear contradiction in objectives in the presence of cheap imports from outside, specifically, China. The Ministry of Non Renewable Energy in a previous anti-dumping duty demand claimed that the duty would not be the right thing because domestic prices are not price competitive. In a scenario where the government is trying to achieve a lower solar energy tariff, it is unlikely that a support mechanism would be used by the state.[116]

## *Cross – National Analysis Of The Anti Dumping Policy*

### *European Union*

The European Union first imposed tariffs on imported solar products back in 2013 when Chinese panels began flooding the European market. An investigation launched in September 2012 showed that some of these Chinese companies were selling solar goods at below market value – hurting local European producers."

"Anti-dumping duty solar panels started in December 2013. Since then, importers of China solar goods are required to pay anti-dumping duty to Customs if the price is above the MIP. In 2016, the European Union decided to extend the anti-dumping duties on crystalline silicon photovoltaic modules and components from China to similar imports from Malaysia and Taiwan.

[116] Refer,MNRE Physical Progress Document, 2017.

The European Union faces a delicate balancing act between the interests of EU manufacturers and of reducing the cost of solar power generation, while also being concerned about the response from Beijing, seen as a possible ally in fights against protectionism and reducing greenhouse gas emissions.[117]

***In Cross with USA***

India has yet to take a definitive step in the anti-dumping war that is currently raging in the solar energy sector; however, its policymakers may be guided by decisions made by U.S. and European Union regulators. An ongoing question is whether the Indian government should create a trade barrier against cheap imports from foreign solar manufacturers, primarily those from China. Options include levying an anti-dumping duty (such as a countervailing duty to offset the huge subsidies offered by China to its solar manufacturers) or offering preferential tariffs to domestic manufacturers of the equipment.Solar power industry in India must overcome numerous development challenges in order to continue its rapid growth. (*Source: Solar Thermal Magazine)*

One reason why Indian solar manufacturers might be harder hit than those the United States is because India's solar industry is relatively new, not more than a decade old. It lacks the same level of technical capacity that its foreign counterparts have. As a new entrant, the Indian industry is relatively small scale and fragmented, leading to higher production costs. Production capacities for Indian module manufacturing range from only 10 to 20 megawatts (MW), compared to the global average of 75 megawatts. Countries such as China and Taiwan have a clear price advantage over Indian manufacturers because of their economies of scale." "Both subsidies and economies of scale have helped Chinese manufacturers produce solar panels and equipment that are 25 to 30 percent cheaper than those produced in India.[118]

What makes India's case singular is that the Indian manufacturers have not only condemned the Chinese solar manufacturing industry as a cause for their trouble, but also accused U.S. financial institutions, such as the U.S. Export Import Bank (Exim) and the Overseas Private Investment Corporation (OPIC), of adding to India's woes through their pro-U.S. solar equipment policies. Indian solar panel manufacturers and the media have raised concern about the fact that both

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117 See,https://uk.reuters.com/article/uk-china-eu-anti-dumping/china-welcomes-eu-decision-on-solar-panel-import-prices-idUKKCN1BT0Q4

118 Refer,http://www.worldwatch.org/developing-india's-solar-power-sector-potentials-and-challenges-part-2-2.

ExIm Bank and OPIC offer low-interest loans (with long repayment periods) to Indian solar project developers—under the mandatory condition that they purchase the panels from U.S. manufacturers. [119]

On the other hand, Indian solar project developers argue just as strongly that cheaper electricity, supported by the lower cost of capital and equipment through such programs, will help Indian solar energy reach grid parity ahead of stated goals. The U.S. banks too have reacted by saying that they are adhering to international rules and regulations for project lending to overseas developers. They also point out that the reasons that Indian solar developers prefer U.S. solar panel imports are because of the superior quality, lower prices, and great post-sales customer service.

### *Criticism Of The Current Initiated Policy*

The possibility of anti-dumping duty on imported solar cells is worrying developers as it will increase the price of imported solar modules to around $0.40 (even after they fall to the previous levels) while locally-made modules are unlikely to become cheaper than the current prices of imported modules. Moreover, India does not have enough manufacturing capacity to cater to the demand — provided that India sticks to its goal of reaching 100 GW of solar energy by 2022.
The cost of local manufacturers is nowhere near the prices that the Chinese manufacturers are able to offer. The size of the Indian solar module manufacturing industry is very small" compared "to the economies of scale the Chinese manufacturers enjoy. Moreover, polysilicon, which is a major cost component in the price of the solar module, is not manufactured in our country.

Furthermore,the anti-dumping duty will make the recently bid projects unviable and create havoc in the industry. If we want to bring anti-dumping, we first need to have a complete supply chain for manufacturing of solar panels in India.

Industry players point out that the only way to prevent recently awarded solar project from making losses, in case India decides to impose the anti-dumping duty, is exempting these projects from its effect. However, so far there is no clarity on this from the policy-makers.[120]

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[119] Sharma, S (2017): "SunEdison's Bid Brings Solar Power Tariff to Record Low," *Livemint*, 5 November.

### *Moving Ahead with Anti Dumping Investigation.*

ADD investigation is another major source of uncertainty. Such challenges and the rising incidence of tender cancellations and tariff renegotiations means that private sector confidence has taken a major hit. The government has got its job cut out to revive the sector. These concerns are widely shared by the renewable power industry.

The industry has been facing some issues on a few fronts. In wind, the slowdown in new capacity installations largely due to the cessation of new project awards under the FIT mechanism was a clear point of concern this year. On the solar front, the anti-dumping duty continues to be a point that the industry will be watching closely.India's wind sector is transitioning from a feed-in tariff regime to tariff-based competitive auctions.

As bids dried up, coupled with sharp decline in solar panel prices, accentuated by developers' adrenalin rush, tariffs simply fell off the cliff, making solar one of the cheapest sources of power in India. However, following GST and associated initial pangs with respect to classification, etc., coupled with an unexpected increase in imported module prices over the last few months, suddenly erstwhile lower tariffs look stretched and feasibility is on a precipiceAware of the strategic task at hand, the National Democratic Alliance government is considering a 30% capital" subsidy as part of a new solar manufacturing policy to spur domestic manufacturing of solar power equipment.[121]

### *Impact On The Solar Sector*

India's endeavour to tap the sun's potential as a sustainable source of energy is quite recent. The National Solar Mission was launched just seven years back, in 2010, with a target of adding 20 GW by 2022. The Government went ahead full throttle on the mission and made remarkable progress. The year 2015 saw a perceptible revision of the mission's target – a mighty five-fold jump to 100 GW! For the world's third-largest economy that sustains 1.3 billion people, the target is both modest and ambitious at the same time. India's energy consumption has doubled

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[120] ORF (2015): Make in India for a Solar India, The Need to Boost R&D and Local Manufacturing in the Solar PV Sector, Newsletter Report, National Centre for Photovoltaic Research & Education (IIT Bombay) and -Observer Research Foundation.

[121]See, https://www.livemint.com/Industry/D9gxoONsr1UqeItOR7SNqI/Challenges-galore-for-Indias-clean-energy-industry.html.

since 2000, even as 240 million people still lack access to electricity. Going ahead, India will be the greatest contributor to the projected rise in global energy demand.[122]
Considering that India's current installed solar energy capacity is a little over 13 GW, the task at hand may seem formidable. However, in light of the country's huge progress in the last three years (the installed capacity at the end of 2014-15 was 3743.97 MW), it is not quite so. That is, if we follow a balanced approach to develop the solar energy ecosystem in the country.

India is strategically positioned to achieve this target and needs to maintain the commendable momentum. Only an enabling policy environment can support the country's solar ambitions. Currently, India's solar cell manufacturing capacity stands at 1,753 MW and solar PV module manufacturing capacity at 6,913 MW. Nearly 4,000 MW of module manufacturing capacity is entirely dependent on imported solar cells. To achieve the 100 GW target by 2022, India needs around 20 GW of solar module availability per year.

In this backdrop, levy of an Anti-Dumping Duty (ADD) on imports of solar cells and modules from China, Malaysia and Taiwan has the potential to make India's module manufacturing capacity uncompetitive. While the Government's policy must certainly help increase the manufacturing capacity in India and improve the quality of the modules as part of the Make "in "India initiative, it needs to simultaneously retain the price competitiveness of solar power so as to not increase the tariff that is ultimately borne by the end consumer.[123]

Imposition of ADD of 12-15 cents per watt of installation cost will increase solar power tariff by Rs 0.80– Rs 1.30 per unit which will take the tariff to Rs 3.50 to Rs 4.00 per unit. Electricity distribution companies are unlikely to buy solar generated electricity with tariffs over Rs 3 per kWh. At that tariff, India would be able to set up only 30 GW of solar plants by 2022.[124]

The Anti-Dumping Investigation on imported solar cells, therefore, needs serious contemplation in view of the 100 GW target. The price of imported solar modules is comparable with the international price settled at the exchange. For instance, the Custom Import price in Q4 of FY

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122 Sharda, J (2015): "India's Solar Ambitions: Challenges and Options," Reports, Equitorias, May, http://www.equitorials.com/report.php.

123 Wolfe, P (2013): *Solar Photovoltaic Projects in the Mainstream Power Market*, Oxon: Earthscan, Routledge, p 95.

124 UNEP (2012–2015): Global Trend in Renewable Energy Investments 2015; 2014; 2013; 2012, Frankfurt School of Finance & Management-United Nations Environment Programme center, Bloomberg New Energy Finance.

16-17, was $0.31-0.46/WP, while as per exchange, the price range was 0.31-0.36/WP. World over, the prices of solar cell and modules have been steadily decreasing. Coupled with increased efficiency, it has resulted in tariff reductions. China commands more than 60 per cent of the total solar cell as well as module manufacturing capacity in the world. But this predominance is by virtue of its installed capacity and not by virtue of its lower prices.

A quick glance at the figures in the public domain indicates that the domestic manufacturing industry may not be under threat in the absence of ADD. In fact, the last few years have shown that it has prospered in the absence of ADD. Between 2014 and 2017, the industry grew three times in size, while the capacity utilization of plants increased from 28 per cent to a whopping 78 per cent. Currently, solar power plants using domestic solar cells have been hugely subsidized through Viability Gap Funding (VGF) to enable domestic manufacturers to remain competitive in the local solar power market. A subsidy of around Rs 1.75 crore per MW is offered to keep the tariffs of such solar plants competitive. This, even as solar power plants using domestic solar cells had reduced output in the range of 4-9 per cent, vis-a-vis plants at the same location with imported cells.

The size of the Indian solar power market is directly proportional to the tariffs. ADD may result in shooting up of tariffs and shrinking of the size of the market. In that case, domestic solar cell" "and module manufacturers stand to suffer the most as their installed manufacturing capacities will remain greatly unutilized. Further, to keep tariffs competitive, the Government will have to cough up more VGF. If at all, the Government needs to consider recommending a minimum import price for import of solar cells and modules as was done for the protection of the steel industry. This will effectively protect the domestic solar parts manufacturing industry while ensuring that it strives to remain competitive and grow on its own efficiencies.

Solar power at a tariff of Rs 2.50 to Rs 2 per unit has the potential to bring huge economic gains to the country. Low cost solar power can make industries such as steel, cement, and aluminium competitive. Low cost of power can also significantly increase private consumption from the current 60 per cent to a higher level that will sustain economic growth of over 7-8 per cent. India's power generation system needs to almost quadruple in size by 2040 to catch up and keep pace with electricity demand that – boosted by rising incomes and new connections to the grid – increases at almost 5 per cent per year.

It is imperative for the Government to walk a tight rope and balance the interests of the two inter-linked industries, namely, the domestic solar parts manufacturing industry and the solar power generation industry. Both the industries are critical to India achieving the target set out by the National Solar Mission and neither industry can be given a preferential treatment to the detriment of the other.[125]

Imposition of ADD on solar cells and modules may derail India's commendable growth in the solar sector and the target of 100 GW solar powers by 2022 could become a missed opportunity. India is at the cusp of a major transformation and has barely tapped its huge potential for renewable energy. On solar rests India's future.

## *Conclusion*

The anti-dumping duty petition filed has created huge uncertainty for the entire solar sector. It comes at a very inopportune time with the sector already reeling from slowdown in new project procurement, extra costs due to GST, import duties and increase in module prices. It affects all stakeholders and projects in pipeline as well as those awaiting auction. The Indian government has a tough decision to make as it needs to strike balance between demands of manufacturing and project development activities. If developers are not compensated for extra cost, many of the underconstruction projects face risk of abandonment as they have little financial cushion. On the other hand, announcement of duties alone is unlikely to have any enduring benefits for domestic manufacturing beyond throwing a financial lifeline to the existing manufacturers.

India plans to install a capacity of 10,000 MW of grid interactive power by 2022, out of which 215.67 MW [126]was achieved by April 2017. The importance of solar and other renewable energy becomes more evident in view of the NDCs developed to meet India's Paris Climate Agreement's obligations. Cheap imports have been essential for achievements in National Solar Mission, but with imports acquiring maximum market share, it is expected that domestic manufacturers will be depressed enough to be wiped out from competition. On lines of the 'Sacrifice Ratio' principle, it can be said that a short term inconvenience of expensive imports can be offset by long term gains of a thriving domestic solar panel industry.

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[125] See,https://energy.economictimes.indiatimes.com/energy-speak/how-would-anti-dumping-duty-impact-india-s-solar-sector/2660.

[126] EAI (2017): *India Solar Energy*, http://www.eai.in/ref/ae/sol/sol.html, accessed on 12 March, 2018.

Coming to anti-dumping duties, it is important to note that the US government has recently imposed a 30 per cent tariff on imported solar cells and modules in the first year, with the duties declining to 15 per cent in the fourth year. The US decision may cause the Indian trade investigation and decision process to swing more in favour of imposing these duties.

Now, the key question arises whether India should follow suit or take advantage of the development. In this context, it is interesting to note that for China's solar module manufacturing capacity, estimated to be around 70 GW per year, the major markets are China itself, followed by the US and India. With green energy activity expected to slow down in the US, China's solar equipment makers may adopt a more competitive stance on pricing to drive demand in India. This will help meet India's 100 GW of solar capacity target by 2022.

However, if the duties are imposed, industry experts believe that the solar power tariff will go beyond Rs 4 per kWh from roughly Rs 2.50 per kW at present. Such high tariff levels will discourage state discoms from buying solar power. Further, this will slow down the ongoing project development activity as the discoms may want to renegotiate PPA terms and conditions, as has happened in some recent tenders, which saw higher than usual bid levels.

Thus, the government should look at the merits and demerits of the duty and its quantum. Ina considerate view, under no circumstances should a developer get impacted by this. When the projects were bid out, it was not known that this safeguard duty would come up. The WTO has its own rules with respect to safeguards duty which deal with whether the domestic industry has got impacted and whether there have been excessive imports. We need to see what the domestic industry is producing and what the quality standards are. On an overall basis, one should think about what is the objective of this duty whether the objective is to have a reasonable tariff or to increase domestic manufacturing irrespective of the costs involved. Every country has its geographic advantages and disadvantages. Much more effort should go into doing an interest subvention scheme – just as it was done for textiles – to promote and handhold the domestic industry. Duties like safeguards and anti-dumping have never worked in the past. It goes without saying that if the duty is fixed at 70 per cent, the tariff will go up. But there should be a mechanism to holistically evaluate the situation on a clear parity basis. For example, there are many types of modules which are not even manufactured in India. If the objective is to promote domestic industry, slapping these duties may or may not work."

# ***To provide clean, affordable and quality Energy for All***


## *Abstract*

***"Like Money saved is Money earned, Power Saved is Power Generated"***

The research paper elaborates the role and action plan by Electricity Regulatory Authorities, by Government, by Central Public Sector Undertakings, by State Public Sector Undertaking, and by private sector. There is discussion about the Indian Electricity (Supply) Act, 1948; it is to be noted that as it was the first act which talked about the state electricity boards, which control generation, distribution and utilization of electricity. Further the establishment of Central Generating Companies in the year 1976, The Electricity Regulatory Commission Act, 1998 which talked about the formation of the Central Electricity Regulatory Commission and the State Electricity Regulatory Commission were evolved. In the year 1991 the Electricity Act 1948 was amended and the formation of the private generating companies. There was amendment in the Electricity Supply Act in 1998 which allowed the participation of the private sector in the transmission of electricity. The latest act in power sector in Electricity Act, 2003 and in 2004 the National Electricity Policy was passed in which there was discussion about the Central Public Sector Undertaking was introduced. In 2005 the Electricity (Amendment) Bill, 2005 was introduced and it provided that the Central and State Government should jointly supply electricity to whole country.



**Keywords:** Generation, Transmission, Distribution**.**



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## *Introduction*

The concept of clean and affordable energy was originated by the 17- Sustainable Development Goals of United Nations, Agenda 2030. It was dealt in the goal seven of the 17- Sustainable Development Goal of United Nation as energy is one of the most crucial prerequisite in current industralised times and subjects deprived of such necessity are lagged far behind in terms of development. More than one billion people in the world don't have the access to electricity (energy) and three billion populations don't get facility of clean fuel and technologies for cooking. According to the Secretary-General of the United Nations, Ban Ki-moon:

"*Energy is the golden thread that connects economic growth, social equity, and environmental sustainability. With access to energy, people can study, go to university, get a job, start a business – and reach their full potential*."[127]

In India, as per our Constitution, power industry is combined responsibility of the Central Government and the State Governments. The Electricity Supply Act, 1948 envisaged three kinds of entities in the power-sector:

- State Electricity Boards (SEBs)
- Generating Companies
- Licensees.

State Electricity Boards are allowed to generate, transmit and distribute electricity within a state; they enjoy all the powers of a licensee. They account for 65 per cent of the power generated in the country. Generating companies are responsible for supplying power to the grid without the specific responsibility of retail distribution. Major players in this category are the following:

- National Thermal Power Corporation.
- Hydro-electric analogue of National Thermal Power Corporation.
- Nuclear Power Corporation of India Limited.

[127] *SDG 7: Affordable and Clean Energy*, (25 march, 2018, 12:00pm)http://in.one.un.org/page/sustainable-development-goals/sdg-7/.

Though Electricity Supply Act, 1948 allowed the government to set up generating companies till 1991, thereafter it was de-reserved and the Independent Power Producers falls under this category. Existing licensees are private-sector utilities licensed by a State Government for power generation, distribution or both within a specified area. For example, Gujarat Industrial Power Corporation, Orissa works in the distribution sector of the electricity and Bombay Suburban Electric Supply Limited and Tata Electric Company works in generation as well as the distribution sector of the electricity.

## *Role and Action Plan by The Electricity Regulatory Authorities*

The Regulatory Commission is a quasi-judicial body as the section 94 of the Electricity Act 2003. It deal with the powers of the Commissions and state that the Commission shall have the power to try inquiry or proceedings under the Electricity Act, 2003 and the Commission will have same powers vested in the Code of Civil Procedure in the cases of summoning. Discovery and production of any document, receiving evidence, maintaining the public record, examination of witness, review the decisions, directions and orders and any other matter which can be prescribed. The Commission will have the power to pass an interim order.[128]

The regulatory body that is the Central Electricity Regulatory Commission and State Electricity Regulatory Commission was formed under the Electricity Regulatory Commission Act, 1998. The preamble of the Electricity Regulatory Commission Act, 1998 state that this act establishes the Central Electricity Regulatory Commission and State Electricity Regulatory Commission as well as determine the electricity taxes, provide subsidies, promote the efficient and environment related policies and any other similar matter.[129] The Central Electricity Regulatory Commission is dealt in the chapter II & III of the Act, 1998. The State Electricity Regulatory Commission is dealt on the chapter IV & V of the Act, 1998.

Working of the Regulating Bodies is the following:

- In designing a regulatory framework, once the Government has determined what regulatory functions are desirable, it needs to determine which entity is to carry out each function and to set out the parameters of each function clearly in the constitutional document of that body.

[128]The Electricity Act, § 94 2003 (India).
[129]The Electricity Regulatory Commission Act, Preamble 1998 (India).

- Ideally one body should be responsible for each function, but it is unlikely that one body will be responsible for all functions. There may already be an entity carrying out a function, such as a company's registry that requires auditing and submission of accounts.

- As regards Economic Regulation, is a Regulator to have the function of tariff setting, or is this to be left to the Government? It might be decided that this function should be split, so that the Regulator collects the necessary data and then makes recommendations for tariff setting, with the decision resting with the Government. The private sector will be anxious to have tariff setting mechanisms firmly established and not subject to political interference.

- Is the entity carrying out Economic Regulation to monitor and enforce performance? It may be more appropriate, for instance in the case of water and sanitation services, for the environmental regulator to monitor performance. This will also depend on the capacity of each institution.

- Thought should also be given to the plan for the specific sector. If it is intended that the sector is to be opened up to competition, then the roles of the regulator in setting entry and exit rules and overseeing and nurturing competition in the Sector are important. Often countries have competition commissions that are separate entities from the sector regulators. In this case thought needs to be given to coordination between them and how their responsibilities should be divided.[130]

Overlaps in responsibilities should be kept to a minimum to ensure that the regulated entity does not receive conflicting instructions or suffer multiple sanctions. However, where one body is responsible for Economic Regulation and another is responsible for Environmental Protection, for example, the Economic Regulator will need to take into account the cost implications of the regulated entity meeting its obligations in relation to environmental protection. This has been illustrated in European Union states where increased requirements for effluent treatment

[130]*Power Sector at a Glance All India*, (26 march, 2018, 5:00 pm) https://powermin.nic.in/en/content/power-sector-glance-all-india.

triggered necessary investment in costly wastewater treatment facilities, the cost of which needed to be reflected by economic regulators in higher tariffs charged to customers.[131]

### *Central Electricity Regulatory Commission*

The Central Electricity Regulatory Commission establishment and incorporation is defined under the section 3 of the Electricity Regulatory Commission Act, 1998. This section has five sub-sections. The first sub-section state that the Central Government within the three months of establishing the Act, 1998 notified in the Official Gazette that there is an establishment of the Central Electricity Regulatory Commission which would exercise the powers and function which are given under the Act,1998. The second sub-section says that the Central Electricity Regulatory Commission should have the perpetual succession, a common seal, have the power to acquire property which can be hold or disposed and the property can be moveable or immovable and have power to be in a contact and by the commission name which can sue or be sued. The third sub-section says that the head office of the Central Electricity Regulatory Commission should at place as the Central Government may, by notifies in the Official Gazette. The fourth sub-section tells who the members of the Central Electricity Regulatory Commission are, there is a chairperson, appointed under the sub-section (3) of section 3 of the Electricity (Supply) Act, 1948[132] and there shall be three other members. The fifth and last sub-section states that the Chairperson and other three members will be appointed by the Central Government after taking recommendation of the Selection Committee defined under the section 5 of the Act, 1998[133]. There is proviso to sub-section fifth which state that nothing shall apply for the appointment of the Chairperson if the person is Judge of the Supreme Court or Chief Justice of the High Court.[134]

The section 13 of the Electricity Regulatory Commission Act, 1998 deal with the functions of the Central Electricity Regulatory Commission. This section has nine sub-sections. The fuctions are the following:

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[131]PallavuBedi&RohitRajagopal, *Electricity Regulation in India: Overview,* (26 March, 2018, 5:15 pm) https://uk.practicallaw.thomsonreuters.com/6-5255272?transitionType=Default&contextData=(sc.Default)&firstPage=true&bhcp=1.

[132]The §3(3) of the Electricity (Supply) Act, 1948 states that the Central Government shall appoint one of the full-time members to be the Chairman of the Authority.

[133]This section deal with constitution of selection committee to recommend members.

[134]The Electricity Regulatory Commission Act, §3 1998 (India).

1. The commission will formulate the taxes of the generating companies which are owned or regulate by the Central Government.

2. The commission will formulate the taxes of the generating companies which are not owned by the Central Government if that company has a composite scheme for generating and sale of electricity in more than one state.

3. The commission will check the inter-State transmission of electricity which will include the taxes on the transmission utilities.

4. The Commission will promote the competition, efficiency and economy in the works of the electricity industries.

5. The Commission will aid and advise to the Central government in forming of taxes policy which would be fair to the consumer and which would facilitate the mobilization of resources in the power sector.

6. The Commission will work with the environmental regulatory bodies to create the policy and procedure for safety of environment in the power sector.

7. The Commission which will create the guidelines for the taxes on the electricity.

8. The Commission will arbitrate or adjudicate the disputes which would involve the generating company and transmission utilities which are in regard with the matter state in the sub-section (a) to (c) of the this section.

9. The Commission will aid and advice to the Central Government on any matter which are referred to the Commission by the Government.[135]

Initiatives by the Central Electricity Regulatory Commission are that they started the open access in the power sector for short-run and for long-term there is grant of connectivity and the open access in inter-state transmission for medium-term, there is agrant of regulatory approval for execution of Inter-State Transmission Scheme to Central Transmission Utility, transmission pricing and power market.[136]

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[135]The Electricity Regulatory Commission Act, § 13 1998 (India).
[136]S.C. Shrivastava ,*Role of Electricity Regulatory Commissions* (26 March, 2018, 5:45 pm) www. cercind.gov.in.

### *State Electricity Regulatory Commission*

The State Electricity Regulatory Commission is established and incorporated under the Section 17 of the Electricity Regulatory Commission Act, 1998. This section has nine sub-sections. The first sub-section deal with that State Government may notify in the Official Gazette the establishment of State Commission Regulatory body which would be called by the name of state, Electricity Regulatory Commission. The second sub-section states that the State Electricity Regulatory Commission should have the power of perpetual succession and should have a common seal, should have the power to acquire the property for holding or disposing the property, it can be moveable and immovable and have the power to enter in the contract under the name of the State Commission and can sue or be sued. The third sub-section states that the head office of the State Commission should be at such places as the State Government may by notification in the Official Gazette. The fourth sub-section states that the State Commission should have one Chairperson and two persons as a member. The fifth sub-section deal with that who can be member or Chairperson of the State Commission and states that the persons shall be of ability, integrity and should have adequate knowledge and should be able to deal with the problem relating to the engineering, finance, commerce, economics , law or management. The sixth sub-section states that the Chairperson and the members of the State Electricity Regulatory Commission should be appointed by the State Government on the advice of the Selection Committee under the section 18 of Act, 1998[137]. The seventh sub-section states that the State Government may appoint the Judge of the High Court as the Chairperson but the State Government consult with the Chief Justice of the High Court before such appointment. The eight sub-sections give the power to Chairperson to be Chief Executive of the State Commission. The ninth and last sub-section states that neither the Chairperson nor members should hold any other office.[138]

Section 22 of the Electricity Regulatory Commission Act 1998 deals with the functions of the State Commission. They are as following:

1. The State Electricity Regulatory Commission shall discharge the following functions:

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[137]This section deal with Constitution of Selection Committee by the State Government.
[138]The Electricity Regulatory Commission Act, § 17 1998 (India).

a. The taxes related to the electricity, wholesale, bulk, grid or retail should be determine according to the section 29 of the Act, 1998.[139]

b. The taxes payable for the transmission facilities should be according to section 29, Act 1998.[140]

c. The power of purchase and procurement of the transmission utilities and distribution utilities which include price at which power is procured from the generating company, generating stations or from transmission, sale, distribution and supply in the state.

d. To promote competition, efficiency and economy in the activities of the electricity industry to achieve the objects and purpose of the Act, 1998.

2. As per the provisions of the Chapter III of the Act,1998 and without the prejudice to the sub-section 1, the State Government notify in Official Gazette may have the following functions:

   a. The State Commission regulates the investment for generations, transmission, distribution and supply of the electricity in the whole state.

   b. The State Commission gives aid and advice to the State Government for electricity generation, transmission, distribution and supply of electricity within the state.

   c. The State Commission controls the operation of the power system in the state.

   d. The State Commission issue licenses for transmission, bulk supply, distribution or supply of electricity and forms the conditions for granting licenses.

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[139]This section deal with the determination of tariff by State Government.
[140]*Id*.

e. The State Commission will regulate the working of the licensees and other authorized person who are linked with the power sector and will check their working conditions.

f. The State Commission require licensees to formulate perspective plans and schemes in co-ordination with generation, transmission, distribution, supply and utilization of electricity, quality of service and to devise proper power purchase and procurement process.

g. The State Commission provides the standards like quality, continuity and reliability of service for the electricity industry within the state.

h. The State Commission promotes competitiveness and avenues for the private sector and fair deal to the customers in the power sector.

i. The State Commission determines the safety standards.

j. The State Commission aid and advise to the State Government for the formulation of state power policy.

k. The State Commission collect and keep record of information of generation, transmission, distribution and utilization of electricity; to collect and publish data and forecasts on the demand for, and use of, electricity in the State and to require the licensees to collect and publish such data.

l. The State Commission regulate the assets, properties and interest in properties concerning or related to the electricity industry in the State including the conditions governing entry into, and exit from, the electricity industry in such manner as to safeguard the public interest.

m. The State Commission adjudicates disputes and difference between the licensees and utilities and refers them to arbitration.

n. The State Commission will work with the environmental regulatory bodies and make policies and procedure for environmental regulations in the power sector.

o. The State Commission gives aid and advice to the State Government on any matter when referred to them.

3. The State Electricity Regulatory Commission also performs those functions which are confirmed by National Power Plan.[141]

### *Central Public Sector Undertaking*

The Union Power Ministry has started a new scheme for providing electricity in villages within five kilometer periphery of generation plants of Central Public Sector Undertakings for giving the reliable and quality power to the people. The program give facility of free electricity connections to the below poverty line people. The scheme will deal with the old and new power plants of Central Public Sector Undertaking and will pay the cost, project cost booked by the Central Public Sector Undertaking, of the program. The Central Public Sector Undertaking will control the current infrastructure of the distribution companies like DISTRIBUTION COMPANIES as to extend requirement.

The State Electricity Board will appoint a Nodal Officer for providing the data, clearances, access and space in the state's sub-station for making an implementation in an effective manner. When the infrastructure work will be completed in the villages, then those villages will be handed-over to the State Utility.[142]

In the cases of hydro-power plants the Central Government will work with the State Governemnt for development of hydro-power plant in the respective states by offering services of the Central Public Sector Undertaking. Example for this is National Hydroelectric Power Corporation.[143]

### *State Public Sector Undertaking*

General Powers of the State Government are given under Section 12 of the Electricity Act, 2003. The Section 12 states the following:

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[141] The Electricity Regulatory Commission Act, § 22 1998 (India).

[142] *CPSU Power Plants to Supply Electricity in nearby Areas,* (26 March, 2018, 9:00pm)https://www.domain-b.com/industry/power/20100430_supply_elecrricity.html .

[143] *National Electricity Policy*, (26 March, 2018, 9:15pm)https://powermin.nic.in/en/content/national-electricity-policy.

1. The State Government shall have the power to issue policy directions on matters concerning electricity in the State including the overall planning and co-ordination. All policy directions shall be issued by the State Government consistent with the objects sought to be achieved by this Act and accordingly shall not adversely affect or interfere with the functions and powers of the Commission including but not limited to determination of the structure of tariffs for supply of electricity to various classes of consumers.

2. If any dispute arises between the Commission and the State Government as to whether or not a question is a matter of policy or whether a policy direction issued by the State Government adversely affects or interferes with the exercise of the functions of the Commission, the same shall be referred by the State Government to a retired judge of the Supreme Court in consultation with the Chief Justice of the Supreme Court whose decision thereon shall be final and binding.

3. The State Government shall be entitled to issue policy directions concerning the subsidies to be allowed for supply of electricity to any class or classes of persons or in respect of any area in addition to the subsidies permitted by the Commission while regulating and approving the tariff structure provided that the State Government shall contribute the amount to compensate such concerned body or unit affected by the grant of the subsidies by the State Government to the extent of the subsidies granted. The Commission shall determine the amounts and the terms and conditions and time frame on which such amounts are to be paid by the State Government.

4. The State Government shall consult the Commission in relation to any proposed legislation or rules concerning any policy direction and shall duly take into account the recommendation by the Commission on all such matters.[144]

In 1964, the Regional Electricity Boards were established in different regions of the country for facilitating integrated operation and for encouraging exchange of power amongthe States. To encourage the States to build infrastructure for exchange of such power,inter-state lines were treated as centrally sponsored schemes and the States were providedinterest free loans outside the State Plan. Fifty-five inter-state lines were constructed in the courseof which thirteen lines

[144]The Electricity Act § 12 2003 (India).

were connecting States located in different regions and this created theinitial set of inter-regional links. The reason for development on the lines of regions was thatthe generation resources in the country were spread unevenly. The hydro resources wereprimarily located in the Himalayan foothills and the North Eastern region whereas coalwas located in the Bihar-Jharkhand-West Bengal area with some reserves also in AndhraPradesh and Madhya Pradesh. Lignite was available in Tamil Nadu and Rajasthan.The Rural Electrification Corporation was set up in 1969 after the famines of the1960s with a mission to "facilitate availability of electricity for accelerated growth and forenrichment of quality of life of rural and semi-urban population. In order to give a boostto power generation, the Government of India created the National Hydroelectric Power Corporation and the National Thermal Power Corporation in 1975. These Corporations established large regional generating stations, the benefits of which wereshared by the States of the region.[145]

### *Private Companies*

The evolution of private participation in the Indian power sector can be divided into different phases. Phase one was commenced with the opening of the generation sector to private investment in 1991. Phase two soon followed - early experiments with state-level unbundling and other reform initiatives, including regulatory reform, culminating in divestiture, and privatization in Orissa and Delhi respectively. Phase three, the passage of the electricity act of 2003 by the central government, followed by a large increase in private entry into generation and forays into transmission and experiments with distribution franchise models in urban and rural areas during the 11th five-year plan (2007-12) period. In phase four, at the start of the 12th five-year plan (2012-17), the sector is seeing a sharp reduction in bid euphoria and greater risk aversion on the part of bidders, who are concerned about access to basic inputs such as fuel and land.[146] Privatization involves the transfer of state-owned utility assets to the private-sector. For example, the state may sell assets to private investors who then have 100% ownership. The private-sector investor's purchase price goes into the country's treasury to be used to plug the fiscal deficit or other state spending priorities. Privatization may or may not involve me structural unbundling of the vertically integrated utility and may or may not introduce

[145]*Distribution*, (27 March, 2018, 12:00pm) https://powermin.nic.in/en/content/distribution-0.
[146]"Mukherjee, Mohua. 2014. Private Participation in the Indian Power Sector : Lessons from Two Decades of Experience (27 March, 2018, 2:00 pm) https://openknowledge.worldbank.org/handle/10986/20410 License: CC BY 3.0 IGO."

competition into the utility system. Privatization alters the means of monitoring managerial behavior. Privatization of a monopoly industry also involves development of a regulatory structure to correct market imperfections and to prevent abuse of monopoly power.

The problem of privatization of distribution is political. Until the Electricity Act of 2003, there were only two instances of privatization. The first was Odisha, when the state was split into four; BSES (which became Reliance) bagged three and the American company, AES, got the fourth. The other was Delhi, which went to the Tatas.

However, the Electricity Act introduced the 'distribution franchisee' concept, where the assets remain with the government-owned distribution companies, but the function is outsourced to a private company, which gets paid on the basis of the efficiency it brings into operations. This has made privatization of distribution function less political.

### *Purchasing Power Parity Model*

More variants of public-private partnership in distribution are emerging, such as 'management operator' where the key managerial positions of the distribution companies are manned by the private sector, and models where the private sector co-invests.

The imperative of bringing down AT&C losses is giving scope for these many variants of PPPs. Today distribution companies want any help in reducing AT&C losses. They want high accountability private sector participation.

In improving billing and collection efficiency experts see a greater role for the private sector. Recent experience has shown that in places where the private sector has been co-opted, things have gotten better. It would be better understood with the help of an example-

Feedback Energy Distribution Company (FEDCO), which operates distribution networks in four districts of Odisha, serving 5.45 lakh consumers, has been able to bring down AT&C losses by 23 per cent over the last four years.[147]

[147] M Ramesh, *Post-UDAY, private sector may get a greater role in power distribution*, (28 March, 2018, 9:00pm) https://www.thehindubusinessline.com/economy/macro-economy/postuday-private-sector-may-get-a-greater-role-in-power-distribution/article9814375.ece.

Similarly, Torrent Power has brought down AT&C losses by 25 per cent in its area, Bhiwandi, in Maharashtra.

Companies such as FEDCO, Torrent Power and India Power (of SREI group, which operates in Gaya) are 'distribution franchisees', to whom the distribution companies outsource operations.

FEDCO, as a distribution franchisee of the Odisha distribution companies, CESU, is unique in that 90 per cent of the consumers in its area are rural. Yet, the company has been able to double collections to Rs. 400 Crore in its area in the last four years of its operation, when the input energy increased 22 per cent, thanks to 67 per cent increase in 'average revenue per user'. This was done partly by installing smart meters that leave no scope for human intervention and hence prevent corruption by meter reading staff—a big problem in government-owned distribution companies.

India's Electricity is set to see a huge boom as the 8-9% economic growth rates require massive amounts of energy. India is planning to nearly treble its electricity capacity to almost 450 GW by 2020 from around 160 GW now which means a yearly addition of nearly 23 GW in the next decade. Presently India's Electricity comes mostly from Coal and Hydro Based Energy. Almost 50% of Energy Requirements and 53% of the Electricity is generated from Coal. Despite Coal being the Dirtiest Form of Energy, India has got little choice in the matter. Most of India's upcoming Electricity Plants are based on Coal. Hydro Energy is generated mostly from India's Northern Himalayan States. Renewable Energy forms only 7.7% of the Capacity with around 11 GW of the 16 GW from Wind Energy.Nuclear Energy is around 3% of the total capacity at around 4.5 GW.Here is the list of the major power utilities in the country which is currently dominated by the state run PSUs.However the next decade should see the rise of private electricity companies.[148]

1) ***National Thermal Power Corporation***- Around 33 GW of power generation capacity is India's largest power utility by far and is planning to more than double that capacity to 75 GW by 2017 .The company mainly depends on coal and gas based power but is diversifying into gas, hydro,nuclear and solar power as well. It is one of the best run state owned companies and has executed well in building as well as running old plants. The company is one of the most valuable companies in terms of market cap as well with a market cap of nearly $35 billion.

[148]Accord Fintech, *Power Sector in India: All you wanted to know in 5 points*, (28 March, 2018,9:30pm) http://www.financialexpress.com/economy/power-sector-in-india-all-you-wanted-to-know-in-5-points/153547/.

2) ***National Hydroelectric Power Corporation*** – State owned like NTPC, this hydro power focused Power Company came out with an IPO with much fanfare. However slow implementation and lower profits have resulted in the stock prices declining a lot. However the company aims to double its electricity generation of 5 GW in the next 5 years or so by focusing on hydro generation in the Northern states of India.

3) ***Tata Power*** – The largest private utility in India has ambitious plans to grow like the other private sector companies in India. The company has interests in electricity distribution as well. Tata Power has a presence in thermal, hydro, solar and wind areas of power generation, transmission and retail with a capacity of nearly 3 GW. Tata Power is building numerous power plants and transmission projects in JV.

4) ***Reliance Power*** – Reliance Power part of the ADAG Group came out with the biggest IPO of its time before the Lehman crisis. The company part of the ADAG Group has the most ambitious expansion plans in the country. The company is raising huge amounts of capital from Chinese banks and placed the largest power equipment order with Don Fang Electric. The company is currently constructing 3 4000 MW projects and has plans of building 35 GW capacity with a mix of hydrate gas and coal based plants. The company also wins a solar thermal project in JNNSM bidding.

5) ***Adani Power*** – Power Limited is part of Adani Group with capacity of 1980MW.The company currently operates India's only super-critical power plant in Gujarat. The company is currently implementing 16500 MW at different stages of construction.The company is currently implementing thermal projects of 3300MW at Maharashtra and 1320MW at Rajasthan. The Adani Group has bought coal mines outside the country and with its port and shipping companies forms an integrated coal to power story.

6) ***Damodar Valley Corporation*** – DamodarValley Corporation is a state owned organization with interests in flood control, irrigation, generation, transmission and distribution of electricity located in the Damdoar Valley in the east of the country. There are hydro-electric power stations at Tilayia, Maithon and Panchet, with total installed capacity of 144 MW.DVC operates thermal power stations at with total capacity of 2745 MW. DVC is expanding its thermal power capacity and with the completion of its present plans by 2012 it would be generating more than 11000 MW of power.

**7) *LancoInfratech*** – Lanco is fast emerging Andhra Pradesh based Group and has become a top private sector power developer with 2 GW capacity and another 18 gw under development..[149]

The revenue that came out of the privatization scheme allowed authorities to improve New Delhi's infrastructure, building roads, hospitals and a metro system, which improved the city's green spaces.[150]

Small interest groups have tried to prevent privatization in the bigger cities. Consumers assume that private companies will fleece consumers and prefer not to entertain such offers criticizing plant operators for producing excessive coal emissions, cutting down forests and dislocating the vast legions of tribal people who live on some of India's richest coal reserves.

Experts say privatization is likely to drive prices up, since the price of certain raw materials has also gone up. But this is inevitable, they say, and electricity cannot be subsidized forever.[151]

## *Conclusion*

In developing countries in particular a number of the sample agreements included on this site, this combination is reflected as follows:

- A third party board is established by contract to monitor performance under the contract, and make recommendations for tariff setting;
- There is a provision in the contract that in time the powers of the board will be transferred to a regulatory body, established by statute.

In addition, there is a growing trend to reduce the amount of discretion that the regulatory body can apply by setting the principles and formulae for tariff setting, etc in "stone". For more on this, go to Regulation by Contract: A New Way to Privatize Electricity Distribution

It was deduced that functions of State Electricity Regulatory Commission as well as Central Electricity Regulatory Commissionaire more or less similar to one another. The difference between them is that Central Electricity Regulatory Commission and State Electricity Regulatory

[149]Abhishek Shah, *List of Top Power/Electricty Companies/ Utilities in India- Growing Exponentially,* (29 March, 2018, 11:30pm)http://www.greenworldinvestor.com/2011/03/02/list-of-top-powerelectricity-companiesutilities-in-india-growing-exponentially/.
[150]*Supra* at 14.
[151]*Supra* at 19.

Commission is that Central Commission gives advice to the Central Government and there is one Chairperson and three members and the State Commission gives advice to the State Government and there is one Chairperson and two members. The Chairperson of the Central Commission is the Judges of the Supreme Court or Chief Justice of the High Court. The Chairperson of the State Electricity Regulatory Commission can be judges of the High Court but there shall be consent of the Chief Justice of the High Court.

Attention should also be paid to the content of fundamental legislation and what can be left to secondary legislation. Secondary legislation is generally subject to less parliamentary scrutiny and can be changed more easily than primary legislation and so investors may be less comfortable with key issues being left to secondary legislation.

If the Government is seeking to encourage investor confidence in a sector then the level of discretion that a regulatory body enjoys (particularly a new body that has no track record) in carrying out its functions is of crucial importance. Private investors will be looking for checks and balances to be built into the legal framework of regulation, and even for assurances from Government, such as:

- building into the license/ PPP agreement of the operator and new entrants detailed "frozen" formulae for tariff setting and the frequency of tariff reviews;
- specifying in the license/ PPP agreement the tariffs for the initial review period;
- Where Government is to provide subsidies to the sector, have these set out in an implementation agreement between the Government and the operator/ included in secondary legislation.

Balanced against this desire for certainty is the interests of consumers and the benefit of giving the Regulator discretion to adapt tariff formulae to changing circumstances over time.

The level of discretion to be granted to the regulatory body also depends on the level of resource that the regulator is to be granted.

# ***Transfer OfGreen Technology – Its Role On Climate Policy***


### *Abstract*

The term Green technology is associated with the idea of bringing the new technologies for cleaner energy sources which can be used to protect the environment from harmful gasses. Many developing countries with the focus of rapid growth in their economy bring a promise to give a better life. Rapid industrial growth and increase in population results in pollution, particularly carbon dioxide (Co2) and other greenhouse gas (GHG) emission. The reason behind the increasing pollution with increasing growth is lack better energy harvesting technologies which would not adversely effect the environment. So as of now is a primary need of the time that there should be ways of production of energy with the view of securing environmental interest. There are many countries huge population which can be treated a reason behind the pollution coming from increasing number of industries and to reduce emission of HGH and other harmful gases, the new technology will be required such as wind and solar energy efficient technologies like hybrid vehicle. These technologies are available for adoption by technology transfers. The technology transfer may be personified as when high tech equipment is physically transported through international trade. This is more likely when a multinational firm licenses its technology to a locally owned firm; the firm retains control of its technology through foreign direct investment. When a new technology is introduced some of the knowledge embodied in the invention becomes public inspiring further innovation. Technological advances can lower the cost of compliance making regulation for more likely. This suggests that advances in technology within developing countries can shorten the time by which they will agree to bind emission reduction.



***key words-*** green technology, developing countries, industrial growth, pollution & technology transfer



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## *Introduction*

In this era of rapid industrial growth, development and expansion. Adam Smith considered that land was not like a mother, but energy could be considered as mother which combines with labor to make the wealth of nations. To achieve sustainable development we need not to reduce the use of energy, but to find new energy resources to cope with the rapidly global growing demand for development. Access to green technology for reducing greenhouse gas emission is important for developing countries to help them address the challenges of climate change. The innovative technologies in this domain have become increasingly patented. Green technology is characterized by two market failures, the public goods nature of knowledge and environmental externalities. This paper reveals that it is a combination of market, regulatory and cultural conditions that contribute to the stage in which distribution and adoption of environmental technologies take place.

## *Green Technology As An Innovative Step:-*

Green technology is an initiative for climate change. After a long research many of the great scientist has create some technologies which are environment friendly. Technology, which, by its Greek etymological background means “science of craft” can be described as (the study and knowledge of) the practical, especially industrial, use of scientific discoveries”[152] . The term technology is being kept very imprecise on purpose, because the meaning is constantly changing, and because technology itself is the emblem of innovation and development, and it would be paradoxical to limit the flexibility of the term, and run the risk of it not adapting to its own growth and development. Technological solution is a fine way to meet the changes related to climate change.  Green technology covers a wide range of technological invention which is environment friendly in nature. The environment friendly technologies can be also being considered as environment sound technologies. There is specific method or criteria to know that the technology is environmentally sound or not. In general those technologies that result in reduction of greenhouse gases’ emissions and technologies that increase the energy efficiency can be considered as climate friendly technologies. Examples will include, advanced and cleaner fossil-fuel technologies (carbon capture and storage, cleaner coal technologies such as Integrated Gasification Combined Cycle (IGCC) and pre-combustion technology, combined heat and

[152]Cambridge Advanced Learner's Dictionary & Thesaurus, Definition of “technology” © Cambridge University Press,<http://dictionary.cambride.org/de/worterbuch/englisch/technology>

power) and, hydrogen cells and hybrid vehicles. In many technologies while first generation technologies are well established the subsequent ones are in pipeline or in various stages of R&D.[153]The UNFCCC and the Kyoto Protocol require Parties to promote and cooperate in the development and diffusion, including transfer, of technologies that control, reduce or prevent GHG emissions[154].

### *Relationship Between Intellectual Property And Transfer Of Green Technology*

The transfer of technology is transferring the rights related to that technology to another organization to use it. In other words it is also like the commercialization of a particular invention. But when we talk the transfer of green technology, it reflects the use of technology of some specific nature. As the name implies green technology is one that has a "green" purpose. Green inventions are environmentally friendly inventions that often involve: energy efficiency, recycling, safety and health concerns, renewable resources, and more[155]. Also this means of energy production that is less harmful to the environment than more traditional ways of generating energy, such as burning fossil fuels[156].

IPR is quite related to transfer of green technology because it helps in incentive the innovation and has a great impact over transfer of technology. IP and clean technologies are connected in many ways:-

1. Patent pools and funds to finance the transfer of green technologies to developing countries.
2. Facilitating licensing of green technologies to developing countries.
3. Fast tracking green patent application.
4. Excluding some clean energy technologies from patent by developing countries.
5. Expanded use of TIRPS flexibilities to facilitate access to clean technologies by developing countries.

[153]http://unpan1.un.org/intradoc/groups/public/documents/un-dpadm/unpan037297.pdf last visited on March 19, 2018 at 2:30 PM.
[154] See, e.g., Article 4.1 (c) of the UNFCCC and Article 10 of the Kyoto Protocol
[155]https://www.thoughtco.com/introduction-to-green-technology ( last visited on March 18, 2018 at 12:10 pm)
[156]Green Tech https://www.investopedia.com/terms/g/green_tech. ( last visited on March 18, 2018 at 12:10 pm)

We emphasize the importance of technology transfer to developing countries and recall the provisions on technology transfer, finance, access to information, and intellectual property rights as agreed in the Johannesburg Plan of Implementation, in particular its call to promote, facilitate and finance, as appropriate, access to and the development, transfer and diffusion of ESTs and corresponding know-how, in particular to developing countries, on favorable terms, including on concessional and preferential terms, as mutually agreed[157].

## *Transfer Of Green Technologies, Innovation And Protection*

Green technology is also sometimes called „clean technology” or „environmental technology”. These terms are mostly used to describe in a very broad manner various types of technology that aim towards reducing, mitigating or adapting to detrimental effects to the environment. These terms encompass a very broad range of environmentally friendly technology, and often address several challenges, like „Global Change, Depletion of Resources, Living in a Healthy Environment, Competitiveness and Growth”.[158]

The field of "green technology" encompasses a continuously evolving group of methods and materials, from techniques for generating energy to non-toxic cleaning products[159].

Technology transfer is an important means by which developing countries may gain access to technologies that are new to them. Technology transfer is usually a basis for technical innovation and often has after-effects in the form of innovation diffusion. Technology transfer can be defined as the inflow of technical knowledge to the market where it is sold and bought. There are varieties of technologies to reduce harmful gasses some of them are at low cost while other implies a high cost of emission reduction. Climate change has become a threat in countries, national climate policies and international efforts to combat, climate change have begun to provide incentives for climate-friendly innovation in developed countries, because of that patent activity for renewable of energy technologies has increased in recent year. A dual role is played by the policy and the technology. Stronger environmental policies stimulate new green technologies on the other hand, better technologies make it easier to regulate.

[157] Rio+outcome outcome document document (2012)

[158]KK Matthias Weber, 'Environmental Technologies' (2005) Background Paper for the European Commission's High Level Group on „Key Technologies”

[159]www.green-technology.org

Formulation of policies and programs for the effective transfer of ESTs that are publicly owned or in the public domain; Purchase of patents and licenses on commercial terms for their transfer to developing countries on non-commercial terms, taking into account the need to protect intellectual property rights. In compliance with and under the specific circumstances recognized by the relevant international conventions adhered to by States, the undertaking of measures to prevent the abuse of intellectual property rights, including rules with respect to their acquisition through compulsory licensing, with the provision of equitable and adequate compensation[160]

When we talk about green technology in association with innovation, it is seen that without innovation there is no technology to transfer and without investment there is no innovation. Private investment capital chases the highest and most predictable return on investment (ROI). If IP protection for green tech IP is weakened, innovation capital will be diverted elsewhere. There are always other options, especially when green technology markets depend on government subsidies

## *Green Technology Transfer: Role And Potential Impact Of Intellectual Property Rights*

The role of IPRs in climate-friendly technologies varies from one sector to another. Patents and trade secrets are two important areas of intellectual property rights for the protection in climate-friendly technologies.The role of Intellectual Property Rights (IPRs) in development and transfer of technologies in the context of climate-change has attracted much attention in the recent literature and debates on climate change, including the Stern Report and the documents from UN[161].

There is particular definition of transfer of green technology but in general sense it can be defined as transfer of method for the manufacture of a green technological products. And for the purpose of this general definition, IP is thus in part an instrument aimed at facilitating the transfer of technology.

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160 Chapter 34 of Agenda 21 (1992)

161 An overview of that debate can be found in Intellectual Property Quarterly Update Fourth Quarter 2008, Feb 2009 www.ciel.org last visted on March 19, 2018.

For the purpose of establishing the role of intellectual property, it is important to discuss some international frameworks. TRIPS agreement establishes the most comprehensive minimum standards of IP protection, both in terms of covered areas and their applicability to all Members of the WTO. The objective of the protection and enforcement of IP should be to contribute "to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare[162]..." and also the measures "may be needed to prevent the abuse of intellectual property rights by right holders or the resort to practices which … adversely affect the international transfer of technology[163]." TRIPS Agreement requires developed country WTO Members to "provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country Members." There are growing concerns, however, that such a mechanism is inadequate to promote effective transfer of technology in least-developed countries[164].

In the context of the UNFCCC, the role of IP rights in the transfer of climate related technologies are not proven any easy task. The UNFCCC and the Kyoto Protocol, like most MEAs, contain specific commitments on technology transfer. UNFCCC urges developed country Parties to take all practicable Climate Change, Technology Transfer and Intellectual Property Rights steps to promote, facilitate and finance the transfer of, or access to, environmentally sound technologies and know-how, particularly to developing countries[165]. Moreover, developed country Parties are required to provide the financial resources needed by the developing country Parties to meet the agreed full incremental costs of implementing their obligations, including for the related transfer of technology.[166]

### *The Committee on Trade and Environment*

History of Discussions in CTE at WTO: The CTE discussed the interaction between environment and TRIPS comprehensively in June 1995[167] The Committee took note of the fact that only

162 Article -7 of TRIPS agreement
163 Article -7 of TRIPS AGREEMENT
164 Article 66.2 of the TRIPS Agreement
165 See Article 4.5 of the UNFCCC and Article 10 of the Kyoto Protocol

166 See Article 4.3 of the UNFCCC
167 WTO Document WT/CTE/W/8, Committee on Trade and Environment, June 8 1995

Art.27.2, as mentioned above, makes an explicit reference to the environment. CTE reviewed the negotiating history of the Convention on Biological Diversity (CBD) and recalled various steps taken so far. Initially, the international community faced the threat of genetic erosion by building a network of ex-situ gene banks. Overtime, the focus however, has changed towards in-situ conservation of biodiversity. It is in this context that the incentives for conserving, sustainably utilizing and augmenting animal and plant biodiversity in the natural habitat has been emphasized. The emphasis in CBD for sharing research and development activities and benefit there from through commercial use of these results on mutually agreed terms has been recognized. The access to and transfer of technology has to be provided keeping in mind the goals of conservation, sustainable utilization and augmentation of biodiversity ensuring in the process prior informed consent of the parities to the Convention. Art.16 of CBD recognizes the role of IPR in transfer of technology that assist conservation and sustainable use of genetic resources and wiMNMHLJY5thout any significant damage to the environment.

### *Policy regarding International Cooperation for Green Energy*

In 2008 federal government of India announced that relevant ministries in India and Israel will collaborate to develop renewable energy technologies. Areas of cooperation are water resources, the development of space technology, bio-energy and nanotechnology.[168]

Art.65 of TRIPS provides longer duration (maximum ten years from the date of entry of the agreement for least developed countries) for enforcing the provisions of TRIPS except Art.2,3, 4 and 5. The developing countries get the time of five years. Environmental concerns are also included in the Agreements on Subsidies and Countervailing Measures, Agriculture and Technical Barriers to Trade and several other WTO provisions.

In the situation of India, technology diffusion centre needs to act as a hub for clean energy technological information as well as an innovation platform for their diffusion and adoption. As a result of tariff liberalization on green products, countries similar to India may eventually becoming and remain technology dependent if no additional actions for cost-effective technology transfer, development and attached funding are set. Thus in India it is necessary to establish the necessary infrastructure for enforcing market mechanisms and fairly set instruments.

[168] Fei DING, Bui Duc KINH, Liina TONISSON, Limin MAO, and Shohei OHYA, Green Energy Development and Technology Transfer in China AND India (March 2 2018), (http://www.inen.com/newenergy/html/newenergy1023102350178962.html)

Another international treaty that has a big impact on technology transfer is the World Intellectual Property Organization ("WIPO"). Article 10 of the Agreement between WIPO and the UN obliges WIPO to the cooperation "in promoting and facilitating the transfer of technology to developing countries in such a manner as to assist these countries in attaining their objectives in the fields of science and technology and trade and development."[169]

The most-cited definition of all is probably the one from the United Nations Conference on Trade and Development (UNCTAD) Draft International Code of Conduct on the Transfer of Technology. According to that Code of conduct, technology transfer is to be defined as "the transfer of systematic knowledge for the manufacture of a product, for the application of a process or for the rendering of a service and does not extend to the transactions involving the mere sale or mere lease of goods."[170]

## *Legal Framework of Green Technology Transfer*

Very important document that has come out of the Rio Summit, also called the „United Nations Conference on Environment and Development"("UNCED"), is Agenda 21, which is a non-binding action plan of the UN for sustainable development. In 1994 the UNFCCC entered into force, and became the most powerful contractual stimulus for global action against climate change. Via the UNFCCC, the so called „Conferences of Parties" or COPs are taking place on a regular basis, in which the parties discuss the results and advancements regarding the provisions of the treaties, as well as eventual amendments to it. The 21st COP took place on 15 December 2015 in Paris and has brought the latest treaty ("the Paris Agreement"). On 7 November 2016, COP22 took place, and served as the first Meeting of the Parties of the Paris Agreement (CMA1).[171]

It wasn't until the Bali Action Plan was agreed to at the 13th COP of the UNFCCC in 2007, that the importance of technology transfer was emphasized.[172] The implementation of this plan took place later in the 2010 Cancun conference, as they created the Technology Mechanism, which

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[169] Agreement between the UN and the WIPO (entered into force 17 December 1974) http://www.wipo.int/treaties/en/agreement/.index.html accessed 29 May 2017.

[170] UNCTAD, 'Compendium of International Arrangements on Transfer of Technology: Selected Instruments - Relevant Provisions in Selected International Arrangements Pertaining to Transfer of Technology' (2001) UNCTAD/ITE/IPC/Misc.5 http://www.unctad.org/en/docs//psiteipcm5.en.pdf accessed 29 May 2017

[171]http://sdg.iisd.org/events/unfcc-cop-22/

[172] Paragraph 1(d), Bali Action Plan, UNFCCC (2007), FCCC/CP/2007/6/Add.1 http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf 1/CP.13

consists of two main bodies: the Technology Executive Committee (TEC) and the Climate Technology Centre and Network (CTCN).[173]

Recognition of important role of IPRS in promoting technological innovation those IPRs may have an adverse impact on the transfer of technologies to developing countries and urgency of addressing many environmental challenges requires considering measures in many regulatory areas, including IPRs.

### *Intellectual Property can be treated as barrier for the transfer of technology to developing countries?*

Issues related with environment are frequently increases they are regional in nature, to resolve these issues solution and local knowledge are required, technologies which are use to resolve these problem are very expensive and the developing countries like Bhutan, Bangladesh, Nepal, India are not able to afford their high cost. Adoption is facilitated by environmental feasibility as well as cultural and political acceptance. Transfers of technologies are boost up by stronger level of patent protection.

IP is being potentially approved as both an incentive and an obstacle for the transfer of green technology. IP rights were taken as rights of private nature to reward innovation and promote the dissemination of knowledge in the context of broader societal goals. The existence of protection under intellectual property doesn't guarantee the effective transfer of technology. It is just that the intellectual property rights need to be buttressed by appropriate structure, regulation, governance and competition systems in order to make it more effective.Moreover, there are circumstances where intellectual property rights are not Incentives always. The market holding powers given to some patents and other intellectual property rights over certain technologies by allowing owners to restrict the availability, use, or development of a process or product may also result in prices that exceed the socially optimal level and hamper the transfer of these technologies to the public domain where need is higher[174]. Developing nations frequently claim that strong intellectual property rights on carbon abatement technologies obstruct developing countries, greenhouse gas abatement efforts, it has been shown that IPRs do not constitute as

[173]A A Latif and others, 'Overcoming the Impasse on Intellectual Property and Climate Change at the UNFCCC: A Way Forward' (2011) ICTSD Programme on Innovation, Technology and Intellectual Property, Policy Brief No 11, 2

[174]https://www.iisd.org/pdf/2008/cph_trade_climate_tech_transfer_ipr.pdf

significant a barrier as claimed since a variety of technologies exist for reducing emissions. The empirical evidence from transfer of technology, technological development and IP protection in developing nations indicates that there is no positive correlation among the three**.** A large share of the worldwide carbon abatement necessary to meet even ambitious targets can be met by increasing forestation and decreasing deforestation in the least developed countries. We assess that the technology for forestation and reduced deforestation does not rely on the use of IPR protected technology to any significant extent. Hence for the least developed countries a large part of the economic burden of abatement is unrelated to IPR[175] When applied to technology development and transfer it means that while developing nations have the responsibility to develop and apply climate friendly technologies, developed nations are expected to take the lead and play a major role in development and transfer so that the common objectives can be met. Since climate change is a problem of global atmospheric commons, developed nations, having been the major cause of the problem, should play a major role in finding technological solutions. This can be achieved only if developed nations accept their responsibility. Since the private sector and bilateral initiatives on technology development and transfer form a significant part of the efforts to use technology as a solution, it will be fair to demand that these also incorporate this principle in development and transfer of technology.

Development and transfer of climate-friendly technologies is an important element in the adaptation strategy. The need for new technologies to face the challenge of global climate change is obvious. The Bali Action Plan recognizes the crucial role of technology and highlights the importance of technological development, transfer and use of technologies Hence it is essential that IP issues do not become a barrier in technological leapfrogging. The challenge of climate change calls for out of the box thinking to find solutions that can make a difference. In our view the IP issues can be tackled by a combination of policy measures, incentives and bringing in changes at the global IP regime under TRIPS[176]

## *Conclusion And Suggestion*

As we know that energy is a paramount resource for economic development and the demand for energy will suddenly increase to meet the needs of national and global economic growth and the prosperity of the people. Green energy resources are Eco friendly resources, but there

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[175] http://trade.ec.europa.eu/doclib/docs/2009/february/tradoc_142371.pdf last visited on March 27, 2018 at 8:30 pm.

[176] Ibid

achievements are very challenging especially for developing countries. Only financial support is not the way to develop or use of green energy in developing, countries but also development of human resource and transfer of green technology can help them in their growth. An international collaborative effort to promote the transfer of clean technologies to developing countries which doesn't address IPRs may face credibility issues. IPR can create incentives for right holders of traditional varieties of crop or horticultural plants to create demand for these products so that they have incentives for conservation. The trading channels such as fair trade intermediaries or even major super chains may invest in promoting ethnic or less known foods and crafts when protected through relevant IPR so that rent on promotional investment can be extracted. In organic agriculture, the blending of agro-biodiversity with organic certification has generated incentives for local communities and individual farmers in several countries. Most of the compulsively organic farmers (that is organic because of less developed markets, uneven terrain, rain fed regions, and poor economic conditions), also conserve and grow land races and local breeds of animals. Economic studies have found that while IP protection facilitates trade flows of patented goods into large and middle-income nations, but has no impact on poor countries.177

For green energy development in developing countries the focus should be on technology transfer, which helps in reducing the gap between developed and developing countries. India needs dynamic service support, maintenance or we can say that good infrastructure that favors green technology transfer in efficient market mechanism. The transfer of technology is not the only economical solution for developing countries – transfer of research and development is also important. This will empower local research and development entities to achieve further innovation. This paper proposes that such transfer could take place through bilateral agreements, international commitment and market based mechanism. Developing countries like Cambodia should collaborate with other developing country like India for technology transfer, as these countries were once at the same level and will be willing to negotiate for appropriate technology transfers.

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[177] Daniel K.N. Johnson & Kristina M. Lybecker Challenges to Technology Transfer: A Literature Review of the Constraints on Environmental Technology Disseminationhttps://papers.ssrn.com/sol3/papers.cfm?abstract_id=1456222 ( last update Aug 17, 2009)

# ***All Great Movements Start At Home, Do Your Bit To Reduce Household Energy Use***


***Abstract***

The energy requirement in India is increasing steadily and this requirement is being met by both conventional and non conventional energy sources. Due to non availability of sufficient resources and a considerable amount of emission of pollutants from conventional sources and the increasing constraints led by the international agreement, it is now felt that renewable energy has to be utilized to greater extent so as to achieve the country goals i.e. green house gases reduction and meeting the energy demand. In India, about 70% of the total renewable power generation is obtained from wind.

The gap between supply and demand of energy is continuously increasing despite huge outlay for energy sector since independence. Further the brining of fossil fuel is resulting in greenhouse gases which are detrimental to the environment. The energy conservation is cost effective with a short payback period and modest investment. There is a good scope of energy conservation in various sectors, viz industry agriculture, transport and domestic, This paper will give overview of need for energy revolution in India.1



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## *Introduction*

Energy plays a key role in the process of economic growth of a nation. The industrial development of any country is dependent on the organised development of its power resources'. Energy is also indispensable for agriculture, transport, business and domestic requirements. In fact, electricity has such a wide range of applications in modern economic development that its per capita consumption is, to the great extent, an index of the material advancement of the country.

Energy is the capacity for doing useful work. It is an essential input for economic growth. This energy is used in the form of electrical energy, thermal energy, light, mechanical energy and chemical energy etc.

Energy measured in joules in Si units. The annual per capita energy consumption in developed countries ranges from 5 to 11 kW whereas in the developing countries it is between 1 to 1.5 KW Only

## *Uses of Energy*

1. Energy is a primary input in any industrial operation.
2. It is also a major input in sectors such as commerce, transport, tele-communications etc.

3. The wide range of services required in the household and industrial sectors.

4. Owing to the far-reaching changes in the forms of energy and their respective roles in supporting human activities, research and training on various aspects of energy and environment have assumed great significance.

## *Sources Of Energy*

An energy resource is a natural resource from which useful work can be obtain. Energy resources are broadly classify as primary and secondary.

## *The Renewable Energy Revolution in India*

India has launched the world's largest renewable energy expansion programme and aims to achieve 175 GW capacity of energy by 2022. The country is taking national actions plans to abide by its duty under the Paris Agreement to keep the rising temperatures of the Earth well below 2 degree Celsius. Tamil Nadu and Rajasthan are leading the renewable energy sector by generating electricity using wind farms. Rajasthan tops the list for solar and wind energy with a total installation capacity of more than 3,000 Megawatts. Indian projects like electrifying Rural India also focused on using clean energy. It is also important to note that coal electricity in India does not see a cut-off. One of the biggest coal plants in Asia, the Mundra Thermal Power Plant in Gujarat seeks to import coal from Australia.

Electricity generation by coal is being oppose by countries at a global level. Due to this, renewable energy revolution in India is very strong. Recently, the government has signed a PPA to develop 1000 Megawatt of wind energy to reduce the burden on the northern grid, which trips every summer.

Although, renewable energy has been bringing clean energy in India, there have been a couple cases of fraud and corruption. Recently, the UP government had to terminate an agreement with six solar companies, who had agreed to install 80 Megawatt capacity of solar energy in the state, but failed to do so within the stipulated period. Such hurdles will not cause the growth and progress of India based on renewable energy.

India is also importing hydropower from Bhutan to electrify villages in Sikkim. The Central government wants to build a new India by 2022, which will be cleaner, greener, more sustainable and healthier.

## *Renewable India - Green Revolution*

Imagine a world where you wake up in a smart green home and go to school in a self-driving electric vehicle to another smart green building. Meanwhile at home, the washing machine automatically turns on when the electricity prices are at the lowest point during the day and turns off when the prices are high.

The light bulbs, air conditioner, refrigerator, and any electrical device in your house can be turn on or off from your phone with an app and can be set to operate at the most efficient setting. The house powered by solar panels on the roof and there is a battery system, which gets charged so that the power consumed from the electric grid is minimised at night when no solar power is available.

You can also use the battery system to charge your electric vehicle. You can make money when you are not using your electric car by selling power from your electric car to the grid when electricity prices are high. All of this is not in the distant future but is happening right now. The technology has developed and is in the process of being commercialised and integrate to create smart, green cities.

### *Types of Renewable Energy*

Energy efficiency and renewable energy generation are effective solutions to tackle climate change – an issue that affects all of us significantly. There are different types of renewable energy generation possible, of which, the most popular resources in India are wind, solar, hydro and biomass. Wind power generated by converting airflow into electricity through turbines.
Windmills have been in use for centuries to pump water and grind grain but they do not produce electricity. Solar power generation involves conversion of sunlight into electricity. This concept can employed in calculators, lanterns and water pumps apart from large generating stations.

Hydropower obtained by harnessing the power of moving water in rivers by building dams or small canals to direct the flow of water through a turbine. Biomass is renewable organic waste, which would left in landfills or burned openly if not used. It may include scraps of wood, manure, forest debris and other organic wastes. Biomass burned to heat water and the steam produced channelled through turbines to generate electricity.

### *Advantages*

The advantages of renewable energy generation have been reiterate often: zero fuel cost and removing dependence on exhaustible supplies of fossil fuels, which keeps energy prices stable and carbon footprint low. Most importantly, it is environment friendly and leads to sustainable development.

The reasons for lacklustre interest in renewable energy until recently can be attributed to relatively higher capital cost (cost in setting up the power plant), ambiguous or absent policies and regulations, inadequate accuracy in forecasting solar and wind output, lower efficiency of power conversion and lack of awareness. There were concerns that the electric grid cannot accommodate a large percentage of renewable resources.

These concerns have been invalidated by countries like Germany, Denmark, Uruguay and Scotland which have successfully generated about forty percent or more of their electricity needs through renewable resources.

### *Growth in India*

India's renewable energy sector is growing at a fast pace. India accounts for 5.8 percent of the world's total wind power generation and is the fourth largest producer of wind power in the world. By 2022, India plans to add 175 Gigawatt of renewable generation – which is almost 55 percent of the current installed capacity. Renewable energy generation was close to 30 percent of the installed capacity as of July 2016, so there is a long way ahead. With Indian cities occupying almost half the spots in the list of most polluted places in the world, the government's ambitious renewable energy target is justifiable.

### *Conclusion*

As a developing country, India does have many challenges in implementing a large amount of renewable energy in the electricity grid. However, with rising pollution levels and increasing energy requirements India needs a focused approach at all levels to ensure that we reduce our carbon footprint. As citizens, we can participate in this process by utilizing LED lights, energy certified refrigerators, washing machines and air conditioners, rooftop solar installations wherever possible and preventing wastage of electricity. Every unit of energy saved is energy generated. Be responsible, be smart and go green!

# ***Clean and Green Energy: The road ahead***


## *Abstract*

India is situated in an advantageous location considering the availability of renewable sources of energy, yet faces a challenge in ensuring the availability of reliable and modern forms of energy for all its citizens. According to the 2015-2016 Annual Report of the Ministry of New and Renewable energy, almost 85% of the rural households depend on solid fuel and only 55% of all the rural households have access to electricity. Out of the 24.67 crore households in India, 68% form part of the rural households, thereby reflecting upon the huge number of deprived households.

This paper shall acknowledge the renewable energy potential of the nation, focusing upon the solar energy and the steps being taken by the government sector and the private sector towards providing green and affordable energy for the rural sector. Solutions shall be recommended by analyzing the difficulties which arise while implementing such methods.

Moreover, the laws applicable such as the National Electricity Plan 2012, National Electrification Policy 2006 along with the Electricity Act of 2003 and the progress made relating to the implementation towards the development shall be critically analyzed.



***Keywords***- Solar Energy, Rural Electrification, Laws And Implementation



***By Bhavya Upadhyay***

## *Introduction*

India is the fourth largest energy consumer after the United States, China and Russia.[178] Energy consumption of India is expected to grow further in the significant future due to the increasing population growth and overall development.[179]

After the setting up of commission for Additional Sources of Energy in the Department of Science and Technology in the year 1981, the promotion of renewable energy in India started in all its vigour. In 1982, the Department of Non- Conventional Energy Sources was set up which was an independent department, the same was converted into the Ministry of Non-conventional Energy Sources (MNES) in 1992 which was renamed to the Ministry of New and Renewable Energy (MNRE) in October 2006 with a broad aim to develop and deploy new and renewable energy for supplementing the energy requirements of the country.[180] Due to the efforts of MNRE and its state level nodal agencies the renewable energy business has grown into a sizable industry and various initiatives are being taken by the government as well as the private sector for providing a cost effective mode of energy for all.[181]

It was the end of the 7th Five year plan which saw the initiation of renewable energy as a source with 18 MW of installed generating capacity which increased to 57,244 MW by the end of the 12th five year plan, and the total capacity being 3,26,833 MW.[182] Yet, studies show that 75% of families which is seven hundred million people regularly get only about six hours of uninterrupted power in a day, which is not sufficient for overall social and economic development.[183]

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178 Vivek Panwar et. al., *Overview of Renewable Energy Resources of India*, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Online: http://www.rroij.com

179 S.C. Bhattacharya et. al., *Renewable Energy in India: Historical developments and prospects,* Elsevier, Online Newsletter: http://wgbis.ces.iisc.ernet.in

180 Ministry of New and Renewable Energy, Government of India, Online Website: www.mnre.gov.in

181 *Id.*at 2

182 Government of India, *Growth of electricity sector in India from 1947-2017,* May 2017 Online: http://www.cea.nic.in/reports/others/planning/pdm/growth_2017.pdf

183 Manipadma Jena, *Rural India needs solar power for more than just lighting, study finds,* Reuters (May 31,2017)

## *Energy Sector: The Current Scenario*

The shares of primary conventional energy consumption in the year 2005 showed coal – 55.0%, oil- 29.9%, natural gas – 8.5%, hydroelectricity- 5.6% and nuclear energy- 1.0%.[184] Moreover, India's dependence on coal and oil accounted for huge atmospheric contamination and economic deterioration due to imports, and in the present year, India, after China, is the largest with 330,000 barrel per day to provide increment in Global Oil consumption growth averaged 1.6 million barrels per day.

Though, the global coal consumption fell by 53 million tonnes of oil equivalent (mtoe), US and China showing the largest decline with 8.8% and 1.6% respectively. The coal production in China fell by 7.9% and in US by 19%, whereas in India, coal production shows a growth rate of 2.4% and coal consumption, a growth rate of 3.6%.

The global renewable power grew by 14.1% in 2016 with wind providing more than half of renewable energy and solar providing a one-third with 18% of the total. China overtook the US to be the largest single renewables producer and Asia Pacific overtook Europe and Eurasia as the largest producing region of renewable power.

Moreover, as Table 1 depicts, India increased its consumption by renewables as a source of primary energy from 1.85% in 2015 to 2.27% in 2016 along with decreasing the overall consumption of coal and oil as a source by 0.99% and 11.77% respectively from 2015 to 2016 which shows progress towards shifting from non-renewable sources of energy towards renewables, even though both coal and oil show a growth which needs to be checked further for Indian market to make its mark globally, as shows the trend in developed nations such as China and US.

***Table 1- Primary Energy: Consumption by fuel***[185]

| | **2015** (Million tonnes oil equivalent) | **2016** (Million tonnes oil equivalent) |
|---|---|---|
| Oil | 195.8 | 212.7 |
| Natural Gas | 41.2 | 45.1 |
| Coal | 396.6 | 411.9 |

184 British Petroleum, *BP statistical review of world energy June 2006*, Online: www.bp. com/statistical review.

185 Bharat Petroleum, BP Statistical Review of World Energy 2017

| | | |
|---|---|---|
| Nuclear Electricity | 8.7 | 8.6 |
| Hydro Electricity | 30.2 | 29.1 |
| Renewable | 12.7 | 16.5 |
| **TOTAL** | **685.1** | **723.9** |

In 2012, about 579 million people in India, that is 35 per cent of world's population, lived without access to electricity.[186] The 12th Five Year plan provided for electricity to households as its objectives, with 55,000 MW of renewable energy capacity, and currently, the installed generating capacity in India of Renewable Energy Sources is 57244 MW which is 17.51% of the total capacity.[187][188] The aim has clearly been achieved yet needs further development to bring an overall change, in the urban as well as the rural sector.[189]

## *Rural Electrification*

Studies show that electrifying the rural areas provide various benefits such as improvement in health as households reduce use of polluting fuels for cooking, lighting and heating, also access to television leads to better knowledge, and refrigeration provides for better storage facilities, hence an overall development.[190] Without adequate supplies of affordable energy it becomes quiet impossible to improve health, education and reduce poverty.[191]

In 2001, the 9th session of the Commission on Sustainable Development gave special attention to energy concluding that "Energy is the central in achieving the goal of sustainable development".

Lack of electricity leads to consumption of kerosene as well as candles for lighting in the rural areas which is highly harmful as candle burning in a closed room for a few hours causes an

186 Tarujyoti Buragohain, *Impact of Solar Energy in Rural Development in India,* International Journal of Environmental Science and Development, Vol. 3, No. 4, August 2012

187 As on 31st March 2017, includes Hydro capacity of 25.00 MW and below as reported by MNRE

188 *Id* at 5

189 Planning Commission Government of India, *12th Five year plan 2012-2017,* Economic Sectors (Volume II)

190 World Bank. *The Welfare Impact of Rural Electrification: A Reassessment of the Cost and Benefits: An IEG impact evaluation*, Online: http:www.worldbank.org/ieg, 2008, ch.5, pp. 39– 52.

191 Global Network on Energy for Sustainable Development (GNESD*), Reaching the Millennium development Goals and Beyond: Access to Modern Forms of Energy as a pre-requisite* Online: htt:www.gnesd.org/downloadables/MDG_energy.pdf, 2007, ch.1, pp. 1–5

increase in lead content which is sufficient to cause fatal damage or harm the mental development of children.[192]

Children and women spend a major portion of their day time doing household utilities or collecting firewood due to lack of electricity, if they are made available electricity during the night, it would lead to improving the socio-economic condition of the rural areas.[193]

Attention is required to be given towards electricity supply in the rural areas, as out of the 24.67 crore households in India, 68% form part of the rural households, and agriculture itself contributes for 14% of GDP, while about 45% of small scale manufacturing units are rural based units and rural India provides for 58.2% of the total availability of job to the youth.[194]

### *Renewable Energy Potential Of India*

Currently, the energy requirement of India is met by oil, coal and petroleum which is not just a non-renewable source but also harmful for the environment. As, energy is one of the main requirements of the present developing as well as developed nations it is of critical importance to meet this need. Some of the renewable resources and technologies which can be used instead of the non-renewable sources being used for the purpose of meeting the energy needs of India are discussed in detail-

***Hydropower-*** Hydro-energy has been used for the purpose of producing electricity since 1947 and beyond, which included 508 MW installed generating capacity in India before independence and has reached a capacity of 44478 MW until the end of the 12th five year plan in the year 2017. Even though, this resource is non-renewable, it is harmful for the environment as large hydropower plants often result in causing flooding and submergence of large areas, along with the flora and fauna of the effected river. Thereby, it should be aimed that small hydropower generating plants are made instead, as they can also be readily commercialized.

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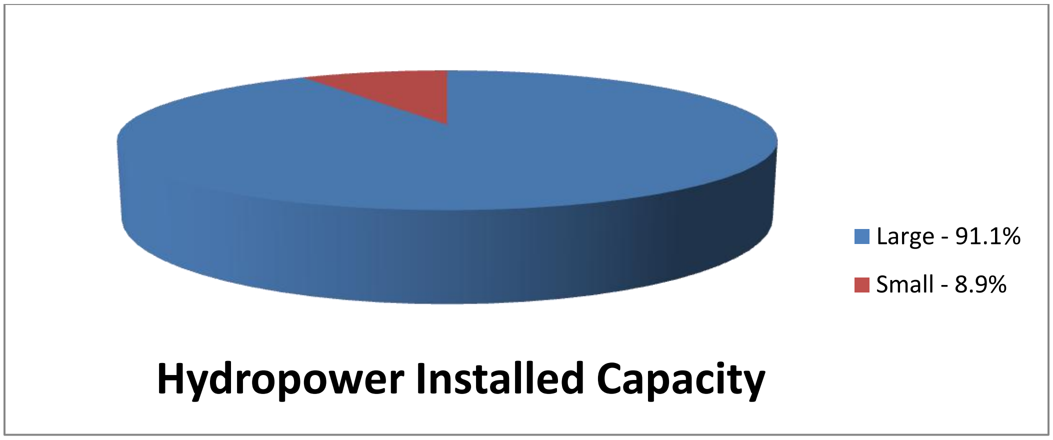
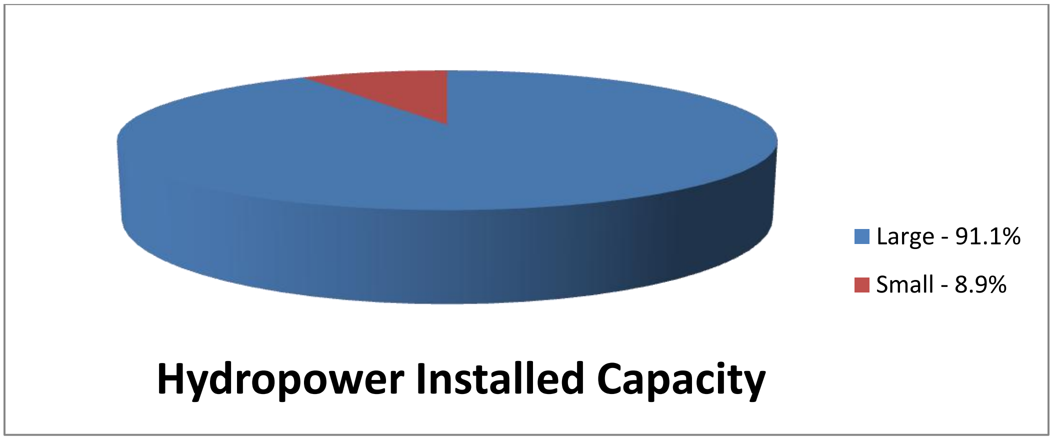
[192] M. Kaplan, *Chronic Neuro-Immune Diseases: Toxins in Burning Candles, Candle Wicks and Incense, in Melissa Kaplan's Chronic Neuroimmune Diseases Information on CFS,* 2007, Online: http://www.anapsid.org/cnd/mcs/candles.html

[193] R. Cabraal et al., *Productive Uses of Energy for Rural Development. Annual Review of Environment and Resources*, 2005, vol. 30, pp. 117–144 , Online: http: envirn.annualreviews.org

[194] Energitica India, *Renewable Energy and their Usage in Indian Rural Sector,* Rudicon Conference on Sustainability through water conservation and renewable energy, (30th May 2014)




***Total Hydropower installed capacity in India***[195]

There is a need to shift towards setting up small-hydropower generating plants, hence electricity shall be generated economically, efficiently and in an environment friendly manner.

***Wind Energy*** **-** Even today, more than 700,000 wind pumps are in regular use over the world.[196] In India, the total energy capacity of wind power is 28700 MW, with the state of Tamil Nadu having the highest installed capacity of wind power with a total of 7515 MW.[197]

The basic requirement for wind pumping to be economical, is the availability of a mean wind speed of about 3 metres per second.[198] The same is subject to the production done, as the cost shall decrease with an increase in production. A lot of work is required to identify the specific

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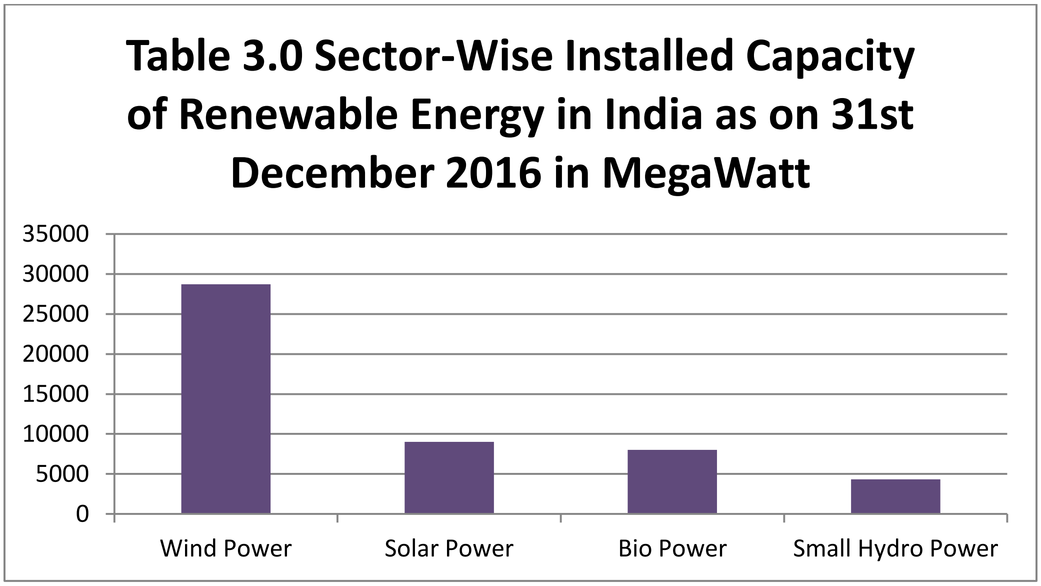
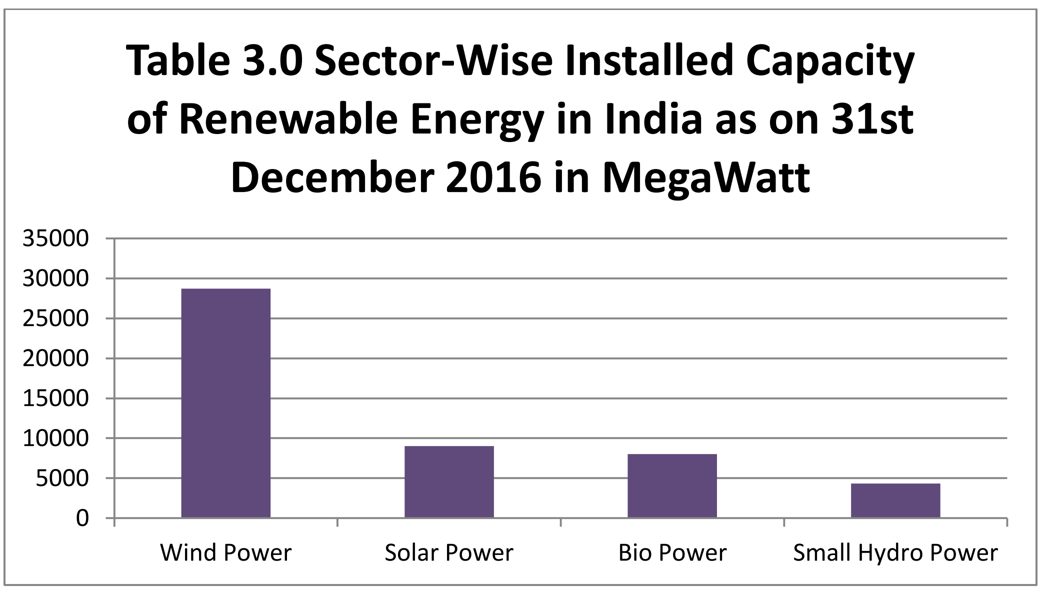
195*Annual Report 2015-2016*, Ministry of new and renewable energy, Government of India
196 Maheshwar Dayal, RENEWABLE SOURCES OF ENERGY, INDIA INTERNATIONAL CENTRE QUARTERLY, Vol. 10, No. 3 (SEPTEMBER 1983), pp. 295-307, Online: http://www.jstor.org/stable/23001369
197*Annual Report 2016-2017*, Ministry of new and renewable energy
198*Report of the United Nations*, Conference on New and Renewable Sources of Energy, (A/Conf/100/11—198)

wind energy possibility, yet it can be said that many of the developing countries have an adequate wind speed.[199] Development of this technology is resulting in improving efficiencies and reducing costs of electricity production. As of 2016, wind power contributes to the maximum part of renewable energy installed in India as depicted in Table 3.0,[200] below.




***Geothermal Energy* -** It refers to the energy derived from the heat in the centre of the earth, this proves being useful for space heating, crop drying or even in cooling systems for vapour absorption. The cost of developing geothermal resources by drilling is relatively high, hence there has not been much progress in this area in India and only a fraction of the potential areas

[199] *Id*
[200] *Annual Report 2016-2017*, Ministry of New and Renewable Energy, Government of India

have been scientifically investigated or developed.[201] Geothermal energy can very efficiently be used in the on-grid and off-grid developments, specially in the rural electrification. The geothermal potential of India is about 10,600 MW, yet due to the high initial cost work in this sector is still required to be initiated efficiently.[202]

***Solar Energy*** **-** The energy received from the sun is enormous with the only disadvantage being its dispersed form. Thus, the isolation rate in India, a high incident tropical country, is only 5-8 kilowatt hours per square metre per day, and the biggest constraint in further spreading the use of this technology which is available at a large scale today is the higher initial cost.

Though, the government is involved in taking various measures for bringing the development of this area of energy building-[203]

- 26 Solar Photo Voltic Power Plant projects of aggregate 330 MW capacity have been commissioned by the MNRE. Thus, 523 MW solar PV projects and 202.5 MW solar thermal power projects have been commissioned under the bundling scheme. Under the 100 SPV power plants, 78 projects were selected to set up 98 MW capacity projects from 12 States. Against this, 71 projects of total capacity of 90.80 MW have been connected to the grid. A Payment Security Mechanism involving a revolving fund of Rs.486 crore has been put in place to ensure timely payments to developers in the event of delays or defaults in payments.

- Under the 750 MW Viability Gap Funding project scheme under Phase II Batch I, large-scale ground-mounted solar PV projects with cumulative capacity of 490 MW have been commissioned and are under commercial operation, thereby bringing the aggregate capacity commissioned and under commercial operation in this scheme to 680 MW across seven states. Under the 2000 MW VGF scheme under phase II batch III, the work has been initiated by signing required documents for 2395 MW in five states and under the 5000 MW VGF scheme under phase IV batch II for 1020 MW in three states.

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[201] *Id* at 19

[202] Shivam Mishra, *Geothetmal Energy and Scope in India,* Times of India (March 1, 2018)

[203] *Id.*

- Under the scheme for setting up of 1000 MW of Grid connected Solar PV power projects by Central Public Sector Undertakings and government organizations under various central, state schemes, self-use, third party sale and merchant sale with Viability Gap Funding (VGF) under Phase-II of Jawahar Lal Nehry National Solar Mission, MNRE had allocated 1037.26 MW capacity to 16 CPSUs and Government organizations within the sanctioned funds of Rs.1000 Crore for this scheme.

- Under the Mission, the Ministry has also set up the following schemes:

  i. Under the grid-connected solar PV power projects (3000 MW) by National Thermal Power Corporation and other PSUs, tenders for 3000 MW capacity project has been allotted to Andhra Pradesh (1250 MW- all in solar park), Rajasthan (420 MW in solar park, 230 MW outside solar park), Uttar Pradesh (100 MW outside solar park), Karnataka (600 MW in solar park) and Telangana (400 MW outside solar park) have been issued by NTPC Ltd.

  ii. Lowest bid for solar power in the country (without any VGF) at Rs. 4.34 per unit has been received for solar PV power plants to be set up at Bhadla Solar Park in Rajasthan under this scheme

  iii. Project for Setting up of 15,000 MW of grid-connected Solar PV power plants through NTPC Limited and NTPC Vidyut Vyapar Nigam Limited (NVVN) under National Solar Mission is under implementation.

- Under the Grid-Interactive Rooftop Photo Voltaic project, 3044 MW powered solar rooftop systems have been sanctioned and approved of and aggregate 506 MW powered systems have been installed in residential, industrial, commercial and institutional sectors.

- Solar rooftop projects are being implemented by State Nodal Agencies (SNA's), Solar Energy Corporation of India (SECI), Public Sector Undertakings (PSUs) and other Multi Government Agencies (MGAs), Private Developers etc. During the year 2016-2017 solar systems having total capacities of 98.50 MW power which includes solar lanterns, solar home lights, solar street lights, solar pumps and power plants were installed in various States.

- Eleven Concentrated Solar Thermal systems for heating and cooling applications with 5090 sq. m collector or reflector area were installed and commissioned and fifty-four Concentrated Solar Thermal projects with 24930 sq. m collector/ reflector area are under installation for process heating, air conditioning and steam cooking requirements in industrial, institutional and commercial establishment.

The ***Private Sector***is also actively involved in contributing towards this development-[204]

- The National Solar Mission, which is a plan to add 20,000 megawatts of new grid-connected solar generation capacity is to be accomplished through the private sector in a span of three phases upto 2022.

- The Indian Renewable Energy Development Agency finances huge projects such as photovoltaic (PV) projects, but the commercial banks have mostly remained outside the loop.

India has a potential of 750 GW solar power, and as various initiatives are being taken and state as well as the private sector is working in this regard, a positive change can surely be witnessed quiet soon.

Also, the government is working towards gaining International cooperation by hosting the International Solar Alliance Summit which shall prove being beneficial for further projects in this area.[205]

***Bio-energy*** **-** Animal and human waste, industrial and municipal wastes and agricultural residues have enormous energy potential. The technology mostly used to obtain energy through processing these products is biogas.

The potential for biogas is large in India as well as other developing nations as the process is economical, the technique is not requiring a specialized hand and the process is beneficial for cleaning the society in the most efficient manner. Various modern techniques of using immobilized cells and enzymes of higher temperature digestion and temperature control where required, can give very useful results.

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204 Mohua Mukherjee, *Private Participation in the Indian Power Sector: Lessons from Two Decades of Experience*, Published October 2014

205 Dipanjan Roy Chaudhury, *India to strengthen solar cooperation at ISA summit,* Economic Times (March 7, 2018)

## *Government Initiatives*

***Deen Dayal Upadhyaya Gram Jyoti Yojana*** **-** In 2004, the Ministry of Power defined an electrified village to be inclusive of:[206]

- Basic infrastructure such as distribution transformer and distribution lines provided in the inhabited locality as well as the Dalit Basti hamlet where it exists.

- Electricity being provided to public places like schools, panchayat office, health centres, dispensaries, community centers etc.

- The number of households electrified should be atleast 10 per cent of the total number of households in the village.

According to this definition, under the Deen Dayal Upadhyaya Gram Jyoti Yojana, out of the scope of 129,064 un-electrified villages 97 per cent have been electrified and out of the 780,464 villages to be Intensively electrified, 63 per cent have been achieved.[207]

The initiative aims to provide electrification through the off-grid approach, the solar standalone systems for households contain fan, LED lamps, mobile charging point and power point for appliances and public buildings to have solar street lightings and solar rooftops, majority of the villages being targeted are in North-East region.

But, these decentralized solutions even though a requirement of these regions, whether provides for a stable alternative to the grid connectivity is a question as the connections provided to these households are often unreliable and the two free-of-cost LED bulbs they are entitled to are often siphoned off to the black market by unscrupulous sub-contractors.[208]

## *National Biomass Cook-stoves Initiative*

For the purpose of deploying improved biomass cooking stoves, several pilot projects have been taken up, according to the Ministry of New and Renewable Energy in its Annual Report of 2016-

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[206] Ministry of Power, Notice vide letter No. 42/1/2001-D(RE) dated 5th February 2004 and its corrigendum vide letter no. 42/1/2001-D(RE), (February 17th, 2004)

[207] Ministry of Power, *Executive Summary of RE Component of DDUGJY*, February 2018

[208] Mukta Patil, *Basic Energy Access does not unlock broader socio-economic benefits,* India Spend (May 18, 2017)

2017, and at present 53 models of improved cooking stoves have been approved by the Ministry, as per test reports of the Test Centres.

## *Conclusion*

The paper has dealt with necessarily only certain aspects of renewable energy, their development and status. These sources of energy though require a certain initial costs to be incurred are beneficial in the long run, they are capable to meet the growing part of the modern energy needs and bringing a complete energy revolution. It is estimated that by the end of the coming two decades almost half of the total energy in India could come from biomass and hydropower and over twenty percent from solar, wind and other technologies provided the required initiative is taken is a right manner.

Currently, the government as well as the private sector is involved towards taking steps for upgrading the electrification statistics of India, but even though the use of renewable sources can be seen to have a positive growth rate, the conventional sources are also being developed further at a higher rate. The Private as well as the Government sectors are working with a profit motive, they are focusing towards the unconventional technologies but, also boosting the production of conventional methods rather than shifting the complete focus on development through the unconventional techniques, this mindset is required to be changed.

Further, in regard with the rural electrification, the aim should be to connect the houses with the off-grid system for the time being but upgrade the villages which are electrified in this manner, to the grid connectivity as soon as practicable.

# ***Paradigm Shift of the Agro-Energy Sector in the Alternate Energy era***


### *Abstract*

Initiatives like DDUGJY, Saubhagya and Kusum Yojanas and Schemes by the Central Government, to stabilize over exploitation of non-renewable energy in the 21st century contemporary India is a decent start towards the acceptance of renewable energy in the agro-energy sectors. A fine execution and implementation of these schemes by the government – backed by legislature – would ensure a healthier and safer environment to the citizens of this country. In this tryst with energy, India having a population of over 1.3 billion most earnestly requires immediate attention in matters relating to environmental degradation by misuse and wastage of energy supplies as well as abuse of the limited fossil energies.

The usage of solar, wind, hydro and biogas energies are certifying as viable sources of generation of electricity and the environmental degradation caused by the practice of renewable energies like such are close to nil. India needs to shift its paradigm and develop itself into a safer and smarter country. With rising campaigns against usage of coal/thermal/nuclear power plants for the generation of electricity, India looks forward towards a technologically smarter future.



***Keywords***: Saubhagya, Environment, Renewable Energy



***Authors: Mayank Shekhar &Keshav Basotia***

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## *Introduction*

The Pradhan Mantri Sahaj Bijli Har Ghar Yojana (‘Saubhagya’) launched in September 2017, which claims to ensure the electrification of all willing households in the country, is too ambitious a project. While it makes extravagant promises to provide a free electricity connection to all willing Below Poverty Line households and to all others on a payment of Rs. 500 (which shall be recovered by the power distribution companies/power departments in 10 instalments along with electricity bills), yet, it expects the poor to pay the bills without providing any subsidy to ease their burden. Even to the best of their abilities the poor would most often not be in a position to pay regular electricity bills, which in turn could result in discontinuation of electricity supplies. The government has conveniently overlooked the fact that for the poor in some States, the inability to pay an electricity bill is a big impediment.

Despite the government’s aggressive village electrification programme, the Deen Dayal Upadhyay Gram Jyoti Yojana launched in July 2015, under which 78% of 18,000 villages have been electrified, it was realised that the problem of electricity ‘access’ wasn’t resolved. This new scheme is just another way of refurbishing the Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY).

There are about 4 crores un-electrified households estimated in the country of which about 1 crores BPL households in rural areas are already covered under sanctioned projects of DDUGJY. Thus, a total of 3 crores households, 2.5 crores in rural areas and 50 lakh in urban areas, are expected to be covered under this scheme.

## *Key Points*

• A village is declared to be electrified if 10% of the households are given electricity along with public places such as schools, panchayat office, health centers, dispensaries and community centers.

• With a large number of households still remaining without access to electricity, the scheme aims at ensuring the coverage of both - urban and rural households.

• It was seen that the electricity distribution companies don’t want to supply electricity to the villages even when the electrification has taken place. By providing electricity access to all households with prepaid and smart meters, demand will be created which in turn will force the distribution companies to supply electricity to these villages.

• The government's record is sullied by the fact that reportedly more than a fourth of the households in the "electrified villages" do not have a connection to the electricity.

• With no subsidy components for a monthly electricity consumption, the Gram Panchayat and public institutions in the rural areas will be authorised to carry out billing and collection tasks which have been too painful for the electricity distribution companies.

• States have also been provided with an incentive of 50% of their loan being converted to grants, if the electrification targets are met by 31 December 2018.

• The Rural Electrification Corporation Limited (RECL) will remain the nodal agency for the operationalization of the scheme throughout the country. In 2015, PM Modi had announced to electrify the remaining 18,452 un-electrified villages within 1,000 days of his Independence Day speech. The Power Ministry, however, is expected to electrify all habited villages by December 2018.

### *Last Mile Connectivity*

The electricity connection to households includes the release of electricity connections by drawing a service cable from the nearest electricity pole to the household premise, installation of an energy meter, wiring for a single light point with an LED bulb and a mobile charging point. In case, the electricity pole is not available near the household for drawing the service cable, an erection of additional pole along with a conductor and other associated accessories shall also be covered under the scheme. Poor households would be provided electricity connections free of cost. Other households would also be provided electricity connections under the scheme, on payment of Rs. 500 which shall be recovered by the DISCOMs/Power Departments in ten (10) installments along with electricity bills.[209] There are no subsidy components in the Scheme for the consumption of power. Additionally, there is no provision in the scheme to provide free power to any category of consumers. The cost of electricity consumption shall have to be paid by

[209]FAQson Pradhan Mantri Sahaj Bijli Har Ghar Yojana "Saubhagya" , 27-September-2017 11:27 IST, Press Information Bureau, Government of India, Ministry of Power

the respective consumers as per the prevailing tariff of the Distribution Company/Power Department.

***In the distribution sector, two major schemes; DDUGJY for rural areas and IPDS in urban areas are already under implementation - then what was the need for a new scheme?***

Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY) envisages the creation of basic electricity infrastructure in rural areas, strengthening & augmentation of existing infrastructure, metering of existing feeders/distribution transformers/consumers, to improve quality and reliability of power supply in rural areas. Besides this, last mile connectivity and free electricity connections are also provided to BPL households only identified by the States as per their lists.

However, among the villages which have been electrified in the past since quite some time now, many households still do not have electricity connections for various reasons. Some of these households who don't even have BPL cards and are too incapable of paying applicable initial connection charges. There is also a lack of awareness as to how to get an electricity connection and thus, taking a connection is not an easy task for illiterate people. In addition, there may not be an electricity pole near a household, the cost of the erection of an additional pole and a conductor is also chargeable from the households for obtaining a connection.

Similarly in urban areas, Integrated Power Development Scheme (IPDS) provides for the creation of necessary infrastructure to provide electricity access however, some households do not have an electricity connection, primarily on account of poor economic condition as they are incapable of paying for the initial connection charges.

Therefore, Saubhagya has been launched to bridge such gaps and comprehensively address the issues of entry barriers, last mile connectivity and release of electricity connections to all un-electrified households in rural and urban areas.

***What would be the estimated rise in power demand with the inclusion of 4 crore new connections in the electricity network?***

Considering an average load of 1 KW per household and average uses of load for 8 hours in a day, there will be a requirement of additional power of about 28,000 MW and additional energy of about 80,000 million units per annum. This is a dynamic figure. With the enhancement of income and change in usage of electricity, the demand of electricity is bound to vary. This figure will also vary if the assumptions are changed.

***Other Benefits***

The scheme will help India, the world's third-largest energy consumer after the US and China, to help meet its global climate change commitments - as electricity will substitute kerosene for bringing light in a household. The bringing of light to a household through electricity will also help in improving education, health, connectivity with the multiplier effect of increased economic activities and job creation in the country.

***How will it work?***

To ensure on-the-spot registration, mobile applications will be used. While free connections will be provided to below poverty line (BPL) households, even those not covered under this category can avail it by paying Rs. 500 in 10 instalments of Rs. 50 each along with their monthly electricity bills. For those household where the national electricity grid can't reach, households will be provided with solar power packs along with battery banks. State-run Rural Electrification Corp. is the nodal agency for the scheme.[210]

***How will the beneficiaries be identified?***

The beneficiaries for free electricity connections will be identified using Socio Economic and Caste Census (SECC) 2011 data.

***Analysis* -** By roping in panchayats and other village-level institutions, the government aims to ensure that Saubhagya does not remain a top-down endeavour. However, the government hasn't found a way out of the other major challenge that afflicts power supply in the country: 'An electricity connection does not always ensure quality power supply.'

The government's claims of being power surplus notwithstanding, it is common knowledge that in many parts of the country, people face power-cuts for several hours. Ensuring reliable supply requires improving the health of distribution companies. The Ujwal Discom Assurance Yojana

[210]FAQson Pradhan Mantri Sahaj Bijli Har Ghar Yojana "Saubhagya" , 27-September-2017 11:27 IST, Press Information Bureau, Government of India, Ministry of Power

(UDAY) scheme, launched in 2015, has made some headway in improving the finances of the state distribution companies. [211]

The losses registered by these companies have been more than 20 percent less this year. It will be interesting to see how states square the Saubhagya scheme with the requirements of UDAY. Saubhagya grants them the leeway to lower tariffs for people covered under the scheme. But at the same time, UDAY makes it incumbent on the states to pay for all the future losses of the distribution companies. It will be interesting to see how the states strike a balance between the imperatives of improving access and the demands of keeping the electricity distribution companies in good health.

***Changing paradigms in the Agro-Energy Sector-*** Agriculture plays a vital role in India's economy. Over 58 per cent of the rural households depend on agriculture as their principal means of livelihood.

If God appeared in the dream of a paddy farmer in India and said, "You have made me happy with your hard work, make any three wishes and they will be granted," the farmer will say "I want rain, rain, rain."[212]

On the onset, it is factually evident that to reduce the dependence on the monsoons, India's farmers have taken 12 million electricity connections and 9 million diesel pump sets with which they pump underground water for irrigation.

Although agriculture's stake in India's economy is declining, as it contributes to less than 15% of India's GDP, yet, it still employs 50% of the country's labour workforce. Not surprisingly, but, perhaps, up to 20% of all the electricity used in India is for agriculture, mostly for irrigation. In some states, this can go as high as 30-50% of all the electricity used in the state.

There are many states where power for agricultural causes is highly subsidized, and this, combined with an irregular supply of electricity, most often causes farmers to leave their pumps

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*211 UDAY SCHEME TO EFFECT STATE FINANCES OVER MEDIUM TERM –RBI, HTTP://INDIANPOWERSECTOR.COM/2016/04/UDAY-SCHEME-TO-EFFECT-STATE-FINANCES-OVER-MEDIUM-TERM-RBI/ - LAST VISITED ON 15 FEB, 2018, 13:00 IST*

212 *Will the Sun God answer poor farmers' prayers or make things worse*, Amit Jain, The World Bank Blog

on all the time. This wastes both electricity and water, with too much energy being used and too much groundwater being extracted, often way more water than needed.

Since more than half of India's cultivated land is yet to be irrigated, a business-as-usual scenario will lead to a huge rise in India's energy needs for agriculture alone.

***Is Solar Energy a Better Alternative?***

India's geographical advantage makes solar-powered water pumps an excellent alternative to diesel powered pumps in particular. Studies estimate India's potential for solar PV water pumps for irrigation to be 9 million to 70 million pump sets.

Further solar pumps can substantially improve the financial health of State Electricity Board (SEB) by reducing subsidized power to farmers and eliminating incremental capital expense to connect farms to grid which is estimated to be ₹1.7 lakh per connection.[213]

While the upfront capital cost of solar powered pumps is higher than traditional pumps, a lucrative payback economics of 3-5 years is possible given the high operating cost for diesel pumps.

Indian government led by the Ministry of New & Renewable Energy (MNRE) has placed a substantial emphasis on further penetration of solar PV power pumps with a vision to replace existing 26 million pumps with more efficient solar power pumps.

In the Union Budget, the Finance Minister announced a ₹415 crores package for installing 100,000 solar powered pump sets. In November 2014, the government launched a programme for promoting 30,000 solar pumping systems per year for the purpose of irrigation.

The programme will be implemented alongside state governments. MNRE will provide a subsidy of 30 per cent (maximum amount is capped per category of pump) and soft loan at 5 per cent with an additional subsidy from state governments.

Rajasthan has been a pioneer in promoting solar water pumps, and offers an additional subsidy of 56 per cent over and above the MNRE subsidy, which means that the solar water pump owner gets 86 per cent subsidy in total.

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[213] *Renewable Energy: Best Bet For Farm Sector*, Vikas Dawra, Business Line, The Hindu

In Tamil Nadu, a total of 80 per cent subsidy is provided, whereas in Punjab, the total subsidy comes to about 70 per cent. Maharashtra has recently proposed a plan to provide 5 lakh solar pumps to farmers and is in the process of formalizing the program.

In spite of favourable macro-economic and government support, solar power pumps have still lagged considerably vis-a-vis diesel power pump addition. Total installed solar pumps are merely 25,000 vis-a-vis 10 million installed diesel pumps.

## *Central Governments' plan to boost farmers' Solar Power Use*

The Centre has announced a ₹1.4 lakh crores scheme for promoting decentralized solar power production of up to 28,250 MW to help farmers.

The Centre will spend ₹48,000 crores on the ten-year scheme which was announced in the Union Budget 2018-19. Kisan Urja Suraksha evam Utthaan Mahaabhiyan or "KUSUM" scheme would provide extra income to farmers, by giving them an option to sell additional power to the grid through solar power projects set up on their barren lands.

It would help in de-dieselizing the sector as also the Electricity distribution companies. India had about 30 million farm pumps that include 10 million pumps running on diesel.

### *KUSUM Yojana - Solar Power Subsidy Scheme for Farmers*

During the Budget 2018-19Announcement, a Scheme named as "KUSUM" was announced. The full form of KUSUM is Kisan Urja Suraksha evam Utthan Mahabhiyan. The main objective of this Scheme is to make Solar Pumps to ensure less consumption of electricity. Being the great initiative it is to the agro-energy sector, this scheme is said to not only benefit farmers but the whole country - not in the farming perspective but also for electricity saving.

### *Benefits of KUSUM Solar Pump Subsidy Scheme*

1. Under this Scheme, the farmers will have to borne only 10% of the cost. The remaining 90% of the cost will be borne by the government. The scheme will cost around 1.40 Lakh Crore to the government. Around 17.5 Lakh Diesel Pumps will be converted into Solar Pumps in the First Phase.[214]

[214] Central Government Schemes, Pradhan Mantri Yojana, Kusum Yojana.

2. This scheme will not only save electricity consumption but also produce around 28 thousand Megawatt additional energy from solar power.
3. This scheme will benefit farmers in two ways –
    i. The farmers will get free electricity for irrigation,
    ii. Any extra electricity can be sent to the grid and the farmers are entitled to earn good money too.
4. All farmers are eligible under this scheme.

## *Conclusion*

Initiatives like DDUGJY, Saubhagya and Kusum Yojanas and Schemes by the Central Government, to stabilize over exploitation of non-renewable energy in the 21$^{st}$ century contemporary India is a decent start towards the acceptance of renewable energy in the agro-energy sectors. A fine execution and implementation of these schemes by the government – backed by legislature – would ensure a healthier and safer environment to the citizens of this country. In this tryst with energy, India having a population of over 1.3 billion most earnestly requires immediate attention in matters relating to environmental degradation by misuse and wastage of energy supplies as well as abuse of the limited fossil energies.

The usage of solar, wind, hydro and biogas energies are certifying as viable sources of generation of electricity and the environmental degradation caused by the practice of renewable energies like such are close to nil. India needs to shift its paradigm and develop itself into a safer and smarter country. With rising campaigns against usage of coal/thermal/nuclear power plants for the generation of electricity, India looks forward towards a technologically smarter future.


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- **Founder of DR. VIJAY FOUNDATION (Philanthropic organization) -** The Moto of the Trust is *Development is life!*. This is a Non-Profit organization working in the field of Agriculture, Health, Education, Environment, livelihoods and Advocacy & Empowerment. Mr. Raj Singh Niranjan has donated all his

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Sh. Raj Singh Niranjan ji with the Officers of the Power Sector in the Three Day Training Program on “Electricity Act 2003, CERC Regulations and SERC”, organized at the National Power Training Institute (Ministry of Power, Govt. of India) on 1st March, 2017.

Sh. Raj Singh Niranjan ji delivering his presentation at the training program on “Electricity Act, 2003”held at National Power Training Institute, Faridabad.

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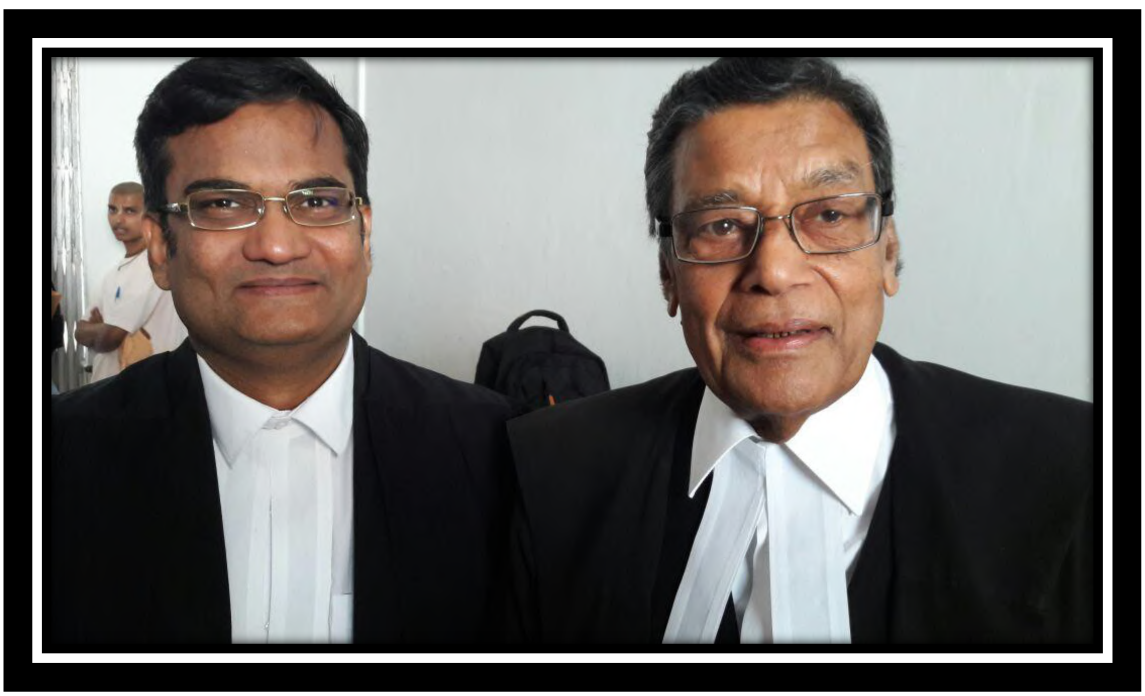
Dr. Vijay Singh ji (IAS, Former Commissioner & Principal Secretary, Govt. of M.P.), Dr. G. P. Patel (former Executive Director, NHPC) and Sh. Raj Singh Niranjan ji Presenting the certificate to the topper of 2017, Mr. Chandan Singh (DERC) for the ‘Electricity Law Online Certificate Course’ by Dr. Gopal Energy Foundation.


Sh. Raj Singh Niranjan ji presenting the DGEF Annual Conference book “Energy for All” to Sh. K. T. S. Tulsi, MP, Rajya Sabha & Sr. Adv.



Sh. Raj Singh Niranjan ji meeting with the legendary Sh. K K Venu Gopal, Sr Adv. Supreme Court.


Railway Energy Management Company Ltd (REMCL) is doing a wonderful job for Power Reforms in Railway sector.Sh. Raj Singh Niranjan ji presenting CEO Sh. Sudhir Saxena with a book on Electricity Laws in India.

Sh. Raj Singh Niranjan ji presenting the book on Electricity Laws in India to Sh. K. S. Popli ji, CMD, IREDA Ltd. (A Govt. of India Enterprise)


Sh. Raj Singh Niranjan and Smt. Dr. Rajni Pate attend World Food India 2017 along with Foc Processing Tycoons Aditya Bagree, Group Director, Bagrrys India Ltd,  AbhijeetPai,Grou President, Lotus Chocolate and Harish Ramn Karachi Backery .

TILA addressed as Agro-Business and Energy Law Expert consultants.

Sh. Raj Singh Niranjan presenting the Rules of International Energy Arbitration Centre, New Delhi to Sh. Pranav Mehta, President elect of Global Solar Council & Chairman NSEFI at Ahmedabad.

Sh. Raj Singh Niranjan ji presenting the IEAC Rules Arbitration, 2017 book to Sh. Rajiv Sharma ji (C.M.D. Power Finance Corp.)


Sh. Raj Singh Niranjan ji delivering his speech on “Role of Law in Republic India” at the 1st National Law Seminar, organized by Prestige Institute of Management, Gwalior.


Sh. Raj Singh Niranjan ji with the Panel members presenting the book on “Role of Law in Republic India” at the 1st National Law Seminar, organized by Prestige Institute of Management, Gwalior.

Sh. Raj Singh Niranjan ji (Founder of TILA) and Sh. Ashok Aneja Ji (Director of DGEF) meeting Sh. P.K. Pujari ji (Chairperson & Chief Executive of CERC).


Sh. Raj Singh Niranjan ji attending the Round Table discussion on Organic Farming with representatives from China, Austria, Newzeland , Turkey at the Organic WorldCongress 2017.

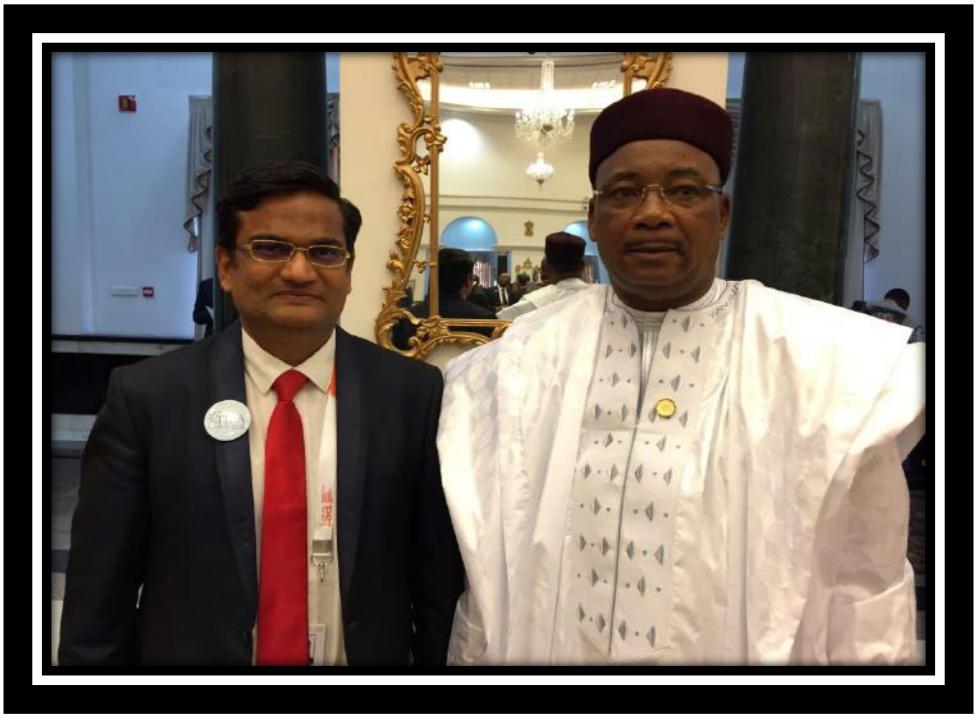

Sh. Raj Singh Niranjan ji delivering his speech on “Energy Laws in India” at Lloyd Law College, Noida.

Sh. Raj Singh Niranjan ji chairing the technical session for the 2nd Edition of the International Symposium on Contemporary International Affairs on "Whether India should sign the Rome Statute on the establishment of the International Criminal Court of Justice" organized by Jamia Millia Islamia, New Delhi


National Solar Energy Federation (NSEF) has become Institutional Partner for TLA INTERNATIONAL ENERGY CONFERENCE 2016. Mr. Pranav R. Mehta, Chairman along with Mr. Y. K. Jain, Advisor of Federation meeting Mr. Raj Singh Niranjan at New Delhi to finalize the understanding.

Sh. Raj Singh Niranjan ji and Sh. SHashank Shekhar Rai meeting his Excellency Sh. Upendra Tripathi ji (D.G. International Solar Alliance).

Sh. Raj Singh Niranjan meeting Sh. Subramaniam Swamy ji, an intellectual politician & Sr. Advocate.



Sh. Raj Singh Niranjan meeting with H.E. President of Niger.

Sh. Raj Singh Niranjan with Smt. Meagon Fallone (CEO Barefoot College, Rajasthan).

Sh. Raj Singh Niranjan and Sh. Abhay Bakre ( Director General, Bureau of Energy Efficiency [BEE] ) discussing as to how BEE and DGEF can collaborate on Online Certification course on Electricity Laws and Energy Efficiency.


Sh. Raj Singh Niranjan presenting the book on “Electricity Laws in India” to Sh. Arvind Kejriwal.

# PART - G

Online Registration at:
www.dgef.in

# TICE-4

# 4th TILA INTERNATIONAL CONFERENCE ENERGY 2019

## ON
## "Energy Revolution in India"

**April 15, 2019**

**Time 8:30 Hrs to 16:30 Hrs**

**VENUE : SILVER OAK, INDIA HABITAT CENTRE, NEW DELHI-110 003, INDIA**

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**TICE - III**

- THEME - A : International Initiatives for Energy Revolution
- THEME - B : National Initiatives for Energy Revolution
- THEME - C : State Initiatives for Energy Revolution

**TICE - II**

- BRAHMA SESSION : Generation/ Production of Energy
- VISHNU SESSION : Transmission/ Distribution/ Supply of Energy
- MAHESH SESSION : Consumption of Energy

**TICE - I**

- MAKE IN INDIA : New & Renewable Energy
- PRODUCE IN INDIA : Power
- FIND IN INDIA : Petroleum & Energy Gas

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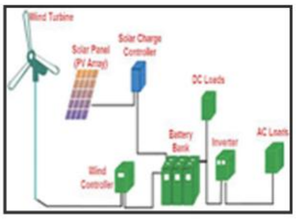


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