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

No. 51/4/SP&PA-2012/ **Date: 02 April 2012**

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: 34th meeting of the Standing Committee on Power System Planning of Southern Region
- **Agenda for the meeting.**

Sir,

The **34th meeting** of the Standing Committee on Power System Planning of Southern Region is scheduled to be held **on 16 April, 2012(Monday) in Hyderabad.**
Meeting would start at 10:30 AM. Venue of the meeting would be communicated shortly.
The agenda is available at CEA's website (www.cea.nic.in).

Please make it convenient to attend the meeting.

Yours faithfully,

(Pardeep Jindal)
Director (SP&PA)
(Telephone: 011 26198092, Fax No. 011 26102045)

Copy to:
Shri S. K. Soonee, CEO, POSOCO,
B-9, Qutub Institutional Area,
Katwaria Sarai,
New Delhi-110016

AGENDA NOTE

Agenda Note for 34th Meeting of
Standing Committee on Power System Planning in Southern Region (SCPSPSR)

Time: 10:30 AM **Date: 16 April, 2012(Monday)**
Venue: Hyderabad (exact place TO BE DECIDED)

1.0 Confirmation of the minutes of 33rd meeting of the Standing Committee

1.1 The Minutes of 33rd meeting of the Standing Committee on Power System Planning of Southern Region were issued vide CEA's letter No. 51/4/SP&PA-2011/1647-58 dated 15th November, 2011.

1.2 GM (SRLDC) vide his letter No. GM/SRLDC/12/0105-74 dated 05-01-2012 have given observation regarding high voltages observed in Vemagiri area of Andhra Pradesh and had suggested for provision of 1x80 MVAR bus reactor at Vemagiri area and that APTRANSCO had agreed to provide this reactor at their Vemagiri 400kV S/S. Members agreed for the same." The above Para is added under Item No. 5.0 in the Minutes of 33rd meeting of the Standing Committee on Power System Planning of Southern Region.

1.3 DGM(Engg-SEF) POWERGRID, vide letter No. C/ENG/SEF/S/00/SCM dated 08-12-2011, requested to add minutes of 13th meeting of Southern Region constituents regarding LTA and Connectivity applications in Southern Region **under Para 18.0** to the Minutes of 33rd meeting of the Standing Committee on Power System Planning of Southern Region. Copy of the minutes is available at CEA and POWERGRID website.

1.4 Based on observations/comments received from SRLDC and POWERGRID, a corrigendum to the minutes of the 33rd meeting was issued vide CEA letter no. 51/4/SP&PA-2012/146-158 dated 06-02-2012 (copy enclosed at Annex-I).

1.5 The Minutes of the 33rd meeting along with corrigendum, as circulated, may be confirmed.

2.0 Transmission System for Evacuation of Wind Power from Tamil Nadu

2.1 Tamil Nadu presently has about 6200MW installed capacity of wind power generation. The state has proposed to establish additional wind generation of about 6000 MW during 12th plan period. For planning of transmission system for these additional wind generations in Tamil Nadu, joint studies were carried out by CEA,

TNEB and POWERGRID in CEA for considering load-generation balance for 2016-17 time-frame.

2.2 Various network configurations were studied to arrive at optimum transmission addition alternatives. Two transmission alternatives were found to be optimal which need reliability criteria of N-1 and also integrate the wind evacuation system of Tamil Nadu with Southern /national Grid. These alternatives are:

2.3 **Transmission Network Option - I**

(a) Transmission system for evacuation of power

i) Thappagundu 400/110 KV (5x200MVA) S/s in Theni area

ii) Anaikadavu 400/230-110 KV (2x315+ 2x200 MVA) S/s in Udumalpet area

iii) Rasipalayam 400/230-110 S/s (2x315+2x200 MVA) in Udumalpet area

iv) Anaikadavu- Rasipalayam 400kV D/c line.

v) Thappagundu- Anaikadavu 400kV D/c with one ckt LILO at Udumalpet 400/220 kV (PGCIL) substation.

vi) Rasipalayam -Singarapet 400kV 2xD/c line

vii) Vagrai 400/230-110 kV substation.

viii) Vagrai-Rasipalayam 400 kV D/c line

ix) Thennampatti 400/230-110 kV substation

x) Thennampatti - Kayathar 400kV D/C line

(b) System for additional inter-connection with ISTS and increased reliability

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

2.4 **Transmission Network Option - II**

(a) Transmission system for evacuation of power

i) Thappagundu 400/110 KV (5x200MVA) S/s in Theni area

ii) Anaikadavu 400/230-110 KV (2x315+ 2x200 MVA) S/s in Udumalpet area

iii) Rasipalayam 400/230-110 S/s (2x315+2x200 MVA) in Udumalpet area

iv) Anaikadavu- Vagrai 400kV D/c line.

v) Thappagundu- Anaikadavu 400kV D/c with one ckt LILO at Udumalpet 400/220 kV (PG) substation.

vi) Rasipalayam -Singarpeta 400kV D/c line.

vii) Vagrai – Singarpeta 400 kV D/c quad line.

viii) Vagrai 400/230-110 kV substation.

ix) Vagrai-Rasipalayam 400 kV D/c line

x) Thennampatti 400/230-110 kV substation

xi) Thennampatti - Kayathar 400kV D/C line

(b) System for additional inter-connection with ISTS and increased reliability

(i) LILO of Vagrai – Singarapet 400 kV D/c quad line at Salem 765/400kV (PGCIL) substation

2.4 System studies were carried out with both the transmission alternatives. Both the alternatives have equal merits. But as there is space constraint in Rasipalayam area, so based on the practical implication of the system, Transmission Network Option–II is found to be more suitable. Study report is given at Annex-II

2.5 As per studies, it was observed that operation of Chandrapur-HVDC back-to-back would need to be linked with wind generation in Southern Region. The quantum and direction of power through this link would depend upon capacity of wind generation and of conventional generation. The Gazuwaka HVDC back-to-back link can also be used in similar manner.

2.6 TNEB should complete the transmission system planned for wind generation on an urgent basis.

2.7 Member may discuss.

3.0 Connectivity for Nirmal 400kV S/S of APTRANSCO:

3.1 The issue of connectivity for Nirmal 400kV S/S of APTRANSCO was discussed in the 32nd meeting of the standing committee and the committee agreed to LILO one of the circuits of Ramagundam – Hyderabad 400kV lines at Nirmal by APTRANSCO for 2x315 MVA 400/220kV new Substation at Nirmal/Adilabad by APTRANSCO. Regarding selection of the circuit to be LILOed POWERGRID, during the 33rd meeting of the standing committee, opined that two circuits of Ramagundam – Hyderabad 400kV lines are already being LILOed, therefore either of the remaining two circuits can be LILOed at Nirmal S/s. Selection of circuit to be LILOed is to be worked out by POWERGRID and APTARNSCO.

3.2 It is observed that the LILO length would of about 170 km. POWERGRID / APTRANSCO may present their finding. Member may discuss.

4.0 Construction of 220kV Mylatti- Puttur line as a System Strengthening Scheme

4.1 KSEB had proposed the construction of 220kV inter state line from Mylatti S/s of KSEB to Puttur S/s of KPTCL as a regional system strengthening scheme. The issue was discussed during 33rd meeting of the standing committee and it was felt that this proposed link at 220kV level would also provide an additional corridor from S1 to S2 thereby reducing the congestion to some extent.

4.2 It was decided that CEA would convene a separate meeting of POWERGRID,

KPTCL and KSEB for discussion on the issue. Accordingly, a meeting was held on 27-03-2012, wherein following was discussed:

(i) KPTCL said that Puttur S/s is fed from Kemar S/s which also feeds to Kudermukh and Kavoor S/s. Further, Puttur S/s is also proposed to feed SEZ coming in that area. Kemar S/s is getting power from Uddupi Generating station through Uddupi-Kemar 220kV D/c line. The simultaneous peak load that Kemar S/s feeds is of the order of 350 - 400 MW. Inter-connection of Puttur and Mylatti would further increase the loading on Uddupi - Kemar 220kV D/c line. Further, no power can be transmitted to Kerala at the time of peak load, if provision for n-1 reliability is to be considered. Therefore, if this line is implemented, Karnataka may have to restrict the flow on this line depending on need to meet its own load. In case of congestion in Kemar area, Karnataka would not be bound to transmit power to Kerala on this line.

(ii) After discussions it was brought out that at present this line would be beneficial mainly for Kerala for feeding the loads in Mylatti area but after commissioning of Mysore –Kozhikode 400kV D/c line, the Mylatti – Puttur 220kV line may feed the load in Puttur and SEZ area and may also help in reducing the congestion in that area.

(iii) On the issue of ownership/construction of the line it was brought out that both the States may construct the line portion upto their State's boundry. As the line would be a natural inter-state line, it may be considered for declaring as deemed ISTS and therefore the matter may be discussed in SRPC. KPTCL and KSEB may coordinate with each other to decide about constructing this line for mutual benefit.

4.3 Member may discuss.

5.0 Associated transmission system for Kaiga APP St-III(U-5& 6)

5.1 GOI had given in – principle approval to NPCIL for expansion of the existing KAPP generation by 2x700 MW as St -III. Regarding the power evacuation arrangement from these units it was observed that due to involvement of the forest area it would be difficult to get a new transmission corridor for building additional transmission lines. Hence, option for enhancing the capacity of the existing corridor, therefore, may be explored.

5.2 A meeting was held on March 05, 2012 at PGCIL, Gurgaon for dissussing the issue and it was noted that technically it may be feasible to re-conductor the existing lines i.e. Kaiga –Davangere and Kaiga - Narendra 400kV twin moose D/C line with HTLS conductor. But for re-conductoring, long period shut down of the existing KAPP generations would be required. Further system studies including stability

studies would be needed to ascertain adequacy of two D/C lines for about 2000 MW of power.

5.3 Member may discuss.

6.0 Transmission System for evacuation of power from Yermarus TPS(2x800 MW)/Edlapur TPS(1x800 MW) of KPCL in Karnataka

6.1 In the 33rd meeting of SCPSPSR, it was decided to review the transmission system for evacuation of power from Yeramaras and Edlapur TPS taking Kudgi Project in consideration. Accordingly, for which joint studies would again be carried out by CEA, POWERGRID and KPTCL. Hence, a meeting of CEA, POWERGRID and KPTCL was held on 27-03-2012 at CEA office in which following system was agreed to be put up in forthcoming meeting of the SCPSPSR:

6.2 Transmission system for evacuation of power:

(i) Edlapur TPS - Yermarus TPS S/S 400 kV DC Twin moose line
(ii) The existing Raichur TPS – Davangere 400kV SC line to be converted to 400kV DC line with QUAD conductors along with shifting of Raichur termination point to Yeramaras TPS switchyard.
(iii) BTPS – Hiriyur (under construction) 400 kV DC twin line
(iv) BTPS – Madhugiri(Tumkur) – 400 kV Quad DC line

6.3 System for additional inter-connection with ISTS and increased reliability:

(i) Yermarus TPS – Raichur (New) 400kV Quad DC line

6.4 It was also agreed that this Yeramaras TPS - Raichur (new) line should be provided only after commissioning of the evacuation system for Yeramaras and Edlapur TPS.

6.5 Member may discuss.

7.0 400kV D/c Quad line from Pugalur 400kV S/S to Sholinganallur 400kV S/S

7.1 Sholinganallur –Kalivanthapattu (Melakottaiyur) 400kV D/C line and Pugalur – Singarapet - Sholinganallur (Ottiampakkam) 400kV D/C line were agreed in the 23rd, 28th and 29th meeting of the standing committee. A meeting was held on March 27, 2012 at CEA, New Delhi for dissussing the issues related to LILO at Melakottayur (PGCIL) instead of Sholinganallur –Kalivanthapattu (Melakottaiyur) and Termination of Thiruvalam - Sholinganallur 400kV D/C line at TNEB S/S.

7.2 Following was discussed in the meeting:

(i) TNEB said that as the existing Kalivanthapattu 400kV S/S is almost in line route of the Singarapet - Sholinganallur 400kV D/C line, so they have proposed to make LILO of one circuit of Singarapet – Sholinganallur 400kV D/C line at Kalivanthapattu 400kV S/s. This would be in place of the

Sholinganallur –Kalivanthapattu 400kV D/C line. The LILO arrangement would also save two number of 400kV bays at Sholinganallur.

(ii) POWERGRID said that they have undertaken construction of Thiruvalam – Sholinganallur line on urgent basis. The line is to be terminated at Sholinganallur S/s and therefore, this substation should be ready by July 2014.

(iii) TNEB informed that acquisition of land for Sholinganallur and Singarapet is yet to take place and construction of these substations would take about 20-24 month after that.

7.3 After the meeting, following was agreed to be put up for discussion in SCPSPSR:

(i) LILO of one circuit of Singarapet – Sholinganallur 400kV line at Kalivanthapattu 400kV S/s as proposed by TNEB would be considered after Sholinganallur S/s have been commissioned or is in the process of commissioning.

(ii) Considering the load growth in the area and space constraint at Sholinganallur S/S, TNEB may plan for 2x500 MVA GIS type S/s at Sholinganallur instead of 2x315 MVA AIS type S/S. This would also enable them to plan additional lines from Sholinganallur to Gindy/ Taramani.

7.4 Members may discuss.

8.0 KSEB proposals to avoid congestion in S1-S2 corridor

8.1 KSEB has proposed a 400kV D/C link from NPCL(Uddupi) to Kozhikode 400kV S/s and setting up a new 40kV s/s at Kasargode by LILO-ing of one ckt of above link to avoid congestion in S1-S2 corridor.

8.2 KSEB has also proposed to convert existing 110kV Konaje- Manjeswaram single circuit feeder to double circuit as a part of southern region system strengthening scheme. At present KSEB is drawing 12-15MW from 110kV S/S, Konje – Manjeswaram –Vidyanagar single circuit feeder. If this feeder is converted to double circuit line then more power can be drawn to Northern part of Kerala, providing direct link from S1 at 110kV level thereby, reducing S1-S2 congestion to some extent

8.3 Member may discuss.

9.0 Establishment of 400/220kV S/s near Doni to facilitate Wind Energy Evacuation:

9.1 During joint study meeting held on 27-03-2012 in CEA, KPTCL informed that maximum 400 MW of wind generation capacity is proposed to be added, gradually upto 2016-17, in Doni area. So, KPTCL proposed to LILO their Munirabad - Davangere (Guttur) 400 kV S/C line to facilitate wind energy evacuation. This

system was found to be suitable for evacuation of power upto 400 MW from wind generations in Doni area.

9.2 Member may discuss.

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

10.1 During 33rd meeting of the standing committee, Neyveli (Replacement) – Sholinganallur 400 kV D/c line was proposed as transmission augmentation for 2x500MW Neyveli Lignite Corporation Ltd. TS-I (Replacement). But TANTRANSCO was of the opinion that this line may not be required because a number of generation projects are proposed in the Chennai area. Therefore, the proposed transmission augmentation viz. Neyveli (Replacement) – Sholinganallur 400 kV D/c was dropped and instead it was decided to identify some other 400kV line for LTA requirement.

10.2 This issue was discussed in a meeting of CEA, POWERGRID and TNEB held in CEA on 27-03-2012. After discussion on the issue, it was agreed that Neyveli (replacement)-Singarapet 400kV D/c line may be taken up for LTA requirement. This line would be proposed in the forthcoming meeting of standing committee and may be built after ascertaining schedule of Singarapet S/s.

10.2 Member may discuss.

11.0 LTA Agenda for discussion.

(Agenda to be circulated by POWERGRID)

12.0 Any other issue with the permission of chair.

Annex-I

Corrigendum to Minutes of 33rd Meeting of
Standing Committee on Power System Planning in Southern Region (SCPSPSR)
held on 20th October, 2011 (Thursday) at Northern Region Power Committee,
Katwaria Sarai, New Delhi.

Corrigendum # 1

Based on the observations from GM (SRLDC) vide his letter No. GM/SRLDC/12/0105-74 dated 05-01-2012, the following Para is added under **Item No. 5.0** in the Minutes of 33rd meeting of the Standing Committee on Power System Planning of Southern Region:

"5.5 GM (SRLDC), informed that high voltages are observed in Vemagiri area of Andhra Pradesh and suggested for provision of 1x80 MVAR bus reactor at Vemagiri area. CE(PS) APTRANSCO, agreed to provide this reactor at their Vemagiri 400 kV substation. Members agreed for the same."

Corrigendum # 2

POWERGRID issued the minutes of 13th meeting of Southern Region constituents regarding LTA and Connectivity applications in Southern Region vide their letter No. C/ENG/SEF/S/00/LTA dated 25-11-2011. Based on the request from DGM(Engg-SEF) POWERGRID vide letter No. C/ENG/SEF/S/00/SCM dated 08-12-2011, the following Para 18.0 is added to the Minutes of 33rd meeting of the Standing Committee on Power System Planning of Southern Region:

"18.0 Discussion on Connectivity **and LTA applications for projects in Southern Region:**

The issues related to provision of LTA and connectivity, based on the applications received by POWERGRID, were discussed in the 13th meeting of Southern Region Constituents held in this regard. Minutes of this discussion were issued by POWERGRID vide their letter No. C/ENG/SEF/S/00/LTA dated 25-11-2011 and the same is given at **Annexure-II"**

Annex-II

Government of India
Ministry of Power
Central Electricity Authority
System Planning & Project Appraisal Division
Sewa Bhawan, R. K. Puram, New Delhi-110066

[ISO: 9001:2008]

No. 56/20/2011-SP&PA/ **Date: 02-04-2012**

To

Member(Distribution),
Tamil Nadu electricity Board,
6th floor, Eastern Wing,
800, Anna Salai,
Chennai-600002.

Sub: Joint Study Report on Evacuation of Wind Generation in Tamil Nadu

Reference: TANGEDCO letter (i) CE/Plg&RC/SE/SS/EEI/AEEII/F.WIND/D.No.350/11 dated 15-10-2011, and (ii) CE/Plg&RC/SE/SS/EEI/AEEII/F.400kV WIND SS/ D.No.142/11 dated 18-05-2011

Sir,

Reference is invited to TNEB/TANGEDCO letters regarding planning of transmission system for additional wind generations in Tamil Nadu. In this regard, joint studies were carried out by CEA, TNEB and POWERGRID from 29-11-2011 to 01-12-2011 in CEA for evacuation of wind generation in Tamil Nadu considering load-generation balance for 2016-17 time period.

A Study Report is enclosed.

(Pardeep Jindal)
Director (SP&PA)

Copy to:

1. Shri S. Akashaya Kumar,
   Director (Transmission Projects),
   TANTRANSCO,
   144, Anna Salai,Chennai-600002.

2. Shri K. Balasubramaniam,
   Director (Generation),
   TANGEDCO, NPKRR Maaligai,
   144, Anna Salai,Chennai-600002.

3. Shri Pankaj Kumar,
   Executive Director(SEF &CE),
   Power Grid Corp. of India Ltd.,
   Plot No-2, Saudamini, Sector-29,
   Gurgaon, Haryana-122001

Joint study report on evacuation of wind generation in Tamil Nadu

List of participants is given at Annexure-I.

1.0 Wind Generatin scenario in Tamil Nadu:

1.1 Tamil Nadu has large renewable energy potential especially wind power and presently there is about 6200 MW of installed capacity of wind power generation. For the purpose of transmission planning, this is taken as Phase-I. The State has proposed to establish additional wind generation of about 6000 MW during 12th plan period. This, for the purpose of transmission planning, is taken as Phase-II. The phase-I generation is under operation. The phase-II generation projects are proposed to be commissioned gradually upto 2016-17.

1.2 In Tamil Nadu, wind generation is mainly concentrated in two areas i.e.

(i) Tirunelveli - Kayathar area

(ii) Theni - Udumalpet area

Each area has sub-areas of wind generation. Wind projects in a sub-area are generally aggregated at 110kV or 230kV S/S. These 110kV or 230kV aggregating S/S are required to be linked to 400kV pooling S/Ss so that the wind generation, after meeting local loads, is pooled at 400kV S/Ss for integration into State/ Regional/ National grid network.

Details of Wind generation under Phase-I and Phase-II with their aggregating / pooling stations, are as shown below:

All figures in MW

Phase-I (Udumalpet - Theni Area)		
Pooling S/s (400kV)	**Location of 110kV/230kV Aggregating S/S**	**Wind Gen. Capacity**
Theni	Theni	170
	Sembatti	200
	Sub-total	**370**
Udumalpet	Udumalpet	600
	M M Patti	600
	Palladam	650
	Ponnabam	650
	Sub-total	**2500**
Total		**2870**

Phase-I (Tirunelveli - Kayathar Area)		
Pooling S/s (400kV)	**Location of 110/230kV Aggregating S/S**	**Wind Gen. Capacity**
Kayathar /	Kayathar	450
Tirunelveli	Kanarapatti	50
(Kanarpati)	Sipwind	50
	Sankaneri	500
	SRPudur	450
	Anupampudur	500
	Udayathur	500
	Virianmeri	500
	Kodrakarachi	500
Total		**3500**

All figures in MW

Phase-II (Udumalpet - Theni Area)		
Pooling S/s (400kV)	**Location of 110/230kV aggregating s/S**	**Wind Gen. Capacity**
Vagrai	Vagrai	400
	Kuathu Palayam	100
	Mudaliyar Palayam	200
	Parindyar	200
	Kannivadi	200
Sub-total		**1100**
Rasia Palayam	Rasipalayam	100
	Sankarapandi Palayam	100
	Periyakumar Palayam	100
	Rangnathapuram	100
	Mylampatti	200
	Thennilai	200
	Sirukinaru	100
Sub-total		**900**
Anikadavu	Sadaya Palayam	150
	Periapatti	200
	Anikadavu	200
	Nelali	50
	Chokkam	50
	Marudur	50
Sub-total		**700**
Thappagundu	Sreepakattai	150
	Kamakshipuram	25
	Sreerangapuram	50
	Rashingapuram	125
	Mottanuthu	100
	Shifting from Kayathar	130
Sub-total		**580**
Total		**3280**

Phase-II (Tirunelveli - Kayathar Area)		
Pooling S/s (400kV)	**Location of 110/230kV aggregating s/S**	**Wind Gen. Capacity**
Thennampatti	Thennampatti	200
	Sankaraperi	200
	Thirumalauram	250
	Pasuvandanai	200
	Ottapidaram	200
Sub-total		**1050**
Kayathar	Pannerkulam	200
	Villiseri	200
	Thirukupatti	125
	Ayanaruthum	25
	Velappaneri	150
	Sub-total	**700**
Kanarpatty	Ramnagar	100
	Sayamalai	200
	Velappaneri	150
	Vannikundal	225
	Kalayanallam	25
	Moovirundhali	50
Sub-total		**750**
Total		**2500**

All figures in MW

Summary

	Udumalpet / Theni Area	Tirunelveli / Kayathar Area	Total
Phase-I	2870	3500	6370
Phase-II	3280	2500	5780
	Grand Total		**12150**

2.0 Transmission system for Phase-I:

2.1 The transmission system for Phase-I Wind generation was evolved and agreed in the 23rd Standing Committee Meeting of Power System Planning in Southern Region held on 22-01-2007. The approved scheme, with following details, was to be implemented by TNEB:

i) Tirunelveli (TNEB) (TN wind/Kanarapatty) 400/230 kV S/S, 3x315 MVA

ii) Tirunelveli (TNEB) - Tirunelveli (PG), 400 kV Quad D/C line.

iii) Five numbers of 230/33 kV wind energy substations at Marandai, Sayamalai, Vagaikulam, Kumarapuram, Sankaralingapuram and one 230/110 kV Samugarangapuram substation with associated 230 kV lines connecting with the Kanarpatti 400 kV S/S.

iv) Kanarpatti (TN Wind) - Kayathar 400 KV, 400 kV D/C line.

v) Kayathar - Karaikudi , 400 kV D/c Quad line

vi) Karaikudi - Pugalur 400 kV D/c Quad line

vii) Establishment of 400/230-110 kV S/S with 2x315 MVA 400/230 kV ICT, and 2x200 MVA 400/110 kV ICT at Kayathar.

viii) Pugalur – Sholinganallur (Ottiampakkam), 400 kV D/C Quad line.

The above system is yet to be implemented by Tamil Nadu.

2.2 At the time of planning of above transmission system, wind generation in Tamil Nadu was about 2900 MW. At present, wind power in Tamil Nadu is about 6200 MW. In the 32nd Standing Committee meeting of Power System Planning in Southern Region, TNEB informed that new wind generation projects of about 4000 MW were coming up in southern part of Tamil Nadu to be commissioned gradually by 2016-17. Further TNEB vide their letter under reference (i) above informed about additional 2000 MW wind capacity. So, total about 12000 MW wind capacity will be installed in Tamil Nadu by end of 12th Plan i.e. 2016-17.

3.0 Transmission system for Phase-II:

3.1 Load – Generation Scenarios: System studies were conducted for peak and off-peak conditions with the aim of assessing export/import capability of Southern Region particularly of Tamil Nadu during high wind, moderate wind and without wind generation scenarios for the time frame of 2016-17.

Table-I **Installed Capacity** **MW**

	Coal	Hydro	Gas	Nuclear	Wind	Total
Central	10090	0	350	3820	0	14260
AP	13100	4244	8900	0	0	26244
Karnataka *	9700	3652	0	0	0	13352
Kerala	295	2060	170	0	0	2525
Tamil Nadu	11601	2231	1213	0	12150	27195
Total	**44786**	**12187**	**10633**	**3820**	**12150**	**83576**

* also includes Kudgi (2400 MW) Generation

3.2 Following tables summarize the various generation scenarios considered during the system studies both in the peak and off-peak conditions in Southern Region:

(All figures in MW)

Table-II **(Peak Load - High Wind Generation)**

	Coal	Hydro	Gas	Nuclear	Wind	Total	Load
Central	8590	0	330	3170	0	12090	
AP	9650	1830	5270	0	0	16750	19300
Karnataka	7640	1405	0	0	0	9045	12000
Kerala	230	1070	130	0	0	1430	4100
Tamil Nadu	9890	1585	490	0	7330	19295	19000
Total	**36000**	**5890**	**6220**	**3170**	**7330**	58610	**55500**

Table-III **(Peak Load - Moderate Wind Generation)**

	Coal	Hydro	Gas	Nuclear	Wind	Total	Load
Central	8590	0	330	3170	0	12090	
AP	9650	1830	5270	0	0	16750	19300
Karnataka	7640	1405	0	0	0	9045	12000
Kerala	230	1070	130	0	0	1430	4100
Tamil Nadu	9890	1585	490	0	4000	15965	19000
Total	**36000**	**5890**	**6220**	**3170**	**4000**	55280	**55500**

Table-IV **(Peak Load - No Wind Generation)**

	Coal	Hydro	Gas	Nuclear	Wind	Total	Load
Central	8590	0	330	3170	0	12090	
AP	9650	1830	5270	0	0	16750	19300
Karnataka	7640	1405	0	0	0	9045	12000
Kerala	230	1070	130	0	0	1430	4100
Tamil Nadu	9890	1585	490	0	0	11965	19000
Total	**36000**	**5890**	**6220**	**3170**	**0**	51280	**55500**

Table-V **(Off-Peak Load - High Wind Generation)**

	Coal	Hydro	Gas	Nuclear	Wind	Total	Load
Central	7600	0	0	3170	0	10770	
AP	8600	800	0	0	0	9400	14400
Karnataka	6600	700	0	0	0	7300	6310
Kerala	230	800	0	0	0	1030	3040
Tamil Nadu	7000	700	0	0	7330	15030	14200
Total	**30030**	**3000**	**0**	**3170**	**7330**	43530	**39000**

Table-VI **(Off-Peak Load-Moderate Wind Generation)**

	Coal	Hydro	Gas	Nuclear	Wind	Total	Load
Central	7600	0	0	3170	0	10770	
AP	8600	800	0	0	0	9400	14400
Karnataka	6600	700	0	0	0	7300	6310
Kerala	230	800	0	0	0	1030	3040
Tamil Nadu	7000	700	0	0	4000	11700	14200
Total	**30030**	**3000**	**0**	**3170**	**4000**	40200	**39000**

Table-VII **(Off-Peak Load - No Wind Generation)**

	Coal	Hydro	Gas	Nuclear	Wind	Total	Load
Central	7600	0	0	3170	0	10770	
AP	8600	800	0	0	0	9400	14400
Karnataka	6600	700	0	0	0	7300	6310
Kerala	230	800	0	0	0	1030	3040
Tamil Nadu	7000	700	0	0	40	7740	14200
Total	**30030**	**3000**	**0**	**3170**	**40**	36240	**39000**

3.1.3 **In addition to above** studies were also carried out for a pessimistic (realistic) scenario in which it was considered that some of the projects like Kudgi, Ind-Bharat, PEL may not be available. In this scenario following four cases were also studied:

(i) Pessimistic Scenario with peak load and high wind generation

(ii) Pessimistic Scenario with peak load and no wind generation

(iii) Pessimistic Scenario with off-peak load and high wind generation

(iv) Pessimistic Scenario with off- peak load and no wind generation

3.2 Evolving Transmission Configurations:

3.2.1 Various network configurations were studied to arrive at optimum transmission addition alternatives. Two transmission network options were found to be optimal which meet reliability criteria of N-1 and also integrate the wind evacuation system of Tamil Nadu with Southern /National Grid. These options are:

3.2.2 **Transmission Network Option - I**

(a) Transmission system for evacuation of power

i) Thappagundu 400/110 KV (5x200MVA) S/s in Theni area

ii) Anaikadavu 400/230-110 KV (2x315+ 2x200 MVA) S/s in Udumalpet area

iii) Rasipalayam 400/230-110 S/s (2x315+2x200 MVA) in Udumalpet area

iv) Anaikadavu- Rasipalayam 400kV D/c line.

v) Thappagundu- Anaikadavu 400kV D/c with one ckt LILO at Udumalpet 400/220 kV (PGCIL) substation.

vi) Rasipalayam -Singarapet 400kV 2xD/c line

vii) Vagrai 400/230-110 kV substation.

viii)Vagrai-Rasipalayam 400 kV D/c line

ix) Thennampatti 400/230-110 kV substation

x) Thennampatti - Kayathar 400kV D/C line

(b) System for additional inter-connection with ISTS and increased reliability

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

3.2.3 **Transmission Network Option - II**

(a) Transmission system for evacuation of power

i) Thappagundu 400/110 KV (5x200MVA) S/s in Theni area

ii) Anaikadavu 400/230-110 KV (2x315+ 2x200 MVA) S/s in Udumalpet area

iii) Rasipalayam 400/230-110 S/s (2x315+2x200 MVA) in Udumalpet area

iv) Anaikadavu- Vagrai 400kV D/c line.

v) Thappagundu- Anaikadavu 400kV D/c with one ckt LILO at Udumalpet 400/220 kV (PG) substation.

vi) Rasipalayam -Singarpeta 400kV D/c line.

vii) Vagrai – Singarpeta 400 kV D/c quad line.

viii) Vagrai 400/230-110 kV substation.

ix) Vagrai-Rasipalayam 400 kV D/c line

x) Thennampatti 400/230-110 kV substation

xi) Thennampatti - Kayathar 400kV D/C line

(b) System for additional inter-connection with ISTS and increased reliability

(i) LILO of Vagrai – Singarapet 400 kV D/c quad line at Salem 765/400kV (PGCIL) substation

4.0 Discussion of System Studies Results:

4.1 Study case during Peak load condition with Option-I:

4.1.1 System studies were carried out for 2016-17 time period considering high wind generation (i.e 60 % of Installed capacity 12150 MW), the projected peak load demand for Tamilnadu of 19000 MW as given by TNEB, Southern Region peak demand of 55500 MW and available peak generation of Southern Region is 59000 MW(refer Table-II). Studies have been carried out by incorporating the transmission system for the Generation projects likely to be commissioned by 2016-17 and the transmission system for phase-I and phase-II wind generation projects in Tamilnadu as proposed by TNEB. The power flow for peak load and high wind condition considering Option-I is given at **Exhibit-I(a).** The power flow in the southern region system is within the limits but power flow on inter-regional links between SR and WR is on the higher side. Power flow on Raichur -Sholapur 765kV D/c line is 3487MW and during n-1 condition the remaining circuit gets overloaded.

4.1.2 To overcome the problem above during peak load condition, the convention of Chandrapur-Ramagundam HVDC back-to-back can be reversed so as to export power from SR to WR on this link. The power flow for this case is given at **Exhibit-I(b).** But, this operating scenario would depend upon the requirement of power in Western region.

4.1.3 **Exhibit-I(c)** illustrates the power flows with the initially proposed network configuration for Thappagundu (i.e. 400kV D/C line from Thappagundu to Kayathar). This network configuration was dropped due practical difficulty, as

anticipated by TNEB, in crossing hills during construction of this line which would also increase cost of this proposal.

4.1.4 Further, studies were also carried out with medium wind generation and no wind generation in Tamil Nadu.(refer Table-III and Table-IV) .The power flow for these cases are given at **Exhibit-II and Exhibit-III** respectively. It is seen that, in no wind scenario, Southern Region would import from outside through Western Region. Flows on inter-regional links are within limits.

4.2 Study case during Peak load condition with Option-II:

4.2.1 System studies were also carried out considering Option –II. Due to space constraint in Rasipalayam area, hence, Option-II is preferred for carrying out further studies. The power flow for Option-II with peak load and high wind generation is given at **Exhibit-IV(a).** Under peak load and high wind generation power flow on Raichur -Sholapur 765kV D/c line is 3351MW and with outage of one circuit the flow becomes 2838MW. (**Exhibit-IV(a)-Outage).**

In this case also, with reverse flow at Chandrapur HVDC back to back link, i.e from WR to SR, the power flow on Raichur -Sholapur 765kV D/c line is 2640MW and with outage of one circuit the flow becomes 2243MW, which though little on higher side, is still manageable. (**Exhibit-IV(b) and Exhibit-IV(b)-Outage).** Otherwise the option would be have one more link between SR and WR.

4.2.2 Study case during Peak load condition with High wind generation in Tirunelveli area and medium wind generation in Udumalpet area and vice versa were also studied (**Exhibit-IV(c) and Exhibit-IV(d), respectively).** The proposed system (Option-II) suits this operating scenario also.

4.3 Study case during Off-Peak load condition with Option-II:

4.3.1 The case for system studies has been developed for 2016-17 time period with considering high wind generation (i.e 60 % of Installed capacity 12150 MW is 7300 MW), and the projected off-peak load demand for Tamilnadu of 14000 MW as given by TNEB, Southern Region peak load demand of 39000 MW and available peak generation of Southern Region is 43500 MW (refer Table-V) The power flow for during off-peak condition for 2016-17 is given at **Exhibit-VII(a).**

4.3.2 During off-peak condition with high wind generation, the inter-regional links between SR and WR are getting overloaded and this overloading further increases with outage of one circuit of Raichur Sholapur 765kV D/C line **(Exhibit-VII(a)-outage)**. Even if the convention of Chandrapur-Ramagundam HVDC back-to-back to be reversed to increase the export capacity of Southern region **(Exhibit-VII(b)-reverse),** the flows are still on higher side. Hence it would be required to curtail the wind generation to about 4000MW (refer Table-VI). The power flow during this case is attached at **Exhibit-VIII(a).** The flows on inter- regional links can further be relieved by reversing the Chandrapur back to back link **Exhibit-VIII(b)-reverse**. This is possible only if western region intends to import the power from southern region. Under the no wind generation

condition (refer Table –VII), SR is exporting to WR (**Exhibit –IX).** In this scenario, the power flow in the Southern Region system is within limits.

4.4 Pessimistic/Realistic Scenario:

4.4.1 System studies were also carried considering the pessimistic/realistic scenario (if some of the projects like Kudgi, Ind-Bharat, PEL do not get materialize). **Exhibit-X** shows the flows during peak load and high wind condition. In this condition, SR is exporting to WR and the power flow on Raichur -Sholapur 765kV D/c line is 1764MW only. However, in no wind and peak load scenario, SR is to importing from WR and the flow on Sholapur-Raichur is 2395 MW **(Exhibit- XI)**. Under the scenario of Off-peak and high wind **(Exhibit-XII)** Raichur-Sholapur flow is 3437 MW on two circuits and can be managed with reversing flow on Chandrapur-Ramagundam back-to-back link. In case of off-peak and no wind scenario, SR would import from WR**(Exhibit-XII)**. This situation is reverse of what is observed in similar scenario but with high generation addition in SR.

5.0 Conclusion:

5.1 The Option-II is a preferred network option.

5.2 The operation of Chandrapur-HVDC back-to-back would need to be linked with wind generation in Southern Region. The quantum and direction of power through this link would depend upon capacity of wind generation and of conventional generation. The Gazuwaka HVDC back-to-back link can also be used in similar manner.

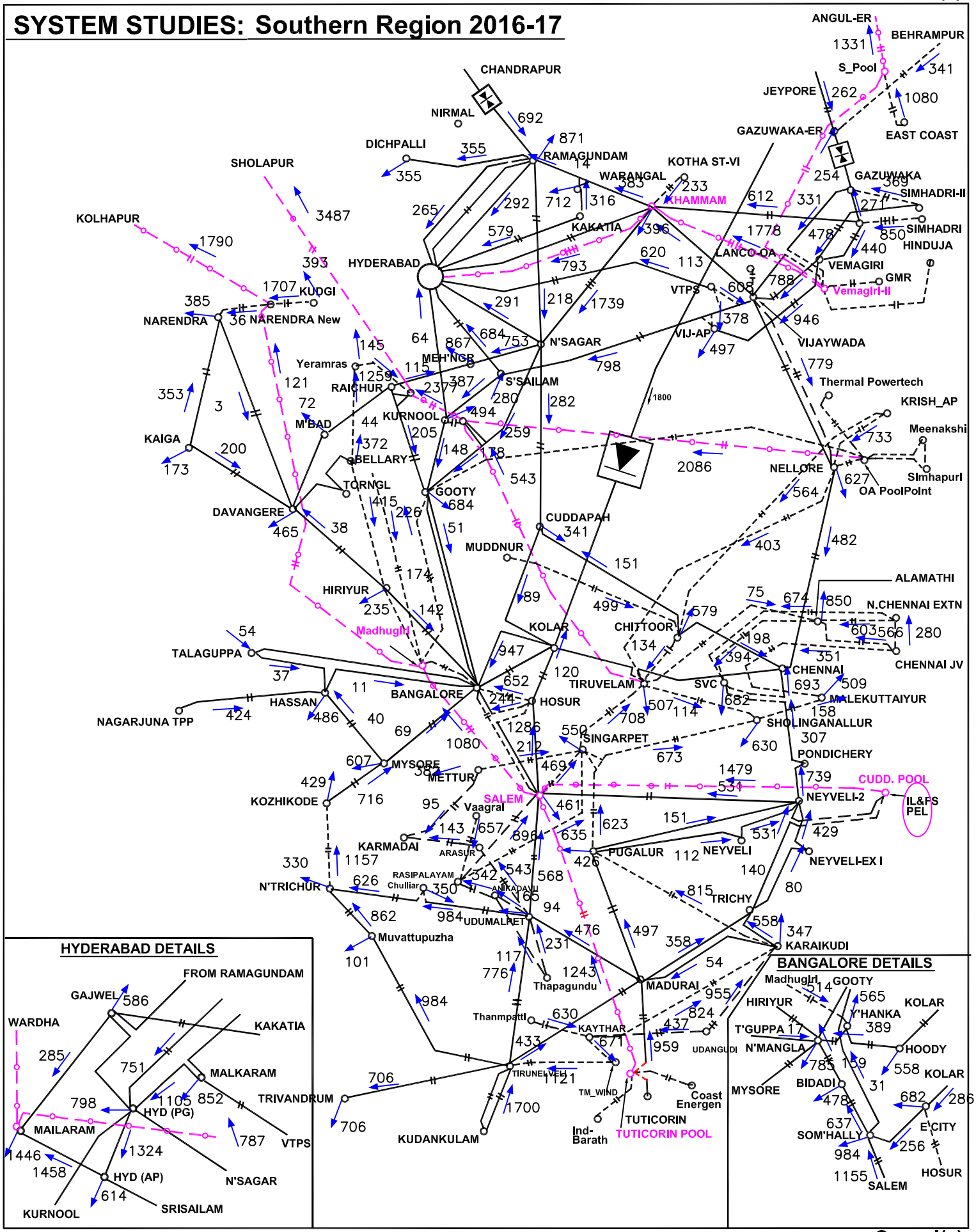
5.3 TNEB should complete the transmission system planned for wind generation on an urgent basis.

Annexure - I

List of participants :

Sl. No.	Name and Organization	Designation
	Central Electricity Authority (CEA)	
1.	Pardeep Jindal	Director (SP&PA)
2.	Manjari Chaturvedi	Deputy Director(SP&PA)
3.	Nageswara Rao Maragani	Engineer (SP&PA)
	Power Grid Corporation of India Ltd (PGCIL)	
1.	Shri Dilip Rozekar	DGM (SEF)
2.	Shri R.V.M.M. Rao	CDE(SEF)
	Tamil Nadu Generation and Distribution Corporation Ltd.(TANGEDCO)	
1.	S. Ravicahndran	EE/System Studies
2.	S. Surendran	EE/NCES
3.	R. Kumutha	AEE/System Studies

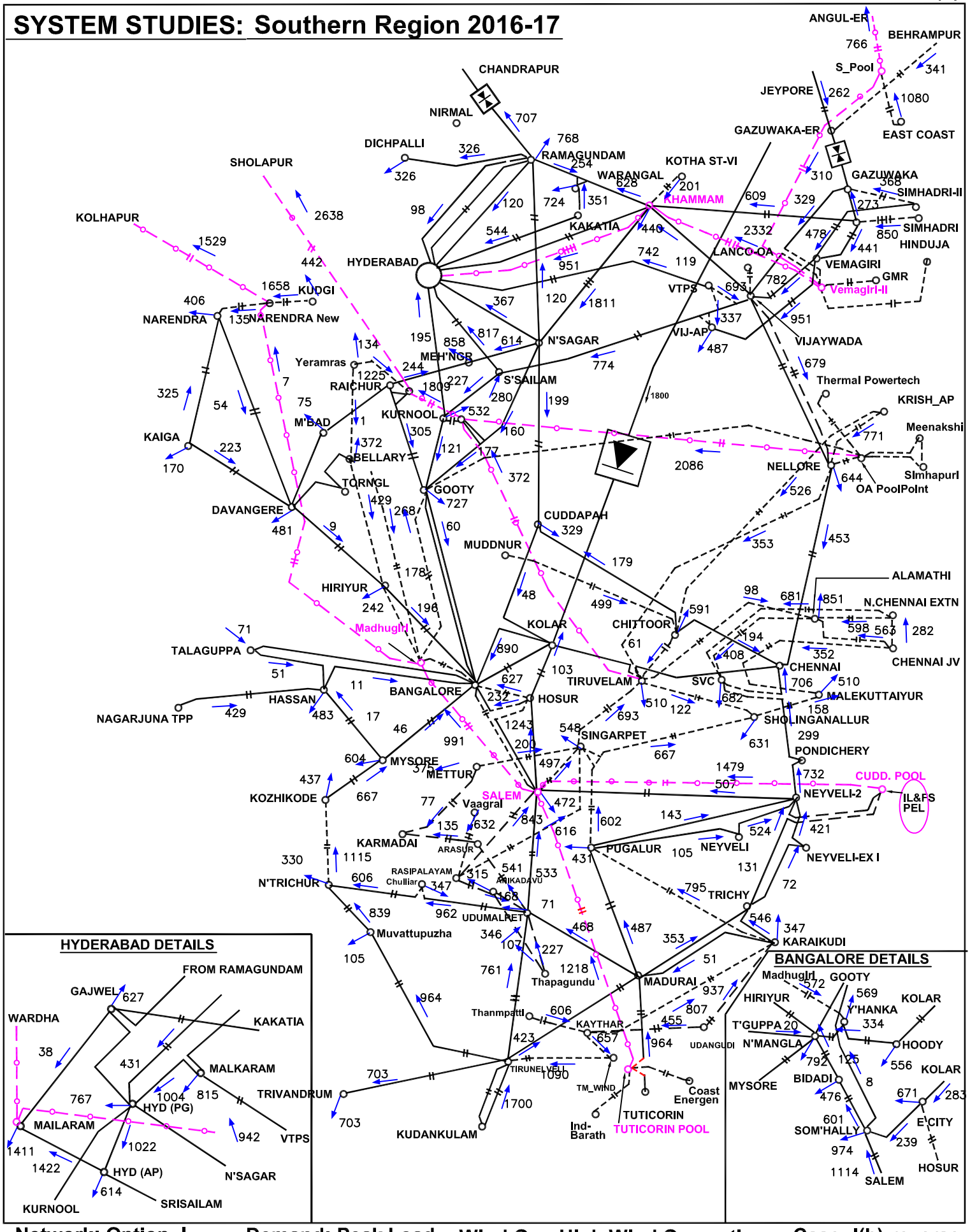
SYSTEM STUDIES: Southern Region 2016-17



Network: Option- I **Demand: Peak Load** **Wind Gen:High Wind Generation** **Case- I(a)**

Exhibit-I(b)

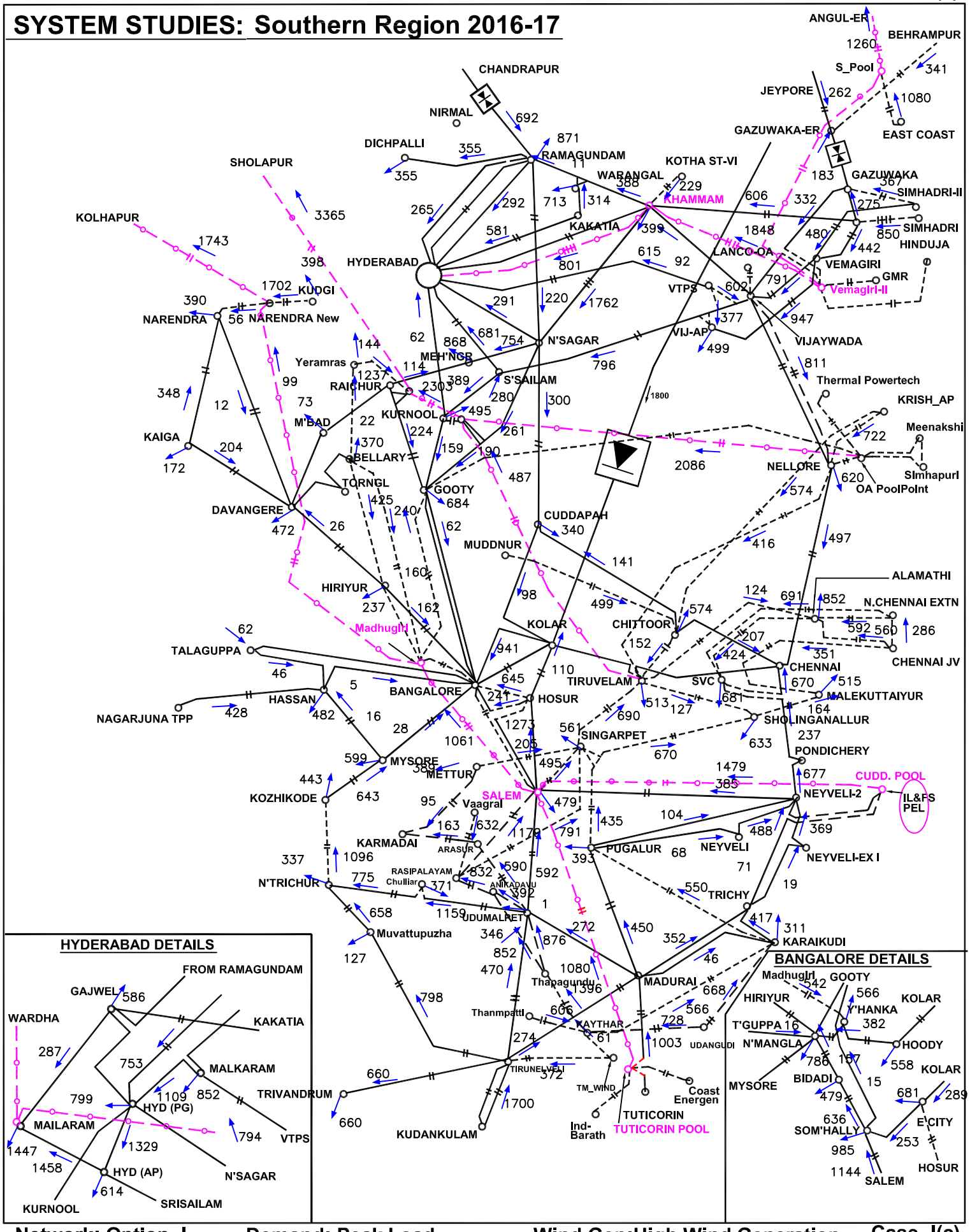
SYSTEM STUDIES: Southern Region 2016-17



Network: Option- I Demand: Peak Load Wind Gen:High Wind Generation Case- I(b)-reverse

Exhibit-I(c)

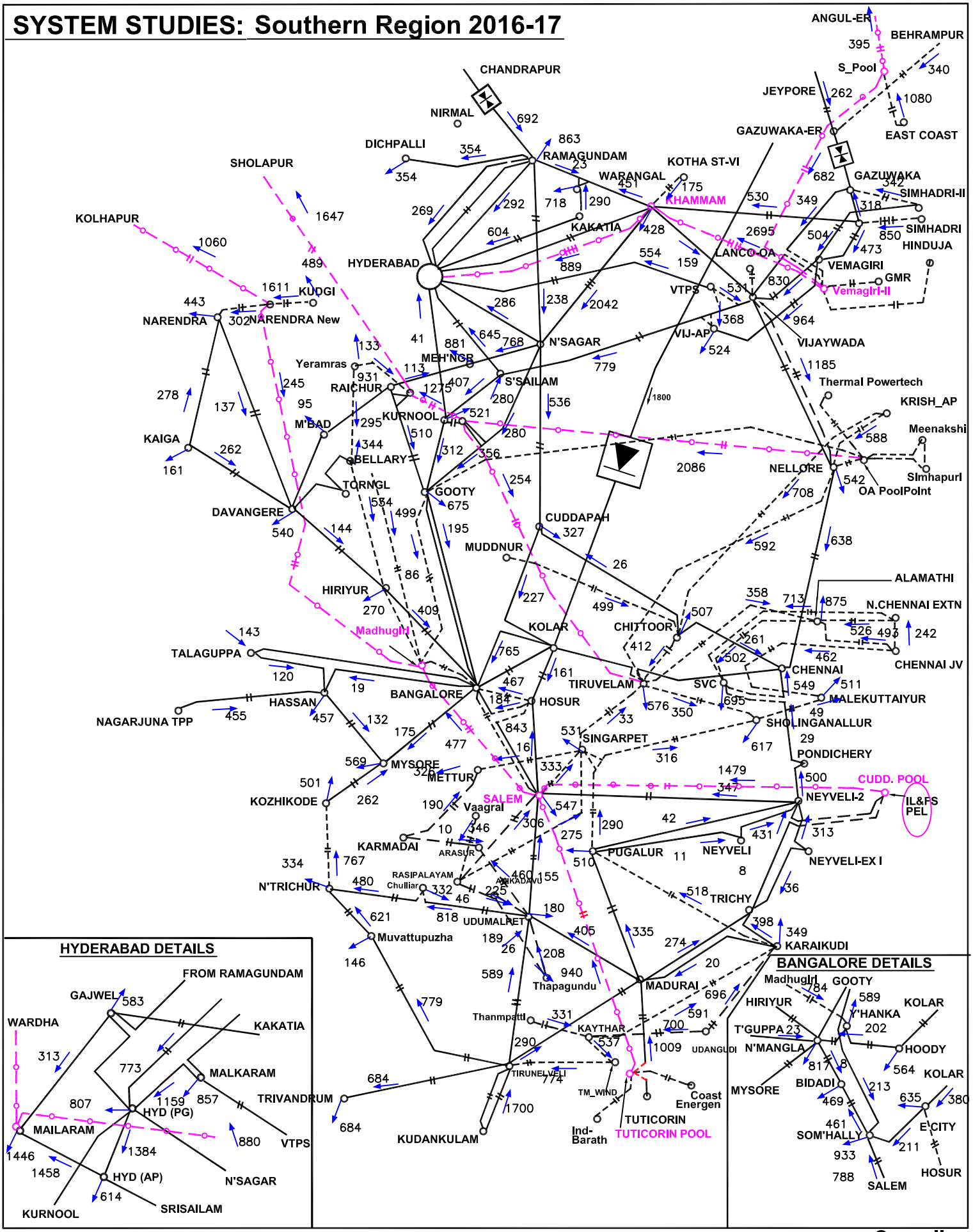
SYSTEM STUDIES: Southern Region 2016-17



Network: Option- I Demand: Peak Load Wind Gen:High Wind Generation Case- I(c)

Exhibit-II

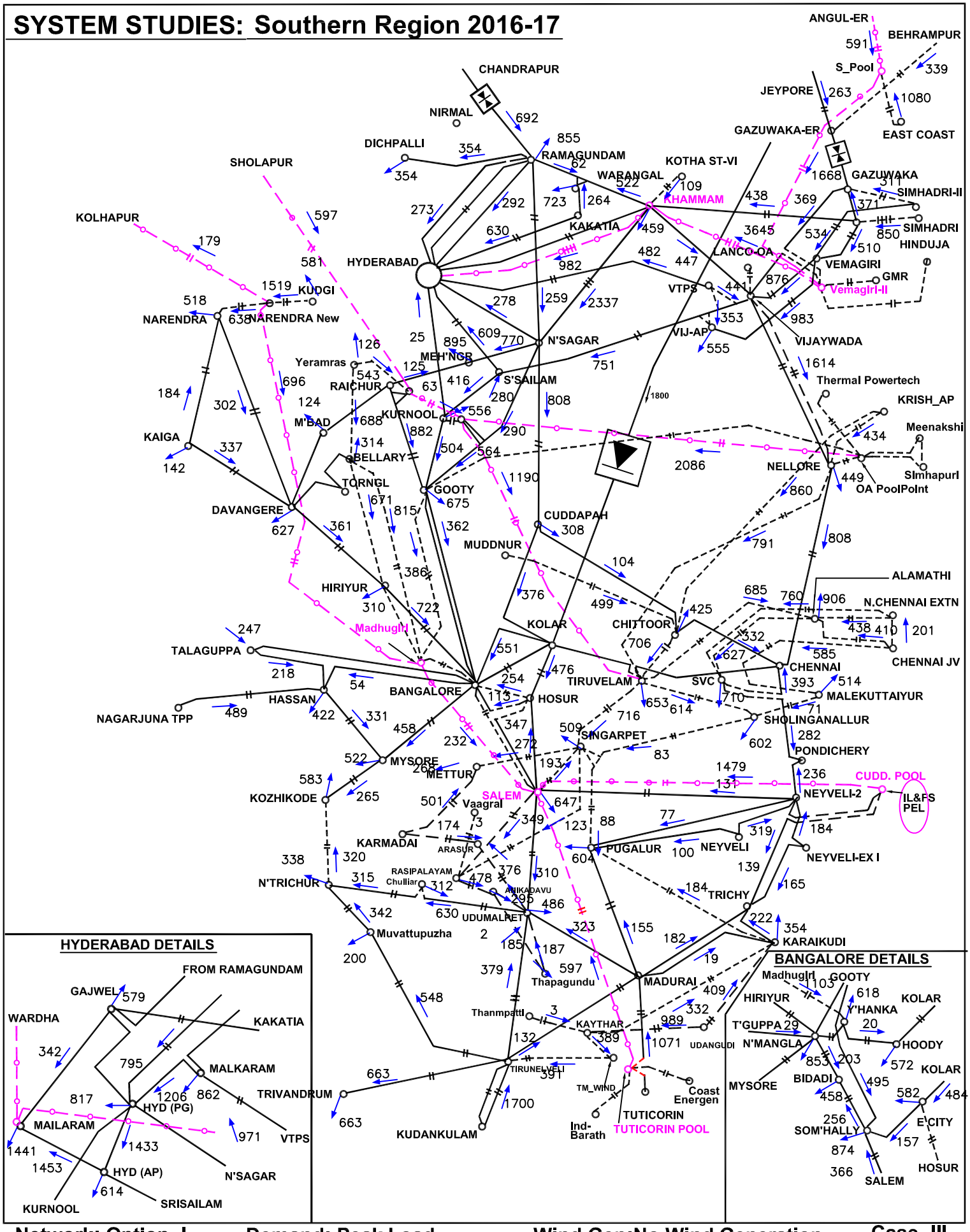
SYSTEM STUDIES: Southern Region 2016-17



Network: Option- I Demand: Peak Load Wind Gen:Medium Wind Generation Case- II

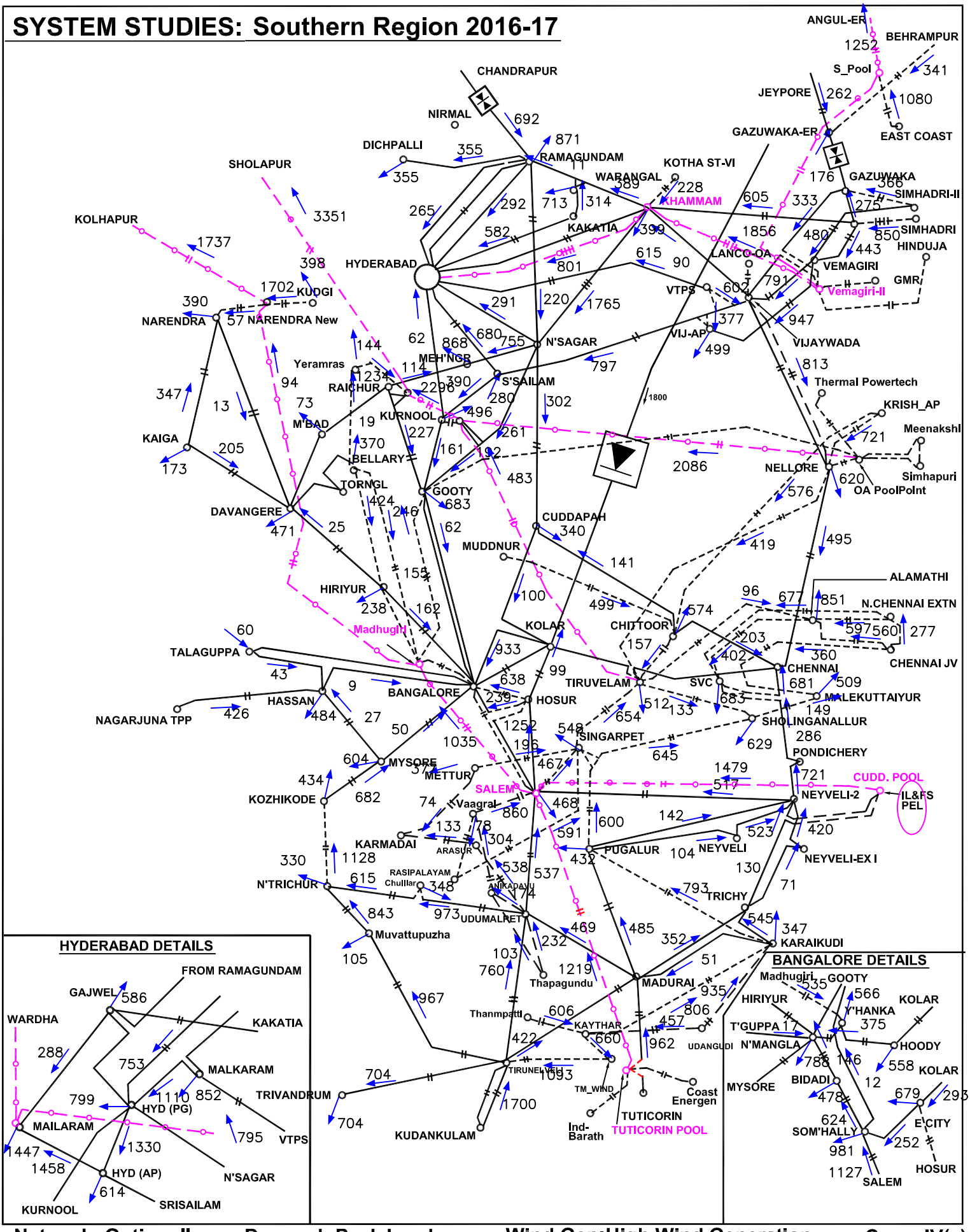
Exhibit-III

SYSTEM STUDIES: Southern Region 2016-17



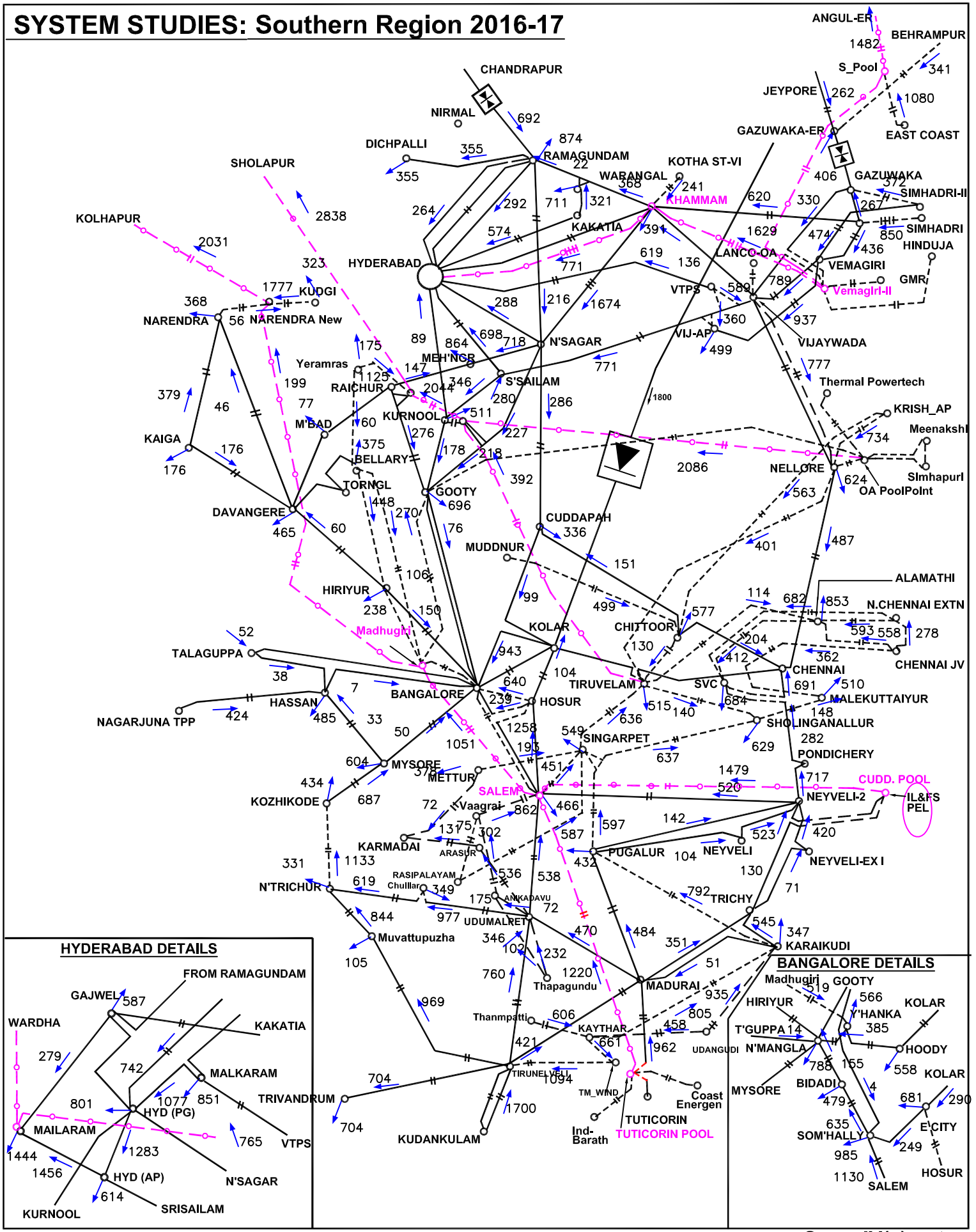
Network: Option- I Demand: Peak Load Wind Gen:No Wind Generation Case- III

SYSTEM STUDIES: Southern Region 2016-17



Network: Option- II Demand: Peak Load Wind Gen:High Wind Generation Case- IV(a)

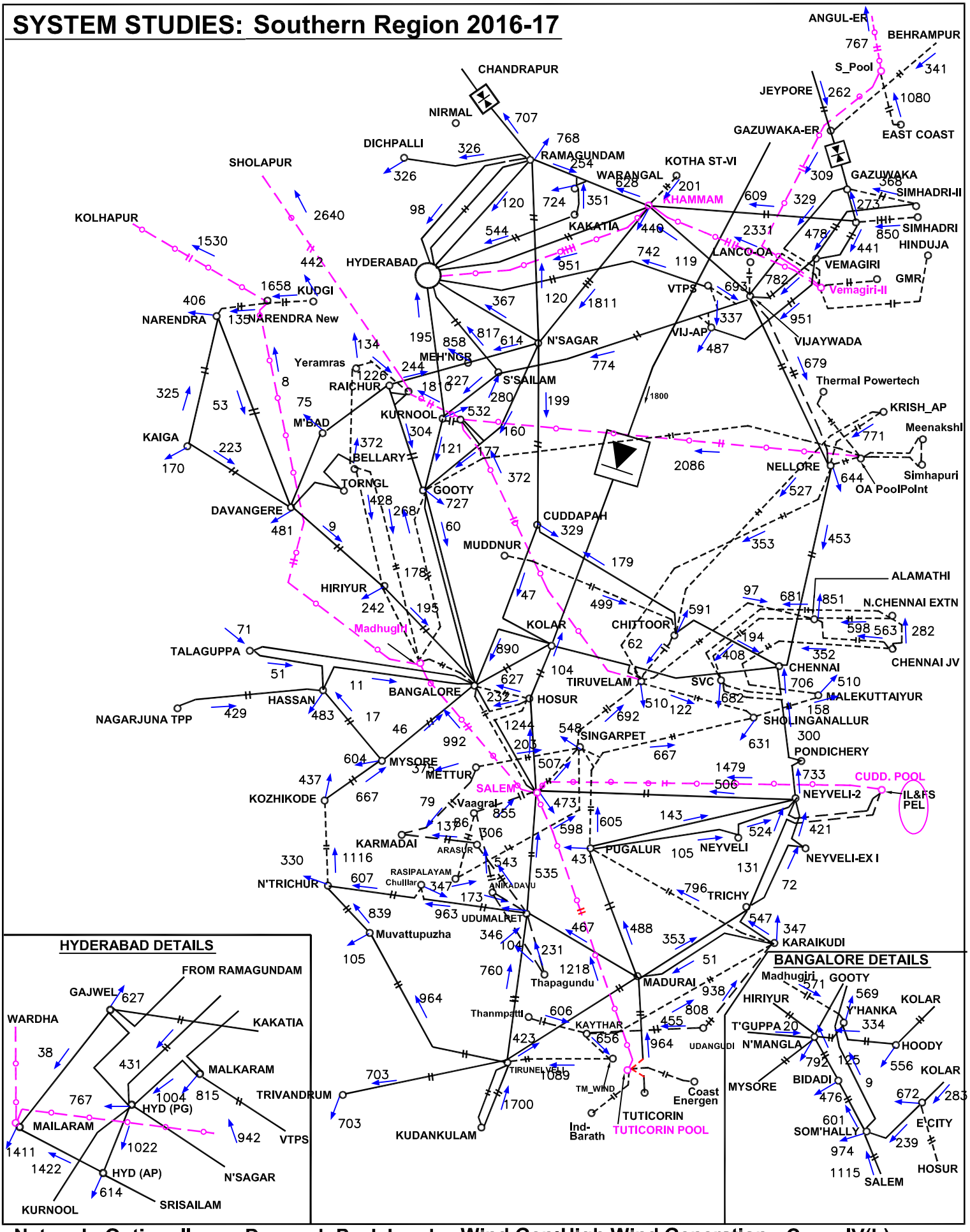
SYSTEM STUDIES: Southern Region 2016-17



Network: Option- II **Demand: Peak Load** **Wind Gen:High Wind Generation** **Case- IV(a)-outage**

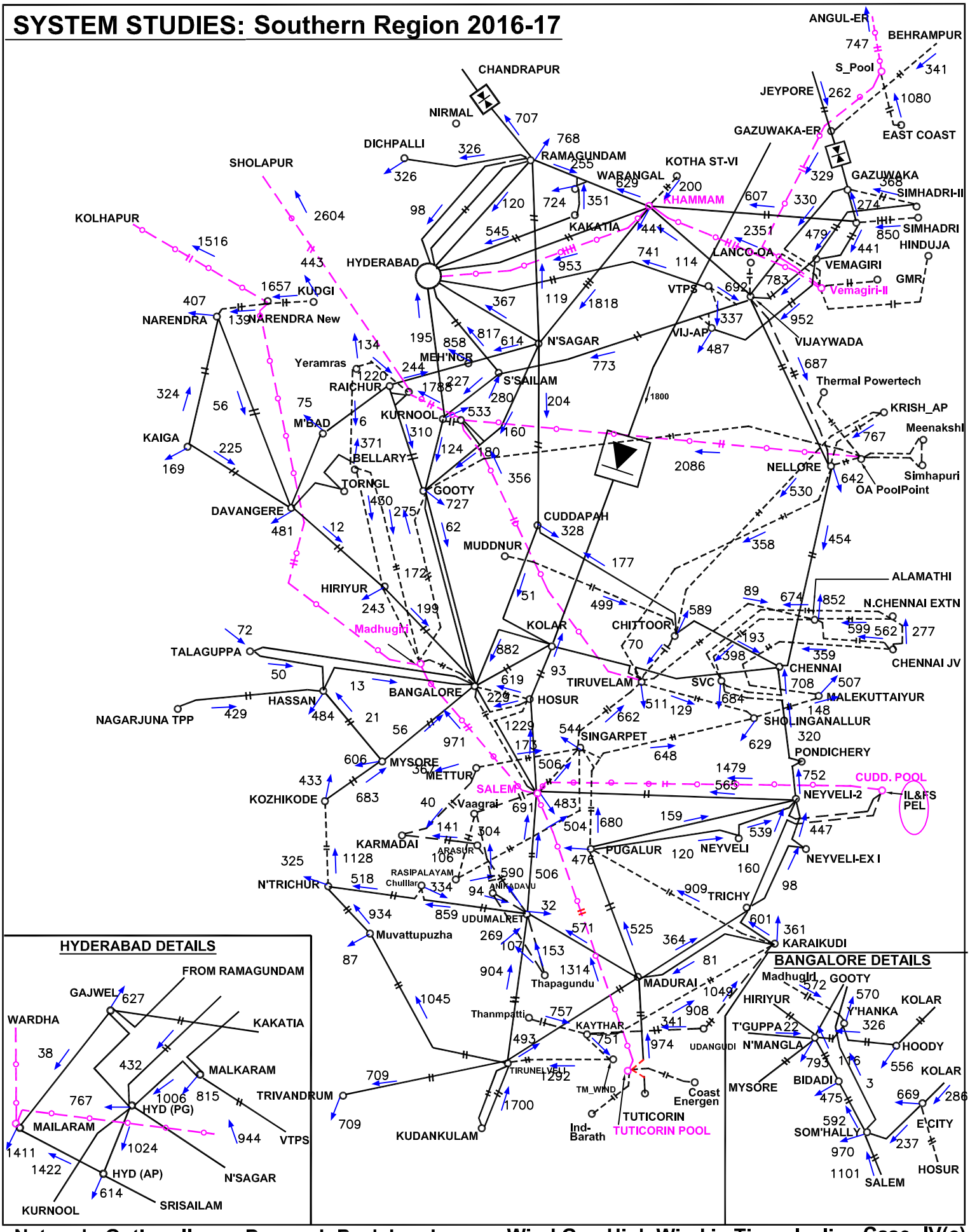
Outage of S/C of Raichur- Sholapur 765kV D/C line

SYSTEM STUDIES: Southern Region 2016-17

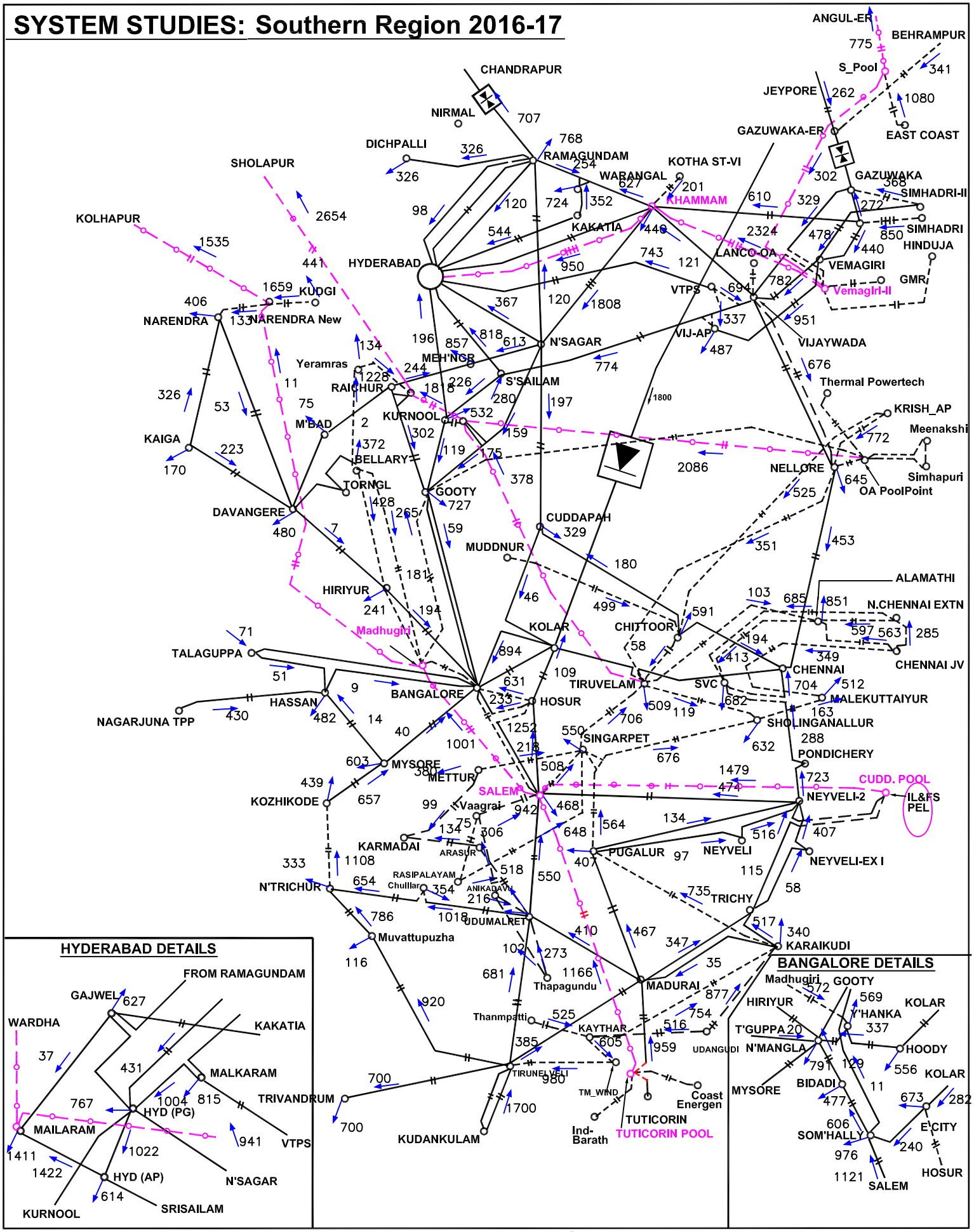


Network: Option- II **Demand: Peak Load** **Wind Gen:High Wind Generation** **Case- IV(b)-reverse**

SYSTEM STUDIES: Southern Region 2016-17



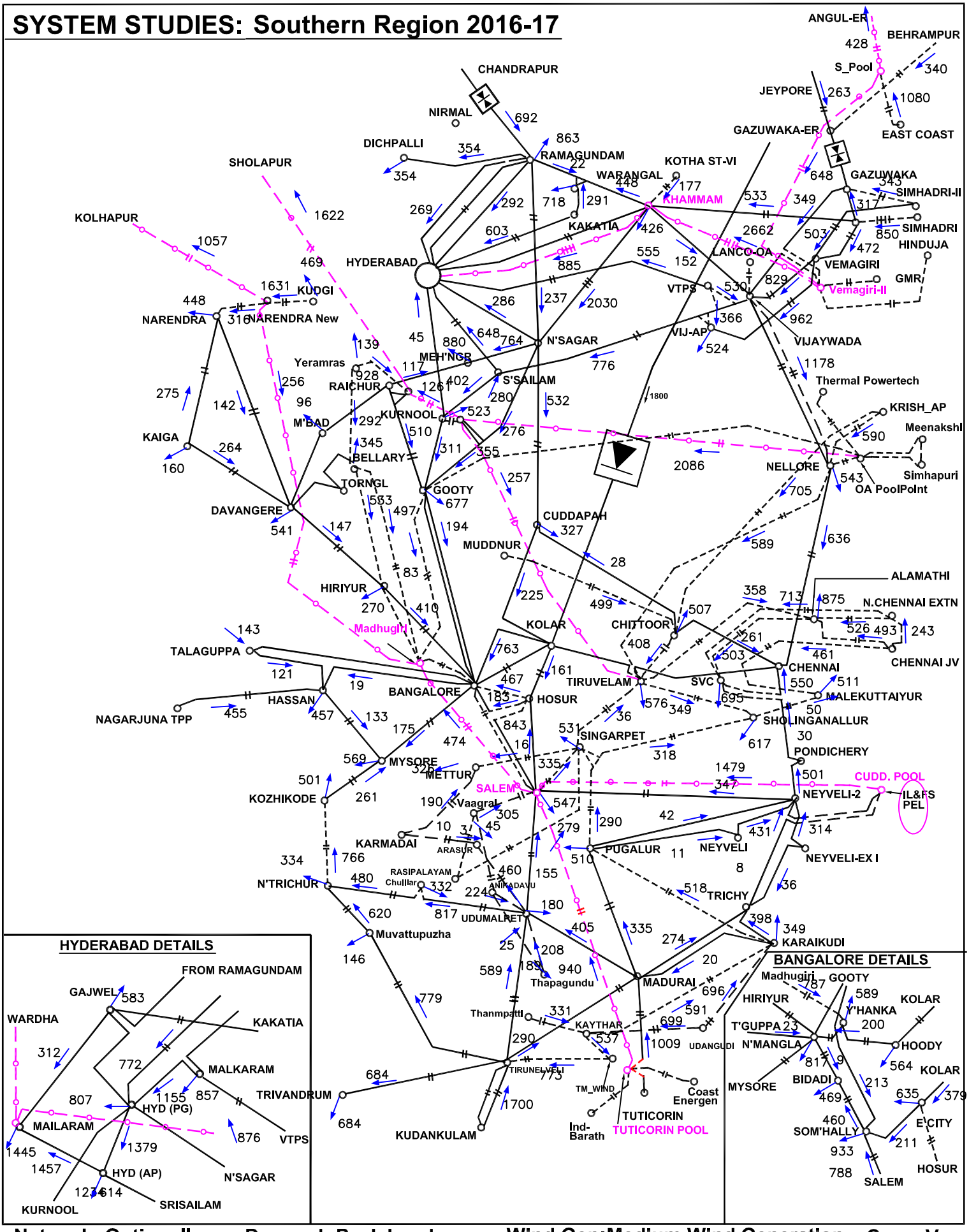
Network: Option- II **Demand: Peak Load** **Wind Gen:High Wind in Tirunelveli**
Medium Wind in Udumulpet **Case- IV(c)**



Network: Option- II Demand: Peak Load Wind Gen:High Wind in Udumulpet Medium Wind in Tirunelveli Case- IV(d)

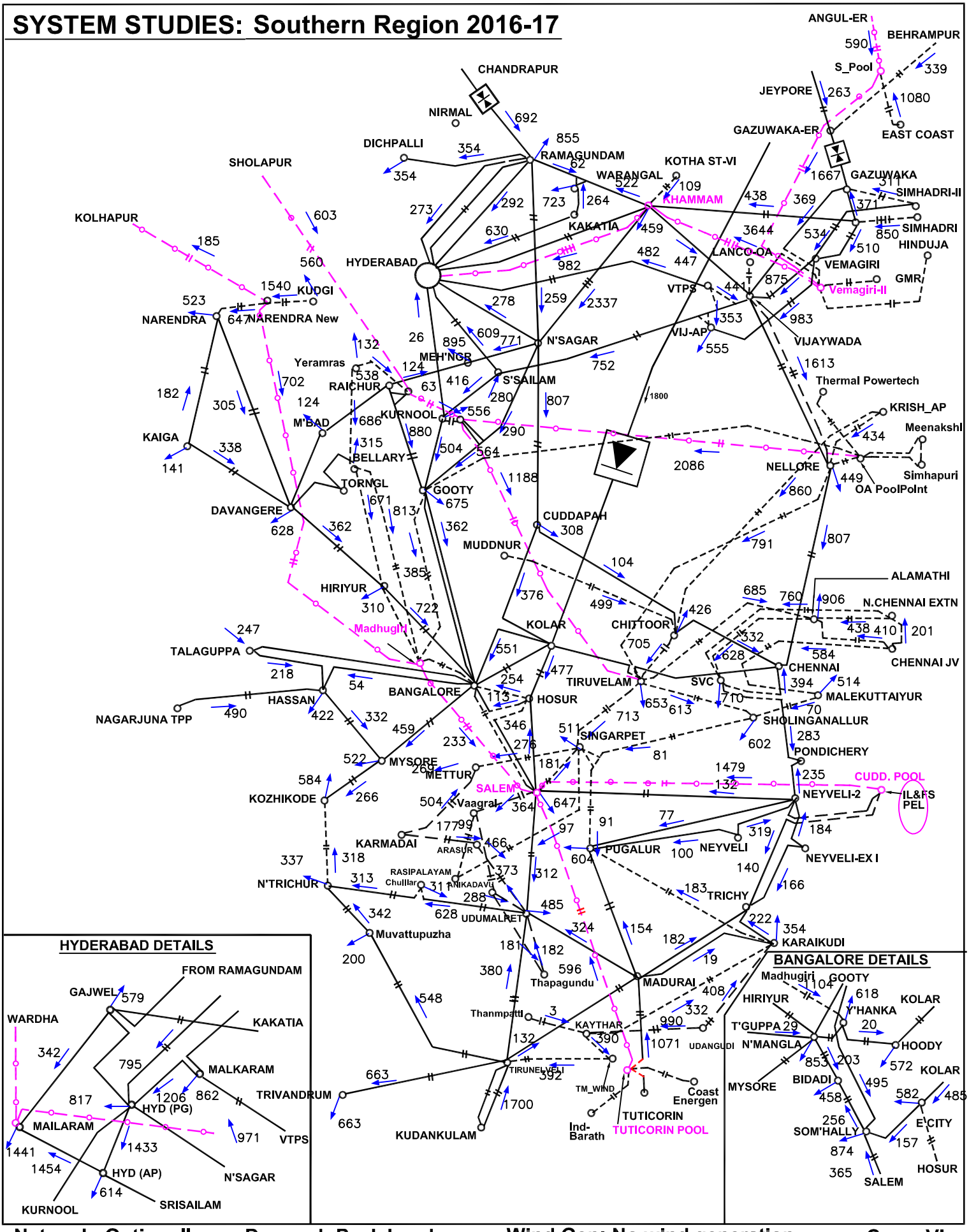
Exhibit-V

SYSTEM STUDIES: Southern Region 2016-17



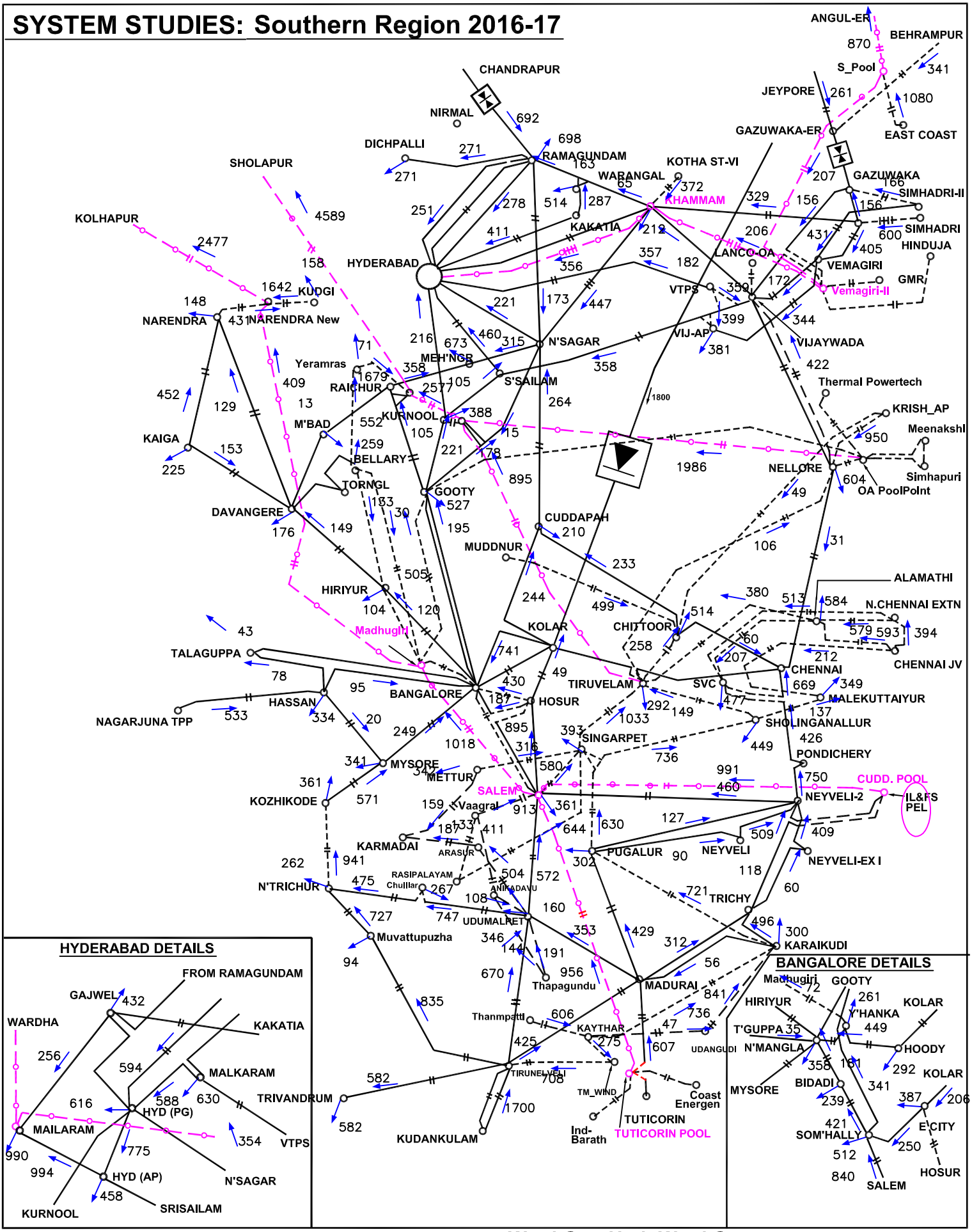
Network: Option- II **Demand: Peak Load** **Wind Gen:Medium Wind Generation** **Case- V**

SYSTEM STUDIES: Southern Region 2016-17



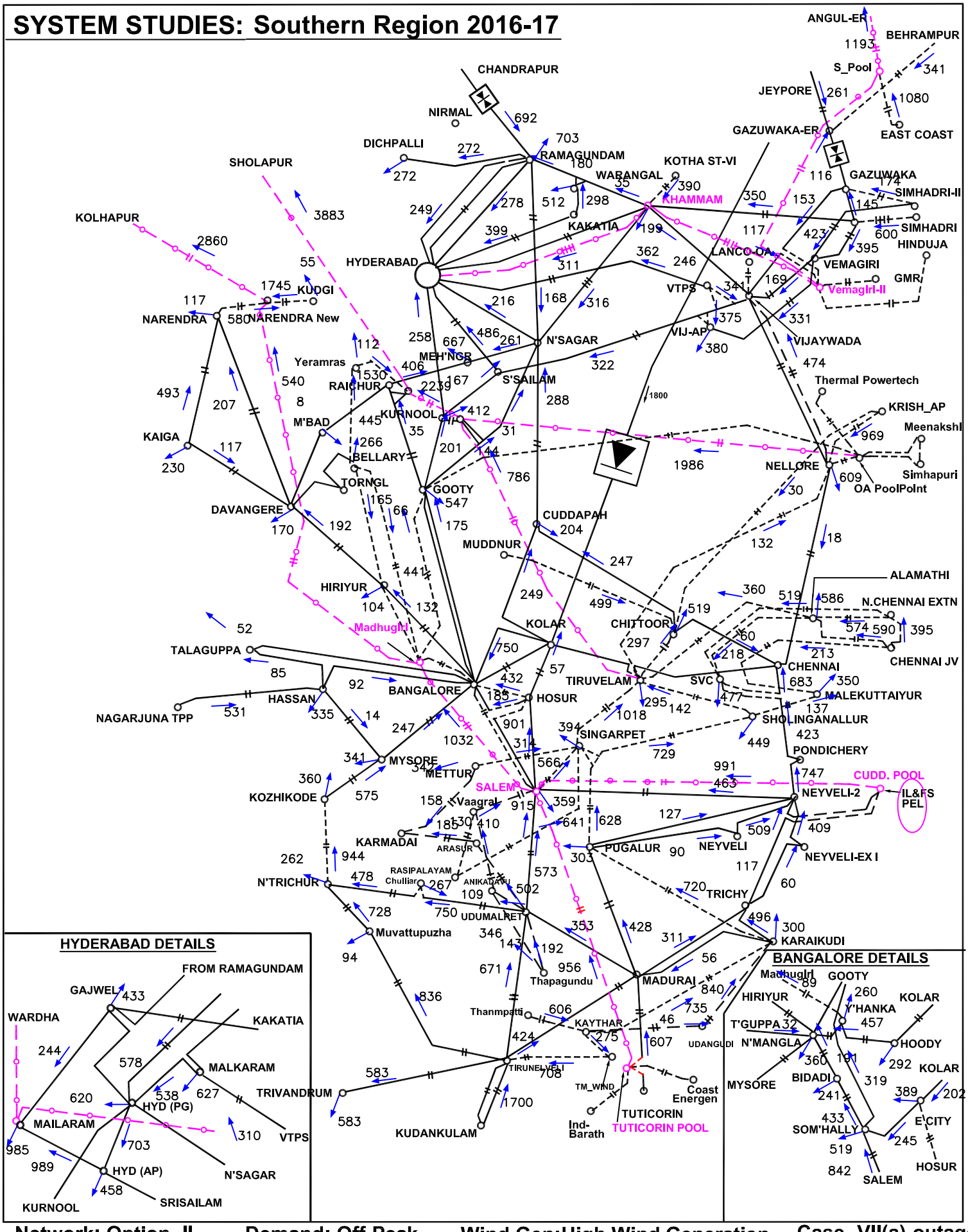
Network: Option- II **Demand: Peak Load** **Wind Gen: No wind generation** **Case- VI**

SYSTEM STUDIES: Southern Region 2016-17



Network: Option- II Demand: Off-Peak Wind Gen:High Wind Generation Case- VII(a)

SYSTEM STUDIES: Southern Region 2016-17

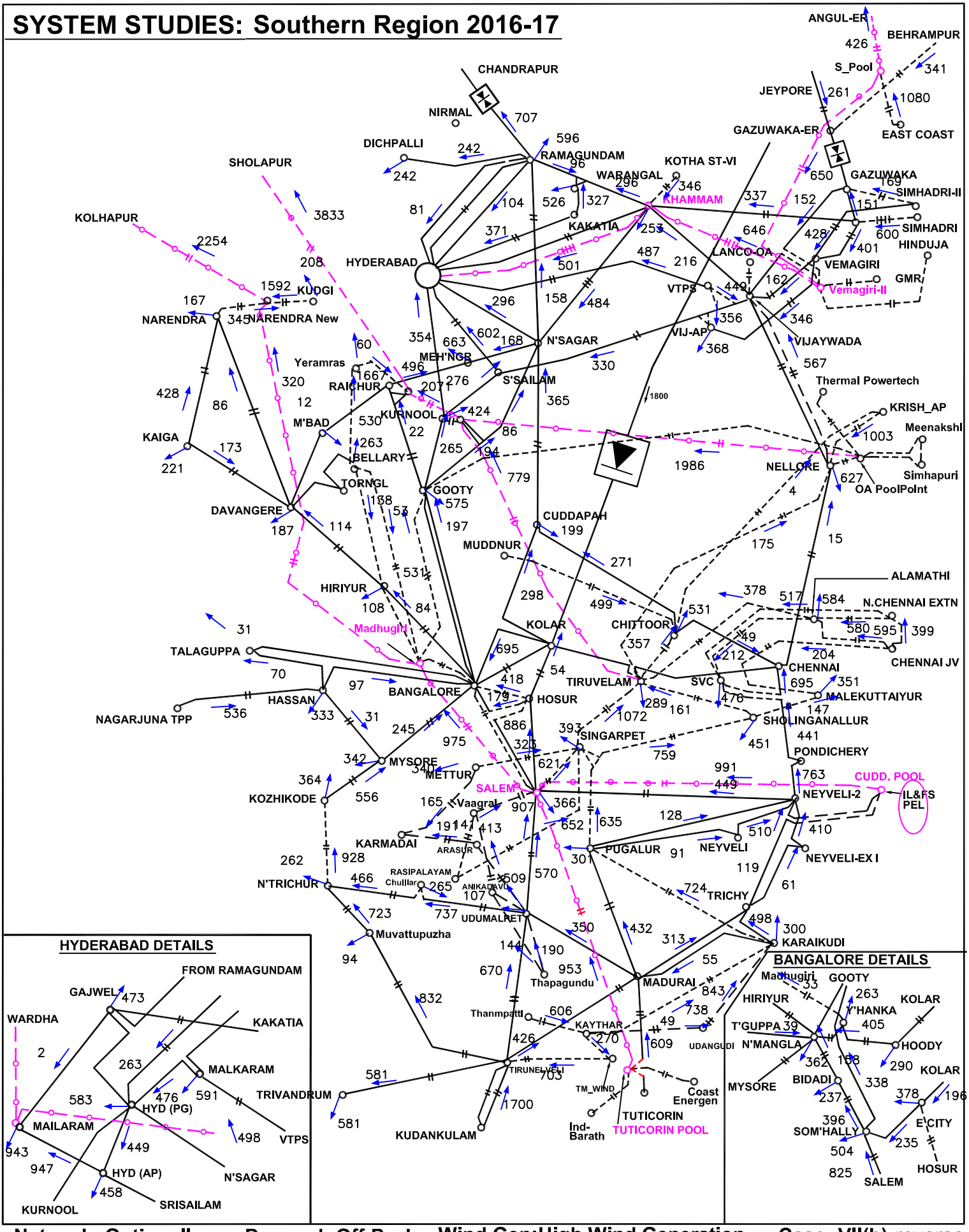


Network: Option- II **Demand: Off-Peak** **Wind Gen:High Wind Generation** **Case- VII(a)-outage**

Outage of S/C of Raichur-Sholapur 765kV D/C Line

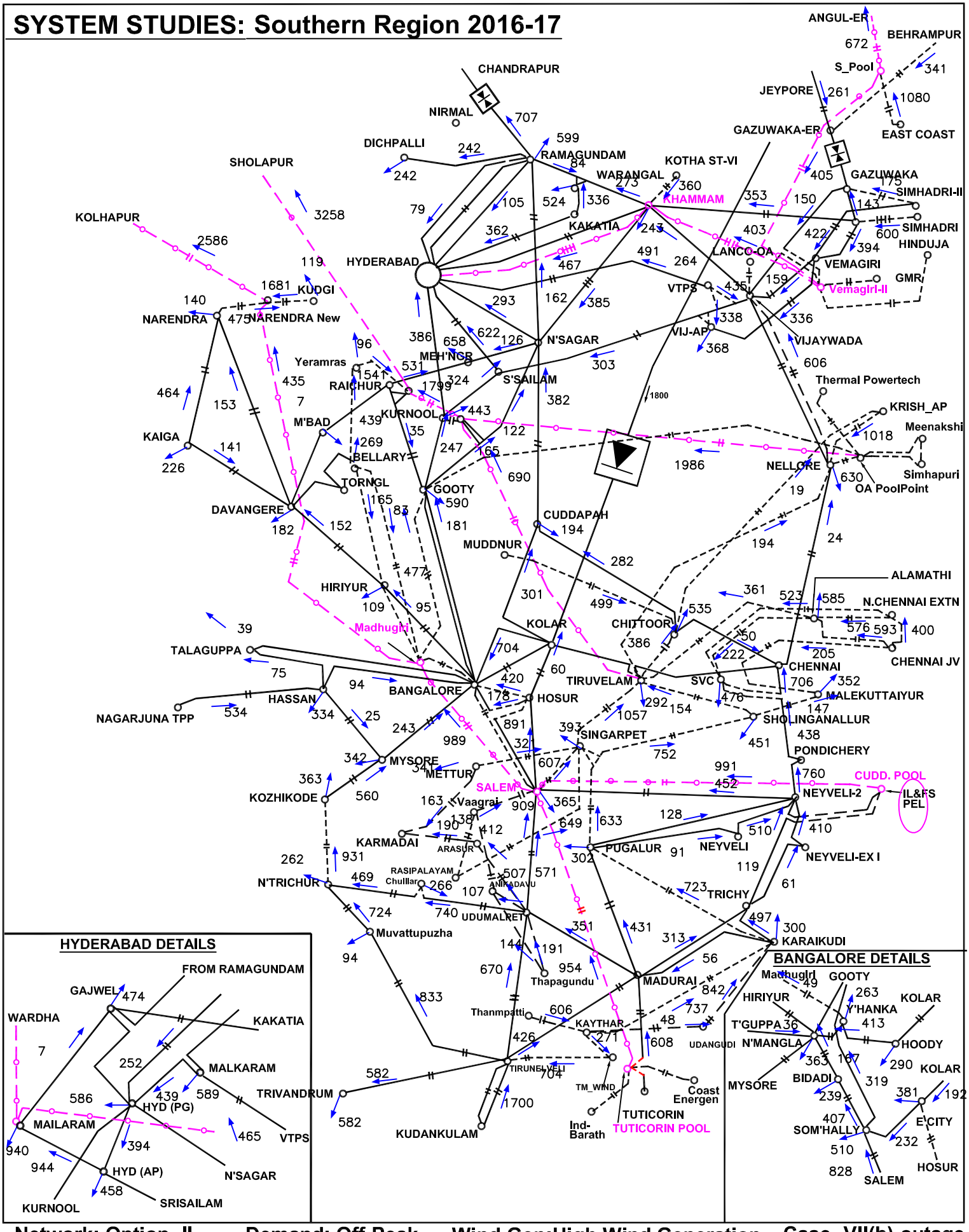
Exhibit-VII(b)

SYSTEM STUDIES: Southern Region 2016-17



Network: Option- II **Demand: Off-Peak** **Wind Gen:High Wind Generation** **Case- VII(b)-reverse**

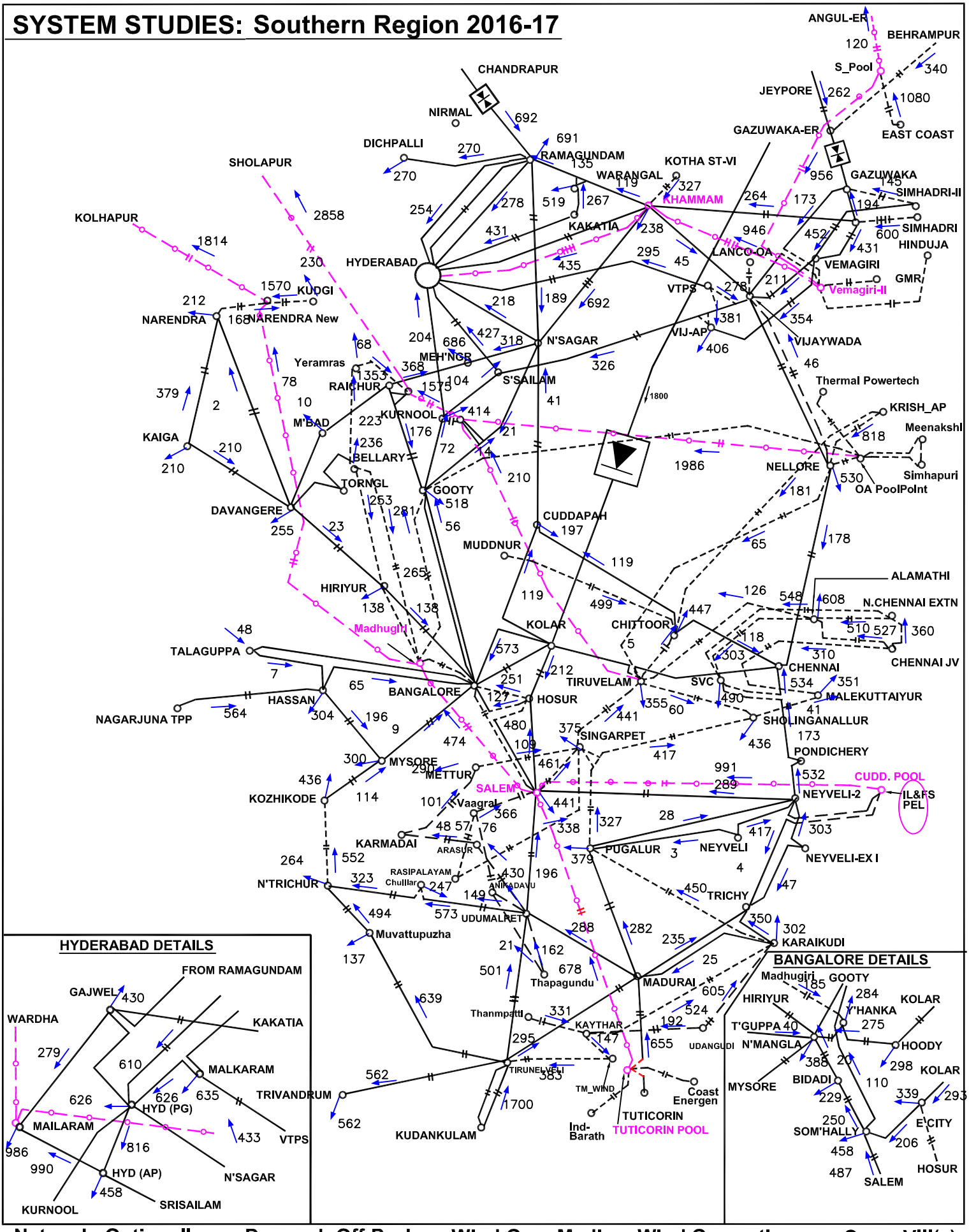
SYSTEM STUDIES: Southern Region 2016-17



Network: Option- II **Demand: Off-Peak** **Wind Gen:High Wind Generation** **Case- VII(b)-outage**

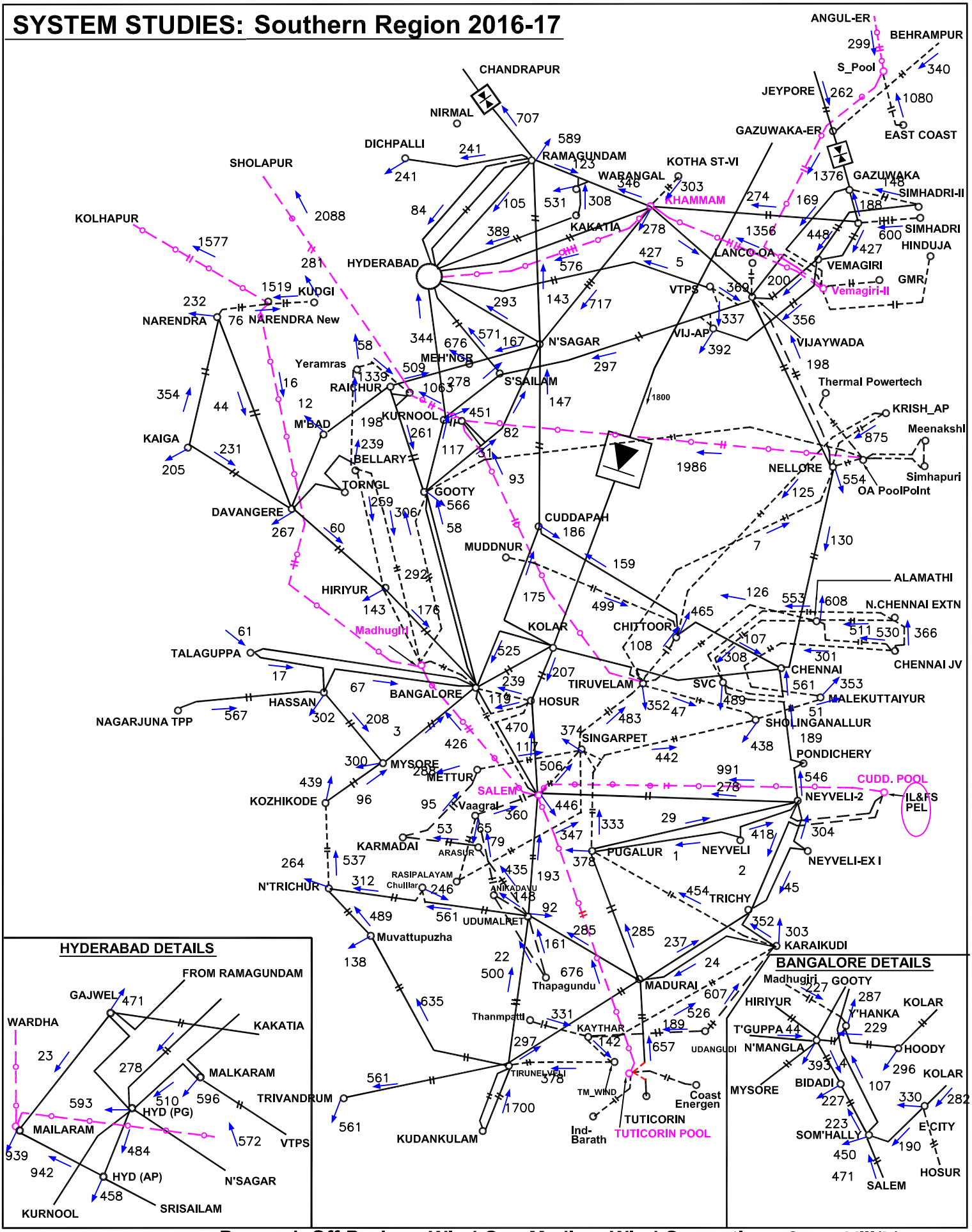
Outage of S/c of Raichur-Sholapur 765kV D/C line

SYSTEM STUDIES: Southern Region 2016-17



Network: Option- II **Demand: Off-Peak** **Wind Gen: Medium Wind Generation** **Case- VIII(a)**

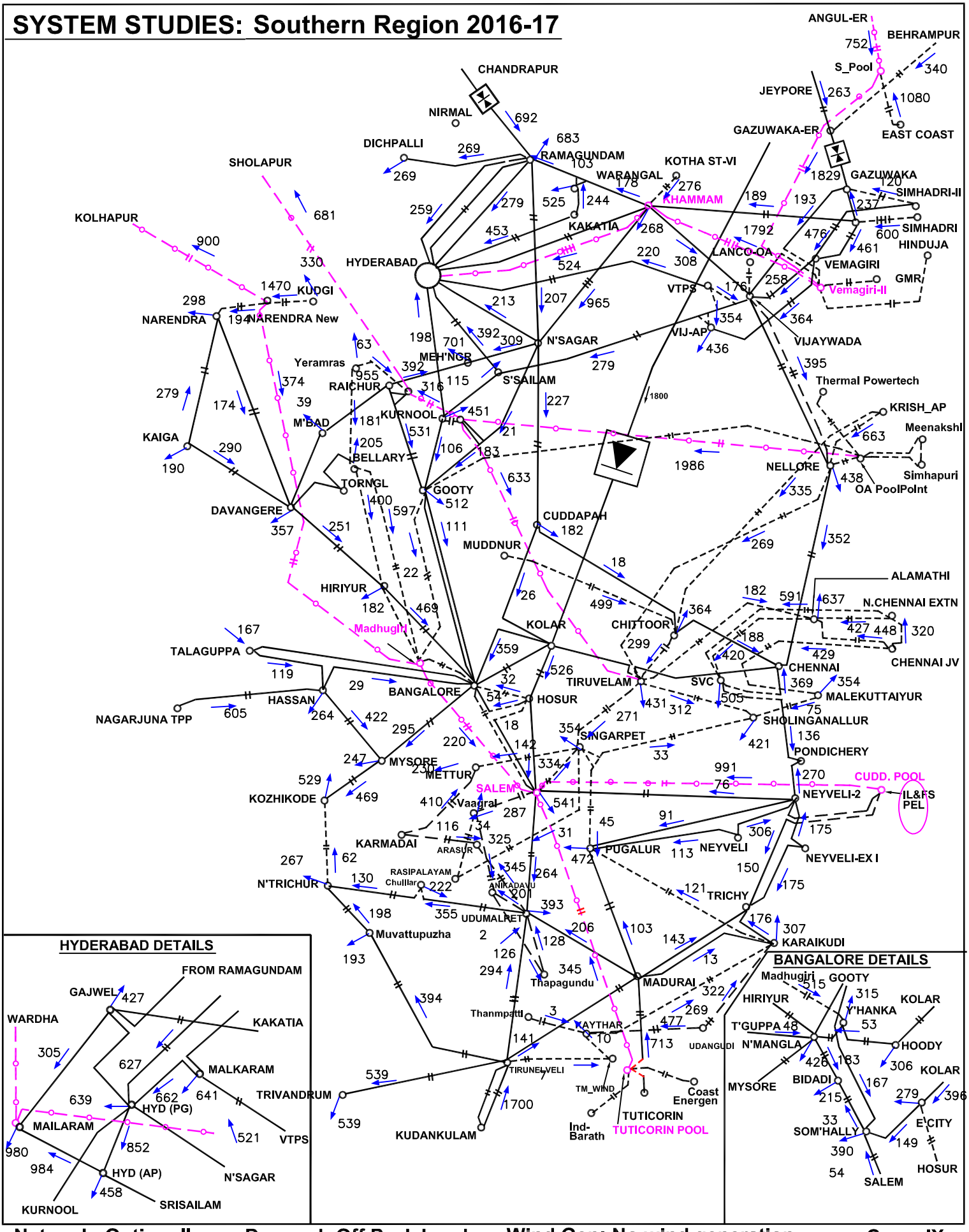
SYSTEM STUDIES: Southern Region 2016-17



Network: Option- II **Demand: Off-Peak** **Wind Gen:Medium Wind Generation** **Case- VIII(b)-reverse**

Exhibit-IX

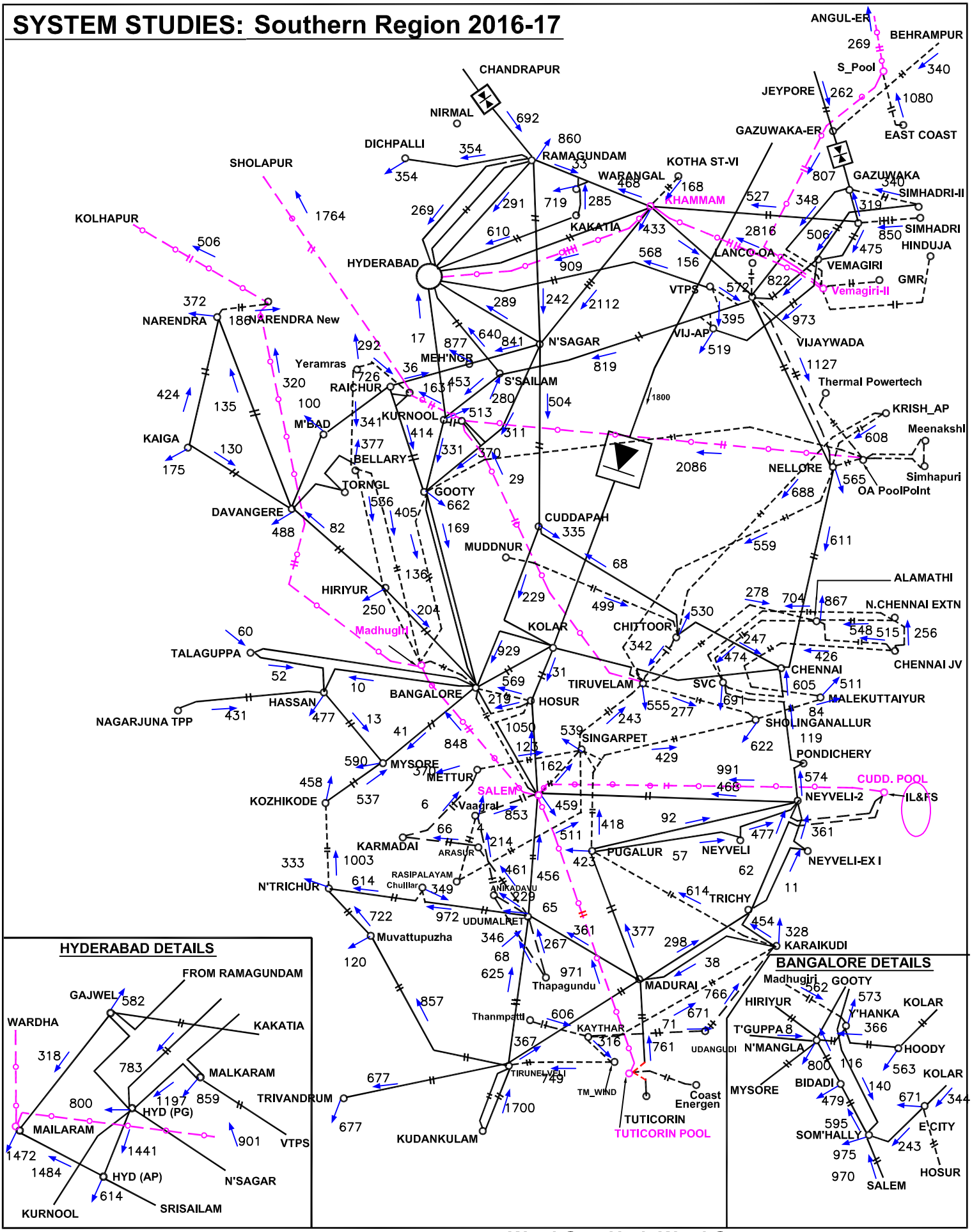
SYSTEM STUDIES: Southern Region 2016-17



Network: Option- II **Demand: Off Peak Load** **Wind Gen: No wind generation** **Case- IX**

Exhibit-X

SYSTEM STUDIES: Southern Region 2016-17



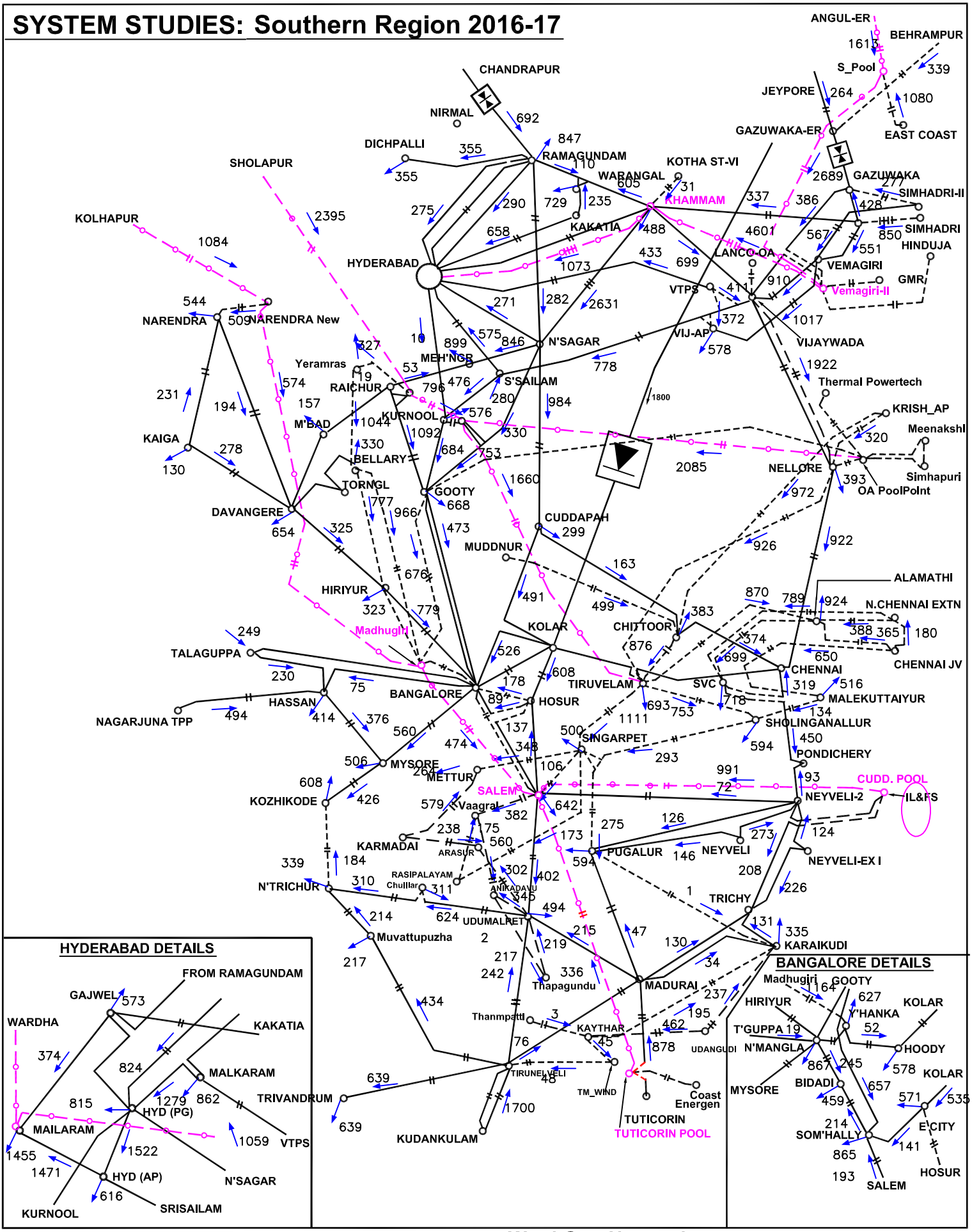
HYDERABAD DETAILS

BANGALORE DETAILS

Network: Option- II **Demand: Peak Load** **Wind Gen:High Wind Generation Pessimistic/Realistic Scenerio** **Case- X**

Exhibit-XI

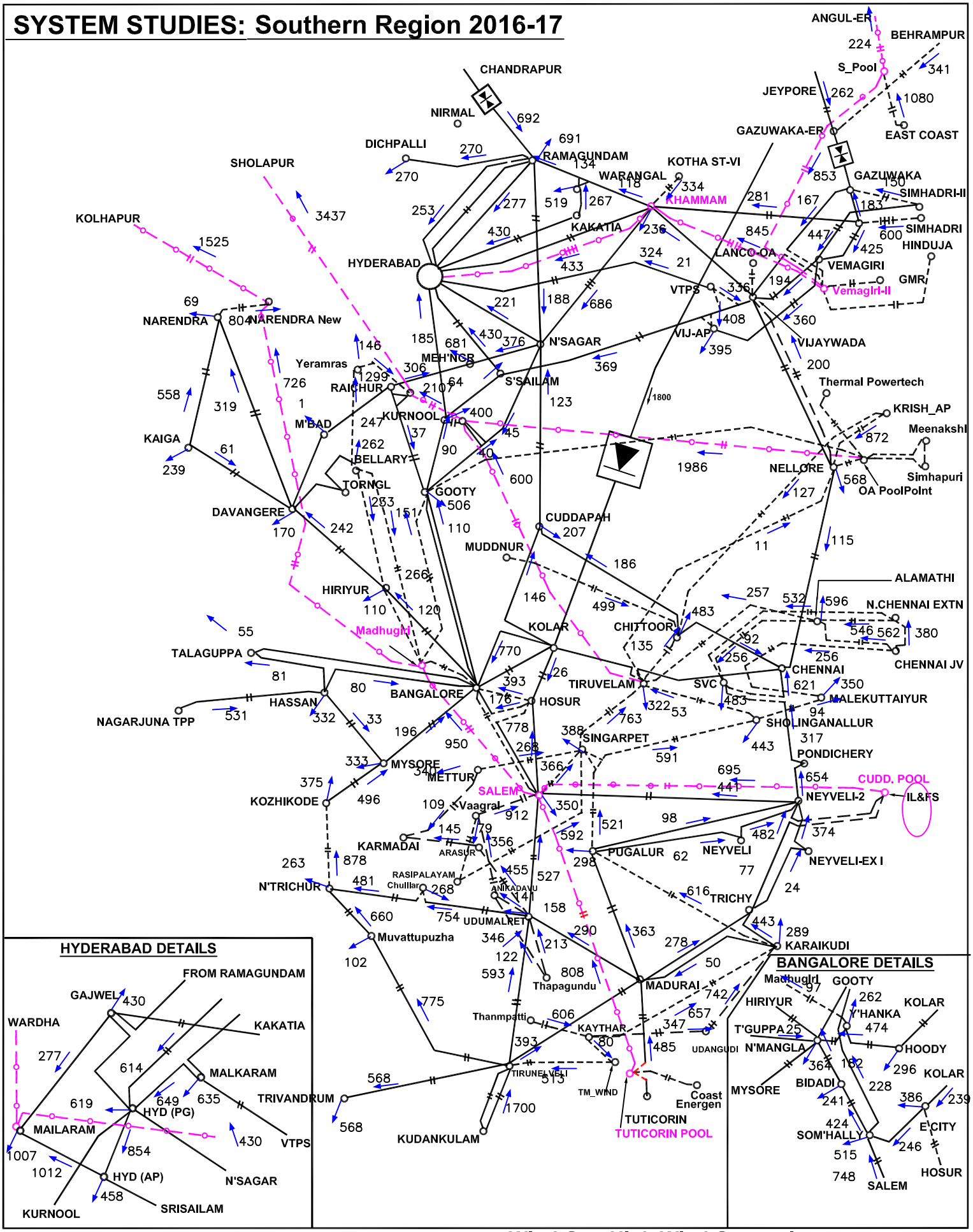
SYSTEM STUDIES: Southern Region 2016-17



Network: Option- II **Demand: Peak Load** **Wind Gen:No wind generation** **Case- XI**

Pessimistic/Realistic Scenerio

SYSTEM STUDIES: Southern Region 2016-17

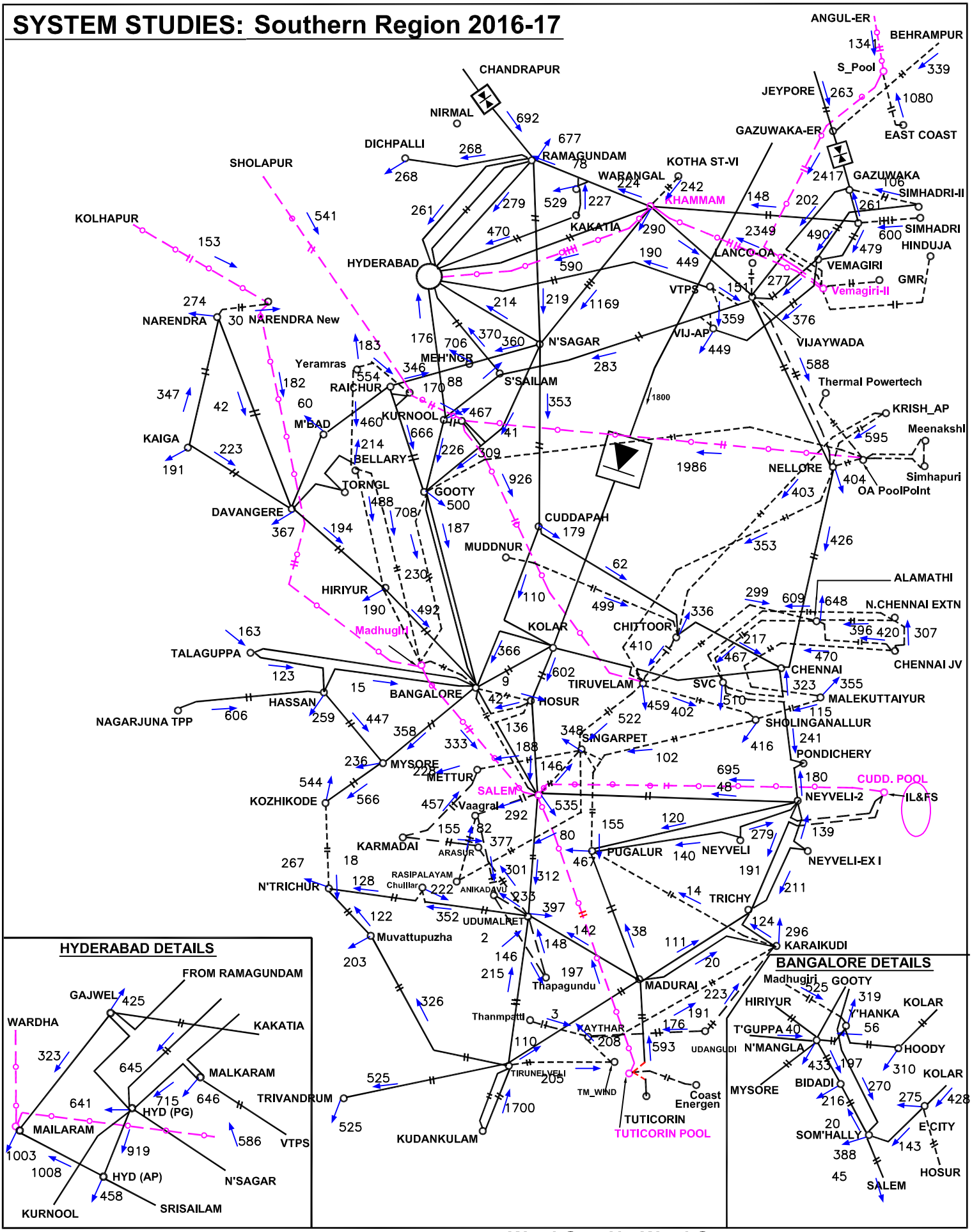


Network: Option- II **Demand: Off-Peak Load** **Wind Gen:High Wind Generation** **Case- XII**

Pessimistic/Realistic Scenerio

Exhibit-XIII

SYSTEM STUDIES: Southern Region 2016-17



Network: Option- II **Demand: Off-Peak Load** **Wind Gen:No Wind Generation** **Case- XIII**

Pessimistic/Realistic Scenerio