Annexure –I

List of the participants joined the meeting virtually on 28.03.2024

S. No	Name	Designation	Organization
1	Sh. Asit Singh	Member Secretary	SRPC
2	Sh. V. Balaji	Executive Director	WRLDC
3	Sh. S P Kumar	Executive Director	SRLDC
4	Sh. N Roy	Executive Director	NRLDC
4	Smt. S Usha	Chief General Manager	WRLDC
5	Smt. Pushpa. S	Chief General Manager	WRLDC
6	Sh. Pramod Kumar Prajapati	Deputy General Manager	WRLDC
7	Sh. Vishal Balram Puppala	Manager	WRLDC
8	Sh. Selvamani M	Manager	WRLDC
	Sh.Omkar Kumbhar	Dy.Manager	WRLDC
9	Sh. Somara Lakhra	Chief General Manager	NRLDC
10	Sh. Sunil Kr Aharwal	General Manager	NRLDC
11	Sh. Ankur Gulai	DGM	NRLDC
12	Sh. Ibtesam Asif	Assistant Manager	NRLDC
13	Sh. Kamaldeep Singh	DGM	NRLDC
14	Sh. T Muthukumar	Sr. DGM	SRLDC
15	Sh. T Srinivas	Chief General Manager	SRLDC
16	Sh. A Janardhan	Manager	SRLDC
17	Sh. Vimal		Senvion India

List of the participants joined the meeting physically on 28.03.2024

Grid-India Meeting with RE Associations/ Developers on 28.03.2024						
S. No	Name	Designation	Organisation	Contact	Email	Sign
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5	Mukesh Kumar	Project Manager	ENEL Green power	8951354758	mukesh.kumar2@enel.com	
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17	Prashant Karanjia	Director	Brookfield Renewables	9560690611	pkaranjia@evrenenergy.com	
18	Samarth Sharma	Director	Serentica wind.	9999023448	[illegible]	
19	Prabhudevagonda Patil	DGM	Suzlon	7350007269	prabhudevagonda.patil@suzlon.com	
20	Vinod Bishnoi	Sr. VP	Suzlon	7774030460	vbishnoi@suzlon.com	
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Grid-India Meeting with RE Associations/ Developers on 28.03.2024

S. No	Name	Designation	Organisation	Contact	Email	Sign
22	RAJIV PORWAL	DIR(SO)	GRID INDIA			[signature]
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24	Sunil Singh	AGM(Engg)	Eden Renewables	8802[illegible]	Sunil.Singh@eden-re.com	[signature]
25	Vikram Yadav	AGM(O&M)	"	9811921434	vikram.yadav@eden-re.com	[signature]
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35	Alok Singh	SECI Mgr	SECI	9910910323	~~alok.singh~~ alok.singh@seci.co.in	[signature]
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41						
42						

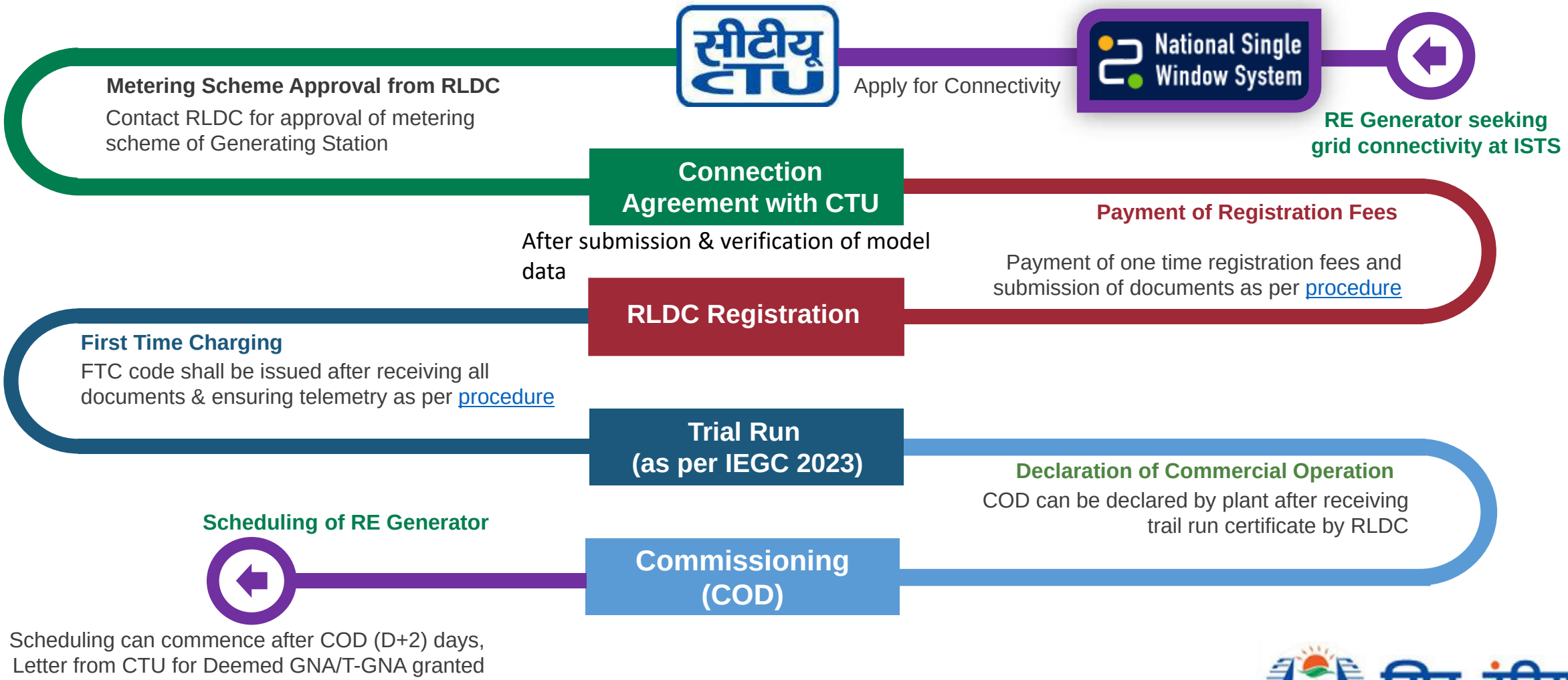
Annexure –II

Coordination Meeting with RE Developers

28th March 2024

Grid Controller of India Ltd.

RE Generator - Grid Integration Process



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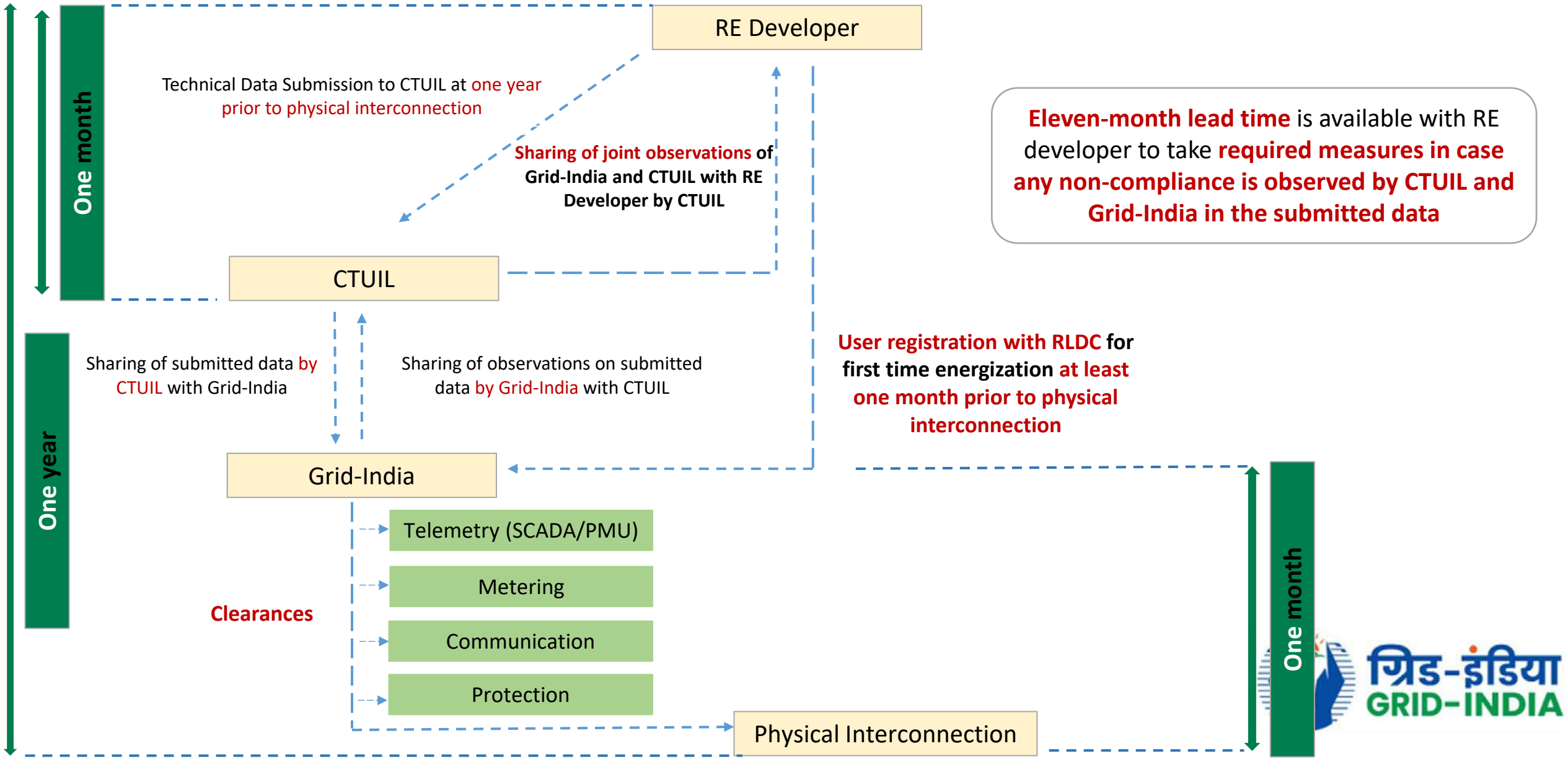
RE Generator - Grid Integration Process



Eleven-month lead time is available with RE developer to take **required measures in case any non-compliance is observed by CTUIL and Grid-India in the submitted data**

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Chronology of CEA Connectivity Standards

Technical Requirements for Solar and Wind Generating Stations

2007 - CEA Technical Standards for Connectivity to the Grid, Regulations 2007

Standards cover **general connectivity conditions for all power system elements (temp.)**, specific requirements for conventional generating units, transmission system & substations, bulk consumers, distribution systems & bulk consumers

2013 - CEA Technical Standards for Connectivity to the Grid, Regulations (Amendment), 2013

- Requirements for **solar and wind generating stations** included in the standards
- Associated terms such as **interconnection point, inverter etc**. defined

Major requirements notified for wind and other generating sources with inverter interface:

- **Power Quality** (Harmonic current injection, DC current, Flicker)
- **Dynamically varying Reactive Power Support** (in the range of ±0.95 p.f.)
- **LVRT (Low Voltage Ride Through)** – For wind generating stations connected at 66 kV voltage level or above

2014 – CERC order in matter of Petition No. 420/MP/2014 directed the wind generating stations to comply with the provisions of CEA Technical Standards for Connectivity Regulations

2019 - CEA Technical Standards for Connectivity to the Grid, Regulations (Amendment), 2019

- Requirements for **solar and wind generating stations** further **strengthened** in this amendment

- **LVRT Requirement –** notified for wind as well as **other generating units with inverter interface**
- **HVRT Requirement –** notified for wind as well as **other generating units with inverter interface**
- **Other requirements for active power and frequency control also notified**

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CERC Regulations (IEGC 2023)

Requirements for Solar and Wind Generating Stations

- **Periodic Testing**
  - Real and Reactive Power Capability for Generator
  - Power Plant Controller Function Test
  - Frequency Response Test
  - Active Power Set Point change test
  - Reactive Power (Voltage / Power Factor / Q) Set Point change test

- **Trial Run Operation**

  - Performed for a minimum capacity aggregating to 50 MW* for > 04 hours
  - Requisite metering system, power plant controller, telemetry and protection system to be in service
  - **Tests Required** - Frequency response of machines as per the CEA Standards; Reactive power capability as per OEM rating

- **Document Submission**
  - Certificate confirming compliance with CEA Technical Standards for Connectivity to the grid regulation
  - Type test report for Fault Ride through Test (LVRT and HVRT)

- All generating units shall have their automatic voltage regulators (AVRs), Power System Stabilizers (PSSs), **voltage (reactive power) controllers (Power Plant Controller)** and any other requirements in operation, as per the CEA Technical Standards for Connectivity.

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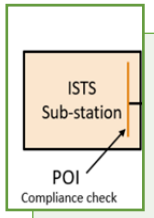
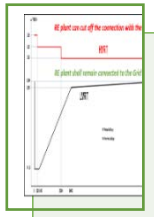
Compliance to provisions of CEA connectivity Standards

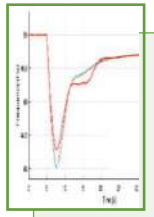


Interconnection Point / Point of Interconnection

Reactive Capability test



Voltage Ride Through Requirement (Low/High)

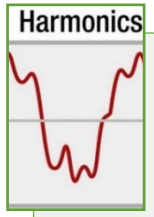


Frequency Response

Active and Reactive Power - Set Point Control

Design Requirement – Weather, Temperature Extremes etc.

Ramping Capability



Power Quality Requirements

Submission of reports and models by RE developers with CTUIL

Sharing of Data by CTUIL with Grid-India

Sharing of joint observations on submitted data to the RE Developer by CTUIL

Compliance verification by CTUIL and Grid-India

- Compliance to all standards/regulations to be honored
- Provisional approval given only for limited time to comply with reactive power capability and power quality requirements

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Common issues observed during Compliance Verification

- **Test Reports:**

  - Some of test reports are being submitted with tests carried out as per other standards instead of CEA Technical Standards for Connectivity to the Grid Regulations

  - Many important testing parameters such as Short Circuit Ratio (SCR), K-factor for LVRT/HVRT, IBR protection settings, Active Power recovery time after the Fault Ride through (FRT), reactive power response time during FRT are absent in the test reports. In such cases, the requisite information is sought from OEM/RE developers.

- **Simulation Models:**

  - Consideration of High Short Circuit ratio (SCR) as compared the actual SCR in the model
  - Improper modelling - Post fault characteristics, Collector System Network etc.
  - Consideration of different LVRT/HVRT K-factors in models in place of implemented value at site
  - Non-consideration of communication delays, polling rates/update rates of equipment in modelling
  - No/incorrect modelling of relay in simulation model for IBRs, Collector system etc.
  - Change in simulation model parameters without proper justification in subsequent submissions

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Common issues observed during First Time Charging Process

- Sharing of requisite data for smooth verification of trial run operation
- Delay in PPC Commissioning; Testing of PPC as per IEGC, 2023
- DR (Disturbance Recorder) installation not as per CEA Technical Standards
- Event logger of IBR/WTG are not synchronized with substation SCADA
- Communication protocol (MODBUS) of IBR leading to delay in reporting of event (incorrect sequence of event)

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Issues observed during real-time operations

- Inadequate dynamic reactive support from RE plant during grid events and in normal operation
- Delayed active power recovery (90% of pre-fault value within 1 sec)
- Tuning of converter parameter based on realistic consideration of Short Circuit level
- Archival and sharing of inverter/WTG level data during grid event with resolution of 1 ms or better for event analysis
- Protection settings of inverters/WTGs sometimes are not coordinated ensure compliance at POI
- Low Frequency oscillations in voltage/reactive power
- High deviation from schedule for prolonged periods
- Significant deviation observed in performance of some of the plants (during faults) in real-time vis-à-vis simulation response

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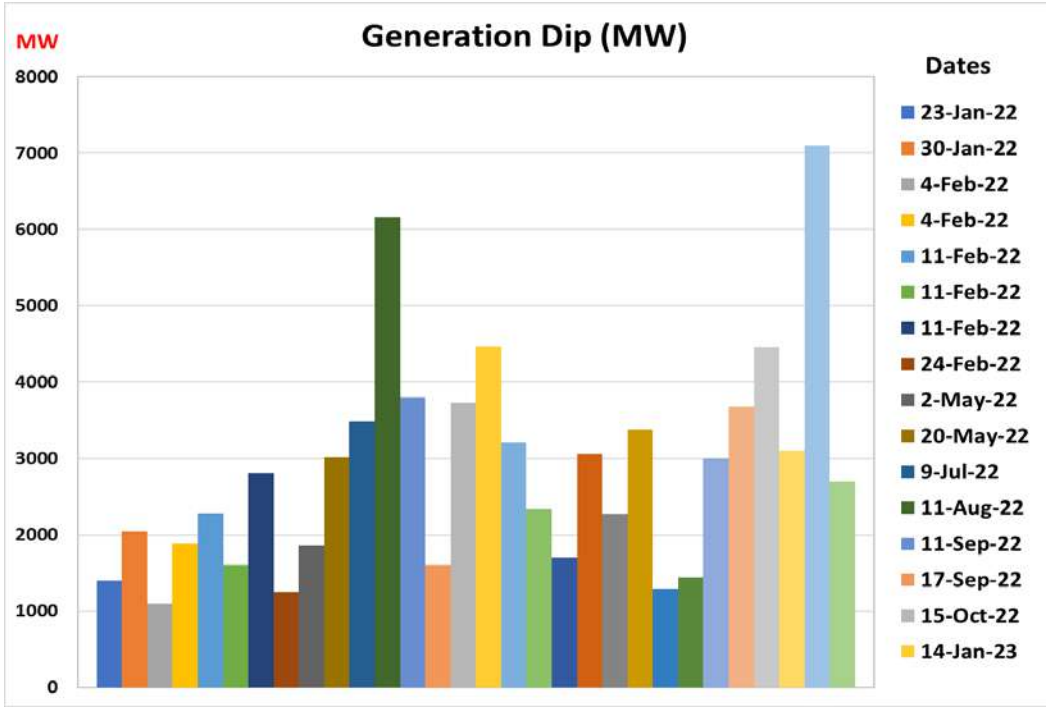
RE Related Grid Events

- **> 31 events** involving **generation loss of above 1000 MW** from renewable power plants - **January'22 to May'2023**
- **Why are these events taking place?**
  - **Root-cause analysis** of the events based on **measurement data**
  - Analysis supplemented with detailed **simulation studies**
- **Recommendations for changes at equipment, developer, operational and regulatory level**

~ 15 events after May 2023



Suggestions and Way Forward

- Monthly coordination meetings to deliberate the pending issues
- Timely submission of requisite data to CTUIL and Grid-India
- Active participation by RE Developers, OEMs, Testing Agencies, Simulation Agencies in the workshop
- Past undertakings and affidavits to be honored by ensuring pending compliances
- Factoring in the effect of cloud, fog, sandstorm etc. in power forecast

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Thank you !!

https://grid-india.in/