



Trends in the Electric Power Generation Industry

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Agenda

- ✍ History
- ✍ Supply Chain Map
- ✍ Integration Trends
- ✍ Deregulation
- ✍ Volatility
- ✍ Capacity
- ✍ Analysis and Projections



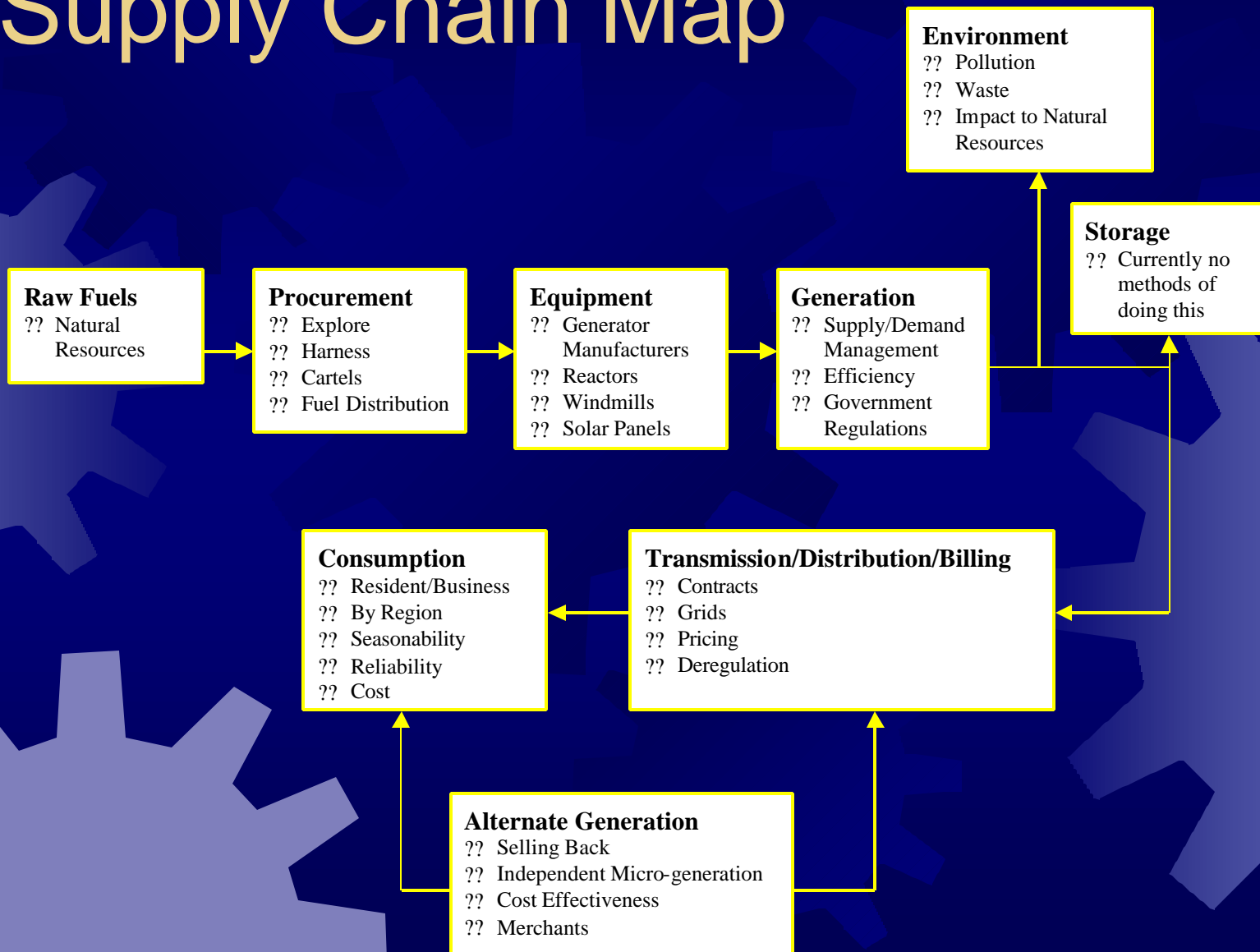
History

- ✍ Thomas Edison 1882
- ✍ Investor Owned Utilities
- ✍ Municipal Utilities
- ✍ Regional Grids

Historical Integration Map

Exclusive Monopoly			
Retailers	PG&E	California Edison (CE)	SD G&E
Distribution			
Transmission			
Generation			

Supply Chain Map



Integration Trends

Deregulation						
Retailers	PG&E		CE		SD G&E	
Distribution						
Transmission	CAL ISO					
Power Exchange	CAL PX/CAL ISO					
Generation	PG&E	CE	SD G&E	Enron	Reliant	El Paso

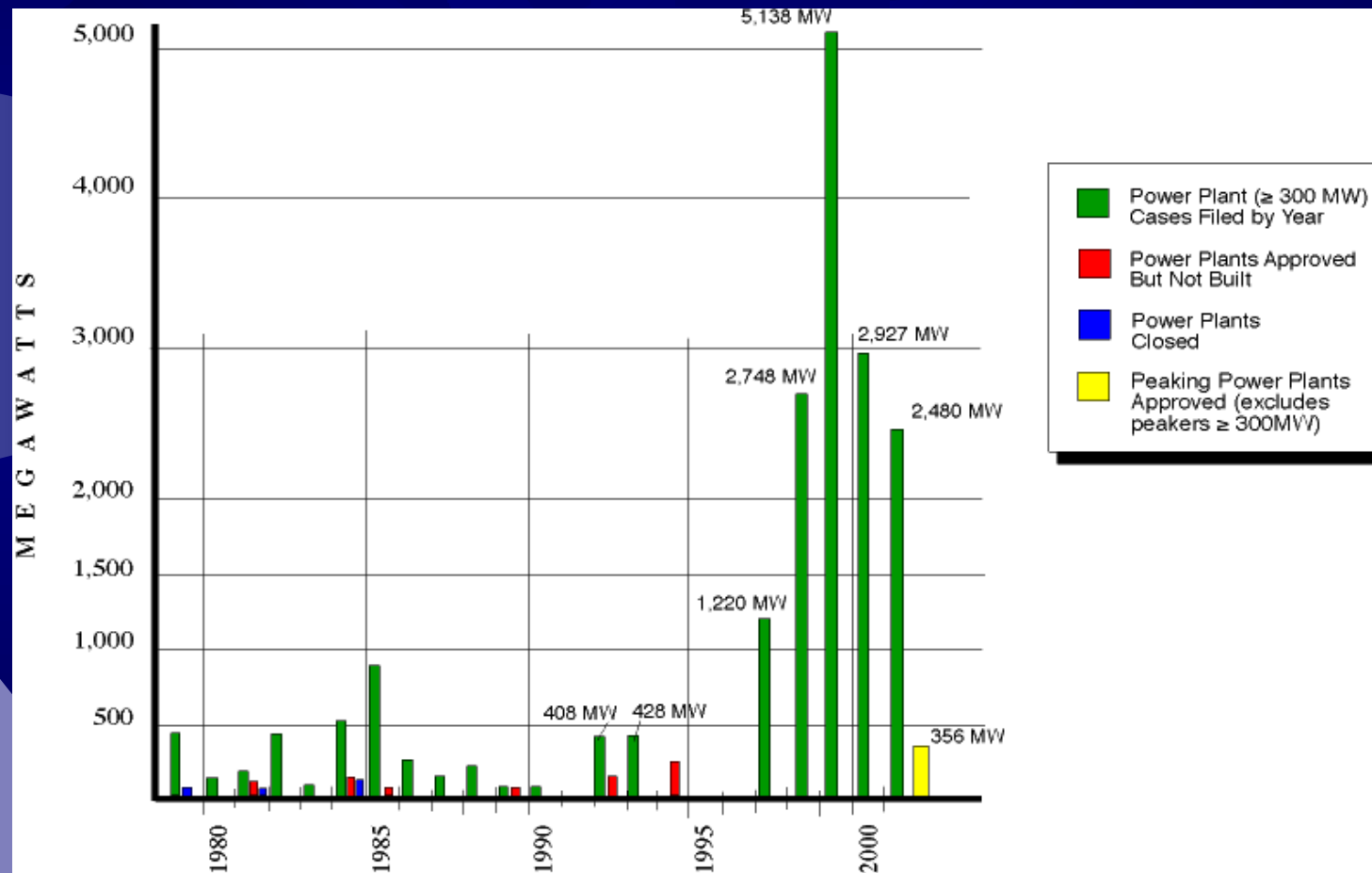
Deregulation

- ✍ Generation
- ✍ Power exchange -CalPX
- ✍ Transmission –Cal ISO
- ✍ Distribution
- ✍ Retail

Volatility

- ✍ Cyclical nature of generation capacity and hence electricity prices
- ✍ Use of System Dynamics modeling to understand sources of volatility
- ✍ Long delays cause oscillations
 - ✍ Construction and equipment procurement
 - ✍ Incentives to expand capacity are only strong when prices are high

Capacity



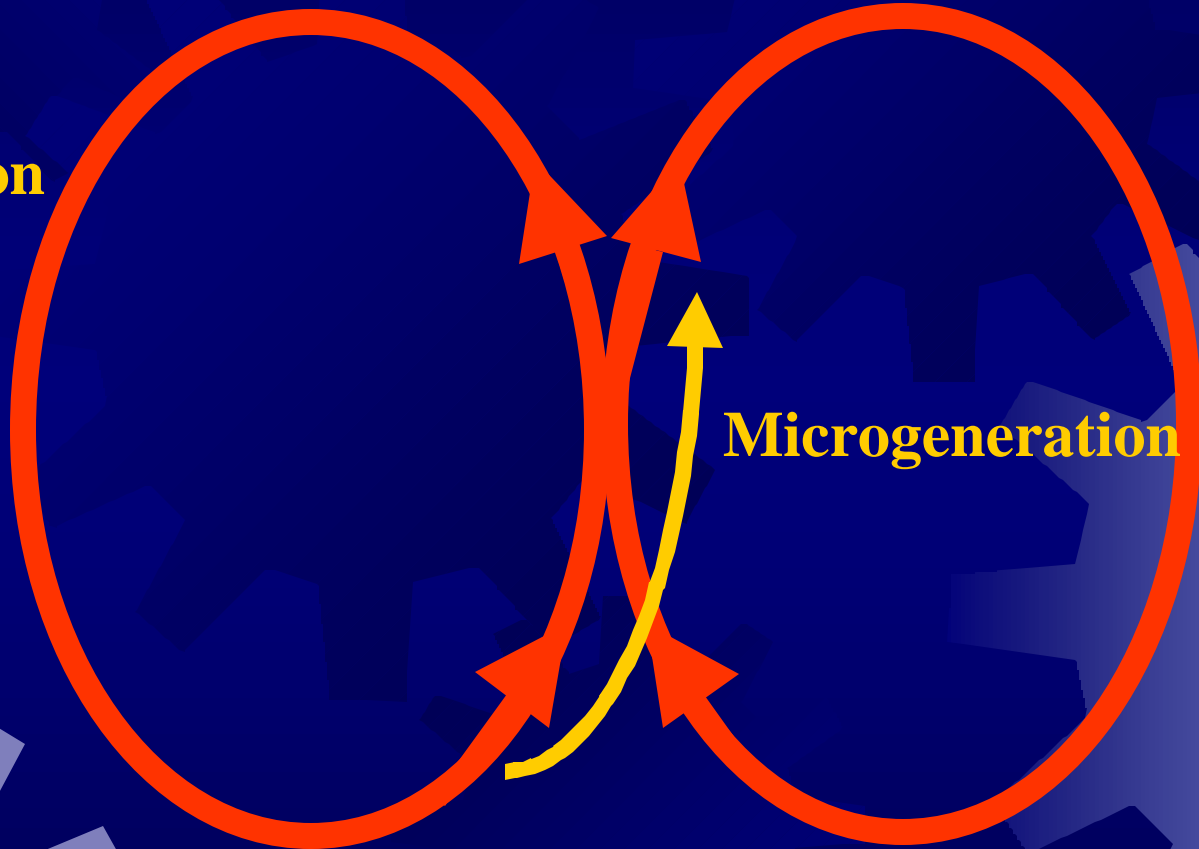
Capacity

- ✍ Capacity planning has moved from the hands of the utilities to generators
- ✍ Power generation investment on a global scale
- ✍ Fuel choice concerns and questions
 - ✍ Environmental issues
 - ✍ Cost considerations

Electricity Double Helix

Deregulation

Microgeneration



Analysis and Projections

Deregulation



- ✍ Utilities continue to divest themselves of generation assets
- ✍ Opened up M&A and markets
 - ✍ Further consolidation in generation
 - C10 = 33%, '92 now at 39% could go as high as 51%
 - ✍ Retail markets will open up as well





Analysis and Projections

Economics



Globalization

-  Diversify fuel sources and foreign dependence
-  Entering new and growth markets & economies of scale

Pendulums of power

-  capacity constrained times good for wholesalers until caps
-  capacity glut times good for retailers since they have bargaining power and customers

Industrial growth and productivity

-  diverting cash to energy related issues
-  no longer incentive to deal with wholesalers



Analysis and Projections

Microgeneration

✍ Reliability and cost will increase investment in microgeneration

✍ Industry

✍ investing in collocation and cogeneration

✍ selling back to the grid

✍ Residential

✍ Back to the days of Edison

✍ Energy in every home



Analysis and Projections

Environment

- ✍ Kyoto protocol

 - ✍ International pressure

 - ✍ International sanctions

- ✍ Run out of oxygen before fossil fuels

 - ✍ pollution becomes the limiting factor

 - ✍ what will consumers demand and be willing to pay for?

- ✍ Conservation and alternative fuels