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From the Chairman's Desk

Dear Friends

June is always a favourite month for the wind fraternity. It is the start of high wind season. Just as a farmer is waiting for reaping his seasonal harvest, the investor in wind energy gets his return during the high wind months lasting up to September.

This windy season unfortunately our members are facing severe problems of back down in two States in particular i.e. in Rajasthan and in Tamil Nadu. In Tamil Nadu it is largely due to NTPC, NLC & Kudankulam units which are pumping in 110 Million Units per day in June 2015 as against 70 M.U they were sending to Tamil Nadu from Central Units during 2014. Your Association has written to the Prime Minister seeking his intervention to advice NTPC, NLC & Kudankulam units to reduce their generation by taking some units for Annual Maintenance and running the balance Thermal Units to their technical minimum.

One more reason for the severe back down is the lack of visibility of likely wind generation for the Grid Manager. This issue is being resolved with the setting up of communicative meters which is expected to be completed within a month. We thank the Tamil Nadu State Government, TNEB, NIWE and the MNRE for their total support in expediting this project. This is a long term solution.

In our petition to the Prime Minister, we have indicated that we expect more evacuation Under" MUST RUN" status awarded by Indian Electricity Grid Code (IEGC). Wind Mills should be permitted to run in full and Central Thermal and Nuclear units should be stopped for Annual Maintenance between June and September and reduce their supply to accommodate Wind Energy to meet the load. We have also indicated that due to non-availability of Spinning reserves, the Grid Code may please be relaxed for Renewable Energy from 150 MW limitation in variation of Scheduling. We have suggested that for the Wind generation in Tamil Nadu, the permissible limit in variation of Wind Scheduling to be at least ±10% of 4,200 MW i.e 420 MW. In a 1,45,000 MW size of Indian Grid system occasional 420 MW variation from RE may not affect the stability of the Grid. This is like permitting a child to pour a mug of water in a big pond. It won't make any perceptible difference. We are in constant touch with the Grid Managers in Tamil Nadu and airing our concerns to the highest authorities. They also want to solve the problem and the Forecasting Project currently undertaken by NIWE would be the solution for our mutual benefit

June 2015 is particularly special since we are organising the 4th International Wind Conference & Exhibition after a gap of two years. When we first came up with the idea of starting an Annual Conference we coined the theme of the Conference series as "WE20 by 2020" i.e. Wind Energy should have a penetration of 20% in the overall Energy mix by the year 2020.

INDIAN WIND POWER ASSOCIATION
Door No. E, 6th Floor, Tower-1, Shakti Towers
No. 766, Anna Salai, Chennai 600 002
Phone : 044 4550 4036 I Fax : 044 4550 4281
E-mail : iwpahq@windpro.org, Website : www.windpro.org

This Conference was planned as an Annual event and national and international experts were invited to deliberate. Actionable points which emanated from these deliberations whichever appropriate were submitted to the Government for propagating the cause of Renewable Energy and Wind Energy in particular.

Unfortunately during the years 2013 and 2014 we were not in a position to organize this annual International Conference because the industry was going through a lean patch and the policies were not conducive. Now with an air of optimism and the Government's emphasis on Renewable Energy, we thought it fit to restart the series which fits in nicely with the Government's ambitious targets of almost a three-fold increase in installations by the year 2022.

Such a large installation within a relatively small time frame calls for a mammoth increase in financial outlay and also a change in the mind set of people to use more and more Renewable Energy in their daily lives. The Government supported MNRE in organizing the first ever Renewable Energy Global Investors Meet in India at Delhi in February 20115, which was a grand success. A climate for investment in Renewable Energy in India was created no doubt.

A large requirement of funds means attracting the flow of private investments into this sector. A discerning investor is not taken in by "what the Government says" but closely watches "what the Government does". Wherever, a Conference of this nature is conducted which propagates the growth of Renewable Energy, it must be patronized and supported whole heartedly by the Government. Only then it proves that "what one does" speaks louder than "what one says"

I welcome and thank the Ms. Varsha Joshi IAS, Jt. Secretary, MNRE who has been a pillar of support and source of energy in all our endeavours. We also thank Shri Upendra Tripathy, Secretary, MNRE and the Shri Dilip Nigam Director, MNRE for their continuous support.

We thank all the speakers for accepting our invitation. I welcome all the delegates, exhibitors and sponsors and I am sure that they will benefit from the deliberations. I am sure that this year also, we will come up with more actionable plans to be submitted to the Government. The think tanks at IWPA had chosen the topics for the Sessions which are issues being faced by investors and consumers in their daily life. These deliberations are not just academic but are real issues faced by the industry which needs solutions.

A Conference of this magnitude cannot be organized without the support of many well-wishers and their generous contributions. I thank the sponsors who in spite of having a lean patch have contributed their mite. I would also like to thank our friends at CODISSIA for hosting this event and the numerous volunteers who have offered to help. We look forward to a fruitful deliberation.

Programme Schedule

Day 1 - EXHIBITION: 21 June 2015 (Sunday)		
Time	**Agenda**	**Speaker**
0900 – 1100	**REGISTRATION**	
1100 – 1200	**INAUGURAL SESSION**	
1100 – 1105	INVOCATION	
1105 – 1110	Lighting of Lamp	**Shri Gireesh B Pradhan** Chairperson, CERC
1110 – 1125	Welcome speech	**Prof. Dr. K Kasthurirangaian** Chairman, IWPA
1125 – 1140	Forecasting of wind energy in India	**Dr. S Gomathinayagam** Director General, NIWE
1140 – 1150	Key note address "Prospects & Challenges of Wind Energy in India to attain 20% grid penetration by 2020"	**Mr. Stefan Gsänger** Secretary General, WWEA, Bonn, Germany
1150 – 1200	Awards Distribution Ceremony "Best Performing Wind Farms"	**Special Guest - Shri Rajesh Lakhoni, IAS** Principal Secretary, Energy Government of Tamil Nadu
1200 – 1230	Inaugural Address by Chief Guest	**Shri Gireesh B Pradhan** Chairperson CERC
1230 – 1250	Key Policy and regulatory measures to be addressed	**Shri Rajesh Lakhoni, IAS** Principal Secretary, Energy Government of Tamil Nadu
1250 – 1310	Renewable Energy Act 2015	**Shri A Velayutham,** Ex-Member, MERC
1310 – 1330	**CHIEF GUEST visit to the Exhibitors' Stalls**	
1330	LUNCH	

Day 2 – CONFERENCE- Main Sessions : 22 June 2015 (Monday)		
Time	**Agenda**	**Speaker**
1000 to 1115	**SESSION 2 : Challenges to be addressed to achieve 60 GW by 2022**	
	Session Chairman	**Ms. Varsha Joshi,** IAS, JS MNRE
1010 to 1040	Conference theme WE20 by 2020	**Shri Ajit Pandit,** Idam Infrastructure
1040 to 1115	Gujarat Energy Transmission Corporation Ltd. (GETCL)'s perspective	**Shri B B Mehta,** CE, SLDC, Gujarat Energy Transmission Corpn. Ltd.
1115 to 1130	**TEA BREAK**	
1130 to 1145	A global perspective	**Dr. Rahul Tongia** Brookings India
1145 to 1200	Q&A Session and Closing Remarks	
1200 to 1215	Introduction to the Indo-German Energy Forum (IGEF) and the opportunities for private sector collaboration	**Mr. Markus Wypior** IGEF Support Office
1215 to 1245	**"Overview of the German Wind Market and the Lessons for India"** Fraunhofer-Institut fur Windenergie und Energiesystemtechnik IWES, Kassel, Germany (address through Skype)	**Dr. Kurt Rohrig,** Deputy Director Division Director Energy Economy & Grid Operation
1245 to 1400	**LUNCH BREAK**	
1400 to 1600	**SESSION 2 (a): REPOWERING**	
	Session Chairman	**Mr. Markus Wypior,** IGEF Support Office
1400 to 1410	Introduction to the Repowering Study conducted by the IGEF Support Office	**Shri Ankan Datta,** IGEF Support Office
1410 to 1440	Findings and outcomes of the Repowering study conducted by the IGEF Support Office	**Shri Ajit Pandit,** Idam Infra
1440 to 1455	Project Developers point of view	**Shri K R Nair,** Wind World
1455 to 1510	Manufacturer's view point on Repowering in India	**Shri Mahesh Vipradas,** Suzlon
1510 to 1525	Regulator's perspective of Repowering in India	**Shri Dilip Nigam,** MNRE
1525 to 1600	Q & A and Discussions	

Time	Agenda	Speaker
1600 to 1650	**SESSION 3 (a): Power Evacuation and Large scale integration of WE in grid**	
	Session Chairman	**Shri V K Agrawal,** ED, NLDC
1600 to 1615	Key grid integration issues in India - Planning/ Scheduling, Transmission Upgrades	**Dr. Balaraman** Chief General Manager, Systems Studies, PRDC
1615 to 1630	Evacuation infrastructure and Grid integration issues	**Shri Rajesh Kumar** Chief Manager, Smart Grid, PGCIL
1630 to 1645	Large Scale Grid Integration of RE Sources - the way forward	**Shri Pankaj Batra,** CEA
1645 to 1650	Q&A Session and Closing Remarks	
1650 to 1930	**SESSION 4 (a): Asset Management of Wind Projects**	
	Session Chairman	**Shri V K Krishnan,** IWPA
1655 to 1710	An integrated approach for efficient O&M management of wind assets	**Dr. Ing. Simone Massaro** Bax Energy, Germany
1710 to 1725	Industrial Internet for Asset & Operations Mgt.	**Shri Milesh Gogad** Senior Marketing Manager, GE
1725 to 1740	Perspectives from a Wind farm developer	**Shri R Balasubramanian,** GM SGIL.
1740 to 1755	Perspectives from a Wind Turbine Manufacturer	**Shri P Rajenthiran,** AVP, Gamesa
1755	TEA	
1930 onwards	Networking Dinner	

Day 2 – CONFERENCE - Parallel Sessions : 22 June 2015 (Monday)		
Time	**Agenda**	**Speaker**
1245 to 1400	LUNCH	
1400 to 1530	**SESSION 4(b): Wind Solar Hybrid System**	
	Session Chairman	**Shri Shuvendu Bose,** Director, Ernst & Young
1405 to 1420	Rationalising tariff related issues to ensure success of Wind Solar Hybrid systems	**Shri U B Reddy,** MD, Enerfra
1420 to 1435	Wind Solar Hybrid – latest trends and future scope	**Shri M P Ramakumar** Sr. VP, R&D, ReGen Powertech
1435 to 1450	Application of Wind Solar Hybrid Systems in Telecom Towers	**Shri J P Singh,** Director (Retd.), MNRE
1450 to 1505	Wind Solar Hybrid System	**Dr. J J Isaac** Former Addl. Director of National Aerospace Lab
1505 to 1530	Q & A Session	
1930 onwards	Networking Dinner	

Day 3 – CONFERENCE - Main Sessions : June 23, 2015 (Tuesday)		
Time	**Agenda**	**Speaker**
0900 to 1130	**SESSION 5 : Wind Forecasting & Scheduling**	
	Session Chairman	**Shri Pankaj Batra,** CEA, Delhi
0905 to 0920	State of the art methodologies for wind resource assessment	**Mr. Miguel Ferreira,** CEO, Megajoule
0920 to 0935	Optimal Design of Wind Machinery incorporating Virtual Simulation	**Shri Naveen Chakradhar,** Senior Technical Specialist, MSC Software
0935 to 0950	REMC	**Ms. Bindoo Srivastava**, Smartelectrons
0950 to 1005	Doppler Radars for Remote Sensing of Wind Fields	**Shri S B Thampi,** Deputy Director General of Meteorology & Head, RMC, Chennai
1005 to 1020	Forecasting & Scheduling in the UK	**Mr. Bihag Mehta,** OST Energy, UK
1020 to 1130	Q & A and Closing Remarks	
1130 to 1200	**TEA BREAK**	
1200 to 1300	**SESSION 6 (a): Transmission infrastructure augmentation**	
	Session Chairman	**Shri V K Agrawal,** ED, NLDC
1205 to 1220	Transmission infrastructure augmentation needed in a wind rich State like Tamil Nadu	**Shri K Rangaraj,** MD TANTRANSCO (Retd.)
1220 to 1235	Infrastructural upgradations needed to increase integration of RE in the grid	**Shri C R Srinivas** Director & CTO, Enerfra
1235 to 1250	Consenting & Strategic Environmental Assessments	**Ms. Karma Dunlop,** UK
1250 to 1300	Q & A Session	
1300 to 1400	**LUNCH BREAK**	
1400 to 1600	**SESSION 7 (a): CEOs CONCLAVE - WE20 by 2020, the way forward**	
	Session Chairman	**Shri Chintan Shah,** President, Suzlon
		Shri Madhusudan Khemkha, CMD, Regen Powertech
		Shri V K Krishnan, ED, Leitner Shriram Mfg. Ltd.
		Dr. Govind Bhagwatikar, WELSPUN
		Mr. Mark Leybourne, IT Power, UK
		Mr. Charles Yates, MD, CY Consultants, UK
1520 to 1600	Q & A Session	
1600 to 1630	**TEA BREAK**	

Day 3 – CONFERENCE - Parallel Sessions : June 23, 2015 (Tuesday)		
Time	**Agenda**	**Speaker**
1300 to 1400	**LUNCH BREAK**	
1400 to 1600	**SESSION 7 (b): Energy Storage**	
	Session Chairman	**Dr. Satyajit Phadke** Senior Consultant Customised Energy Solutions
1405 to 1420	Pumped Hydel Storage - its use in absorbing more wind energy in the grid	**Shri Essaki Muthu** Energy Consultant
1420 to 1435	Global storage concepts	**Dr. Satyajit Phadke** Senior Consultant Customised Energy Solutions
1435 to 1450	Benefits of Energy Storage in Smart Grid	**Shri Akshay Ahuja** India Smart Grid Forum
1450 to 1600	Panel Discussion	**Dr. Satyajit Phadke** Senior Consultant Customised Energy Solutions
		Shri Essaki Muthu Energy Consultant
		Shri Akshay Ahuja India Smart Grid Forum
		Shri T S Seshadri, Consultant
1600 to 1630	**TEA BREAK**	
1630 to 1730	**CONCLUDING SESSION**	
1630 to 1645	Awards Ceremony for "Best Performance of Wind Turbine Manufacturers & States"	**Dr. M Saikumar**, IAS CMD, TANGEDCO
1645 to 1700	Concluding Address : Achieving 60GW of wind installations by 2022	**Shri Upendra Tripathy,** IAS Secretary, MNRE
1700 to 1720	Summary of the proceedings of the Conference	**Shri A Raja Sukumar** Conference Convenor
1720 to 1730	Vote of thanks	**Shri Ramesh Babu** Exhibition Chairman

Speakers Profile

Mr. Stefan Gsänger
Secretary General, WWEA, Bonn, Germany

Ms. Varsha Joshi IAS
Joint Secretary, MNRE

Ms. Varsha Joshi joined the Indian Administrative Service, premier service of the Government of India in 1995. She is from AGMUT Cadre. She has done Masters in Physics from Delhi University. Presently she is the Joint Secretary in Ministry of New and Renewable Energy, holding portfolio of wind power, Improved Chulha, IREDA, Policy and Regulatory matters, Administration and others. Before that she has taken up various important responsibilities in the fields of infrastructure, industry, finance and policy in various Government departments. She has held important posts in Govt. of Delhi; Chandigarh Housing Board; Chandigarh Tourism; Public Instruction Chandigarh; Govt. of Arunachal Pradesh; Delhi Jal Board etc.

Ajit Pandit
Director, Idam Infrastructure Advisory Services
Email : ajit.pandit@idaminfra.com

Ajit Pandit has over 17 years of experience in the power and renewable energy sector. His experience in the power sector spans the technical, commercial, regulatory and financial spheres. He has worked extensively in the power and renewable energy sector in India in varied capacities as (i) Private Power Project Developer (project structuring and successful financial closure, contract finalisation, commercial execution of project from concept to commissioning), (ii) as Regulatory Advisor (regulatory assistance to several ERCs and Utilities) and (iii) as Management Consultant (industry restructuring and electricity market design assignments for Public Utilities).

He has assisted several State Electricity Regulatory Commissions in addressing regulatory issues influencing growth of renewable energy sector in India. He has also been associated with variety of renewable energy technologies such as wind energy, biomass power, bagasse based co-generation, small hydel power and solar power for development of enabling regulatory and policy framework for harnessing these RE sources. He has assisted Ministry of New and Renewable Energy (MNRE) for development of Conceptual Framework for Renewable Energy Certificate (REC) mechanism for India. He has also assisted Forum of Regulators (FOR) for development of uniform Renewable Energy Policy framework across States. Currently, he is assisting Central Electricity Regulatory Commission (CERC) for development of Norms and Regulations for Renewable Energy Tariff determination which can act as guidelines for States across India. He has assisted Maharashtra Electricity Regulatory Commission in development of innovative RPO Operating framework during 2004 and subsequently for development of RPS Mechanism within Maharashtra during 2006.

Professional Achievements:

2003	A Study Report for formulation of National Tariff Policy for renewable energy sources within India for MNES/IREDA
2006	An Approach Paper on long term development of renewable energy sources and Renewable Purchase Specification (RPS) Regulations within Maharashtra.
2006	Knowledge Partner for International Conference on Wind India 2006 by WISE.
2006	Knowledge Partner and Key Speaker on Grid integration issues for renewables and issues related to RPS implementation at 'Regulators' Retreat', Goa.
2005-07	Faculty at Induction Training Programmes for Wind Industry Professionals organized by WISE
2006-07	Speaker at Media Training Workshops conducted by MNRE/WISE.
2006	A Theme Paper on 'Transmission Expressways' for India Power Summit 2006 organised by NDTV Profit.
2007	Knowledge Partner for International Conference on Solar India 2007 by WISE
2008	Guest Speaker for Green Power 2008 organised by CII-GBC and delivered presentation on 'Renewable Tradable Certificates to advance Green Power in India'
2008	Faculty for WISE-USAID Training Programmes on 'Regulatory and Policy Framework for Market Development of Renewable Energy' for Regulators, Lenders, Utility representatives
2009	Development of Conceptual Framework for Renewable Energy Certificate mechanism for India for MNRE
2009	Assistance to CERC in formulating Feed-in Tariff Regulations for all Renewable Energy sources in India

A. Velayutham

Ex-Member, MERC

1. **Power & Energy Systems Consultancy (from Sep,2009 onwards)**

   A. Consultancy

   a) Resource Person for Task Force-2 on Advance System Interconnection(of South Asian Countries) [Integrated Research and Action for Devlopment(IRADe),South Asia Regional Initiative for Energy Integration(SARI –EI), US Agency for International Development (USAID)]

   b) Member of Enquiry Committee, constituted by Ministry of Power, Government of India, on grid disturbance on Northern Region on 30th July,2012 and Northern Region, Eastern Region and North-Eastern Region on 31st July,2012

   c) Honorary Member of Forum of Indian Regulators

   d) National Advisor to Asian Power Qualitative Initiative (APQI)

   e) Member of Technical team under a Committee (Chaired by Shri.V.K.Shunklu, former CAG) constituted by Planning Commission (approved by Prime Minister) –„High Level Panel on the Financial Position of Distribution Utilities." (2010)

   f) Member of Standing Committee on Solar Power constituted by Govt of Tamilnadu.(2010)

   g) Member of Task forces relating to Power Sector constituted by Govt & Electricity Regulators. Advisor to Power Sector Consultants, Wind Power Grid Integration etc.

2. **MERC** (Maharashtra Electricity Regulatory Commission) Member for full term 5 years (18 Aug' 2004-17 Aug 2009) (Principal Secretary level-Govt of Maharashtra)

3. **CEA (Central Electricity Authority)**

   Central Power Engg Service, Ministry of Power, Govt of India.

   About 30years (Feb'1974-Aug2004)

   Member Secretary, WREB, CEA, Mumbai from April 2000(about 4years)

   Director, CEA, Newdelhi from June, 1991(about 9 years)

   Grid operation, TEC (Techno Economic Clearance) of Unified

   LDC(Load Despatch and communication) Schemes,

   Chairperson of Central PTCC(Power Telecom Coordination Committee.

   Deputy Director, PSTI (Power System Training Institute), CEA, Bangalore

   (Presently NPTI), 1987-1991(about 4 years)

   Modeled & Installed Despatcher Training Simulator at PSTI, Bangalore, under UNDP Project .Imparted Training to Power System

   Engineers through Simulator.

Dr. S. Gomathinayagam

Director General - NIWE

Dr. S. Gomathinayagam, a graduate (Civil Engineering) of Regional Engineering College Trichirapalli of the Madras University, obtained his post-graduate and doctoral degrees from the IIT-M. After serving as a Project Associate at IIT-M for about one and a half years, and with a brief stint at Best & Crompton design office, he joined Structural Engineering Research Centre, Madras in 1983 as Scientist and has risen to the position of Deputy Director and Project Leader of Field Experiments in Wind Engineering. After serving 25 years in solving various multidisciplinary industrial, consultancy and software development problems at Structural Engineering Research Centre, Madras he has joined as Executive Director in Centre for Wind Energy Technology, an autonomous research body of Ministry of New and Renewable Energy (MNRE, GOI) in January 2009.

During 1989-90, he visited T.H.Darmstadt, Germany as a DAAD Scholar and worked in the field of nonlinear transient analysis of RCC structures and toured France, Switzerland and Austria. He has also visited, the University of Notre Dame, Colorado State University, and Texas Tech University, USA under the UNDP Fellowship Programme for wind engineering research. He also visited Monash University, Melbourne, Australia under AUSAID fellowship. He shares as a scientist involved for CSIR-Technology Prize for Engineering Software development in 1999, and is one of the members of the team which has won the CSIR Technology Shield for centre of excellence in wind engineering in 2000 and the "A.S.Arya – UOR Disaster Prevention Award" in the year 2001, for their contribution towards cyclone disaster mitigation. In the 4th World Renewable Energy Technology Congress Conference in September, 2013, he has been awarded "Global Excellence Award-2013 in Renewable Energy".

He has been awarded "Distinguished Alumnus Award" for excellence in Scientific/Industrial Research in the Golden Jubilee Celebrations of the National Institute of Technology (NIT), Tiruchirappalli in July, 2014. He has published over eighty (80) interdisciplinary technical papers in refereed national / international journals / conferences / seminars. He has over hundred technical reports to his credit based on the research and consultancy in the areas of power, wind energy, space, railways and Indian Navy involving instrumentation experimental analysis, design and testing and software development. He is a Life Member and Chartered Engineer of Institution of Engineers (India) and life member of Computer Society of India, Instrument Society of India, Indian Society for Wind Engineering and India Meteorological Society. He has guided several ME, MTech, MSc and MCA projects. He served/serves in various awards/ selection/promotion/Academic/ Professional committees including Wind Energy committee of Bureau of Indian Standards. Now at NIWE (formerly C-WET) as Director General has to do technology management and coordination of research, analysis, design, certification and performance testing, consultancy and human resource development related to Wind Power development in India.

Dilip Nigam
Director, MNRE

Mr. Nigam has done his M. Tech. in Energy Technology from Asian Institute of Technology, Bangkok, Thailand. His specialization is in Wind Energy and Solar Thermal Energy. After working in private sector initially for few years, he joined the Ministry of New and Renewable Energy in 1987. He worked in wind energy programme of the Ministry from 1994 to 2003, when many important policies for development of wind energy sector in the country were initiated. Extensive wind resource assessment activities were taken up and the Centre for Wind Energy Technology (C-WET) was established. Mr. Nigam again joined the wind power programme of the Ministry in 2008 and is presently working as Director. During this period, an important scheme on Generation Based Incentive (GBI) was started which has increased the investor base by attracting the Independent Power Producer (IPP) and Foreign Direct Investment (FDI) in the wind sector. The Accelerated Depreciation in the wind sector was reintroduced. He possess around 17 years of experience in wind energy sector.

Markus Wypior
Director, Indo-German Energy Forum Support Office

Mr. Markus Wypior holds a degree in economics from the University of Bonn, Germany. He has been working in various infrastructure and development co-operation projects in Eastern Europe, Central Asia, South Asia and South East Asia. Mr. Wypior joined GIZ in 2003 as a regional manager in the Asia-Pacific department responsible for bilateral and multilateral co-operation in the fields of energy and environmental protection. From 2005 - 2010 he was seconded to India for the implementation of the National CFC Consumption Phase-out Plan and the National CTC Phase-out Plan under the Montreal Protocol on Substances that deplete the Ozone Layer. Since September 2012 he is the Director of the Indo-German Energy Forum Support Office in New Delhi.

Milesh Gogad

Milesh Gogad leads the Marketing function for GE Renewable Energy in the South Asia region. He is responsible to drive the growth strategy and thought leadership for this business in the region. Milesh has been working with GE for four years in multiple roles across businesses. In his 10 year career, he worked in global and regional strategy and marketing functions for Honeywell and Subex. He holds an MBA in Marketing from Pune University, along with a Mechanical Engineering degree from the same.'

Dr. J.J. Isaac
Former Addl. Director of
National Aerospace Lab

Dr. J.J. Isaac is currently an Adviser (Propulsion) at the National Aerospace Laboratories (NAL) (Council of Scientific and Industrial Research), Bangalore and also a Professor of Aeronautical Engineering at the PARK College of Engineering & Technology, Coimbatore. He has a Ph.D in Mechanical Engineering (Aircraft Propulsion) from the Cranfield Institute of Technology (now Cranfield University), Bedford, UK. At the time of his retirement in March 2009, he was the Head of both the Propulsion Division & the Wind Energy Division as well as the Additional Director of NAL. He has over 40 years experience in 'Combustors for advanced air-breathing propulsion systems' and 'Renewable energy power generation systems'. He has led a number of collaborative programmes between NAL & the Vikram Sarabhai Space Centre (VSSC), ISRO, Thiruvananthapuram, Defence Research & Development Laboratory (DRDL), DRDO, Hyderabad and the Gas Turbine Research Establishment (GTRE), DRDO, Bangalore for the development of Advanced Propulsion Engines for the National Aerospace Programmes. Presently, he is associated at NAL with projects on " Combat Aircraft Fluidic Thrust Vectoring" and "Satellite Micro Thruster Propulsion" sponsored by the Aeronautical Development Agency (ADA), DRDO, Bangalore and the Aeronautical Research and Development Board (AR&DB), DRDO, New-Delhi respectively.

He has also led R&D programmes related to the applications of NAL's aerospace technology spin–off's to the development of renewable energy power generation systems. Among the recent programmes have been the development of India's first fully indigenous 500kW two–bladed, stall-regulated, downwind horizontal-axis wind turbine at Kethanur, Coimbatore under the Govt. of India's `New Millennium Indian Technology Leadership Initiative', the development of India's first fully indigenous solar pond thermal pilot power plant at Pondicherry under sponsorship of the Planning Commission, Govt. of India through the Govt. of Pondicherry and the development of India's first geothermal pilot power plant at Manikaran, Kullu District, Himachal Pradesh under sponsorship of MNES (now MNRE), Govt of India. Presently, he is associated at the PARK College with the projects "Study of the feasibility of a small wind turbine for power generation at a high-altitude site" sponsored by the Snow & Avalanche Studies Establishment (SASE), DRDO, Chandigarh and the project "Design and development of grid – interactive 3kW class rooftop wind turbine based hybrid system" sponsored by MNRE and also on the project "Pumpjet propulsion" sponsored by the Naval Science & Technology Laboratory (NSTL), DRDO, Visakhapatnam.

He is a Fellow of both the Aeronautical Society of India and the Institution of Engineers (India).

Dr. Ing. Simone Massaro
Chief Technology Officer
BaxEnergy GmbH.

Dr. Ing. Massaro is a leading technology expert in the renewable energy industry. Member of the OPC Foundation and Microsoft IT Council, winner of the Microsoft Odyssey Award, he is currently the Chief Technology Officer at BaxEnergy GmbH. He holds a master degree in computer engineering. After his studies he spent ten years working on data visualization technologies adopted in high-profile projects such as The Pentagon, NASA and Heathrow Airport. He has spent the last five years designing integrated solutions for visualizing, analyzing and optimizing renewable energy power plants for utilities around the World including EDF, RWE, ENEL Green Power.

More recently Dr. Massaro has designed the new Enercon Operation Control Center in Germany which is responsible for monitoring all operations across 25000 wind turbines in 4700+ wind parks with 500+ interconnected substations. Dr.Massaro has also designed the first offshore monitoring room for the project Global Tech I in the North Sea which is responsible for monitoring and controlling an off-shore array of 480 MW of wind turbines.

Dr. Massaro's expertise also includes the design and implementation of cost-effective solutions for maintenance planning, execution, and control for renewable energy power plants by means of an integrated information system, which encompasses data and functions from such diverse systems as SCADA, online data visualization, historical data analysis, weather condition monitoring, power forecast, reliability analysis, people and vehicles tracking systems, material management, logistics, human resources, documentation lifecycle management, and auditing.

Shri J.P. Singh
Former Director, MNRE
Govt. of India

Shri J.P.Singh completed his graduation in Engineering from Punjab Agricultural University, Ludhiana, in 1983. He started his career as Graduate Engineer Trainee with M/s Danfoss (India) Ltd, New Delhi wherein he was actively associated with the designing and implementation of Integrated Renewable Energy Systems at Kapur Solar Farms, New Delhi. He then moved to State Govt of Uttar Pradesh in 1984 where he worked as Divisional Head and undertook implementation of several renewable energy projects relating to small wind, bio gas & solar energy.

He joined at Regional Office Chandigarh of the Ministry of New and Renewable Energy (MNRE) as Senior Scientific Officer (SSO) in 1988 and was responsible for formulation of Policy, Promotion & Monitoring of Renewable Energy Programmes in the country. He has rich experience of more than 25 years of working in different Divisions covering almost all areas of renewable Energy and Wind Energy in particular of the Ministry. He played key role in opening wind programme in two states i.e Maharashtra & Rajasthan, developing off-grid projects based on wind solar hybrid systems and new initiatives on development of Off Shore Wind Power Programme.

Dr. Kurt Rohrig
Deputy Director of the Fraunhofer Institute for Wind Energy and Energy Systems Technology (IWES)

Dr. Kurt Rohrig is deputy director of the Fraunhofer Institute for Wind Energy and Energy Systems Technology (IWES) and head of the R&D division "Energy Economy and Grid Operation" at IWES. He is a mechanical engineer with a diploma in numerical mechanics. In November of 2003, he completed his PhD "Computer Models and Information Systems for Technical Assistance of Large Wind Power Integration" at the faculty of electrical engineering at the University of Kassel. Dr. Rohrig worked with ISET/IWES since 1991 and he has more than 20 years experience in wind power projects. He is the scientist-in-charge for projects handling the online monitoring and prediction of wind power for large supply areas – operated in co-operation with large power transmission utilities. The computer models and approaches, developed in frame of his work are in operation at German transmission system operators with high wind power penetration. Furthermore, Dr. Rohrig is significantly involved in the "Renewable Combi-Plant" and the German Wind Energy Monitor. Dr. Rohrig is member of the German work group of CIGRE. On European level, he is leading the sub-program Grid Integration of the Joint Program Wind Energy in frame of the European Energy Research Alliance (EERA). In 2009, Dr. Rohrig received the German Award for Climate Protection.

Charles Yates, FRSA
Managing Director
CmY Consultants Limited

Charles Yates founded CmY Consultants to help clients to profitably develop, finance and operate renewable and other energy projects. He works closely and effectively with clients to deliver secure, sustainable energy and create lasting value. He has over twenty years of experience working on major projects and has led teams which worked with the UK Government to develop green policy and introduce competition in the water market; and with major energy companies to execute transactions. He was lead financial advisor on more than £1.4billion of investment in four offshore wind farms.

Charles was part of Ofwat's team for the PR14 price review. More recently he managed negotiations, due diligence and credit approval on three solar PV projects for a UK bank.

Before this Charles was a member of the Principal Finance Group private equity team which acquired businesses worth more than $21 billion. This role included planning and executing large acquisitions and financings.

Rajesh Kumar
Chief Manager (Smart Grid)

Mr. Rajesh Kumar is currently working as Chief Manager, Smart Grid at POWERGRID. He is responsible for planning, design and implementation of Smart Grid solutions. He is member of various national and international professional bodies such as IEEE, CIGRE and Institute of Engineers. He has published several papers in national and international forums. He has the firsthand experience of working in the System Operation at Load Dispatch Center.

Mr. Rajesh has done his graduation in Electrical Engineering from NIT, Rourkela and M. Tech from from I.I.T., Delhi. He has around 18 years of work experience in the in the field power system operations planning & control, Energy Management and Smart Grid.

Praveen Kakulte
MD, Powercon Ventures India Pvt. Ltd.

Praveen Kakulte - a Renewable Energy Technologist with 2 decades of work in field operations of Wind assets, and recently Sun Assets. Praveen's core contribution to the renewable energy industry has been the WISE award winner 'Wind O&M Service' conferred as the 'Best Service Provider' in India consecutively for five years in a row!

Praveen's brainchild - 'Wind Training Academy' set-up for Enercon serves Global wind industry with ~250 technical commandos pa. Wind Blatt has referred it as a world class, premier & exemplary institution in Wind Engineering. Praveen has worked integrally with the world eminent wind energy Scientist Dr Aloys Wobben & led ~5000MW wind O&M business of Enercon as VP & Groups Head – India.

Praveen's Inventive work on Wind Solar Integration, Solar PV maintenance mechanism, BI Wind turbine, Integrated Energy Generation & Storage System, are few of the IPR filings. Currently, Praveen leads Powercon - an IT integrated Wind O&M Company with focus on 'Yield Optimization & Asset Longevity'. While serving the IPPs, OEMs & Developers of Wind & Sun parks of varied technologies; Praveen's aim is to contribute for an increase in current nationwide average CF of operating wind assets by a humble ~10% level i.e. say an average productivity rise by ~1.6% through his unique Energy Studio…. merely through optimization & service efforts; energy integration gains apart!

Dr. Satyajit Phadke
PhD, Senior Consultant

Dr. Satyajit Phadke joined CES in January 2015. His focus is on consulting services in the area of energy storage and conversion technologies for various applications such as automotive, stationary power, portable power and grid scale storage. Additionally he assists with evaluation, validation and competitive bench marking of technologies.

Satyajit has in depth understanding of various energy storage technologies owing to his many years of involvement in the research and development of novel battery chemistry and materials for fuel cells. He obtained his PhD from University of Florida in the year 2010 where his research was focused development of novel materials for hydrogen fuel cells. Thereafter he has worked on various battery chemistries as a post doctoral associate at Massachusetts Institute of Technology (MIT) and Princeton University. He holds three licensed US patents in the area of batteries and is the author of several technical articles in this field.

Pankaj Batra
Chief Engineer (Regulatory Affairs), CEA

Shri Pankaj Batra did his B.Tech in Electrical Engineering from Institute of Technology, Banaras Hindu University, in the year 1981. He also did his Diploma in Systems Management from NMIMS, Mumbai, Diploma in Financial Management from IGNOU, New Delhi and Diploma in Public Speaking from Nazareth Speakers Academy, Mumbai. He passed the Combined Engineering Services Examination conducted by Union Public Service Commission, was selected in the Central Power Engineering Service and posted to Central Electricity Authority (CEA) in 1983.

He worked in the Western Regional Load Despatch Centre (WRLDC) as a System Operator for about 4 years and was also involved in the preparation of various technical reports on Western Regional Gird operations. He also worked in the Commercial Division of Western Regional Electricity Board (WREB), wherein he dealt with various commercial matters including the Availability Based Tariff (ABT) and frequency-linked Unscheduled Interchange(UI) charges.

He was deputed by Govt of India to Chukha Hydro Power Corporation in Bhutan in August, 1991, where he joined as Executive Engineer (Operations), responsible for operation of the Power House, Switchyard and Dam. He also later worked as Executive Engineer (Transmission), where he was responsible for operation and maintenance of transmission and distribution system of Bhutan and also erection of the first 220 kV station in Bhutan at Thimphu.

After return from deputation in January, 1996 he was posted in the CEA Headquarters in New Delhi in Grid Management Division. He was involved in monitoring of Regional Grids, analysis of grid disturbances and preparation of various technical reports. He was involved in the finalization of issues in the Indian Electricity Grid Code (IEGC), Availability Based Tariff (ABT), Open Access, Power Exchange, etc. He framed the regulations of CEA on Technical Standards for Connectivity to the Grid and regulations on Grid Standards.

He worked as Chief (Engineering) in Central Electricity Regulatory Commission (CERC) from April 2009 to February 2013 and was involved in formulating various Regulations, viz. Grant of Connectivity, Long-term Access and Medium-term Open Access, Measures to relieve congestion in real time operation, Grant of Regulatory Approval for Capital Investment to CTU for execution of Inter-State Transmission, the revised Indian Electricity Grid Code, Power Market Regulations, Regulation of Power Supply, Regulations on intervening transmission facilities, etc. He introduced various provisions of smart grid in the IEGC.

He is presently handling the Division on Regulatory Affairs in CEA, dealing with Standards and Regulations of CEA, Regulations of CERC and SERCs, and associated issues. He also handles various policy issues.

He is the Chairperson of Working Group VI on "Policy and Regulation" in the India Smart Grid Forum. He has conducted a number of Workshops for Regulators and Transmission and Distribution companies. He is also in the Committee of Ministry of Power for framing Model Regulations on Smart Grid.

Mark Leybourne
Senior Engineer
IT Power, UK

Mark is a senior engineer from IT Power's offshore renewable energy group, based in Bristol in the UK, and works on a range of offshore wind, wave and tidal energy projects. He joined the consultancy 7 years ago and, for the past 18 months, has been managing the group's activities in the Foreign and Commonwealth Office funded, UK-India offshore wind co-operation project. Additionally, he manages IT Power's offshore wind advisory projects in China and Taiwan.

Mark studied at the University of Southampton, completing an undergraduate degree in Aerospace Engineering and an Engineering Doctorate in Marine Renewable Energy.

Vishal Pandya

An engineer by heart and has passion for power markets.

He brings good understanding on regulations, power system studies, market models, programming, algorithms and renewable energy.

He loves innovation through technology and believes in delivering things with a difference. He is an alumnus of IIT Bombay with specialization in power systems & power electronics.

Before co-founding REConnect Energy, he worked with IEX (business development) and L&T (power transmission and distribution).

REConnect Energy today is India's largest REC Trading Company and also the Company with largest service portfolio in Wind Power Forecasting and Scheduling.

Akshay Ahuja
India Smart Grid Forum

Akshay is currently working as Business Analyst at India Smart Grid Forum, a public-private partnership initiative of the Ministry of Power. He is working closely with two working groups namely "Policy and Regulation" and "Pilots and Business Models". As part of the both working groups at ISGF, he has worked on various projects.

He is also part of modelling team working with Planning Commission of India on energy scenario exercise by putting all relevant numbers together into a calculator called "India Energy Security Scenarios, 2047", for which he has worked on four themes – Electricity Import/export, Electrical Energy Storage, Carbon Capture and Storage, and Transmission & Distribution (T&D) losses and currently is also working on version 2 of the tool. He is also a contributor to India Smart Grid Bulletin, a monthly newsletter by ISGF.

He is also a member of BIS ETD 46 committee on Grid Integration and part of CBIP committee preparing manual on best practices in distribution.

Akshay earned an MBA in Power Management from National Power Training Institute (NPTI), and has a B.Tech in Electrical and Electronics Engineering from Lingaya's Institute of Management and Technology.

Bindoo Srivastava
Chief Engineer, SLDC,
Gujarat

Bindoo works as an independent consultant in the field of smart Infrastructure. She is actively involved in policy, standards and implementation roadmap formulation for leveraging Digital technologies to core infrastructure. She has founded her own consulting firm- Smart Electrons for this purpose.

Bindoo also works in the field of Capacity Building and Training on AMI/Smart Grids/Smart Cities. She advises on creation, solutioning and program governance of Projects in this space.

She has been a key contributor to Smart Grids standards development at BIS.

In a career spanning approx.25 years, she has worked on marquee projects like SCADA projects for clients in the power generation and transmission/distribution space in India, AMR based projects with multi make meters, RAPDRP project etc. She has consulted with key industrial sector companies as an electrical engineering expert.

She is working on the Green Energy Corridor Project of Govt. of India on a study for setting up Renewable Energy Management Centres in the country. She is also actively engaged with TSDSI, Telecom Standards Development Society for India, a Telecom SDO in M2M/IoT space and to establish the secretariat practices.

Bindoo holds a Bachelors degree in Electrical Engineering from Delhi College of Engineering and a Masters in Electrical Energy Systems from IIT Madras. She is a certified Energy auditor from BEE and has a diploma in management from IGNOU.

Shri B B MEHTA
Chief Engineer, SLDC,
Gujarat

Shri B B Mehta is working as Chief Engineer at State Load Dispatch Center, Vadodara since 2012.

He is having degree of BE (Electrical &Electronics) and ME (ComputerSyst). He is having more than 31 years' experience in the field of Scada, PLCC communication, Power System studies, power system operation and control, scheduling, Energy accounting and billing as well as project management and O & M of transmission assets.

He has presented various papers on at National / International level meet.

He has undergone various training related to load dispatch, Scada & IT segments including at Hydro Qubec, Montreal Canada for power system master plan in 1998 and at GE facility Florida USA for XA/21 Scada in 2004.

Dr. Govind Bhagwatikar

An Astute, High-integrity, Techno-Commercial Professional with Diverse Experience of 20+ Years of Business Development, Operations and Technology in Wind, Solar Energy and Regulatory in Power Sector

Broad Experience Developing Wind/Solar Energy Projects from Concept to Commissioning and Off-Take (PPA) Arrangements, Investment Planning and Project Appraisal, Permitting and Contracts, Acquisition of Technologies & Operational Projects

Associated with Global Wind Turbine Manufacturers (Vestas & Siemens), International & Domestic Independent Power Producers (BP Alternative Energy & Welspun), Startup Wind Turbines manufacturers (GEPL & WIL) and Nodal Agency for Renewable Energy (MEDA) and worked on varied projects

PhD in Electrical Engineering and MBA in Finance & Banking Chartered Engineer accredited by Institution of Engineers India and Accredited Lead Auditor for Quality Management System – ISO 9001:2008

Karma Dunlop

With over twenty years international experience in environmental policy and management associated with fisheries, offshore construction and permitting, Karma began her career, following university, working as a fisheries biologist for the National Marine Fisheries Service on commercial fishing vessels off Alaska. She was responsible for data collection and monitoring industry compliance. Karma then went to work for an internationally recognised fisheries consulting firm in Seattle where she took on increasing management responsibilities conducting environmental assessment studies for several subsea international telecommunications systems and the U.S. Navy. During this time, Karma became versed in Geographic Information Systems and remotely sensed satellite data, and routinely carried out resource and risk assessments most notably analysing the effect of fishing effort on the survivability of deployed submarine assets. Under a $1.5 million NASA-funded project to evaluate the uses of satellite data to fisheries and coastal resource management, Karma was a technical analyst as part of team to develop a state-of-the-art space-based vessel information system which later became a commercially successful venture marketed under the brand OCENS.

Karma's involvement in the offshore wind industry began following her relocation to the UK where she was appointed Environmental Manager of an entrepreneurial offshore renewables company to compete for UK Round 2 offshore windfarm leases. She further held several independent contracts providing environmental and permitting consulting services to several UK offshore wind applications and developments including the flagship London Array Offshore Wind Farm. In 2010 she was appointed Vice President of Health, Safety and Environment at Baryonyx Corporation, a Texas-registered, vertically-integrated renewable energy company which currently holds three offshore wind leases from the Texas General Land Office for the purposes of developing utility-scale, offshore wind power. There she was responsible for the co-ordination of all permitting and consent requirements associated with Baryonyx' offshore wind lease sites including Project Management of the required Environmental Impact Statement and requirements for US Army Corps of Engineers offshore construction Sect. 10 and Sect 404 permits. Ms. Dunlop has co-authored several grants for federal funding including a successful application under the U.S. Dept. of Energy $180 million offshore wind research initiative of which Baryonyx Corporation was awarded $2 million in 2013.

Theme Paper for IWPA 4th International Conference on Wind Energy: WE 20 by 2020

1. Introduction

Wind energy is the fastest growing renewable energy sector in India. With the capacity of 23,444 MW as on April 30, 2015, it accounts for nearly 65% of the installed capacity in the renewable energy sector in the Country. Tamil Nadu is at leading position in terms of installed wind capacity but attention is quickly shifting to states such as Maharashtra, Gujarat, Andhra Pradesh, Karnataka and Rajasthan where the gap between the available potential and installed capacities are much higher than those for Tamil Nadu.

The sector is growing rapidly and thus presents substantial opportunities for both the international and domestic players. In 2014, the Indian wind sector experienced moderate annual growth, with 2.21 GW of new installations. India ranks fifth in terms of global installed capacity and third in annual capacity growth. The Indian Wind Atlas prepared by National Institute of Wind Energy indicates the wind energy potential of the country as 49 GW and 100 GW at 50 m and 80 m hub heights respectively. However, the estimated potential at 80 m level is yet to be validated. The recent assessments done by various institutions suggest higher wind power potential available to be tapped. For example, LBNL, USA has estimated the potential of 800 GW at 80 m masts. With strong political will and the low cost financing, wind energy can play a major role in securing a sustainable and clean energy future for India.

However, the annual wind power capacity addition in the recent past has suffered significantly with country adding only around 3600 MW in the last two years i.e., during 2012-13 and 2013-14. The total wind generation capacity in the Country stands at 23,444 MW (as on April 2015) while total estimated potential is well in excess of 100 GW.

Vast quantum of untapped wind potential is yet to be harnessed which is going to play a vital role in meeting India's projected demand expected to double the current levels by the year 2021-22.

Figure 1: Annual Wind Power Capacity addition

International Wind Conference: WE by 2020

To deal with issues associated with growth of wind energy sector, Indian Wind Power Association (IWPA), a premier association committed to the growth of excellence in wind energy in India, is planning to hold 4th International Wind Conference and Exhibition (WE20 By 2020) at Coimbatore during 21-23 June 2015. The conference will focus on key developments, challenges, and opportunities in the Indian Wind Power sector.

Since the year 2010, IWPA is organizing this WE20 by 2020 Conference and Exhibition series with the single objective to find technical, financial, commercial, policy and regulatory solutions to achieve 20% grid penetration (at least in local grids) in India by 2020 by drawing in the best of the best from India and the World to deliberate and discuss the involved issues.

The Theme and Objective of this Conference and Exhibition will be to discuss and prepare the roadmap of what India should do to have 20% grid penetration by year 2020, to be in line with the 60 GW target set by MNRE by 2022.

This Theme Paper aims to highlight key issues to be deliberated in order to accomplish goal of 20% penetration of wind energy by 2020 in India. In this context, the deliberations should cover following aspects:

- Key barriers and challenges in achieving wind power penetration level of 20% by 2020 in Indian context
  a. Policy and Regulatory framework
  b. Grid Integration and Evacuation
  c. Forecasting and Scheduling
  d. Wind Power procurement and RPO
  e. Financing and Incentives
  f. Innovative Technology options
- Steps to be taken in achieving the target level of 20 by 2020 by Government, Utilities, RE Developers and Financial Institutions

2. Policy and Regulatory framework

Electricity Act, 2003

The EA 2003 has radically changed legal and regulatory framework for the renewable energy sector. The Act provides for policy formulation by the Government of India and mandates State Electricity Regulatory Commissions to take steps to promote renewable and non-conventional sources of energy within their area of jurisdiction. In fact, Section 3 of EA 2003 clearly mandates that formulation of National Electricity Policy, National Tariff Policy and Plan thereof for development of power systems shall be based on optimal utilization of all resources including renewable sources of energy.

The wind energy sector development in India received significant impetus post the enactment of Electricity Act 2003. Feed in tariff regime, renewable purchase obligations and accelerated depreciation policies resulted in the sector witnessing impressive growth of around 30 percent. Annual generation capacity addition reached peak in 2011 when wind sector added in excess of 3000 MW capacity, which was around 65% of total renewable energy capacity added in that year.

Regulatory framework

In accordance with the principles specified in Electricity Act 2003 and National Tariff Policy, various SERCs have developed the framework for development of renewable energy in their State. However, there exist various issues pertaining to prevailing framework and alignment of which is key to enable accelerated growth of wind sector.

- **Favourable FIT scenario:** Many SERCs have adopted normative tariff approach for determination of a generic tariff for project commissioned during the pre–specified control period without considering the location, technology, and size of the wind turbine generators. These norms vary significantly across States. Besides, the capital cost of the wind power project varies over the control period depending on prevalent market conditions for raw materials. Further, Capacity Utilisation factor (CUF) for wind project varies from site to site. As against these, many SERCs have specified a uniform CUF for all wind projects within the states without considering the site specific issues. CERC under its RE Tariff Regulations, 2009 and subsequently in its RE Tariff Regulations, 2012 has tried to address these issues by specifying zone wise tariff and linking capital cost with indexation formula. It is important to adopt these norms by SERCs to bring uniformity and greater confidence in all stakeholders.
- **RPO enforcement:** RPO Regulations are forward looking and require advance actions by licensees to fulfil their

mandatory obligations stipulated under RPO Regulations. Only few of State Utilities have fulfilled the targets stipulated as per RPO framework. Further putting the obligation of RE purchase on captive and open access consumption as well, with suitable monitoring mechanism will have to be implemented across States. The seriousness with which RPO is implemented shall decide on the fate of REC mechanism, which was brought in as an alternate market mechanism of true potential in the Country.

- **Grid Code Amendments:** Grid codes by CERC and the States have been formulated from the perspective of managing the national level and State level grid with conventional sources of power connected to it. However, with the fast changing scenario of increasing focus on RE sources with its own peculiar characteristics of variability and intermittency, such grid code should be aligned to ensure hassle free off-take of RE sources. While doing so, due focus should be given to grid code provisions dealing with evacuation infrastructure planning, grid interconnection, RE forecasting and scheduling aspects, etc.

- **Connectivity Regulations and Transmission/Evacuation Arrangements:** With advancement of technology and availability of MW scale turbines, proliferation of the large scale wind farms/wind parks concept is emerging. Planning for evacuation infrastructure and addressing requirements of transmission network augmentation are crucial for future growth of wind power capacity addition. There are different practices and standards followed by different States for grant of connectivity and interconnection with the grid. The definitions of Interconnection Point, Metering Point, responsibility of development of Evacuation infrastructure also varies from State to State. There is urgent need to evolve uniform Inter-Connection Code and Standards for connection procedure.

Policy Initiatives

On the policy front, Central and State Governments have been taking concerted efforts through notification of various policy instruments favouring growth of wind sector. Key Government initiatives that have benefitted the sector include direct tax benefits in the form of accelerated depreciation and income tax holidays and indirect tax benefits in the form of exemption from excise duty and reduced custom duties etc. Besides, Generation Based Incentive @ 50 paisa/kWh (over and above feed-in-tariff specified by the State Electricity Regulatory Commission) to the developers who do not intend to avail accelerated depreciation benefit has attracted large IPP players to fuel wind capacity addition in the sector. It is interesting to note that in 2011-12, capacity addition in excess of 3,000 MW was undertaken by 502 investors. Of these more than 96% i.e., 482 investors (who chose the AD route) were responsible in adding an aggregate of 1,875 MW. The balance 4% of the investors i.e. around 20 of them were large IPPs (who opted for the GBI route) had set up 1,275 MW.

Despite such significant responses from the developers, subsequent development of discontinuation of AD benefits, ambiguity about extension of GBI benefits, led to policy uncertainty, thereby affecting the annual capacity addition in the following years. However, acknowledging role of such benefits/ incentives in the growth of the sector, the Government has decided to re-introduce the same, which has brought back confidence and hope to the developers and the sector as a whole. However, there is a need to have longer term policy certainty on the control period of the AD benefit/GBI incentive. The Government should confirm that the continuation of these benefits to be available for at least 5-7 years of policy period.

Draft National Wind Mission, 2015

With the intention to working closely with the State Governments towards large scale deployment of wind power in the country so as to achieve the target of 60,000 MW (cumulative) by 2022, the Government of India published the Draft National Wind Mission, 2015. A separate mission specific for Wind development is a welcome initiative from the Government which would bring more focused approach towards promotion of the same. The draft published is a well thought out document covering various favorable policy initiatives for the entire value chain of the Wind sector. However, the final shape and structure of the various implementation aspects, business model, institutional structures and their capacity building requirements under the Wind Mission would require detailed deliberations and stakeholder consultation. The deliberations during IWPA's 4th International conference WE 20 by 2020 would provide good platform for deliberations on various initiatives and schemes envisaged under the National Wind Mission.

Electricity Act (Amendment) Bill, 2014

The Electricity Act (Amendment) Bill, 2014 was tabled recently in the House, which has given due focus to renewable energy and includes various provisions that re-affirms the Government's mandate for promotion of RE sector in the Country. The Bill proposes to: include definitions of RE sources and obligated entities, concessional open access charges incl. Cross subsidy surcharge for OA transaction for RE, recognition for RECs, et al. The Bill also introduces the concept of Renewable Generation Obligation in the Country which requires coal based generators to also set up RE generation, not be less than ten per cent of its thermal power installed capacity, which are welcome changes. However, it is observed that no sufficient consideration has been given to the feature of seasonality of RE availability in India, capacity balancing requirement under integrated resource planning and its relevance for the success of RE in India. In this context, the government should also include suitable provision to make available annual banking for RE before the passing of the amendments to the Electricity Act. The proposed amendments in the Bill however, will be crucial for achieving the proposed RE capacity additions targets as envisaged for the Country.

3. Grid Integration and Evacuation Infrastructure

A robust grid infrastructure is one of the key important factors in ensuring off-take of wind energy generated. Most of the wind farms in India are located in remote areas that are located far away from load centers. Due to inadequate or weak grid infrastructure, it is difficult to transmit the power from wind farms to the load centers. Grid constraint has emerged as the biggest impediment for scaling-up RE capacity in India. Wind projects are forced to back down for want of evacuation infrastructure. Inadequate management of variable generation, ambiguity surrounding responsibility of sharing for forecasting of RE generation remains a concern. Addressing these issues assumes immense significance in the present scenario wherein the grid penetration level is expected to grow exponentially. Further, the targeted capacity of 60 GW by 2022 translates to annual wind power capacity addition target of 6GW to 8 GW every year from now on.

1. **Aligning Grid Planning Processes for RE:** The activity of transmission planning has been aligned with conventional generation and transmission requirements and in accordance with provisions of the Electricity Act of 2003, with national electricity policy, with tariff policy and regulations, and with the prevalent market structure of the electricity industry. The Central Electricity Authority (CEA) has been vested with the function to formulate a National Electricity Plan, of which National Transmission Plan forms a crucial component. State level transmission plans are formulated by State Transmission Utilities in accordance with provisions of the State Grid Code. However, the expansion of transmission infrastructure rarely takes into account the need for renewable energy evacuation requirements. Unless the process for planning transmission capacity incorporates a long-term vision of planned RE capacity additions and involves RE stakeholders at the planning stage, it is expected that bottlenecks in RE evacuation capacity will remain.

   Some key questions to be addressed in this context include the following:

   i. Is there a need to devise separate planning standards and criteria for evacuation and transmission for renewable energy (especially wind and solar) projects?

   ii. What should be the institutional arrangement to address concerns of evacuation and transmission planning for RE projects? Is there a need for creation of RE transmission planning authority or a stand-alone RE Transmission Plan?

   iii. What are best practices in international experience for grid planning in markets with high penetration of renewable energy?

2. **Uniform Approach for Interconnection Processes across States:** One of the major barriers encountered by RE generators and developers is the non-uniform approach and diverse set of practices followed by utilities across states for interconnection of RE projects. Numerous differences exist with regard to interconnections, such as the definition of an interconnection point, applicable charges for interconnection, permissions and clearances, and the contractual framework for an interconnection agreement. In addition, practices

vary depending upon the type of renewable energy project (e.g., wind or solar), and this often results in significant delays in implementation. There is an urgent need to devise a standard methodology that will be followed across states, and the protocols that institute uniformity in interconnection processes. The key questions that need to be addressed are:

i. Is it desirable and feasible to develop a standard, or model, interconnection procedure(s) for interconnection of various RE technologies at the national level, for similar voltage levels?

ii. What should be the appropriate model for sharing responsibility among RE developers and transmission and distribution utilities, with regard to development and construction of evacuation infrastructure? What costing models need to be followed for the development of appropriate evacuation infrastructure?

iii. What are the options for funding and sharing the evacuation infrastructure among RE generators, transmission utilities, transmission system users, etc.?

iv. What are the common practices followed for RE interconnections in international markets that have high penetration of RE?

3. **Initiatives by Nodal Agencies and Authorities:** There have been various initiatives at the Government level, CERC and CEA levels for tackling the issues associated with grid integration and transmission infrastructure of RE evacuation. The Green Energy Corridor report prepared in co-ordination with PGCIL and CERC is a welcome initiative. In line with the RE capacity plan envisaged in the report, CEA has also formulated a national level perspective plan for evacuation of RE capacity, particularly for evacuation of wind and solar sources. This is a positive step for the development of RE grid evacuation Infrastructure in the Country. The said perspective plan proposes development of transmission corridors that will evacuate surplus RE power form States of Tamil Nadu, Andhra Pradesh, Karnataka, Maharashtra, Gujarat and Rajasthan and transmit to deficit States. However, considering the huge funding requirement to the tune of around Rs. 32,000 Crore, there should be adequate and timely support from the Government for mobilizing same. Private participation should also be encouraged to bring in funding support in order to cater to the requirements of setting up transmission infrastructure.

4. **Technical standards for integration of RE with National Grid:** CEA has issued amendment to connectivity standards specifying the technical requirements from wind generators to be synchronized with the grid, as per which, generating stations shall be capable of supplying dynamically varying reactive power support so as to maintain power factor within limits of 0.95 lagging to 0.95 leading. Also, the generating stations shall have fault ride through capability of not less than 300 milli-seconds so that grid is not destabilized due to sudden outage of renewable generation in the event of a grid disturbance. Standards for maximum harmonic distortion also have been specified in the amended technical standards. However, the applicability of these standards across all the turbines, irrespective of age, make and size remains a concern on which developers should arrive at consensus and sufficient clarity in the matter has to be provided by CEA.

5. **Renewable Energy Management Centres:** Recently PGCIL and GIZ have been given the responsibility by Indian government, under KFW funding for installing the REMC in the wind rich States of India. REMCs are proposed to be set up in every wind resource rich States to achieve multiple objectives including - Close coordination with respective LDC for RE generation and control for smooth grid operation and Single source information repository and coordination point for RE penetration. International Co-operation for establishment of such institutions and along with capacity building of grid operators will be necessary so as to derive the desired benefits of such institutional set up. Further, roles and responsibilities as well and the operational protocol of REMCs should be defined at the central level to maintain homogeneity in its operations. The authorities should also target setting up such institutions within the current five year plan to facilitate RE capacity additions as planned.

4. Forecasting and Scheduling Framework

The level of RE penetration (in terms of energy generated) in India is presently around 5 to 6 percent. However, even at this low level of RE penetration, a few states are finding it difficult to absorb and manage the feed-in of RE and the associated variability in their grid. For example, it is not uncommon to back down wind generating plants in states like Tamil Nadu during the monsoons (windy season), for want of sufficient evacuation capacity.

With the kind of capacity addition planned over the coming few years, the penetration level is expected to increase to around 18% by 2022 in energy terms (an increase of almost 2 percent per annum). To absorb this increase in RE capacity, there is a need for significant increases in grid infrastructure and deployment of the appropriate balancing mechanisms required, if this energy is to be used properly.

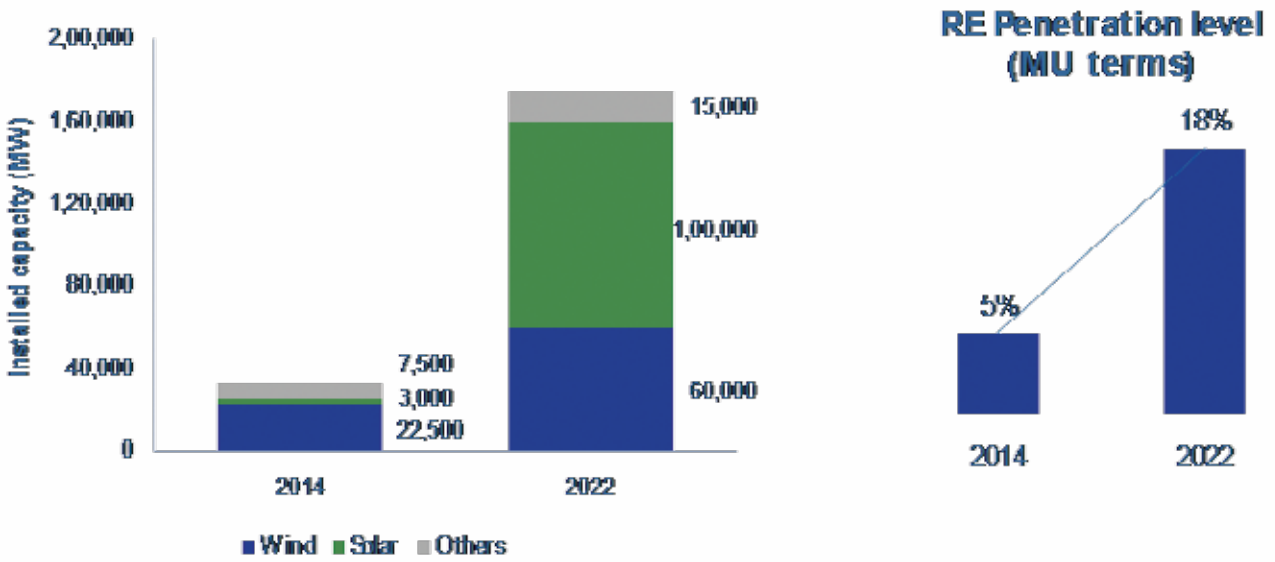

Figure 1: Increase in Installed RE Capacity and Penetration, 2014-2022

In this context, it is important to establish an appropriate policy and regulatory frameworks, to enable and support grid-strengthening and balancing mechanisms. These frameworks need to focus on addressing the challenges faced by developers at the various stages of planning, development, deployment, financing, construction and operation of RE, and its integration into the larger grid.

1. **Framework through RRF mechanism:** The concept of forecasting and scheduling of wind generators and commercial settlement thereof through the Renewable Regulatory Fund (RRF) mechanism was first introduced by CERC through Indian Electricity Grid Code, 2010. This mechanism has proposed requirement of forecasting Wind and Solar generation coupled with scheduling and commercial settlement with respect to the deviations (±30%) from the schedule. The RRF mechanism was envisaged to be implemented from January 1, 2011. However, owing to several implementation issues, the mechanism is yet to be made operational.

2. **Revised draft framework by CERC:** Very recently, CERC has proposed a framework on scheduling and forecasting of wind and solar generators connected to the inter-state network. The key features of the proposed framework are:

   - Wind/solar generators at the inter-state level whose scheduling is done by RLDCs are to be scheduled like any other generator and paid as per scheduled generation
   - An operating band of ±12% is proposed for such generators

This mechanism is fundamentally different from the earlier proposed RRF mechanism by CERC and still has few aspects to be re-examined before its implementation. The settlement under the proposed framework would be as follows:

Table 2: Proposed amendments to RRF mechanism

Actual Generation	Penalty/Incentive
Between 88% to 100% of schedule	Payment of INR 3/kWh to DSM Pool and transfer of REC to Buyer
Below 88% of schedule	Payment of INR 4/kWh to DSM Pool and transfer of REC to Buyer
Between 100% to 112% of schedule	Payment of INR 4/kWh to Generator and allotment of REC to Generator
Beyond 112% of schedule	Allotment of REC to Generator
Actual Generation	Penalty/Incentive
Between 88% to 100% of schedule	Payment of INR 3/kWh to DSM Pool and transfer of REC to Buyer
Below 88% of schedule	Payment of INR 4/kWh to DSM Pool and transfer of REC to Buyer
Between 100% to 112% of schedule	Payment of INR 4/kWh to Generator and allotment of REC to Generator
Beyond 112% of schedule	Allotment of REC to Generator

3. **Managing Variability of Wind Power Generation:** Intermittency refers to the limited control of electrical output from variable and partially predictable generating technologies, such as wind and solar. With present practice of state boundary as area control centre, the state grid can accommodate small amounts of intermittent electricity generation, but large-scale penetration requires rebalancing the different elements of the electricity system: generation, transmission, demand management, and regulation. At present, the states are using hydro resources, limited gas based generation with peaking capacity, Unscheduled Interchange mechanism and load management as tools to deal with variable renewable generation in renewable rich states.

In Germany, amendment to Renewable Energy Sources Act introduced a new mechanism for wind power balancing, which requires each system operator to contribute to balancing the whole country's wind power output in proportion to the size of its regional grid. This mechanism allocates wind power and the associated fluctuation to each system operator in real time. It is more equitable in the distribution of balance services and related costs.

In Japan, to enhance wind power integration, a collaboration scheme is developed to use inter-ties between utilities efficiently to balance wind power generation output with the output of the thermal power plants being reduced accordingly to absorb the incoming wind power.

In Spain, Red Eléctrica de España, S.A.(REE) is dedicated to the transmission of electricity and the operation of electricity systems of Spain. Red Eléctrica, the Spanish TSO, started up a Control Centre of Renewable Energies (CECRE) in 2006, a worldwide pioneering initiative to monitor and control Renewable energy. CECRE allows the maximum amount of production from renewable energy sources, especially wind energy, to be integrated into the power system under secure conditions.

In USA, due to different grid composition, rules for wind power penetration in the various regional grids of the USA have developed with wide variation in framework for wind power scheduling, dispatch and operational mechanisms. For example, the California Independent System Operator (CAISO), as a leader in state-of-the-art mechanisms, has developed a Participating Intermittent Resource Program (PIRP) that allows individual wind facilities to self-schedule according to shared forecasting technologies. One tool the ISO uses in managing the grid is the ancillary services market.

The mitigation of intermittency must address both variability and uncertainty. A variable, but predictable, resource can be managed with careful day-ahead scheduling, while uncertainty introduces the need for additional reserves that supply the load in the case of unpredictable reductions in generation or increases in load. The key questions to be addressed in this context are as under:

i. What options do system operators have for managing variability of intermittent RE generation? Do present practices for load-generation balancing in India pose limitations for large scale grid variable RE integration?

ii. How should regulators address the dilemma of an appropriate model for forecasting for forecasting of variable RE generation?

iii. How do system operators and regulators handle the variability of RE resources in markets with high penetration of RE?

4. **Fundamental issues to be addressed:** While the deliberations on proposed amendment to RRF mechanisms are still underway, following fundamental issues should be addressed for successful implementation of any Scheduling and forecasting framework for RE sources:

- Centralized Vs Decentralized Forecasting
- Centralized Vs Decentralized Scheduling
- Appropriate institution to manage and facilitate the mechanism
- Extent of socialization of cost of deviation and sharing
- Incentive for forecasting accuracy

5. **Preparedness of implementing institutions to be assessed:** While the capability of generators to forecast generation and provide timely schedules is a key requirement, it is equally important to assess the preparedness of other institutions involved. Apart from wind/solar generators, the implementing institution of SLDC, RLDC, NLDC and RPC need to be geared up with adequate infrastructure and trained manpower. A few wind farm developers in Gujarat have initiated forecasting wind generation and providing day-ahead schedules to SLDC. It has also installed RTUs at all 220 kV and above s/s for remote data transfer to SLDCs. Real time Renewable Energy (Solar & wind) generation data is integrated with existing system and posted on the website of Gujarat SLDC. However, it is not clear whether any analysis of data or feedback for correction/improvement in the forecasts is provided to Wind Generators or not. Besides, it is also not clear whether wind generators have exercised allowable provision for revision for six times a day for improving the accuracy of wind forecast/schedules. It is important that detailed assessment of Gujarat experience of wind forecasting & scheduling is undertaken and gaps in processes, systems and institutional structure are identified. The learnings of such study should be used for institutional strengthening inter-State and Intra-State levels across board, for successful implementation of the forecasting and scheduling framework in India.

5. Wind Power Procurement models

Wind power procurement based on feed-in tariff approach has worked very well in Indian context. Besides, renewable energy certificate mechanism has also worked well during initial period but for lack of adequate RPO enforcement, RE power off-take under this route is suffering. Reverse bidding through discount on tariff has enabled another option for allotment of project development rights and power procurement in case of solar power projects. While the debate on competitive procurement as against feed-in tariff based procurement would continue, the selection of appropriate model for RE procurement needs to be compliant with the framework of Electricity Act, National Electricity policy and Tariff policy.

India has experience with a number of RE procurement mechanisms. Both the feed-in tariff approach and reverse bidding have met with success in different sectors, and at different stages of market development. However, no concrete analysis has been undertaken to understand the economic cost and impact of these mechanisms.

The draft National Wind Mission has suggested yet another model of centralized RE procurement at national level as against existing practice of state level procurement as

guided by state specific requirement and prevalent policy & regulatory regime at state level. There are several merits and de-merits associated with each of the option of RE procurement. Transparency in procurement, ease of RE power procurement, standard contracting arrangement, certainty of regulatory principles and approach are the key to success of any RE procurement model.

6. Stringent enforcement of RPO compliance

With the recent stern Orders from various Regulatory Commissions of JERC, HPERC and MPERC on RPO enforcement and with the Supreme Court Judgment regarding Obligated Entities, there is a revived hope in the Industry about RPO mechanism getting implemented of in its true spirit.

Hon'ble Supreme Court Judgment on RPO Compliance: The Apex Court in its Judgment dated 13th May 2015 has upheld the RPO Regulations of the Rajasthan Regulatory Commission, whereby the Court has ruled that the Commission is right in treating OA and captive consumers as obligated entities under the RPO framework and thus the RPO targets shall apply to them. The Judgment has come in the backdrop of appeal filed by Hindustan Zinc Ltd., Ambuja Cements Ltd., Grasim Industries Ltd. and 14 other companies that challenged RPO regulations enacted by the state regulator.

RPO Compliance Orders issued by various SERCs: The Joint Electricity Regulatory Commission (JERC) for Goa and Union Territories in its Order dated 12th November 2014, has issued strict directions towards RPO compliance. In the order the commission has asked all the distribution companies to comply with their RPO and submit a report on the compliance. In a similar Case, the Himachal Pradesh Regulatory Commission HPERC on 10th November 2014 issued order on petition filed by M/s Ujaas Energy Limited for non compliance of Renewable Power Purchase Obligation by obligated entities. The Commission has directed obligated entities to procure RECs from power exchange if there is any shortfall in the fulfilment of RPPO. In an order dated 20th October 2014, Madhya Pradesh Electricity Regulatory Commission (MPERC) has imposed a token penalty of Rs. 25,000 for non compliance of RPO.

Electricity Act (Amendment) Bill, 2014 and RPO: The bill proposes to include definition obligated entities and also recognize RECs by way of proposing that obligated entities may be mandated to procure electricity from or any market instrument representing the renewable energy sources. These changes are significant as they lay to rest the argument that the obligation to meet RPO is not mandated in the Electricity Act 2003 ('EA'), particularly for open access and captive generation.

While, the need for enforcement is getting established, all the State Regulators should strengthen its framework for monitoring of RPO compliance by Distribution Licensees, OA and Captive users. Considering the number of entities and the nature of consumption, Specific repository and framework will have to be formulated for OA and Captive users by the Regulator in co-ordination with the designated State Agency. States like Maharashtra and Rajasthan has already initiated formulation of specific compliance and monitory framework for OA and Captive users. All other States should take immediate steps towards formulation of similar frameworks for respective States.

7. Financing Mechanisms

Affordable financing is one of the critical factors limiting the large scale proliferation of wind energy. This is closely related to the cash-flow characteristics of wind energy projects. There are large and medium-sized projects that require a high initial investment. Operating costs are relatively low as one does not have to pay for the "fuel" supply. It is evident that the cost of the funds necessary for the initial investment is crucial in determining whether a specific wind energy project is competitive with a conventional source of energy project.

Some of the challenges faced by the wind project developers in financing the projects are:

- High interest rate environment in India
- Longer tenor debt is generally unavailable
- Fixed interest rate debt is rare
- Debt is not strictly non-recourse

Various avenues will have to be explored to meet the financing requirement of the Wind Industry. Following are few suggestions being discussed at various forums.

a. The government should allocate funds from the National Clean Energy Fund to meet the critical viability gaps.

b. A new escrow fund may be created to provide a payment security mechanism for developers.

c. Further, a separate category of RE financing may be created to encourage the banks and priority sector lending status to RE financing will also encourage the banks.

d. Avenues should also be explored whereby, benefits can be provided to retail investors for investment in wind to increase participation in capital market.

8. Framework for Incentives

As discussed earlier, the capacity target of 60 GW target set by MNRE by 2022, translating to 12-15 GW per year, calls for creation of appropriate incentive through pricing and other measures. Key point that requires comprehensive deliberation is whether the prevailing level of incentives is sustainable in the long run. Central Government has put in place fiscal and promotional incentives like GBI, concessional import duty, AD, Excise duty relief, cheaper loans through IREDA, etc. Incentives could make India an attractive location for manufacturers both for the Indian markets as well as for exports. DTC and GST are two fiscal provisions which would have far reaching implication on the growth of the sector. The implications of the same should be discussed and appropriate recommendations to be evolved for ensuring continued benefit to the Wind Industry.

Direct Tax Code (DTC)	
Proposed DTC	Direct Taxes Code Bill, is expected to consolidate and integration all the direct tax laws and replacement of both the Income Tax Act, 1961 and the Wealth Tax Act, 1957 This amalgamation will bring together an economically efficient, operative, and equitable direct tax system, which, in turn, will facilitate voluntary compliance and assist in widening the tax - GDP ratio.
Impact	The main implication is the withdrawal of the income tax holiday and similar benefits. It is not clear from the proposed code whether the income tax holidays currently enjoyed by various renewable energy projects in India will be continued
Suggestions	Ensure that the Direct Tax Code continues to provide the tax holiday as provided under the current direct tax laws to some categories of infrastructure projects
Goods and Services Tax (GST)	
Proposed	GST is envisaged to abolish all other existing tax structures such as octroi, the central sales tax, state-level sales tax, excise duty, service tax, and VAT. Both the Central and State governments will impose the GST on all goods and services produced domestically or imported
Impact	Cascading tax structure No excise duty exemption RE currently forms a part of negative list of services imposing a greater tax burden
Suggestions	Electricity duty should be considered within the GST and a suitable mechanism formulated to share the GST collected on account of electricity duty between the Centre and the States. Extend the exemption from excise duty enjoyed by most renewable energy generators Place the services rendered to or by or for the development of renewable energy in India in the negative list

9. Emerging Business Opportunities:

9.1 Repowering:

Repowering is replacement of small- capacity wind; turbines of old wind farms with modern megawatt scale wind turbine, thereby enhancing the generation capacity of the wind farm. Countries like Germany, USA, and Denmark have already implemented repowering programs to effectively utilization of wind resources. In spite of obvious advantages and potential of repowering in India, it has failed to pick up steam. There are several barriers or challenges in context of repowering of wind projects in India. Some of the major barriers/challenges/ Points to be discussed are as given below:

- **Turbine ownership:** Repowering will reduce the number of turbines and there may not be one to one replacement. Thus, the issue of ownership needs to be handled carefully.
- **Land ownership:** Multi-ownership of wind farm land may create complications in conceiving repowering projects.
- **Power purchase agreement (PPA):** PPA is signed with Distribution Company for 10/13/ 20 years and Distribution Company may not be interested in dishonouring or revising the PPA before its stipulated time.
- **Captive sale / sale to DISCOM / third party sale:** Modes of sale of electricity are different. The third party buyer may not allow or investor may not want to interrupt the captive usage of electricity.
- **Evacuation facilities:** Evacuation facilities are designed to support present generation capacities and may require grid augmentation and up gradation.
- **Treatment of additional capital cost:** The question arises as who will bear the additional project cost required to make the repowering project viable: investor, developer or the government. Moreover, other additional cost components which are required to be considered are decommissioning cost, transportation and shifting charges of old turbines, net present value of revenue from future generation depending upon balance life, etc.
- **Problem of disposal of old turbines:** There are various options such as scrapping, buy-back by the government or manufacturer or exporting to other countries.
- **Suitable incentive structure:** One of the primary barriers to repowering is the general lack of economic incentive to replace the old wind turbines. In order to compensate the additional cost of repowering, there should be certain incentive mechanism.

Concerted effort is required to identify suitable mitigation measures to overcome difficulties faced in promotion of wind repowering in India. We can strive to learn from repowering efforts undertaken across the world to identify possible measures.

9.2 Promoting Off-shore wind:

Development of offshore wind projects present variety of construction, operation, and regulatory challenges that are not encountered in the development of land-based onshore wind projects. Some of the major barriers/ challenges are as given below:

- **Lack of reliable data on Offshore Wind Potential:** As of today, the potential for offshore wind power generation and wind power density in the Indian context has not yet been estimated. However, taking the right steps towards estimating potential for offshore wind projects in India, MNRE along with National Institute of Wind Energy (NIWE) is undertaking a study to ascertain the feasibility of setting up wind farms in India's offshore areas and the study is expected to get completed in the coming years.
- **High Initial Capital Cost and Cost of Energy:** Offshore wind systems are costlier than their onshore counterparts, both in terms of capital and operating costs. According to the estimates of Douglas Westwood 2010 , the current capital cost of the offshore wind power system for typical shallow water and semi-near shore conditions in the UK is USD 4 471/kW which is around 2.5 times higher than onshore. It should be noted that offshore wind farm costs increased in the decade to 2012 as experience with the complexities of offshore wind farms grew.

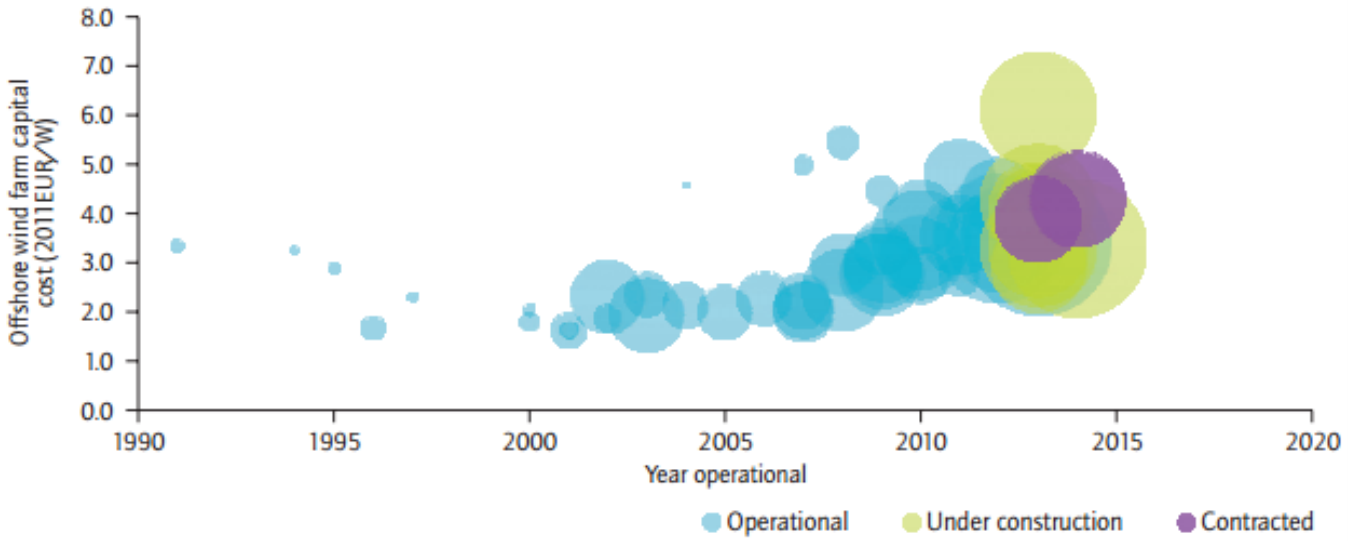

Figure 3: Capital cost movement for Offshore Wind

Similarly, the operation and maintenance cost amounts to 1 to 3 per cent of the capital cost for onshore wind projects, whereas the same for offshore projects amounts to 3 to 7 per cent of the capital cost. Based on the same, levellized cost of generation offshore wind is estimated to be almost 1.5-2 times than that of the onshore wind farms as per the draft national offshore wind energy policy by MNRE.

- **Power Evacuation Infrastructure:** In contrast to the power evacuation infrastructure requirements of the onshore wind projects, offshore wind projects requires long distance underwater cables for evacuating power from the wind farms offshore to the load centres in the costal line or to the grid substations in the mainland. Though there exist proven technologies for such power evacuation, since the cost involved will be at higher side, there could be a genuine need for a cost sharing mechanism to be in place for the projects to be made viable.
- **Grid Integration Issues:** Offshore wind farms are larger in capacity terms compared to its onshore counterparts. Also the degree of infirmity is lesser for the former ones. However, integrating larger scale offshore wind projects, though with lesser degree of infirmity could pose a challenge to the healthy operation of the grid. This calls for necessary technical up-gradation of the Grid as well as amendments in the Grid operation codes to be in place so as to ensure reliable integration and operation of the Grid.

9.3 Wind-Solar Hybrid Systems:

The issue of variable power generation profile with seasonal / daily variation in power output associated with standalone Wind or standalone solar projects can be addressed effectively by devising hybrid RE (Wind-Solar) project scheme. Hybrid RE solutions can get a more consistent power generation output that can be fed to the grid. The hybrid RE (Wind-Solar) scheme offer several advantages in terms of optimal utilisation of RE resource and land usage, shared interconnection & evacuation infrastructure and improved power generation & scheduling regime.

While several small scale (Watt and kW range) hybrids schemes are operational for some time, there are no MW class hybrids installations yet established in India. Several technical studies in terms of optimal sizing of wind-solar mix, transmission/evacuation power flow studies etc. would be necessary before implementation roadmap for development of hybrid RE can be drawn up by policy makers and planners. The main challenges associated with implementation of utility scale Hybrid RE (wind-solar) can be categories into following: (a) Technical Challenges –

viz. interconnection arrangements, metering and energy accounting mechanism (b) Commercial Challenges – viz applicable tariff & regulatory treatment for RPO, framework for commercial settlement, offtake arrangements etc. Suitable policy guidance and regulatory framework need to be put in place to encourage Solar-Wind Hybrid systems.

9.4 Promoting Energy Storage applications:

Energy storage devices play key role in optimizing supply and demand imbalance thereby supporting the growth of intermittent RE sources. It also facilitates reducing congestion on transmission/distribution network elements and helps defer investment in upgrade requirement of transmission /distribution network. The advancement in technology options for Energy storage and reduction in cost of storage devices has opened up new opportunities for micro-grid operators for rural electrification as well as for urban rooftops & distributed generation applications. It is estimated that market potential for energy storage devices/applications is in excess of 20 GW in India. However, there is urgent need to develop suitable policy framework and regulatory incentives in terms of pricing signals, creation of ancillary services market which would encourage investment in energy storage devices/ applications.

9.5 Small Wind Turbines:

Small Wind Turbines (SWT) is defined as wind turbines having rated capacities of 100 kW or less. SWT and Small Wind–Solar Hybrid Systems (SWES) are becoming more popular worldwide as the technology has matured.

SWT are used throughout the developed and developing world and are primarily used in rural or remote settings in the domestic and international markets. SWT can be used to power communities, businesses, schools, clinics, single households, farms and a variety of equipment. SWT can be developed to meet the specifications suitable for the domestic and international (developed and developing) markets and can be hybridized with other renewable energy technologies to offer better generation profile and to have optimum utilization of existing infrastructure.

On a stand-alone basis, small wind systems may not be economical in comparison to utility scale projects. But there exists immense scope for SWT-solar hybrid systems, water pumping mills and other applications. Hybrid systems are fairly cost competitive and more efficient as the different sources complement overall generation, thereby improving system reliability. SWT based applications are suitable for captive generation in industries. In the case of telecom towers however, there may be issues in installing turbines as they could cause hindrance in tower operations. This can be circumvented by factoring in the SWT at the design stage of the telecom towers. SWT can be easily installed on the northern boundaries of large grid-connected solar projects, without any shadow effect on the panels. Power produced from these turbines can be easily evacuated and transported to grid through the infrastructure set-up for the solar project.

10. Conclusion: Achieving the target level WE 20 by 2020

With an ambitious target of 60 GW by 2022 set by Government of India, the wind energy sector is poised to achieve 6 GW per annum installation in the next 5 years. The wind power industry is confident of achieving this ambitious target on the back of Hon'ble Prime Minister's "Make in India" campaign. The confidence was evident throughout the first renewable energy global investors meet and Expo organised by the MNRE – "RE INVEST 2015". The Central Government has also given assurance in helping to sorting out the issues and challenges the sector is grappling with. The Central government has informed it has already started interactions with the State Governments to facilitate the fulfilment of the commitments received in the RE-INVEST 2015.

The deliberation during 4th International Conference on Wind Energy (WE 20 by 2020) presents an opportunity and platform to build consensus on several policies, regulatory, technological, implementation aspects that would influence the future growth of the wind sector in India.

Overall, the hopes are high in the air for the Wind sector, however the realisation of capacity addition target will require concerted efforts and focusing & solving the various issues pertinent as discussed in this paper.

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The wind energy markets worldwide:

An overview

Stefan Gsänger — Coimbatore, 21 June 2015

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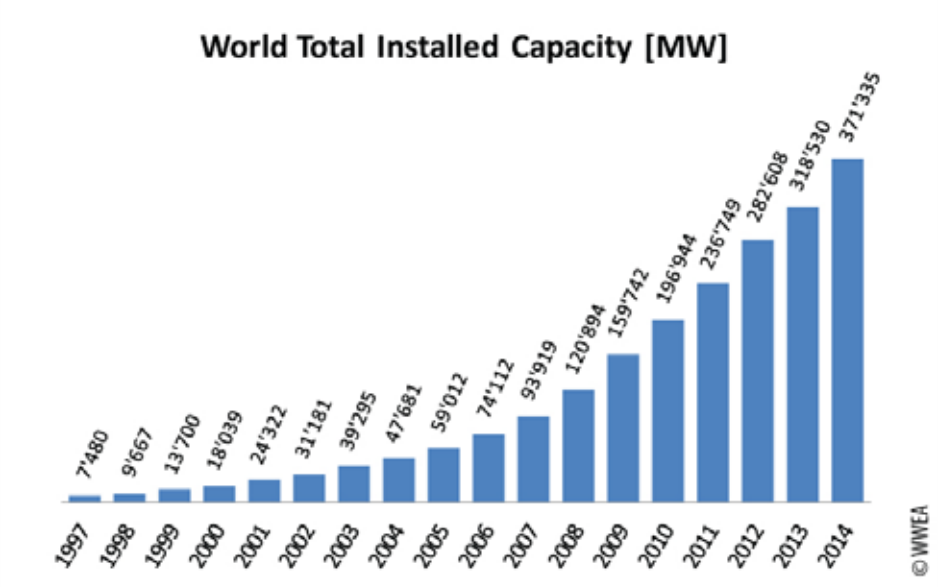

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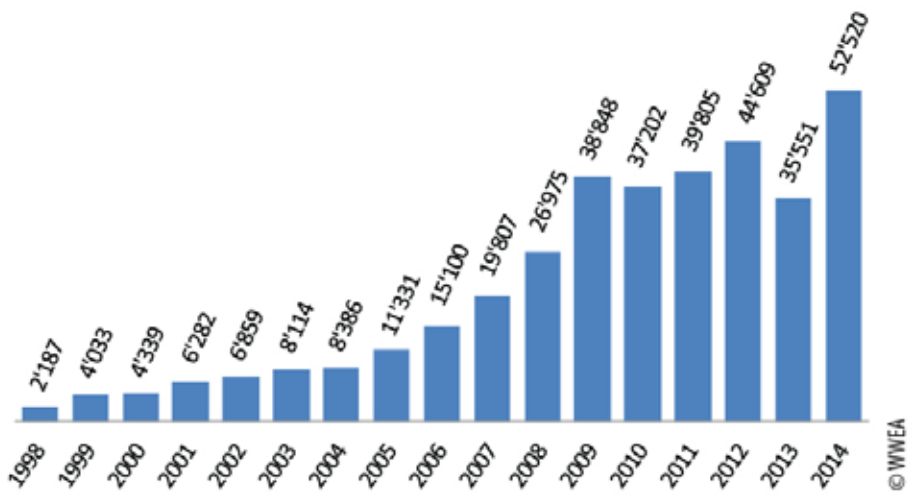
New Installed Capacity [MW]



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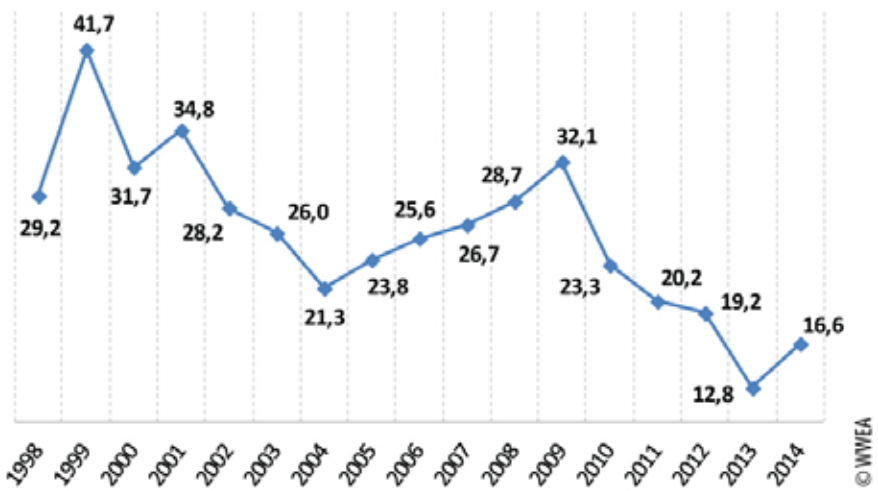

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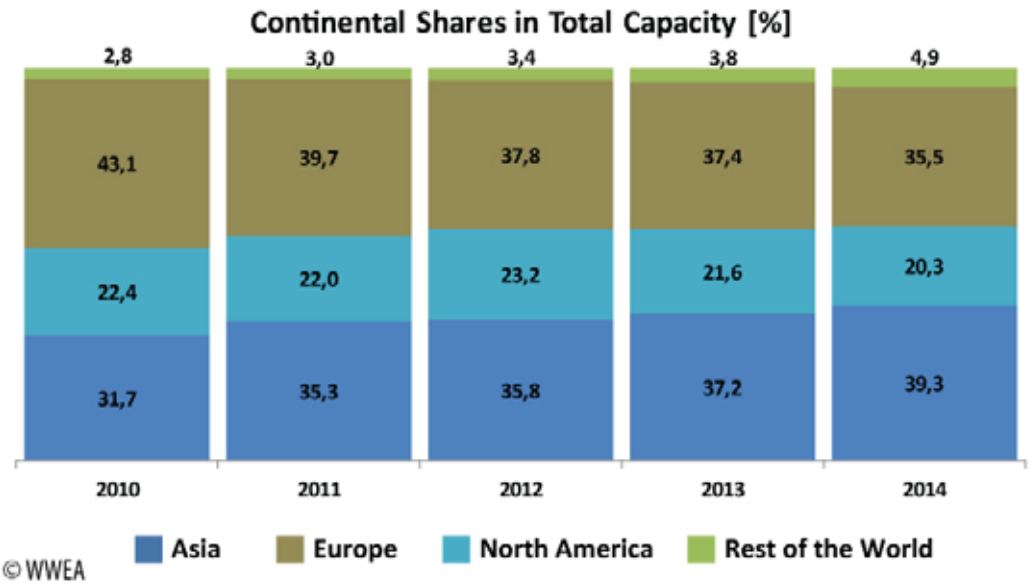
Asia is leading!



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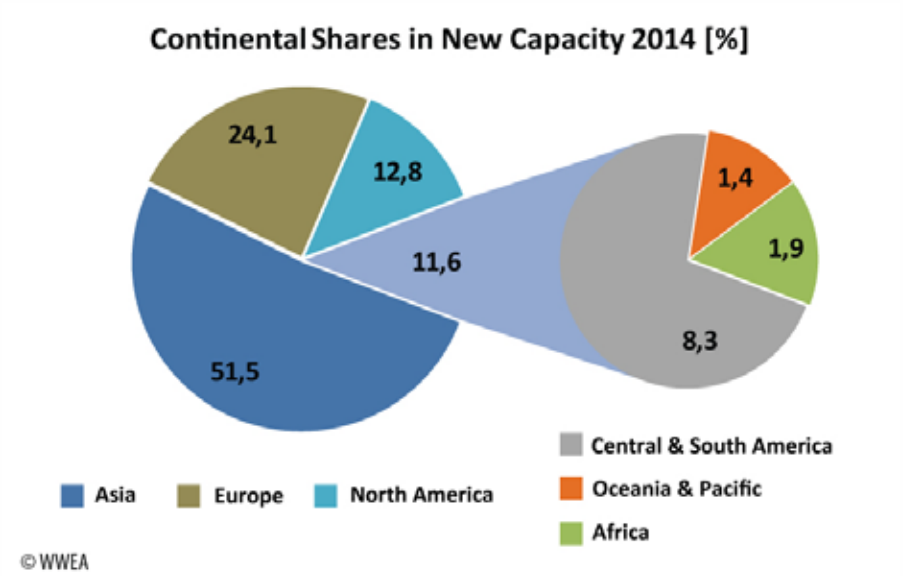
New Markets are coming up



Top Ten Markets

Position 2014	Country/Region	Total capacity end 2014	Added capacity 2014	Growth rate 2014
		[MW]	[MW]	[%]
1	China	114'763,0	23'350,0	25,7
2	United States	65'754,0	4'854,0	7,6
3	Germany	40'468,0	5'808,0	16,8
4	Spain	22'986,5	27,5	0,1
5	India	22'465,0	2'315,1	11,5
6	United Kingdom	12'440,3	1'736,4	16,1
7	Canada	9'694,0	1'871,0	25,9
8	France	9'296,0	1'042,0	12,6
9	Italy	8'662,8	107,5	1,3
10	Brazil	5'961,6	2'495,5	72,0

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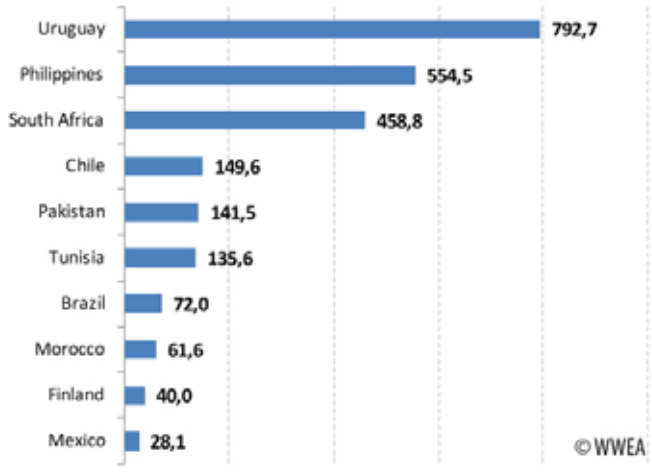
Top 10 Countries by Growth Rate 2014 [%]
- Markets bigger than 200 MW -



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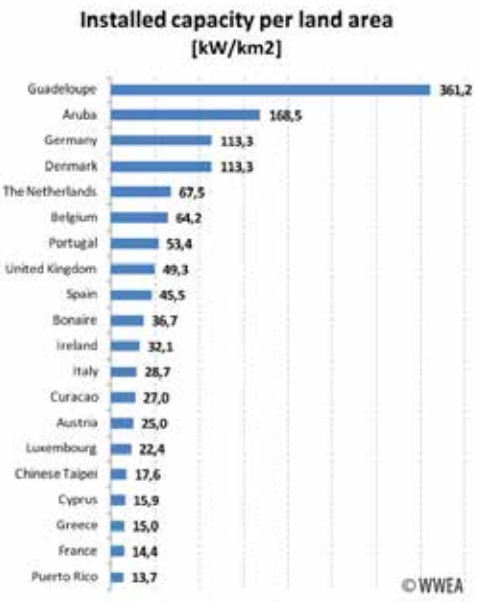

If the world follows Denmark or Germany:

> 12‘000‘000 MW wind capacity

←→ India: 370‘000 MW

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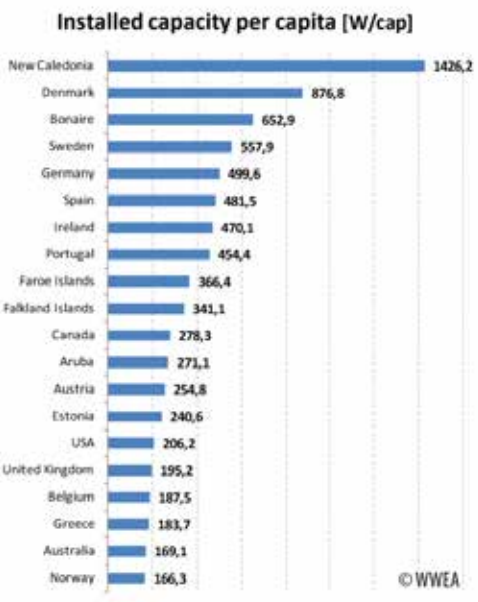


If the world follows Denmark:

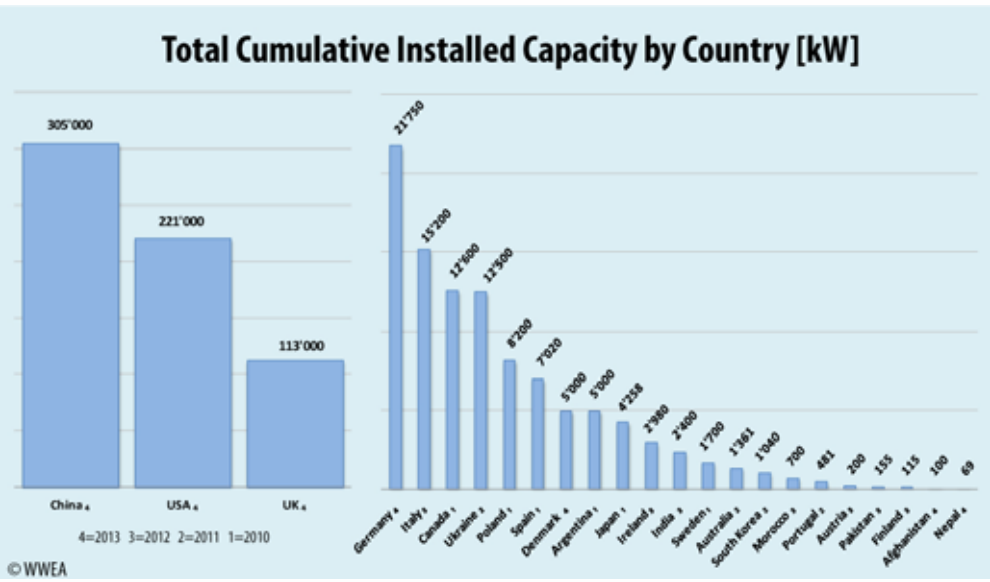
> 6‘400‘000 MW wind capacity

←→ India: >1‘000‘000 MW

Electricity generated:	**~ 800 TWh**
Share in global electricity demand:	**~ 4 %**
Countries with high wind shares:	**Denmark 34 %** **Spain 21 %** Portugal > 20 % Ireland 16 % Uruguay 18 % Germany 10 %

World Wind Energy Association
Uniting the World of Wind Energy
www.wwindea.org

Small Wind (< 100kW)



Stefan Gsänger Coimbatore, 21 June 2015

WWEA

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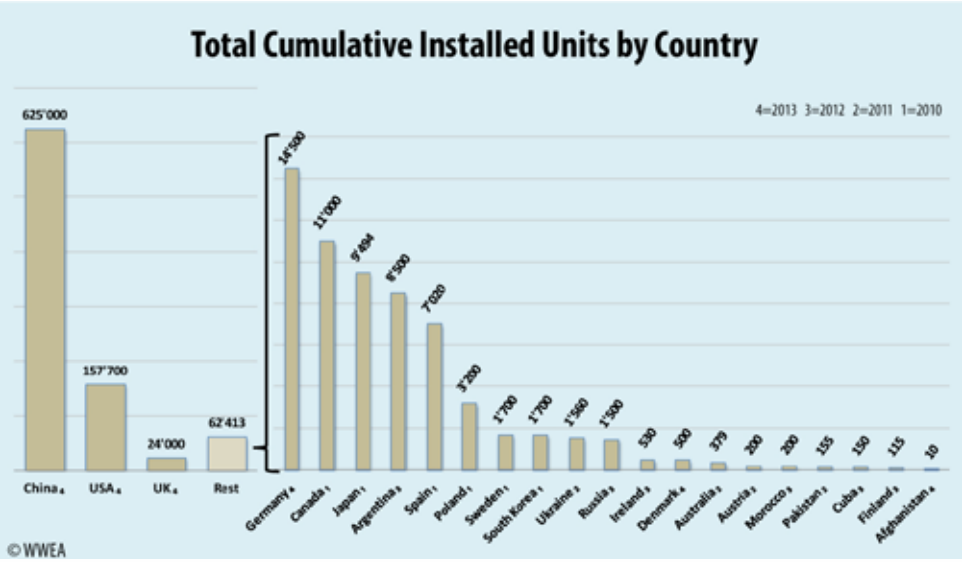
Small Wind (< 100kW)



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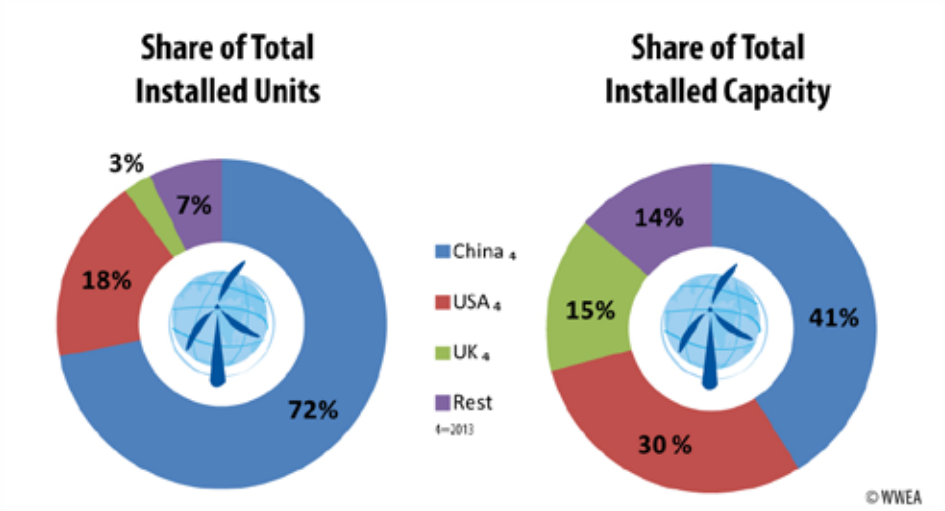

WWEA

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Uniting the World of Wind Energy
www.wwindea.org

A Result of COP18: A Global Campaign

100% RENEWABLES
www.go100re.net

Stefan Gsänger — Coimbatore, 21 June 2015

WWEA

World Wind Energy Association
Uniting the World of Wind Energy
www.wwindea.org

Symphony of the Renewables

Stefan Gsänger — Coimbatore, 21 June 2015

Powering a Greener Tomorrow, Today

Global Installations
Over 26,000 MW

Global Presence
30+ countries

Product Portfolio
600 kW - 6.15 MW

R&D Facilities

Denmark, Germany, India and The Netherlands

SUZLON

POWERING A GREENER TOMORROW

www.suzlon.com

WWEA

World Wind Energy Association
Uniting the World of Wind Energy
www.wwindea.org

Vision and Goals

1. Fossil and nuclear free world

100% renewable energy in all energy sectors globally: power, heating/cooling, and transport sectors

2. Investing today in the renewable energy system of tomorrow

New energy investment must be 100% renewable energy based, starting now

3. Encouraging local solutions

Decentralized and community-based approach is the proven fastest way to transition to 100% renewable energy - and adds local value

Stefan Gsänger **Coimbatore, 21 June 2015**

WWEA

World Wind Energy Association
Uniting the World of Wind Energy
www.wwindea.org

How to reach 100 % Renewable Energy?

100% RENEWABLES
www.go100re.net

Stefan Gsänger **Coimbatore, 21 June 2015**

Symphony of the Renewables: Inspire Change

WWEA
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Uniting the World of Wind Energy
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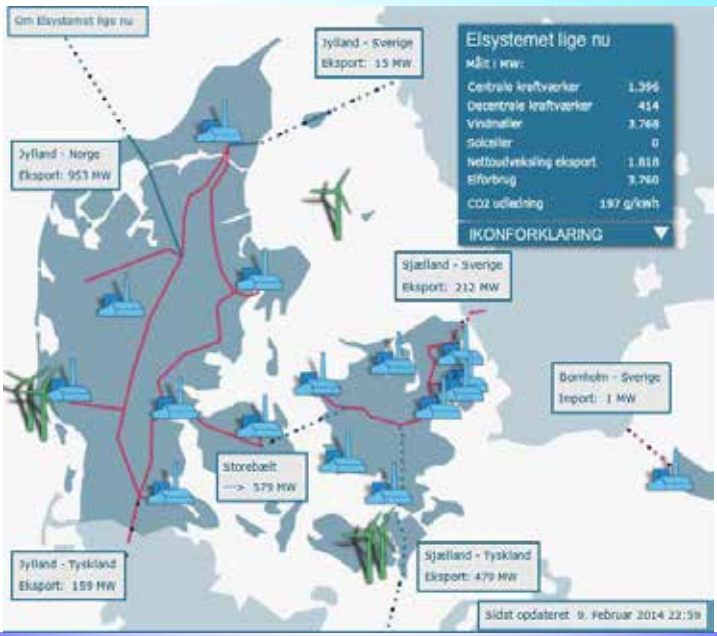
Learning from Best Practice: 100% Wind Power



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Building Alliances: Campaign Supporters

Associations

Civil Society

Research Institutes

Projects

Stefan Gsänger — Coimbatore, 21 June 2015

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Campaign Projects

The international 100% RE Region Network

The global 100% RE network

The World Map of 100% RE case studies

& Group of International Ambassadors

& Global Progress Panel

& …

Stefan Gsänger — Coimbatore, 21 June 2015

WWEA

World Wind Energy Association
Uniting the World of Wind Energy
www.wwindea.org

FINANCE IS ONE KEY

Financing Wind in "Developing" Countries:

Dedicated funds and mechanisms are needed:

REN Alliance published a position paper on the

Green Climate Fund

Coimbatore, 21 June 2015

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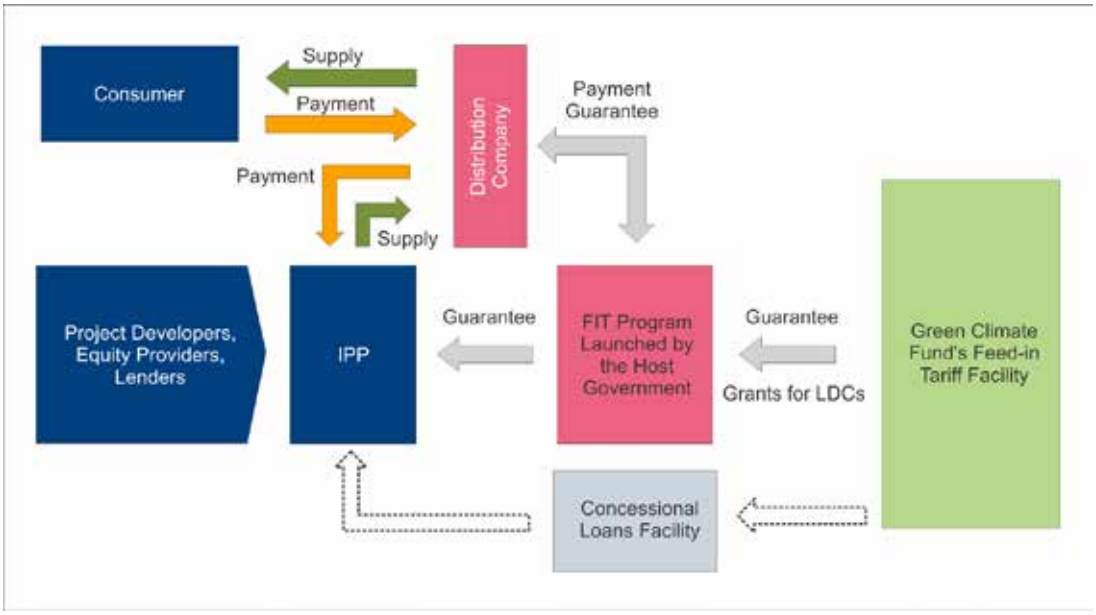
Uniting the World of Wind Energy
www.wwindea.org

Proposal for a Global FIT Programme



Coimbatore, 21 June 2015

WWEA

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Uniting the World of Wind Energy
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Based on 5 Billion USD available for climate change mitigation

a Global FIT programme could leverage

investment of 200 Billion USD in renewable energy

⇔ more than 100‘000 MW of wind power!

Coimbatore, 21 June 2015

WWEA

World Wind Energy Association
Uniting the World of Wind Energy
www.wwindea.org

Join the World of Wind Energy!

www.worldwindconf.net

Stefan Gsänger Coimbatore, 21 June 2015

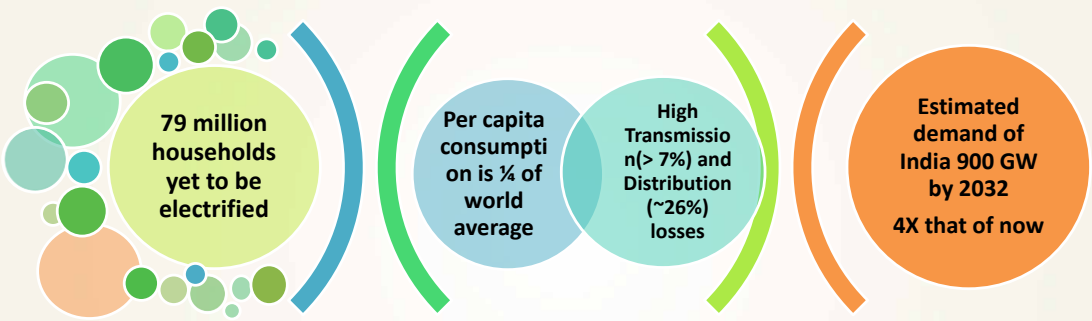
ROLE OF ENERGY STORAGE IN SMART GRIDS

ISGF
India Smart Grid Forum

Akshay Ahuja
Business Analyst
India Smart Grid Forum (ISGF)

June 2015

Challenges for India



To address the above challenges, the Indian power system is expected to grow 8-10% p.a for next several decades

Developing countries like India need to invest in both strengthening the electrical network as well as adding communications, IT and automation systems to build a strong and smart grid

By implementing incremental improvements in a BAU scenario we will not be able to provide 24x7 electricity to all households in the country

It requires innovative strategies, breakthrough technologies and bold decisions

Traditional grid

- *Defined boundaries (G+T+D)*
- *One-way flow of electricity*
- *Investments in "G&T&D*
- *Volumetric Tariffs*
- *Inflexible Demand*
- *Merit Order Dispatch*
- *Expensive renewable energy*
- Supply demand shortfall

Smart grid

- *More generation at Distribution*
- *Prosumers ->bi-directional flows*
- *Distributed Generation + Storage + Distribution*
- *Transactive Tariffs*
- *Price Responsive Demand*
- *Energy Efficient and Environmentally responsible dispatch regime*
- SPV parity reached(INR *6-7/kWh*
- *Large fleets of EVs that can be aggregated as virtual power plants to support short term supply-demand balancing*

Policies and Programs

The smart grid vision and roadmap for India and the National Smart Grid Mission soon to be launched along with all these ground breaking initiatives, India has already emerged as the prime destination for Smart Grids and Smart Cities

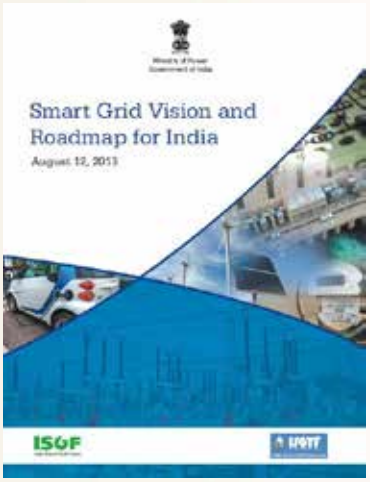
Pursuing world's largest grid connected RE programs (100 GW solar, 60 GW wind)

3 focused programs for providing 24x7 power for all with total capital outlay of US$ 14 billion

National Electric Mobility Mission with a target of 6 million EVs by 2020

New Govt has announced ambitious programs to build 100 Smart Cities

Smart Grid Vision & Roadmap for India



During 12th Plan	During 13th Plan	During 14th Plan
A) Enable Access and Availability of Quality Power for All		
• Electrification of all households by 2017 • Reduction in power cuts: 24 hrs availability of power at principal cities, 22 hrs for all towns and Life line supply (8 hrs, including evening peak) to all by 2017	• 24 hour supply in all urban areas; Minimum 12 hour supply to all consumers (including evening peak) by 2022	• Stable and quality 24x7 power supply to all categories of consumers across the country
C) Smart Grid Rollouts including Automation, Microgrids and other improvements		
• SG Pilots, full SG roll out in pilot project cities • Infrastructure for AMI roll out for all consumers with load >20KW or as per prioritised target areas of Utilities • Deployment of Wide Area Monitoring Systems (WAMS) • Development of micro grids in 1,000 villages/industrial parks/commercial hubs • Enablement of "Prosumers" in select areas	• SG roll out in all urban areas • Nationwide AMI roll out for customers with 3-phase connections • Deployment of WAMS at all substations and grid connected generation units • Development of micro grids in total 10,000 villages/industrial parks/commercial hubs • Enablement of "Prosumers" in metros and major urban areas	• SG rollout nationwide • Nationwide AMI roll out for all customers • Development of micro grids in 20,000 villages/industrial parks/commercial hubs • Active Participation of "Prosumers"
F) Electric Vehicles and Energy Storage		
• Development of EV and smart grid synergy plan (in coordination with National Electric Mobility Mission) • EV charging stations in urban areas and along selected highways • Introduction of Battery Parks and other Energy Storage Systems on trial basis	• Large roll outs of Energy Storage Systems • EV charging stations in all urban areas and strategic locations on highways	• EV charging stations in all urban areas and along all state and national highways

ISGF India Smart Grid Forum

Drivers for Energy Storage in India

- Balance supply-demand mismatch & utilize storage for peak periods
- Ancillary Services
- Time Shift
- Reliable power supply/Backup
- Defer/reduce the need for new generation capacity and transmission upgrades
- Renewable Integration
- Microgrids
- Electric Vehicles

ISGF India Smart Grid Forum

Role of Energy Storage

New Renewable Energy Targets

- India is already operating as one of the largest grid in the world with around 258 GW installed capacity, 200 million + consumers
- Presently, Installed capacity of grid connected solar in India is 2 GW approx. and wind has a installed capacity of 18 GW approx.
- In 2010, National Solar Mission was launched with a target of 20 GW by 2022
- New Government has raised the bar and has set ambitious target of 175 GW of renewable energy by 2022.
    - 100 GW of Solar
    - 60 GW of Wind
    - 10 GW of Bio Energy
    - 5 GW of Small Hydro
- As much as 40 GW of the 100 GW solar is expected to come from rooftop solar projects 40 GW which may be spread across nearly 20 million+ rooftops – i.e **20 million points of power injection to the grid and equal opportunity for energy storage**

Net Metering Policy

- As a part of a regulatory overhaul in favour of distributed solar, several state governments are incentivizing rooftop solar systems through net metering schemes.
- Net-metering allows rooftop solar power generators to feed solar power, which has not been consumed, into the grid and be compensated for that. The compensation per unit is usually the same as the grid tariff
- Implementation of net metering policy across states will lead to a wide adoption of solar PV by small consumers
- Until January 2015, 13 Indian states: Andhra Pradesh, Uttarakhand, Tamil Nadu, West Bengal, Madhya Pradesh, Kerala, Assam, Haryana, Delhi, Karnataka, Assam, Punjab, Goa and Union Territories have released the net metering policies with some of them having policy in draft stage.
- Many States provides consumers with an option of **energy storage** along with the net metering.

Mandatory Rooftop Policy

- The State of Haryana has made it mandatory for all buildings on plot size of 500 square yards or more to install rooftop solar power systems by September 2015.
- The order will be applicable to private bungalows, group housing societies, builder apartments, malls, offices, commercial complexes, schools, hospitals — any building, new or old, that meets the plot size criteria.
- The minimum solar power capacity to be installed is 1 kilo Watt or 5% of a building's connected load, whichever is higher.
- Energy Storage is going to be one of the key component
- More States will come forward with policies like this

Microgrids

- In the Smart Grid Vision and Roadmap for India, it is envisaged that 1000 microgrids will be implemented in present 12th five year plan, 10000 microgrids in 13th five year plan and 20000 microgrids in 14th five year plan.
- India has approximately 24,000 unelectrified villages
- Government of India is planning to provide 24x7 electricity supply to all. In order to achieve this target, Government has released programs like Deendayal Upadhyaya Gram Jyoti Yojana (DUGJY) which will work towards rural electricfication.
- Energy Storage as a part of Microgrids for rural electrification will play a vital role in India specially for the places where grid cannot be reached.

Deendayal Upadhyaya Gram Jyoti Yojana (DUGJY)

The DDUGJY scheme carries forward the RGGVY targets and sanctions for rural electrification with special emphasis on agricultural feeder separation and strengthening of sub-transmission and distribution infrastructure including metering of DTs, feeders and consumers in rural areas. Again the promise of speedy completion and delivery of projects is heartening. Total capital outlay of INR 430.33 billion has been sanctioned in addition to the INR 392.75 billion previously sanctioned under the RGGVY.

National Smart Grid Mission

- A **National Smart Grid Mission (NSGM)** has been approved and will be launched soon that will have the overall responsibility to bring all stakeholders for successful implementation of the policies and programs envisaged under this Roadmap.
- Indicative components of Smart Grids will be:
  - Development of medium sized Microgrids
  - Development of Distributed Generation in form of Roof Top PVs
  - Creation of EV charging Infrastructure for supporting proliferation of EVs

Electric Vehicles

- Department of Heavy Industry, Government of India in 2012 launched **National Electric Mobility Mission (NEMM)** in order to promote electric vehicles in India
- Targets envisaged in NEMM is **6 million** electric vehicles on road by **2020**
  - **4 million 2 wheelers**
  - **2 million 4 wheelers**
- Mission will start in April 2015; consumer incentives will be announced; electronic-reimbursement-system to manufacturers; for a period of 5 years till 2020.
- In a move to boost electric vehicles sales in the country, the government has earmarked Rs. 1,000 crore ($160 million) for the National Electric Mobility Mission Plan for the next two financial years (FY 2015-16 & FY 2016-17).

Smart Cities

- India plans 100 new smart cities and will develop modern satellite towns around existing cities under the smart cities programme
- Smart Cities initiative is aimed at increasing urban grid reliability and accessibility and that can be supported by energy storage. Some of the desired features of a Smart Cities will be:
  - Smart electricity grids that ensure 24x7 stable supply of electricity to all citizens
  - High levels of renewable energy mix that is integrated with the smart power grid; evolution to smart microgrid that can island from main grids
  - Electric Vehicle (EV) charging infrastructure and ability to operate large fleet of grid-connected EVs as virtual power plants (VPPs)
  - Intelligent buildings with rooftop PV and EV charging facilities integrated with automation systems of the electric utility participating in the demand response market
  - Demand Response (DR) that would create “negawatt” market and IT infrastructure that permit its aggregation for meaningful dispatch

Summarizing the Role

- Avoiding high generation cost during peak demand period
- Long distance between generation and consumption
- Vehicle to Grid Technology
- Help in reducing ramping impacts on fossil fuel generators caused by infirm nature of renewable energy
- Energy storage can play a vital role in ancillary services
- Provision for islanding of a grid into multiple microgrids

Some Initiatives in India

Some Initiatives in India

Ministry of New and Renewable Energy (MNRE)

The Ministry of New and Renewable Energy (MNRE) has identified high potential application areas. Looking at the increasing importance of energy storage for integrating renewable energy, the MNRE propose to support demonstration projects for energy storage to assess feasibility of energy storage technologies for small scale and grid connected MW scale renewable energy applications.

MNRE is looking to support demonstrations of energy storage technologies in each of the following categories:

- Large scale grid connected project for integrating wind and solar generation into the transmission grids – up to 5 MWh
- Rural Micro Grids – up to 100 kWh
- Micro grids in commercial, industrial, residential, defense or other applications – up to 100 kWh to 1 MWh
- Large scale standalone systems – up to 1 MWh

Some Initiatives in India

Continue…

The main objective of these projects is:

- To demonstrate the technical performance, value of energy storage and potential business models to support energy storage in priority application areas
- Outcome of these projects would help in developing a large programme for energy storage in the country and ways to scale up deployment in key application areas
- Identify policy measures to support the scale up, while reducing direct public support or subsidies
- Develop protocol for effective validation of technical performance of storage technologies
- Engage key stakeholders by attracting their participation in the demonstration programme and making them aware of the benefits of the technology, market potential, innovative ways of using the technology etc.

In Oct 2014, MNRE posted RfP for energy storage applications. Presently MNRE is doing technical evaluation of the proposals and setting up of pilot projects is proposed to begin from September 2015

Some Initiatives in India

Power Grid Corporation of India Ltd (PGCIL)

To find suitability of battery technologies for grid scale storage system in India, Power Grid Corporation is India (PGCIL) invited bids for energy storage demonstration projects under 3 categories:

- Lithium Ion batteries
- Advanced lead Acid batteries &
- Sodium Nickel Chloride / Alkaline/ Flow Battery

This demonstration project could establish the criteria for integration of large scale energy storage for grid integration of renewable as well as ancillary services in India

PGCIL has already done the tendering process and 13 bids were received which are presently being evaluated and most likely to be awarded by July 2015.

Some Initiatives in India

Telecom Regulatory Authority of India (TRAI)

- Department of Telecommunication (DoT) issued guideline making it mandatory for telecom companies to power at least 50 per cent of mobile towers in rural areas and 20 per cent in urban areas by hybrid power by 2015
- Also, 75 per cent of rural towers and 33 per cent of urban towers are likely to be powered by hybrid power by 2020
- The hybrid solution consists of power from renewable sources, hydrogen fuel cells- and grid electricity

Some Initiatives in India

State Governments Initiatives

- The Bangalore Metropolitan Transport Corporation (BMTC) introduced the country's first electric zero-emission bus in the Bangalore city
- Gujarat Government will soon introduce a pilot project to run 'electric buses' for public transport between the state capital Gandhinagar and Ahmedabad
- It is reported that more than 1,00,000 E-Ricks are already plying on Delhi roads. These E-Ricks are economical and eco-friendly mode of transport, which provides last mile connectivity from residential colonies to main roads and metro stations which are within a radius of 2 to 3 km. If the current trend continues, the numbers of E-Ricks are expected to go up to 5,00,000 by 2020 in Delhi alone and are also expected to proliferate in other cities across India.

Thank You!!

akshay@indiasmartgrid.org

ISGF
India Smart Grid Forum

Media News

Renewable energy targets quadruple globally in 10 years: International Renewable Energy Agency

DUBAI: Renewable energy targets are now a "defining feature" of the global energy landscape with developing economies leading its adoption, the International Renewable Energy Agency has said.

A total of 164 countries have adopted at least one type of renewable energy target, up from just 43 countries in 2005, according to the Renewable Energy Target Setting which was launched on the sidelines of IRENA's ninth Council meeting.

"Renewable energy targets have emerged as a popular mechanism to set national and regional economies on the path towards a more secure and sustainable energy future. They provide an important signal to the industry and can help align stakeholders by creating a clearer, common vision for the development of the energy sector," IRENA Director-General Adnan Z Amin said yesterday.

"Renewable energy targets are now a defining feature of the global energy landscape," IRENA said, adding that developing and emerging economies are leading the adoption of targets, accounting for 131 of the 164 countries with renewable energy targets.

The majority of countries focus on the electricity sector - 150 countries has renewable electricity targets - but commitments in other sectors are also on the rise.

The number of countries setting targets for the heating/cooling sector increased from two countries in 2005 to 47 today. Similarly, renewable transport targets have more than doubled from 27 countries in 2005 to 59 today.

"Governments are increasingly adopting renewable energy targets to meet multiple objectives including energy security, environmental sustainability and socio-economic benefits. The rapid growth of targets is just one more signal of the world's ongoing shift towards renewable energy and away from fossil fuels," said Amin.

In order to be seen as credible by investors and society and to provide a reliable trajectory for the future evolution of the energy mix, renewable energy targets need to be accompanied by a clear strategy and backed by specific policies and measures, the report added.

RECONNECT ENERGY
The Energy Solutions Company

Central Forecasting – An Assessment

15 APR 2014

Vishal PANDYA | Madhusudan C | Vineet SHASHTRY

Bangalore | New Delhi | Mumbai | Chennai | Hyderabad | Indore

ABOUT RECONNECT

Management & Team

		Education	Key Positions / Experience	Current Engagement
Advisory Board	**Prof. S A Khaparde**	PhD – IIT Kharagpur	• Member (Advisory Committee): MERC, IEX • Member – Indian Smart Grid Forum	Professor, Dept. of EE, **IIT Bombay**
	Bruce M Usher	MBA – Harvard Business School	• CEO – EcoSecurities (World's largest Carbon trading firm) • CEO – Treasury Connect LLC • Chairman – Persistent Energy Partners	Executive in Residence – Social Enterprise Program **Columbia B-School**
Core Team	**Vibhav Nuwal** (New Delhi)	MBA – Columbia Business School	• Carbon Finance – Managing Emissions • Worked with J P Morgan, Arthur Andersen, LEK Energy (UK)	Director (Head – RPO Market)
	Vishal Pandya (Bangalore)	M.Tech – IIT Bombay	• Power Trading & REC - IEX • Sub-station Designing – L&T	Director (Head – Electricity and Market Analytics)
	Ramkumar (Mumbai)	MBA - Symbiosis	• Carbon Advisory – GENSOL • Marketing – Chequered Flag	Director (Head – REC Market)
	Madhusudan C (Bangalore)	MBA – RSM, The Netherlands	• Tech Director – Erasmus Medical Center, Netherlands	Chief Technology Officer (Head – IT Systems)

Equity Partner – INFUSE (IIM Ahmedabad)

INFUSE VENTURES

India's first CLEAN-TECH Venture Fund

- **An MNRE + IIM Ahmedabad** initiative
- **Core Focus** – To promote innovation in Indian Clean-Tech space with focus on Energy & Renewables

IIM Ahmedabad – *Centre for Innovation Incubation and Entrepreneurship*

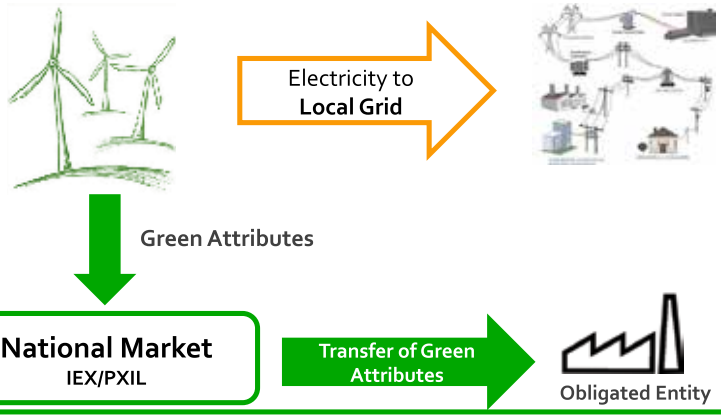
Key Venture Partners supporting INFUSE

IFC International Finance Corporation

Ministry of New and Renewable Energy

bp

REC Mechanism: from where we started...



- No physical power transfer required – A virtual open access
- A mechanism free of subsidies and other institutional incentives
- Modular for obligated entities, scalable for RE developers

What we do?

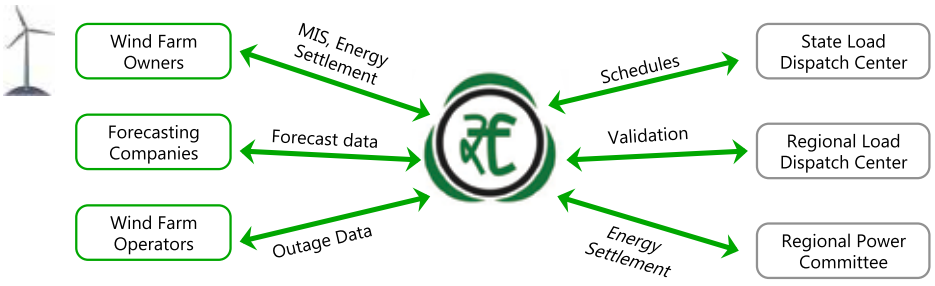
We help clients to buy/sell RECs and manage their portfolio.

RECONNECT ENERGY

5

Wind Power Scheduling ...

- In July 2013, CERC mandated wind power forecasting and scheduling
- Applicable all wind/solar farms commissioned after May-2010
- Mechanism required strong operations support, coordination between OEM, Forecaster, SLDC, RLDC and RPC



What we do?

Provide strong operational support to wind farms:

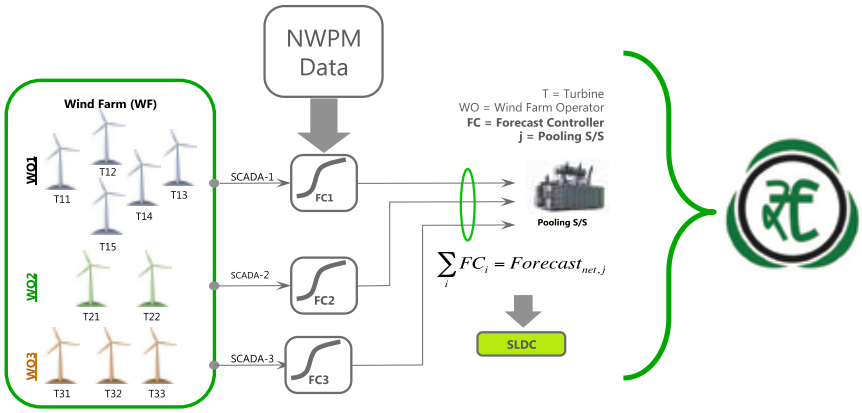
24*7 operations, Detailed MIS and analytics, multi-agency coordination and energy settlement.

RECONNECT ENERGY

6

Wind Power Forecasting Solution – **First in India**

- Transition from **A SERVICE PROVIDER** to **A TECHNOLOGY SOLUTION PROVIDER**
- Developed an in-house model for wind power forecasting model (Artificial Neural Network based)
- **Model already under testing for few sites.**

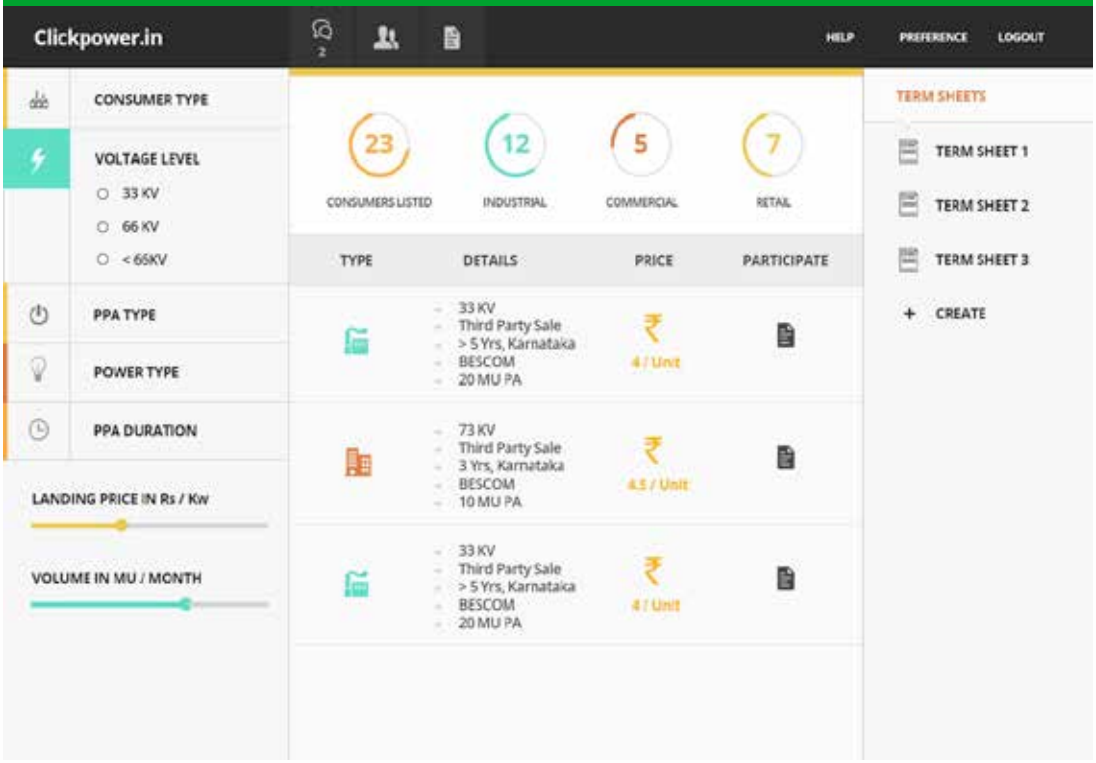


Our Aim:
Become First Indian Company to offer commercial grade wind power forecast

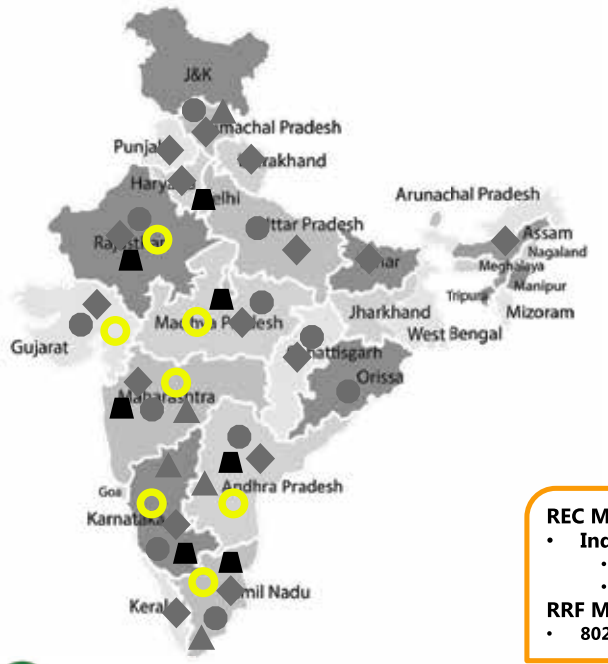
RECONNECT ENERGY

7

Our yet another pinnacle for RE Market – clickpower.in*



Our presence in Indian Renewable Market



REConnect Office

CPP/Open Access Client [**~800 MW**]

RE Generation [**~2000 MW**, all size, all types]

Wind/Solar Forecasting & Scheduling **[~800MW]**

Bilateral Power Transactions **[~40 MW]**

REC Market
- **India's largest** REC Trading Company
  - **46%** Market share in Non-Solar RECs
  - **85%** Market Share in Solar RECs

RRF Market
- **802 MW** of Wind **[India's Largest]**

Experience as a Coordinating Agency

- **802 MW** of Wind capacity under management
  - Kandamanur S/S, Tamil Nadu – 51 MW Wind Farm
  - Kalamangi S/S, Karnataka – 24 MW Wind Farm
  - Hiwarwadi S/S, Maharashtra – **162 MW** Wind Farm
  - Sidenur S/S, Karnataka – 31.5 MW Wind Farm
  - Jaora-I S/S, Madhya Pradesh – 14.4 MW Wind Farm
  - Nerale S/S (Panama Wind), Maharashtra – **72 MW** Wind + Beed S/S – **80 MW Wind** S/S in MH
  - Dangri S/S (INOX Wind), Rajasthan – **264 MW** Wind Farm
  - Agar III S/S, Madhya Pradesh – 15 MW Wind Farm
  - Mahuria II S/S, Madhya Pradesh – 15 MW Wind Farm
  - Mahurai I S/S – Madhya Pradesh – 15 MW Wind Farm
  - Tadipatri S/S – Andhra Pradesh – 43.2 MW Wind Farm
  - Wayphale S/S – Maharashtra – 15 MW Wind Farm
- 24x7 operations since 14.07.2013
- Daily and Weekly MIS summarizing
  - Actual vs. Forecast (including 8 revisions);
  - RRF Statement; Financial Analysis; Frequency Analysis
  - Coordination with Wind Farm operators, SLDC, RLDC and RPCs
- Working experience with **Suzlon, ReGen, Lietner Shriram, INOX, GE, Pioneer Wincorn**

OUR PRACTICAL EXPERIENCE IN RRF

Services Offered by REConnect for RRF

Forecast / Scheduling

- Selection of desired forecasting technology
- Collection of past data, train the forecasting model
- Obtain day ahead and close to real-time ahead forecasts
- Provide schedules to SLDC and coordinate the communication

Energy Accounting & De-Pooling

Accounting

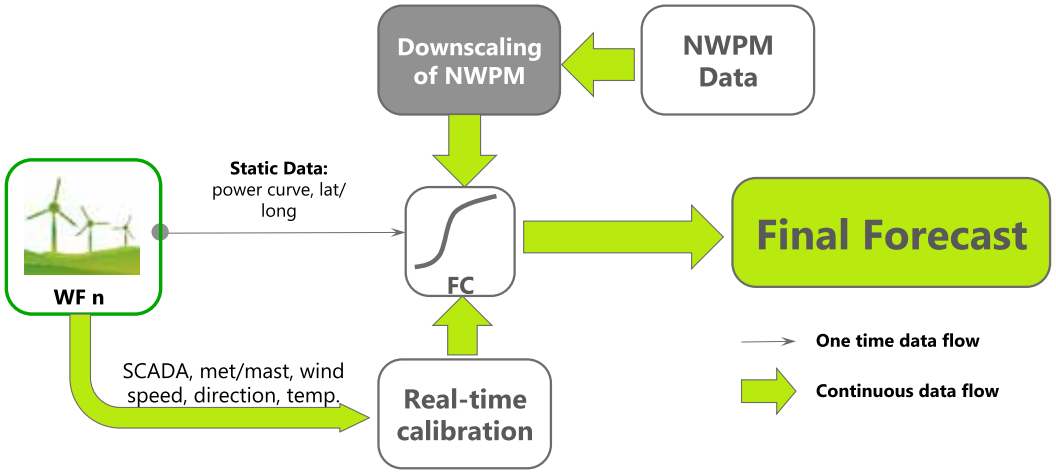
- Daily/weekly energy accounting and reporting
- Coordinate with SLDC for all energy accounting related matters
- Coordinate with client for energy accounting

De-Pooling

- Receive RRF settlement data from SLDC
- Perform de-pooling as per mutual agreement
- Raise debit/credit note for all developers
- Ensure timely collection/disbursal of debit/credit from Clients and SLDC

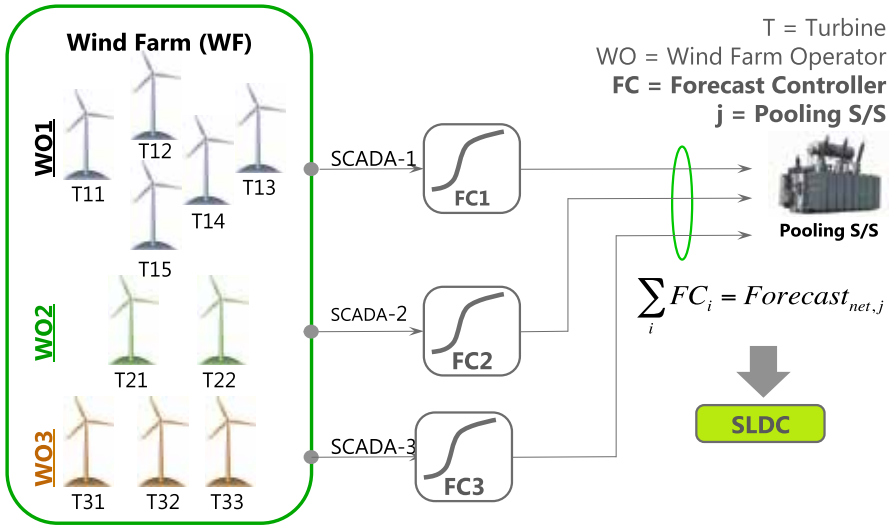
** - varies from state to state*

How Forecasting is accomplished?



- Static data helps build the correlation model in the forecast algorithm
- Past history of generation, real-time information on power generation, wind speed, temp, wind direction helps algorithm calibrate the correlation model
- Such correction can be done through statistical model or Artificial Neural Network or Fuzzy Logic based Models
- **Calibration remains the continuous process and better the calibration, better the forecast.**

Forecasting with Multiple OEM / Different Turbines in same wind farm



Forecast Controller can be modeled for different hub heights, different power curves and different machine characteristics within the same wind farm and output from each controller can be aggregated to derive total forecast at wind farm level.

Key Highlights of Tasks Delivered

1. Quick turn around time for adding new site (4-8 days)
2. Data processing to help bring alignment between the O&M data & forecaster's turn-key formats
3. Undertaking daily quality check & engaging forecaster to improve on lapses
4. Operating 24 x 7 to provide regular updates on schedules to SLDC and clients
5. Coordinating with site to model outages in the schedules to maintain accuracy
6. Daily MIS being published to compare the quality of forecast in terms of quantum of energy, number of time blocks etc.
7. Financial obligation of the mechanism being modeled on daily basis
8. Weekly accounting of the RRF mechanism
9. Verification, reconciliation & highlighting issues regarding RRF account as published by RPC on weekly basis
10. Engaging with regulators on behalf of clients at all forums to secure their interests
11. On request, providing customized reports to clients taking into account their specific needs

Key Milestones

Only company to be appointed as Coordinating Agency under RRF Mechanism **across 7 states**

Issued over **15,000 schedules** and revisions on **14 Sub-Stations** under operations covering **more than 800 MW**

Running **24x7 operations** more than **9 months**, with coordination at **sub-station level**

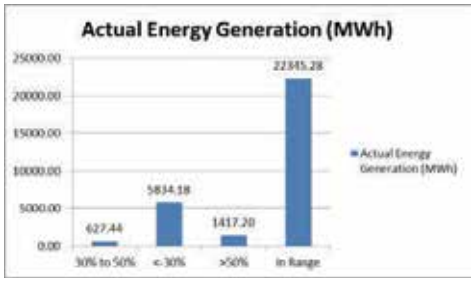
Punished more than **1000 analytical reports** – **Daily, Weekly & Monthly**

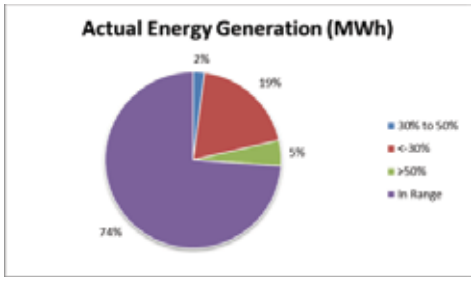
Comparing accuracy of **forecast vs actual** generation by **processing 2.5 million data points everyday**

Covered close to **432 MUs of wind power generation** under forecasting & scheduling

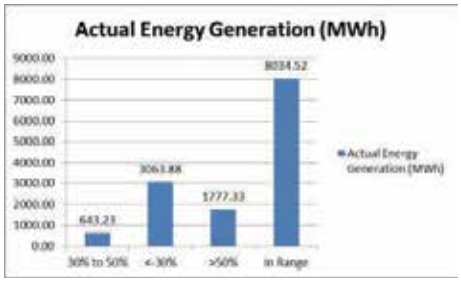
Importance of Historical Data

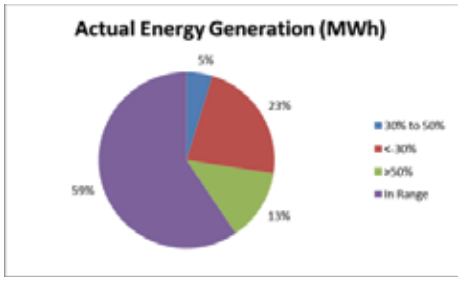
Site With Past Data – S1





Site Without Past Data – S2

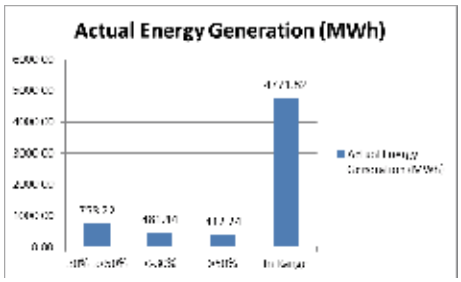


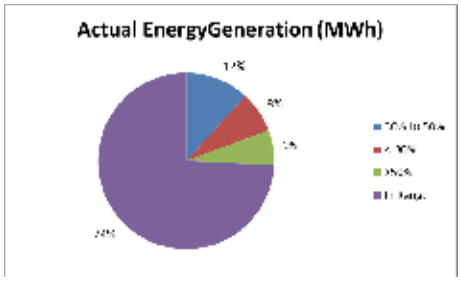


Data for two months for sub Stations managed in the capacity of Coordinating agency under RRF Mechanism

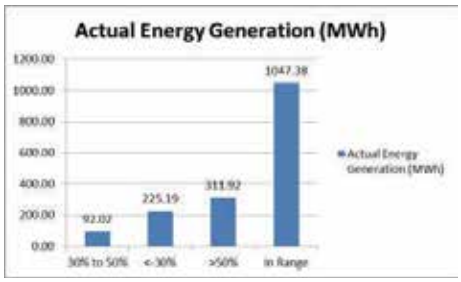
Importance of real-time calibration

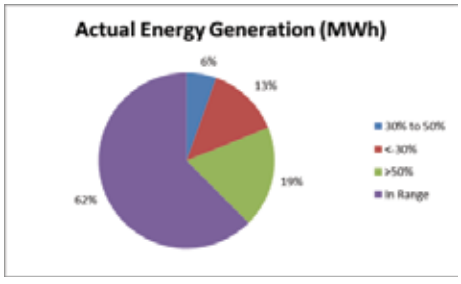
Site with real-time data – S3





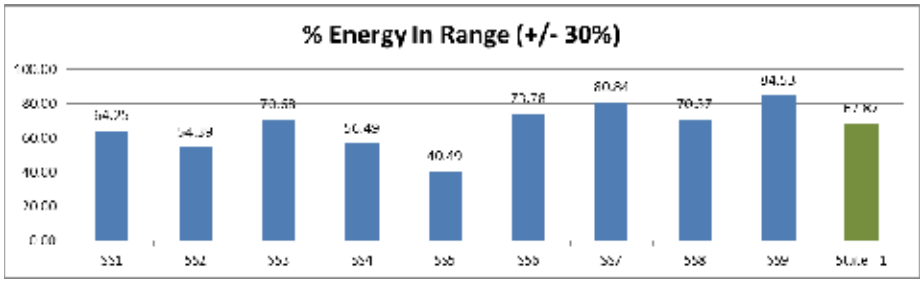
Site without real-time data – S4

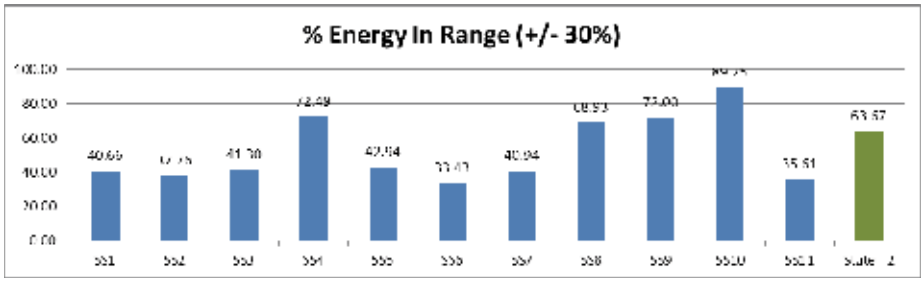




Data for two months for sub Stations managed in the capacity of Coordinating agency under RRF Mechanism

Effect of Regional Consolidation



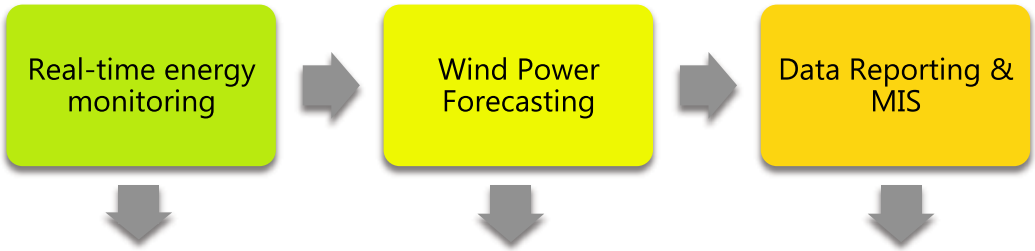


The consolidate regional forecast normalizes the accuracy level of the forecast at sub station level

Source – Data published by RPCs

WIND ENERGY INTEGRATION FACILITY (WEIF)

The Scope



Hardware Integration

Metering
- Extract meter info
- Transmit it to webserver
- Use it for wind power forecast and MIS

Server Architecture
- Scalability, load-balancing, modularity & inter-operability

Forecasting Methods

Cost vs. Feasibility
- Data driven models
- "what's available" vs. "what could be made available"?
- Cost vs. implementation time

Application Layer

Data Reporting/MIS
- Real-time tracking
- Visualization
- MIS & Analytics
- Support in load-generation planning
- Multi-user

Hardware (Metering): Modem vs. RTUs

Modems / DCU

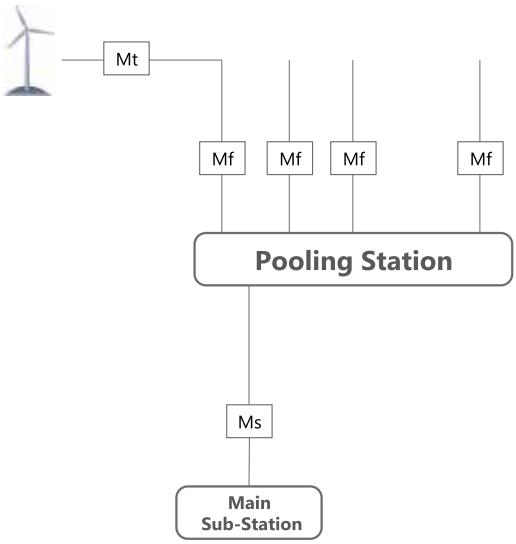
- GSM/GPRS/Landline/Leased-line based communication protocol
- Data transfer to central server
- Compliant with MODBUS / RS232 / RS485
- May not be complaint with ICCP/DNP3.0/IEC61850/ IEC60870-5-101
- Can perform same functions as RTUs
- Approx. cost – **Rs.25,000/Unit**
- Custom built software for data processing/analytics/reporting

RTU

- GSM/GPRS/Landline/Leased-line/ FO/PLCC based communication protocol
- Data transfer to central server and SCADA Master (SLDC)
- Compliant with MODBUS / RS232 / RS485
- Complaint with ICCP/DNP3.0/ IEC61850/IEC60870-5-101
- Can provide control function to SLDC
- Approx. cost **– Rs.8 Lakh-10 Lakh/ Unit (excluding control function)**
- Custom built software may be an expensive affair

- **Modems can be very cost effective and can provide speedier implementation**

Access to meters and cost implications



- **Challenges in Access to Meters**
  - TANGEDCO may not permit access
  - If access permitted, huge coordination efforts are required
  - O&M of modem/DCU would be costlier
  - **Ideal scenario** – having modem integrated with meters in our/OEM custody
- **Challenges in access to meter information**
  - Only L&T provides open-access to meter integration with external modem
  - Secure/EDMI – need to take their proprietary software (adds costs)
  - Even within L&T, if meter types are different, customized integration of modem would add to the cost.
- **Other hardware requirements**
  - If new meters are to be set-up, CT/PT other hardware would add up cost and delay implementation

Wind Power Forecasting: Data Requirements

- ***Static Data***
  - Lat-Long of each turbine
  - Hub Height
  - COD Details, Past Generation History, Turbine Power Curve
  - Past SCADA comprising – wind speed, wind direction, generation in kWh/ MWh, Temperature, other meteorological parameters as available
- ***Dynamic Data***
  - Actual power generation data (SCADA or remote monitoring unit)
  - Actual meteorological data:
    - Wind speed
    - Wind direction
    - Wind density
    - Temperature
    - Humidity level
    - Any other machine specific details that can be provided
  - Outage Planning / Forced Outage Data

Important to understand what data can be made available

Types of Forecasting models available

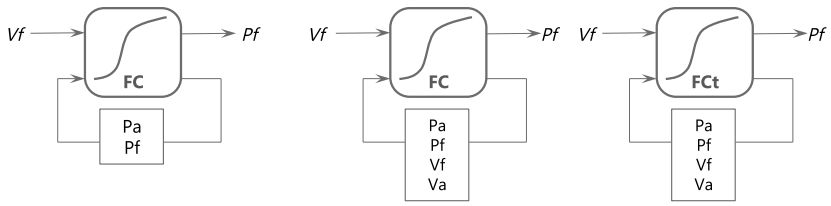
Preferred model for forecasting solar generation

Correlation based	• Past weather data • Correlation based	• Reduced level of accuracy • Quick set-up and lowest cost to operate
Dynamic, Model-centric	• Weather data and Correlation based • Detailed model built on extensive past data	• Acceptable level of accuracy • Quick set-up and low cost to operate
Dynamic, ANN Based, Real-time data centric	• Weather data and Correlation based; more advanced algorithms • Detailed model built on real-time data	• High level of accuracy • Longer set-up and high cost to operate

Most preferred for WIND Power Forecast

Data/Infra. Dependency & Forecasting Methods

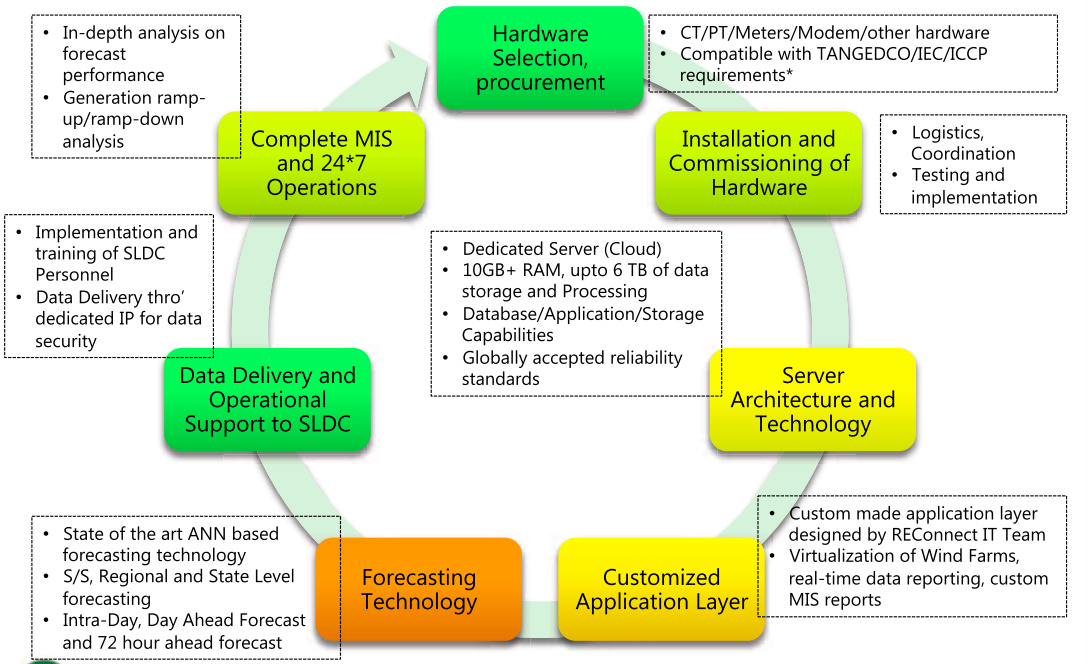
Data/Infrastructure	Case-1	Case-2	Case-3
AMR	Yes	Yes	Yes
Met-Mast	No	Yes	Yes/No
SCADA	No	No	Yes
Data Processing	Low	Moderate	High
Algorithm Complexity	Low	Moderate	High
Learning Ability	Moderate	Good	Good/Excellent
Accuracy Expected	Moderate	Moderate to Good	Good/Excellent



***AMR** – Automatic Meter Reading; Vf = forecasted wind speed; Va = actual wind speed; Pf = Power Forecast; Pa = Actual Power Generation*

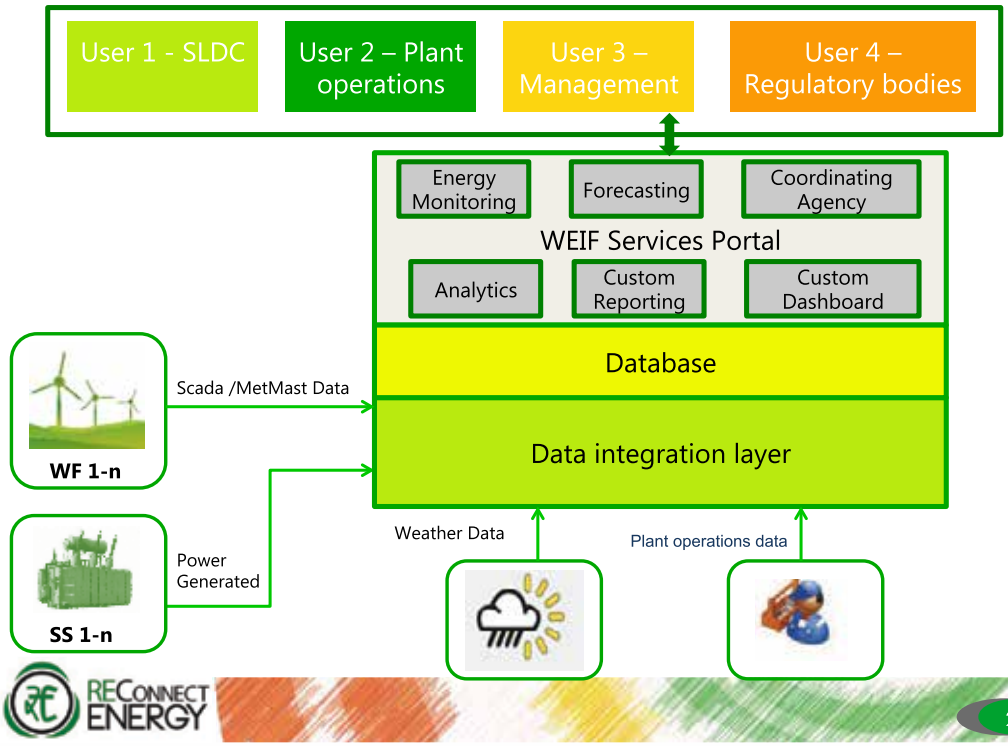
Information Technology

Complete implementation – not just a software



REConnect ENERGY

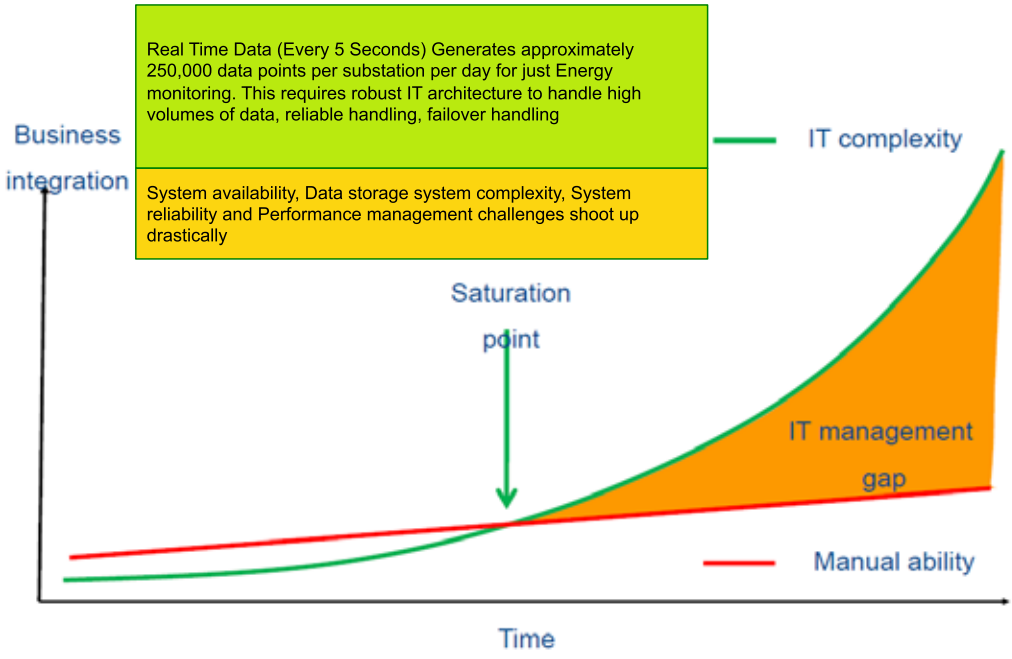
Flexible platform to suit individual needs



RECONNECT ENERGY

29

Business Data integration Challenges

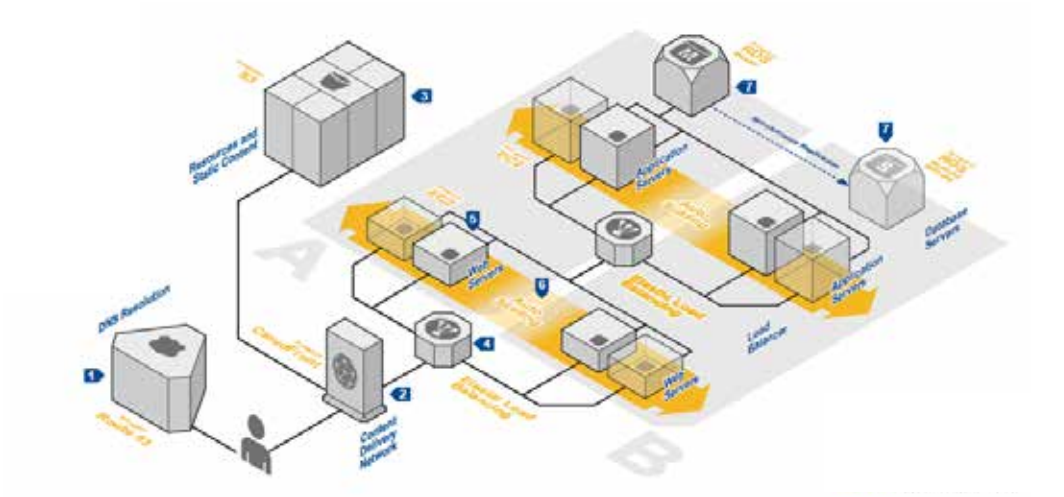


Source – Forrester Report – IT Integration - 2010

RECONNECT ENERGY

30

REConnect - Cloud based multitier architecture



- **3 tier architecture**
  - UI layer
  - Application layer
  - DB layer
- Load balanced
- Multi tenant
- Virtualized hardware layer

Reconnect Software layer – key highlights

- **Proven application stack**
  - Linux, Ubuntu, Apache server (Hadoop for cluster architecture)
  - Elastic load balanced cluster, 3 layer architecture
  - My Sql Database with optimized indexing
  - Persistence layer to reduce latency
  - Cloud based architecture
  - Advanced visualization, data representation methods
  - Long term data storage and retrieval technologies in place
- **Wide range of integration formats**
  - Support for TCP/IP/Modbus based transmission
  - SFTP / FTP Protocols
  - SMTP / POP3 Protocols – Reporting integration, automation
  - Remote authentication for transmission on secure networks

Customizable software Dashboards

- **User driven dashboards – Customized for user types**
  - Near Real Time Energy Tracking
    - Substation Level data
    - Time block based (10 Second intervals)
    - Voltage, Current, Power, Frequency, KWH, Reactive Power, KVAh,
    - Data Aggregation at Regional, District, State Level
    - Reporting, Alerting
  - **Forecasting**
    - Substation level day ahead forecast
    - Revisions – 8 per day
  - **Analytics**
    - Plant performance reporting
    - Detailed reporting at substation level – Energy generated Vs Energy forecasted, Energy wastage, Effciency

RE CONNECT ENERGY 33

Challenges Vs Capability

- **Can we scale?**
  - Designed for full scaling up capability – up to 10 GW of renewable power
- **Can we handle Variability?**
  - Designed for accepting data from a wide variety of formats and wide types of data
  - Designed for handling variety of generation types and their nuances.
- **Is the system Reliable?**
  - Proven architecture guarantees highest uptime standards (> 99.98%)
  - Reduce failover by special regional replication
- Will the software become slow with added features/ users
  - Low latency build architecture takes care of this. No issues

RE CONNECT ENERGY 34

OUR PROPOSAL

Key Deliverables

- **Deliverables to SLDC**
  - Very close to real-time **(~1 Min interval)** generation reporting ***[To enable SLDC manage contingencies]***
    - Generation at S/S Level
    - Aggregated Generation at Regional Level
    - Aggregated Generation at State Level
  - Generation Forecast Data ***[for better load-generation planning]***
    - Hour Ahead, Day Ahead and 72 Hour Ahead Forecast
    - Multiple Revisions in Wind Forecast as required under IEGC and RRF Mechanism
  - MIS Reports ***[for improved forecast and Grid Operations]***
    - Daily MIS comprising (Forecast vs. Actual), generation ramp-up/ramp-down analysis at
      - Sub-station level
      - Regional Level
      - State Level
    - Event Analysis (power ramp-up time, ramp-down time etc.)

Implementation Timelines

Hardware Set-up	• CT/PT/Meter/Modem Set-up: **45-60 Days per S/S** (4-5 S/Ss can be taken up simultaneously) • Only Meter/Modem Set-up: **8-10 days** provided no TANGEDCO approvals required and meter remains in our custody
Forecasting	• **8-10 working days from the receipt of Static & Dynamic Data** (multiple S/S can be taken up simultaneously)
Server Set-up	• **15 Days** from the date of MOU Signing
Application Layer Design	• **45-60 Days** from the confirmation of detailed SCOPE by the buyer; draft scope to be provided by REConnect
User Training	• **15 Days** to cover professional training of SLDC staff, system handover etc.
Overall Timeline	**120-240 Days** to cover ALL the S/Ss in TN (~7000 MW). Part implementation can be carried out quickly.

Our other presentations

- *Renewable Energy Certificates*
- *Renewable Purchase Obligation*
- *Electricity Portfolio Management*

THANK YOU!!

VISHAL PANDYA / MADHUSUDAN C

CONTACT US

Bangalore

#4123, 6th Cross, 19th Main,
HAL 2nd Stage, Indira Nagar,
Bangalore – 560008 INDIA

(O): 080-6547 3383/84
(F): 080 – 3072 3571

New Delhi

216, Nirvana courtyard, Nirvana
Country, Sector 50
Gurgaon 122018, Haryana

(O): 0124-4103 216
(F): 080 – 3072 3571

Mumbai

F-159, Haware Fantasia
Business Park, Plot No 47,
Sector 30 A, Vashi,
Navi Mumbai-400703

(M): 9930359992
(F): 080 – 3072 3571

Chennai

#18/1 (88), Aarya
Gowda Road, 2nd Floor,
West Mambalam,
Chennai - 600 033,
India

(M) +91-99404 78306
(F): 080 – 3072 3571

Prof. Dr. K Kasthurirangaian
Chairman

603 'C' Block, Pioneer Complex, 1075, Avinashi Road
Coimbatore - 641 108 INDIA
Phone : 91-422-6585908, 6586908
Fax : 91-422-2248408
E-mail : office@rsmautokast.com, chairmaniwpa@windpro.org

S.O.S. - In this High Wind Season 5500 MW Wind Mills not Permitted to Run in Tamil Nadu - Your intervention requested to permit Wind Mills Generate.

June 19, 2015

Shri . Hon. Narendra Modi Ji
Hon Prime Minister, Government of India
South Block, Raisina Hill, New Delhi 110011

May to September is high wind time in India when high Velocity South Westerly Winds can bring more generation in the Western States of India like Tamil Nadu, Andhra Pradesh, Maharastra, Gujarat & Rajasthan can generate more Wind Energy.

Under" MUST RUN" status awarded by Indian Electricity Grid Code (IEGC) Wind Mills should be permitted to run in full and Central Thermal & Nuclear units should be stopped for Annual Maintenance between June - September to give way for Wind Energy to meet the load. Unfortunately in 2015 Central Thermal & Nuclear units in Southern 7 Western parts of India generating more energy brushing aside the plea of Wind Power Generators to reduce their Thermal generation during high Windy time.

For Example - In Tamil Nadu, NTPC, NLC & Kudankulam units are Pumping in 110 Million Units per day in June 2015 against 70 M.U they were sending to Tamil Nadu from Central Units during 2014.

Pray advice NTPC, NLC & Kudankulam units to reduce their generation by taking some units for Annual Maintenance and running balance Thermal Units to their technical minimum.

Advice TNEB to evacuate in full all the Wind Energy giving Wind Mills MUST RUN status.

Considering intermittency & high variability in velocity of Winds on which we humans have no control and non availability of Spinning reserves, Grid Code may please be relaxed for RE from 150 MW limitation in variation of Scheduling. Wind generation in Tamil Nadu during June - September high Wind period goes up to 4200 MW. Permissible limit in variation of Wind Scheduling to be atleast ±10% of 4200 MW i.e 420 MW. In a 1,45,000 MW size of Indian grid system occasional 420 MW from RE may not make a big variation. This is like permitting a child to pour a mug of water in a big pond. No harm will take place.

If TNEB is persuaded to give" MUST RUN" Status to Wind to evacuate all Wind Energy daily availability could be in the order of 100 M.U Per day or 4000 MW against 25 Million Units evacuated yesterday 18th June 2015 and 35 Million Units evacuated day before 17th June 2015.

Pray immediate action.

With best wishes and regards,

For Indian Wind Power Association,

Prof. Dr. K. Kasthurirangaian
Chairman

Copy to:

1. Hon Shri Piyush Goyal Ji, MNRE,New Delhi
2. Secretary, MNRE, New Delhi
3. Joint Secretary, MNRE, New Delhi
4. Director (Wind), MNRE, New Delhi
5. Mr.K.R.Nair, VP,NRC -IWPA, New Delhi
6. Mr. Ravi Arora, Green Infra, New Delhi
7. Ms. Rameeza, Co-ordinator, New Delhi with a request to attend 3 p.m. meet with our Members in MOP, 2nd Floor, Shram Sakthi Bhavan, Rafi Marg, New Delhi
8. Mr. Rajsekhar, CTO, Il&FS, New Delhi
9. Peacock Chemical, New Delhi
10. KRBL, New Delhi
11. Vardhaman, New Delhi
12. Mr. Dev Anand, leap Green, Coimbatore
13. Mr.T.S. Jayachandran, Premier Mills, Coimbatore

Prof. Dr. K Kasthurirangaian
Chairman

603 'C' Block, Pioneer Complex, 1075, Avinashi Road
Coimbatore - 641 108 INDIA
Phone : 91-422-6585908, 6586908
Fax : 91-422-2248408
E-mail : office@rsmautokast.com, chairmaniwpa@windpro.org

Pray for Your Kind Urgent Attention

June 15, 2015

Shri Piyush Goyal
Hon'ble Minister for Power, Coal & New and Renewable Energy
Government of India, New Delhi - 110 003

Respected Sir,

References:

1. 29-05-2015, Letter to Hon'ble Minister for New and Renewable Energy
2. 01-06-2015, Letter to Hon'ble Minister for New and Renewable Energy
3. 10-06-2015, Letter to Shri Upendra Tripathy, Secretary, MNRE

In continuation to my aforesaid letters to your good self, I request your urgent attention to the following:

1. Immediate ramping down of Central Government owned Thermal Stations to "Technical Minimum" at Vallur, Talcher, Ramagundam and Simhadhri.
2. Your urgent direction to NTPC to reschedule "Maintenance Stoppage" of the Central Government owned Thermal Stations at Vallur, Talcher, Ramagundam and Simhadhri to "June – September" instead of "November – December".

   Sir, your immediate action to the aforesaid point will be of paramount importance as wind energy is getting wasted to the "tune of 15 million to 35 million units per day". Details are given as per "attached statement".

   I also wish to point out in the same said attachment, the fact that Tamil Nadu is trying its best to help wind evacuation by backing down its Thermal, Hydro and Gas but the same is not adequate enough as the Central Government owned Thermal Stations are consistently pumping in 105 to 110 million units into the Tamil Nadu grid. "TANGEDCO is forced to consume this 110 million units from Central Stations as they stand to be penalized otherwise".

   If NTPC is asked to "run their operating plant at technical minimum" and "also reschedule maintenance outage", around 40 million wind units can be saved from going to waste and also an equivalent amount of coal can also be conserved.

   During my personal meeting with your ministry on 11-06-2015, your ministry had promised to touch base with NTPC to address the issue.

   Considering the urgency of the situation Sir, I once again pray for your support and immediate action on the matter.

Kindly arrange to do the needful, Sir.

With best wishes and regards

For Indian Wind Power Association,

Prof. Dr. K. Kasthurirangaian
Chairman

Enclosure: Evacuation details in Tamil Nadu between 01-06-2015 to 15-06-2015.

Copy together with the Enclosure forwarded for information and necessary action to:

1. Secretary, MNRE, New Delhi
2. Secretary, Ministry of Power, New Delhi
3. Joint Secretary, MNRE, New Delhi
4. Member Secretary, SRPC, Bangalore

Evacuation details in Tamil Nadu

(01-06-2015 to 15-06-2015)

State	Date	Thermal	Hydro	GAS	Wind	Wind Backdown per day	Others	Net SCH	From Grid	Availability	Demand Met	Shortage
TN	6/1/2015	84.61	6.77	8.4	22.88	32.03	35.45	105.44	105.27	263.55	263.38	6.33
TN	6/2/2015	87.89	7.5	7.49	25.79	24.25	35.49	108.46	107.58	272.62	271.74	6.79
TN	6/3/2015	91.68	9.23	8.54	10.52	4.80	39.76	110.74	115.78	270.47	275.51	6.85
TN	6/4/2015	96.3	9.95	8.49	9.36	0.67	39.18	112.59	112.26	275.87	275.54	15.96
TN	6/5/2015	94.51	6.6	9.04	20.58	8.35	38.53	111.48	109.61	280.74	278.87	0.3
TN	6/6/2015	85.17	9.25	8.45	25.19	4.78	38.95	104.45	101.85	271.46	268.86	0.61
TN	6/7/2015	88.24	6.91	8.39	26.79	3.05	33.39	102.64	100.23	266.36	263.95	0
TN	6/8/2015	87.02	7.52	8.29	36.06	13.52	33.26	104.2	101.04	276.35	273.19	0.3
TN	6/9/2015	83.02	6.87	8.43	47.84	19.06	35.03	104.58	100.91	285.77	282.1	0.45
TN	6/10/2015	83.14	10.3	9.9	35.81	11.15	37.79	100.23	102.02	277.17	278.96	5.32
TN	6/11/2015	88.92	5.38	12.61	46.81	19.22	37	98.83	95.53	289.55	286.25	0
TN	6/12/2015	81.45	6.77	8.17	42.83	21.15	35.15	110.19	107.39	284.56	281.76	0.15
TN	6/13/2015	76.31	5.63	8.28	47.69	24.88	34.24	109.54	109.7	281.69	281.85	0
TN	6/14/2015	73.62	6.2	8.5	28.35	36.44	34.63	112.77	112.76	264.07	264.06	0

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Chairman

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Coimbatore - 641 108 INDIA
Phone : 91-422-6585908, 6586908
Fax : 91-422-2248408
E-mail : office@rsmautokast.com, chairmaniwpa@windpro.org

Suggestions / Comments on Wind Energy Mission document

June 10, 2015

Shri Dilip Nigam

Director - Wind, MNRE, Block No. 14

CGO Complex, Lodi Road, New Delhi 110 003

Dear Sir

IWPA welcomes the initiative of the MNRE in bringing out the draft Wind Energy Mission document which clearly spells out the objectives and the various focus areas with necessary action plans for realising the objectives. IWPA offers its views and comments on the draft document:

Point No. 5.2.2.

a. Market defined floor price could have severe adverse effect on the viability of the project given that there is a huge inventory of unsold RECs. The present system needs to be continued for a period of at least 10 years to protect investments made and to promote further investments.

b. Government shall use the NCEF fund or any other fund to buy up unsold RECs of vintage of over a year with a view to lend credibility and to protect investments made earlier under this mechanism.

c. In order to fund compliance to RPO by DISCOMS, a separate cess (Like education cess which is utilised only for promoting the cause of education) may be charged on all consumers by all States which should be exclusively used only for buying RECs. This would ensure that the DISCOM poor financial condition does not come in the way of RPO fulfilment and would not also financially injure them.

Point No. 5.2.3

IWPA submits that the spot market for real time trading of power is essential to handle variation and sudden change in generation / load pattern in the control area and to have them stabilised through this mechanism.

Point No. 5.2.4

Alongside the ancillary services market, mechanism of utilising the balancing resources and other resources of other states to handle the variation in generation from WEGs in the host state on exchangeable basis or such other arrangement on mutually agreed terms or predefined terms is equally essential. Today, wind energy is being wasted with a view to maintain grid discipline stipulated for each state (150 MW limit) while it is likely that the neighbouring states continue to operate high cost power which is a national loss. This can be done through regulatory and Electricity Act amendments and can be taken up through FOR (Forum of Regulators).

Given that only 7 states are blessed with high wind potential and that these states also need to comply with the Grid Code which requires adherence to several discipline, with increase

in installation of wind energy generators, the host states would increasingly find it difficult to manage and would eventually resort to backing down which could run counter to the objectives of the mission and the Electricity Act.

Andhra Pradesh too has resorted to backing down in the last few days, though only on a couple of occasions, primarily due to the stringent requirements of the Grid Code. The current installed capacity in AP is expected to increase several fold when this could become even more complex to manage. The Mission should provide equal impetus to finding a sustained regulatory solution with a view to accommodate the wind energy generation in full and thus achieve the intended objective.

Point No. 5.2.5

(ii) Uniform RPO to become mandatory across all states in the country and the host States be entitled to avail REC in respect of renewable power procured in excess of the RPO. This would financially incentivise the host States to encourage renewables. Otherwise, host States may resist to procure power in excess of RPO.

(iii) Like in Solar, the transmission charges and wheeling charges be exempted for inter-State sale. In some states, the charges are collected on MW basis which should be collected only on MWh basis.

(iv) Pl refer comments on Point No 5.2.2

(v) Fiscal Incentives – The existing incentives – GBI and AD to continue. Exemption on Electricity duty and Generation Tax for power generated from wind.

Point No. 5.3.2

a) Forecasting and Scheduling

Forecasting and Scheduling to be done at the centralised level (State or the regional level), as the accuracy level of the forecast over a larger area is far better and becomes more reliable. This can be done through the SLDC or the SRLDC through a professional agency and the cost of variation be socialised which would not be very high when it is done over a larger area. The suggestion of IWPA is to create a separate control area at the SRLDC level where the schedule for wind to the host state would be provided by them which can be taken as a firm schedule by the host State for drawal. This would ensure total evacuation of wind power and variation at the regional level can be handled by socialising the costs, if any.

IWPA would extend all necessary cooperation in doing this as IWPA recognises the need for a forecast.

b) Balancing resources

Pl refer comments given to point no 5.2.4 and 5.2.3 above where IWPA has suggested to expand the balancing resources to other states with a view to harness the wind in full.

5.4 Land Policies

All States should be encouraged to have a single window system like in Tamil Nadu to accelerate the clearance process and to bring about certainty of the project development.

To get over ROW issues, it is suggested a suitable amendment to the Electricity Act be considered for erection of towers and completing the lines on time.

5.6 Repowering

The clause pertaining to compulsory removal of machines that have completed 20 years of life to be removed for the following reasons:

a. The machines are still in good working condition and are generating good PLF.

b. In most cases, the lands are not available contiguously that the land required for repowering may not be available for repowering.

c. Modern machines have a larger diameter and may not be able to fulfil the minimum spacing requirements.

d. Some of the project developers have installed for captive consumption who may not require additional

power going in for a higher capacity; they may also not have the required financial resources to repower.

e. Repowering may require removal of a few small turbines to accommodate one big modern turbine and if the small machines to be removed are owned by multiple owners, confusion could arise on who would invest for repowering and sharing the costs and revenues. This could be even complex when the sale mode is different for those generators (one selling to the utility and the other one being utilised for captive consumption) as the sale mode of repowered machine itself could create differences.

IWPA submits that the clause relating to compulsory removal be removed and instead promote repowering through compensatory tariff as rightly brought out in the Mission document so generators voluntarily opt for repowering. This is even more important for captive and open access mode of installations.

5.8 Project Financing

At present the financing for renewables is taking a long time and at very high cost of financing. This being capital intensive, it has a higher sensitivity to cost of financing. Hence it is imperative that the renewables are brought under priority sector and banks are granted for a longer tenure of 20 years.

Further, the existing loans be also allowed to reschedule for a longer term.

12. Monitoring Committee

IWPA submits to provide representation to its Chairman in the Mission Committees so the issues that arise from time to time in achieving the Mission objective can be highlighted for necessary redressal.

Regulatory and Other related suggestions

a. MUST RUN to be implemented in spirit and reality. All the regulations and Grid Codes to be amended to realise this objective through appropriate amendments to ensure that when other sources of power are allowed to run, WEGs are backed down.

b. Deemed Generation for wind to be granted (like in Germany where if WEGs are asked to back down they are compensated for the loss in generation).

c. Harmonising the CERC and SERC methodology for determination of tariff. Presently there is a difference between CERC and SERC tariff as SERC follows a different method for fixation of tariff and this should be harmonised. APPC rates of different states are significantly different from CERC determined APPC rates for each state as some states do not include high cost power with a view to reduce the APPC rates.

d. Regulatory certainty – PPAs in some states are signed after commissioning and the project developer runs the risk of not being able to sign the PPA post commissioning. Permit signing PPA one w in advance to provide confidence to project developer and lenders.

e. Exempt WEG from the purview of Pollution control clearance for projects developed in non-forest lands as there is lack of clarity on this.

f. Notify Wind Industry as a non-factory and exempt from application of Factories Act.

g. Property Tax and Professional Tax to be exempted for wind.

We would request you to kindly consider our views, suggestions and comments given above before finalising the Wind Energy Mission document.

We thank you very much for giving us the opportunity to offer our views.

Thanking you

For Indian Wind Power Association

Prof. Dr. K Kasthurirangaian
Chairman

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