SHAKTI
SUSTAINABLE ENERGY
FOUNDATION

Idam

WIND VISION
INDIA 2032
Evolving consensus through stakeholder engagement

A Multi Stakeholder Perspective

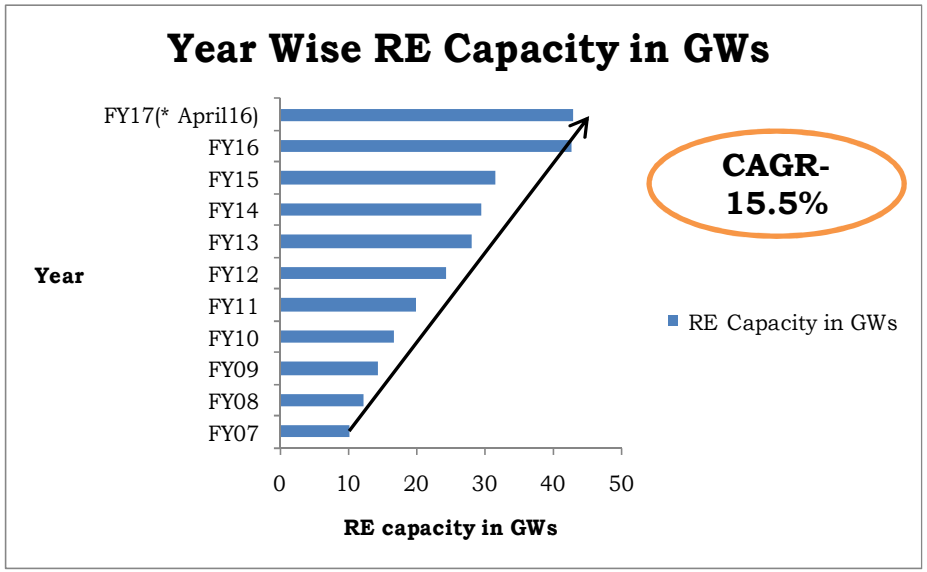
Grid Integration of Wind Power

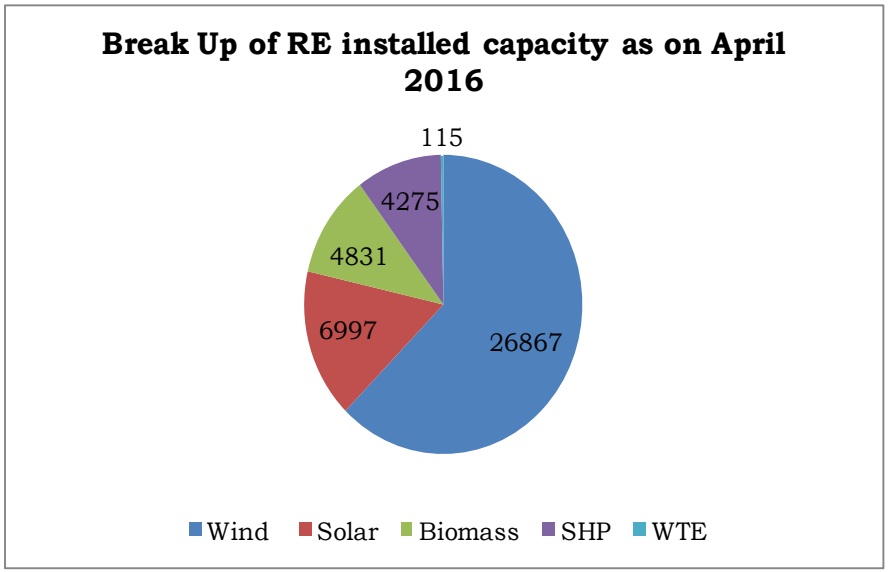
June15, 2016

Agenda of the Presentation

- **Context setting**
- **Key challenges and Focus Areas for Grid Integration of RE**
- **Managing Grid Integration - Potential Intervention measures**
  a. Planning phase
  b. Construction and Development phase
  c. Operation phase
- **Addressing implementation aspects of Forecasting and Scheduling framework at State level**
- **Way forward : Evolving Implementation Roadmap & Action Plan**

Growth of RE Sector in India





Key Statistics and Drivers

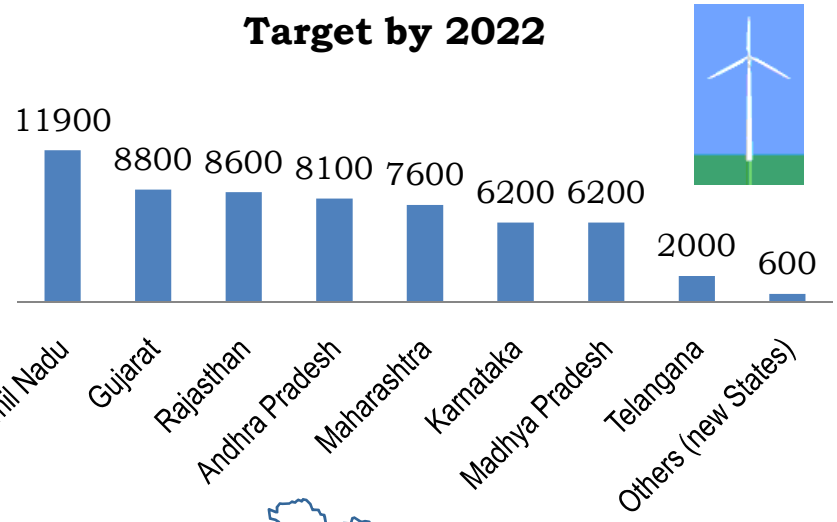
- Cumulative capacity of **43,083 MW** of RE installed as on **April 2016**
- RE capacity comprises **14.3%** of total generation capacity of India
- Wind Energy forms largest share among RE technologies (around 61%)
- RE generation contributes to **~7%** of total generation of the Country
- 175GW targets by 2022

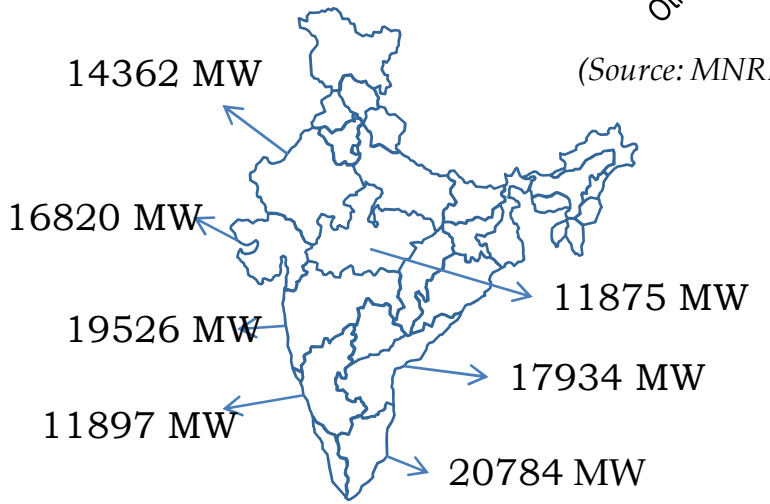
State-wise share of Solar and Wind Targets by 2022

State-Wise share of 100GW of Solar Targets by 2022

1	Delhi	**2,762**	20	Kerala	**1,870**
2	Haryana	**4,142**	21	Tamil Nadu	**8,884**
3	Himachal Pradesh	**776**	22	Puducherry	**246**
4	J&K	**1,155**		**Southern Region**	**26,531**
5	Punjab	**4,772**	23	Bihar	**2,493**
6	Rajasthan	**5,762**	24	Jharkhand	**1,995**
7	Uttar Pradesh	**10,697**	25	Odisha	**2,377**
8	Uttarakhand	**900**	26	West Bengal	**5,336**
9	Chandigargh	**153**	27	Sikkim	**36**
	Northern Region	**31,120**		**Eastern Region**	**12,237**
10	Goa	**358**	28	Assam	**663**
11	Guajarat	**8,020**	29	Manipur	**105**
12	Chattisgargh	**1,783**	30	Meghalaya	**161**
13	Madhya Pradesh	**5,675**	31	Nagaland	**61**
14	Maharashtra	**11,926**	32	Tripura	**105**
15	D&N Haveli	**449**	33	Arunachal Pradesh	**39**
16	Daman & Diu	**199**	34	Mizoram	**72**
	Western Region	**28,410**		**North Eastern Region**	**1,205**
17	Andhra Pradesh	**9,834**	35	Andaman Islands	**27**
18	Telengana		36	Lakshadweep	**4**
19	Karnataka	**5,697**		**All India**	**99,533**

State-wise share of 60 GW of Wind Target by 2022





(Source: MNRE)

Large scale integration of Variable (Solar & Wind) energy is expected to be added to Grid

Framework for Grid Integration

Aspects of Tx system development	Planning	Construction	Operation
Entities	CEA, CTU and STU	CTU, STU	CERC, RLDC SLDC
Governing Framework	National Electricity Plan, IEGC	CEA Regulations and Standards	IEGC and State Grid Code
Functions	• Long term & short term System Planning • Investment plan	• Construction of Transmission lines • Substations • Protection • Technical standards	• Scheduling • Despatch • Balancing & Control • Metering

Key Challenges in Grid Integration of RE

- In order to accomplish RE targets of 175 GW by 2022, annual RE capacity addition need to grow by 3x to 5x over next 5 to 7 years.
- Existing implementation challenges need to be addressed.

Planning Stage

- *Tx Planning process not aligned for RE requirement.*
- *Limited or no involvement of RE stakeholders in state level planning process*

Construction Stage

- *No uniform grid interconnection process*
- *Lack of appropriate RE Transmission Development Model*
- *ROW issues and local challenges*

Operation Stage

- *Issues pertaining to forecasting and scheduling*
- *Managing grid variability*
- *Institutional Capacity Building requirement at SLDC*
- *Development of ancillary services*

Potential interventions in the Planning Stage

Planning Stage

Description of Key Focus Area	Potential Action Points
Aligning grid planning processes for RE	Recognition of Planning Standards and criteria for RE at State level
Emphasis on RE under state level planning	Creation of RE Transmission Planning Authority

Failing to plan is planning to fail
- Alan Lakein

Potential interventions in the construction stage

Development/Construction stage

Description of Key Focus Area	Potential actions
Uniform procedures and practices for interconnection for RE across states.	Model interconnection standards for RE (Wind/Solar)
Facilitative framework for Grid access and interconnection for RE	Options for Funding and socialising the cost of RE evacuation infrastructure
Uniform standards for Communication and Metering infrastructure	Common Code for development of communication and metering infrastructure

The best way to predict your future is to create it

- Abraham Lincoln

Key Focus Areas for Grid Integration of RE

- Grid Planning processes : need for paradigm shift
- Interconnection process : uniformity across States
- Managing variable and infirm generation
- Operationalising Forecasting and Scheduling Regime
- Institutional Capacity Building Requirement
- Development of Ancillary Services
- Assessing and socialising cost of Integration

Potential interventions in the Operational Stage(1/2)

Operational Stage

Description of Key Focus Area	Potential actions
Framework for forecasting and scheduling regime and imbalance settlement at state	Model regulations for F&S regime and Model ABT and DSM Code addressing state specific variations.
Seamless integration of state level and regional level framework to facilitate inter-state/inter-regional transfer of RE power	Model Code for Communication to be formulated
Need for Institutional capacity building at SLDC and RE Developers	Need for Empanelment of Institutional set up – QCA/REMCs etc.

Efficiency is doing things right, Effectiveness is doing the right things- Peter Drucker

Potential interventions in the Operational Stage(2/2)

Description of thematic issues	Potential actions
Development of Ancillary Services Market	Rules for Ancillary Services to expand the scope and coverage of ancillary services
Deployment of Storage capacities with variable RE generation	• Development of multiple pilot /demonstration storage projects • Mandatory installation of storages for Mega/Ultra-Mega RE projects
Development of Hybrid RE solutions and integrated approach for harnessing multiple RE resources	• Amendments to Codes to address Technical challenges for hybrid RE • Modifications to FIT/OA/RPO regimes and regulations to address commercial challenges of Hybrid RE development

Recent Regulatory Interventions at the central level

Date	Actions Taken	Highlights
May 2016	**CERC DSM(Third Amendment)Regulations,2016**	Increase in deviation limits for RE rich states(250 MW)
April 2016	**CERC IEGC(Fourth Amendment)Regulations,2016**	Technical minimum of conv. Gen operation -55% of MCR
Nov 2015	**Constitution of Technical Committee for devising framework for RE integration at state level**	Intrastate ABT/DSM, Ancillary services at state level, facililitating the F&S framework at state level
Nov 2015	**Model forecasting and Scheduling regulations for RE at state level-FOR**	Day ahead forecasting, QCA, Commercial& deviation settlement
Oct 2015	**CERC-Roadmap to operationalise reserves**	Primary, secondary and tertiary reserves, spinning reserves, Implementation of AGC by 2017
Aug 2015	**CERC Ancillary Services Operationalisation Regulations**	Regulation Up and Down Services, ISGS only, Incentives
Aug 2015	**CERC Regulatory framework for interstate RE Generation**	F&S of interstate RE gen, DSM mechanism; function of fixed rate; generator payments on schedule energy basis
Aug 2015	**Power Exchanges-24x7 Round the clock market session**	Extended Intraday session; extended contingency session/market

State Level regulatory interventions

Sr. No.	Name of the state level regulations	States
1.	**Draft Forecasting and Scheduling Regulations Published**	Tamil Nadu, Karnataka, Madhya Pradesh, Rajasthan, Jharkhand, Manipur & Mizoram Gujarat and Odisha (specified in their state Grid codes)
2.	**Draft Intrastate Ancillary Services Regulations**	Madhya Pradesh
3.	**Intrastate ABT Regulations**	Delhi, Madhya Pradesh, Maharashtra, Gujarat, Chattisgarh , AP and Telengana *Tamil Nadu (draft)*

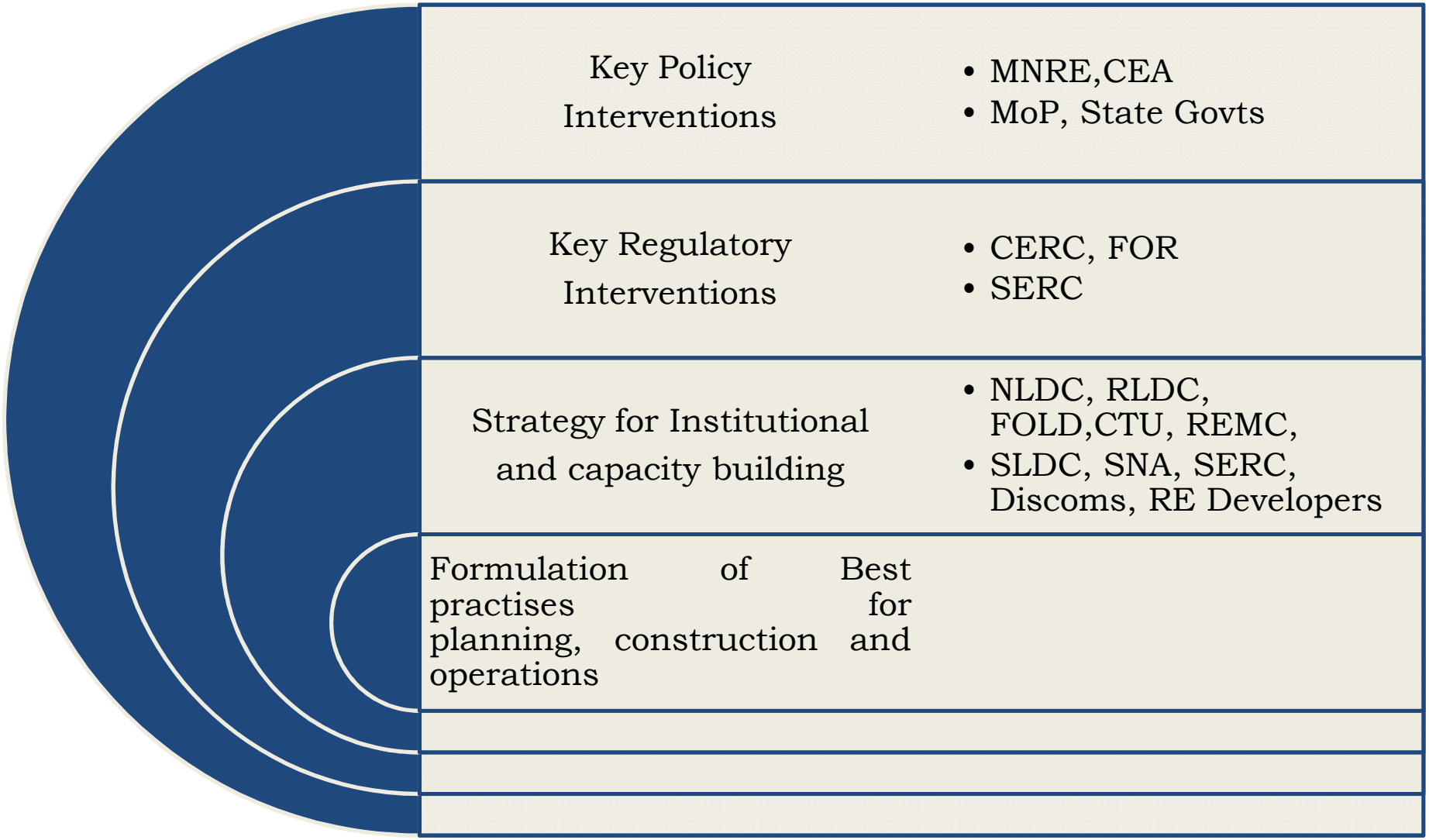
Key Issues/Challenges to be addressed in the model FOR regulations

Role of QCA and institutional Structure	Operationalisation of the virtual pool within the state imbalance pool	De-pooling /Apportionment of deviation charges among RE generators and pooling S/S	Funding of Deficit in the imbalance pool

Deliberations/ Discussions

a) Regulatory oversight for QCA b) Technical &Financial Criteria of QCA c) Institutional /Governance mechanism of QCA d) Model Termsheet for engagement	a) Mechanism of Operation of virtual pool. b) Entity responsible for operating the virtual pool	Principles of de-pooling of deviation charges a) Between State and pooling S/Ss b) Between RE generators at the pooling S/S	a) Availability of national level funds for long term basis. b) Need for creation of state level funds for funding socialisation cost

Points for Further deliberation and discussion



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Thank You