EEL303: Power Engineering - 1

Introductory Lecture

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Evaluation Scheme

- Minor 1: 20
- Minor 2: 20
- Re-Minor: 20

Best 2 out of 3 will be considered

- Major: 40
- Pre-Minor 1 Quiz: 7
- Pre-Minor 2 Quiz: 7
- Pre-Major Quiz: 7

Best 2 out of 3 will be considered

- Attendance: 6

Attendance Marks Distribution

- 100% = 6
- 95<= Attendance <100 = 5
- 90<= Attendance <95 = 4
- 85<= Attendance <90 = 3
- 80<= Attendance <85 = 2
- 75<= Attendance <80 = 1
- Attendance <75 = 0

Books / References

- Power System Analysis: John Grainger and W D Stevenson, Tata McGraw Hill
- Electric Energy Systems Theory: Olle Elgerd, Tata MacGraw Hill
- Power System Engineering: I J Nagrath and D P Kothari, Tata MacGraw Hill
- Power Generation, Operation and Control: Wood and Wollenberg, John Wiley
- Your own class notes!

General Instructions

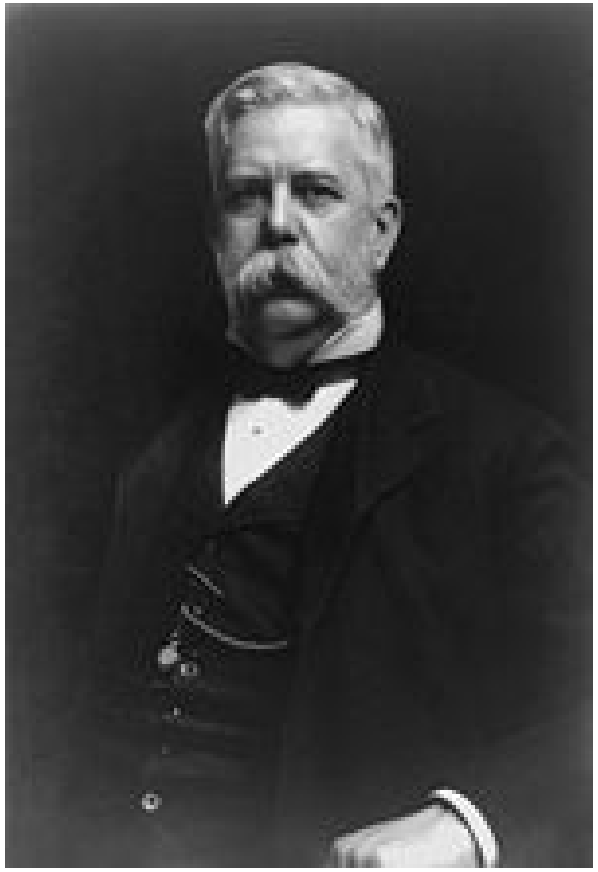
- Please be on time. Late entry into the class not allowed.
- Switch-off your cell phones, laptops, i-pads, tabs (did I miss something?)
- Switch-on your brain cells of curiosity!
- Tutorials will start from 6th August 2012.
- Attendance to be registered with TAs.
- 80 Marks and above: Basic Requirement for “A” grade (**please note:** 80+ marks does not guarantee an “A”!)
- Less than 30 Marks: *“non-pass”* grade guaranteed for sure!

Introduction to Power Systems

Courtesy: google images

Courtesy: google images

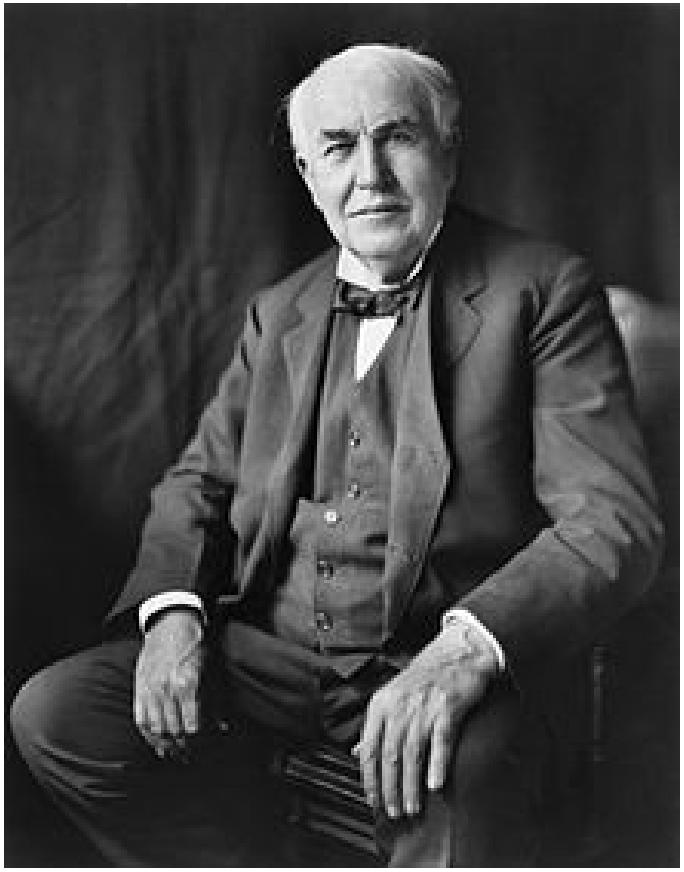
George Westinghouse



Courtesy: Wikipedia

Built world’s first commercial AC system

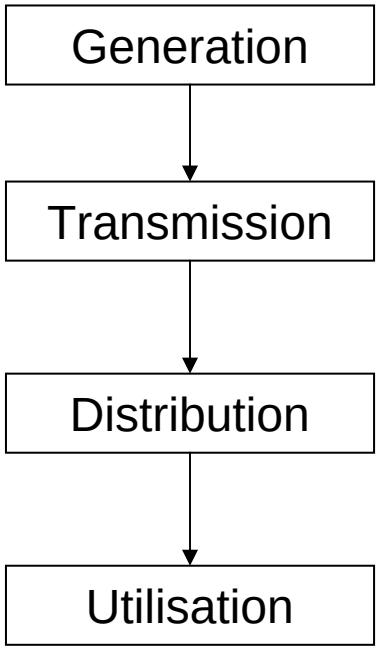
Thomas Alva Edison



Courtesy: Wikipedia

"Genius is one percent inspiration, ninety-nine percent perspiration."

What is Power System?



Control of these functions at appropriate levels

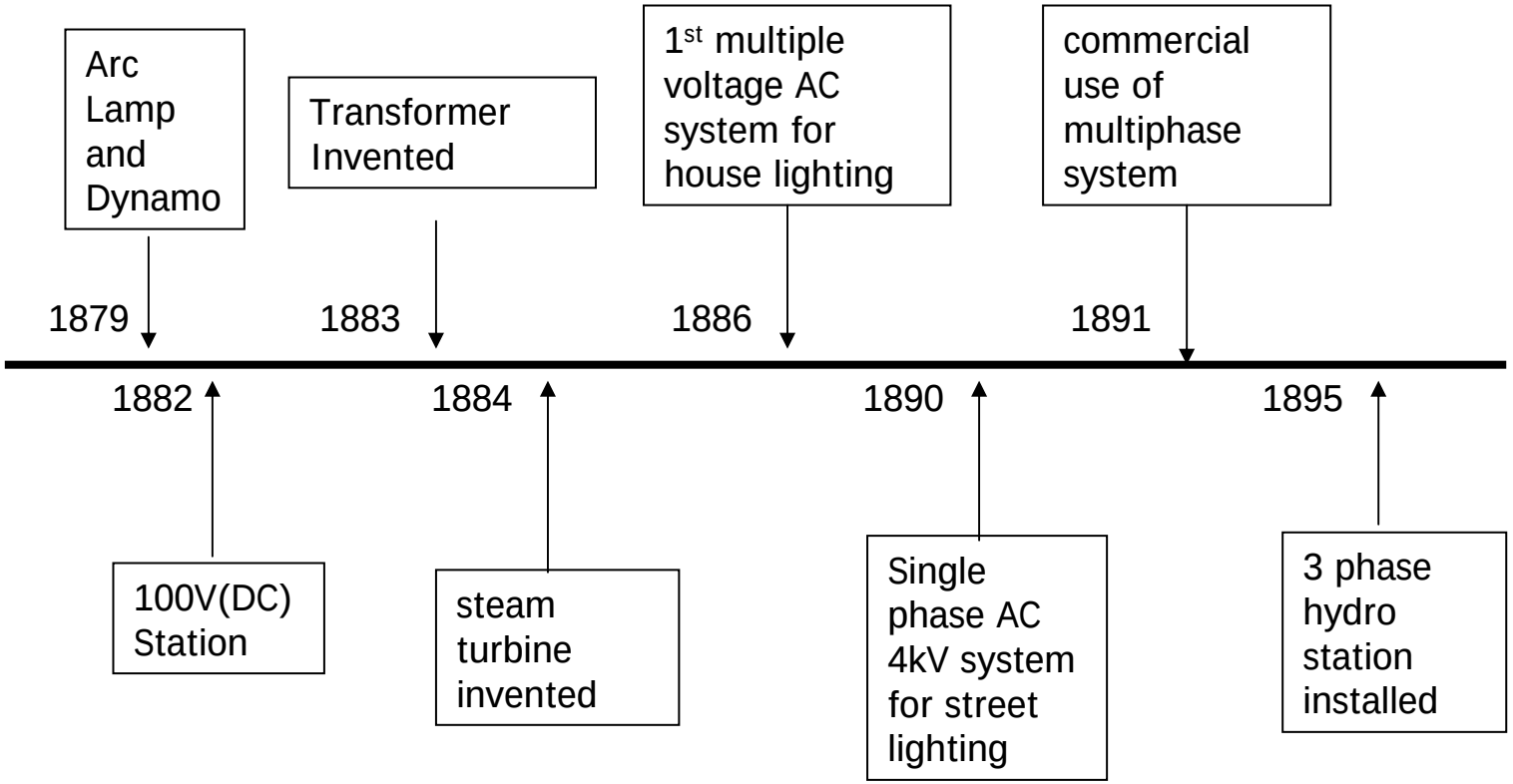
"I worked on aerospace problems for many years before converting to power systems, and, in my opinion at least, power problems are tougher in many respects."

"The number of variables in a power system is huge, and many types of uncertainties are present."

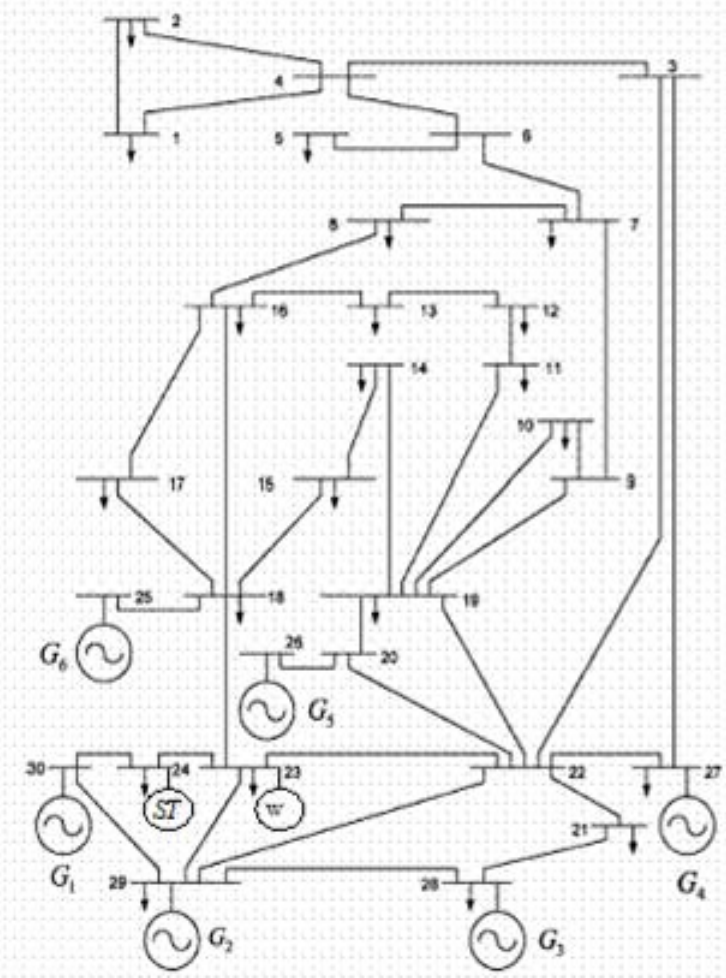
"Few if any aerospace problems yield such a challenging set of conditions."

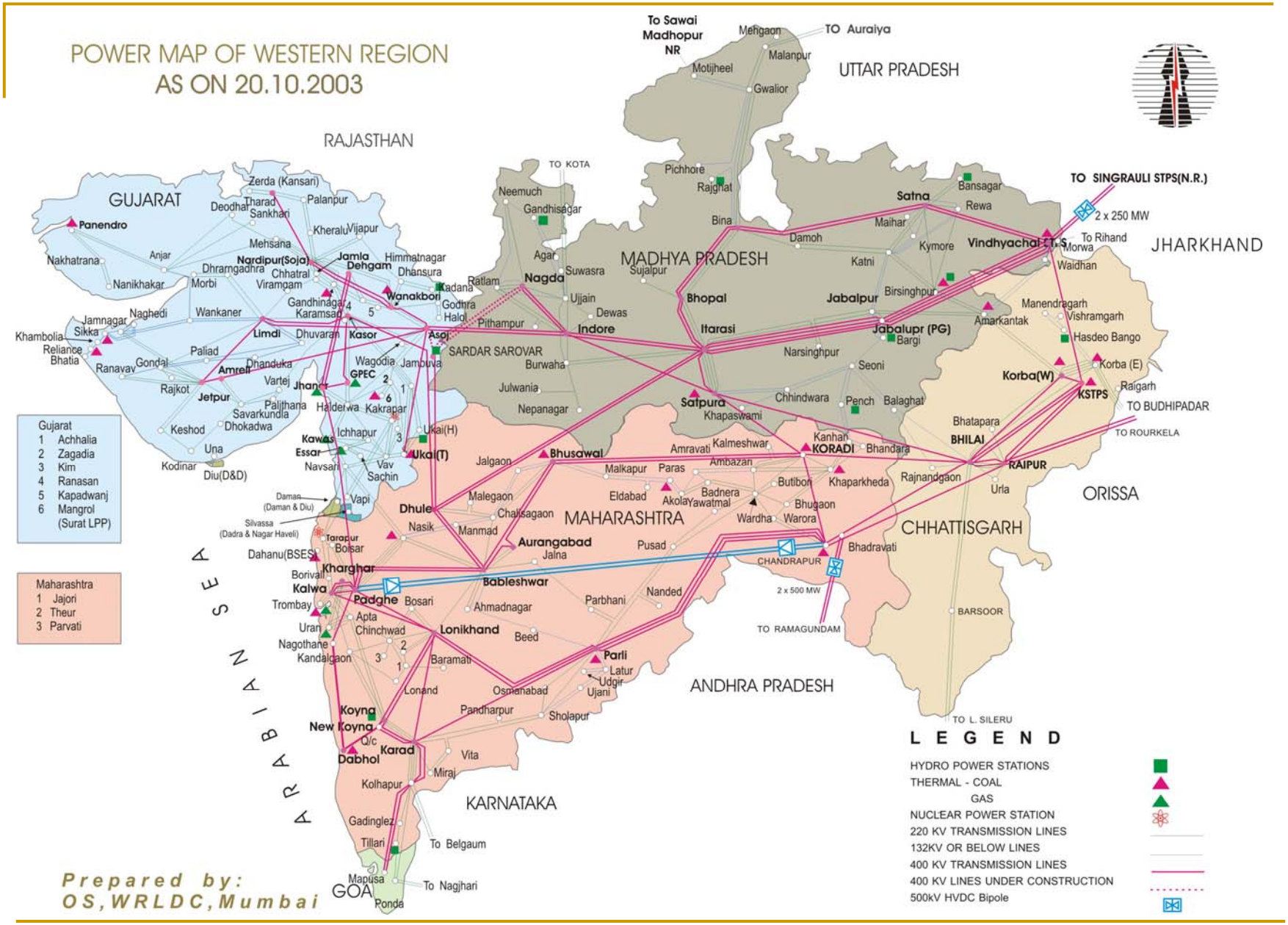
Fred C. Schweppe (1934-1988)
Professor of Electrical Engineering, MIT

Brief History



Single Line Diagram Representation





Power Generation

Courtesy: Google Images

Power Transmission

Courtesy: Google Images

Substation

Courtesy: Google Images

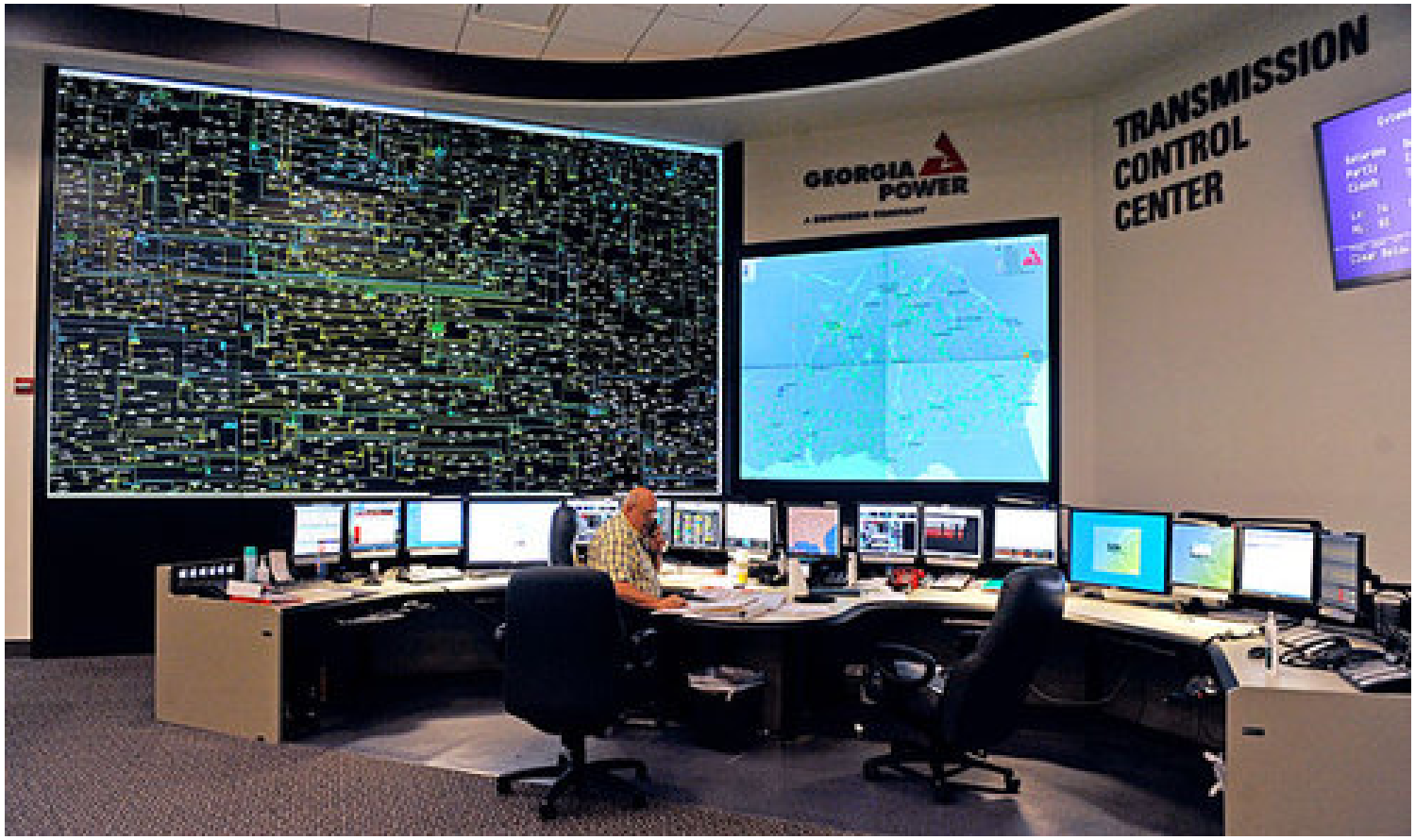
Power Distribution

Courtesy: Google Images

Power Distribution!!! (or Confusion??)

Courtesy: Google Images

Power System Control



Courtesy: Google Images

Why AC Generation and Transmission?

- Economics!!! Easier and Cheaper to generate AC power and transmit
- Voltage (and current) transformation
- Efficient uitilisation: Cheap and effective AC motors

Topological Difference

- Transmission – Mesh (or Loop) (Why?)
  - Reliability: main concern
  - A contingency has system-wide effects
- Distribution – Radial (Why?)
  - Economics!
  - A fault has local disruption
  - Protection issues

Indian Scenario

- Salient features:
  - One of the largest interconnected power systems in the world
  - Installed capacity comparable with the largest power markets in the world
  - Member of VLPGO Association
  - Characterised by power deficit situation

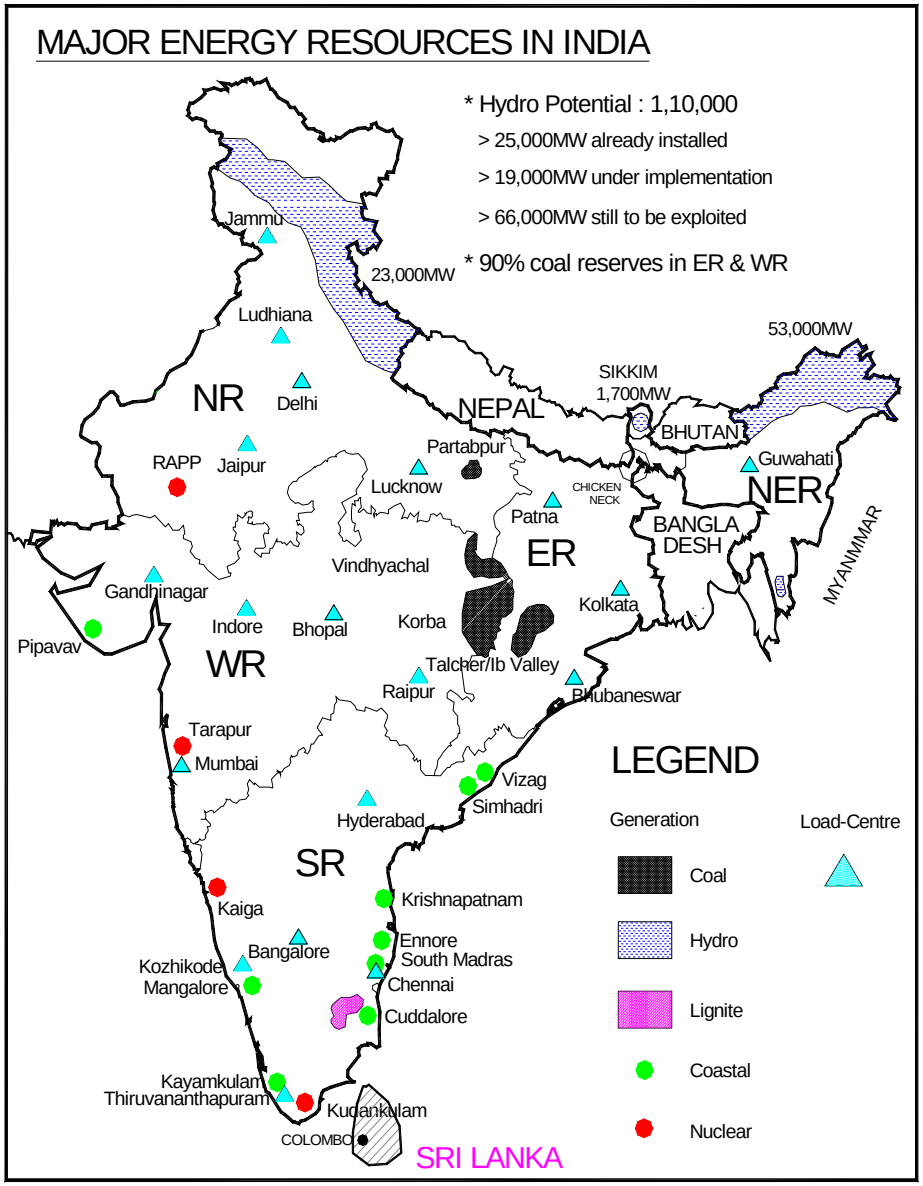
India: Power Facts

- Area :2,973,190 km^2
- Population : 1.25 billion
- Per capita consumption : 820 kWh
- Five regional grids
- Two synchronous grids
- Installed Capacity 205 GW
- Peak Demand ~129 GW

All India Installed Capacity

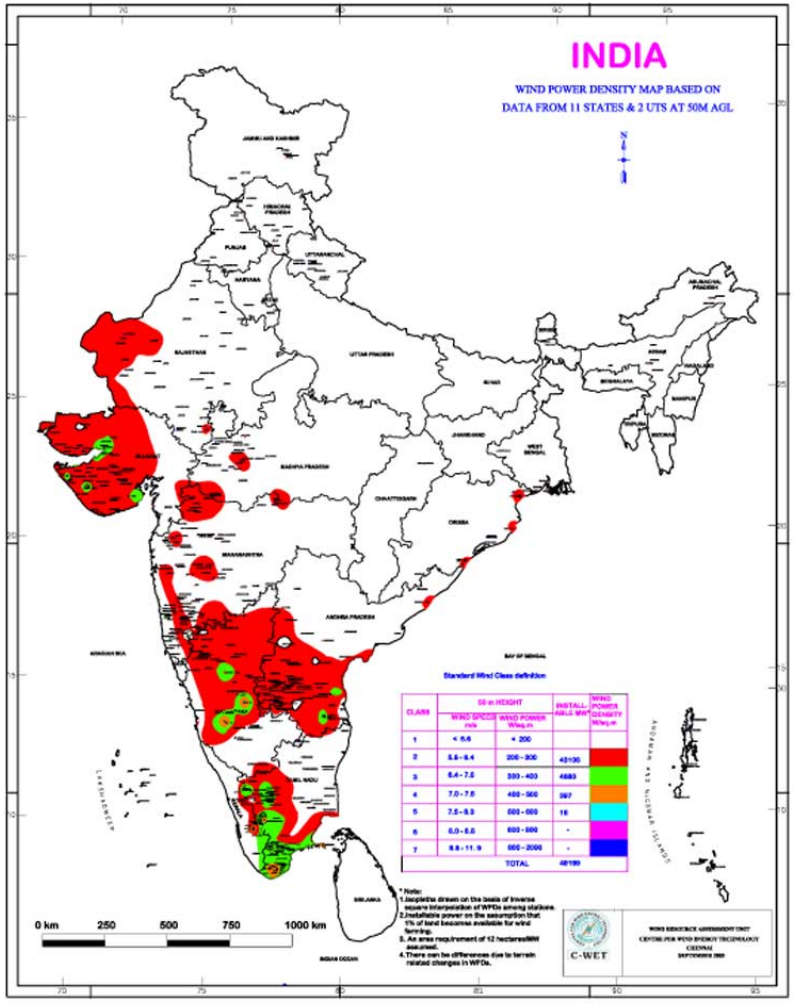
All India	Thermal				Nuclear	Hydro	RES@	Grand
	Coal	Gas	Diesel	Total		Renewable	(MNRE)	Total
MW	116333.38	18903.05	1199.75	136436.18	4780.00	39291.40	24832.68	205340.26
%age	56.7	9.2	0.6	66.4	2.3	19.1	12.1	100.0
@ Based on data as on 31.05.2012.								

Courtesy: www.cea.nic.in



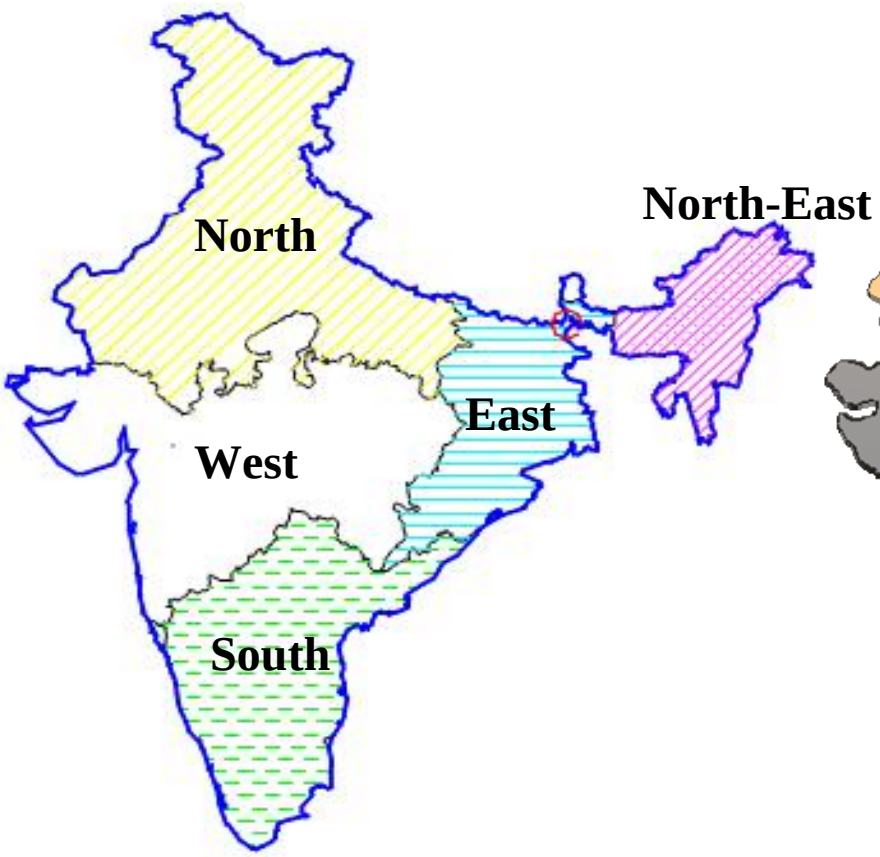
Courtesy: cea.nic.in

Wind Potential in India



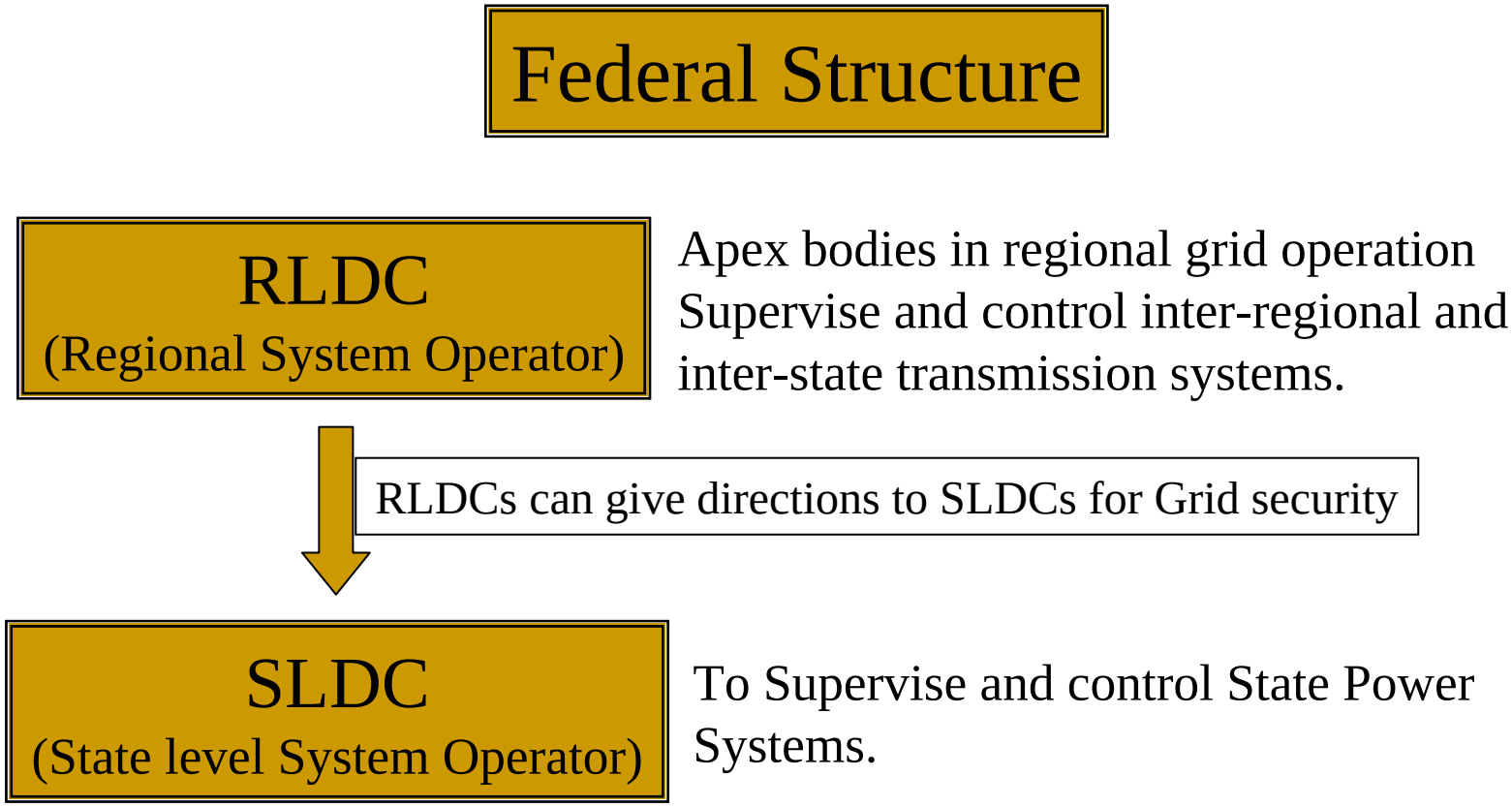
Courtesy: http://www.inwea.org/

Electricity Regions

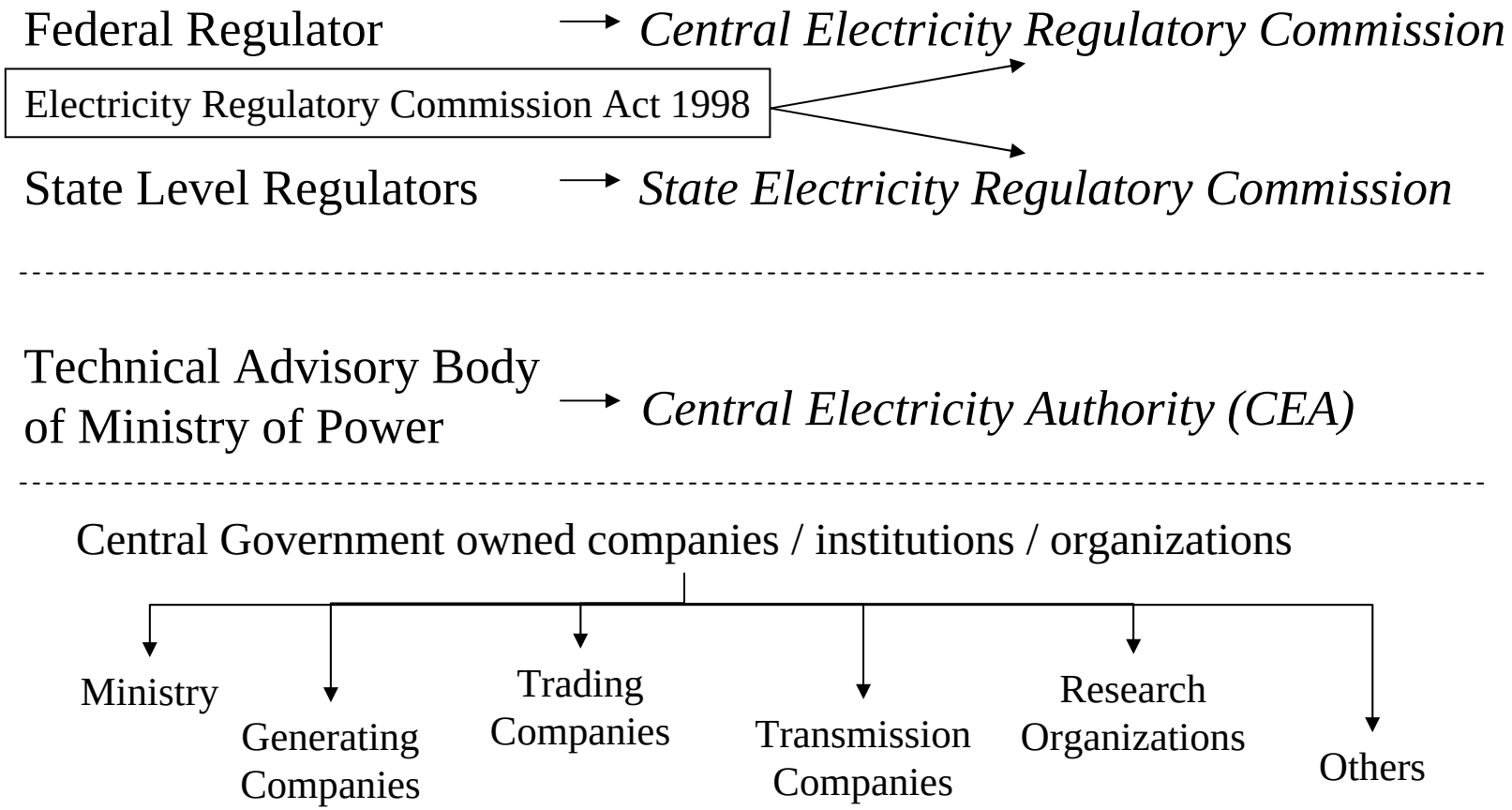


Synchronous Regions

Power Sector in India: Structure



The Institutional Framework

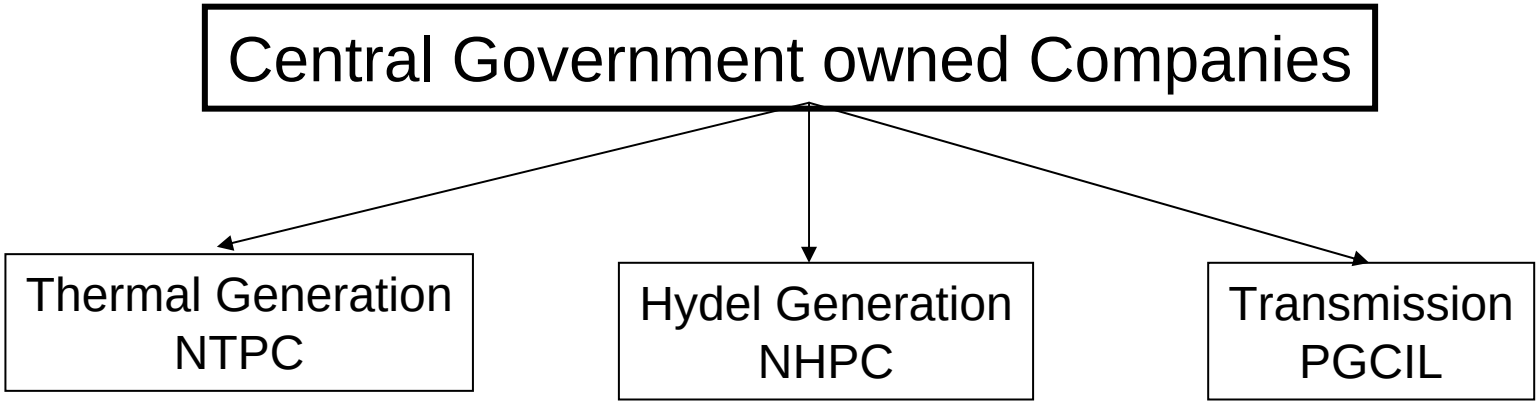


Central Level Organizations

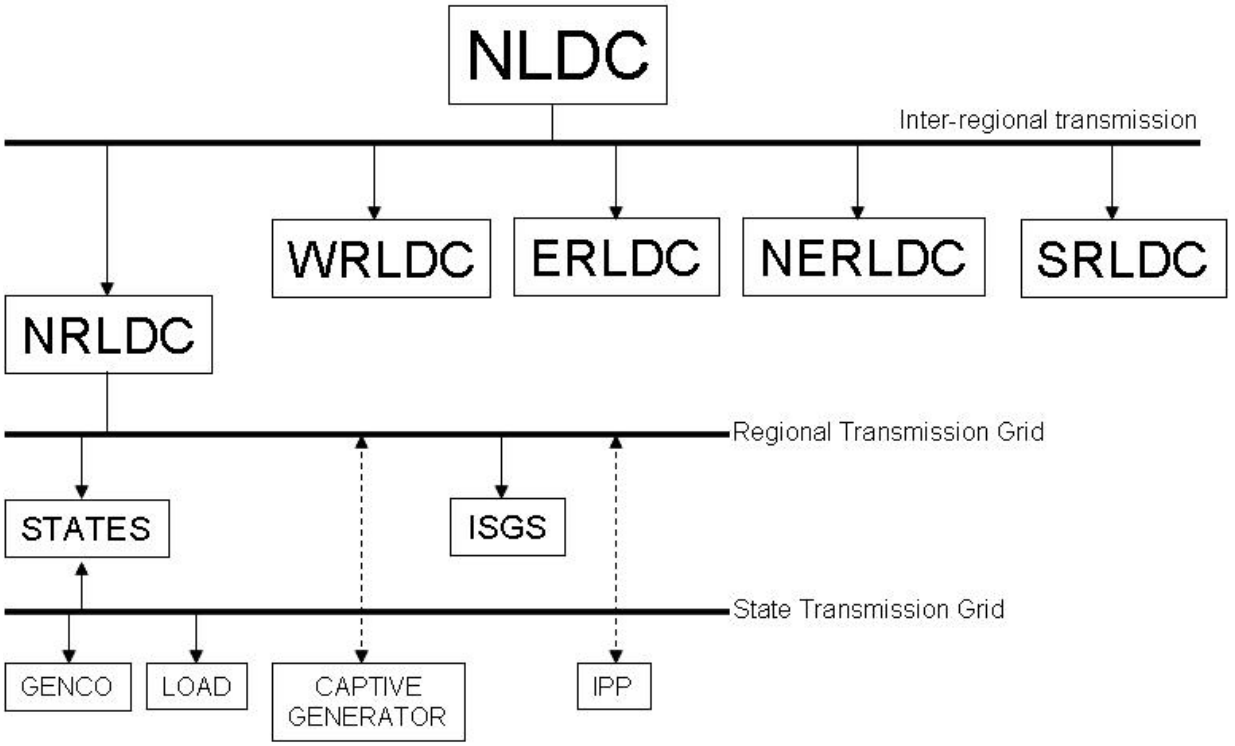
Federal Regulator: Central Electricity Regulatory Commission

State Level Regulator: State Electricity Regulatory Commissions

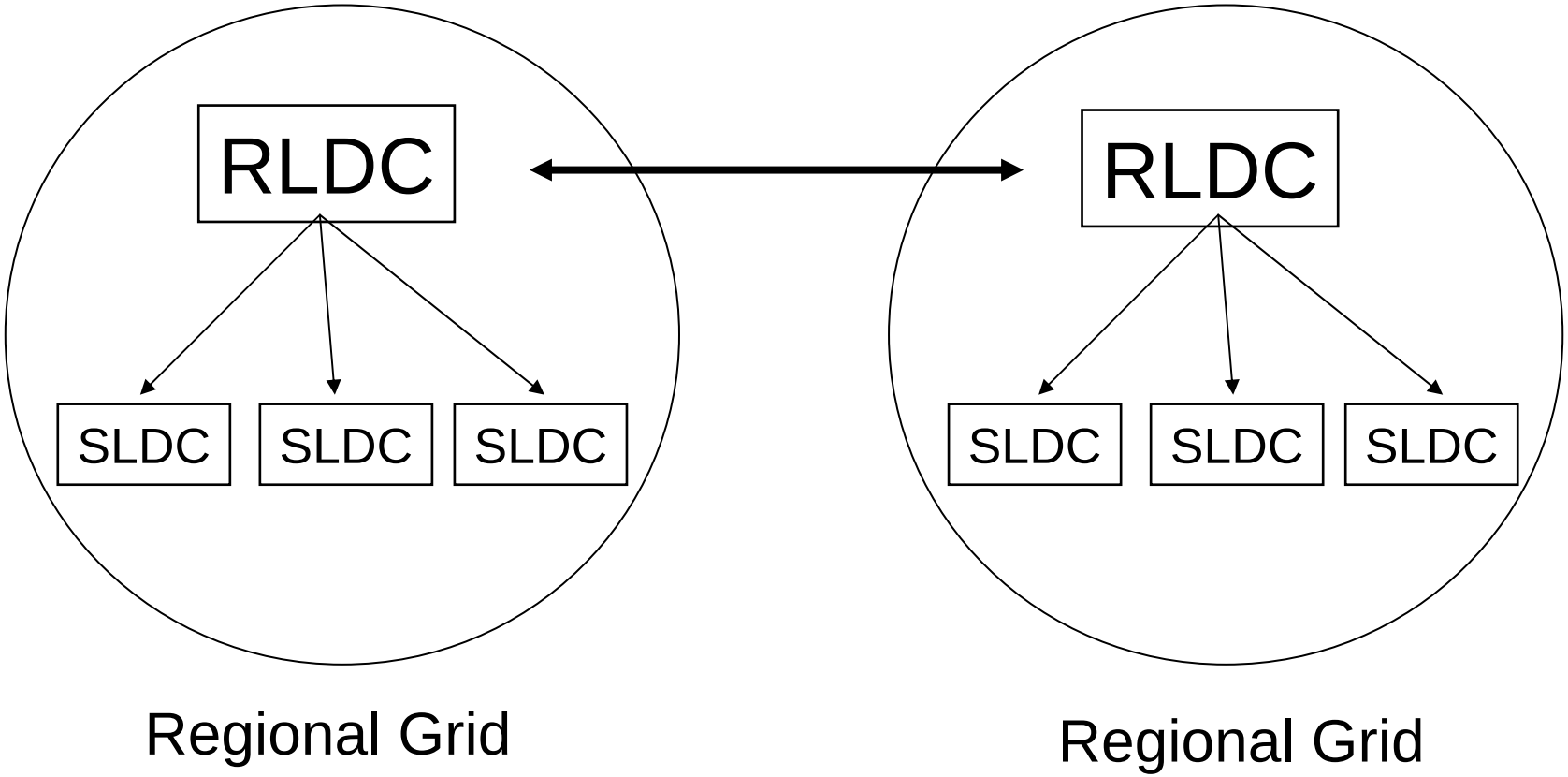
Technical Advisory Body of MoP: Central Electricity Authority



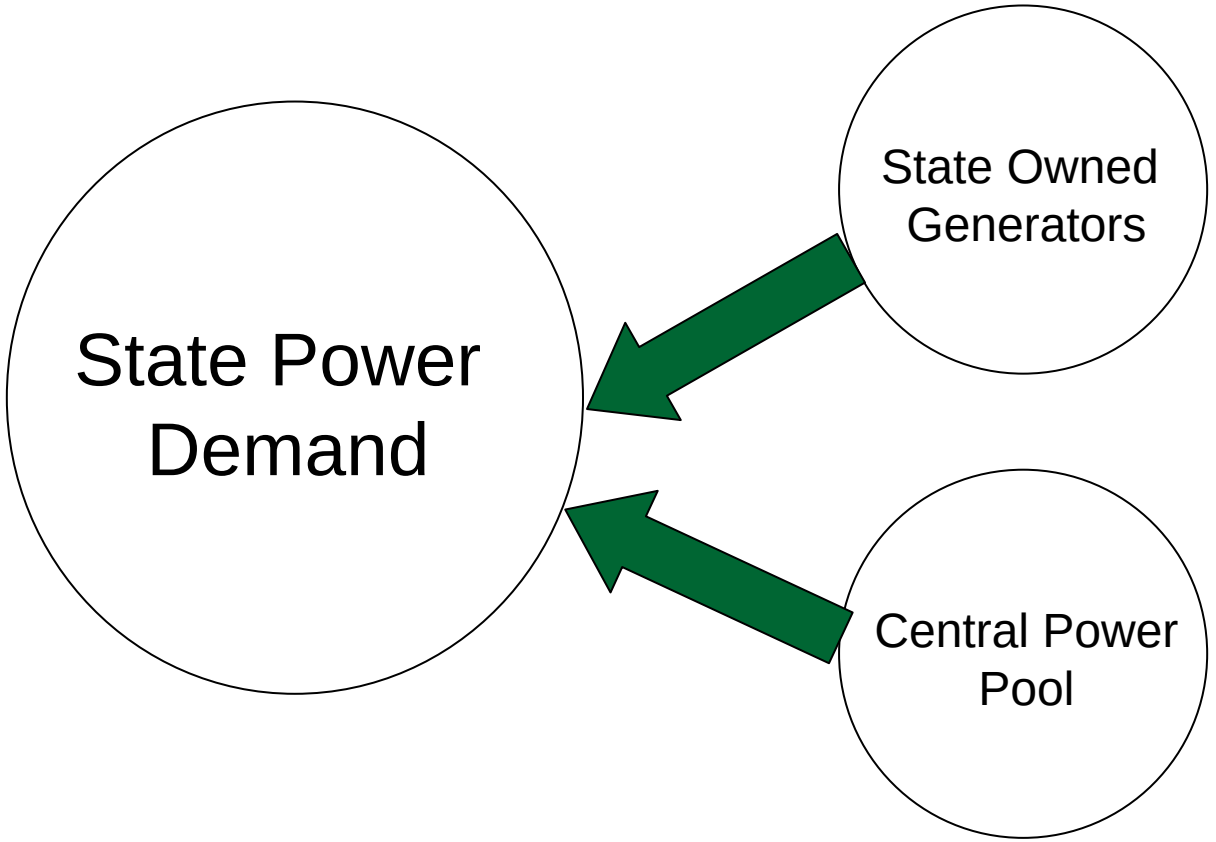
Operational and Ownership Hierarchy



Electric Supply Industry: Structure



State Power Demand



EEL 303: Course Contents

- Revision of fundamentals and per unit analysis
- Transmission line modeling, characteristics and performance
- Power flow analysis
- Fault analysis
- Symmetrical components and sequence networks
- Economic operation of power systems
- Power system stability