MINUTES OF THE
FOURTEENTH MEETING OF THE FORUM OF REGULATORS (FOR)

Venue : NLDC, Power Grid Corporation of India Ltd.
B-9, Qutab Institutional Area,
Katwaria Sarai, New Delhi

Date : 4th September, 2009

The list of participants is at **Annexure-I**.

1. Welcome to the new Members

Dr. Pramod Deo, Chairperson, CERC/FOR welcomed Shri Manoj Dey, Chairperson, CSERC and Shri P.J. Bazeley, Chairperson, MSERC to Forum who were attending the meeting for the first time.

2. Confirmation of the minutes of the 13th meeting of FOR held on 17th July, 2009 at New Delhi and the Action Taken Report.

The minutes as circulated were confirmed. The Forum also noted the Action Taken Report.

3. Consideration of the Model Regulations for Implementation of REC Framework.

3.1 Based on the discussions on the subject matter "Renewable Energy Certificate (REC) Implementation Framework" held in the 12th Meeting of the Forum, the Secretariat had prepared the following two draft regulations and the same were circulated to all the SERCs:

i) Draft CERC regulations on REC implementation
ii) Draft SERC regulations on REC implementation

3.2 A presentation was made in the meeting by the Secretariat (copy at **Annexure-II**) highlighting the salient features of the draft regulations, comments received from SERCs thereon and the views of the Secretariat on the comments. The Forum also noted the point-wise status on the issues flagged in the discussions in 12th meeting of the Forum on subject matter of REC. Specifically, the following was noted:

a) The legal opinion dated 2nd September, 2009 obtained from Shri Gopal Subramanium, Solicitor General of India in which it has been concluded that

   i) The renewable purchase obligation can and should be imposed, in addition to distribution licensees, on open access consumers and captive generation consumers.
   ii) The proposal in the draft model SERC regulations requiring the defaulting licensees (shortfall in fulfillment of RPO) to deposit the price of the REC is in substance a regulatory measure and is in order in view of the stipulation that the amount so deposited will be used for purposes relating to purchase of REC and development of transmission infrastructure for renewables. Solicitor General has concluded that the proposal of this regulatory measure as contained in the model regulations was in order.

b) Impact on tariff of proposal of solar REC to be exchanged at a price of about Rs.12 to Rs.13 per unit if solar RPO is kept at 0.1% will be around one paise per unit.

3.3 During the discussions, the following four issues were raised by the Members:

   i) Chairpersons of MPERC, OERC and MERC expressed the likely difficulties to be faced by the distribution utilities in arranging funds for purchase of RECs. Chairperson, RERC said that key issue was the level of RPO to be specified by SERCs. After discussions, there was consensus that the key issue was the level at which the RPO is specified and REC was just an alternative mechanism to facilitate compliance with RPOs. It was also realized that REC mechanism would make imposition of RPOs on captive consumers and open access consumers practically possible otherwise these entities would find it extremely difficult to procure small quantities of electricity generated from renewable sources.

   Chairperson, CERC/FOR said that the level at which the RPOs were required to be fixed in view of the aspirations articulated in National Action Plan on Climate Change was an important issue on which FOR has already given its recommendations. However, it would be desirable that this matter is also discussed by the Central Government

with the States in an appropriate forum. This issue was relevant in itself and is not to be seen as an issue to be linked with REC mechanism. REC mechanism would simply facilitate fulfillment of RPO.

After discussions, the Forum decided to proceed for finalization of REC implementation framework and separately undertake a study on feasible renewable energy potential in each State and the possible trajectory for setting RPOs so as to reach the levels indicated in the National Action Plan on Climate Change, after taking into account the likely impact on consumer tariff. The Secretariat was directed to undertake the study expeditiously.

ii) Chairperson, RERC suggested that different RECs needed to be awarded to generators for one unit of renewable electricity generated depending upon the costs involved in generation from different technologies. He emphasized that this was required so as to ensure that generators using different technologies were able to recover their full cost while at the same time no generator gains disproportionately.

It emerged in the discussions that FOR had agreed in its 12th meeting that two types of RECs i.e. solar and non solar, should be provided for. It was also pointed out that even in mechanisms like CDM, a unit of CO2 emission avoided is priced in market uniformly irrespective of the cost involved in different CDM projects.

After discussions, it was agreed to keep the REC framework in its present form to keep it simple and avoid splitting the liquidity in market for RECs. However, the issue raised by RERC would be kept in view and appropriate action would be taken in future depending on the development of market in RECs and the movement of tariff for different RE technologies.

iii) RERC and TNERC raised the difficulties being faced by these States in absorbing increasingly large share of infirm power in their state grids. Chairperson, RERC specifically emphasized the huge variations faced in Rajasthan.

The Forum was apprised by the Secretariat that CERC was already seized with the issue related to reliable grid operations in the scenario

of increasing penetration of power in certain states. The Forum emphasized that the suitable remedial measures may be taken in this regard as early as possible. However, it became clear that this issue has nothing to do with REC mechanism per se.

iv) RERC said that the home state should not be burdened with evacuation cost on electricity sold to other states.

It was clarified that the transmission cost of renewable electricity purchased is to be borne by the buyer state/utility in the same manner as is being done for conventional electricity.

3.4 After detailed discussions, the Forum approved the two draft regulations with the following modifications:

a) In case of genuine difficulty in meeting RPOs because of non-availability of RECs, the obligated entity can approach SERCs for carry forward of RPO compliance requirement.
b) The fund to be created out of the compliance charges should be utilized for the purchase of RECs only and not for transmission infrastructure which is the duty of STUs.
c) The provision for solar REC may be included as proposed in the 12th meeting of the Forum.
d) If State Nodal Agency (SNA) is not able to perform the function assigned satisfactorily, SERCs can designate any other agency to perform the function meant for SNAs.
e) A small percentage of the sale proceeds received by sale of RECs may be earmarked in the draft CERC regulations for the purpose of capacity building of SNAs and other facilitative initiatives such as common software applications etc.
f) Other drafting suggestions received from SERCs may be appropriately incorporated.

4. Discussion on APTEL Judgement regarding upholding of CERC's Order on Maharashtra State Electricity Power Trading Corporation Pvt. Ltd.

The legal principle as enunciated in the order of CERC and the judgement of APTEL upholding the order of CERC was appreciated by FOR. In the CERC

order, lifting of corporate veil was justified to ensure independent and autonomous functioning of SLDCs.

The Forum further decided that the Secretariat should seek legal opinion on the issue whether the trading entities formed as process of reorganization of SEBs would have status of deemed licensees under the Electricity Act, 2003.

5. Consideration and approval of TOR on the proposed Study on Implementation and Impact Analysis of Time of Day (ToD) Tariff in India.

The proposal was approved with the following modifications:

a) A good mix of states should be covered in the study to ensure representation of the states where there is no scope of load shifting due to flat nature of demand curve. This emerged out of the suggestion given by PSERC.
b) The study should also take into account (i) the cases where rebate has been made permissible in tariff for off-peak supply of electricity and (ii) the cost of metering involved in implementing Time of Day tariff.

6. Status on compilation AT&C Loss as input to MoP for APDRP.

The status as compiled by FOR Secretariat based on data forwarded by SERCs was noted. SERCs were again requested to scrutinize the data regarding AT&C losses based on the information available with them and send the comments if any by 18th September, 2009. The status of AT&C losses after incorporating the comments received by the date would be sent to the Ministry of Power presuming that there are no further comments.

7. Discussion on Discriminatory Trading Margin.

The Forum noted the recommendation of the Inter-Ministerial Task Force on "Measures for Operationalization of Open Access", chaired by Shri B.K. Chaturvedi, Member (Energy), Planning Commission that "some SERCs have fixed trading margins for intra-State transactions relating to electricity that is ultimately consumed within the State, however, no such margin is being fixed where ultimate consumer is outside the State." The recommendation also mentioned that 'such discrimination is untenable and violates the provisions of the Constitution of India that prohibit restrictions on inter-State trade'.

The Secretariat apprised the Members of the Forum that the Hon'ble Supreme Court in its judgement dated 13th August, 2008 in Civil Appeal No. 5722 of 2006 (GRIDCO Vs. Gajendra Haldea & Others) had ruled that the sale by an intra-state trading licensee would not be inter-state trading transaction and therefore would accordingly be governed by the trading margin fixed by the SERC.

After discussions, the Forum agreed that the trading margin fixed by SERC should not be discriminatory. In other words, same trading margin should apply to all sales made by an intra-state trading licensee whether the sale is made to an entity within the state or to an inter-state trading licensee for ultimate sale outside the state.

8. Interpretation of Scope of Sections 107 and 108 of the Electricity Act, 2003.

The Forum noted the legal opinion dated 17th August, 2009 from the Attorney General of India regarding interpretation of Scope of Sections 107 and 108 of the Electricity Act.

9. Presentation by POWERGRID on "New initiatives in Transmission and Load Despatch".

The following two presentations were made on behalf of POWERGRID:

i) New Initiatives in Transmission Development **(Annexure-III)**
ii) New Initiatives in Load Despatch **(Annexure-IV)**

The Members of the Forum appreciated the presentations.

10. Any other issues :

Chairperson, MPERC said that the draft Direct Tax Code provided for exemption from income tax to CERC only. He suggested that the Secretariat should send an appropriate communication to Ministry of Finance for extending this exemption to SERCs also. This was agreed.

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

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/ ANNEXURE – I /

LIST OF PARTICIPANTS ATTENDED THE FOURTEENTH MEETING OF

FORUM OF REGULATORS (FOR)

HELD ON 04TH SEPTEMBER, 2009

AT NLDC, PGCIL, QUTAB INSTITUTIONAL AREA, KATWARIA SARAI, NEW DELHI

S. No.	NAME	ERC
01.	Dr. Pramod Deo Chairperson	CERC – in Chair.
02.	A. Raghotham Rao Chairperson	APERC
03.	Shri B.K. Halder Chairperson	BERC
04.	Shri Manoj Dey Chairperson	CSERC
05.	Shri Berjinder Singh Chairperson	DERC
06.	Dr. P.K. Mishra Chairperson	GERC
07.	Shri Yogesh Khanna Chairperson	HPERC
08.	Shri Mukhtiar Singh Chairperson	JSERC
09.	Dr. V.K. Garg Chairperson	Joint ERC for Goa & all UTs except Delhi
10.	Dr. J.L. Bose Chairperson	MPERC
11.	Shri V.P. Raja Chairperson	MERC
12.	Shri P.J. Bazeley Chairperson	MSERC
13.	Shri B.K. Das Chairperson	OERC

14.	Shri Jai Singh Gill Chairperson	PSERC
15.	Shri D.C. Samant Chairperson	RERC
16.	Shri Manoranjan Karmakar Chairperson	TERC
17.	Shri V.J. Talwar Chairperson	UERC
18.	Shri Rajesh Awasthi Chairperson	UPERC
19.	Shri Prasad Ranjan Ray Chairperson	WBERC
20.	Shri Himdari Dutta Member	AERC
21.	Shri Vishwanath Hiremath Member	KERC
22.	Shri C. Abdulla Member	KSERC
23.	Shri R. Rajupandi Member	TNERC
24.	Shri Alok Kumar Secretary	CERC
25.	Shri Sushanta K. Chatterjee Deputy Chief (Regulatory Affairs)	CERC

Regulations for REC implementation

14th FOR Meeting

Date: 4th September 2009

Model Regulations for SERC

Salient features …… 1

RPO Targets

- SERC to decide minimum percentage of procurement from RE Sources under for obligated entities under section 86 (1) (e) of the Act
- SERC to define Obligated Entities

REC Certificate

- REC to be treated as valid instrument for RPO obligation

Salient features …2

Effect of Default

- SERC to direct obligated entities to create separate Fund in case of default
- The amount will be equivalent to the amount required for purchase of REC shortfall at forbearance price (i.e. maximum price) of REC in a separate fund.
- SERC may nominate an officer from SNA for procurement of short fall of REC.

Salient features ….. 3

Effect of Default

- Fund will be utilized partly for the purchase of REC and partly for development of infrastructure for evacuation of power from RE sources.
- Fund can't be used without approval of SERC.
- The above fund would be in addition to the penalty liable under section 142 of the Act.

CERC Regulations for REC implementation

Salient features…..1

Central Agency :

- **Establishment of Central Agency**
  - An Agency operating NLDC or any other such agency would work as Central Agency, as per the direction of CERC.

- **Functions of Central agency** would include registration, maintaining account, repository settlement and such other functions as designated by CERC.

- Detailed procedures, bye laws to be prepared by Central Agency would need CERC approval

Salient features…..2

Monitoring Mechanisms :

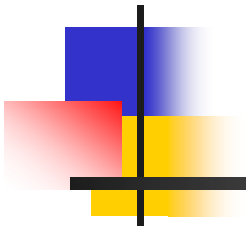
- Appointment of Compliance Auditors by CERC for post monitoring of the REC Transactions.
- **Remuneration charges** payable to such auditors would be met by Central Agency.
- **Qualification and experience** would be as per CERC guidelines

Salient features…..3

REC Certificates

- REC exchange only through power exchanges approved by CERC.
- Certificates will be exchanged within forbearance price (ceiling price) decided by CERC time to time and not exceeding forbearance price.
- RE generators are not allowed to bank more than 25% of REC for the next year.
- Fees and charges payable under this mechanism would be specified by CERC

Response of FOR Members on Draft Regulations



Response on Eligibility Issues

1. The Regulations do not provide for RPOs for CPPs and open access consumers…. (UPERC)

Views of 'FOR SECRETARIAT' :

1. **Legal opinion has been solicited. RPO can be imposed on OA consumers and CPPs.**

Response on Eligibility Issues

1. Different credits should be allowed for different RE sources …. (RERC & UPERC)

Views of 'FOR SECRETARIAT' :

- **FOR in its earlier meeting decided to provide for two categories for pricing of REC - i) Non -Solar and ii) Solar REC .**
- **The proposed pricing methodology of REC assigns weightage to each RE technology based on its share in total RE capacity.**
- **Different credits for different technologies would lead to market fragmentation and make the mechanism complicated.**
- **Even in CDM mechanism CER credits are uniform despite the fact that the cost of saving CO_2 emission is different for different projects .**

Response on REC Exchange

1. Validity of REC beyond one year may lead to hoarding in the beginning. ….(UPERC)
2. The mandatory provision of sale of REC within the forbearance price will lead to sale of RECs only at the ceiling price.. (KSERC)

Views of 'FOR SECRETARIAT' :

1. **No incentive/motivation for developers to hoard RECs as they are required to sell the certificate and recover their cost and margin.**

   Further, the fact that REC cannot be sold at a price more than the forbearance price would discourage REC generators from hoarding REC.

   The provision of carry forward of RECs is meant to safeguard the developers against loss in the event of their not finding adequate buyers in the first year.
2. **Forbearance price safeguards the obligated entities against volatility of price which is not desirable and which has the potential of rendering REC mechanism infructuous.**

Response on Monitoring Mechanism ..1

1. Compliance charges or penalty under section 142 should be avoided in the initial year (say 3 – 5 years) till it is ensured that there is sufficient renewable generation available in the market. (UPERC)

Views of 'FOR SECRETARIAT' :

Moratorium period for application of compliance charges may not bring the desired discipline in compliance of RPO. It may at the same time affect the development of market for the RECs.

In case of genuine difficulty of meeting RPO because of non-availability of RECs, the obligated entity can approach SERCs for carry forward of RPO compliance requirement.

Response on Monitoring Mechanism..2

1. The fund to be created out the compliance charges should be utilized for the purpose of RECs and not for transmission infrastructure which is the duty of STUs. ….. (TNERC)
2. State Agency should maintain fund and accounts of RPOs and also purchase and sell the certificate with the permission of SERCs. ….(UPERC)

Views of 'FOR SECRETARIAT' :

1. **We may agree to this suggestion.**
2. **There should not be any concern regarding mis-utilization of fund as along as the fund can not be utilized without the permission of SERC. Even sale and purchase in the event of default shall be with the permission of SERC.**

Response on pricing methodology ….

1. REC pricing mechanism should ensure viability of investment and at the same time prevent excessive gain….(RERC)

Views of 'FOR SECRETARIAT' :

1. **Proposed REC pricing mechanism ensures recovery of cost of RE generation equivalent to preferential tariff which a discom would otherwise pay if it chooses to buy renewable energy under normal circumstances .**

Response on other issues …1

1. Methodology of sale of energy component under REC mechanism, particularly, in respect of infirm source like Wind Energy, has not been specified in the Regulations ....***(RERC)***
2. Home state should not be burdened with evacuation cost…… ***(RERC)***

Views of 'FOR SECRETARIAT' :

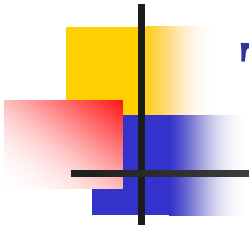
1. **CERC is taking care of the issues relating to scheduling and imbalance settlement in inter-state transfer of infirm power separately and the same is expected to be in place by the time REC mechanism is launched.**
2. **This issue is beyond the scope of regulation under 86 (1) (e). FOR may like to deliberate on this issue separately.**

Response on other issues..2

1. No provision for accreditation of RE purchase in the State Regulations. ..*(KSERC)*
2. The issue raised in the FOR meeting held in June, 2009 have not been resolved....*(RERC)*

Views of 'FOR SECRETARIAT' :

1. **Definition of "State Agency" in the State Regulations [Regulation 2 (k)] covers accreditation. However, the provision that 'procedures for accreditation shall be stipulated in the detailed procedures to be notified by the Central Agency' can be incorporated in the State Regulations.**
2. **Point-wise status on each of these issues raised in the FOR meeting held in June, 2009 are enclosed**



Thank you …

Pricing of REC

Step-1

- RE Tariff for Different Sates according to RE technologies

	State	Wind	SHP	Biomass	Bagasse
1	Andhra Pradesh	3.37	2.6	4.15	3.29
2	Gujarat	3.37	-	3.08	3
3	Himachal Pradesh	-	2.87	-	-
4	Haryana	4.08	3.67	4	3.74
5	Karnataka	3.4	2.8	3.1	3.06
6	Madhya Pradesh	3.69	-	3.39	2.82
7	Maharashtra	3.5	3	4.28	3.05
8	Rajasthan	3.69	-	4.36	-
9	Tamil Nadu	3.39	-	4.5	4.38
10	West Bengal	4	3.6	4	2.55

Step - 2

- **Three options** considered for Electricity Component Price

- From these two tables Average value for Each RE technology and for each option can be calculated.

Sr No	State	Competitive Bidding Price (Rs/kWh)	Cost of GenCo Gen. (Rs/kWh)	Average Power Purchase Cost (Rs/kWh)
		Option-1	Option-2	Option-3
1	Andhra Pradesh	2.33	1.38	1.74
2	Gujarat	2.89	-	2.17
3	Himachal . Pradesh	-	1.14	1.58
4	Haryana	2.335	1.28	2.49
5	Karnataka	-	-	1.88
6	Madhya Pradesh	2.298	1.66	1.97
7	Maharashtra	2.642	-	2.39
8	Rajasthan	-	1.43	2.52
9	Tamil Nadu	-	1.93	1.78
10	West Bengal	-	1.75	2.03

State wise REC price (Pre. Tariff – Elec. Comp.) for each tech. under each option

		Comp. Bidding Option 1	Genco cost Option 2	Avg PPC Option 3	Comp. Bidding Option 1	Genco cost Option 2	Avg PPC Option 3	Comp. Bidding Option 1	Genco cost Option 2	Avg PPC Option 3	Comp. Bidding Option 1	Genco cost Option 2	Avg PPC Option 3
	State	Wind	Wind	Wind	SHP	SHP	SHP	Biomass	Biomass	Biomass	Baggase	Baggase	Baggase
1	Andhra Pradesh	1.04	1.99	1.63	0.27	1.22	0.86	1.82	2.77	2.41	0.96	1.91	1.55
2	Gujarat	0.48	-	1.2	-	-	-	0.19	-	0.91	0.11	-	0.83
3	Himachal Pradesh	-	-	-	-	1.73	1.29	-	-	-	-	-	-
4	Haryana	1.745	2.8	1.59	1.335	2.39	1.18	1.665	2.72	1.51	1.405	2.46	1.25
5	Karnataka	-	-	1.52	-	-	0.92	-	-	1.22	-	-	1.18
6	Madhya Pradesh	1.392	2.03	1.72	-	-	-	1.092	1.73	1.42	0.522	1.16	0.85
7	Maharashtra	0.858	-	1.11	0.358	-	0.61	1.638	-	1.89	0.408	-	0.66
8	Rajasthan	-	2.26	1.17	-	-	-	-	2.93	1.84	-	-	-
9	Tamil Nadu	-	1.46	1.61	-	-	-	-	2.57	2.72	-	2.45	2.6
10	West Bengal	-	2.25	1.97	-	1.85	1.57	-	2.25	1.97	-	0.8	0.52

- By considering the weighted average of each technology w.r.t. its contribution, final average price of REC can be calculated for each option as shown
- Then averaging all three scenario gives Final Average REC price of **1.5 Rs./kWh**

	Weighted Avg of Tech	Competitive Bidding Price	Cost of Generation	Average Power Purchase Cost
		Option-1	Option-2	Option-3
Wind	53%	1.1	2.13	1.5
SHP	23%	0.91	1.9	1.2
Biomass	12%	1.28	2.5	1.77
Bagasse	13%	0.68	1.76	1.18

Option		Weighted Average REC price (Rs/kWh)
Option -1	Competitive Bidding	1.02
Option -2	Cost of generation	2.07
Option -3	Average power purchase cost	1.43

Point-wise Status on some of the Suggestions made by the Forum

Legality of the proposal for enforcing compliance of Renewable Purchase Obligations through imposition of some sort of charge be got examined further in detail.

1.1 Legal opinion has been sought. Legal opinion on whether RPO can be imposed on OA consumer and CPPs is also contained therein.

The effectiveness of the jurisdiction of the SERCs on the State Designated Agencies (SDAs) be further examined and necessary interface with MNRE in this regard be evolved.

1.2 If State Nodal Agency (SNA) is not able to perform the functions assigned, SERC can designate any other agency to perform the functions meant for SNAs.

Impact of proposal of solar REC to be exchanged at a price of about Rs.12 to Rs.13 per unit, on consumer tariffs needs to be assessed further.

1.3 The cost of electricity generation of solar based power projects is relatively high in comparison to other RE as well as conventional sources. However, solar technologies are still in development phase and it is expected that cost of generation of such technologies will reduce in future.

1.4 The NAPCC promotes the use of solar energy for power generation. It emphasises the need for the policy and regulatory measures required for promotion of solar technologies as common to all renewables based technologies. In order to promote electricity generation from solar based power projects, it is proposed that each state should fix a minimum level of solar energy purchase obligation (0.1%).

1.5 An analysis has been done to calculate the impact of purchase of electricity from solar projects on the overall average power purchase cost of a state. A solar RPO of 0.1% is considered. The impact has been calculated on assumption that the total energy consumption portfolio (excluding solar) for the state will remain constant and the purchase of electricity from solar projects will be made to meet the RPO.

1.6 The table below shows the details of impact of solar purchase on Average power purchase cost for four states :

	Total energy consumption	Solar RPO	Average power purchase cost	Solar REC price	Total Energy Consumption purchase without Solar	Purchase from Solar projects	New Average power purchase cost	Increase in Average power purchase cost due to Solar RPO
	MU	%	Rs/kWh	Rs/kWh	MU	MU	Rs/kWh	Rs/kWh
Madhya Pradesh	37110.71	0.10%	1.973	12	37074	37.1	1.9833	0.0100
Maharashtra	109038.6	0.10%	2.391	12	108930	109.0	2.4011	0.0096
Gujarat	55368	0.10%	2.17	12	55313	55.4	2.1817	0.0098
Rajasthan	36787	0.10%	2.52	12	36750	36.8	2.5267	0.0095

1.7 The analysis shows that a Solar RPO of 0.1% will result in an increase in average power purchase cost of around 1 paisa/kWh.

1.8 The impact has been calculated for average power purchase cost for the state. The impact has not calculated on the consumer tariff as the percentage of losses, consumer segment will vary from one distribution utility to other.

The accreditation agencies at state level would need to have adequate monitoring capability, particularly in respect of use of fossil fuel by biomass based generators.

1.9 As per the report, State Nodal Agencies have been proposed to be entrusted with the job of accreditation of projects. The same agencies are entrusted to monitor various aspects pertaining to renewable energy projects including use of fossil fuel by biomass based generators. For example, the biomass order issued by MERC, dated 8th August, 2005, details self-declaration by project developers of the usage of fossil fuel by them and verification by concerned licensees. It also specifies the monitoring and verification procedure by MEDA, the State Nodal Agency in Maharashtra. The Order further prescribes templates to be furnished by developers pertaining to usage of fossil fuel by biomass plants. Similarly, other SERCs have assigned the responsibility of monitoring of renewable energy plants to SNAs.

1.10 It is imperative that SNAs along with other relevant stakeholders need to assign resources for the implementation of REC. We may consider levying charge (a small percentage of revenues from RECs, transacted) for use for capacity building of SNAs.

1.11 Going forward, the implementation of REC would require capacity building of stakeholders involved on various implementation issues such as accreditation of projects, registration, and issuance of REC etc. Capacity of SNA needs to be built on accreditation of projects and monitoring requirements as per the proposed implementation framework.

New Initiatives in Transmission Development

I.S. Jha

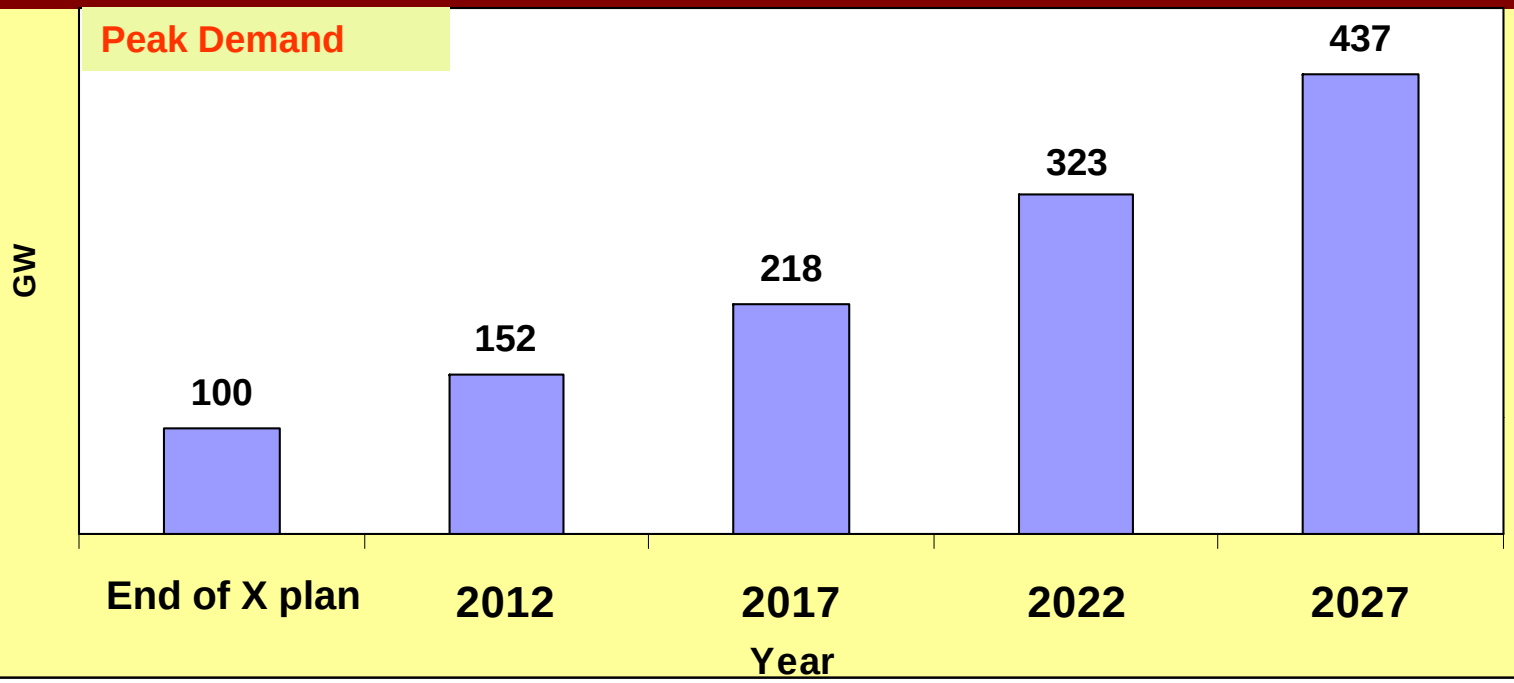
Director(Projects)

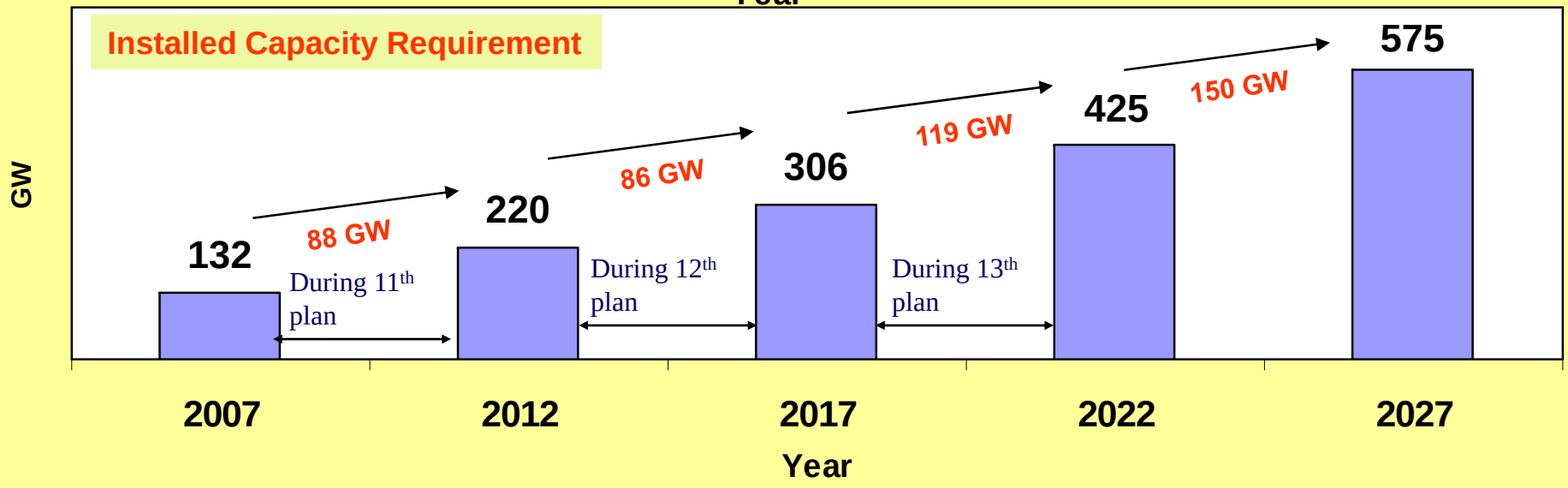
Power Grid Corpn. of India Ltd.

Need of new initiatives in Transmission

- Change in generation profile
  - Quantity
  - Location of the generation project
- Scarce Right of Way
- Complex dynamism due to high technology
  - Reactive Power Management
  - Control of power flow
  - Stability of the system
  - Control of harmonics
- Implementation in time
- Shortage of skilled manpower

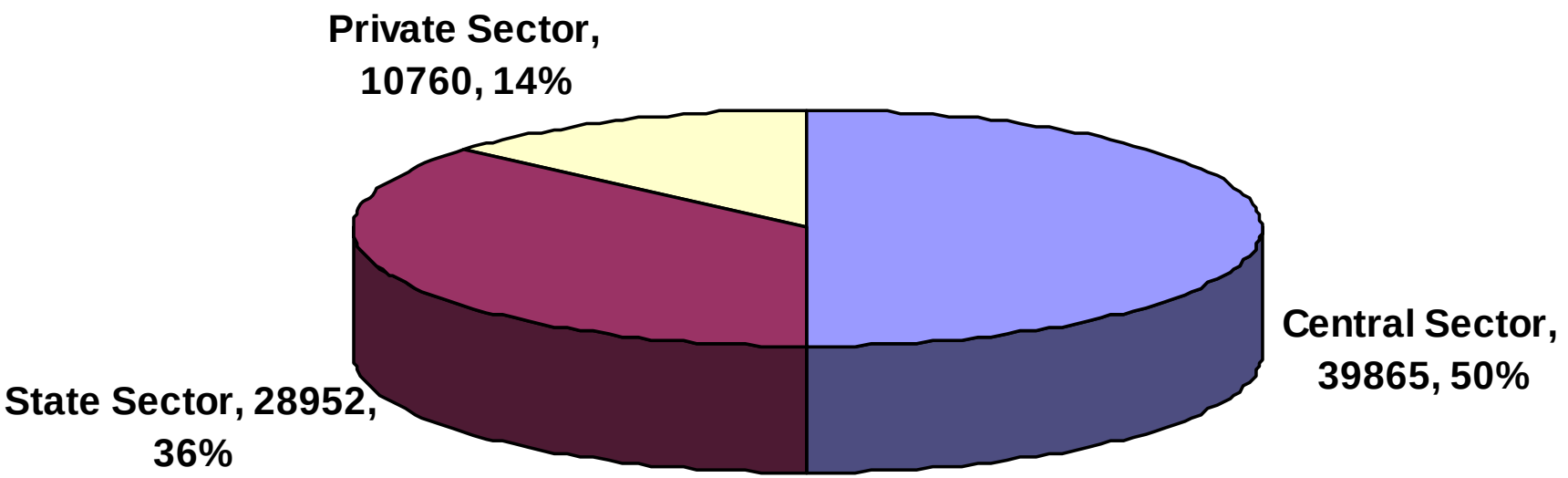
Generation Growth Profile





Enhancement of generation during 11th Plan

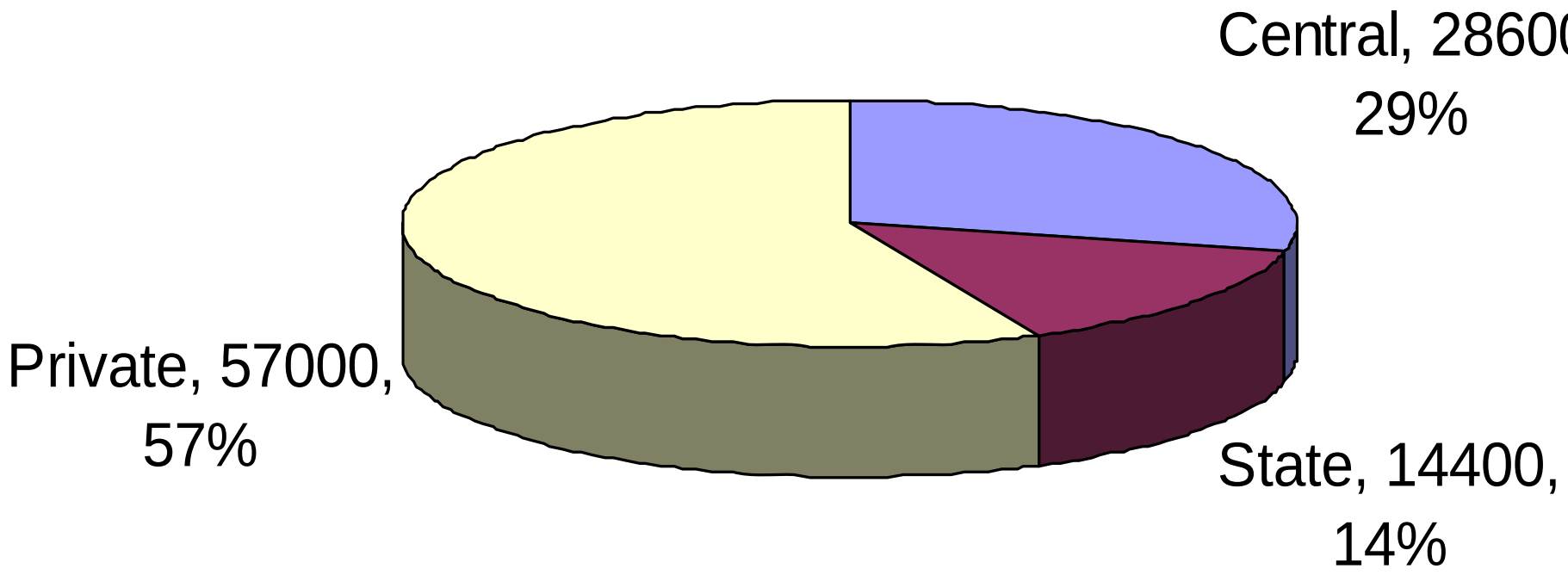
- Target capacity addition in 11th Plan : 78,577 MW



- Capacity addition envisaged under Central Sector: about 40,000 MW

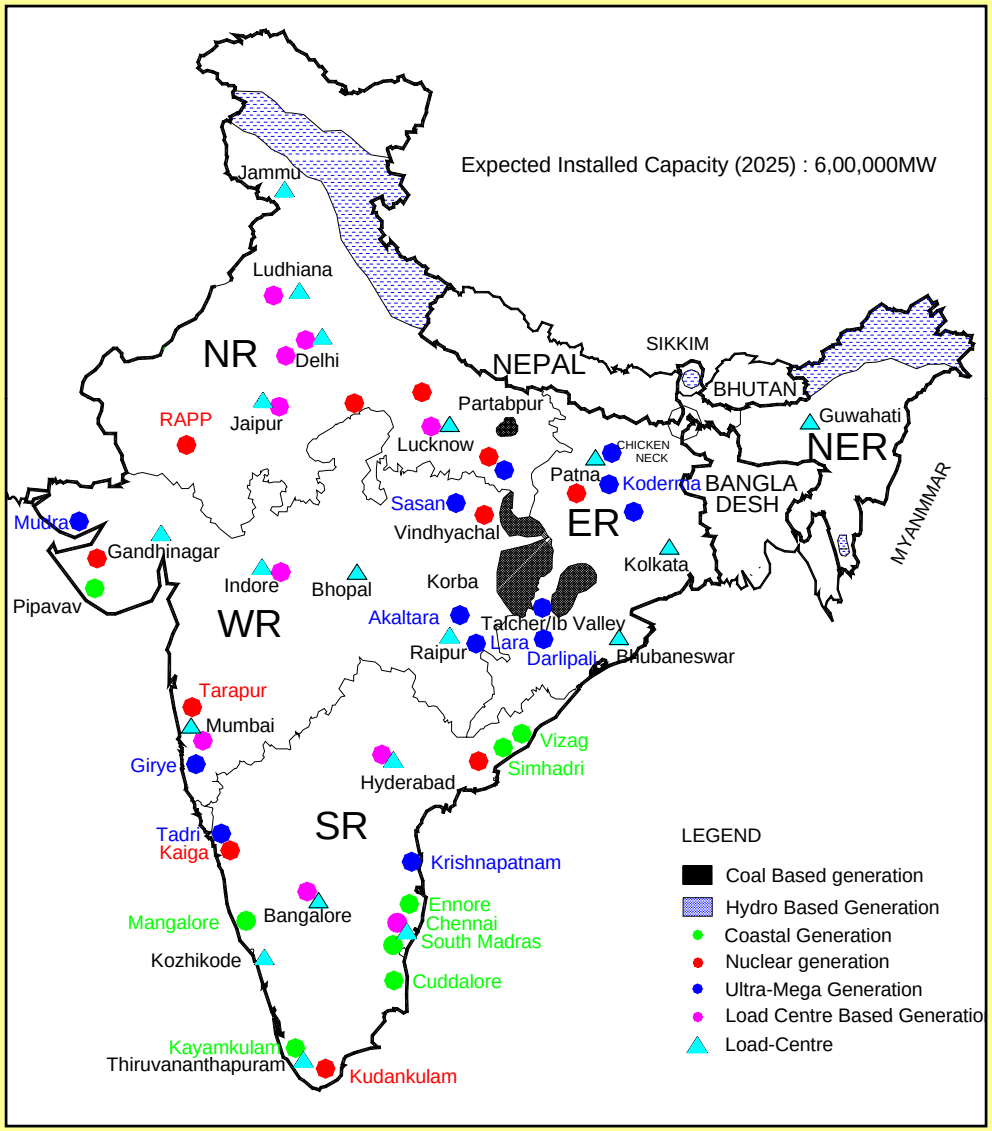
Enhancement of generation during 12th Plan

- **Target capacity addition in 12th Plan : 100,000 MW (Tentative)**



- **Capacity addition envisaged**
  - **Under Central Sector : about 28,600 MW**
  - **Under Private Sector : about 57,000 MW**

Uneven Disposition of Energy Resource

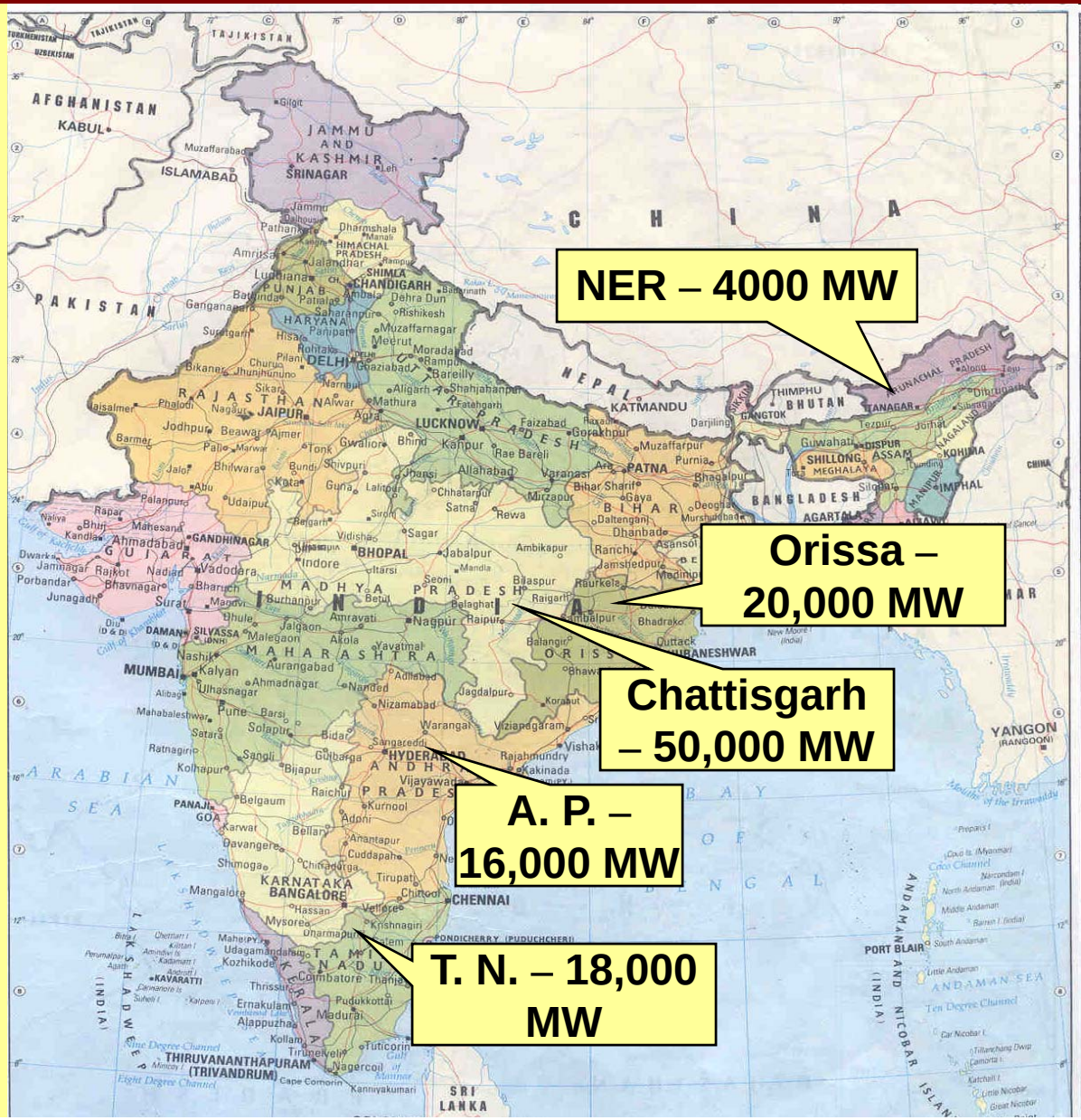


- Coal resources – Eastern/Central India
- Lignite – Gujarat, Rajasthan, Tamil Nadu
- Load centre – Western, Northern and Southern States

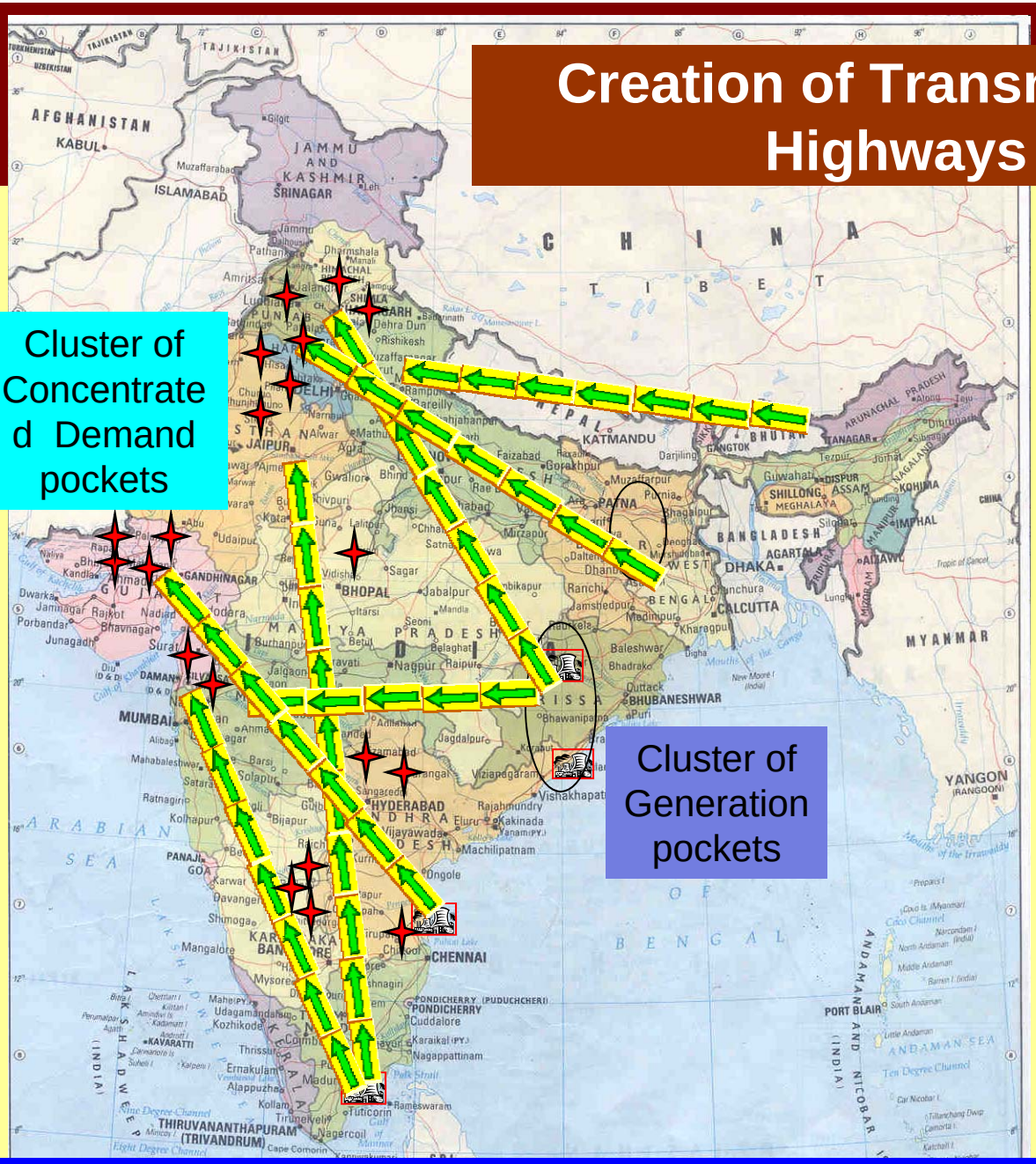
Generation Pockets

- Very large Power Stations located near coal mines –
  - Orissa, Chhattisgarh, M.P, Jharkhand
- Large HEP's located far off from load centers
  - Sikkim, North-eastern Region
- Coastal Power Stations based on imported or domestic coal
  - Mundra, Krishnapatnam, Tuticorin, Cuddalore, Ennore
- Gas based Power Stations located along the gas-grid
- Load centre based Power Stations

Potential Generation Pockets

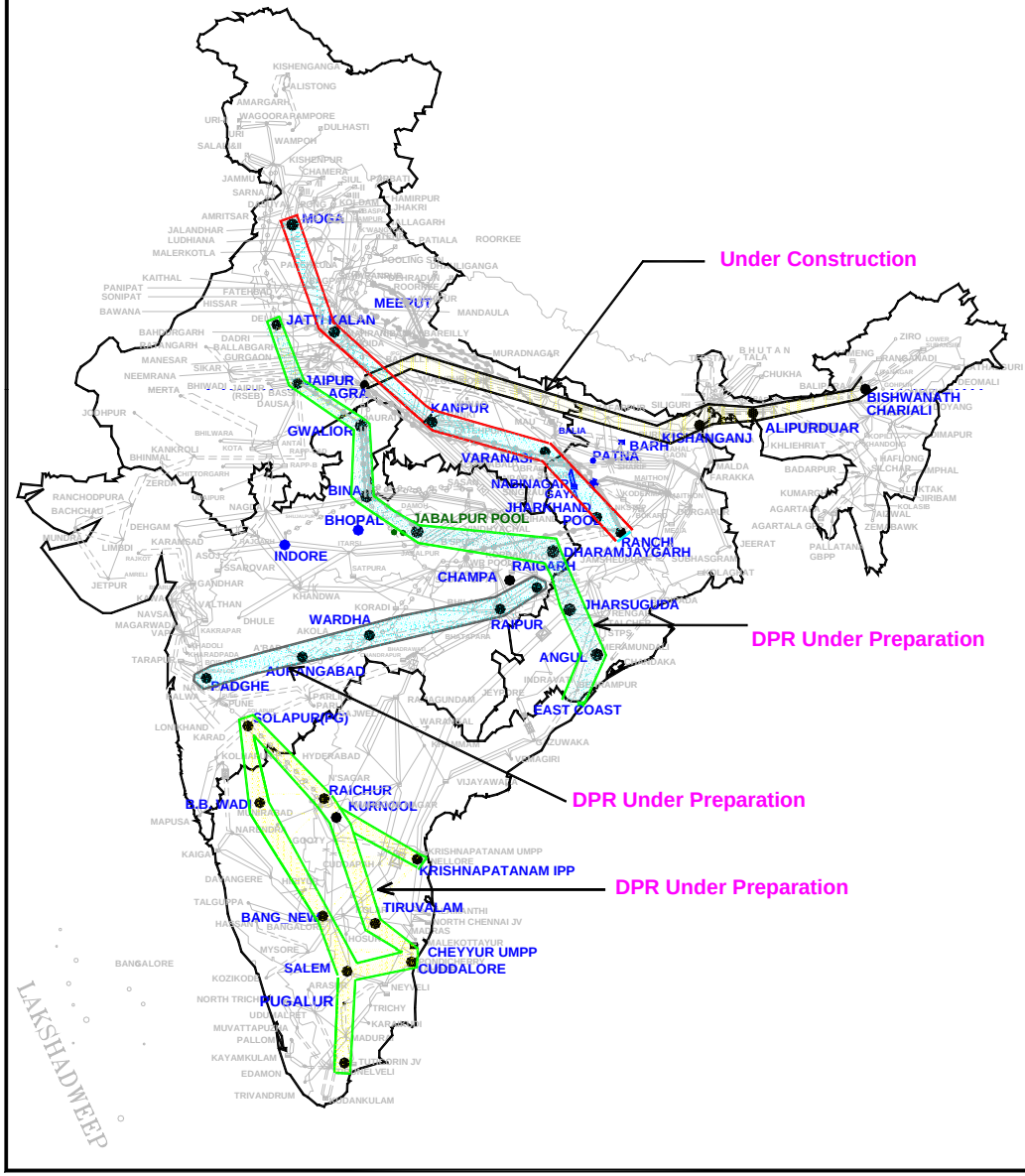


Creation of Transmission Highways



Need to be developed in Phases matching with Commissioning of Generation Projects

Proposed High Capacity Transmission Corridors Under Various IPP'S



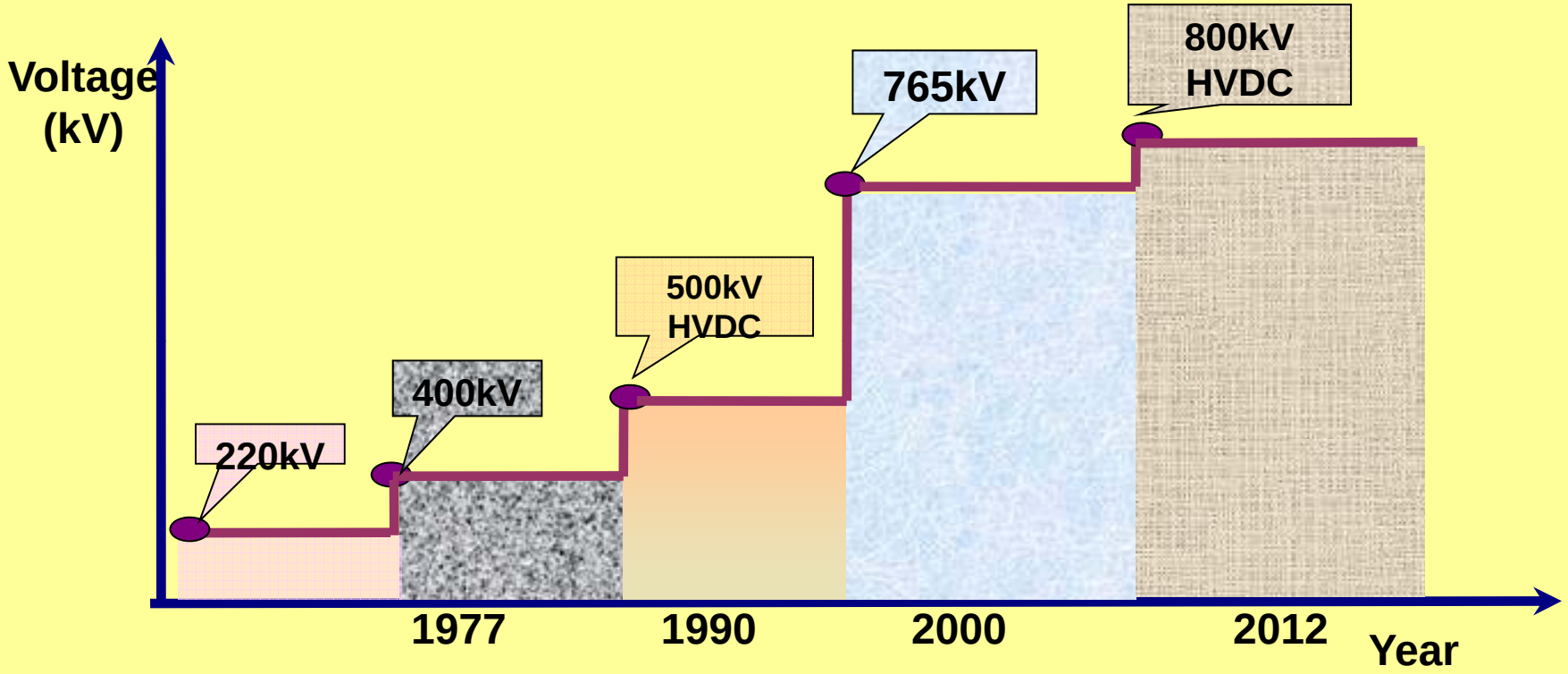
Strategy for Transmission Development

- Transmission development commensurate with generation / load growth
- Creation of Transmission Highways
- Enhancing transmission capacity of existing system
- Conservation of land for substation and Trans. lines
- Control of operation of grid with increased complexity
- Overall economy in delivered power

Technology Options

- **Increase in System voltage**
- **Use of multi-circuit/multi-conductors**
- **Utilisation of transmission lines upto full thermal capacity –** Series capacitors, SVC, FACTS
- **Use of high capacity conductor –** high temperature, High Temperature Low Sag(HTLS)
- **Uprating and upgrading of existing lines**
- **GIS substation**
- **Remote operation**

Increase in Transmission voltage



Challenges with high voltage AC system

- Reactive Power Management
- Availability of switchgear
- Corona Loss
- Sustainability of grid during contingencies

Road Map for Indian Power System

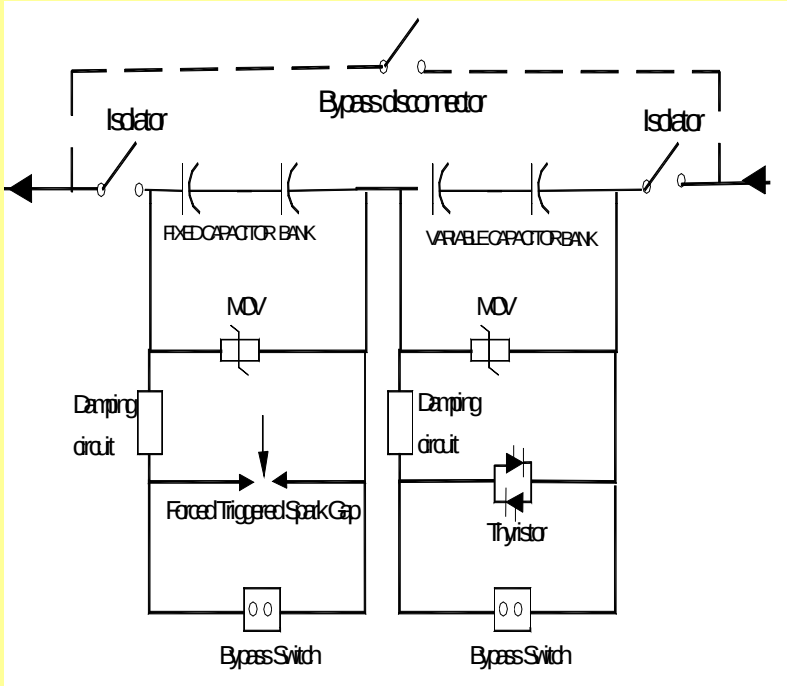
- 400kV Transmission System – Present Backbone
- 765kV Transmission system – 700 ckm under operation, more than 8000 ckm under different stages of execution
- HVDC system - ±800kV NER- Agra under execution
- 1200kV AC Transmission System – under development – operation by 2016-17

Multi-conductor Bundle/Multi-ckt line

- **Bundle conductors line (3-conductors/4-conductors), enhances power transfer capacity**
  - **No additional Right-of-Way required**
  - **Already about 6000 ckm lines under operation and more than 10,000 ckm under construction**
- **Multi-ckt. line- on the same tower more than 2 lines, enhances power transfer capacity**
  - **No additional Right-of-Way require**

Series Compensation

- **Installation of series capacitors on the lines reduce the effective reactance of the transmission line**
- **Enhance line loadability upto its thermal limit**
- **Series capacitor has self-regulating action**
- **Defer Investment for new lines**



Series Capacitors – Major installations

- **Series capacitors already installed – 20 nos. on 400kV lines**
  - Rourkela – Raipur 400kV D/c
  - Purnea – Muzaffarpur – Gorakhpur 400kV D/c(quad)
  - Ranchi – Sipat 400kV D/c
  - Seoni – Khandwa 400kV D/c(Quad)
  - Gooty – Bangalore 400kV 2xS/c
  - Jeypore – Gazuwaka 400kV D/c
  - Meramundali – Jeypore 400kV D/c
- **Series capacitors under construction/planned – 22 nos. on 400kV lines**

Uprating & Upgrading of lines

- Uprating of lines by
  - ➢ Reducing ruling span
  - ➢ Re-tensioning may be required in critical spans
  - ➢ Re-conductoring
    - ✓ AAAC
    - ✓ Compact Conductors
    - ✓ ACSS Conductors
    - ✓ Invar Conductors
    - ✓ Gap Conductors

Siliguri – Purnea 400kV D/c line is being uprated from twin Moose conductor by twin HTLS conductors (to double the capacity)

POWERGRID'S Initiatives towards upgrading

- Upgrading of line by increasing the voltage
- Upgrading designs developed and actual case studies conducted:
  - 66 kV D/C line to 110/132 kV D/C line
  - 132 kV D/C line to 220 kV D/C line
  - 132 kV D/C line to 400 kV S/C line
  - 220 kV D/C line to 400 kV S/C line
- Upgrading of kV D/C Kishtwar-Kishenpur line to 400kV S/C successfully commissioned by POWERGRID.

Gas Insulated Substation

Control Room,Bhiwadi

Switchyard ,Bhiwadi

Control Room , Ballabhgarh

Remote Operation of Bhiwadi S/s

Other technological Initiatives

- Survey through Satellite Imagery
- Compact tower
- High rise tower
- Pole type tower

Technology at O & M Stage

- **Preventive State-of-the-Art Maintenance techniques**

  a) Live line maintenance

  b) Emergency restoration system

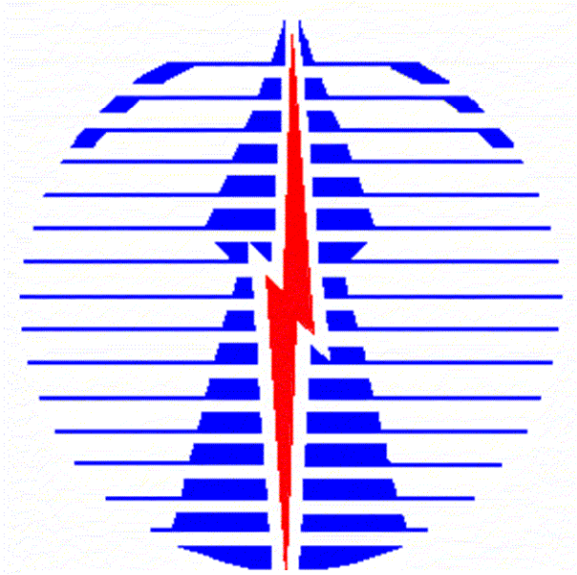
  c) Thermo-vision scaanning for hot spots

  d) Humidity/Fogging Analysis

  e) Analysis of failure statistics & remedial measures

Thank You

New Initiatives in Load Despatch



Presentation

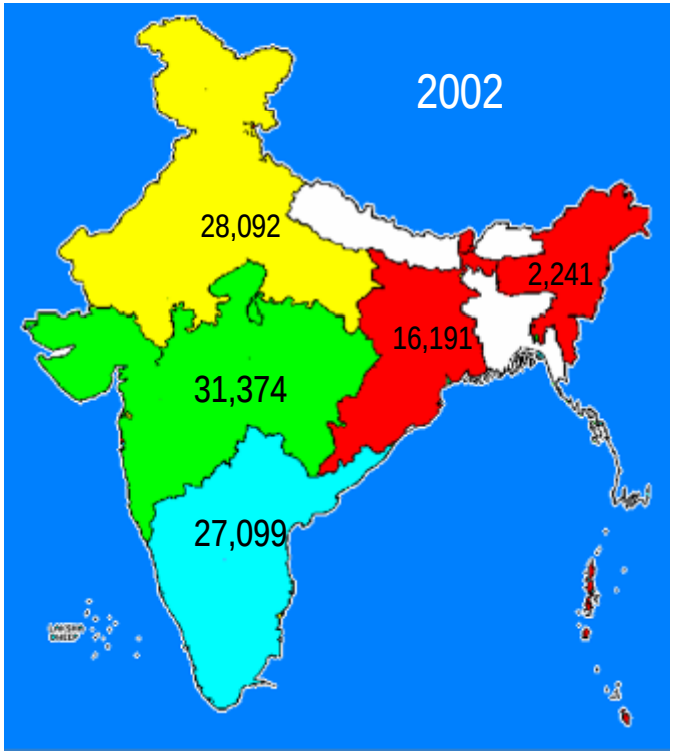
by

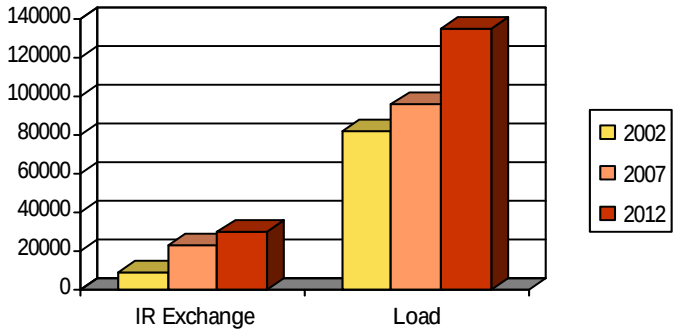
N. S. Sodha GM (I/c)

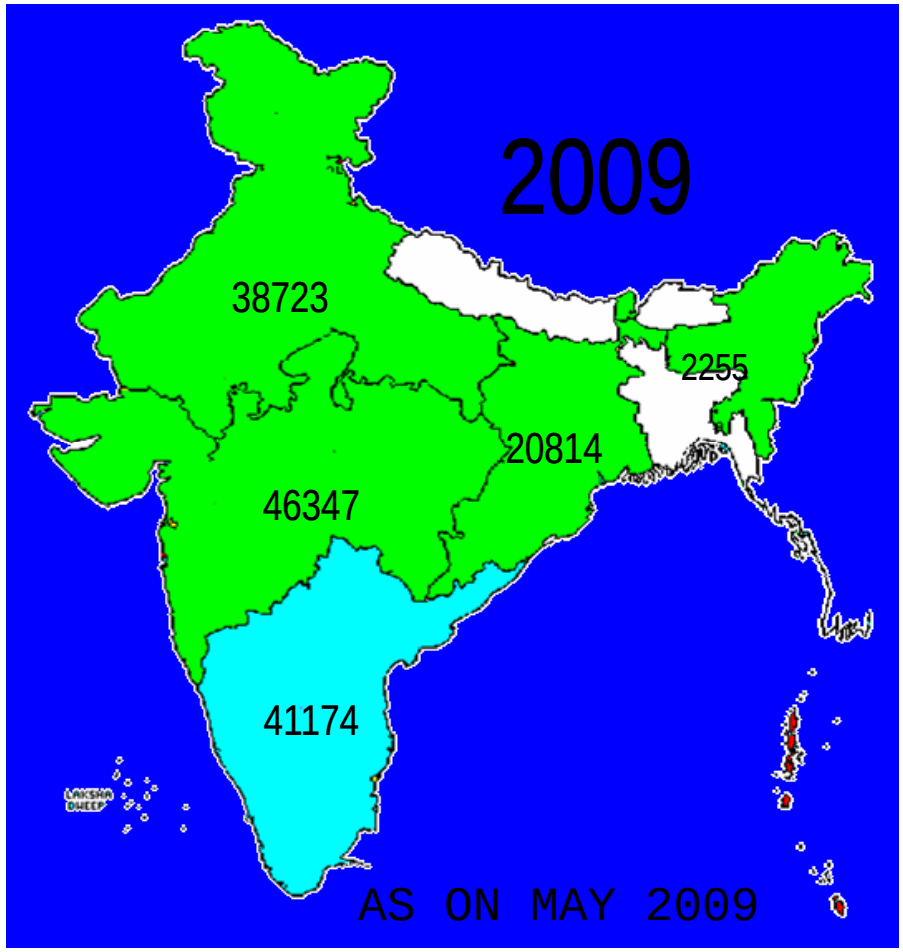
Load Despatch & Communication Department

SYSTEM CHANGE

INSTALLED CAPACITY







CHANGE DRIVERS

- **Obsolescence** of supplied system
  - OS and Hardware support
  - Exponential expansion of Power System
  - ISR issues

The Technology GAP
Between Present & Future Solution

- Market Management Solution in Indian Context.
- Pre internet Architecture design makes existing EMS/SCADA platform vulnerable to cyber attacks.
- Standardised Data models representing electricity network
  - Common Information Model (CIM)
- Service oriented Architecture (SOA)
- State estimation to state measurement
- Backup Control Centre

For survival we need……..

New Technology (61850, 61970, OPC)

Plug n Play Facility- CIM

Vendor Independence- CIM

High Speed Bus/ Enterprise Bus- SOA

Solution for Renewable Energy Integration

IP based Architecture

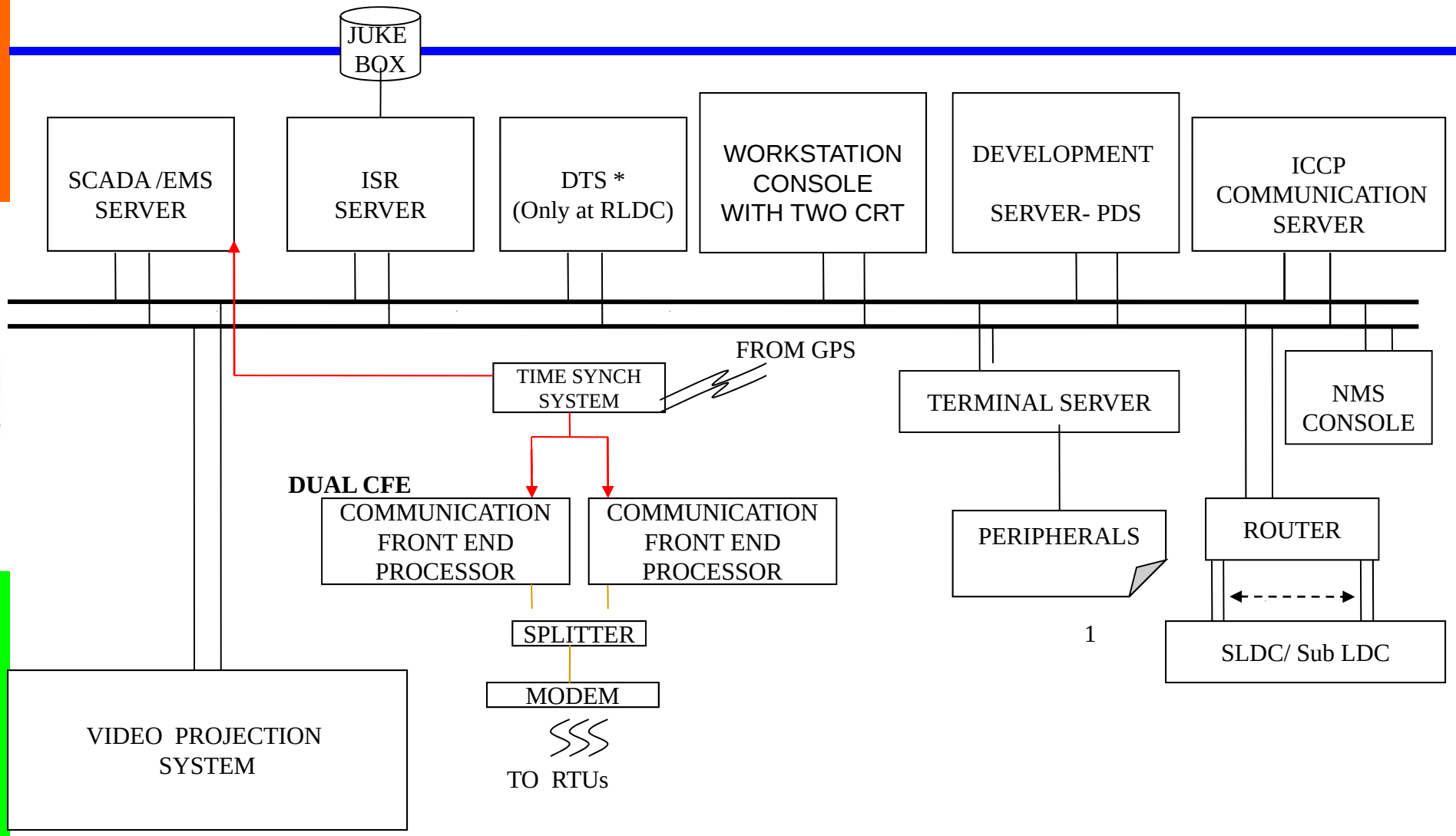
Built-In-Security - System Resistant to cyber attacks

Provision for PMU data Integration- Smart grid

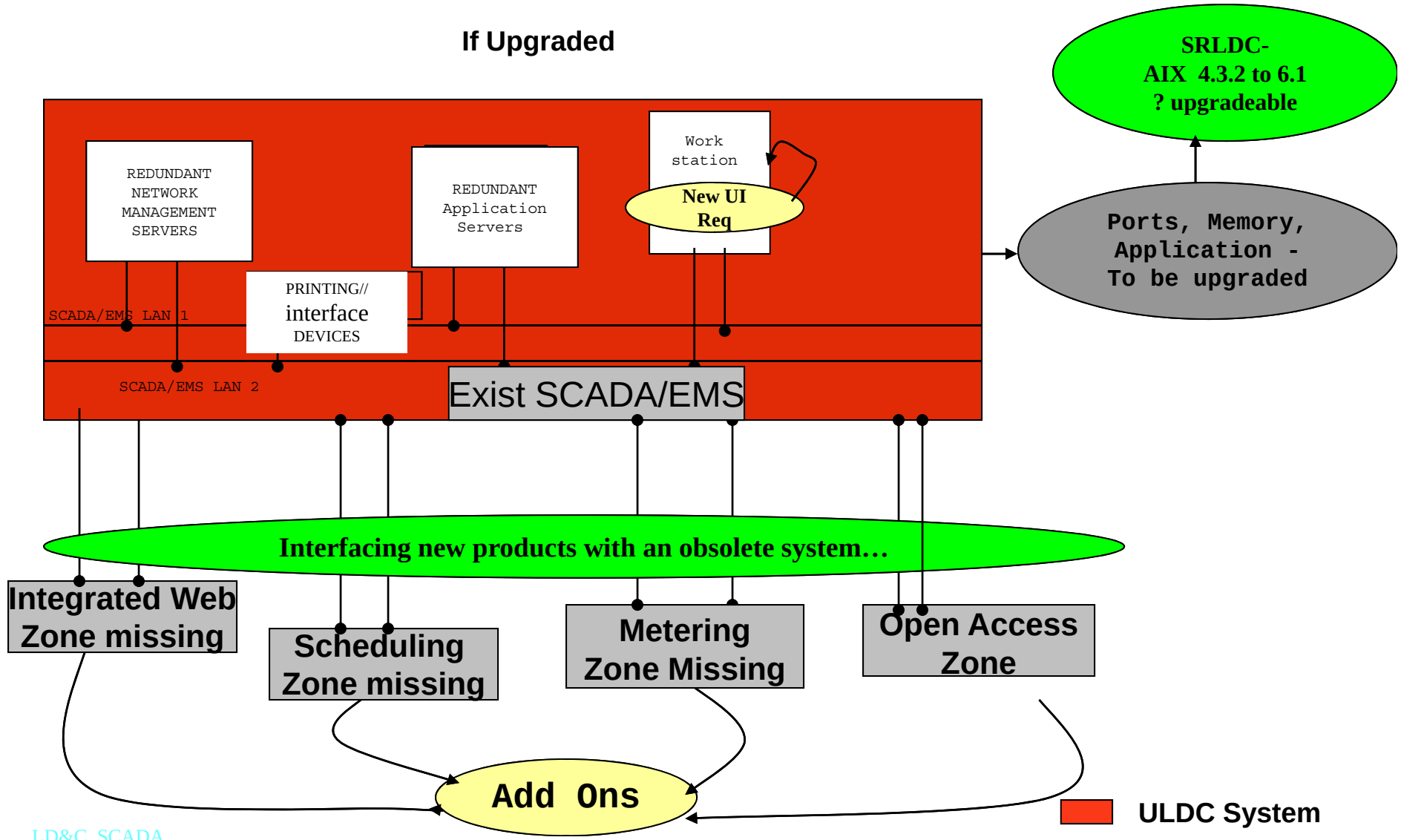
IEC Common Information Model (CIM)

- Enable data access in a standard way
- Common language to navigate and access complex data structures in any database
- Provides a hierarchical view of data for browsing and access with no knowledge of actual logical schema
- Inspiration for logical data schemas (e.g., for an operational data store)
- Not tied to a particular application's view of the world
- But permits same model to be used by all applications to facilitate information sharing between applications

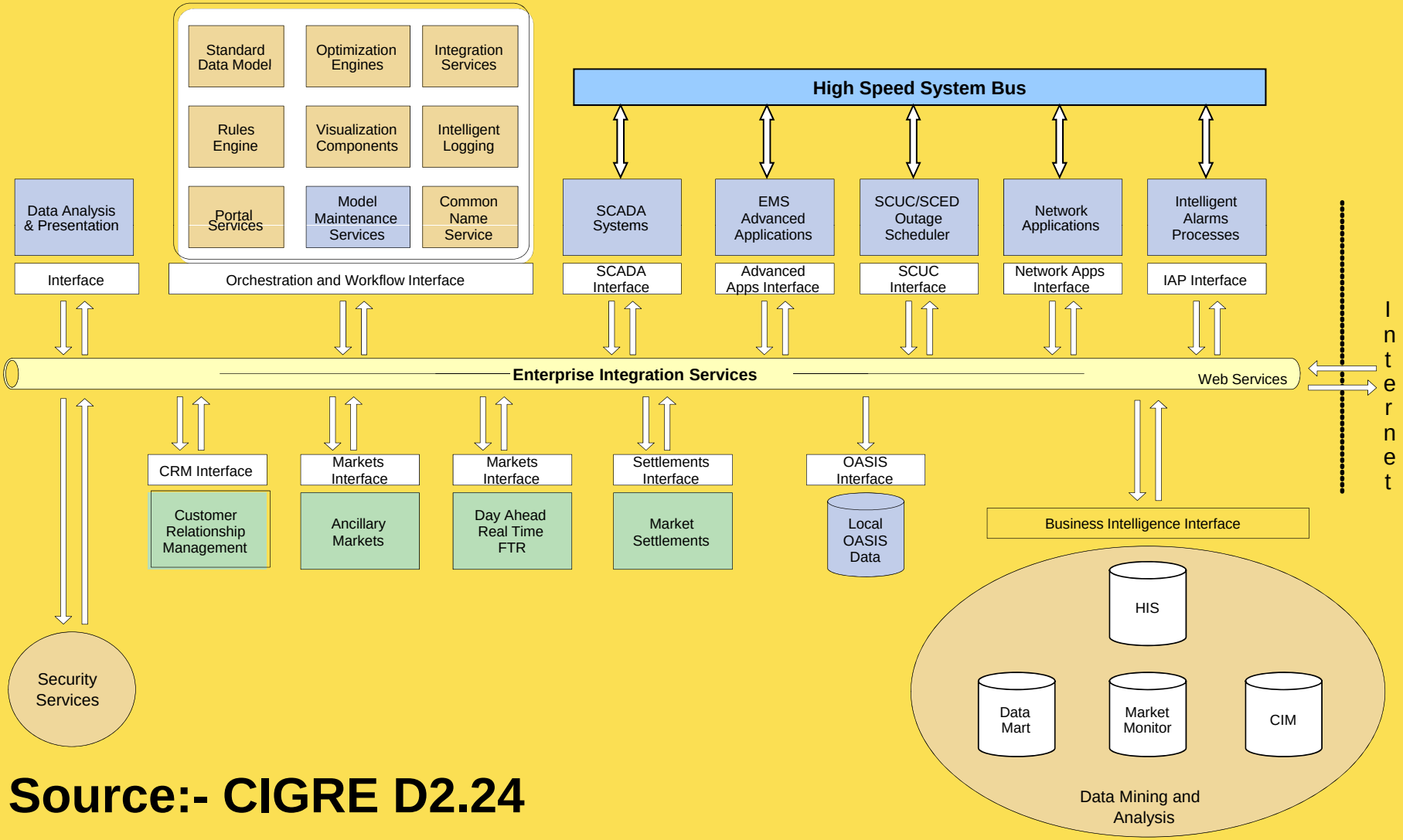
Existing CONTROL CENTRE Architecture



Up gradation of Existing LOAD DESPATCH CENTRE

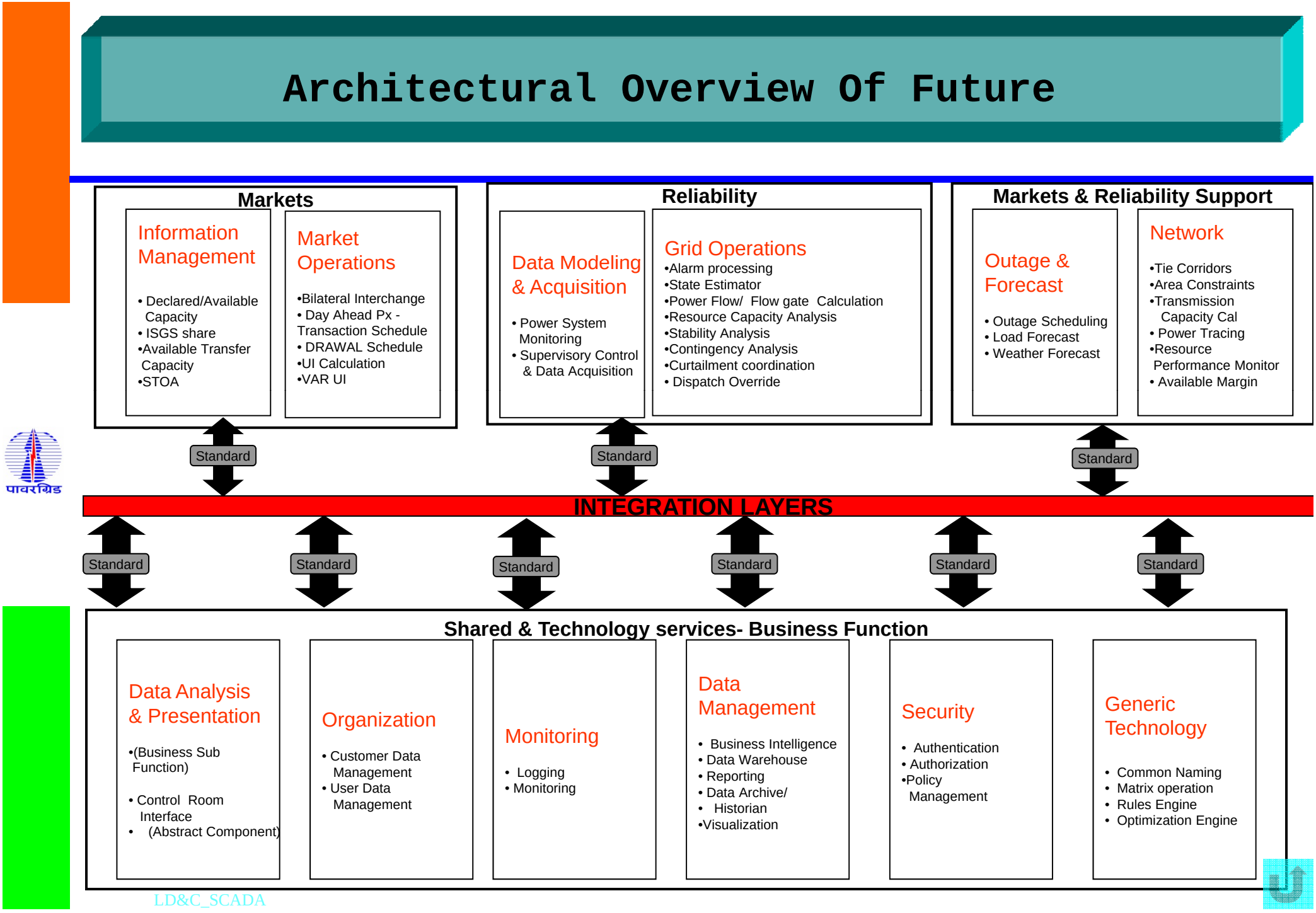


FUTURE STATE –CONCEPTUAL SOA MODEL

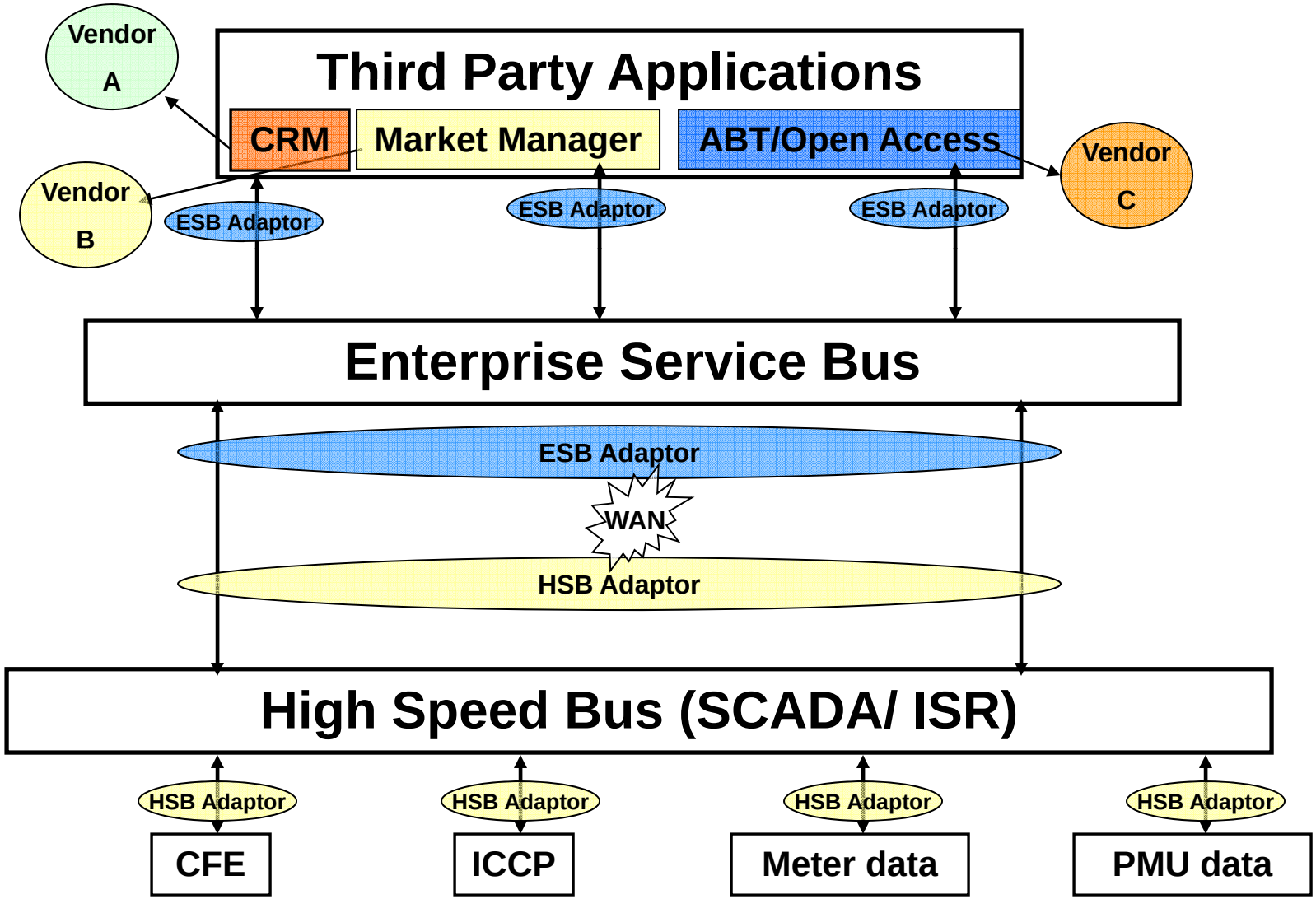


Source:- CIGRE D2.24

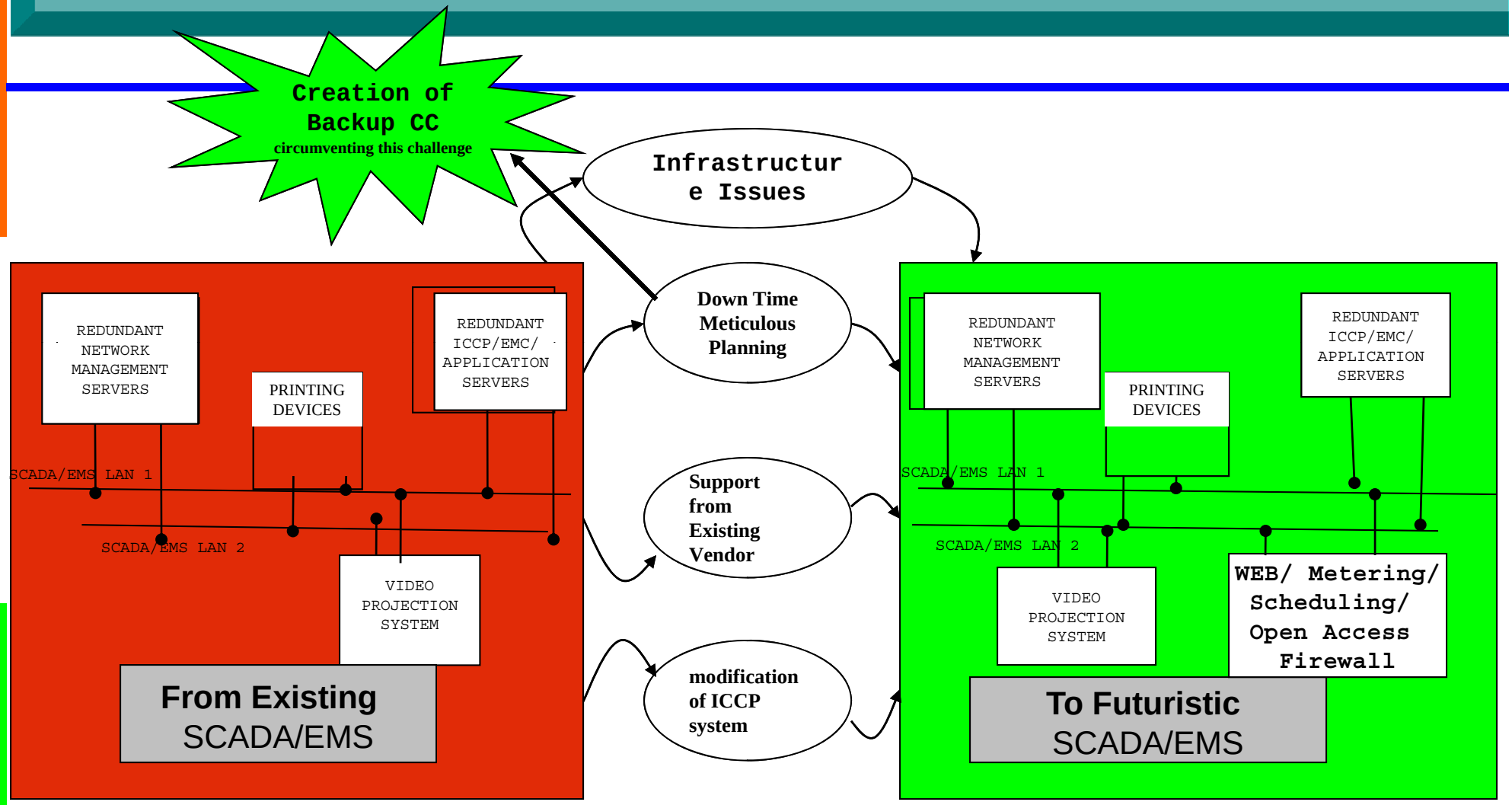
Architectural Overview Of Future



The Future Architecture …..



Replacement- Mission Critical LDCs



Impact Of Above Changes
Inevitable Action by GRID-Managers

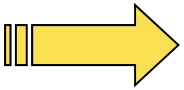
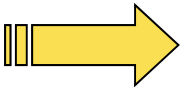
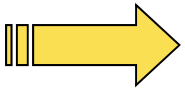
- **Establishment** of **Back Up Control Center**
  - RLDC
  - SLDC

- **Up gradation** of Existing
  - RLDC
  - SLDC

or

- **Replacement** of Existing
  - RLDC
  - SLDC

BACKUP - THREAT Vs LOCATION

Accidents		**Different establishments with separation in KMs would suffice**
Sabotage		**Different establishment will suffice**
Natural Disasters		**Locations shall be as far as possible, ~ 100 KM, in different Seismic zones**

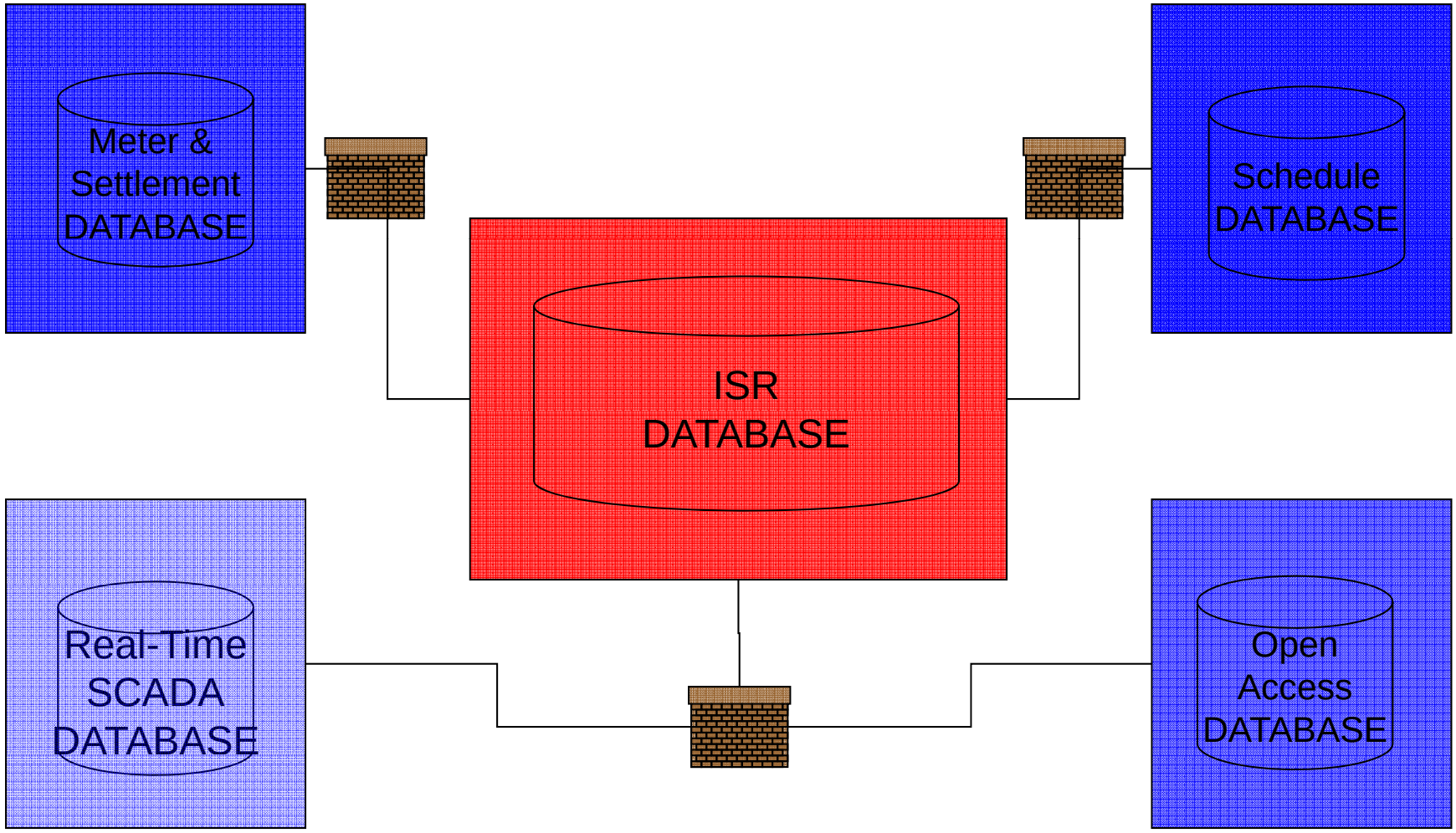
Backup Control Center

- **RLDC**
- **SLDC**

ISR

- SCADA v/s all system ISR – Metering & Settlement/ STOA
- ISR from 3rd party?
- ISR across the firewall (different LAN)
- Report with spreadsheet interface
- Trending
  - Of different Values
  - Of Same value diff timeline
- Import and configure existing database

Proposed ISR Interface

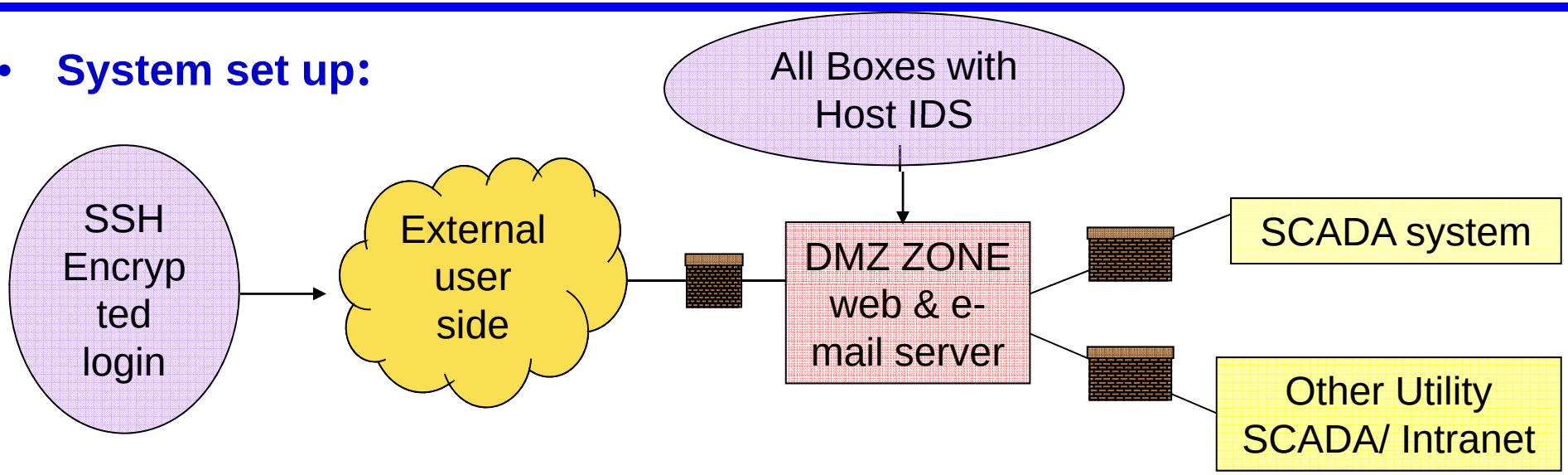


System Security

- **Cyber Security has emerged as major area of concern as SCADA allows control of underlying process – Power System**
- **Government of India recommendation – system to be in line with ISO 27001**

Security – Current Plan

- **System set up:**



•All functions (SCADA/WEB/E-mail) are to be run on redundant server
•LDCs to have backup

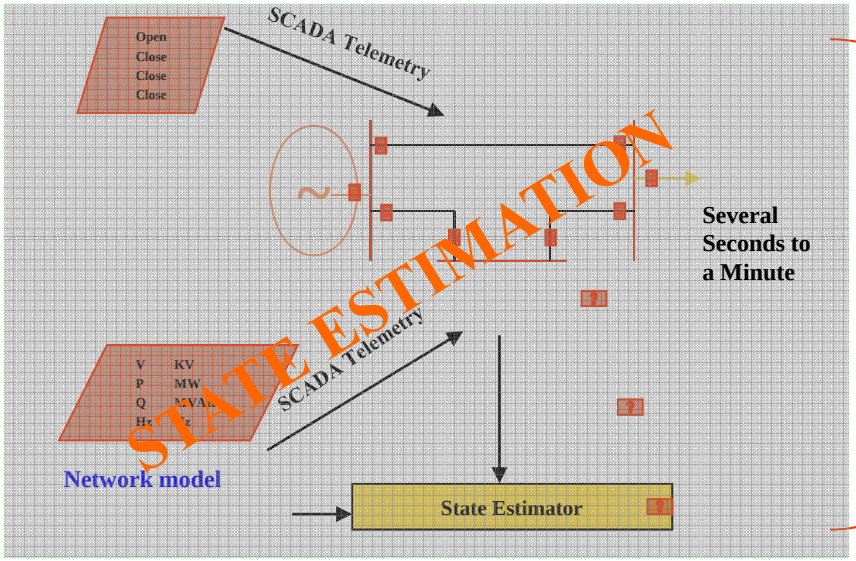
The data/image/configuration need to be Backed -up :

- On Network shared drives/CD/DAT/DVD/TAPES
- Off site storage
- **Fire proof cabinets** for critical software

SLDC- Critical Infrastructure

- Authorised Access System
- Video Survillence system
- Fencing
- Fire Fighting
- Air conditioning
- Public Announcement System
- Video Conferencing facility
- ….

SCADA v/s PMUs



- **Traditionally developed for accommodating old information technology regime (Slow communication, data without time stamp)**

- **Made possible for all round development in technologies**

Road Ahead

- Simultaneous upgrade of RLDC and SLDCs to have uniform technology and seamless integration and execution
- States to decide setting up of backup SLDCs quickly
- States to arrange funds for implementation

  (Approx. Rs 45 crores per control centres)
- States to share RLDC upgrade and backup RLDC project cost
- POWERGRID's Role – RLDC upgrades and setting up of Backup RLDC Service/consultancy

Road Ahead

- POWERGRID's Role –
  - RLDC upgrades and setting up of Backup RLDC
  - Provide Consultancy Services for SLDC upgrades and setting up of Backup SLDCs
  - Consultancy Route means
    - Preparation of DPR only
    - Concept to commissioning
      - State wise
      - Combined

THANK YOU

for

your kind Attention

Please