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ScottMadden's Energy Industry Update – Don't Stop Believin'

Webinar

November 2, 2018

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THE SCOTTMADDEN ENERGY INDUSTRY UPDATE

Cristin Lyons

Partner and Energy Practice Leader

Cristin Lyons is a partner with ScottMadden and leads the firm's Energy practice. Until April of this year she led the firm's Grid Transformation practice, which helps clients adapt to the operational, planning, customer, and regulatory changes driven by the increasing penetration of distributed energy resources. Since joining the firm in 1999, Cristin has consulted with myriad energy clients on issues ranging from process and organizational redesign to merger integration to project and program management. She is also a frequent speaker and panelist at conferences across the country. Cristin earned a B.A. in political science and Spanish from Gettysburg College and an M.B.A. from the Cox School of Business at Southern Methodist University. She is also a member of Phi Beta Kappa.

Efficient Electrification

The Electric Industry Sees a Growth Opportunity

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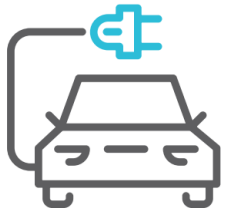
Justin Stevens

Director

Justin Stevens has more than 10 years of consulting experience with a track record of delivering successful client outcomes across different types of engagements. His primary focus areas with the firm include strategy development, performance management, and merger integration. Justin has led or supported numerous integration projects for a diverse set of energy clients, including regulated electric and gas utilities, competitive energy suppliers, and regional transmission organizations. Prior to joining ScottMadden, Justin developed expertise in government policy and the legislative process while working at a public affairs consulting firm, specializing in government relations and strategic communications. Justin holds a B.A. in English and journalism from Wake Forest University and an M.B.A. from the Darden School of Business at the University of Virginia.

What Is Electrification?

Electrification: The process of **switching** from the **combustion of non-electricity** based fuel (i.e., natural gas or propane) to **electricity** to provide a comparable service



Transportation

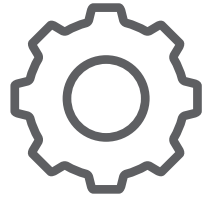
- Light-duty vehicles
- Transit/school buses
- Heavy-duty trucks

Residential

- Air-source and ground-source heat pumps
- Variable-capacity ducted heat pumps

Commercial

- Variable refrigerant flow heat pumps
- Variable-capacity rooftop heat pumps
- Heat pump water heaters



Industrial

- Infrared curing and drying
- UV curing
- Induction surface treatment
- Induction furnaces

Efficient Electrification: Electrifying the end use of energy—**where it is more efficient** to do so—for the **benefit of customers**, the **environment**, and **society**. – Electric Power Research Institute

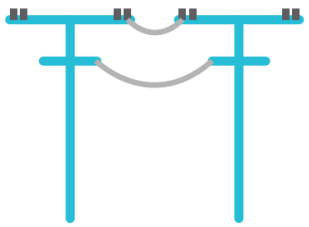
Electrification Stakeholder Groups

Stakeholders react differently to the expected outcomes of electrification.

Environmental Groups

End Users

Local Governments



Electric Utilities

Expected Outcomes

- Growth in electric load
- Decrease in GHG emissions
- Decrease in local air pollution
- Decrease in natural gas consumption
- Low-cost clean energy

Gas Utilities

Recent Electrification Studies

Three organizations have released electrification studies in the past six months:

Electrification Futures Study: Scenarios of Electric Technology Adoption and Power Consumption for the United States

- Characterize changes to end-use sectors under futures with increasing levels of electrification
- Quantify how electrification impacts total electricity demand and consumption profiles

U.S. National Electrification Assessment

- Examined four scenarios to consider opportunities, drivers, and challenges for electrification
- Detailed disaggregation of sectors, activities, end uses, and technologies
- End-use technology adoption based on economic and operational characteristics for specific applications over time

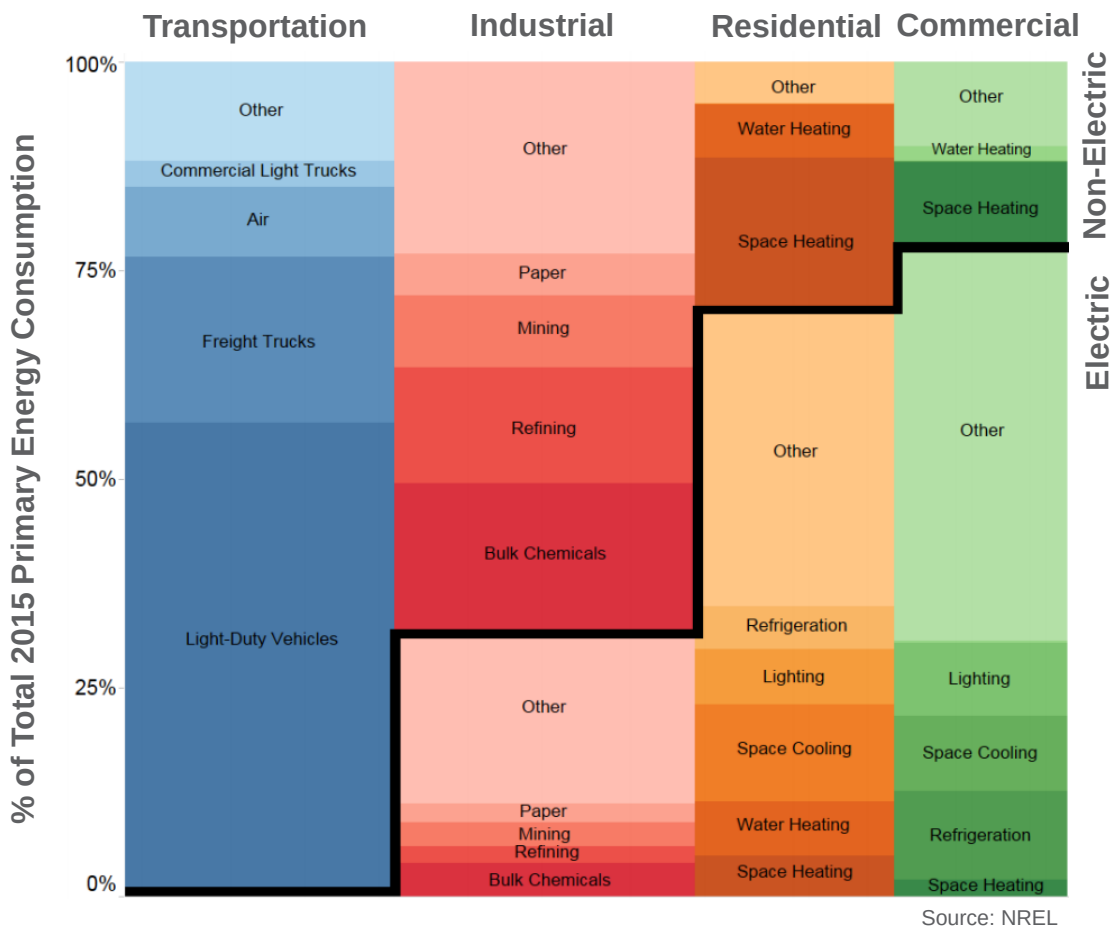
Implications of Policy-Driven Residential Electrification

- Will policy-driven residential electrification actually reduce emissions?
- How will policy-driven residential electrification impact natural gas utility customers?
- What will be the impacts on the power sector and on electric transmission infrastructure requirements?

Electrification Opportunities by Sector

The electrification of the transportation sector is widely seen as having the largest potential increase in electricity usage.

Primary Energy Consumption Shares in 2015



Source: NREL

Transportation

28 Quads Total
0 Quads Electricity

Industrial

31 Quads Total
10 Quads Electricity

Residential

21 Quads Total
14 Quads Electricity

Commercial

18 Quads Total
14 Quads Electricity

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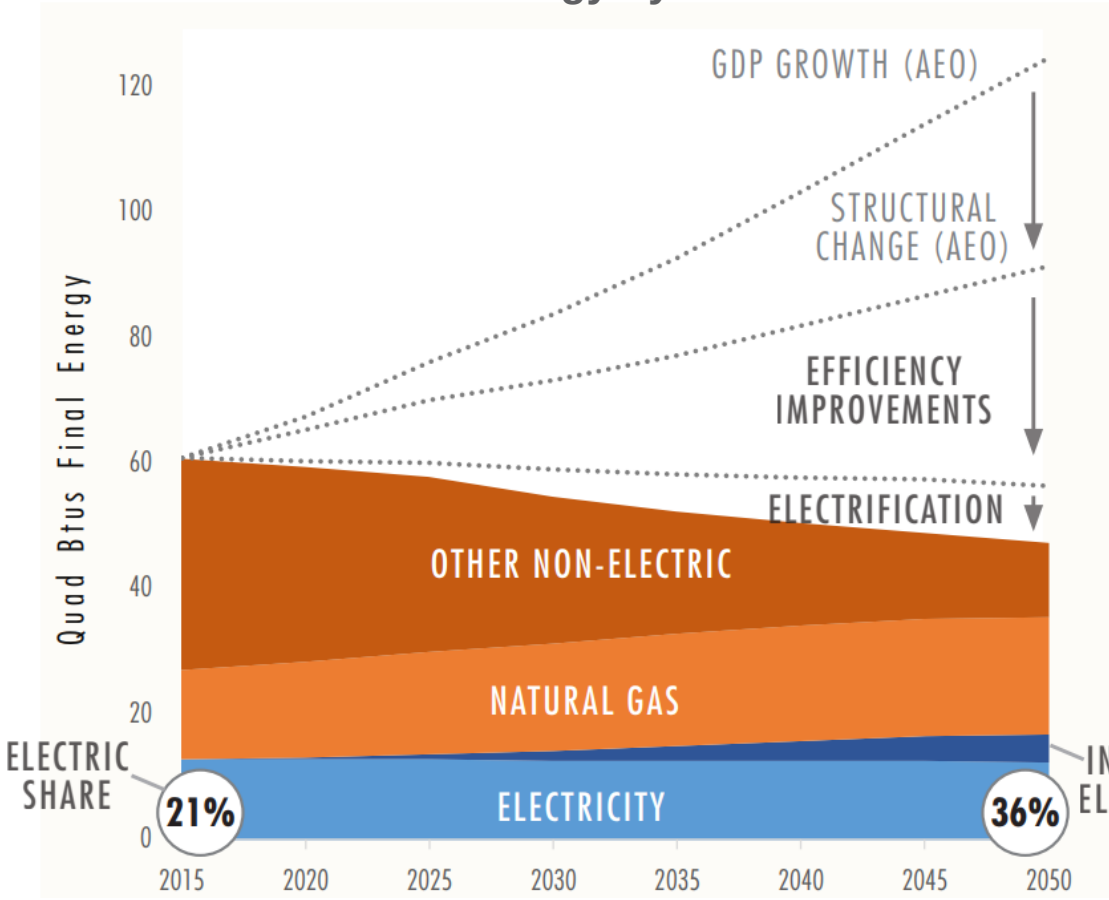
Load Growth through Electrification

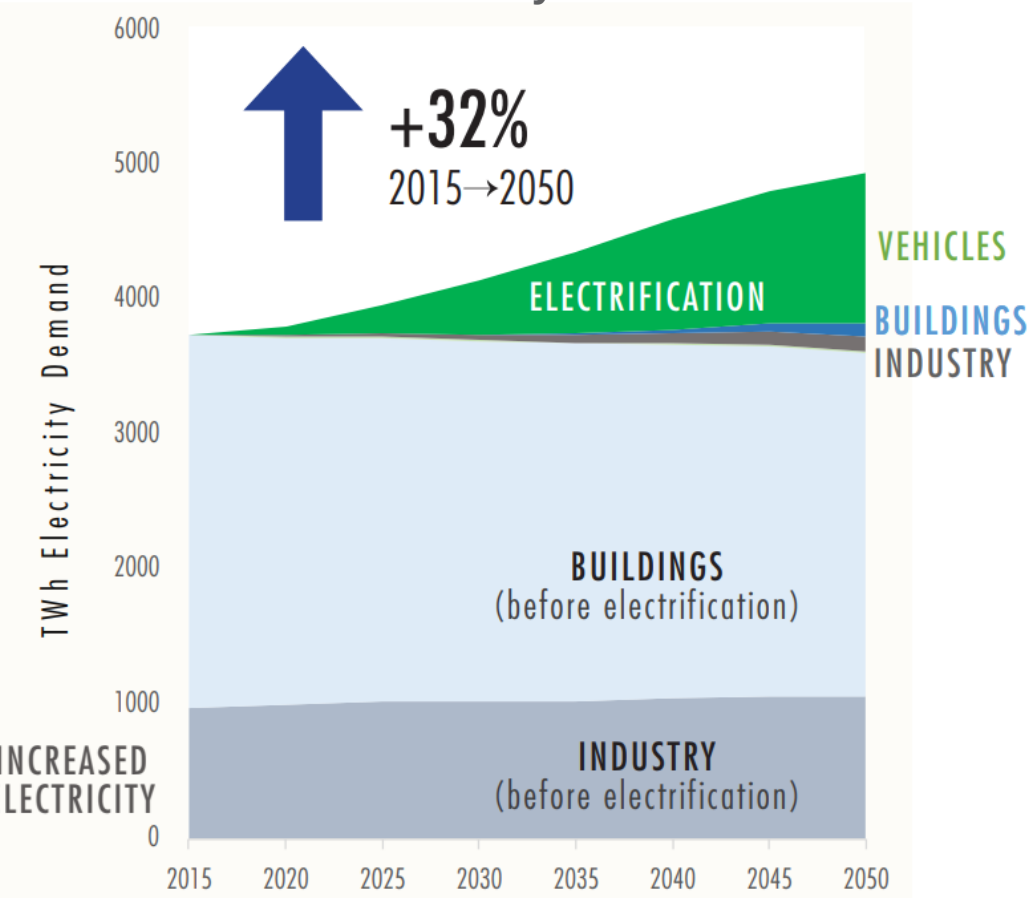
Electrification of non-electric end uses is expected to increase electricity's share of final energy.

Reference Scenario Projections for U.S. Total Final Energy by Fuel



Source: EPRI

Reference Scenario Projections for U.S. Electricity Demand

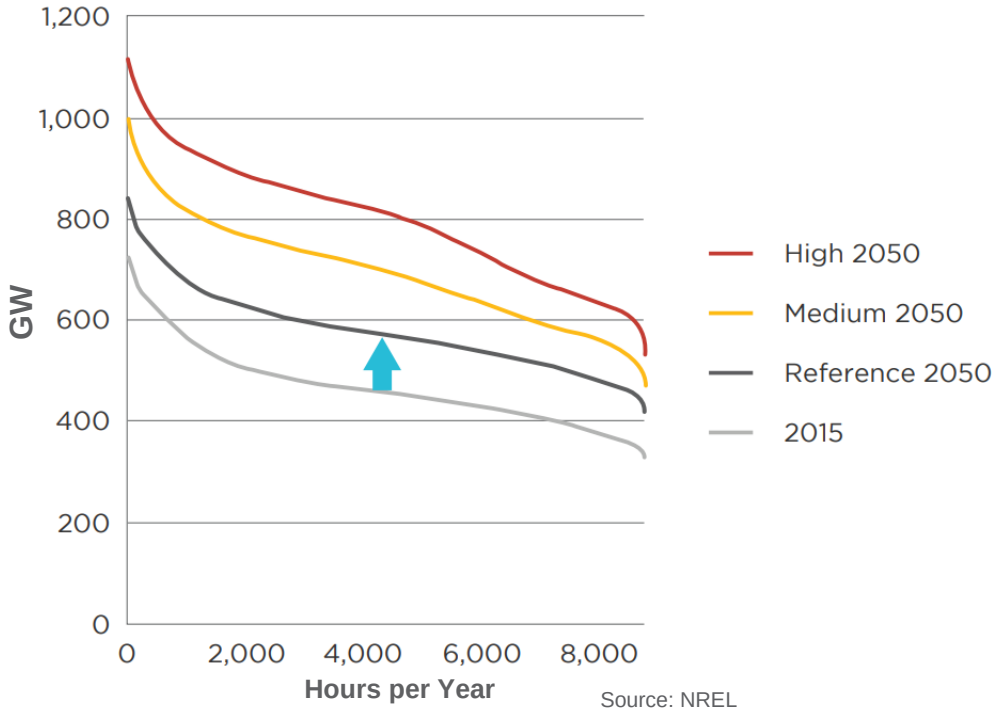


Source: EPRI

Electric Grid Impacts

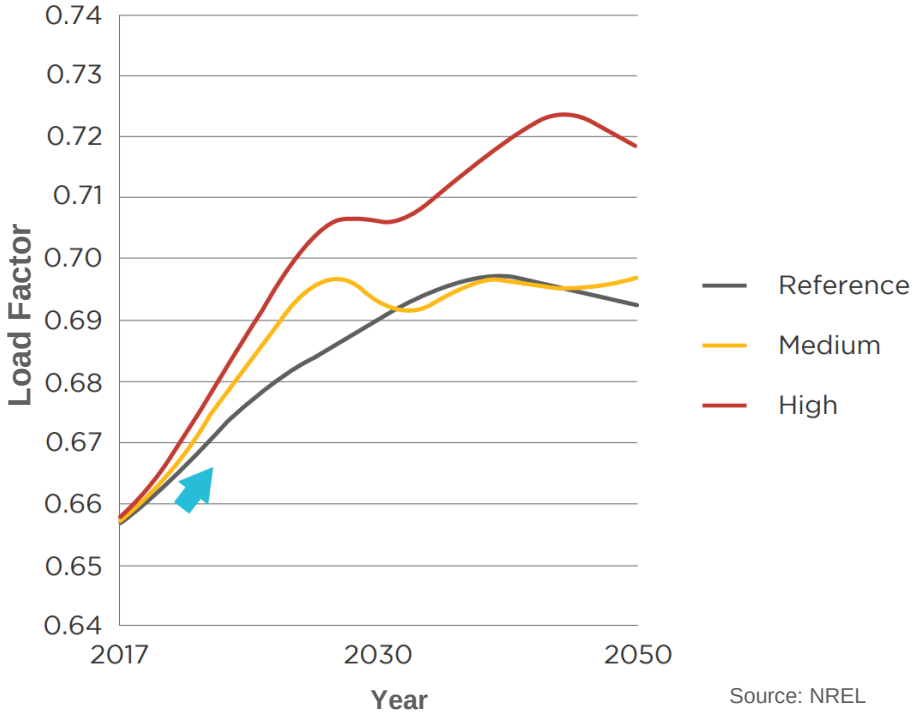
NREL believes that electrification of non-electric end uses will increase electric loads and the load factor.

Load Duration Estimates for NREL Electrification Scenarios (Current and in 2050)



Source: NREL

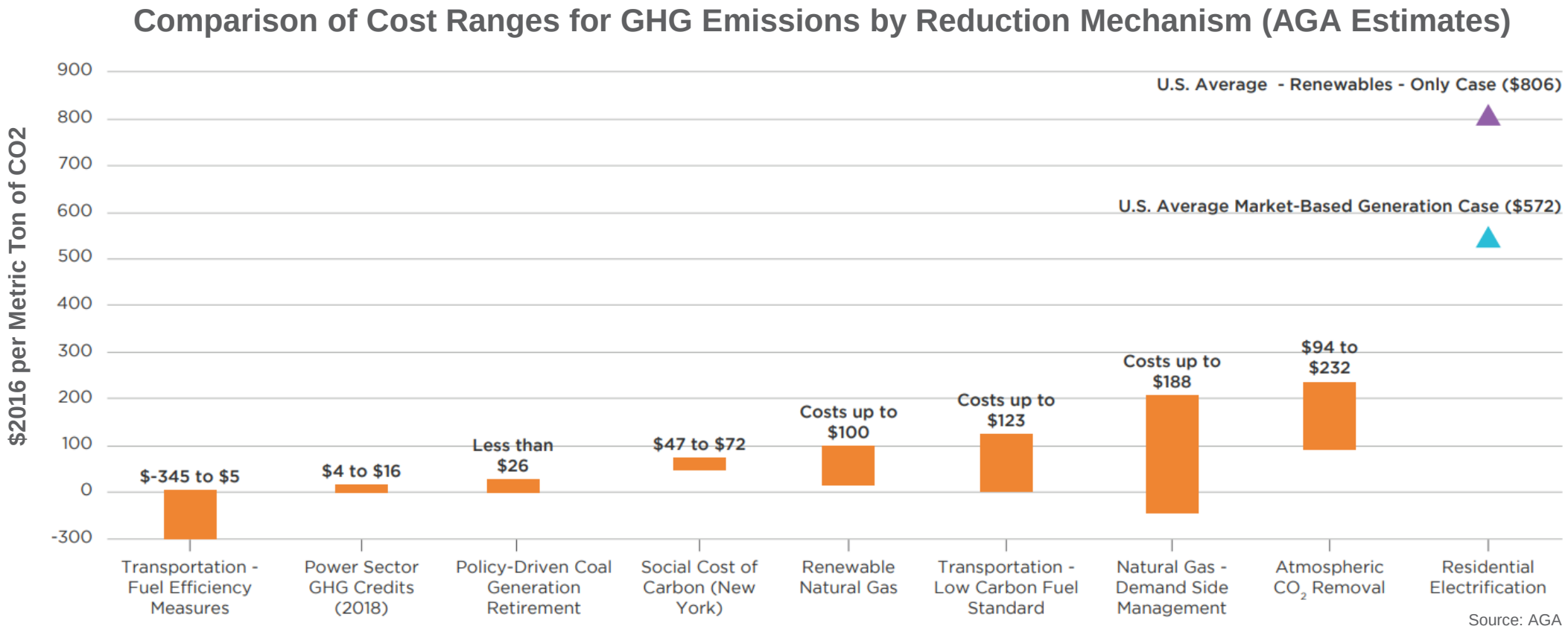
Load Factor Estimates for NREL Electrification Scenarios (2017 to 2050)



Source: NREL

Limitations in Emissions Reduction

AGA recently studied potential impacts of "policy-driven" electrification of the residential sector.



Source: AGA

Assumptions and Limitations

Any electrification scenario depends upon assumptions about technology, prices, and behavioral responses.

Key Question: How much work is performed using how much primary energy and issuing how much in emissions?

Key Takeaways

Efficient Electrification: The Electric Industry Sees a Growth Opportunity

1. EPRI believes that electrification of non-electric end uses is expected to increase electricity's share of final energy from 21% today to 32%–47% in 2050 and to grow demand for electricity by 32% by 2050.

2. The transportation sector has the highest and most immediate potential for electrification, while electricity could continue to displace natural gas in the building's sector.

3. Grid planning and modernization will be especially critical for grid operators, as electrification is expected to change load profiles in addition to increasing peak loads and load factors.

4. High up-front costs, low natural gas prices, incumbent technology advantages, and technological challenges may prevent the widespread electrification of some applications.

Grid Modernization

States and Utilities Test the Waters

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THE SCOTTMADDEN ENERGY INDUSTRY UPDATE

Chris Sturgill

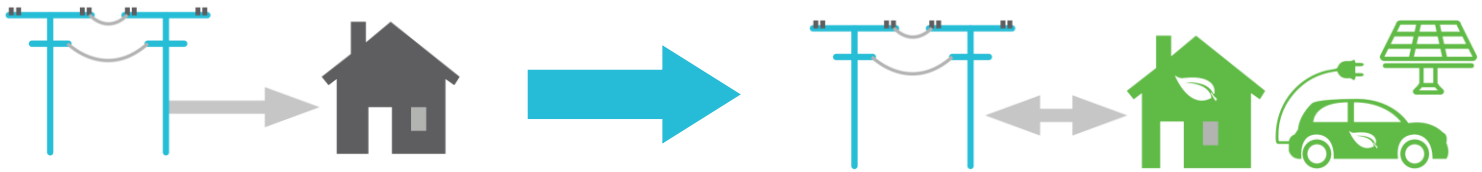
Manager

Chris Sturgill joined ScottMadden in 2015, after eight years with IBM in server hardware design. Chris' experience includes work in grid transformation and integration of distributed energy resources and regulatory reform as part of New York's Reforming the Energy Vision (REV), process improvement, and project management. Prior to working at ScottMadden, Chris worked as a reliability, availability, and service ability engineer, using statistical analysis to predict and improve the quality and resiliency of several generations of POWER brand servers. Chris earned a B.S. in engineering sciences and mechanics and a minor in mathematics at Virginia Tech and an M.B.A., with a concentration in strategy and leadership, from the University of North Carolina Kenan-Flagler Business School. Chris also earned Lean Six Sigma Green Belt certification.

What Is Grid Modernization?

Grid Modernization: Investments—some of which may be considered foundational and/or DSP-enabling—that improve the **reliability, resiliency, efficiency, and automation** of the T&D system. Such investments can include the sensors, data, and communications networks that enable enhanced visibility and understanding of the behavior of the network; technologies and equipment that **facilitate greater customer engagement** regarding energy usage and alternatives; and the underlying systems, data management and analytics that facilitate situational awareness, asset management, contingency and risk analysis, outage management and restoration. These necessary core investments underpin the required focus on grid reliability and resiliency. They provide the basis for increased **operational flexibility**, can enable efforts toward **achieving state policy goals**, such as the **integration of various types of DER**, and are beneficial for any resource mix.
– New York Joint Utilities

A modernized grid assures continued safe, **reliable, and resilient** utility network operations, and enables Minnesota to meet its **energy policy goals**, including the **integration of variable renewable electricity sources and distributed energy resources**. An integrated, modern grid provides for greater **system efficiency** and greater utilization of grid assets, enables the development of new products and services, **provides customers with necessary information** and tools to enable their energy choices, and supports a standards-based and interoperable utility network.
– MPUC Grid Modernization Report (March 2016)

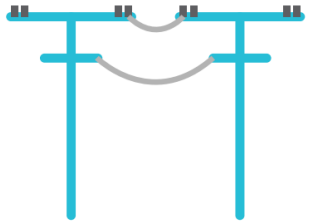


Grid Modernization Drivers

Customer Expectations

Technology Advances

DER Penetration

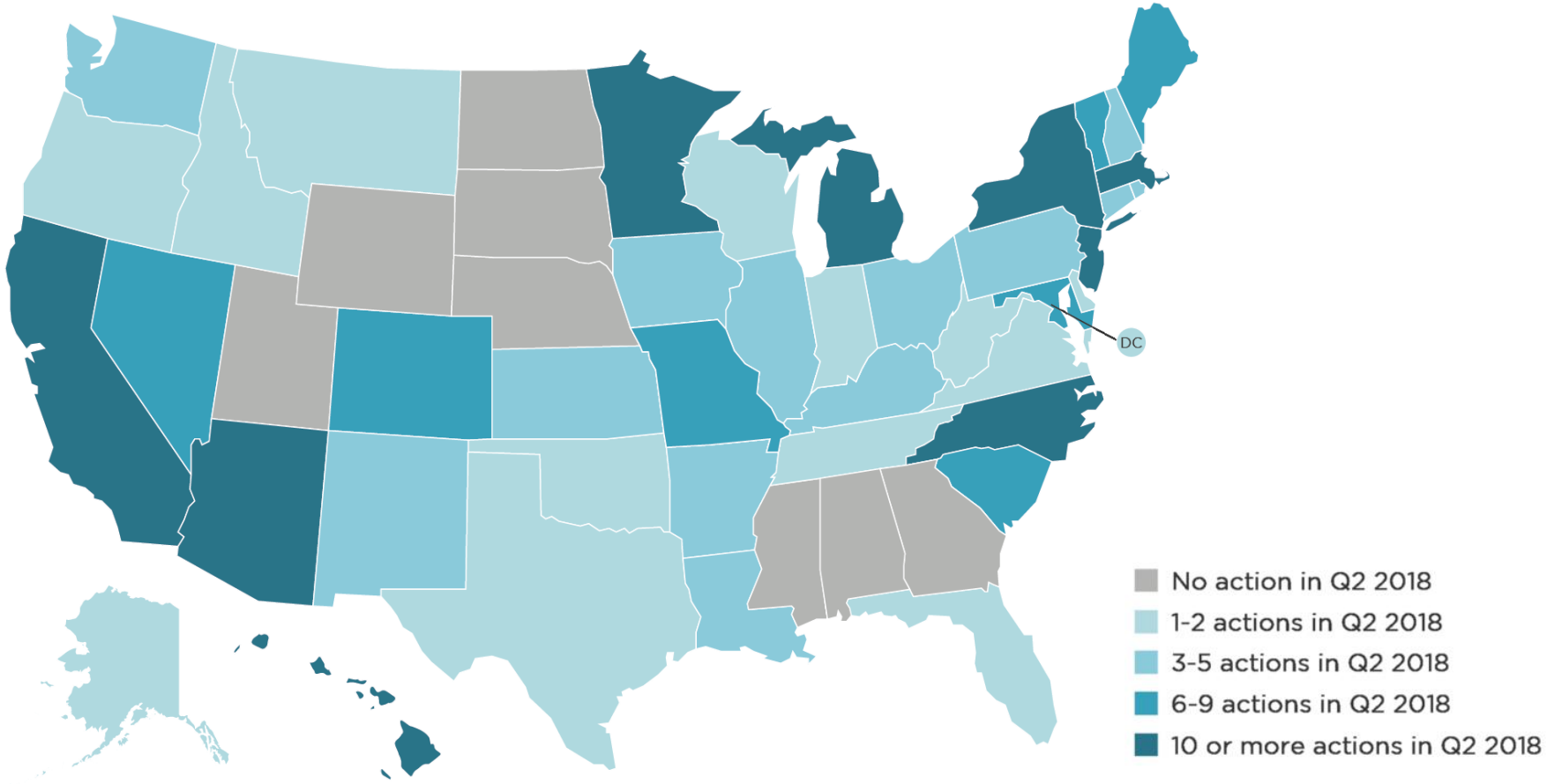


Aging Infrastructure

Policy Drivers

Latest News

Q2 2018 Legislative and Regulatory Action on Grid Modernization



Source: N.C. Clean Energy Technology Center

Grid Modernization Technologies

Distribution Automation

Communicating sensors and switches that can operate autonomously or through centralized control systems

- Smart switches
- Load tap controllers automatically managed with Volt-VAR optimization (VVO)
- SCADA-capable voltage regulators

Tools and Analytics

Advanced technologies, including big data analytics, to enhance decision making and/or real-time operations

- Data management hardware
- Asset health monitoring
- Power quality monitoring
- Outage impact analysis

Flexible Resources

Resources or management systems that enable the use of a more diverse and distributed mix of supply or services

- Distributed energy resource management system (DERMS)
- Energy storage and microgrids
- Electric vehicle infrastructure

Grid Edge Sensing

Sensors and other smart devices that provide enhanced visibility and situational awareness

- Environmental sensors
- Advanced metering infrastructure (AMI) edge devices

Foundational Systems and Infrastructure

IT and OT systems and equipment necessary to enable current and future capabilities

- AMI
- Geographic information system
- Advanced distribution management system (ADMS)
- Communications infrastructure

Justify Investments

Least-Cost, Best-Fit	Positive Business Case/Value
Standards and Safety Compliance ▪ Grid expenditures required to ensure reliable operations or comply with service quality and safety standards, including both ongoing asset management replacement of aging and failing infrastructure and relevant grid modernization technologies	**Net Benefits** ▪ Expenditures that are not required for standards and safety compliance or policy but would provide positive net benefits for customers
Policy Compliance ▪ Expenditures that are needed to comply with state policy goals, like the renewable portfolio standard, or direction to interconnect and enable customer adoption of DERs	**Self-Supporting** ▪ Expenditures incurred for a specific customer (e.g., interconnection) with costs directly assigned to those specific customers
Mandatory	**Discretionary**

Paying for Investments

Rate Cases

Grid Modernization Riders

Legislative Action

Grid Modernization Strategy for Utilities

	1	2	3	4
	Develop grid modernization strategy and required capabilities	**Identify investments to meet capabilities**	**Create the roadmap**	**Develop implementation plans and execute**
Activities	▪ Identify key drivers for grid modernization ▪ Survey peer utilities ▪ Gain alignment on the strategic direction	▪ Brainstorm projects to meet necessary capabilities ▪ Leverage industry standards and use cases to check for a cohesive solution ▪ Size scalable investments to meet needs over time	▪ Determine how the pieces fit together ▪ Rationalize projects against resource and budget constraints ▪ Conduct prioritization workshops to sequence the roadmap	▪ Develop implementation plans ▪ Establish governance ▪ Track and report
Key Questions	▪ Why is grid modernization a pressing issue for you? ▪ What do we need to be able to do in the future that we can't do today? ▪ How are others doing it? And why?	▪ What gets us from current to future state? ▪ Does the sum of the parts work as a whole? ▪ What do I need today? In two years? In 10 years?	▪ Which projects depend on which? Which are foundational to many? ▪ Do we have the time, money, and people to execute on all the work it will take to achieve future state? ▪ What comes first?	▪ How do we know we're doing the right stuff? ▪ How do we know it's having the desired effect?

Key Takeaways

Grid Modernization: States and Utilities Test the Waters

1. Though utilities have been prudently using the latest technologies, a concerted push for grid modernization is being driven by a confluence of factors which require utilities to develop new capabilities.

2. Grid modernization activity continues across the United States and is not limited to bellwether jurisdictions, like California, New York, and Hawaii, but it is also happening in places with less fanfare, including Ohio, Massachusetts, Illinois, and Rhode Island.

3. There is no one-size-fits-all definition for what grid modernization is or what investments comprise grid modernization initiatives; however, there are common themes around enabling customer engagement, enhancing reliability and resiliency, and more efficiently and flexibly using grid assets.

4. Utilities are not getting a “blank check” for grid modernization: regulators require rigorous cost-benefit justification for some investments.

Gas and Power Infrastructure Development

Challenges and Opportunities

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THE SCOTTMADDEN ENERGY INDUSTRY UPDATE

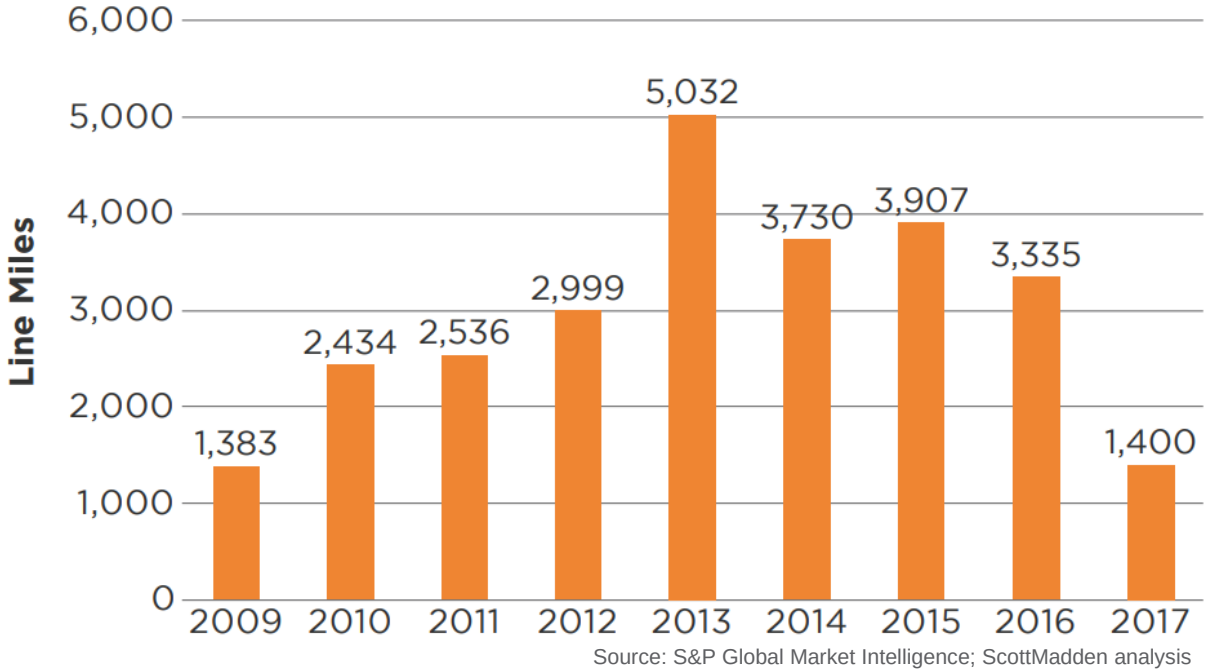
Jennifer Nelson

Director

Jennifer Nelson has more than 10 years of experience in the energy industry, spanning the oil, gas, electric, and renewable energy sectors. Jennifer has provided expert testimony regarding alternative ratemaking and formula rate structures, and she has supported expert witness testimony on subjects including cost of capital and capital structure, integrated resource planning, and natural gas supply planning. She has extensive experience researching regulatory and energy market issues, performing statistical analyses, developing economic and financial models, and providing policy analysis and recommendations. Jennifer holds a B.S. in business economics from Bentley University, where she graduated *magna cum laude*, and an M.S. in resource and applied economics from the University of Alaska.

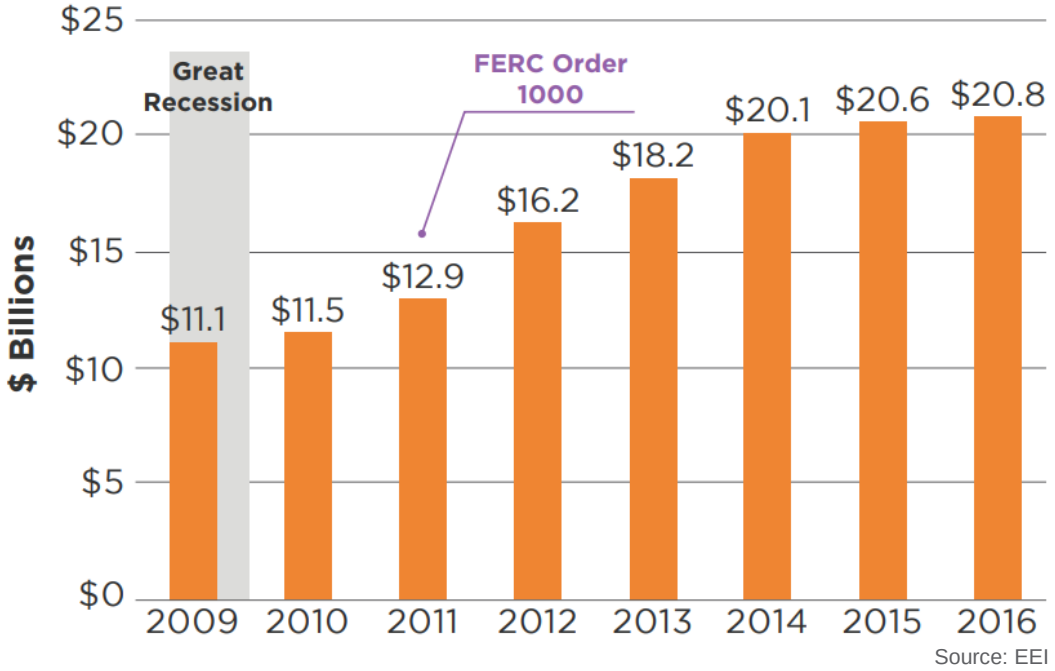
Power Transmission Investment – Current Status

Completed U.S. Transmission Projects by Year (2009–2017) (in Line Miles)



Source: S&P Global Market Intelligence; ScottMadden analysis

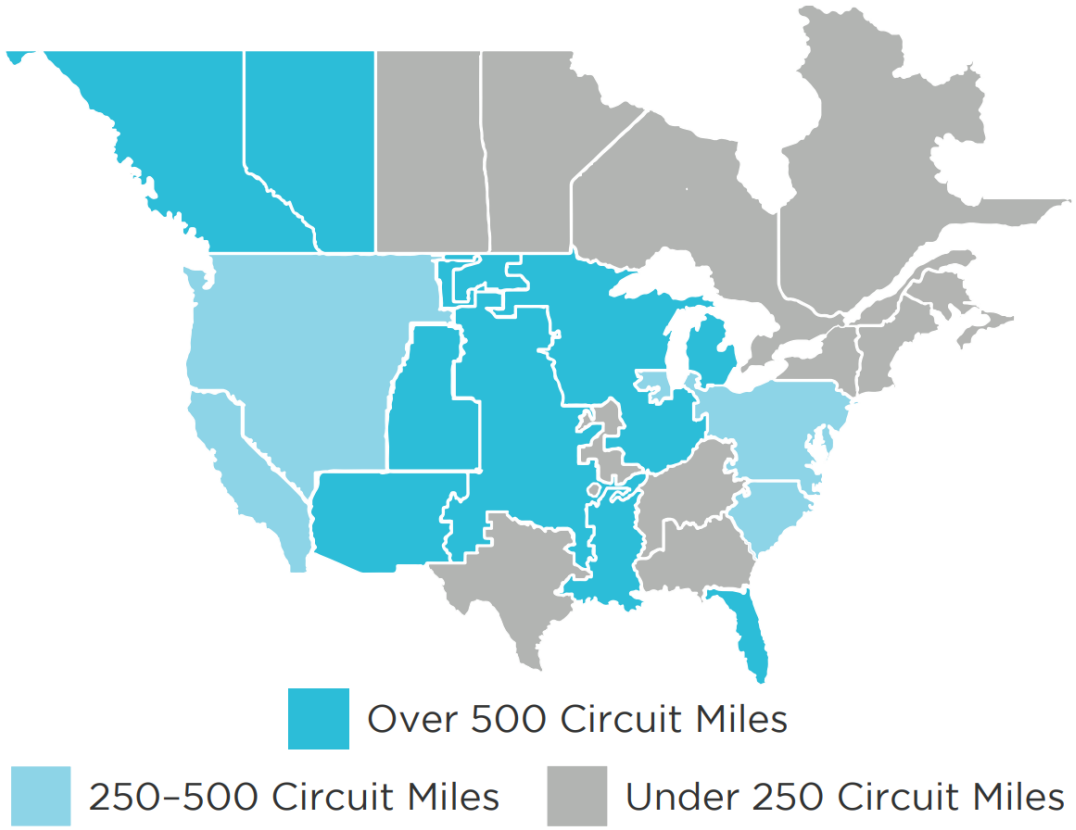
Construction Expenditures for Transmission by Investor-Owned Utilities (2009–2016) (Real 2016$ Billions)



Source: EEI

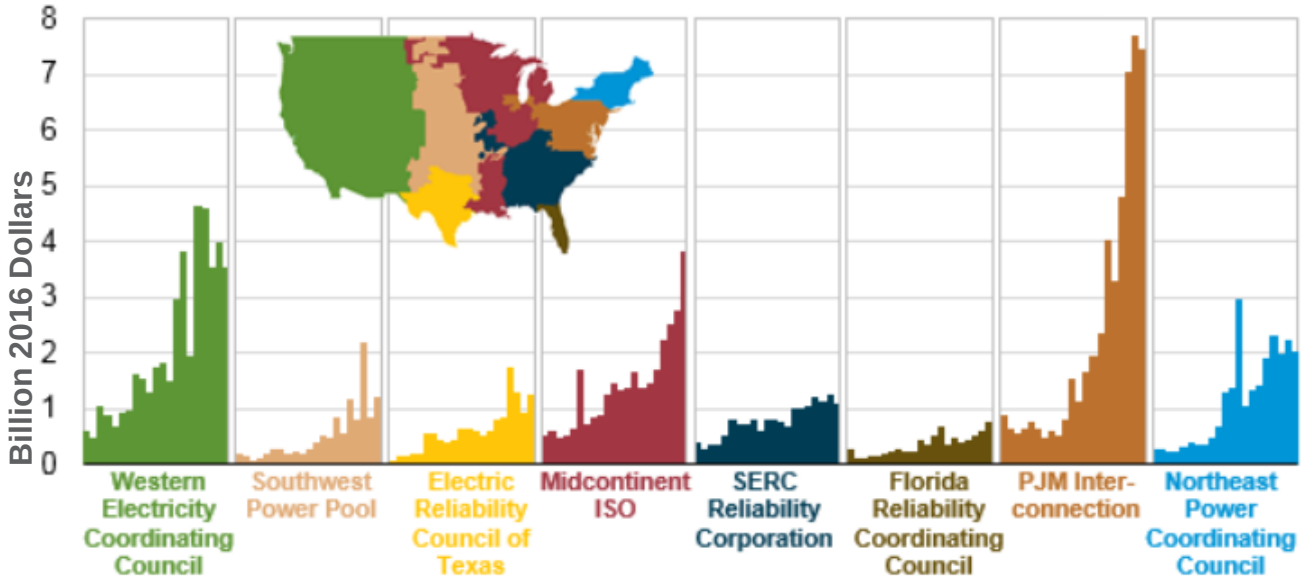
Power Transmission Investment – Trends

NERC Assessment Areas with High Levels of Prospective Transmission Additions



Source: NERC

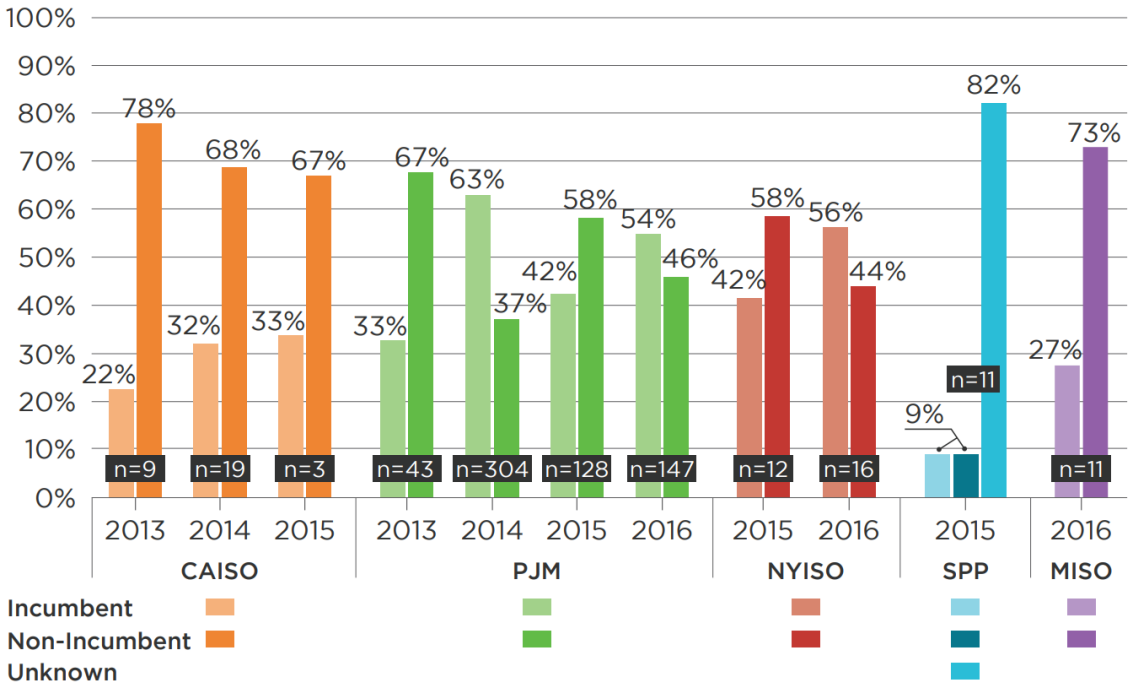
Utility Transmission Investments by NERC Region (1996–2016)



Source: EIA

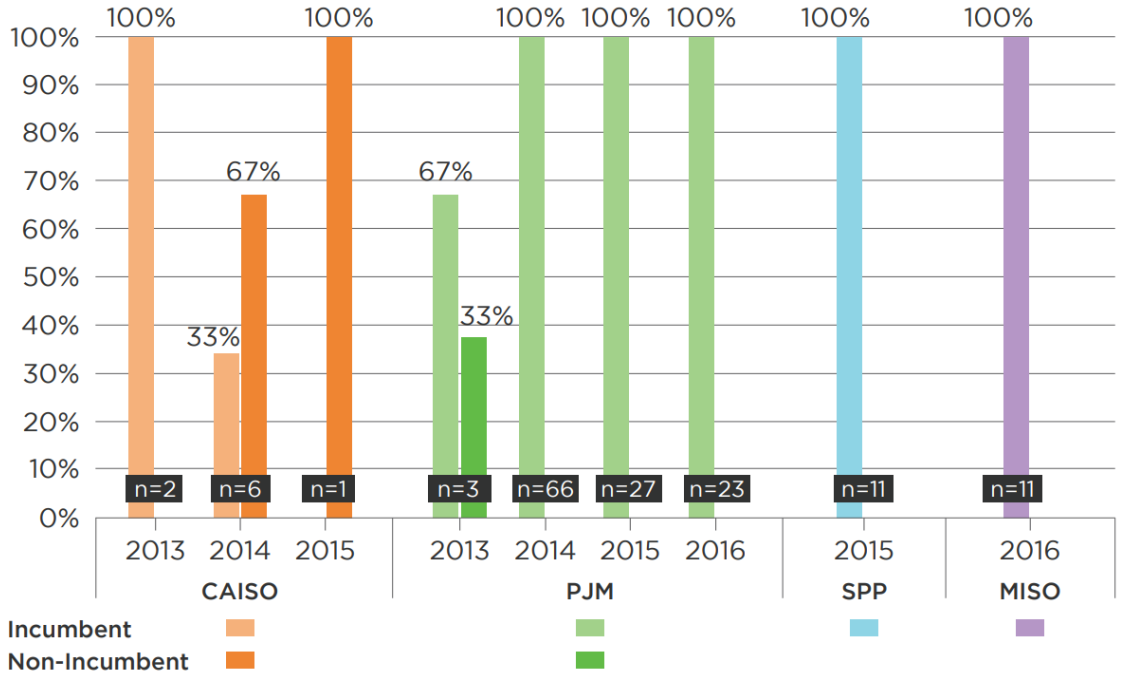
Competitive Transmission

Competitive Proposals by Incumbents vs. Non-Incumbents for Selected RTOs/ISOs (2013–2016)



Source: FERC

Number and Percentage of Awards Made to Incumbents and Non-Incumbents for Selected RTOs/ISOs (2013–2016)



Source: FERC

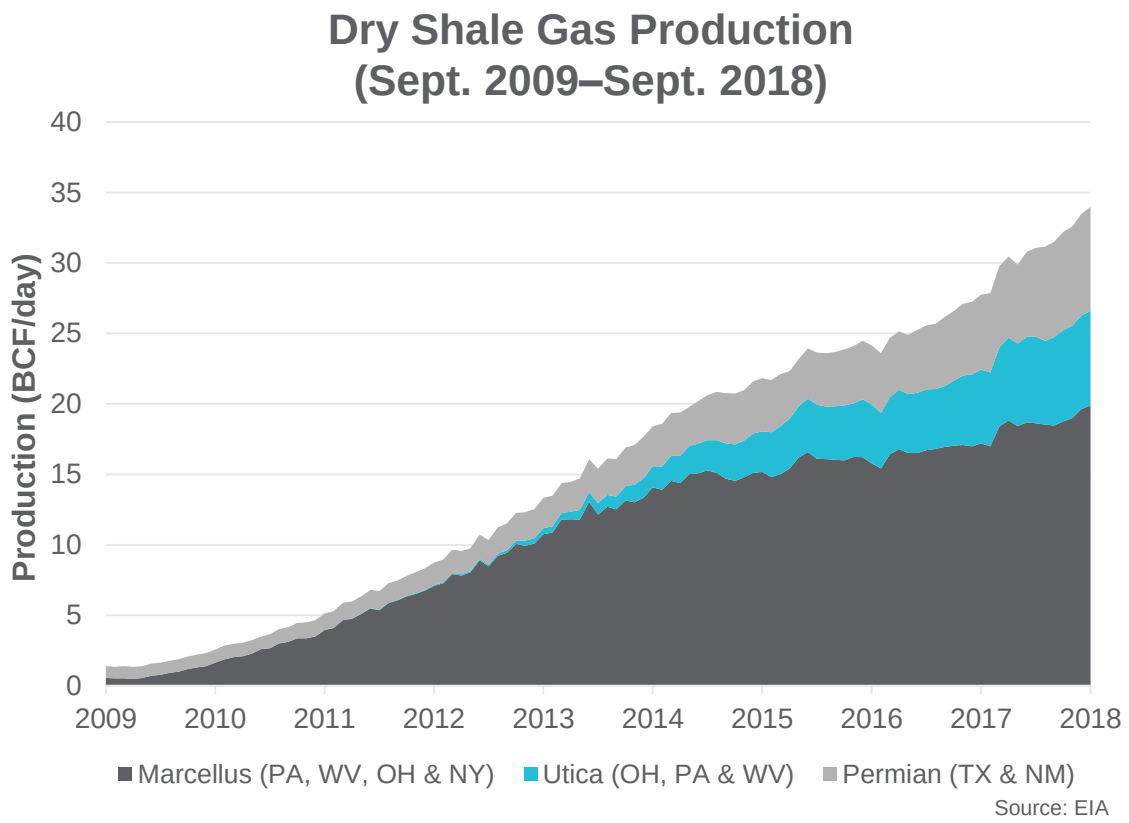
Transmission Incentives

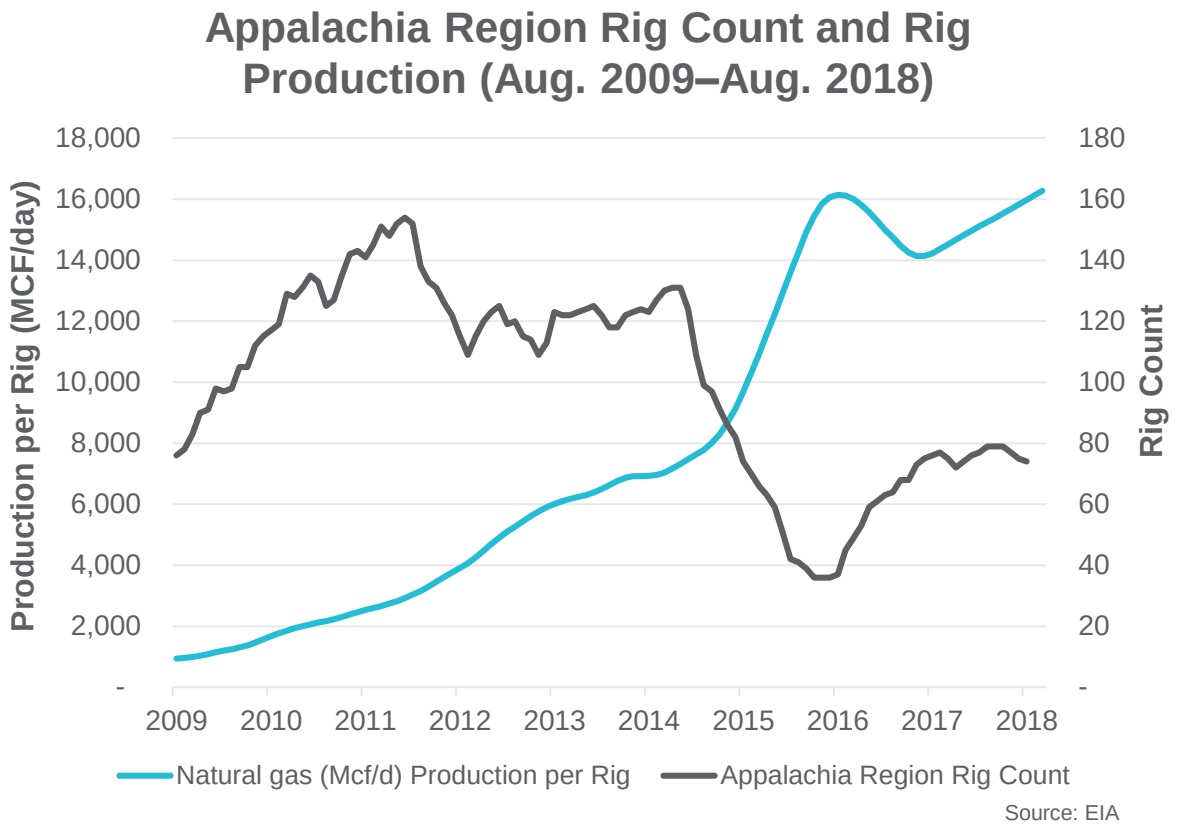
Recently Awarded FERC Transmission Incentives (2017–2018)

	Projects											
Order 679 Incentives	NextEra Energy Transmission (PJM, MISO, NYISO, SPP)	NextEra - Empire State Line - NY	Transource (MD & PA) - Project 9A	GridLiance West - VETA HVTS	GridLiance West - Bob Tap Project	So Cal Edison - Aberhill, Eldorado (E-L-M)	So Cal Edison - Mesa 500kV SS	Dairyland - Middleton-Hickory Creek	ITC Midwest - Huntley-Wilmarth	Citizens & SDG&E - Sycamore	NY Transco - AC Project	Republic Transmission - Duff-Coleman
Construction Work in Progress (CWIP)		100%	100%		100%	100%	100%				In rate base	
Hypothetical Capital Structure	60/40		60/40					45/55		50/50		55/45
Recovery of 100% of Costs of Abandoned Facilities		100%	100%			100%		100%	100%	100%	100%	100%
ROE Adder for Risk and Challenges, RTO Adder, and Transco Adder	50 bp RTO adder	50 bp risk adder, 50 bp transco adder		50 bp RTO adder							50 bp risk adder, 50 bp congestion relief	50 bp RTO adder
Regulatory Asset	✓		✓	✓								✓

Source: AVANGRID

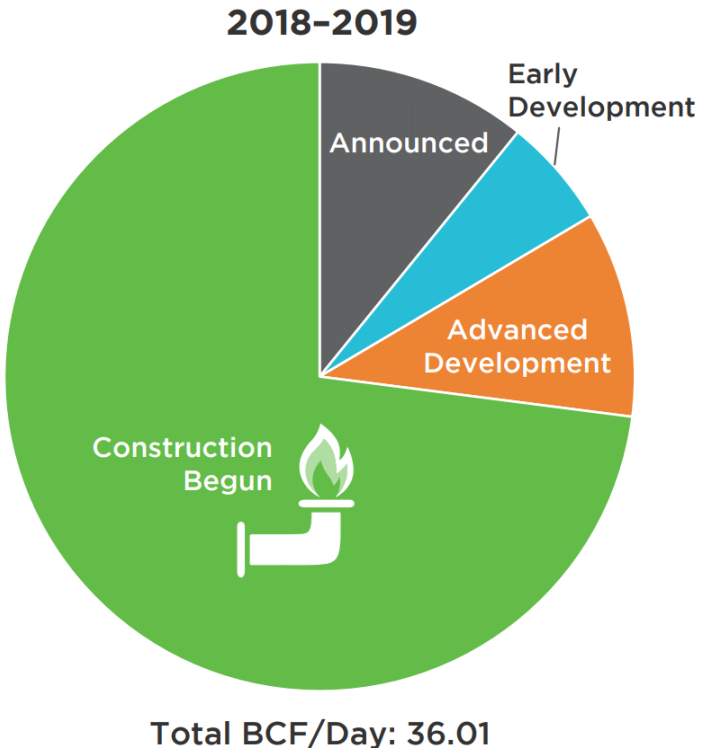
Marcellus and Utica Shale Production





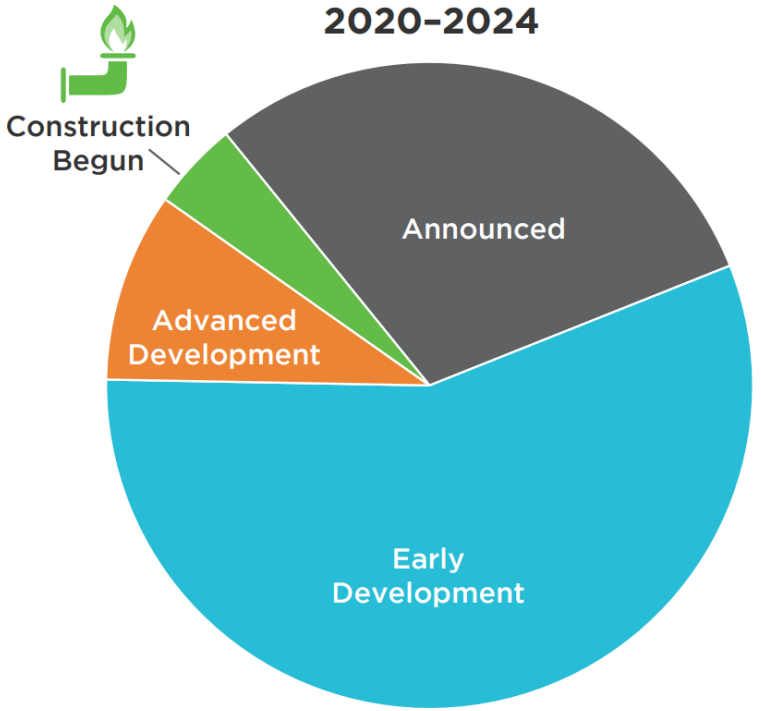
Introduction to Gas Pipelines

U.S. Gas Pipeline Development Projects (by Expected Year in Service)



Total BCF/Day: 36.01

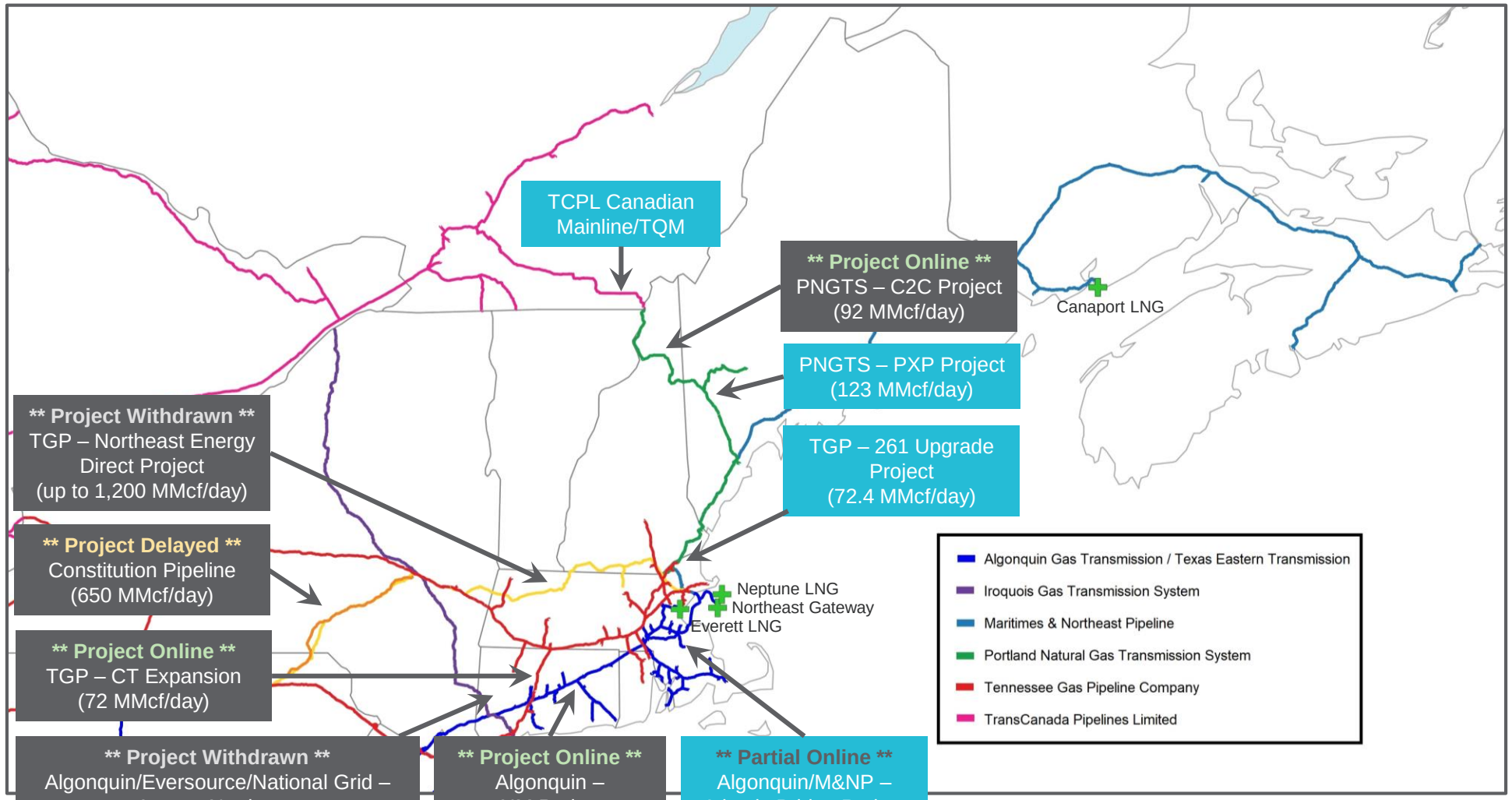
Source: S&P Global Market Intelligence



Total BCF/Day: 40.87

Source: S&P Global Market Intelligence

Infrastructure Projects – New England Region



Sources: S&P Global Market Intelligence [modified by ScottMadden]; and based on ScottMadden's review and analysis of public documents

Stakeholder Challenges to Infrastructure Projects

Working through Challenges: Projects Run the Gauntlet

Project	Type	Capacity	Estimated Cost	Issues
Northern Pass	Power	1,092 MW	$1.6B	▪ Stymied after NH officials refused to issue a siting permit ▪ MA utilities pivot to the Northern New England Clean Energy Connect project
Grain Belt Express	Power	4,000 MW	$2.3B	▪ Project wrongly denied a construction permit, sending the project back for consideration
PennEast	Gas	1.1 BCF/day	$1B	▪ NJ seeks FERC reconsideration of project approval
Mountain Valley	Gas	2 BCF/day	$3.7B	▪ Parts of project under FERC stop-work orders, with other WV portions able to continue
Atlantic Coast	Gas	1.5 BCF/day	$6B to $6.5B	▪ After challenge, FERC reengages U.S. Fish & Wildlife Service on further biological analysis ▪ Construction suspended
Atlantic Sunrise	Gas	1.7 BCF/day	$3B	▪ Environmentalists challenge FERC approval, PA water quality certificate
Sabal Train	Gas	1.1 BCF/day	$3.2B	▪ DC federal court upholds decision to vacate FERC approval of Southeast Market Pipelines project, including operational Sabal Trail pipeline

Source: Industry news, ScottMadden analysis

Key Takeaways

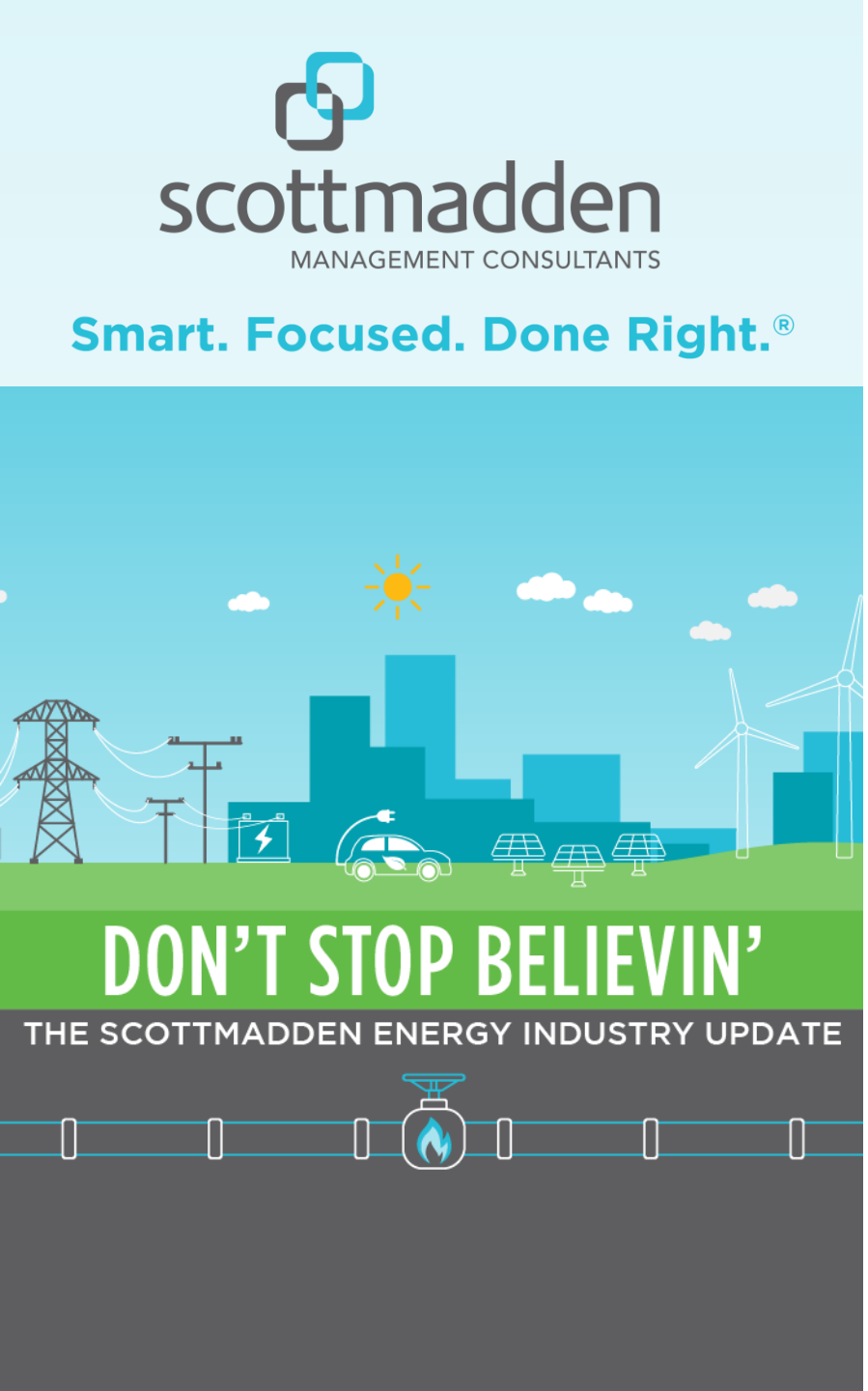
Infrastructure Development: Challenges and Opportunities

1. Infrastructure projects continue to push ahead, albeit at a slower pace due to challenges and increased development time.

2. Large transmission projects continue to face state and local challenges, especially where local benefits are unclear. Smaller natural gas pipeline expansion projects face fewer challenges, but still receive opposition.

3. Competitive transmission continues to face headwinds, as non-incumbents appear to have few successes in the transmission development process.

4. FERC is considering policy changes that may affect infrastructure development, specifically regarding pipeline certifications and financial incentives for electric transmission. Some decisions may be delayed as one seat remains vacant.



Greg Litra

Partner and Director of Research

Greg Litra is a partner with ScottMadden, with principal expertise in financial, economic and regulatory analysis, strategic planning, corporate governance, risk management, and transaction support. He specializes in the energy and utilities business sectors. He also leads the firm's energy, clean tech, and sustainability research activities and spearheads the publication of ScottMadden's Energy Industry Update. Prior to joining the firm in 1995, Greg was a corporate lawyer and business litigator on Wall Street and in Atlanta. As a lawyer, Greg worked with utilities, investment banks, and other companies in equity and debt offerings, project and secured financings, corporate litigation, and transaction due diligence.

The ScottMadden Team

Cristin Lyons
Partner and Energy Practice Leader

Greg Litra
Partner and Director of Research

Justin Stevens
Director

Chris Sturgill
Manager

Jennifer Nelson
Director

See the link below for the latest Energy Industry Update

https://www.scottmadden.com/energy-industry-update/