Key Electric Industry Trends

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Hosted by:

FEMP
Federal Energy Management Program

TVA
Agenda

• Landscape of the Electric Industry
• EEI CEO Task Force on Military Resilience
Industry Trends
Transformation of the Electric Power Sector

Drivers:

• Customers
• Technology
• Policy
Industry Capital Expenditures

Notes: Total company spending of U.S. Investor-Owned Electric Utilities, consolidated at the parent or appropriate holding company. Projections based on publicly available information and extrapolated for companies reporting fewer than three projected years (0.1% and 2.5% of the industry for 2018 and 2019, respectively).

Source: EEI Finance Department, company reports, S&P Global Market Intelligence (August 2017).
Projected Functional CapEx

**2016P** as of August 2016

$120.8 B

- **Generation**: $41.9B (35%)
- **Distribution**: $32.1B (27%)
- **Transmission**: $20.8B (17%)
- **Gas-Related**: $17.9B (15%)
- **Environment**: $3.4B (3%)
- **Other**: $4.7B (4%)

**2017P** as of August 2017

$122.8 B

- **Generation**: $35.6B (29%)
- **Distribution**: $35.7B (29%)
- **Transmission**: $21.5B (17%)
- **Gas-Related**: $19.6B (16%)
- **Environment**: $4.5B (4%)
- **Other**: $5.9B (5%)

Notes: Total company functional spending of U.S. Investor-Owned Electric Utilities may not sum to 100% due to rounding error. Projections based on publicly available information and extrapolated for companies not reporting functional detail (0.7% and 0.9% of the industry for 2016 and 2017, respectively).

Source: EEI Finance Department, company reports, S&P Global Market Intelligence (August 2017).
The Mix of Resources Used to Generate Electricity Is Changing Dramatically

2007 National Energy Resource Mix
- 19.4% Nuclear
- 48.5% Coal
- 21.6% Natural Gas
- 6.0% Hydro
- 2.5% Non-Hydro Renewables
- 1.6% Fuel Oil
- 0.5% Other

2017 National Energy Resource Mix (preliminary)
- 30.1% Coal
- 31.7% Natural Gas
- 20.0% Nuclear
- 7.4% Hydro
- 9.6% Non-Hydro Renewables
- 0.5% Fuel Oil
- 0.5% Other

Source: Department of Energy, Energy Information Administration.
# 10 Ways Electric Companies Are Leading on Clean Energy

| 1 | Investing more than $100 billion each year to build smarter energy infrastructure and to transition to even cleaner energy sources. |
| 2 | Reducing CO₂ emissions nearly 25 percent below 2005 levels as of 2016, the lowest annual emissions level since 1988. |
| 3 | Decreasing emissions of nitrogen oxides by 82 percent and sulfur dioxide emissions by 91 percent, while electricity use grew by 36 percent (1990-2016). |
| 4 | Changing the energy mix: more than one-third of the nation’s electricity now comes from zero-emissions sources (like nuclear, hydropower, and renewables). |
| 5 | Providing virtually all of the wind, geothermal, and hydropower—and 64 percent of the solar—in the U.S. |
| 6 | Driving the majority of demand for solar, accounting for 72 percent of installed solar capacity in 2016. |
| 7 | Using more than 90 percent of all energy storage in the U.S. |
| 8 | Investing in energy efficiency programs that saved enough energy in 2015 to power 17.5 million U.S. homes for a year. |
| 9 | Creating a nationwide initiative that expanded the use of EVs in our member companies’ fleets by 18 percent in 2016. |
| 10 | Promoting widespread adoption of EVs that could reduce greenhouse gas emissions by the equivalent of removing 100 million conventional vehicles from the road. |
We Are Adding More Non-Hydro Renewable Resources + Storage

Front-of-the-meter KWs account for 81% of total installed battery storage.

Our universal solar projects accounted for 72% of all INSTALLED U.S. SOLAR CAPACITY in 2016.

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**OUR SOLAR PV** had an average cost of $1.06 per watt in 2016.

**RESIDENTIAL ROOFTOP Solar PV** had an average cost of $2.89 per watt in 2016.

Our wind projects provide almost 100% of wind energy nationwide.
Power Plant Emissions Drop Significantly Since 1990

- Real GDP ↑86%
- Electricity Use ↑36%
- Nitrogen Oxides Emissions ↓82%
- Sulfur Dioxide Emissions ↓91%

1990 represents the base year. Graph depicts increases or decreases from the base year.

Sources: U.S. Department of Energy, Energy Information Administration (EIA), U.S. Environmental Protection Agency (EPA), and U.S. Bureau of Economic Analysis.
U.S. Power Sector Carbon Dioxide Emissions Declining (2005-2016)

1/3 of U.S. power generation comes from zero-emissions sources
As of 2016, industry CO₂ emissions were nearly 25 percent below 2005 levels
Trajectory will continue based on current trends

Smarter Energy Infrastructure

**DRIVERS**

1. Customer Wants & Needs
2. Environmental Goals
3. Growth in Distributed Energy Resources
4. New Technologies

**BENEFITS**

1. Enhanced Reliability
2. Increased Resiliency
3. Reduced Carbon Emissions
4. Empowered Customers
5. Flexible & Responsive Energy Grid Platform
Changing Demand Curves

July 27, 2017 Demand

- Day-Ahead Demand Forecast
- Hour-Ahead Demand Forecast
- Actual Demand

Energy Exchange: Connect • Collaborate • Conserve
Renewable Generation

July 27, 2017 Renewables

- Wind
- Geothermal
- Biomass
- Biogas
- Small Hydro
- Solar

Hour

Megawatts
Peak Demand is Changing

Original estimate of net-load as more renewables are integrated into the grid

Typical Spring Day

- Net Load 14,160 MW on April 5, 2015 at 15:46
- Ramp need ~13,000 MW in three hours
- Over generation risk
Flattening the Beast

- Dynamic Pricing (e.g. TOU, demand, customer charges for DER customers)
- Demand Response
- Beneficial Electrification
- Smart IT Hardware, Software, and Energy Analytics
- Energy Storage (batteries, TES, etc.)
Energy Storage

Energy storage can be deployed in all parts of the energy grid, and has applications in all parts of the value chain.

Enhance Electric Company Operations
- Alleviate high energy prices through time shifts
- Reduce the need for new generation

Provide Grid Support
- Regulate frequency
- Reduce spinning, non-spinning, and supplemental reserve requirements
- Voltage support
- Black start electricity restoration

Optimize Power System
- Defer transmission and distribution upgrades
- Relieve electricity congestion

Enhance Customer Experience
- Higher power quality and reliability
- Retail electric energy time shift

Source: Adapted from DOE/EPRI Handbook, EEI (graphic)
Electrification

In the last 6 years, more than 600,000 electric vehicles have been sold in the U.S.

At least 70 electric companies will invest $250 million over the next five years to increase the use of electric vehicles in their fleets.

DID YOU KNOW?

Widespread adoption of electric vehicles could reduce greenhouse gas emissions by more than 550 million metric tons annually by 2050.

DID YOU KNOW?

That’s equal to buying 125 million gallons of gas.
DoD CEO Task Force on Energy Resilience
Goals: Task Force on Military Resilience

• Engage new DoD leadership, looking broadly at inside the fence, outside the fence issues
• Set priorities for collaboration
  – Assist with DoD mapping exercises and vulnerability assessments
  – Develop/replicate electric company-installation energy resiliency collaborations
  – Address issues that hamper further collaboration
  – EEI member Fed agency/DoD account management teams continue to push issues/solutions uphill
Thanks

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