

Central Electricity Authority
System Planning & Project Appraisal Division
Sewa Bhawan, R.K. Puram, New Delhi – 110066

No. 51/4/SP&PA-2013/ 1357-1368

Date: 12- August-2013

To

1.The Member Secretary, Southern Regional Power Committee, 29, Race Course Cross Road, Bangalore 560 009. FAX : 080-22259343	2.The Director (Projects), Power Grid Corp. of India Ltd. “Saudamini”, Plot No.2, Sector-29, Gurgaon 122 001, Haryana. FAX : 95124-2571932
3.The Director (Transmission), Transmission Corp. of Andhra Pradesh Ltd., Vidyut Soudha, Hyderabad – 500 082. FAX : 040-66665137	4.The Director (Transmission), Karnataka State Power Transmission Corp.Ltd., Cauvery Bhawan, Bangalore 560 009. FAX : 080 -22228367
5.The Member (Transmission), Kerala State Electricity Board, Vidyuthi Bhawanam, Pattom, P.B. No. 1028, Thiruvananthapuram - 695 004. FAX : 0471-2444738	6. Member (Distribution), Tamil Nadu electricity Board (TNEB), 6 th Floor, Eastern Wing, 800 Anna Salai, Chennai - 600002. FAX : 044-28516362
7.The Director (Power), Corporate Office, Block – I, Neyveli Lignite Corp. Ltd., Neyveli , Tamil Nadu – 607 801. FAX : 04142-252650	8.The Superintending Engineer –I, First Floor, Electricity Department, Gingy Salai, Puducherry – 605 001. FAX : 0413-2334277/2331556
9. Director (Projects), National Thermal Power Corp. Ltd. (NTPC), NTPC Bhawan, Core-7, Scope Complex, Lodhi Road, New Delhi-110003. FAX-011-24360912	10. Director (Operations), NPCIL, 12 th Floor, Vikram Sarabhai Bhawan, Anushakti Nagar, Mumbai – 400 094. FAX : 022- 25991258

Sub: 36th meeting of the Standing Committee on Power System Planning of Southern Region
- **Additional Agenda-II.**

Sir,

The **36th meeting** of the Standing Committee on Power System Planning of Southern Region is proposed to be held on 30-08-2013 at NRPC, Katwaria Sarai, New Delhi. Complete agenda is available at CEA's website.

(www.cea.nic.in).

Please make it convenient to attend the meeting.

Yours faithfully,

(Manjari Chaturvedi)
Deputy Director (SP&PA)
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Copy to:

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**Additional Agenda-II Note for 36th Meeting of
Standing Committee on Power System Planning in Southern Region (SCPSPSR)**

Date and Venue: 30-Aug-2013, NRPC, Katwaria Sarai, New Delhi.

A.0 Installation of line reactors for Narendra - Madhugiri 765kV D/C line (initially at 400kV level)

A.1 POWERGRID has proposed to provide line reactors of 63MVAR both at the sending end and the receiving end of Narendra - Madhugiri 765kV D/C line (initially at 400kV level) to control the overvoltages during the charging of the line. Also they have proposed to provide NGRs on line reactors for the above line to limit the secondary arc current for successful single pole auto reclosure.

A.2 The studies are given at Annex-II. Members may discuss and agree.

B.0 TNEB's Proposal (vide letter no Lr.No.CE/Plg&R.C/SE/SS/EE1/AEE1/F.36th Agenda /D.292/2013 dt.23.07.13)

B.1.0 Transmission evacuation system for the proposed power plants at North Chennai & Ennore:

B.1.1 In TamilNadu, the following power projects are proposed in North Chennai area as State Sector Power Projects.

SL.NO	PROJECTS	CAPACITY	PROBABLE PERIOD OF COMMISSIONING	Phase
1	ETPS Expansion	1x660MW	September - 2016	Phase I
2	Ennore SEZ (NCTPS Stage-IV)	2x660MW	Unit 1 – Dec- 2016 Unit 2 – March	
3	NCTPS Stage –III	1x800MW	May - 2018	Phase II
4	ETPS Replacement	1X660MW	Feb - 2019	
	Total capacity in	3440 MW		

B.1.2 In addition, M/S.OPG Power Generation Pvt. Ltd., Gummidipoondi have proposed to establish 2X360MW coal based power plant at Gummidipoondi in North Chennai.

B.1.3 In North Chennai area, there are existing four power plants, i.e., ETPS (450MW), NCTPS (630MW), NCTPS Stage –II – 2X600MW and Vallur JV – 3X500MW are available. As the associated transmission lines of the above power plants at 400kV level and 230kV level are emanating from this area, there is a severe RoW constraint to lay new transmission lines from North Chennai area. To avoid more number of 400kV lines emanating from the new projects, it has been decided to propose a 765/400kV pooling station at North Chennai area with pooling of all generation mentioned in para II.1 above.

B.1.4 During the joint study meeting conducted at Hyderabad held on 29-30 June 2013, the above scheme has been discussed with CEA and POWERGRID. Based on the discussions, following proposal has been evolved by TNEB.

I. Associated Transmission System (ATS) FOR ETPS EXPANSION – 1X660MW:

400kV DC Quad connectivity from ETPS Expansion switchyard to the 765/400kV Pooling station at North Chennai.

II. Associated Transmission System (ATS) FOR ENNORE SEZ (NCTPS Stage-IV) – 2X660MW:

- i. 400kV DC Quad connectivity from Ennore SEZ switchyard to the 765/400kV Pooling station at North Chennai.
- ii. 400kV DC Quad inter link between the above two plants switchyard for reliability.

III. Associated Transmission System (ATS) FOR NCTPS Stage III – 1X800MW:

765kV DC line from NCTPS Stage IV switchyard to the Pooling station.

IV. Associated Transmission System (ATS) FOR ETPS Replacement – 1X660MW:

- i. 765kV DC line from ETPS Replacement switchyard to Pooling station.
- ii. 765kV DC inter link between the above two plants switchyard for reliability.

V. Establishment of 765/400kV Pooling Station in North Chennai area:

- i. 2X1500MVA, 765/400kV ICTs at Pooling Station in North Chennai

- ii. 765kV DC connectivity from North Chennai 765kV pooling station to the proposed Kilpennathur 765/400kV SS.

VI. Associated Transmission System (ATS) for M/S.OPG Power generation Ltd.- 2X360MW:

- i. 400kV DC line to the sanctioned Thervoikandigai Pooling station.
- ii. 400kV DC line from Thervoikandigai Pooling station to the proposed Pulianthope 400/230kV SS.

VII. Establishment of 765/400/230kV SS in Kilpennathur:

- i. 2X1500MVA, 765/400kV ICTs with the following 765kV and 400kV connectivity.

765kV Connectivity:

- i. 765kV DC connectivity from 765/400kV North Chennai Pooling station to the proposed Kilpennathur 765/400kV SS.
- ii. 765kV DC connectivity from Kilpennathur 765/400kV SS to the proposed Coimbatore 765/400kV SS.
- iii. 765kV DC connectivity from Kilpennathur 765/400kV SS to the Thiruvalem PGCIL 765/400kV SS.

400kV Connectivity:

- i. LILO of Pugalur – Kalivantapattu 400kV DC Quad line.
- ii. With other approved connectivity of Singarapet S/S.

VIII. Establishment of 765/400kV SS in Coimbatore region (upgradation of Rasipalayam 400kV SS):

2X1500MVA, 765/400kV ICTs with the following 400kV and 765kV connectivity.

765kV Connectivity:

- i. 765kV DC connectivity to the proposed Kilpennathur 765/400kV SS.

400kV Connectivity:

- i. 400kV DC connectivity to the proposed Edayarpalayam 400kV SS.
- ii. With other approved connectivity.

B.1.5 TNEB may present the studies. Members may discuss.

B.2.0 Transmission evacuation system for the proposed power plants at Udangudi

B.2.1 In Southern part of Tamil Nadu, the following projects are proposed as state sector projects.

SL. NO	PROJECTS	CAPACITY	PROBABLE PERIOD OF COMMISSIONING
1	Udangudi Stage I	2X660MW	Unit - I May - 2017 Unit - II Nov - 2017
2	Udangudi Stage II –	1X800MW	Mar- 2018

B.2.2 Regarding Udangudi Stage –I project, the following scheme has already been approved:

- 400kV DC Quad line to Kayathar 400kV SS.
- 400kV DC Quad line to Karaikudi PGCIL 400/230kV SS.

B.2.3 In Southern part of Tamil Nadu, there are following power plants, i.e., TTPS (5X210MW), Kudankulam (2X1000MW), NLC JV – 2X500MW, Coastal Energen – 2X660MW, Ind Bharath – 2X660MW, 3X63MW and 3X150MW are available. As the associated transmission lines of the above power plants and wind evacuation system at 400kV level and 230kV level are emanating from this area, there is severe RoW constraint to lay new transmission lines from Udangudi. Further, southern part of Tamil Nadu is not a load centre also, it has been decided to evacuate the Udangudi generation at 765kV level with the following scheme.

- (i) Udangudi – proposed Kilpennathur 765kV DC line with an anchoring 765/400kV SS near Karaikudi/Sivaganga.
- (ii) Establishment of 765/400kV SS with 2X1500MVA ICTs in Karaikudi/Sivaganga:
- (iii) 765kV DC line from Karaikudi/Sivaganga to Udangudi Pooling station.
- (iv) 765kV DC line from Karaikudi/Sivaganga to proposed Kilpennathur 765/400kV SS
- (v) LILO of Karaikudi – Pugalur 400kV DC Quad line at 765/400kV Karaikudi SS
- (vi) 400kV DC line from Karaikudi/Sivaganga to the proposed Tanjore /Thiruvarur 400kV SS.

B.2.4 TNEB may present the studies. Members may discuss.

B.3.0 Transmission system for the proposed 400 KV Pooling station for solar power Evacuation:

- B.3.1 TNEB vide their above letter has proposed to establish Kamudhi 400/230-110kV SS for solar power Evacuation in the first phase, with the following connectivity :
- i. Establishment of Kamudhi 400/230-110 KV SS with 3x 315MVA 400/230kV ICTs and 3x200 MVA, 400/110kV ICTs
 - ii. 400 KV DC line from Kamudhi SS to the existing Karaikudi 400kV PGCIL SS.
- B.3.2 TNEB may present the studies. Members may discuss.

B.4.0 Numbers of 220kV bays with 400/220kV transformers under ISTS:

B.4.1 In the 31st Standing committee meeting, the following norm was decided for providing 220kV bays with new substations:

For 2X315MVA transformers - 6 nos. of Line Bays.

For 3rd/4th 315MVA transformer - 2 line Bays per transformer.

For 500MVA Transformer - 4 Line Bays per Transformer.

B.4.2 Based on the above, TNEB suggested that, in the following PGCIL 400kV substations in which transformer augmentation was agreed in the 33rd Standing Committee meeting, two/four numbers of 230kV line Bays may be provided by PGCIL.

- a. Pugalur 400kV SS - 1X500MVA
- b. Trichy - 1X500MVA
- c. Kalivantapattu - 1X500MVA
- d. Hosur - 1X315MVA

B.4.3 Members may discuss.

B.5.0 Kayathar – Koilpatty (Tuticorin Pooling point) 400kV DC Quad line:

B.5.1 TNEB has proposed Kayathar – Koilpatty(Tuticorin Pooling point) 400kV DC Quad line for additional connectivity with ISTS and increased reliability purpose.

B.5.2 Members may discuss and agree.

B.6.0 400kV Bays in Dharmapuri (Salem) 765/400kV SS for terminating 400kV DC line from Rasipalayam 400kV SS:

B.6.1 During the 34th Standing Committee Meeting for Southern Region, following connectivity has been approved for the transmission System for Evacuation of Wind Power from Tamil Nadu
System for additional inter-connection with ISTS and increased reliability:

- i) LILO of one Rasipalayam -Singarapet 400kV D/c line at Salem 765/400kV (POWERGRID) substation

TNEB has requested PGCIL to provide two bays at Dharmapuri 765/400kV SS for terminating Rasipalayam 400kV DC line, as the tender for the wind corridor works would to be awarded shortly. PGCIL vide letter dated 11.07.2013, has stated that there is no space available in Dharmapuri 765/400kV SS as per the present system configuration.

B.6.2 Members may discuss.

B.7.0 Transmission System for evacuation of power from 2x500 MW Neyveli Lignite Corporation Ltd. TS-I (Replacement) (NNTPS) in Neyveli, Tamil Nadu:

B.7.1 The following modification has been requested vide ref (1) above, for the transmission system of evacuation of power from 2X500MW NNTPS (Neyveli TS-1 Replacement).

“LILO of one of the Neyveli TS II – NNTPS switchyard DC lines at the TANTRANSCO 230kV SS at a later date (By TNEB).”

B.7.2 TNEB vide their letter Lr.No.CE/Plg&R.C/SE/SS/EE1/AEE1/F.36th Agenda /D.292/2013 dt.23.07.13 has suggested that the above line may be included, thereby TANTRANSCO 230kV SS at NLC will have 3 feeders from NNTPS switchyard and 3 feeders from NLC TS-II switchyard. During contingency condition, this additional connectivity will be useful for drawing NNTPS power. During contingency condition, i.e., outage of one of the NLC TSII – NLC TNEB 230kV DC feeders, the other line is over loaded. Hence, it is requested for the 3rd connectivity from NNTPS switchyard to NLC TNEB 230kV SS by making LILO of one of the NLC TS-II – NNTPS circuits.

B.7.3 TNEB may present the studies. Members may discuss.

C.0 Contingency Plan for evacuation of Power from ILFS (2x600 MW).

C.1 The transmission system for evacuation of power from ILFS power project consist of 400kV 2xD/c quad line from generation switchyard to Nagapatinam. For evacuation of power beyond Nagapatinam, the implementation of Nagapatinam - Salem 765kV S/C line & Salem - Madhugiri 765kV S/c line is in the scope of ‘POWERGRID NM Transmission Company Ltd’(PNMTL) a subsidiary of POWERGRID .Due to delay in commencement of work on the 765kV lines by

PNMTL, CERC has directed POWERGRID to submit the contingency plan of action to evacuate the power from ILFS project.

- C.2 CTU vide their letter C\CTU\S\LTA-Nagapatinam dated 31st July,2013 has mentioned that load flow studies has been carried out for contingency plan for ILFS and it is found that LILO of both the circuits of Neyveli - Trichy 400kV D/C line at Nagapatonam pooling station shall provide additional reliability and give advantages in some cases for evacuation of power to the extent margins available in grid. LTA granted to ILFS shall be effective only on commissioning of transmission system being implemented under TBCB till such time the power may be transferred by availing short term/ medium term open access to the extent margins available in grid.
- C.3 The above proposal is only for the purpose of contingency plan of action. The evacuation system for ILFS generation project i.e. Nagapatinam - Salem 765kV S/C line & Salem - Madhugiri 765kV S/c line must be completed at the earliest. Members may discuss and agree.

D.0 System Strengthening in SR for import of power from ER- being implemented through TBCB route:

- D.1 The scheme 'System Strengthening in SR for import of power from ER' inter-alia involves 400kV Khammam Pooling Station - Nagarjuna Sagar S/Stn D/C line. Due to delay in the commissioning of Khammam Pooling Station, the termination of above line has been modified to Khammam (existing) substation. CEA vide its letter 100/11/REC/7/2012-SP&PA/859-60 dated 14-06-2013 has conveyed in principle approval for the modification i.e. 400kV Khammam (existing) - Nagarjuna Sagar S/Stn D/C line instead of 400kV Khammam Pooling Station - Nagarjuna Sagar S/Stn D/C line.
- D.2 Members may kindly note.

**Studies for Reactive Compensation in Narendra – Madhugiri 765kV D/c line
(initially at 400kV level)**

- (a) Studies for provision of Line Reactors on Narendra - Madhugiri 765 kV D/c line
(initially charged at 400 kV level) Line Length: approx 350 km

The line reactors are required to be provided on long lines to facilitate charging of the line to control over voltages at the open end. Such over voltages are result of what is called Ferranti effect. The Ferranti effect is the result of connecting unloaded line from one end which electrically have an effect of connecting large capacitor at the sending end, thereby causing source rise and line rise. The combined effect of these two voltage rises are reflected at the open end of transmission lines causing over voltages therein. Provision of reactors are required at sending and receiving end facilitate control of source rise and line rise respectively to value less than 1.05 PU (420 kV).

In the instant case, following results have been obtained while charging from either ends of transmission line, the relevant outputs are enclosed at **Exhibit-I**

Charging from Madhugiri end without Line Reactors.

Source rise – 5 kV
Line Rise – 28 kV
Total Rise – 33 kV

Charging from Narendra end without Line Reactors.

Source rise – 1 kV
Line Rise – 27 kV
Total Rise – 28 kV

From the above it may be seen that charging the line from either of the ends without reactor shall lead to high voltage at the open end. Accordingly, it may be seen that reactors are necessary for charging of the line. Relevant charging studies are given at **Annexure-I**

Charging from Madhugiri end with 63 MVAR Line Reactor at both the ends.

Source rise – 3 kV
Line Rise – 13 kV
Total Rise – 16 kV

Charging from Narendra end with 63 MVAR Line Reactor at both the ends

Source rise – 1 kV
Line Rise – 14 kV
Total Rise – 15 kV

(b) Studies for provision of NGRs on Line Reactors of Narendra - Madhugiri 765 kV D/c line (initially charged at 400 kV level) Line Length: approx 350 km.

NGRs are required to be provided with line reactors of long line to limit the secondary arc current for successful Single Pole Auto Re-closure.

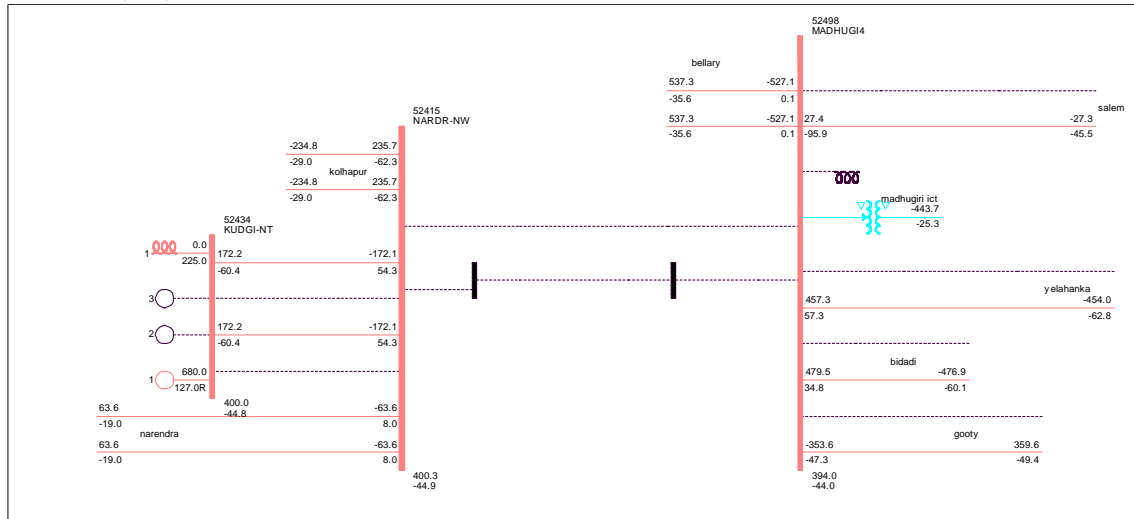
In the instant case, following results have been obtained through EMTP studies

- Secondary Arc Current with out NGR on line reactors - **48 amps**
- Secondary Arc Current with 600 ohm NGR on line reactor at both the ends – **28 amps**

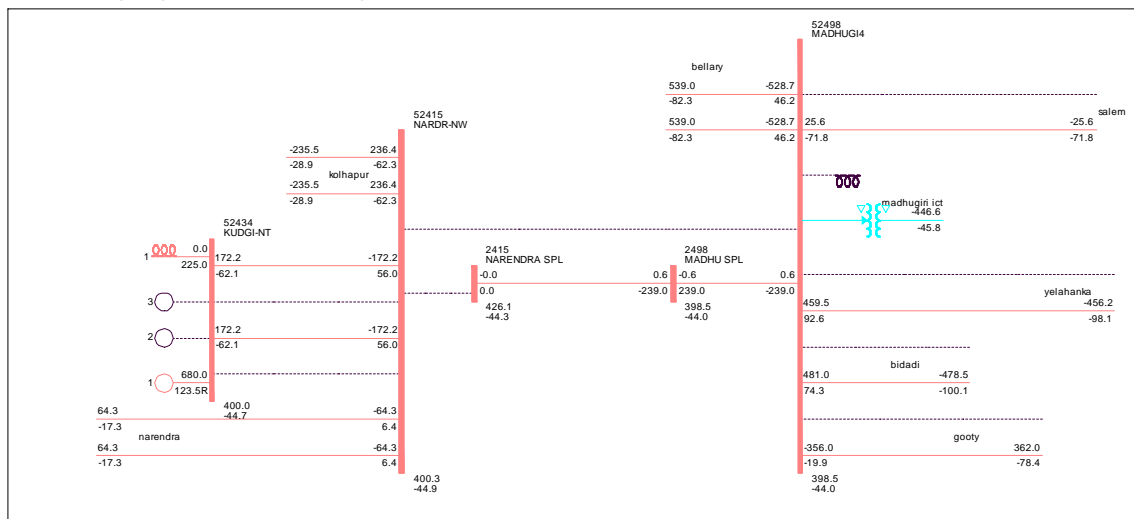
From the above it is prudent to have 600 ohm NGR with line reactors at both the ends to limit the secondary arc current for successful single pole auto re-closure.

Charging of Narendra – Madhugiri 765kV D/c line (initially @400kV) without reactive compensation

Pre-charging condition

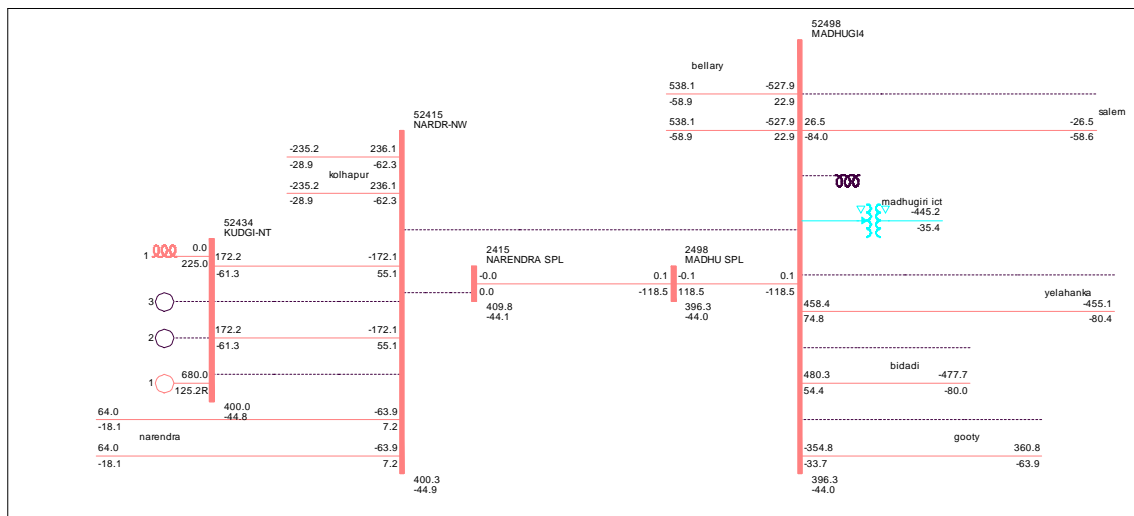


On-charging (from Madhugiri end)



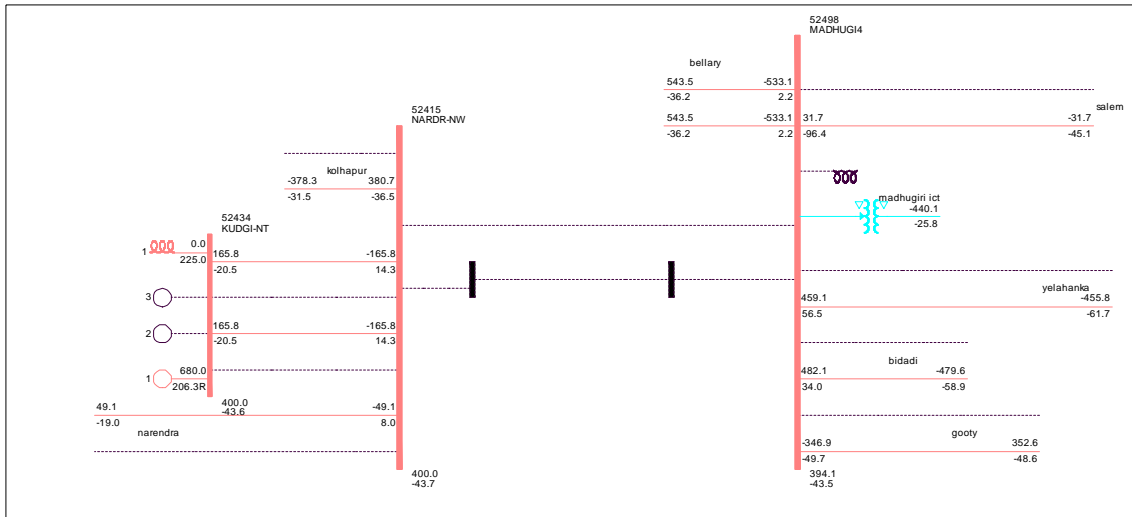
Line Charging with 1x63 MVAR reactors at Narendra and Madhugiri end

On-charging (from Madhugiri end)

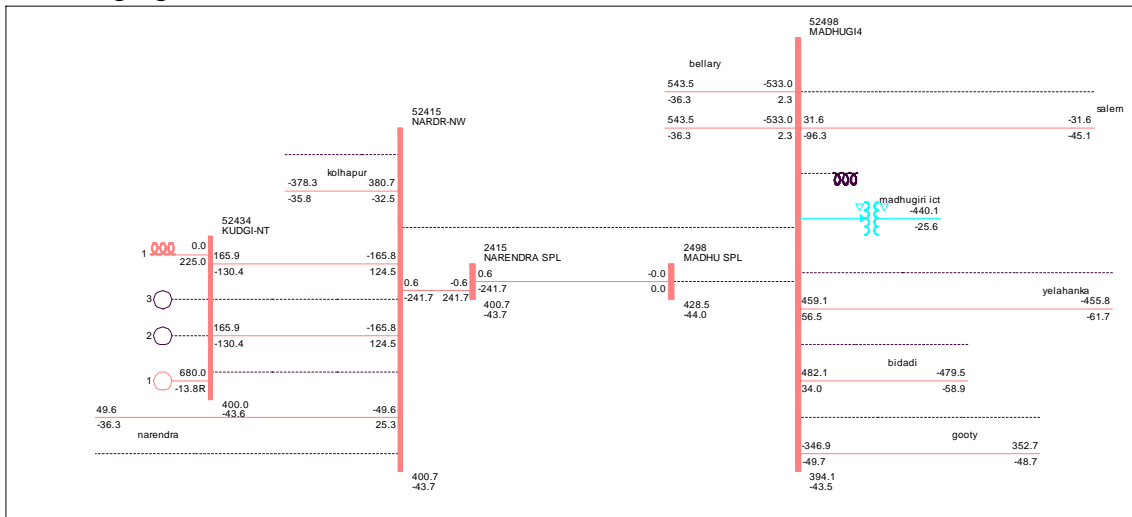


Charging of Narendra – Madhugiri 765kV D/c line (initially @400kV) without reactive compensation

Pre-charging condition



On-charging (from Narendra end)



Line Charging with 1x63 MVAR reactors at Narendra and Madhugiri end

