A Transmission Primer for Government Officials

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Outline

- A Quick History Lesson
- Why transmission is important
- How transmission works
  - Cost,
  - new technologies,
  - west/east interconnection
- Policy and jurisdiction
  - FERC
  - RTOs
  - The state role

A Quick History Lesson

- The earliest power plants did not rely on any transmission but were really a form of distributed generation.
- By the early 20th century AC transmission lines were developing. The earliest carried power in northern New York State.
- Within a few years, electricity had become an interstate network industry.

A Quick History Lesson

- Supreme Court decisions in the 1920s affirmed that electricity was in interstate commerce and subject to federal jurisdiction.
- Over time, Federal law and FERC orders defined the specific role of federal and state governments.

Quick History Lesson

- Major federal laws:
  - PURPA
  - Energy Policy Act of 1992
- Major FERC orders
  - 888
  - 2000
  - Recent action

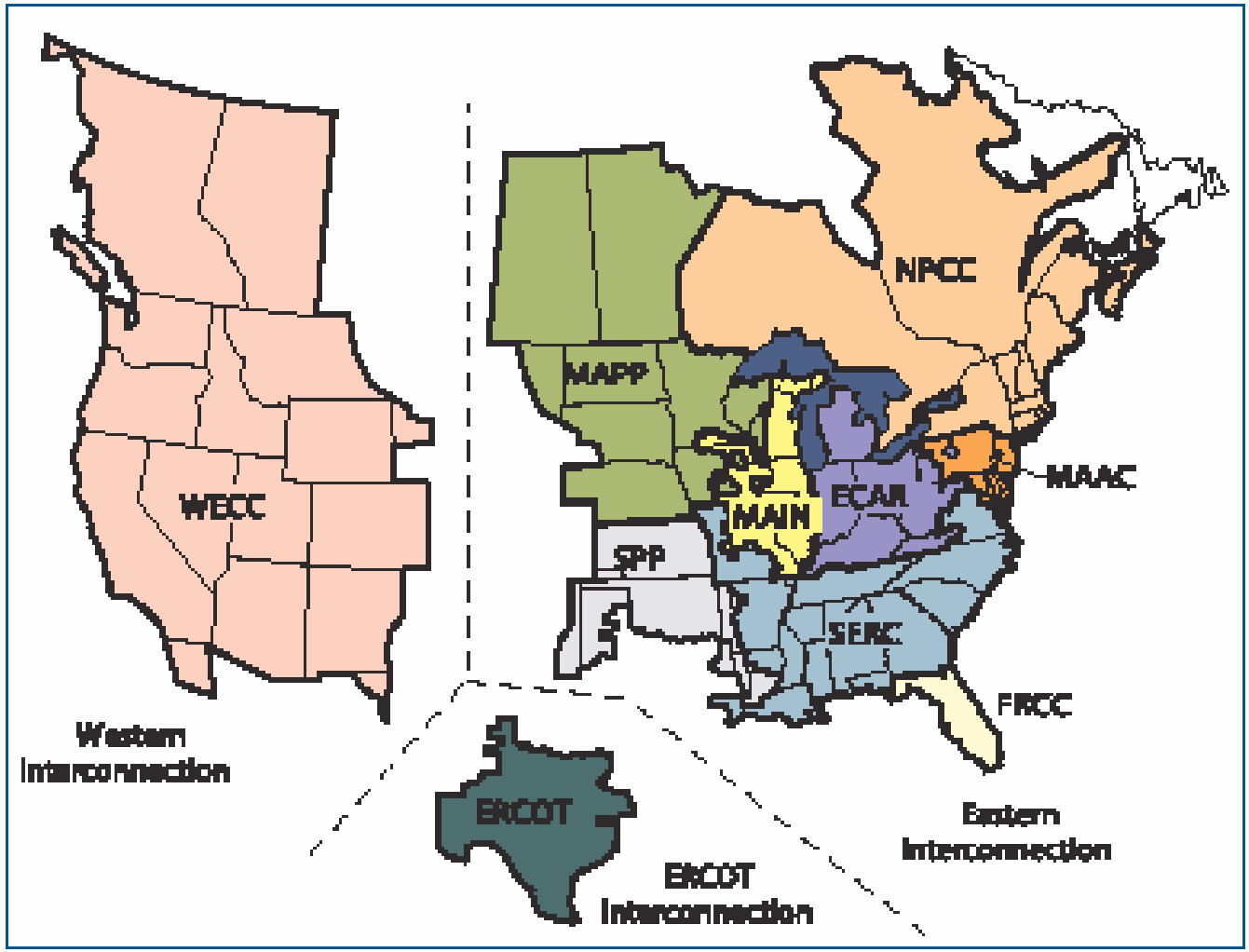
Transmission is Important

- Reliability
- Flexibility
- Economics
- Competition

Reliability and Transmission

- Adequacy
  - Minimizes amount of capacity needed for sufficient reliability
- Stability
  - Maximizes operator capability to react to real time contingencies
- (NERC) North American Electric Reliability Council
  - Sets key standards for reliability
  - Regional reliability council monitor performance

Interconnections, NERC, Regional Reliability Councils



Flexibility

- Gives operators access to a big diversity of resources.
  - Coal
  - Nuclear
  - Wind
- Load Growth not uniform

Economics

- Transmission gives operators access to many plants, and allows access to least cost resources.
- The least cost way to serve load changes from hour to hour, year to year

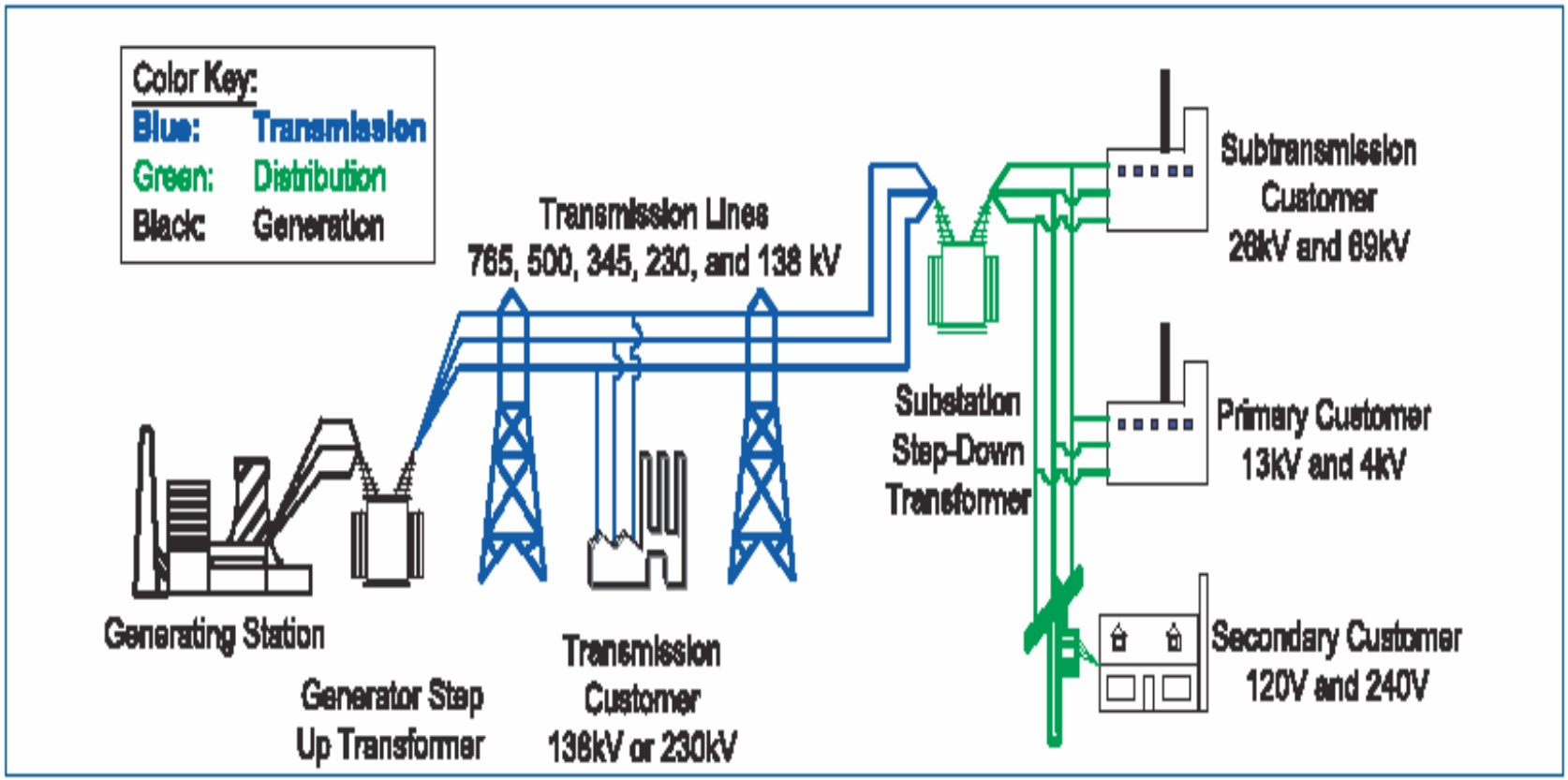
Competition

- Transmission gives many power plants access to markets. Competition among those plants creates healthy competition.
- Energy, Capacity, Ancillary Service Markets work best with unconstrained system
- Cost to resolve constraints sometimes exceed value

How Transmission Works

- A network system
- Power flows based on generators, lines available and loads in real time
  - Limited ability to control flow
  - Operators can control loads, generators, lines
- Control Areas
- Regional Transmission Organizations

Elements of the Power System



Cost of Transmission

- 115 kV and up
- Rates: ~10% of rates
- Cross country cost, plus
  - Terrain
  - Right of way acquisition
  - Substation additions and modifications
  - Interconnections
  - Other devices

Transmission Costs

Transmission Facility	**Typical Capital Cost**
New 345 kV single circuit line	$915,000 per mile
New 345 kV double circuit line	$1,710,000 per mile
New 138 kV single circuit line	$390,000 per mile
New 138 kV double circuit line	$540,000 per mile

Value of Transmission

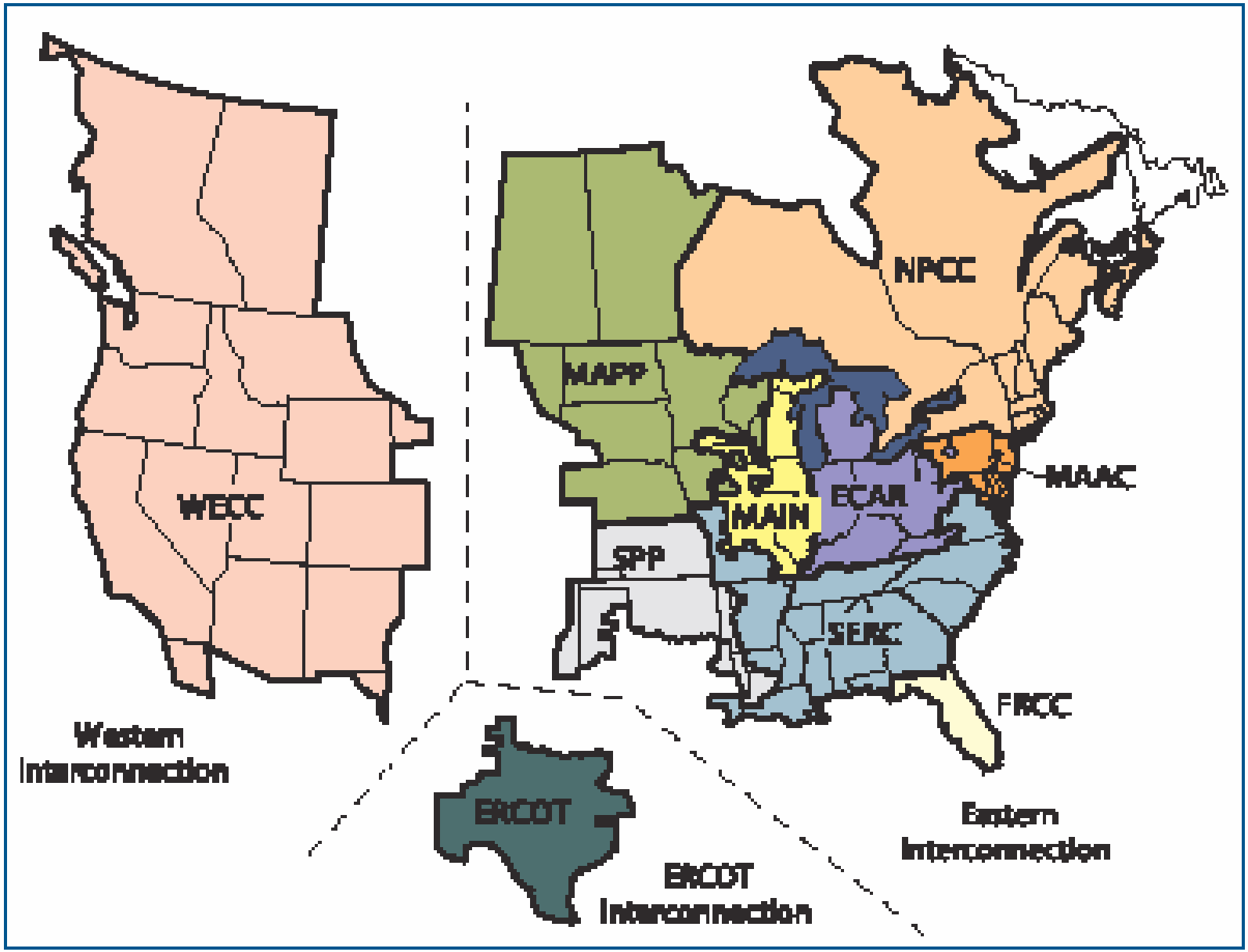
- Depends on purpose and alternatives
- Purposes we have already discussed
- Value depends on alternatives
  - Growth: can it be slowed or stopped cost-effectively
  - Congestion: can it be solved cost-effectively by load center resources
- Only some utility engineers, cost recovery systems are organized to assess value

New Technologies

- Extra High Voltage (500, 765 kV)
  - More power in a given ROW
  - More prominent structure
- FACTS (flexible AC transmission system)
  - Gives operators more control over power flows
- High Temperature Superconductivity
  - Ceramic conductor
  - High power density
  - Applications still developing

Interconnections and DC

- AC system is free flowing
- Grid is partitioned into four distinct areas
  - West, East, Texas, Quebec
  - Reliability is primary reason
- Power can flow across partitions, through AC-DC-AC converters


NPCC
MAPP
WECC
MAIN
ECAR
MAAC
SPP
SERC
FRCC
Western
Interconnection
ERCOT
ERCOT
Interconnection
Eastern
Interconnection

Policy and Jurisdiction

- Transmission: Interstate Commerce
  - Federal regulation of rates
- Transmission: Local impacts
  - State regulation of siting
- Federal Energy Regulatory Commission
  - Tariffs
  - Market monitoring
  - No oversight over reliability standards
- State PUCs or Siting Authorities

Jurisdiction

- Federal Energy Regulatory Commission
  - Tariffs
  - Market monitoring
  - RTOs
  - No oversight over reliability standards
- State PUCs or Siting Authorities
  - Multi-state entities or regional state comm.
  - Need
  - Emerging disconnect between transmission and resource planning and investment

RTOs

- Regional markets, regional decisions
  - Cost allocation
  - System needs
  - Solution options
  - Detailed, real time market oversight
  - Reliability standards
- Range of levels of control, influence

State Policy Issues

- Transmission siting
- Planning at the state level
- Planning and coordination at the regional level
- Demand response programs
- Matching states' generating resources (coal or wind) with new or existing transmission (economic development and transmission).

What's Next?

- State/Federal jurisdictional discussions will continue.
- Continuing need to balance demand response/efficiency measures with the need for new transmission and generation.
- Transmission and power system planning: the role of state, federal government in such planning.
- Increased need for regional collaboration.