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Hardening the Grid:

How States Are Working to Establish a Resilient and Reliable Electric System

Hardening the Grid: How States Are Working to Establish a Resilient and Reliable Electric System

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The National Conference of State Legislatures is the bipartisan organization dedicated to serving the lawmakers and staffs of the nation's 50 states, its commonwealths and territories.

NCSL provides research, technical assistance and opportunities for policymakers to exchange ideas on the most pressing state issues, and is an effective and respected advocate for the interests of the states in the American federal system. Its objectives are:

- Improve the quality and effectiveness of state legislatures
- Promote policy innovation and communication among state legislatures
- Ensure state legislatures a strong, cohesive voice in the federal system

The conference operates from offices in Denver, Colorado and Washington, D.C.

Introduction

Questions surrounding energy security are back in the spotlight after an eventful 2017. The most devastating hurricane season of the modern era was complemented by persistent wildfires, flooding and other natural disasters that wreaked havoc on electric infrastructure. Meanwhile, a policy proposal from Energy Secretary Rick Perry sought to reward certain baseload electric generators for resiliency attributes. While the Federal Energy Regulatory Commission (FERC) ultimately struck down the proposal, it has nonetheless sparked debate over the nature of resiliency and how it should be valued.

The issue itself can be broadly defined, and is more often broken down into a variety of sub-categories. Energy security touches on how resilient energy systems are against extreme events, how reliably systems operate as the grid changes and modernizes, how well they're protected against malicious attacks, along with how well federal, state and local governments prepare for these scenarios.

Throughout 2017, state legislatures have been tackling these issues, developing policies aimed at establishing a reliable and resilient electric system. Legislators in at least 40 states considered more than 260 bills throughout the 2017 legislative session, with more than 35 bills and resolutions from at least 16 states passing.

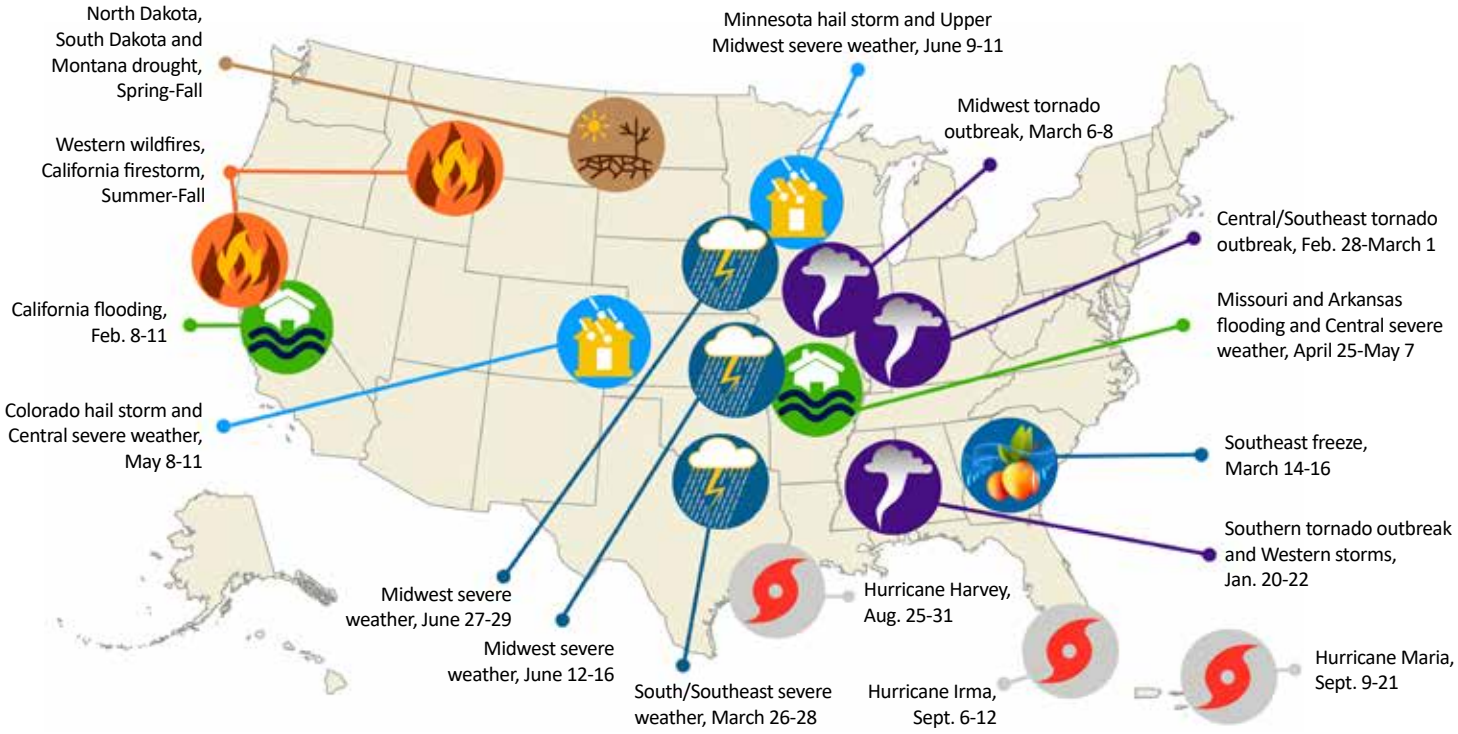
State legislatures play a key role in the process of developing policies that contribute to energy security. They can signal the legislature's support or opposition to certain policies and initiatives, like grid hardening or grid modernization, and urge action on the part of the federal government. They can initiate dialogue, establish study committees to develop policy recommendations or issue reports. More directly, they can provide funding, incentives, and mandates for technologies that help strengthen the grid. In the same way, they can impose restrictions, planning requirements or action from state agencies.

For this report, NCSL has divided energy security into several themes intended to allow for greater consideration of the various elements that make up the somewhat nebulous subject. In 2017, as in recent years, the highest number of bills could be characterized as disaster preparedness bills, although only a half dozen of these passed into law.

Much more productive were bills related to long-term planning, grid hardening and grid modernization—including microgrids and energy storage. In fact, we may look back at 2017 as the year energy storage began its move into the mainstream, with more than 20 bills introduced in at least 10 states. Ultimately, nine energy storage measures passed.

In addition, states considered manmade threats to the electric grid, with legislation that focused on cybersecurity, physical threats and electromagnetic pulses (EMPs).

2017 U.S. Billion-Dollar Weather and Climate Disasters



This map denotes the approximate location for each of the 16 billion-dollar weather and climate disasters that impacted the United States in 2017.

Source: NOAA

Disaster Preparedness

Given the extent of the damage in 2017, it seems increasingly likely that state legislatures will find themselves inundated by disaster preparedness legislation in the coming years. In 2013, the year following Superstorm Sandy, state legislatures saw a near doubling of energy security legislation introduced, and only in the past couple of sessions has the number dropped.

Last year was the most destructive year for natural disasters in modern history, with nearly every region of the country affected in some way. Not only did 2017 tie the previous record for the most billion-dollar disasters in a calendar year—there were 16—but it was by far the most costly year on record. Total official damages came in at $306 billion, while the previous record was $214 billion, according to the National Oceanic and Atmospheric Administration (NOAA). Hurricane Harvey caused $125 billion in damages on its own, while Hurricanes Maria and Irma accounted for another $140 billion.

By comparison, Superstorm Sandy was estimated to have cost about $75 billion in damages, while Hurricane Katrina was about $110 billion.

Disaster preparedness bills focus on the inevitability of years like 2017. They aim to ready the state and its energy infrastructure with three primary goals in mind: preventing damage, increasing the survivability of service, and providing for a rapid recovery in the aftermath of an event. It's important to note, however, the interconnectivity of the various elements. For example, front-end investments to protect the grid from damage and to modernize the grid help to ensure the grid can recover faster on the back end, while the same could be said for microgrids and other technologies intended to keep the lights on throughout an event.

The efficacy of these front-end investments was reinforced in a recent report from the National Institute of Building Sciences, which updates cost-estimates for how much mitigation projects save on the back end of a disaster. According to the report, every $1 spent through federal grants to mitigate damage from disasters avoids $6 of disaster response costs. Previous estimates established a $1-for-$4 ratio used in budgets and planning. The new estimate could make the economic case easier for policymakers.

Legislators from at least 18 states considered more than 60 bills related to disaster preparedness in 2017. A number of these measures focused on damage prevention, including flood mitigation planning requirements, and bolstering tree-trimming practices for utilities or undergrounding electrical lines. Other bills focused on survivability of service, requiring backup generation at critical facilities, like public shelters, hospitals and housing developments. Still others dealt with facilitating a rapid recovery, including the exemption of out-of-state workers from state and local taxes and registration requirements for disaster recovery work.

Damage Prevention: Hardening the Grid and Planning for Disaster

State legislatures have worked to mitigate the damage done by extreme weather events by encouraging utilities to invest in upgrades, maintenance and planning for more resilient infrastructure. They may require utilities under the jurisdiction of state regulators to make investments through integrated resource plans, in addition to requiring that certain regions and facilities—especially those prone to certain types of damage, like flooding—develop plans to address vulnerabilities. In addition, some states have urged the federal government to reassess and issue new standards for reliability and redundancy on the power grid.

The concept of undergrounding electrical lines falls under this category, and at least three states—Illinois, New Jersey and Virginia—introduced measures that would have required the undergrounding of certain electrical lines for added resiliency. While there is significant interest in undergrounding, fiscal realities often limit widespread implementation, as most industry estimates put the cost at about $1 million per mile.

States can also provide financing options and assistance with grid hardening projects, as New Jersey did in 2014 when it established an Energy Resilience Bank. Other states, such as Connecticut and New York, have authorized clean energy banks to also finance resiliency projects.

In all, at least six states considered 42 bills related to damage prevention for the energy sector, with three measures passing in 2017. New Jersey alone introduced nearly 30 bills, none of which passed.

KEY BILLS FROM 2017

■ **IL S.B. 1494** (pending) would amend the municipal code to require that all new electric transmission lines over 138 kilowatts to be undergrounded, and to allow utilities to recover the cost from consumers.

■ **MA S.B. 2196/H.B. 2147** (pending) would establish a comprehensive adaptation management plan in preparation for actual and expected changes in the environment to enhance resiliency and reduce vulnerability to natural events.

■ **NJ S.B. 216** (pending) would require the installation of emergency power supply systems to certain common areas of new real estate developments, and provide tax incentives.

■ **ND H.C.R. 3010** (adopted) recognizes the efforts undertaken and the continued need for North Dakota and the United States to undertake responsible measures to harden the commercial electric grid against multiple serious threats.

■ **VA S.B. 1473** (enacted) declares that it is in the public interest that certain existing overhead electrical lines with an elevated history of unplanned outage events over the past 10 years should be replaced by underground lines to increase system reliability, and that associated costs are presumed to be reasonable and prudent.

Service Survivability: Keeping the Lights On

While parts of the grid may be down, backup generators and microgrids can keep certain loads powered and operational, which is especially important for critical facilities. Microgrids have received significant consideration in recent legislative sessions—and not only for their ability to supply power and run independently of the grid, but also for their ability to support the grid's normal operations through frequency response and voltage regulation.

In 2017, there were at least 24 bills introduced in seven states relating to microgrids, although Connecticut was the only state to pass measures. New Jersey considered at least 11 bills and New York considered at least four.

Perhaps no state has been more aggressive in establishing policies to support microgrid development than Connecticut. Following the impact from Superstorm Sandy in 2012, the state has enacted four primary policies touching on microgrids.

First, it established a pilot program, offering $18 million toward nine microgrid projects targeting critical facilities— | a program which was successful enough to merit a second round with an additional $30 million. After that, Connecticut included microgrid projects under its definition of "energy improvements" that the state's green bank could assist with financing. This was followed by legislation that included microgrids under projects that local governments can develop under "energy improvement districts." Finally, in 2017, the legislature included microgrids in its Property Assessed Clean Energy financing program.

State legislatures also may require that certain types of critical facilities have backup generators, or that new residential developments include community spaces with these backups. Several bills incentivize natural gas-powered cogeneration, which can anchor microgrids and rely on pipeline infrastructure—often more resilient than electrical lines.

In addition, legislatures can enact policies that impose requirements to ensure that certain motor fuel storage, distribution and dispensing facilities remain in operation during a disaster, and address concerns related to price-gouging.

KEY BILLS FROM 2017

■ **CT H.B. 7208** (enacted) includes microgrids in the commercial property assessed clean energy financing program.

■ **CT H.B. 7036** (enacted) promotes the use of fuel cells for distribution system benefits and reliability, including their use in microgrids, and amends related programs and requirements to include fuel cells.

■ **NJ A.B. 5184** (failed-adjourned) would direct the New Jersey Board of Public Utilities to adopt certain standards for district energy collaborative and establish a grant program for cogeneration facilities.

■ **NY A.B. 8212** (failed) would establish a grant program under the New York State Energy Research and Development Authority to award funding for microgrid projects.

Rapid Recovery: Minimizing the Danger and Disturbance

Finally, states are pursuing measures to facilitate a rapid response to disasters. Six months after Hurricane Maria hit Puerto Rico, more than 10 percent of the island's residents were still without power. Similarly, it took the U.S. Virgin Islands more than four months to fully restore power after being hit by Hurricanes Irma and Maria. Both U.S. territories have proven to be tragic tales of what happens in the absence of electricity: water systems fail, the economy grinds to a halt, food goes bad and public health is at risk.

Meanwhile, the recovery in other areas has been much quicker—in part because they're easier to access. After Irma hit the Southeast, knocking out power to 7.8 million customers, 60,000 utility workers from across the country deployed and restored power to 97 percent of the population in about a week. Florida Power & Light, which invested about $3 billion in grid hardening over the past decade, said the restoration efforts were four times faster than after Hurricane Wilma in 2005.

States have sought to facilitate that kind of rapid response by allowing out-of-state utility workers to pour into a region in the wake of a disaster to rebuild the damaged infrastructure. These bills often exempt out-of-state workers from paying certain state and local taxes or limiting their liability while performing disaster response work. In 2017, North Dakota was the only state to pass this type of legislation, but New Jersey and New York also considered bills.

In addition, Hawaii and Indiana considered legislation that touched on planning for a recovery to ensure that state agencies and officials would be ready to activate certain protocol in the event of an emergency.

KEY BILLS FROM 2017

■ **HI S.B. 909** (enacted) provides policy guidance on preparing for, responding to and recovering from an energy emergency or energy supply disruption.

■ **ND S.B. 2199** (enacted) facilitates entry of an out-of-state business to perform disaster or emergency remediation work in the state by exempting them from state and local taxes, fees, and licensing requirements during the recovery period.

Grid Modernization and Resource Planning

Smart grid technologies can serve to help utilities assess damage and recover from natural disasters more quickly, in addition to allowing customers to use energy more efficiently and grid operators to manage systems more effectively. On a day-to-day basis, grid modernization initiatives—including smart meter deployment, integration of distributed generation, energy storage, demand response, distribution system management, and much more—facilitate a more reliable electric grid.

Often the funding for grid modernization is wrapped into a utility's integrated resource plan (IRP), but several states have provided additional funding to spur investments through grant programs. IRPs are the vehicles for ensuring long-term resource and infrastructure adequacy, and allow utilities to address various system deficiencies. In this same way, state legislatures can pass laws that require regulators and utilities to make considerations and investments that meet state goals.

At least seven states considered 13 bills related to IRPs in 2017, while another nine states considered close to 20 bills that would have promoted grid modernization initiatives. Meanwhile, at least seven states considered resolutions that urged federal and state agencies and utilities to invest in grid modernization, with special consideration given to advanced and innovative transmission lines.

KEY BILLS FROM 2017

■ **CA S.B. 338** (enacted) requires state electric utility regulators to consider the role of energy technologies and energy efficiency tools in the integrated resource planning process to ensure energy and reliability needs are met, while reducing the need for new generation and transmission.

■ **LA H.R. 161** (adopted) requests the Louisiana Public Service Commission to promote the deployment of advanced transmission technologies.

■ **MN S.B. 1456** (enacted) establishes a Legislative Energy Commission to study and make recommendations to the Legislature, requires utility owners of the state's two nuclear plants to pay into a Renewable Development Account, which can be used on grid modernization efforts, including renewable integration, storage, load control, smart meters, microgrids, demand response or innovative projects to reduce demand or increase efficiency and flexibility. Nuclear plants must pay between $350,000 and $500,000 for every dry cask of spent fuel stored at the plant for each year the plant is in operation.

■ **NM S.J.M. 21** (adopted) encourages state agencies to support the development of an energy road map for New Mexico.

■ **TN H.B. 438** (enacted) creates the Energy Policy Council to make recommendations to the governor and General Assembly on how to manage energy resources in the state.

■ **WA S.B. 5965** (enacted) allocates $13 million in funding for grants to advanced transmission and distribution controls to enhance reliability and resiliency of the electric grid, including grants for research and development for smart grid technologies and grid modernization.

Energy Storage

Energy storage could have fit neatly into two of the previous categories: survivability of service and grid modernization. However, it seems appropriate to highlight the growing technology because of the degree to which state legislatures have moved forward with energy storage measures in 2017.

At least 10 states considered about two dozen energy storage measures during the 2017 legislative session, with at least nine measures enacted. These bills require state agencies to conduct studies, establish goals and provide funding for energy storage initiatives. So far, three states have established energy storage procurement mandates—California, Massachusetts and Oregon. Nevada and New York also committed to establishing mandates, requesting that state regulators establish targets.

The measures appear less focused on the resiliency attributes offered by energy storage than the reliability attributes—focusing on the ability to respond quickly to system requirements and manage the intermittency issues associated with a high penetration of renewables. Due to its ability to act as both load and generator, energy storage provides system flexibilities that are increasingly attractive to system operators that not only have to manage changes in load, but also rapid changes in supply.

States have also expressed an interest in how the grid can benefit from the energy storage that's been deployed rolling around city streets. Electric vehicles are rolling batteries. Get enough of them organized, and they could serve as a substantial asset to the grid. Several states have considered bills to study and implement pilot projects for vehicle-to-grid technology.

KEY BILLS FROM 2017

■ **CA A.B. 546** (enacted) requires certain cities and counties to make all permitting documentation and requirements for advanced energy storage systems available on public websites, including providing applications, guidance, best practices and other factors under consideration by local government.

■ **MD H.B. 773** (enacted) requires the Power Plant Research Program to study regulatory reforms and market incentives that could be beneficial to energy storage in the state.

■ **LA H.R. 133** (adopted) requests the Louisiana Public Service Commission to study a residential battery storage pilot project and feasibility of implementation.

■ **NV S.B. 145** (enacted) establishes a program for the payment of incentives for the installation of certain energy storage systems under the Solar Energy Systems Incentive Program, in addition to creating the Electric Vehicle Infrastructure Demonstration program.

■ **NV S.B. 204** (enacted) requires the Nevada Public Utilities Commission to investigate and establish biennial targets for certain utilities to procure energy storage systems, and requires systems procured by utilities to meet certain criteria.

■ **NY A.B. 6571** (enacted) establishes an Energy Storage Deployment Program to encourage the installation of qualified energy storage systems. The governor has signed the law on the condition that the legislature pass amendments next year, which would send the matter to the New York Public Service Commission to study the matter and establish a program for the state.

■ **VA H.B. 1760** (enacted) authorized utilities to petition the Virginia Corporation Commission for approval of a rate adjustment for recovery of costs of for pumped hydroelectricity generation and storage facilities that utilize renewable energy and are located in the coalfield region of Virginia.

Baseload Resources

The role of legacy baseload generators—primarily coal and nuclear plants—has been the focus of significant debate over the past several years, but it clearly intensified in 2017. As the electric system changes rapidly, there have been concerns over the effect that incorporating new technologies and systems could have on electric reliability. The shift toward natural gas-fired generators and renewables, in particular, has caused coal and nuclear plants to struggle in the current market environment and even forced plants to shut down.

With these concerns as a backdrop, Energy Secretary Rick Perry commissioned a staff report on grid reliability, followed by a directive for the Federal Energy Regulatory Commission (FERC) to mandate that competitive markets value fuel-secure, baseload resources through a Grid Resiliency Pricing Rule. The directive has been highly controversial, and in January 2018 FERC unanimously rejected the proposal. However, the debate over the nature of electricity pricing and how to account for reliability and resiliency appears to have just begun.

States have been addressing this in various capacities for several years—either through resolutions that urged the federal government to relax environmental regulations due to the effect coal plant retirements could have on the grid, or more recently through policies to provide financial support to nuclear plants. So far, Illinois and New York have implemented nuclear support policies, while Connecticut recently passed legislation that gives state agencies that option. Several other states have also considered policies to provide financial support to coal plants.

These state policies have forced some regional grid operators to introduce their own proposals to change the way markets compensate various resources.

In 2017, six states considered more than a dozen bills in support of baseload resources.

KEY BILLS IN 2017

■ **CT S.B. 501** (enacted) gives state agencies the option of allowing a nuclear plant to sell up to 75 percent of its electricity in a market set aside for renewable energy, if deemed in the interest of the state and ratepayers.

■ **ND S.C.R. 4008** (adopted) urges the federal government to refrain from regulations that could threaten electric reliability and to support research and development for next-generation carbon-based technologies.

■ **PA S.R. 227/H.R. 576** (adopted) urges FERC to swiftly consider the U.S. Department of Energy's proposed Grid Resiliency Pricing Rule and implement policies to ensure fuel-secure baseload electric generation resources receive proper compensation for the positive attributes they provide to the commonwealth's electric system.

■ **VA H.B. 2291** (enacted) allows utilities to petition the Virginia Corporation Commission for a rate adjustment for recovery of costs related to upgrading systems and equipment at a nuclear generating facility for the purpose of extending the facility's operating license with the Nuclear Regulatory Commission.

Cybersecurity

The rapid rise in cyberattacks has been cause for concern throughout the U.S. economy, and the energy sector is no exception. The energy industry was the most heavily targeted sub-sector of all U.S. critical infrastructure, before attackers turned their attention to water and wastewater systems over the past two years, according to the U.S. Department of Homeland Security.

Cybersecurity is an increasingly important consideration in light of grid modernization efforts. New, intelligent components are working in tandem with legacy equipment that may be decades old. Information technology and operations technology have converged, linking computer systems with physical, equipment-oriented technologies.

With those advancements has come an increased susceptibility to cyberintrusions, and a heightened effort to coordinate among industry and government entities to promote and deploy the most effective defenses. Given the complexity and every-changing nature of cybersecurity, communication between industry and government has been instrumental to ensuring common vulnerabilities are addressed before systems are compromised.

The electric power industry coordinates with the North American Electric Reliability Corporation (NERC), along with the National Security Agency (NSA), the Federal Energy Regulatory Commission (FERC), the U.S. Department of Homeland Security (DHS) and the U.S. Department of Energy (DOE). FERC has approved cybersecurity standards developed by NERC, and the two organizations released a joint restoration and recovery report in 2017 that offered additional recommendations to entities that would be responsible for restoring the grid in the absence of the modern control systems.

That isn't to say states are sitting on the sidelines. A number of states participate in NERC-sponsored grid security exercises like GridEx, while also exploring ways to strengthen the grid's cyberdefenses and ensure state agencies are prepared for recovery and restoration efforts.

Thirty bills were introduced in state legislatures this session that deal with cyberthreats to critical infrastructure. Of those, at least seven bills passed. The majority of the bills would accomplish two items: Create a task force or committee to consider the issue, or restrict public disclosure through the Freedom of Information Act (FOIA) of certain information that could reveal cyber vulnerabilities to critical infrastructure.

Iowa passed two FIOA exemption bills (IA H.B. 445 and IA H.B. 601), while Virginia passed three (VA H.B. 817, VA S.B. 645, and VA H.B. 1539). Virginia's bills in particular focus specifically on vulnerabilities to critical infrastructure, information related to response plans and planning activities and information that would hinder antiterrorism efforts. For more information on state and federal efforts to exempt certain critical energy infrastructure, NCSL recently published, "Open Government Laws and Critical Energy Infrastructure."

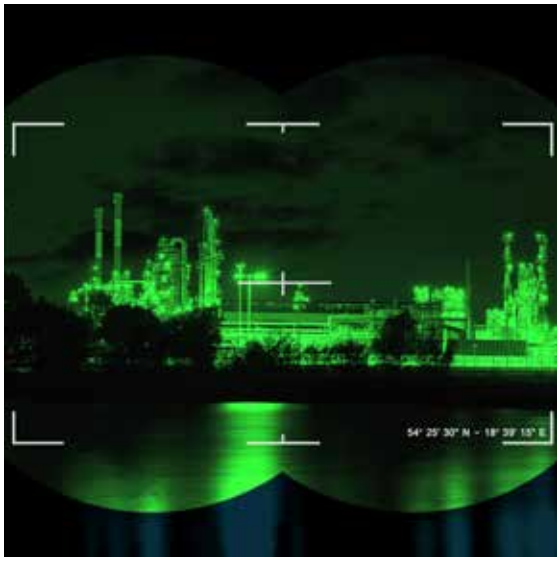
At least six states—California, Nevada, New Jersey, New York, Texas and Washington—considered measures to establish task forces or study committees.

KEY BILLS FROM 2017

- **AL H.R. 88** (adopted) urges protection of the U.S. electric grid from cyber threats.
- **NM S.B. 380** (enacted) authorizes the activation of the National Guard in response to a cybersecurity threat under various circumstances, including the protection of critical infrastructure.
- **NY S.B. 4615** (pending) would offer tax credits for the purchase of data breach insurance for businesses.

Terrorism

The topic of terrorism and physical assaults to energy infrastructure continues to be a concern for policymakers. These threats include everything from a gunman shooting and destroying part of a key substation to a high-altitude nuclear weapon detonation that results in an electromagnetic pulse (EMP) attack.



The Department of Energy issued a final rule in January 2018 that grants the energy secretary broad authority to order emergency measures to protect and restore the electric grid in the aftermath of a grid security emergency, as declared by the president. According to the rule, such an emergency could result from a physical attack, cyberattack or EMP event that results in significant damage to critical electric infrastructure. The final rule is intended to ensure that, in the event of such an emergency, the federal government has the authority to issue emergency orders under the Federal Power Act that will minimize damage and disruption.

At least seven states considered nearly 20 measures relating to protecting the energy industry and critical infrastructure from these physical attacks. Texas introduced nine bills—none of which passed—while Maine's governor vetoed a measure that would have required utilities in the state to begin preparing for and reporting on actions to insulate the state's infrastructure from the effects of an EMP attack. The costs associated with EMP protections have often proven to be barriers to the passage of these types of measures.

KEY BILLS FROM 2017

■ **ND H.C.R. 3010** (adopted) recognizes the efforts undertaken and continued need for the state and U.S. to harden the commercial power grid against multiple serious threats, including an electromagnetic pulse (EMP).

■ **ME H.B. 373** (vetoed) would have required electric companies to report to the Maine Public Utilities Commission annually on actions taken regarding protections from geomagnetic disturbances and EMPs, and requires the commission to compile the information received.

■ **OK H.B. 1123** (enacted) prohibits trespass without owner permission for critical facilities, and provides penalties for persons who willfully damage, destroy, vandalize or otherwise tamper with critical infrastructure facilities used for: petroleum refining, electric generation, chemical manufacturing, water infrastructure, telecommunications, ports, railroads, dams and pipelines.

Conclusion

State legislators continued to advance measures that address the many aspects of energy security in 2017, working to ensure that residents, businesses and industries have access to the reliable energy they need. These efforts continue to adapt to the changing operating environment, as the grid grows increasingly connected and complex.

In 2018, we expect to see a continuation of many of the trends from previous years, with a particular focus on energy storage, microgrids and grid-hardening measures in response to the devastation wrought in the previous year. In addition, it appears increasingly likely that continued state decisions to incentivize certain resources will force market operators to make fundamental changes to the way they price electricity.

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