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

No. 51/4/SP&PA-2009/ 186-195 **Date: February 24, 2009**

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), 6th 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, 12th Floor,Vikram Sarabhai Bhawan, Anushakti Nagar, **Mumbai – 400 094.** **FAX : 022- 25991258**

Sub: **27th meeting** of the Standing Committee on Power System Planning of Southern Region - Agenda Note and notice for the meeting.

Sir,

Please find enclosed the agenda for the **27th meeting** of the Standing Committee on Power System Planning of Southern Region.

The meeting would be held at SRPC office, Bangalore on 03rd March 2009 (Tuesday) at 10:00 AM.

Yours faithfully,

(Ravinder)
Chief Engineer (SP&PA)
(Telephone/FAX No. 011 26102045)

AGENDA NOTE

Agenda Note for 27th Meeting of Standing Committee on Power System Planning in Southern Region (SCPSPSR)

Time: To be announced later, Venue: To be announced later

1.0 Confirmation of the minutes of 26th meeting of the Standing Committee

1.1 The minutes of the 26th meeting held on June 13, 2008 at Hyderabad, was circulated vide our letter No.51/4/SP&PA/2008/690-699 dated 15-07-2008.

1.2 TNEB vide their letter no. SE/SS/EE1/AEE1/F Stg Committee/D151/2008 dated 21-08-08 have sent their observations regarding 400kV D/C inter-connection line between Vallur JV TPS and NCTPS Stage-II projects as mentioned in para 6.3 of the minutes.

"6.3 GM, NTPC suggested that the two projects i.e. the Vallur TPS and the North Chennai-II TPS might be inter-connected by a 400kV D/C line for reliability purpose. The proposal was agreed and it was decided that this line would be built by POWERGRID, and M/s NTECL and TNEB would share the transmission charges of the line on 50:50 sharing basis. All the members agreed for this arrangement."

TNEB has now proposed that the 400kV link line may be owned either by NTCEL or TNEB so that maintenance of the lines be hitch free. They also suggested that this link may be executed by PGCIL and to be owned by M/s NTECL and TNEB shall provide additional two numbers 400kV bays at NCTPS Stage-II.

1.3 It is observed that the minutes as recorded and circulated are in accordance with the discussions during the 26th meeting and as such no corrigendum is required on this issue. This issue regarding inter-connection line between Vallur JV TPS and NCTPS Stage-II projects, however, could be re-discussed and the same is included under Agenda No. 3.

1.4 The Minutes as circulated may be confirmed.

2.0 Status of Under Construction / Approved Schemes:

2.1 POWERGRID may inform the progress of the transmission works that are being implemented by them as part of regional schemes.

2.2 State utilities may also inform the progress on their transmission works that are necessary to match with the regional schemes by POWERGRID for effective utilization of the system.

3.0 Inter-connection line between Vallur JV TPS and NCTPS Stage-II projects:

3.1 The Vallur JV TPS and NCTPS Stage-II 400kV D/C link line would serve the purpose of increasing reliability of evacuation of power from both the projects, one owned by TNEB and the other by NTCEL (a JV of NTPC and TNEB). If the line is to be in the ownership of NTCEL or TNEB or with a 50:50 ownership between NTCEL & TNEB, the line could be taken up as a dedicated transmission system for both the projects. The transmission charges for this line should be shared equally by NTCEL and TNEB. If line is owned by NTCEL, TNEB would pay 50% transmission charges to NTCEL and would recover their investment

from project beneficiaries of the respective projects. And vice-versa, if TNEB owns the link line, NTCEL should pay 50% charges to TNEB.

3.2 TNEB and NTPC (NTCEL) may mutually discuss and members may decide.

4.0 Transmission System for Evacuation of Power from Vallur JV TPS and North Chennai TPS Stage-II (1x600 MW)

4.1 Following transmission was agreed for Vallur JV TPS (3x500 MW) and North Chennai TPS Stage-II (1x600 MW) during the 26th meeting of the Standing Committee held on 13-06-2008.

4.2 Evacuation System for Vallur JV TPS(3x500MW)

1. LILO of one of the circuits of Sriperumbudur – Alamathy 400 kV D/C line at Vallur JV TPS (instead of LILO of both the circuits of Sriperumbudur – Alamathi D/C as earlier planned)
2. Extending the other two 400kV circuits from Vallur JV TPS on a 400kV D/C line upto Sunguvarchatram(TN) to have Vallur JV TPS- Sunguvarchatram 400kV D/C line.
3. Providing two nos. of additional 400kV line bays at Sriperumbudur so as to restore Kolar – Sriperumbudur 400kV line and terminate the Melakottaiyur LILO line into Sriperumbudur S/S so as to have Sriperumbudur-Melakottaiyur 400kV D/C line- one circuit of which LILOed at SVChatram. With this arrangement the Kolar – Sriperumbudur 400kV S/C link will be restored as direct line between Kolar and Sriperumbudur.
   Based on site visit by CE (SP&PA) and engineers of PGCIL held on 14-06-2008, feasibility and optimality of the above was also confirmed.

4. 50% of Vallur TPS –North Chennai 400 kV DC line.

4.3 Evacuation System for North Chennai Stage-II of TNEB

1. LILO of one circuit of Sriperumbudur – Alamathy 400 kV D/C line at NCTPS Stage-II (This LILO would be on the second circuit of Sriperumbudur – Alamathy 400 kV D/C line. The first circuit would have LILO at Vallur TPS, as in (4.2(1.) above)
2. 50% of Vallur TPS –North Chennai 400 kV DC line.

4.4 Earlier, the transmission system for evacuation of power from Vallur JV TPS with 2x500 MW units was identified and firmed up in the 24th meeting of the Standing Committee and 5th meeting of the SRPC. The transmission requirement had to be reviewed in view of the proposal of NTCEL for addition of 3rd 500 MW unit at Vallur TPS and proposals by TNEB to add NCTPS Stage-II (600 MW) and Ennore TPS Annex (600 MW) in /around Chennai area.

4.5 TNEB vide their letters no. SE/SS/EE1/AEE1/F Stg Committee/D151/2008 dated 21-08-08, and no. SE/SS/EE1/AEE1/F Stg Committee/D164/2008 dated 16-09-08 have now informed that only four bays were available at Sunguvarchatram SS of TNEB. (Two for Alamathi - SVChatram and two for LILO of Sriperumbudur-Melakottaiyur 400kV line). As such, the extension of two 400kV circuits from Vallur JV TPS on a 400kV D/C line upto Sunguvarchatram(TN) to have Vallur JV TPS- Sunguvarchatram 400kV D/C line would not be possible.

4.6 POWERGRID vide their letter no. C\ENG\SEF\S\Vallur Tr. System dated 17-09-2008 have now informed that:

i) They had already taken up the LILO of both circuits of Sriperumbudur-Alamathi 400kV D/C line as approved in 24th meeting of Standing Committee and 5th meeting of SRPC. And the additional transmission elements to meet requirement of 3rd unit at Vallur TPS would be taken up as a supplementary scheme.

ii) Provision of additional two 400kV bays at Sriperumbudur, as required for the transmission system given at 4.2(3.) above under Vallur TPS, is infeasible on account of physical limitations.

iii) The transmission system given at 4.1(3.) under Vallur TPS shall not have much effect on evacuation/delivery of power from Vallur TPS.

4.7 In view of above new views/proposals/observations of TNEB and POWERGRID, which were not presented during the 26th meeting of the Standing Committee, it was felt that the transmission system for evacuation of power from both NCTPS Stage-II and from 3rd unit at Vallur TPS should be revisited. Accordingly, system studies were carried out jointly by CEA, POWERGRID and TNEB in CEA office during 06-07 January 2009. A report based on the studies for evolving the emerged transmission system for the NCTPS-II (2x600 MW of TNEB) and Vallur JV TPS (3x500 MW of NTCEL) is enclosed at **Annex-I.** Following transmission system had emerged from the system studies.

4.8 Transmission System for Evacuation of Power from Vallur TPS (3x500 MW)

i) Vallur TPS – Alamathi 400kV D/C line. This connecting D/C line would be built upto the LILO point of Nellore-Sriperumbudur for Alamathi and then would use one tower of the LILO section upto Alamathi to have a D/C connection between Vallur TPS and Alamathi and restoring Nellore-Sriperumbudur one circuit.

ii) Vallur TPS – Melakottaiyur (Kalivanthapattu) 400kV D/C line. This connection would be built by using part of the LILO section of the Kolar-Sriperumbudur 400kV S/C line that was LILOed at Melakottaiyur. With this, the Kolar – Sriperumbudur 400kV S/C connection would be restored. It is learnt that a few number of towers of the LILO section at Melakottaiyur might remain unused. POWERGRID would make effort to put these towers to economic use.

iii) New 400/220 kV S/S at Tiruvalam with 2x315 MVA transformer.

iv) Alamathi – Tiruvalam 400kV D/C line.

v) Tiruvalam – Singarapet 400kV D/C line

vi) Tiruvalam – Chitoor 400kV D/C **Quad** line

4.9 Transmission System for Evacuation of Power from North Chennai TPS-II (2x600 MW)

i) NCTPS Stage-II – Alamathi 400kV D/C line. This connecting D/C line would be built upto the LILO point of Nellore-Sriperumbudur for Alamathi and then would use one tower of the LILO section upto Alamathi to have a D/C connection between NCTPS Stage-II and Alamathi and restoring Nellore-Sriperumbudur second circuit.

ii) NCTPS Stage-II – Sunguvarchatram (SVChatram) 400kV D/C line.

4.10 Members may discuss and agree.

5.0 Transmission Proposals of TNEB:

5.1 TNEB vide their letters no. SE/SS/EE1/AEE1/F Stg Committee/D151/2008 dated 21-08-08, and no. SE/SS/EE1/AEE1/F Stg Committee/D164/2008 dated 16-09-08, have proposed following transmission schemes:

5.2 Termination of 400kV D/C quad line from Pugalur at Sholinganallur(Ottiampakkam) 400kV S/S

5.2.1 As discussed in the 24th meeting of the Standing Committee, TNEB have informed that they would execute the Pugalur- Sholinganallur (Ottiampakkam) 400kV D/C Quad line. This line was planned as part of the transmission scheme for evacuation of power from wind projects in Tirunelveli/Kayathar area in Tamil Nadu.

5.2.2 TNEB may inform about progress of the transmission scheme and status of wind generation projects coming up in that area.

5.3 Execution of Singarapet 400/230kV S/S by TNEB

5.3.1 TNEB have proposed following transmission system to be executed by them:

(i) Establishment of 400/230 kV SS at Singarapet with 2x315 MVA ICT
(ii) Hosur – Singarapet – 400 kV DC line with twin moose conductor.
(iii) LILO of both the circuits of Pugalur – Ottiampakkam (Sholinganallur) 400 kV DC Quad line at Singarapet 400 kV SS with Quad conductor.

5.3.2 The above system was earlier proposed by TNEB as regional strengthening scheme and was taken up for discussion in the 25th meeting of SCPSPSR (held on 28-03-2008) alongwith the transmission system for generation projects in Tamil Nadu. During the discussions it was decided that the transmission proposals of TNEB would be revisited and for this they would coordinate with CEA and POWERGRID in carrying out further studies. The studies were carried out in CEA jointly by TNEB, CEA and POWERGRID in June 2008 and results were put up as part of the agenda for 26th meeting. However, no particular discussion was held for the above proposals, as TNEB had not finalised whether the scheme would be under regional or under state sector.

5.3.3 During the discussions in the 25th meeting, POWERGRID stated that TNEB with the commissioning of new generation projects would be surplus in power and would be utilizing ISTS to transfer the surplus to other constituents within and across the Southern region, therefore, TNEB should seek long term open access for utilization of ISTS for new generation projects planned for development under State sector. TNEB representatives agreed to look into the matter.

5.3.4 Members may discuss.

5.4 Transmission system for evacuation of power from EnnoreTPS Annex(1x500 MW)

5.4.1 Transmission system for evacuation of power for Ennore TPS Annex(1x500 MW) was taken up for discussion in the previous meeting of this Committee. The generation would be stepped up to 230kV level and the transmission system is to be build up by TNEB. TNEB have informed following transmission system for this project.

(i) LILO of existing ETPS – Manali 230 kV SC line at ETPS Annex
(ii) 230 kV, 2 x DC lines from ETPS Annex to be erected on multi circuit towers in such a way that two circuits will be terminated at proposed Ambattur Industrial Estate 230/110 kV SS and the other two circuits will be connected to Guindy 230 kV SS.

5.4.2 Members may agree.

5.5 Inter-link between Tirunelveli (POWERGRID) and Kanarapatty (TNEB) 400kV S/ss near Tirunelveli (TN)

5.5.1 This issue was taken up during the 25th meeting and following is as per the minutes:

"20.3 Regarding the establishment of Tirunelveli 400/230 kV substation to evacuate wind projects in the south of Tamil Nadu, GM, POWERGRID informed that there was only one bay space available at Tiruneliveli (POWERGRID) and therefore, TNEB should either construct a single circuit interconnection between Tirunelveli (TNEB) and Tirunelveli (POWERGRID) or alternatively, consider bunching of both the circuits of the planned D/C line. TNEB agreed to look into the options and inform the same to Standing Committee accordingly.

20.4 POWERGRID representative also stated that in regard to evacuation of power from the wind power projects in Tamil Nadu, TNEB should apply for long term open access for utilization of ISTS complying with the decision of CERC in this regard. TNEB agreed to comply with the directions of CERC."

5.5.2 TNEB have informed that they would execute the Kanarapatty (TNEB SS) – Abishekapatty (POWERGRID S/S at Tiruneliveli) link line as a 400 kV S/C line on D/C tower with quad moose conductor.

5.5.3 Members may agree.

6.0 Transmission Proposals of KPTCL:

6.1 Further to the discussions in the 25th and 26th meeting of the Standing Committee on Power System Planning of Southern Region, system studies were carried out in CEA during 25-27 June 2008 and subsequently during 19-20 February 2009 with participation of officers from CEA and KPTCL, for evolving transmission system for the grid strengthening and evacuation of power in Karnataka.

Study report is given at **Annex-II**. Based on these studies, following transmission schemes have emerged:

6.2 Establishing connectivity to Yelahanka 2X500 MVA, 400/220 KV S/S.

6.2.1 Following transmission system is proposed for establishing connectivity to the planned Yelahanka S/S of POWERGRID:

1. LILO of Nelamangala-Hoody 400kV line at Yelahanka 400/220kV S/S.
2. LILO of Somanahalli-Hoody 400 kV line at Yelahanka 400/220kV S/S.
3. Gooty – Yelahanka, 400kV D/C line
4. Yelahanka - Hiriyur 400kV D/C (already a part of BTPS evacuation system as given above, to be implemented by KPTCL)

Members may discuss and agree.

6.2.2 PGCIL has informed that due to encroachment at the selected Yelahanka S/S site, the 400kV side may be constructed as GIS and the 220kV side as the conventional AIS. Considering difficulties in procuring alternate suitable land around Bangalore, this proposal may be discussed and agreed by the Members.

6.2.3 For 220kV interconnections of Yelahanka with KPTCL grid, in the system studies a tentative connectivity at 220 kV with Hebbal, BIAL, DB Pura, and Nelamangla was considered. The final 220kV transmission system configuration to take off power from 400 kV is to be confirmed by KPTCL. KPTCL may inform about status of 220kV transmission lines from Yelahanka.

6.3 Proposal of KPTCL for establishment of 400 kV SS at Electronic City in Bangalore.

6.3.1 KPTCL have proposed establishing 400/220kV S/S at Electronic City near Yerandanahally (south of Bangalore) with 2X500 MVA transformation capacity to meet the load demand of Electronic City and near by areas in Bangalore south. For system studies a tentative connectivity at 220kV with Yerandanahally, Nagnathpura and HSR layout was considered. The final 220kV transmission system configuration to take off power from 400 kV would be confirmed by KPTCL. KPTCL may inform about the associated 220kV system. This scheme would be built by KPTCL as State project. Following system is proposed:

(i) LILO of Somanahalli – Kolar 400 kV S/C line at Electronic city 400/220 kV S/S.

6.3.2 In addition to above system, system studies were also carried out for strengthening of Bangalore 400kV ring. It was found that, with above arrangements of connectivity for Yelahanka and Electronic City 400kV S/S, the formation of 400kV ring around Bangalore would be Nelamangala – Yelahanka S/C line, Yelahanka – Hoody - Kolar D/C line, Kolar - Electronic City - Somanahalli S/C line and Somanahalli – Bidadi - Nelamangala D/C line. In the above 400kV ring formation the Kolar - Electronic City - Somanahalli S/C seems to be a weak link and needs to be made as D/C line. One option is that this section could be converted to a D/C line using RoW of existing S/C line in phased manner. This option has been proposed by KPTCL. Alternatively, the Kolar-Hosur line may be LILOed at Electronic city, thus establishing 2xS/C 400kV inter-connection between Kolar-Electronic City. The Electronic City-Somanahalli section could be strengthened at a later date depending upon need at that time. The final solution could be firmed up after further studies and practicability of the alternative. **Members may discuss.**

6.3.3 Also, in the 400kV ring formation, the Nelamangala – Yelahanka S/C line becomes a weak link and needs to be made as D/C line. The option of LILO of Yelahanka – Somanahalli S/C link at Nelamangala could be considered after confirmation from KPTCL regarding availability of ROW and bays for this. **Members may discuss.**

6.4 Proposal of KPTCL for establishment of Basvana Bagewadi 400 kV S/S:

6.4.1 KPTCL have proposed establishing 400/220kV S/S at Basvana Bagewadi and its interconnection with Narendra and RTPS through 400kV D/C lines. They have also proposed to change the 765kV line corridor of "Nellore/Kurnool- Raichur-Sholapur" to "Nellore/Gooty- Hiriyur – Basvana Bagewadi –Sholapur". With the new proposal of KPTCL, they have also suggested to plan new 765kV S/Ss at Gooty, Hiriyur and Basvana Bagewadi instead of the Kurnool and Raichur 765kV S/Ss. It is seen that this proposal would cost additional 700-800 Crore due to increased 765kV line lengths of about 600 ckm and an additional 765kV S/S. The issue was discussed at length with KPTCL. The "Nellore/Kurnool- Raichur-Sholapur" corridor was planned and approved with Krishnapattnam UMPP and IPPs in Nellore/Krishnapattnam area, and may not be appropriate to change/modified this at this stage.

6.4.2 Considering above issues, alternative options were considered while planning a transmission system for evacuation of power from Yeramas/Edlapur(2x800 + 1x800 MW) generation projects. And following transmission system has emerged, as an optimum transmission system, from the studies:

1. Yeramas/Edlapur – Basvana Bagewadi 400kV quad D/C line
2. Basvana Bagewadi 400/220kV S/S, 2x500 MVA

3. Yeramas/Edlapur – Raichur 400kV quad line. This line would bypass Raichur 400kV bus and would be linked with the existing Raichur-Gooty 400kV quad line for establishing a Yeramas/Edlapur – Gooty 400kV D/C connection. Thus, the Gooty-Raichur connection would then become as Gooty-Yeramas/Edlapur connection. This has been done to reduce the short circuit level at new 765kV Raichur(PGCIL) S/S.

Members may discuss and agree.

6.5 Proposal of KPTCL for transmission system for Tadri UMPP :

Following transmission system is proposed by KPTCL for evacuation of power from Tadri UMPP (4000 MW) in Karnataka:

1. 400 kV MC line (Four Circuits) from Tadri to Kaiga.
2. Construction of 765 kV sub station at Kaiga.
3. Construction of 765 kV line from Kaiga to Munirabad in the existing 400 kV line corridor of Kaiga –Guttur.
4. Construction of 765kV sub station at Munirabad.
5. Realignment of Krishnapatnam evacuation by 765 kV line from Kurnool to Munirabad and to Sholapur (instead of Kurnool to RTPS to Sholapur).

The decision of having an Ultra Mega Power Project at Tadri location and its time schedule for implementation is yet to be decided. Under this scenario, considering transmission system for this project at this stage would be premature. Members may discuss.

7.0 Evacuation System for Kothagudam TPS (1x500 MW)

7.1 APTRANSCO has proposed following transmission system for evacuation of power from Kothagudam TPS of 1x500 MW capacity:

(i) 400 kV D/C line from Kothagudam to Khammam.

7.2 The studies were carried out in CEA considering following alternatives:

ALT (i) Kothagudam-Khammam 400 kV D/C line.

ALT (ii) Kothagudam-Khammam 400 kV D/C line and Kothagudem - Suryapet 400 kV S/C.

ALT (iii) Kothagudam-Khammam 400 kV D/C line and 220kV bus splitting to evacuate power from one 250 MW unit of Kothagudem D at 400kV level.

ALT (iv) Kothagudam-Khammam 400 kV D/C line and Phase shifting transformer at KTPS.

7.3 From the study results it was observed that Kothagudam-Khammam 220 kV D/C line gets overloaded in Alternative(i) and (ii). Alternative (iii) and (iv) are found to meeting the n-1 reliability criteria. The Alternative (iv) is preferred as it causes saving of about 10 MW of losses under peak conditions and also would gives more flexibility in system operation in controlling flow on the 220kV network. For transmitting the power beyond Khammam, APTRANSCO would use their 400kV Khammam-Hyderabad D/C line. The system is to be built by APTRANSCO. APTRNSCO can also link the Kothagudam with their proposed Suryapet 400kV substation in future.

7.4 System study results are given at **ANNEX-III**.

7.5 Members may discuss.

8.0 Evacuation System for Bhoopalapally Stage-I (1x500 MW) and Stage-II (1x600 MW)

8.1 APTRANSCO has proposed following transmission system for evacuation of power from Bhoopalapally Stage-I & II (1x500 + 1x600 MW) generating stations of APGENCO.

(i) Bhoopalapally – Warangal 400 kV D/C line
(ii) Bhoopalapally – Gajwel 400 kV D/C line

8.2 APTRANSCO has also indicated following 220kV transmission lines at the Warangal 400/220kV S/S
(i) Warangal – Durshed 220kV D/C line
(ii) Warangal – Pulakurthy/Ramapa 220kV D/C line

8.3 During discussions in CEA with APTRANSCO officials, following was brought out:
(i) APTRANSCO/APGENCO should consider the option of having a 400/220kV transformer at the Bhoopalapally switchyard for and feeding nearby 220kV load point directly from the generation switchyard. This would cause less transmission losses and would also have more reliability margins in the 400kV system and the 400/220kV substation at Warrangal.
(ii) APTRANSCO may identify a suitable location for a new 400kV S/S between Warangal/ Ramagundam /Pulakurthy for strengthening the 220kV network around Warangal

8.4 System study results are given at **ANNEX-IV**.

8.5 Members may kindly note.

9. 400/220 kV Transformer at Berhampur 400kV Sw. Stn. in Orissa

The 400kV Talcher-Gazuwaka D/C transmission line via Berhampur switching station under the scheme of "Augmentation of Talcher-II Transmission System" is being implemented under private sector. Orissa had proposed to establish a 400kV S/S with 2x315 MVA 400/220kV transformers at Berhampur. Eastern Region constituents have agreed to make this switching station as a full-fledged 400/220kV sub-station with 2x315 MVA transformer under state sector. Orissa has also agreed to share the transmission charges for the Talcher-Gazuwaka 400kV D/C line in proportion to the allocation from Talcher. The issue may be discussed in SRPC and agreed by members.

10.0 Transmission system for evacuation of power from Kudankulam APP Stage-II (2x1000 MW):

10.1 NPCIL vide their letter no. NPCIL/KK/ELECT/2008 dated 29th September, 2008 have informed that construction activity for their Kudankulam NPP 3&4 (KKNPP Stage-II) was expected to be taken up soon and requested to initiate studies for finalization of transmission system for this project.

10.2 Transmission system for Kudankulam NPP 1&2(2x1000 MW) was discussed in 16th ,17th and 18th meeting of Standing Committee on Power System Planning of Southern Region

and following transmission system was finalized in the 18th meeting held at Chennai on 5th March ,2004 :

1. KAPP-Tirunelveli 400kV Quad D/C line-1.*
2. KAPP-Tirunelveli 400kV Quad D/C line-1.*
3. LILO of both circuits of Madurai - Thiruvananthapuram 400 kV D/C line at Tirunelveli.
4. Tirunelveli-Udumalpet 400kV D/C line.
5. Tirunelveli –Cochin – Trissur 400kV Quad D/C line. **
6. Tirunelveli –Edamon 400kV D/C line – Initially to be operated at 220 kV. **
7. Establishment of new 400/220kV,2x315MVA Sub-station at Tirunelveli and Cochin (Muvattapuzha)
8. 3rd 400/220kV, 1x315MVA transformers at Thiruvananthapuram and Udumalpet S/Ss.

* The two KAPP-Tirunelveli 400kV Quad D/C lines to be on different routes.

** The construction of 400 kV Tirunelveli-Cochin 400kV Quad D/C line and Tirunelveli -Edamon 400 kV TM D/C line (to be operated initially at 220 kV) would utilize the RoW of the existing 220kV inter-state Kayathar-Edamon S/C line and a multi-ckt line from Tirunelveli up to Edamon would be erected utilizing the existing corridor. This would consist of four 400kV circuits – two Quad and two Twin. These would be 2-circuits of Tirunelveli-Cochin 400kV Quad D/C line and 2-circuits of Tirunelveli-Edamon 400kV D/C line (initially to be operated at 220kV and later to become Tirunelveli-Thiruvananthapuram 400kV D/C line).

10.3 It has been noticed that about six number of generators in Tamil Nadu have applied for LTOA for evacuation of power from their projects. Total generation capacity of these new projects is of the order of 12,000 MW. As, such a comprehensive transmission system for evacuation of power as well as transmission to perspective beneficiaries would be planned from the new projects coming in Tamil Nadu alongwith identification of additional inter-region capacity. NPCIL may inform status, commissioning schedule and expected beneficiaries of their Kudankulam NPP 3&4 project for working out an optimum transmission scheme.

11.0 LTOA Applications Made to CTU for Projects in Southern Region:

POWERGRID may take up the agenda points related to the transmission system requirements for evacuation of power from generation projects.

Annex-I

Central Electricity Authority
System Planning and Project Appraisal Division

Study Report for Evolving Transmission System for Evacuation of Power from Vallur JV TPS (3x500 MW) of NTCEL (a Joint venture of NTPC and TNEB), and North Chennai TPS Stage-II (2x600 MW) of TNEB

1.0 Following transmission was agreed for Vallur JV TPS (3x500 MW) and North Chennai TPS Stage-II (1x600 MW) during the 26th meeting of the Standing Committee held on 13-06-2008.

1.1 Evacuation System for Vallur JV TPS(3x500MW)

1. LILO of one of the circuits of Sriperumbudur – Alamathy 400 kV D/C line at Vallur JV TPS (instead of LILO of both the circuits of Sriperumbudur – Alamathi D/C as earlier planned)
2. Extending the other two 400kV circuits from Vallur JV TPS on a 400kV D/C line upto Sunguvarchatram(TN) to have Vallur JV TPS- Sunguvarchatram 400kV D/C line.
3. Providing two nos of additional 400kV line bays at Sriperumbudur so as to restore Kolar – Sriperumbudur 400kV line and terminate the Melakottaiyur LILO line into Sriperumbudur S/S so as to have Sriperumbudur-Melakottaiyur 400kV D/C line- one circuit of which LILOed at SVChatram. With this arrangement the Kolar – Sriperumbudur 400kV S/C link will be restored as direct line between Kolar and Sriperumbudur.
   Based on site visit by CE (SP&PA) and engineers of PGCIL held on 14-06-2008 feasibility and optimality of the above was also confirmed.

4. 50% of Vallur TPS –North Chennai 400 kV DC line.

1.2 Evacuation System for North Chennai Stage-II of TNEB

1. LILO of one circuit of Sriperumbudur – Alamathy 400 kV D/C line at NCTPS Stage-II (This LILO would be on the second circuit of Sriperumbudur – Alamathy 400 kV D/C line. The first circuit would have LILO at Vallur TPS, as in (1.1(1.) above)
2. 50% of Vallur TPS –North Chennai 400 kV DC line.

2.0 Earlier, the transmission system for evacuation of power from Vallur JV TPS with 2x500 MW units was identified and firmed up in the 24th meeting of the Standing Committee and 5th meeting of the SRPC. The transmission requirement has to be reviewed because of proposal of NTCEL for addition of 3rd 500 MW unit at Vallur TPS and proposals by TNEB to add NCTPS Stage-II (600 MW) and Ennore TPS Annex (600 MW) in /around Chennai area.

2.1 TNEB vide their letters no. SE/SS/EE1/AEE1/F Stg Committee/D151/2008 dated 21-08-08, and no. SE/SS/EE1/AEE1/F Stg Committee/D164/2008 dated 16-09-08, have now informed that only four bays were available at Sunguvarchatram SS of TNEB. (Two for Alamathi - SVChatram and two for LILO of Sriperumbudur-Melakottaiyur 400kV line). As such, the extension of two 400kV circuits from Vallur JV TPS on a 400kV D/C line upto Sunguvarchatram (TN) to have Vallur JV TPS- Sunguvarchatram 400kV D/C line would not be possible.

2.2 POWERGRID vide their letter no. C\ENG\SEF\S\Vallur Tr. System dated 17-09-2008 have had informed that:

i) They had already taken up the LILO of both circuits of Sriperumbudur-Alamati 400kV D/C line as approved in 24th meeting of Standing Committee and 5th meeting of SRPC. And the additional transmission elements to meet requirement of 3rd unit at Vallur TPS would be taken up as a supplementary scheme.

ii) Provision of additional two 400kV bays at Sriperumbudur, as required for the transmission system given at 1.1(3.) above under Vallur TPS, is infeasible on account of physical limitations.

3.0 In view of above new views/proposals/observations of TNEB and POWERGRID, which were not presented during the 26th meeting of the Standing Committee, it was felt that the transmission system for evacuation of power from both NCTPS Stage-II and from 3rd unit at Vallur TPS should be reworked out. Accordingly, system studies were carried out during 06-07 January 2009 in CEA jointly with TNEB and POWERGRID.

3.1 After considering various configurations (Significant alternative configurations and outage cases are reported in subsequent paragraph at 5.0), it emerged that an additional 400kV S/S was needed and as proposed by TNEB, **Tiruvalam** was considered as a suitable location that could also be used for connecting future generation projects in Chennai area (it is learnt that a 1200 MW generation project in north of Chennai is envisaged and has sought LTOA) and also as a future pooling point. The Tiruvalam could be connected with Alamathi, Chitoor and Singarapet.

3.2 It was also observed that the lines from Alamathi/NCTPS/Vallur to Sriperumbudur were getting overloaded and the overloading worsened in the event of outage of single circuit of the two circuits (ALT-IV). To mitigate the problem of overloading it was found that the using the LILO section of the Nellore-Sriperumbudur 400kV D/C line at Alamathi for connecting Alamathi with both NCTPS and Vallur and thus restoring the Nellore-Sriperumbudur 400kV D/C link not only reduces the overloading but also gives an economic solution to the problem. The overloading was further reduced by connecting Alamathi with new Tiruvalam by a 400kV D/C line (ALT-I). Other configurations viz., without Tiruvalam (ALT-II) and with Tiruvalam but without Chitoor- Tiruvalam 400kV D/C (ALT-III) are also reported. In absence of Tiruvalam S/S, the Nellore-SPBudur and Vallur-Melakottaiyur second circuits get overloaded in the event of outage of their respective first circuits (ref. Subsequent Paragraph 5.0 for Alternatives and Outage Cases). This justifies need of Tiruvalam and its interconnection with Alamathi, Hosur and Chitoor.

4.0 The transmission system that emerged from these studies is given below:

4.1 Transmission System for Evacuation of Power from Vallur TPS (3x500 MW)

i) Vallur TPS – Alamathi 400kV D/C line. This connecting D/C line would be built upto the LILO point of Nellore-Sriperumbudur for Alamathi and then would use one tower of the LILO section upto Alamathi to have a D/C connection between Vallur TPS and Alamathi and restoring Nellore-Sriperumbudur one circuit.

ii) Vallur TPS – Melakottaiyur (Kalivanthapattu) 400kV D/C line. This connection would be built by using part of the LILO section of the Kolar-Sriperumbudur 400kV S/C line that was LILOed at Melakottaiyur. With this, the Kolar – Sriperumbudur 400kV S/C connection would be restored. It is learnt that a few number of towers of the LILO section at Melakottaiyur might remain unused. POWERGRID would make effort to put these towers to economic use.

iii) New 400/220 kV S/S at Tiruvalam with 2x315 MVA transformer.

iv) Alamathi – Tiruvalam 400kV D/C line.
v) Tiruvalam – Singarapet 400kV D/C line
vi) Tiruvalam – Chitoor 400kV D/C **Quad** line

4.2 Transmission System for Evacuation of Power from North Chennai TPS-II (2x600 MW)

i) NCTPS Stage-II – Alamathi 400kV D/C line. This connecting D/C line would be built upto the LILO point of Nellore-Sriperumbudur for Alamathi and then would use one tower of the LILO section upto Alamathi to have a D/C connection between NCTPS Stage-II and Alamathi and restoring Nellore-Sriperumbudur second circuit.
ii) NCTPS Stage-II – Sunguvarchatram (SVChatram) 400kV D/C line.

4.3 Inter-connection line between Vallur JV TPS and NCTPS Stage-II projects:

The Vallur JV TPS and NCTPS Stage-II 400kV D/C link line would serve the purpose of increasing reliability of evacuation of power from both the projects, one owned by TNEB and the other by NTCEL (a JV of NTPC and TNEB). Ownership of the line could again be discussed in the next meeting of the Standing Committee. The line could be in the ownership of either NTCEL or TNEB and could be taken up as a Dedicated Transmission line for both the projects. If line were owned by NTCEL, TNEB would pay 50% transmission charges to NTCEL and would recover their investment from project beneficiaries of the respective projects. And vice-versa, if TNEB owns the link line, NTCEL should pay 50% charges to TNEB. This line could also be taken up with joint ownership of NTCEL and TNEB with a 50:50 ownership between NTCEL & TNEB and the transmission charges could be recovered from respective beneficiaries.

5.0 Significant Alternative Configurations and Outage Cases

Study results of significant alternative configurations and outage cases are reported in following Exhibits:

Sl. No.	Study Case	Exhibit No.
1.	**ALT-I : (Base Case)** The final transmission configuration as given at Para 4.2 and 4.3 above	Exhibit No. 01
2.	**ALT-I : (Outage Case)** Outage of Vallur-Melakottaiyur S/C	Exhibit No. 02
3.	**ALT-I : (Outage Case)** Outage of Nellore-SPBudur S/C	Exhibit No. 03
4.	**ALT-I : (Outage Case)** Outage of NCTPS-Alamathi S/C	Exhibit No. 04
5.	**ALT-I : (Outage Case)** Outage of Vallur-Alamathi S/C	Exhibit No. 05
6.	**ALT-II :** ALT-I, but without Tiruvalam 400kV S/S and associated links.	Exhibit No. 06
7.	**ALT-II : (Outage Case)** Outage of Vallur-Melakottaiyur S/C	Exhibit No. 07
8.	**ALT-II : (Outage Case)** Outage of Nellore-SPBudur S/C	Exhibit No. 08
9.	**ALT-III :**ALT-I, but without Tiruvalam – Chitoor 400kV D/C line.	Exhibit No. 09
10.	**ALT-IV :**Configuration as decided in the 26th meeting but with Tiruvalam and considering constraint of bay space at SVChatram and SPBudur.	Exhibit No. 10
11.	**ALT-IV**: **(Outage Case)** Outage of Vallur-SPBudur 400kV S/C	Exhibit No. 11
12.	**ALT-IV: (Outage Case)** Outage of Nellore-Alamathi 400kV S/C	Exhibit No. 12

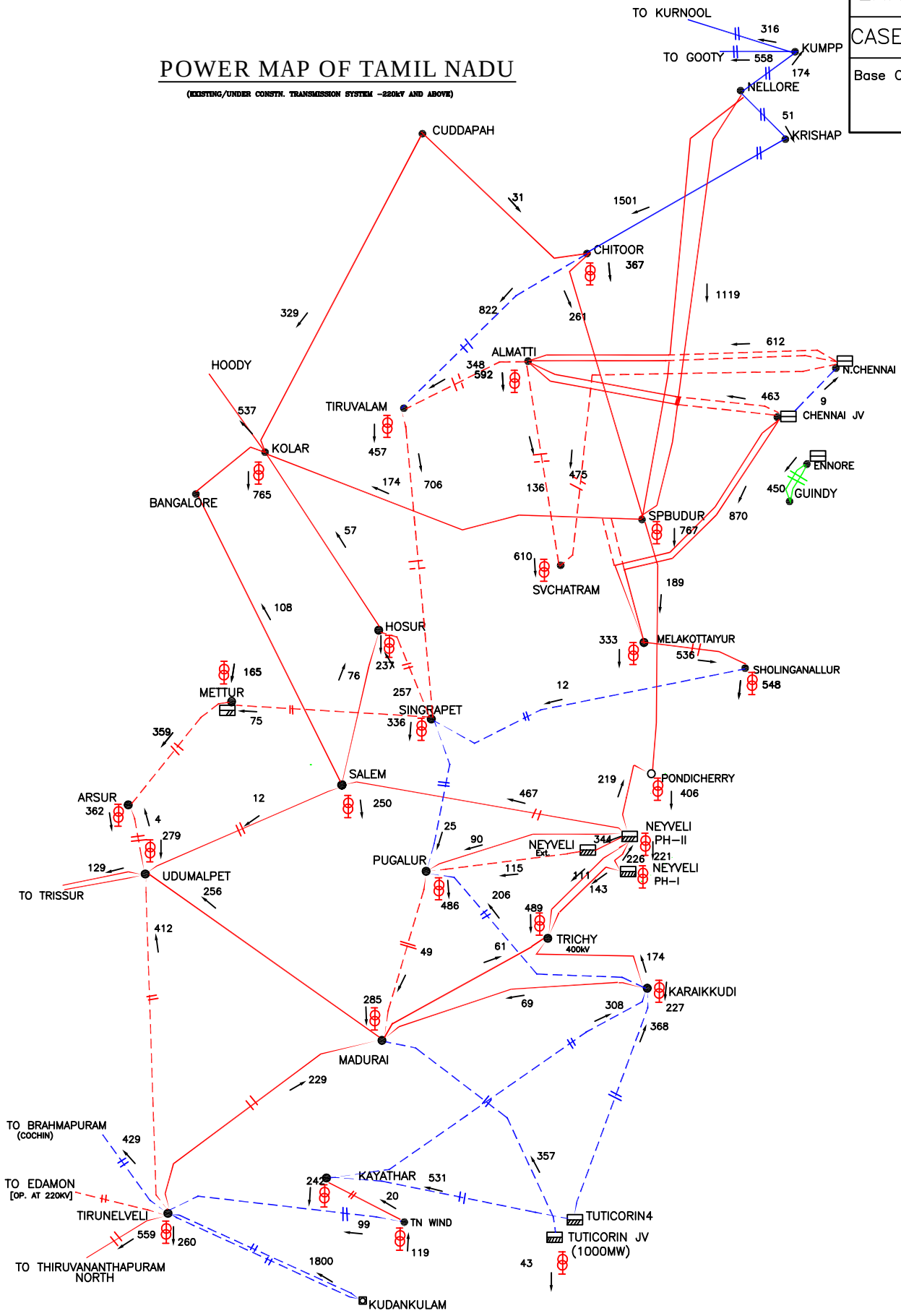
POWER MAP OF TAMIL NADU

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM -220kV AND ABOVE)

EXHIBIT- 01

CASE:ALT- I

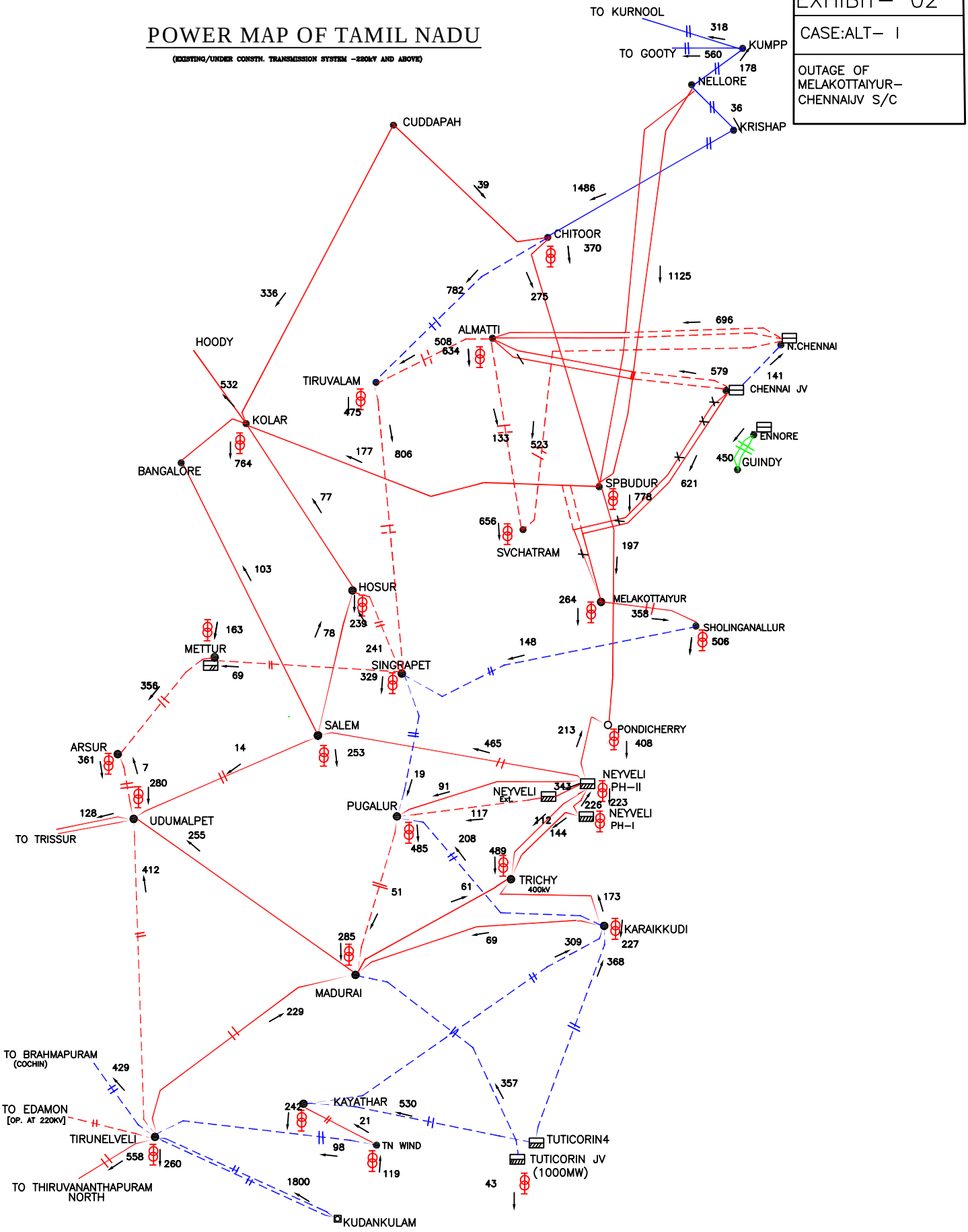
Base Case



POWER MAP OF TAMIL NADU

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM -220kV AND ABOVE)

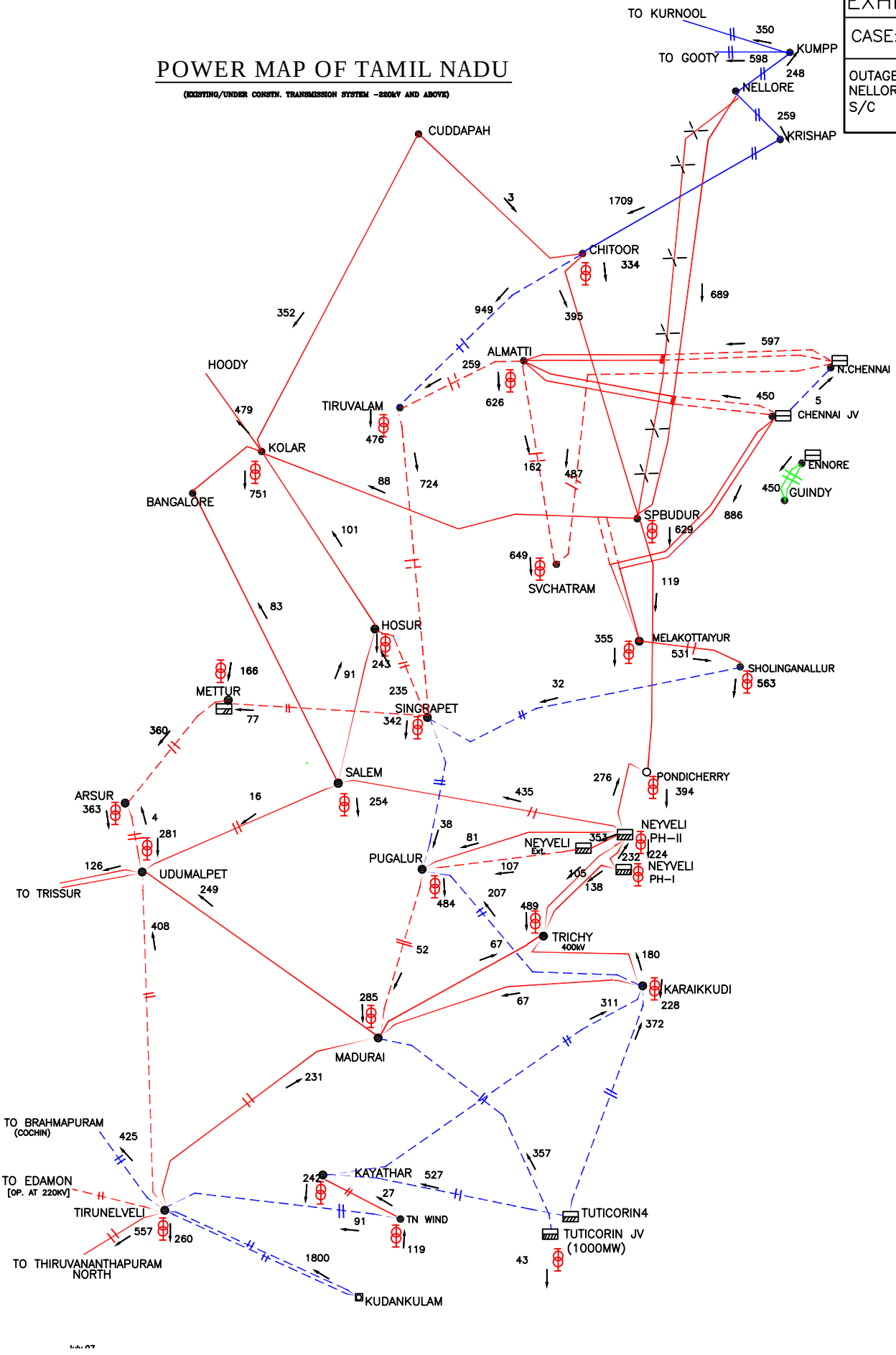
EXHIBIT- 02
CASE:ALT- I
OUTAGE OF MELAKOTTAIYUR-CHENNAIJV S/C



EXHIBIT– 03
CASE:ALT– I
OUTAGE OF NELLORE–SPBUDUR S/C

POWER MAP OF TAMIL NADU

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM –220kV AND ABOVE)



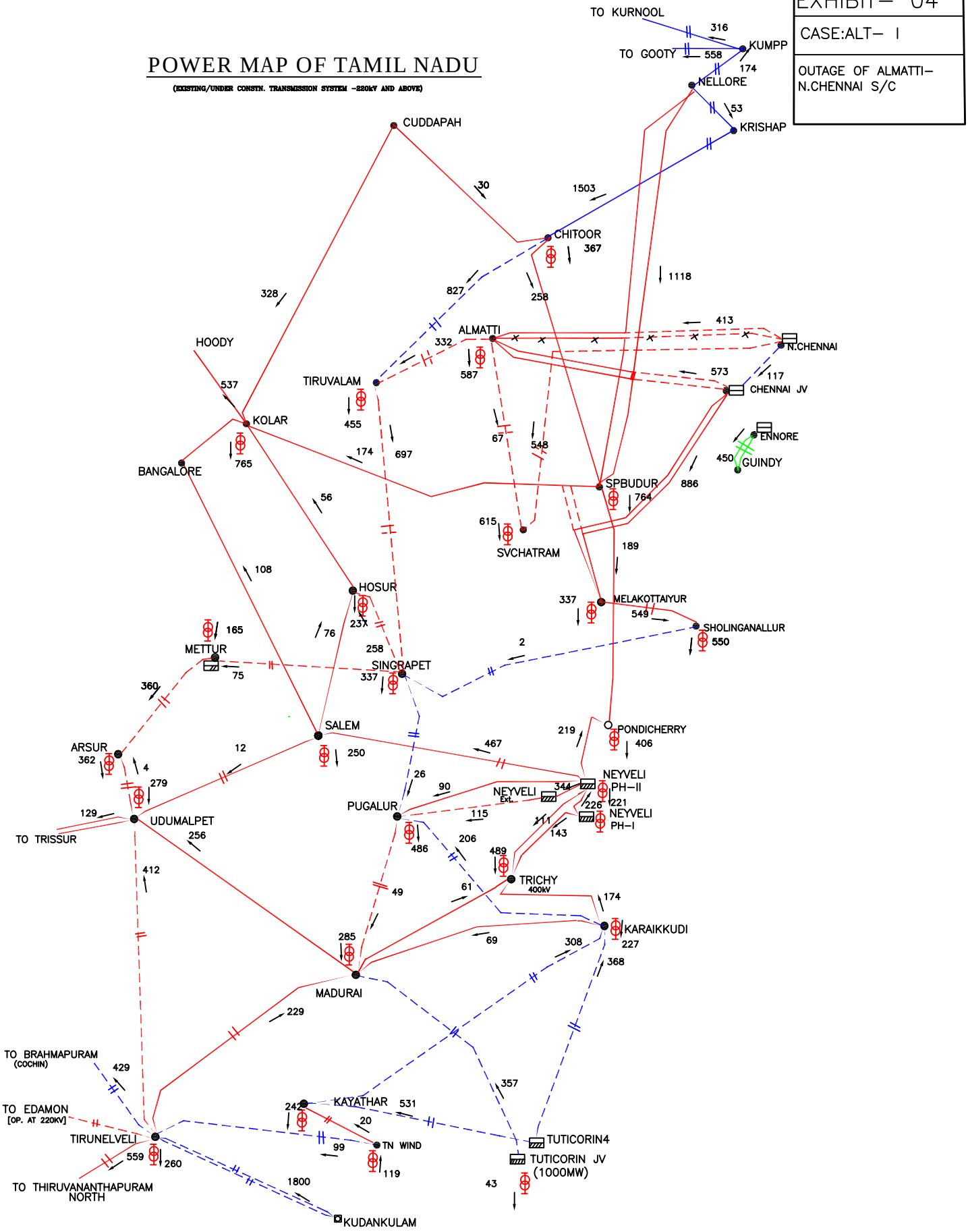
POWER MAP OF TAMIL NADU

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM -220kV AND ABOVE)

EXHIBIT- 04

CASE:ALT- I

OUTAGE OF ALMATTI-N.CHENNAI S/C



POWER MAP OF TAMIL NADU

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM -220kV AND ABOVE)

EXHIBIT– 05

CASE:ALT– I

OUTAGE OF ALMATTI–CHENNAIJV S/C

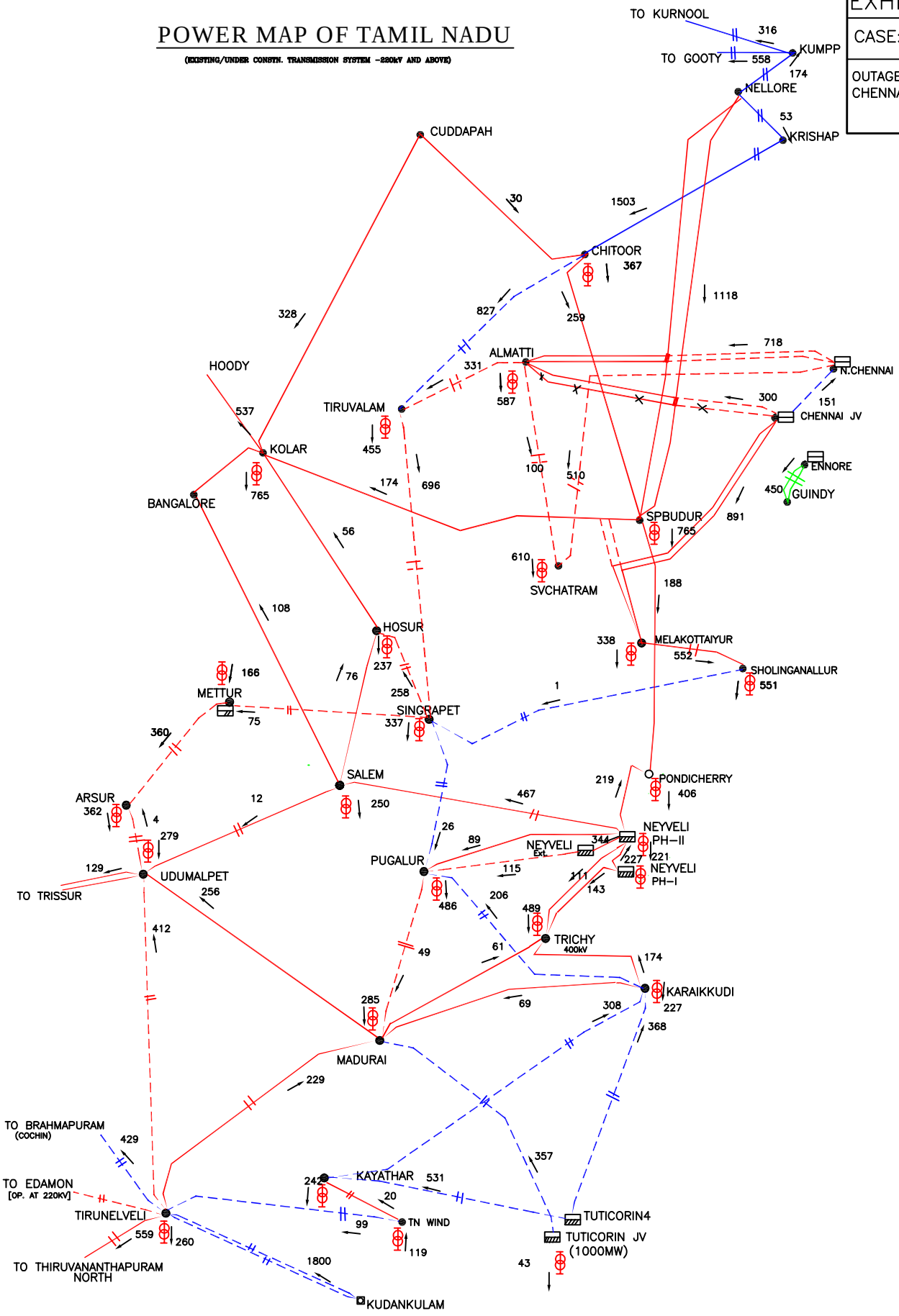
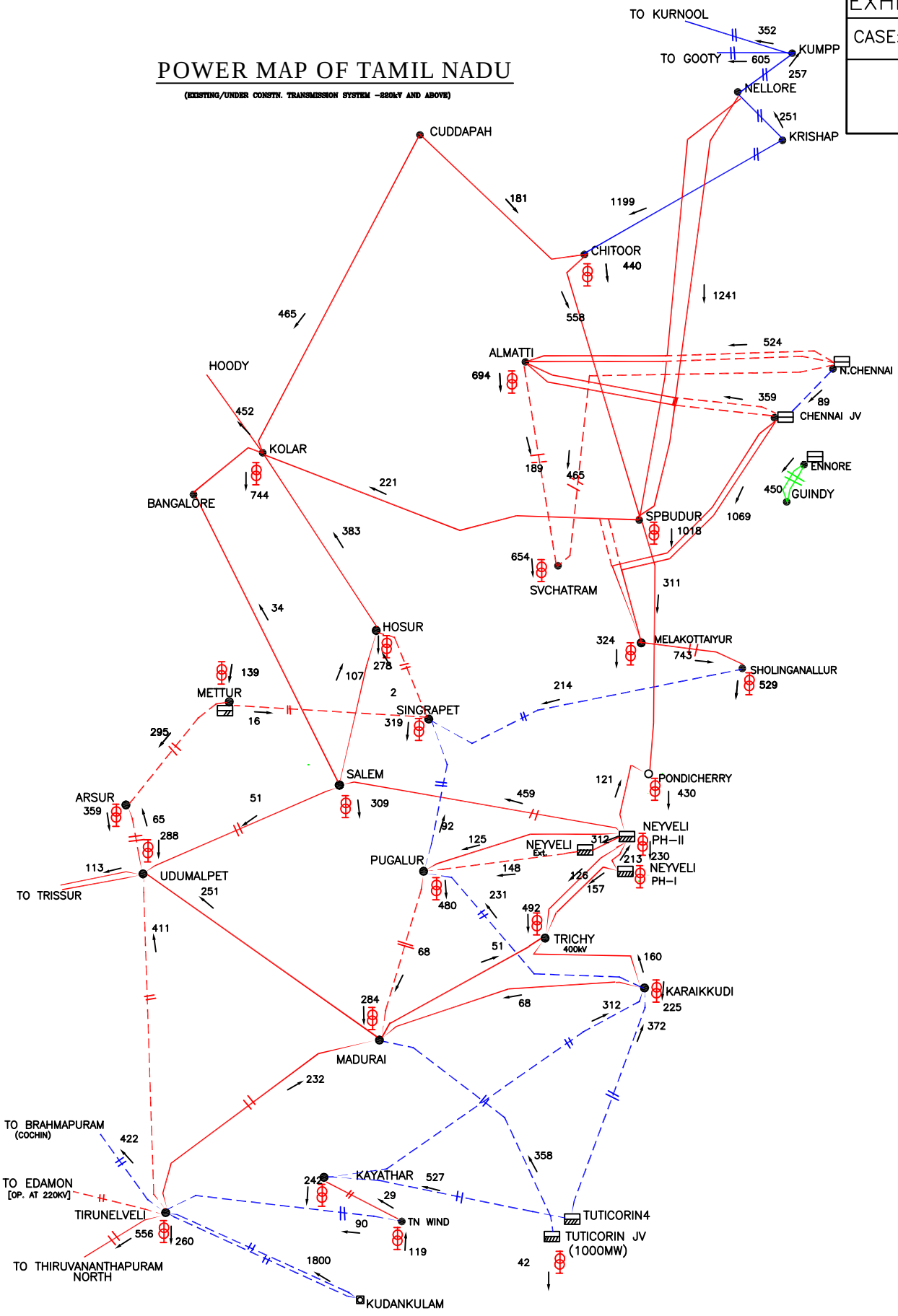


EXHIBIT – 06
CASE:ALT – II

POWER MAP OF TAMIL NADU

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM –220kV AND ABOVE)



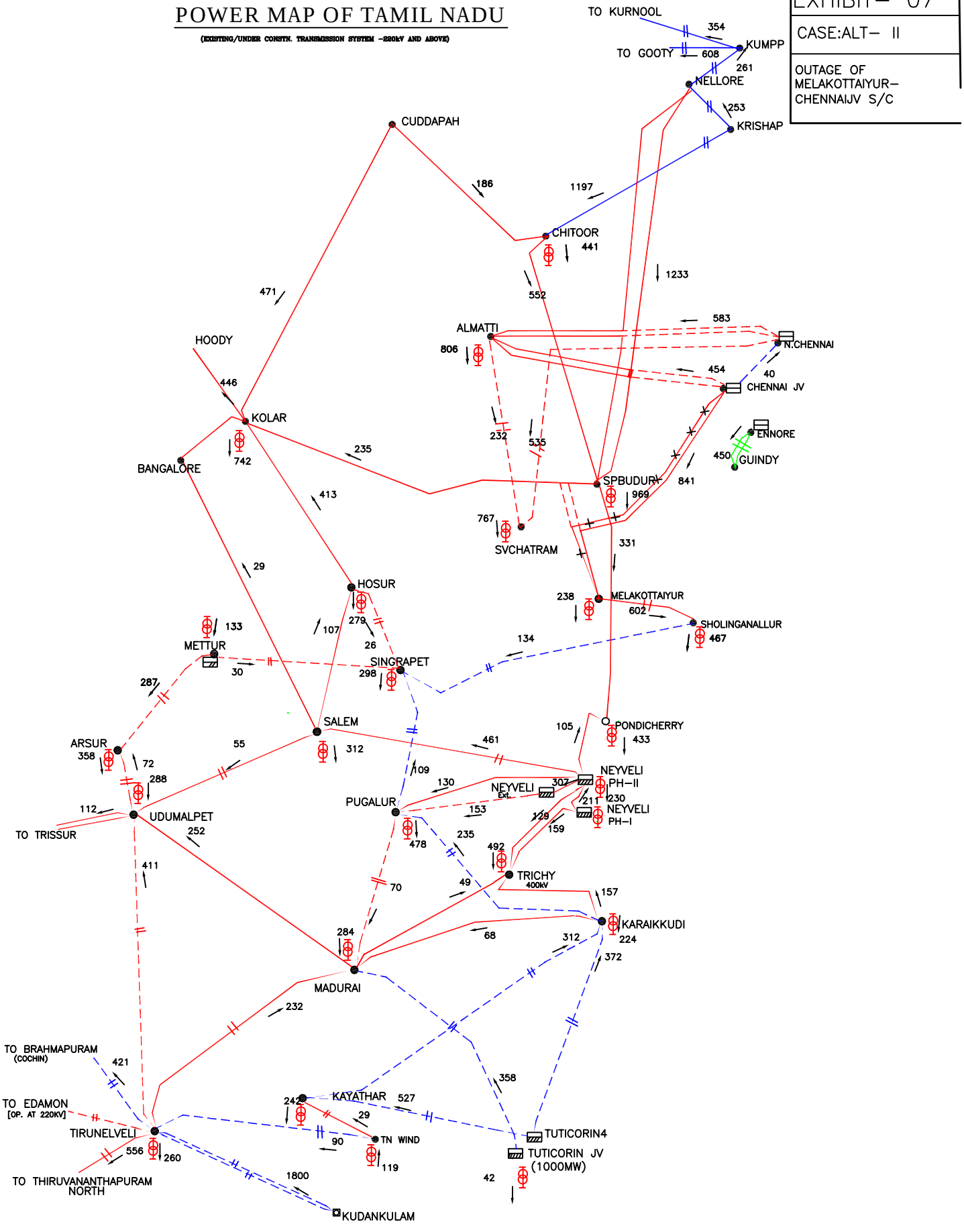
POWER MAP OF TAMIL NADU

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM –220kV AND ABOVE)

EXHIBIT– 07

CASE:ALT– II

OUTAGE OF MELAKOTTAIYUR–CHENNAIJV S/C



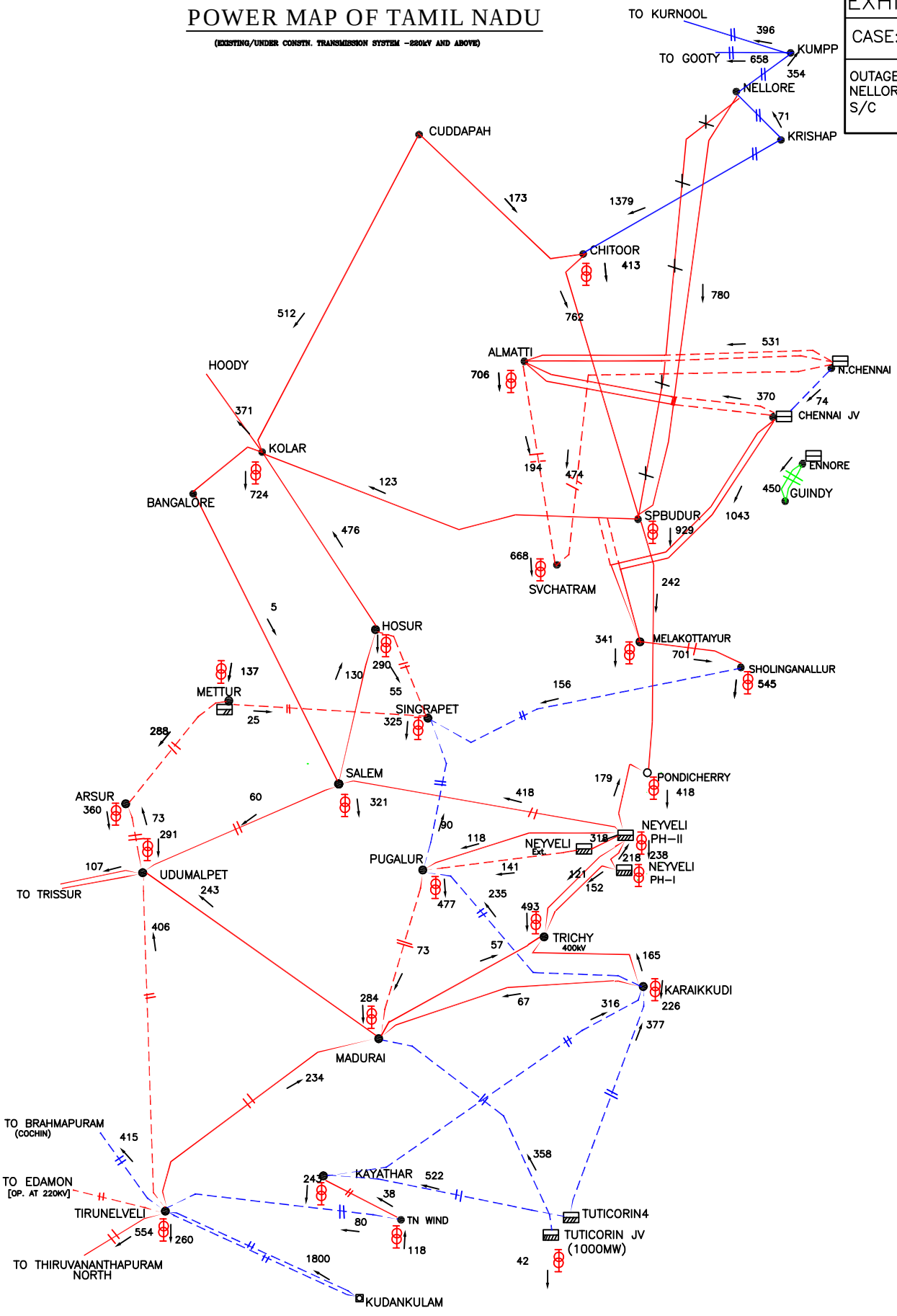
POWER MAP OF TAMIL NADU

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM –220kV AND ABOVE)

EXHIBIT– 08

CASE: ALT– II

OUTAGE OF NELLORE–SPBUDUR S/C

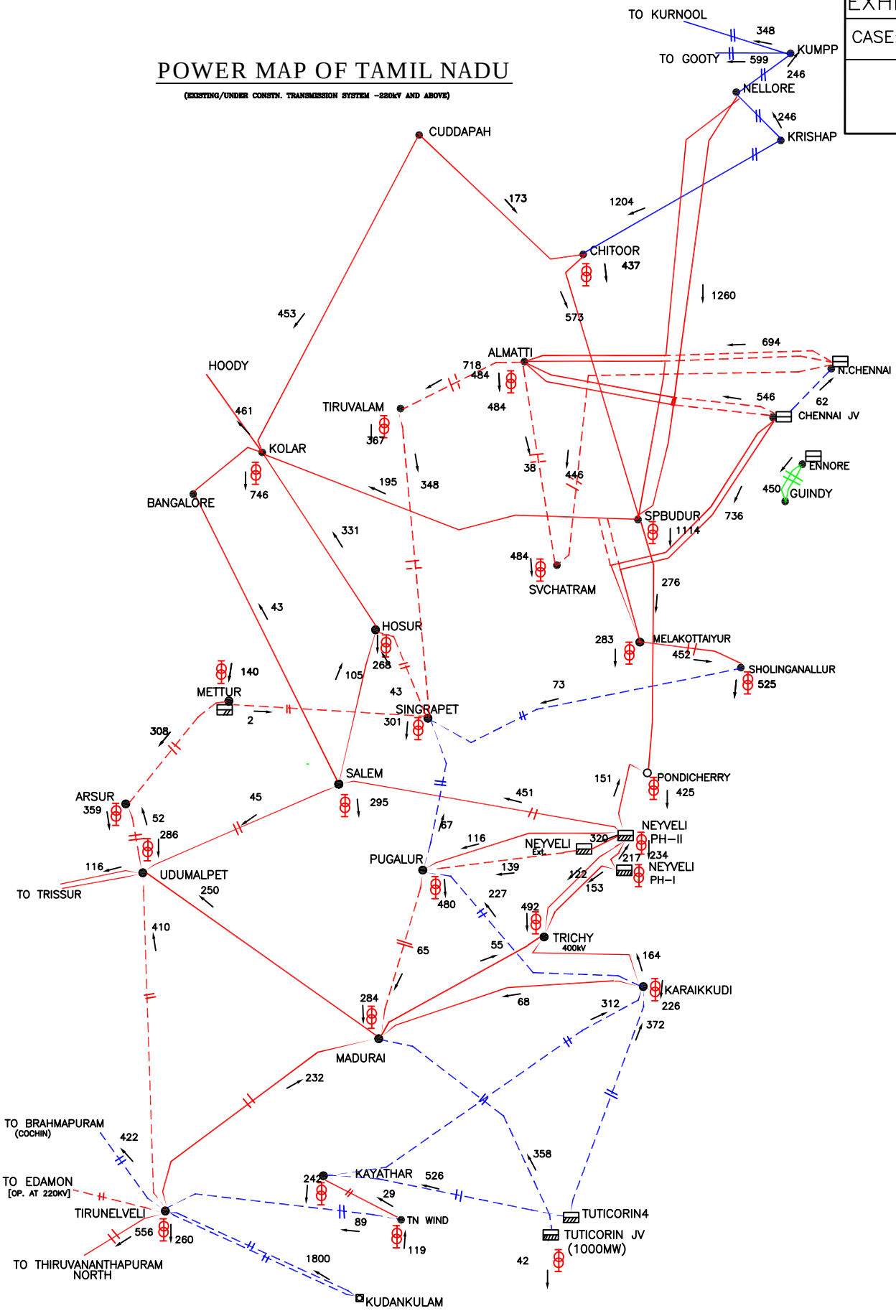


EXHIBIT– 09

CASE:ALT– III

POWER MAP OF TAMIL NADU

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM –220kV AND ABOVE)



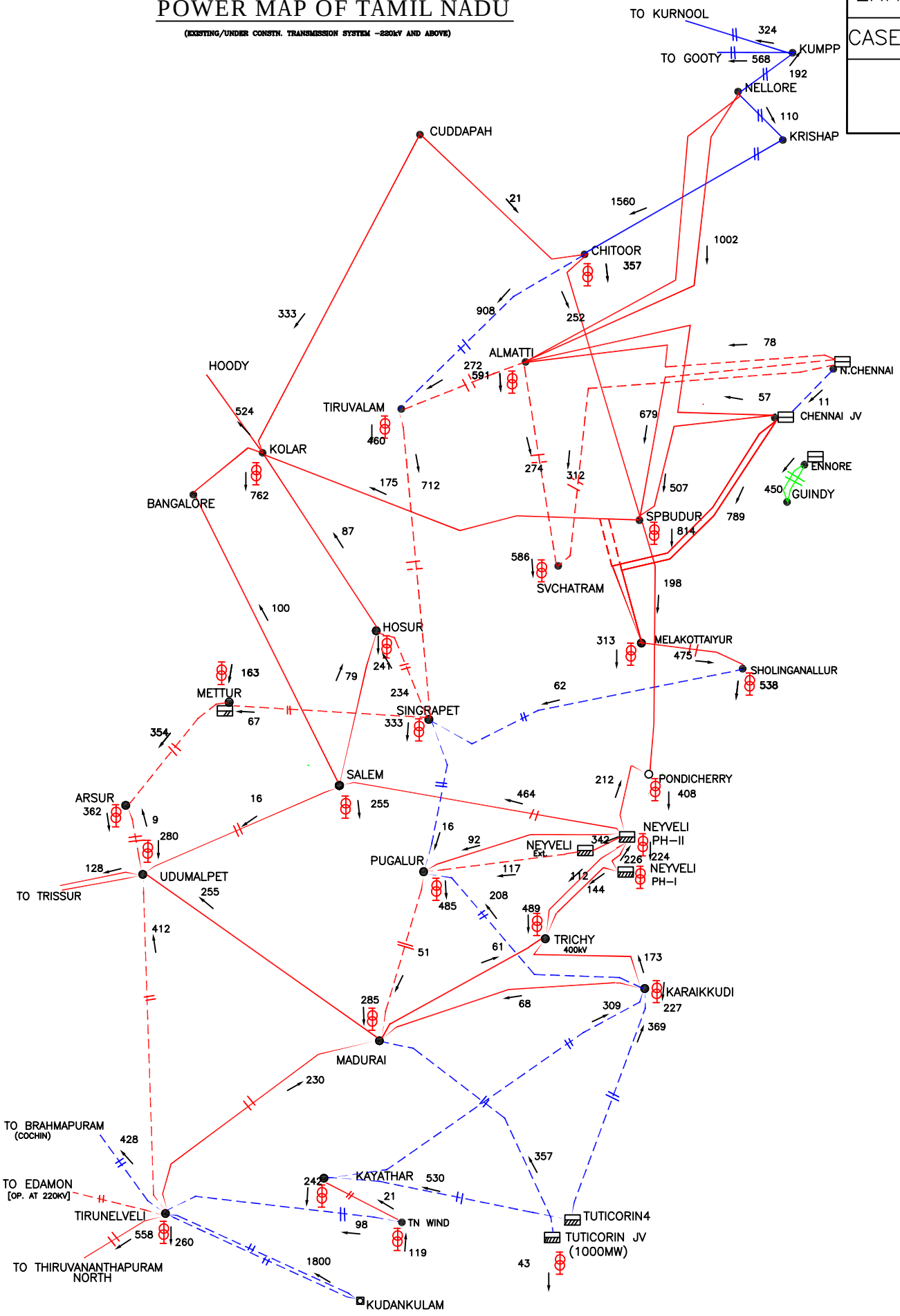
July,07

POWER MAP OF TAMIL NADU

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM –220kV AND ABOVE)

EXHIBIT– 10

CASE:ALT– IV



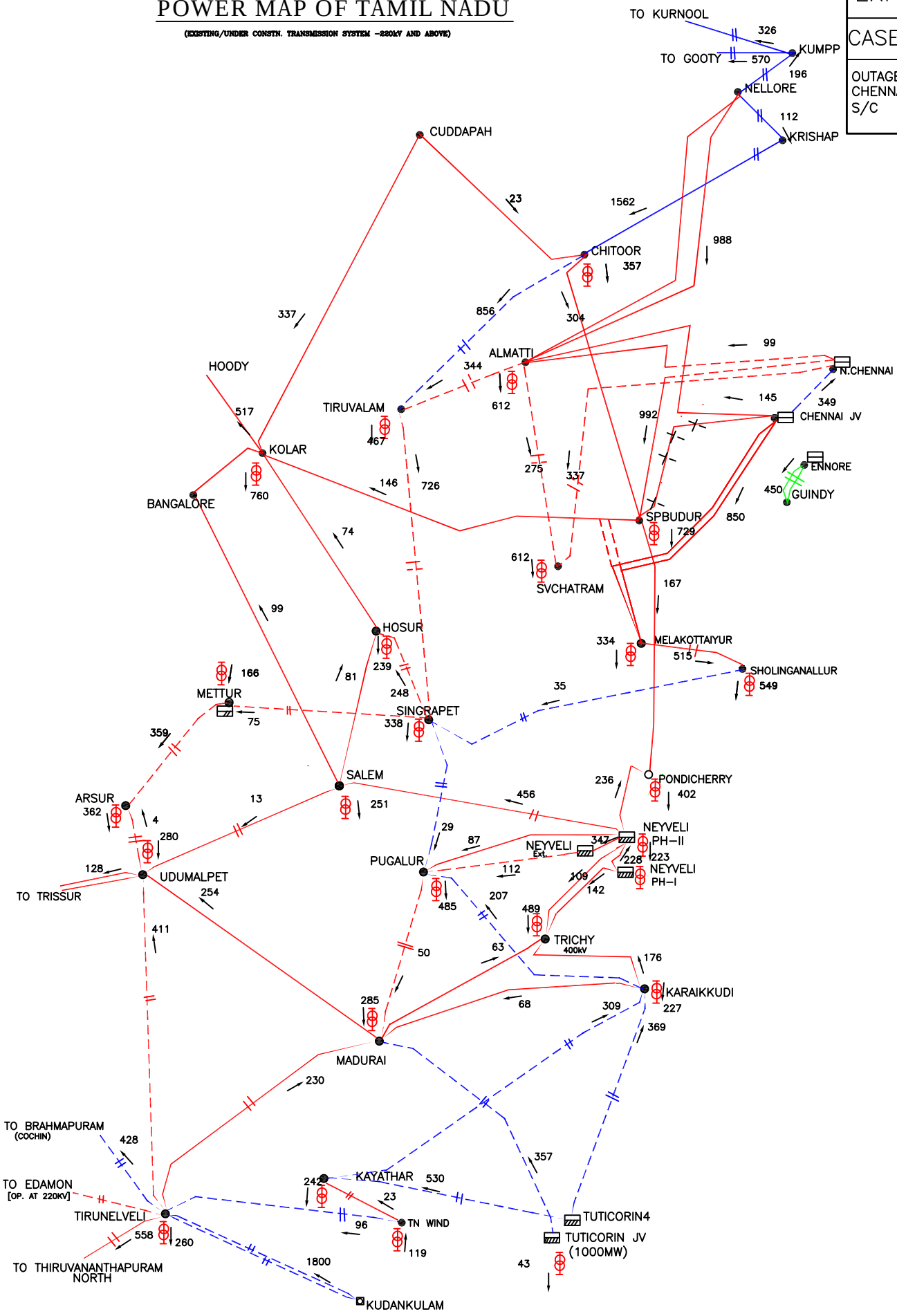
POWER MAP OF TAMIL NADU

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM -220kV AND ABOVE)

EXHIBIT- 11

CASE:ALT- IV

OUTAGE OF CHENNAIJV-SPBUDUR S/C



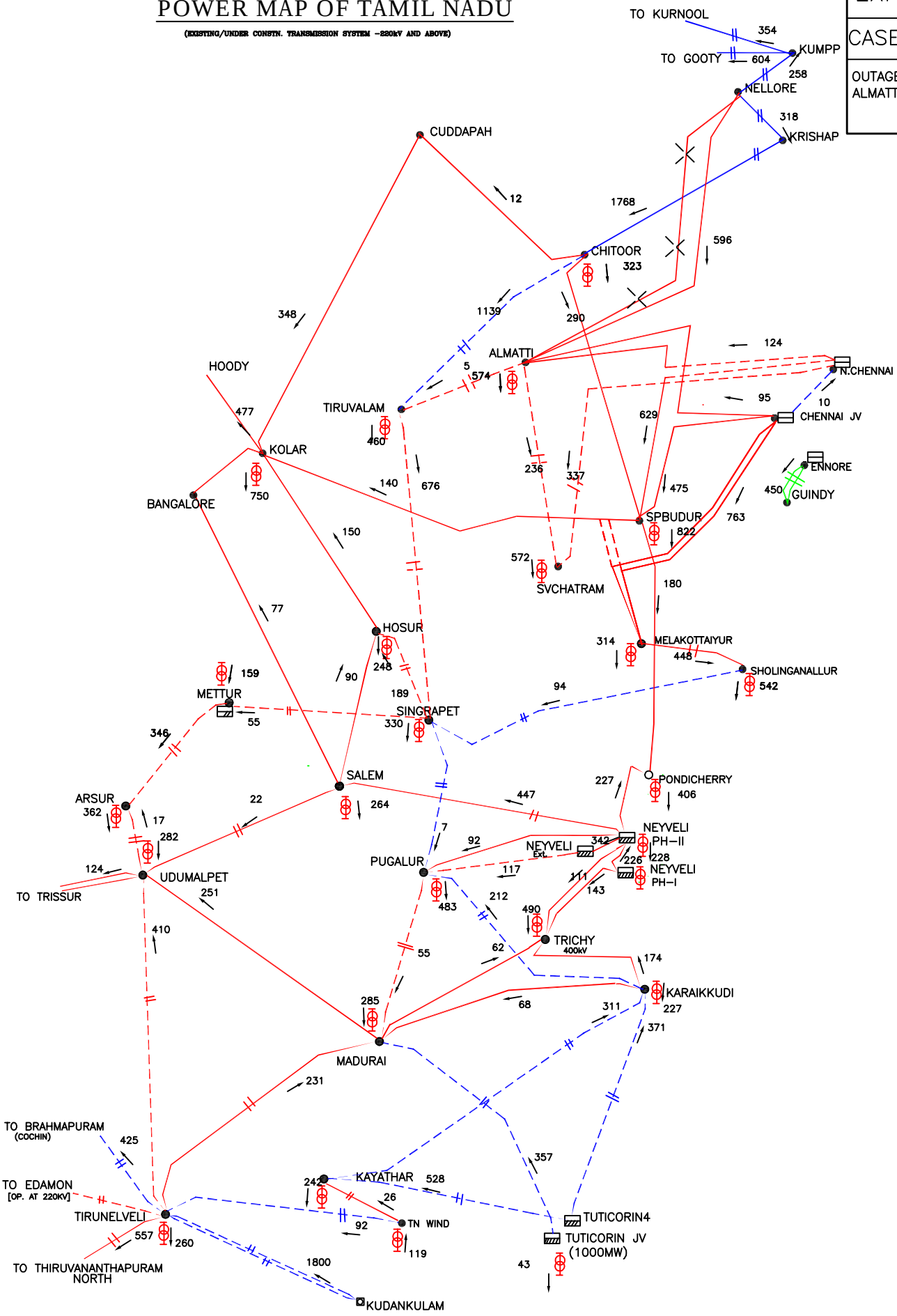
POWER MAP OF TAMIL NADU

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM –220kV AND ABOVE)

EXHIBIT– 12

CASE:ALT–IV

OUTAGE OF NELLORE–ALMATTI S/C



ANNEX-II

Studies for Karnataka

(1) Linking of Yelahanka 400/220kV S/S, and

(2) Strengthening of 400kV Ring Around Bangalore including a new Electronic City 400/220kV S/S of KPTCL in Bangalore

AND

(3) KPTCL Proposal for Evolving Transmission System for Yeramas/Edlapur (2x800 MW + 1x800 MW) Generation Projects

Sl. No.	Description		Exhibit
	For Bangalore Ring		
1.	Alt-I	Studies for linking of Yelahanka, And Bangalore Ring - Base Alternative	Exhibit - I
2.	Alt-II	Bangalore Ring - additional strengthening	Exhibit - II

Sl. No.	Description		Exhibit
	For Yeramas/Edlapur generation evacuation		
3.	Alt-I	KPTCL Proposal for Gooty-Hiriyur-Basvana Bagewadi-Sholapur 765kV 2xS/C lines instead of Kurnool-Raichur-Sholapur 765kV 2xS/C lines, and additional system for Yeramas/Edlapur	Exhibit - III
4.	Alt-II	Additional Yeramas/Edlapur transmission system keeping the system as decided for Krishnapatnam UMPP	Exhibit - IV
5.	Alt-III	Additional Yeramas/Edlapur transmission system keeping the system as decided for Krishnapatnam UMPP	Exhibit - V

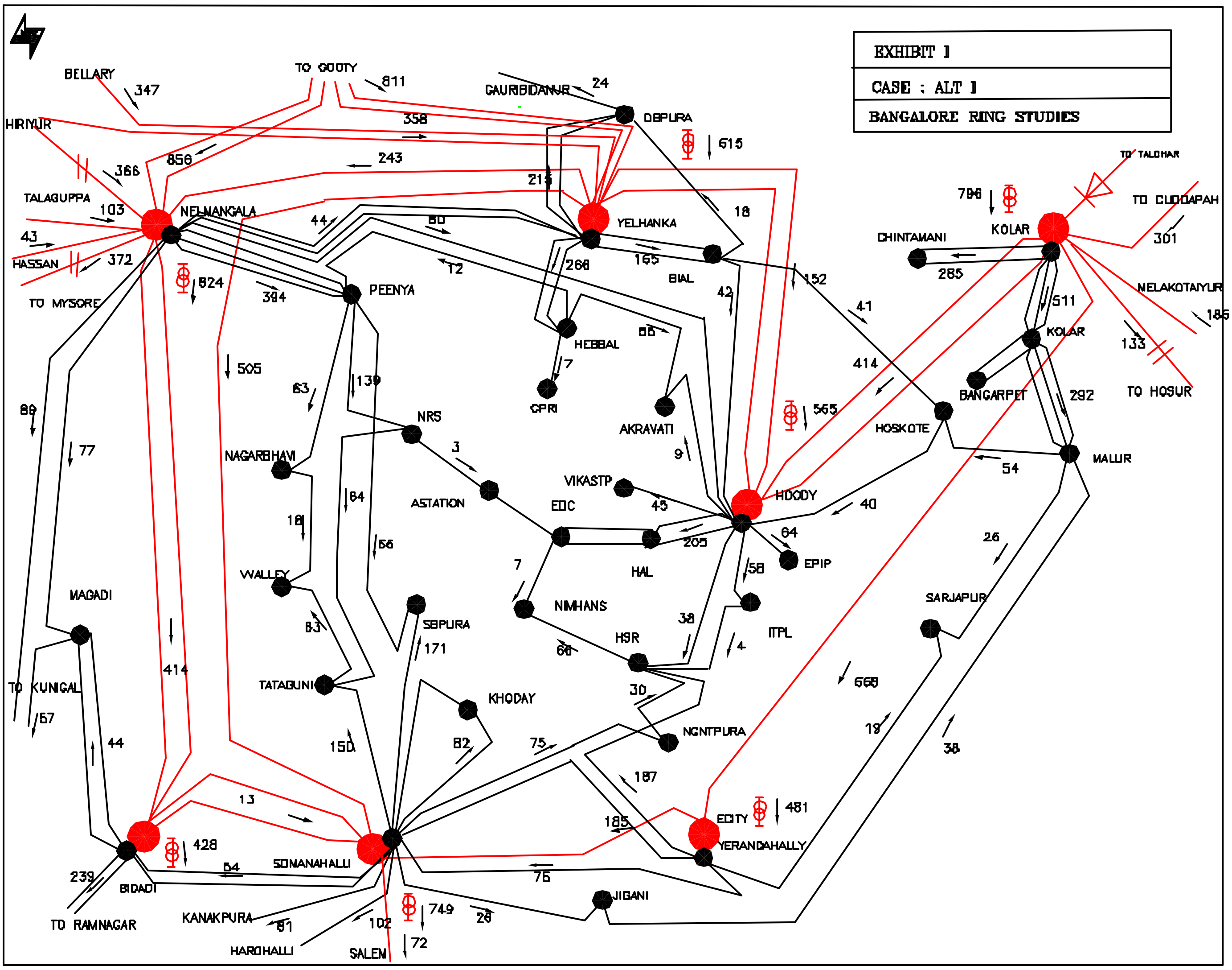


EXHIBIT 1
CASE : ALT 1
BANGALORE RING STUDIES
BELLARY
HIRIYUR
TALAGUPPA
HASSAN
TO MYSORE
TO GOOTY
GAURIBIDANUR
DBPURA
NELMANGALA
PEENYA
YELHANKA
BIAL
HEBBAL
CPRI
AKRAVATI
CHINTAMANI
KOLAR
TO TALCHAR
TO CUDDAPAH
MELAKOTAIYUR
TO HOSUR
BANGARPET
HOSKOTE
MALUR
NRS
NAGARBHAVI
ASTATION
VIKASTP
HOODY
EDC
HAL
EPIP
ITPL
NIMHANS
HSR
WALLEY
MAGADI
SBPURA
TATAGUNI
TO KUNIGAL
KHODAY
NGNTPURA
SARJAPUR
EDITY
YERANDAHALLY
SOMANAHALLI
BIDADI
TO RAMNAGAR
KANAKPURA
HAROHALLI
SALEM
JIGANI

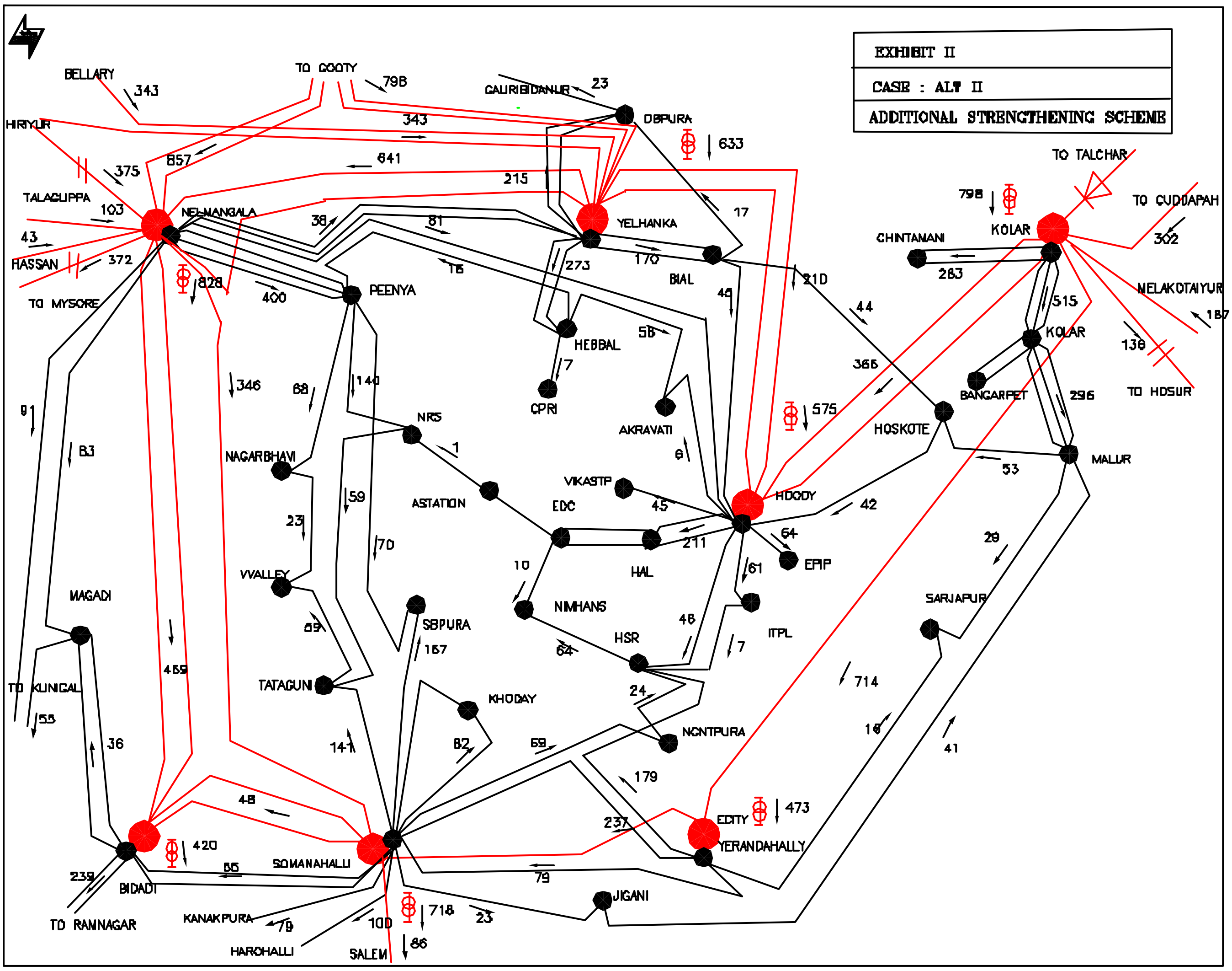
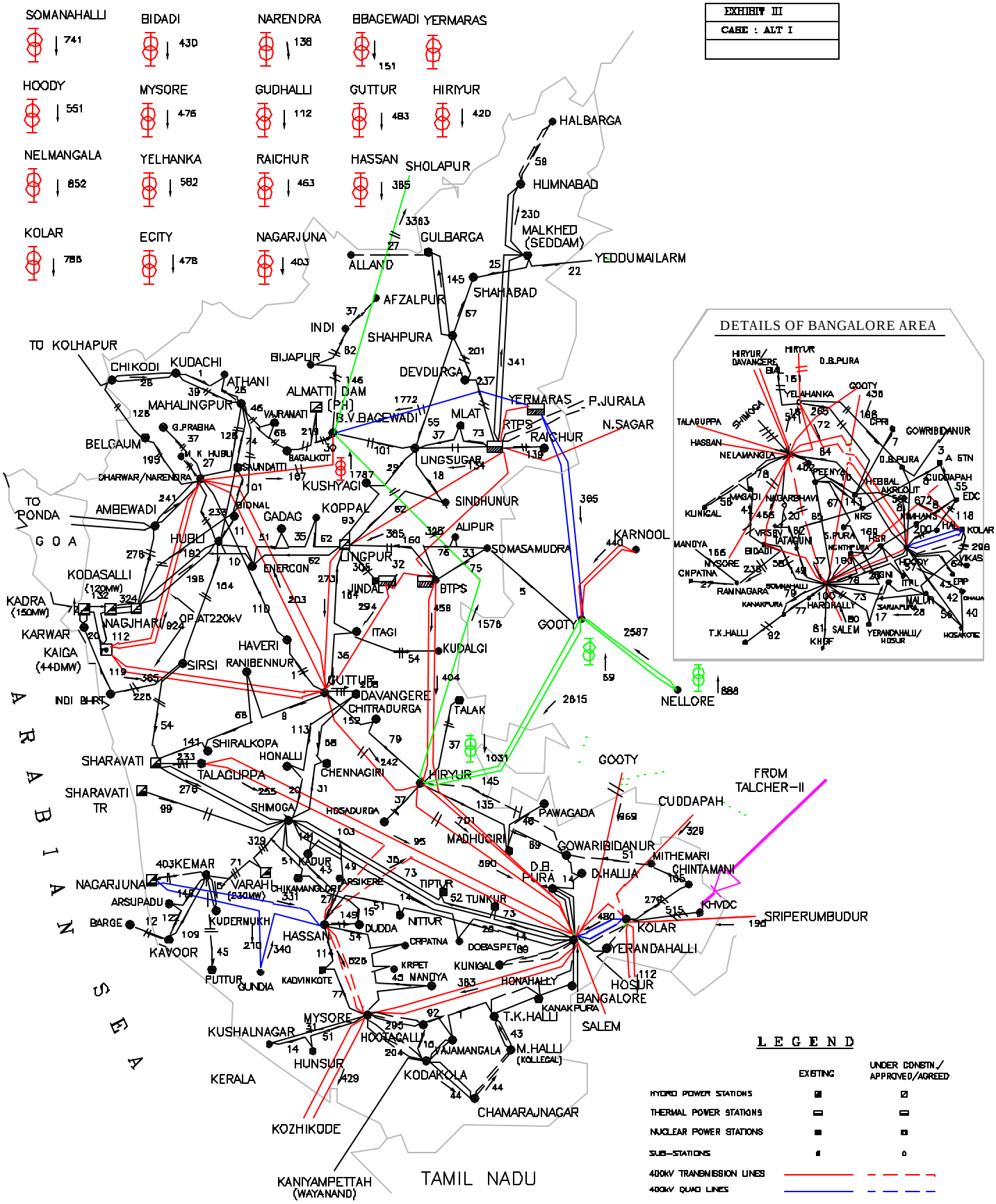


EXHIBIT II
CASE : ALT II
ADDITIONAL STRENGTHENING SCHEME
BELLARY
TO GOOTY
GAURIBIDANUR
DBPURA
HIRIYUR
TALAGUPPA
HASSAN
TO MYSORE
NELAMANGALA
YELHANKA
BIAL
PEENYA
HEBBAL
CPRI
AKRAVATI
NRS
NAGARBHAVI
ASTATION
VIKASTP
HOODY
EDC
HAL
EPIP
ITPL
NIMHANS
HSR
VVALLEY
SBPURA
TATAGUNI
KHODAY
NCNTPURA
MAGADI
TO KUNIGAL
BIDADI
TO RAMNAGAR
SOMANAHALLI
KANAKPURA
HAROHALLI
SALEM
JIGANI
ECITY
YERANDAHALLY
SARJAPUR
HOSKOTE
CHINTAMANI
KOLAR
BANGARPET
MALUR
TO TALCHAR
TO CUDDAPAH
MELAKOTAIYUR
TO HOSUR

POWER MAP OF KARNATAKA

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM -220kV AND ABOVE)

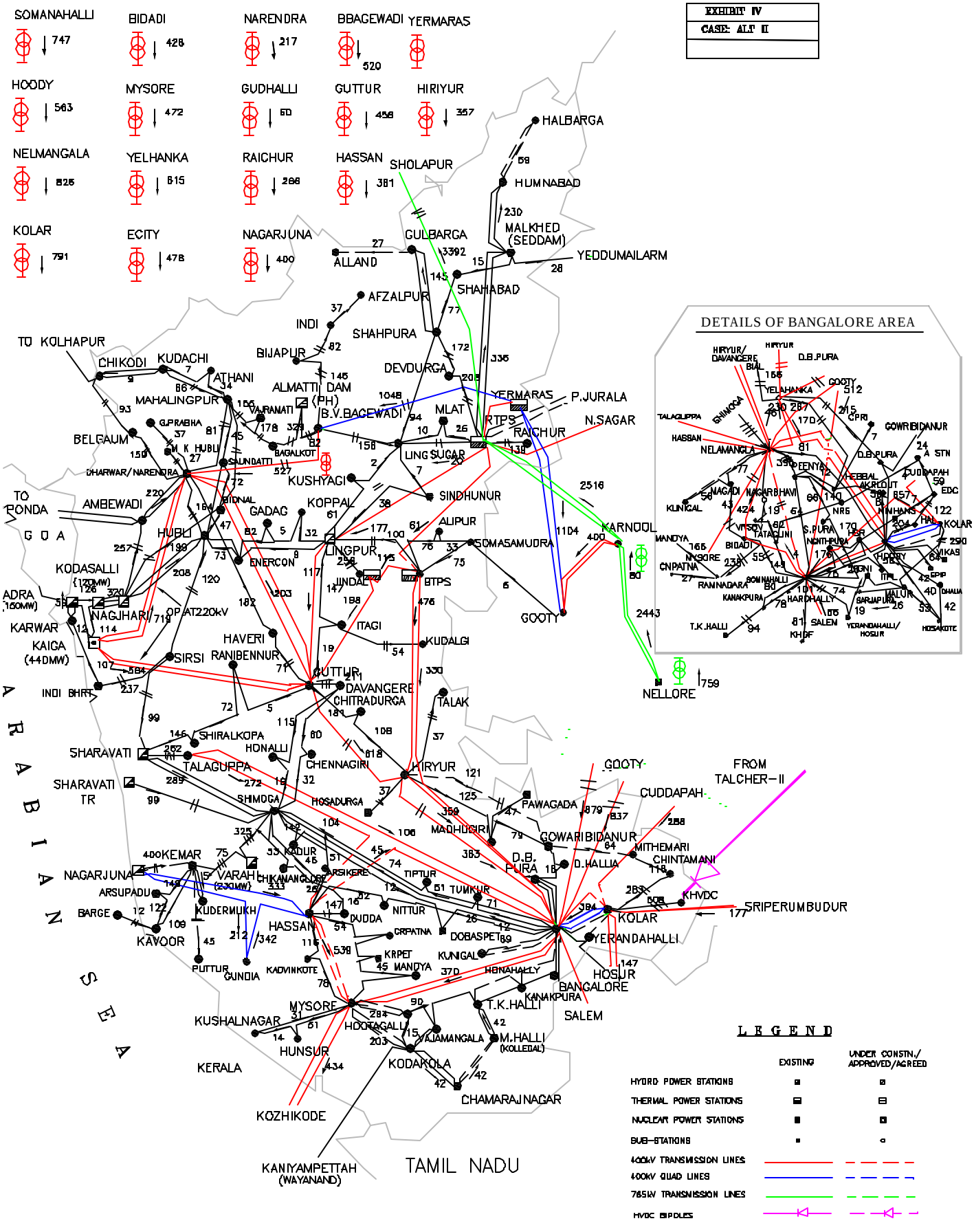
EXHIBIT III
CASE : ALT I



POWER MAP OF KARNATAKA

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM –220kV AND ABOVE)

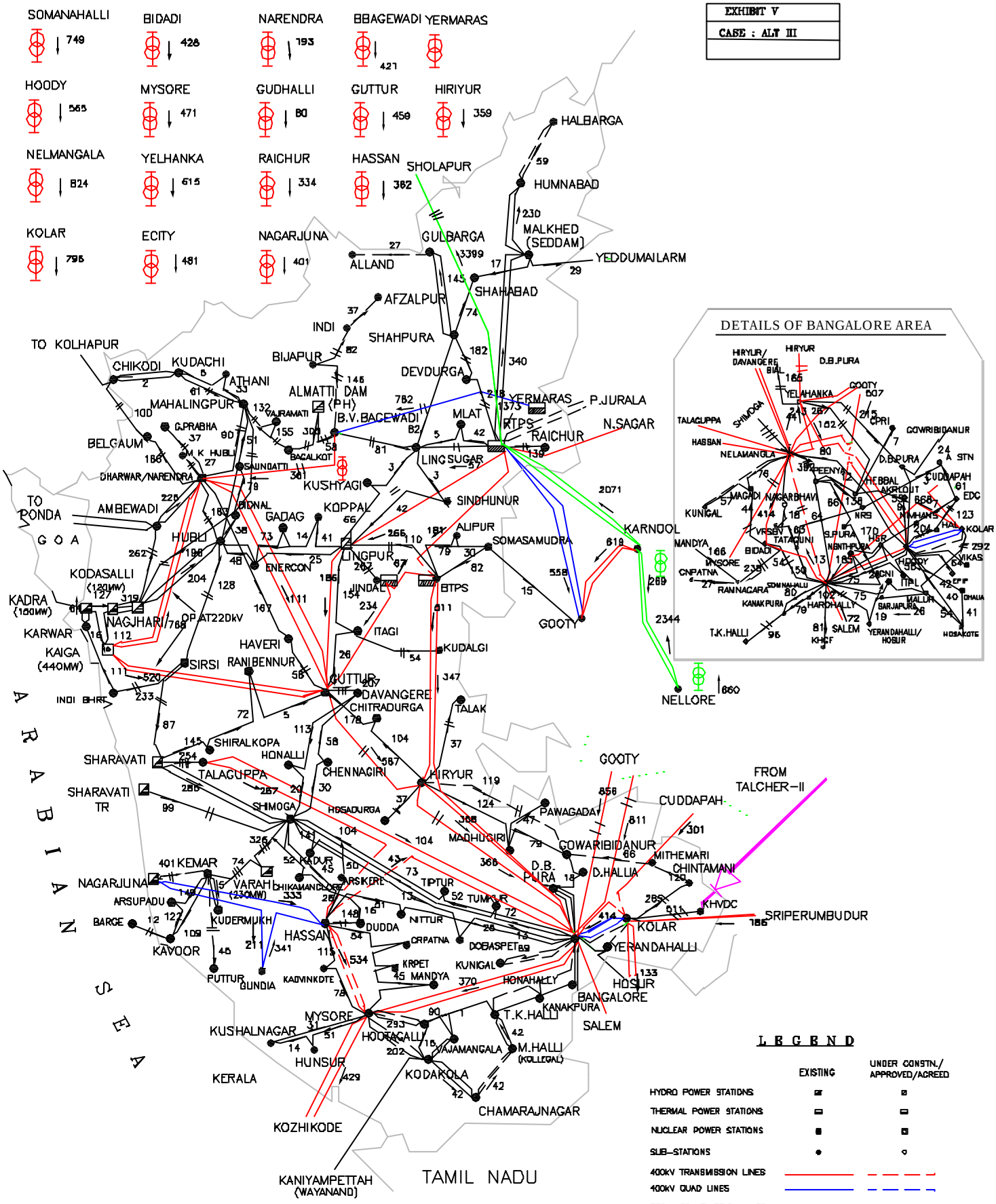
EXHIBIT IV
CASE: ALT II



POWER MAP OF KARNATAKA

(EXISTING/UNDER CONSTN. TRANSMISSION SYSTEM –220kV AND ABOVE)

EXHIBIT V
CASE : ALT III



ANNEX-III

Studies for Kothagudam TPS VI (1x500 MW) Transmission System

Sl. No.	Alternative	Case Description	Exhibit
1.	Alt-I	KTPS – Khammam 400kV D/C line	Exhibit - I
2.	Alt-II	KTPS – Khammam 400kV D/C line and KTPS – Suryapet 400kV S/C line	Exhibit - II
3	Alt-III	KTPS – Khammam 400kV D/C line with 220kV bus split to evacuate 1x250 MW of KTPS'D' at 400kV	Exhibit - III
	Alt-IV	KTPS – Khammam 400kV D/C with 400/220kV Phase Shifting Transformer at KTPS. Following phase shift angle were studied:	
4.	(i)	10^o Phase shift	Exhibit - IV
5.	(ii)	12^o Phase shift	Exhibit - V
6.	(iii)	15^o Phase shift	Exhibit - VI
7.	(iv)	20^o Phase shift	Exhibit - VII
8.	Alt-IV (Outage Case)	20^o Phase shift. Outage of one circuit of KTPS-Khammam 400kV D/C line	Exhibit - VIII

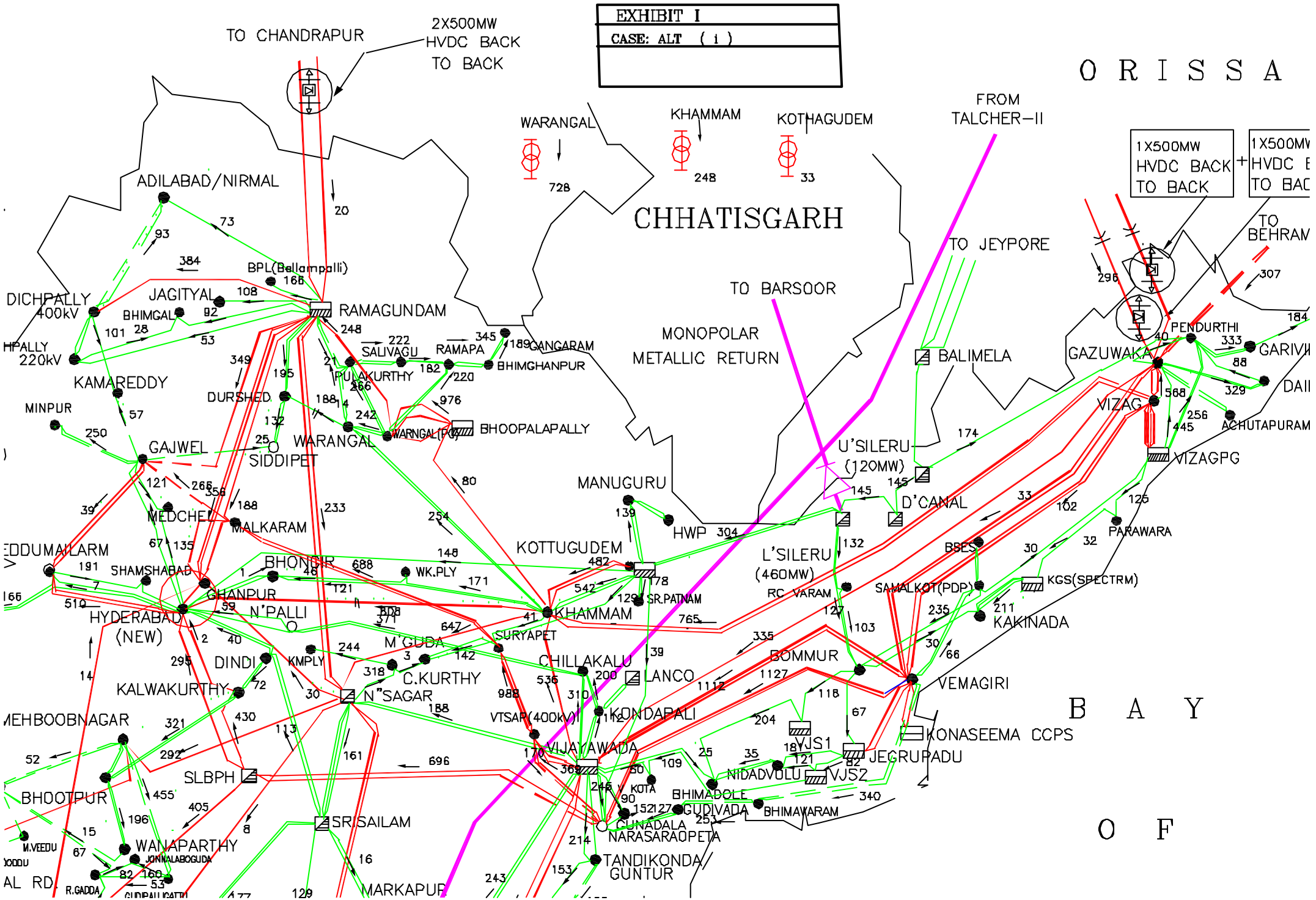


EXHIBIT I
CASE: ALT (1)
TO CHANDRAPUR
2X500MW
HVDC BACK
TO BACK
ORISSA
WARANGAL
KHAMMAM
KOTHAGUDEM
FROM
TALCHER-II
1X500MW
HVDC BACK
TO BACK
TO
BEHRAM
ADILABAD/NIRMAL
CHHATISGARH
TO JEYPORE
TO BARSOOR
MONOPOLAR
METALLIC RETURN
BPL(Bellampalli)
DICHPALLY
400kV
JAGITYAL
BHIMGAL
RAMAGUNDAM
HPALLY
220kV
KAMAREDDY
SALIVAGU
RAMAPA
GANGARAM
BHIMGHANPUR
PULAKURTHY
DURSHED
BHOOPALAPALLY
WARANGAL(PG)
WARANGAL
MINPUR
GAJWEL
SIDDIPET
MANUGURU
HWP
U'SILERU
(120MW)
BALIMELA
GAZUWAKA
PENDURTHI
VIZAG
VIZAGPG
ACHUTAPURAM
GARIVI
DAI
D'CANAL
PARAWARA
MEDCHEL
MALKARAM
KOTTUGUDEM
L'SILERU
(460MW)
BBES
SAMALKOT(PDP)
KGS(SPECTRM)
KAKINADA
EDDUMAILARM
SHAMSHABAD
BHONGIR
WK.PLY
GHANPUR
N'PALLI
HYDERABAD
(NEW)
KHAMMAM
SR.PATNAM
RC VARAM
M'GUDA
SURYAPET
DINDI
KMPLY
C.KURTHY
N"SAGAR
CHILLAKALU
LANCO
BOMMUR
VEMAGIRI
KALWAKURTHY
KONDAPALI
VTSAP(400kV)
MEHBOOBNAGAR
VIJAYAWADA
VJS1
KONASEEMA CCPS
JEGRUPADU
SLBPH
NIDADVOLU
VJS2
BHOOTPUR
KOTA
BHIMADOLE
GUDIVADA
BHIMAVARAM
SR.SAILAM
GUNADALA
NARASARAOPETA
WANAPARTHY
JONNALABOGUDA
TANDIKONDA
GUNTUR
MARKAPUR
BAY
OF

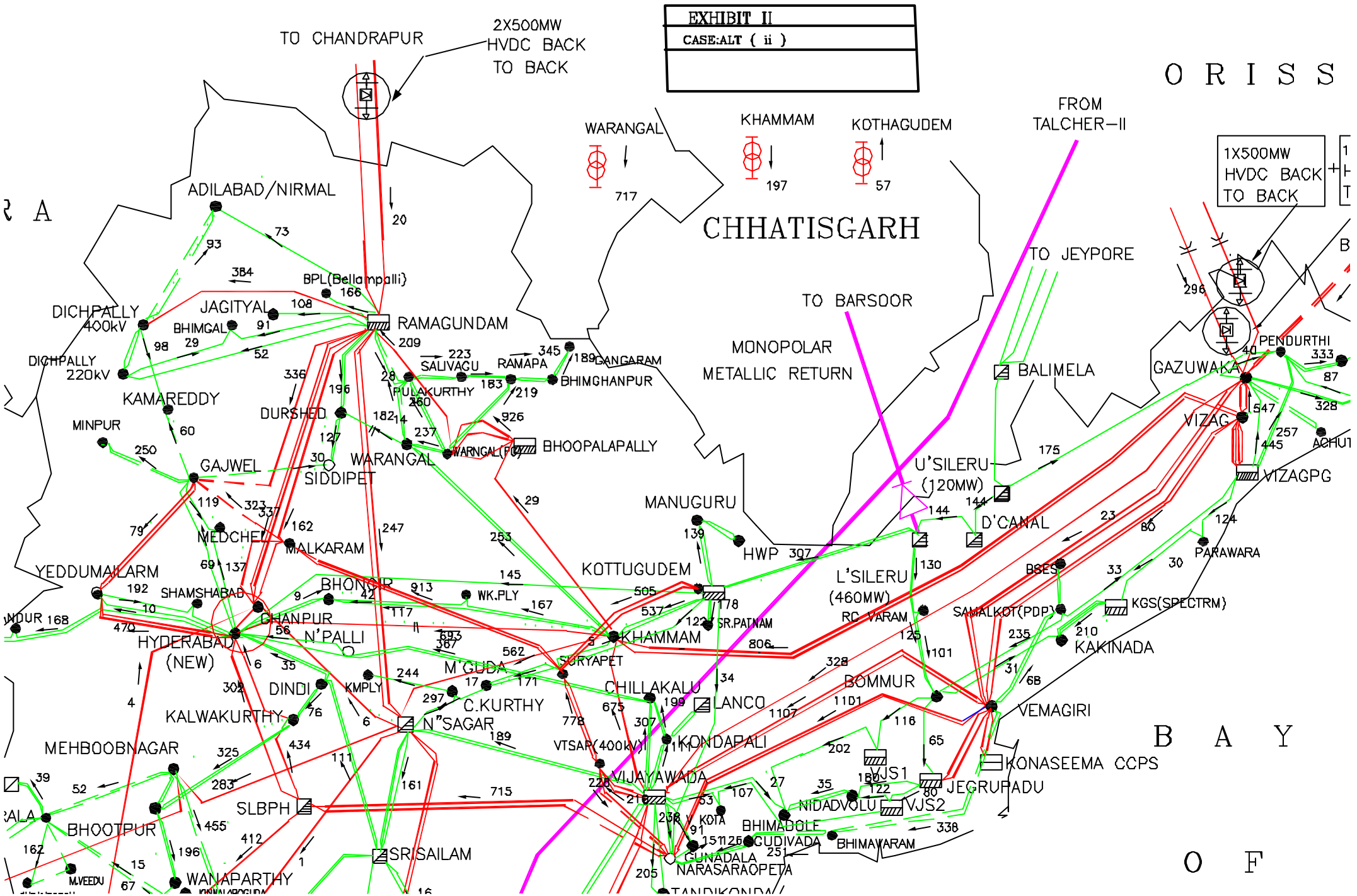


EXHIBIT II
CASE:ALT (ii)
TO CHANDRAPUR
2X500MW
HVDC BACK
TO BACK
WARANGAL
717
KHAMMAM
197
KOTHAGUDEM
57
FROM
TALCHER-II
1X500MW
HVDC BACK
TO BACK
CHHATISGARH
TO JEYPORE
TO BARSOOR
MONOPOLAR
METALLIC RETURN
ADILABAD/NIRMAL
BPL(Bellampalli)
DICHPALLY
400kV
JAGITYAL
BHIMGAL
RAMAGUNDAM
DICHPALLY
220kV
KAMAREDDY
SALIVAGU
RAMAPA
GANGARAM
BHIMGHANPUR
PULAKURTHY
DURSHED
MINPUR
GAJWEL
SIDDIPET
WARANGAL
WARNGAL(PG)
BHOOPALAPALLY
MANUGURU
HWP
U'SILERU
(120MW)
D'CANAL
L'SILERU
(460MW)
RC VARAM
BALIMELA
GAZUWAKA
PENDURTHI
VIZAG
VIZAGPG
ACHUT
PARAWARA
BSES
SAMALKOT(PDP)
KGS(SPECTRM)
KAKINADA
MEDCHEL
MALKARAM
YEDDUMAILARM
SHAMSHABAD
BHONGIR
WK.PLY
CHANPUR
N'PALLI
HYDERABAD
(NEW)
KOTTUGUDEM
SR.PATNAM
KHAMMAM
SURYAPET
M'GUDA
DINDI
KMPLY
C.KURTHY
N"SAGAR
KALWAKURTHY
CHILLAKALU
LANCO
KONDAPALI
VTSAP(400kV)
VIJAYAWADA
BOMMUR
VEMAGIRI
KONASEEMA CCPS
VJS1
VJS2
NIDADVOLU
JEGRUPADU
BHIMADOLE
GUDIVADA
BHIMAVARAM
GUNADALA
NARASARAOPETA
KOTA
MEHBOOBNAGAR
BHOOTPUR
SLBPH
SRISAILAM
WANAPARTHY
M.VEEDU
O R I S S
B A Y
O F

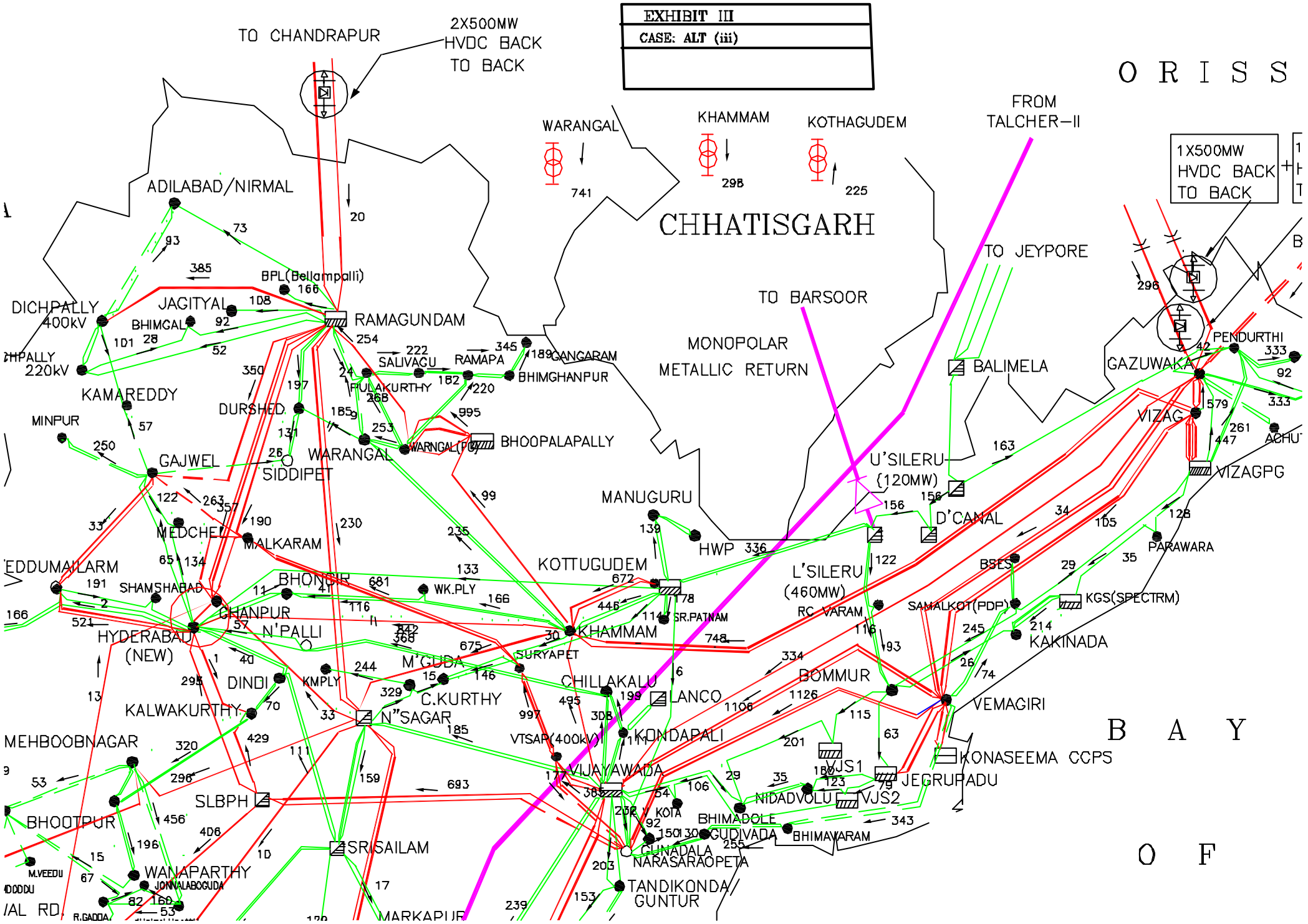


EXHIBIT III
CASE: ALT (iii)
TO CHANDRAPUR
2X500MW
HVDC BACK
TO BACK
WARANGAL
741
KHAMMAM
298
KOTHAGUDEM
225
FROM
TALCHER-II
1X500MW
HVDC BACK
TO BACK
ORISS
CHHATISGARH
TO JEYPORE
TO BARSOOR
MONOPOLAR
METALLIC RETURN
ADILABAD/NIRMAL
DICHPALLY
400kV
JAGITYAL
BHIMGAL
BPL(Bellampalli)
RAMAGUNDAM
DICHPALLY
220kV
KAMAREDDY
MINPUR
GAJWEL
SIDDIPET
DURSHED
SALIVAGU
RAMAPA
GANGARAM
BHIMGHANPUR
FULAKURTHY
WARANGAL
WARNGAL(PG)
BHOOPALAPALLY
MANUGURU
HWP
KOTTUGUDEM
WK.PLY
SR.PATNAM
KHAMMAM
SURYAPET
M'GUDA
C.KURTHY
N"SAGAR
CHILLAKALU
LANCO
KONDAPALI
VTSAP(400kV)
VIJAYAWADA
NIDADVOLU
BHIMADOLE
GUDIVADA
BHIMAVARAM
GUNADALA
NARASARAOPETA
TANDIKONDA/
GUNTUR
MARKAPUR
U'SILERU
(120MW)
L'SILERU
(460MW)
RC VARAM
BALIMELA
D'CANAL
BSES
SAMALKOT(PDP)
KAKINADA
KGS(SPECTRM)
BOMMUR
VEMAGIRI
KONASEEMA CCPS
JEGRUPADU
VJS1
VJS2
GAZUWAKA
PENDURTHI
VIZAG
VIZAGPG
PARAWARA
ACHU
EDDUMAILARM
SHAMSHABAD
HYDERABAD
(NEW)
MEDCHEL
MALKARAM
CHANPUR
N'PALLI
BHONGIR
DINDI
KMPLY
KALWAKURTHY
MEHBOOBNAGAR
BHOOTPUR
WANAPARTHY
JONNALABOGUDA
SLBPH
SRISAILAM
M.VEEDU
R.GADDA
/AL RD
BAY
OF

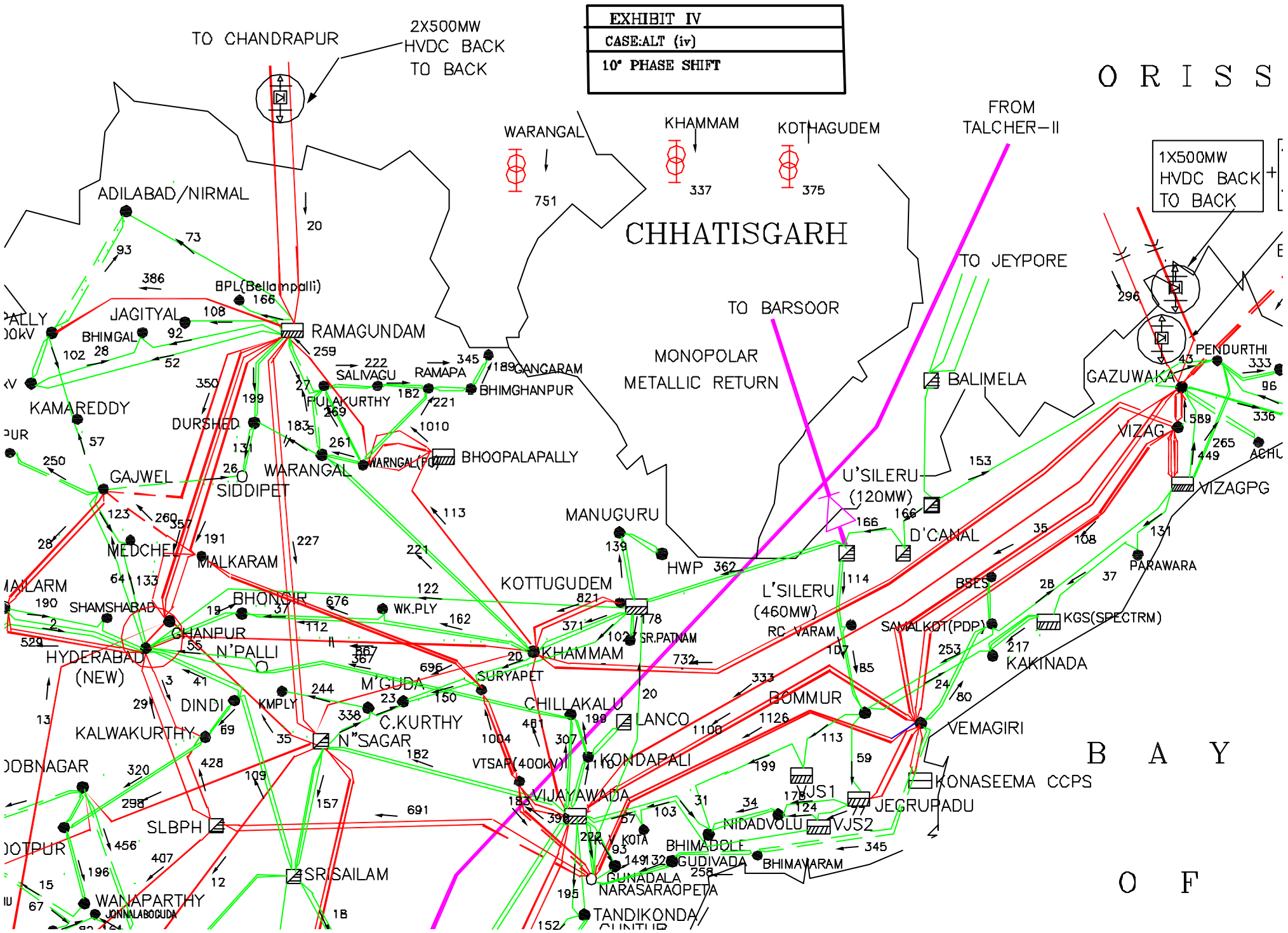


EXHIBIT IV
CASE:ALT (iv)
10° PHASE SHIFT
TO CHANDRAPUR
2X500MW
HVDC BACK
TO BACK
WARANGAL
751
KHAMMAM
337
KOTHAGUDEM
375
FROM
TALCHER-II
1X500MW
HVDC BACK
TO BACK
ORISS
CHHATISGARH
TO JEYPORE
TO BARSOOR
MONOPOLAR
METALLIC RETURN
ADILABAD/NIRMAL
BPL(Bellampalli)
JAGITYAL
BHIMGAL
RAMAGUNDAM
KAMAREDDY
DURSHED
SALIVAGU
RAMAPA
GANGARAM
BHIMGHANPUR
PULAKURTHY
BHOOPALAPALLY
WARANGAL
WARNGAL(PG)
SIDDIPET
GAJWEL
MEDCHEL
MALKARAM
MANUGURU
HWP
KOTTUGUDEM
BHONGIR
WK.PLY
SHAMSHABAD
GHANPUR
HYDERABAD
(NEW)
N'PALLI
SURYAPET
KHAMMAM
SR.PATNAM
M'GUDA
DINDI
KMPLY
C.KURTHY
KALWAKURTHY
N"SAGAR
CHILLAKALU
LANCO
KONDAPALI
VTSAP(400kV)
VIJAYAWADA
SLBPH
SRISAILAM
WANAPARTHY
JONNALABOGUDA
NARASARAOPETA
TANDIKONDA
GUNADALA
GUDIVADA
BHIMADOLE
BHIMAVARAM
NIDADVOLU
VJS1
VJS2
JEGRUPADU
KONASEEMA CCPS
VEMAGIRI
BOMMUR
RC VARAM
L'SILERU
(460MW)
U'SILERU
(120MW)
BALIMELA
D'CANAL
VIZAG
VIZAGPG
GAZUWAKA
PENDURTHI
PARAWARA
BSES
SAMALKOT(PDP)
KGS(SPECTRM)
KAKINADA
B A Y
O F

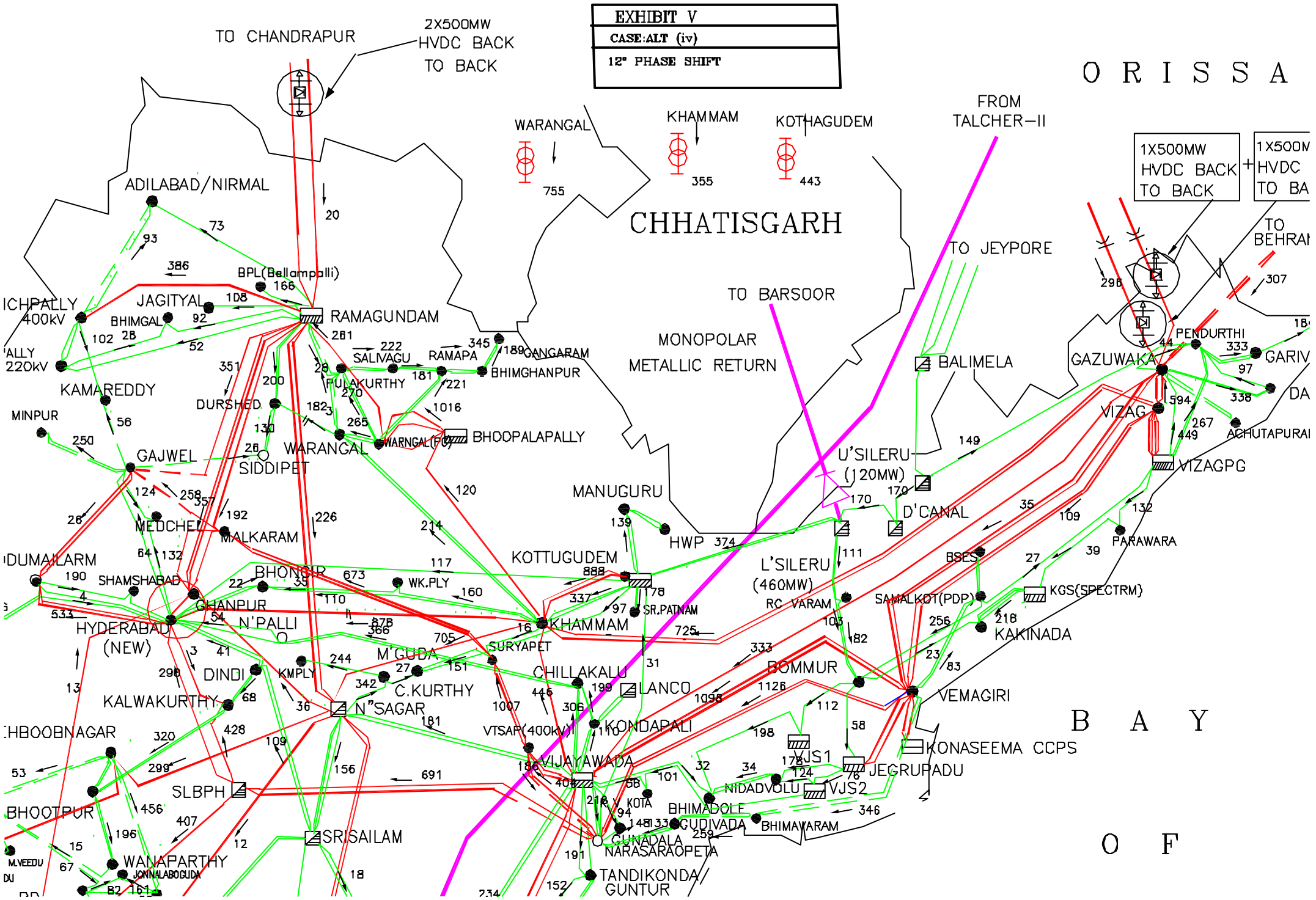


EXHIBIT V
CASE:ALT (iv)
12° PHASE SHIFT
TO CHANDRAPUR
2X500MW
HVDC BACK
TO BACK
ORISSA
WARANGAL
755
KHAMMAM
355
KOTHAGUDEM
443
FROM
TALCHER-II
1X500MW
HVDC BACK
TO BACK
1X500M
HVDC
TO BA
TO
BEHRAI
CHHATISGARH
TO JEYPORE
TO BARSOOR
MONOPOLAR
METALLIC RETURN
ADILABAD/NIRMAL
BPL(Bellampalli)
ICHPALLY
400kV
JAGITYAL
BHIMGAL
RAMAGUNDAM
'ALLY
220kV
KAMAREDDY
MINPUR
GAJWEL
SIDDIPET
MEDCHEL
MALKARAM
DUMAILARM
SHAMSHABAD
BHONGIR
GHANPUR
N'PALLI
HYDERABAD
(NEW)
DINDI
KALWAKURTHY
KMPLY
M'GUDA
C.KURTHY
N"SAGAR
:HBOOBNAGAR
SLBPH
BHOOTPUR
WANAPARTHY
JONNALABOGUDA
M.VEEDU
SRISAILAM
DURSHED
SALIVAGU
RAMAPA
GANGARAM
BHIMGHANPUR
PULAKURTHY
WARANGAL
WARNGAL(PG)
BHOOPALAPALLY
WK.PLY
SURYAPET
VTSAP(400kV)
MANUGURU
HWP
KOTTUGUDEM
SR.PATNAM
KHAMMAM
CHILLAKALU
LANCO
KONDAPALI
VIJAYAWADA
KOTA
GUNADALA
NARASARAOPETA
TANDIKONDA
GUNTUR
BHIMADOLE
GUDIVADA
BHIMAVARAM
NIDADVOLU
VJS1
VJS2
JEGRUPADU
U'SILERU
(120MW)
L'SILERU
(460MW)
RC VARAM
BALIMELA
D'CANAL
BSES
SAMALKOT(PDP)
BOMMUR
VEMAGIRI
KONASEEMA CCPS
KAKINADA
KGS(SPECTRM)
PARAWARA
ACHUTAPURAI
VIZAGPG
VIZAG
GAZUWAKA
PENDURTHI
GARIV
DA
B A Y
O F

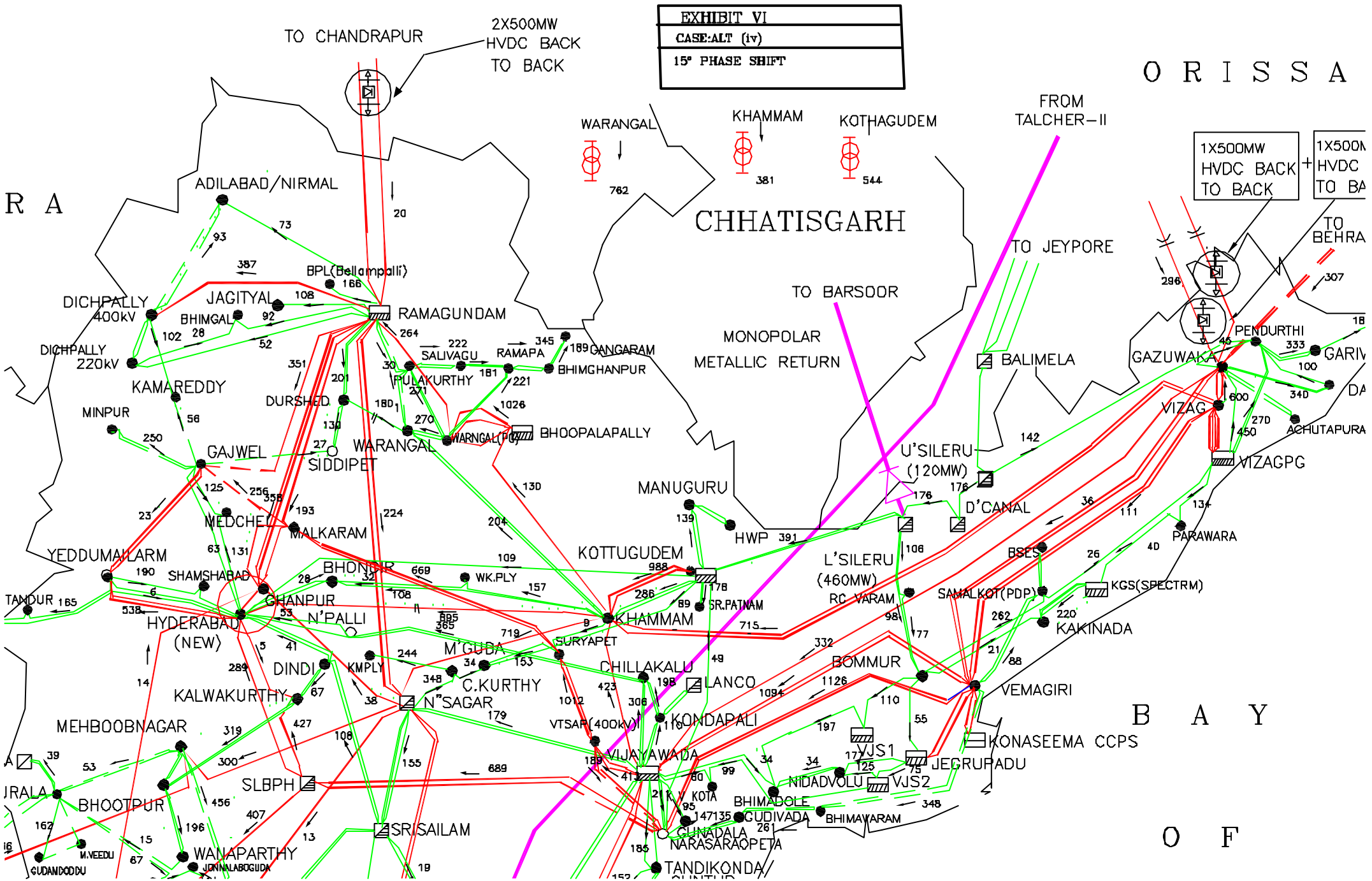


EXHIBIT VI
CASE:ALT (iv)
15° PHASE SHIFT
TO CHANDRAPUR
2X500MW
HVDC BACK
TO BACK
WARANGAL
KHAMMAM
KOTHAGUDEM
762
381
544
FROM
TALCHER-II
ORISSA
CHHATISGARH
TO JEYPORE
TO BARSOOR
MONOPOLAR
METALLIC RETURN
1X500MW
HVDC BACK
TO BACK
TO
BEHRA
ADILABAD/NIRMAL
BPL(Bellampalli)
DICHPALLY
400kV
JAGITYAL
BHIMGAL
DICHPALLY
220kV
RAMAGUNDAM
KAMAREDDY
MINPUR
GAJWEL
SIDDIPET
DURSHED
SALIVAGU
RAMAPA
GANGARAM
BHIMGHANPUR
PULAKURTHY
WARANGAL
WARNGAL(PG)
BHOOPALAPALLY
MANUGURU
HWP
KOTTUGUDEM
KHAMMAM
SR.PATNAM
WK.PLY
SURYAPET
BALIMELA
U'SILERU
(120MW)
D'CANAL
L'SILERU
(460MW)
RC VARAM
BSES
SAMALKOT(PDP)
KGS(SPECTRM)
KAKINADA
PARAWARA
VIZAGPG
VIZAG
GAZUWAKA
PENDURTHI
ACHUTAPURA
YEDDUMAILARM
TANDUR
SHAMSHABAD
HYDERABAD
(NEW)
BHONGIR
CHANPUR
N'PALLI
M'GUDA
DINDI
KMPLY
C.KURTHY
N"SAGAR
KALWAKURTHY
MEHBOOBNAGAR
BHOOTPUR
SLBPH
SRISAILAM
WANAPARTHY
M.VEEDU
GUDAMPODDU
JDNNALABOGUDA
CHILLAKALU
LANCO
KONDAPALI
VTSAP(400kV)
VIJAYAWADA
KOTA
GUNADALA
NARASARAOPETA
TANDIKONDA
BOMMUR
VEMAGIRI
VJS1
VJS2
NIDADVOLU
JEGRUPADU
BHIMADOLE
GUDIVADA
BHIMAVARAM
KONASEEMA CCPS
B A Y
O F

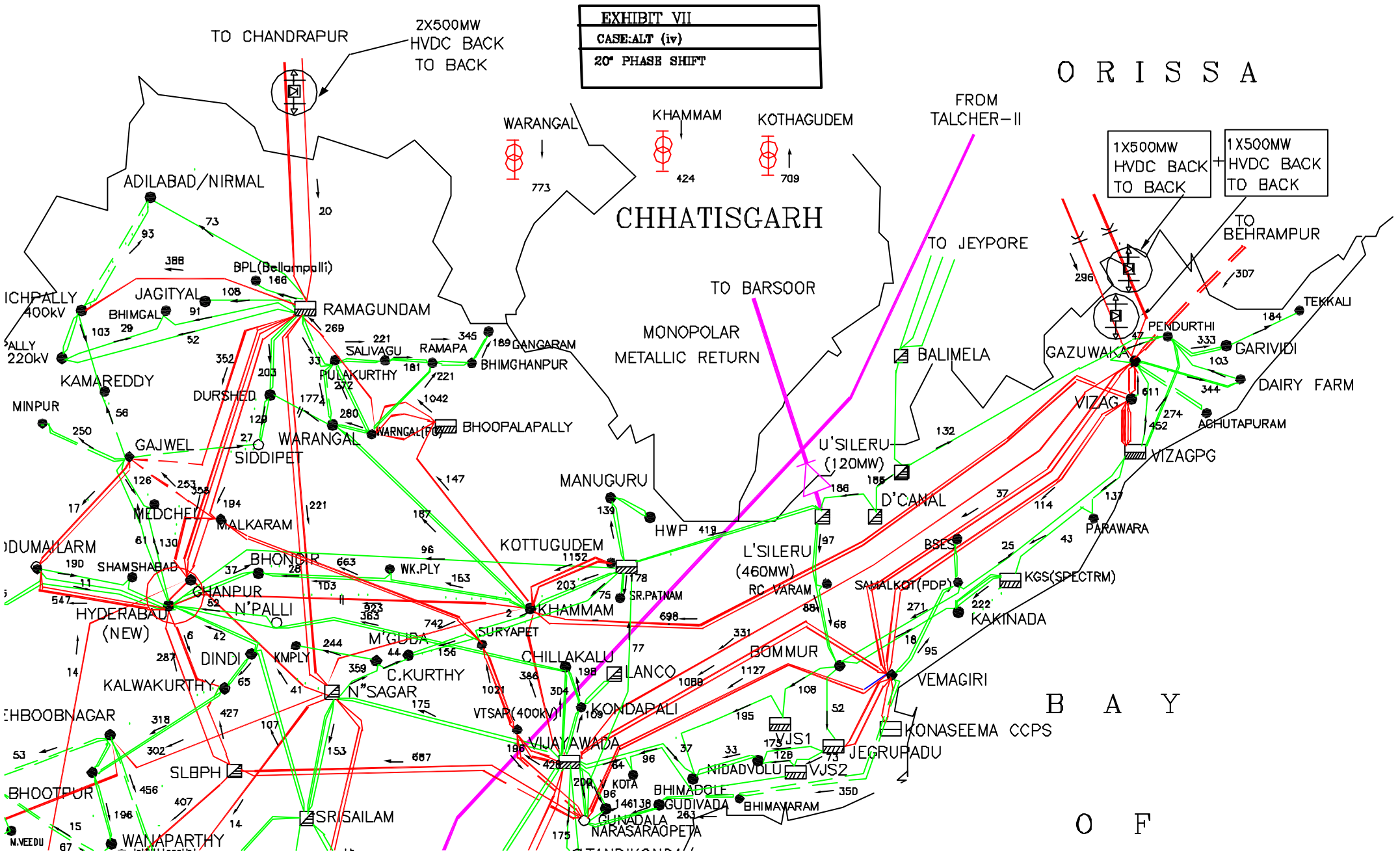


EXHIBIT VII
CASE:ALT (iv)
20° PHASE SHIFT
TO CHANDRAPUR
2X500MW
HVDC BACK
TO BACK
ORISSA
WARANGAL
773
KHAMMAM
424
KOTHAGUDEM
709
FROM
TALCHER-II
1X500MW
HVDC BACK
TO BACK
1X500MW
HVDC BACK
TO BACK
TO
BEHRAMPUR
CHHATISGARH
TO JEYPORE
TO BARSOOR
MONOPOLAR
METALLIC RETURN
ADILABAD/NIRMAL
BPL(Bellampalli)
JAGITYAL
BHIMGAL
ICHPALLY
400kV
ALLY
220kV
RAMAGUNDAM
KAMAREDDY
SALIVAGU
RAMAPA
GANGARAM
BHIMGHANPUR
PULAKURTHY
DURSHED
MINPUR
GAJWEL
SIDDIPET
WARANGAL
WARNGAL(PG)
BHOOPALAPALLY
MEDCHEL
MALKARAM
DUMAILARM
SHAMSHABAD
BHONGIR
WK.PLY
GHANPUR
N'PALLI
HYDERABAD
(NEW)
DINDI
KMPLY
M'GUDA
C.KURTHY
N"SAGAR
KALWAKURTHY
CHBOOBNAGAR
SLBPH
BHOOTPUR
SRISAILAM
WANAPARTHY
N.VEEDU
MANUGURU
HWP
KOTTUGUDEM
SR.PATNAM
KHAMMAM
SURYAPET
CHILLAKALU
LANCO
KONDAPALI
VTSAP(400kV)
VIJAYAWADA
NIDADVOLU
BHIMADOLE
GUDIVADA
GUNADALA
NARASARAOPETA
BHIMAVARAM
U'SILERU
(120MW)
D'CANAL
L'SILERU
(460MW)
RC VARAM
BOMMUR
VEMAGIRI
VJS1
VJS2
JEGRUPADU
KONASEEMA CCPS
BSES
SAMALKOT(PDP)
KAKINADA
KGS(SPECTRM)
PARAWARA
VIZAG
VIZAGPG
GAZUWAKA
PENDURTHI
ACHUTAPURAM
DAIRY FARM
GARIVIDI
TEKKALI
BALIMELA
BAY
OF

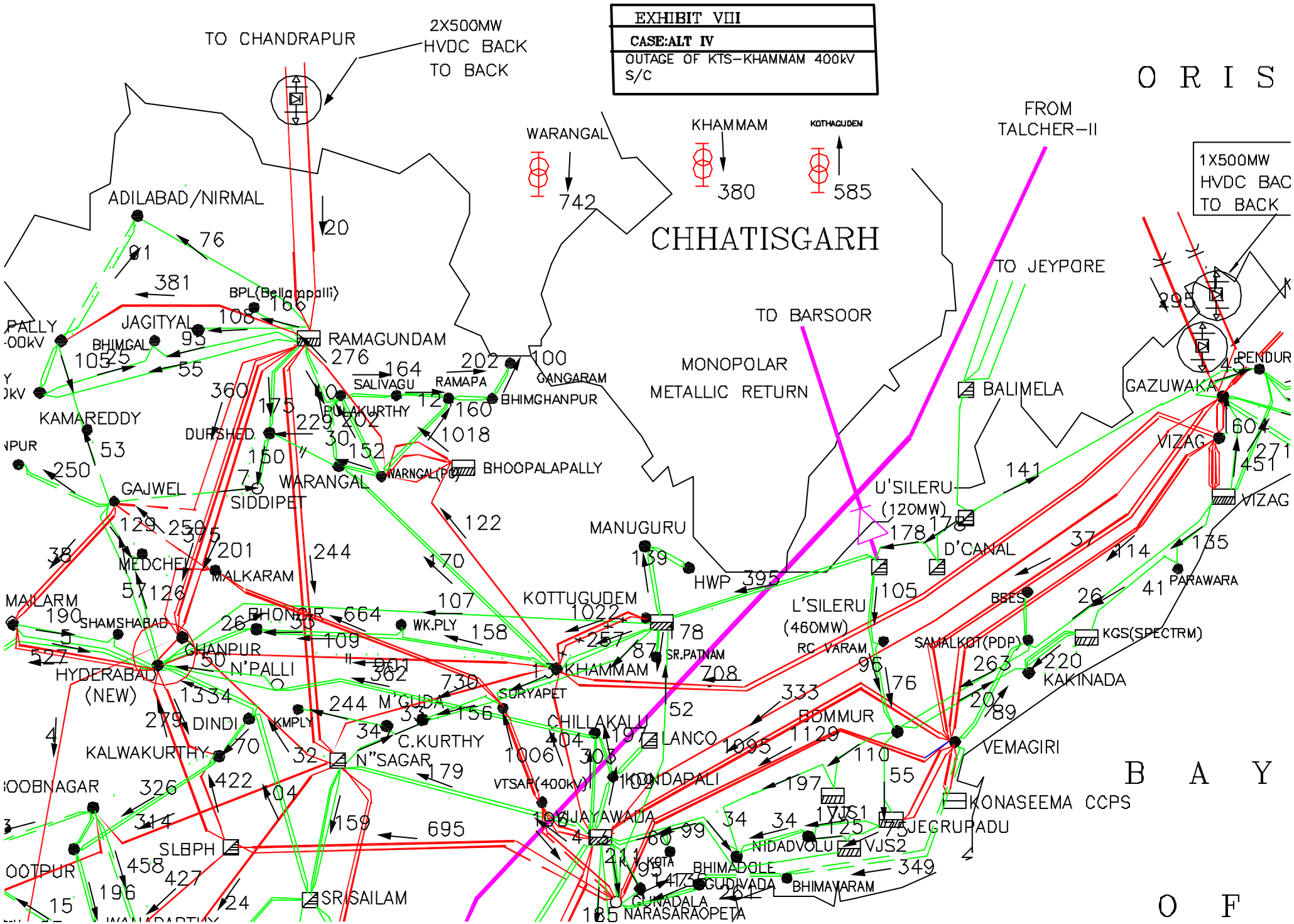


EXHIBIT VIII
CASE:ALT IV
OUTAGE OF KTS-KHAMMAM 400kV S/C
TO CHANDRAPUR
2X500MW HVDC BACK TO BACK
WARANGAL
742
KHAMMAM
380
KOTHAGUDEN
585
FROM TALCHER-II
1X500MW HVDC BAC TO BACK
ORIS
CHHATISGARH
TO JEYPORE
TO BARSOOR
MONOPOLAR METALLIC RETURN
ADILABAD/NIRMAL
BPL(Bellampalli)
JAGITYAL
BHIMGAL
RAMAGUNDAM
SALIVAGU
RAMAPA
GANGARAM
BHIMGHANPUR
BUDAKURTHY
DURSHED
KAMAREDDY
WARANGAL(PG)
BHOOPALAPALLY
WARANGAL
SIDDIPET
GAJWEL
MEDCHEL
MALKARAM
MAILARM
SHAMSHABAD
BHONGIR
WK.PLY
GHANPUR
N'PALLI
HYDERABAD (NEW)
DINDI
KMPLY
KALWAKURTHY
C.KURTHY
N"SAGAR
M'GUDA
SURYAPET
KOTTUGUDEM
KHAMMAM
SR.PATNAM
MANUGURU
HWP
CHILLAKALU
LANCO
KONDAPALI
VTSAP(400kV)
VIJAYAWADA
NIDADVOLU
VJS1
VJS2
SJEGRUPADU
BHIMADOLE
GUDIVADA
BHIMAVARAM
GHANADALA
NARASARAOPETA
U'SILERU (120MW)
L'SILERU (460MW)
D'CANAL
RC VARAM
BBES
SAMALKOT(PDP)
KGS(SPECTRM)
KAKINADA
BOMMUR
VEMAGIRI
KONASEEMA CCPS
PARAWARA
VIZAG
GAZUWAKA
PENDUR
BALIMELA
SLBPH
SRISAILAM
BAY
OF

ANNEX-IV

Studies for Evolving Transmission System for
Bhoopalapally Stage-I (1x500 MW), and
Bhoopalapally Stage-II (1x600 MW) TPS of APGENCO

Sl. No.	Alternative	Case Description	Exhibit
1.	Alt-I	Bhoopalapally – Warangal 400kV D/C line (with Stage-I) and Bhoopalapally – Gajwel 400kV D/C line (with Stage-II)	Exhibit - I
2.	Alt-II	Bhoopalapally – Warangal 400kV D/C line (with Stage-I) and LILO of Warangal – Khammam 400kV S/C line at Bhoopalapally (with Stage-II)	Exhibit - II
3	Alt-II (Outage Case)	Outage of Bhoopalapally – Warangal 400kV one ckt	Exhibit - III

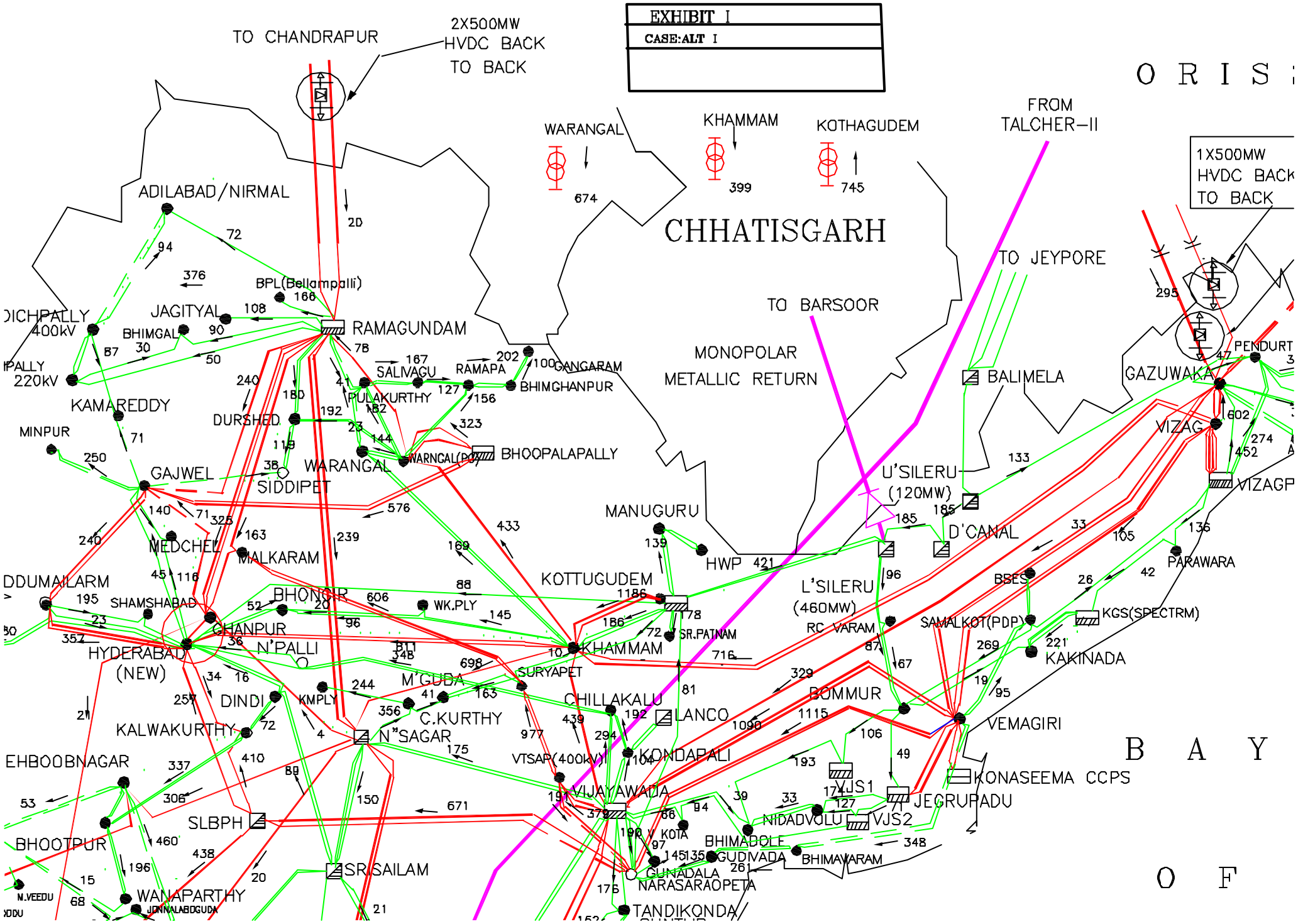


EXHIBIT I
CASE:ALT I
TO CHANDRAPUR
2X500MW
HVDC BACK
TO BACK
WARANGAL
KHAMMAM
KOTHAGUDEM
674
399
745
FROM
TALCHER-II
1X500MW
HVDC BACK
TO BACK
CHHATISGARH
TO JEYPORE
TO BARSOOR
MONOPOLAR
METALLIC RETURN
ADILABAD/NIRMAL
BPL(Bellampalli)
JAGITYAL
RAMAGUNDAM
BHIMGAL
KAMAREDDY
MINPUR
DURSHED
SALIVAGU
RAMAPA
GANGARAM
BHIMGHANPUR
PULAKURTHY
BHOOPALAPALLY
WARANGAL
SIDDIPET
GAJWEL
MEDCHEL
MALKARAM
DDUMAILARM
SHAMSHABAD
BHONGIR
GHANPUR
HYDERABAD
(NEW)
N'PALLI
M'GUDA
SURYAPET
DINDI
KMPLY
KALWAKURTHY
C.KURTHY
N"SAGAR
EHBOOBNAGAR
SLBPH
BHOOTPUR
SRISAILAM
WANAPARTHY
N.VEEDU
MANUGURU
HWP
KOTTUGUDEM
WK.PLY
SR.PATNAM
KHAMMAM
CHILLAKALU
LANCO
KONDAPALI
VTSAP(400kV)
VIJAYAWADA
NARASARAOPETA
TANDIKONDA
U'SILERU
(120MW)
L'SILERU
(460MW)
RC VARAM
BALIMELA
D'CANAL
BBES
SAMALKOT(PDP)
KAKINADA
KGS(SPECTRM)
PARAWARA
GAZUWAKA
VIZAG
VIZAGP
PENDURT
BOMMUR
VEMAGIRI
VJS1
VJS2
JEGURUPADU
KONASEEMA CCPS
NIDADVOLU
BHIMADOLE
BHIMAVARAM
GUDIVADA
GUNADALA
KOTA
ORIS
BAY
OF

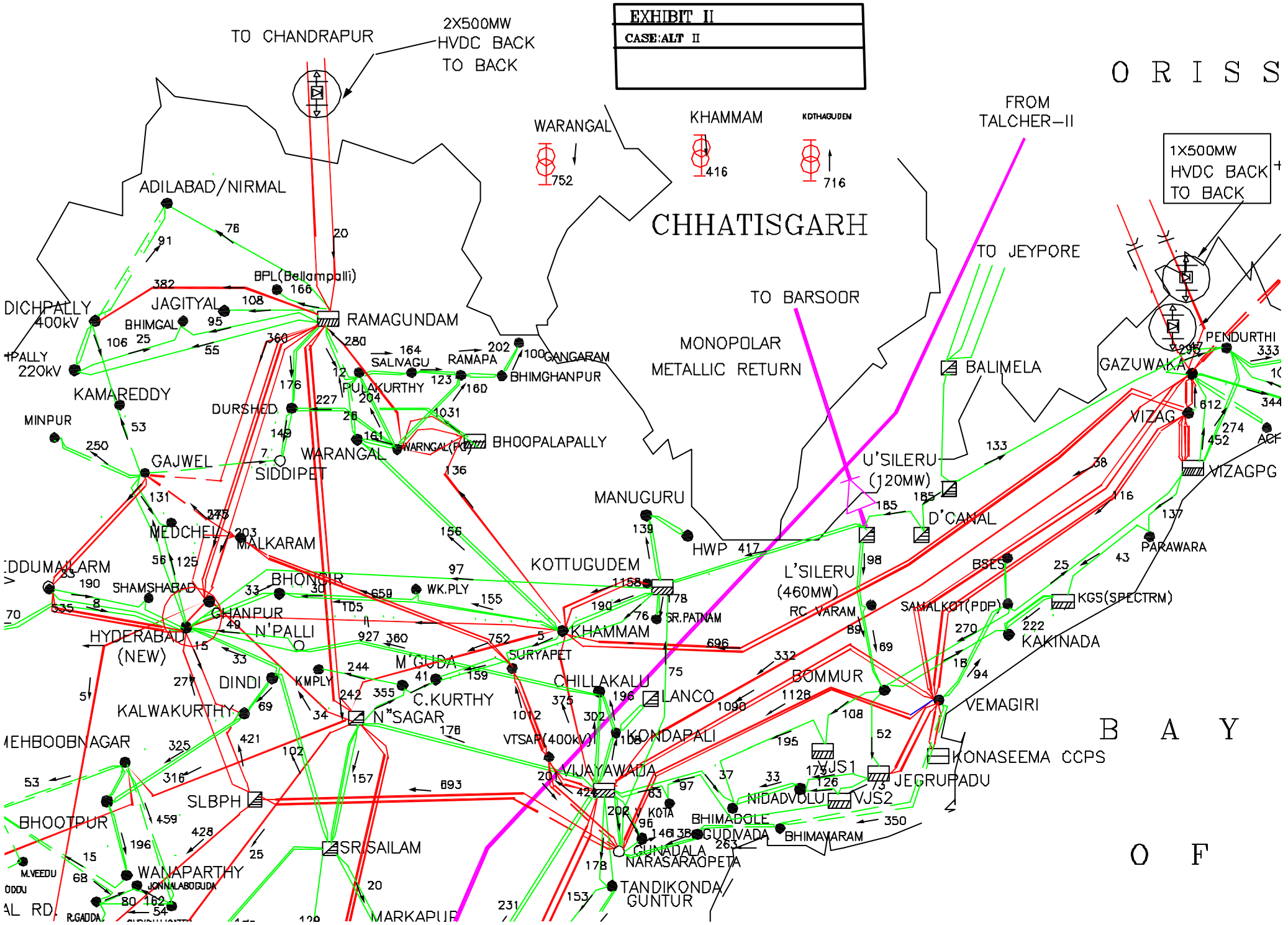


EXHIBIT II
CASE:ALT II
TO CHANDRAPUR
2X500MW
HVDC BACK
TO BACK
WARANGAL
752
KHAMMAM
416
KOTHAGUDEM
716
FROM
TALCHER-II
1X500MW
HVDC BACK
TO BACK
ORISS
CHHATISGARH
TO JEYPORE
TO BARSOOR
MONOPOLAR
METALLIC RETURN
ADILABAD/NIRMAL
DICHPALLY
400kV
IPALLY
220kV
BPL(Bellampalli)
JAGITYAL
BHIMGAL
RAMAGUNDAM
KAMAREDDY
MINPUR
GAJWEL
SIDDIPET
DURSHED
PULAKURTHY
SALIVAGU
RAMAPA
GANGARAM
BHIMGHANPUR
WARANGAL
WARNGAL(PG)
BHOOPALAPALLY
MEDCHEL
MALKARAM
SHAMSHABAD
GHANPUR
BHONGIR
N'PALLI
HYDERABAD
(NEW)
DINDI
KALWAKURTHY
KMPLY
M'GUDA
C.KURTHY
N"SAGAR
SURYAPET
WK.PLY
MANUGURU
HWP 417
KOTTUGUDEM
KHAMMAM
CHILLAKALU
LANCO
KONDAPALI
VIJAYAWADA
VTSAP(400kV)
U'SILERU
(120MW)
L'SILERU
(460MW)
D'CANAL
RC VARAM
SR.PATNAM
BALIMELA
BSES
SAMALKOT(PDP)
KGS(SPECTRM)
KAKINADA
PARAWARA
VIZAG
VIZAGPG
GAZUWAKA
PENDURTHI
BOMMUR
VEMAGIRI
KONASEEMA CCPS
JEGRUPADU
VJS1
VJS2
NIDADVOLU
BHIMADOLE
GUDIVADA
BHIMAVARAM
GUNADALA
NARASARAOPETA
TANDIKONDA
GUNTUR
MARKAPUR
SR.SAILAM
SLBPH
BHOOTPUR
WANAPARTHY
MEHBOOBNAGAR
BAY
OF

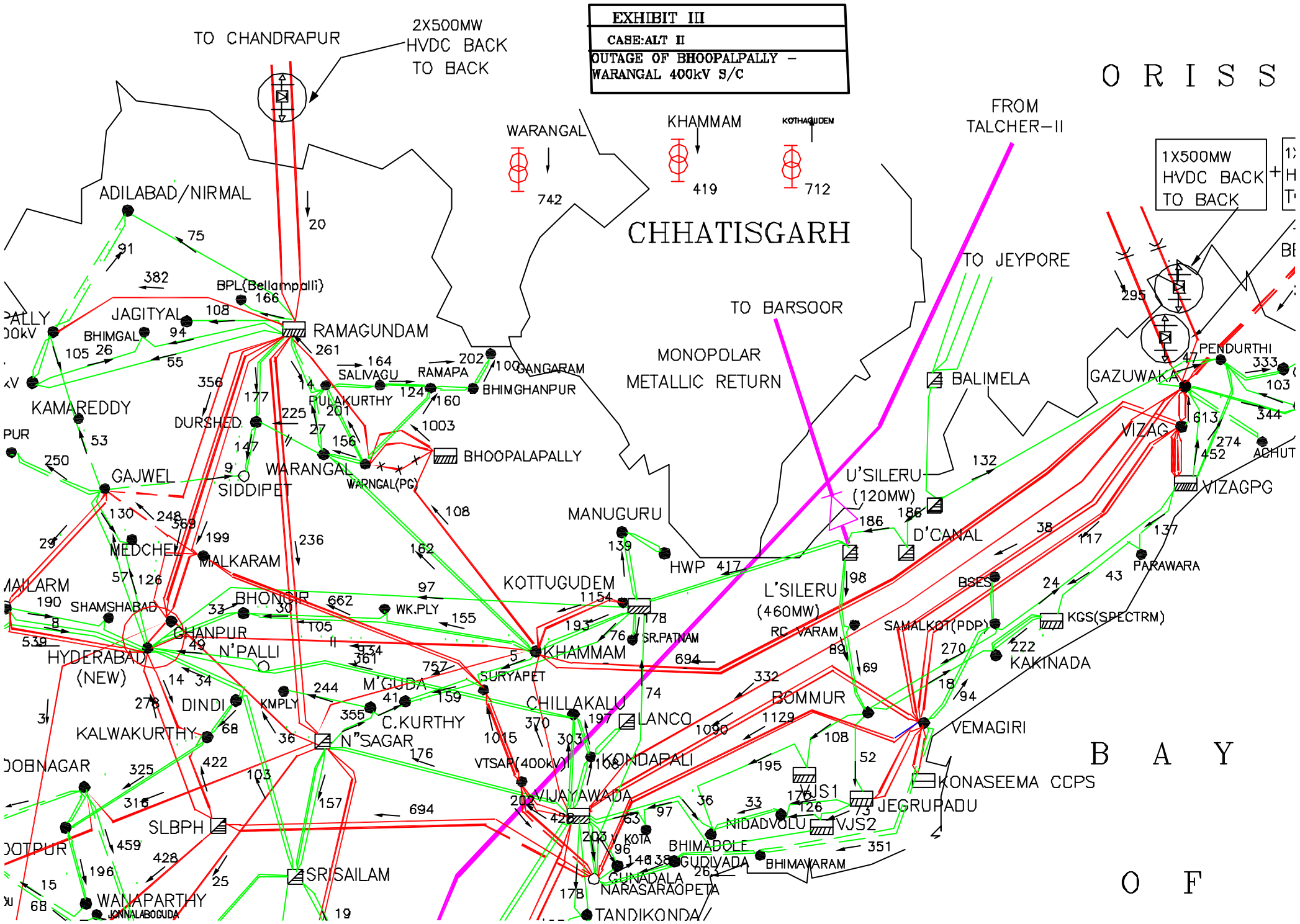


EXHIBIT III
CASE:ALT II
OUTAGE OF BHOOPALPALLY - WARANGAL 400kV S/C
TO CHANDRAPUR
2X500MW HVDC BACK TO BACK
WARANGAL
742
KHAMMAM
419
KOTHAGUDEN
712
FROM TALCHER-II
1X500MW HVDC BACK TO BACK
ORISS
CHHATISGARH
TO JEYPORE
TO BARSOOR
MONOPOLAR METALLIC RETURN
ADILABAD/NIRMAL
JAGITYAL
BPL(Bellampalli)
RAMAGUNDAM
BHIMGAL
KAMAREDDY
DURSHED
SALIVAGU
RAMAPA
GANGARAM
BHIMGHANPUR
PULAKURTHY
BHOOPALAPALLY
WARANGAL
WARNGAL(PC)
SIDDIPET
GAJWEL
MEDCHEL
MALKARAM
MANUGURU
HWP 417
KOTTUGUDEM
KHAMMAM
SURYAPET
SR.PATNAM
WK.PLY
BHONGIR
SHAMSHABAD
CHANPUR
N'PALLI
HYDERABAD (NEW)
M'GUDA
DINDI
KMPLY
C.KURTHY
N"SAGAR
KALWAKURTHY
DOBNAGAR
SLBPH
SRISAILAM
WANAPARTHY
JONNALABOGUDA
DOTPUR
VTSAP(400kV)
CHILLAKALU
LANCO
KONDAPALI
VIJAYAWADA
GUNADALA
NARASARAOPETA
TANDIKONDA
KOTA
BHIMADOLE
GUDIVADA
BHIMAVARAM
NIDADVOLU
VJS1
VJS2
JEGRUPADU
BALIMELA
U'SILERU (120MW)
L'SILERU (460MW)
D'CANAL
RC VARAM
BOMMUR
VEMAGIRI
KONASEEMA CCPS
BSES
SAMALKOT(PDP)
KAKINADA
KGS(SPECTRM)
PARAWARA
GAZUWAKA
PENDURTHI
VIZAG
VIZAGPG
ACHUT
B A Y
O F