3RD ANNUAL

GRID MODERNIZATION INDEX

January 2016

GRIDWISE® ALLIANCE

in collaboration with CLEAN EDGE

About GridWise Alliance

The GridWise Alliance (GWA) is a coalition of electricity industry stakeholders that brings together electric utilities, industry suppliers, and service providers from the equipment, communications, and information technology sectors. Joined by universities, national laboratories and others, the GWA works to enhance electric grid performance, and to transform our nation's electric system to meet the needs of the 21st century.

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DISCLAIMER: The state rankings included in the GridWise Alliance's 3rd Annual Grid Modernization Index (GMI) were developed based on publicly available information regarding state energy policies and electric grid operations including, but not limited to, customer access to usage information, meter deployments, rate structures, and state energy plans. In addition, stakeholder survey responses and interviews with regulators, policy makers and utility operations personnel were also used in the process of finalizing state rankings. The final state rankings reflect a summary of the inputs collected and are not intended to prescribe specific policy initiatives or grid modernization investment strategies.

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The GridWise Alliance (GWA) is pleased to publish its third annual Grid Modernization Index (GMI). This GMI ranks the states according to the progress each has made in actually *implementing* grid modernization measures.

Electricity continues to be at the heart of our economy and truly does power our lives. As our economy becomes even more digitally driven, electricity becomes all the more critical. As a result, how we manage and operate our electric grid must also evolve to a more digital, automated system. This modernized grid increases our ability to support advances in technology while maintaining the underlying energy infrastructure that allows our economy to grow and thrive. It provides customers opportunities to take control of their energy decisions and even participate by providing power back to the grid. The electricity grid must also support our national security objectives in a world of increasing cyber and physical security risks as well as those from major storms and other natural events.

As a result of these drivers, the electric utility industry is experiencing a monumental transition in the way in which electricity is produced, delivered, and used. This transition is happening in different ways across the U.S., in large part due to the diversity and history of how our electric infrastructure was built over the last century. It is often noted that "states are the laboratory of democracy," and this is particularly true in regulating and managing electric utilities to ensure that the public good is served, while enabling individual rights and choices. To achieve a modernized grid, changes to state and federal energy policies will be needed. In addition, changes to the utility business and regulatory models, allowing electric utilities to become service-oriented entities and not simply commodity suppliers, will be vital.

We believe that the GMI is an important tool to help understand the various policy and related changes that are driving grid modernization efforts at the state level. We have made several improvements to the GMI this year to ensure that the data is more representative of ongoing grid modernization efforts across the United States. This latest GMI has been expanded to highlight some best practices, so that states can leverage these examples and lessons learned, should they wish to do so.

STEVE Becky

EXECUTIVE SUMMARY

The transformation of the electric grid in the United States continues to proceed at an unprecedented rate. The proliferation of advanced metering infrastructure (AMI), utility-scale renewable generation, distributed energy resources (DERs), energy storage, electric vehicles, and other technologies is changing the way electric power is transmitted, distributed, and managed, in both large and small ways. These changes affect the full range of grid stakeholders – utilities, regulators, policymakers, grid operators, electric service providers, and customers – in all 50 states and the District of Columbia.

This third annual Grid Modernization Index (GMI), published by the GridWise Alliance in collaboration with Clean Edge, ranks and assesses the states and D.C., based upon the degree to which they have moved toward a modernized electric "Grid of the Future." This GMI, based on survey data collected in June-October 2015, benchmarks states on a wide range of grid modernization policies, investments, and activities. The report also provides insights into some of the relationships and connections between state policies and regulations, customer engagement, and utility investments in modernizing the grid.

The GMI ranking system uses a clearly defined set of criteria to evaluate and convey the progress and impacts of this transformative set of improvements to the states' electricity infrastructure. The GMI rankings consist of three broad categories:

- **STATE SUPPORT**, which is based on plans and policies that support grid modernization
- **CUSTOMER ENGAGEMENT**, which ranks states on their rate structures, customer outreach, and data collection practices
- **GRID OPERATIONS**, which benchmarks the deployment of grid modernization technologies such as sensors and smart meters, as well as the advanced capabilities they enable

Appendix A lists the survey questions used in the GMI.

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2 ILLINOIS
3 TEXAS
4 MARYLAND
5 DELAWARE
6 DC
7 OREGON
8 ARIZONA
9 PENNSYLVANIA
10 GEORGIA

Major Developments

- **CALIFORNIA** now requires its major investor-owned utilities (IOUs) to submit distributed resource plans (DRPs) that detail how they will value DERs as distribution grid assets.

- **NEW YORK**'s landmark Reforming the Energy Vision (REV) proceeding recognizes the need for advanced metering functionality (such as smart meters). Advanced metering functionality is one of the foundational investments that will allow New York to achieve its ultimate goal: reforming the retail market to leverage DERs to optimize the electric system. The state's utilities are already proposing plans to provide smart meters to those customers who do not yet have them.

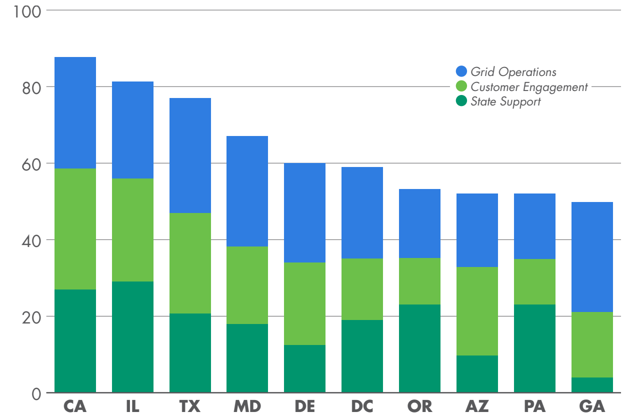
- In 2015, **HAWAII** increased its Renewable Portfolio Standard (RPS, i.e. the amount of renewable energy required) to 100 percent by 2045. Its utilities have struggled to integrate more solar photovoltaic (PV) (as well as storage and other DERs), which have grown rapidly as a result of net metering (the policy that allows customers with solar PV to be compensated for the electricity their solar panels add to the grid). In October 2015, the Public Utility Commission eliminated net metering in favor of two new rate options. (See sidebar on page 18.)

- **MASSACHUSETTS** required its utilities to submit grid modernization plans by September 2015. Utilities' proposals include additional smart meters, experiments with time of use and critical peak pricing tariffs, and DER management systems.

- **MINNESOTA** has finished Phase I of its e21 Initiative, which aims to help utilities recognize the new role that customers play in electricity production and consumption, and offer new services and rates that reflect this emerging reality. In March 2014, it also created the country's first-ever formula, or method, that helps value solar energy for utilities to use to compensate solar customers for the excess electricity they send back to the grid.

- **ARIZONA** has been experiencing a major debate over net metering. To address this challenge, in October 2015, the state decided to consider both the costs and values of solar together in one Commission proceeding. Doing so is an important step, especially given that utilities and solar companies had previously been discussing whether to consider the value of solar power at all.

FIGURE 1: 3RD ANNUAL GRID MODERNIZATION INDEX: TOP 10 STATES



Source: GridWise Alliance and Clean Edge.

Leading State Scores

California is the highest-ranked state in this year's GMI, with a score of 88, more than six points higher than its score in 2014. The state ranks first in the Customer Engagement category (as it did in the previous GMI), and second in both State Support and Grid Operations. California has a nearly seven-point lead over second-place Illinois, while Texas (which tied California for the top score in the previous GMI) ranks third. Maryland and Delaware (two of four states in the top 10 that lie fully within the PJM Interconnection territory) each move up a spot to fourth and fifth, respectively. This year, the top states have started to pull away from the rest of the field: in the previous GMI, the difference between first place and fifth was 15 points; now it is almost 28 points.

The bottom half of the top 10 has gone through some significant shifts. The District of Columbia increases its ranking by two places to sixth, followed by Oregon, which adds 11 points to its overall score with big improvements in Customer Engagement and Grid Operations. Arizona and Pennsylvania are tied for eighth; the latter fell 19 points, though its ranking only fell four places. Finally, Georgia ranks 10th; Georgia's score is the same as in the previous GMI, but it places in the top 10, due to big declines by other states. North Carolina is worth watching: It has added 10 points to its overall score and just misses ranking in the top 10.

The top 10 states have an average overall score of 64 points. For the states ranked 11 through 20, the average is 41 points, representing a 36 percent decline from the top 10; for states ranked 21 through 30, the decline reaches nearly 58 percent (27 is the average score). These gaps between the highest-scoring states and the next two tiers are larger than they were in the previous GMI.

Key Takeaways

- Continuing to fund investments in grid modernization is a challenge for both utilities and regulators due to pressure to keep rates low, making the internal competition for capital more challenging.

- A wide gap generally exists with respect to progress achieved in modernizing the grid between the leading states and those that have not yet started to make significant investments.

- Key factors associated with high GMI scores currently include AMI penetration, electric market deregulation, and the presence of demand response programs.

- Deployment of grid modernization technologies, such as AMI infrastructure, has progressed, but the full potential range of benefits that such technologies could provide has yet to be realized, particularly around customer education and empowerment.

- States and utilities need to consider dynamic rate structure reforms to fully unlock the benefits offered by the smart grid.

- The source of leadership of grid modernization efforts varies widely from state to state, including between regulators, legislatures, governors, utilities, and customers. There is no one-size-fits-all approach, but collaboration among stakeholders is essential.

GRID MODERNIZATION INDEX OVERVIEW + METHODOLOGY

The Grid Modernization Index (GMI) ranks and analyzes all 50 U.S. states and the District of Columbia, based upon the degree to which each one has moved toward a modernized electric grid. This grid will look fundamentally different than the one we have used for more than a century. It will be much more dynamic, will enable the two-way flow of electricity and information, empower consumers and commercial users (some of whom produce their own electricity), and will increase resiliency and responsiveness.

The first GMI was released in 2013, with the second GMI having been released in 2014. Now in its third iteration, this year's GMI ranks the states on factors in three broad categories:

- **STATE SUPPORT**, which is based on plans and policies that support grid modernization
- **CUSTOMER ENGAGEMENT**, which ranks states on their rate structures, customer outreach, and data collection practices
- **GRID OPERATIONS**, which benchmarks the deployment of grid modernization technologies such as sensors and smart meters, as well as the advanced capabilities they enable

Data collection for this year's GMI took place in June-October 2015. To carry out the data collection effort, the GridWise Alliance (GWA) assembled a project team of individuals from utilities, consultants, and non-profit groups. Project team members gathered data primarily through phone interviews and e-mail surveys with public utility commission (PUC) members, utility representatives, and other sources (see Appendix A for the full list of indicators). For certain states where data was not readily available, team members had to rely on publicly available information to gather data. Data for many questions is difficult to uncover, so where information from respondents and publicly available sources was lacking, states received significantly lower scores.

STATE SUPPORT 30PTS

- Grid Modernization Policy/Plan
- RPS/EERS
- Cybersecurity Plan
- Education/Outreach/Measurement/Reporting Requirements
- EV/Storage Incentives/Mandates

CUSTOMER ENGAGEMENT 34PTS

- Dynamic Tariffs/Rate Structures
- Communication with Customers
- Tariffs for EVs/Storage/PV
- Data Access/Sharing
- Customer Segmentation/Analytics

GRID OPERATIONS 36PTS

- AMR/AMI Deployment
- Advanced Sensors for Transmission & Distribution
- Energy Storage & Microgrids
- Integration of AMI & Distribution Management Systems
- Probabilistic Planning
- Advanced GIS & Visualization

100 TOTAL POINTS

To provide added context to the GMI, GridWise Alliance member, Accenture, performed a detailed statistical analysis to see which factors correlate with GMI scores. The analysis involved running correlation models to determine the relationship between several variables, such as state gross domestic product (GDP) and advanced metering infrastructure (AMI) penetration, and GMI scores. The statistical section and Appendix B discuss this analysis further.

This year's GMI is organized to show overall results and trends from the survey, followed by a deeper discussion of the 10 states with the top overall GMI scores. Then, it provides an in-depth look at each of the three GMI categories before examining the results of Accenture's work and concluding with several key takeaways for stakeholders.

Methodology

For this year's GMI, states were scored based on a weighted system where each question was scored on a 1-5 scale. This raw score was then multiplied by a weight (which ranged from 1 to 4) applied to that indicator to get the total points for the item. For example, a state receiving a raw score of 5 on a question with a weight of 4 would get 20 total points for that question. Weighted scores for the indicators in each category were then totaled.

GWA then subtracted the number of questions in that category (30 for State Support, 34 for Customer Engagement, 36 for Grid Operations), and divided the result by four to obtain final category scores. The three category scores were then added together to obtain an overall score. This method normalized the scores so that each state could get a maximum of 100 points overall, with maximum category scores being equal to the number of questions in that category.

Questions that focused on deployment penetration or customer coverage were scored on the following scale:

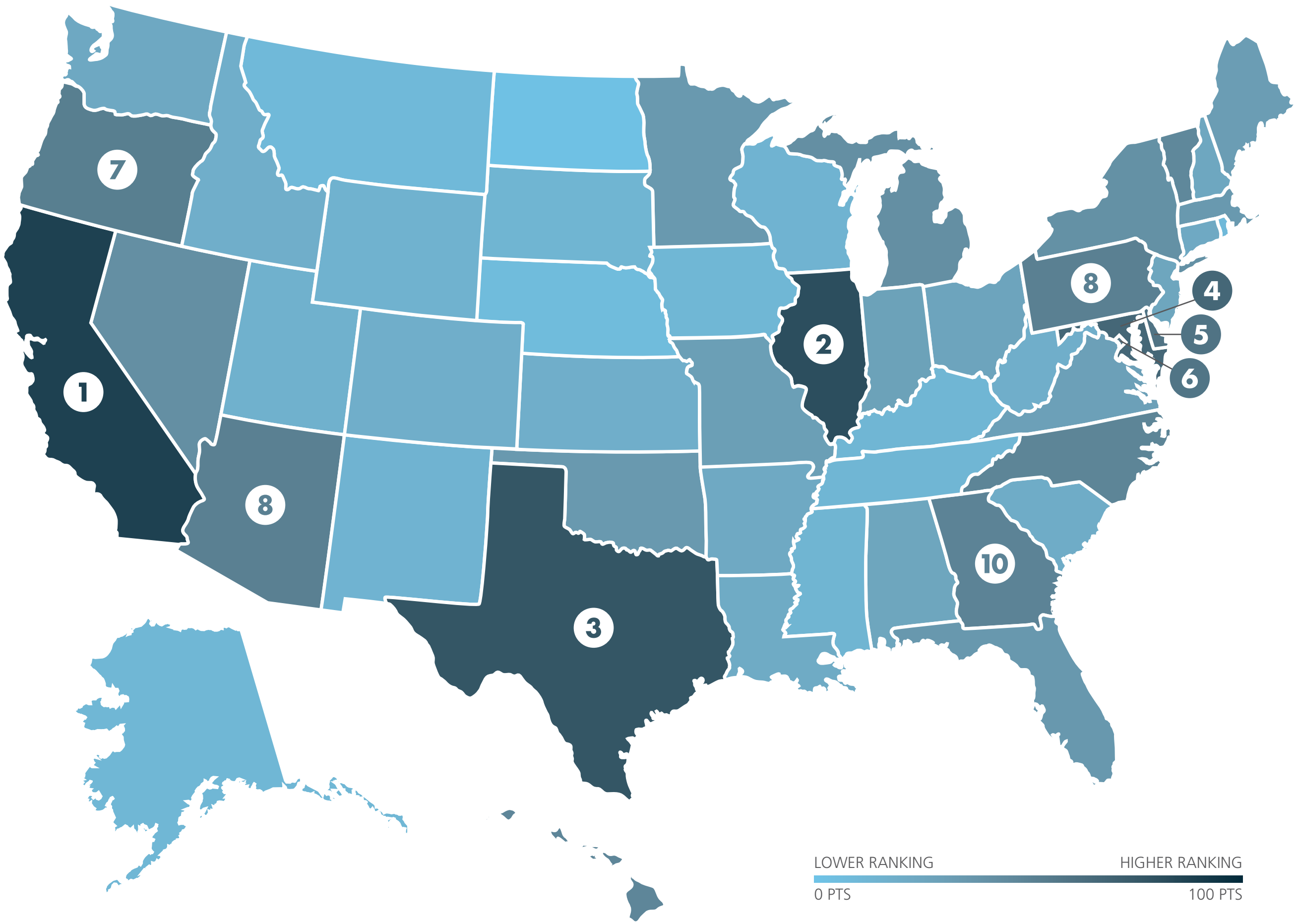
Less than 10%	1
10-20%	2
20-35%	3
35-60%	4
60% or more	5

Data for these questions came directly from respondents or, absent such information, from 2013 Energy Information Administration (EIA) figures (2014 EIA data was released too late in the data collection period to be incorporated).

The scoring system for this year's GMI was interpreted slightly differently than it has been in previous GMIs. For example, the American Recovery and Reinvestment Act (ARRA) provided states with extensive funding for grid modernization upgrades from 2009 to approximately 2014. But with the completion of this funding, states must now be more proactive, both in terms of providing funding and through the implementation of policies and regulations to encourage modernization. Whereas in previous years simple consideration of certain grid modernization policies at the state level earned those states some credit, this year, in contrast, more credit was given for actual state implementation of policies and programs.

This year, more credit was given for required actions than for actions utilities took of their own accord. The rationale behind this change is that required actions affect most or all of a state's residents, whereas actions by a single utility impact only those residents within its service area and, depending on the utility, this may only represent a small portion of the state's residents. These reinterpretations, combined with better data and generally stricter scoring, have contributed to significant changes in both scores and rankings from the two previous GMIs.

OVERALL RESULTS



RANK	+/-	STATE	LEADERSHIP SCORE
1	1	California	87.8
2	1	Illinois	81.3
3	-2	Texas	77.0
4	1	Maryland	67.0
5	1	Delaware	60.0
6	2	Washington, DC	59.0
7	10	Oregon	53.3
8	1	Arizona	52.0
8	-4	Pennsylvania	52.0
10	3	Georgia	49.8
11	13	North Carolina	48.8
12	6	Hawaii	47.5
13	2	Vermont	47.3
14	-7	Nevada	41.8
15	-1	Michigan	41.5
16	7	New York	41.3
17	3	Florida	36.3
18	8	Minnesota	34.8
18	-6	Oklahoma	34.8
20	0	Massachusetts	34.5
21	-5	Maine	32.3
22	0	Missouri	31.0
23	-13	Virginia	29.5
24	5	Indiana	28.8
25	-6	Ohio	26.5
26	0	New Jersey	26.3
27	9	Alabama	25.5
28	11	New Hampshire	24.8
29	5	Washington	23.8
30	2	Arkansas	23.3
31	-6	Connecticut	22.8
32	14	Louisiana	21.5
33	-2	South Carolina	20.8
34	-2	Colorado	19.0
34	-23	Idaho	19.0
36	4	Kansas	18.8
37	7	West Virginia	18.5
38	-2	Utah	17.3
39	12	Wyoming	16.0
40	6	Wisconsin	15.0
41	4	New Mexico	14.8
42	-16	South Dakota	14.0
43	-2	Mississippi	13.8
44	-2	Kentucky	12.8
44	-9	Tennessee	12.8
46	-3	Iowa	12.3
47	-17	Alaska	12.0
48	-10	Montana	10.0
48	2	Rhode Island	10.0
50	-1	Nebraska	8.3
51	-3	North Dakota	3.3

OVERALL RESULTS

California is the highest-ranked state in this year's GMI, with a score of 87.8, more than six points higher than its score in 2014. The state ranks first in Customer Engagement (as it did in the previous GMI), and second in both State Support and Grid Operations. California has a full 6.5-point lead over second-place Illinois, while Texas ranks third. Maryland and Delaware (two of four states in the top 10 that lie fully within the PJM Interconnection territory) each move up a spot to fourth and fifth respectively. This year, the top states have started to pull away from the rest of the field: in the previous GMI, the difference between first place and fifth was 15.3 points; now it is almost 28 points.

The bottom half of the top 10 has gone through some significant shifts. The District of Columbia increases its ranking by two places to sixth. It is followed by Oregon, which adds 11 points to its overall score with big improvements in Customer Engagement and Grid Operations. Arizona and Pennsylvania are tied for eighth; the latter fell 19.3 points, though its ranking only fell four places. Finally, Georgia ranks 10th;

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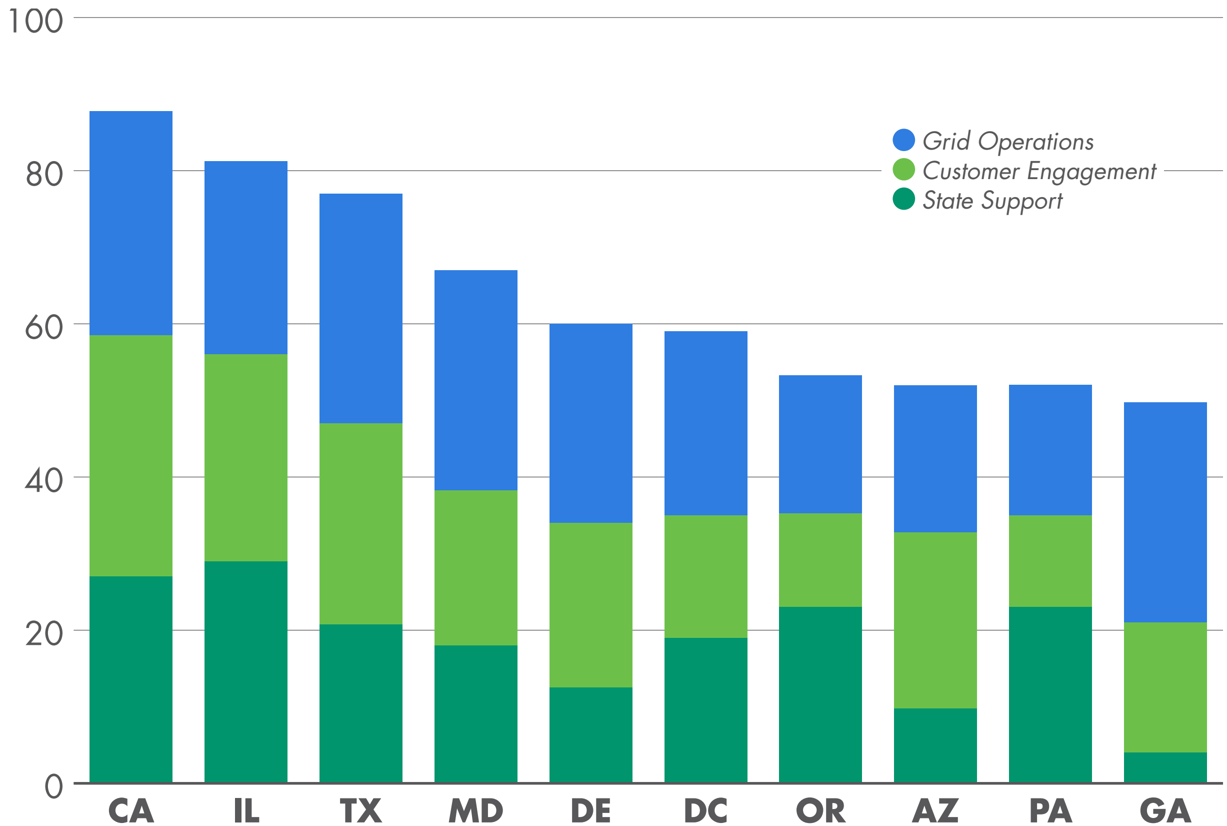


Source: GridWise Alliance and Clean Edge.

STATES WITH GAINS OR LOSSES OF AT LEAST 10 PLACES OR 10 POINTS

LOUISIANA
↑14
↑6.00
Beginning to deploy grid modernization technologies, though primarily pilot projects.

NORTH CAROLINA
↑13
↑10.00
Investments in the grid have led the way. Still opportunities with AMI deployments but 64% of meters being AMR have delayed AMI in state.

WYOMING
↑12
↑11.50
Policy support growing in the state.

NEW HAMPSHIRE
↑11
↑4.75
Rise attributed to more complete data on grid investments and customer engagement efforts.

OREGON
↑10
↑11.00
Improved smart grid metric reporting requirements for major utilities. Passed energy storage mandate in 2015.

PENNSYLVANIA
↓4
↓19.25
Dynamic pricing rates only vary by month instead of by hour or day. More limited communication channels used to notify consumers regarding DR events than previously

MAINE
↓5
↓11.00
Less credit given due to stricter scoring criteria and inability to validate grid investments.

CONNECTICUT
↓6
↓14.25
Tightening criteria on policy scoring impacted State Support scores. Granular usage data not available to customers because no AMI infrastructure deployed to support daily information.

OHIO
↓6
↓14.75
State froze energy efficiency goals for two years in 2014. Less support for grid investments overall. Major utilities have made few significant investments outside of ARRA.

OKLAHOMA
↓6
↓16.50
No longer continuing processes put in place during ARRA implementation. Only one state utility made significant investments during ARRA (OG&E, 37% of customers), based on publicly available data.

NEVADA
↓7
↓17.75
Tightening criteria on policy scoring impacted State Support scores. Could not validate grid modernization investments and capabilities that had gotten credit in previous years.

TENNESSEE
↓9
↓10.50
State has large number of municipal and cooperative utilties. Very hard to find data for many of them. State PUC has very limited authority due to utility structure in state.

MONTANA
↓10
↓11.75
Tighter scoring criteria impacted scores. State representatives did not respond to data inquiries.

VIRGINIA
↓13
↓22.25
Regulatory support not there for utility investments. Grid investments were only pilots or targeted to specific customers rather than widespread deployments.

SOUTH DAKOTA
↓16
↓18.25
Tighter scoring criteria in State Support category impacted scores. Little information on investments and rates to support previous scores in Customer Engagement and Grid Operations.

ALASKA
↓17
↓16.75
Tighter scoring criteria impacted scores. Utility structure in state makes it difficult to gather data for grid operations investments.

IDAHO
↓23
↓32.50
Better data suggests less deployment than previously believed. Few significant drivers for grid modernization.

Georgia's score is the same as in the previous GMI, but it places in the top 10 due to big declines by other states. North Carolina is worth watching: It has added 10 points to its overall score and just misses ranking in the top 10.

Several themes emerge from this year's GMI. One is the divide between the highest-scoring states and the rest of the nation. The top 10 states have an average overall score of 63.9 points. For the states ranked 11 through 20, the average is 40.8 points, representing a 36 percent decline from the top 10; for states ranked 21 through 30, the decline from the top 10 reaches nearly 58 percent (27.2 is the average score). These gaps between the highest-scoring states and the next two tiers are larger than they were in the previous GMI. (For reference, states ranked 31-40 have an average overall score of 18.9, and the bottom 11 states average a score of 11.3.)

The graphic on page 13 shows the states that either rose or fell by 10 or more points, or rose or fell by 10 or more places in the overall GMI rankings (or both). One dozen states have declined as such, while five states have increased or risen in this manner. Some of these changes can be attributed to a tightening of scoring standards (discussed in the Methodology section), as well as better data than was available in 2014. At the same time, though, several states are seeing their smart grid investments drop off as ARRA projects have been completed, and many of the pilot projects have not been advanced into full deployments.

Oregon rises 11 points and 10 ranking spots in the current GMI. The state requires its utilities to file annual grid modernization updates; 2015 was the first year that it required such reports to include metrics. These reports have helped fill information gaps that previously existed, and contribute to Oregon's significant rise in the Grid Operations category, in particular. But the state also improved in areas not directly related to better reporting; in 2015, it instituted an energy storage mandate, and enhanced its education, outreach, and analytical capabilities. Portland General Electric is taking advantage of these changes (and some remaining ARRA funding) to deploy a five-megawatt battery as part of its Salem Smart Power Project.

Idaho missed the top 10 by a mere one-quarter point in the previous GMI; in the current version, it falls by 32.5 points and 23 places. Part of this decline has to do with better data that indicate its smart grid efforts are not as extensive as they appeared previously. Lower electricity prices in Idaho reduce the financial drivers that typically exist in states with much higher GMI scores. However, some grid modernization investments are being made: Idaho Power and Avista were allowed to rate base their deployments of hundreds of thousands of meters.

One clear trend that emerges from this year's GMI is an increasing margin between the high-scoring and low-scoring states. What impact could this have moving forward? Those states that lag in making critical investments in modernizing their grid increasingly will find their power supply to be less efficient and less reliable. They will also be unable to leverage the rapid innovations taking place in energy technology, particularly those focused on consumers.

Perhaps a bigger question is: How can we enable and accelerate these needed investments? This question is complicated at best and the answer varies from state to state based on existing policies and regulatory structures. More funding for upgrading the electricity grid infrastructure is certainly needed, but the mechanism for making these investments is burdened with many pros and cons and various stakeholder viewpoints. What is clear is that better tools and analyses are needed to understand the costs and values associated with modernizing the grid. Decisions are not always clear cut and the competition for capital is challenging.

A second theme revolves around the issue of ensuring that both consumers and utilities can take advantage of the value and benefits of grid modernization. The GMI results show that states differ dramatically in several areas that pertain to customer engagement. These include dynamic rate structures (such as time of use rates, critical peak pricing, and other types of real-time electricity rates), access to and use of energy data, and education and outreach efforts that help customers understand the smart grid and how they can benefit from it. Here, again, we see a familiar pattern: The 20 highest-scoring states perform reasonably well in these areas, but the rest of the nation tends to fall short.

Without a number of foundational capabilities for modernizing the grid in place, many states are not well positioned for the added diversity that energy systems will see in the coming years from the growth of distributed generation, storage, microgrids, grid-connected electric vehicles (EVs), and other elements. Without offering pricing incentives, for example, utilities are unlikely to see beneficial customer behavior changes, such as reductions in energy consumption during peak demand periods.

A number of states are actively building such foundational capabilities:

- **CALIFORNIA** now requires its major investor-owned utilities (IOUs) to submit distributed resource plans (DRPs) that detail how they will value distributed energy resources (DERs) as distribution grid assets. More recently, a member of the state Public Utility Commission submitted a proposal on how to value DERs in their entirety, rather than looking at projects individually.

- **NEW YORK**'s landmark Reforming the Energy Vision (REV) proceeding recognizes the need for advanced metering functionality (such as smart meters). Advanced metering functionality is one of the foundational investments that will allow New York to achieve its ultimate goal: reforming the retail market to leverage DERs to optimize the electric system. The state's utilities are already proposing plans to provide smart meters to those customers who do not yet have them (as of 2013, less than one-half percent of the state had AMI).

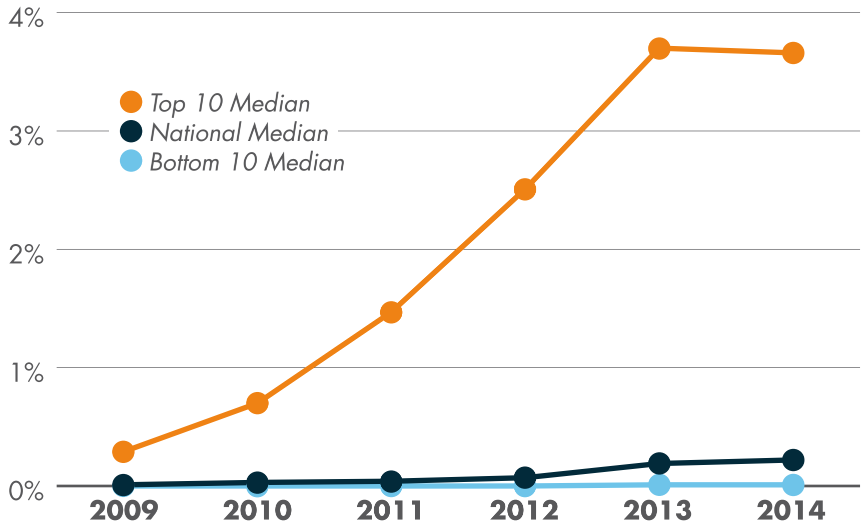
- **HAWAII** in 2015 increased its Renewable Portfolio Standard (RPS) (i.e., the amount of renewable energy required) to 100 percent by 2045. Its utilities have struggled to integrate more solar photovoltaic (PV) (as well as storage and other DERs), which have grown rapidly as a result of net metering (NEM, the policy that allows customers with solar PV to be compensated for the electricity their solar panels add to the grid). In October 2015, the Public Utility Commission eliminated net metering in favor of two new rate options. (See sidebar on page 18.)

- **MASSACHUSETTS** required its utilities to submit grid modernization plans by September 2015. Utilities' proposals include additional smart meters, experiments with time of use and critical peak pricing tariffs, and DER management systems.

- **MINNESOTA** has finished Phase I of its e21 Initiative, which aims to help utilities recognize the new role that customers play in electricity production and consumption, and offer new services and rates that reflect this emerging reality. In March 2014, it also created the country's first-ever formula, or method, that helps value solar energy and that utilities can use to compensate solar customers for the excess electricity they send back to the grid.

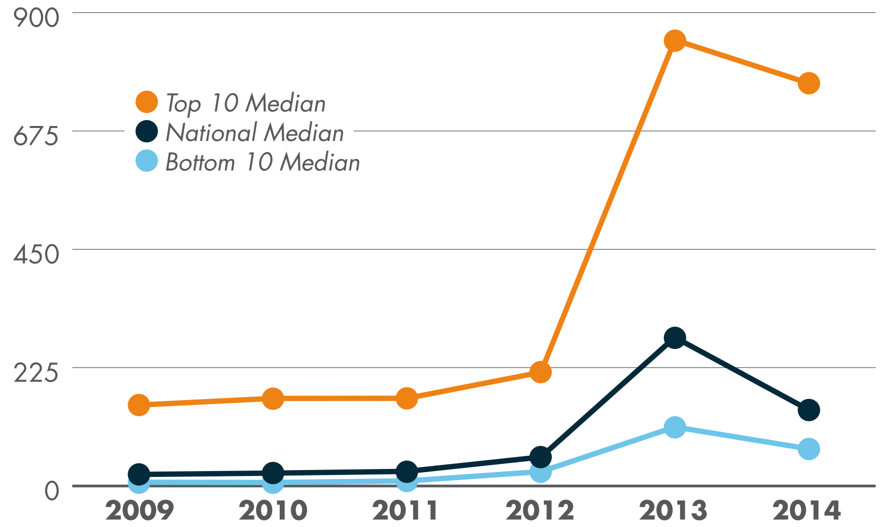
- **ARIZONA** has been experiencing a major debate over NEM. To address this challenge, in October 2015, the state decided to consider both the costs and values of solar together in one Commission

FIGURE 2: INSTALLED SOLAR CAPACITY (% OF TOTAL INSTALLED CAPACITY), 2009-2014



Source: Clean Edge's U.S. Clean Tech Leadership Index, with data from IREC and Solar Electric Power Association (SEPA).

FIGURE 3: ELECTRIC VEHICLE REGISTRATIONS (EVS PER MILLION PEOPLE), 2009-2014



Source: Clean Edge's U.S. Clean Tech Leadership Index, with data from IHS Automotive.

proceeding. Doing so is an important step, especially given that utilities and solar companies had previously been discussing whether to consider the value of solar power at all.

The increasing penetration of DERs is another trend, one that will likely have a profound effect on the grid in the short to medium term. The charts above show how two types of DERs, solar PV and EVs, have seen rapid expansion that is likely to continue. Upgrades to the distribution system are necessary, for instance, to allow large amounts of rooftop solar power to be fed back into the grid. The same is true for the recent, growing practice of aggregating distributed energy storage or charging EVs and using them as demand response providers.

But, as the GMI shows, the focus on the integration of DERs differs dramatically among the states. The Grid Operations category, for instance, demonstrates how the states differ regarding deployment of the physical smart grid infrastructure. Rate structures (covered in the Customer Engagement category) also reflect this trend. Most states have some sort of special tariff for solar PV, but this is not the case for storage or

EV charging rates, which are relatively rare to date. Additionally, dynamic pricing structures, such as time of use rates, usually do not take into account the locational value provided by DERs. Finally, debates over NEM policies persist nationwide. (See the sidebar on page 25 for more on DERs and their impact on the smart grid.)

California is a leading state in this area. It continues to advance policies that require a modern grid, such as a 50 percent RPS, an energy storage mandate, and the aforementioned DRPs. It approaches these issues in a comprehensive way, so that the various elements of its greenhouse gas reduction strategy tend to work together. These efforts are producing results: In September 2015, the energy storage company Stem successfully bid aggregated distributed storage into the California ISO (CAISO) real-time electricity market for the first time and, in November, the state's major IOUs submitted bids for the first-ever Demand Response Auction. States like New York, Massachusetts, Hawaii, and Texas are also looking to better integrate DERs into their grids.

TABLE 1: THREE STATES TO WATCH: KEY STRUCTURES FOR GRID MODERNIZATION

	CA	MA	NY
SOURCE OF INITIATION	Policy then regulatory-led; CA has passed many policies that have then been implemented by CPUC, such as requiring utility plans for integrating and valuing DERs	State legislature with Green Communities Act in 2008; 2014 DPU issued Order 12-76-B requiring utilities to develop and implement 10-year grid modernrization plan; and Order 14-04-B requiring time-varying rates.	Top-down effort led by Gov. Andrew Cuomo's Reforming the Energy Vision (REV) utility and regulatory reform initiative, which is being driven by the Public Service Commission
MAIN DRIVERS	Integrating renewables to meet 50% RPS by 2030; improving demand-side efficiency; net-zero goals for new construction, leading to large penetrations of PV; incentives for adoption of EVs; mandates for energy storage; restructuring of electricity markets	Restructuring of electricity markets; energy efficiency; resiliency; reliability; cost reductions; clean energy	Restructuring of electricity markets; grid resiliency post-Hurricane Sandy; energy efficiency; GHG reductions; increasing customer enablement
KEY ELEMENTS	Integration of utility-scale & distributed renewables; storage; rate design	AMI integration for outage management; TOU rates; DER integration	Development of the distribution system platform to enable greater penetration of third party (non-regulated) DERs, including increasing demand side management and microgrids. Numerous demonstration projects underway to test business models as well as technologies.
YEAR INITIATED	RPS - first implemented in 2002, net-zero targets established in 2007; greenhouse gas regulations (AB32) signed in 2006; started deploying AMI in 2006	2008 (Green Communities Act); greenhouse gas regulations (Global Warming Solutions Act) also signed in 2008; DPU order for utility modernization plans in 2014	REV launched 2014

Source: GridWise Alliance and Clean Edge.

One final theme revolves around data availability. In numerous instances, the declines in states' scores are due to lack of available data. The current year's results show that measuring and reporting grid modernization benefits are not widespread practices: only eight states receive full credit for this indicator. As a result, data collection for the GMI to date has relied on intensive information gathering through direct outreach. Furthermore, in many states, customers do not even have access to their own electricity usage data beyond their monthly bill, and there are few standardized ways for them to share this data with third parties. Green Button Connect, a utility industry initiative that allows users to download their detailed energy usage with a single click of a computer mouse is the most notable example. Some ARRA dollars were directed toward helping states measure and report their smart grid metrics, but states and utilities are often not continuing to do so in the absence of that funding. Going forward, data collection, distribution, and use will need to improve, if the full benefits of the smart grid are to be realized.

Table 1 on page 17 brings several of these trends together. It compares and contrasts the characteristics and drivers behind smart grid deployment in three important states: California, New York, and Massachusetts.

The following sections will examine some of these trends in more detail and offer insights into the states' scores and rankings, particularly those of the highest-scoring states. While smart grid deployment may not be proceeding uniformly across all states, nevertheless, grid modernization is moving forward in the United States and will offer significant benefits into the future.

HAWAII UNDER THE SPOTLIGHT

For a relatively small state, Hawaii is under a bright spotlight in the world of U.S. utilities.

Along with California and New York, Hawaii is undertaking the nation's arguably most closely-watched industry and regulatory reforms. And it is doing so while its largest utility, Hawaiian Electric (HECO), is seeking to be acquired by Florida-based NextEra Energy in a controversial $4.3 billion deal. HECO supplies power to the state's three most populous islands: Oahu, Maui, and Hawaii (The Big Island).

In October 2015, the Hawaii PUC issued a landmark "post-net-metering" ruling, ending the state's net energy metering (NEM) policy for rooftop solar in favor of two new programs called self-supply and grid-supply. While the NEM program credited solar customers at the retail kilowatt/hour rate, the new options will compensate grid-supply customers at a new, lower fixed rate (essentially the utility's wholesale rate) for supplying power back to the grid, or provide self-supply customers with a minimum bill if they are not doing so. (Existing NEM customers are grandfathered in and, therefore, will not experience any changes to their rates). Earlier in 2015, HECO approved a backlog of nearly 3,000 residential rooftop PV installations on Maui and The Big Island.

The PUC decision is one of the first major steps in an evolution of DER policies that regulators say will ease the integration of renewables, as Hawaii works toward its goal of 100 percent renewables by 2045. That historic target was established by the state legislature and signed into law by Governor David Ige in June 2015. Roughly 16 percent of HECO customers receive NEM credits for rooftop solar PV systems, one of the highest utility penetration levels in the U.S.

As the penetration of distributed solar increases, traditional NEM policies have come under pressure from utilities and others. Thus, Hawaii's actions in this regard, and in seeking alternatives to net metering, will be watched closely.

In Hawaii, Governor Ige and several state agencies, along with many others, have urged the PUC to reject the NextEra acquisition of HECO, arguing that the deal may slow progress in the state's drive toward 100 percent renewables. They note that NextEra's regulated utility, Florida Power & Light, has a very low penetration of renewables in a service territory with abundant solar resources. Solar power advocates and some Hawaii legislators have called for the state to establish a publicly-held utility instead. The Federal Energy Regulatory Commission (FERC) has ruled that the NextEra-HECO deal may proceed; a final PUC ruling is expected by mid-2016.

Hawaii ranks 12th overall (just out of the top 10) in the overall GMI rankings and is worth watching closely, because its market dynamics – particularly the high penetration of distributed solar PV – are driving the grid modernization conversation. More than 10 percent of the state's homes are powered by solar energy, and on the most populous island, Oahu, the penetration level is 16 percent.

THE TOP 10 STATES

1 CALIFORNIA

After tying with Texas in the second annual GMI, CALIFORNIA takes the top spot in this GMI by a comfortable margin, with its 87.8 score nearly seven points ahead of second-ranked Illinois. Widely recognized as a national and global leader in clean energy policies and deployment, California leads the nation in the Customer Engagement category and ranks second in Grid Operations and State Support. California (which represents the world's eighth largest economy) last year approved an aggressive RPS mandate of 50 percent by 2030, and the state's three large IOUs did not oppose the establishment of that goal.

2 ILLINOIS

Second-place ILLINOIS improved its previous score by 8.5 points, the fourth-highest jump of any state, and rises one spot from the last GMI. Illinois leads the nation in State Support, continuing the momentum from its Energy Infrastructure Modernization Act, passed by the state legislature (over the veto of former Governor Pat Quinn) in 2011. The Act authorized a 10-year, $2.6 billion grid modernization program for Exelon's ComEd subsidiary and a $648 million grid modernization program for Ameren.

3 TEXAS

The only state to operate a grid entirely within its own borders, TEXAS, drops to Number 3 from the top spot in the previous GMI, but still holds the lead in the Grid Operations category. The home of the Electric Reliability Council of Texas (ERCOT) grid, which serves 85 percent of the state, Texas is Number 3 in Customer Engagement and Number 8 in State Support. Texas' overall score fell nearly 4.8 points to 77. Although Texas is not subject to FERC jurisdiction, it is wrestling with the same pricing issues associated with demand-side management (DSM) as other states. And, as the nation's leading producer of wind power, the state faces integration issues for that increasingly affordable renewable resource; TXU and other utilities recently began offering free electricity at night and on weekends to some customers.

4 MARYLAND

MARYLAND, one of four states ranked in the top 10 served by the PJM Interconnection, moved up one place to Number 4 with just a one-half point increase in its overall score. Like its neighbors, Delaware and the District of Columbia, Maryland ranks highest in Grid Operations, tied for the nation's third-best score. But it is also in the top 10 in Customer Engagement (ranked seventh) and 11th in State Support. In July 2015, state regulators passed one of the country's most aggressive energy efficiency mandates, requiring Maryland utilities to cut sales by two percent per year.

5 DELAWARE

Neighboring DELAWARE, another state served by PJM, moves up one place into the top five despite a 4.5-point drop in its score to 60. By far the smallest and least populous among the leading states, Delaware ranks Number 5 in Grid Operations, sixth in Customer Engagement, and 14th in State Support. Delaware also is unique among the top states in that it did not receive ARRA grid modernization funds, yet has achieved a 68 percent AMI penetration.

6 DISTRICT OF COLUMBIA

The sixth-place DISTRICT OF COLUMBIA added just one overall point to achieve a score of 59, but jumped two spots from Number 8 in the previous report. DC stepped into the industry spotlight in August 2015 when its Public Service Commission (PSC) voted unanimously to reject Exelon's proposed acquisition of Pepco, in part over concerns about regulating the utility giant. This decision is currently under reconsideration by the PSC. DC is particularly strong in Grid Operations (ranking seventh) and State Support (tenth); its AMI penetration is 100 percent.

7 OREGON

Seventh-ranked OREGON had the second-largest score increase over the previous GMI, with an 11-point surge to 53 points (Wyoming's score increased by 11.5 points). That was good for a 10-place leap from 17th place in the 2014 report. Oregon ranks fourth in State Support (behind Illinois, California, and Massachusetts, and tied with Pennsylvania); it ranks 14th in Grid Operations and 15th in Customer Engagement. Among other State Support leadership factors, in June 2015, Oregon became the nation's second state (along with California) to pass an energy storage mandate. Regulators will begin hearings on a rulemaking for the mandate in early 2016.

8 ARIZONA

ARIZONA, which is experiencing considerable debate over NEM policies, is tied with Pennsylvania at Number 8. Its overall score dropped four points to 52, but the state still moved up one place from the previous GMI. Arizona is the only overall top 10 state, except California, that has Customer Engagement as its highest-ranking category, for which it ranks Number 5. Arizona ranks 11th in Grid Operations and is tied with Louisiana and Ohio for 19th in State Support.

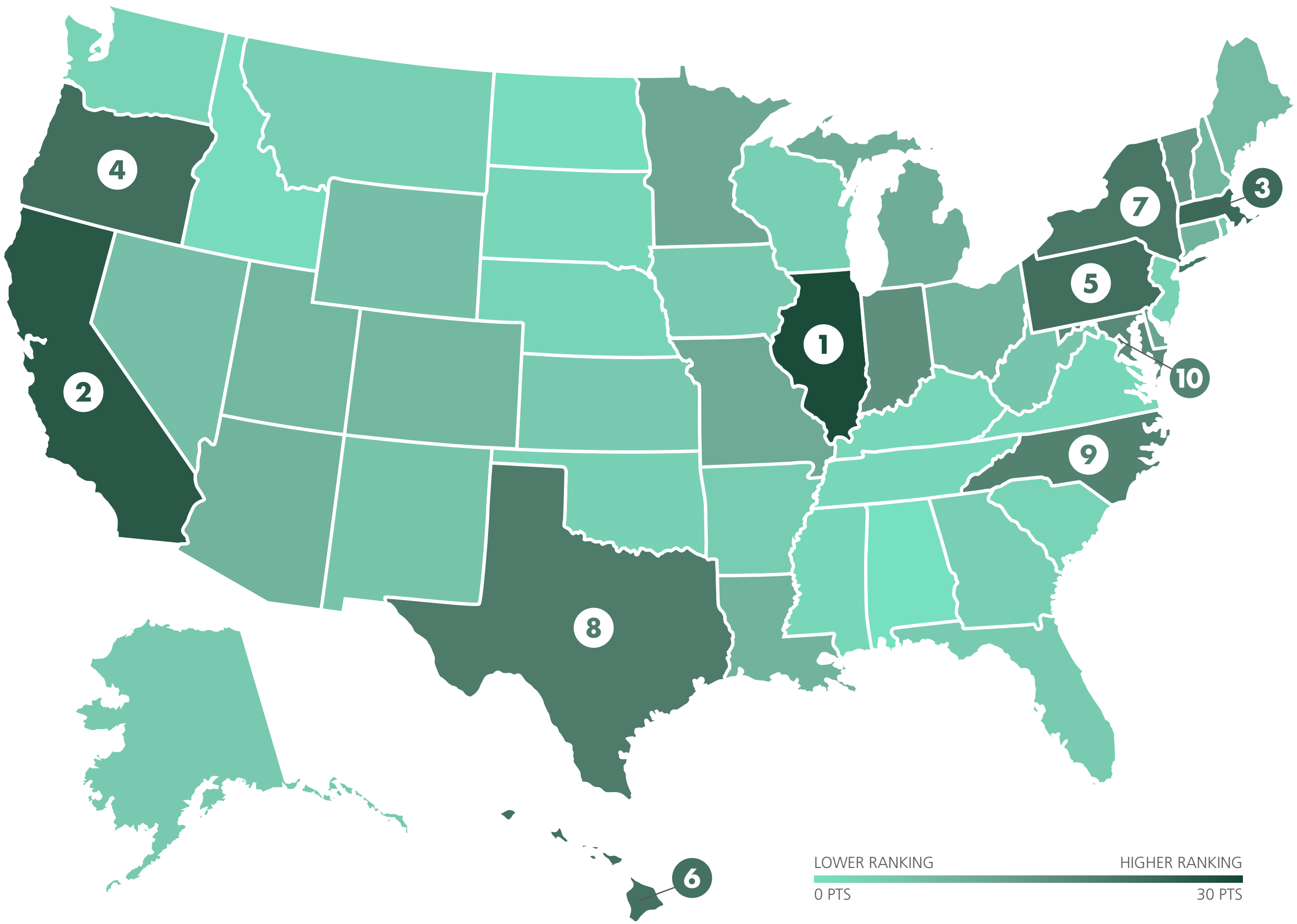
8 PENNSYLVANIA

Tied with Arizona for eighth with a score of 52, PENNSYLVANIA returns as a top 10 state as it was in the 2014 report. Its rank fell only four places, but it experienced the third most significant score decline of all of the states, down 19.3 points from 71.3. Pennsylvania is tied for fourth with Oregon in State Support, 16th in Customer Engagement, and 15th in Grid Operations. Its grid modernization efforts continue; in October 2015, the Pennsylvania PUC approved a five-year, $274 million plan by PECO (the state's largest utility) for grid resiliency upgrades, including microgrids.

10 GEORGIA

Cracking the top 10 with a three-place leap from the 2014 GMI is GEORGIA, helped by a Number 3 finish in the Grid Operations category, with an 81 percent AMI penetration rate. Georgia saw little change from its previous GMI score, attaining 49.8 points overall. Georgia also made the top 10 in Customer Engagement, ranking ninth, and ranks 36th in State Support.

STATE SUPPORT



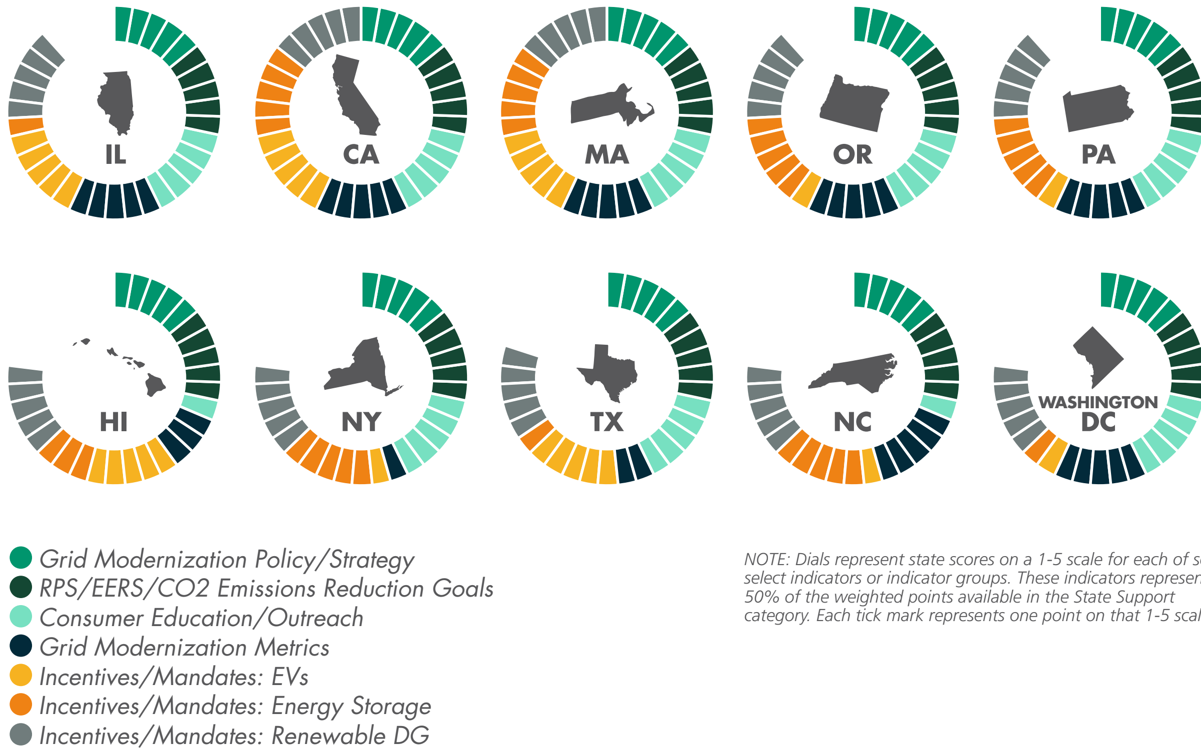
RANK	+/-	STATE	LEADERSHIP SCORE
1	0	Illinois	29.0
2	1	California	27.0
3	8	Massachusetts	24.0
4	5	Oregon	23.0
4	0	Pennsylvania	23.0
6	10	Hawaii	22.5
7	3	New York	21.5
8	-6	Texas	20.8
9	6	North Carolina	19.5
10	-2	Washington, DC	19.0
11	-5	Maryland	18.0
12	10	Indiana	16.8
13	-6	Vermont	15.5
14	-9	Delaware	12.5
15	14	Minnesota	12.0
16	12	Missouri	11.8
17	-3	Michigan	11.0
18	3	Connecticut	10.0
19	-3	Arizona	9.8
19	3	Ohio	9.8
19	19	Louisiana	9.8
22	15	New Hampshire	9.0
22	3	Colorado	9.0
22	7	Utah	9.0
25	-12	Maine	8.0
26	-2	Nevada	7.5
26	25	Wyoming	7.5
28	19	New Mexico	6.3
29	15	West Virginia	6.0
30	19	Kansas	5.0
30	-4	Iowa	5.0
30	-18	Alaska	5.0
30	18	Rhode Island	5.0
34	-16	Florida	4.8
35	-3	Arkansas	4.5
36	-10	Georgia	4.0
36	9	Wisconsin	4.0
36	-5	Montana	4.0
39	-19	Oklahoma	3.5
40	-5	New Jersey	3.3
41	-9	Washington	3.0
41	2	South Carolina	3.0
43	2	Nebraska	2.8
44	-8	Virginia	2.5
44	-5	South Dakota	2.5
44	-2	Mississippi	2.5
44	-10	Kentucky	2.5
48	2	Tennessee	2.0
49	-30	Idaho	1.3
50	-11	North Dakota	0.8
51	-12	Alabama	0.0

STATE SUPPORT OVERVIEW

The State Support category analyzes, evaluates, and ranks states' policies to advance and/or encourage grid modernization, including incentives, mandates (for EVs, energy storage, and other technologies), and investments. The presence of an overall statewide grid modernization policy and strategy guide the states' performance in this category, with other broad policy indicators, such as an RPS, Energy Efficiency Resource Standard (EERS), and carbon dioxide (CO2) emissions reduction goals also influencing the scores.

Interestingly, six of the overall GMI top 10 states also ranked in the top 10 in the State Support category. By contrast, seven of the overall top 10 states also rank in the top 10 in the other two categories of this year's GMI, Customer Engagement and Grid Operations. This may reflect the fact that many utilities have not had sufficient time to make the needed investments to respond to new grid modernization policies. In other words, there will always be lag time between when policies are enacted and the implementation of those policies through investments in grid moderniza- tion. Therefore, it is reasonable to anticipate a two-

STATE SUPPORT TOP 10 STATES: PERFORMANCE IN SELECT INDICATORS



NOTE: Dials represent state scores on a 1-5 scale for each of seven select indicators or indicator groups. These indicators represent 50% of the weighted points available in the State Support category. Each tick mark represents one point on that 1-5 scale.

to-three year lag between a policy being enacted and utilities having deployed sufficient grid modernization technologies and capabilities to have an impact on the other components of the GMI.

Illinois ranked first in State Support in the 2014 GMI, and it retains that position in this year's GMI. California moves up one place from 2014 to second, while Massachusetts surges eight places to third in State Support, its best ranking by far among the three categories. (Massachusetts ranks 20th overall, placing 41st in Customer Engagement and 38th in Grid Operations).

Hawaii, which has been on the front lines of utility regulatory reform, moves up 10 places from 16th to sixth, the largest gain from the prior year of any of the top 10 states in this category. Pennsylvania and Oregon are tied at fourth in this category; rounding out the top 10 are New York, Texas, North Carolina, and the District of Columbia.

The highest-ranked states following Illinois are in the Pacific region or the Northeast, reflecting the general tendency of these regions to have more progressive energy policies that promote or lend themselves to a modernized grid. That said, New Jersey ranks 40th in State Support, and Washington is tied with South Carolina, ranking 41st. Six southern states and three Upper Midwest states scored in the bottom 20 percent (10 lowest).

The graphic on page 22 shows how the top 10 states score in this category, based on several different factors, or groups of indicators. It thereby shows some of the relative strengths and weaknesses of these states.

Whether states have grid modernization policies and strategies in place tended to drive the scores for this category. In addition, whether states require electricity service providers (ESPs, which include both utilities and retail service providers) to submit grid modernization plans and report progress on them also affects states' scores in this category. Another major determinant of states' scores in State Support is whether they have clean energy and energy efficiency requirements, i.e., an RPS or EERS. State CO2 emissions reductions goals (or participation in regional CO2 emissions reductions programs) could be another factor in this regard. A modernized grid clearly enables a state to help meet these types of policy objectives and, as a result, experience benefits in return.

The top 10 states plus Maryland receive the highest possible score of 15 for these types of policies. Of the next nine (highest-ranked) states, four receive top scores for grid modernization policies and ESP, or clean energy, requirements: Indiana, Delaware, Connecticut, and Ohio. Six receive the maximum score of 15 for clean energy requirements: Vermont, Delaware, Minnesota, Missouri, Connecticut, and Arizona.

Of the remaining 30 states, nearly half (13) receive the maximum score for clean energy requirements, including Washington State, which places 41st in this category. Three of the bottom 30 states receive the maximum score for grid modernization policies and ESP (clean energy) requirements: Louisiana, West Virginia, and Maine.

Specific state requirements for ESPs (beyond the submission of and reporting progress on a grid modernization policy) include: cybersecurity plans; policies for consumer energy usage data privacy; consumer education and outreach on grid modernization benefits; state funding (or ESP cost recovery provisions) for grid modernization efforts; and utilization of grid modernization metrics and public reporting on their progress. The top five states in this category all receive full credit for each of these indicators, with the exception of Massachusetts, which lacks data privacy policies.

However, scores reflecting the presence or absence of these requirements drop notably beyond the top 10 states in the category. This is not surprising considering that many states lack overall grid modernization policies/strategies and ESP modernization plan requirements. Of states that are not in the top 10 in State Support, Michigan (17th) has the highest score on these ESP requirements, getting full credit for four of the five requirements (all but metrics). New England neighbors

Vermont and New Hampshire, which rank 13th and 22nd respectively in State Support, receive full credit on three of these five requirements. Of states ranked 30th through 51st, only two outscore the minimum on any of the five requirements: 29th-ranked Kansas receives partial credit for data privacy, and 33rd-ranked Florida receives full credit for cybersecurity.

To date, the cybersecurity plan requirement has gained little traction nationwide. After the top eight State Support states, which all receive full credit, only three states fulfill this requirement: Michigan, Connecticut, and New Hampshire. This means that 39 states – plus, notably, the District of Columbia – lack this requirement (two states, Indiana and Colorado, receive partial credit). In some cases, the belief that utilities are adequately managing, or working to manage, cybersecurity threats, could be one reason why state policy makers might choose not to impose this type of requirement.

Scores on the other aforementioned requirements vary a bit more. Fourteen states receive the maximum score for requiring consumer energy usage data privacy policies, and four receive partial credit. Twelve states obtain full credit for consumer education/outreach and related funding, and six more receive partial credit. Another 12 states receive the maximum score for requiring grid modernization metrics from ESPs, and an additional seven states – including Wyoming (26th), receive partial credit. This is a principal reason why Wyoming jumped 25 places in State Support compared to the 2014 GMI. Wyoming, ranked last (51st) in 2014, raised its State Support score from just 2 points to 7.5. Louisiana, New Mexico, and Kansas tied for the second largest improvement in this category, each moving up 19 places.

The State Support category also scores states based on whether they implement incentives or mandates for one or more of four specific clean-energy technologies that generally go hand-in-hand with strong grid modernization policies or programs: electric vehicles, energy storage, distributed generation (solar PV or small wind turbines), and other distributed energy resources (fuel cells, combined heat and power (CHP), smart load management). Only two states, California and Massachusetts, possess policies that pertain to all four of these technologies, although Vermont comes close with three out of five possible points for EVs and full credit for policies addressing the other three technologies.

Fifteen additional states receive full credit for policies covering three of these four technologies (they do not have storage-related policies), and they range in their rankings in this category from first place (Illinois) to 40th (South Carolina). Throughout the rankings, **policies supporting distributed solar and wind are the most prevalent, while energy storage incentives and mandates thus far have hardly permeated the states at all.** In fact, 30 of the top 34 states in the category have incentives for renewable distributed generation; the only outliers are 12th-ranked Indiana (which is unique in supporting energy storage but none of the other three technologies), Michigan (17th in State Support), Ohio (19th), and West Virginia (ranked 29th). The absence of those incentives in Indiana, Michigan, and Ohio means that two lower quintiles in the State Support category (states ranked 20-29 and 30-39) actually score better on this indicator than the states ranked 10th through 19th.

Among the top 10 states, EV-related policies actually score lower than energy storage, the only State Support quintile where that is the case. Only five of the top 10 receive credit for EV support: the three highest-ranking states of Illinois, California, and Massachusetts, plus Hawaii and Texas. But, energy storage garners full credit in six of the top 10 states and partial credit in Hawaii.

States also were scored in the following three areas: whether they have a clear cost recovery mechanism for grid modernization projects; a coordinated, centralized workforce development program to support modernization; and measurement (meaning by requiring utilities to report) of grid modernization investments. Of these three practices, workforce development lags far behind. Three states – Illinois, Hawaii, and Arizona – receive the maximum score, and six others receive partial credit, in terms of workforce development. These latter six states run the gamut from ninth-place North Carolina, to 50th-place North Dakota. Some states had workforce development requirements for ARRA projects, but since these projects have been completed, such requirements generally have not been continued. This could be attributable to the lack of additional projects that have been pursued in this space, or that utilities are doing much of their work under their traditional base rates.

The other two practices (i.e., cost recovery and measurement) are not widespread throughout the U.S., but enjoy fairly robust support in the leading states. Seven of the top 10 states (including all of the top five) receive the maximum score for cost recovery mechanisms, and two of the top 10 states receive partial credit in this regard. Just three states beyond the top 10, however, get full credit for having cost recovery mechanisms. Measurement of grid modernization investments occurs fully in six of the top 10 states and partially in one other; the next highest-ranked states, Maryland (11th) and Indiana (12th), also receive full credit here.

DISTRIBUTED ENERGY RESOURCES ARE DRIVING GRID MODERNIZATION

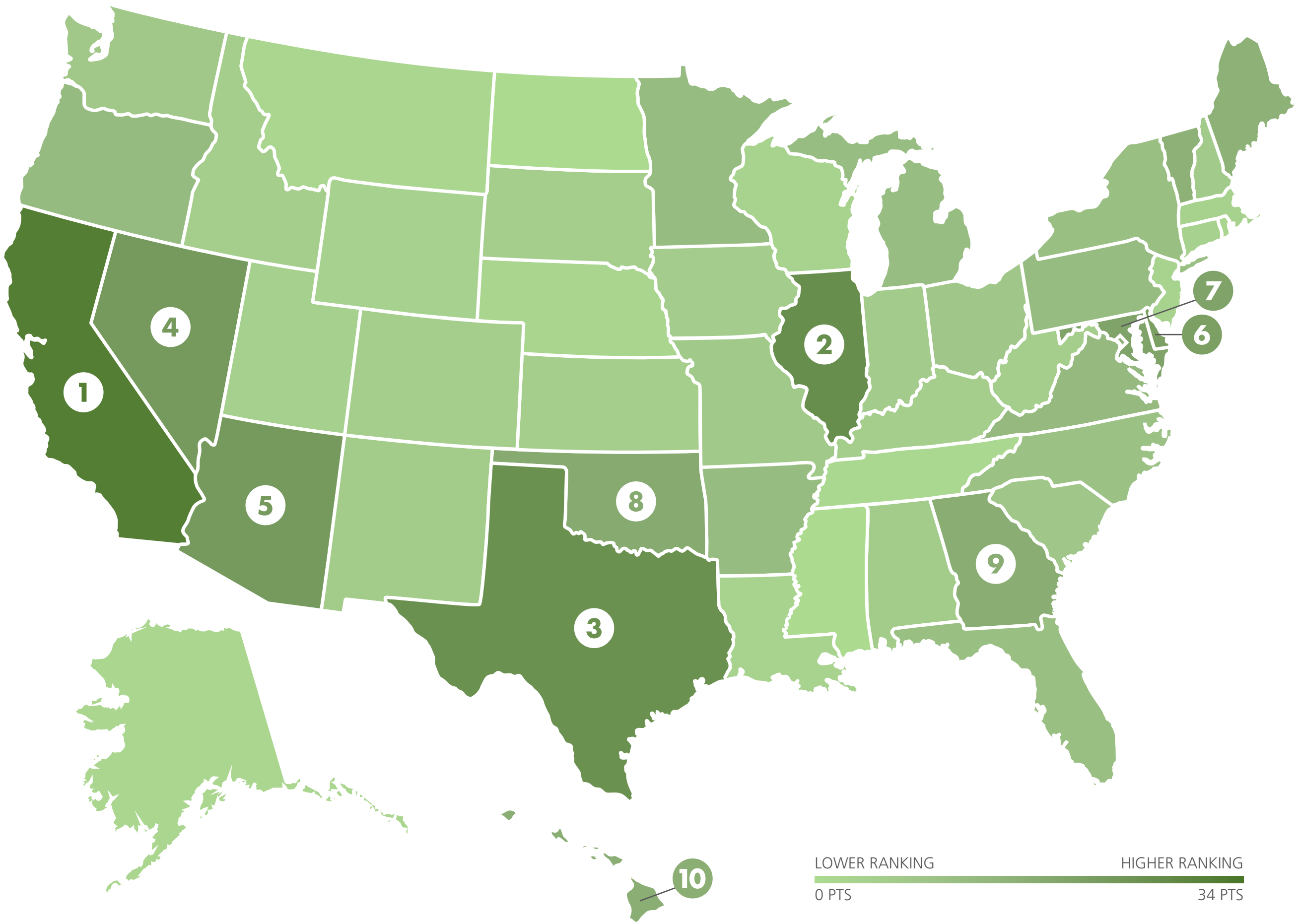
Distributed energy resources (DERs) are rapidly changing the way America's electric grid will function in the future. DERs – from rooftop solar PV and energy storage, to connected appliances, smart thermostats, and EVs – have been spreading at an increasing pace in recent years, and it is not difficult to see why. Significant cost decreases for renewable energy, particularly solar, is one huge reason. Experts expect energy storage to follow a cost decline similar to that of solar. Improvements in customer-facing technologies are a second driver, one that has allowed Internet-connected "smart" devices (such as Nest thermostats and connected, controllable LED lighting) and building energy management systems to proliferate.

These developments have been helped significantly by supportive policies at the state level, such as renewable portfolio standards (especially those that include a solar "carve-out"), NEM, third-party solar ownership, EV incentives, and energy storage mandates. The Federal Energy Regulatory Commission (FERC) entered the discussion in 2011, when it ruled that "fast responding" frequency regulation services (the kind that can be provided by batteries, for instance) should be fairly compensated. The PJM market in the mid-Atlantic has been particularly aggressive in implementing this ruling.

The challenge that utilities, grid operators, and regulators face is how to manage the transition to DERs, and the collective response to it, in turn, becomes one of the drivers of grid modernization. States with high penetrations of distributed solar, for example, are modernizing to allow for two-way energy flows, with the goal of enabling customers to send clean electricity to the grid in a way that is fair for consumers and benefits the overall system. Grid operators also are working to integrate energy storage into their operations, as a way in which to level out their load profile, while also instituting regulations so that customer owners of storage can be fairly compensated for their investments.

California, for instance, in July 2015 required its investor-owned utilities to file distributed resource plans describing how they plan to integrate increasing DERs into their distribution networks. Texas, meanwhile, is working on ways it might aggregate DERs, both so DER projects are profitable to the owners, and so that DERs can be located in places that would be beneficial to the grid. In New York, integration and optimization of DERs is a critical core of its REV initiative. Numerous demonstration projects are underway there to showcase how DERs could be integrated into the state's grid, while also exploring new business models for regulated utilities. And, in October 2015, Hawaii responded to high solar penetrations by eliminating NEM and replacing it with two new options (see the sidebar on Hawaii on page 18).

CUSTOMER ENGAGEMENT



RANK	+/-	STATE	LEADERSHIP SCORE
1	0	California	31.5
2	3	Illinois	27.0
3	-1	Texas	26.3
4	0	Nevada	23.3
5	1	Arizona	23.0
6	1	Delaware	21.5
7	0	Maryland	20.3
8	1	Oklahoma	18.0
9	15	Georgia	17.0
10	0	Hawaii	16.5
11	2	Washington, DC	16.0
12	2	Vermont	15.5
12	3	Maine	15.5
14	-2	Virginia	13.0
15	8	Oregon	12.3
16	-13	Pennsylvania	12.0
16	6	Minnesota	12.0
18	7	Arkansas	11.8
19	2	Michigan	11.5
20	11	New York	10.8
20	14	Florida	10.8
22	14	North Carolina	10.3
23	-13	Ohio	7.8
23	15	South Carolina	7.8
25	6	Washington	7.5
26	-8	Missouri	7.3
27	18	New Hampshire	6.8
28	5	Indiana	6.5
29	9	Alabama	6.0
29	6	New Mexico	6.0
31	17	Iowa	5.8
32	-12	Colorado	5.5
32	-3	Idaho	5.5
32	-15	South Dakota	5.5
35	1	Kentucky	5.3
36	-11	Kansas	5.0
36	11	West Virginia	5.0
38	0	Utah	4.3
39	-20	Connecticut	4.0
39	11	Wyoming	4.0
41	-26	Massachusetts	3.8
42	0	Louisiana	3.5
43	-15	New Jersey	3.0
43	-2	Wisconsin	3.0
45	5	Rhode Island	2.5
45	4	Nebraska	2.5
47	-2	Alaska	2.0
47	-3	Montana	2.0
49	-24	Tennessee	1.3
50	-21	Mississippi	0.0
50	-8	North Dakota	0.0

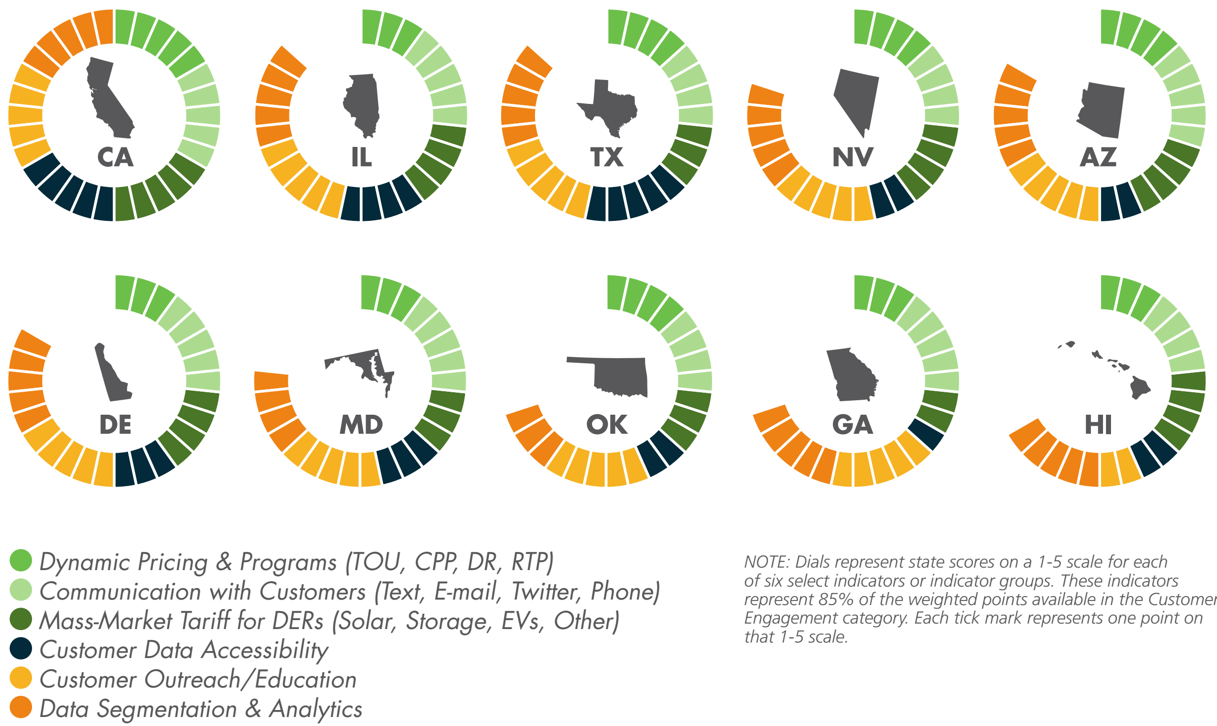
CUSTOMER ENGAGEMENT OVERVIEW

The Customer Engagement category ranks each state according to how well its utilities involve customers in their smart grid implementation efforts. This category encompasses a range of topics: the availability of differential electricity pricing schemes; the ways in and degree to which utilities communicate with their customers; and how customer data is used, both by customers and by utilities.

The results for this category mirror the overall rankings in one important way: the three highest-scoring states overall – California, Illinois, and Texas – are also the highest-scoring states (in the same order) in the Customer Engagement category. California ranks first in Customer Engagement, as it did in the previous GMI, adding 3.5 points to its score. Illinois, meanwhile, moves up three spots to second in the category's rankings with a six-point increase.

The remainder of the top 10 states in this category includes Nevada in fourth, followed by Arizona, Delaware, Maryland, Oklahoma, Georgia, and Hawaii. Georgia's 15-spot increase is noteworthy:

CUSTOMER ENGAGEMENT TOP 10 STATES: PERFORMANCE IN SELECT INDICATORS



NOTE: Dials represent state scores on a 1-5 scale for each of six select indicators or indicator groups. These indicators represent 85% of the weighted points available in the Customer Engagement category. Each tick mark represents one point on that 1-5 scale.

it adds nine points to its category total, due to improved time of use (TOU) rate structures and better communication with customers. Pennsylvania, previously ranked third, moves down 13 places, because new information shows it lacks rates that vary on a daily or hourly basis, and it does not leverage multiple channels to communicate with its customers about demand response events.

The graphic on page 27 shows how the top 10 Customer Engagement states stack up on several different groups of indicators. The graphic shows the relative strengths and weaknesses of the top 10. California, for instance, scores well across the board, whereas Georgia scores lower in DER tariffs and data accessibility. That latter area is, as mentioned below, a weakness nationally: standards for allowing customers to access and transmit their data to third parties are not widely available.

The lowest-scoring states in this category are fairly diverse, with states from New England to the Deep South to the upper Midwest. Several among the lowest-scoring states have seen significant declines since the previous GMI; New Jersey, Tennessee, Mississippi, and Massachusetts all dropped 15 places or more, largely due to lower performance in TOU and other time-differentiated rates. In general, the states that receive low scores in Customer Engagement also have lower scores in other categories, though Massachusetts and New Jersey are the exceptions: Massachusetts is third in State Support, and New Jersey is ninth in Grid Operations.

In this third GMI, Customer Engagement is the category in which states' scores generally are the lowest. Only nine states receive one-half or more of the 34 available Customer Engagement points, the lowest number of states to exceed that threshold among the three categories (13 states receive at least 50 percent of the points in State Support, and 14 do so in Grid Operations). A close examination of scores both at the category and at the indicator levels shows a large gap between the highest-scoring 20 states and the rest of the nation. At the category level, a large difference is seen between the top 10 states and states ranked 11 through 20. The top 10 states in the category, for instance, average more than 22 Customer Engagement points; for states ranked 11-20, that number drops to 13 points, with further drops for the remaining states.

So what is causing these differences? There are four important areas where some states score well, while others do not. One of these is rate structures.

Most states have TOU rates available for some of their customers. However, the presence of any of these special rates drops considerably for the 10 lowest-scoring states in the category. On the other hand, critical peak pricing (CPP) and real-time pricing (RTP) score lower throughout the U.S.; most states either do not have such rate structures, or have them only for a small number of customers. There have been numerous pilots of dynamic rates, many in association with the ARRA grants. However, these have not resulted in such rates being adopted as a standard offering. One area of relative consensus: most states have some type of mass market tariff for rooftop solar and other types of distributed generation, while such tariffs for EVs are not as popular, and only one state (California) has a widely-available energy storage tariff.

Demand response (DR) follows a similar trajectory. This year's GMI shows that most states have DR programs available for at least some of their customers. That does not appear to be true, though, for the 10 lowest-scoring states in the category, where the prevalence of such programs declines significantly. It is interesting to note, though, that both TOU rates and DR programs appear to be more popular for residential customers than for commercial/industrial ones. This is confirmed by data gathered from the Smart Grid Consumer Collaborative's annual Consumer Pulse and Segmentation Study, which shows very high residential consumer interest in time-varying rate programs. Consumers are motivated for different reasons: saving money, a desire to reduce energy waste, or environmental concerns.

California is clearly a leader in rate structures. It receives the highest score on nearly all rate structure indicators in the GMI. The state is seeking to improve further through its Public Utility Commission's July 2015 decision that increases transparency in electricity rates (by clarifying for customers what products and services they are paying for), implements TOU as a default rate structure (except for those customers who opt out) by 2019, and postpones changes to NEM and fixed charges until that time, as well.

Many of the remaining top 10 states follow a general pattern, scoring particularly well on TOU and DR rates but poorly for CPP and RTP rates. (The exception: Illinois, which receives low TOU rate scores, but makes up for it with very strong marks on RTP rates.) Contrast that with the states ranked 40-51 in the category, where even states like Massachusetts and New Jersey – top scorers in other parts of the GMI – have little access to differentiated electricity rates.

A third difference involves communication and outreach. This year's GMI evaluates whether – and the degree to which – a state's utilities communicate with their customers about pricing events (such as a DR event) by e-mail, text messages, phone, or Twitter. The results show that Twitter and phone are not popular options, but the states vary greatly in how they use e-mail and text messaging. The top 10 Customer Engagement states all receive high scores for these methods but, outside of this group, only three states receive the top possible score for the same methods. The story is the same regarding states' efforts to educate customers about grid modernization. Most of the highest-scoring Customer Engagement states (with the exception of Hawaii, which has pilot outreach programs) have robust education and outreach efforts, but such efforts in the 20 lowest-scoring states are largely absent.

Finally, the GMI asks about customer segmentation abilities, and how utilities use analytics to better serve their customers. Here, again, the highest-scoring states tend to do quite well: all but two of the top 10 states (the exceptions being Maryland and Oklahoma) receive the full allotment of GMI points on this topic. States ranked 11 through 20 also fare relatively well but, even here, only four (the District of Columbia, Maine, Arkansas, and Michigan) receive top marks. There is a significant decline for subsequent states. Of states ranked 21st through 30th, only North Carolina gets full credit for customer segmentation and analytics, and the lowest-scoring 21 states in the category basically have no deployment in this area.

In sum, the Customer Engagement results indicate that, while grid modernization infrastructure deployment continues, the mechanisms by which utility customers could make the best use of those technologies are not evolving at the same pace. CPP and RTP rates, for instance, have been the subject of many pilot projects, but these have not resulted in widespread or permanent availability (though whether this is due to a lack of customer interest or another reason remains unknown). Similarly, the ARRA offered states funding to conduct outreach but, with that funding no longer available, these efforts have slowed down. Between these gaps and a lack of data availability and analytics, it seems that the end users of electricity, the customers, are not receiving the information they need to make informed decisions about their electricity use – which would also allow grid operators to run energy systems more efficiently and effectively. That makes the smart grid somewhat less "smart" than its potential would enable.

There are places that are "getting it right." In Colorado, for example, the City of Fort Collins' municipal utility has used data and customer segmentation to identify specific households that would be good candidates for its DR programs. Once the original equipment was installed, the data was used to further refine the utilities' DR program offerings. (Details can be found in a City of Fort Collins case study documented by the Smart Grid Consumer Collaborative and is available at: www.smartgridcc.org.) Illinois-based utility ComEd used its smart grid network to help reduce electricity usage by 9.6 megawatt hours during a very hot July 2015 day. It did so by offering up to 40 dollars in incentives for customers to reduce their energy use for a three-hour period. San Diego Gas & Electric also has done extensive work on the rate structure front, testing an EV TOU charging rate and showing that variable electricity prices do have an effect on the time(s) at which owners charge their vehicles. Other utilities are exploring similar programs to effectively engage customers in managing the grid.

NEXT-LEVEL DEMAND SIDE MANAGEMENT

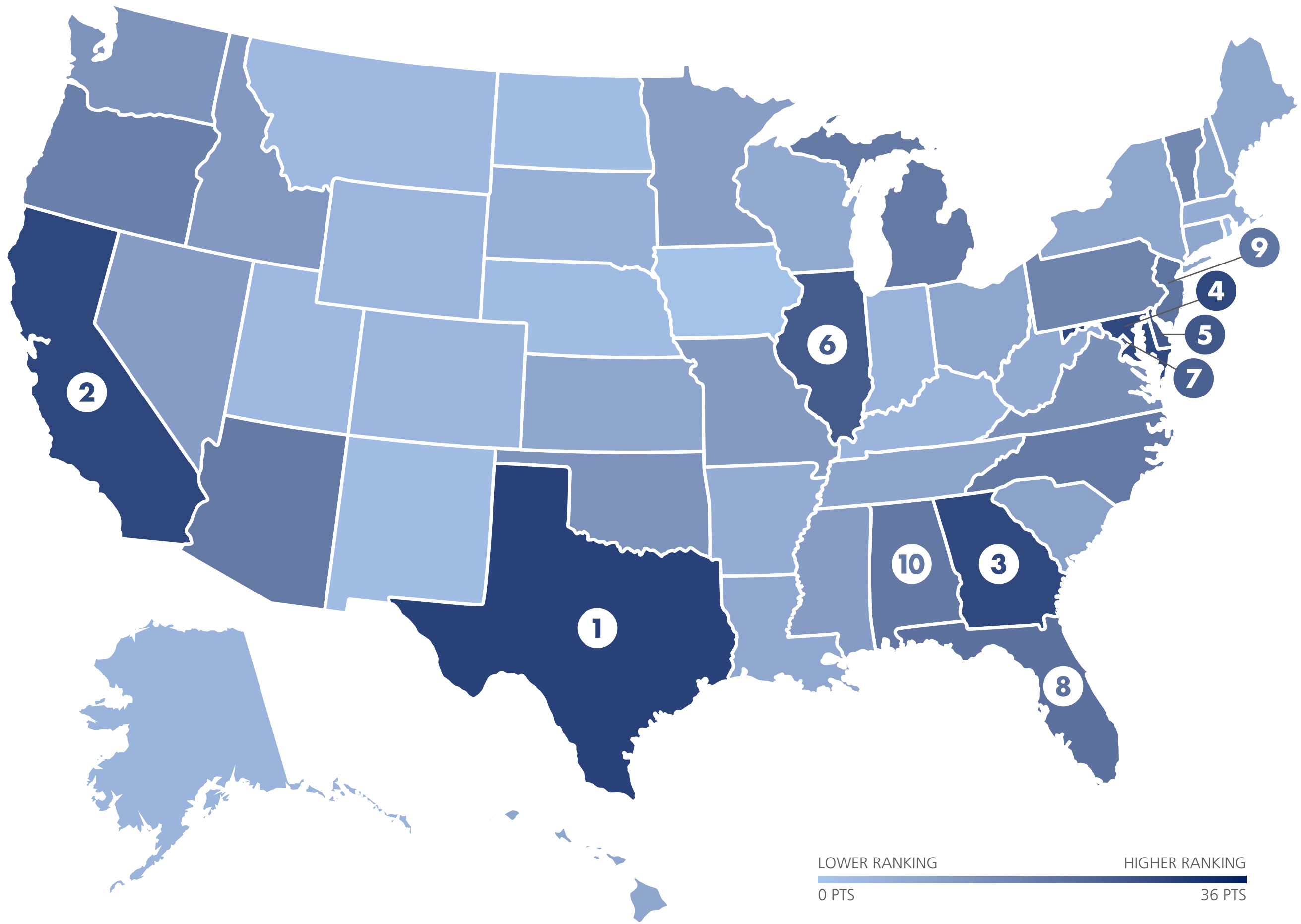
Demand side management (DSM) has advanced significantly in recent years. Thanks to more sophisticated technology, DSM has moved beyond traditional demand response, where utilities anticipated a coming demand peak and asked customers (particularly industrial and major corporate users) to curtail their usage until the peak passed. This approach is being replaced with a more continual load management model. The "smart" device revolution has enabled this shift. The proliferation of intelligent, programmable thermostats, like the Nest, and many other connected devices, has opened new avenues for utilities to help customers cut their energy use at times when it is beneficial for the grid.

The goal for utilities and regulators is now to match supply with demand on a continual basis. While significant peak periods remain, demand side resources are increasingly well-positioned to help address them. A modernized electric grid is critical to accomplishing this goal. AMI meters, advanced sensors, and communications equipment are all necessary for utilities and customers to take full advantage of smart, connected devices and the DSM programs they enable.

Examples of how DSM can be harnessed for load management abound. Georgia Power combines a discounted Nest thermostat with a "smart usage rate" to help customers reduce energy usage. Austin Energy and Southern California Edison are among the utilities that have piloted programs that use EV chargers as part of their demand response initiatives. And at least two parts of the country – the PJM territory and the Pacific Northwest – have tested the use of hot water heaters for fast-response grid services and potential absorption of excess generation.

Many challenges remain, though. FERC Order 745, issued in 2012, requires grid operators to pay the full market price for economic demand response resources, as long as dispatching DR at that time is cost-effective. In May 2014, however, the U.S. Court of Appeals vacated the FERC ruling, stating that the Commission had overstepped its jurisdictional boundaries in regulating retail electricity, which generally falls under state control. The ruling removed an important price signal for DSM providers. The issue remains unsettled; the U.S. Supreme Court heard the case in October 2015 and is expected to issue a decision in the near future.

GRID OPERATIONS



RANK	+/-	STATE	LEADERSHIP SCORE
1	2	Texas	30.0
2	3	California	29.3
3	-1	Georgia	28.8
3	4	Maryland	28.8
5	6	Delaware	26.0
6	1	Illinois	25.3
7	2	Washington, DC	24.0
8	6	Florida	20.8
9	10	New Jersey	20.0
10	21	Alabama	19.5
11	2	Arizona	19.3
12	0	Michigan	19.0
12	4	North Carolina	19.0
14	11	Oregon	18.0
15	-5	Pennsylvania	17.0
16	12	Vermont	16.3
17	-16	Virginia	14.0
18	-3	Oklahoma	13.3
18	20	Washington	13.3
20	-16	Idaho	12.3
21	-5	Missouri	12.0
22	21	Mississippi	11.3
23	-17	Nevada	11.0
24	4	Minnesota	10.8
25	-7	South Carolina	10.0
26	-4	Tennessee	9.5
27	-7	Ohio	9.0
27	-3	New York	9.0
27	6	New Hampshire	9.0
30	-7	Maine	8.8
30	-4	Connecticut	8.8
30	3	Kansas	8.8
33	-7	Hawaii	8.5
34	10	Louisiana	8.3
35	3	Wisconsin	8.0
36	-1	West Virginia	7.5
37	0	Arkansas	7.0
38	-6	Massachusetts	6.8
39	-19	South Dakota	6.0
40	-12	Indiana	5.5
41	-3	Alaska	5.0
41	6	Kentucky	5.0
43	5	Colorado	4.5
43	5	Wyoming	4.5
45	-9	Montana	4.0
45	-3	Utah	4.0
47	1	Nebraska	3.0
48	-7	New Mexico	2.5
48	-2	Rhode Island	2.5
48	3	North Dakota	2.5
51	-6	Iowa	1.5

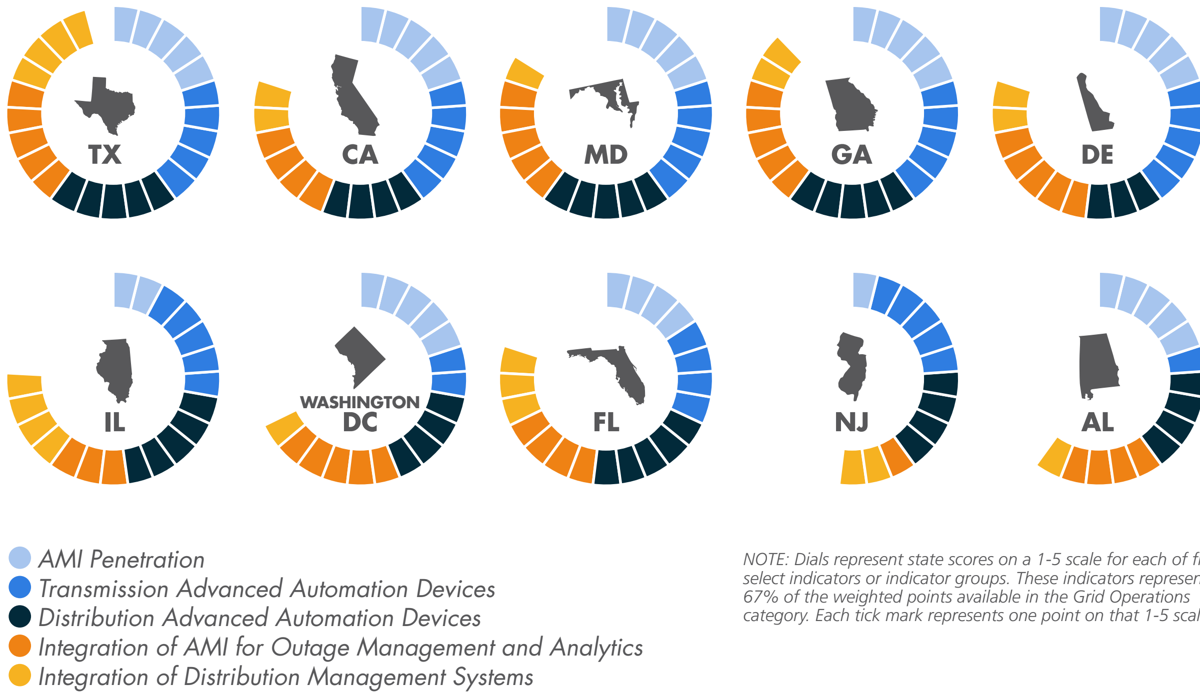
GRID OPERATIONS OVERVIEW

The Grid Operations category measures states' actual deployment of the technologies that represent a modern grid. This includes smart meters (a foundational technology of the smart grid), automated systems, and other sensors and control equipment.

This year's top-ranking Grid Operations state, Texas, moves up one spot from the previous GMI. Meanwhile, 2014's leader, Virginia, fell to 17th place; this decline was caused by better information that indicated the state's investment in smart grid infrastructure was not as extensive as previously thought. Texas received one of the largest ARRA-funded smart grid projects in the country (a $200 million federal grant toward a total project budget of about $640 million), and receives full credit with respect to most indicators or criteria pertaining to the deployment of hardware. California ranks second, less than one full point behind, and is followed by Maryland and Georgia, which are tied for third, while Delaware ranks fifth.

The bottom half of the top 10 includes Illinois, the District of Columbia, and Florida in the sixth through

GRID OPERATIONS TOP 10 STATES: PERFORMANCE IN SELECT INDICATORS



NOTE: Dials represent state scores on a 1-5 scale for each of five select indicators or indicator groups. These indicators represent 67% of the weighted points available in the Grid Operations category. Each tick mark represents one point on that 1-5 scale.

eighth spots, followed by two newcomers to the Grid Operations top 10, New Jersey and Alabama. New Jersey adds six points to its previous score, which brings it from 19th to ninth place. Alabama, meanwhile, rises to 10th from 31st after adding 10 points to its score from the previous GMI. That represents the highest point increase in any one category that we see in this year's GMI, as well as the second-highest category-ranking increase (tied with Mississippi's similar Grid Operations increase, behind Wyoming's 25-spot rise in State Support).

Alabama's performance, in fact, is consistent with many of its neighbors in the southern and mid-Atlantic states. If one were to draw a straight line on a map from Wilmington, Delaware, to Dallas, Texas, many of the states that lie on or below that line rank in the top one-half in Grid Operations. Eight of these states – including North Carolina, which is ranked 12th – rank in the top quartile.

While many drivers could be affecting this pattern, one of them is likely ARRA smart grid funding. Project information available on the DOE's Smart Grid Internet site (www.smartgrid.gov) shows that six of the seven largest ARRA projects involved utilities with service areas in Maryland, North Carolina, Georgia, Florida, Alabama, Mississippi, and Texas. These projects represent a substantial investment in smart meters, communication equipment, and automation infrastructure that will continue to pay dividends for years to come.

The graphic on page 32 shows the top 10 states in the category and how they perform in five different groups, or categories, of indicators. Texas receives the highest possible scores in nearly all of these categories. The only category for which it does not receive full credit is integration of distribution management system functionality (with sensors and other equipment). (Integration of distribution management systems, in fact, is the category for which the top 10 states receive the lowest scores.) New Jersey, on the other hand, receives low scores for deploying AMI: it has installed only a small percentage of AMI, which, of course, makes it difficult for utilities to use AMI to enhance outage management and analytics.

A close examination of the Grid Operations results reveals several key findings, one of which pertains to metering infrastructure. This technology has evolved over decades, to the point at which two types of advanced metering technology have emerged. One is automated meter reading, or AMR, which allows for remote one-way communication from the customer to the utility. It is used to help reduce the costs for sending meter readers out every month to collect usage data.

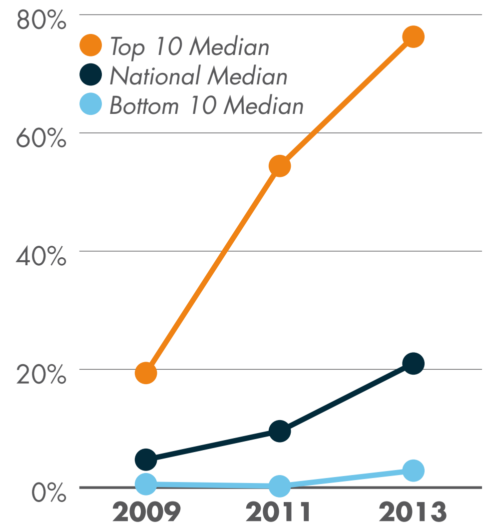
AMI, on the other hand, is a key component of the smart grid. Its use of two-way communications allows customers to obtain detailed, near-real time information on their energy usage, and allows utilities to offer programs and dynamic rates to their customers. AMI also gives the utility greater situational awareness into what is happening on their system, including which customers are experiencing a power outage, when an outage occurs, and when power has been restored. One Texas utility corrects 20 percent of its outages before these are even reported by customers (oftentimes, such technology enables power to be maintained, or restored, without customers ever even knowing that the outage had occurred). While other technology solutions can add communications, energy information and functionality, **AMI is often key to a fully functioning grid modernization strategy.**

States' overall GMI scores vary greatly between those with high AMI penetrations and those with high rates of AMR deployment. This year's GMI shows that states with higher AMI penetrations tend to have higher GMI scores. Thirty-four states that rank from high to low receive full credit for AMR deployment. Of states with at least a 50 percent penetration of AMR, only two – North Carolina and Virginia – are among the 20 highest-scoring states in the Grid Operations category. On the other hand, the only two states with at least 50 percent penetration of AMI that are not among the Grid Operations top 10 are Nevada (ranked 23rd) and Maine (ranked 30th). Thirteen states receive full credit on the GMI's AMI indicator, seven of which place in the top 10 in the category. Since AMI infrastructure is critical to many aspects of successful smart grid implementation, these results should not be surprising.

Just as AMI is a key component of the smart grid on the distribution side, phasor measurement units (PMUs) are key components of the smart grid on the transmission side. PMUs measure voltage, current, and frequency at critical locations along the grid, giving transmission grid operators broad situational awareness that can help prevent widespread outages, such as the 2003 Northeast blackout. In terms of GMI scores, PMUs are the third most popular devices (after AMR and AMI infrastructure) among those on which states are scored. States receive relatively high scores for transmission PMU deployment across the country (in large part due to the significant ARRA dollars that have been directed toward their deployment). Distribution grid PMUs are just starting to gain traction and their deployment is being evaluated. The 20 highest-scoring states in Grid Operations receive high scores for this indicator, but states ranked from 21 to 30 receive, on average, only fifty percent credit, with the rest of the nation scoring lower.

That difference between transmission and distribution grid deployment is a theme in the Grid Operations category. The GMI covers three types of transmission automation sensors, four types of distribution automation sensors, as well as automation in substations, line switches, and circuit ties. Scores for the top Grid Operations states are relatively high for deployment of smart grid equipment for both transmission and distribution. However, the lowest-scoring states in the category receive low scores across virtually all indicators, and the middle 30 or so states tend to perform slightly better in deploying such devices for transmission as opposed to distribution – primarily due to the aforementioned PMU deployment trends.

FIGURE 4: SMART METER PENETRATION (% OF TOTAL METERS), 2009-2013



Source: Clean Edge's U.S. Clean Tech Leadership Index, with data from FERC and EIA.

One explanation for the difference is that grid modernization investments have often started with the transmission grid before moving downstream to the distribution grid. PMUs are a good example of a technology that was originally developed for use on the transmission grid, and is now being considered for use on the distribution system. Other equipment and systems that are used to track, monitor, and control the transmission grid are migrating down to the distribution level, even while new innovations are continuing to take place at the transmission level.

One explanation for this phenomenon could pertain to the proliferation of DERs. (Another explanation is the need to reduce outage time after major storms.) The increasing popularity of rooftop solar, EVs, "smart home" devices, and even distributed energy storage is forcing many states to at least consider upgrading their distribution grids. They need to make sure the distribution grid can adequately manage the two-way power flows that come from DERs, while ensuring power quality (such as voltage) remains reliable. This is why, for instance, California utilities recently submitted plans for how they will integrate new DERs, which include distribution system upgrades.

Perhaps more importantly, though, is grid operators' desire to better integrate DERs into their grids. DERs can provide a number of services, such as power balancing, demand response, and other types of load control. DERs can also help customers manage their electricity usage, and produce some of their own electricity. But as these DERs are deployed to a greater extent, the system needs a robust, modernized grid to take full advantage of their benefits. The smart grid and DERs therefore need to develop simultaneously to keep system reliability, safety, and affordability as top priorities. Hawaiian Electric's use of micro-inverter data serves as a good example. The data helped the utility clear its solar backlog and pinpoint areas where solar power could be safely integrated.

Finally, there is a difference between simply deploying the smart grid and maximizing its capability. A utility can simply install smart meters and PMUs, or it can proceed one step further and use all of the data those devices generate to improve its service. The GMI covers some of these uses: the extent to which states integrate AMI data for outage management; the extent to which they integrate distribution management data with sensor data; and whether such data is integrated into planning processes and GIS analysis.

The GMI shows that these practices are primarily happening in the highest-scoring Grid Operations states. For instance, integrating data into planning and GIS analyses is generally only prevalent in the top 10 states, while the 20 highest scorers appear to integrate AMI data fairly well. Integration of distribution management systems, on the other hand, is a much less common practice across the board. Thus, many opportunities remain to modernize the grid. Fortunately, innovative new technologies and systems are constantly being developed.

STATISTICAL ANALYSIS

As it has done in the past, GridWise Alliance member, Accenture, volunteered to conduct a statistical analysis of the GMI. The goals of the analysis were: 1) for the categorical variables, to find the correlation between the State Support, Customer Engagement, and Grid Operations categories when measured by various dimensions (such as geography, regulatory structure, and several others); and 2) for the numerical variables, to analyze the relationship between GMI scores and measures such as retail price, per capita GDP, and others. This was accomplished by using a test called a Pearson correlation, the results of which range from -1 (signifying a direct inverse correlation) to 1 (a direct positive correlation). (See Appendix B for additional details on how the tests were run.)

Accenture looked at a number of variables in these tests. Table 2 displays all of these variables. Many of them look at state-level policies, such as the presence of a RPS, EERS, revenue decoupling, and deregulation; for these categorical variables, Accenture broke the states into groups and ran Pearson correlations for each group. Accenture also looked at states grouped by geographic region. Finally, several numerical variables were incorporated, including installed solar and wind capacity, AMI and AMR percentage, per capita GDP, and average electricity price.

TABLE 2: GMI VARIABLES FOR STATISTICAL ANALYSIS

Geography	Regulatory Structure (Regulated vs. Deregulated)
Presence of Renewable Portfolio Standard (RPS)	Presence of Energy Efficiency Resource Standard (EERS)
Presence of Retail and Wholesale Demand Response	Presence of Revenue Decoupling
AMI/AMR Dominant States	Solar Penetration (Residential and Non-Residential, Capacity [MW] and Number of Installations)
Electric Vehicle (EV) Penetration	Average Electricity Price
Average Monthly Electricity Consumption	Average Monthly Electric Bill
Per Capita Real GDP	Per Capita Personal Income

Source: Accenture and GridWise Alliance.

The tables on the following pages show the results for the variables studied. Table 3 displays the correlations between each category pairing. The column headings show which two categories are being compared. For instance, the correlation between State Support and Customer Engagement for all 51 states combined is 0.58. For certain variables, Accenture also looked at the correlations between the individual category scores and overall GMI scores. This data is found in Table 4, which is structured the same as Table 3. Finally, Table 5 shows the results of the numeric variable tests. The numbers shown in this table represent correlations between the variable and scores in each category. Each table also has a legend describing what the cell colors mean. They range from a strongly positive correlation (bright green) to a strongly weak correlation (deep red). Statistically significant correlations are shown with a bold white asterisk.

A number of themes emerge from this statistical analysis. One of them is the importance of customer engagement. As noted elsewhere in this report, the Customer Engagement category is the one that shows the lowest scores overall: the average state gets only 29 percent of available Customer Engagement points, the lowest of the three categories. But, as Table 3 shows, Customer Engagement has more statistically significant, highly positive correlations between itself and the other two categories than do State Support and Grid Operations. Further, the states with the 10 largest score increases in this year's GMI averaged nearly a 3.5 point increase in this category, higher than either of the other two categories. (Interestingly, for the 10 states with the largest point drops, State Support showed the biggest decline, nearly nine points on average.) Given the direction and statistical significance of the relationships, it is safe to say that Customer Engagement is strongly, positively correlated with the other two categories, and has a significant impact on GMI scores.

- *High Positive Correlation (0.5 to 1.0)*
- *Low Positive Correlation (0 to 0.49)*
- *Low Negative Correlation (0 to -0.49)*
- *High Negative Correlation (-0.5 to -1)*
- ** Indicates Statistical Significance at the p=.05 Level*

TABLE 3: SUMMARY OF AVERAGE SCORES AND CORRELATIONS BETWEEN GMI CATEGORIES

	GROUP (NUMBER OF STATES IN PARENTHESES)	**CORRELATION BETWEEN TWO CATEGORIES**			**AVERAGE SCORES**			
		STATE SUPPORT/ CUSTOMER ENGAGEMENT	STATE SUPPORT/ GRID OPERATIONS	CUSTOMER ENGAGEMENT/ GRID OPERATIONS	STATE SUPPORT	CUSTOMER ENGAGEMENT	GRID OPERATIONS	OVERALL
ALL 51 STATES	All 50 States plus DC	*	*	*	9.78	9.89	12.31	31.98
GEOGRAPHY	Pacific States (5)			*	9.75	23.00	19.25	52.00
	Mountain States (6)				14.00	10.75	14.25	39.00
	Central States (17)	*			7.63	8.04	9.08	24.75
	Southeast States (7)	*		*	5.11	7.29	16.96	29.36
	Mid-Atlantic States (8)				15.75	18.75	25.00	59.50
	New England States (6)				14.50	10.00	16.38	40.88
AMI/AMR DOMINANT STATES	AMI Dominant States (17)	*			12.26	16.72	20.10	49.09
	AMR Dominant States (18)			*	7.71	5.40	7.78	20.89
	Neither AMI nor AMR Dominant States (16)	*			9.48	7.77	9.13	26.38
RENEWABLE PORTFOLIO STANDARD	States with a Mandatory RPS (31)	*	*	*	12.57	12.39	13.43	38.39
	States without a Mandatory RPS (20)	*		*	9.30	10.00	16.65	35.95
ENERGY EFFICIENCY RESOURCE STANDARD	States with an EERS (20)	*		*	12.13	16.21	15.79	44.13
	States without an EERS (31)	*		*	9.54	10.57	16.14	36.25
REVENUE DECOUPLING	States with Rate Decoupling (15)	*		*	12.63	13.88	16.88	43.38
	States without Rate Decoupling (36)	*	*	*	5.80	8.48	10.43	24.70
	States with Neither Electricity Nor Gas Decoupling (20)	*		*	10.44	10.88	15.50	36.81
	States with Both Electricity and Gas Decopuling (13)	*		*	13.75	22.08	18.50	54.33
	States with Gas Decoupling (12)	*		*	6.50	9.06	12.88	28.44
	States with Electricity Decoupling (6)	*		*	10.13	10.75	18.13	39.00
REGULATORY STRUCTURE	Regulated States (33)	*		*	6.70	8.18	10.08	24.97
	Deregulated States (18)	*	*	*	15.43	13.10	16.39	44.92
	States with Wholesale Deregulation (18)	*	*	*	15.43	13.10	16.39	44.92
	States without Wholesale Deregulation (33)	*		*	6.70	8.18	10.08	24.97
	States with Retail Deregulation (10)			*	17.03	12.68	17.35	47.05
	States without Retail Deregulation (41)	*	*	*	8.02	9.24	11.08	28.34
DEMAND RESPONSE	States with Retail and Wholesale DR Programs (34)	*	*	*	11.82	10.74	12.85	35.40
	States with Retail DR Programs Only (15)				6.05	9.20	11.72	26.97

Source: Accenture, GridWise Alliance, and Clean Edge.

There are some correlations with geography, as well. Some parts of the country appear to succeed in specific areas more than others. On average, the Mid-Atlantic states tend to be good at everything – not surprising given that some of the highest-scoring GMI states like Maryland, Delaware, Washington, DC, and Pennsylvania can be found there. The Central states, on the other hand, average lower scores across the board. The Southeast states generally score higher in Grid Operations, and lower in other areas. The West Coast, meanwhile, is strong in Customer Engagement. Finally, the New England states do not score very well in most areas, save for Massachusetts' third-ranked performance in State Support, and Vermont's solid scores in all categories.

There are a number of factors within state and utility control that may boost grid modernization:

- **AMI DEPLOYMENT:** States with at least 50 percent smart meter penetration tend to have higher scores across all GMI categories than states with less than 50 percent AMI meters. On top of that, there are statistically significant positive relationships between AMI percentage and scores in every category save State Support. By comparison, the exact opposite relationship is seen as AMR percentages increase: higher AMR percentages are correlated with lower GMI scores.

TABLE 4: SUMMARY OF CORRELATIONS BETWEEN GMI CATEGORY SCORES AND OVERALL SCORES

	GROUP (NUMBER OF STATES IN PARENTHESES)	CORRELATION BETWEEN OVERALL SCORE AND CATEGORY		
		STATE SUPPORT	CUSTOMER ENGAGEMENT	GRID OPERATIONS
ALL 51 STATES	All 50 States plus DC	*	*	*
GEOGRAPHY	Pacific States (5)	*	*	*
	Mountain States (6)		*	*
	Central States (17)	*	*	*
	Southeast States (7)	*	*	*
	Mid-Atlantic States (8)	*	*	
	New England States (6)		*	
RENEWABLE PORTFOLIO STANDARD	States with a Mandatory RPS (31)	*	*	*
	States without a Mandatory RPS (20)	*	*	*
ENERGY EFFICIENCY RESOURCE STANDARD	States with an EERS (20)	*	*	*
	States without an EERS (31)	*	*	*
REVENUE DECOUPLING	States with Rate Decoupling (15)	*	*	*
	States without Rate Decoupling (36)	*	*	*
	States with Neither Electricity Nor Gas Decoupling (20)	*	*	*
	States with Both Electricity and Gas Decoupling (13)	*	*	*
	States with Gas Decoupling (12)	*	*	*
	States with Electricity Decoupling (6)		*	

Source: Accenture, GridWise Alliance, and Clean Edge.

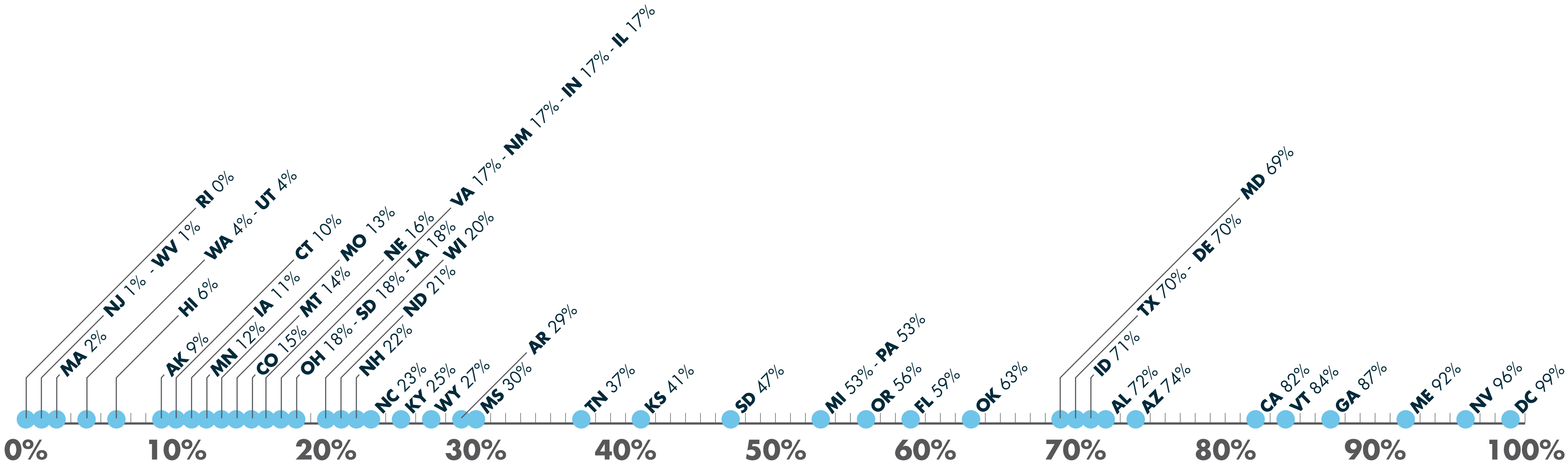
TABLE 5: SUMMARY OF CORRELATIONS BETWEEN NUMERIC VARIABLES AND GMI CATEGORY SCORES

	CORRELATION BETWEEN VARIABLE AND CATEGORY			
	STATE SUPPORT	CUSTOMER ENGAGEMENT	GRID OPERATIONS	OVERALL
Percent AMI		*	*	*
Percent AMR		*	*	*
Average Monthly Consumption (kWh)	*			
Average Monthly Bill (Dollars)				
Per Capita Real GDP	*			
Per Capita Real Income (Dollars)	*			
Solar: Total Residential Installations	*	*	*	*
Solar: Total Residential Capacity (MW)	*	*	*	*
Solar: Total Non-Residential Installations	*	*	*	*
Solar: Total Non-Residential Capacity (MW)	*	*	*	*
Electric Vehicles (Number of Vehicles)	*	*	*	*
Average Electricity Price (All Sectors)	*			

Source: Accenture, GridWise Alliance, and Clean Edge.

- *High Positive Correlation (0.5 to 1.0)*
- *Low Positive Correlation (0 to 0.49)*
- *Low Negative Correlation (0 to -0.49)*
- *High Negative Correlation (-0.5 to -1)*
- * *Indicates Statistical Significance at the p=.05 Level*

FIGURE 5: 2014 STATE PERCENT OF AMI METER PENETRATION



Source: EIA.

- **DEREGULATION:** States that have deregulated at least one of their wholesale or retail sectors have higher average GMI scores than do fully regulated states. Moreover, the positive relationships between the categories are stronger, and more of those relationships are statistically significant, than they are for regulated states.
- **DEMAND RESPONSE:** Having demand response programs at both the retail and wholesale levels makes a difference. Such states see statistically significant, strongly positive relationships between all three categories, whereas the relationships between categories for states with only retail demand response are weak and not statistically significant.

Though they are rarely under direct control of states and utilities, DERs (specifically distributed solar and electric vehicles) appear to have at least some correlation with GMI success. Both solar and EVs have statistically significant, although weak, positive correlations with all categories of the GMI: as the number of EVs increases, or installed solar capacity rises, GMI scores also go up, but not by much. The relationship is likely weak because neither solar nor EVs have achieved a critical mass yet; as penetrations increase, so might their impact on the GMI.

On the other hand, a "random forest" analysis showed that EVs are the second-best indicator of GMI performance (just behind – unsurprisingly – AMI penetration percentage). Together, these pieces of information indicate that DERs play at least some role in grid modernization success, though perhaps not a large one yet. The question is: how will this change over the next several years? Will the states with higher DER penetrations become the leaders in grid modernization?

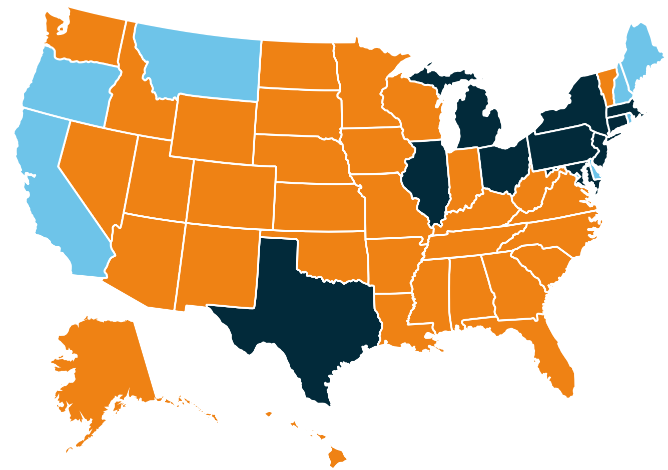
EERS and RPS policies are prevalent across the country, but it is difficult to say with certainty that either has a strong impact on GMI scores. There is some mixed evidence that EERS policies are correlated with performance in the GMI. Average scores are higher for states with EERS policies for the State Support and Customer Engagement categories, as well as for overall scores. However, non-EERS states outscore EERS states in Grid Operations (though by only about one-third of a point). The strength of the correlations between categories is mixed: in some cases, those correlations are higher for EERS states, and in some cases they are lower.

The evidence is somewhat clearer for RPS goals: they cannot be said to significantly impact GMI scores. While states with a RPS have higher average GMI scores than those that don't, the difference is small (less than 2.5 points overall). Further, the correlations between category scores are similar for states with RPSs and those without, although the relationship is statistically more significant for the former. Taken together, this evidence does not show that RPS goals have a significant relationship with GMI scores.

One additional policy under state control that doesn't impact GMI scores is utility revenue decoupling. It is true that states that have revenue decoupling for at least one of their energy sectors (electricity or natural gas) do generally show statistically significant correlations between GMI categories. (The exception is the relationship between State Support and Grid Operations, which is not statistically significant). However, the same pattern of relationships can be seen for the states that do not have any type of revenue decoupling. This indicates that decoupling of revenue rates has little impact on grid modernization.

Some factors outside of state control also have little influence on grid modernization. These include average electricity price, average electricity bill size, average electricity consumption, per capita state GDP, and per capita state income. The correlations between these factors and GMI scores are weak and generally not statistically significant. This is a bit surprising since one might expect that states with high electricity prices might be more interested in the efficiency gains that modernization can offer, and more affluent states might be better able to afford modernization upgrades. Whether these relationships change over the next few years remains to be seen.

FIGURE 6: ELECTRICITY SECTOR REGULATION STATUS



Source: EIA.

KEY TAKEAWAYS

1 Continuing to fund investments in grid modernization is a challenge for both utilities and regulators due to pressure to keep rates low, making the internal competition for capital more challenging. The ARRA grants, which previously funded many of these investments, allowed utilities to buy down the cost of these projects, making it much easier to get regulatory approval due to the reduced impact on rates.

2 A wide gap generally exists with respect to progress achieved in modernizing the grid between the leading states and those that have not yet started to make significant investments.

3 Key factors associated with high GMI scores currently include AMI penetration, electric market deregulation, and the presence of demand response programs. The impacts of EVs, solar energy, storage, and other DERs will likely increase in the coming years and will serve as additional drivers for grid modernization.

4 Deployment of grid modernization technologies, such as AMI infrastructure, has progressed, but the full potential range of benefits that such technologies could provide has yet to be realized, particularly around customer education and empowerment.

5 States and utilities need to consider dynamic rate structure reforms to fully unlock the benefits offered by the smart grid, including updated tariffs that equitably assign value and support customer-related and grid-related benefits.

6 Leadership – in terms of initiation and implementation of effective grid modernization efforts – varies widely from state to state, including among regulators, legislatures, governors, utilities, and customers. There is no one-size-fits-all approach, but collaboration among stakeholders is essential to ensuring comprehensive grid modernization success.

APPENDIX A
GRID MODERNIZATION INDEX INDICATORS

The following is a list of indicators used to calculate the Grid Modernization Index. It is organized by category. The numbers in parentheses display the weight applied to that indicator in calculating the GMI.

STATE SUPPORT

- Grid Modernization Policy (3)
- Grid Modernization Strategy (3)
- Grid Modernization Plan (3)
- Grid Modernization Plan Reporting (3)
- Renewable Portfolio Standard (3)
- State CO2 Emissions Reduction Goal (3)
- Regional CO2 Emissions Reduction Goal (3)
- Energy Efficiency Resource Standard (3)
- Cybersecurity Plan (1)
- Consumer Energy Usage Data Privacy Policy (3)
- Grid Modernization Consumer Education/Outreach Requirement (3)
- Grid Modernization Consumer Education/Outreach Cost Recovery (3)
- Grid Modernization Metrics Reporting Requirement (3)
- EV Incentive/Mandate (1)
- Energy Storage Incentive/Mandate (1)
- Distributed Renewable Incentive/Mandate (1)
- Other DER Incentive/Mandate (1)
- Cost Recovery of Grid Modernization Projects (3)
- Grid Modernization Workforce Development Program (3)
- Measuring of Benefits of Grid Modernization (3)

CUSTOMER ENGAGEMENT

- Residential TOU/TOD Rates (1)
- Commercial TOU/TOD Rates (1)
- Residential CPP Rates (1)
- Small/Medium Commercial CPP Rates (1)
- Residential DR Programs (1)
- Small/Medium Commercial DR Programs (1)
- Mass Market RTP Rates (2)
- Mass Market Reactive Power Rates (1)
- CPP/PTR Communication: E-mail (2)
- CPP/PTR Communication: Text Message (2)
- CPP/PTR Communication: Twitter (2)
- CPP/PTR Communication: Phone (2)
- EV Tariff (1)
- Energy Storage Tariff (1)
- Solar PV Tariff (1)
- Other DG Tariff (1)
- Integration Standard:Third-Party Integration with Smart Meter Data (4)
- Methodology to Access Energy Use on Daily Basis (1)
- Methodology to Give Energy Usage Data to Third Parties (1)
- Methodology to Give Energy Usage Data to Third Parties on Daily Basis (1)
- Standard for Utilities to Grant Third Party Access to Customer Energy Usage Data (1)
- Grid Modernization Consumer Education/Outreach Campaign (4)
- Planning of New/Deeper Customer Analytics Capabilities (3)
- Implementation of New/Deeper Customer Analytics Capabilities (3)
- Utilization of Analytics to Understand Customer Classes (3)
- Utilization of Customer Data/Analytics to Segment and Communicate with Customers (3)
- Utilization of Analytics to Design Customer Programs (3)

GRID OPERATIONS

AMR Penetration (2)
AMI Penetration (2)
Transmission Advanced Automation: PMUs (1)
Transmission Advanced Automation: DLR Sensors/Software (1)
Transmission Advanced Automation: Fault Sensors/ Other IEDs (1)
Distribution Advanced Automation: Micro PMUs (1)
Distribution Advanced Automation: Medium Voltage Line Sensor (1)
Distribution Advanced Automation: Two-Way Volt/VAR Control/Monitoring (1)
Distribution Advanced Automation: Communicating Fault Sensors (1)
Energy Storage Used for Transmission Grid (3)
Microgrids: Single Party (1)
Microgrids: Multi Party (1)
Leveraging AMI for Outage Management (1)
Enhanced System Integration: AMI Outage Management (1)
Enhanced System Integration: AMI Data Analytics (1)
IEDs (1)
Remote Operation of Line Re-Closers (1)
Remote Control Line Switches (1)
Volt/VAR Optimization (1)
State Estimation for Distribution Feeders (1)
Near Real-Time Load Flow Analysis (1)
Transmission: Condition-Based Maintenance (1)
Transmission: Increased Asset Utilization (1)
Transmission: Forensic & Diagnostic Analysis (1)
Transmission: Probabilistic Risk Assessment (1)
Transmission: New Planning Functions/Processes (1)
Transmission: Other (1)
Distribution: Asset Utilization/Optimization (1)
Distribution: Condition-Based Maintenance (1)
Distribution: Forensic & Diagnostic Analysis (1)
Distribution: Probabilistic Risk Assessment (1)
Distribution: New Planning Functions/Processes (1)
Distribution: Analytics for DER Forecasting (1)
Distribution: Other (1)
Leveraging Probabilistic Planning to Better Serve Customers (1)
Leveraging Probabilistic Planning to Enhance New Connection Process (1)
FDIR/FLISR (2)
Advanced GIS: Enterprise or Just Distribution (2)
Enhanced System Integration: GIS & Asset Management (2)
Transmission: Advanced Visualization (2)
Distribution Advanced Visualization (2)

APPENDIX B
STATISTICAL TABLES AND METHODOLOGY

As with the previous GMI, GridWise Alliance member Accenture donated its resources to perform a statistical analysis of the GMI data. The goals of the analysis were to: 1) for the categorical variables, find the correlation between the State Support, Customer Engagement, and Grid Operations categories when measured by various dimensions (such as geography, regulatory structure, and several others); and 2) for the numerical variables, analyze the relationship between GMI scores and measures like retail price, per capita GDP, and others.

The type of test Accenture conducted was a correlation test referred to as a Pearson correlation. This test determines the extent to which one can draw a straight line to represent the relationship between two variables. Pearson correlation coefficients can range from -1 (meaning a direct inverse relationship) to 1 (signifying a direct positive relationship). Pearson correlation coefficients were calculated for both categorical and numerical variables.

For each of the categorical variables, Accenture first broke the states into two or more groups. They then ran Pearson correlations to see to what extent the three GMI category scores (State Support, Customer Engagement, and Grid Operations) were correlated with each other. In this way, we can see, for instance, whether a strong showing in one category is associated with a strong showing in the others. In some cases, Accenture ran Pearson correlations between each category and the overall GMI score, as well.

The categorical variables studied are as follows:

- **ALL 50 STATES+D.C.:** This variable took all 50 states plus the District of Columbia together and examined the relationships between category and overall scores.
- **REGULATORY STRUCTURE:** This variable broke the states down based upon whether they have deregulated any part of their electricity industry. The states were tested in three different ways:
  - » **Integrated vs. restructured:** This test broke the states into two groups, based upon whether they have deregulated any portion of their electric utility industry (at the wholesale and/or retail level). One group (consisting of 33 states) has fully regulated utilities. The second group (18 states) has deregulated one or both aspects of its electricity generation.
  - » **Wholesale deregulation:** This test broke the states into two groups, one of which (33 states) has a fully regulated wholesale electric industry, and the other (18 states) which has deregulated at the wholesale level. Because all states that have deregulated have wholesale deregulation, the results for this test were the same as the integrated vs. restructured test.
  - » **Retail deregulation:** This test broke the states into two groups, one of which (41 states) has fully regulated retail electricity, and the second (10 states) that has retail deregulation. This

test provided different results from the others because not every state that has wholesale deregulation also has retail deregulation.

- **DEMAND RESPONSE (DR):** This variable created two groups of states based upon the demand response programs that are allowed in the state. One group (34 states) had both retail and wholesale DR. The second group (15 states) had retail DR only. Two states were excluded from the analysis: Mississippi, the only state without a DR program; and Montana, which has wholesale DR only.

- **GEOGRAPHY:** The states were broken down geographically into six groups. The Pacific group consisted of five states. The Mountain group was made up of six states. The Central group was the largest, consisting of 17 states. The Southeast group of states had seven states. The Mid-Atlantic group had eight states in it, while the New England group consisted of six states. A seventh group, the Pacific Non-Contiguous group, consisted of only Alaska and Hawaii and was too small to complete any statistical tests on.

- **AMI/AMR DOMINANT STATES:** This variable examined how states broke down based upon the percentage of AMI and AMR meters each state has. This resulted in three groups of states. One group (17 states), referred to as the "AMI dominant" group, has an AMI penetration rate of greater than 50 percent. A second "AMR dominant" group (18 states) has AMR penetration rates of greater than 50 percent. The third group (16 states) has both AMI and AMR penetration rates of less than 50 percent.

- **RENEWABLE PORTFOLIO STANDARDS (RPS):** This variable examined the states based upon whether they had a mandatory RPS or not. Thirty-one states have mandatory RPS', while 20 states do not.

- **ENERGY EFFICIENCY RESOURCE STANDARD (EERS):** This variable examined the states based upon whether they had an EERS or not. Thirty-one states have an EERS, while 20 states do not.

- **UTILITY REVENUE DECOUPLING:** This variable looked at states based upon whether they had revenue decoupling for utilities within the state. The states were tested in two different ways:

  » **Decoupling vs. No Decoupling:** This test broke the states down based upon whether they had decoupling in place for either the electric and/or the natural gas sectors. Fifteen states have revenue decoupling while 36 do not.

  » **Gas/electricity decoupling vs. gas decoupling vs. electricity decoupling vs. neither:** This second test was more nuanced. It broke the states down based upon which sector(s) they had decoupling available for. The "neither gas nor electricity decoupling" group (20 states) has not decoupled rates for either natural gas or electricity. The "both electricity and natural gas decoupling" group (13 states) has decoupled both sectors. The "electricity decoupling" group (six states) has decoupled only the electricity sector, while the "natural gas decoupling" group (12 states) has only decoupled the natural gas sector.

For each numerical variable, Pearson correlations were run to see whether that variable was correlated with category and overall GMI scores. In this way, we can see the direct impact that each variable has on GMI scores. The numerical variables studied were as follows:

- **AMI PERCENTAGE:** The percent of meters within the state that have AMI technology.

- **AMR PERCENTAGE:** The percent of meters within the state that have AMR technology.

- **AVERAGE MONTHLY CONSUMPTION:** The average size of a customer's monthly electric bill (in kilowatt hours).
- **AVERAGE MONTHLY ELECTRIC BILL SIZE:** The average size of a customer's monthly electric bill (in dollars).
- **PER CAPITA REAL GROSS DOMESTIC PRODUCT (GDP):** The size of a state's GDP per person (in dollars).
- **PERSONAL INCOME:** The yearly personal income (in dollars) per person.
- **TOTAL RESIDENTIAL SOLAR INSTALLATIONS:** The number of residential solar photovoltaic (PV) installations in the state at the end of 2014.
- **TOTAL RESIDENTIAL SOLAR CAPACITY:** The total number of installed megawatts (MW) of residential solar in the state at the end of 2014.

● *High Positive Correlation (0.5 to 1.0)*
● *Low Positive Correlation (0 to 0.49)*
● *Low Negative Correlation (0 to -0.49)*
● *High Negative Correlation (-0.5 to -1)*
White Bold Italic Numbers *Indicate Statistical Significance at the p=.05 Level*

TABLE 6: AVERAGE SCORES AND CORRELATIONS BETWEEN GMI CATEGORIES

	GROUP (NUMBER OF STATES IN PARENTHESES)	CORRELATION BETWEEN TWO CATEGORIES			AVERAGE SCORES			
		STATE SUPPORT/ CUSTOMER ENGAGEMENT	STATE SUPPORT/ GRID OPERATIONS	CUSTOMER ENGAGEMENT/ GRID OPERATIONS	STATE SUPPORT	CUSTOMER ENGAGEMENT	GRID OPERATIONS	OVERALL
ALL 51 STATES	All 50 States plus DC	***0.58***	***0.45***	***0.73***	9.78	9.89	12.31	31.98
	p-value	0.00	0.00	0.00				
GEOGRAPHY	Pacific States (5)	0.74	0.86	***0.95***	9.75	23.00	19.25	52.00
	p-value	0.15	0.06	0.01				
	Mountain States (6)	0.32	0.03	0.87	14.00	10.75	14.25	39.00
	p-value	0.54	0.95	0.02				
	Central States (17)	***0.73***	0.44	0.76	7.63	8.04	9.08	24.75
	p-value	0.00	0.08	0.00				
	Southeast States (7)	***0.78***	0.60	***0.82***	5.11	7.29	16.96	29.36
	p-value	0.04	0.15	0.02				
	Mid-Atlantic States (8)	0.66	-0.08	0.61	15.75	18.75	25.00	59.50
	p-value	0.08	0.86	0.11				
	New England States (6)	0.38	-0.43	0.53	14.50	10.00	16.38	40.88
	p-value	0.46	0.39	0.28				
AMI/AMR DOMINANT STATES	AMI Dominant States (17)	***0.51***	0.44	0.43	12.26	16.72	20.10	49.09
	p-value	0.03	0.08	0.08				
	AMR Dominant States (18)	0.24	0.35	***0.82***	7.71	5.40	7.78	20.89
	p-value	0.34	0.16	0.00				
	Neither AMI nor AMR Dominant States (16)	***0.83***	0.41	0.47	9.48	7.77	9.13	26.38
	p-value	0.00	0.11	0.06				
RENEWABLE PORTFOLIO STANDARD	States with a Mandatory RPS (31)	***0.57***	***0.36***	***0.69***	12.57	12.39	13.43	38.39
	p-value	0.00	0.04	<.0001				
	States without a Mandatory RPS (20)	***0.71***	0.38	***0.73***	9.30	10.00	16.65	35.95
	p-value	0.00	0.09	0.00				
ENERGY EFFICIENCY RESOURCE STANDARD	States with an EERS (20)	***0.56***	0.37	***0.78***		16.21	15.79	44.13
	p-value	0.01	0.11	<.0001				
	States without an EERS (31)	***0.60***	0.35	***0.67***	9.54	10.57	16.14	36.25
	p-value	0.00	0.05	<.0001				

Source: Accenture, GridWise Alliance, and Clean Edge.

continued on next page >

- **TOTAL NON-RESIDENTIAL SOLAR INSTALLATIONS:** The number of non-residential solar PV installations in the state at the end of 2014.
- **TOTAL NON-RESIDENTIAL SOLAR CAPACITY:** The total number of installed MW of non-residential solar in the state at the end of 2014.
- **ELECTRIC VEHICLES (EVS) AND PLUG-IN ELECTRIC VEHICLES (PHEVS):** The number of EVs and PHEVs in a state at the end of 2014.
- **AVERAGE RETAIL ELECTRICITY PRICE FOR ALL SECTORS:** The average price (in cents per kilowatt hour) of electricity for all customer sectors.

The following three tables describe the results of the analysis. Table 6 displays the correlations between each category pairing. The column headings show which two categories are being compared. For instance, the correlation between State Support

- *High Positive Correlation (0.5 to 1.0)*
- *Low Positive Correlation (0 to 0.49)*
- *Low Negative Correlation (0 to -0.49)*
- *High Negative Correlation (-0.5 to -1)*

White Bold Italic Numbers *Indicate Statistical Significance at the p=.05 Level*

TABLE 6: AVERAGE SCORES AND CORRELATIONS BETWEEN GMI CATEGORIES (CONTINUED)

	GROUP (NUMBER OF STATES IN PARENTHESES)	CORRELATION BETWEEN TWO CATEGORIES			AVERAGE SCORES			
		STATE SUPPORT/ CUSTOMER ENGAGEMENT	STATE SUPPORT/ GRID OPERATIONS	CUSTOMER ENGAGEMENT/ GRID OPERATIONS	STATE SUPPORT	CUSTOMER ENGAGEMENT	GRID OPERATIONS	OVERALL
REVENUE DECOUPLING	States with Rate Decoupling (15)	***0.77***	0.41	***0.81***	12.63	13.88	16.88	43.38
	p-value	0.00	0.13	0.00				
	States without Rate Decoupling (36)	***0.59***	***0.37***	***0.68***	5.80	8.48	10.43	24.70
	p-value	0.00	0.02	<.0001				
	States with Neither Electricity Nor Gas Decoupling (20)	***0.71***	0.38	***0.73***	10.44	10.88	15.50	36.81
	p-value	0.00	0.09	0.00				
	States with Both Electricity and Gas Decopuling (13)	***0.66***	0.28	***0.74***	13.75	22.08	18.50	54.33
	p-value	0.01	0.35	0.00				
	States with Gas Decoupling (12)	***0.71***	0.26	***0.75***	6.50	9.06	12.88	28.44
	p-value	0.01	0.41	0.01				
	States with Electricity Decoupling (6)	***0.88***	0.01	***0.85***	10.13	10.75	18.13	39.00
	p-value	0.02	0.98	0.03				
REGULATORY STRUCTURE	Regulated States (33)	***0.37***	0.06	***0.53***	6.70	8.18	10.08	24.97
	p-value	0.03	0.72	0.00				
	Deregulated States (18)	***0.64***	***0.52***	***0.84***	15.43	13.10	16.39	44.92
	p-value	0.00	0.03	0.00				
	States with Wholesale Deregulation (18)	***0.64***	***0.52***	***0.84***	15.43	13.10	16.39	44.92
	p-value	0.00	0.03	0.00				
	States without Wholesale Deregulation (33)	***0.37***	0.06	***0.53***	6.70	8.18	10.08	24.97
	p-value	0.03	0.72	0.00				
	States with Retail Deregulation (10)	0.59	0.18	***0.81***	17.03	12.68	17.35	47.05
	p-value	0.07	0.62	0.00				
	States without Retail Deregulation (41)	***0.57***	***0.42***	***0.69***	8.02	9.24	11.08	28.34
	p-value	0.00	0.01	0.00				
DEMAND RESPONSE	States with Retail and Wholesale DR Programs (34)	***0.61***	***0.62***	***0.82***	11.82	10.74	12.85	35.40
	p-value	0.00	0.00	0.00				
	States with Retail DR Programs Only (15)	0.45	-0.24	0.46	6.05	9.20	11.72	26.97
	p-value	0.09	0.39	0.08				

Source: Accenture, GridWise Alliance, and Clean Edge.

and Customer Engagement for all states is 0.58. P-values are shown below the correlations, with bold, white, italicized text indicating a relationship that is significant at the p=.05 level. For certain variables, Accenture also looked at the correlations between the individual category scores and overall scores. This data is found in Table 7, which is structured the same as Table 6. Finally, Table 8 shows the results of the numeric variable tests. The numbers shown in this table represent correlations between the variable and scores in each category. Each table also has a legend describing what the cell colors mean. They range from a strongly positive correlation (bright green) to a strongly weak correlation (deep red).

TABLE 7: CORRELATIONS BETWEEN GMI CATEGORY SCORES AND OVERALL SCORES

	GROUP (NUMBER OF STATES IN PARENTHESES)	CORRELATION BETWEEN OVERALL SCORE AND CATEGORY		
		STATE SUPPORT	CUSTOMER ENGAGEMENT	GRID OPERATIONS
ALL 51 STATES	All 50 States plus DC	***0.79***	***0.90***	***0.86***
	p-value	0.00	0.00	0.00
GEOGRAPHY	Pacific States (5)	***0.90***	***0.96***	***0.99***
	p-value	0.04	0.01	0.00
	Mountain States (6)	0.45	***0.96***	***0.90***
	p-value	0.37	0.00	0.02
	Central States (17)	***0.82***	***0.95***	***0.85***
	p-value	<0.0001	<0.0001	<0.0001
	Southeast States (7)	***0.86***	***0.96***	***0.89***
	p-value	0.01	0.00	0.01
	Mid-Atlantic States (8)	***0.71***	***0.97***	0.64
	p-value	0.05	<0.0001	0.09
	New England States (6)	0.42	***0.95***	0.61
	p-value	0.41	0.00	0.19
RENEWABLE PORTFOLIO STANDARD	States with a Mandatory RPS (31)	***0.76***	***0.90***	***0.83***
	p-value	<.0001	<.0001	<.0001
	States without a Mandatory RPS (20)	***0.80***	***0.95***	***0.83***
	p-value	<.0001	<.0001	<.0001
ENERGY EFFICIENCY RESOURCE STANDARD	States with an EERS (20)	***0.75***	***0.92***	***0.86***
	p-value	0.00	<.0001	<.0001
	States without an EERS (31)	***0.77***	***0.91***	***0.82***
	p-value	<.0001	<.0001	<.0001
REVENUE DECOUPLING	States with Rate Decoupling (15)	***0.81***	***0.97***	***0.85***
	p-value	0.00	<.0001	0.00
	States without Rate Decoupling (36)	***0.77***	***0.91***	***0.83***
	p-value	<.0001	<.0001	<.0001
	States with Neither Electricity Nor Gas Decoupling (20)	***0.80***	***0.95***	***0.83***
	p-value	<.0001	<.0001	<.0001
	States with Both Electricity and Gas Decoupling (13)	***0.77***	***0.95***	***0.81***
	p-value	0.00	<.0001	0.00
	States with Gas Decoupling (12)	***0.77***	***0.97***	***0.81***
	p-value	0.00	<.0001	0.00
	States with Electricity Decoupling (6)	0.41	***0.98***	0.52
	p-value	0.42	0.00	0.29

High Positive Correlation (0.5 to 1.0)
Low Positive Correlation (0 to 0.49)
Low Negative Correlation (0 to -0.49)
High Negative Correlation (-0.5 to -1)
White Bold Italic Numbers *Indicate Statistical Significance at the p=.05 Level*

Source: Accenture, GridWise Alliance, and Clean Edge.

TABLE 8: CORRELATIONS BETWEEN NUMERIC VARIABLES AND GMI CATEGORY SCORES

	CORRELATION BETWEEN VARIABLE AND CATEGORY			
	STATE SUPPORT	CUSTOMER ENGAGEMENT	GRID OPERATIONS	OVERALL
Percent AMI	0.12	***0.62***	***0.63***	***0.53***
p-value	0.41	0.00	0.00	0.00
Percent AMR	-0.19	***-0.52***	***-0.55***	***-0.49***
p-value	0.17	0.00	0.00	0.00
Average Monthly Consumption (kWh)	***-0.42***	-0.14	0.10	-0.17
p-value	0.00	0.34	0.50	0.22
Average Monthly Bill (Dollars)	0.01	0.09	0.22	0.12
p-value	0.95	0.55	0.12	0.38
Per Capita Real GDP	***0.31***	0.11	0.19	0.24
p-value	0.02	0.43	0.18	0.09
Per Capita Real Income (Dollars)	***0.30***	0.03	0.10	0.17
p-value	0.03	0.83	0.49	0.23
Solar: Total Residential Installations	***0.38***	***0.45***	***0.31***	***0.45***
p-value	0.01	0.00	0.02	0.00
Solar: Total Residential Capacity (MW)	***0.40***	***0.45***	***0.32***	***0.46***
p-value	0.00	0.00	0.02	0.00
Solar: Total Non-Residential Installations	***0.38***	***0.45***	***0.31***	***0.45***
p-value	0.01	0.00	0.02	0.00
Solar: Total Non-Residential Capacity (MW)	***0.38***	***0.35***	***0.37***	***0.43***
p-value	0.01	0.01	0.01	0.00
Electric Vehicles (Number of Vehicles)	***0.37***	***0.46***	***0.40***	***0.48***
p-value	0.01	0.00	0.00	0.00
Average Electricity Price (All Sectors)	***0.36***	0.12	-0.01	0.18
p-value	0.01	0.42	0.97	0.20

- *High Positive Correlation (0.5 to 1.0)*
- *Low Positive Correlation (0 to 0.49)*
- *Low Negative Correlation (0 to -0.49)*
- *High Negative Correlation (-0.5 to -1)*

White Bold Italic Numbers *Indicate Statistical Significance at the p=.05 Level*

Source: Accenture, GridWise Alliance, and Clean Edge.