

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

No. 51/4/SP&PA-2015/ 484-498

Date: 24-Feb-2015

Sub: 38th meeting of the Standing Committee on Power System Planning of Southern Region
- **Agenda for the meeting**

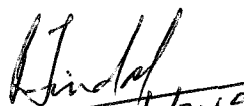
Sir,

The **38th meeting** of the Standing Committee on Power System Planning of Southern Region **is to be held on 7th March 2015 (Saturday)** at NRPC Katwaria Sarai, New Delhi. The meeting will commence at 11:00 AM.

The agenda is available at CEA's website (www.cea.nic.in).

Kindly make it convenient to attend the meeting.

Yours faithfully,


24/2/2015
(Pardeep Jindal)
Director (SP&PA)

(Telephone: 011 26732325, Fax No. 011 26102045)

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
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3. CEO, POSOCO, B-9, Qutub Institutional Area, Katwaria Sarai, New Delhi-110016	4. The Director (Transmission), Karnataka State Power Trans. Corp.Ltd., Cauvery Bhawan, Bangalore - 560 009. FAX : 080 -22228367
5.The Director (Transmission), Transmission Corp. of Andhra Pradesh Ltd., (APTRANSCO) Vidyut Soudha, Hyderabad – 500 082. FAX : 040-66665137	6. The Director (Grid Transmission and Management), Transmission Corp. of Telangana Ltd., (TSTRANSCO) Vidyut Soudha, Khairatabad Hyderabad – 500 082. FAX : 040-23321751
7. The Director (Trans. & System Op.), Kerala State Electricity Board, Vidyuthi Bhawanam, Pattom, Thiruvananthapuram - 695 004. FAX : 0471-2444738	8. Member (Distribution), Tamil Nadu electricity Board (TNEB), 6 th Floor, Eastern Wing, 800 Anna Salai, Chennai - 600002. FAX : 044-28516362
9. The Director (Power), Corporate Office, Block – I, Neyveli Lignite Corp. Ltd., Neyveli , Tamil Nadu – 607 801. FAX : 04142-252650	10. The Superintending Engineer –I, First Floor, Electricity Department, Gingy Salai, Puducherry – 605 001. FAX : 0413-2334277/2331556
11. Director (Projects), National Thermal Power Corp. Ltd. (NTPC), NTPC Bhawan, Core-7, Scope Complex, Lodhi Road, New Delhi-110003. FAX-011-24360912	12. Director (Operations), NPCIL, 12 th Floor, Vikram Sarabhai Bhawan, Anushakti Nagar, Mumbai – 400 094. FAX : 022- 25991258

Copy to:

1.	The Director (Projects), Power Grid Corp. of India Ltd. “Saudamini”, Plot No.2, Sector-29, Gurgaon 122 001, Haryana. FAX : 95124-2571932
2.	GM, SRLDC, 29, Race Course Cross Road, Bangalore 560 009 FAX – 080-22268725

Agenda Note for 38th Meeting of Standing Committee on Power System Planning in Southern Region (SCPSPSR)

Date: 7th March 2015 (Saturday)

Venue: at NRPC Katwaria Sarai, New Delhi

1.0 Confirmation of the minutes of 37th meeting of the Standing Committee

1.1 The Minutes of 37th meeting of the Standing Committee on Power System Planning of Southern Region were issued vide CEA's letter No. 51/4/(37th)/SP&PA-2014/ 1729-42 dated 22nd September, 2014.

1.2 SRLDC vide their letter No एसआरएलडीसी/अमप्र/2014 gave their observations regarding Vemagiri rearrangement and Hinduja Plant evacuation and additional agenda related to Vemagiri- Khammam- Hyderabad corridor. POSOCO vide their letter No NLDC/Planning/761 dated 24th Sept, 2014 cited a correction in para 12.3 of the minutes regarding 400/230 kV S/S at Tirunelveli Pooling Station. POSOCO suggested 'one and a half breaker scheme' instead of 'double bus scheme for increased reliability'.

Based on these observations a corrigendum to the minutes of 37th SCM was issued vide CEA letter no 51/4/(37th)/SP&PA-2014/1796-1809 dated 9th October, 2014.

1.3 Transmission Corporation of Andhra Pradesh Ltd(APTRANSCO) vide their letter No CE(IPC&PS)/ SE(PS)/DE(SS<SS) ADE-2/ F.37thSCM/ D.No.156/2014 dated 05.11.2014 have commented that the Cuddapah-Hindupur 400kV (quad) D/c line with 80 MVAR switchable line reactor at both ends may be implemented as ISTS instead of by APTRANSCO. Accordingly, corrigendum#2 was issued vide CEA letter no 51/4/(37th)/SP&PA-2014/2417-30 dated 22-December, 2014.

1.4 The minutes of 37th Meeting along with corrigendum given under Annex-1.0, and as circulated, may be confirmed.

2.0 Augmentation of Transformer Capacities in SR

2.1 During the 37th Standing Committee Meeting it was desired that the augmentation of transformers may be needed at a number of 400kV Substations and a detailed exercise may be carried out.

2.2 Accordingly, studies have been carried out for 2018-19 time frames.

2.3 To determine the transformer requirement in individual State, the power demand of states was made equal to peak load as per 18th EPS projections of the State under focus. In the studies transformer over loading was observed at number of locations. Details of studies are enclosed at **Exhibit-II under the Annex-2.0**. For accessing the requirement following methodology was followed:

- Peak load as per EPS was simulated for the States one at a time. **Column-A** shows the loading and **column-B** shows the available transformer.
- All transformers loaded 50% under above base case (under Column-A & B) was selected for augmentation so as to avoid more than 100% loading under outage of single transformer. Column-C shows the loading after transformer augmentation while column-D shows the revised MVA capacity.
- The transformers loading at each location were again tested separately for need of augmentation and to sustain outage. Based on the loading, transformer augmentation required is tabulated in Column- E.

2.4 For example at Vemagiri-I, the loading in base case is 1341 MW while transformer rating is only 1260 MVA. Outage of one transformer would reduce the transformation capacity to 945 MVA. Hence to load the transformer to 1341 MVA under such condition transformer augmentation of 500 MVA is proposed. After adding transformers, at various locations at Vemagiri-I under outage of 500 MVA transformers, the loading on remaining transformers is 1302 MVA against available transformation capacity of 1260 MVA. Accordingly transformer Augmentation of 1000 MVA has been proposed at Vemagiri-I. Similar exercise has been carried out at all substations.

2.5 Based on above exercise, Augmentation required at following number of locations is summarized below:

State	Peak Load	No of locations where overloading observed
Andhra Pradesh+ Telegana	26150MW	16
Karnataka	14750MW	8
Tamil Nadu	23750MW	14
Kerala	5100MW	3

2.6 In the above studies augmentation requirement at following POWERGRID substation emerges:

Sl no	Substation	Existing / Approved trf.	Transformer Augmentation Required	Remarks
1	HYDERABAD	$3*315+500=1445$	1000	Space not available
2	GAZUWAKA	$2*315=630$	500	Space not available
3	WARANGAL	$2*315+500=1130$	500	Space not available
4	MUNIRABAD	$2*315=630$	500	Can be carried out
5	MYSORE	$2*315+500=1130$	500	Space not available
6	KOLAR	$2*500=1000$	500	Space not available
7	NARENDRA	$2*500=1000$	500	Space not available
8	MADHUGIRI	$2*500=1000$	500	Can be carried out
9	MUVATTUPUZHA (KOCHIN)	$2*315=630$	500	Can be carried out
10	PALAKKAD	$2*315=630$	500	Can be carried out
11	TRICHY	$2*315=630$	$2*500$	One unit already approved. No space for second
12	HOSUR	$3*315=945$	1000	Space not available
13	PUGALUR	$2*315=630$	$2*500$	One already approved. No space for second
14	ARASUR	$2*315=630$	500	Can be carried out
15	KARAIKUDI	$2*315=630$	500	Can be carried out
16	TIRUNELVELI	$2*315=630$	500	Can be carried out
17	PONDICHERRY	$2*315=630$	500	Can be carried out

2.7 In stations where in space is not available, it is proposed that joint studies can be carried out to finalise the various options like augmentation/Replenishing the transformers, shifting of loads, creation of new stations to meet the load.

2.8 Accordingly, following transformer additions are proposed for discussion:

Sl no	Substation	Existing / Approved trf.	Transformer Augmentation Required
1	MUNIRABAD	$2*315=630$	500
2	MADHUGIRI	$2*500=1000$	500
3	MUVATTUPUZHA (KOCHIN)	$2*315=630$	500
4	PALAKKAD	$2*315=630$	500
5	ARASUR	$2*315=630$	500
6	KARAIKUDI	$2*315=630$	500
7	TIRUNELVELI	$2*315=630$	500
8	PONDICHERRY	$2*315=630$	500

3.0 Transmission System for Coastal Tamil Nadu Power Ltd. (4000 MW) Cheyyur UMPP in Kanchipuram of Tamil Nadu

3.1 M/s Costal Tamil Nadu Power Ltd.,(CTNP Ltd.) which is a SPV of PFC had applied for connectivity and LTA to CTU for evacuation of power from Cheyyur UMPP. The beneficiaries of the project are as given below :

Southern Region (3100 MW)		Western Region (400 MW)	Northern Region (500 MW)
Tamil Nadu	-1600 MW	Maharashtra	- 400 MW
Karnataka	- 800 MW		Uttar Pradesh -300 MW
Andhra Pradesh	- 400 MW		Punjab - 200 MW
Kerala	- 300 MW		

3.2 The project is expected to be commissioned progressively from March 2019 to 2021.

3.3 Study has been carried out for 2020-21 condition with all generations expected in that time frame. Import of 6000MW has been considered through PugalurHVDC. Net Import to SR has been considered as 15800 MW. The Load Generation Scenario considered is as follows :

Sl. No.	State	EPS load (2020-21)	Generation	Demand
1	Andhra Pradesh + Telangana	28524*	19148	26285
2	Karnataka	15945*	11104	15016
3	Kerala	5369*	1645	5270
4	Tamil Nadu+Pondy	26573*	22990	24138
Total		76413	54887	70709

***Loads after diversity**

3.4 Simulation Study:

Considering the quantum of power to be evacuated 765kV lines have been considered.

For evacuation of power from Cheyyur, two nos 765kV D/c has been considered. One 765kV D/c has been considered to Thiruvalem and another to Salem. Salem is to be connected to Madhugiri through 765kV D/c charged at 400kV while Thiruvalem is to be connected to Cuddapah through 765kV D/c. Hence the above lines would facilitate transfer of power to beneficiaries. Charging of Salem-Madhugiri765kV D/c line at its rated voltage has been considered. Accordingly following system has been considered

- Cheyyur UMPP - Thiruvalem 765kV D/c line
- Cheyyur UMPP –Salem 765 kV D/c line
- Charging of Salem - Madhugiri 765kV D/c line at its rated voltage.

3.5 The results are tabulated in **Exhibit-IV-01 to 03 under Annex-3.0**. From the studies it is seen that Cheyyur-Thiruvalem 765kV line is loaded to 696 MW/ckt, while Cheyyur –Salem is loaded to 1098MW/ckt. Under outage of one circuit of Cheyyur-Thiruvalem 765kV line the other circuit gets loaded to 1161 MW and outage of one circuit of Cheyyur-Salem 765kV line the other circuit gets loaded to 1632MW.

3.6 Study has been carried out for outage of 400kV lines at Salem and Thiruvalem. It is seen that all line loadings are within limits.

3.7 It is learnt that the Government has presently suspended the bidding process for the generation project. PGCIL may confirm from the applicant i.e. the CTNP Ltd of PFC. Members may like to discuss.

4.0 Converting Fixed Line Reactors into Switchable Line Reactors in Over Compensated lines

4.1 It has been observed that due to reduction in line lengths generally after LILO at certain nodes, some lines as listed below are being overcompensated with the existing fixed Reactors. This is creating resonance in line section leading to vibration in Reactors causing damage to Reactor windings, core and bushings.

4.2 It is proposed that fixed Line Reactors installed in these lines be converted to switchable Line Reactors so that they may be utilised as Bus Reactors, as and when needed.

S.N o.	Name of the Line	Length (ckt km)	Capacity (MVar)		Switchable (S) / Fixed(F)		% Compensa tion
			End I	End II	End I	End II	
1	Malakaram - Hyderabad-II (upto LILO point) *	27.87	--	50	--	F	326.1
2	Kurnool – Gooty **	112.60	--	50	--	F	80.7

* - LILO of the one circuit of RTPS – Hyderabad(Ghanapur) 400 kV line at Malkaram.

** - LILO of N.Sagar – Gooty line at Kurnool

4.3 The proposal was also discussed during 26th TCC/SRPC meetings on 19th& 20th Dec'14 and members had agreed to the proposal. Maps are given at Annex-4-0. Members may discuss and agree.

4.4 Further to above, PGCIL vide their email dated 17-Feb-2015 have proposed following lines where the existing fixed Line Reactor(s) is overcompensating the transmission line. And hence, may be converted into switchable line reactor.

S.No.	Name of the Line	Length (ckt km)	Capacity (MVA)		Switchable (S) / Fixed(F)		% Compen sation
			End I	End II	End I	End II	
1	Gazwel-Hyderabad-II	62.5	-	50	-	F	132
2	Nellore-Tiruvellam-I & II	173	50	50	f	f	95
3	Sriperumbdur-chitoor	105.7	50	-	F	-	78
4	Thiruvananthapuram- Tirunelveli	160	63	-	F		65
5	Trichur-Palakkad- I & II	84	50	-	f	-	98
6	Udumalpet-Salem -II	137	63	-	F	-	76
7	Madurai-Karaikudi	130	63	-	F		80
8	Sriperumbadur-SV Chatram	18	50	-	F		458
9	Bangalore-Gooty	302	63	63	F	F	69
10	Kochi-Tirunelveli-I & II	231	63	63			90
11	Madurai-Trichy	130	50	-	F		63
12	Trichy-Nagapattinam-I	159	50		F		52
13	Trichy-Nagapattinam-II	159	63		F		65
14	Salem-Hosur-II	125	50	-	F		66

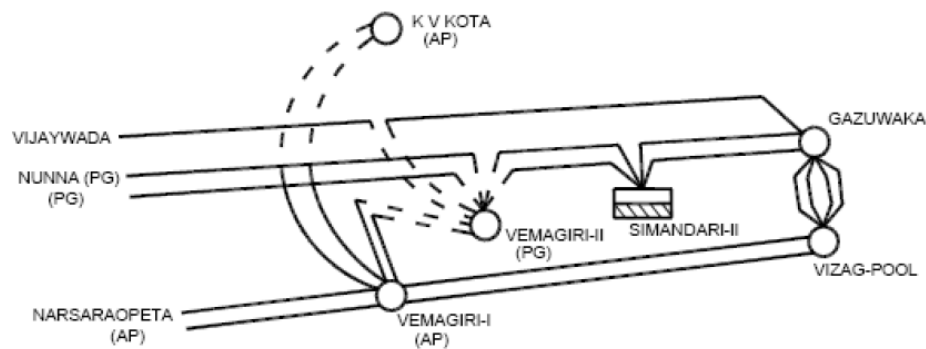
4.5 PGCIL may present. Members may discuss and agree.

5.0 Reactive compensation at Vemagiri S/S

5.1 The following scheme was agreed under Constraints in 400 kV bays extensions at 400 kV Vemagiri S/s:

- (i) LILO of both circuits of Gazuwaka/Simhadri-II –Vemagiri-I(AP) 400kV D/C line at Vemagiri-II(PG)
- (ii) Straighten Nunna- Gazuwaka 400kV D/C line (by disconnecting the LILO at Vemagiri-I) so as to make Nunna – Vemagiri-II (PG) 400 D/C link
- (iii) Use one LILO D/C portion (of Gazuwaka-Nunna at Vemagiri-I(AP)) to connect with K.V.Kota.

(iv) Second LILO D/C portion to be extended to Vemagiri-II(PG)



5.2 The 2x63 MVAR line reactors at Gazuwaka end on Simhadiri-II –Gazuwaka line (11 km) are proposed to be shifted to Vemagiri-II(PG) end of Simhadiri-II-Vemagiri-II(PG) 400kV D/c line (200km) instead of planning new reactors.

5.3 PGCIL may present in the light of 25th TCC minutes at item no 24.1. Maps are given at Annex-5-0. Members may discuss and agree.

6.0 Termination of Narendra-Madhugiri line under TBCB

6.1 As a part of Transmission system for evacuation of power from Kudgi generation(3x800 MW) project, Narendra-Madhugiri 765kV D/c line, charged at 400kV, has been proposed. The transmission line is being developed through Tariff based competitive Bidding route and has already been awarded to successful bidder, M/s L&T IDPL. Narendra-Madhugiri 765kV D/c is to be charged initially at 400kV and subsequently would be charged at 765kV.

6.2 Bay for the termination of lines are to be provided by POWERGRID. As the line is to be charged at 400kV, presently only 400kV bays are being provided at both ends of line. Later when line is to be charged at 765kV line shall be reoriented for termination at 765kV and bays shall be covered under ongoing or proposed scheme at that time.

6.3 PGCIL may present. Members may discuss.

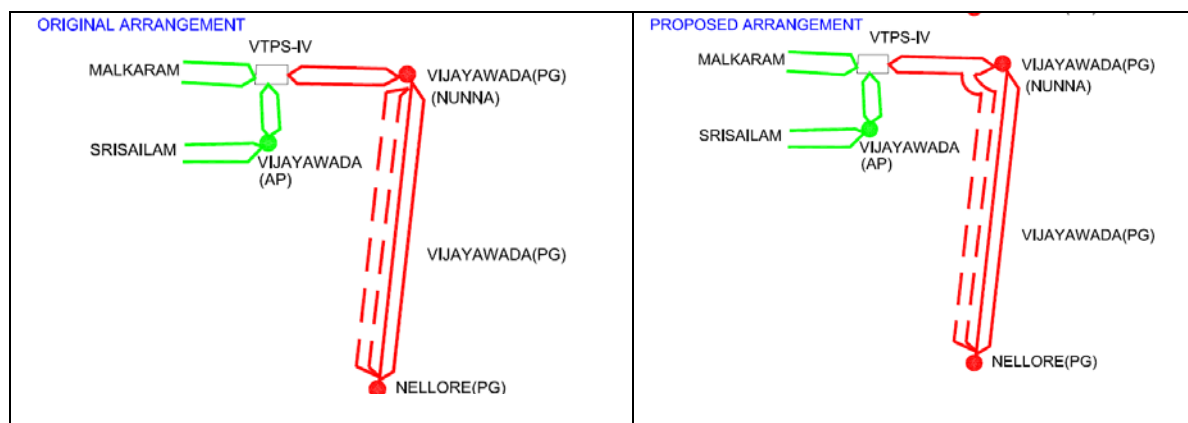
7.0 Charging for Kurnool - Thiruvalam 765kV D/c at 400kV

7.1 Kurnool-Thiruvalam 765 kV D/c line of POWERGRID shall facilitate in import of power through Raichur - Sholapur 765 kV D/c lines to the power deficit states of Southern Region. However due to certain unavoidable circumstances there is delay of about 4-5 months in supply of 765kV equipment's at Thiruvalam end.

- 7.2** As an interim measure, till 765kV equipment's are available, the line was proposed to be charged at 400kV level. CEA vide its letter dated 29/10/2014 has given in-principle clearance to charge Kurnool - Thiruvalam 765kV D/c at 400kV (**copy under Annex-7.0**). This line along with Thiruvalam-MTPS Stage-III 400 kV D/c line of TANTRANSCO would help in enhancement of TTC between NEW Grid-SR Grid which shall be instrumental in transferring the much required power to the Southern Region states.
- 7.3** PGCIL has informed that they have charged the line at 400kV on 27-11-2014 and that the line is expected to be charged at 765kV level by March 2015.
- 7.4** PGCIL may present. Members may note.

8.0 Re-orientation of Nellore –Vijayawada 400kV D/c line

- 8.1** The Vijaywada PG (Nunna)- Nellore- Thiruvalam- Sholinganallur 400kV D/c line, part of System Strengthening in Southern Region – XVIII, helps to enhance power transfer capacity from S1 to S2. The Nellore-Thiruvalam 400kV D/c and Thiruvalam-Sholinganallur 400kV D/c lines have been commissioned in April'14 and July'14 respectively.
- 8.2** Most of the works in VijayawadaPG (Nunna).-Nellore 400kV D/c has been completed. However, severe ROW problem is being encountered in termination of line at Vijayawada PG (Nunna). It is proposed to commission the line by reorientation of one circuit of Vijayawada TPS-IV –Vijayawada 400kV D/c.
- 8.3** PGCIL has proposed to terminate this line at Vijayawada end by LILO of one circuit of the VTPS-Nunna link of APTRANSCO. The proposed reorientation is as shown below.



- 8.4** APTRNSCO, vide their letter dated 16-Feb-2015 has conveyed their agreement for the proposed re-orientation. PGCIL's proposal, CEA's letter dated 27-01-2015 and APTRANSCO letters are given under Annex-8.0.
- 8.5** Study has been carried out with original arrangement and with proposed arrangement. Studies are also given under the Annex-8.0. It is seen that the power flow on Nellore - Vijayawada 400kV lines is identical in both the cases.
- 8.6** APTRANSCO while conveying its agreement has stated that PGCIL would need to do the following:
- Land to be acquired by PGCIL from APGENCO on payment for market value.
 - Any short falls such as PIR for breakers at Vijayawada TPS and, PLCC equipment and any other civil structure works/shortfalls if required, to be borne by PGCIL.
 - One 63 MVAR line reactor shifting to Vijaywada TPS (APGENCO switchyard) and of Vijaywada TPS - Nellore 400 kV line to be implemented by PGCIL
- 8.7** One of the line reactor proposed at Vijayawada PG (Nunna) end shall be re-located to VTPS. PGCIL may present. Members may discuss and agree.
- 9.0 Tapping of Uravakonda- Jammalamadagu D/c Quad line with Gooty – Madhugiri 400kV D/c line:**
- 9.1** PGCIL vide their letter no. C\CTU-Plg\tap-Gooty-Madh dated 29-12-2014 has informed that Transmission Corporation of Andhra Pradesh Ltd. has proposed to tap Uravakonda- Kondapur (Jammalamadugu) 400kv Quad moose line of APTRANSCO to Gooty - Madhugiri twin moose D/C line.
- 9.2** As a part of evacuation of around 3150MW wind generation in and around Anantapur, Cuddapah & Kurnool area, APTRANSCO is developing Uravakonda400kV S/s which is expected to be commissioned by March'15 for evacuation of about 300-400MW wind generation expected in the similar time frame. However 400kV lines, envisaged from Uravakonda to Jammalnadugu and Mahaboobnagar substations, may not be completed by this time frame. Accordingly, APTRANSCO vide its letter dated 14/11/2014 to PGCIL, has requested for connecting completed portion of Gooty-Madhugiri 400kV D/c line with Uravakonda - Jammalamadugu 400kV D/c Quad line near Pamidi village in Anantapur so as to form Uravakonda - Gooty 400kV D/c line up to one wind season i.e. from Apr 2015 to Oct 2015.

9.3 System studies carried out considering impact of on flows in the Southern region grid due to 400 MW injection from Urvakonda into Gooty bus, proposed tapping arrangement by APTRANSCO and reference letters are given under Annex-9.0.

9.4 APTRANSCO may present. Members may discuss.

10.0 YTPS- Providing start-up power for Boiler light up and commissioning activities of unit 1:

10.1 KPCL has informed that 100 MVA start up is required to start boiler light up and other commissioning activities of Yermarus TPS. KPTCL has informed PGCIL that EPC contract has been awarded for executing work of LILO'ing the existing SC line between RTPS and Davanagere to facilitate drawl of power at 400kV level. The said LILO line crosses RTPS-Gooty 400kV Quad D/c line at a distance of 4.5 km from YTPS. Therefore, KPCL has requested for permission for tapping/LILO'ing of RTPS-Gooty 400kV Quad D/c line, owned by PGCIL.

10.2 The evacuation system for Yermarus TPS was agreed in Joint Standing Committee Meeting on Power System planning of WR and SR held on 26th Dec, 2013. In the meeting, the said LILO of S/c line between RTPS and Davanagere was not agreed. Tapping/LILO'ing of RTPS-Gooty 400kV Quad D/c line for start up power may have adverse implication on TTC and ATC.

10.3 Also, SRLDC vide their email dated January 9, 2014, has informed that the issue of issue of T Connection from Raichur New-Gooty line for Yermaras startup was discussed in TCC and SRPC Meetings on 19-20 Dec 2014 at Vizag. The forum decided that such T Connection cannot be agreed to due to on 400 kV lines due to reliability risk and Protection issues.

10.4 Further to above a meeting and site visit of officials from CEA, SRPC, SRLDC, CTU, KPCL and KPTCL was held in Raichur on 3-2-2015, in which, following was concluded.

“After discussions, following was concluded:

- (i) *KPTCL will commission the entire transmission system, as was planned and approved in the Standing Committee, for enabling evacuation of power from YTPS as early as possible. In the absence of the planned ATS, it would be difficult to evacuate power from YTPS.*
- (ii) *KPCL will complete the pending works in YTPS Switchyard so as to make it ready to receive start-up power for YTPS Unit 1. From discussion with KPCL & BHEL, it was noted that they would be able to complete the pending works in 40-50 days.*
- (iii) *KPTCL would expedite the works on the entire line from YTPS to LILO point of Raichur TPS – Davangere 400 kV S/C (of KPTCL) for the purpose*

of start-up power to YTPS Unit 1. KPTCL informed that they would complete the entire section within 40-50 days.

- (iv) *KPCL was requested to furnish the status of BoP like Coal Handling, Ash Handling, DM Water & Cooling Water Arrangements etc. They would also furnish the commissioning schedule.”*

10.5 The MoM of the above meeting and studies carried out for this purpose are given under Annex-10.0. It may also be noted that the proposed LILO of the Raichur - Davangere line was not discussed / brought up for the deliberation in SCPSPSR. Also, it involves impact on TTC/ATC for import of power into SR, commercial issues, metering, reduction of dispatch at Raichur TPS etc, the same need to be studied / analysed and discussed in the meeting of the SCPSPSR.

10.6 Presently one of the main constraints in import of power is loading on Gooty-Neelmangla and Gooty- Somanlli lines. It is seen that with the addition of one unit with 720 MW generation and increase in Karnataka load Neelmangla line increase by about 120 MW with the addition of one unit. In case of Uravkondan 400 MW, the increase in line loading is of the order 70 MW. However under outage of Somanhalli line the increase in loading as against similar condition without any injection in case of Uravkonda is 30 MW (680-650 MW) as against 94 MW (748-654 MW).

10.7 KPTCL may present. Members may discuss.

11.0 Provision of space at various substations of POWERGRID

11.1 During the 37th Standing committee meeting of Southern Region held on 31/7/2014 following interconnection with ISTS was approved under system strengthening in Tamil Nadu (map depicting these systems is under Annex-11.0). TANTRANSCO has approached POWERGRID for execution of line bays at POWERGRID substations :

- Kayathar – Koilpatty(PG) (Tuticorin Pooling point) 400kV DC
- Kamuthi – Karaikudi(PG) 400kV D/c
- Ariyalur – Thiruvalem(PG) 765kV D/c

11.3 PGCIL has informed that at Koilpatty space is available only for one bay. It is therefore requested that the termination of the line from Kayathar may be considered at Tirunelveli(PG) in place of Koilpatty(PG). Further, after provision of above bays at Karaikudi, no further space would be available for any future line bays at Karaikudi 400kV. The bays for Thiruvalem(PG) 765kV line can be accommodated.

11.2 In addition, TANTRANSCO has requested following 230kV bays :

- Two no of 230kV Bays at Arasur
- Two no of 230kV Bays at Shoolagiri (Hosur)
- One no of 230kV Bays at Abhishekpatty

11.4 The bays for Abhishekpatty 230kV line can be accommodated. Further it may be mentioned after provision of above bays no further space would be available for future line bays at Arasur 230kV. At Shoolagiri (Hosur) 2nos of 230kV line bays are available which could be utilised for termination of the line by TANTRANSCO.

11.5 PGCIL may present. Members may discuss and agree.

12.0 TNEB issues:

TANTRANSCO vide their letter NoCE/Plg.&R.C/SE/SS/EE1/AEE1/ F.Stg. committee/ D.444 dated 23.12.2014 has submitted the following issues:

Evacuation of SEPC IPP:

12.1 TNEB informed that M/S SPIC Electric Power Corporation Private Ltd (SEPC) is proposed to establish 1X525 MW power plant in Tuticorin as an IPP. To evacuate power from this project, TNEB has proposed following transmission system:

“400kV D/C line to the proposed Ottapidaram 400/230-110kV substation”.

12.2 TNEB has also informed that the earlier envisaged Udangudi projects(2X660 MW+ X 800 MW) are being reviewed. TANTRANSCO has informed that the capacity of Udangudi Phase-II is being revised to 2x660 MW instead of 1x800 MW and a third phase of 2x660 MW is also under consideration.

12.3 Earlier, in the 37th SCPSPSR, following transmission system was agreed:

- a. 400kV D/C Quad line to the Kayathar 400kV S/S.
- b. 400kV D/C Quad line to the proposed Samugarengapuram 400/230-110 kV S/s
- c. 400kV D/C Quad line to the proposed Ottapidaram 400/230-110 kV S/s.

And:

“An **Udangudi Pooling Station** where both the Stage-I and Stage-II would be pooled with following connectivity lines:

Connectivity for Udangudi Power Project Stage-I (2x660MW):

- i) 400kV DC Quad line to the Udangudi Pooling station.

Connectivity for Udangudi Power Project Stage-II (1x800MW):

- i) 400kV DC Quad line to the Udangudi Pooling station.
- ii) 400kV DC Quad line to the Udangudi Power Project Stage -1 -2x660MW

These lines and the Udangudi Pooling Station would be in addition to the earlier planned system. **This system for Udangudi projects was agreed provided the Udangudi Pooling Station is commissioned along with the generation project commissioned first.”**

- 12.4** TNEB has proposed that since the evacuation scheme of Udangudi is approved for the entire capacity of 2X660 MW+1X800 MW, SEPC of 1X525 MW may be accommodated in Ottapidaram itself in place of Udangudi Phase-II, whose revised capacity is 1X800 MW.
- 12.4** Loadflow cases submitted by TNEB, their letters and earlier agreed system is given under Annex-12.0.
- 12.5** TANTRANSCO may present. Members may discuss.

Modifications for the Pulianthope 400/230kV S/s:

- 12.6** The following scheme has been approved for Pulianthope 400/230kV S/s:
“400kV D/C Quad line from the proposed North Chennai Pooling Station and 400kV D/C line from Manali 400/230-110kV S/s”
- 12.7** TANTRANSCO has stated that North Chennai Pooling Station takes some time to materialize, thus 400 kV SC line may be erected from North Chennai Stage II power plant to Pulianthope as a temporary measure.
- 12.8** TANTRANSCO may present. Members may discuss.

New 400kV Load Substation at Usilampatty

- 12.9** TANTRANSCO has proposed 400kV load substation at Usilampatty with the following connectivity:
 - a. 400kV D/C connectivity with Kamuthi 400 kV S/s.
 - b. 400kV D/C connectivity with Thappagundu 400 kV S/s.
- 12.10** TANTRANSCO may present. Members may discuss.

13.0 Edayarpalayam 400/230-110kV S/s under the scope of TANTRANSKO:

13.1 During the 37th SCPSR held on 31st July, 2014, the following scheme was agreed:

Scheme-II: HVDC Bipole link between Western region (Raigarh, Chhattisgarh) and Southern region (Pugalur, Tamil Nadu)

- (i) Raigarh(HVDC Stn) – Pugalur (HVDC Stn) 6000 MW HVDC bipole
- (ii) Establishment of Raigarh HVDC Stn with 6000 MW HVDC terminals
- (iii) Establishment of Pugalur HVDC Stn with 6000 MW HVDC terminals **(or Alternatively:** (i) with Pugalur HVDC Stn with 4000 MW terminal, and (ii) Madakkathara, in Kerala HVDC Stn with 2000 MW terminal and inter-connection with existing 400kV AC S/S at Madakkathara)
- (iv) Raigarh HVDC Station – Raigarh(Existing) 400kV (quad) 2xD/c lines (or with bay extension)
- (v) **Pugalur HVDC Station – Pugalur (Existing) 400kV (quad) D/c line.**
- (vi) **Pugalur HVDC Station – Arasur 400kV (quad) D/c line with 80 MVAR switchable line reactor at Arasur end.**
- (vii) **Pugalur HVDC Station – Thiruvalem 400kV (quad) D/c line with 80 MVAR switchable line reactor at both ends.**
- (viii) **Pugalur HVDC Station – Edayarpalayam 400 kV (quad) D/c line with 63 MVAR switchable line reactor at Edayarpalayam end.**
- (ix) **Edayarpalayam – Udumalpet 400 kV (quad) D/c line.**
- (x) **Establishment of 400/220kV substation with 2x500 MVA transformers at Edayarpalayam and 2x125 MVAR bus reactors.**

13.2 TANTRANSKO, vide their letter no CE/Plg.&R.C/SE/SS/EE1/AEE1/F.37th SCM/D.10/15 dated.13.01.2015, has stated that for the establishment of Edayarpalayam S/s, land has been purchased and the tendering work is under progress and the establishment of Edayarpalayam 400/230-110 kV substation will be under the scope of TANTRANSKO. Also, there is no scope for 400kV bay extension at Udumalpet S/s. Therefore TANTRANSKO has suggested that Udumalpet- Anikadavu 400kV S/c line may be LILOed at Edayarpalayam S/s.

Thus the following works are under the scope of TANTRANSCO:

- a. LILO of Udumalpet- Anikadavu 400kV S/c line at Edayarpalyam S/s.
- b. Establishment of 400/230-110 kV substation with 2x500MVA transformer at Edayarpalyam and 2x125 MVAR bus reactors.

13.3 The reference letter and the diagram of proposal are given under Annex-13.0. TANTRANSCO may present. Members may discuss.

14.0 Construction of 400kV Quad D/C line from UPCIL (Karnataka) to Kasargod(Kerala).

14.1 During the 35th meeting of Standing Committee on Power System Planning of Southern region the following scheme was discussed and agreed:

“8.5 Member(PS), CEA said that the proposed line from Udupi(UPCL) to Areacode is a good proposal to avoid S1-S2 congestion and the Udupi 400kV switchyard is an ISTS point. He further said that the Udupi(UPCL) to Areacode line could be built as an ISTS line.

8.6 Member(KSEB) also proposed to strengthen the existing Kadakola (Karnataka) –Kaniyampetta(Kerala) 220kV single circuit line into double circuit line. He said that at some locations on this line the sag has become more resulting in reducing the allowable ground clearance. MS(SRPC) said that there are 9 critical locations in Karnataka portion of this line which need to be strengthened by putting additional towers in between. This issue was also discussed in the SRPC meetings, and Karnataka had agreed to strengthen this line. Member(PS), CEA said that Karnataka may strengthen this line at their cost as these line locations are in their portion. The issue was discussed and Director(Transmission), KPTCL agreed for the same.

8.7 Regarding the UPCL – Kasargode - Kozhikode link, Member(KSEB) said that northern part of Kerala is facing lot of transmission congestion, as the planned lines i.e. the Mysore-Kozhikode and the Trissur-Kozhikode are getting delayed because of RoW problem.

8.8 The matter was deliberated and following scheme was agreed:

Mangalore(Udipi PCL) – Kasargode – Kozhikode 400kV Link

- (i) Mangalore(Udipi PCL) – Kasargode, 400kV quad D/c line*
- (ii) Kasargode – Kozhikode(Areacode), 400kV quad D/C line*
- (iii) Establishment of 2x500 MVA, 400/220kV GIS substation at Kasargode*

*(Load flow studies for the above system are given at **Annex-III.**)”*

- 14.2** The issue was further discussed by the Empowered Committee on transmission in its 31st meeting held on 18.02.2013 for recommending it to the government for implementation through TBCB. During the discussions, POWERGRID pointed out that there is sever RoW problem in the area and CEA may take up the matter with the Government of Kerala that they will cooperate in implementation of the scheme. He further said that in case compensation for construction of line is sought for the land covered by the shadow of the conductors, the schemes would become unviable. He said that compensation only for the tower footing should be paid as is practice in other parts of the country.
- 14.3** The Empowered Committee recommended the schemes for implementation through TBCB subject to the above commitment from the Kerala Government. EC also suggested that firm commitment from UPCL for providing 400 kV bays at Mangalore (UPCL) switchyard may be obtained; otherwise the bays may be included in the scope of the bidder.
- 14.4** Accordingly, Government of Kerala vide their letter 2625/CT/2013/PD dated 22.6.2013 has stated that - "Having examined the matter, in consultation with PGCIL, the Government hereby commit that the land compensation only for Right of Way (RoW) for the tower footing area will be paid, instead the entire corridor, as proposed by KSEB."
- 14.5** Further M/s UPCL vide their letter no. UPCL/B23/2013/732 dated 26.07.2013 has communicated the following:
- "a) UPCL facility do not have any surplus land where 2 nos. of 400 kV bays can be erected as desired by you.
 - b) Under the provision of Power Purchase Agreement entered into between UPCL and ESCOM's of Karnataka, UPCL and Punjab State Power Corporation Limited, Punjab, power is sold to the Buyers ex our switchyard and transmission facility is the responsibility of the Buyers.
 - c) Any additional Capital expenditure required o be incurred by UPCL needs to be approved by the Buyers as per the provisions of Power Purchase Agreement referred to above.

Under these circumstances, we are unable to convey our acceptance for maintenance of 2 nos. of 400 kV bays in our generation switchyard and we request you to take up this with Karnataka Power Transmission Corporation Limited who is the Nodal Agency for power transmission."

- 14.6** Further a team of officers from CEA, PGCIL, KSEB and KPTCL visited Kozikode, Kasargod and Udupi PCL during 4-7 October, 2014 to examine

space availability for accommodating 400 kV D/c line at UPCL switchyard and also broadly inspecting possible route of the proposed UPCL-Kasargod-Kozikode transmission line. During site visit to UPCL generation switchyard, it was observed that there is space for additional two nos. of 400 kV line bays. These line bays can be construed by extending the existing generation switchyard and dismantling some of the civil structures for creating gantry for the proposed 400 kV DC transmission line. The route from Kozikode to Kasargod has a thick plantation of coconut, rubber and beetle nut trees. Building transmission lines having sufficient clearance over and above these tall trees would require high rise transmission towers or cutting of these trees under the shadow of transmission lines. The route between UPCL to Kasargode is comparatively better for laying transmission line and the space is also available at existing 220 kV Kasargode station to upgrade it to 400 kV voltage level.

- 14.7** KPTCL vide their letter No CEE(P&C)/SEE(PIg)/KCO-97/55319/2013-14/8985-8990 dated 6th Nov, 2014 has opined (with reference to the load flow studies carried out earlier) that with UPCL – Kasargod -Kozikode link, the power flow from UPCL to Kasargod is to extent of 439 MW but the flows on Mysore – Kozikode line reduces from 480 MW to 254 MW. In this scenario, the flow from UPCL to Hasan also gets reduced to an extent of 226 MW from 572 MW. Hence the proposed 400 kV DC line to link UPCL to Kasargod may not serve the purpose. The investment will not justify benefits derived from other constituents to share the cost. And therefore, KPTCL requested that this aspect may be revisited.
- 14.8** KPTCL further observed that since UPCL is an ISGS with 90% share of Karnataka, with the construction of 400kV line from UPCL to Kasargode, the 400kV D/C line from UPCL to Hasan will be under utilized. Also, Manglore(Udupi PCL)- Kasargod, 400kV D/C Quad line would not relieve S1-S2 congestion since the upstream 400kV lines beyond Hassan are not having capacity.
- 14.9** In this regard it may be mentioned that the proposed Udupi-Kasargode-Kozhikode line shall improve the reliability of power evacuation from Udupi generation. The line shall help in meeting the present reliability Criteria of (n-1-1) contingency. The line would also act as a parallel path to the Hasan-Mysore corridors and thereby improve the reliability of power supply in the Mysore and Kozhikode area. The revised Loadflow studies and reference documents are given under Annex-14.0.
- 14.9** Members may discuss.

15.0 Start up power requirement of under construction NCC PPL Power Plant.

15.1 NCC Power Projects Limited(NCCPPL) vide their letter no. NCCPPL/COM-PGCIL/14-15/49 dated 17.11.2014 has informed that NCCPPL (2X660MW) and Thermal Powertech Corporation India Ltd(2X660MW) (TPCIL) are geographically located adjacent to each other. The evacuation system for TPCIL (TPCIL- Nellore 400kV (QUAD)D/C) is already commissioned in Aug,2013.. They have informed that TPCIL is expected to commission in December, 2014 and NCCPPL by the end of 2015. NCCPPL- Nellore 400kV D/C (Quad) line, to be built by PGCIL, is expected to commission in Dec, 2015. However, back charging of 400kV switchyard of NCCPPL is expected in May, 2015.

15.2 As a solution, NCCPPL have proposed LILO of one of the existing TPCIL- Nellore 400kV D/C line at NCCPPL bus bar to meet the start up power requirement.

15.3 In this regard, NCC has submitted that-

1. NCC PPL to construct at its own expense the proposed temporary Loop in Loop out (LILO) portion of the transmission system (in compliance with CEA technical standards and IEGC for constructing & maintaining the lines) and will NOT request for any tariffs from CERC.
2. NCC PPL to bear the resultant transmission losses due to construction of LILO portion and will adhere to instructions of SRLDC/SRPC for all day to day activities.
3. NCC PPL to utilize the LILO arrangement for its start-up power requirements (from May'2015 onwards) and post commissioning of PGCIL dedicated line of NCC PPL to Nellore PS 400 kV D/C, the LILO will be disconnected.
4. NCC PPL agrees to transfer the ownership of the LILO to M/s PGCIL, if required (under regulations/ as advised by Standing Committee).

15.4 The maps of the proposal and reference letter is given in Annex-15.0. Members may discuss.

16.0 Tentative cost of new schemes:

16.1 During the 37th Meeting of the Standing Committee on Power System Planning in Western Region held on 5.9.2014, it was decided that the tentative cost of new schemes would be included in the agenda/ minutes. In this meeting, the

WR constituents have also expressed that it would be prudent if impact of new schemes on the transmission tariff is indicated in the agenda/minutes of the meeting.

- 16.2** Accordingly, the estimated costs, as given for discussion in the Empowered Committee, for the schemes concerning Southern Region are summarized below. Detail break-up of the cost estimates are given in subsequent para.

Table - A : List of New Schemes

Sl. No.	Name of Transmission Scheme	Est. Cost (Rs Crore)	Yearly Trans. Charges(YTC) (Levelized) Rs Crore (@17% of cost)
1	Constraints in 400kV bays extensions at 400 kV Vemagiri S/S	1526	259
2	Additional inter-Regional AC link for import into Southern Region i.e. Warora – Warangal and Chilakaluripeta - Hyderabad - Kurnool 765kV link	8570	1457
3	HVDC Bipole link between Western region (Raigarh, Chhattisgarh) and Southern region (Pugalur, Tamil Nadu) HVDC part (as agreed earlier upto TN and Ker) – Rs. 23359 Crore AC Part (in TN only, as agreed earlier) – Rs. 3461 Crore	26820	4559
4	Strengthening of transmission system beyond Vemagiri	7032	1195
5	System Strengthening-XXIV in Southern Region	1010	172
6	Connectivity for Kudankulam 3&4 (2x1000MW) with interstate transmission system.	45	8
7	Erection of 220 kV line to Karaikal	50	9
8	Transmission System for evacuation of power from 2x500 MW Neyveli Lignite Corp. Ltd. TS-I (Replacement) (NNTPS) in Neyveli, Tamil Nadu	15	3
9	Connectivity lines for Maheshwaram (Hyderabad) 765 / 400kV Pooling S/S	396	67

	Total (A)	45464	7729
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16.3 Detail break-up of the cost estimates of above schemes are given below:

1. Constraints in 400kV bays extensions at 400 kV Vemagiri S/S.

Sl. No.	Transmission Scheme	Estd. Line Length (km)	Estd. Cost in Rs(Crs.)
1.	LILO of both circuits of Gazuwaka/Simhadri-II – Vemagiri(AP) 400kV D/C line at Vemagiri-II.	48	194
2.	Straighten Nunna- Gazuwaka 400kV D/C line (by disconnecting the LILO at Vemagiri-I) so as to make Nunna – Vemagiri-II 400 D/C link	300	1207
3.	Use one LILO D/C portion (of Gazuwaka-Nunna at Vemagiri-I) to connect with K.V. Kota. APTARNSCO is implementing kV Kota-Vemagiri 400 kV DC line agreed 36th meeting.	10	25
4.	Second LILO D/C portion to be extended to Vemagiri-II (by PGCIL	10	25
5.	400 kV Bay Provisions: <ul style="list-style-type: none"> • 2 bays at Vemagiri-I • 6 bays at Vemagiri-II 		75
	Total (Rs. Crore)		1526

2. Additional inter-Regional AC link for import into Southern Region i.e. Warora – Warangal and Chilakaluripeta - Hyderabad - Kurnool 765kV link

Sl. No.	Transmission Scheme	Estd. Line Length (km)	Estd. Cost in Rs(Crs.)
1.	i) Establishment of 765/400kV substations at Warangal (New) with 2x1500 MVA transformers and 2x240 MVAR bus reactors.	350	640
2.	ii) Warora Pool – Warangal (New) 765kV D/c line with 240 MVAR switchable line reactor at both ends.	160	2618
3.	iii) Warangal (New) –Hyderabad 765 kV D/c line with 330 MVAR switchable line reactor at Warangal end.	10	1310
4.	iv) Warangal (New) – Warangal (existing) 400 kV (quad) D/c line.	170	40
5.	v) Hyderabad – Kurnool 765 kV D/c line with 240 MVAR switchable line reactor at Kurnool end.	250	1279
6.	vi) Warangal (New) – Chilakaluripeta 765kV D/c line with 240 MVAR switchable line reactor at both	200	1873

7.	ends. vii) Cuddapah – Hoodi 400kV (quad) D/c line with 63 MVAR switchable line reactor at both ends.	8	810
8.	<u>765 & 400 kV Bay Requirements</u> i) 765 kV line bays at Warangal (New) ii) 765/400 kV Transformer bays at Warangal (New) iii) 400 kV line bays Warangal (New) iv) Space for future 765 kV line bays at Warangal (New) v) Space for future 400 kV line bays at Warangal (New)	2 2 6 8	
	Total (Rs. Crore)		8570

3. HVDC Bipole link between Western region (Raigarh, Chhattisgarh) and Southern region (Pugalur, Tamil Nadu)

Sl. No.	Transmission Scheme	Est. Line Length (km)	Estd. Cost in Rs(Crs.)
1.	Raigarh(HVDC Stn) – Pugalur (HVDC Stn) 6000 MW HVDC bipole	1750	9443
2.	Establishment of Raigarh HVDC Stn with 6000 MW HVDC terminals		6958
3.	Establishment of Pugalur HVDC Stn with 6000 MW HVDC terminals (or Alternatively: (i) with Pugalur HVDC Stn with 4000 MW terminal, <u>and</u> (ii) Madakkathara, in Kerala HVDC Stn with 2000 MW terminal and inter-connection with existing 400kV AC S/S at Madakkathara)		6958
4.	Raigarh HVDC Station – Raigarh(Existing) 400kV (quad) 2xD/c lines (or with bay extension)	20	80
5.	Pugalur HVDC Station – Pugalur (Existing) 400kV (quad) D/c line.	10	41
6.	Pugalur HVDC Station – Arasur 400kV (quad) D/c line with 80 MVAR switchable line reactor at Arasur end.	150	634
7.	Pugalur HVDC Station – Thiruvalam 400kV (quad) D/c line with 80 MVAR switchable line reactor at both ends.	330	1358
8.	Pugalur HVDC Station – Edayarpalayam 400 kV (quad) D/c line with 63 MVAR switchable line reactor at Edayarpalayam end.	160	666
9.	Edayarpalayam – Udumulpeta 400 kV (quad) D/c line.	85	342
10.	Establishment of 400/220kV substation with 2x500 MVA transformers at Edayarpalayam and 2x125 MVAR bus reactors.		340
11.	<u>400 kV line Bay Provisions</u>		Cost

	<ul style="list-style-type: none"> • Raigarh(Existing) – 2 • Pugalur (Existing) – 2 • Arasur - 2 • Thiruvalam -2 • Edayarpalayam -2 • Udumulpeta -2 		Included
	Total (Rs. Crore)		26820

4. Strengthening of transmission system beyond Vemagiri

Sl. No.	Transmission Scheme	Est. Line Length (km)	Estd. Cost in Rs(Crs.)
1.	i) Vemagiri-II – Chilakaluripeta 765kV D/c line with 240 MVAR switchable line reactor at both ends.	270	2038
2.	ii) Chilakaluripeta – Cuddapah 765kV D/c line with 240 MVAR switchable line reactor at both ends.	270	2038
3.	iii) Chilakaluripeta – Narsaraopeta 400kV (quad) D/c line	21	84
4.	iv) Cuddapah – Madhugiri 400kV (quad) D/c line with 80 MVAR switchable line reactor at both ends.	240	973
5.	v) Cuddapah – Hindupur 400kV (quad) D/c line with 80 MVAR switchable line reactor at Hindupur end.	180	732
6.	vi) Srikaukulam Pooling Station – Garividi 400 kV (Quad) D/c line with 80 MVAR switchable line reactor at Garividi end.	130	527
7.	vii) Establishment of 765/400kV substation at Chilakaluripeta with 2x1500 MVA transformers and 2x240 MVAR bus reactors each.		640
8.	<u>765 & 400 kV Bay Requirements</u>		
	i) 765 kV line bays at Chilakaluripeta	4	
	ii) 765/400 kV Transformer bays at Chilakaluripeta	2	
	iii) 400 kV line bays Chilakaluripeta	2	
	iv) Space for future 765 kV line bays at Chilakaluripeta	6	
	v) Space for future 400 kV line bays at Chilakaluripeta	8	
	Total (Rs. Crore)		7032

5. System Strengthening-XXIV in Southern Region

Sl. No.	Transmission Scheme	Est. Line Length (km)	Estd. Cost in Rs(Crs.)
1.	i) LILO of Kurnool-Thiruvalam 765 kV D/c at Cuddapah	50	370

2.	ii) Establishment of 765/400kV substation at Cuddapah with 2x1500 MVA transformers and 2x240 MVAR bus reactors each and requisite line bays & line reactors for transmission schemes-I & III	--	640
Total (Rs. Crore)			1010

6. Connectivity for Kudankulam 3&4 (2x1000MW) with interstate transmission system.

Sl. No.	Transmission Scheme	Est. Line Length (km)	Estd. Cost in Rs(Crs.)
1.	i) Extension of Kudankulam APP – Tirunelveli 400kV Quad D/c line to Tuticorin Pooling Station along with necessary bay modification works at Tuticorin Pooling station	10	40
2.	ii) bay modification works at Tuticorin Pooling station and Tirunelveli		5
Total (Rs. Crore)			45

7. Erection of 220 kV line to Karaikal

Sl. No.	Transmission Scheme	Est. Line Length (km)	Estd. Cost in Rs(Crs.)
1.	i) NLC – Karaikal 220 kV D/C line	56	45
2.	ii) bay modification works at Tuticorin Pooling station and Tirunelveli		5
Total (Rs. Crore)			50

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

Sl. No.	Transmission Scheme	Est. Line Length (km)	Estd. Cost in Rs(Crs.)
1.	NNTPS switchyard – Ariyalur (Villupuram) 400kV D/c line with	80	15
2.	<u>400 kV line Bay Provisions</u> • Ariyalur – 2		
Total (Rs. Crore)			15

9. Name of the Scheme: Connectivity lines for Maheshwaram (Hyderabad) 765/400kV Pooling S/s.

Sl. No.	Transmission Scheme	Est. Line Length (km)	Estd. Cost in Rs(Crs.)
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1	Maheshwaram (PG) – Mahboob Nagar 400 kV D/C line	100	132
2	Nizamabad – Yeddumailaram (Shankarapalli) 400 kV D/C line	200	264
Total (Rs. Crore)			396

16.4 The cost estimates of some of the ongoing schemes of PGCIL, other than those listed above, are given below. These may be updated/verified by PGCIL.

Table - B : List of Ongoing Schemes by PGCIL

Sl. No.	Name of Project	Cost, in Rs Crore	Yearly Trans. Charges(YTC) (Levelized) Rs Crore (@17% of cost)
1	Transmission System associated with KRAISHNAPATNAM UMPP-Part-B.	1927.16	
2	Common System associated with East Coast Energy Pvt. Ltd. and NCC Power Proj. Ltd. LTOA Gen. Proj. in Srikakulam – Part-A.	1909.24	
3	System Strengthening – XVII in Southern Regional Grid	1508.74	
4	Common System associated with East Coast Energy Pvt. Ltd. and NCC Power Proj. Ltd. LTOA Gen. Proj. in Srikakulam – Part-C.	514	
5	Common System Associated with ISGS Projects in Krishnapatnam area of Andhra Pradesh	1637.34	
6	Common System Associated with Costal Energen Pvt. Ltd and Ind-Barath Power Ltd. (LTOA) Gen. Proj. in Tuticorin area Part-B.	1940.13	
7	System Strengthening – XIII SR Grid	487.49	
8	System Strengthening in SR – XIV	297.33	
9	Common System associated with East coast energy and Private Ltd. and Ind-Barath Powe (Madras) Ltd. (LTOA) Gen. Poj. in Tuticorin area Part-A.	90.44	
10	Transmission System Associated with Krishnapatnam UMPP – Par – C1	324.33	

11	Common transmission Scheme associated with ISGS Project in Vemagiri Area of Andhra Pradesh – Part – A1	206.44	
12	System Strengthening in SR – XVIII	1263.26	
13	System Strengthening in SR – XIX	1935.35	
14	common transmission scheme associated with ISGS Projects in Nagapattinum/Cuddalore area of Tamil Nadu	182.8	
15	Transmission System Associated with Contingency plan for Evacuation of Power from II&FS (2x600MW)	97.95	
16	System Strengthening in SR – XXII	243.53	
17	Sub station Extn. Works associated with Trans. System Required for evacuation of Power from Kudgi TPS (3x800 MW-Phi) of NTPC	167.4	
18	Trans. System for connectivity for NCC Power Project Ltd.	188.75	
19	System Strengthening in SR – XX	288.49	
20	Common Transmission Scheme Associated with ISGS Projects in Nagapattinum/Cuddalore area of Tamil Nadu – Part – A(b)	74.29	
21	Sub station works associated with System Strengthening in SR for Import of Power from ER	972.42	
	Total (B)	16257	2763

16.4 The cost estimates and discovered Tariff of the shemes being implemented through the ‘tariff based Competitive Bidding’ process are given below;

Table - C : List of TBCB Schemes in/for SR

Sl. No.	Name of Transmission Scheme	Est. Cost (Rs Crore)	Discovered Levelized YTC Rs Crore
1	Transmission system associated with IPP’s of Nagapattinam/Cuddalore area – Package ‘A’ (PGCIL)	1025	98.7
2	Raichur – Sholapur line	440	29.4

	(Patel Consortium)		
3	Vemagiri Package – ‘A’ (PGCIL)	1300	119.7
4	System Strengthening in Southern Region (PGCIL)	1180	231.1
5	Transmission system for evacuation of power from Kudgi TPS (L&T)	1240	179.6
6	Connectivity lines from Maheshwaram (Bidding is in cess)	396	65 (Indicative only @ 17%)
	Total (A)	5581	723*

* Through TBCB, the average discovered Tariff is about 13% of the estimated cost, as compared to the Tariff of about 17% of the estimated cost under Regulated Tariff Mechanism.

16.5 To have a broad idea of cost impact, following table gives monthly transmission charges(MTC) of Southern Region for the months of March 2014 and January 2015:

(all figures are in Rs. Crore)

Sl. No.	MTC / YTC	Southern Region	All-India
1	Monthly charges for the month of March 2014	142	
2	Monthly charges for the month of January 2015	172	
3	Approximate YTC for 2013-14 (12x Monthly charges of March 2014)	1708	
4	Approximate YTC for 2014-15 (12x Monthly charges of January 2015)	2059	

16.5 The additional YTC on account of ONGOING, TBCB and NEW schemes might be of the order of Rs 11215 Crore / Annum. Please refer to List-A(7729 Crore), List-B(2763 Crore) and List-C(723 crore), above. Members may like to discuss.

17.0 **Transmission system for evacuation of power from 6650 MW of Wind and Solar projects in Andhra Pradesh**

17.1 The following transmission system for evacuation of power from about 3150

MW of wind generation projects in Uravakonda(1361 MW), Kondapuram(1109 MW) and Hindupur(680MW) was firmed up in the 35th meeting of the SCPSPSR held on 04-Jan-2013.

- a. 400kV Uravakonda- Kondapuram quad DC line.
- b. 400kV Kondapuram –Kurnool (AP) DC line (QM).
- c. 400kV Uravakonda- Hindupur quad DC line.
- d. 400kV Uravakonda- Mehboobnagar quad DC line.

17.2 APTRANSCO has informed following new wind (Aspiri-1000 MW) and solar projects (N P Kunta-1000MW, Galiveedu- 600 MW and Panayam- 1000 MW) coming in the State of Andhra Pradesh by 2017. Broad transmission system and the studies carried out by them are given under Annex-17.0.

17.2.1 Transmission Evacuation Scheme for Solar Power Park at Ghani/Panyam (1000 MW)

Phase-I Works:

- 1) 400/220kV Substation at Gani/Panyam – 3x500 MVA.
- 2) 400kV QMDC Line from Kurnool to proposed 400kV Gani/Panyam SS–35 km.
- 3) 400kV Bay Extensions at Kurnool SS – 2 Nos.

Phase-II works

- 4) 400kV QMDC Line from Jammalamadugu/ Kondapuram to the proposed 400kV Gani/Panyam SS – 90 kM.

17.2.2 Transmission Evacuation Scheme for 1000MW Wind Power at Aspiri

- 1) 400/220kV Substation with 3x315 MVA
- 2) 400kV QMDC line from Aspiri to 400kV Uravakonda SS.

17.3 Ministry of Power vide their letter dated 22-Jan-2015 has asked CEA to firm up transmission plan for 1500 MW Solar Park at NP.Kunta/Galiveedu in Andhra Pradesh(copy of Mop letter under Annex-17.0)

17.4 Considering above projects, a total of about 6650 MW of Wind and solar is expected in Andhra Pradesh by 2017, as summarized below:

SI	Name	Location	Type	Capacity (MW)	Developer	Time Frame
1	NP. Kunta	Anantapur	Solar	1000	APSCPL	Dec'15/Sep'16
2.	Galiveedu	Cuddapah	Solar	500 (+100)	APSCPL	Dec'16

Sl	Name	Location	Type	Capacity (MW)	Developer	Time Frame
3.	Panayam	Kurnool	Solar	1000	NVVNL	March,17
	Sub-total		Solar	2500 (+100)		
4	Aspiri	Kurnool	Wind	1000	Pvt developers	March,17
5	Uravakonda	Anantapur	Wind	1361	Pvt developers	March,17
6.	Kondapur	Cuddapah	Wind	1106	Pvt developers	March,17
7	Hindupur	Anantapur	Wind	683	Pvt developers	March, 17
	Sub-total		Wind	4150		
	Total			6650 (+100)		

* APSCPL is An Andhra Pradesh Solar Corporation Private Limited (a JV of SECI, APGENCO and NREDCAP)

17.5 M/s APSCPL has applied for Connectivity and LTA under the CERC regulation for the 1500 MW N.P.Kunta Solar park. Out of this, 90% is for transmitting to AP DISCOMS and rest 10% to Southern Region as target region. This solar park is to be developed in three phases. The first phase (250 MW) of NP Kunta is scheduled for commissioning in one (1) year [Dec'15] for which tenders have been issued by NTPC. In Phase-II and Phase-III (Galiveedu), additional 750 MW & 500 MW capacity is proposed to be commissioned in by Sep'16 and Dec'16 respectively.

17.6 PGCIL, as CTU, has proposed following transmission system for giving connectivity and LTA to this project:

17.6.1 Considering the time line for implementation of N.P.Kunta solar Park as well as requirement for development of matching transmission system for its integration, transmission scheme is also proposed to be developed in three phases as under. In the studies for evacuation of power from Panyam and Aspiri system as proposed by APTRANSCO has been considered.

17.6.1 Phase-I : Transmission system for NP Kunta Ultra Mega Solar Park (250 MW)

As part of NP Kunta Phase-I (250 MW) generation, which is scheduled to be commissioned in one (1) year, considering NP Kunta site being en route to 400kV Cuddapah(Kadapa)-Kolar line, it is proposed to establish a Pooling station at NP Kunta 400/220kV, with 3x500 MVA transformation capacity and LILO at existing 400kV Cuddapah(Kadapa)-Kolar S/c line at proposed 400kV NP Kunta S/s. There would be one 220kV pooling point for every 250MW block

and from the 220kV Pooling point a 220kV D/c would be constructed to NP Kunta 400/220kV substation by the STU.

Results of base case with above transmission system is enclosed at **Exhibit-III-01 to 04**. From the studies, it is seen that all line loadings are within limits and no constraint is envisaged

Further regarding requirement of STATCOM it may be mentioned that RE generation including Solar is characterized by intermittency and variability as well as having low/high voltage ride through issues. To analyse impact of this phenomenon on system, voltage profile of 400kV buses near NP Kunta i.e. Cuddapah, Kolar, Somanahally was analysed. Voltage profile for the period of Dec'13 to Nov'14 in this regard is tabulated as under:

Monthly Maximum	Dec'13	Jan'14	Feb'14	Mar'14	Apr'14	May'14	Jun'14	Jul'14	Aug'14	Sep'14	Oct'14	Nov'14	Yearly Max.
Cuddapah	428	428	421	421	419	425	428	423	429	428	429	431	431
Somanhalli	418	417	407	413	410	419	421	419	419	420	421	421	421
Kolar	426	424	416	416	416	427	428	426	425	427	432	431	432

Monthly Minimum	Dec'13	Jan'14	Feb'14	Mar'14	Apr'14	May'14	Jun'14	Jul'14	Aug'14	Sep'14	Oct'14	Nov'14	Yearly Min.
Cuddapah	394	393	392	389	391	395	400	399	400	396	402	405	389
Somanhalli	376	376	366	371	367	369	377	372	376	377	382	380	366
Kolar	393	395	385	389	387	385	395	388	395	395	395	377	377

From above, it may be observed that there is wide variation in voltages at 400kV Cuddapah/Kolar/Somanhally substations. In order to address reactive power management aspect during low/no solar generation condition, 1x125 MVAR bus reactor at NP Kunta is proposed. In addition, to address low/high voltage ride through, dynamic compensation in the form of ± 100 MVAR STATCOM at 400kV NP Kunta is proposed. This STATCOM shall help in Voltage ride though as well as support the grid during various operational conditions. Further, as NP Kunta is proposed to be connected to Hindupur as part of Phase-II scheme, above STATCOM would also provide support to the Wind Generation complex (3000 MW) of Hindupur, Urvakonda and Kondapuram to a certain extent in the event of fault ride through requirement etc.

Results of dynamic studies in this regard for various contingency conditions and impact of STATCOM in such events is enclosed at **Exhibit-III-05 to 07**. From the results, it is observed that STATCOM helps in providing support during contingency conditions well as Fault Ride through.

17.6.2 Phase-II: Transmission system for NP Kunta Ultra Mega Solar Park (750 MW)

For phase –II solar generation (additional 750 MW), LILO of Hindupur- Kadapa (Cuddapah) 400kV D/c line at NP Kunta, is considered. Cuddapah (Kadapa) – Hindupur 400kV D/c line (quad) is to be implemented under compressed time schedule as part of System Strengthening-XXIV in SR. The system study with this transmission system is enclosed at **Exhibit-III-08 to 10**

17.6.3 Phase-III : Transmission system for NP Kunta Ultra Mega Solar Park (Galiveedu Site - 500 MW)

Power from Galiveedu site (which is adjacent to NP kunta mandalam) is also to be pooled at NP.Kunta POWERGRID station at 220kV level. As in the case of NP Kunta there would be one 220kV pooling point for every 250MW and from the 220kV Pooling point a 220kV D/c would be constructed to NP Kunta 400/220kV substation. Hence there would be two nos of 220kV D/c to NP Kunta 400/220kV substation from Galiveedu. As informed by AP solar power corporation, 220kV Pooling station and 220kV inter connecting lines for Galiveedu project will be taken up by APTRANSCO. To facilitate transfer of power from above 500 MW generation, 1x500 MVA, 400/220kV (4th) transformer is required at N. P. Kunta. Study results with Galiveedu are enclosed at **Exhibit-III-11 to 13**. No Constraint is envisaged in evacuation of power under (n-1).

17.7 Studies indicate that all lines are within limits and system proposed is able to cater to power transfer requirement of the proposed generations.

Accordingly, following transmission system is proposed for NP.Kunta Ultra Mega Solar park (1500MW) . PGCIL studies are given under Annex-17.0.

Transmission system for NP Kunta Ultra Mega Solar Park (1500 MW)

Phase-I (250 MW)

- Establishment of 3x500 MVA, 400/220KV Substation at NP Kunta Pooling station
- LILO of 400KV Kadapa(Cuddapah) - Kolar S/c line at NP Kunta Pooling station
- 1x125 MVAR Bus Reactor at NP Kunta Pooling station
- ±100 MVAR STATCOM at 400kV NP Kunta Pooling station

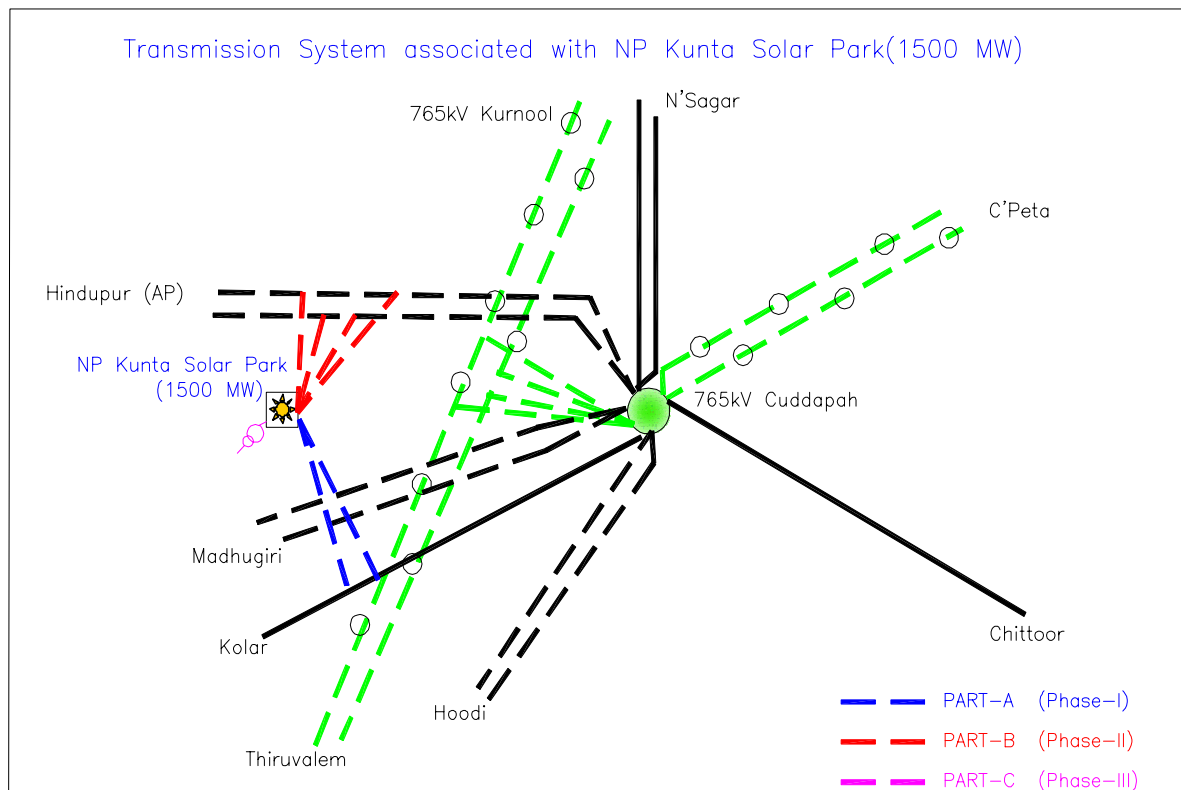
Phase-II (750 MW)

- LILO of Hindupur- Kadapa(Cuddapah) 400kV D/c (quad) line at NP Kunta Pooling station

Phase-III (500 MW)

- 1x500 MVA, 400/220kV transformer (4th) at N. P. Kunta Pooling station

Schematic for the above proposed transmission scheme is as below



17.8 PGCIL has further informed that M/s /s APSPCL has requested for 4 nos. 220kV line bays in each of above phase, for interconnection of their 220kV D/c dedicated line(s), in the scope of ISTS.

17.9 PGCIL and APTRANSCO may also give estimated cost of the State and ISTS parts of the above transmission systems.

17.10 Members may discuss.

18.0 Modification for the System Strengthening-XXIV in Southern Region – GIS for Cuddapah 765kV S/s:

18.1 During 37th Standing Committee Meeting in SR held on 31/07/2014 under System Strengthening-XXIV in Southern Region, following elements have been approved at Cuddapah:

- (i) Establishment of 765/400kV substation at Cuddapah with 2x1500 MVA transformers and 2x240 MVAR bus reactors.
- (ii) LILO of Kurnool-Thiruvalam 765 kV D/c at Cuddapah along with associated bays
- (iii) Cuddapah-Hindupur 400 kV (Quad) D/C line along with associated bays and 80 MVAR switchable line reactor at Hindupur end (Hindupur S/s to be implemented by APTRANSCO)

18.2 In addition to above, following lines have been planned at Cuddapah for import of power to SR (under TBCB) as discussed and agreed in 33rd Empowered Committee on Transmission

- (i) Chilakaluripeta – Cuddapah 765kV D/c line
- (ii) Cuddapah – Madhugiri 400kV (quad) D/C.
- (iii) Cuddapah – Hoodi 400kV (quad) D/c line.

18.3 The new 765/400KV substation at Cuddapah is proposed to be established in the land available adjacent to the existing substation. Keeping in view the requirement of 765kV and 400kV under present scope of work, it is not possible to accommodate these works as AIS in the available land. Acquisition of new land for Cuddapah Substation with the above scope of work would take considerable time. Keeping in view the system requirement above works are to be implemented under compressed time schedule, it is therefore proposed that the new Cuddapah 765/400kV S/s may be taken up as GIS in the land available adjacent to the existing 400/220kV Cuddapah substation.

18.4 PGCIL may present by giving following information (layout of the S/s furnished by PGCIL is given under Annex-18.0):

- Total land area in the Cuddapah S/s (covered in existing switchyard and vacant)
- Additional land needed for 765kV/400kV part if built as AIS and if built as GIS.
- Difference in cost of establishing GIS and AIS for the proposed configuration in Cuddapah S/s

18.5 Members may discuss.

19.0 Additional Agenda from PGCIL

19.1 PGCIL vide their letter dated 19-Feb-2015 has proposed following for discussion in the SCPSP. Details, as given in PGCIL letter, are given in the Annex-19.0.

1. Procurement of ERS substation
2. Procurement of 500MVA ICT as spare instead of 315 MVA ICT approved under Ramagundum Transmission System
3. Procurement of 3 NOS. 125 MVAr reactors instead of 3 NOS. 50 MVAR Reactors approved under Ramagundum Transmission System
4. Converting Fixed Line Reactors into Switchable Line Reactors in Over Compensated lines
5. Replacement of 50MVAR bus reactor with 125MVAR at Mysore

19.2 PGCIL may present. Members may discuss.