

# The Changing Mix: Reliability and Infrastructure Needs

NCSL Clean Power Plan Policy Workshop

**PRESENTED BY**

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THE **Brattle** GROUP

# Disclaimer

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# Reliability and Infrastructure issues are partially linked and both required longer term and shorter term considerations

## Infrastructure

- Traditional: Power Plants, Transmission and Distribution networks
- Newer: Demand-side measures including DR enabling technology and DG, storage
- Traditionally requires long lead times
  - Often large and complex undertakings
  - Complex permitting and PR/stakeholder issues
  - Complex planning and multi-stakeholder financing issues
- Typically associated with resource adequacy issues (capacity)

## Reliability

- Often associated as “keeping the lights on”, i.e. making sure the system is in balance in the short run
  - Ancillary services, markets, operational procedures, forecasting
- Changes to market rules can involve significant and lengthy stakeholder processes
  - Typically less time-consuming than infrastructure, but not immediate

Can be a substitute for

# What is the impact of the CPP on infrastructure and reliability? It depends...

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- The final CPP provides many options for states to comply
  - Rate-based versus mass-based approaches
  - Various possible degrees of cooperation/trading are possible
- Under some scenarios, implementing the CPP could lead to significant incremental infrastructure needs and potential local/regional reliability issues
  - Part of the problem is that there are many possible constellations of how states choose to comply
  - Part of the problem may also be that states choose approaches that are driven by politics more than by economics
- Even recognizing that politics/policy shapes the future energy system, the impact of the CPP also depends on a “realistic” view of the “Business As Usual” evolution of the electricity system

# The compliance path likely impacts both infrastructure needs and reliability issues

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- State-specific approaches (for example state-measures, mass-based) could lead to more significant shifts in the local production mix and hence require more infrastructure/reliability upgrades
- Coal-retirements could be much more severe in a single-state compliance approach than under regional (or super-regional) trading
  - Might require emissions reductions through coal plant retirements even though emissions reductions could be accomplished at lower cost from other retirements in a regional/national trading program
- On the other hand, a regional or super-regional approach might create opportunities for renewable generation being clustered in high-resource quality areas and provide cross-state emissions reductions
  - Might require significant infrastructure

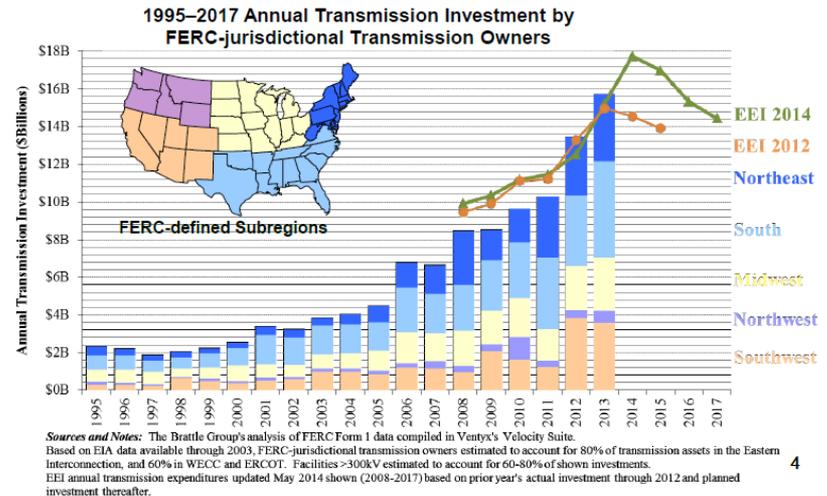
# There may be infrastructure and reliability issues, but they may not be due to the CPP

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- A fundamental transformation of the U.S. electricity industry is underway
  - Cheap natural gas (and plenty of it)
  - Cost declines of renewable energy sources
  - Many more opportunities for distributed supply and demand solutions
- This transformation will create non-trivial infrastructure needs
  - Transmission upgrades to access high quality renewables
  - Distribution system changes to accommodate distributed resources
  - Coal (and nuclear) retirements due to low gas prices potentially mean new plant investment is needed
- The CPP will probably accelerate some aspects of this transformation, but it is likely not the (primary) cause of the transformation (even though climate change issues are of course an important driver)
- Given long lead times for both infrastructure (especially T&D) and to some extent market design changes, states should plan for a transformed future system rather than think about extending the current system into the indefinite future

# Example 1: Transmission investments

- The U.S. has recently underinvested in its T&D infrastructure
  - Advanced age likely requires significant upgrades over the coming decade (\$12-16 billion per year over the next decade compared to less than \$5 billion on average over the past decade)



- Renewable resources likely require incremental investments to allow accessing those resources
  - CREZ lines in Texas are one example, but significant related activity elsewhere
- Overall transmission investments to accommodate more RE likely higher than without RE, but most of additional RE not driven by CPP
- Planning and paying for transmission remains complex
  - FERC Order 1000 designed to help to some extent
  - Given long lead times and the likely ultimate role of RE, working on upgraded transmission system should likely be a top priority

## Example 2: Planning for reliability

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- Essentially all U.S. electricity systems will move towards higher shares of variable renewable generation, more distributed supply and demand resources and a different mix of fossil/non-RE sources
  - Increased challenges due to more variability and new sources of forecast errors
  - Ultimately (down the road) potential challenges due to loss of inertia (rotating mass from conventional generation)
  - Potential loss of “reliable” capacity resources
- ISOs/RTOs/utilities are already adapting and likely will continue to adapt (they are good at this!)
  - Improve forecasting quality
  - Make some investments in fossil resources to increase flexibility
  - Rethink ancillary services (types, levels)
  - Encourage participation of non-traditional resources (DR, RE)
  - Emerging technologies will likely provide additional tools (storage, smart inverters, etc.)

# Summary

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- The U.S. (and global) electricity industry is going through a profound transformation
- Unlikely that the CPP does more than somewhat accelerate this transformation
- Along the transformation, infrastructure and operations will likely have to change significantly
  - Transmission has long lead times, so investments that will likely need to be made should be emphasized early
  - Short-term challenges can likely be handled without major cost implications, through a mix of operational/market rule changes and smaller investments
  - Both require careful planning and likely more cross-state/market coordination than in the past
    - Regional transmission investments
    - Market and operational rules increasingly involve multiple states
- States would likely benefit from supporting cross-state activities along these lines.

# Jurgen Weiss bio

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## **JURGEN WEISS**

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Dr. Weiss, head of The Brattle Group's climate change practice, is an energy economist with 20 years of consulting experience. He specializes in issues broadly motivated by climate change concerns, such as renewable energy, energy efficiency, energy storage, the interaction between electricity, gas and transportation, and carbon pricing and the impact these changes have on existing assets, market structures, and long-term planning needs for electric utilities in North America, Europe, and the Middle East.

His consulting and expert testimony experience have focused on the impact of changing regulatory and incentive frameworks for low-carbon technologies, on the economics of both renewable generation sources and existing generation assets, and on the design of efficient incentive mechanisms for renewable energy, energy efficiency, energy storage, and climate change measures.

Jürgen has advised clients and authored reports on the design of incentives for renewable energy, the impact of renewable energy on existing wholesale markets, the role energy storage might play in future energy systems characterized by an increasing share of renewable energy, the optimal choice of alternative approaches to lowering energy consumption and/or GHG emissions, and the implications of a changing energy system on wholesale market design. He has also been active in determining the value of electric power assets in a quickly changing market environment.

Jürgen was born in Germany, received an undergraduate degree in European Business Administration from the European Partnership of Business Schools, an MBA from Columbia University and a PhD. in Business Economics from Harvard University. He has lived, studied and worked in Germany, France and the United States.

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