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NCSL & NASEO Solar Workshop
Grid Technologies: Transforming the Power Sector
June 9, 2017

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Digitization of the electric power sector

- Strategic opportunity to enhance grid resiliency, reliability, and cybersecurity.
- Supports the transition to a clean energy future
- Critical link to distributed energy resources
- Aligns with evolving customer expectations
- 1 in 100 year opportunity to expand/reinvent business model

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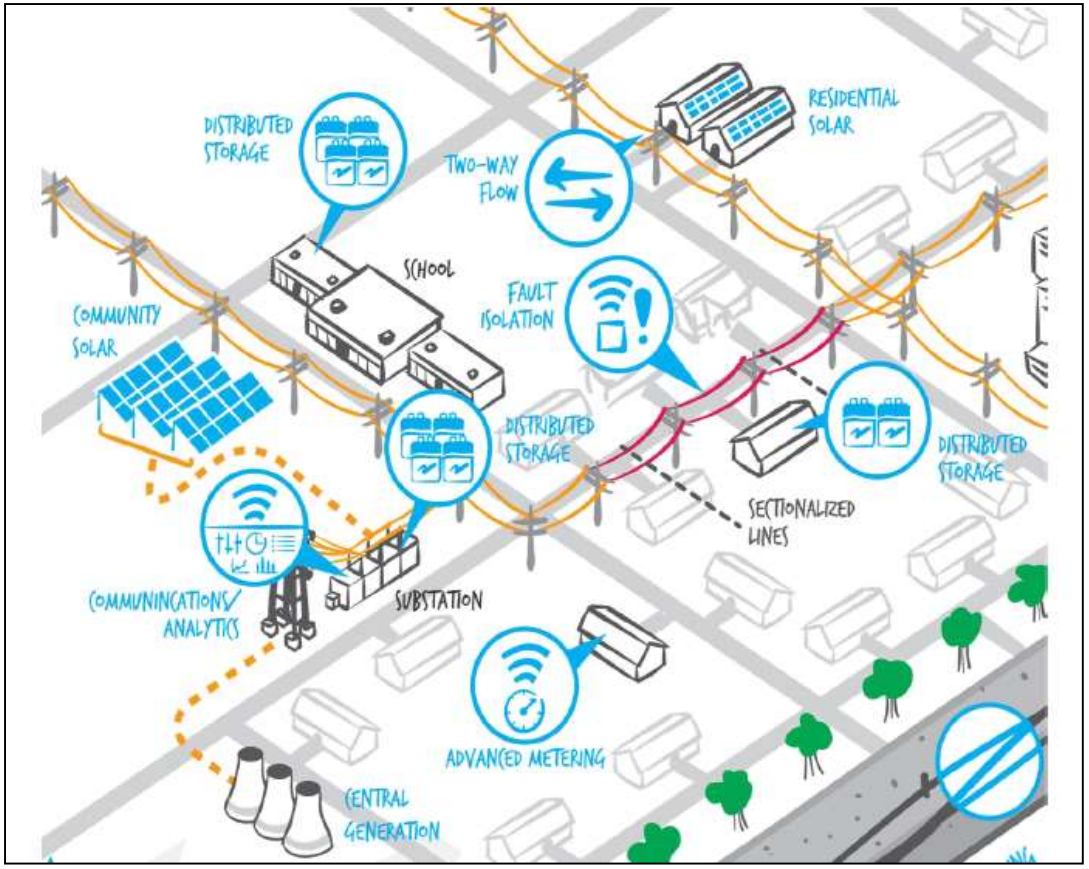
Customers expect...

- Choice, convenience, and control over energy usage
  - > Proactive multi-channel communication
  - > Enhanced billing and payment options
  - > Ability to regularly monitor energy usage
  - > Customized usage alerts/other notifications
- Reliable energy service and access to cleaner energy solutions
  - > 24/7 power
  - > Minimized outages when weather strikes
  - > Renewable ready grid
  - > Seamless connections with new energy technologies
- Electric companies to leverage data to enhance the customer experience

Technology is fundamentally reshaping the power sector

- Decentralized
  - > Intelligent devices from substation to customers' homes
- Digitalized
  - > Network services across multiple platforms for energy products and services providing customers with greater control
- Decarbonized
  - > Cleaner, greener more sustainable energy options



Source: Duke Energy (graphic)

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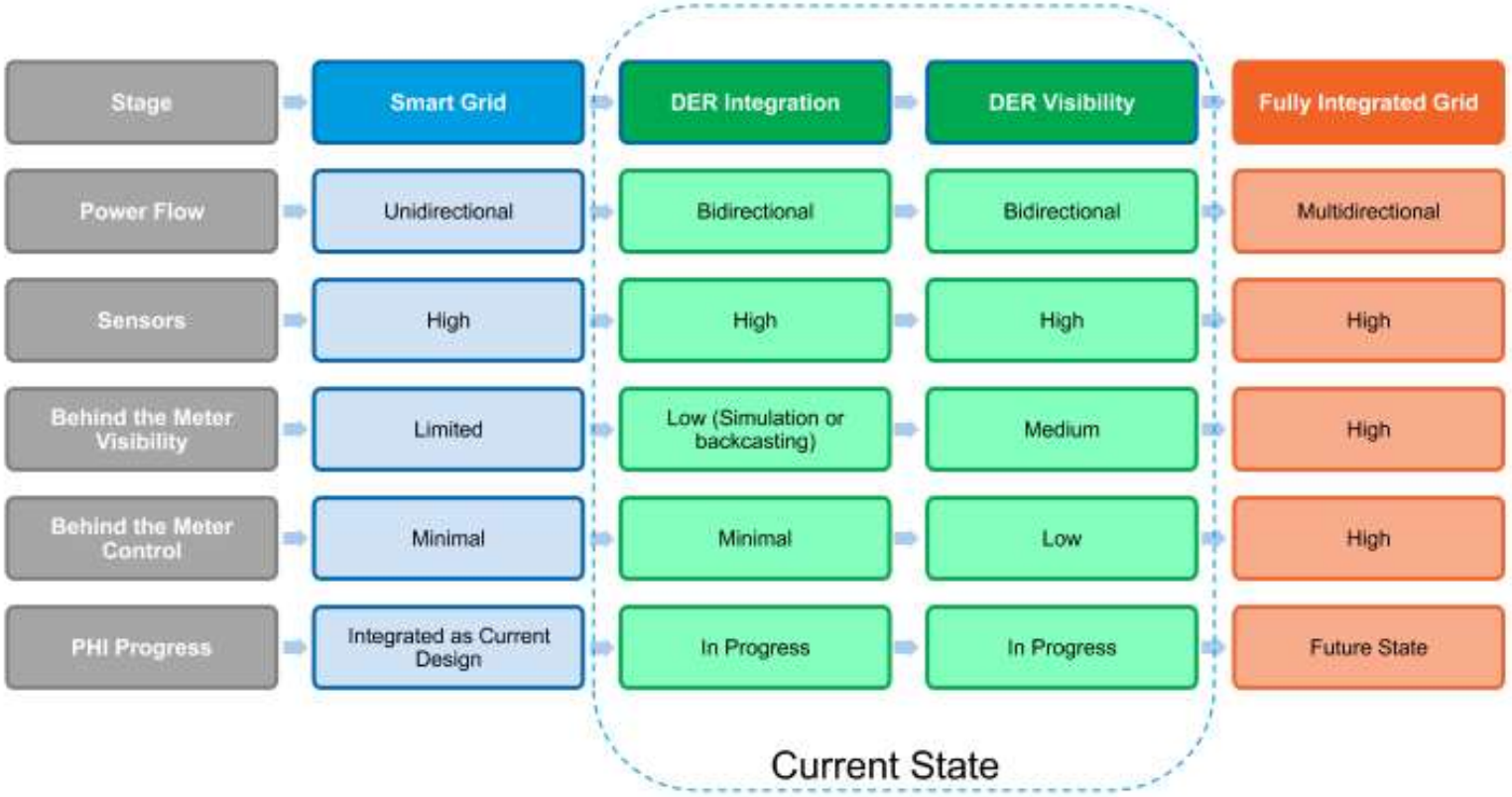
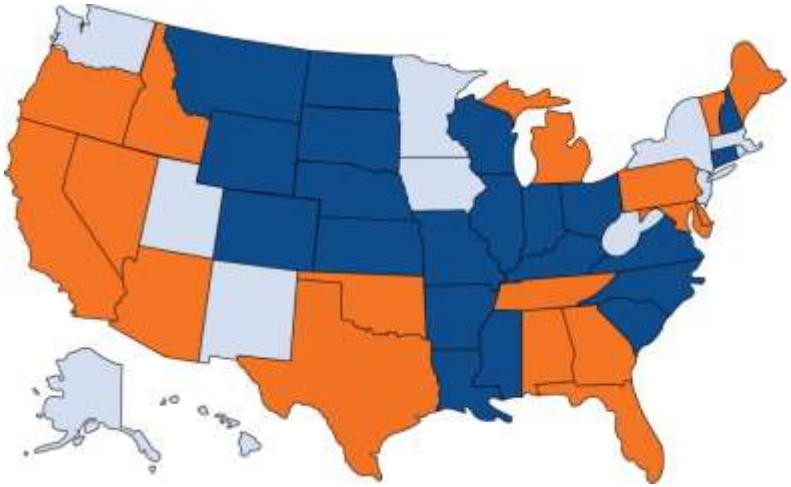
Stages of grid modernization



Source: Pepco Holdings

Sensing technologies on the rise in the U.S.

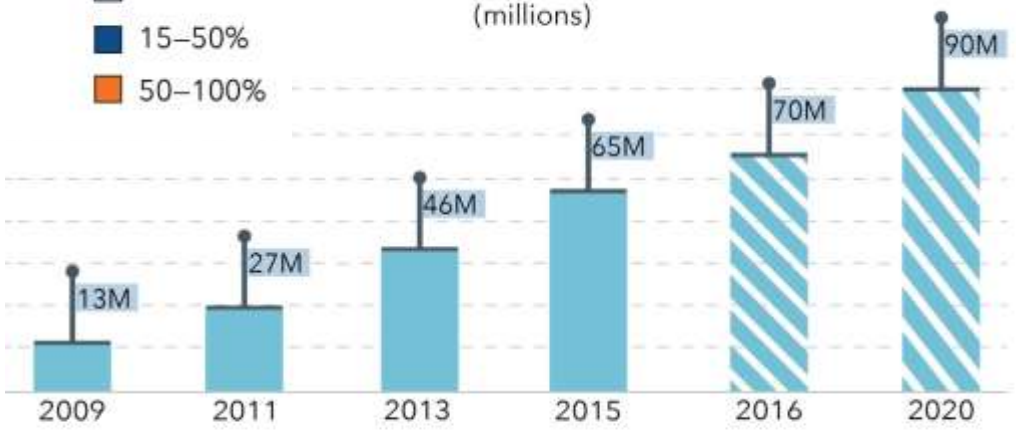


SMART METERS INSTALLED

Percent of households

- 0–15%
- 15–50%
- 50–100%

NUMBER OF SMART METERS
(millions)



Continued investment in smart meters is key to building a **SMARTER ENERGY INFRASTRUCTURE**

A smart meter is.....
a computer platform where smart metering is one of the many applications.

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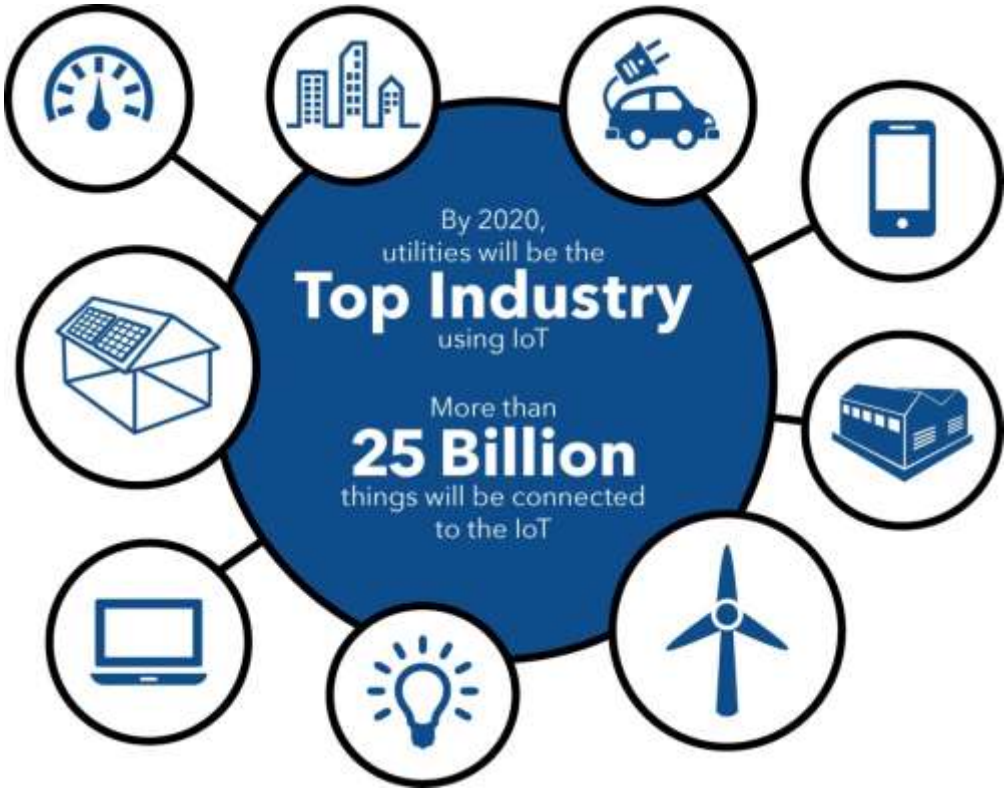
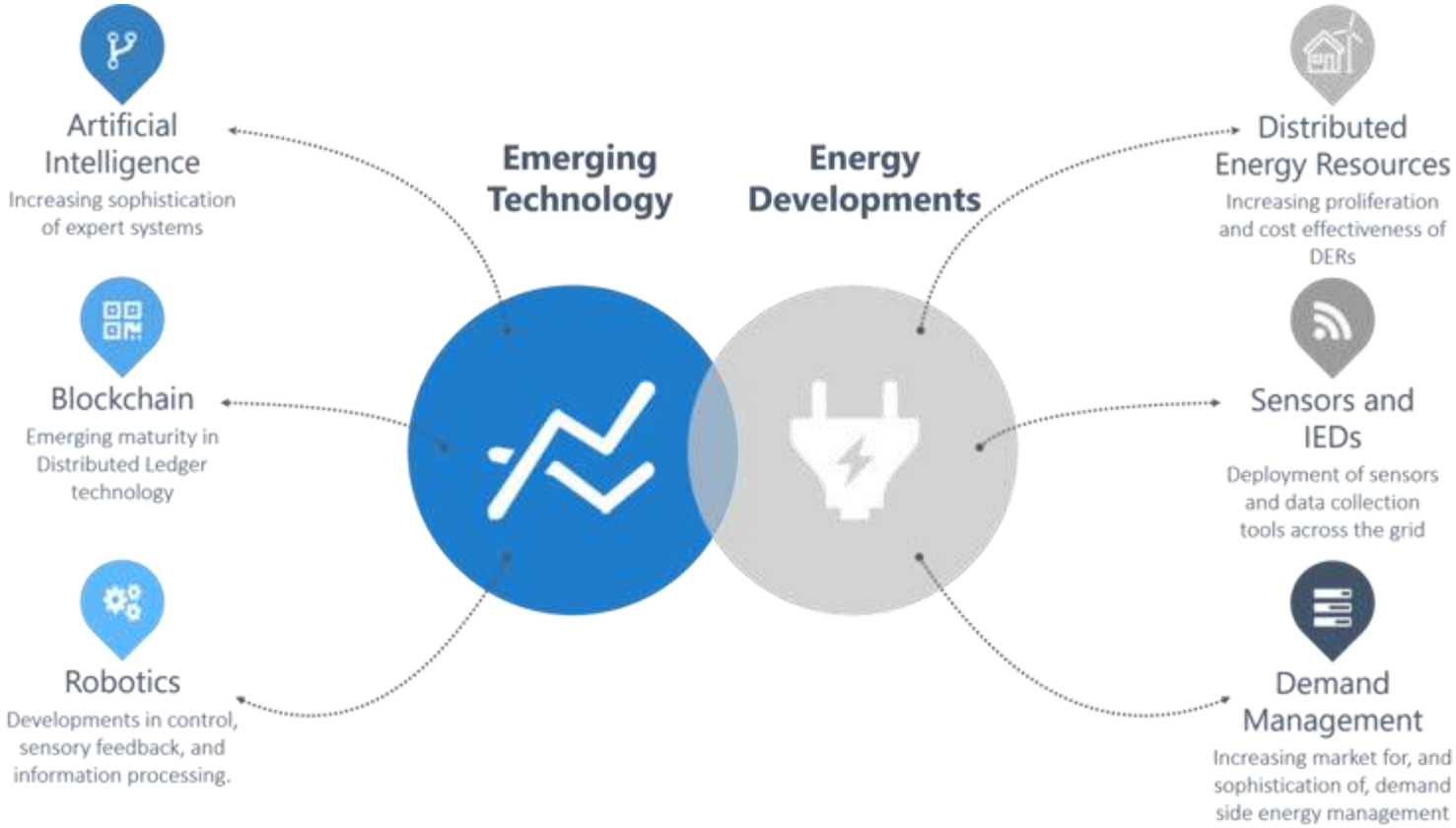
Similar to the Internet of Things, a Grid of Things is evolving

Digital energy technologies:

- Develop visibility and predictive capabilities across the entire energy value chain.
- Create actionable intelligence from diverse sources.
- Expand the business model to move from commodity provider to integrated grid manager, planner, and operator.



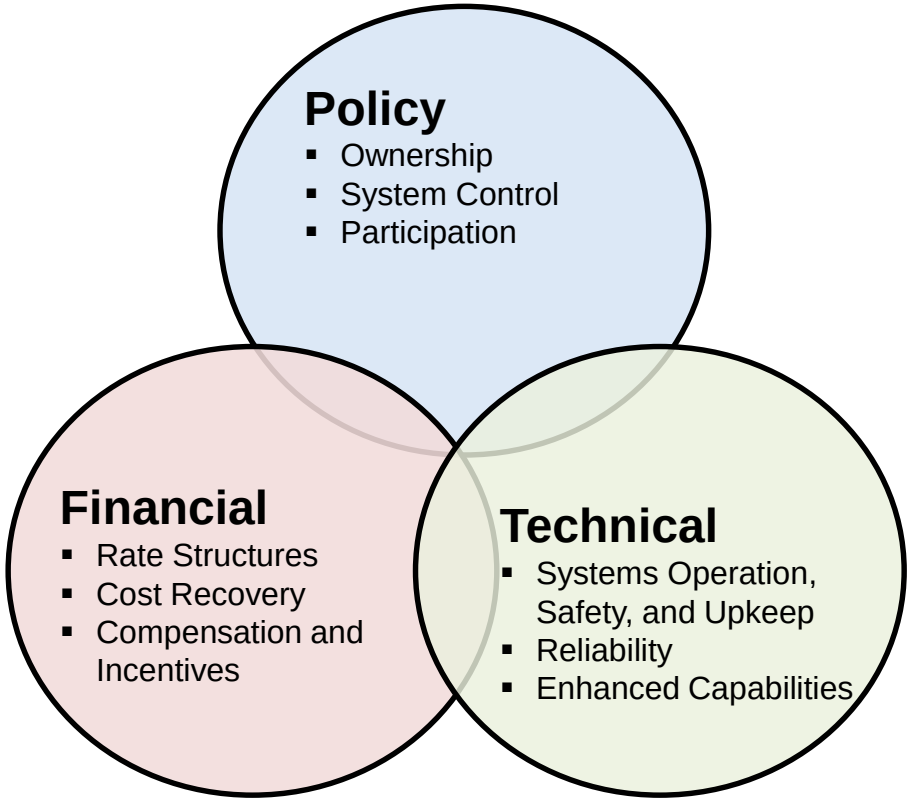
Blockchain: Part of the 4th Industrial Revolution



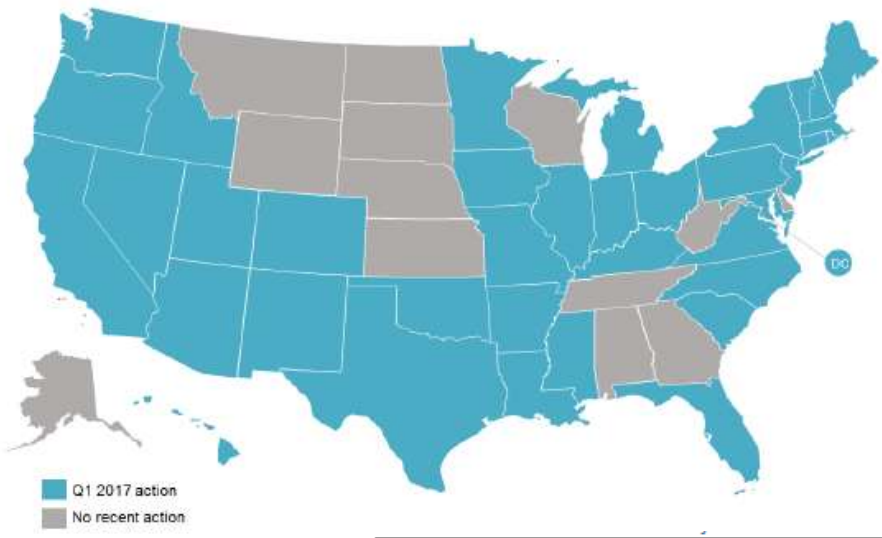
Source: Indigo Advisory Group

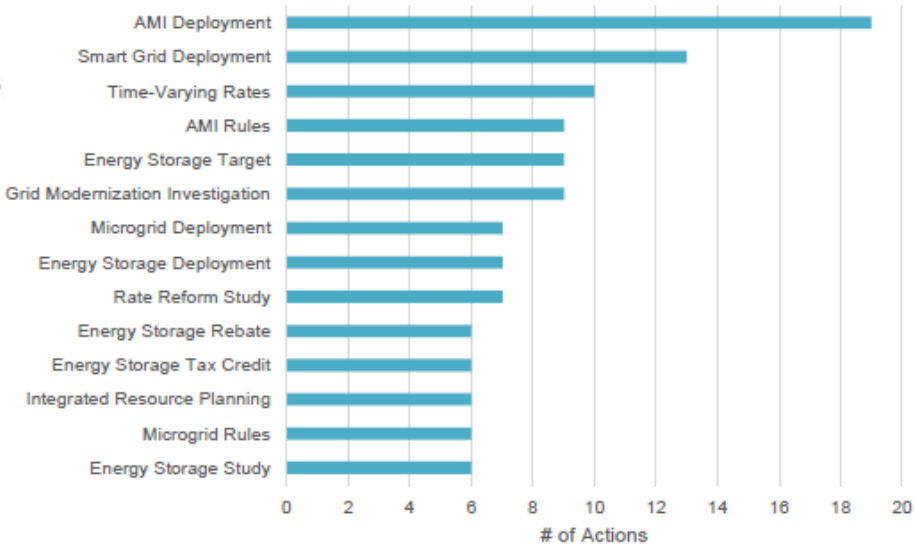
Evolving power grid: points to consider

- Planning and operating the future distribution grid will become more complicated
  - > Higher DER penetration; Deployment of storage; Microgrids; PEVs; Advanced demand response.
- Distribution system operators will need to manage the distribution system using a much higher level of visibility, control and automation
  - > Control, Measure, Dispatch, Protect, Optimize.
- In order to maximize the amount of DER connected to the grid, the way systems are operated and dispatched will need to be better understood.



Q1 2017- Legislative and regulatory grid modernization activities





Type of Action	# of Actions	% by Type	# of States
Deployment	36	24%	19
Policies	29	20%	16
Financial Incentives	25	17%	11
Studies and Investigations	22	15%	16 + DC
Business Model and Rate Reform	18	12%	13
Planning and Market Access	18	12%	12
Total	**148**	**100%**	**37 States + DC**

Note: The "# of States/ Districts" total is not the sum of the rows because some states have multiple actions. Percentages are rounded and may not add up to 100%.

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Source: NC Clean Energy Technology Center, *The 50 States of Grid Modernization.* May 2017

Collaboration is key

- Growing importance for electric companies to collaborate with peers and vendors to stay in sync with technology development cycle.
- Joint, coordinated education and outreach with key stakeholders is extremely helpful when discussing technology investments.
- Flexibility and room for experimentation will allow for an efficient transition to a digital grid.

Questions?