MINUTES OF THE FORTY THIRD MEETING

OF

FORUM OF REGULATORS (FOR) HELD AT MUSSOORIE.

Venue	**:**	**Conference Hall, Seventh Floor Hotel Royal Orchid Fort Resort Mussoorie (Uttarakhand).**
Dates	**:**	**16th - 18th October, 2014**
List of Participants	**:**	**At Annexure-I (enclosed).**

The meeting was chaired by Shri Gireesh B. Pradhan, Chairperson, Central Electricity Regulatory Commission (CERC) and Forum of Regulators (FOR). He extended a warm welcome to all members of the Forum. The Chairperson welcomed Shri Jagjeet Singh, Chairperson, Haryana Electricity Regulatory Commission (HERC) who was attending the FOR meeting for the first time.

The FOR thereafter took up the agenda items for consideration.

Agenda Item No. 1 : Confirmation of the Minutes of the 42nd Meeting of "FOR" held on 27th August, 2014 at CERC's Office, New Delhi.

The Forum noted and endorsed the minutes of the 42nd Meeting of FOR held at CERC's Office, New Delhi on 27th August, 2014.

Agenda Item No. 2 : To consider and discuss the report of the Working Group on "Power Supply Challenges & Way Forward".

Chairperson, CERC & FOR remarked that the Forum in its Meeting held on 27.6.2014 had decided, in pursuance of a request by the Hon'ble Minister of Power, to constitute a Working Group from amongst the Members of the FOR to examine the issues inter alia connected with power supply challenges and a suggested way forward. The Working Group on "Power Supply Challenges" has since been constituted. The Working Group met on 27.8.2014 and 10.10.2014 in CERC, New Delhi. The Working Group strongly felt that -

- Detailed analysis / assessment of generation capacity requirement needs to be undertaken with due regard to an accurate estimation of demand and transmission and distribution losses;
- Long term planning for capacity addition has to be done and cannot be deferred. But the same would have to keep in mind the constraints of fuel, poor health of Discoms, stranded capacity etc.;
- The financial impact of supply of 24X7 power to various consumer categories has to be examined;

- The measurement of efficiency improvement, requirement of capital expenditure, efficient methodologies for power procurement and demand side management are also required to be examined in detail.

The Working Group decided that in order to carry out a detailed study on the above, two small Sub-Group consisting of members from the Working Group be constituted **(Annexure-II)**.

Sub-Group (I) - to study the issues relating to "24X7 Power Supply to the Consumers & Impact thereof" :

A presentation **(Annexure-III)** was made by Shri M.R. Sreenivasa Murthy, Chairperson – KERC & Chairman of the Sub-Group (I), highlighting the issues relating to Power Supply Position and Energy Shortage, Strategy for 24X7 power supply, implications of electricity shortage, power supply position in Rural Areas, experience on 24X7 power supply in respect of Gujarat, West Bengal, Kerala and Punjab, Estimated demand, target capacity addition, projected availability, strategic Roadmap bridging the gap in the areas of generation / transmission / distribution etc.

Discussion:

Many of the members of the Forum highlighted the need to define the concept of 24X7 supply to consumers. Ideally, it should mean reliable 24x7 supply to all (except agriculture) consumers and to agriculture consumers a supply of power for 8-10 hours daily or as may be decided keeping in view the conditions in different States. 24X7 power supply should factor in the requirement of supply of electricity to all un-electrified households. The total household consumption of 183.7BU in 2012-13 is likely to increase to 339.76 BU if 100% electrification of 262.4 million households projected by 2018-19, takes place. In order to meet the demand-supply gap in respect of peak load and energy demand, various options for augmentation of capacities under generation, transmission and distribution need be explored.

Decisions:

After discussion, the following was agreed:-

- Requirement of investment in generation augmentation to be assessed and included in the report.
- Realistic targets for reduction of AT&C loss levels and impact of the same on energy demand and peak demand along with investment requirement for achieving the targets should be assessed and included in the report.

- The data considered by the Sub-Group may be circulated amongst the Members of FOR for verification / authentication.
- Members of FOR may like to provide any other suggestion in order to finalize the report.

It was further highlighted by the Chairman of the Sub-Group that only a few SERCs have responded to their request for providing data on power supply position, future demand etc. Chairperson, FOR requested the ERCs to provide the information within a week's time, so that the report could be finalized for further consideration in the next FOR meeting.

Sub-Group (II) - to study the issues relating to "Feeder Segregation of Rural and Agricultural Loads" :

A presentation **(Annexure-IV)** was made by Shri Pravinbhai Patel, Chairperson – GERC & Member of the Sub-Group (II) on the issues relating to "Feeder Segregation of Rural & Agricultural Loads" highlighting *inter alia* the objective of feeder segregation programme, analysis of the past experience in feeder segregation of selected States (Punjab, Gujarat, erstwhile Andhra Pradesh, Rajasthan and Haryana), issues relating to Physical Segregation, Virtual Segregation, Metering, Implementation of HVDS, Solar Pump sets, impact of Subsidy, DSM Measures, Structure and Phasing of implementation of

Feeder Segregation programme, Cost Benefit Analysis of Feeder Segregation, funding mechanism, measures for effective metering, recommendations on the national level framework for feeder segregation etc.

Discussion:

The objective of agriculture feeder segregation includes improvement in load management; improvement in power supply to rural non-agricultural consumers; reduction in line losses through better monitoring of consumption in the agricultural sector; and improvement in management of environmental resources.

The structure and phasing of feeder segregation vary across States. Only virtual segregation has been carried out in Rajasthan, whereas physical segregation was carried out in Andhra Pradesh, Gujarat, Punjab and Haryana. The cost of feeder segregation has varied approximately in the range of Rs.33.94 lacs. to Rs.67.75 lacs., excluding expenditure on account of manpower.

Decisions:

After discussion, the following was agreed :

- Each State would need to prepare its own blue prints for a feeder segregation strategy.

- Agriculture feeder segregation facilitates accurate measurement of losses on account of agriculture consumers which directly helps State Government in identifying the actual subsidy component required to be provided to the sector. The report should suitably address this issue. The agriculture feeder segregation closely relates to efficient rural electrification and therefore, a funding pattern on the lines of the RGGVY Scheme may be desirable.

- Threshold conditions for feeder segregation project may be examined and assessed by the Sub-Group in detail and recommendations may be included in the final report. It was also felt that there would not be in any more need for "pilot projects" on feeder segregation except where States think that peculiar circumstances in their respective areas warrant such pilots.

- Funding mechanism may be suggested on total project basis.

- The data considered by the Sub-Group may be circulated amongst the Members of FOR for verification / authentication.

- Members of FOR may like to provide any other suggestion within a week to enable the Working Group to finalize the report at the earliest and present before the next FOR meeting for consideration.

It was further informed that only a few SERCs have responded to the request for providing relevant data. Chairperson, FOR requested the ERCs to respond to provide the information within a week's time, so that the report could be finalized for further consideration in the next FOR meeting.

Agenda Item No. 3 : Presentation and Discussion on "Assessing the Key issues in Grid Integration of Renewable Energy in India using a Grid Dispatch Model".

A presentation **(Annexure-V)** was made by Dr. Nikit Abhyankar from Lawrence Berkeley National Laboratory, USA on key issues involved in grid integration of renewable energy in India using a grid dispatch model, which *inter alia*, include the following.

1. Motivation & reasons for studies on grid integration of renewable energy
2. Cost benefit analysis of renewable purchase scheme in USA

3. Cost benefit analysis of California Energy Imbalance Market

4. Analysis of grid dispatch simulation with high renewable energy penetration in Indian scenario, including modeling framework, impact on transmission, dispatch simulations projected for FY 2021-22

5. Way forward

During the course of presentation, Dr. Abhyakar highlighted the urgent need for a detailed cost benefit analysis vis-à-vis RPO targets, feed in tariff and integration costs, so that a least cost integration strategy could be identified and adopted by the utilities. He further analyzed the importance of key issues viz. hourly load profiles, hourly solar and wind profiles, existing / new conventional generation, transmission model and their impact on generation and transmission investments and overall system costs. The role of complementary programmes viz. demand response besides sharing of resources across States and deviation settlement markets were also deliberated upon.

The Forum appreciated the presentation.

Agenda Item No. 4 : Presentation and Discussion on "Measures for Reduction of Technical & Commercial Losses in Distribution: Best Practices".

A presentation **(Annexure-VI)** was made by Shri Ajoy Mehta, C&MD, MSEDCL on measures for reduction of technical and commercial losses in distribution and best practices adopted by MSEDCL. During the presentation, the issues including 24X7 power delivery vis-à-vis input energy and cash, Load shedding strategy, Involvement of people and consumer centric loss reduction strategy, Experiences in metering / billing / cash collection, Complaint redressal mechanism were discussed. The following specific issues emerged in course of discussion:-

- In order to ensure 24X7 supply to the consumers, feeder-wise cash flows commensurate with the energy input and mapping of consumers to their respective feeders are essential. Accordingly, mapping of consumers with feeders (approximately 16,000) was carried out by MSEDCL and this subsequently enabled the discom to identify the feeder-wise technical and cash losses and zero in on the target areas for initiating appropriate consumer-centric measures for reduction of such losses.
- After mapping the consumers and establishing energy input – cash flow link, feeders were segregated into eight categories (A to G3) and a transparent methodology was adopted for carrying out load shedding in the feeder areas with loss levels of 42% and above.

- This measure generated greater awareness among consumers and the discom attained support of the consumers.
- In order to keep the entire system transparent, feeder-wise Billing / Metering / Energy Audit information was kept in public domain.
- This resulted in exponential growth in load-shedding-free feeders from 1064 in January, 2012 to 7290 in July, 2014, thereby taking the load-shedding-free feeders to constitute 85% of the total distribution network.
- As a next step, large scale automation was done by using latest technological interventions with the objective of reducing human interface.
- IR / RF / AMR meters, based on the technology developed in-house (manufactured by a host of manufacturers) were brought into use.
- In order to minimize inconvenience to the consumers for payment of electricity bills, facilities such as acceptance of payment through ATP machines, credit/debit cards, net banking / RTGS, collection centres, mobile kiosks etc. were started.
- A technology driven system was put in place, whereby the official, upon receipt of an application was mandated to upload the application into the system. All activities connected to providing new connections were to be uploaded on the system thereby keeping the entire transaction transparent and open. This not only helped eliminate corrupt practices, but also gave the Head Quarters an access to the status of pending applications in

respect of new connections and reasons for such pendency, thereby facilitating the competent authority to take corrective measures.

The consumer complaint redressal mechanism was also improved by establishing a centralized call centre for handling complaints. Any consumer in Maharashtra can dial the call centre and register his/her complaint, which will then be transmitted to an appropriate authority for taking necessary action. Once the corrective action is completed, the call centre would contact the complainant to confirm action on the complaint for closure.

Chairperson, FOR directed the FOR Secretariat to prepare a detailed account of measures adopted by MSEDCL for circulation among the SERCs enabling them to take suitable action in their states.

The Forum appreciated the presentation.

Agenda Item No. 5 : Presentation and Discussion on "Reduction of AT&C Losses – A Successful Journey".

A presentation **(Annexure-VII)** was made by Shri Praveer Sinha, CEO&ED, TPDDL on measures identified and implemented by them for reduction of AT&C losses and their successful journey in achieving the loss targets. During the presentation, the following issues have been discussed :

1. The key reasons for AT&C losses
2. Strategies adopted for AT&C loss reduction
3. Milestones achieved during the journey
4. Technology up-gradation & data analytics
5. Approaches for control of power theft
6. Engaging the community

During the course of presentation, Shri Sinha discussed the impact of key initiatives taken by TPDDL on the overall distribution system initially through energy audit and checking the inaccuracies in metering / billing. He further elaborated on the measures taken through metering at DT level, installation of latest circuit breakers / ring main units, revamping sub-stations, revamping net-work, GIS, new metering technology, establishing AMR architecture and in-house developed software for data analytics. The level of success achieved by adoption of consumer centric initiatives, particularly in JJ clusters, by reducing cost of new connection, offering door-step customized service, improving their socio-economic condition, building their capacity to pay thereby building a long-term relationship with them for becoming a disciplined consume.

It was further stated that owing to the measure adopted by the discom from July, 2002 till March, 2014, AT&C losses were reduced from 53.1% to 10.5% thereby saving USD 1.8 Billion to the Government; system reliability was substantially increased from 70% to 99.5%, transformer failure rate was reduced from 11% to 0.55% and new connection energization time reduced from 51.8 days to 6 days. The discom has also paid back the USD 100 loan to the Government.

The Forum noted and appreciated the presentation.

The Forum appreciated the efforts made by UERC under Shri C.S. Sharma, Member and Shri K.P. Singh, Member for the arrangements made for the meeting.

A vote of thanks was extended by Ms. Shubha Sarma, Secretary, CERC. She conveyed her sincere thanks to all the dignitaries present in the meeting. She also thanked the staff of "FOR" Secretariat for their arduous efforts at organizing the meeting.

The meeting ended with a vote of thanks to the Chair.

/ ANNEXURE – I /

LIST OF PARTICIPANTS ATTENDED THE FORTY THIRD MEETING OF

FORUM OF REGULATORS (FOR)

HELD DURING 16TH – 18TH OCTOBER, 2014 AT MUSSOORIE

S. No.	NAME	ERC
01.	Shri Gireesh B. Pradhan Chairperson	CERC/FOR – in Chair.
02.	Shri Naba Kumar Das Chairperson	AERC
03.	Shri Digvijai Nath Chairperson	APSERC
04.	Shri Umesh Narayan Panjiar Chairperson	BERC
05.	Shri Narayan Singh Chairperson	CSERC
06.	Shri Pravinbhai Patel Chairperson	GERC
07.	Shri Jagjeet Singh Chairperson	HERC
08.	Shri Subhash Chander Negi Chairperson	HPERC
09.	Shri Basharat Ahmed Dhar Chairperson	J&KSERC
10.	Justice (Retd.) Shri N.N. Tiwari Chairperson	JSERC
11.	Shri S.K. Chaturvedi Chairperson	JERC for Goa & All UTs except Delhi
12.	Shri M.R. Sreenivasa Murthy Chairperson	KERC
13.	Shri T.M. Manoharan Chairperson	KSERC
14.	Shri Anand Kumar Chairperson	MSERC
15.	Ms. Romila Dubey Chairperson	PSERC
16.	Shri Vishwanath Hiremath Chairperson	RERC

17.	Shri Desh Deepak Verma Chairperson	UPERC
18.	Shri A.B. Bajpai Member	MPERC
19.	Shri Aswini Kumar Das Member	OERC
20.	Shri C.S. Sharma Member	UERC
21.	Ms. Shubha Sarma Secretary	CERC/FOR
22.	Shri Sushanta K. Chatterjee Joint Chief (RA)	CERC
SPECIAL INVITEES		
23.	Shri M. Deena Dayalan Member	CERC
24.	Shri A.S. Bakshi Member	CERC

/ ANNEXURE-II TO MINUTES /

FORUM OF REGULATORS (FOR)
C/o Sectt.: CENTRAL ELECTRICITY REGULATORY COMMISSION (CERC)
3rd & 4th Floor, Chandralok Building, 36, Janpath, New Delhi 110 001
☎: 011-23353503/23752958

No. 15/2(41)/2014-FOR/CERC Dated 29.8.2014

Sub: Constitution of FOR Sub-Group (I) on "Power Supply Challenges & Way Forward".

Reference is invited to the decision taken in the Forum of Regulators (FOR) Working Group Meeting held on 27.8.2014 to constitute a Sub-Group from amongst the Members of the FOR WG on "Power Supply Challenges & Way Forward" to examine issues *inter alia* connected with Adequacy of Generation Capacity & 24X7 Power Supply to the Consumers & Impact thereof.

2. In pursuance to the above, the Chairperson, CERC / FOR has constituted the FOR Sub-Group (I) with the following composition to facilitate the Working Group with their recommendations on the above areas:-

1. Chairperson, Karnataka ERC	-	Chairperson of the Sub-Group (I)
2. Member (AK), MERC	-	Member
3. Member (Planning), CEA	-	Member

A Copy of the minutes of the FOR Working Group, which outline inter alia the issues to be examined by the Sub-Group (I) is enclosed. The secretarial assistance to the Sub-Group would be provided by the office of the Chairperson of the Sub-Group (I).

3. The Sub-Group would submit its report within a month for consideration of the FOR Working Group.

Sd/-
(Sushanta K. Chatterjee)
Joint Chief (RA)

Copy to:

Members of the Sub-Group as above.

Copy for information to:

1. PPS to Chairperson, CERC / FOR
2. Members of Working Group

FORUM OF REGULATORS (FOR)
C/o Sectt.: CENTRAL ELECTRICITY REGULATORY COMMISSION (CERC)
3rd & 4th Floor, Chandralok Building, 36, Janpath, New Delhi 110 001
☎: 011-23353503/23752958

No. 15/2(41)/2014-FOR/CERC Dated 29.8.2014

Sub: Constitution of FOR Sub-Group (II) on "Power Supply Challenges & Way Forward".

Reference is invited to the decision taken in the Forum of Regulators (FOR) Working Group Meeting held on 27.8.2014 to constitute a Sub-Group from amongst the Members of the FOR WG on "Power Supply Challenges & Way Forward" to examine issues *inter alia* connected with Feeder Segregation of Rural & Agricultural Loads.

2. In pursuance to the above, the Chairperson, CERC / FOR has constituted the FOR Sub-Group (II) with the following composition to facilitate the Working Group with their recommendations on the above areas:-

1. Chairperson, APERC	-	Chairperson of the Sub-Group (II)
2. Chairperson, GERC	-	Member
3. Member (VS), PSERC	-	Member

A Copy of the minutes of the FOR Working Group, which outline inter alia the issues to be examined by the Sub-Group (II) is enclosed. The secretarial assistance to the Sub-Group would be provided by the office of the Chairperson of the Sub-Group (II).

3. The Sub-Group would submit its report within a month for consideration of the FOR Working Group.

Sd/-
(Sushanta K. Chatterjee)
Joint Chief (RA)

Copy to:

Members of the Sub-Group as above.

Copy for information to:

1. PPS to Chairperson, CERC / FOR
2. Members of Working Group

presentation on

ROAD MAP FOR 24X7 POWER SUPPLY

Introduction

- Government of India declares 24 x 7 power supply as the policy objective
- "*…the Government is committed to bring about a transformative change in the power sector and ensure affordable 24 x 7 power for all homes, industrial and commercial establishment and adequate power for farms, in the next few years*"

  – Union power minister Sri. Piyush Goyal quoted in The Hindu dated 8th Sept. 2014

Introduction

- Forum of Regulators constitutes working group on "*Power Supply Challenges*"
- Sub group on power supply challenges and way forward constituted by the working group on 29th August 2014
- Meetings of sub-group held on 22nd September 2014 (New Delhi), 30th September & 7th October at Bangalore, 10th October at New Delhi.

24 x 7 Power Supply – Defined

- Reliable 24x7 supply to all consumers (except agriculture) within a period of FIVE years of commencement of the program
- Provision of Electricity for all un-electrified households
- Agriculture consumers to be supplied power for 8-10 hours daily as may be decided keeping in view the conditions in different States

Strategy for 24 x 7 Supply

- Adequate capacity addition for generation of power at affordable price to meet the projected increase in demand for power.
- Energy mix optimization, reduction in power procurement costs and improving operational efficiency of state generation plant(s).
- Strengthening the transmission and distribution network to cater to the expected growth in demand from existing as well as forthcoming consumers.

Strategy for 24 x 7 Supply

- Expansion of distribution network for electrification of all unconnected households in a time bound manner by FY 2018-19.
- Strengthening the financial position of distribution utilities by improving liquidity and the viability of their operations.

Present study focuses on the All India context and it is required that every State should prepare its own road map/plan for 24 x 7 power supply taking into account its demand requirement, generation plan, transmission and distribution constraints

Existing Installed capacity (MW) (August 2014)

Sector	Thermal				Nuclear	Hydro	RES (MNRE)	Grand Total
	Coal	Gas	Diesel	Total				
State	55290	6974	603	62867	0	27482	3804	94153
Private	50495	8568	597	59660	0	2694	27888	90242
Central	46525	7065	0	53590	4780	10623	0	68993
Total	152310	22607	1200	176117	4780	40799	31692	253389
%	60.1%	8.9%	0.5%	69.5%	1.9%	16.1%	12.5%	100%

For the year 2014-15 (with 10% coal shortage and 30% availability of gas) annual LOLP is around 11.88% for India -close to 12% of time the supply is falling short of demand.

Existing Installed capacity (MW) to meet peak

Source		Installed	Auxillary	FOR	Constraint	Available
Thermal	Coal	152311	9%	12%	10%	105095
	Gas	22608	6%	12%	50%	7235
	Diesel	1199.75				
	Total	176119				
Nuclear		4780	9%	12%	30%	2342
Hydro		40798.8	1%	10%	30%	24071
RES (MNRE)		31692.1			80%	6338
Grand Total		253389				145081
				Loading/ reserve	10%	14508
				Gen Capacity to Meet Peak		130573

Power supply position against Restricted Requirement

Period	Peak Demand (MW)				Energy (MU)			
	Peak Demand	Peak Demand Met	**Surplus(+) / Deficit(–)**	(%) Surplus / Deficit	Energy Requirement	Availability	**Surplus(+) / Deficit(–)**	(%) Surplus / Deficit
2007-2008	739,343	666,007	**-73,336**	-9.92	108,866	90,793	**-18,073**	-16.60
2008-2009	109,809	96,785	**-13,024**	-11.86	777,039	691,038	**-86,001**	-11.07
2009-2010	119,166	104,009	**-15,157**	-12.72	830,594	746,644	**-83,950**	-10.11
2010-2011	122,287	110,256	**-12,031**	-9.84	861,591	788,355	**-73,236**	-8.50
2011-2012	130,006	116,191	**-13,815**	-10.63	937,199	857,886	**-79,313**	-8.46
2012-2013	135,453	123,294	**-12,159**	-8.98	998,114	911,209	**-86,905**	-8.71
2013-2014	135,918	129,815	**-6,103**	-4.49	1,002,257	959,829	**-42,428**	-4.23

Per Capita Consumption* – State wise (2012-13)

State	PCC kWh	State	PCC kWh	State	PCC kWh
Bihar	145	Arunachal Pradesh	719	Maharashtra	1239
Assam	240	Madhya Pradesh	753	Uttarakhand	1297
Nagaland	268	Jharkhand	847	Himachal Pradesh	1380
Tripura	296	Sikkim	862	Chhattisgarh	1495
Manipur	353	Rajasthan	982	Delhi	1613
Uttar Pradesh	450	Jammu & Kashmir	1043	Haryana	1722
Mizoram	469	Karnataka	1129	Punjab	1761
West Bengal	594	Andhra Pradesh	1135	Gujarat	1796
Kerala	630	Orissa	1209	Goa	2045
Meghalaya	690	Tamil Nadu	1226		

Region Wise

NORTH EASTERN	298	EASTERN	552	NORTHERN	852
SOUTHERN	1094	WESTERN	1284	All India	914

Total Generation including private/captive generation (CEA General Review)

Households data of INDIA as per Census 2011

No. of Households in India		Electrified house holds	Un-electrified Households
Total	246,692,667	165,897,294	80,795,373
		(67.25%)	(32.75%)
Urban	78,865,937	73,089,256	5,776,681
	(31.97%)	(92.68%)	(7.32%)
Rural	167,826,730	92,808,038	75,018,692
	(68.03%)	(55.3%)	(44.7%)

- The lowest electrification is in the States of Bihar (16.36%), Uttar Pradesh (36.81%), Assam (37.055)
- Highest electrification in Lakshadweep (99.68%), Delhi (99.11%), Daman & Diu (99.08%).

Per household consumption is projected to increase from 2.82 units/day at the end of 11th plan to 3.55 units/day by 2018-19

Household having Electricity – State-wise

State / UT	% HHE	State / UT	% HHE	State / UT	% HHE
Bihar	16.4%	Manipur	68.3%	Karnataka	90.6%
Uttar Pradesh	36.8%	Tripura	68.4%	Andhra Pradesh	92.2%
Assam	37.0%	Chhattisgarh	75.3%	Sikkim	92.5%
Orissa	43.0%	Nagaland	81.6%	Tamil Nadu	93.4%
Jharkhand	45.8%	Maharashtra	83.9%	Kerala	94.4%
West Bengal	54.5%	Mizoram	84.2%	Punjab	96.6%
Meghalaya	60.9%	Jammu & Kashmir	85.1%	Himachal Pradesh	96.8%
Arunachal Pradesh	65.7%	Uttaranchal	87.0%	Goa	96.9%
Rajasthan	67.0%	Gujarat	90.4%	Delhi	99.1%
Madhya Pradesh	67.1%	Haryana	90.5%		

Region Wise

NORTH EASTERN	47.0%	EASTERN	38.4%	NORTHERN	59.5%
SOUTHERN	92.5%	WESTERN	80.2%	All India	67.2%

(2011 Census)

Per capita consumption in kWh- Comparison with Other Countries

World	**2972**	**Asia**	**893**
Russia	6602	South Africa	4410
Malaysia	4313	China	3488
Argentina	3027	Brazil	2509
Mexico	2098	Vietnam	1273
Germany	7138	Japan	7753
Srilanka	527	UK	5452
USA	12947	India	760

2012 Data as per IEA Energy Statistics

24 x 7 power supply – Experience of States – Gujarat

- Program for 24 x 7 supply rolled out between 2007–08 and 2009–10
- 24/7 power supply to all categories of consumers except agricultural consumers
- Per capita consumption of the State goes up from 1493.25 units in 2007–08 to 1796.3 in 2012–13.
- Gross generation of Utilities including net import increases from 62762.69 MU to 84749.64 MU from 2007–08 to 2012–13
- Captive generation is increased from 20978.94 MU to 23494.78 MU from 2007–08 to 2012–13
- Total Gross energy generation in the state is increased from 83741.63 MU to 108244.42 MU from 2007–08 to 2012–13
- Average Tariff increased from Rs.4.30/kWh in 2009–10 to Rs.4.45/kWh in 2013–14.
- Long term power purchase contracts entered into for over 90% of required energy with average procurement cost Rs.3.38/kWh in 2013–14
- Share of Agricultural consumption is 23.61 % and 53% of the agriculture connections metered
- Household electrification 90.4%

West Bengal

- 24 hours power supply to all categories of consumers
- Per capita consumption of the State goes up from 436.48 units in 2007-08 to 593.86 units in 2012-13.
- Gross generation of Utilities including net import increases from 35976.04 MU to 51422.58 MU from 2007-08 to 2012-13
- Captive generation has increased from 2189.83 MU to 2499.48 MU from 2007-08 to 2012-13
- Total Gross energy generation in the state is increased from 38165.87 MU to 53922.06 MU from 2007-08 to 2012-13
- Average Tariff increased from Rs. 6.047/kWh in 2011-12 to Rs. 6.069/kWh in 2013-14.
- average procurement cost Rs. 3.38/kWh in 2013-14.
- Share of Agricultural consumption is 3.43 % and 100 % of the agriculture connections metered
- Household electrification 54.5 %

Kerala

- 22 hours power supply to all categories of consumers
- Per capita consumption of the State goes up from 443.85 units in 2007-08 to 630.07 units in 2012-13.
- Gross generation of Utilities including net import increases from 14660.13 MU to 21417.09 MU from 2007-08 to 2012-13
- Captive generation is increased from 470.76 MU to 597.71 MU from 2007-08 to 2012-13
- Total Gross energy generation in the state is increased from 15130.89 MU to 22014.80 MU from 2007-08 to 2012-13
- Average Tariff increased from Rs. 4.18/kWh in 2007-08 to Rs. 5.03/kWh in 2012-13.
- Average procurement cost is Rs. 2.85/kWh in 2012-13
- Share of Agricultural consumption is 1.14 % and 100 % of the agriculture connections metered
- Household electrification 94.4 %

Punjab

- 21 to 22 hours power supply to all categories of consumers except agriculture
- Per capita consumption of the State goes up from 1613.84 units in 2007-08 to 1761.08 units in 2012-13.
- Gross generation of Utilities including net import increases from 41843.04 MU to 48213.09 MU from 2007-08 to 2012-13
- Captive generation is increased from 875.38 MU to 1378.9 from 2007-08 to 2012-13 1 MU
- Total Gross energy generation in the state is increased from 42718.42 MU to 49592 MU from 2007-08 to 2012-13
- Average Tariff increased from Rs. 3.44/kWh in 2007-08 to Rs. 4.54/kWh in 2012-13.
- average procurement cost Rs. 3.28/kWh in 2012-13
- Share of Agricultural consumption is 30.09 % and -- of the agriculture connections metered
- Household electrification 96.6 %

Some Observations

- 24 x 7 power supply may not imply greatly increased demand in highly electrified States
- Lower share of agricultural consumption seen in States with close to 100% metering
- A high percentage of (21%) captive consumption seen in Gujarat
- Low level of electrification of households and low percentage of Agriculture consumption has resulted in near 24 x 7 supply in West Bengal

Demand Supply Gap – Energy – 18th EPS

- As per CEA's 18th Electric Power Survey of India, for 2013-14 unrestricted electrical energy requirement for all states/ Utilities together stood as 1,084,610 MU.

Year	Generation Requirement (Ex-Bus) in MU (as per 18thEPS)	Electricity Generation (at Ex-Bus) in MU (Actual)	% shortage
2011-12	936,589	876,888	6.37
2012-13	1,007,694	912,056	9.49
2013-14	1,084,610	966,378	10.9

Ex-bus energy requirement & Actual values for FY 2011-12 & FY 2013-14

Demand Supply Gap – Peak Demand– 18th EPS

- Annual peak load (as per 18th EPS) & actual for FY 2011-12 & FY 2013-14

Year	Annual Peak Load in MW (as per 18th EPS)	Peak Load in MW (Actual)	% shortage (MW)
2011-12	132,685	116,191	12.4
2012-13	143,967	123,294	14.36
2013-14	156,208	129,815	16.89

- Energy requirement (MU) & Peak load projections for the next 5 years as per 18th EPS

Year	EX-Bus Generation requirement (MU)	Annual Peak Load (MW)
2014-15	1,167,731	169,491
2015-16	1,257,589	183,902
2016-17	1,354,874	199,540
2017-18	1,450,982	214,093
2018-19	1,552,008	229,465

- Category wise Energy Sale Projection (as per 18th EPS) in MU

Categories	2012-13 (Restricted)	2014-15 (Unrestricted	2018-19 (unrestricted)	Projected Increase in MU	% increase
Domestic	183700	237347	339762	156062	84.95%
Commercial	72794	95497	140506	67712	93.02%
Irrigation	147462	179784	239194	91732	62.21%
Industries	365989	326158	458967	92978	25.40%
Others	54356	76461	102014	47658	87.68%
Total	824301	915247	1280443	456142	55.34%

Estimate of household demand

- Per household consumption is projected to increase from 2.82 units/day in 2011-12 to 3.55 units/day by 2018-19 as per 18th EPS.
- Total HH consumption of 183.7BU in 2012-13 will increase to 339.76 BU for 100% electrification of 262.4 million households projected by 2018-19

Capacity Addition (in MW) target for 12th plan

Sector	Hydro	Thermal			Total thermal	Nuclear	Total
		COAL	LIGNITE	GAS/LNG			
CENTRAL	6004	13800	250	827.6	14878	5300	26182
STATE	1608	12210	0	1712	13922	0	15530
PRIVATE	3285	43270	270	0	43540	0	46825
TOTAL	10897	69280	520	2539.6	72340	5300	88537

As per plan it is projected to add additional 32,000MW during first two years of 13th plan i.e., 2017-18 & 2018-19

Projected Availability (BAU)

- The projected requirement by 2018-19 is 1,552,008 MU
- Projected availability (source wise) as per capacity addition planned/likely

Power Plant		Installed Capacity MW	Case -1		Case -2	
			PLF	MU	PLF	MU
Thermal	Coal	193802	0.65	1103511	0.76	1290259
	Gas	22608	0.30	59414	0.45	89121
	Diesel	1200	0.00	0	0.00	0
	Hydro	54387	0.40	190573	0.40	190573
	Nuclear	4780	0.76	31823	0.76	31823
Renewables	Wind	26693	0.22	51443	0.22	51443
	Solar	11200	0.16	15698	0.16	15698
	Others	7307	0.40	25604	0.4	25604
Total		321977		1478065.6		1694520.4

Projected shortfall in Energy is 73942MU in Case 1 and surplus of 142512 MU in Case 2

Projected Availability (BAU)

- The projected requirement by 2018-19 is 229,465 MW
- Projected Installed Generation Capacity to meet peak demand 321,977 MW
- Short fall in capacity in meeting LOLP of 0.2% is around 16700 MW with full fuel availability

Bridging the Gap

- The options available for providing 24 x 7 power supply by 2018-19
  - Option -1 :
    - 76% PLF of Coal and gas based generation plants (installed capacity 193802 MW & 22608MW)
    - Commisisioning16,200 MW of Thermal power (in addition to identified 28,500 MW for commissioning of power plants in remaining period of12th plan and 12,500 MW in the first two years of 13th plan)
    - Hydro Capacity addition of 13500 MW
    - Renewable Energy capacity addition 13500MW
    - Committing all the stranded generation capacity
- Reduction of Loss level to 17.5% by 2018-19

Bridging the Gap

- The options available for providing 24 x 7 power supply by 2018-19
  - Option -2 :
    - 65% PLF of Coal and 30% PLF gas based generation plants (installed capacity 193802MW & 22608MW)
    - Hydro Capacity addition of 13500 MW
    - Renewable Energy capacity addition 13500 MW
    - Renewable Energy addition of 1,20,000MW (wind + Solar) and
    - 8% DSM initiative (or storage option)

Utilizing existing capacity

- Region wise stranded capacity of power plants

Sl.No	Region	Coal/Lignite based capacity (MW)	Gas based capacity (MW)	Total stranded capacity (MW)
1	Western Region	3445	4229	7674
2	Eastern Region	5345	68	5413
3	Northern Region	3262	1447	4709
4	Southern Region	306	2151	2457
5	North-Eastern Region	0	57	57
6	All India	12358	7952	20310

Recommended to contract supply from stranded capacity through a central utility / SPV for sale of power to distribution utilities facing shortage

Generation plan - Option 1

- Coal requirement by 2018-19 for thermal power plant (193802 MW) would be 980 MTPA
- The present coal supply to energy sector is limited to less than 400 MTPA
- Gas requirement for the power sector is estimated to be 189 MMSCMD out of total demand of 438 MMSCMD
- Likely Gas availability 166.2 MMSCMD in 2011and may increase to 384 MMSCMD by 2018-19 considering domestic, imports and cross border pipelines

Generation plan for Renewables - Option 2

- On shore wind potential at 80meter hub height is conservatively estimated to be about 103GW (C-Wet).
- Solar potential in India is estimated in excess of 100 GW (MNRE).

Generation plan for Renewables - Option 2

Promotion of Solar Energy

- **Solar Rooftops**
  - As per 2011 Census, there are 330 million houses in India out of which 150 million houses (excluding institutional households) have proper roofs (concrete etc.)
  - A conservative estimate of 1 kWp at 30% of such houses (45 million households) there is a potential to add 45,000MW.
- **Canal top solar PV which additionally helps in saving of water of the river from evaporating**
- **Utilization of periphery along the tank bed areas**
- **Wasteland utilization in different parts of the country including deserts.**

Utilizing Pumped Storage

- As now, the most economical energy storage is pumped hydro and also not burning of the fuel.
- At present, India has a pumped storage capacity to an extent of 4,804 MW from 11 pumped storage plants. It is planned for adding 1000 MW pumped storage in Tehri during this plan period.
- The utilities have to contract at least 80 to 90% of their requirement through long term power purchase and the same holds good for the generation companies also

Generation Capacity Addition (in MW) Summary

Year	Thermal	Nuclear	Hydro	RE	Option-1 Thermal plant addition	Option 2: RE Addition as an option*	Total
Till 31/08/14	176119	4780	40798	31692			253389
2015-16	15000		4000	3500		10,000	32500
2016-17	13500		5500	3500		25,000	47500
2017-18	6250**		2000**	3000	8100	30000	41250
2018-19	6250**		2500**	3500	8100	30000	42250

** – distributed equally for two years

0.2% LOLP for the year 2018-19 can be achieved if 16,200 MW of thermal power plant may have to be committed in addition to ongoing generation works already identified in LTOA

*5 to 8% of DSM is recommended to optimize the generation investments

Policy Measures for RE promotion

- In order to integrate renewable energy successfully into the grid, the following measures need to be under taken
  - Creating Flexible Energy sources and utilizing existing pumped storage resources
  - Establishment of “Renewable Energy Management System”
  - In order to have higher penetration of the renewable energy generation, ancillary services like frequency balancing mechanism, hour ahead market should be developed.
  - Present deviation mechanism act as a deterrent in Renewable energy rich states
  - With Interconnection, for 4000MW sudden variation of RE (very less probable) the frequency variation is only 1 Hz

For wind variation in Tamilnadu and Karnataka, the hydro resources in Karnataka, Kerala and Andhra Pradesh can be used for balancing services.
The hydro capacity in Southern region of 9000 MW can manage the variation in the wind and solar with accurate forecasting and RE management system is in place.

Transmission Planning Principles

- Each region in the country should be connected to its adjacent regions through atleast TWO high capacity (400 or 765kV) lines and an HVDC bi-pole/Back-to-Back link
- A strong integrated National Grid needed to harness unevenly distributed generation resources in the country
- High penetration of Renewable Energy requires transmission network aimed at moderating the impact of variability
- Augmentation of Transmission network needed for promoting vibrant short term market to meet the seasonal and daily variations in power requirement

Existing Transmission System

- Transmission line length as on 31.03.2013

Voltage class in kV	Length of lines (ckm)
HVDC (O.H)	8,008
765kV kV	6,472
400	1,10,408
230 & 220 kV	1,38,534
78/66	58,403
78/66	53,936
Total Line length (ckm)	3,75,761

The total number of step-up transformers installed at various electricity generating stations and substations in the country as on 31st March 2013 were 2,993 having aggregate capacity of **1,96,005** MVA.

Transmission Issues

- Congestion in Transmission system is seen.
  - Between Inter-regional corridor for transferring power from surplus region (ER and WR) to deficit region (SR)
  - In the Inter State / Intra State corridors
- Short -term/Medium term transfers of power are constrained
- Power Plants under long term PPA's lost 1.93 billion units of generation in 2013 due to transmission capacity bottlenecks.

Transmission Issues

- In the 11th plan period, the growth in generation capacity is over 50% but the transmission system addition is only by 30%.
- The existing transmission capacity is not used to its optimal capacity with the absence of reactive power compensation in the transmission system.
- Reactive power compensation in the transmission system is employed only to contain over-voltages.
- Plan for adding dynamic reactive power compensators at 12 locations is underway

Transmission Issues (Contd..),

- In India, the Twin conductor is loaded to around 600 MVA/ckt. and Quad conductor is loaded to around 850 MVA/ckt.
- National Grid Company UK transmission system operates
  - 400 kV Twin Conductor close to 1500 MVA/ckt.
  - 400 kV Quad Conductor close to 3000 MVA/ckt
- National Grid Company UK, employs reactive power compensation of 19,000 MVAr (capacitive) and 10,677 MVAr (reactive) at transmission level for meeting peak demand of around 53GW in 2013.
- In addition, loading is permitted above thermal rating for short periods with
  - Different ratings of transmission system for 4 seasons
  - 5 minutes, 20 minutes and 2 hours rating of transmission system

The system has 12 numbers of re-locatable SVC which can be moved out to taking care of varying requirements.

Transmission Plan (2018-19)

- A summary of growth of I-R transmission capacity, between various regions

I-R Transmission Capacity between Regions	At the end of 11th plan (MW)	Expected at 2018-19 (MW)
ER – SR	3630	3630
ER – NR	12130	17930
ER – WR	4390	12790
ER – NER	1260	2860
NR – WR	4220	14420
WR – SR	1520	7920
NER/ER – NR/WR	0	6000
132/110kV radial links	600	0
Total ALL INDIA	27750	65550

Transmission Plan (2018-19)

- Transmission lines (220 kV and above system)

Transmission lines (both AC and HVDC) expected by the end of 12th plan (values in ckm)	At the end of 11th plan	Expected addition during 12th plan	Expected by the end of 12th plan
HVDC Bipole lines	9432	7440	16872
765 kV	5250	27000	32250
400 kV	106819	38000	144819
220 kV	135980	35000	17098
Total transmission lines, ckm	257481	107440	364921

Transmission (Contd..),

- Considering 88 GW generation addition for 12th plan, total fund requirement for development of transmission system is estimated to be **Rs 2,00,000 crore**.
- The additional investment required for optimum loading of transmission network with reactive power compensation is tentatively estimated at **Rs,1,20,000 Cr** (for transmission system **Rs.90,000 Cr.** and for reactive power compensation Rs.30,000 Cr) by 2018-19.

The total Investment on Transmission system is difference of Rs.320,000 & Investment already made in first two years of 12th plan

Distribution system at a Glance

- Distribution line length as on 31.03.2013

Voltage class in kV	Length of lines (ckm)
33	3,09,250
22/20	86,358
15/11	29,54,056
6.6	32,828
3.3/2.2	198
Up to 500V	52,20,446
Total line length	86,03,136

The total numbers of step-down and distribution transformers were 52,421 and 62,51,685 with an aggregate capacity of **9,98,663** MVA and **3,74,418** MVA respectively

Distribution System Challenges

- Coverage of Un-electrified Households in the next 5 years
- Reduction of AT & C Losses
- Revenue recovery and financial viability
- Improving power quality and reducing interruptions
- Strengthening Distribution system Management

Coverage of Un-Electrified HH

- Over 30% of households are to be electrified as per 2011 census (80.79 million)
- RGGVY coverage of specified category of households – 14 million households since inception
- Total Domestic connections at the end of 31st March 2013 is 216.1 million.
- Grid connections needed for 80 million households and Off grid supply for remaining households
- Estimated expenditure is close to Rs.200,000 crores (at about Rs.25,000 per household)

Reduction of AT&C losses

- The present AT&C losses estimated at over 27% (about 270 BU).
- Reduction of AT&C losses to 17.5% by 2018-19 will result in additional availability of 150 BU with planned capacity addition
- Value of energy saved is about Rs.45,000 Cr./year at Rs.3/kWh
- This justifies investment of at least Rs.200,000 crores for strengthening distribution network, metering and management.

Revenue Recovery and Financial viability – Suggested Measures

- Adequacy and regularity of tariff revision to be ensured by regulatory commissions to enable Discoms to recover costs
- Accumulated losses and unrecoverable arrears of charges / dues from consumers as at the end of 2013-14 need to be taken off the balance sheets
- Electro-mechanical Energy meters to be replaced by hi-precision meters with data storage & retrieval facility
- Accountability systems to be introduced for recovery of charges against power supplied on each feeder / DTC based on energy audit and feeder/DTC metering

Improving Power Quality – Suggested measures

- Daily monitoring of power quality parameters feeder-wise at the utility level to be made mandatory by regulatory orders
- Regulators to publish details of quality of actual supply by utilities including number and duration of interruptions, voltage fluctuations etc.,
- Penalties for non compliance of prescribed quality parameters to be imposed in calculating consumer tariff

Strengthening Distribution System Management

- Feeder strengthening and feeder segregation to be taken up on top priority
- Installation of high precision meters in place of outmoded electro-mechanical meters
- HVDS to be introduced in areas with high AT&C losses (with losses above 20%)
- Centralised / online consumer feedback facilities to be installed by each utility.
- District/division-wise CGRF's to be set up with powers to enforce SoPs

Strengthening Distribution System Management

- Universal DTC metering with AMR / RMR and consumer indexing to be made mandatory
- Converting divisions / sub-divisions of distribution utilities as strategic business units / profit centers

Total Investment in Distribution System would be Rs.2,00,000 Cr for HH Electrification & its infrastructure, Rs.175,000 Cr. for network improvement and Rs.25,000 Cr. for Distribution Management
This is in addition to present R-APDRP spending of Rs.50,000 Cr. (10,000 Crore IT enabled services and 40,000 – Distribution System program)

Discussions

Thank you

A framework to draw up a scheme at national level for feeder segregation of rural and agricultural consumers and suggest measures on effective metering

Presented by the

Sub-Group (II)

Under Working Group on Power Supply Challenges and Way Forward

Member (Sub Group II)	**Chairperson (Sub Group II)**	**Member (Sub Group II)**
Mr Pravinbhai Patel	Dr V Bhaskar	Er Virinder Singh
Chairperson, GERC	Chairperson, APERC	Member, PSERC

New Delhi - October 17 2014

Forum of Regulators

Sub Group-II (SG) has identified eight important questions that need to be addressed

1. What was the objective for undertaking feeder segregation program?
2. What was the structure and phasing of the implementation program?
3. How was the program funded and how was it managed?
4. What economic and social benefits were derived from the program?
5. What is the ideal framework for Government of India to roll out a national scheme for feeder segregation?
6. Is feeder segregation an end in itself? If not, what additional initiatives/ minimum requirements need to be simultaneously undertaken to leverage the desired benefits?
7. Are there any alternatives to the feeder segregation program?
8. What is the best framework for effective metering?

SG has followed three different approaches to address the eight questions

- **Review of the existing reports as well as literature** on the experience of agriculture feeder separation and metering and culling out lessons to be drawn from previous work and analysis

- **Intensive interaction with officials of the distribution utilities in the four states** of Gujarat, Punjab, Telangana and Andhra Pradesh to review the experience in agricultural feeder separation and metering.

- **Field visits in the three states of** Gujarat, Punjab and Telangana to villages where feeder separation had been implemented to ascertain from both agricultural and non agricultural consumers the benefits derived from the separation

The following are some of the important reports that are reviewed by the SG

S. N	Name of the report	Organization	Date
1	Presentation on Feeder Segregation of Rural and Agricultural Loads	FOR Secretariat	Aug-14
2	Faster, Sustainable and More Inclusive Growth –An approach to the Twelfth Five year Plan(2012-17	Planning Commission of India	Oct-11
3	Lighting Rural India-Experience of Rural Load Segregation Schemes in States	Energy Sector Unit South Asia Sustainable Development(ESMAP),	Aug-12
4	Report on 'Loss Reduction Strategy'	FOR	Sep-08
5	Report on 'Metering Issues'	FOR	Aug-09
6	Lighting Rural India-Load Segregation Experience in Selected States	World Bank	Feb-14
7	More Power to India-The Challenge of Electricity Distribution	World Bank	2014
8	Presentation on implementation of Jyoti Gram Yojna in Gujarat	MD, DGVCL	
9	Jyoti Gram Yojna, 'Power ring Rural Gujarat'	CEPT Ahemdabad	Dec-04
10	Impact Assessment of the Jyoti Gram Program of the government of Gujarat	IIM Ahemdabad	Dec-10
11	Impact Assessment of Jyoti Gram Yojna in Gujarat	IRMA	
12	Note on scaling up Agricultural DSM in Punjab	Energy Efficiency Services Limited	

The SG interacted extensively with the senior management of discoms and officers at ERCs in Gujarat, Punjab, Telangana and Andhra Pradesh

- During visits to the three states, the SG interacted extensively with the respective Regulatory Commissions.
- It has reviewed the feeder segregation program and metering with the senior management officials of the following utilities in Gujarat, Punjab, Telangana and Andhra Pradesh:
  - Uttar Gujarat Vij Company Limited (UGVCL)
  - Dakshin Gujarat Vij Company Limited (DGVCL)
  - Paschim Gujarat Vij Company Limited (PGVCL)
  - Madhya Gujarat Vij Company Limited (MGVCL)
  - Punjab State Power Corporation Limited (PSPCL)
  - Southern Power Distribution Company of Telangana State Limited (TSSPDCL)
  - Northern Power Distribution Company of Telangana State Limited (TSNPDCL)
  - Eastern Power Distribution Company of Andhra Pradesh Limited (APEPDCL)
  - Southern Power Distribution Company of Andhra Pradesh Limited (APSPDCL)

SG has benefited from the field visits in the three states of Gujarat, Punjab and Telangana

- The SG met three times as under:
  - Ahmedabad, Gujarat (10th-11th September 2014)
  - Chandigarh, Punjab (18th-19th September 2014)
  - Hyderabad, Telangana (1st October 2014)

- **SG collected detailed information** about the feeder segregation projects undertaken in the states of Gujarat, Punjab, Telangana and Andhra Pradesh.

- The **data is analysed for obtaining insights** on the feeder segregation projects.

- The SG has benefited from the **field visits to a number of villages** in each of the three states where it interacted with farmers as well as non-agricultural consumers.

Answering the eight important questions …

1. **What was the objective for undertaking feeder segregation program?**
2. What was the structure and phasing of the implementation program?
3. How was the program funded and how was it managed?
4. What economic and social benefits were derived from the program?
5. What is the ideal framework for Government of India to roll out a national scheme for feeder segregation?
6. Is feeder segregation an end in itself? If not, what additional initiatives/ minimum requirements need to be simultaneously undertaken to leverage the desired benefits?
7. Are there any alternatives to the feeder segregation program?
8. What is the best framework for effective metering?

Objectives of Feeder Segregation Programme

Most common objectives:

- Improved power supply to rural non-agricultural consumers. Consequent improvement in the quality of their lives and catalysis of rural industry. Subject to adequate availability of power.
- Improved load management through a better ability to regulate supply to agricultural customers. Consequent transparency as well as capping of agricultural subsidies and thus stabilising financial position of the utilities

Other objectives

- Reduction in line losses through better monitoring of consumption in the agricultural sector.
- Improved management of environmental resources through husbanding ground water resources.

Answering the eight important questions …

1. What was the objective for undertaking feeder segregation program?
2. **What was the structure and phasing of the implementation program?**
3. How was the program funded and how was it managed?
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The structure and phasing of Feeder Segregation Programme

State	Type of segregation	Program Planning	Phasing
Erstwhile Andhra Pradesh	• Virtual segregation completed • Physical segregation on pilot basis only	• Draft DPR. • Administrative feeders elected at Mandal level and envisioned benefits not included in DPR	• Physical segregation has been implemented on pilot basis
Gujarat	• Virtual segregation followed by physical segregation in year 2005	• No DPR. • Cost of scheme was estimated at sub division level and approved by respective Discom	• Pilot was done before taking up JGY
Rajasthan	• Virtual segregation	• Feeder-wise DPR. • Percent IRR: 22.7% • Initially scheme prioritized high loss feeders and balance later	• Pilot was done before taking up full scale projects
Haryana	• Physical segregation in year 2006 to 2010	• Sub division specific DPR. • Cost benefit analyzed through gross percent returns (27.5%)	• Segregation was outsourced with learning from FSP implementation in other state
Punjab	• Virtual segregation followed by physical segregation during year 1996 to 2004	• Feeder wise DPRs. • Cost benefit analysis of the schemes prepared for projects executed on turnkey basis.	• Segregation initiated in 1996-97 departmentally • Remaining was outsourced in 2003-04

Answering the eight important questions …

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Funding of Feeder Segregation Programme

State	Project Owner	Financing arrangements
Erstwhile Andhra Pradesh	Discom	• Pilot funded by Utilities • Full scale project funding not finalized
Gujarat	State Govt	• Mainly funded by state government grant (86% of the project cost) and balance from ADB and other sources
Rajasthan	Discom	• Financial institutions
Haryana	Discom	• Financial institutions
Punjab	Discom	• Contribution from village Panchayats, state government & financial institution.

During the presentation to the SG, utilities mentioned that feeder segregation can be taken up only with significant assistance from the Government of India or the respective State Government

Comparison of Project cost for different states

Particular	Erstwhile Andhra Pradesh	Gujarat	Rajasthan	Haryana
Number of Agricultural feeders	8,878	1,904	8,126	1,226
Total (Rs Crore)	3,014	1,290	4,485	573
Per feeder (Rs Lakh)	33.94	67.75	55.19	46.73

- In Punjab, one of the feeder segregation projects taken up departmentally required material costing nearly Rs 211.55 Crore for nearly 848 mixed feeders
- This translates to a cost of nearly Rs 24.95 Lakh per feeder (excluding the cost of manpower)

- *Note: The figures are extracted from the World Bank Report on "Lighting Rural India-Load Segregation Experience in Selected States". However, GERC has assessed the per feeder cost of Rs 37.5 lakhs based on 3439 numbers of new feeders*

Management of the feeder segregation projects

State	Institutional Framework	Procurement Strategy
Erstwhile Andhra Pradesh	• Pilot managed through routine business operations • Framework for complete plan yet to be decided	• Partial turnkey for physical segregation • Discoms procure VCBs, DTs and HT and LT conductors • Balance by implementing contractor
Gujarat	• No scheme specific plan for execution	• All material by erstwhile Gujarat Electricity Board
Rajasthan	• Only state with project management unit • Circle head as Project Managers • Junior engineers as managers of feeders	• Typically partial turnkey • Discoms procure VCBs, DTs, HT/XPLE conductors • Balance by contractor
Haryana	• Discoms planning and design cell for planning, awarding contract and project execution	• Turnkey contractor for turnkey works • In house management for labor contracts
Punjab	• CE level officer responsible for monitoring, awarding & implementation	• Work was carried out both departmentally and on turnkey basis

Answering the eight important questions …

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Key benefits of the Feeder Segregation Progammes

- Economic benefits
  - Improved load management (ability to regulate supply to agricultural customers) resulting in saving of peak time power procurement costs
  - Reduction in transmission charges as a result of reduction in peak demand
  - Reduction in line losses (features such as HVDS, effective metering help)
  - Improved transparency in subsidy distribution and improved financial condition of discoms
- Social benefits
  - Better health service and infrastructure service
  - Improved rural industry conditions resulting in enhanced local employment
  - Increased study and working hours
  - Improved mobility and social life for women
  - Reduction in migration from rural to urban areas
  - Better ground water resource management

Answering the eight important questions …

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2. What was the structure and phasing of the implementation program?
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8. What is the best framework for effective metering?

Framework for Feeder Segregation Progamme at National Level

- States should have the flexibility to adapt the design of the project consistent with their respective felt needs and priorities.
- Mandatory features suggested for projects assisted by the central government
  - Conducting a base line study in all the feeders before implementation of the project.
  - Project management units for effective supervision of the feeder segregation projects.
  - Establishment of an effective monitoring and evaluation framework
  - Participation of discom staff in every phase of the project
- Bottom-up approach and decentralized project implementation is recommended
- Feeder segregation may not be the first priority of some state utilities which may want to prioritize alternative projects such as increasing substation density/compact substations and HVDS .
- Such projects should be allowed provided they pass the cost benefit analysis test as specified by the central government.

Prioritization and implementation of Feeder Segregation Progamme

- Prioritization
  - **Group 1- High Priority States:** Agricultural consumption higher than a GoI specified norm (say, 10% of total consumption) where feeder segregation could lead to greater and immediate benefits.
  - **Group 2 -Other States:** Agricultural consumption lower than the norm could also be considered for support if they so desire.

- Two staged implementation
  - **Stage 1 – Pilot Projects**: Discoms would initially implement pilot projects that help to validate the design, prove the benefits of the projects and help in developing in-house capabilities.
  - **Stage 2 – Full Scale Projects:** With the benefit of learning from the pilot projects, disoms would take up full scale projects covering all feeders with a significant agricultural load.

- States that have already implemented pilot projects and demonstrated the benefits of feeder segregation may be allowed to proceed directly for full scale projects.

Threshold condition for selection of Feeder Segregation Projects-(1/2)

- **Total Resources Cost Test (TRC)**
  - The TRC Test measures the net costs of the feeder segregation program including both the utility's as well as the participants' costs using the following parameters:
    - Net Present Value (NPV) of benefits such as reduction in losses
    - NPV of costs such as capital expenditure (Capital expenditure) and additional operational expenditure (Operational Expenditure)
    - NPV of benefits minus the NPV of costs
- **Ratepayer Impact Measure Test (RIM Test)**
  - The Ratepayer Impact Measure test is similar to the TRC test except for the following additional costs considered which are relevant in the context of Indian discoms.
    - Cost corresponding to a *"increase in sale to subsidised categories due to the Feeder segregation program"*
    - Benefit corresponding to a *"increase in sale to subsidizing categories due to the Feeder segregation program"*

Threshold condition for selection of Feeder Segregation Projects-(2/2)

- Projects that do not pass the TRC and RIM tests may still be taken up if the following conditions are met:
  - Project passes the TRC and RIM tests under an assumption that about 80% of cost of supply is realized through tariff and subsidy received for the subsidizing categories
  - Significant positive socioeconomic impact is expected in qualitative terms
  - Project passes the SC test
  - Impact on the tariff as seen in the LRIRIM test is reasonable

- Life-cycle Revenue Impact (LRI Test): Conducted using the same data used for calculating the results of the RIM test. The difference between the NPV of Costs and the NPV of Benefits is then to be divided by the total energy sales under the feeders considered to determine the rate impact on the customers.

- Societal Cost Test (SCT): Net economic benefit to the society gained from the Feeder segregation programs under consideration should be positive.

Funding Mechanism

- **Initial Funding (Pilot):** The central government should provide financial support by way of grant for fully funding the pilot project.
- **Full Scale Projects on RAPDRP lines:** Upon achievement of the outcome indicators, loans for the full scale project to be converted partly or fully into grant
- **Balance Funding:** From internal Resources/ Loans from financial institution/Multi-lateral agencies
- **Incentive:** To incentivize 100% metering component in the full scale projects, such projects would get 75% funding from GoI as against 50% for other projects

Stage	For projects proposing 100% metering for the customers in the project area	For other projects
Stage-1: Pilot Projects	100%	100%
Stage-2: Full Scale Projects	75%	50%

Assumptions used for estimated funding for FSP (Preliminary estimate)

SN	Particulars	Units	Value
1	Connected load of agricultural pump sets in Gujarat (2007-08)	MW	7,541
2	Amount spent for Gujarat FSP (2007-08)	Rs Crore	1,290
3	Amount spent for Gujarat FSP (2007-08)	Rs Lakh/MW	17
4	Cost of feeder segregation (2014-15) assuming a 7% annual escalation	Rs Lakh/MW of agricultural connected load	27.47
5	Connected Load of agricultural pump sets in India (2009-10)	MW	81,500
6	Connected Load of agricultural pump sets in India (2014-15) assuming a 5% annual escalation	MW	105,000
7	FSP already completed in various states (proportion)	%	10%
8	Estimated proportion of pilot projects	%	3%
9	Cost of metering per pump set	Rs/Pump set	4,500
10	Cost of HVDS per pump set	Rs/Pump set	40,000
11	Total number of pump sets in India	Crore Nos	1.92

Calculation for funding required for the FSP

S. No.	Particulars	Units	Value
1	Estimated cost of FSP in India (Balance load)	Rs Crore	25,958
2	Cost of HVDS for 50% of pump sets	Rs Crore	38,307
3	Cost of metering for 50% of pump sets	Rs Crore	4,310
4	FSP Cost including HVDS and Metering (Grand Total)	Rs Crore	68,575
5	Proportion of pilot projects in the total project	%	3%
6	Total cost of pilot projects (Stage-1)	Rs Crore	2,057
7	Total cost of full scale projects (Stage-2)	Rs Crore	66,517
8	Range of GoI funding for Stage-1 Projects (Pilot Phase)	%	100%
9	Range of GoI funding for Stage-2 projects (Full Scale)	%	50%-75%
10	GoI funding for Stage-1 Pilot projects (100% of project cost)	Rs Crore	2,057
11	GoI funding for Stage-2 (Range from 50% to 75% of project cost)	Rs Crore	33,259 to 49,888
12	Total GoI funding: (Range from 50% to 75% of project cost in Stage-2)	Rs Crore	35,316 to 51,945
13	Total GoI funding: Assuming 50% of projects have 100% metering and hence would get 75% funding	Rs Crore	43,631

Monitoring Committees at two levels should be constituted- Central and State level with different set of responsibilities

- Central level steering committee
  - Setting up the guidelines for operationalization of the scheme
  - Approving proposals for funding the pilot projects
  - Sanctioning DPRs after reviewing results of the pilot programs
  - Periodically monitoring and reviewing the implementation
  - Appointing third party agencies for verification and validation of the outcome indicators.
  - Approval of the conversion of loan into grant upon fulfilment of the conditions
- Monitoring committee at the state level
  - Recommending pilot projects for approval by the Central Committee, monitoring and reviewing the implementation of the pilot projects and recommending DPRs for approval of the Central Committee.
  - Periodically monitoring the implementation of the FRP with reference to the achievement of milestones and outcome indicators under the Scheme.

Answering the eight important questions …

1. What was the objective for undertaking feeder segregation program?
2. What was the structure and phasing of the implementation program?
3. How was the program funded and how was it managed?
4. What economic and social benefits were derived from the program?
5. What is the ideal framework for Government of India to roll out a national scheme for feeder segregation?
6. **Is feeder segregation an end in itself? If not, what additional initiatives/ minimum requirements need to be simultaneously undertaken to leverage the desired benefits?**
7. Are there any alternatives to the feeder segregation program?
8. What is the best framework for effective metering?

Supplementing the Feeder Segregation Programme

- Feeder segregation alone cannot help gain the benefits which Advanced Metering Infrastructure (AMI) can provide:
  - Remote monitoring and operation
  - Real time (or near real time) operation of distribution network
  - Implementation of TOD schedules
  - Remote metering of agriculture loads
- HVDS may be essential in several discoms to reduce technical and commercial losses
- Feeder segregation alone cannot ensure improvement in the quality of supply of power to rural areas since most Indian states are facing a significant gap between demand and supply. The deficiencies in the generation capacity should be addressed in order to provide reliable supply to the consumers.

Punjab Experience:

- In Punjab, post segregation, it was found that non agricultural rural feeders ("UPS" feeders) had very high technical and commercial losses in the range of 50%-70%,
- This due to increased supply hours to UPS feeders and poor quality of distribution system.
- Besides, while the power supply hours increased from 6-8 hours to 20-24 hours, the quality and reliability of supply on the UPS feeders was not good.
- To address these issues, Punjab State Power Corporation Limited (PSPCL) has taken up other projects such as
  - HVDS/less LT project for AP Feeders:
  - Low-cost T&D Loss Reduction Program for non-AP feeders in rural and sub-urban areas
- Virtual segregation did help in loss reduction in Rajasthan. On the other hand, increased sale to subsidised rural consumers led to increased financial burden on the discom.

Telangana Experience:

- Southern Power Distribution Company Limited of Telangana State Limited (TSSPDCL) has implemented segregation on a pilot basis in 5 mandals

- Northern Power Distribution Company Limited of Telangana State Limited (TSNPDCL) has implemented project in 48 feeders on a pilot basis

- The observations of Telangana Discoms on FSP are:
  - Discoms have already implemented virtual segregation and hence would be able to provide 24x7 supply to consumers even without physical segregation if adequate power is available.
  - There is an increase in AT&C loss level in the pilot FSP mandals in TSSPDCL
  - Increase in commercial and industrial category sales is not substantial in the pilot FSP mandals
  - Discoms suggest that it is economical lay an extra feeder to meet new industrial loads in the rural areas on demand rather than providing a separate feeder with 3 ph supply in advance

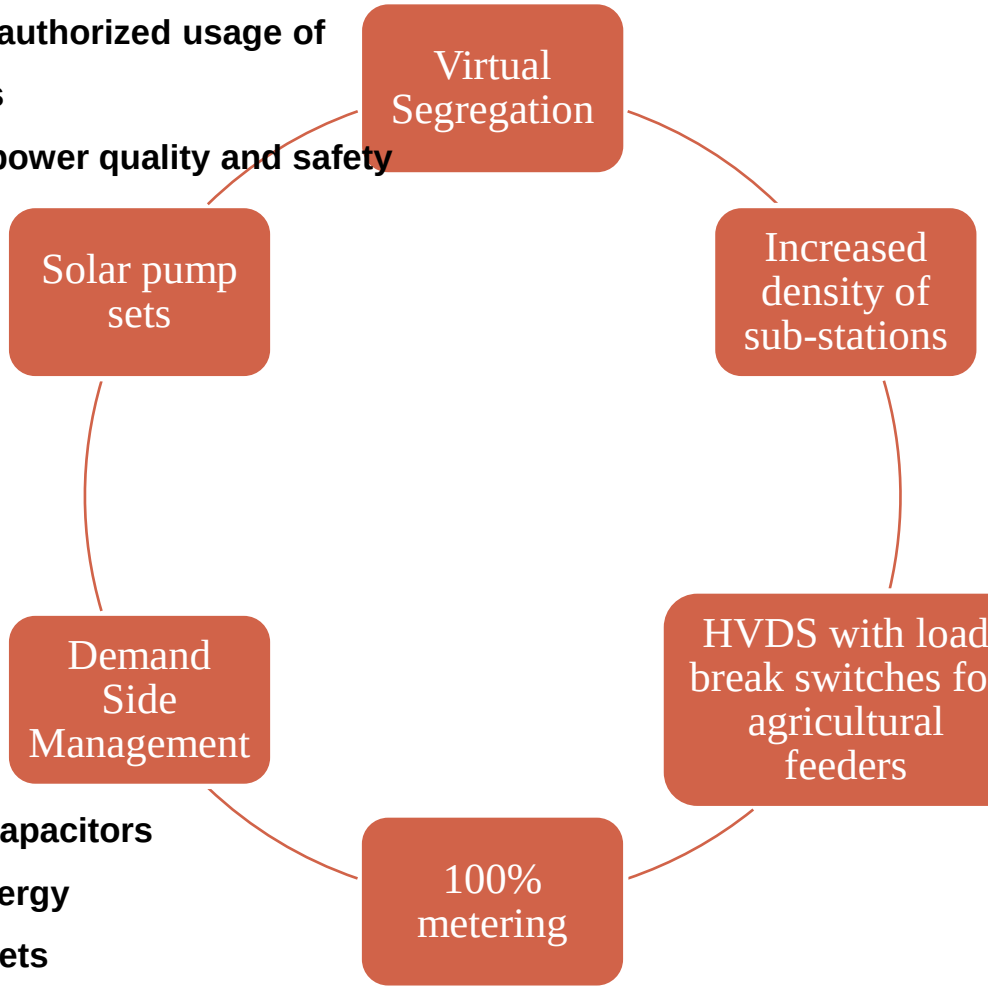
Gujarat Experience- Jyoti Gram Yojna

- Feeder Segregation Programme was undertaken throughout the state to provide 24 hours 3 phase supply to rural consumers
- The scheme was evaluated by various independent agencies, namely- IIM-A, IRMA and CEPT. Some of the benefits observed by these agencies are:
  - Overall per capita household income in rural areas grew by 8 to 9%.
  - Migration from rural areas came down by 33%
  - Overall growth in village based small industries and commercial activities increased
  - Better education facility and consequent reduction in drop outs
- In order to provide 24 hours supply to families residing in farms, special designed transformers have been installed to provide 1 phase supply during the period when 3 phase agricultural supply is cut off.

Answering the eight important questions …

1. What was the objective for undertaking feeder segregation program?
2. What was the structure and phasing of the implementation program?
3. How was the program funded and how was it managed?
4. What economic and social benefits were derived from the program?
5. What is the ideal framework for Government of India to roll out a national scheme for feeder segregation?
6. Is feeder segregation an end in itself? If not, what additional initiatives/ minimum requirements need to be simultaneously undertaken to leverage the desired benefits?
7. **Are there any alternatives to the feeder segregation program ?**
8. What is the best framework for effective metering?

Alternative options available



•Low investment option for segregation

•Possibility of unauthorized usage of phase convertors

•Relatively poor power quality and safety

•Increased 33/11KV ratio

•Reduced losses

•Improved Voltage profile

•Reduced failure of motors

•Improved reliability

•Any disturbance due to interruptions is confined to a small area only

•Benefits maximized in remote areas with good solar radiation

•Substantial savings due to avoiding line losses and network investments

High voltage Distribution System (HVDS) is very effective against energy theft in rural areas apart from reduction of technical losses

•Installation of capacitors and usage of energy efficient pump sets

• ESCO model can substantially reduce capital investments

Enabling utility to account supplied energy, thus ease in supply and subsidy rationing

Among available options, 100% metering of all customers is the best solution to achieve different objectives

- 100% metering of all customers-
  - Benefits-
    - ↓ 24x7 supply to non-agricultural rural consumers
    - ↓ Energy audit and reduction of AT&C losses in rural area
    - ↓ Improvement in the quality of supply
    - ↓ Improvement in the financial performance of the utility
  - Challenge- 100% metering and its reading (specially for non remunerative categories like AP consumers) is recognized as a highly challenging task for most of the discoms in the present socio-political conditions
- However, physical segregation of feeders is widely recognized as a practical solution

Virtual Segregation	**Physical Segregation**
Enables limiting 3 ph supply on the feeder	Physically separates Agri and other consumers
Does not require massive investment	Significantly higher investment
Possibility of unauthorized usage of phase convertors	Easier operation
Relatively poor power quality and safety	Better quality of power supply and safety

Sub Group (SG) has identified eight important questions that needs to be addressed

1. What was the objective for undertaking feeder segregation program?
2. What was the structure and phasing of the implementation program?
3. How was the program funded and how was it managed?
4. What economic and social benefits were derived from the program?
5. What is the ideal framework for Government of India to roll out a national scheme for feeder segregation?
6. Is feeder segregation an end in itself? If not, what additional initiatives/ minimum requirements need to be simultaneously undertaken to leverage the desired benefits?
7. Are there any alternatives to the feeder segregation program?
8. **What is the best framework for effective metering?**

Existing inadequacies in the metering system in the Indian discoms at various levels

SN	Level	Requirement	Status of Meter	Action	Status of Process
1	Customer	Electronic/ High accuracy	Customers are not metered. e.g. Agricultural, BPL (in some cases)	Some discoms to replace the electromechanical /Low accuracy meters	Some discoms do not have an effective process
2	Distribution Transformer	Remotely readable	Most discoms do not have metering infrastructure at this level	Need to upgrade the conventional meters installed in some discoms	Most discoms where meters are installed do not have an effective process
3	Feeder	Connected to online data acquisition system	Most discoms have metering at this level	Most discoms need to upgrade the meters	Several discoms do not have an effective process

Metering should be encouraged by all means at customer, DTR and feeder levels

- Continuous research and innovation is required for tackling new ways of power theft
- Completion of consumer indexing on a time bound basis by utilities
- Provisional meter reading shall be discouraged and actual meter reading should be incentivized
- SERCs should encourage metered supply via lower tariff rates to metered supply in comparison to flat rate supply
- DTR based group metering on pro-rata basis should be adopted till the time individual metering is not possible.
- Standards to be followed in meter type, accuracy, installation procedure and sealing
- Third party meter testing should be done through accredited institutions
- Use of smart meters, pre-paid meters and kVAh metering should be encouraged

SG recommends that metering at feeder and DTR level to be made an essential requirement for FSP to leverage the desired benefits

- Metering at feeder level would help the utility in effective energy audit thus identifying high loss feeders

- Economical remote metering infrastructure for DTRs or External meters for all customers on the lines of Pillar box metering done in Punjab for non-agricultural customers should be one of the prerequisites for feeder segregation to facilitate, identify and avoid any type of power pilferage in the system

Conclusions:

- Feeder Segregation is socially beneficial for rural population and should be carried out throughout the country
- The central government should intervene by funding the projects on the lines recommended
- The feeder segregation should be detailed with milestones for effective metering and revenue generation
- Reduction in distribution losses to be one of the milestones for grant/ loans under the scheme
- HVDS and such other measures for loss reduction and load management to be undertaken
- Conservation of ground water resources to be part of the management of agricultural feeders

Thank You

Grid Integration Studies: Key for Enhancing Renewable Energy Penetration

Dr. Nikit Abhyankar

Lawrence Berkeley National Laboratory

Presentation made to FOR

17 Oct 2014

Mussoorie

Introduction to Lawrence Berkeley National Laboratory

Managed by the University of California for the United States Department of Energy

Lawrence Berkeley National Laboratory

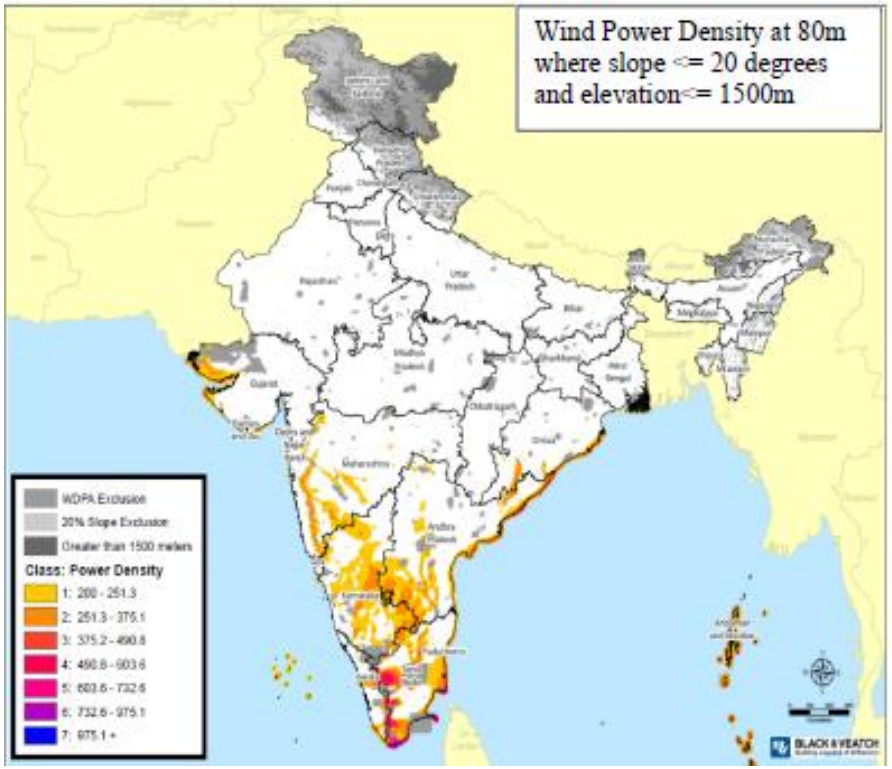
13 — Nobel Prizes
13 — National Medal of Science recipients
4,200 — Employees
200 — Site acreage

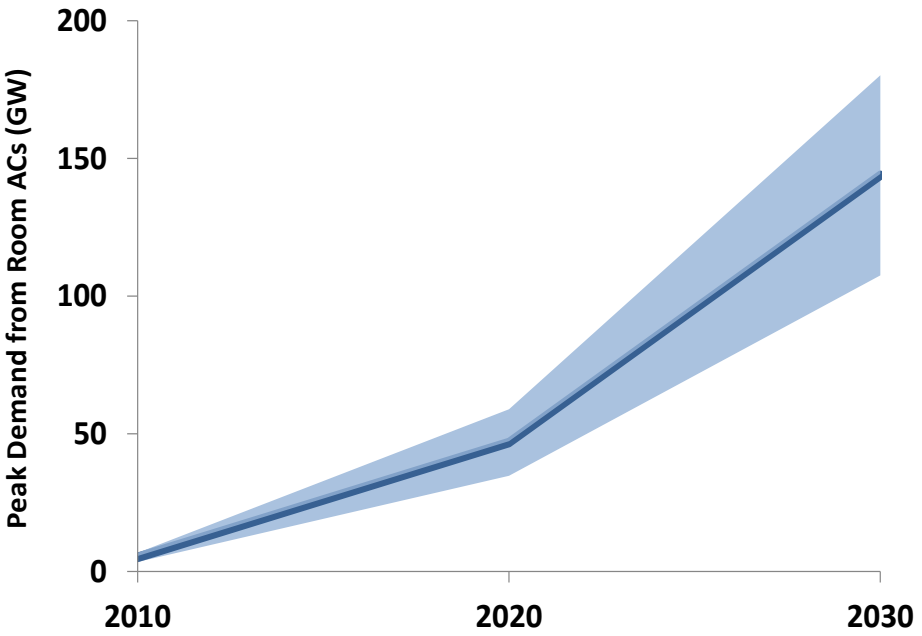
- **Dedicated to solving the most pressing scientific problems facing humankind**
  - Basic science for a secure energy future
  - Science of living systems to improve the environment and energy supply
  - Understanding and control of matter and energy in the universe
  - Translation to applied energy programs
- **Build and safely operate world-class scientific facilities**
- **Train the next generation of scientists and engineers**

LBNL Collaborations in India

- FOR and CERC
- MOP and MNRE
- Planning Commission
- BEE
- POSOCO
- PGCIL

Recent high impact analyses in India by LBNL





Wind potential in India is >3,000 GW

Projected AC demand may be ~150 GW by 2030 or so

Outline

- Motivation for grid integration studies
- Brief overview of the grid integration studies in the US
- Example analysis: Grid integration analysis for India using grid dispatch simulations
- Potential next steps

Motivation: Regulators need independent analysis ..1

- Decide RPO targets, feed-in tariffs and integration costs
  - Net costs/benefits of RPO on consumers
  - Considering integration costs is key in evaluating the RPO policies (simple levelized cost analysis may not work)

- Assess the technical feasibility of large scale RE grid integration
  - For example, if 3000MW of solar comes up in Rajasthan, can it be integrated reliably ?
  - Need to assess whether the utility is following a least cost integration strategy

Motivation: Regulators need independent analysis ..2

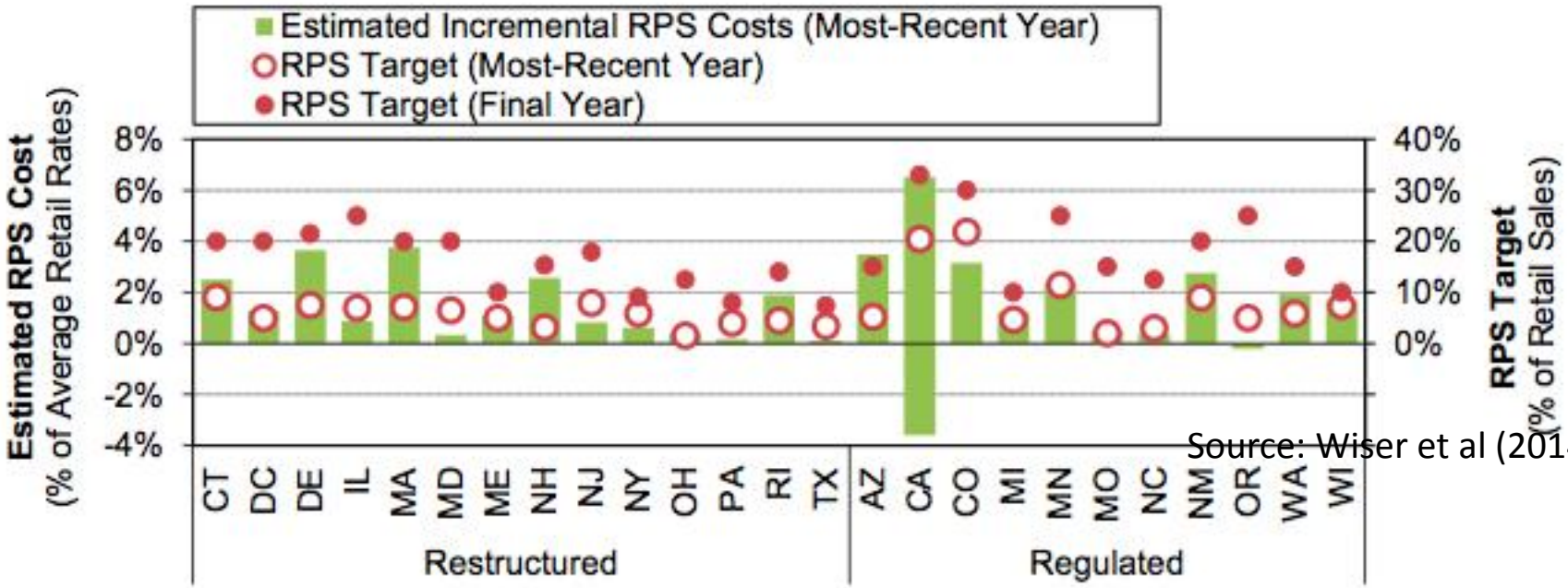
- Evaluate the system operations
  - Forecasting, scheduling etc.
  - Optimization of the existing dispatch (especially hydro)

- Assess the mechanisms for incentivizing system flexibility
  - Investments in key flexible resources such as gas, hydro etc
  - Complementary programs such as demand response
  - Sharing of resources across states (through markets ?)
  - Deviation settlement markets

EXAMPLE ANALYSES FROM UNITED STATES

Cost-Benefit of RPS Policies in United States

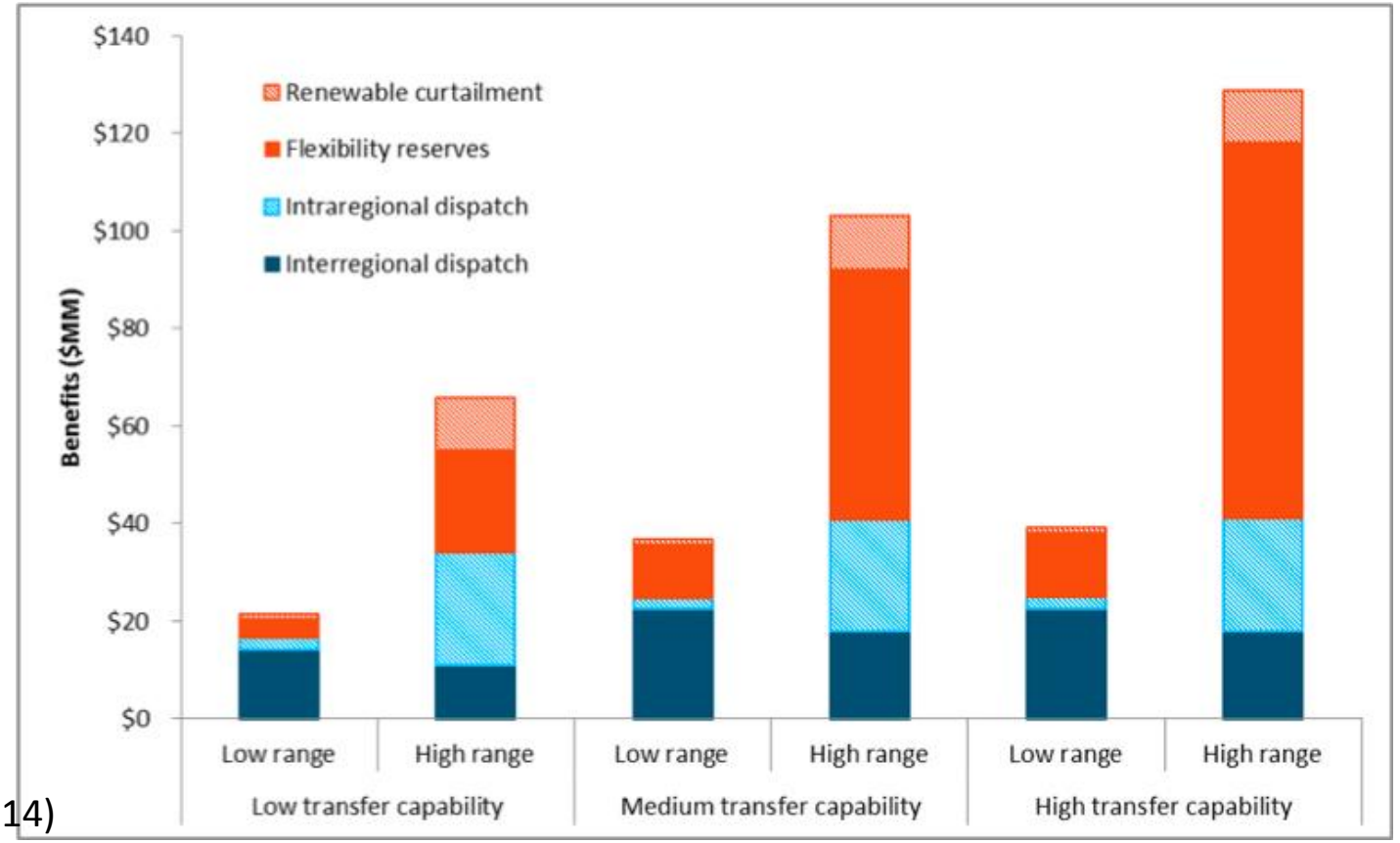
- In all states the incremental cost of RPS (including integration costs) is found to be fairly small



Source: Wiser et al (2014)

California: Benefits of Energy Imbalance Market

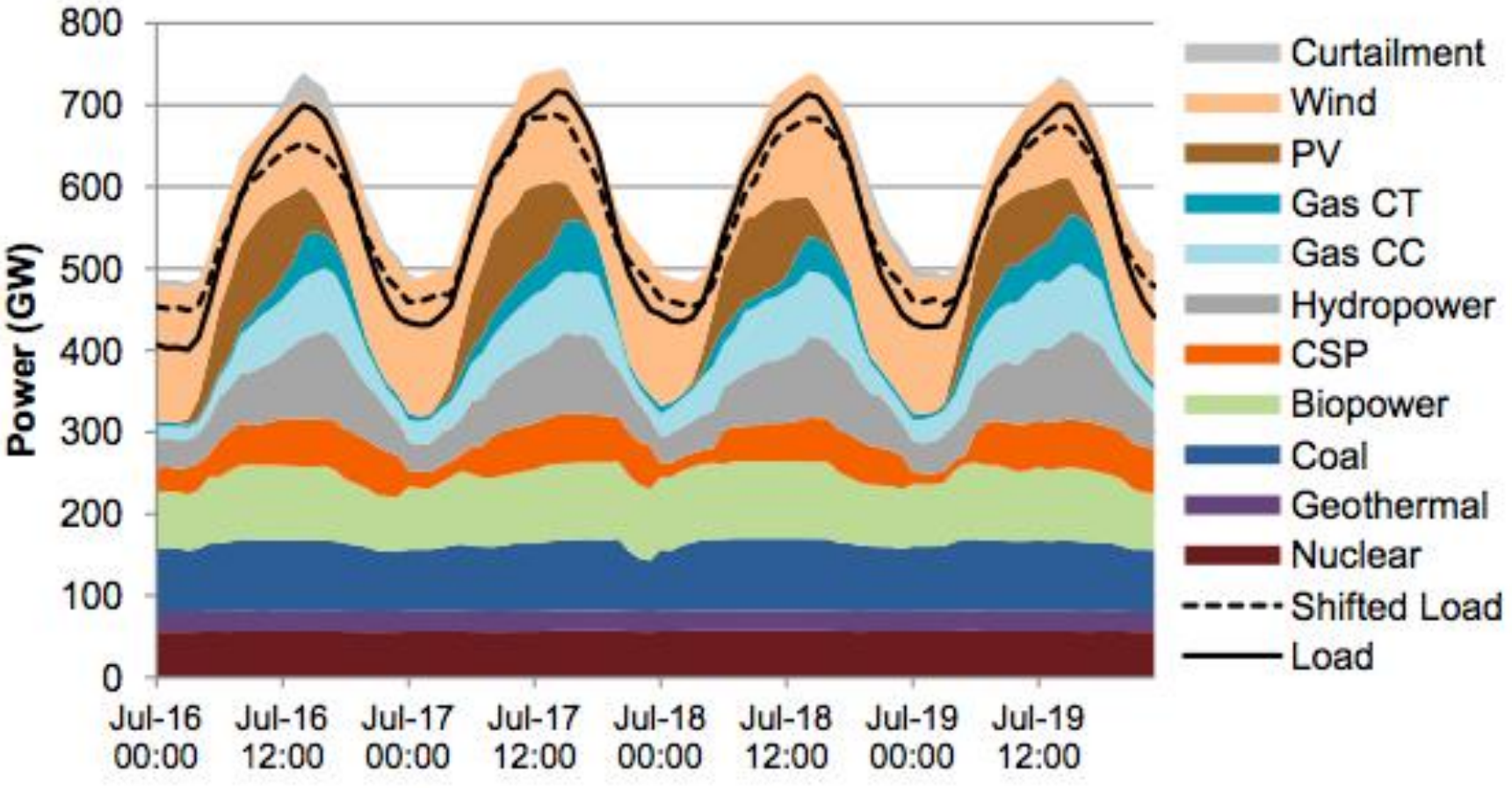
- Energy Imbalance Market is a real time market for sharing resources across states / balancing authorities in the Western US



Source: E3 (2014)

US Department of Energy: 80% RE by 2050

- Renewable Electricity Future Study – Dispatch Simulation

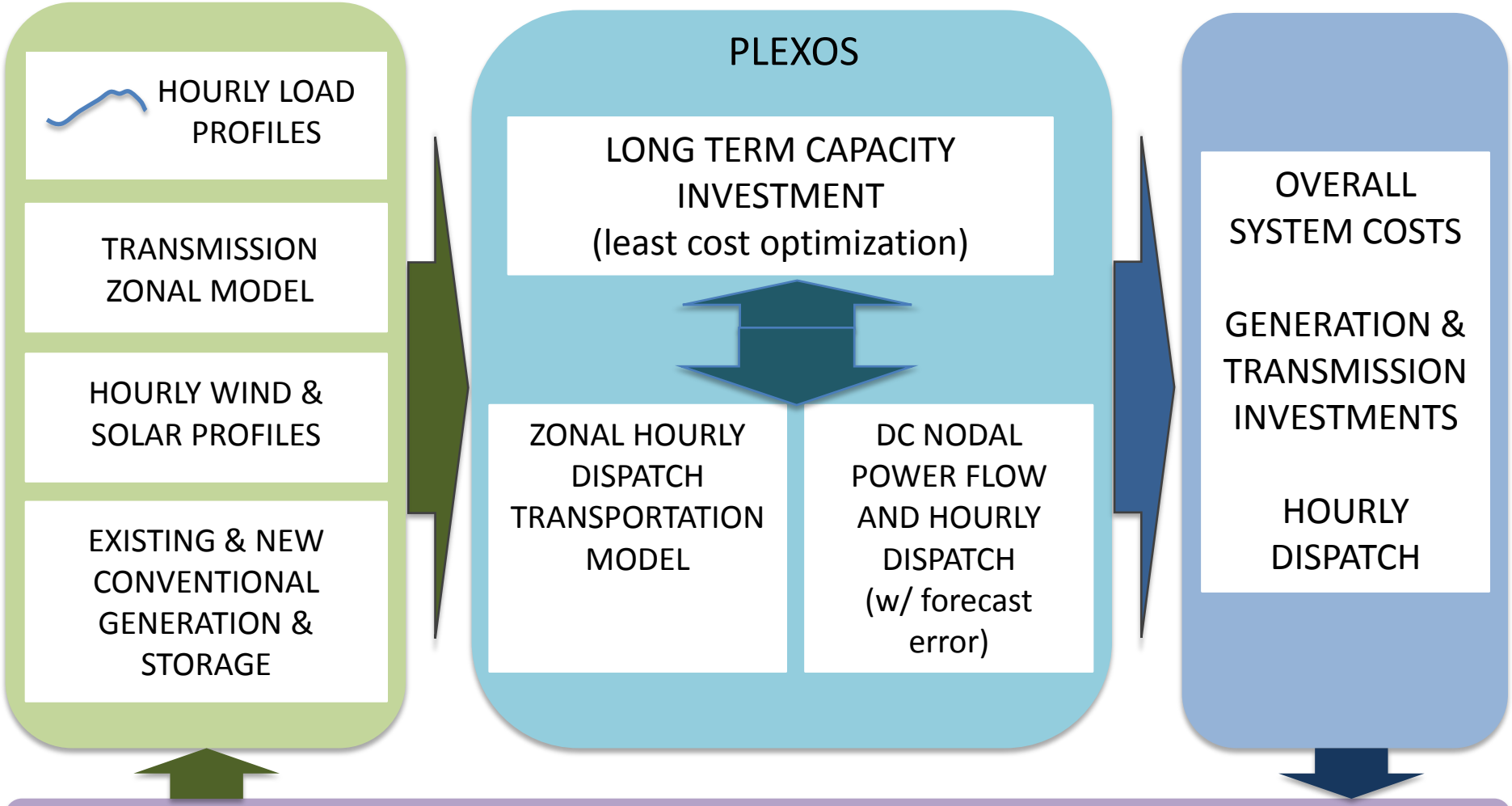


Source: NREL (2013)

Example Analysis for India:

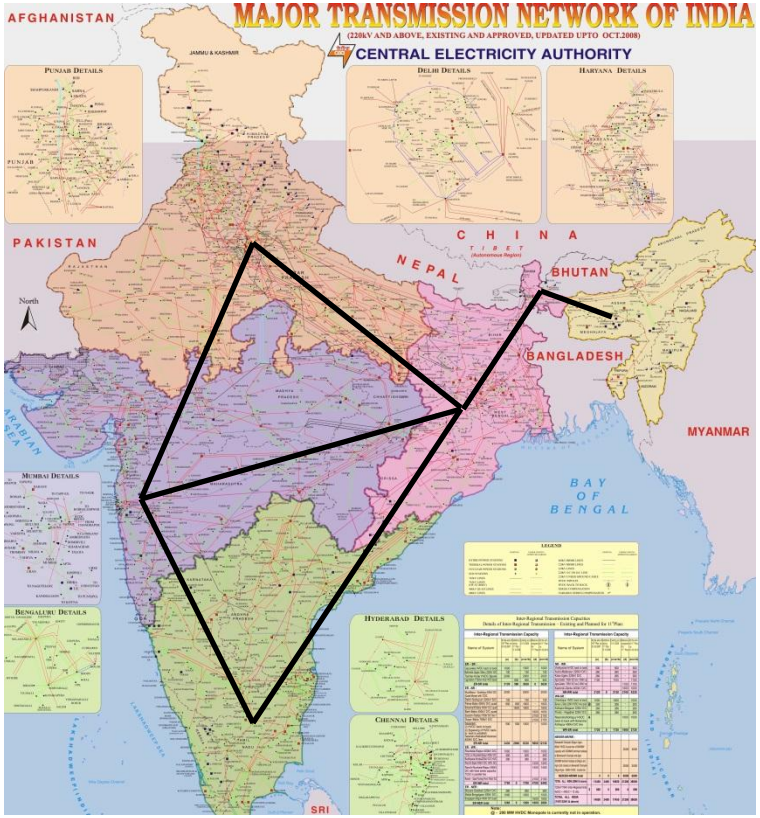
Grid Dispatch Simulation with High RE penetration

India modeling framework



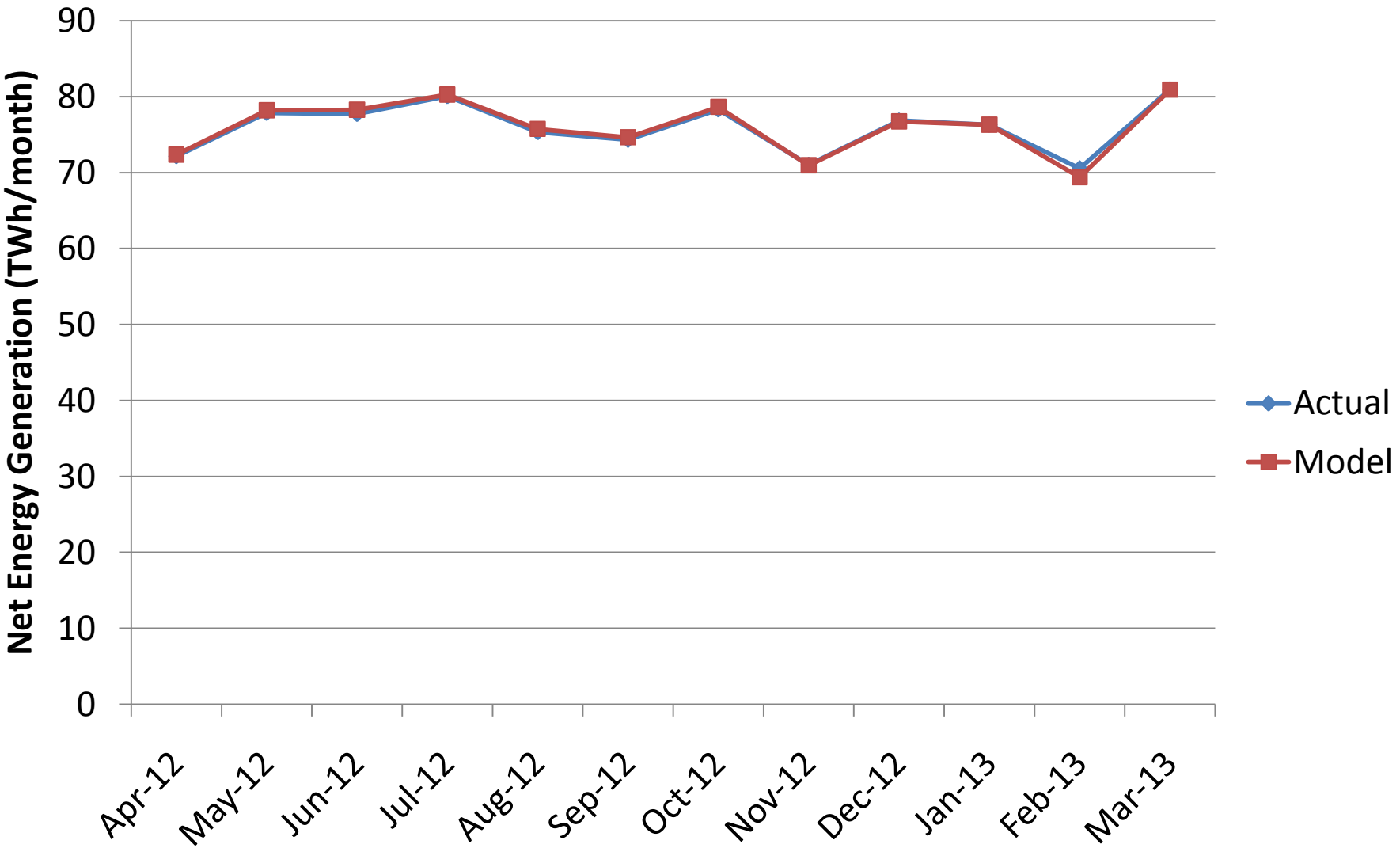
Transmission

- Transmission model with each region as node



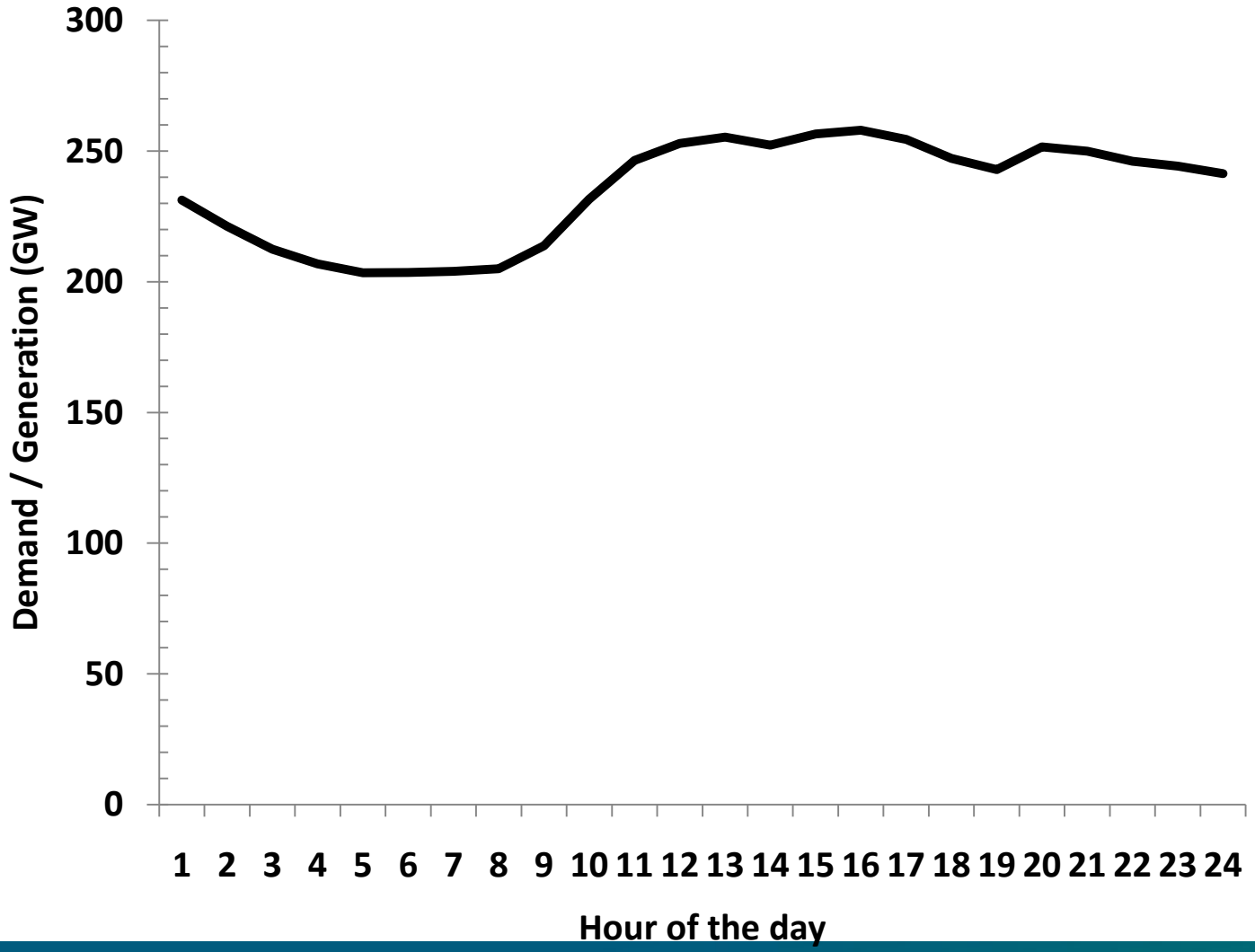
Transmission corridors are illustrative

Model was calibrated to the actual dispatch in 2012-13

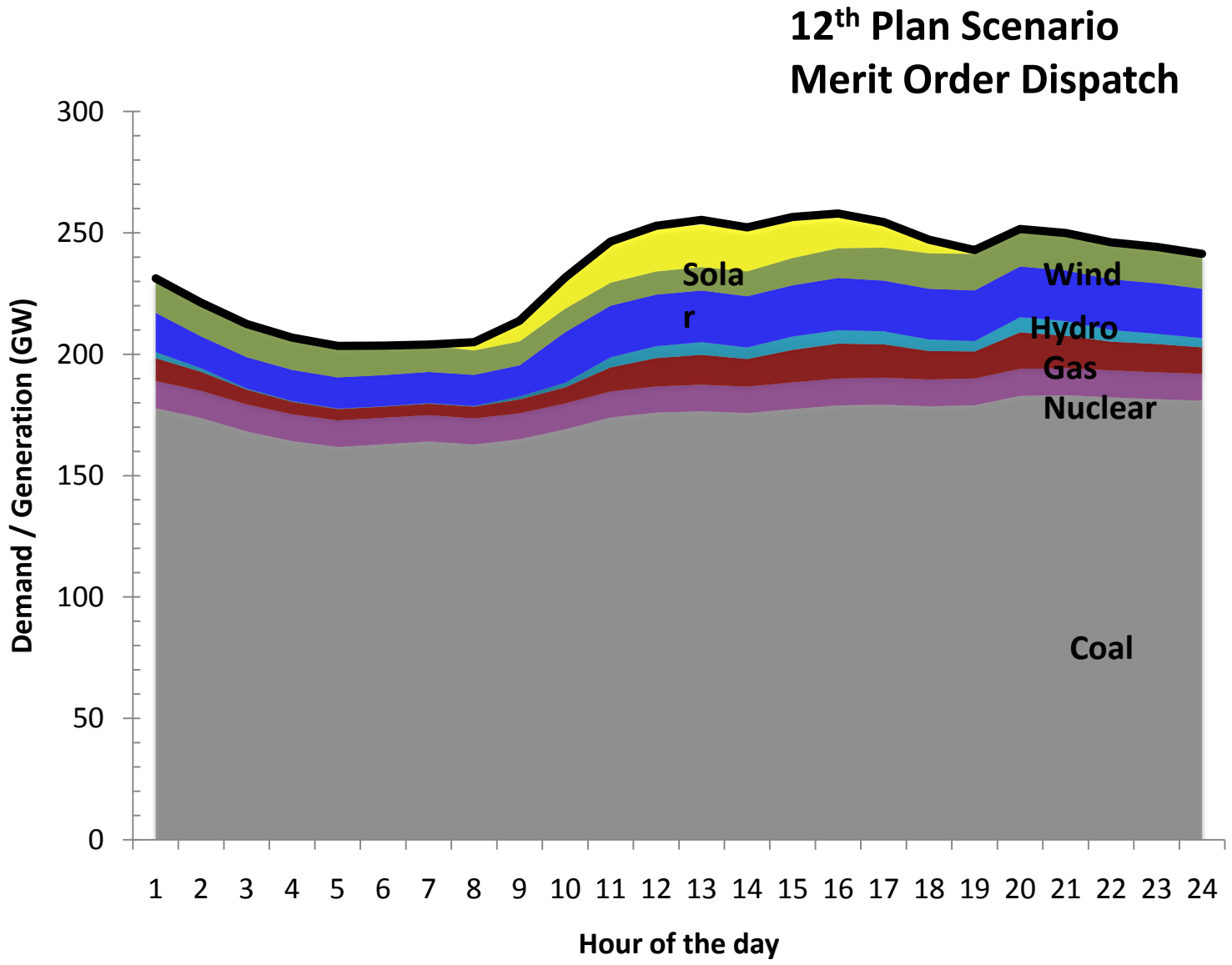


Dispatch simulations

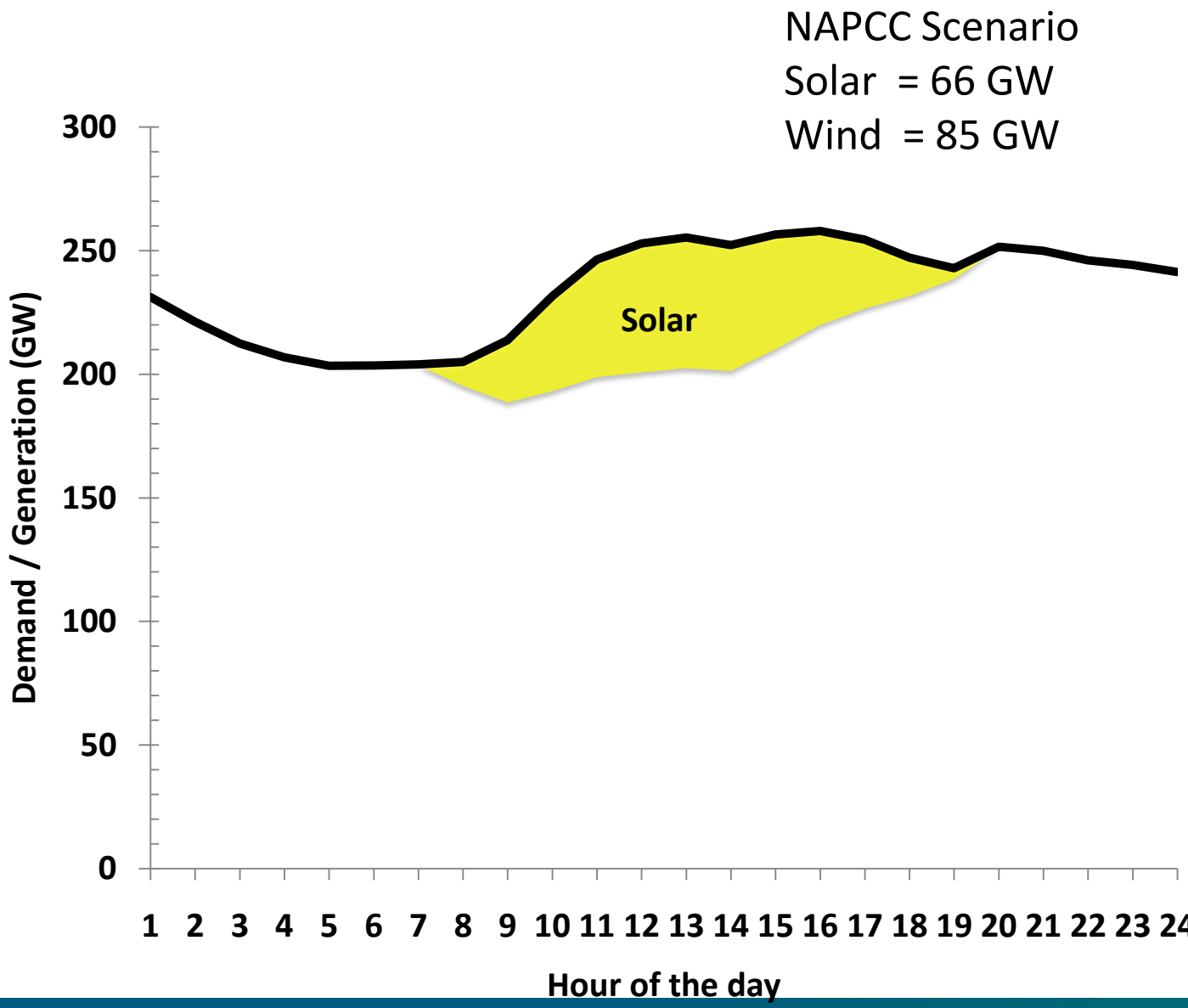
Average Summer Day (2022)



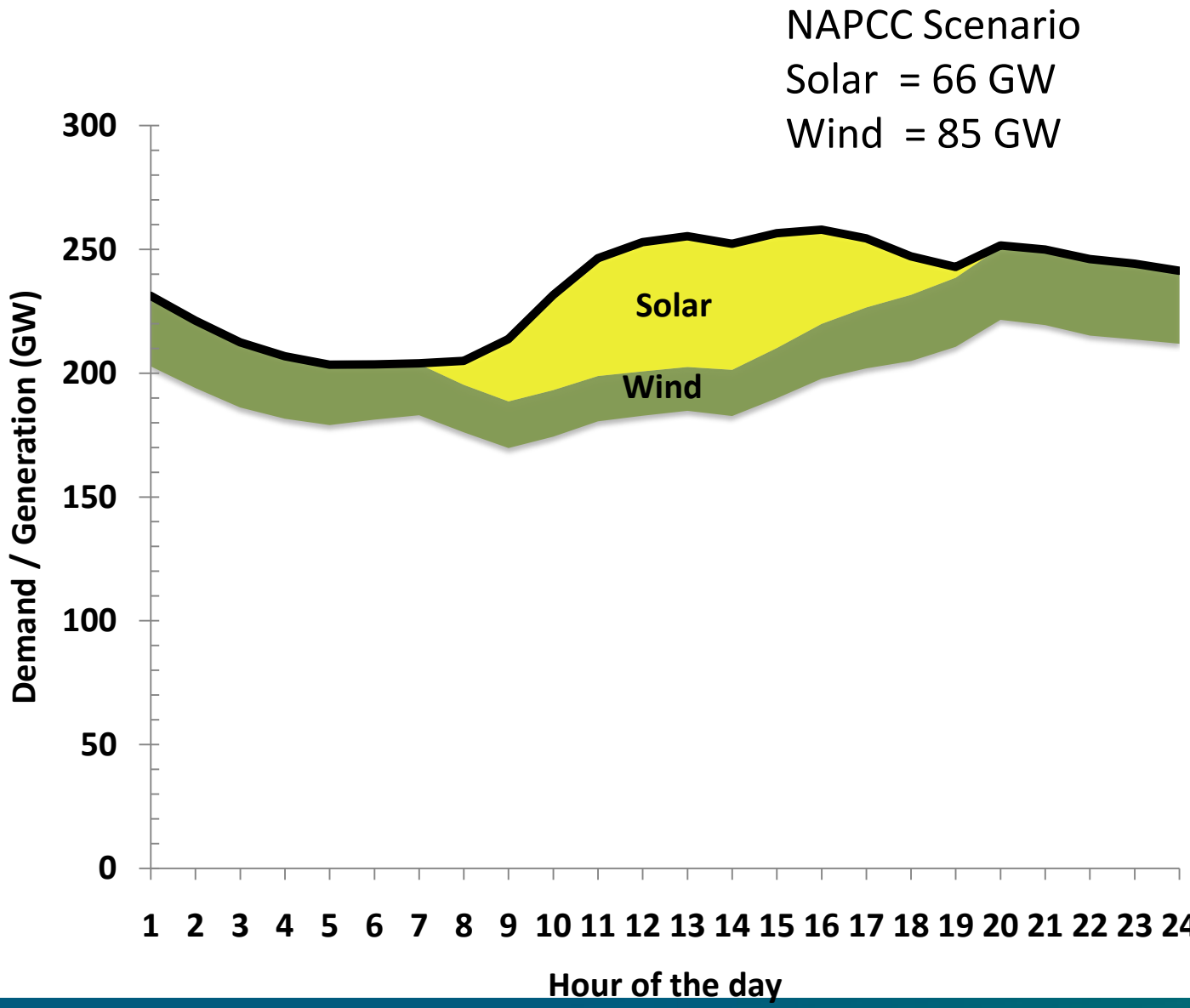
Average Summer Day (2022)



Average Summer Day (2022)



Average Summer Day (2022)



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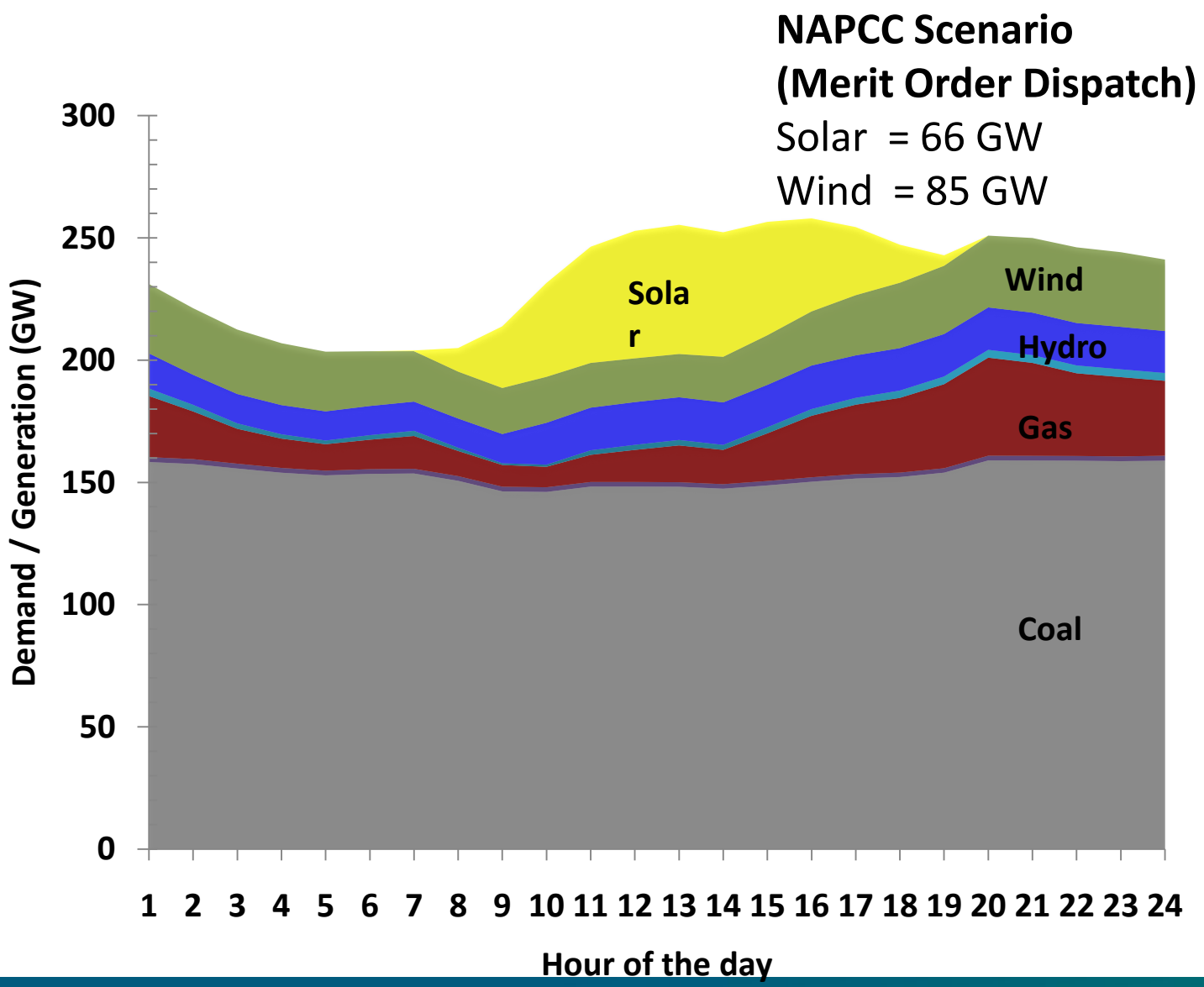
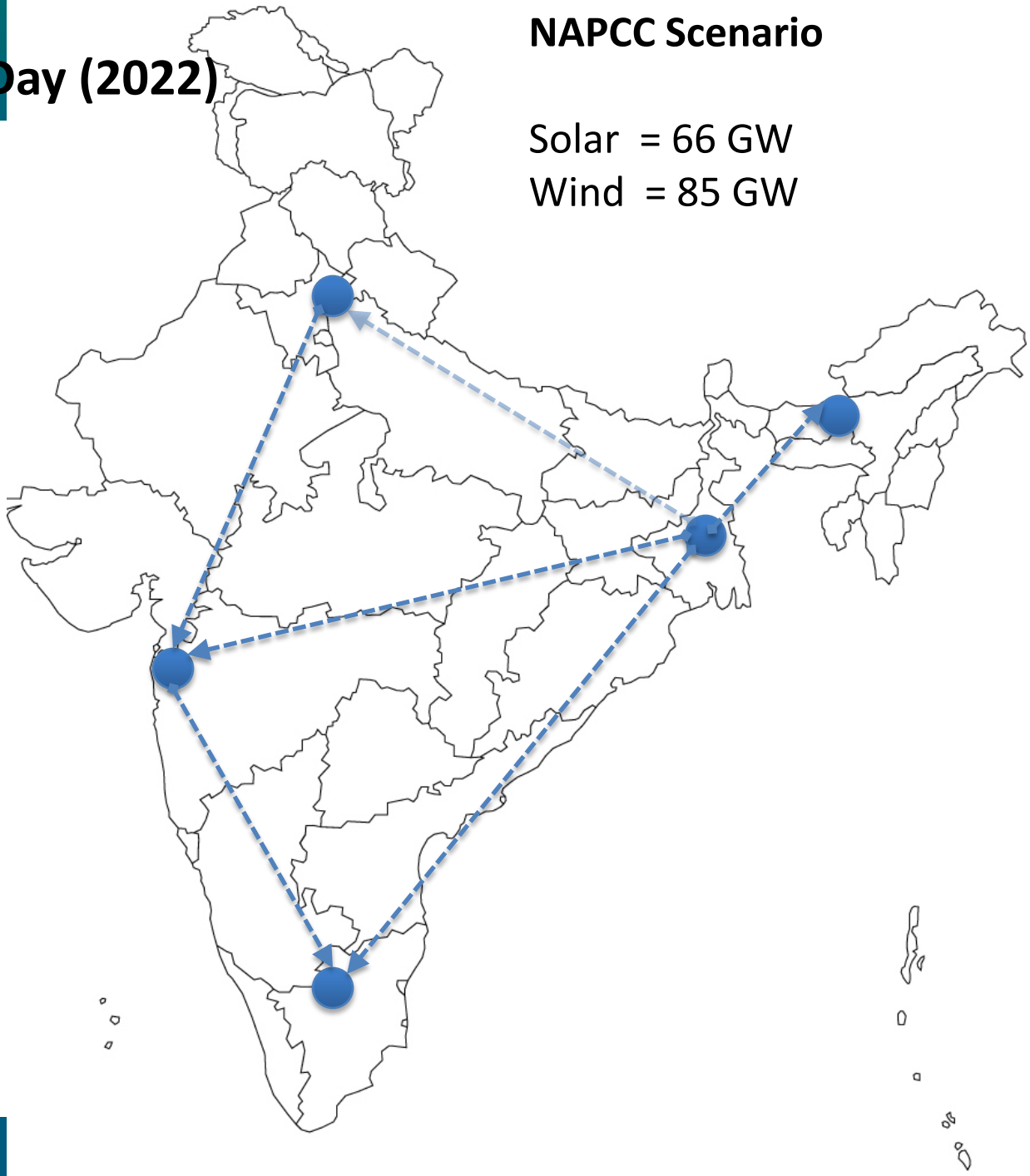
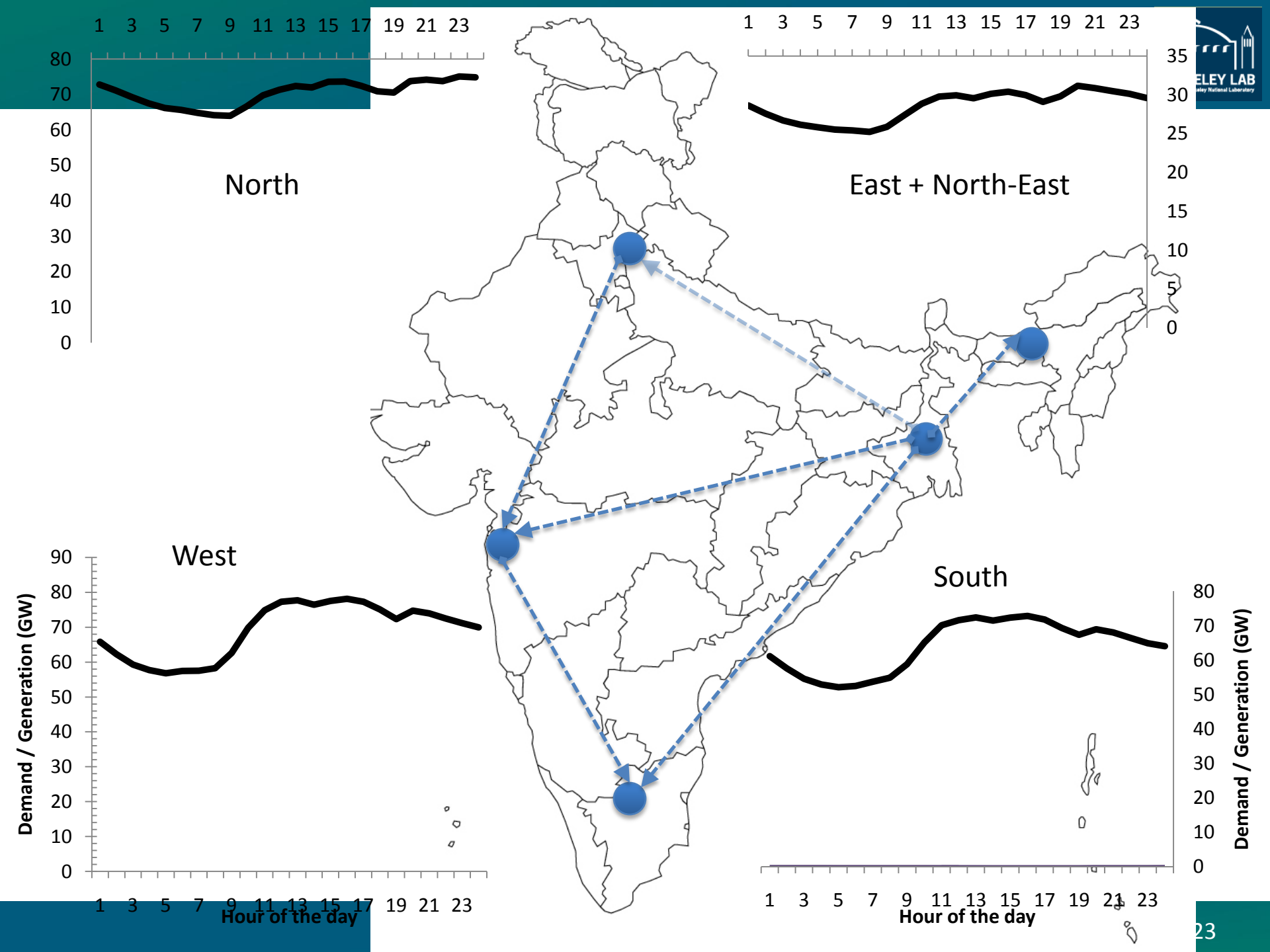
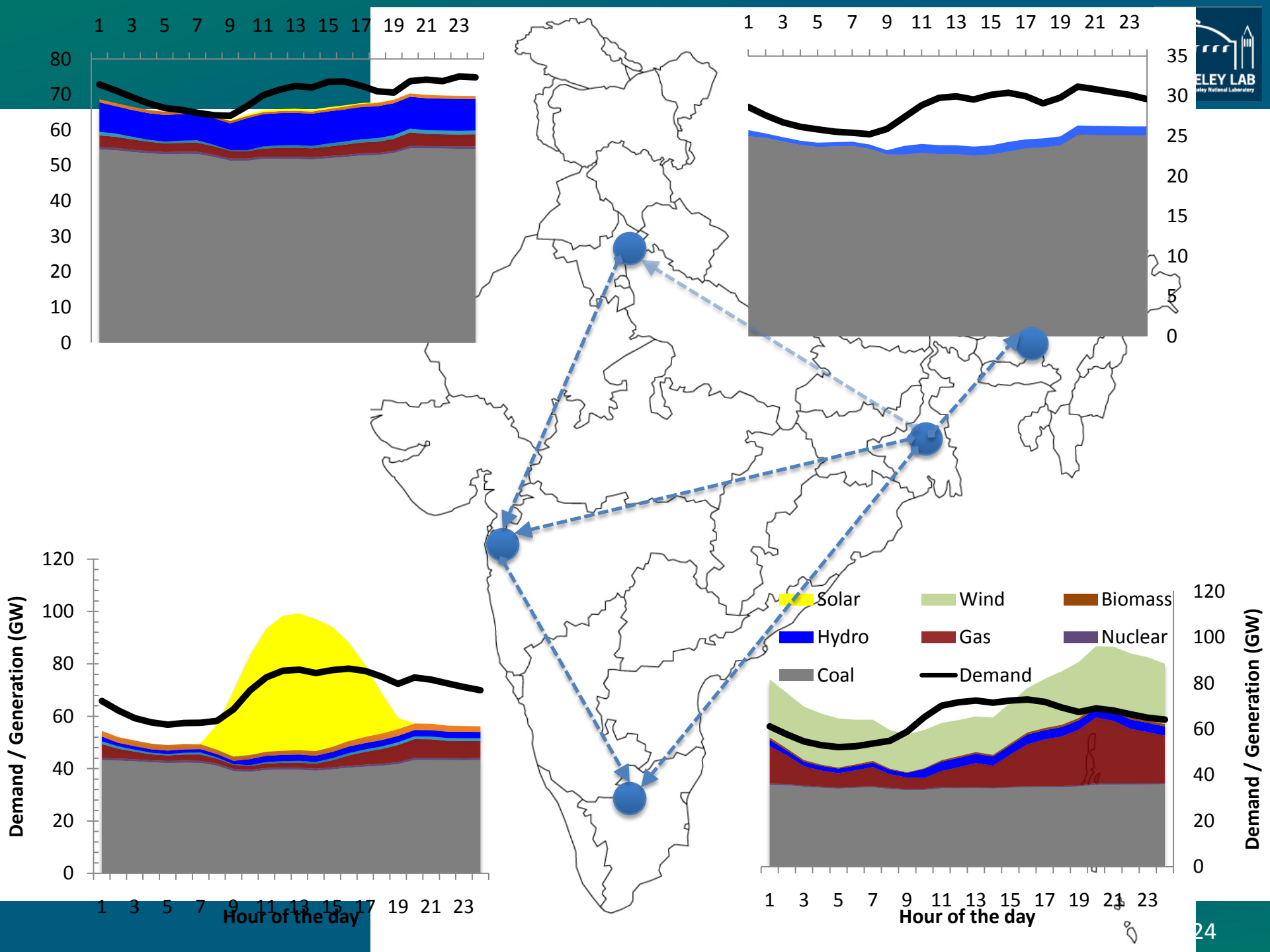
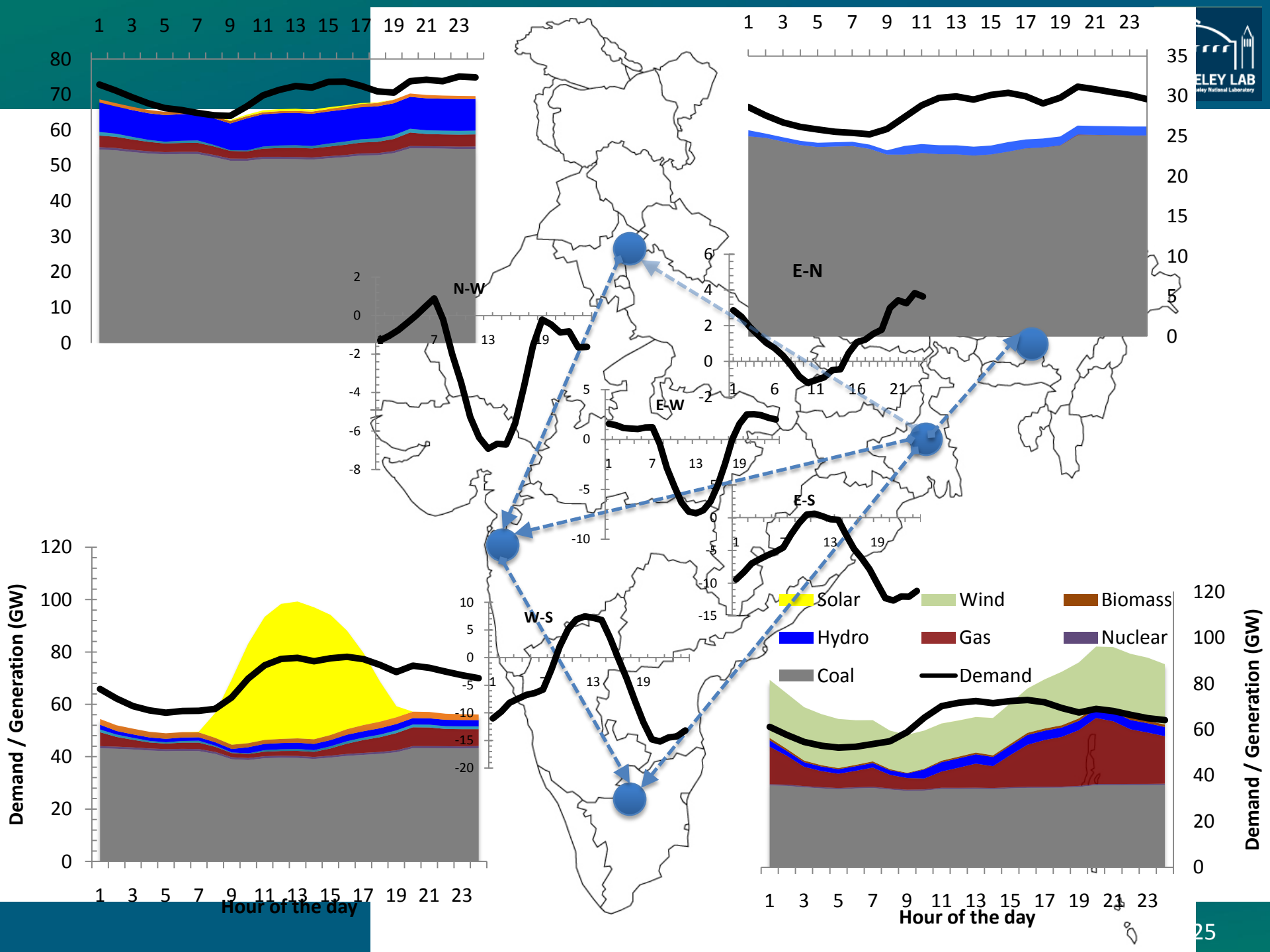


Average Summer Day (2022)

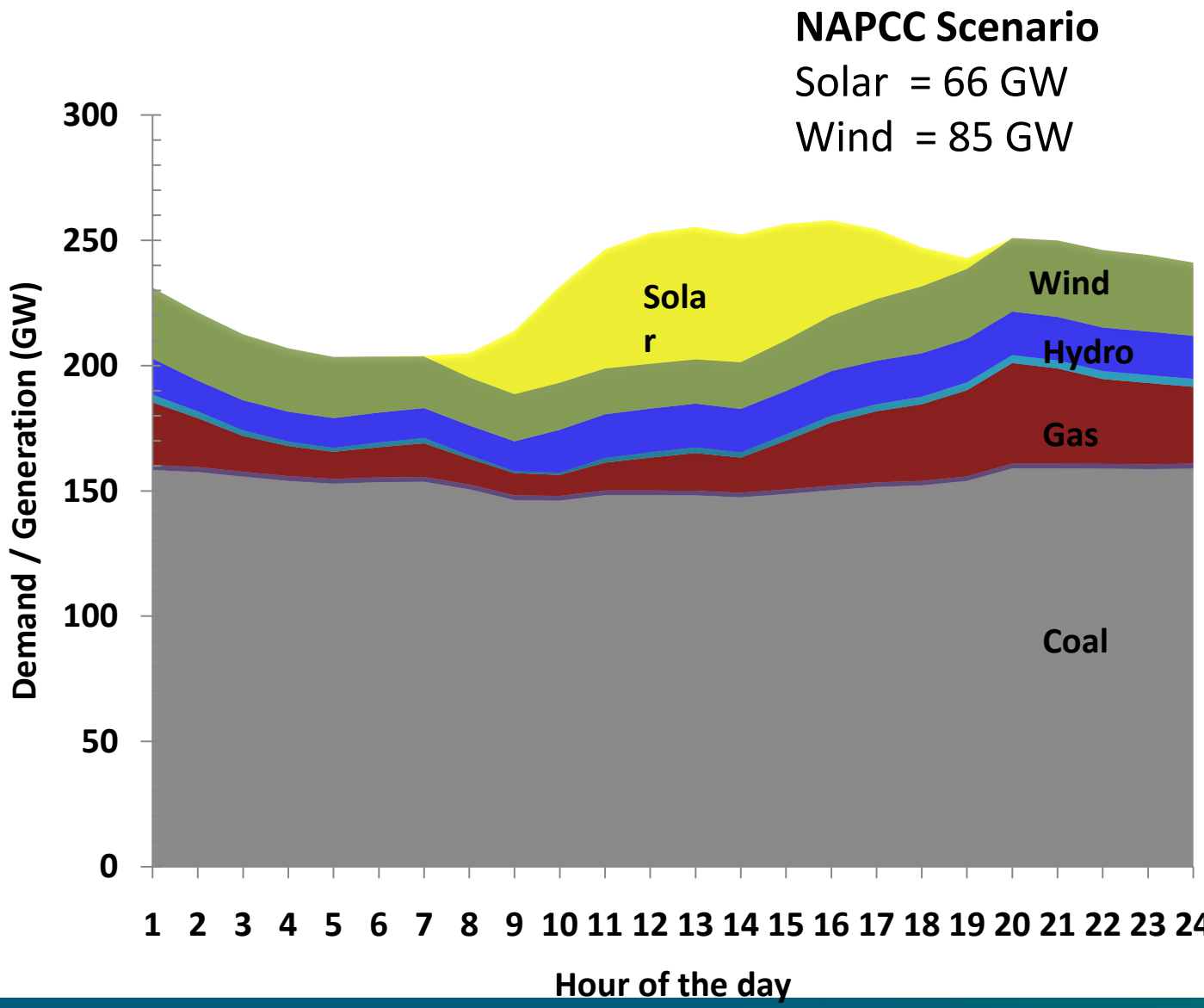



North
East + North-East
West
South
Demand / Generation (GW)
Hour of the day

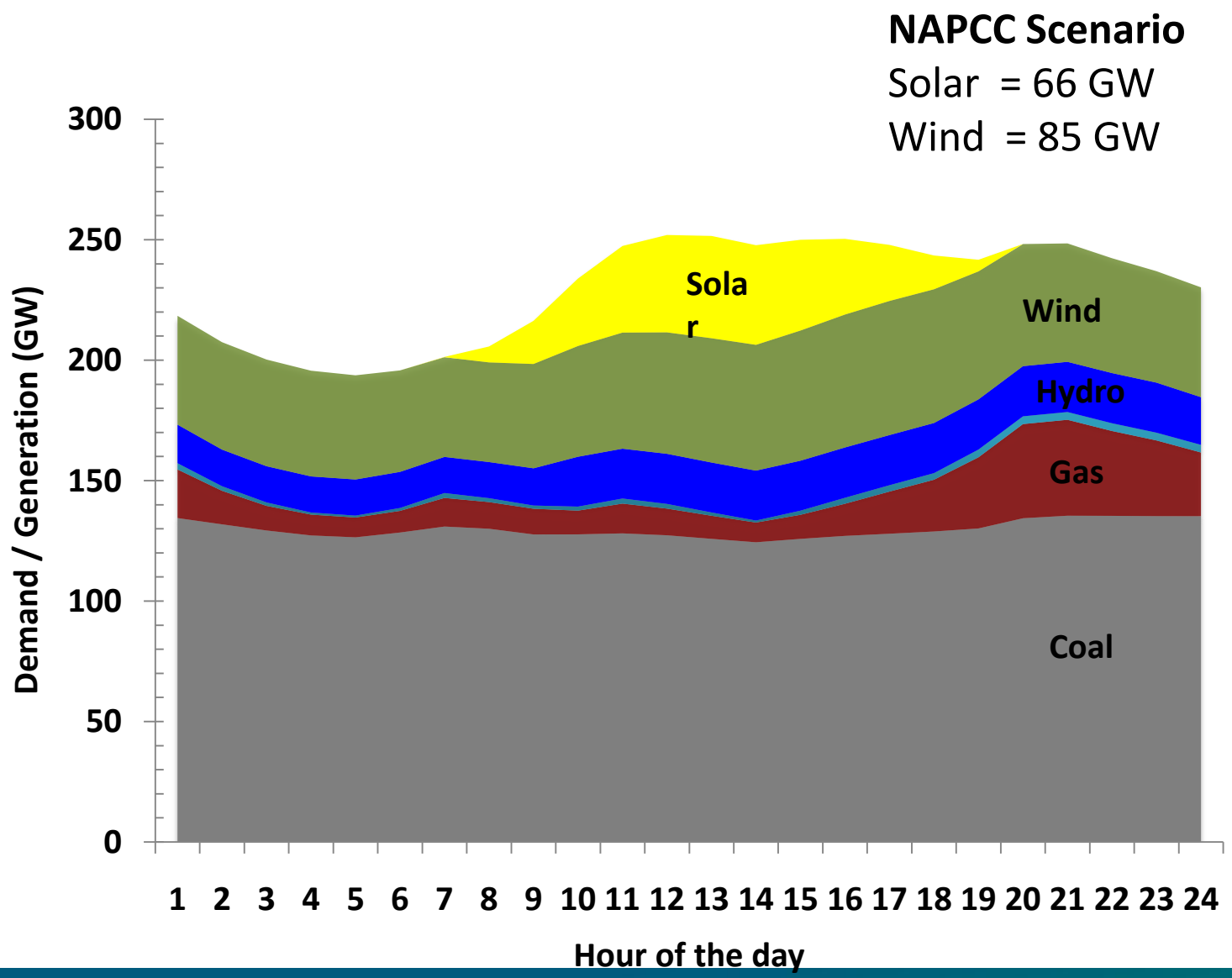

Solar
Wind
Biomass
Hydro
Gas
Nuclear
Coal
Demand
Demand / Generation (GW)
Hour of the day


N-W
E-N
E-W
E-S
W-S
Solar
Wind
Biomass
Hydro
Gas
Nuclear
Coal
Demand
Demand / Generation (GW)
Hour of the day

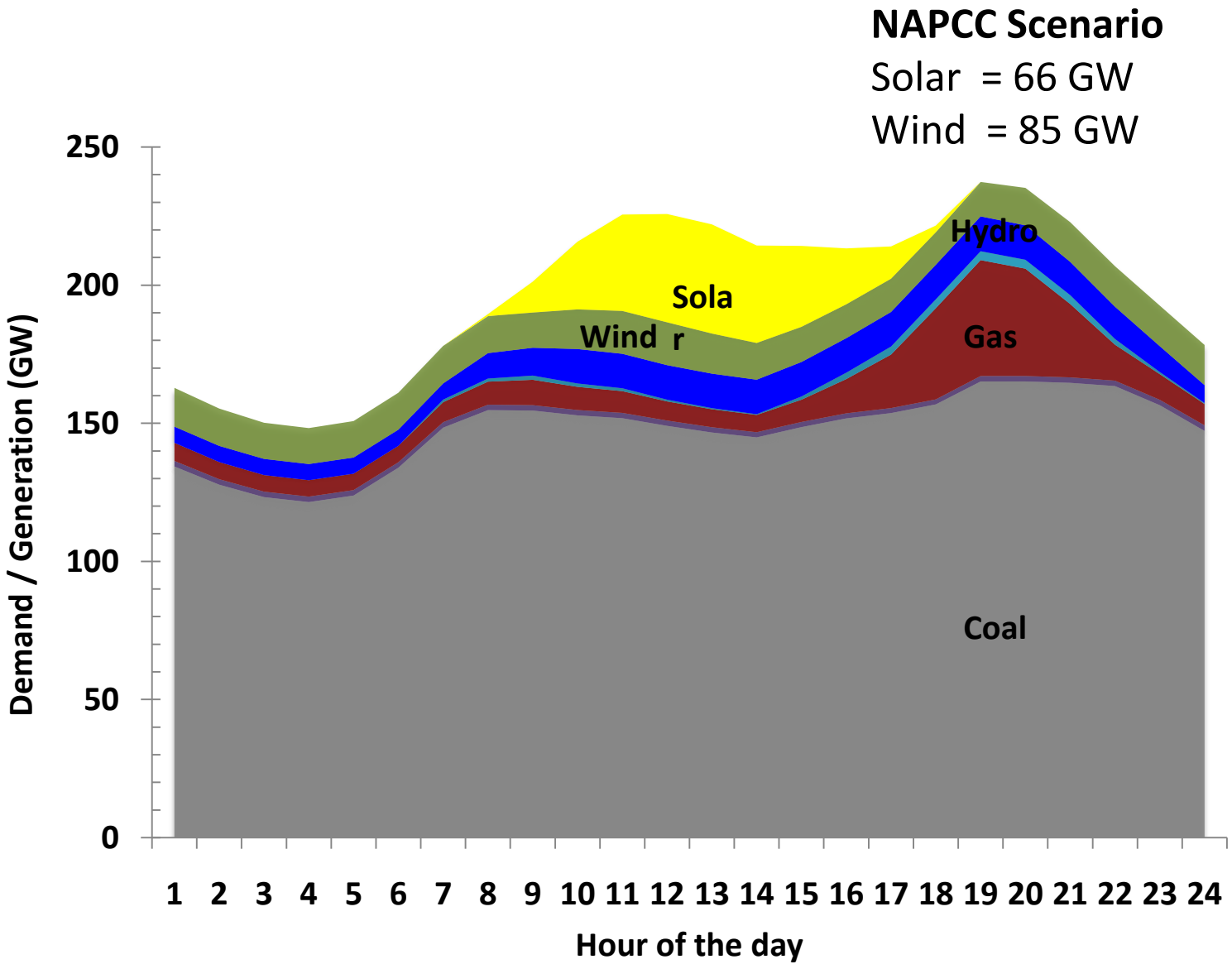
Average Summer Day (2022)



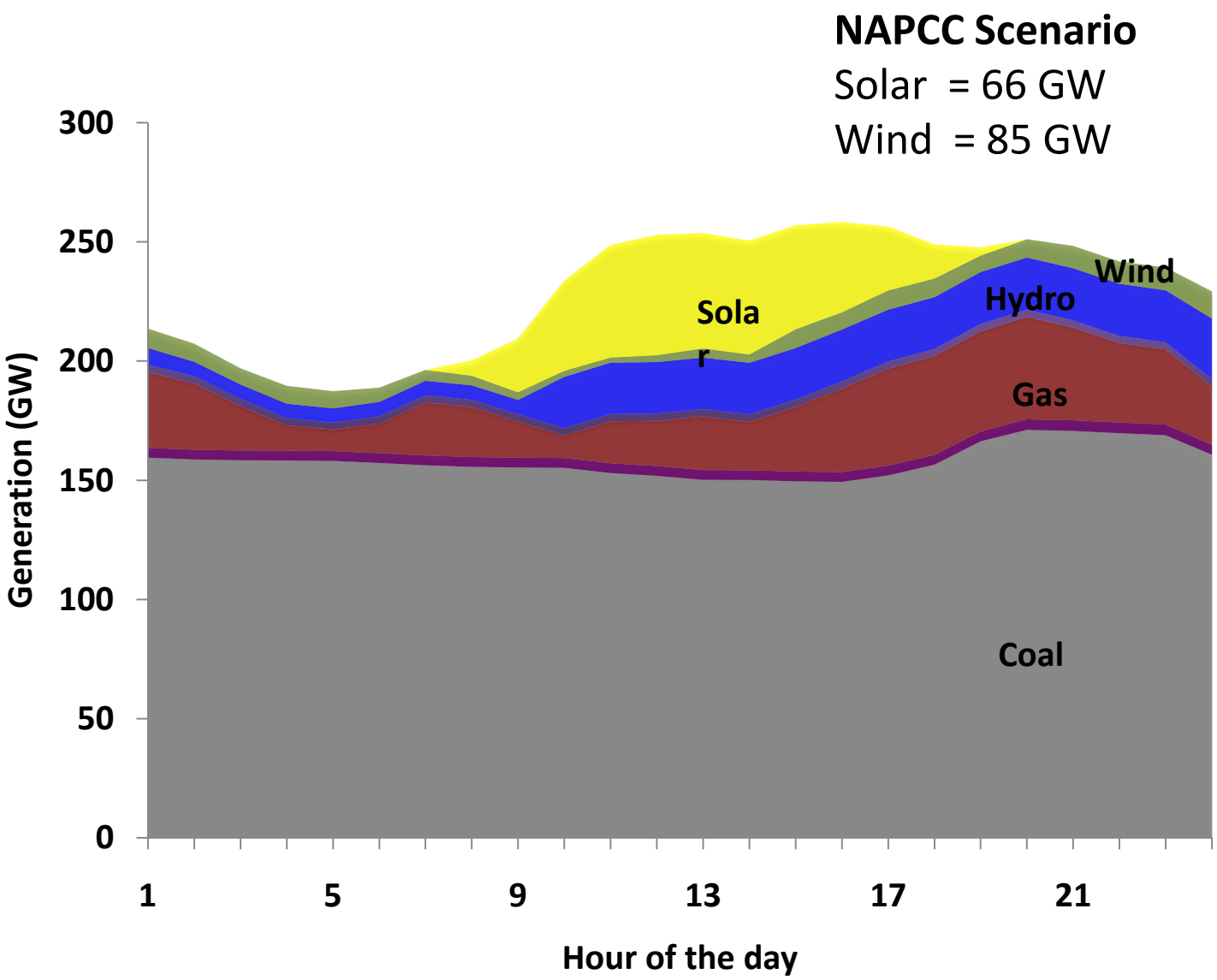
Average Monsoon Day (2022)



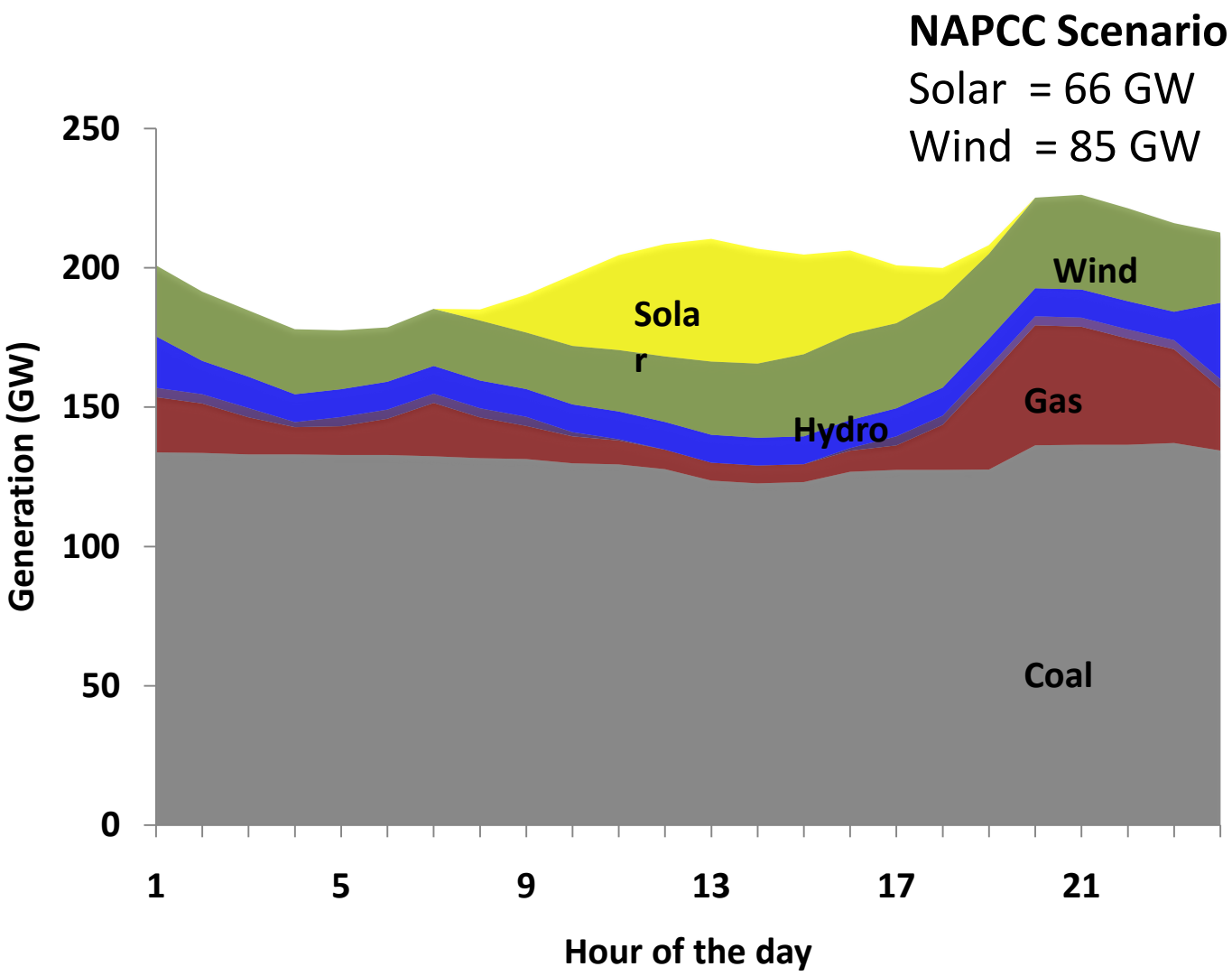
Average Winter Day (2022)



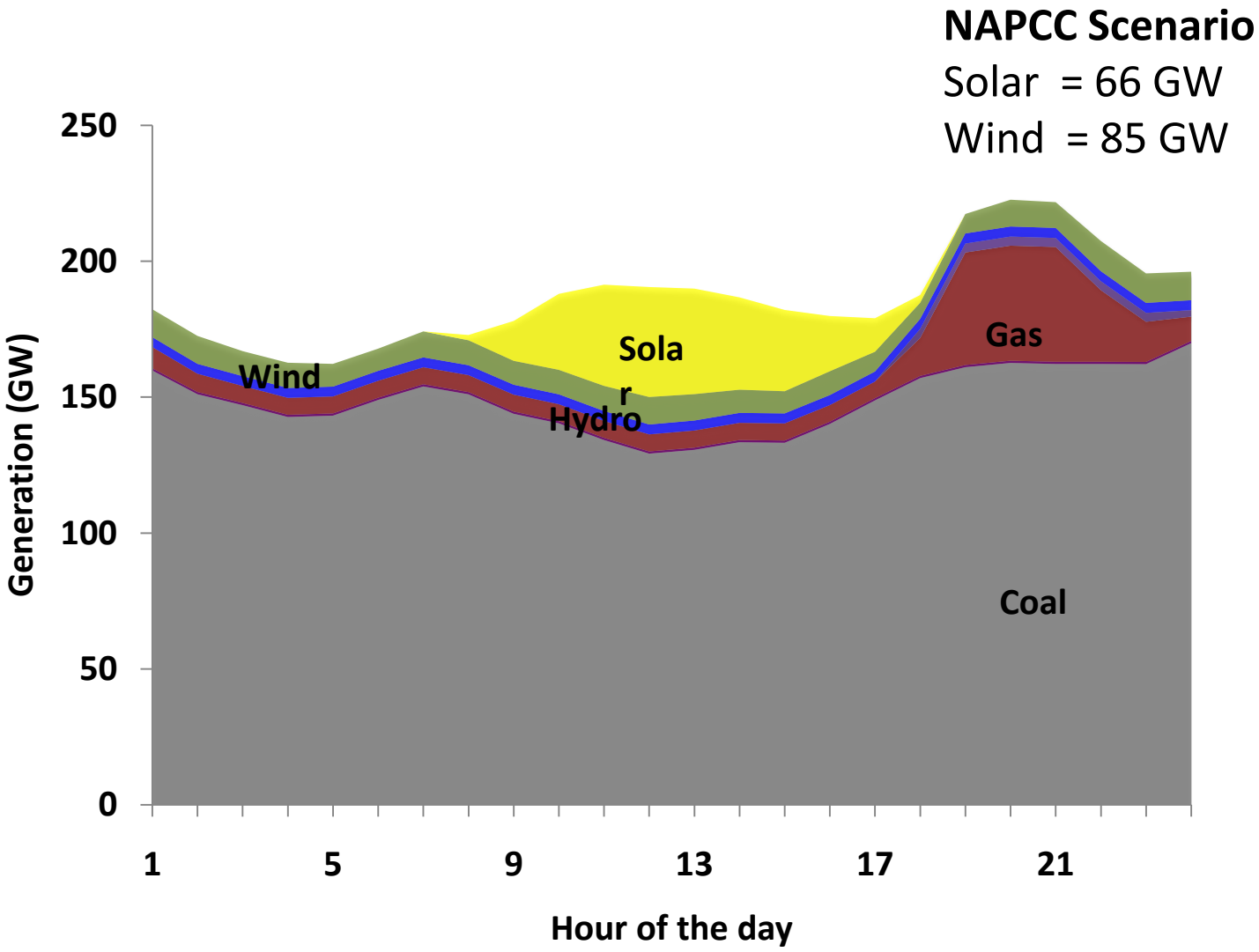
Day of Min. Solar Generation (8 April 2021)



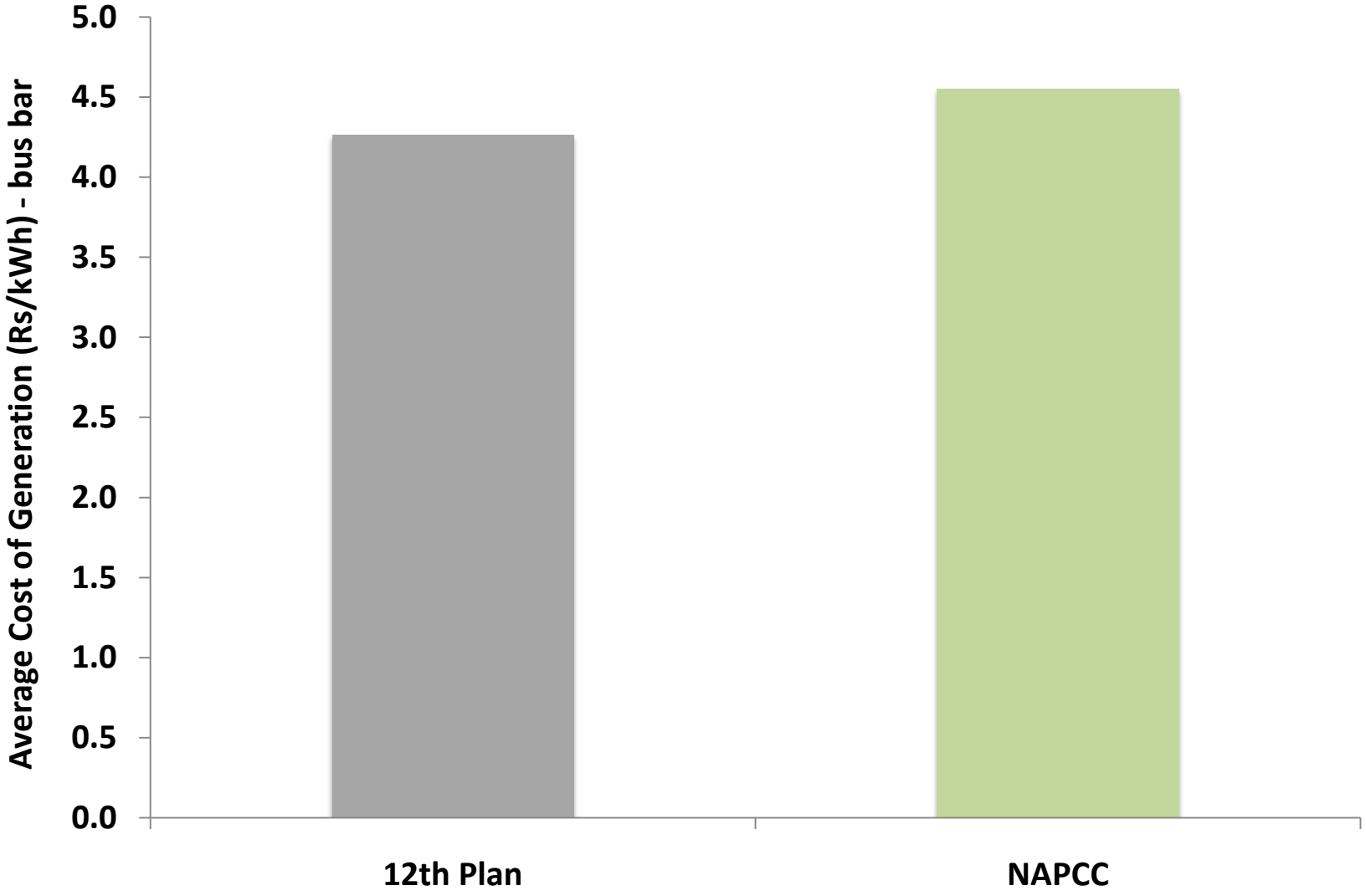
Day of Min. Wind Generation (in Monsoon) (22 Aug 2021)



Day of Max. Load Ramp (>450MW/min) (6 Nov. 2021)



Clean Energy Scenarios are Only Moderately Expensive



Potential next steps

- Conduct detailed grid integration analyses at national / regional and state level

- Identify the key requirements and mechanisms for integrating high penetration of RE
  - Forecasting
  - Markets

- Build capacity at SERCs and SLDC/RLDCs to conduct such analyses

Thank You

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Presentation on
Best Practices Adopted by MSEDCL
for
Technical & Commercial Loss Reduction

MAHAVITARAN
Maharashtra State Electricity Distribution Co. Ltd.

Maharashtra State Electricity Distribution co. Ltd.

Date:- 17th October 2014

Delivery – 24 x 7 Power

MAHAVITARAN
Maharashtra State Electricity Distribution Co. Ltd.

A. Generation Capacity/ Transmission Improvement.

B. Feeder Separation/ Manage Demand Side.

Cash / Liquidity

MAHAVITARAN
Maharashtra State Electricity Distribution Co. Ltd.

- 24 x 7 Power is a myth without hard cash.
- Therefore, Incentivise Cash.
- Three things:
  A. Feeder wise Metering.
  B. Feeder wise Cash Collection.
  C. Put Consumer at Center.

Energy Input / Cash

MAHAVITARAN
Maharashtra State Electricity Distribution Co. Ltd.

- Meter every Feeder.
- Map Consumers to Feeder.
- Establish **Energy Input – Cash** link.
- Make it transparent.
- Distribution & Cash Losses.
  [Penalize Cash Loss]

Targetted Load Shedding [People's Movement]

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Group	Other /Non AG feeders	
	Distribution Collection Losses (DCL)	Load shedding hours
A	0% to 18%	LS WITHDRAWN
B	>18% to 26%	
C	>26% to 34%	
D	>34% to 42%	
E	>42% to 50%	3.15
F	>50% to 58%	3.3
G1	>58% to 66%	5.45
G2	>66% to 74%	6
G3	Above 74%	6.15

- **No Load Shedding in ABCD Groups.**
- No Load shedding in Industries on Industrial Feeders.
- No Load shedding on Express feeders to Water supply, IT Parks & Public Utilities.
- Three phase supply of 8 hours during day time and 10 hrs. during night time in rotation to Agriculture Pumps. 24 hrs single phase supply to single phase feeders under ABCD groups

People Involvement / Profile

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A. Divisional / District H.Q.

B. Places of tourist / Religious interest.

C. Put out Feeder wise Billing/ Metering/ Energy Audit in Public domain [R-APDRP].

Load Shedding Free Feeders

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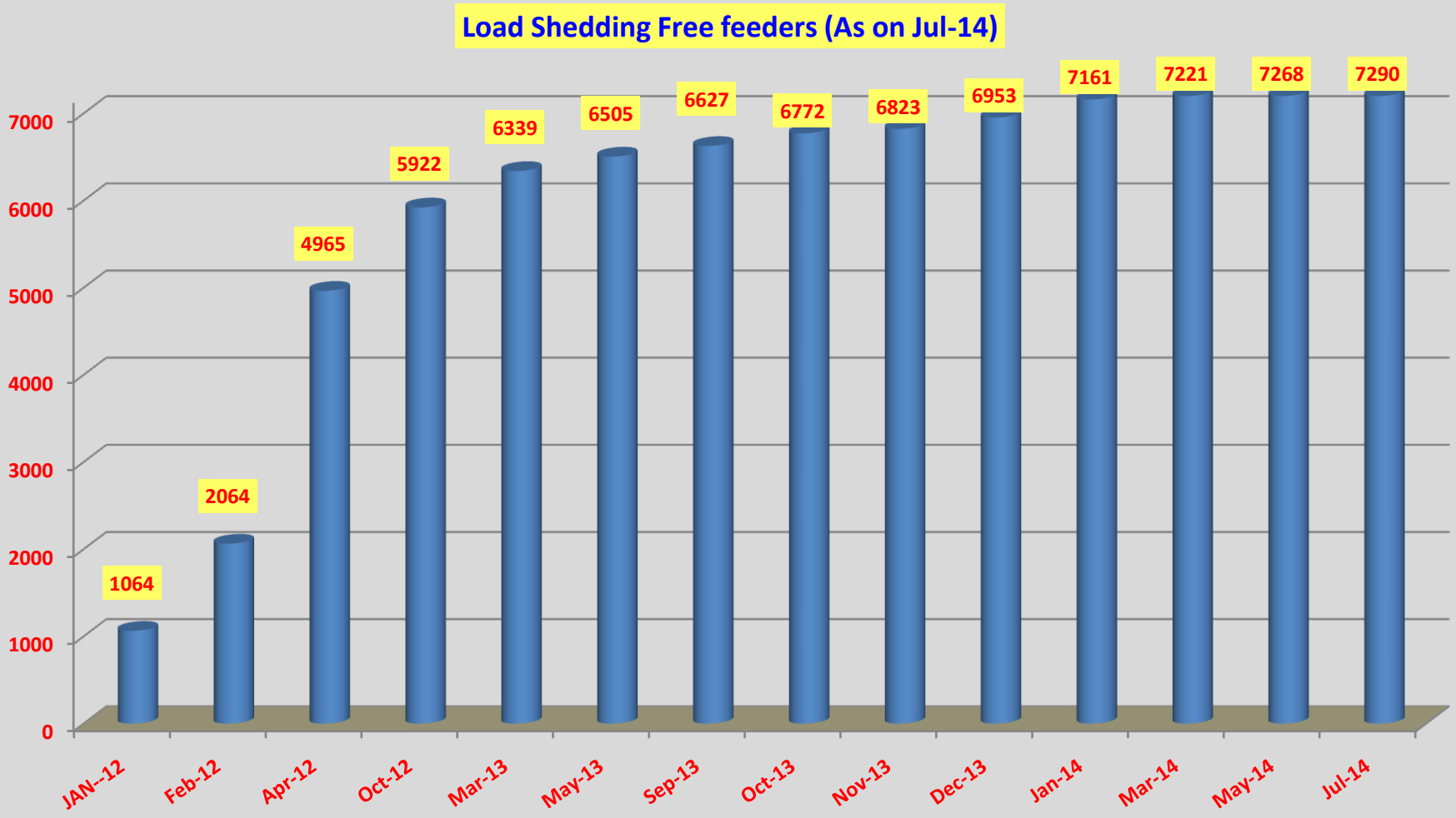

Total non-Ag feeders - 8623
LS Free feeders - 7290

% LS FREE Feeders **85%**

Consumer Centric Loss Reduction

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- Put Consumer at the Center
- Have Faith that most don't Steal
- System fault creates non payment culture.
- With 2.5 Crs. Consumers
- We have 7.5 Crs. transactions (Meter Reading, Bill Delivery, Payment)

Consumer transaction to delight and not Harass

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Maharashtra State Electricity Distribution Co. Ltd.

- Put Technology, remove human interface in each of the three transactions.
  - A. Metering.
  - B. Bill delivery.
  - C. Bill Collection.
- In each transaction improve
  - 1) Ease.
  - 2) Accuracy.
  - 3) Promptness.

Metering

RF module is inbuilt

IR Port

AMR

Hand Held Units (HHU) for IR

Bill delivery

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- Accurate Bill delivery
  a) E-mail.
  b) SMS.
  c) Courier.
  d) POST OFFICE.

Cash Collection

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- Target every bill should be payable within walking distance of 15 mins. at most convenient timing.
  a) ATP Machines
  b) Credit/Debit Card.
  c) Mobile payment kiosks.
  d) Post Offices.
  e) Mobile – SMS.
  f) Co-operative Societies/ Banks.
  g) Net Banking.
  h) Cash collection centers at MSEDCL offices.

Managing Bill Payment

- Industrial/Commercial through RTGS
- Domestic & Other through Online/ATP

Online Connection Release

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- All section office with computer and communication link.
- Manual form first into electronic.
- Connection charges standardized

Category	Charges Approved by MERC (Rs.)
1) LT Supply:	
Single Phase:	
a) For load upto 0.5 kW	950
b) For load above 0.5 kW and upto 10kW	1,500
Three Phase:	
a) For load upto 21 HP	3,500
b) For load above 21 HP upto 107 HP	8,000
c) For load above 107 HP upto 200 HP	13,000
2) HT Supply:	
Upto 500 kVA *	20,500

* Rs. 30/kVA for excess load above 500 kVA

- Each Step monitored.

Fault / Complaint Redressal

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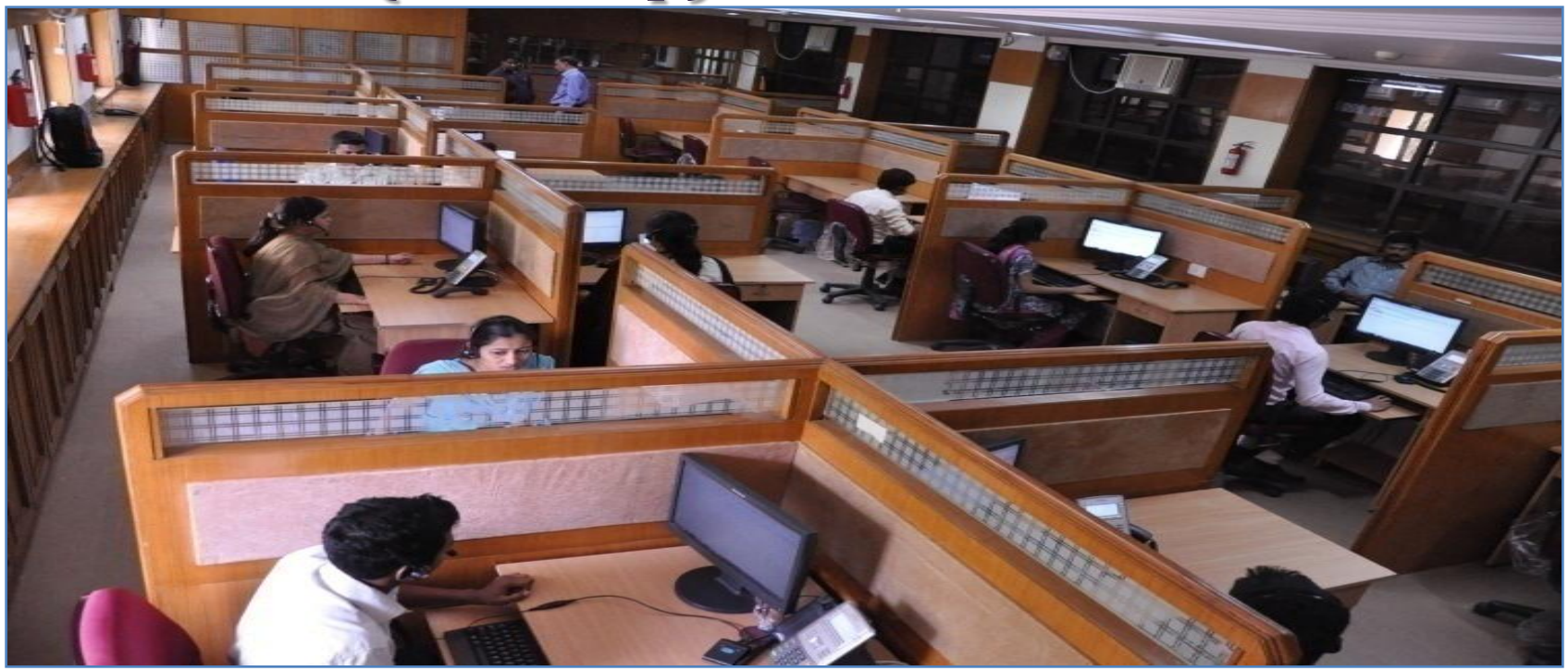
- Break employee – Consumer Nexus.
- Centralized Call Center.
- Centralized Monitoring.

Centralized Call Center

At Mumbai (Bhandup)



24X7 Call Center

- 60 Seater Call Centre at Bhandup and 40 Seater Call Centre at Pune covering all consumers of the states.
- Average Calls – 3000 per day

Consumer Facilitation Center (CFC) Concept

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CFC Thane

Data Center

Thank you…

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Maharashtra State Electricity Distribution Co. Ltd.

TATA POWER-DDL

TATA POWER DELHI DISTRIBUTION LIMITED

A Tata Power and Delhi Government Joint Venture

Reduction of AT&C Losses

A Successful Journey ...

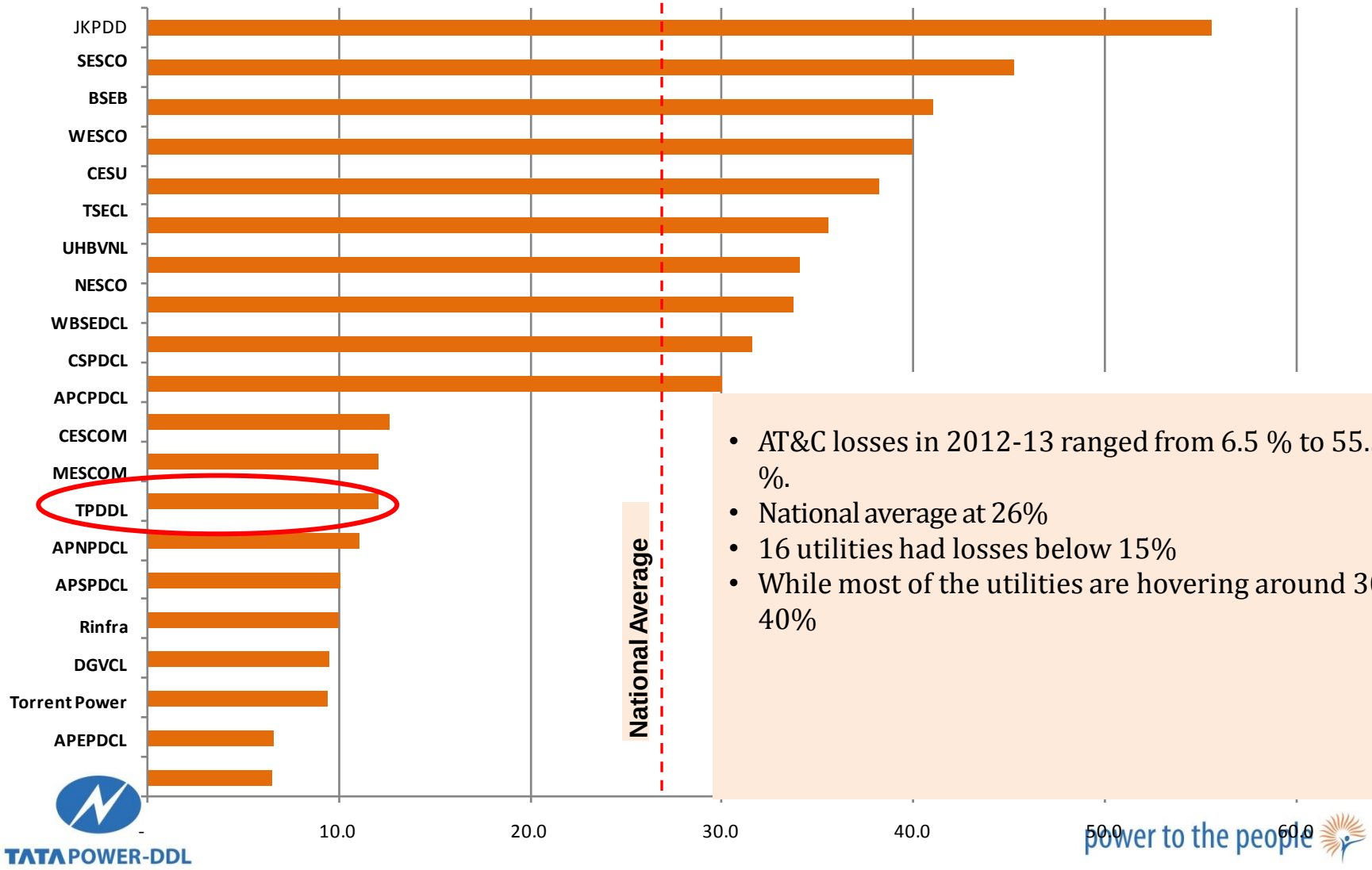
Praveer Sinha

CEO & ED , TPDDL

power to the people

State Wise AT&C Losses – FY13

Top 10 and Bottom 10 Utilities in terms of AT&C Losses



- AT&C losses in 2012-13 ranged from 6.5 % to 55.5 %.
- National average at 26%
- 16 utilities had losses below 15%
- While most of the utilities are hovering around 30-40%

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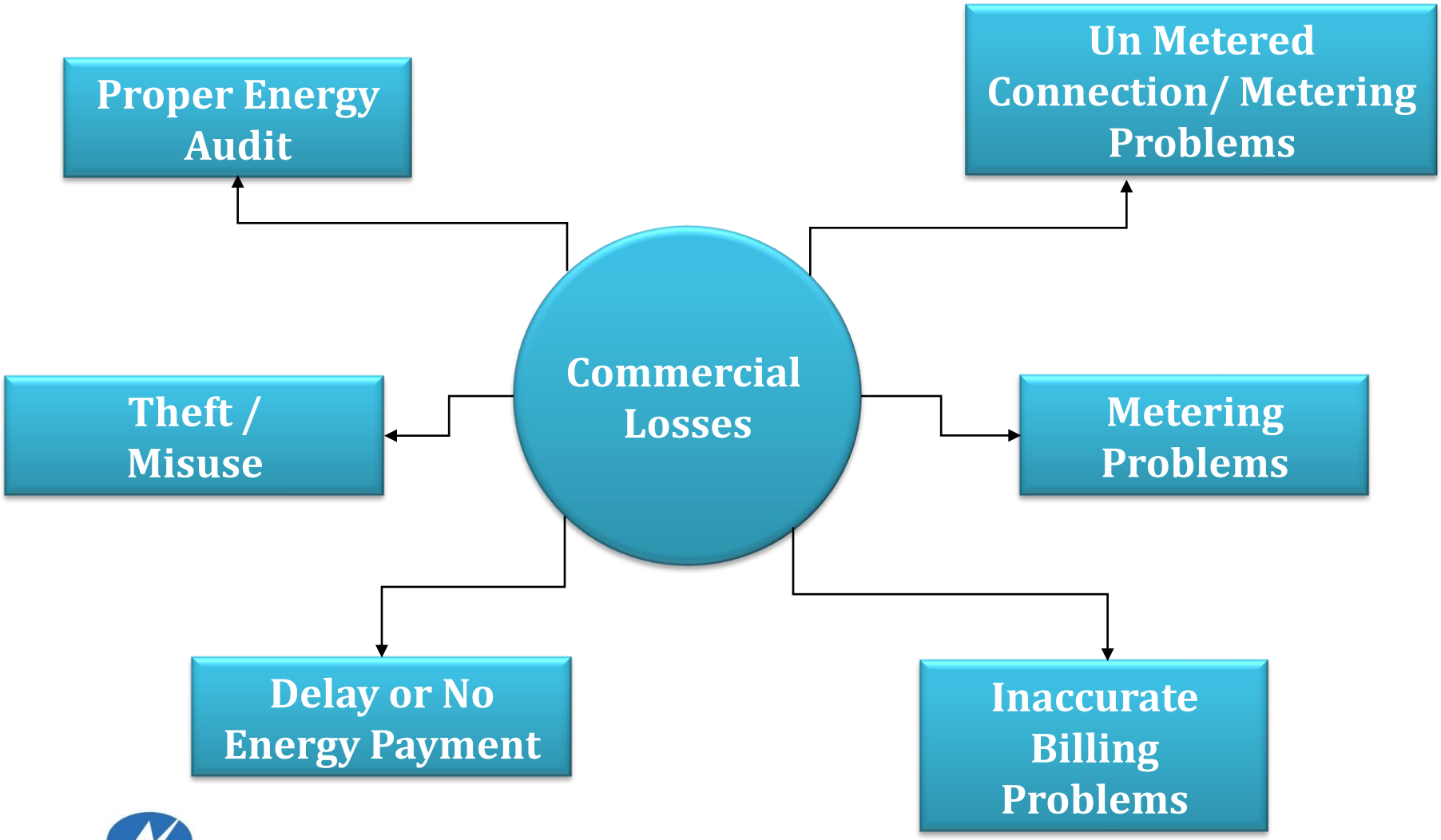
power to the people

AT&C Losses – Key Reasons



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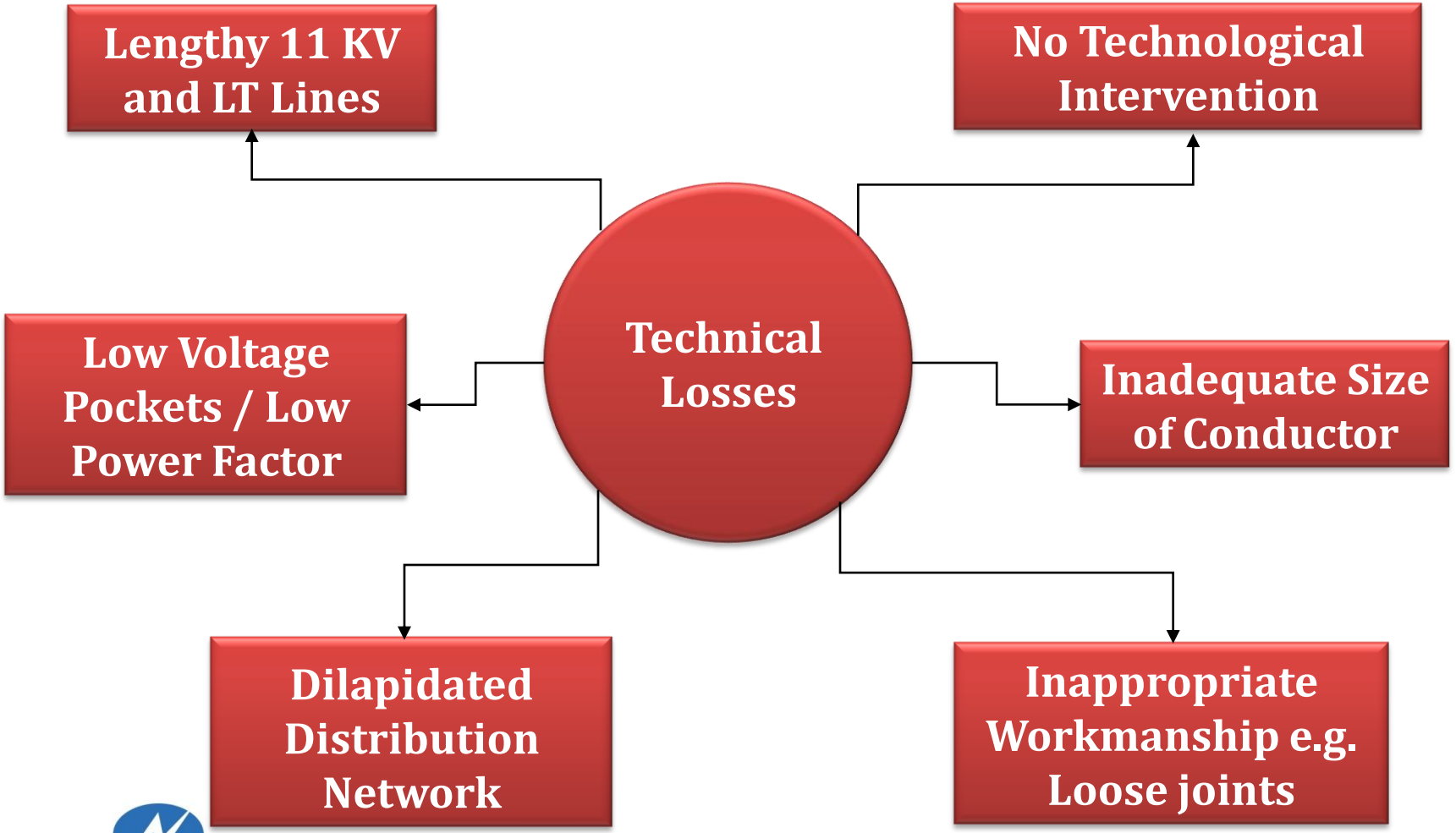
AT&C Losses – Key Reasons



Transformation Case Study at TPDDL

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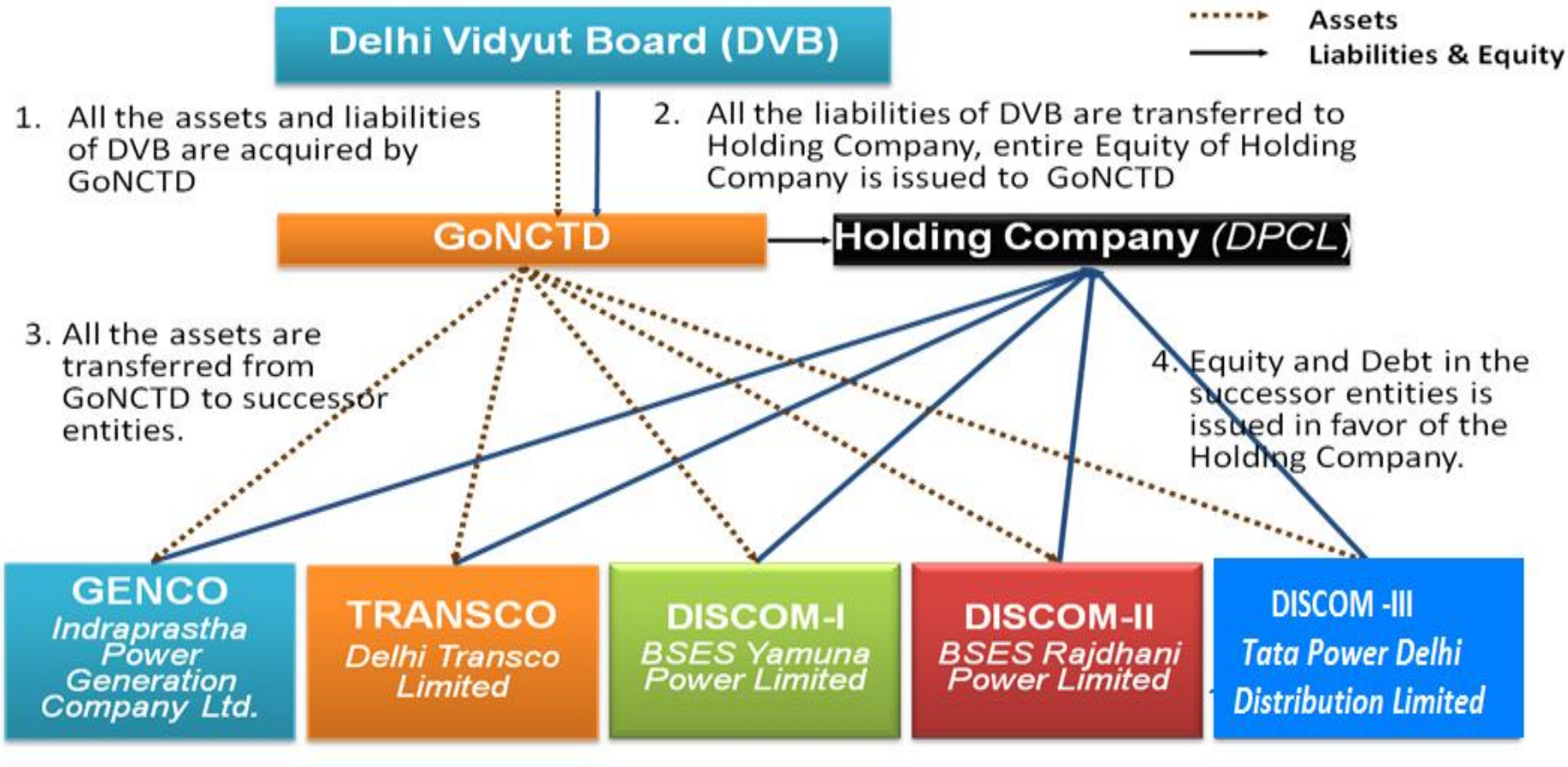
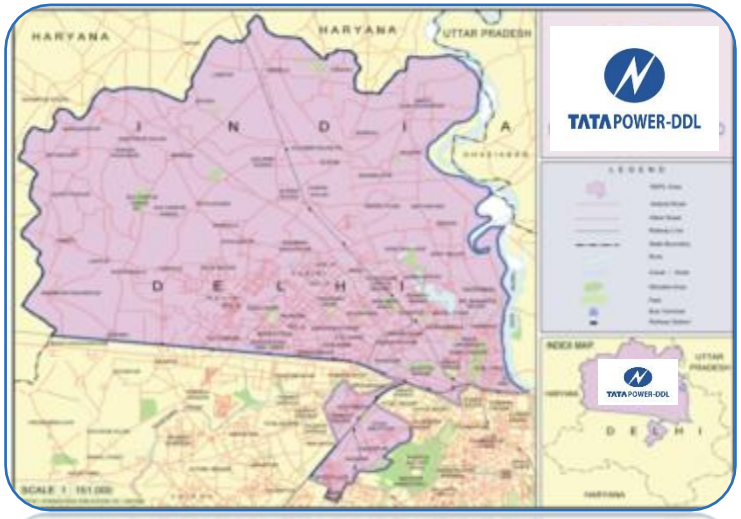
Delhi Reform Model



- Asset valuation was done in Business Valuation Method
- License-based Regulated business for 25 years.
- Guaranteed 16% RoE on meeting AT&C Targets.
- Tariff set by regulator on cost plus RoE basis.

About TPDDL



Joint Venture of Tata Power Company and Govt. of NCT of Delhi (51: 49)

Licensed for distribution of power in North and North West Delhi

Parameter	FY '14
Turnover	INR 5979 Cr
Peak Load	1508 MW till Mar'14 1704 MW till Aug'14
Annual energy requirement	8041 MUs
Total registered consumers	13.89 Lacs
Number of employees	3527
Area	510 Sq Kms
Population serviced in Network area (approx)	6 Million
Number of consumers per Sq.Km	2725

Certifications : ISO 9001, 14001, 27001 ; SA 8000 ; OHSAS 18001
UN Global Compact Reporting

TATA POWER

the people

Operational Excellence: Performance Snapshot

Parameter	Unit	Jul-02	Mar 14	% Change
Operational Performance				
AT&C Losses	%	53.1	10.5	**80%**
System Reliability – ASAI -Availability Index	%	70	99.5	**42%**
Transformer Failure Rate	%	11	0.55	**95%**
Peak Load	MW	930	1508	**62%**
Length of Network	Ckt. Km	6750	10979	**63%**
Street Light Functionality	%	40	99.57	**149%**
Consumer Related Performance				
New Connection Energization Time	Days	51.8	6	**88%**
Meter Replacement Time	Days	25	6	**76%**
Provisional Billing	%	15	2	**87%**
Defective Bills	%	6	0.2	**97%**
Bill Complaint Resolution	Days	45	6	**87%**
Mean Time to Repair Faults	Hours	11	1.34	**88%**
Call Center Performance - Service Level	%	-	91	
Payment Collection Avenues	Nos.	20	5377	**26785%**
Consumer Satisfaction Index	%	-	88	
Financial Performance				
Capex Incurred -Distribution (Cumulative)	Rs. Cr.	1210	4843	**300%**
Revenue (Annualized for FY 03 and FY14)	Rs. Cr.	1156.3	5979.0	**417%**
Others				
Consumers	Lacs	7	13.89	**98%**
Employees	Nos.	5,600	3,527	**37%**

TPDDL In July 2002

BURGEONING LOSSES

Losses range from 53% to 60% (approx. 10 crores/day)

DILAPIDATED NETWORK

(Approx. 10000 No Supply complaints/day)

DISSATISFIED CONSUMER BASE

(backlog of 1,00,000 billing complaints & 20000 new connections)

LARGE UNSKILLED WORKFORCE

(5638 employees with little Skills set)

ABSENCE OF MANAGEMENT SYSTEM

(HR, Finance, Governance)

POOR DOCUMENTATION

(50% records were erronious)

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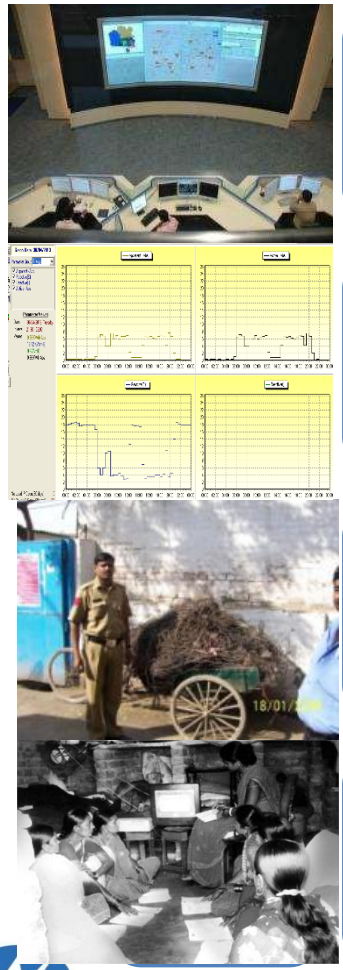
Strategy
for
AT&C Loss Reduction

Key Strategies



Technology Upgradation

Data Analytics

Strong Enforcement

Social Intervention

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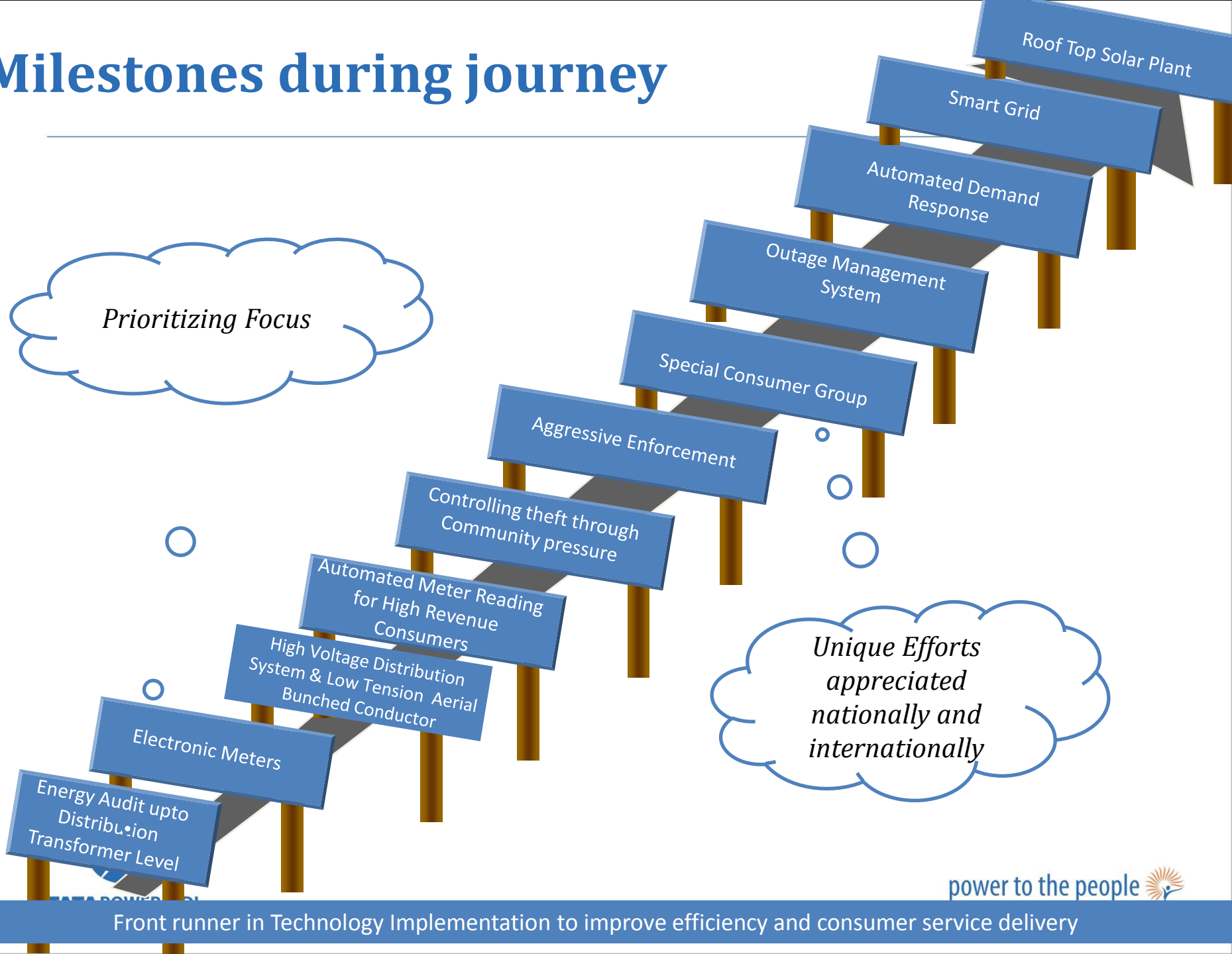
power to the people

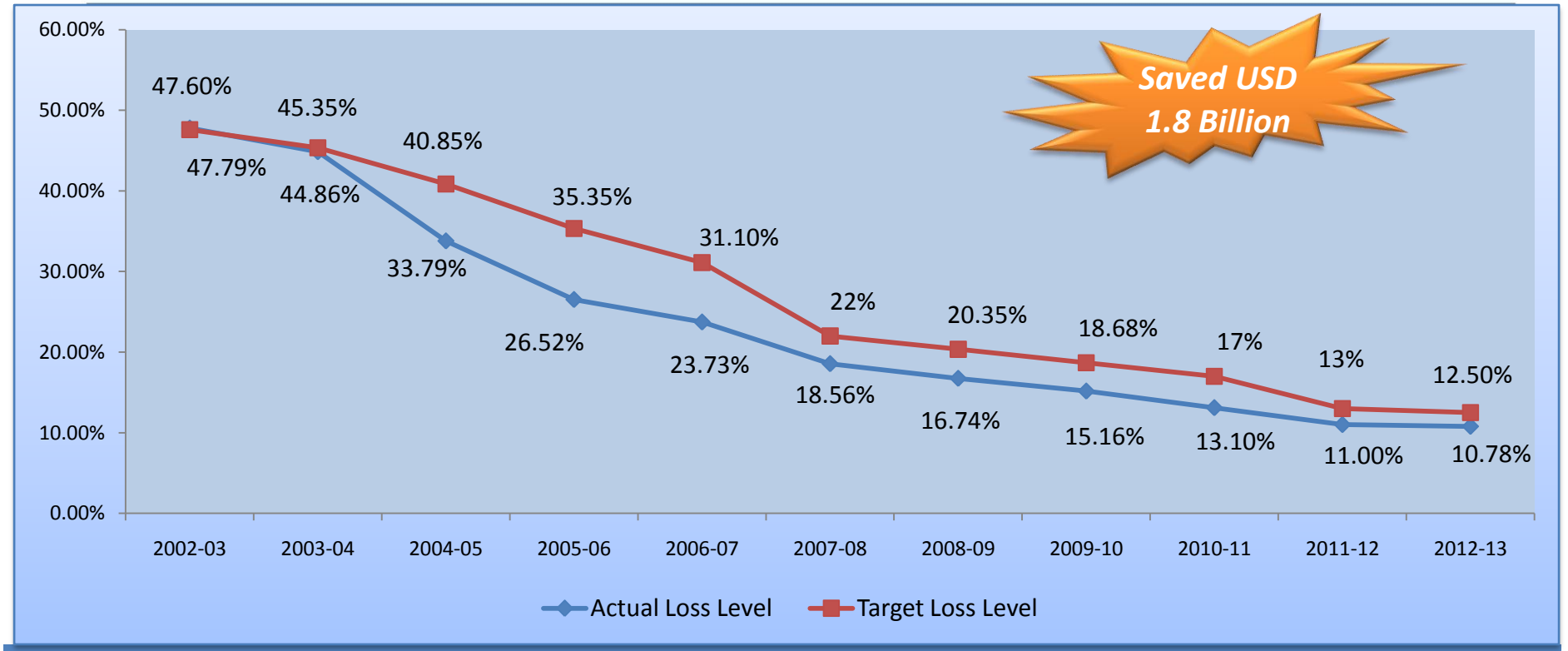
Milestones during journey



power to the people

Front runner in Technology Implementation to improve efficiency and consumer service delivery

Milestones during journey

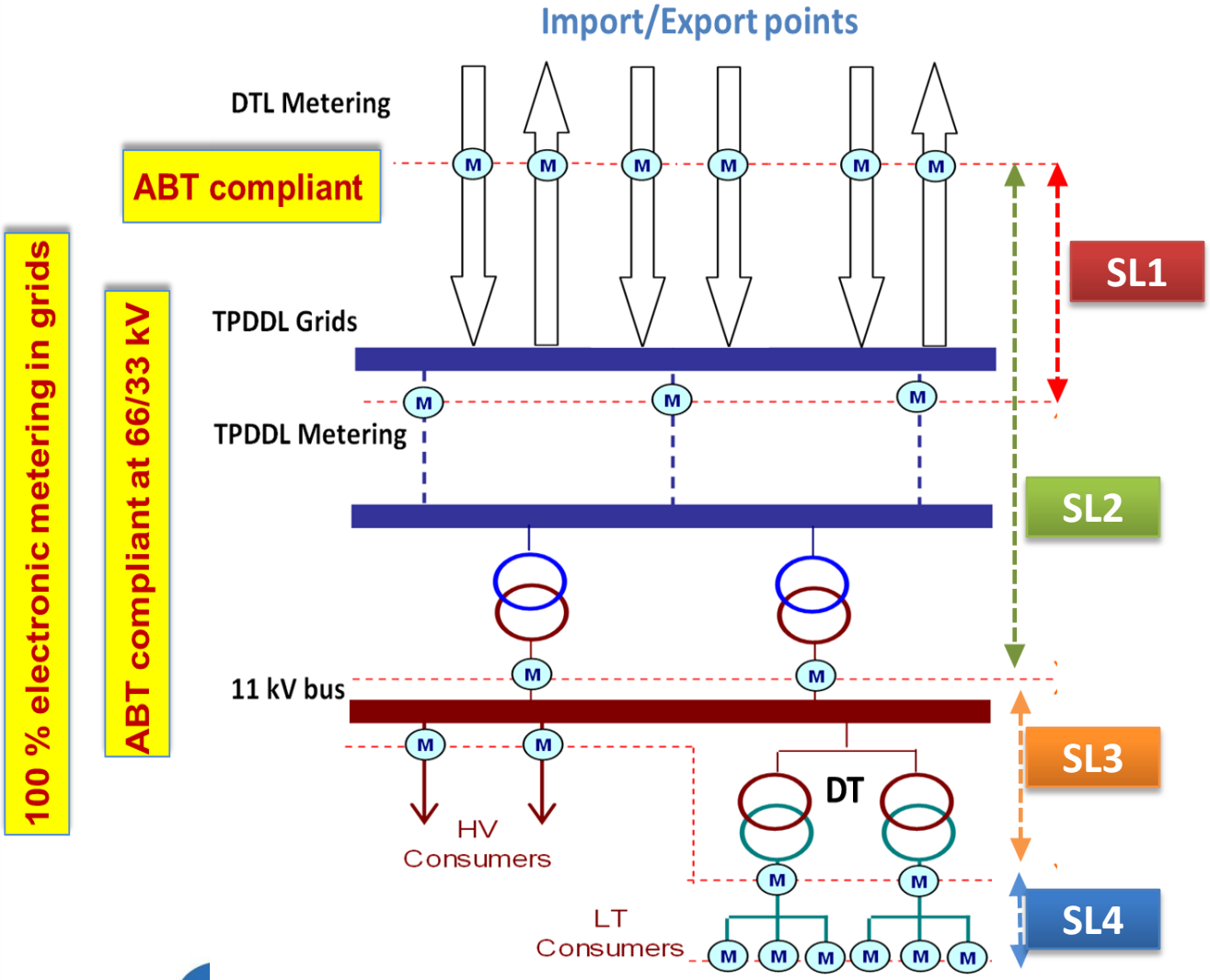


Consistently Loss Reduction Exceeding Targets

- ***Saved over USD 1.8 Billion for Govt. in 11 years; facilitated development of other infrastructure; lower taxes***
- ***Repaid USD 100 Million loan to Govt.***
- ***Paid Dividends to Govt. and Tata Power for four years (FY 2005-06 to FY 2008-09)***
- ***Amongst lowest Tariffs in the country with highest availability and reliability of power***
- ***1:2 Bonus Shares Issued in FY '09***

Technology Upgradation

DT Metering



SL 3 & 4

- AMR installed on 3948 DTs and 208 HVDS meters
- All meter's data uploaded in AMRDA Server
- Peak kVA report generation
- DT meter Phase wise report generation Phasor Analysis
- Physical Site verification for all DT Meters

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Installation of Latest Circuit Breaker

Before

After

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Installation of Latest RMU

Before : Old Switch Gears

After : New Ring Main Units

Ring Main Units Installed for the first time in Delhi

TATA POWER-DDL

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Revamped Substations

Before

After

o the people

Network Revamping

Before

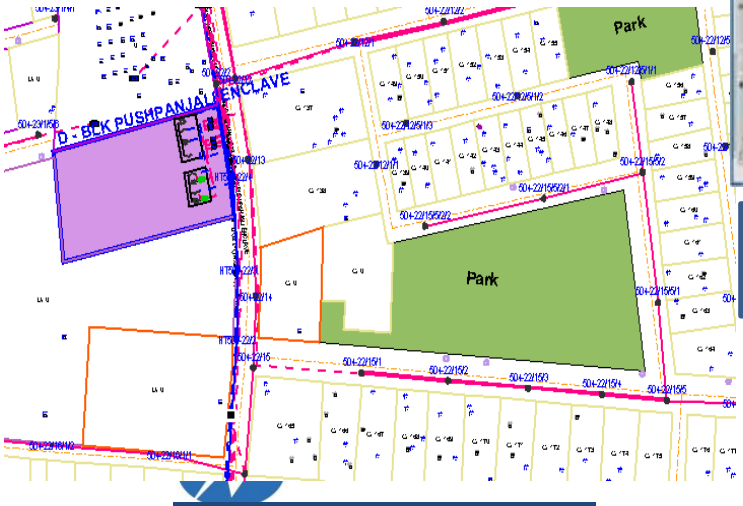
After

Technology Interventions

Unmanned Grids

Monitoring of total load through SCADA

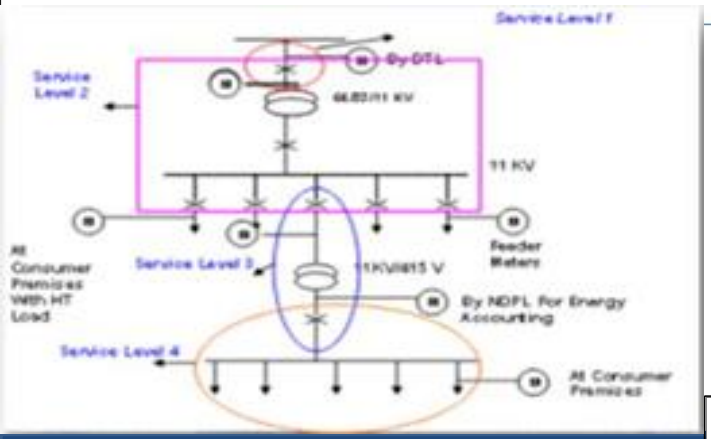
SCADA



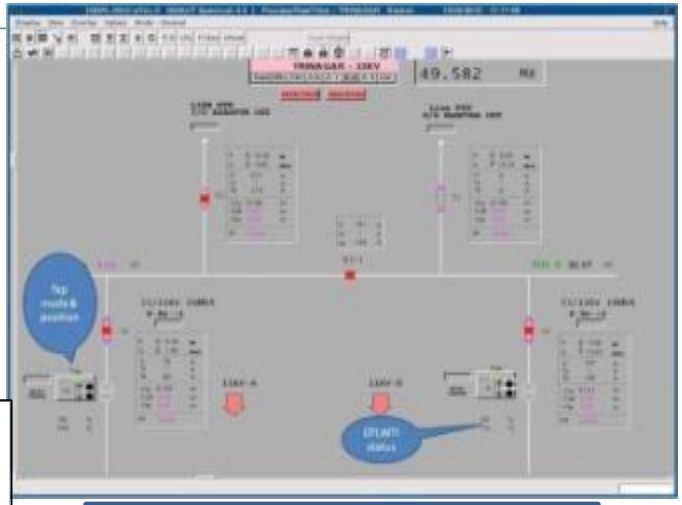
GIS

OMS

Technology Interventions



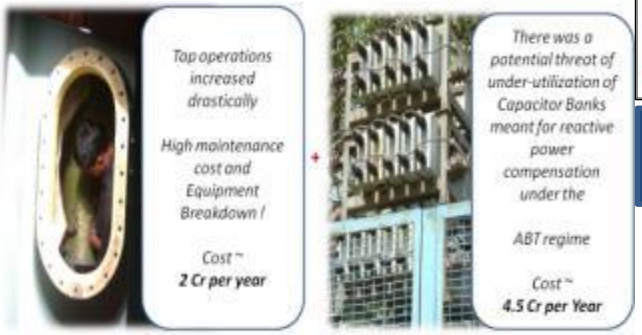
DT Level Metering



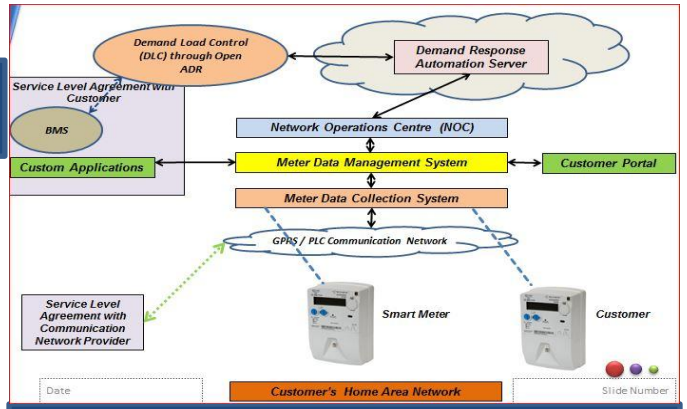
Cap on Tap

Integrated Call Center with BCM

NDPL is the only utility in India to have 100% 'Automatic Voltage Regulation'



100% Automatic Voltage Regulation



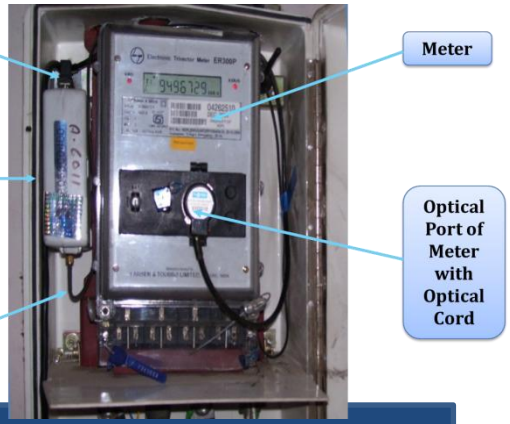
Smart Grid Pilot Architecture

Use of New Metering Technologies

Electronic Metering

Split Metering

Group Metering



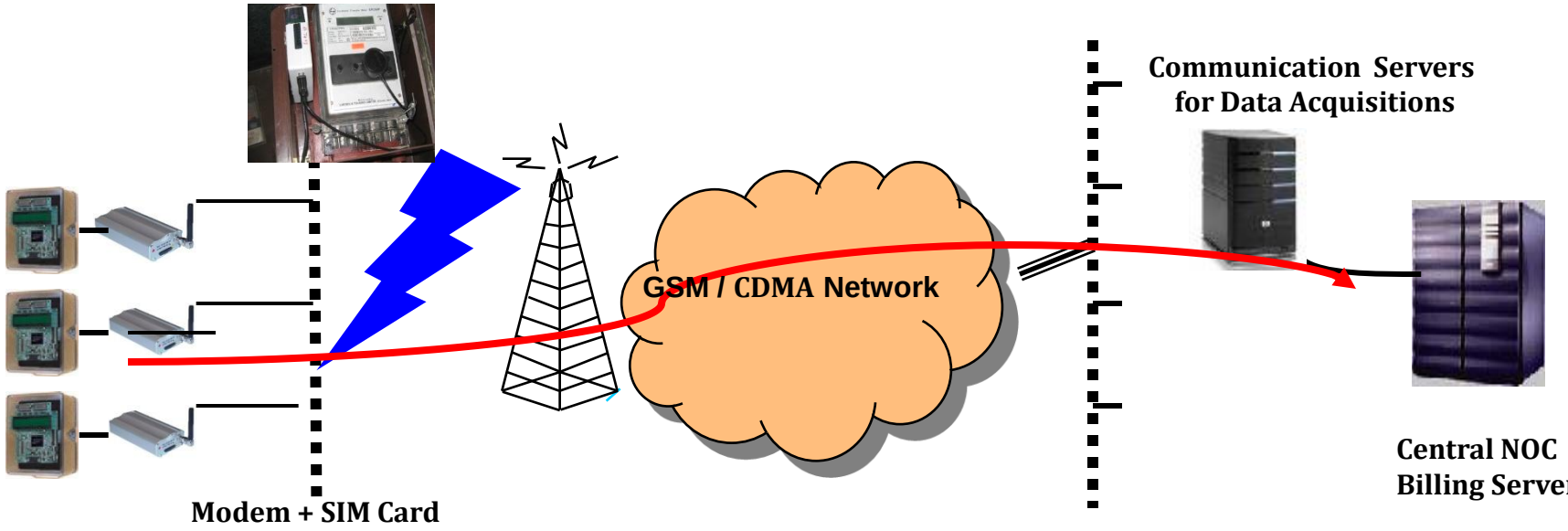
Advanced Data downloading through AMR & AMI

Pre-Paid Metering

SMART Meter

Data Analytics

AMR Architecture – TPDDL



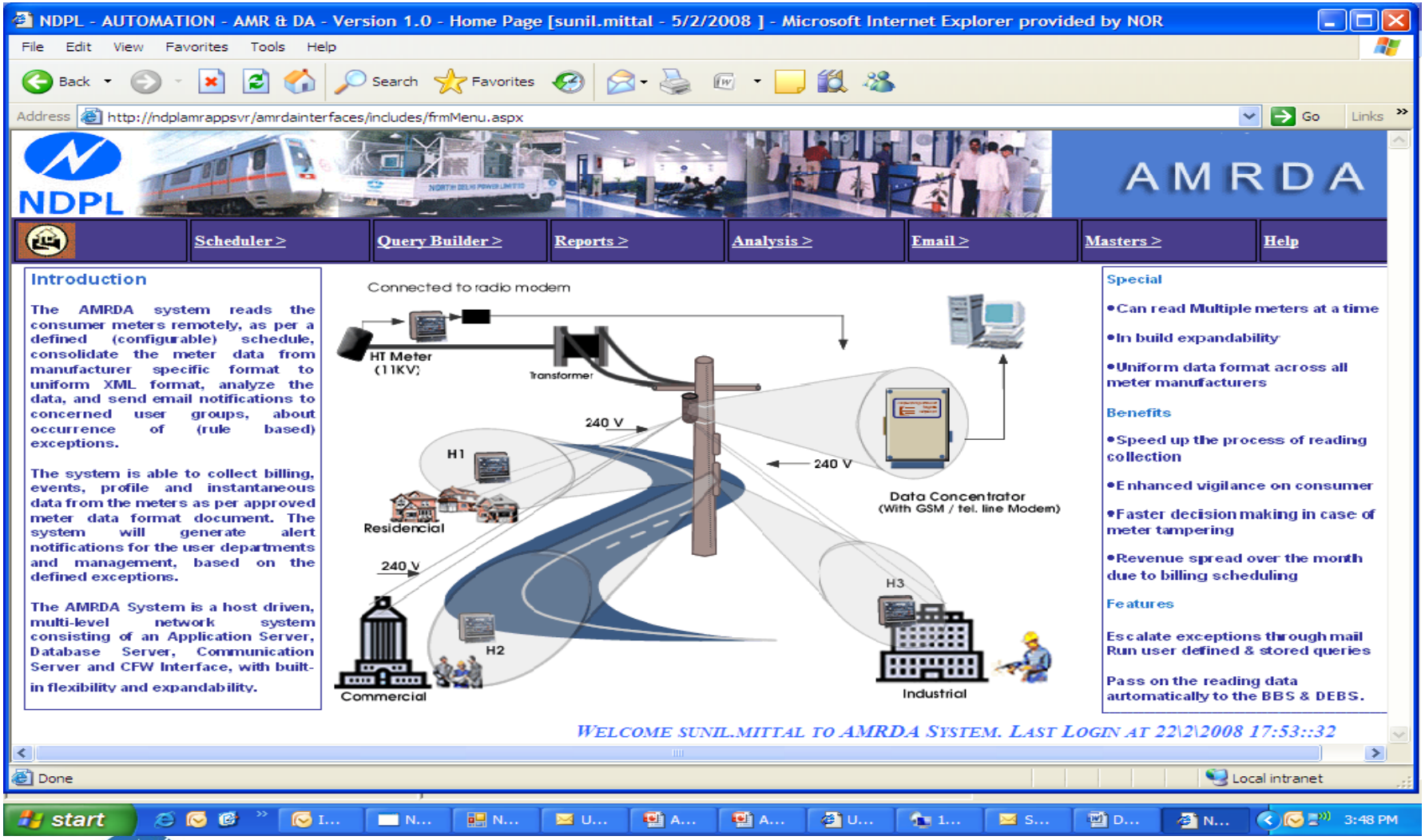
- First Indian utility to implement AMR for all connections above 11 KW
- Approx. 55,000 LT-CT, HT and DT meters contributing 70% to TPDDL's revenue
- Indigenously developed AMRDA carries out seamless reading and analysis

Success Rate: More than 98% per month

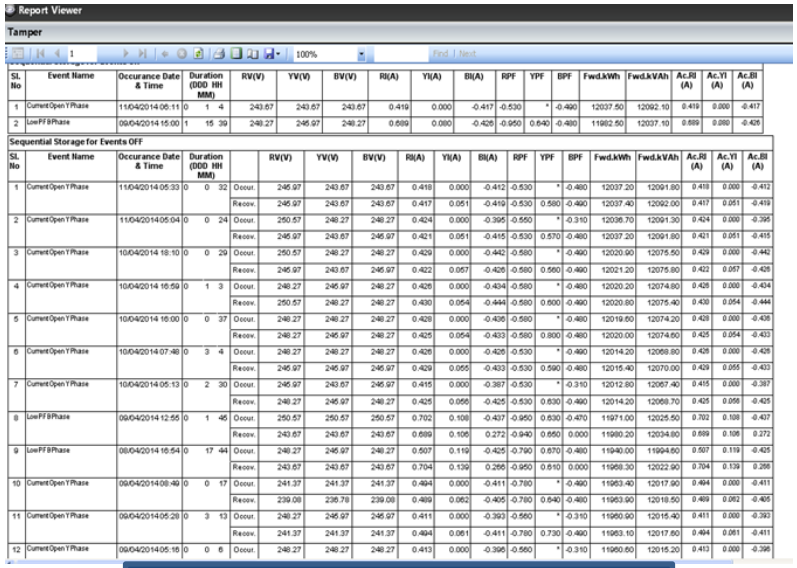
TATA POWER-DDL

power to the people

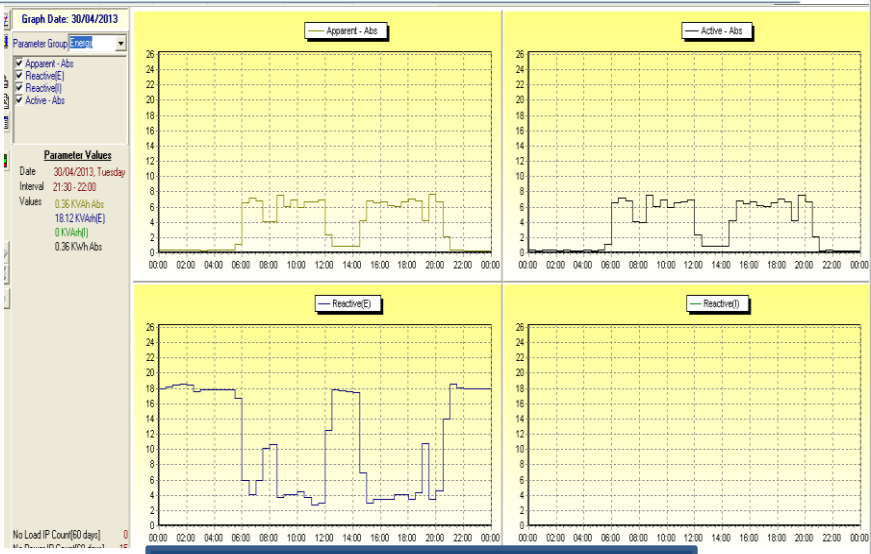
AMRDA Software – In-house Developed



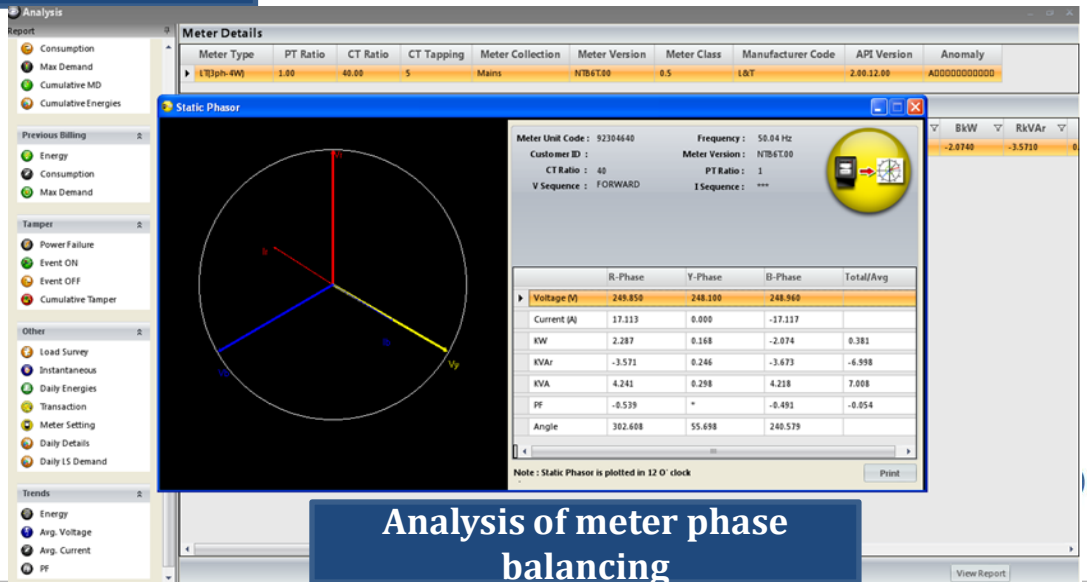
Data Analysis



Tamper Review Study



Load survey analysis



Analysis of meter phase balancing

TATA POWER-DDL

Power to the people

Theft Reduction-Detection Process in AMR/AMI

THEFT DETECTION IN AMR/AMI CONSUMERS

AMR/AMI Downloaded Meter Data → Sets of Logics are run on raw data → Exceptional cases are analyzed → Theft/ Doubtful cases are referred to Enforcement → Raids are being conducted & book case

AMR/AMI Logics:
Identifying Suspected Cases based on Data Analysis (High Revenue Consumer)

VOLTAGE RELATED
- VOLTAGE FAILURE
- NEUTRAL DISTURBANCE
- POWER FAILURE

CURRENT RELATED
- CURRENT REVERSAL
- CT OPEN
- LOAD UNBALANCE/ CT SHORT

OTHERS
- LOW POWER FACTOR
- NVM FAILURE
- POOR BATTERY
- DROP IN CONSUMPTION
- CT OVERLOAD
- MAGNET
- MANUAL RESET
- METER CONSTANTS CHANGE

Assessment of Technical Loss

S No	Particulars	% Loss
1	Technical Loss in the Sub Transmission Network	0.91
2	Technical Loss in HT Network	1.86
3	Technical Loss in LT Network	3.28
4	Technical Loss in Service Cables	0.03
5	Distributed losses at various Voltage Level	0.38
	Total	**6.46**

Undertook a study with IIT to identify actual Technical Loss Level through network up-dation. load flow analysis, simulation tools, Loading analysis, categorization of consumer on cable size, analysis of occurrences of hot spots, cable faults etc.,

Power Theft Control

Scientific Approach – Energy Audit

Using Energy Audit as a tool to pinpoint areas of high loss....
100% Feeder / DT / Consumer Metering & Indexing

Identifying Focus Area
– Mapping Resource Vs Priority

Monthly Review of Actual AT&C Loss Level VS Target (Area Wise)
On Track / Slow Track / Back Track Performing Zones / Districts

Knowledge and Learning sessions conducted – sharing of best practices among the zones

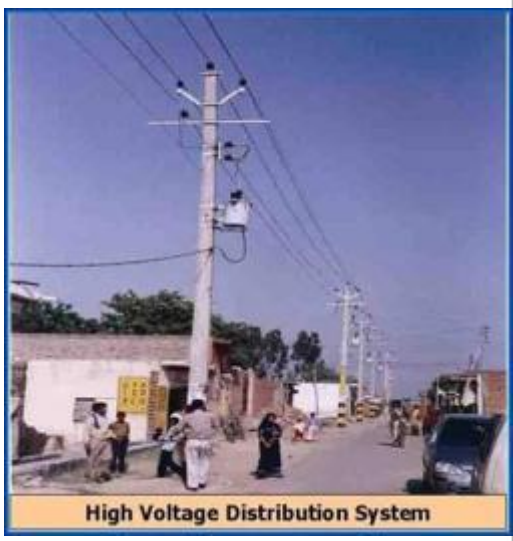
Surveillance to Keep Power Theft Away...

Theft Deterrent Electrical Network

High Loss
High Resistance

HVDS Installation

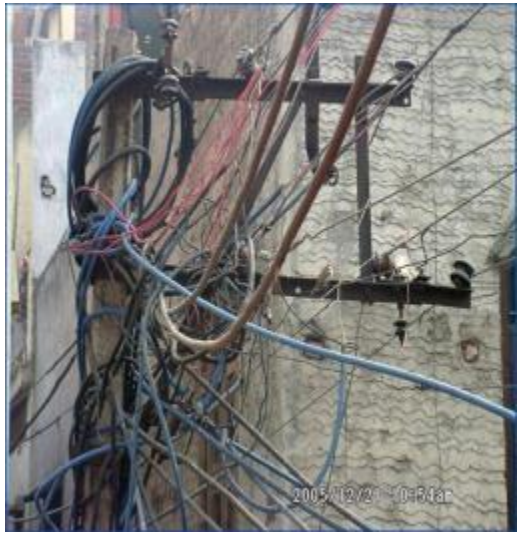
HVDS for Reduction of Technical & Commercial losses, failures due to illegal tapping & for enhanced safety.



Before Revamp

Implemented in more than 100 areas.

After Revamp



High Loss
Low Resistance

LTABC Installation

LT ABC Conductors for immediate reduction...

Vigilance Against Theft Strengthened

Strengthening Enforcement → ***Restructured in to field and assessment teams*** → ***Monthly collection has gone up 2.5 times since privatization***

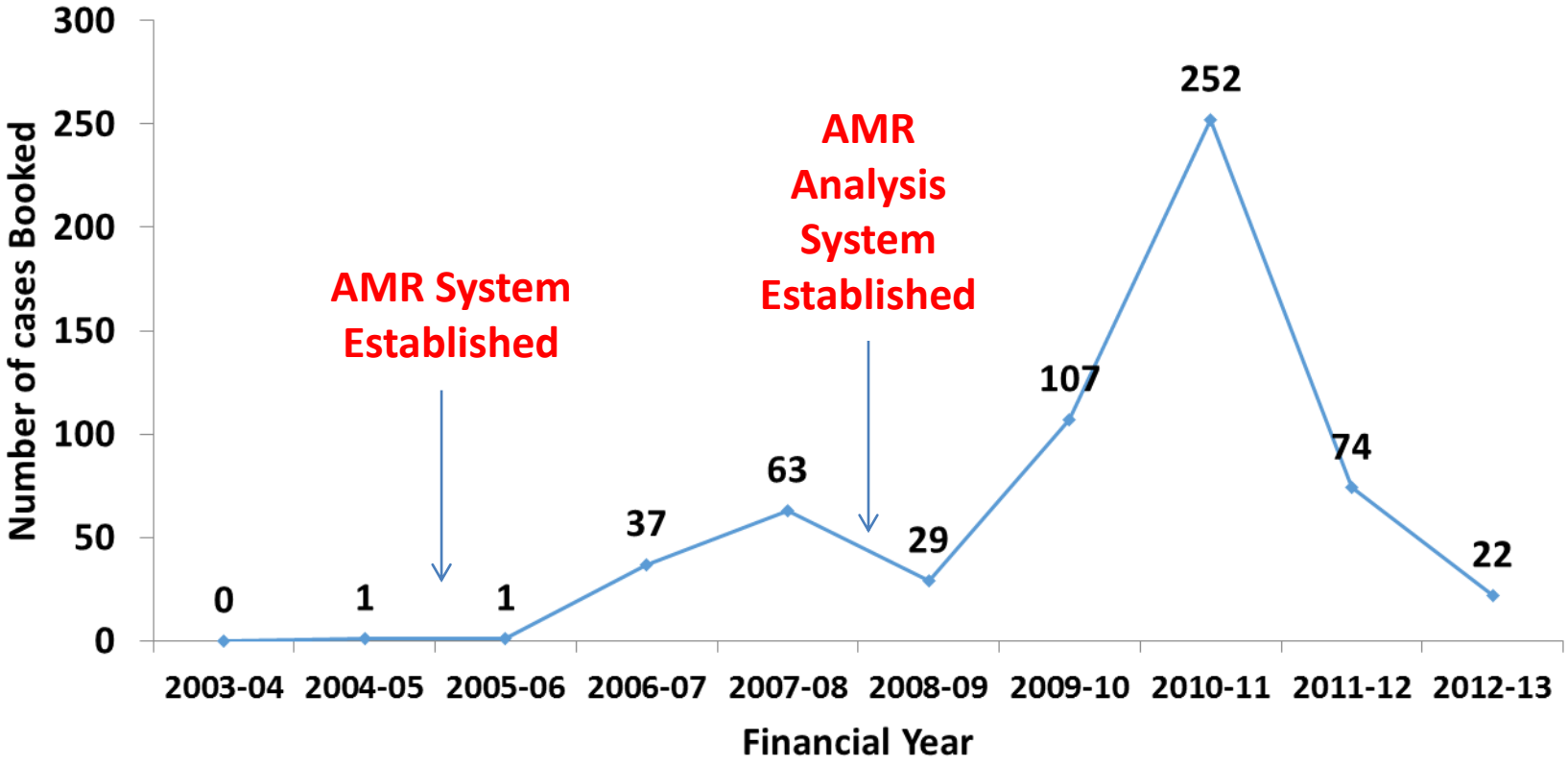
Strong enforcement of law


Mass Raids


Removed Hooks after raid

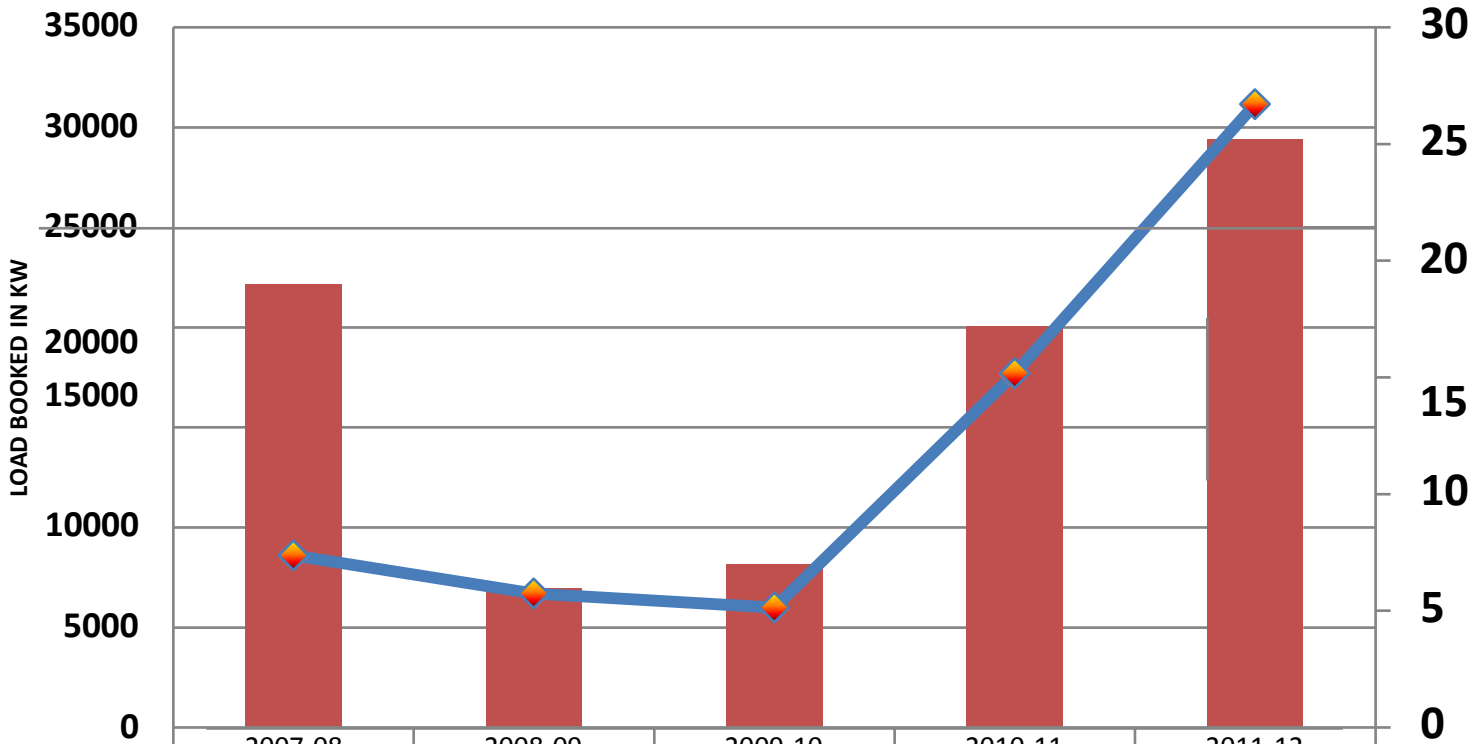
- **Constitution of Special Court**
- **Assistance of Police Force / CISF during Enforcement Activities**
- **Payment of Energy Bills through website**
- **Relocation of JJ Clusters to new resettlement Colonies**
- **Amnesty schemes for settlement of old disputed cases**
- **Awareness Campaign Against Theft….**

Cases booked on the basis of electronic Data Analysis



Establishment of a Intelligent AMR ANALYSIS SYSTEM is crucial for getting maximum benefits from AMR Investment. TPDDL has in-house developed Data Analysis System which has provisions to detect more than 30 types of tampering and meter malfunctioning.

Load & Revenue Booked: AMR Theft



	2007-08	2008-09	2009-10	2010-11	2011-12
Amount Raised in Cr.	19	6	7	17.23	25.2
Load Booked in KW	8600	6700	6000	17700	31160

TATA POWER-DDL

power to the people

Engaging with community

Innovative Business Case

Special Consumer Group + **CS Group**

Formation of **Special Consumer Segment**

- Making **Metering & Billing affordable**
  - Reducing the cost of new connection
  - Offering door step customized services.
  - Advocated for Re. 1 subsidy in electricity charges for consumer <= 200 U.

- **CS initiative's** for people residing in 223 JJ Clusters for:
  - Improving socio economic condition
  - Building the capacity to pay
  - Building long term Relationship with family member of different age group.

Special Consumer Group + Corporate Sustainability Group

TATA POWER-DDL

Initiatives

- ***Entrepreneurship:*** Franchisee from within JJ clusters
- ***Employment :***Through BA's
- ***Support:*** Drug De-addiction , Mobile dispensary
- ***Employability*** :Adult Literacy, Vocational Training, Neighborhood Electrician Program, Beauty Culture
- ***Education:*** Scholarships

Generating Smiles

More than 1.5 lacs consumers brought into billing net; AT&C reduction by 4%

Creating Win – Win Situation

Unmetered to Metered → *JJ Cluster Scheme* → *Approx 150000 Unmetered Connection converted into Metered connection*

LIC Policy - TPDDL Offered Free Life Insurance Policy to Consumers in JJ Colonies in May 2008.

Various Metering Arrangements at JJ Cluster Areas

Instant Connections, Spot Billing


NDPL provides free life insurance to consumers

NEW DELHI, June 16: In the first of its kind initiative taken by any power distribution company in India, North Delhi Power Limited (NDPL) today announced a unique scheme as a goodwill gesture of providing free life insurance policies of Rs one lakh to its registered consumers residing in JJ colonies.

There are over 100 JJ clusters under NDPL area with a consumer base of 50,000. During the announcement, chief executive officer, NDPL, Mr Sunil Wadhwa, said, "It is just a matter of gesture to our JJ cluster consumers to communicate that we care for them and their families. Whenever, they approach us to take a metered connection, it happens to be a right time to express the same."

"We hope that this small step from NDPL might bring awareness amongst the JJ cluster residents about the need to protect their families against the unforeseen eventualities," Mr Wadhwa added.

The term insurance policy of LIC for death cover is being offered free of cost to consumers residing in JJ colonies in NDPL's distribution network of south and north-west Delhi and to those who will take metered connections from NDPL.

"These consumers will also be entitled to avail the tariff subsidy recently announced by government of NCT of Delhi for metered consumers," said an NDPL spokesperson. ■ SNS

Care for Community

3 pronged strategy adopted for CSR

- Philanthropic - *giving back to the society*
- Compensatory – *empowering and enriching quality of life*
- Business Oriented – *creating a win-win situation*

Adult Literacy Center

Support to MS patients

Drug De-Addiction Camp

Health Camp

Energy Conservation

Nukkad Nataks

TATA POWER-DDL

power to the people

Care for Community

Affirmative Action

Education

Sponsoring students

Employment

Job opportunities

Employability

Vocational Training, Support to ITIs

Entrepreneurship

Beautician courses, Franchisees

TPDDL is the recipient of Jury Awards and Serious Adoption Award for AA among TATA Group Companies

TATA POWER-DDL

power to the people

Care of Community - Education

- **Education Support at Govt. Schools**
  Scholarships to Class X – XII students;
  1165 beneficiaries till FY 14

- **Adult Literacy Centers**
  Enhanced to 161 in FY 14
  10200 beneficiaries till FY 14

- **Tutorial Classes**
  Underprivileged Students of Class I – X;
  925 beneficiaries till FY 14

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Care of Community - Employability

- **Support for ITI / Diploma / Degree**
  Scholarship scheme for SC / ST beneficiaries;
  523 beneficiaries till FY 14

- **Vocational Training Centers**
  Skill based training to youths from JJ Cluster and BA employees;
  4414 beneficiaries till FY 14

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Care of Community - Entreprenuership

- **Positive discrimination for SC / ST candidates in campus recruitment**

  19% of TPDDL workforce comprise of SC / ST employees

- **Promoting indirect employment of SC / ST employees by Business Associates (BA)**

  23% of BA workforce comprise of SC / ST employees

Results Yield from PPP Model

Challenges addressed

High AT&C losses

- Incentive to overachieve Targets
- Penalty for not achieving Targets
- Solutions need to be sustainable requiring long term approach
- High Capex Involved in Technology Interventions-HVDS, SCADA, AMR
- Effective Enforcement by follow up in Courts
- Flexibility for Settlements (out of Courts)

Lack of Service Orientation

- Public Tolerance is high with Electricity Boards & less with private players
- High Expectations from private players push performance

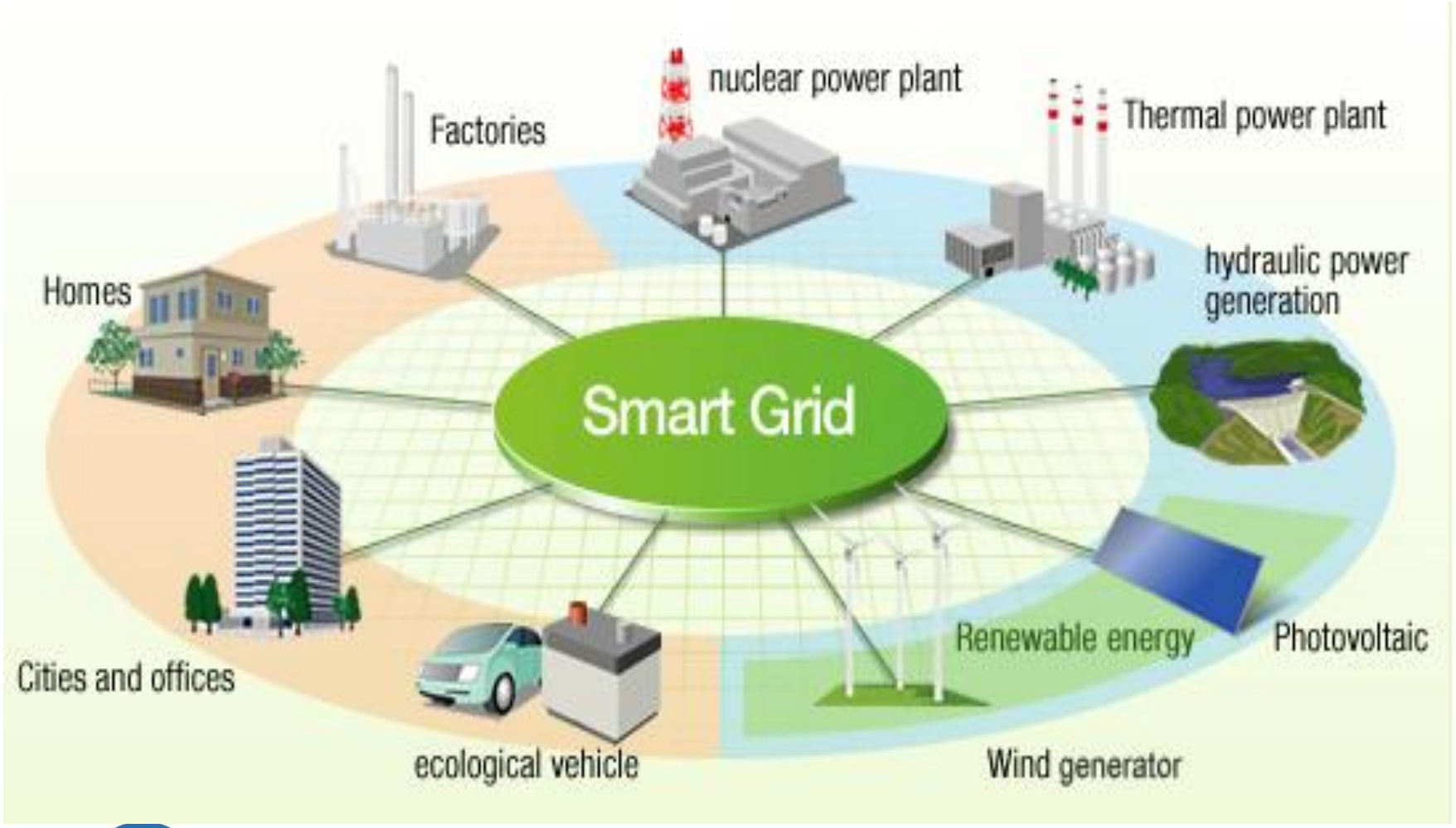
Reliability of Supply: Needs huge Capex to modernize Networks

Regulation: Issue of Regulators autonomy can be a problem when public sector is to be regulated

Pressure to perform: Subsidies are easy way out for SEBs but not for private players

MAKING INDIA PROUD

Vision Towards Smart Utility



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Thank You