Welcome to Today’s Webinar: Uncovering the Transmission Opportunities Created by the Clean Power Plan

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Chris MacCracken, Principal
Kiran Kumaraswamy, Senior Manager
Kenneth Collison, Vice President
Today’s Featured ICF Speakers

Chris MacCracken is a Principal with ICF. He directs studies examining the impacts of environmental regulation on emission, power and fuel markets, compliance planning, and generating unit valuations. Chris’ clients include electric utilities, IPPs, industry associations, and non-profit policy organizations. He has led ICF’s support for numerous engagements, including RGGI’s recent Program Review and NRDC’s assessment of CO₂ standards for existing sources. He is currently leading projects evaluating the potential impacts of the proposed Clean Power Plan. Chris is also the editor of ICF’s quarterly ICForecast publication.

Contact Information:
chris.maccracken@icfi.com
+1.703.934.3277
Kiran Kumaraswamy has expertise in transmission planning studies, transmission asset valuation, due diligence, locational marginal price (LMP) forecasting, merchant transmission investment assessment, and power systems modeling. He also specializes in generation interconnection assessments, estimation of transmission congestion, North American Electric Reliability Corporation (NERC) reliability standards compliance, and benefits of regional transmission organizations (RTO) in deregulated energy markets. Prior to joining ICF, Mr. Kumaraswamy worked on the dynamics of distributed generation (DG) systems where he studied the modeling of fuel cells and microturbines related to power generation.

Contact Information:
Kiran.Kumaraswamy@icfi.com
+1.703.934.3623
Today’s Featured ICF Speakers

Ken Collison, is a Vice President at ICF International and currently leads the Transmission and Ancillary Services Group within Energy Advisory Solutions. Mr. Collison assists clients in various aspects of power markets assessments, including power system planning and analysis, power markets restructuring, reliability and economic studies, and transmission and ancillary services valuation. Mr. Collison also supports clients as an expert witness on electric transmission issues.

Contact Information:
Kenneth.Collison@icfi.com
+1.703.934.3806
The Bottom Line

CPP-driven retirements and changes in generating resource patterns can alter transmission flows and impact transmission security and overall system reliability.

ICF’s analysis indicates that the U.S. will require at least $1.5-$2.5 billion in additional transmission investments to maintain grid security under the draft CPP proposal.

— Overall investment level is manageable.
— Timeline for planning and constructing new infrastructure is a greater challenge.

Stakeholders will need to start their analyses as soon as there is clarity on final rule to identify and seize opportunities in the competitive transmission environment.
Clean Power Plan Essential Information

Proposed CPP regulates existing units through state-level CO\textsubscript{2} emission rate standards.

EPA modeled four building blocks of compliance for each state, including system re-dispatch from coal to natural gas and increased renewable generation, both of which would directly affect transmission flows.

Each state can determine its own compliance plan. To the extent that states rely on these building blocks to comply, the recent trend of coal retirements will likely continue or accelerate.

The final rule is expected this summer. Initial state plans are due in 2016, with final plans due for states acting alone in 2017 and for states in multi-state compliance groups in 2018. The glide path for emissions reductions could begin as early as 2020.
CPP Proposal Effects: More Coal Retirements

*Change in coal retirements, EPA Base Case to Option 1 State Case*

Size of bubbles in the map indicate higher or lower levels of increase or decrease.

EPA’s Projections Indicate Significant Coal Retirements in Mid-West and South-Eastern Regions

Likely CPP Effects: Renewables Almost Double
Change in wind additions, EPA Base Case to Option 1 State Case

Size of bubbles in the map indicate higher or lower levels of increase or decrease

Likely CPP Effects: Imports Increase In Certain Areas

Change in total generation, EPA Base Case to Option 1 State Case

Size of bubbles in the map indicate higher or lower levels of increase or decrease

What Could These Changes Mean for Reliability?

And more specifically, transmission security

- Significant retirements and changes in generating resource mix, locations and dispatch can cause changes in transmission flow patterns /substation voltages.

- This leads to usage of the transmission system different from what it was designed for.

- Retirement of a single generating facility may be considered critical to the operation of the grid if it increases power flows over certain transmission lines to the point where it causes them to overload or creates variations in substation voltages beyond the reliable operating limits.

Power System Reliability

Resource Adequacy
- Maintaining sufficient capacity to meet customer needs in spite of scheduled and unscheduled outages

Transmission Security
- The ability to continue operating reliably following sudden and unexpected contingencies

Transmission Adequacy
- Having sufficient transmission capacity to move power across key interfaces and corridors in the system
System Operators Have Expressed Some Concerns on Potential CPP-Driven Transmission Challenges

Examples from ISO/RTO published or filed comments based on their own studies or views

**ERCOT**

“...[CPP] could result in transmission reliability issues due to the loss of generation resources in and around major urban centers...will likely require significant upgrades to the transmission infrastructure.”

**SPP**

“...the SPP region will experience numerous thermal overloads and low voltage occurrences...even with generation capacity added to replace the assumed EGU retirements, additional transmission infrastructure will be needed to maintain reliable operation of the grid...assessment revealed 38 overloaded elements that SPP would be required to mitigate with transmission planning solutions.”

**WECC**

“The expected reduction in traditional base-load resources will impact essential reliability services (e.g., voltage and frequency support, system inertia).”
Motivation for This Study

- There have been a range of regional assessments on reliability.

- Some have looked at transmission security in a more detailed fashion.

- But no study so far has tried to take a system-wide view to estimate the total size of the issue, and then to assess the challenge it poses to CPP implementation based on that projection.
Methodology: How We Estimated CPP-Driven Transmission Security Related Investments

- **Model future MISO economic retirements and builds**
  - Start with EPA’s CPP RIA assumptions, state-level compliance achieved without interstate trading

- **Model MISO under normal & contingency conditions in GE-PSLF**
  - Assume system conditions consistent with the MISO 2022 power flow case

- **Compare grid stresses under normal vs. contingency conditions**
  - Includes thermal violations, unsolved contingencies, voltage violations, and unsolved transformer contingencies

- **Identify solutions and associated costs**
  - Includes upgrading lines to double circuits, adding reactive power support devices, and upgrading existing transformers. Already approved projects excluded.

- **Extrapolate MISO investment to national level**
  - Based on retirements as a percentage of peak demand
Power Flow Modeling Allows for Detailed Transmission Security Analysis

Power Flow Modeling

• Power flow modeling and contingency analysis simulate actual transmission line flows to determine the ability of the system to operate reliably under many different system conditions.

• Similar to studies conducted by system planners to ensure that the transmission system continues to operate reliably under varying conditions.

• Implications of lost transmission lines, loss of generation injections, and other contingencies.
RESULTS
Results: Range and Severity of MISO Incremental Transmission Line Overloads under Proposed CPP

43 transmission lines at or above Long Term Emergency (LTE) ratings—should be addressed

12 loaded over 120% of their LTE ratings—a more significant reliability concern
Results: Projected MISO Transmission Security Violations

“Incremental $500 million to $750 million improvements eliminate all violations”
Based on projected violations and overloads, MISO would require an additional investment of at least $500 to $750 million to address transmission security issues caused by CPP-driven additional retirements and builds.

Depending on the CPP implementation glide path and policy mechanisms in the final rule, the majority of investments could be needed as soon as 2020, or they could start coming into place in the following years.

Extrapolating by assuming that the average impact of a generator retirement on transmission security is similar in other regions suggests that at least $1.5 to $2.5 billion in new transmission investments will be required nationally.
Nationally CPP Could Drive $1.5 to 2.5 Billion in Transmission Security Investments
Transmission Projects – Merchant And/or Utility to Preserve System Reliability In the Face of Changing Generation

- Forward thinking entities could potentially propose new projects that will help maintain and enhance reliability in the face of changing generation and power flow patterns.

- Think about the broad concept of new transmission centered on pending retirements.

- Previous-era concepts have been focused on movement of renewables – combine them with facilitating retirements
Limitations to Our Analysis

Uncertainty around CPP final form, requirements, and glide path for implementation

We focused on transmission security, not the full spectrum of investment drivers including resource adequacy and transmission adequacy

System planners focus on more severe contingency scenarios

Detailed, region-specific transmission security analysis is needed to provide a more accurate assessment
Timeline for EPA’s proposed Clean Power Plan – At The Start Of A Long Process

EPA Proposes Clean Power Plan

2013-14

Final Rule Due

2015

States Submit Initial State Plans, Request Extensions

2016

Plans Due from States

2017-18

Interim Reductions Begin and States Submit First Interim Report to EPA

2020-22

Full Compliance with Emission Rate Standards

2030

Legal Challenges

Source: Carbon Pollution Guidelines for Existing Power Plants, 79 Fed. Reg. 34829 (June 18, 2014)
Implications: Cost is Manageable, Timeline is Challenge

- The projected incremental $1.5 to $2.5 billion investment represents less than 3% of the national 5-year capital expenditure on transmission and will therefore not impede CPP implementation.

- Under the draft proposal, states must begin to show progress toward compliance in 2020, and continue to show annual progress through 2030. But EPA may grant flexibility that would ease the timeline for transmission investments.

- Much of the estimated additional economic coal retirements anticipated to occur under CPP are front-loaded in this timeframe.

- The challenge will lie in identifying needs and constructing new infrastructure (or reworking planned investments) quickly enough to match the timeline of retirements and new builds.
Why is this Challenging?
A Timeline for Transmission Investment

Transmission Projects Can Take Up to Ten Years from Concept to Completion

Preliminary Planning / RTO Process
Environmental Impact Assessment and Regulatory Filing
State PUC review and approval
Environmental Permitting/Right of Way Acquisition
Construction

1 Year
1.5 years
2.5 years
2 years
3 Years

Therefore…

While many projects can be completed in 5 to 7 years, the process can also easily stretch to ten years for high voltage projects

With the draft proposed schedule, many states would not submit plans until 2018

Stakeholders should strongly consider conducting detailed regional analyses as soon as this summer upon the announcement of the final rule.
**But Why Is This Such An Opportunity?**

- **New Projects**: $60+ billion in planned transmission in next 10 years among EEI members — new proposals for CPP-driven projects could be fast-tracked.

- **New Priorities**: Investors who can understand the specific regional transmission challenges could have a chance to respond or add to existing projects based on identified CPP-driven needs.

- **Funding**: The President’s budget proposal to create a $4 billion Clean Power State Incentive Fund shows that there may be a range of potential options for federal support for spreading costs and creating incentives for needed reliability investments.

*Bottom line: challenges are solvable, but solutions won’t just happen. Stakeholders must aggressively address transmission through analysis, policy design and planning...those that do so and engage early may uncover real opportunities.*
Where are we Headed?
Transmission Industry Structure and Prospects

• More near-term opportunities, more organized
  – More non-incumbent participation
  – More financial players and joint ventures
  – More targeted lines and substations opportunities
  – Prospects arising from the advent of EPA regulations

• Several types of RFPs for reliability and congestion
• Potential inter-regional merchant opportunities
• M&A among transcos (spinoffs and acquisitions)
• Possible utility spinoffs of transmission
• Consolidated resource planning – synthesis of generation, transmission and distributed energy resources (DERs)
What Will it Take To be Successful in the Transmission Business? The Integration of Many Skills

Policy and Regulation
Planning and Project Development
Energy Markets
DERs and Technology Integration

Transmission is Hard, but Remains a Critical Linchpin
Conclusion: Opportunity is Manageable, but Act Fast

- CPP will accentuate recent trends (coal retirements, integration of renewables), requiring transmission planners to shift priorities. It will also present an opportunity for those who act soon to identify transmission security and reliability needs.

- The size and scope of the needed transmission investment is manageable, but the timeline to conceive and complete projects is a greater challenge.

- ICF is actively working with clients on identifying future transmission needs in their regions, valuing existing or planned assets, assessing the impact of projected generating unit retirements, and mitigating overall risks in a rapidly changing environment.
Questions & Contact Information

Kiran Kumaraswamy, Senior Manager
Kiran.Kumaraswamy@icfi.com
+1.703.934.3623

Kenneth Collison, Vice President
Kenneth.Collison@icfi.com
+1.703.934.3806

Chris MacCracken, Principal
Chris.MacCracken@icfi.com
+1.703.934.3277
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