The ScottMadden ENERGY INDUSTRY UPDATE

NEITHER FISH NOR FOWL

Volume 16 - Issue 1

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VIEW FROM THE EXECUTIVE SUITE

Neither Fish Nor Fowl

The energy industry is in a period of transition. Distributed resources, like rooftop solar photovoltaics, are taking hold. Non-traditional players are increasingly involved in energy-related endeavors. Natural gas remains cheap, which along with proposed environmental regulations and other mandates, is prompting changes in the power generation mix. Regulation and business models are evolving, too, as traditional utility roles and functions are being reconsidered. Thus, stakeholders are acting and reacting to technology, regulation, and operating models that are sometimes "neither fish nor fowl."

Neither Fish Nor Fowl

Neither fish nor fowl *(phrase)*:
of indefinite character and difficult to identify or classify; like one thing in some ways and like another thing in other ways

Some Highlights of This ScottMadden Energy Industry Update	
Blurring Operating Boundaries	• Roles and responsibilities that were the exclusive province of utilities are being assumed (or at least impacted) by new utility-related energy services such as distributed generation (largely solar photovoltaics) and microgrids. Critical questions remain, though, such as who is responsible for reliability?
Blurring Technology Boundaries	• Operating technology and information technology are merging with increasingly ubiquitous digital systems, leading firms to seek converged cybersecurity solutions • Energy storage is of increasing interest and proponents advocate looking at the multiple value streams that some storage technologies can provide, but classifying it according to the traditional power system rubric of generation, transmission, or distribution is proving tricky • Gas-fired generation and utility-scale renewables continue to grow and are the nation's shifting power supply portfolio. Influencing this trend is the still uncertain legal outcome of the Clean Power Plan
Blurring Regulatory Boundaries	• Frictions at the regulatory boundaries of each of the Federal Energy Regulatory Commission, the U.S. Environmental Protection Agency, and state regulators are having legal ramifications, as energy industry stakeholders seek to determine their limits—and the rules of the road—in "seams" areas such as wholesale power markets, emissions regulation of power generators, and demand response compensation

MERGERS & ACQUISITIONS:
PICKING UP THE PACE

Low interest rates, rising importance of natural gas, and a search for growth sends energy companies shopping.

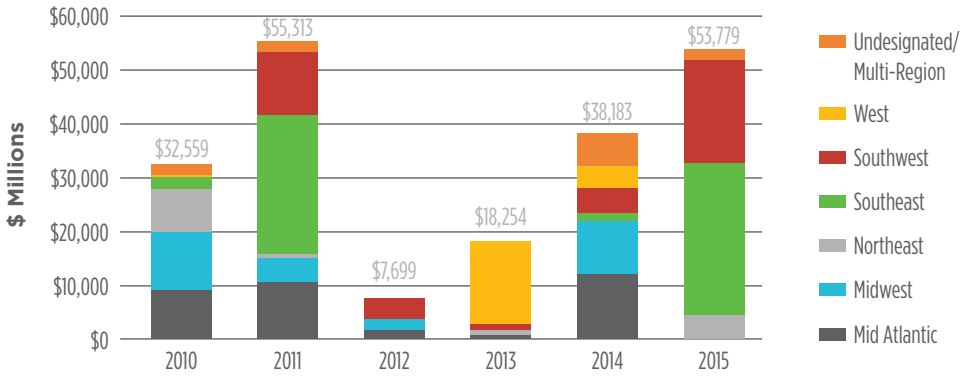
Convergence Is the Word; Rate Base Investment Is the Melody

- Energy companies face organic growth headwinds, including low usage growth, falling allowable ROEs, and compressed wholesale margins. In this environment, acquisition continues to be an appealing growth strategy (see charts at right)
- Major acquisitions have been announced since Spring 2015, with seven significant transactions (totaling nearly $50 billion) involving natural gas distribution properties:
  - Southern Co./ AGL Resources
  - Duke Energy/ Piedmont
  - Black Hills/SourceGas
  - Emera/TECO Energy
  - Dominion/Questar
  - Fortis/ITC Holdings
  - Algonquin/Empire District Electric
- For Southern and Duke, natural gas infrastructure platforms (given the shift from coal to gas) and territory overlap were attractive features of their prospective partners
- Along with geographic and/or business mix diversification, growth through infrastructure investment was cited as a main driver for these combinations
  - Regulated, rate base growth opportunities
  - Incremental capex through infrastructure replacement programs, pipeline expansions, and investment in midstream and storage

> We continue to believe that additional convergence mergers will be announced in 2016. In addition to pursuing local gas distribution utilities, we would not be surprised if an electric company (or two) were to pursue a natural gas pipeline company.
>
> *– Michael Worms, BMO Capital Markets*

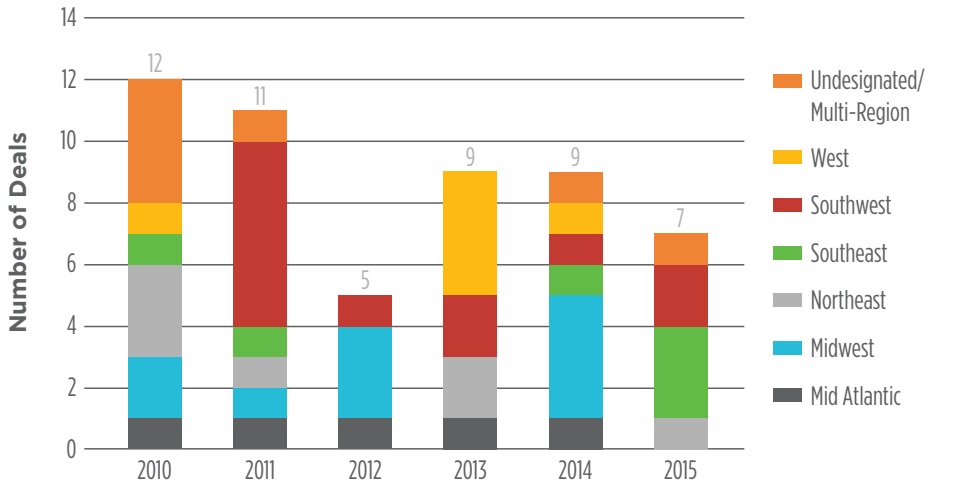
NOTES:
*Figures represent total transaction values (including assumed debt) based on year announced. ROE means return on equity.

Value of Announced Gas Utility and Power Corporate Acquisitions by Region*
(in $ Millions) (2010-2015)



Source: SNL Financial

Historical Deal Count by Target Region
(2010-2015)

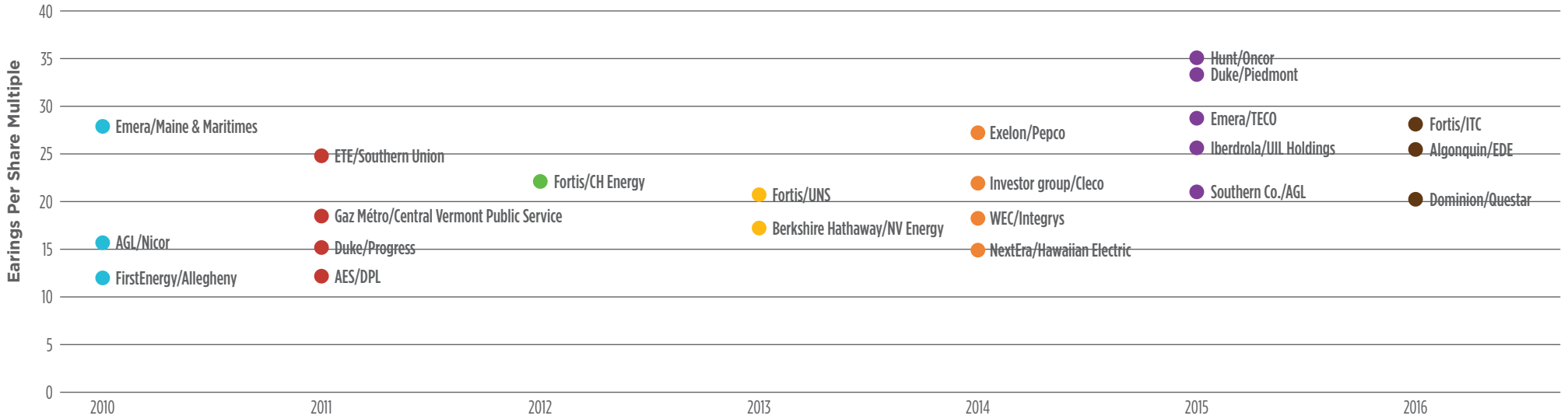


Source: SNL Financial

What's Next for M&A?

- Regulatory hurdles, especially ratepayer relief and "home rule" concerns may continue to pose hurdles to completing transactions, as evidenced by proceedings in Exelon/Pepco and NextEra/Hawaii Electric deals
- Opportunistic acquisitions of upstream (and perhaps midstream) gas companies by players with strong balance sheets and patient capital may come. Low oil and gas prices continue to stress those sectors
- Rumors are mounting among investors about potential targets of interest: smaller electric utilities, large midstream/local gas distribution company players, and others conducting "strategic assessments"
- Price-earnings multiples for utility acquisitions in 2015 were generally higher than those seen in 2013 and 2014 (see chart below). According to UBS, implied 2017 P/E valuations for recent utility transactions have been over 20x compared to a regulated peer group trading at 14x to 16x. Some observers and industry executives expect those valuations to moderate in 2016. However, some investment bankers claim high premiums will continue as the number of potential dance partners thins out

High Premiums: Earnings Per Share Multiple of Selected Deals
(2010-2016)



Sources: SNL Financial; ScottMadden analysis

NOTES:
Deals shown include whole gas and electric utility (excluding minority share purchases) corporate deals >$50 million by date announced. Excluded from these are MLP and midstream transactions.
SOURCES:
Industry news; SNL Financial; UBS; BMO Capital Markets; ScottMadden analysis

RATE AND REGULATORY ISSUES

WHAT IS A UTILITY?

For years, electric utilities have had a special role in providing electricity to consumers, an exclusive franchise territory, and an obligation to serve all customers at reasonable rates. With the advance of distributed approaches to energy production and delivery and a DIY ethos, some utility functions are being assumed by customers and "non-utilities." However, this splintering of responsibilities has implications both for consumers and utilities.

Some New Energy Delivery Models That Encroach On Functions of Traditional Utility Service Functions and Its Special Role:

Microgrid *E.g., Princeton University's hybrid (islanded or connected)*	• Generates power when prices are high, permitting lower consumption from traditional utility in high-demand periods • Bids into PJM ancillary markets • Islands from grid during emergencies
Third-Party Solar Ownership *E.g., SolarCity Model*	• Third-party developer owns, operates, and maintains the photovoltaic (PV) system • Host customer agrees to site the system on its roof or property and leases the system or purchases the electric output from the developer for a predetermined period • Developer or another party acquires valuable financial benefits such as tax credits and income generated from the lease or sale of electricity to the host customer
Community Solar	• A community solar project often includes multiple end users or subscribers purchasing a portion of the capacity or output from a solar PV facility and receiving the benefit on their electric bill • "Up-front payment" programs require customers to purchase or lease panels; "on-going payment" programs require customers to provide monthly payments to access solar capacity or output • Depending on program design, customer receives retail or partial retail bill credit for actual or guaranteed system output • Customers often pay a premium for solar output but receive hedge against future rate increases as costs are often locked in for the duration of the contract

KEY: ● Significant Impact ◐ Some Impact

Traditional Utility Functions, Roles, and Obligations

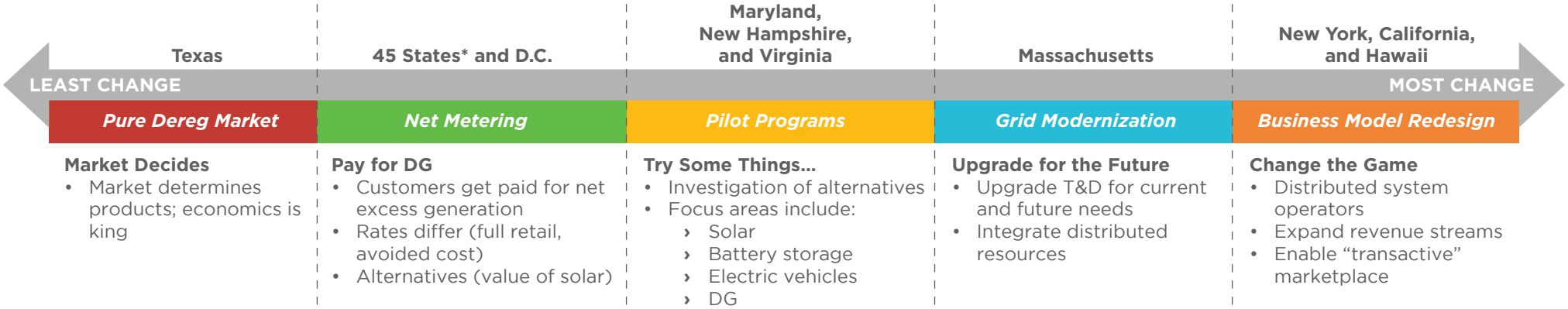
	Traditional Utility Service	Microgrid	Third-Party Solar Ownership	Community Solar	Implications and Observations
Obligation to serve	●				• Only utility must serve all customers within its franchised territory with similar and transparent terms of service
Least cost	●	◐	◐		• Least-cost obligation for system remains with utility, which cannot offer customer choice of differentiated offerings; alternative models can provide differentiated offerings at perceived value • Some third-party solar and microgrid offerings may be least cost relative to a customer's retail rates
Exclusive territory	●				• If lost, risk of migration of most attractive customers (load factor, creditworthy, etc.) to alternative providers, leaving system costs to remaining "utility" customers
Natural monopoly	●	●			• Distributed resources challenge the notion of natural monopoly
Customer aggregation	●	●	●	●	• Customer aggregation was typically an exclusive utility function
Just, reasonable, and non-discriminatory rates	●		◐	◐	• Alternative models permit more differentiated prices (rates) which may or may not eliminate cross-subsidies • Net metering reforms in some jurisdictions may be "just and reasonable" and encourage third-party ownership
Power procurement	●	●	●	●	• Benefits of pooled load for economies of scale and diversity of load profiles
Power delivery	●	●	●	●	• Delivered power is a key value proposition for new distributed approaches
Reliable system operation	●	●	◐	◐	• Microgrid operations provide reliability as a core value to customers • Solar and other distributed resources have value for peak and load reduction • Utilities remain responsible for grid reliability and determining which assets are connected
System ownership and maintenance	●	●	◐	◐	• Joint ownership of community solar facilities is emerging in ME, CO, and WA • Under both joint and third-party ownership models, vendors or co-owners assume ownership and maintenance responsibility • Wires system costs remain with utility
Infrastructure financing	●	●	●	●	• Third-party ownership of solar equipment shifts credit issues to consumers, providers • Larger, longer-term grid investments remain with the utility
Customer billing and collection	●		●	●	• Group billing and virtual net metering socialize costs with more granularity and put others in the business of being a utility without the regulation • Billing sometimes still relies upon utility in the first instance, with settlement among "community" members (in the case of solar, for example)

SOURCES:
Industry news; EPA Green Power Partnership; Nat'l Renewable Energy Laboratory; ScottMadden analysis

GRID TRANSFORMATION:
PATHS TO THE FUTURE DIVERGE

As distributed energy resources proliferate, different jurisdictions and utilities therein are taking different approaches to adapting the traditional regulatory construct.

Laissez Faire to Radical Redesign: A Continuum of Responses



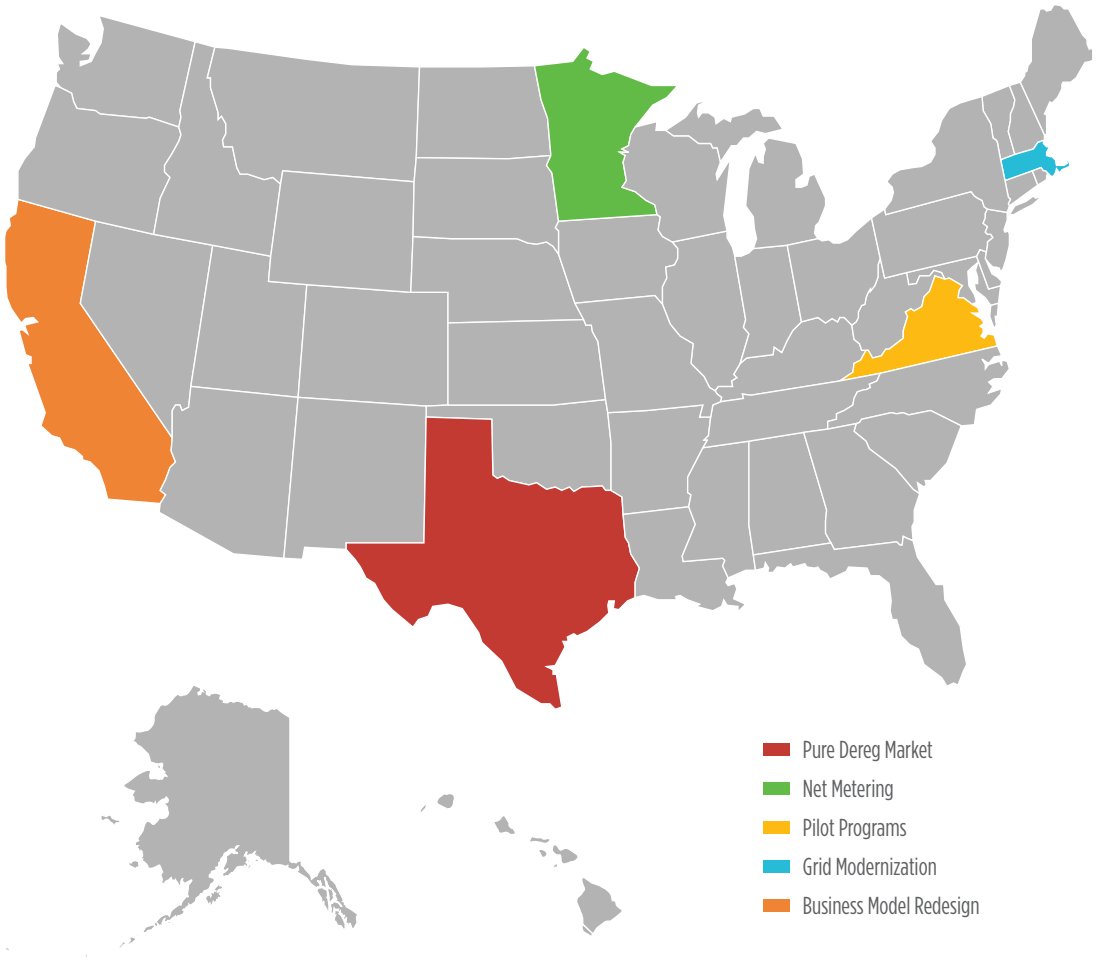
Key Questions

Area	Questions
Stakeholders	• Who gets a say? • For what issues?
System Planning	• What resources will be where, when? • How do I know it will be reliable?
Operations	• Who operates what, where, when, and how? • What's actually out there anyway?
Pricing	• How do we price the products we offer? • What are customers willing to pay?
Regulatory	• What are the rules? • How and when will they change?
Revenue Generation	• How does the utility make money?
Customers	• What do they really want? • What services? • How much control? • How much information?

NOTES:
*Includes 4 states with statewide DG compensation rules other than net metering.

Some examples by state:

Five Selected Examples of State Grid Tranformation Activity*



Texas

- Complete wholesale deregulation for IOUs (wires companies that earn an ROE on T&D)
- Retail energy service providers create products that customers will buy in IOU territories; mainly compete on price with limited DER offerings currently

Minnesota

- Customers with qualifying facilities <1 MW at IOUs are eligible
- IOUs cannot place a standby charge on net-metered facilities with a capacity of 100 kW or less
- Net excess generation (NEG) of customers with systems less than 40 kW compensated at "average retail utility energy rate"
- Systems ≥40 kW but <1 MW, NEG is credited at the avoided cost rate

Virginia

- Dominion launched a Community Solar Pilot program and experimental rate rider to enable voluntary customer purchases of 100-kWh blocks of solar generation from a company-owned 2-MW solar facility
- Rate will be used to gather information about the "effects and benefits" to its distribution systems of subscription-based DG

Massachusetts

- In mid-2014, DPU orders IOUs to develop 10-year grid modernization plans along with time-varying rate proposals
- In Aug. 2015, IOUs submitted plans focused on distribution-side improvements, including AMI, improved distribution control, and flexibility to accommodate more DERs

California

Maintaining basic ROR construct but:

- Requiring distribution resource plans (for DER-friendly grid investment)
- Implementing policies to promote DER, e.g., loading order (EE/DER first; central station generation last), solar initiative and DER programs (rebates), and storage mandate (1.325 GWs by 2020)
- Implementing structural measures to facilitate DER, including interconnection rules and long-term resource procurement

NOTES:
*Some states fall into multiple categories, but for simplicity, we've assigned them to one category to illustrate approaches being used. Even within categories, approaches may differ, e.g., HI, CA, and NY diverge significantly in approach to, and degree of, business model redesign. DG means distributed generation; IOUs means investor-owned utilities; ROE means return on equity; DER means distributed energy resources; DPU means Massachusetts Department of Public Utilities; AMI means advanced metering infrastructure; ROR means rate of return; EE means energy efficiency.
SOURCES:
Industry news; ScottMadden analysis

FERC JURISDICTION:
A BLURRY, NOT BRIGHT, LINE

FERC, the states, and the EPA are pushing and testing the boundaries of their traditional jurisdictions to pursue their respective policy priorities. Border skirmishes ensue.

	Three Playing Fields for Contested Jurisdiction		
	Demand Response Compensation	**Power Generation Markets and Price Formation**	**Environmental Regulation of Power Sector**
The Battlefront	• Power generators challenge FERC Order 745, which requires wholesale market operators to pay the same compensation to demand response (DR) providers for conserving energy as paid to generators for producing it—implicit in these arguments is yet another regarding the increasingly hazy line between transmission (FERC) and distribution (states) jurisdictions resulting from the growing impacts of DERs (including DR)	• Maryland and New Jersey authorize long-term contracts with power plant developers that guarantee a fixed price • Factual debate over whether Maryland required those developers to bid in PJM capacity auction	• EPA releases Clean Power Plan (CPP) with limited consultation with FERC • "Building blocks" include resource and performance standards (more renewables, higher plant utilization rates, move to gas) and timeline that may impact reliability
Challenger's Arguments	• DR is an inherently retail activity, subject to the ratemaking authority of the states, not FERC • DR has effect of "luring" retail customers into the wholesale markets and driving down compensation for "steel in the ground" projects • If allowed to "affect" retail prices, a limiting principle may be hard to find – e.g., why couldn't FERC regulate net metering? • DR-induced avoidance of consumption is not a "sale of energy for resale" as typically characterized wholesale (FERC-jurisdictional) power	• Guaranteed price to developer alters bidding behavior and undermines FERC-approved mechanism in PJM to set capacity and energy prices • If a generator would get the guaranteed price only if it cleared PJM's auction (and mitigate the state's financial obligation), generator could bid low to ensure the assets in question cleared the PJM auction • Artificially low prices affect efficiency of market because price signals for development are not fully seen by market participants	• EPA's "best system of emissions reduction" under the CPP goes beyond the fence line, attempting to regulate the bulk power system, not just the emitter, and encroaching on FERC's jurisdiction • As a result of CPP, state air regulators may make significant decisions that state utility commissioners have made for decades

	Three Playing Fields for Contested Jurisdiction		
	Demand Response Compensation	**Power Generation Markets and Price Formation**	**Environmental Regulation of Power Sector**
Proponent's Arguments	• FERC has jurisdiction over wholesale power markets, and DR rules directly affect those markets (a negawatt = a megawatt) and FERC's jurisdictional mandate of "just and reasonable" rates • Per the U.S. Supreme Court: DR is not a FERC "power grab" but a "market generated innovation for more optimally balancing… supply and demand," aimed at holding down prices and enhancing reliability in peak periods, within FERC's purview	• Challenges to this state approach open door for attack on any state-directed mechanism to assure adequate generation capacity • State authority over resource adequacy and reliability was not preempted by the Federal Power Act • Market mechanisms were not working: volatile capacity prices were not encouraging generation in a particularly reliability-challenged area	• FERC, EPA, and other agencies can collaborate and coordinate on significant rulemakings like the CPP, and EPA has proposed such collaboration for a reliability safety valve and review of state plans for reliability issues • EPA regulatory authority over CO_2 is not dissimilar to its jurisdiction over SO_2 and thus has been accommodated by overlapping FERC jurisdiction
The Outcome (or What's Next)	• U.S. Supreme Court upheld FERC's DR pricing order, FERC can regulate wholesale markets and other matters "directly affecting" wholesale rates even if this "affects—even substantially—the quantity or terms of retail sales" • States still have authority to ban or limit customer participation in DR—the remaining blurriness was acknowledged by the Justices who deferred to the "inextricably linked" nature of the wholesale and retail markets	• The U.S. Supreme Court recently threw out the Maryland program that incentivized new in-state power generation, finding it intruded on FERC's jurisdiction over wholesale energy markets. But its holding was narrow, focusing on the requirement of capacity having to clear auction, and it did not preclude all state generation incentive programs • The decision will have implications for a similar New Jersey case, as well as a recent Ohio PUC ruling (see below)	• About half of the states, and others subject to the rule, have challenged the CPP while 18 states and tens of corporations (e.g., Apple, Amazon, Google) have filed in support • U.S. Supreme Court stayed enforcement of CPP in an unprecedented ruling, but it is unclear whether it will be tolled or compliance deadlines will remain in place • D.C. Circuit will review the case in June with decision due in fall 2016 and certain appeal to the U.S. Supreme Court

Ohio Tests Generation Support

- The Public Utilities Commission of Ohio (PUCO) on March 31 unanimously approved modified, yet controversial eight-year subsidy plans from AEP Ohio and FirstEnergy Corp.'s (FE) utilities designed to guarantee income for primarily coal-fired generation
- Commissioners cited the challenges utilities face due to low prices and decreasing demand and, through a contract for differences, the need for safe, reliable, and cost-effective electric services
- FERC rescinded market-based rate waivers tied to power sales restrictions for AEP and FE by the end of April and Wall Street predicts similar rejections of the PUCO-approved PPAs in the coming months

SOURCES:
Industry news; law firm newsletters; *Energy Bar Journal*; SCOTUS blog; ScottMadden analysis

INFRASTRUCTURE AND TECHNOLOGY

HAWAII AND TEXAS: WHAT UTILITY EXECUTIVES LEARNED FROM A SOLAR "HOT SPOT" AND ONE THAT COULD BE

Utility leaders, the Smart Electric Power Alliance (SEPA), and ScottMadden visited the states and got insights from the key players.

Why Examine Renewables in Hawaii and Texas?

- SEPA and ScottMadden hosted senior utility executives on fact-finding missions to Hawaii in September 2015 and to Texas in November 2015
- The trips explored how the electric grid accommodates high penetrations of renewables (Hawaii) and the impact of the role of solar in a competitive market with retail choice (Texas)

Understanding Hawaii: Microgrids in the Pacific

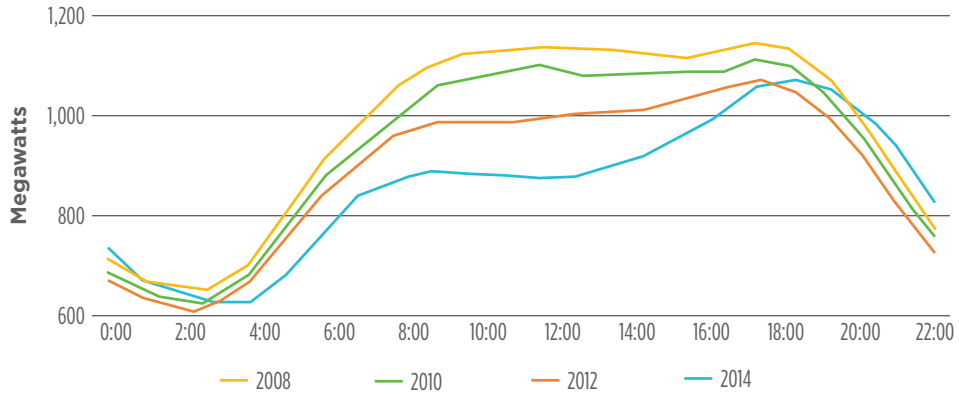
- Lacking interconnections, each island must be energy self-sufficient. Driven by expensive oil, retail electricity prices average more than 25¢/kWh, double the U.S. average
- Spurred by high electricity prices, non-hydro renewables have grown rapidly and accounted for 16% of electric generation in 2014. In addition, growth of customer-sited solar continues to reduce average daily load during midday periods (see chart)

Texas Two-Step: Public Power Versus Competitive Retail

Texas consists of two distinct energy markets (see map)

- Served by 140 providers, municipal and cooperative utilities account for 25% of ERCOT load. The utilities provide full retail service and have an ability to innovate to meet policy goals
- The competitive market is driven more by near-term economics. Served by 110 registered retail electric providers; competitively served retail deregulated markets account for 75% of ERCOT load

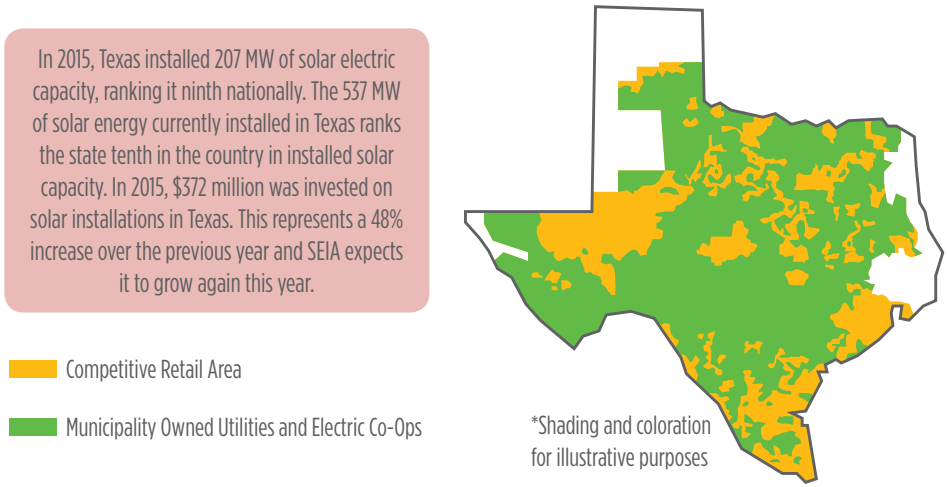
Hawaii Average Daily Load: Signs of a "Duck Curve" (2008-2014)



Sources: SNL Financial; ScottMadden analysis

A Patchwork: Texas End-Use Electric Territories by Provider Type

In 2015, Texas installed 207 MW of solar electric capacity, ranking it ninth nationally. The 537 MW of solar energy currently installed in Texas ranks the state tenth in the country in installed solar capacity. In 2015, $372 million was invested on solar installations in Texas. This represents a 48% increase over the previous year and SEIA expects it to grow again this year.

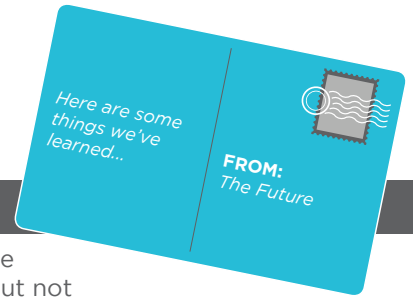


Source: Texas Solar Power Association

Postcards from the Future: Distributed Generation Lessons from Hawaii

- As distributed and renewable energy choices become widely affordable and accessible in Hawaii, the status quo in the electricity market changed quickly
- This experience is often described as the "postcard from the future" as trip participants agreed that, despite market differences, mainland utilities could see similar shifts in utility, solar industry, and regulatory mindsets someday in the future
- However, mainland utilities and regulators can prepare by focusing on customer expectations and new ways to manage the grid

> "Change is coming and you can look to Hawaii to get ideas. There is great opportunity for an electric utility to play a vital role, but if you live in the past, you won't be part of the future."
> *-Utility Executive*



Key Observations and Lessons for Mainland Electric Utilities

Area	Observations	Key Lessons
Operational and Technical Issues	• Reverse power flows are now normal on the distribution grid • Grid has not collapsed but requires more refined system planning, detailed analytics, and new technology (e.g., advanced inverters)	• Expect that the grid can take more • Technical issues are challenging but not impossible to solve with the right economics and regulatory environment
Customer and Stakeholder Relations	• Interest in reducing electricity bills drove customers to distributed solar • Slow regulatory and planning processes hampered utility responses, including processing interconnection requests • Utility responses need to align with customer desires while ensuring system improvements, if needed • Utilities can lead the conversation—and should	• Recognize that market drivers can easily outpace regulatory and utility-planning cycles • Do not underestimate customers' off-grid options • Establish trust between stakeholders through two-way communication • Be the enabler of solutions by saying "yes, with..."
Leadership and Managing Change	• Interconnection response rates led to customer and regulatory frustration • Situation required utility to have a focused vision for moving forward • Utility must have internal alignment before being able to partner with service providers, test new technologies, and respond to customer needs	• Anticipate change and get ahead of it before it overwhelms you • Ensure that leaders and all parts of the organization speak with one voice. Internal alignment is crucial • Establish checkpoints and milestones. Don't strive for perfection: iterate and improve

Municipal and cooperative utilities meet customer demand with innovative solar programs.

Fact-Finding Mission Discovers Early Solar Innovation and Significant Long-Term Potential

In 2013, Austin Energy served 4% of Texas residents, yet accounted for 30% of Texas' solar capacity.

- The offering of full retail service to customers has allowed municipal and cooperative utilities to emerge as distributed energy resource innovators in Texas
- The combination of retail and wholesale restructuring has been unique in Texas—with an energy-only market and munis and co-ops exempt from retail choice—and the ongoing deployment of solar will be subject to its relative competitiveness with other resources
- Technical and program implementation challenges are very real, but stakeholders have the time and ability to figure them out

Economics and Resolving Technical Issues Will Be Critical Moving Forward

- Consumers and retail energy providers are subject to long-term price uncertainty in the competitive retail market. If the economics of utility-scale solar continue to improve, solar may be able to follow the example and success of Texas wind
- If economics improve, utility-scale solar development would likely occur in the western portion of Texas, where less cloud cover allows a 30% to 50% increase in solar production
- Solar can put new strain on distribution system infrastructure. Distributed energy resource deployment, such as smart inverters and batteries, can offer solutions but are not yet cost effective

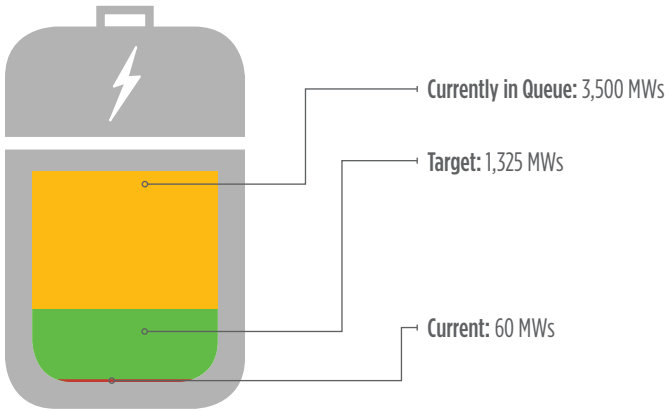
Utility	Notable Solar Activity
Austin Energy	• Goal to meet 65% of energy with renewable resources by 2025, including 750 MW utility-scale solar and 200 MW local solar (half of which should be customer-sited PV) • Shifted from net metering to value of solar payment which attempts to quantify value at which the utility is "neutral" to paying for locally generated PV • Signed multiple utility-scale solar PPAs totaling more than 400 MW • Community solar project with storage integration under development
CPS Energy	• CPS Energy pays a host fee to customers to allow developers to install solar on rooftop; developer owns panels and sells power to CPS Energy • "Roofless" solar allows customers to own panels and receive bill credit from utility-scale system • Solar activity has driven economic development with multiple solar and smart grid companies committing to locate jobs in the community or support education initiatives
Georgetown Utility Systems	• City of Georgetown moving to 100% renewables thanks to storage and active scheduling through ERCOT • Utility will buy double their energy needs through: › 144 MW wind PPA with EDF: 20-year fixed price; operations began in 2015 › 150 MW solar PPA with SunEdison: 25-year fixed price; operational before Jan. 2017

SOURCES:
Austin Energy; CPS Energy; Georgetown Utility Systems; SEPA; ScottMadden

ENERGY STORAGE:
LOOKING AT BOTH POLES OF THE BATTERY (+ & -)

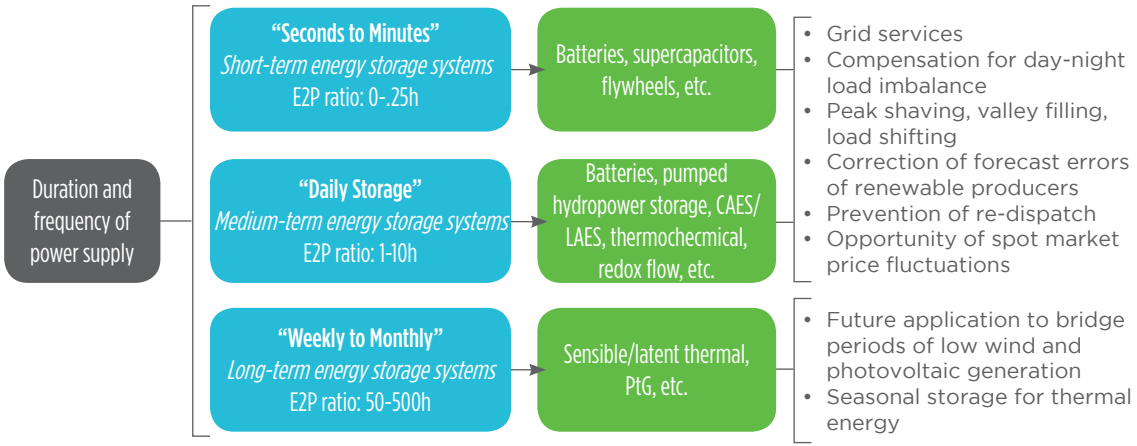
What is the value of energy storage, and what is it anyway—generation, distribution, transmission, or something else?

California Dreamin':
The Golden State's Energy Storage Goals



Source: GTM Research

Different Technologies Offer Different Applications for Storage



Source: World Energy Council

Tsunami Waiting to Happen

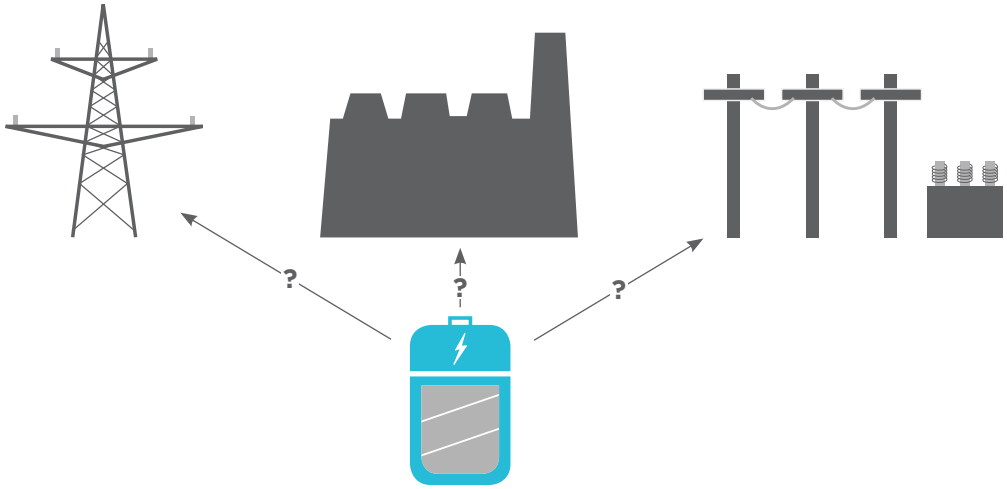
- Energy storage capacity continues to grow, adding 221 MWs in 2015, with 112 MWs coming in Q4 alone. One forecaster anticipates that installed storage capacity will cross the 1-GW threshold in 2019
- California is a significant market for storage, much driven by its state mandate (1,325 MWs by 2020). While it added only about 60 MWs since 2013, it has 3.5 GWs in the interconnection queue for 2016–2018
- While behind-the-meter installations have grown, most of the significant activity expected in the near term are front-of-meter installations pursuant to utility solicitations and providing ancillary services and similar support

Much Talk About Cost, But What About Value?

- Levelized cost of storage is a useful barometer of its economics, but increasingly, value is seen in storage for capacity and ancillary services rather than solely for energy applications
- Critical to economic success of storage is the potential for multiple revenue streams such as capacity, regulation service, and energy price arbitrage
- Industry stakeholders have commented on the need to develop common performance specifications for different storage use cases

NOTES:
E2P ratio is energy-to-power ratio or discharge time; CAES is Compressed Air Energy Storage; LAES is Liquid Air Energy Storage; PtG is power-to-gas.

Tough to Classify:
Determining a Category for Storage under Traditional Energy Value Chain



Illustrative Net Load – March 31 (California ISO)

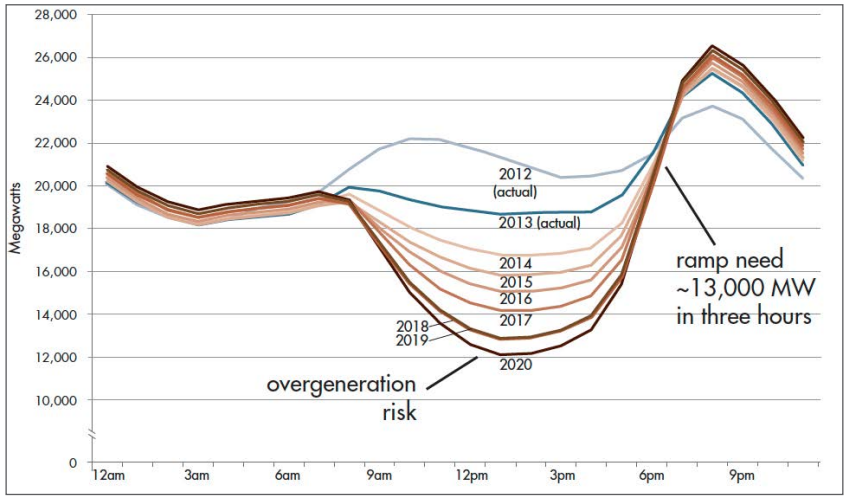


Chart Courtesy of California ISO; Moody's Investor Service

"Neither Fish Nor Fowl"

- Independent system operators, spurred by FERC rules such as Order 755, are making strides in incorporating storage into tariffs and operations. But technologies are heterogeneous, and classifying resources under current wholesale constructs has been problematic
  - For example, short-term storage (flywheel, battery)—for frequency regulation, blackstart, and reactive supply and voltage control—has qualified under MISO's tariff since 2009
  - But under current rules, medium-term storage (battery, thermal storage) that can provide 4+ hours of power does not qualify as capacity, energy, or reserves
  - Moreover, depending upon application, storage eludes clear categorization as a generation or transmission resource, which affects how it is compensated. But in some cases, storage could serve dual roles such as frequency regulation and demand-charge reduction

Perhaps "Fowl": In the Belly of the Duck Curve

- As distributed energy resources, particularly solar PV, make their way onto the grid, storage is seen as a potential partner to help moderate the rapid declines and increases in load during peak hours accompanying high solar production
- Battery storage might be used for both energy injection (e.g., demand response) and withdrawal (e.g., dispatchable load)
- According to Moody's, this could help pull up the belly of the duck curve (above) during the day and flatten the neck. This could trim capacity prices and possibly lower some generators' profit margins

SOURCES:
World Energy Council; Lazard; Midcontinent ISO; *RTO Insider*; Moody's Investors Service; Energy Storage Ass'n; Greentech Media; industry news; ScottMadden analysis

CYBERSECURITY AND IT/OT CONVERGENCE

A December 2015 Ukrainian power outage demonstrated how a cyber attack on an electric utility might unfold. The attack targeted utilities' operational technology (OT), including an operator's ability to monitor power flow. This demonstrates utilities' need to include OT, along with information technology (IT), within their enterprise cybersecurity programs.

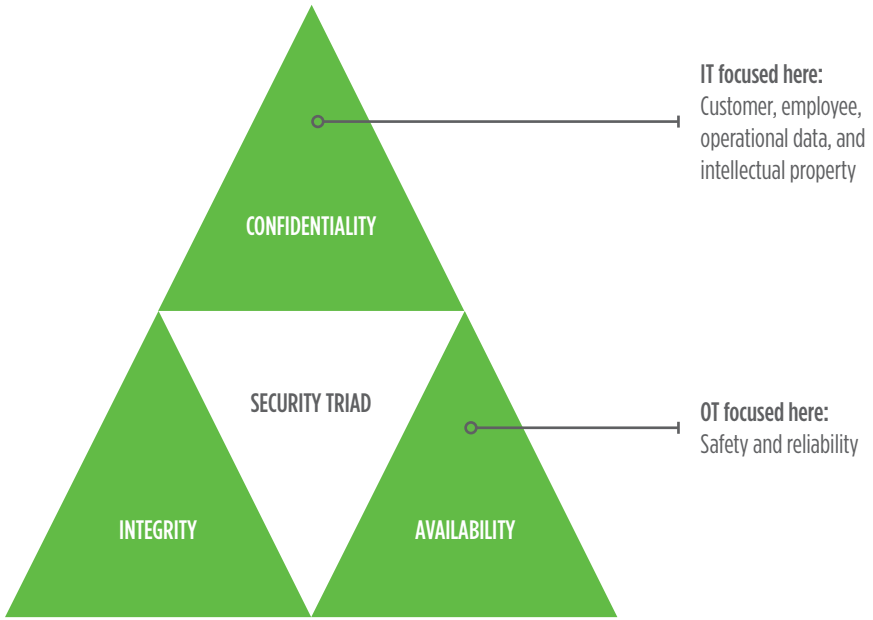
IT and OT Have Historically Been Distinct

- IT and OT have had distinct asset types, fulfilling distinct missions, managed by distinct organizations
- Corporate IT was responsible for the IT that supported corporate users, back office, and customer support functions
- Engineers supported the OT that supported generation, transmission, and distribution operations
- IT assets were commodity and open technologies, while OT assets were proprietary, often unchanged over years or decades
- IT priorities were generally related to the confidentiality of data, while OT priorities were focused on availability of systems

Recent Developments Are Challenging This Model

- OT systems are moving toward standard and commodity technology platforms (IP networks, Windows, etc.)
- New technologies (e.g., Internet of Things, mobility, cloud) are creeping into operating environments, providing monitoring, data collection, and asset and work management capabilities
- Real-time energy trading, demand response requirements, and grid transformation technologies have forced integration of IT and OT systems
- IT and OT are no longer independent actors; they are converging

There Have Been Differences in Security Priorities: IT vs. OT



IT/OT Convergence: A Macro Trend

> "When compared with previous industrial revolutions, the Fourth Industrial Revolution [cyber-physical systems] is evolving at an exponential rather than a linear pace. Moreover, it is disrupting almost every industry in every country. And the breadth and depth of these changes herald the transformation of entire systems of production, management, and governance."
>
> *-World Economic Forum*

To support these new developments, a converged cybersecurity model is required, but a number of challenges have slowed progress toward an IT/OT convergence.

Key Challenges to IT/OT Convergence

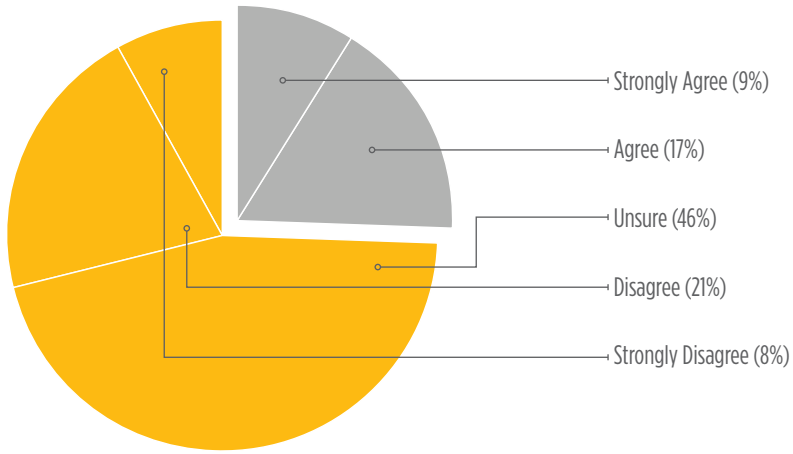
- ***Cultural/political:*** Finding common ground between IT and OT organizations has proven difficult (cats and dogs); each has its own perspectives on priorities and practices and struggles to reconcile these perspectives
- ***Technical:*** Even though the technology is converging, there are still differences in the system environments and tolerance requirements that prevent one-size-fits-all technologies and tools from being used throughout the enterprise
- ***Workforce:*** The nature of these systems requires knowledge of both current technologies and older, even outdated, technologies; organizations need to balance these competing priorities so they can continue to maintain critical systems, while not ignoring the benefits that new technologies can provide
- ***Security:*** Moving OT toward more current technologies introduces security risks; one of the unintended benefits of operating on dated, proprietary technology is "security through obscurity"—systems that are unique to a certain environment may be less vulnerable because of the special knowledge required to understand how they operate

Learning from Ukraine: A Cautionary Tale

What Happened	On December 23, 2015, hackers caused a six-hour outage affecting more than 225,000 customers across eight of Ukraine's 24 regions
How It Happened	After installing malware to prevent technicians from detecting the attack in six different utilities, the hackers remotely switched breakers to cut power while simultaneously sabotaging operator workstations and flooding the utilities' customer-service centers with calls to prevent customers from raising alerts
Why It's Important	Experts widely describe the incident as the first known power outage caused by a cyber attack, and specifically the first to target OT networks in addition to the utilities' enterprise IT networks
Lesson Learned	Ultimately, the Ukraine outage demonstrates that utilities need to include OT, along with IT, within their enterprise cybersecurity programs

Security Risk Management Confidence: Industry Leaders Speak

My organization effectively manages security risks to information assets, enterprise systems, SCADA networks, and critical infrastructure.



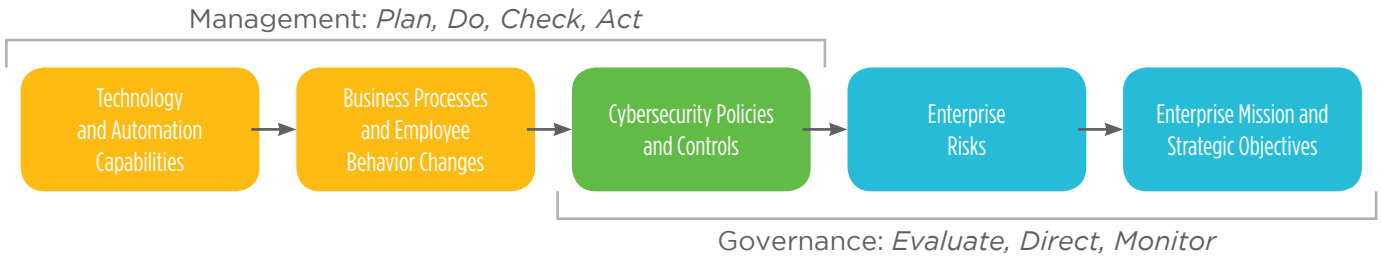
Source: Ponemon Institute

Successful IT/OT convergence requires a strategic enterprise cybersecurity program backed by strong executive leadership and project and change management.

Lessons From Successful Companies Addressing Convergence Challenges

- ***Scope and mandate convergence from the top:*** Because of the entrenched interests, leadership is required to set direction, monitor progress, and resolve issues that prove irresolvable
- ***Acknowledge and design for legitimate differences across IT and OT environments:*** A one-size-fits-all solution will not work, and security practices that may prove successful for an ERP system are not practical for a SCADA system. But that should not prevent moving toward a converged program. It only means that standards need to be robust enough to account for these differences. Leaders need to be able to distinguish between what are legitimate differences and what are simply personal or functional preferences
- ***Realize that cybersecurity is a journey:*** Companies should set priorities, establish responsibilities, focus on their biggest risks, and adjust their plans as new information becomes available
- ***Support efforts with strong project and change management:*** These changes are not trivial and require project management to execute successfully and change management to address the inevitable resistance that will come

Developing a Strategic Cybersecurity Program



Key program elements: governance and oversight; an appropriate policy framework; cybersecurity functional management; and program implementation capabilities

Program Implementation Imperatives

- Engage senior leadership in cybersecurity direction setting, decision making, and performance monitoring
- Define enterprise risks and cybersecurity priorities
- Develop and track meaningful measures of progress against priorities
- Tailor program to account for differences between OT and IT assets
- Integrate cybersecurity regulatory compliance into cybersecurity program

LNG EXPORTS:
SUPPLY TO OUTPACE DEMAND...FOR NOW

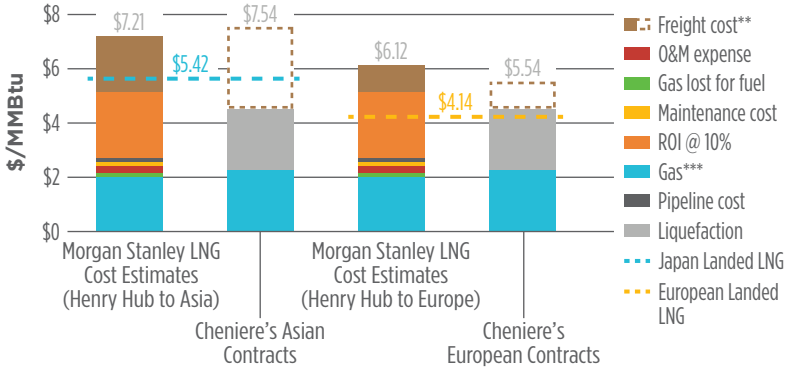
Cheap natural gas could turn the United States into a major global gas supplier, but concerns remain.

U.S. LNG Exports Set to Launch into a Bust Market

- ***Beginning of an era:*** On Feb. 24, 2016, Cheniere shipped the first cargo of U.S. (lower 48) domestically produced natural gas to international markets
- ***Increasing global supply:*** U.S. LNG export capacity of ~7.5 BCF/day is expected online by year-end 2018, with more than triple that pending or in pre-filing with FERC; Australia set to increase export capacity more than 70% by 2020 to ~33 BCF/day
- ***Amid decreasing global demand:*** Japanese and South Korean LNG imports are down 14.4% and 4.7% respectively year-over-year from 2014 to 2015; forecast Chinese gas demand growth down 6.5% through 2020; EU gas consumption decreasing since 2010
- ***And competition:*** Large players like Qatar and Australia continue to be active in locking in LNG contracts with aggressive pricing, as many LNG contract prices are linked to stubbornly low oil prices*
- ***Leads to unfavorable price differentials:*** As an example of challenging conditions, Cheniere has contracted 87% of its capacity with prices set at 115% of Henry Hub plus $2.25 fixed costs, mainly liquefaction. One analyst estimates at March's global LNG spot prices, at $1 freight to Europe and $3 to Asia, this pricing would have netted a $1.25/MMBtu loss in European markets and an ~$2.95/MMBtu deficit in Asian markets
- ***But there's hope:*** Some observers say the current LNG glut will clear in the 2020 to 2022 time frame. In addition, there are geopolitical considerations involving competition, diversification of supply, and security (e.g., unpredictable Russian supply) that can incentivize buyers to pay premiums for U.S. LNG—the question is how much and for how long?

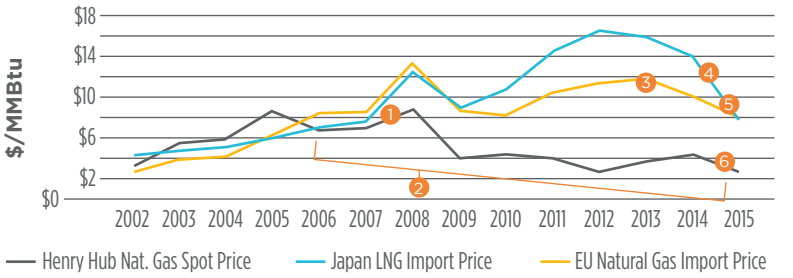
NOTES:
*One analyst says that oil prices would need to rise to $50 to $55 per barrel to make oil-linked LNG prices "in the money" for U.S. LNG sellers; **Morgan Stanley Research estimate of $0.95 to Europe and $2.04 to Asia, and Cheniere range of $0.50 to $1.00 to Europe and $1.50 to $3.00 to Asia; ***Assumes HH at $1.99/MMBtu, construction cost at $1,000/mtpa and 40-year useful life, 10% ROI.

Challenging Breakeven: Selected LNG Export Costs/Contracts vs. Recent Landed Prices



Sources: Cheniere; Japan METI; Energy Intelligence; Morgan Stanley

Regional Natural Gas Price Benchmarks Used in Gas Trade



Source: World Energy Council

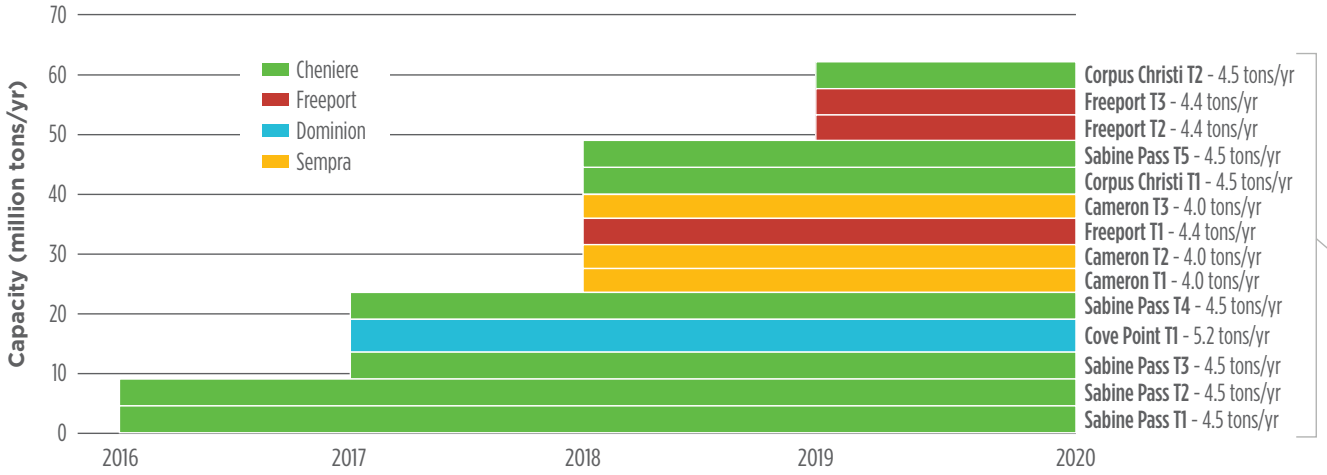
EVENTS AND TRENDS

1. U.S. shale gas boom begins
2. Continued growth in U.S. shale gas supply; domestic supply glut leads to depressed prices; 20+ proposals submitted for LNG export terminals; economics drive coal to gas switching
3. Fuel switching occurs due to flood of cheap coal on the market
4. Asian demand growth dampens; oil price collapse followed by LNG natural gas price collapse
5. First Japanese nuclear reactor comes back online
6. Five LNG export terminals approved; 60+ million tons/year coming online through 2020

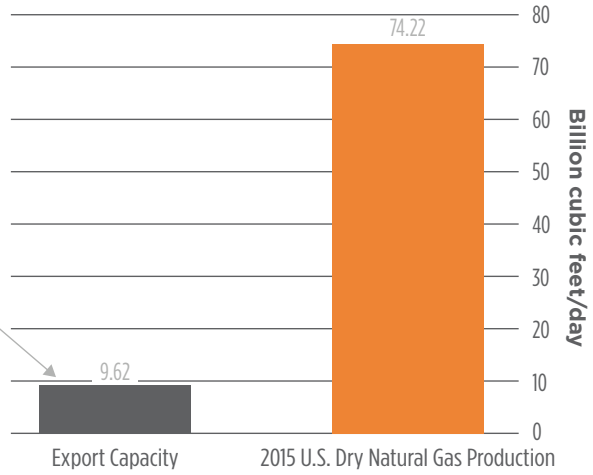
How Might Large-Scale LNG Exports Affect the U.S. Market?

- EIA forecasts that the United States will be a net exporter of LNG by late 2016 and a net exporter of natural gas by late 2017, with 10% of domestic supply being exported by 2020
- A December 2015 DOE report found that increased LNG exports will boost domestic production and generate $7 billion to $20 billion annually through 2040, leading the Center for LNG to claim that "the time for U.S. LNG exports is now"
- Industrial groups claim that the report only examines the effects of increasing exports from 12 BCF/day to 20 BCF/day, thereby excluding the considerably higher costs of initiating exports from 0 BCF/day to 12 BCF/day—costs that would be to the specific detriment of "energy-intensive trade-exposed industries and the U.S. consumer"
- The DOE report acknowledges potential adverse domestic price impacts on energy-intensive sectors. Its base case assumes moving from 12 BCF/day to 20 BCF/day in exports will result in an ~25¢/MMBtu to 29¢/MMBtu increase in domestic gas prices. For comparison, NYMEX Henry Hub futures for February 2018 are trading at $3.09/MMBtu, while futures for February 2020 are trading at $3.24/MMBtu
- A key assumption is the ability of the domestic U.S. upstream gas sector to respond to increased demand with expanded production, and a key uncertainty is the level of gas demand in the power sector that will be generated by the Clean Power Plan

FERC-Approved LNG Export Terminals under Construction
(by intended start date)



Projected 2020 LNG Export Capacity ~13% of 2015 U.S. Production



Sources: Morgan Stanley; EIA; ScottMadden analysis

NOTES:
LNG is liquefied natural gas; BCF/day is billion cubic feet of gas per day; DOE is U.S. Department of Energy; MMBtu is millions of British thermal units.
SOURCES:
Energy Intelligence; EIA; U.S. Department of Energy; Japan METI; Deutsche Bank; World Energy Council; ICIS; Cheniere; Credit Suisse; FERC; Morgan Stanley; Macquarie Research; BMI Research; SNL Financial; ScottMadden analysis

CLEAN TECH AND ENVIRONMENT

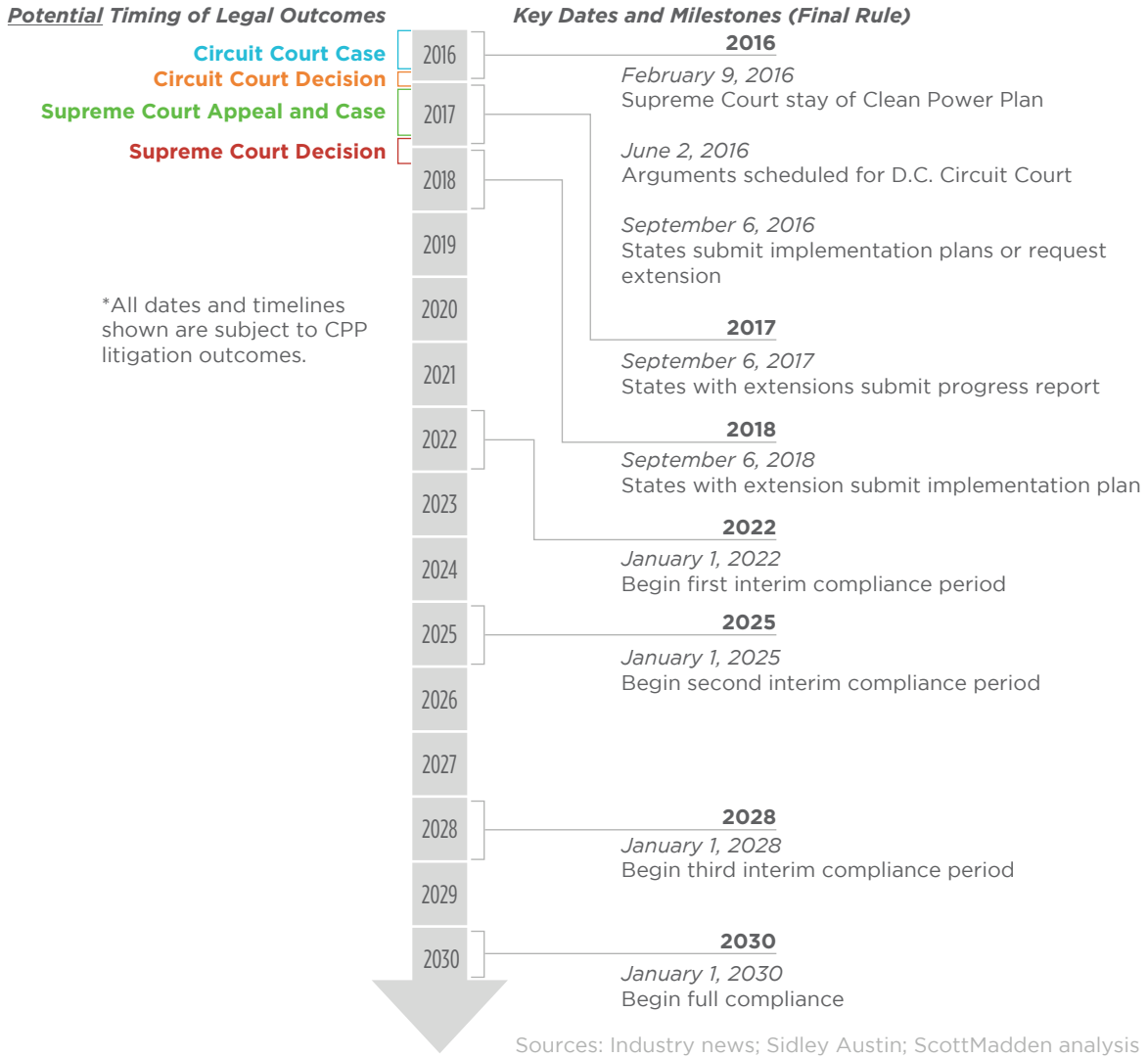
CLEAN POWER PLAN:
AN UNPRECEDENTED STAY OF THE EPA RULE

The Supreme Court agrees to review EPA's Clean Power Plan (or CPP), extending—for a time—uncertainty in the utility and power generation sectors about the rule's validity and timing.

Supreme Court Stay Puts Clean Power Plan in Flux

- On February 9, the U.S. Supreme Court stayed enforcement of the EPA's Clean Power Plan in a 5-4 vote. This was widely viewed as unprecedented since, until now, the Court has not stayed a rule while challenges were pending in a lower court
- Some posit that the Court's majority voted to stay the applicability of the CPP because of EPA's "four corners" offense on MATS, effectively forcing utilities into compliance while they litigated the MATS rule's validity
- The D.C. Circuit will hear challenges to the CPP in June, with a decision widely expected by Fall 2016 and a certain appeal to the Supreme Court expected for its 2017 docket

CPP Milestones vs. Potential Litigation Timing*



Sources: Industry news; Sidley Austin; ScottMadden analysis

NOTES:
Utility MATS is EPA's final rule on mercury and air toxics standards for coal- and oil-fired electric utility steam generating units, issued in November 2014.

Numerous states suspend compliance planning; EPA mum on deadline revisions.

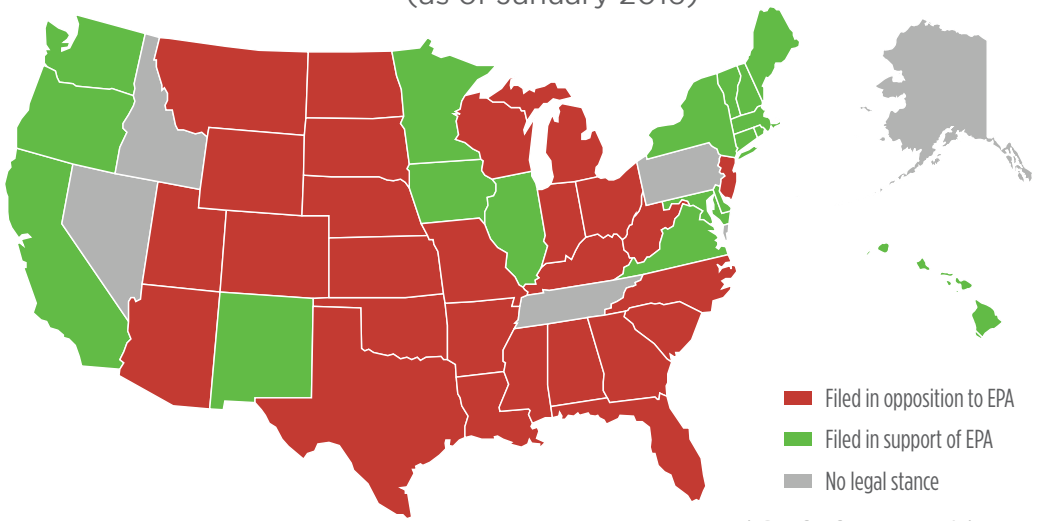
States Ponder Deadlines and Options

- In response to the stay, 19 of the 27 states with legal challenges suspended compliance planning. An equal number of states will continue planning (see charts at right)
- The EPA has offered voluntary assistance to states and plans to develop model trading plans and the Clean Energy Incentive Program
- If the rule is ultimately upheld, a significant question becomes the possible delay or "tolling" of rule deadlines*
- Under the CPP, final state plans are due to EPA in 2018. If EPA were to prevail in the U.S. Supreme Court, which may not happen until late 2017, and deadlines do not change, states could end up with one year or less to develop and submit implementation plans. Some believe this date would be pushed back to give states extra time to submit their plans
- Less certain is whether the 2022 start date and subsequent implementation dates of the CPP compliance period would also be similarly extended or tolled*

> "The Supreme Court did stay the rule. They did not speak to any tolling of the deadlines...We're not implementing or enforcing, but we're going to be there if states are asking us for help."
>
> *-Gina McCarthy*
> *EPA Administrator*

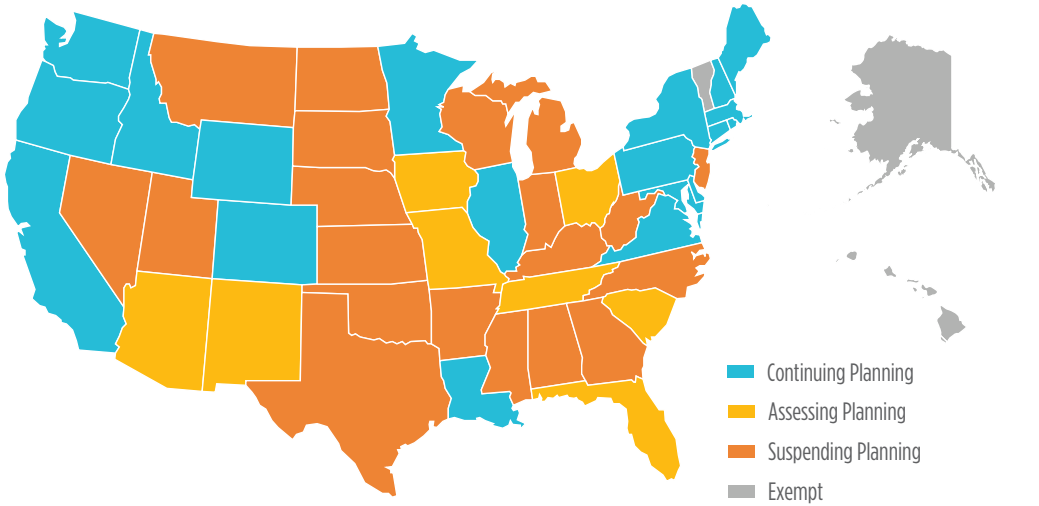
NOTES:
*Tolling allows for pausing, delaying, or suspending of some or all of the deadlines of the CPP. **Based on U.S. Court of Appeals for the D.C. Circuit case No. 15-363 as of Jan. 21, 2016.

States' Legal Stance in CPP Appeals**
(as of January 2016)



Source: Nat'l Conf. of State Legislatures

States' CPP Compliance Planning Activities Pending Appeals of Rule



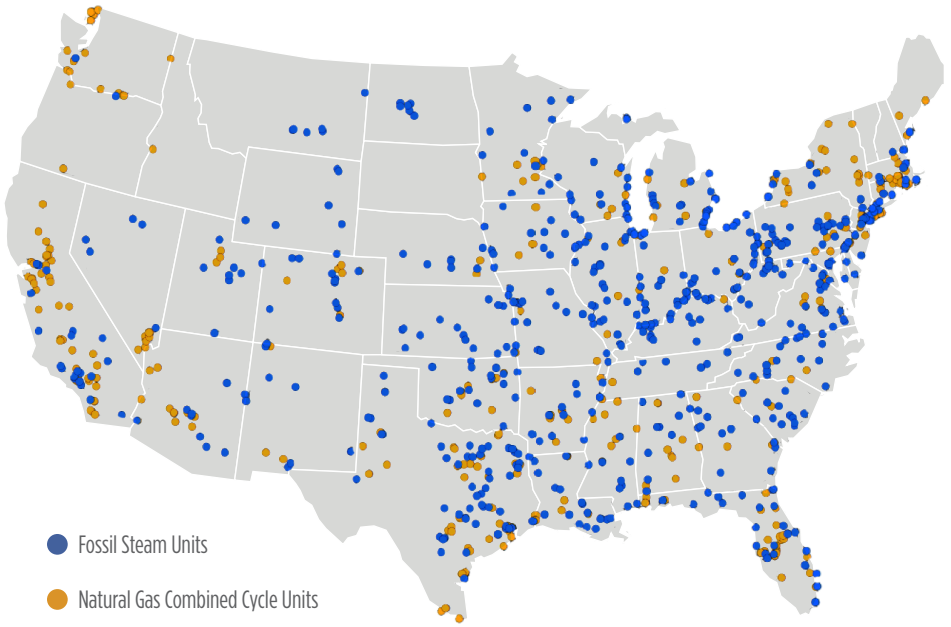
Source: E&E News

Owners of power generation are trying to navigate the time required to plan and implement CPP compliance strategies, their regulators' and legislators' wishes, and lack of clarity on the ultimate implementation dates of the CPP.

Announced CPP Plans for Selected "Generation-Heavy" Utilities

Ameren Corporation	We think it's mostly [the case that we] are going to see it [i.e., capital **investments** in generation projects, especially renewables] be **more toward the back end of the timeline.**
American Electric Power Company	We need to look in detail at what needs to be done in each particular state and we've looked at it in terms of a **mass-based approach** so that would allow trading to occur among states…In the integrated regulated states, which most of ours are, [this] would be a great opportunity for us to continue to **invest in additional resources**.
Dominion Resources	We fully expect that we're going to need **significantly more gas and significantly more solar** than what has been announced thus far to comply in the state of Virginia…But CPP can be implemented "in a way that is challenging but ultimately manageable for regulated power plants."
Duke Energy Corporation	The **mass-based plan** would be Duke's choice…states and utilities have extensive experience with mass-based trading programs….Under a mass-based approach, where allowances are freely allocated to existing EGUs, utilities like Duke will be able to **prevent rate spikes** while still achieving appropriate emission reduction.
Southern Company	Southern Co.'s goal [as a result of the CPP and its acquisition of AGL Resources] is to increase natural gas' share in its generation mix to **55% by 2020 from the current 40%** while at the same time reducing coal's share in its generation mix to **21% by 2020 from the current 40%**. Southern Co. is also going strong on **solar**.

Affected Electric Generating Units (EGUs) Under the EPA's CPP*



Source: EPA

NOTES:
*Dots represent approximate unit location.

The First Step in a State Implementation Plan Is Choosing a Mass- or Rate-Based Compliance Target

- States developing implementation plans must first decide if they will meet mass- or rate-based targets outlined by the EPA. The table below highlights key decision criteria and the direction in which the criteria may push a state. In addition to the criteria outlined below, a state must also consider the current generation portfolio, planned retirements and additions, physical infrastructure constraints (e.g., natural gas pipeline capacity), existing renewable energy policies, state energy policy, and current rates and regulations.

Key Decision Criteria for Mass- or Rate-Based Compliance Approach

KEY: ○ low ◐ medium ● high

Criteria	Impact on Rate- vs. Mass-Based Decision	Drives Towards Mass Compliance	Drives Towards Rate Compliance	Discussion
Participate in existing carbon trading system (i.e., RGGI or California)	●	✔		• States can expand existing trading programs to incorporate CPP targets under an exclusively mass-based "state measures" approach
Rely on prior experience regulating mass-based emission regulations	●	✔		• States may leverage experience from mass-based cap-and-trade Acid Rain Program implementation (i.e., SO_2 and No_x)
Plan to complete construction of new nuclear generation	●		✔	• The addition of zero-emission baseload generation may significantly lower the overall emission rate, thereby making rate-based compliance a potentially attractive option in the Southeast
Manage compliance costs by trading in multi-state markets	●	TOSS-UP		• Cost efficiencies are gained by joining regional trading markets; late movers may adopt the compliance strategies of neighboring states
Plan to construct new fossil generation to meet future load growth	◐		✔	• Rate-based compliance would only apply to existing electric generating sources. New fossil units for demand growth would need to meet 111b new source standards but could operate outside of CPP 111d caps
Plan to increase output from existing fossil units to meet future load growth	◐		✔	• Increasing generation from fossil units with low capacity factors would increase total emissions under a mass-based approach but will not adversely affect average rate of emissions
Plan to maintain and/or expand energy efficiency programs	◐	✔		• Energy efficiency under mass-based compliance reduces carbon emissions; under rate-based compliance, these savings must be measured and verified in order to generate emission rate credits
Rely heavily on any or all of EPA's "building blocks" (i.e., increase efficiency of coal plants, shift from coal to natural gas, or use zero-emission generation resources)	○	TOSS-UP		• The relative abundance of a building block in a state (e.g., high solar resource) has important implications for the state implementation plan but does not necessarily push a state toward mass- or rate-based compliance

Studies disagree on compliance costs and household impact of the final rule.

Common Themes Emerge from Conflicting Reports

- Robust trading can mitigate compliance costs and impacts. National trading is ideal, but regional trading still results in benefits
- Allocation of emission allowances is a critical design question in mass-based compliance. In a given state, utilities may have very different interests in how allocation will work. Customers may be negatively impacted if auction revenue does not lower electric rates or bills
- Energy efficiency is a wildcard in terms of modeling, deployment potential, and economic impact. Energy efficiency may also impact electric rates and bills differently (i.e., rates can increase while bills decrease)
- A multi-year renewable energy tax credit extension was not considered in studies but could lower compliance cost impacts
- Economic impact does not equate to cost-benefit analysis; only one study below offered a cost-benefit figure

Key Findings of Reports Evaluating the Economic Impact of the Final Clean Power Plan Rule

Report	Summary of Analysis	Compliance Costs	Household Impact	Notable Observations
M.J. Bradley & Associates (MJB&A)	• Models 14 compliance scenarios that consider varying compliance methods (mass v. rate) and energy efficiency deployment	• Electric system costs increase $0.8 to $6.2 billion in 2030 relative to BAU assumptions • Efficiency investments reduce costs	• Monthly household electric bills decrease 5% to 20% in 2030 • Higher savings originate from allowance auction revenue being invested in customer programs	• A patchwork scenario that assumes multiple mass-based trading zones (with the exception of the Southeast) provides the lowest compliance cost • Coal retirements reduced in mass-based scenarios with inclusion of national trading and higher efficiency
Morgan Stanley	• Reference scenario assumes renewables are more than 23% of installed capacity in 2030 • Compliance costs consider national cap-and-trade and regional trading	• Annual customer rate impact in reference case is $1.6 to $11 billion • Low end assumes national cap-and-trade	• Greatest rate impact is the Southeast; residential electricity rates increase ~5% from current levels	• CPP is expected to reduce carbon emissions 32% from 2005 to 2030 • BAU coal retirements and renewables development will result in a carbon reduction of 28% by 2030
NERA Economic Consulting (for ACCCE)	• Two mass-based scenarios compare intra-state trading and regional trading to BAU • Study also considers various allocations of emission allowances, including auction among generators	• Average annual expenditures increase $29 to $39 billion relative to BAU • Low end represents regional trading	• Average annual U.S. retail electricity rates increases by 11% to 14% relative to BAU	• Model assumes auction revenue returns to households, but not through lower electricity rate impacts • Rate-based scenario in appendix shows lower compliance costs and household impacts

NOTES:
MJB&A defines electric system costs as fuel, capital, O&M, and energy efficiency program costs (both utility and program participant costs). NERA defines expenditures as changes in electricity generation costs (including allowance costs), energy efficiency costs, and increased natural gas costs for non-electric consumers. Where provided, natural gas assumptions were similar (MJB&A = $5.14/MMBtu to $6.00/MMBtu, NERA = $5.70/MMBtu to $5.80/MMBtu). BAU means business as usual (without CPP). ACCCE is American Coalition for Clean Coal Electricity.
SOURCES:
Company reports; industry news; E&E News; EPA; MJB&A; Morgan Stanley; Brattle Group; PURC; Nat'l Conf. of State Legislatures; NERA; Sidley Austin; SNL Financial; Bloomberg; Van Ness Feldman; ScottMadden analysis

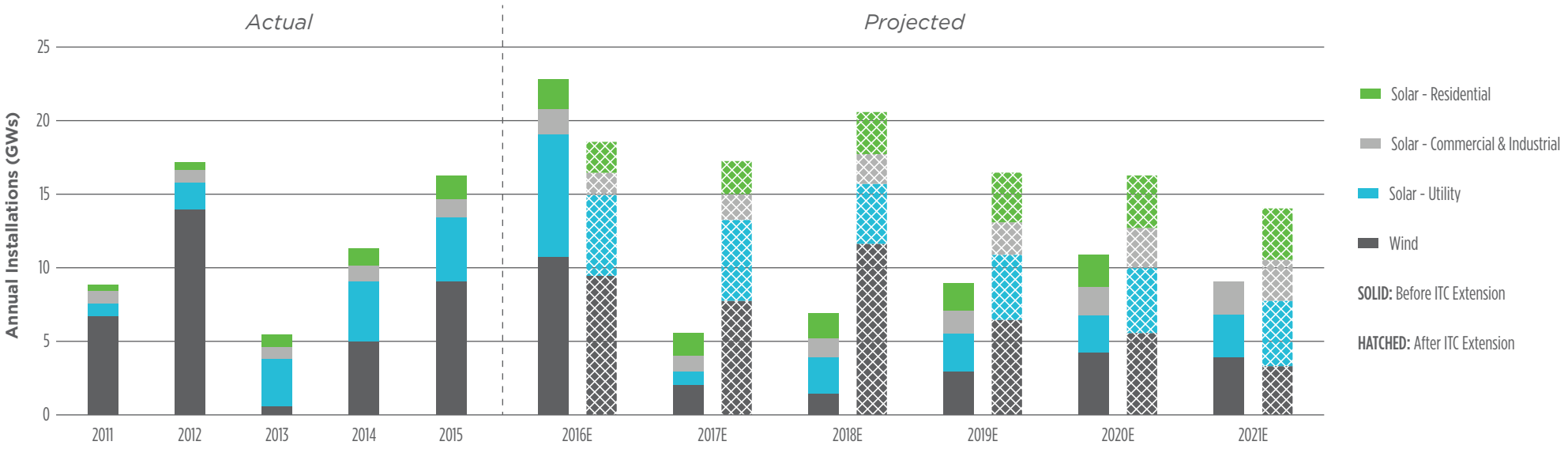
RENEWABLE ENERGY TAX CREDIT:
EXTENSION PASSED BY CONGRESS

A multi-year extension, part of a December 2015 budget deal, provides some certainty.

Big Winners: Solar and Wind with Phase-Out Periods

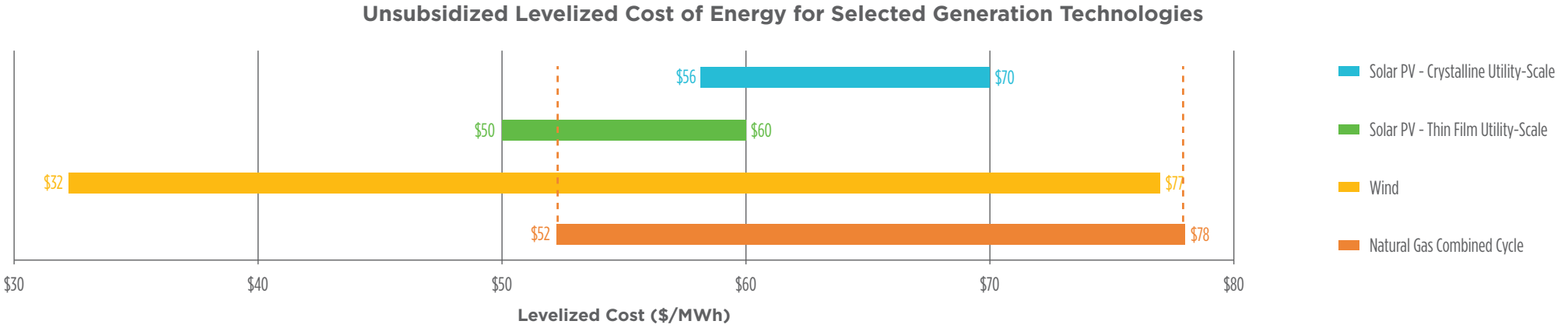
- The 30% business investment tax credit (ITC) for solar was extended through 2019; this steps down to 26% in 2020, 22% in 2021, and 10% thereafter. In addition, the "placed in service" requirement was replaced with a more flexible "commence construction" provision
- The production tax credit (PTC) was extended for wind, geothermal, landfill gas, and hydro projects commencing construction in 2015 and 2016
- For wind only: 80% of the PTC is available for projects commencing construction in 2017, 60% of PTC in 2018, and 40% of PTC in 2019
- In addition, 50% bonus depreciation was extended for renewable and conventional generation placed in service during 2015, 2016, and 2017; this phases down to 40% in 2018 and 30% in 2019

Actual and Projected Annual Solar and Wind Installations
(2011-2021)



Source: Bloomberg New Energy Finance

Reaching Parity: Lower cost plus favorable resource helps solar and wind compete with gas generation.



Source: Lazard

Will Tax Credit Extensions Be a Bridge to Long-Term Stability for Renewables Development?

- Utility-scale solar and wind projects located in ideal resource locations (i.e., solar in Southwest, wind in Texas) do not require tax credits to compete on economics with new natural gas generation (see chart above)
- Consequently, it is not surprising that Bloomberg New Energy Finance forecasts the ITC/PTC extension will result in a significant rise in solar and wind capacity additions from 2016 to 2021
  - › New solar capacity increases 44% or 41 GWs to 59 GWs
  - › Residential solar benefits the most with a 54% increase in new capacity
  - › New wind capacity increases 76% or 25 GWs to 44 GWs
- With this robust near-term pipeline, the extension is likely to support further cost reductions (driven by experience curve effects) and technology improvements that expand the competitive reach of unsubsidized solar and wind

> "At a time when the rest of the world is seeking to adjust to a world without incentives... and auctions where solar has to compete with other forms of energy, it is almost staggering the level of funding in what appears to be a once-in-a-lifetime blank cheque offering to local [solar] installers and developers.
> *- Finlay Colville, Head of Market Intelligence, Solar Media*"

> "These policies will provide a critical level of certainty and continuity that will encourage ongoing private investments in wind and solar energy resources at lower costs for customers.
> *– Kyle Davis, Director, Congressional Relations, Berkshire Hathaway Energy*"

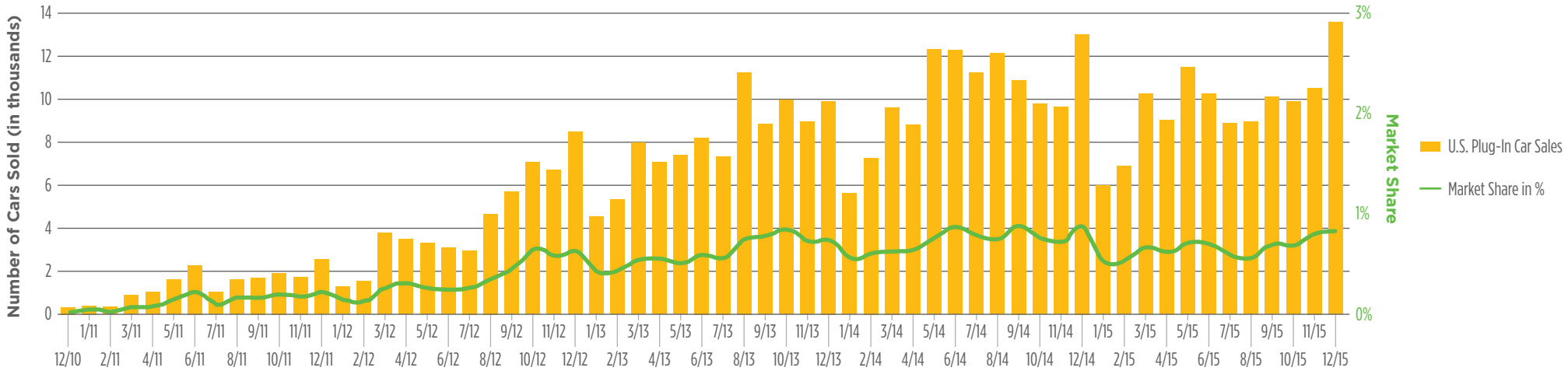
SOURCES:
AWEA; Baker Tilly; Bloomberg; Bloomberg New Energy Finance; Lazard; SNL Financial; ScottMadden analysis

Increased EV range and competitive pricing, autonomous vehicles in development, and ride sharing might portend a paradigm shift in vehicle transportation and good news for EVs.

Could Convergence Be the Boost Electric Vehicles (EVs) Need?

- Information technology is disrupting the transportation sector through the "mobility trifecta:" EVs, autonomous driving, and the sharing economy (e.g., Uber and Lyft)
- Tech giants like Google and Apple are following the "Internet of Things" trend into transportation, but remain largely on the periphery for now, although Apple is spending $3 to $5 billion on its mobility project, looking at market entry for an autonomous vehicle by 2020. Meanwhile, Tesla is innovating with software that uploads new features similar to updating mobile apps
- Payback on EVs, especially given low gasoline prices, is a challenge with an individually owned vehicle. But analysts believe higher vehicle utilization (through ride sharing) and improved EV range could shorten the breakeven period
- Companies are forming alliances and making investments now
    - For example, GM has invested $500 million in ride-sharing service Lyft and is pursuing a national network of self-driving cars
    - There is some discussion of a Google/Ford venture, but nothing has been announced yet

U.S. Plug-In Electric Vehicle Sales by Month and as Share of Total Car Sales



Source: Insideevs.com

Moving from Niche to Mass Market Appeal

- Amidst this longer-dated evolution, EV manufacturers continue to improve vehicle charging range and pricing
- Chevrolet, Tesla, and Nissan plan to release next-gen vehicles in the next two years with extended ranges (~200 miles per charge) and a price point (after incentives) that competes with the average price of a new car ($31,000)
- With continued cost improvements, Bloomberg forecasts a $22,500 electric car would be a practical choice for almost 70% of car buyers
- Some key features of the vehicle point to the convergence model noted earlier (see sidebar)

Charging Infrastructure Models Tested in California

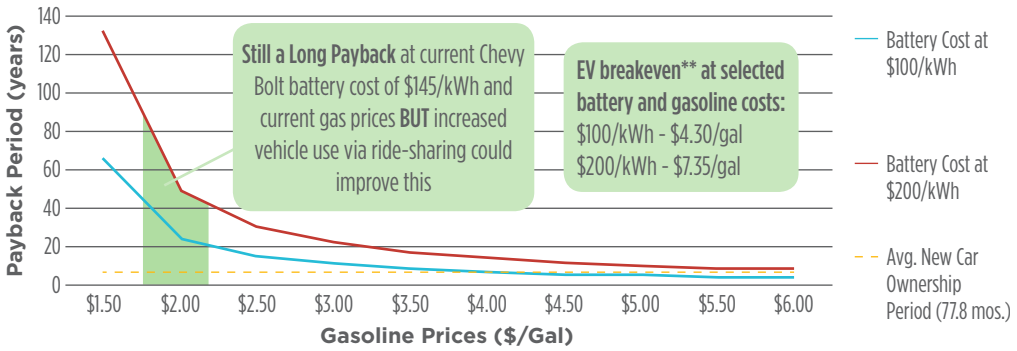
- California PUC will allow San Diego Gas & Electric (SDG&E) to spend $45 million to deploy 3,500 EV chargers under its Vehicle Grid Integration program and Southern California Edison (SCE) to spend $22 million to roll out 1,500 EV chargers as part of its Charge Ready program. Still pending is a Pacific Gas & Electric request for $160 million for 7,500 charging stations
- SCE will own all of the infrastructure except the EV charging units, while SDG&E will retain ownership of chargers, along with the distribution lines, transformers, and other gear needed to hook them to the grid
- As the first large-scale deployments being funded by rate-based investments, these pilots could provide an important model for how utilities and state regulators across the country approach their EV goals

Chevy Bolt Concept Car Raises Stakes

Photo Courtesy of Chevrolet

- Expected release: late 2016
- "Built for sharing" (built-in app includes ride-sharing management, including reservations, payment, and tracking)
- Auto-valet function (car can drive itself into a garage and be retrieved upon command)
- Single-motor drive unit, electronic precision shift system, 7.05:1 final drive ratio (0 to 60 mph <7 seconds; 0 to 30 mph <2.9 seconds), 91 mph top speed
- Capable of up to 266 lb.-ft. of torque and 200 hp (150 kW) of power
- 60 kWh lithium-ion battery pack with >200 miles of range, 288 lithium-ion cells, 96 cell groups, 3 per group
- 7.2 kW onboard charger for charging from 240 V, 50-mile recharge <2 hours, full charge ~9 hours; DC Fast Charging gives 90 miles of range in ~30 minutes
- Regen system provides one-pedal driving, slowing vehicle to a stop without using the brake pedal in certain conditions (instead using a steering-wheel-based paddle lever)
- 960 lbs. total weight

Estimated EV Payback Period vs. 40 MPG Internal Combustion Engine* at Selected Gasoine Prices and Battery Costs ($/kWh)



Sources: Morgan Stanley; Kelley Blue Book; ScottMadden analysis

NOTES:
*At assumed 10,000 miles per year; **over average new car ownership period.
SOURCES:
Morgan Stanley; *Automobile* magazine; Bloomberg New Energy Finance; industry news; ScottMadden analysis

ENERGY SUPPLY, DEMAND, AND MARKETS

WHOLESALE POWER MARKETS:
HOW ARE ADAPTATIONS FARING?

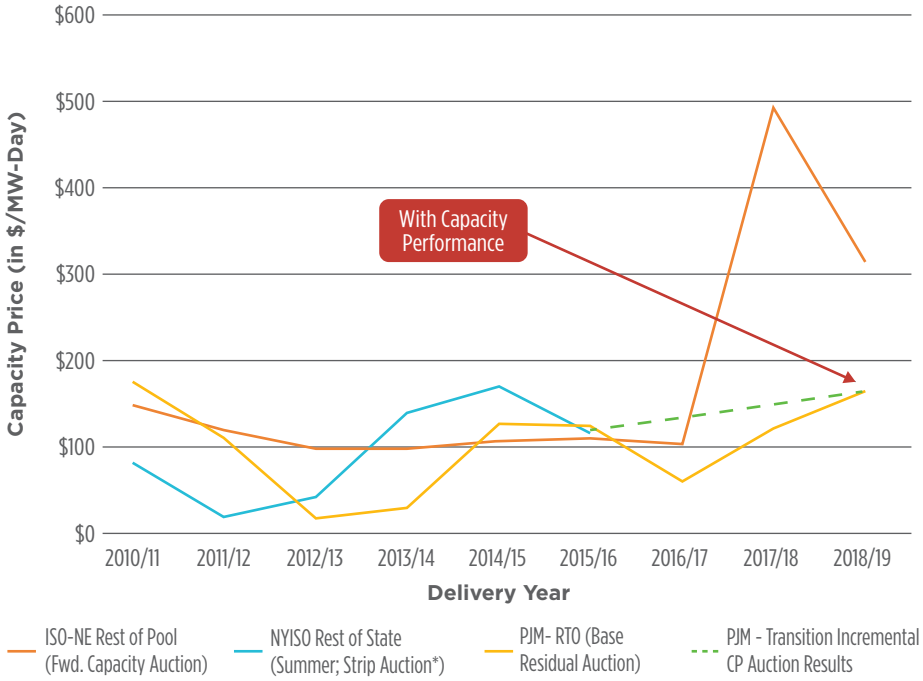
Market operators and states make administrative changes to compensation of energy resources.

Paying for Capacity Performance

- In 2015 and early 2016, PJM's Capacity Performance (CP) resource proposal was accepted by FERC. CP allows PJM to procure "pay for performance" capacity resources, including generation, demand response, and energy efficiency. Providers must produce power when called upon, regardless of extreme weather or system conditions, or incur significant financial penalties. CP was instituted in response to significant generator availability issues the prior two winters
- PJM has conducted two transitional auctions—for 2016–17 and 2017–18 capacity resources. The transition allows for changes—dual fuel for firm gas contracts, O&M, weatherization, etc.—to phase in support for the more stringent CP requirements
- CP requirements increased capacity prices (see chart at right), but did not raise them to the offer cap, which is based upon cost of a new entrant, typically the cost of a new gas-combustion turbine
- Additional transition auctions remain for delivery years 2018–19 and 2019–20. The 2020-21 auction will be the first 100% CP solicitation and therefore the first one without any transition effects
- Nuclear generators are supportive of CP, which compensates for their "always on" capabilities. Only as additional auctions occur, and any penalties for non-performance are assessed, will it be seen whether CP's pricing signals will improve the capacity market and what types of resources will be most valuable

Bearish Outlook: ISO-New England's February 2016 auction for 2019–20 resources yielded prices lower than most analysts expected. Many point to higher bonus depreciation for new build alternatives, which may have contributed in lower prices than expected. This outcome came despite a resource performance program similar to PJM's CP program. Some expect this to weigh on PJM's next auction. One bright spot: expectation that full implementation of CP will lead to higher capacity prices by 2020–21.

Selected ISO Capacity Auction Results by Delivery Year
(in $/Megawatt-Day)



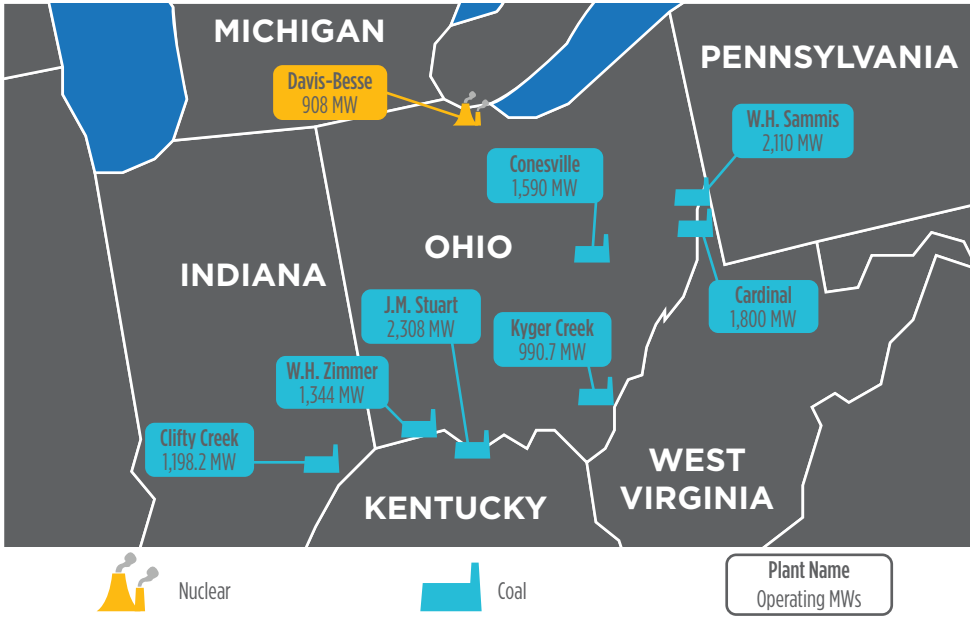
NOTES:
*As of this release, NYISO strip auction results for 2016/2017 were not yet announced.

Sources: SNL Financial, ScottMadden analysis

Ohio Approves Contracts for Differences to Encourage Generation to Stay Online

- Ohio, which embarked on retail competition in 2001, has required its utilities to establish Electric Security Plans, aimed at setting rates and pricing for generation service. Typically, rates for wholesale power were set through auction
- Ohio-based AEP and FirstEnergy utilities recently proposed a new, supplemental approach—long-term power purchase agreements (PPAs) for capacity and energy from designated generation sources (see map) at rates that reflect fully embedded cost of plant operations. Pricing would be under a contract for differences, in which output would be sold into the PJM market with the excess or deficit over costs flowing to ratepayers via a non-bypassable distribution rider
- The Ohio PUC approved the arrangement, as the utilities argued that the PPAs will act as a financial hedge against future power price increases and will support the local economy through continued plant employment
- Other power suppliers are challenging these proposals—some referring to them as "bailouts" for utility generation that undermine both wholesale and retail competition
- If upheld by the Ohio courts, an appeal to FERC and federal courts is all but certain. Key questions for this arrangement:
  - The U.S. Supreme Court recently rejected a Maryland arrangement for generation pricing. Given the narrow scope of the ruling, is the Ohio arrangement satisfactory or can it be reworked to be made so based upon that ruling?
  - Will FERC see Ohio's PPAs as adversely impacting the working of the wholesale power market and thus intervene?

Ohio Plants Whose Output Is Subject to Proposed PPAs



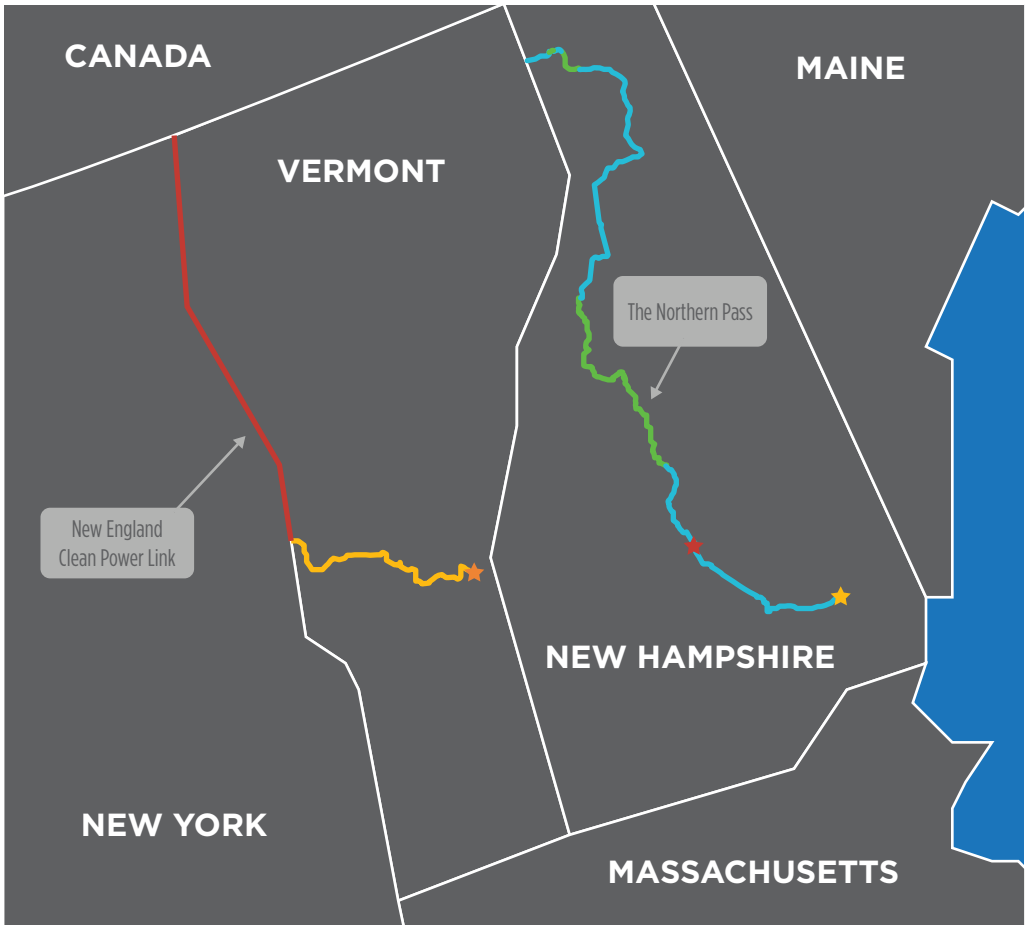
Source: SNL Financial

NOTES:
On Feb. 22, AES Corp. subsidiary Dayton Power and Light filed for Ohio PUC approval of a new electric security plan (ESP) (Case No. 16-0395-EL-SSO) that appears to be modeled on the AEP and FirstEnergy PPAs.

New England: Expanding Infrastructure to Ease Constraints

- New England's generation mix is shifting: about 4.2 GWs are scheduled for retirement in the next five years (including more than 1 GW of nuclear generation)
- New England's power markets are increasingly reliant upon natural gas as a fuel, while state regulators, its ISO, and politicians are looking to preserve reliability and to avoid price spikes
- To that end, several market adjustments are being pursued:
  - Under a proposed process, Massachusetts electric distribution companies may sign long-term contracts for firm gas transportation and socialize those costs in rates in the same manner as a gas distribution company. This process is pending review by Massachusetts' supreme court
  - Massachusetts seeks to increase hydro and wind imports from Canada. Some large transmission projects are being pursued to support this effort:
    - New England Clean Power Link: a $1.2 billion, 154-mile, 1,000-MW high-voltage DC line, being developed by a subsidiary of private equity firm Blackstone
    - Northern Pass Line: a $1.6 billion, 192-mile, 1,090-MW high-voltage DC line, developed by an Eversource Energy affiliate
  - For homegrown power, several New England states (CT, RI, and MA) have jointly solicited clean energy proposals for the region, including renewable development and transmission development

Importing Renewable Power: Two Large New England Projects



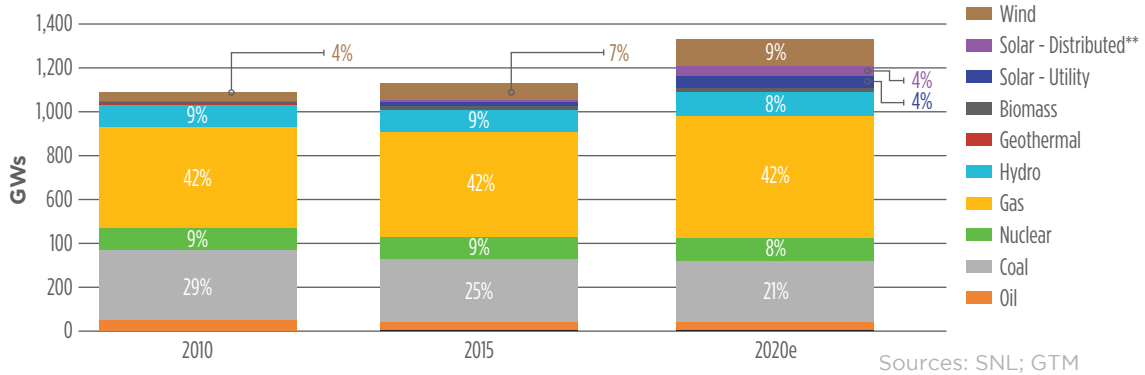
Source: Project websites

SOURCES:
PJM; SNL Financial; industry news; *RTO Insider*; analyst reports; New England Clean Power Link; Northern Pass; Ohio PUC Case Nos. 13-2385-EL-SSO (AEP) and 14-1297-EL-SSO (FirstEnergy); complaints filed with the FERC by the Electric Power Supply Association, the Retail Energy Supply Association and a group of merchant generators (Dockets EL16-34 and EL-16-33); ScottMadden analysis

A ONCE-IN-A-LIFETIME TRANSFORMATION OF THE NATION'S POWER GENERATION FUEL MIX

New natural gas, wind, and solar-powered generation represent the majority of capacity added since 2010 and projected through 2020. In the same time frame, coal and oil will have declined and will continue to decline at an historic pace.

Historic and Future* Power Plant Capacity
(All NERC Regions; 2010, 2015, 2020e)



Sources: SNL; GTM

Growth by Type as Percentage of Capacity Additions

	2010 - 2015	2015 - 2020e
Renewables (non-hydro)	73.6%	56.2%
Gas	23.8%	37.7%
Other	2.6%	6.2%

NOTES:
*Future capacity is based on actual planned/under construction projects, and not based on any projections of unreported new developments or retirements.
**Distributed residential and non-residential data from GTM Research PV deployment estimates. Assumes distributed solar is additive to historical and projected capacity, not duplicative of other resources.

The Regions Speak: Emerging Operational and Reserve Issues in Some Areas with a Changing Fuel Mix

Texas (ERCOT)
- Between 2015 and 2020, will add 20 GWs of natural gas capacity and 21 GWs of wind
- As wind capacity grows, system stability challenges are possible, especially in areas far from load centers like the Panhandle
- "Sleeping giant" of solar is awakening: growing both utility and distributed solar (more than 2.2 GWs and 1.5 GWs, respectively)

California (CAISO)
With high distributed solar penetration:
- Short, steep ramps of dispatchable resources and overgeneration risk (the "duck curve")
- Decreased frequency response with fewer flexible resources

Midcontinent (MISO)
- The combination of a 3-GW decrease in coal-fired capacity (replaced with gas), a 14-GW increase in wind from 2010 to 2020, and tightening reserve margins (below 15% in 2021 down to 11% in 2025) will require use of all available resources

Southeast (SERC)
- About 15% of coal capacity to be retired between 2010 and 2020 (more than 13 GWs), more than any other NERC region
- New gas-fired plants and 6 GWs of nuclear capacity expected to offset retirements and support demand growth
- A reliability task force is studying potential issues

Northeast (NPCC)
- Economic and political pressures forcing coal and nuclear units to retire, with potential resource deficiency and reduced fuel diversity
- Combined-cycle, gas turbines may not be capable of extended baseload or load-following operation
- Increasing variable resources as synchronous capacity is retired, replaced by wind (~3.5 GWs between 2015 and 2020), utility solar (0.6 GW), and distributed solar (1 GW)

Projection: Non-hydro renewables and gas will account for 64% and 34% respectively of all capacity added from 2010 to 2020

SOURCES:
SNL Financial; GTM Research; California ISO; NYISO; NERC 2015 Long-Term Reliability Assessment (LTRA); ScottMadden analysis

CAN THE FUTURE COME FAST ENOUGH FOR NUCLEAR?

Difficult markets pressure the industry to streamline operations and pursue new technologies.

Despite Closures, Total Nuclear Capacity Scheduled to Increase by 2020

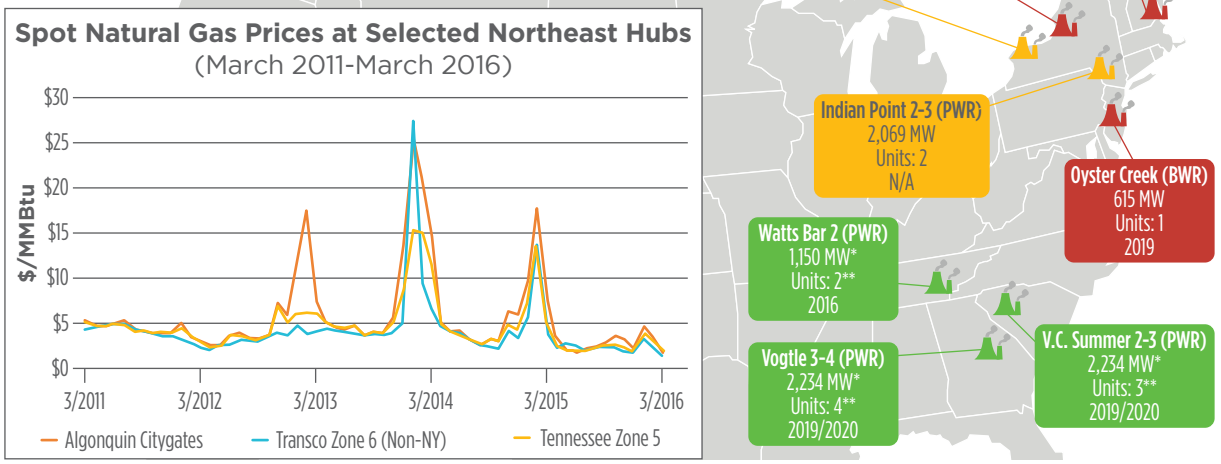
- Sustained low natural gas prices, capacity markets that some say do not compensate for nuclear's full value as clean baseload generation, and the high cost of operating a single-unit plant are pressuring nuclear plant operators to consider early plant retirements
- A pocket of hope for new nuclear capacity is the Southeast, which continues to push new reactors toward completion, although the learning curve has proven more costly than expected

> "We need to build new reactors early in the next decade, demonstrate them through the 2020s, and scale up by the 2030 time frame"
>
> *-Stephen Kuczynski*
> *CEO, Southern Nuclear Operating Co.*

The NY Nuclear Debate: Tensions Are High

- Despite its profitability and $1.6 billion in annual economic output statewide, New York Governor Cuomo has repeatedly called for retirement of Entergy's Indian Point nuclear plant due to "intolerable" operating performance and proximity to NYC. Some cry foul saying the NRC has sole jurisdiction over nuclear safety
- In stark contrast, Governor Cuomo has expedited the creation of zero-emission credit subsidies in order to exclusively support the continued operation of Entergy's unprofitable upstate FitzPatrick nuclear plant. Governor Cuomo had earlier criticized Entergy for seeking similar subsidies
- Entergy responded by reaffirming that FitzPatrick will be decommissioned, thus dealing Governor Cuomo's emission reduction plan a major blow

Selected Nuclear Plants Under Construction, Under Pressure, or Annouced Retirement



Sources: NEI; EIA; IAEA; NRC; SNL

But some potential growth signs are on the horizon.

The Clean Power Plan Sparks Hope…Kind Of

- The EPA's Clean Power Plan (CPP) does not expressly recognize existing nuclear generation as a potential compliance avenue for CPP. New reactors and uprates clearly count toward compliance. In addition, closing existing nuclear plants could hinder compliance under an mass-based approach
- But the EPA acknowledges that nuclear generation makes emissions lower than they would otherwise be and are lower in emissions than gas-fired generation, with some of the same baseload characteristics
- There is some hope that state plans—through allocation, auction, or set-aside of emissions allowances or even financial incentives (see New York discussion earlier)—will provide economic signals to help keep low-emitting, existing nuclear generation online

Increased R&D for Advanced and Small Modular Reactor (SMR) Designs

- The Obama Administration's Gateway for Accelerated Innovation in Nuclear (GAIN) initiative, announced in early November, connects the nuclear industry with DOE technical, regulatory, and financial expertise to expedite advanced nuclear reactor design commercialization
- The 2016 Omnibus Appropriations Act passed in December increased nuclear energy programs funding by 9% over the budget request, with notable increases in R&D funding to support advanced and SMR development. It also directed the NRC to submit a plan to review license renewal applications allowing existing nuclear plants to operate beyond 60 years
- In January, NEI's SMR Start program began a consortium of leading developers and potential customers to advance SMR commercialization through cost-share funding structures and to provide a unified voice on policy and regulation

Realizing the "Nuclear Promise"

- Driven by low gas prices and near-zero load growth, INPO and EPRI joined NEI in December to launch a multi-year initiative—the Nuclear Promise—which aims to improve nuclear competitiveness through a 30% operating cost improvement by 2018 and a $12/MWh cost reduction industry-wide by 2020. Strategic focus areas include market reform, NRC accountability, and operational excellence
- Working groups led by chief nuclear officers have identified 53 immediate improvement opportunities

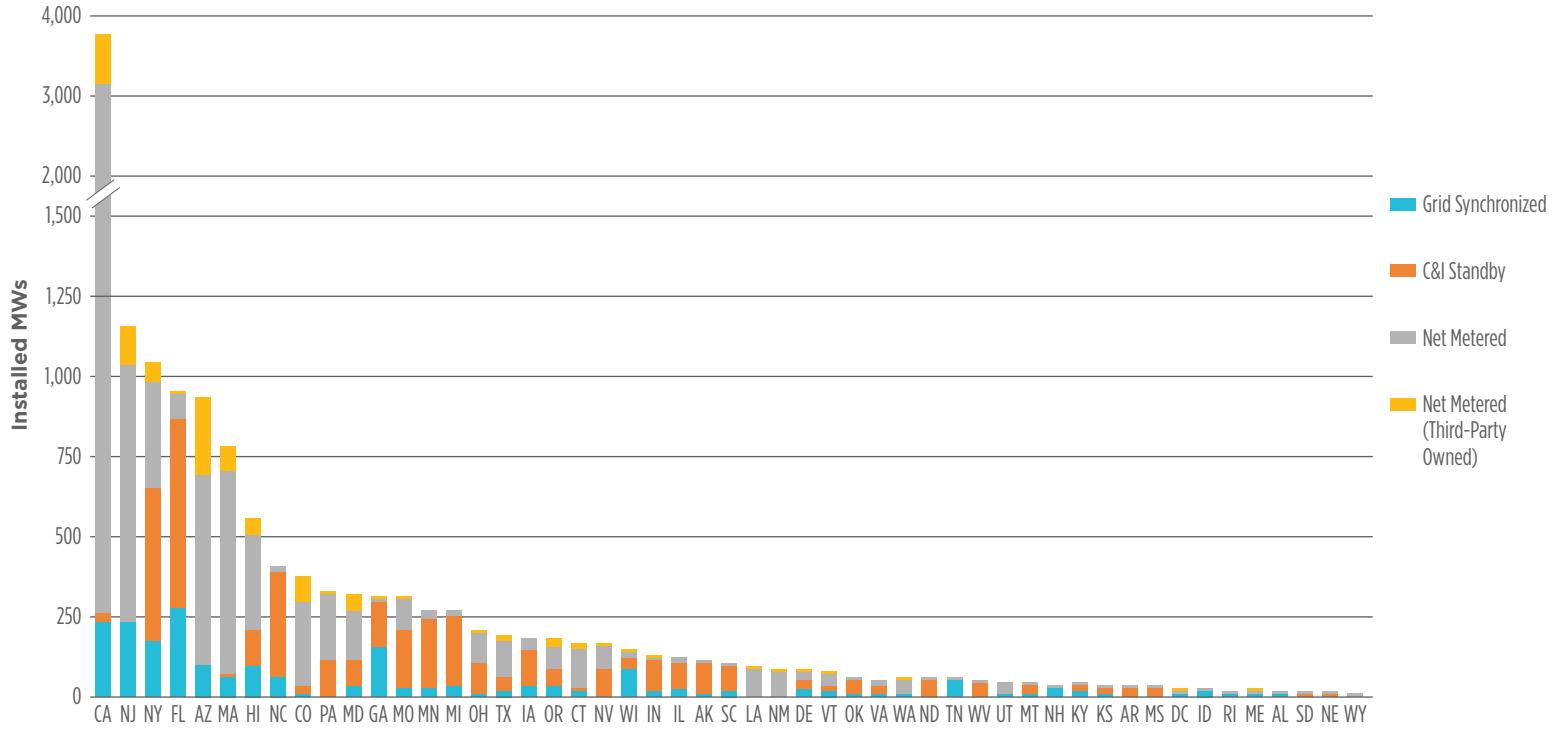
NOTES:
DOE means U.S. Dept. of Energy; EPA means U.S. Environmental Protection Agency; EPRI means Electric Power Research Institute; INPO means Institute of Nuclear Power Operations; NEI means Nuclear Energy Institute; NRC means U.S. Nuclear Regulatory Commission; SMR means small modular reactor.
SOURCES:
EIA; Nuclear Energy Institute; EPA; American Nuclear Society; SNL Financial; Electric Utility Cost Group

Decentralized Generation (DG) Grew by Nearly a Third in 2014

Solar Photovoltaic (PV) Capacity Is 1.7 Times All Other Decentralized Generation Combined

- ***How much:*** Year-end 2014 DG totaled 14.4 GW, nearly doubling since 2011. This remains a relatively small portion of the 1,164 GW of nameplate capacity in the United States
- ***Where:*** The top five states—CA, NJ, NY, FL and AZ—account for more than half of DG capacity in the United States. California alone accounts for 26% of all DG

Decentralized Generation by Use and State



DG as Percentage of Total Nameplate Capacity within State

STATE	% DG
California	4.8
New Jersey	5.5
New York	2.4
Florida	1.4
Arizona	3.0
Massachusetts	5.1
Hawaii	18.4
North Carolina	1.2
Colorado	2.3
Pennsylvania	0.7

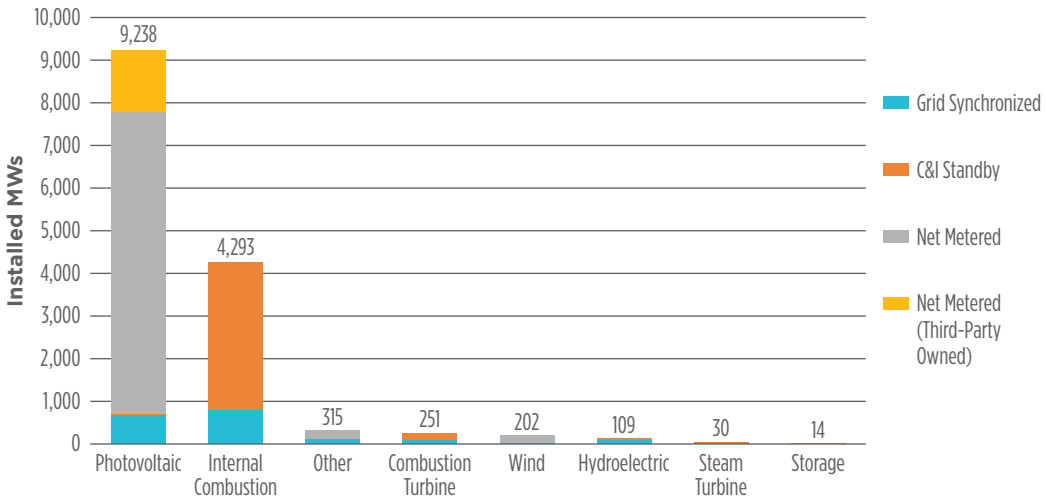
Sources: EIA, ScottMadden analysis

NOTES:
The grid-synchronized category includes commercial and industrial generators less than 1 MW in capacity that are grid connected and grid synchronized. The C&I standby category includes commercial and industrial generators less than 1 MW in capacity that are not connected nor synchronized to the grid. The net metered category refers to residential, commercial, and industrial generators that are less than 2 MW in capacity and maintain a net-metering agreement with the local utility. Due to the nature of the data, it is possible some systems may be double counted. Figures are from 2014, the most recent data available.

The Big Numbers: By State and Type

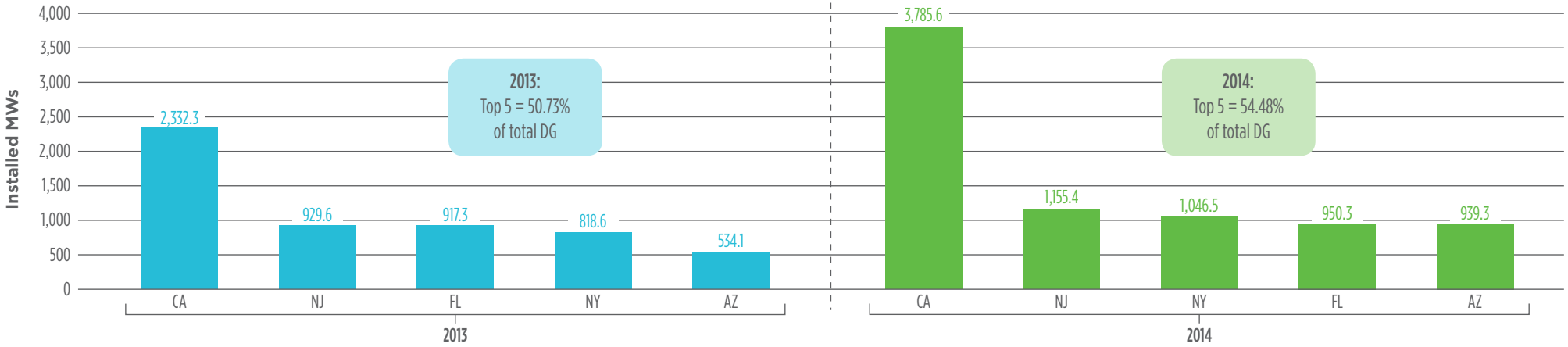
- ***What:*** Three primary types of DG exist. First is PV capacity, which is nearly 64% of DG. Second, internal combustion standby generation located at C&I customer sites. And third, grid-synchronized generation at C&I customer sites
- ***Why:*** Favorable policy (NJ, NY, MA) and solar resources (CA, AZ), as well as relatively high residential electricity prices, continue to be the key to DG expansion, aided by declining PV installed costs
- ***What It Means:*** DG continues to make headway, with solar PV clearly dominating. DG growth trajectory may be impacted by state policies, especially changes to net metering and third-party ownership

U.S. Decentralized Generation by Use and Resource Type
(Year-End 2014)



Sources: EIA; ScottMadden analysis

Top States for Cumulative Installed Decentalized Generation
(2013 and 2014)



Sources: EIA; ScottMadden analysis

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EIA; ScottMadden analysis

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ENERGY PRACTICE:
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