Stakeholder Workshop

Procedure for Carrying Out Inter-Connection Studies of New Power System Elements

1st August 2023

Grid Controller of India Ltd.
(erstwhile POSOCO)

Contents

- Background
- Motivation for Interconnection Studies
  - Case Study from Indian Power System
- Roles & Responsibilities
- Data Submission by Stakeholders
  - Timelines for Data Submission
  - Details of Technical Data Submission
- Timelines for Interconnection Study by NLDC/RLDCs/SLDCs
- Interconnection Studies – Types and Methodology
- Action points after completion of Interconnection Studies
- Sample Formats for technical and modelling data & Annexures

Background

The procedure on "Interconnection Studies" is in accordance with regulation 10(3) of the Indian Electricity Grid Code, 2023 notified by the Central Electricity Regulatory Commission.

"NLDC shall publish a detailed Procedure covering modalities for carrying out interconnection studies."

This procedure lays down the **guidelines for data submission and performing the interconnection studies for new power system elements** to be integrated into the Indian grid.

Reference: IEGC – 2023: Connection Code – Clause 10

Motivation for Inter-connection Studies

Sufficient Lead Time for System Studies	Interconnection studies 6 months ahead of the envisaged energization of any element will give sufficient time for assessing the grid conditions under new elements
Identification of System Constraints	Any system constraint which may arise due to delayed/part/complete implementation of a transmission/generation system can be identified much ahead of the real-time constraints.
Necessary Interim/Permanent Measures	After the identification of system constraints, the stakeholders, NLDC/RLDC/SLDC/CTU/STU may explore any interim/ permanent measures to facilitate the first-time energization of the power system elements.

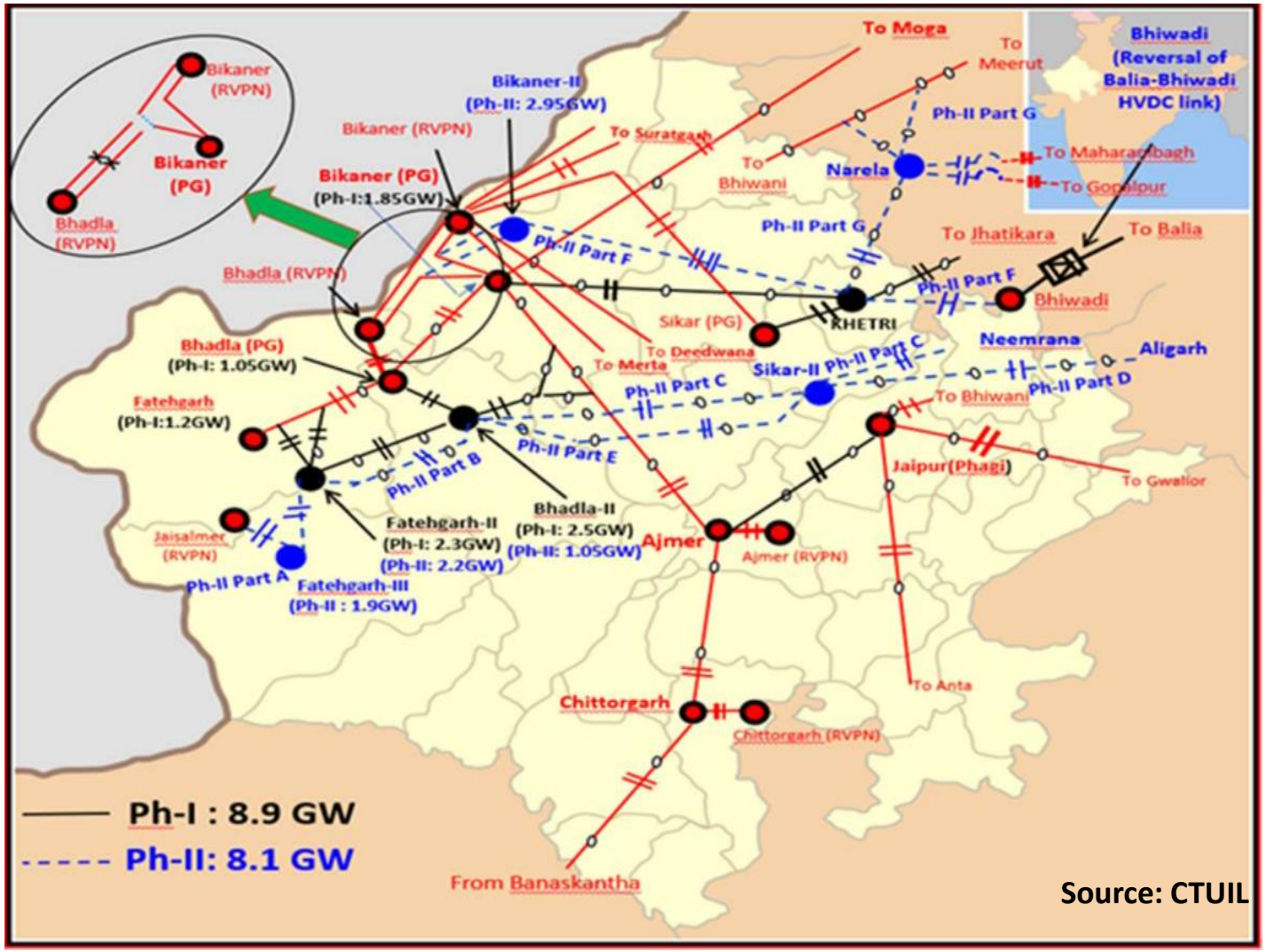
Motivation for Inter-connection Studies

Case Study from Indian Power System

- Transmission systems in major RE complexes are planned in phases commensurate to the upcoming RE capacity.
- Envisaged RE capacity was added at Bikaner (PG) before the implementation of the transmission system.
- Constraints were observed in ICTs at 765/400/220 kV Bikaner – PG & 400 kV Bikaner (PG) – Bikaner (RS) line due to a delay in the Phase – II transmission scheme.

Interim arrangement to relieve transmission congestions till the availability of the planned Ph-II system:

- To interconnect one part of LILO to 400 kV Bhadla (RVPN) - Bikaner (RVPN) line so as to form 400kV Bikaner (PG)- Bikaner(RVPN) 2 circuits and isolate 400kV Bhadla (RVPN) from both Bikaner (PG) & Bhadla (RVPN)



Roles & Responsibilities

SUBMISSION OF DATA FOR INTERCONNECTION STUDIES

USERS & CONNECTIVITY GRANTEE

- Generation Entity
- Load Serving Entity
- Transmission Licensee
- Settlement Nodal Agency

Data to be submitted to SLDC, RLDC or NLDC

INTERCONNECTION STUDIES FOR NEW POWER SYSTEM ELEMENTS BEFORE SIX MONTHS

SLDC

Study for following new elements

- Intra-state elements

Consultation with Concerned STU & RLDC

RLDC

Study for following new elements

- Intra-state connected to inter-state,
- Inter-state elements

Consultation with SLDCs , NLDC, STU & CTU

NLDC

Study for following new elements

- Intra-regional connected to inter-regional,
- Inter-regional,
- Cross-border elements

Consultation with RLDCs & CTU

Roles & Responsibilities (Contd.)

S. No.	Power System Element	Data Submission Responsibility	Data to be submitted to
1.	Transnational links (including HVDC) and associated elements (irrespective of voltage level)	Concerned Transmission Licensee (s) / Settlement Nodal Agency (SNA)	NLDC
2.	Inter-regional transmission system (including HVDC) and associated elements (irrespective of voltage level)	Concerned Transmission Licensee (s)	Concerned RLDCs
3.	ISTS elements within the region including HVDC, FACTS devices, any other transmission element (irrespective of voltage level)	Concerned ISTS Licensee	Concerned RLDC

Roles & Responsibilities (Contd.)

S. No.	Power System Element	Data Submission Responsibility	Data to be submitted to
4.	Intra-state transmission system including HVDC, FACTS devices, any other transmission element	Concerned ISTS Licensee / Concerned STU through SLDC	Concerned SLDC
5.	Generating Plants, Bulk Consumers or Load Serving Entities and Combined (Load & Captive) generation complex, Energy Storage Systems, and Synchronous Condensers connected to the ISTS network (including details of associated dedicated transmission lines)	Concerned Generation Entity/ Load Serving Entity / Connectivity Grantee	Concerned RLDC
6.	Generating Plants, Bulk Consumers or Load Serving Entities and Combined (Load & Captive) generation complex, Energy Storage Systems, and Synchronous Condensers connected to the intra-state network (including details of associated dedicated transmission lines)	Concerned Generation Entity / Load Serving Entity / Connectivity Grantee	Concerned SLDC

Data Submission by Stakeholders

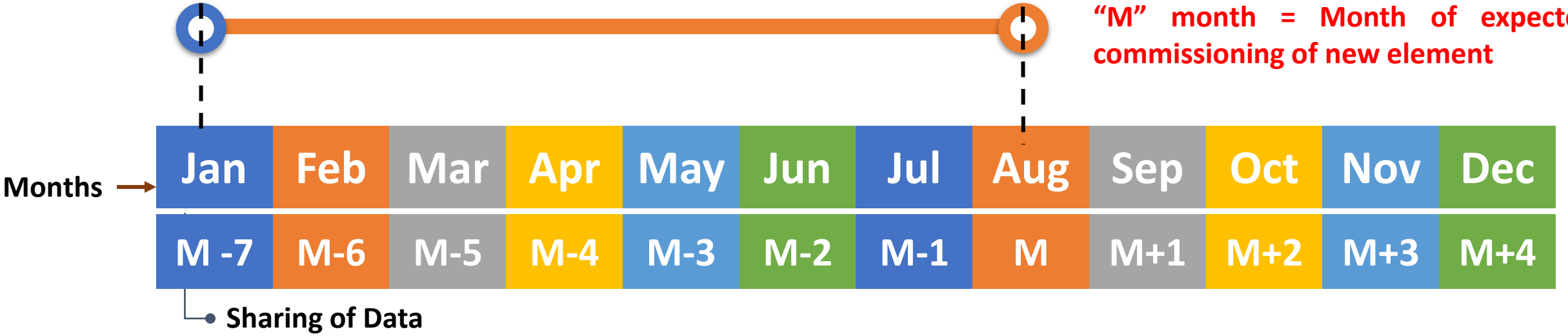
- Each entity responsible for providing the necessary data shall furnish the following information **each month on a rolling basis** within the specified timelines **(i.e. 15th day of "M-7" month)** to the concerned SLDCs/RLDCs/NLDC responsible for carrying out the inter-connection studies:

1. The **summary of all the new elements expected to be energized in the "M" month** shall be provided in the format specified at **Annexure-I.**

2. The **necessary technical and modelling data of all the elements** expected to be energized in the "M" month shall be submitted in the formats specified in Grid-India/NLDC's procedure for ***"First Time Charging/Energization (FTC) and Integration of New or Modified Power System Element"***, as amended from time to time, for carrying out the necessary studies.

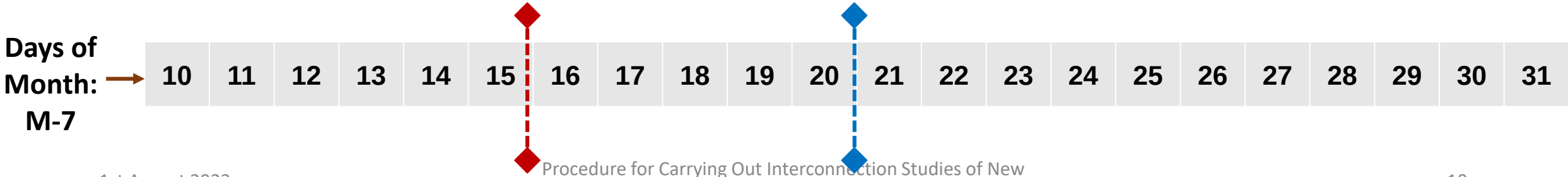
https://posoco.in/wp-content/uploads/2021/04/Procedure_for_Integration_of_Power_System_Elements.pdf

Data Submission by Stakeholders - Timelines



- Each entity responsible for providing the necessary data shall furnish the information each month on a **rolling basis** within the specified timelines **(i.e. 15th day of "M-7" month)** to the concerned SLDCs/RLDCs/NLDC responsible for carrying out the inter-connection studies

- The consolidated data will then be shared by the responsible LDC for inter-connection studies with the other concerned LDCs by **the 20th of "M-7" month**



Data Submission by Stakeholders – Technical Data

The necessary technical and modelling to be submitted as per Grid-India/NLDC's procedure for ***"First Time Charging/Energization (FTC) and Integration of New or Modified Power System Element"***, as amended from time to time, for carrying out the necessary studies

https://posoco.in/wp-content/uploads/2021/04/Procedure_for_Integration_of_Power_System_Elements.pdf

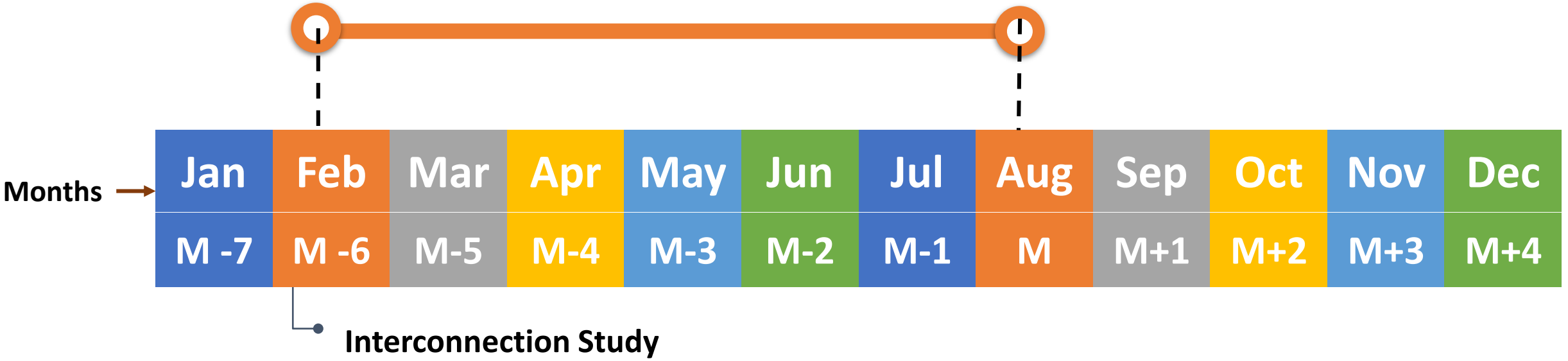
Any revision in timeline/configuration of new element may be intimated to the concerned SLDCs/RLDCs/NLDC on immediate basis for revising the study

In case of non-submission of necessary technical and modelling data by the specified entities, **necessary assumptions** shall be made by respective entities responsible for conducting interconnection studies

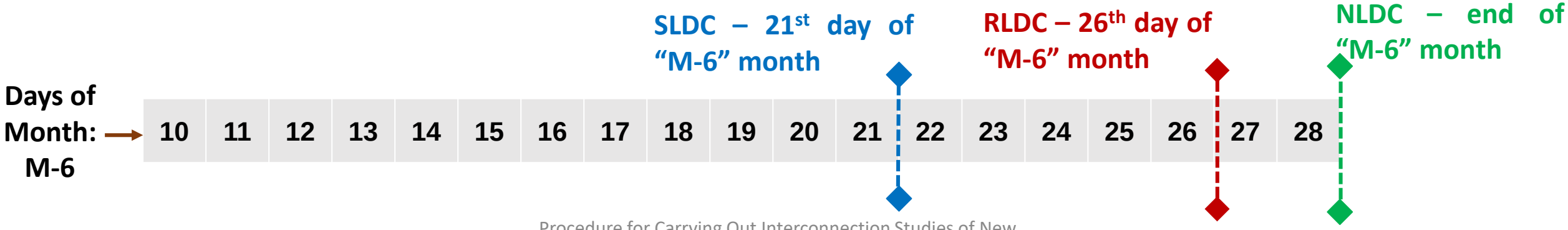
CEA's manual on Transmission Planning Criteria, as amended from time to time, may be referred in this regard

https://cea.nic.in/wp-content/uploads/psp___a_ii/2023/03/Manual_on_Transmission_Planning_Criteria_2023.pdf

Timelines for Interconnection Study by NLDC/RLDCs/SLDCs



- SLDC shall complete & share the results of the studies with the concerned RLDC by **21st day of the "M-6" month**
- The RLDC shall complete & share the results of the studies with NLDC by **26th day of the "M-6" month**
- NLDC shall complete the inter-connection study **by the end of "M-6" month**



Interconnection Studies - Types

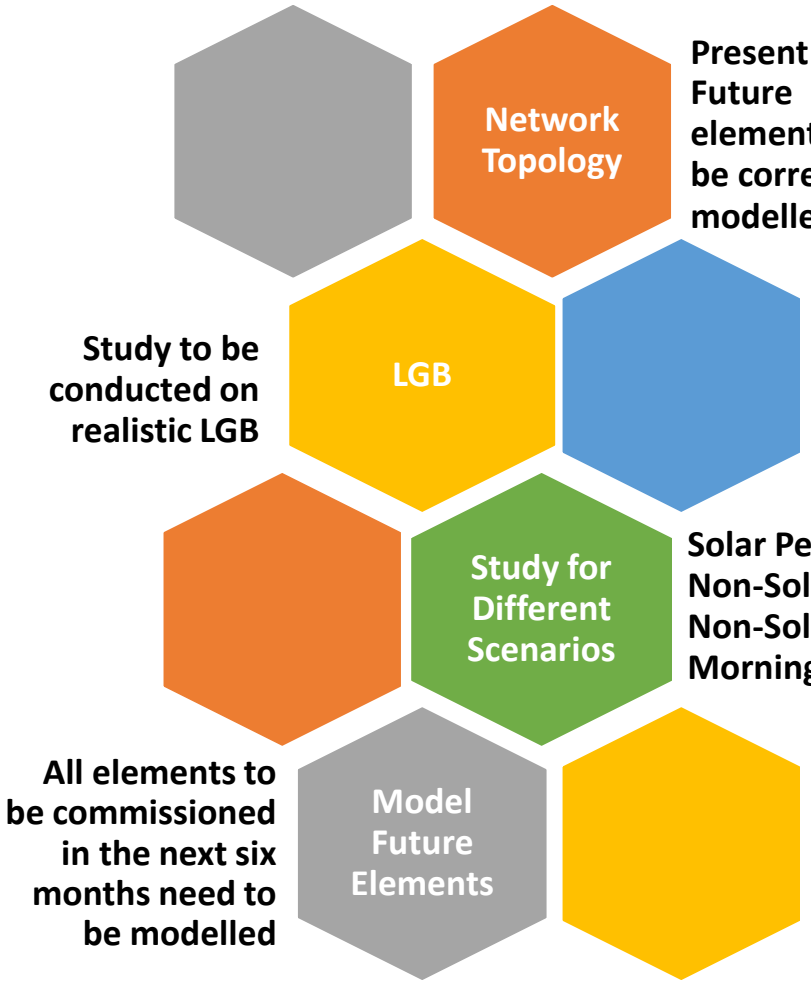
Type of studies which may be carried out in the interconnection analysis:

Studies in line with the provisions specified in the **extant standards and regulations notified by the Central Electricity Authority (CEA) and Central Electricity Regulatory Commission (CERC).** CEA's extant Manual on Transmission Planning Criteria may also be referred in this regard

- ❑ Transmission Element Charging and Switching Studies
- ❑ Power Flow Studies
- ❑ Short Circuit Studies
- ❑ Reactive Power Management Studies
- ❑ Impact on transfer capability of different control areas/group of control areas
- ❑ Stability Studies as applicable
- ❑ Any other study as per the requirement

NLDC & RLDCs may conduct workshops on various simulations required for interconnection studies as per request of SLDCs

Interconnection Studies - Methodology

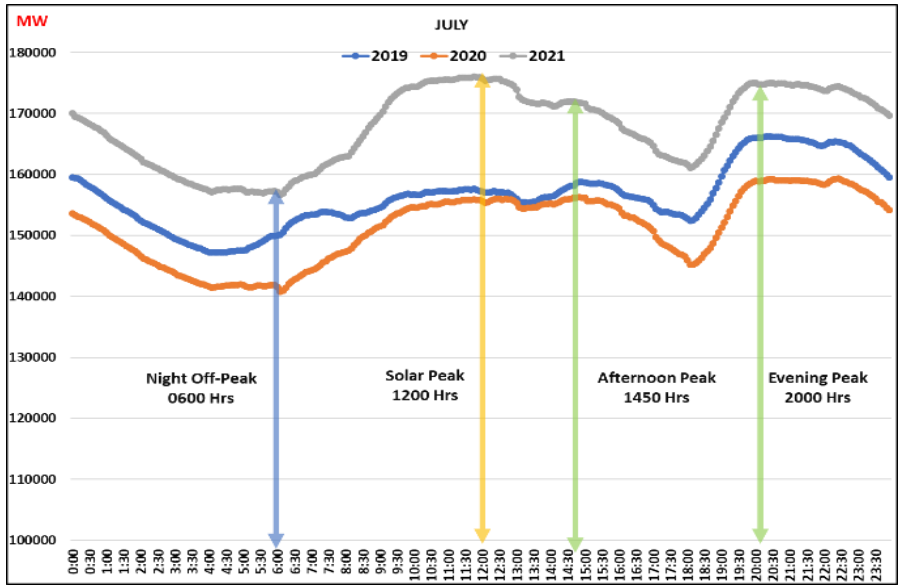


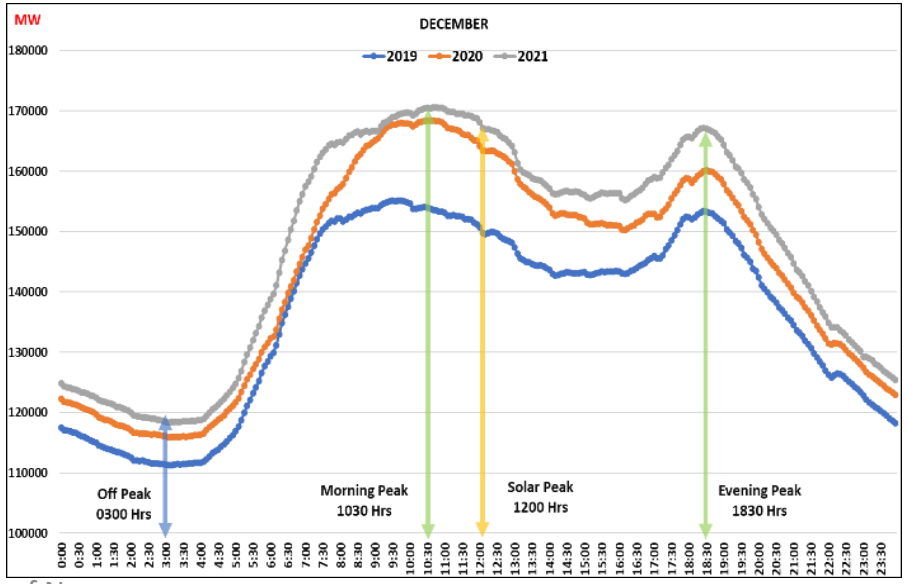
Present & Future elements to be correctly modelled

Study to be conducted on realistic LGB

Solar Peak, Non-Solar Peak, Non-Solar Off-peak, Morning Peak

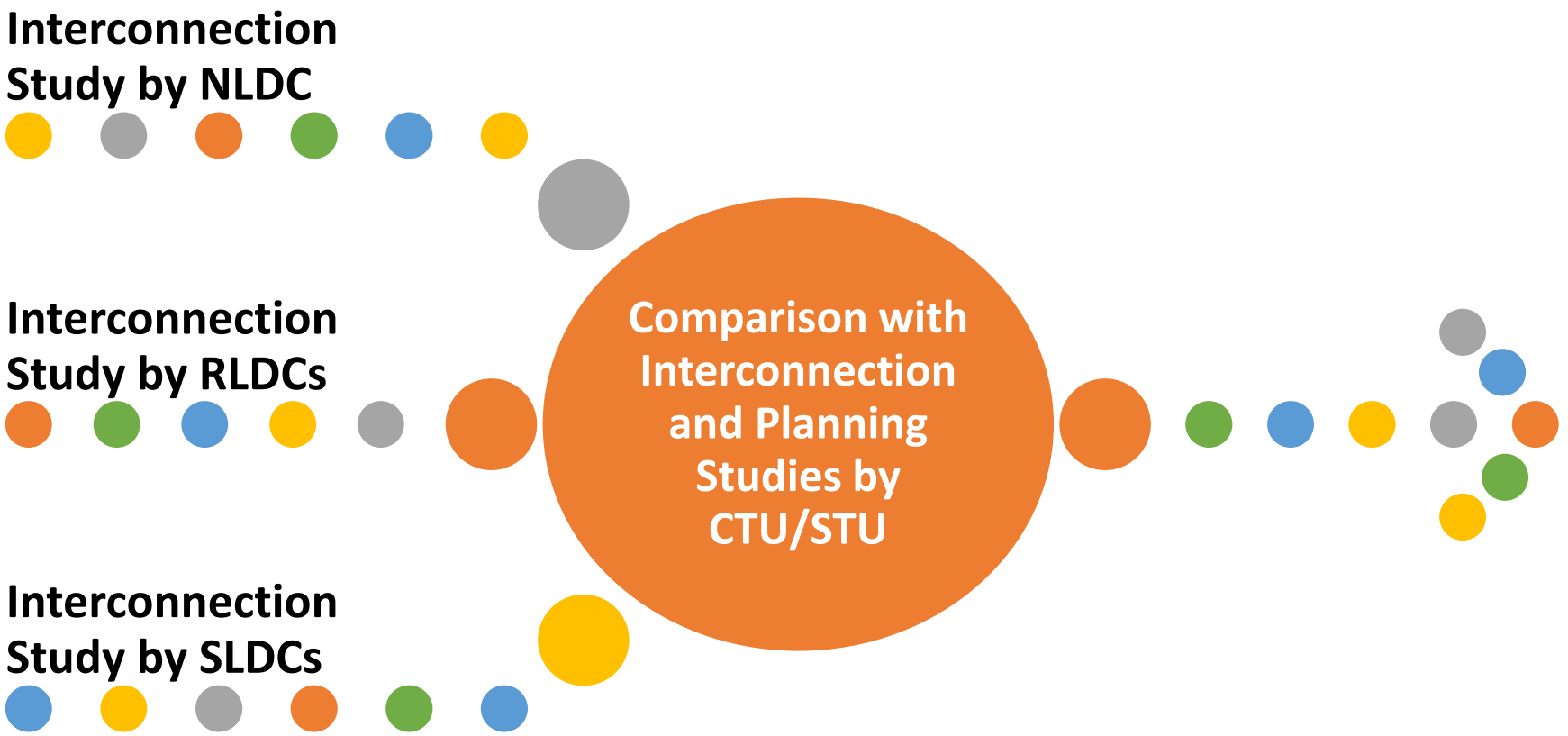
All elements to be commissioned in the next six months need to be modelled





Different Simulation base cases for different cardinal points of the demand curve

Action points after completion of Interconnection Studies



In case of significant variations observed, NLDC/RLDC/SLDC shall communicate the same to CEA, RPCs, CTU and STUs for immediate and long-term mitigation measures

In case of any constraint observed in the interconnection of the new element, CTU/NLDC/RLDC/SLDC shall explore possible measures for facilitating the integration of the element, subject to grid security

Reference: IEGC – 2023: Operating Code – Clause 33 (09,10,11,12,13)

Annexure-I: Sample Summary of the elements expected to be first-time energized in the next six (06) months

GENERATING UNITS								
S.No.	Region	Location	Plant/Unit Name	Unit No	Type/Source	Total Capacity (MW)	Owner/ Agency	Expected Commissioning Date/Month
1	NR	Rajasthan	A	Unit-1	Hydro	250	X	-
2	WR	Gujarat	B	Unit-2	Coal	300	Y	-
3	SR	Tamil Nadu	C	NA	Solar	300	Z	-
Interconnecting/Generator/Station Transformers								
S.No.	Region	Location	Sub-Station	ICT No.	Voltage Level (kV)	Capacity (MVA)	Owner/ Agency	Expected Commissioning Date/Month
1	NR	Rajasthan	A	3	765/400/33	1500	X	-
2	WR	Gujarat	B	1	400/220	500	Y	-
3	SR	Tamil Nadu	C	2	220/33	150	Z	-
Substation Bays								
S.No.	Region	Location	Sub-Station Name	Bays to be charged	Voltage Level (kV)	Bus Switching scheme	Owner/ Agency	Expected Commissioning Date/Month
1	NR	Rajasthan	A	X	765 KV	Breaker & half scheme	X	-
2	WR	Gujarat	B	Y	400 KV	Double main & transfer bus scheme	Y	-
3	SR	Tamil Nadu	C	Z	220 KV	Double bus scheme	Z	-

Annexure-I: Sample Summary of the elements expected to be first-time energized in the next six (06) months

TRANSMISSION LINES								
S.No.	Region(s)	Location	Line Name	Length (KM)	Voltage Level (kV)	Rating (SIL/Thermal)	Conductor Type & Parameters	Expected Commissioning Date/Month
1	Inter-regional (ER-NR)	Bihar - UP	A-B	M	765 kV	X		-
2	WR	Gujarat	C-D	N	400 kV	Y		-
3	SR	Tamil Nadu	E-F	P	220 kV	Z		-

LILO/Re-Arrangement/Reconductoring of Transmission Lines								
S.No.	Region(s)	Location	Line Name/LILO/Rearrangement/Reconductoring at station	Length (KM)	Voltage Level (kV)	Rating (SIL)	Rating (Thermal)	Expected Commissioning Date/Month
1	Inter-regional (ER-NR)	Bihar - UP	A-B-C	M	765 kV	X	X	-
2	WR	Gujarat	B	N	400 kV	Y	Y	-
3	SR	Tamil Nadu	C	P	220 kV	Z	Z	-

Annexure-I: Sample Summary of the elements expected to be first-time energized in the next six (06) months

BUS/LINE REACTORS								
S.No.	Region	Location	Sub-Station/Line	Type	Voltage Level (kV)	Rating (MVAr)	Owner/ Agency	Expected Commissioning Date/Month
1	NER	A	X	Bus Reactor	400	125	M	-
2	NR	B	Y	Line Reactor of … Line at … end	765	125	N	-
2	NR	c	Z	Line Reactor of … Line at … end	400	125	N	-

HVDC /AC Filter bank / FACTS DEVICEs/Any other element								
S.No.	Region(s)	Substation(s)	Element Name	Type	Voltage Level (kV)	Rating (MW/MVAR) (*Both Forward & Reverse Direction Rating for HVDC)	Owner/ Agency	Expected Commissioning Date/Month
1	NR	A/B	X					-
2	WR	C/D	Y					-

Back

Questions??

Thank You !!

Last date for submission of the comments on the draft procedure at nldcreliability@grid-india.in is 7th August 2023

IEGC – 2023: Connection Code

Clause 10: Technical Requirements

(1)NLDC or RLDC, as the case may be, in consultation with CTU, STU or SLDC, as the case may be, shall carry out a joint ***system study six (6) months before the expected date of first energization of a new power system element*** *to identify operational constraints, if any. In case of constraints, CTU, NLDC or RLDC, as the case may be and SLDC shall identify measures for facilitating the integration of the element, subject to grid security. The connectivity grantee, transmission licensee and SLDC/STU shall furnish all technical data including that of its embedded generators and other elements to the CTU and NLDC or RLDC, as the case may be, for necessary technical studies.*

(2)Similar exercise shall be done by SLDC in consultation with STU for the intra-state system, and specifically for elements of 220 kV and above (132 kV and above in case of North Eastern region).

(3)NLDC shall publish a detailed Procedure covering modalities for carrying out interconnection studies.

Back

IEGC – 2023:Operating Code

Clause 33: Operational Planning Study

(9) Each SLDC shall undertake a study on the impact of new elements to be commissioned in the intra-state system in the next six (6) months on the TTC and ATC for the State and share the results of the studies with RLDC.

(10) Each RLDC shall undertake a study on the impact of new elements to be commissioned in the next six (6) months in (a) the ISTS of the region and (b) the intrastate system on the inter-state system and share the results of the studies with NLDC.

(11) NLDC shall undertake study on the impact of new elements to be commissioned in the next six (6) months in (a) inter-regional system, (b) cross-border link and (c) intraregional system on the inter-regional system

(12) NLDC, RLDCs and SLDCs shall compare the results of the studies of the impact of new elements on the system and transfer capability addition with those of the interconnection and planning studies by CTU and STUs, and any significant variations observed shall be communicated to CEA, RPCs, CTU and STUs for immediate and long-term mitigation measures.

(13) Defense mechanisms like system protection scheme, load-rejection scheme, generation run-back, islanding scheme or any other scheme for system security shall be proposed by the concerned user or SLDC or RLDC or NLDC and shall be deployed as finalized by the respective RPC

Back