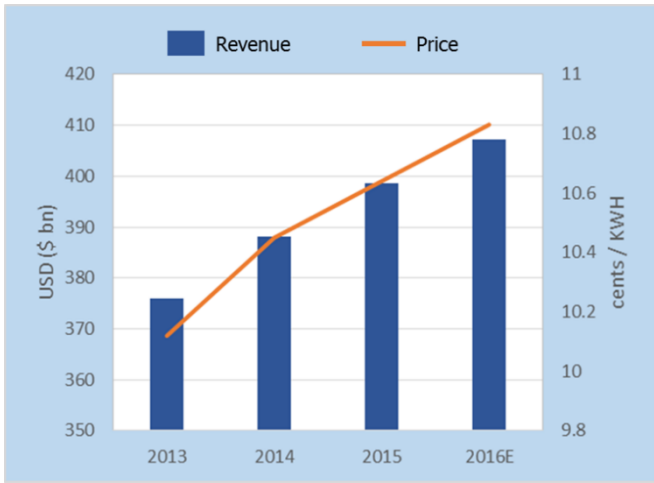


Industry Trends	Yearly Revenue and Average Price of Electric Power 2013 - 2016	Industry Forecast
<ul style="list-style-type: none"> <li>• Slower demand growth</li> <li>• Future demand driven by higher economic activity</li> <li>• Increased energy efficiencies</li> <li>• Higher profit margins</li> <li>• Growth in distributed generation, battery storage</li> <li>• Use of analytics</li> <li>• Smart grid security</li> <li>• Consolidation</li> </ul>	 <p>Source: U.S Energy Information Agency – Short-term energy outlook, Jul. 2015</p>	<ul style="list-style-type: none"> <li>• <b>Power production</b> is set to grow by &lt; 1% in 2015</li> <li>• <b>Solar power</b> sector currently accounts for &lt; 1% of total power and is expected to grow with a 16% CAGR till 2016</li> <li>• <b>Increased use of natural gas</b> - exceeded coal based generation in April, 2015 - expected to contribute to 31% of total power production in 2015</li> <li>• <b>Increased use of analytics</b> in the transmission and distribution sector</li> </ul>

Industry Opportunities	Key Statistics (Source: EIA, BLS and IBIS World) NAICS Code 221: Electric Power Generation	Issues/Challenges																																
<ul style="list-style-type: none"> <li>• Investment in distributed power, solar in particular</li> <li>• Smart grid and smart metering programs</li> <li>• Battery storage investments</li> <li>• Development of analytics programs in power generation, transmission and distribution</li> </ul>	<table border="1"> <thead> <tr> <th>Key Stats</th> <th>2011</th> <th>2014</th> <th>Trend 2011 to 2014</th> </tr> </thead> <tbody> <tr> <td>Sales (\$bn) -all power</td> <td>370.1</td> <td>397.6</td> <td>↑</td> </tr> <tr> <td>Sales (\$bn) -generation</td> <td>NA</td> <td>138.5</td> <td>↑</td> </tr> <tr> <td>Nat. gas price/MMBTU</td> <td>4.12</td> <td>3.55</td> <td>↓</td> </tr> <tr> <td>Unit price (cents/KWH)</td> <td>11.4</td> <td>12.3</td> <td>↑</td> </tr> <tr> <th>Employment Stats</th> <th>2011</th> <th>2014</th> <th></th> </tr> <tr> <td>Employees in power generation industry</td> <td>200,000</td> <td>193,950</td> <td>↓</td> </tr> <tr> <td>Employees in solar power generation</td> <td>480</td> <td>1450</td> <td>↑</td> </tr> </tbody> </table>	Key Stats	2011	2014	Trend 2011 to 2014	Sales (\$bn) -all power	370.1	397.6	↑	Sales (\$bn) -generation	NA	138.5	↑	Nat. gas price/MMBTU	4.12	3.55	↓	Unit price (cents/KWH)	11.4	12.3	↑	Employment Stats	2011	2014		Employees in power generation industry	200,000	193,950	↓	Employees in solar power generation	480	1450	↑	<ul style="list-style-type: none"> <li>• Emissions regulations</li> <li>• Increased energy efficiency and growth of distributed power → reduced demand</li> <li>• Regulation for distributed generation</li> <li>• Grid reliability risk due to microgrids, dist. gen, storage</li> <li>• Employment in fossil fuel powered generation</li> <li>• Aging workforce</li> </ul>
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Power generation specific trends	Transmission and Distribution specific trends
<ul style="list-style-type: none"> <li>• <b>Solar power</b> is growing at a fast pace due to reduced production costs and lower installation costs. 53% of new capacity in the first half of 2014 is solar based.</li> <li>• <b>Total cost</b> to generate solar power is expected to be reduced from \$177/MWH in 2015 to \$81/MWH in 2030.</li> <li>• Solar Photo Voltaic installations have increased from 689 MWdc in Q3, 2012 to 1354 MWdc in Q3, 2014.</li> <li>• Firms like GE and Tesla are investing in <b>battery technologies</b> to improve the storage of power.</li> <li>• <b>Regulations</b> to become very critical in this industry as the end user may have to still use the grid.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Smart meters at a critical mass:</b> 46 million smart meters installed nationwide enabling real-time communication between providers and customers.</li> <li>• <b>Analytics:</b> Increased use of analytics in generation, transmission and distribution. On the generation front, sensor data analysis aids in recognizing patterns for equipment failure and maintenance. From a transmission and distribution point of view, it enables firms to monitor grid health, to better forecast demand and to engage, and target customers.</li> </ul>

## Details

### Industry Trends and Drivers

- **Slower demand:** Growth in electricity consumption over the past two years has been relatively flat or low and is expected to grow at a low rate till 2016<sup>1</sup>.
- **Economic activity:** Over next few years till 2019, stronger economic growth is expected to lead to increased incomes which will stimulate greater demand for electricity<sup>2</sup> in the residential segment.
- **Commercial and industrial:** From a commercial and industrial stand point, businesses will expand into new office spaces that require more electricity to run, and industrial producers are expected to ramp up production for various goods<sup>3</sup> that leads to increased demand of power.
- **Profit margins:** Higher profit margins are expected over the next few years due to higher retail power prices and lower natural gas prices.
- **Smart grid security:** As many benefits as smart grid provides in terms of intelligence and automation, securing the grid where the physical infrastructure interacts with information infrastructure is becoming more and more critical. Security to prevent cyber-attacks and address privacy of the average consumer will be the key<sup>4</sup>. Many firms are already developing state of the art solutions to address smart grid security<sup>5</sup> and this will continue as standards evolve. Current security regulation has minimal federal guidance and the responsibility falls on the individual state commissions which lack experience. This drives the need for utilities to educate the regulators as firms make new security investments<sup>6</sup>.
- **Consolidation:** Since 1995, the number of electricity utility holding companies has been cut in half. 2014 was a huge year in terms of deal activity (> 160 deals were made in 2014<sup>7</sup>); even though there was dramatic decrease in the number of deals in Q1, 2015, the value of the individual deals was higher compared to Q1, 2014. Strong interest is seen in the contracted renewable assets and renewable development pipelines over the rest of the year.

### Industry Forecast<sup>8</sup>

- **Generation:** Based on the expected economic conditions, the US electricity generation is expected to grow by 1.1% in 2015 and 0.9% in 2016.
- **Demand:** Overall electricity consumption including commercial, industrial and residential sectors is expected to grow by 0.8% in 2015 and 0.9% in 2016. Residential sector is expected to foresee a decline of 0.3% in electricity consumption in 2015 due to milder temperature forecasts.
- **Pricing:** Retail pricing is expected to increase slightly by 1% in 2015 and 1.8% in 2016 for the residential and commercial sectors. For the industrial sector, pricing is expected to decline by 1.4% in 2015 and increase by 1.6% in 2016. The decline in industrial sector price will bode well for manufacturing especially in light of the expected increase of manufacturing production index by 2.9% in 2015.
- **Fuel Mix:** The mix of energy sources used to generate power are expected to change over the next two years. Total generation fueled by coal is expected to decline from 39% in 2014 to 35.6% in 2015 as some coal powered

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<sup>1</sup> U.S. Energy Information Agency, Short-term Energy Outlook, Jul. 2015

<sup>2</sup> Ibid

<sup>3</sup> U.S. Energy Information Agency, Macroeconomic Indicators, Short-term Energy Outlook, Jan. 2015

<sup>4</sup> Top 5 Smart Grid Trends to Watch in 2014: End-of-Year Report Card, Transmission and Distribution World magazine

<sup>5</sup> Top 18 smart grid security companies, <http://www.technavio.com/blog/top-18-smart-grid-cyber-security-companies>

<sup>6</sup> Utility Dive, State of the Electric Utility, 2015, Jan. 2015

<sup>7</sup> North American Power and Utility Deals, PWC Q4 2014, Q1 2015 Reports

<sup>8</sup> U.S. Energy Information Agency, Short-term Energy Outlook, Jul. 2015

plants are retired and as lower and declining natural gas prices will make that source more attractive. This decline in coal is balanced by increase in natural gas based generation which rises from 27.3% in 2014 to 31% in 2015 and by increase from the renewable sources which rises from 6.7% to 7.9% during the same period. Of the new capacity addition in 2015, natural gas based generation is expected to be one of the dominant fuels according to the top 10 electricity generators based on market value<sup>9</sup>. The expected lower price of natural gas in combination with the expected implementation of more stringent carbon emissions regulations, will aid in the continuous shift from coal to natural gas<sup>10</sup>. April 2015 marked the first time ever that natural gas generated more electricity than coal.

- **Renewables:** Even though the fossil fuel based power generation industry is at a mature stage, renewables based generation is in the growth phase and power produced from renewable sources increased from 4.7% in 2011 to 6.7% in 2014 and is expected to be 7.9% in 2016.
- **Distributed generation:** Distributed generation refers to power generated at the point of consumption. This includes solar based generation, wind turbines, fuel cells, gas fired engines, etc. Currently 90% of the distributed generation in the US is contributed to solar energy. Solar based generation is expected to grow by 23% in 2015 and 10% in 2016.

### Industry Opportunities

- **Solar Power:** In terms of opportunity, solar power is poised to grow at the fastest pace over the next few years as the price of products and installation charges are expected to go down. Although distributed energy is a great opportunity, majority of the businesses are unsure of what type of business model to adopt. Part of the reason for this is lack of clear regulation. Some utilities are favoring a traditional approach of partnering with independent vendors while some are willing to try the new approach of buying power from customer-sited distributed energy.
- **Smart meters and smart grids:** Smart meters and other digital grid assets are delivering advancements in areas such as grid optimization, demand response, distributed generation, customer engagement. Smart metering also allows for distribution planning, load forecasting, etc.
- **Increased use of Analytics:** On the power generation front, based on the sensor data, analytics will help in putting together better equipment maintenance programs. It will also help integrate renewables and traditional generation to optimize demand response. On the transmission and distribution end, analytics will play a key role in understanding which components of the network are stressed and in turn have better maintenance and timely investments. It will also aid in distribution planning, demand forecasting based on usage patterns, load management by engaging with the end customer, etc. Customer engagement will enable firms to do better segmentation and have more targeted products and pricing programs.

### Issues/Challenges:

- **Emissions:** Emissions from fossil fuels are expected to grow by 0.9% in 2015 and 0.3% in 2016<sup>11</sup>. Due to regulations, some power generators are either retiring the coal based plants or replacing them with gas powered plants as coal generates higher emissions. The US EPA has been working on an approach to cut carbon pollution from power plants. The clean power plan for existing plants and new plants will maintain an affordable, reliable energy system, while cutting pollution. EPA announced proposed standards and is in the beginning process of proposing federal plan to meet the goals for cutting carbon pollution<sup>12</sup>.

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<sup>9</sup> 10Q Reports - 3Q2014 for Duke Energy, AEP, Dominion, NextEra, Southern Company

<sup>10</sup> IBIS World Industry Report: Coal & Natural Gas Power in the US, Dec. 2014

<sup>11</sup> U.S. Energy Information Agency, Short-term Energy Outlook, Jan. 2015

<sup>12</sup> FACT SHEET: Clean Power Plan & Carbon Pollution Standards Key Dates, EPA

- **Weather patterns:** Demand in a particular year is greatly impacted by the expected weather especially based on number of heating degree and cooling degree days.
- **Employment:** Due to flat/declining sales in electric power owing to the recent economic downturn and energy efficiency improvements, there has been a decline in power generation jobs especially in the fossil fuel based generation. These losses are slightly offset by the growth in employment opportunities in the renewables power generation with solar leading the way. The employment opportunities in the renewable sector are more geographically concentrated based on the proximity to the generation locations<sup>13</sup>.
- **Aging workforce:** Utility industry is facing a dearth of young employees at a time where the utility operations are becoming more complex with the advent of newer technologies. This will be challenge as the older workforce is more accustomed to conservative consensus driven culture that could be detrimental to further innovation<sup>14</sup>.
- **Increased energy efficiency** over the past few years in residential & commercial sectors and the growth of distributed generation is contributing to reduced demand for power<sup>15</sup>.
- **Distributed power:** The growth of distributed power like solar is expected to have a negative impact on the power transmission and distribution (T&D) industry as revenues coming into the T&D industry will be reduced.
- **Peak load estimates and generation:** Estimating peak loads during the time of day and time of year will be critical to manage production. Current challenges include production of much more peak power than needed or having more generation capacity on standby. Use of analytics to estimate the peak loads based on usage patterns will ease this problem.

#### **Distributed generation fast growth:**

- **Growth in Solar:** As of 2011, 4GW of solar power capacity has been installed in the US and is expected to grow to 9GW by 2016 and 20GW by 2020<sup>16</sup>. Key factors contributing to the increased capacity are government incentives in terms of tax credits, renewable portfolio standard laws<sup>17</sup> and the decline in cost of the solar panels and installation costs. Another encouraging sign for solar power is that the top 25 corporate users of solar power more than doubled their capacity since 2012. From a consumer perspective, increasing utility rates (tiered pricing with higher rates for higher usage) and time of use rates (depending on the time of day based on peak consumption), make moving towards distributed generation beneficial. More than 50% of the new capacity added in the first half of 2014<sup>18</sup> is from solar power and this trend is expected to continue. In the US, solar generated consumption is expected to have a CAGR of 16% over a 2 year period till 2016. The IEA report<sup>19</sup> shows that levelized cost of electricity or in other words cost to produce electricity for solar based generation on a comparable basis with other fuels will reduce from \$177/MWH in 2015 to \$133/MWH in 2020 and \$81/MWH by 2030. This significant reduction in cost makes solar more attractive to consumers. In comparison gas fueled power generation costs between \$65/MWH to \$ 130/MWH currently<sup>20</sup>. Another factor that is contributing to the solar power growth is the rise of innovative financing mechanisms that include power purchase agreements as they facilitate the sale of energy from solar producers.
- **Employment:** As of November 2014, solar power industry employs 173,807 workers representing a growth rate of 22% since November 2013. It includes installation, manufacturing, sales, and distribution, project development

<sup>13</sup> U.S. Energy Information Agency, Today in Energy, Dec. 19<sup>th</sup>, 2014

<sup>14</sup> Utility Dive, State of the Electric Utility 2015, Jan, 2015

<sup>15</sup> Ibid

<sup>16</sup> American Public Power Association, Distributed Generation – An Overview of Recent Policy and Market Developments, Nov. 2013

<sup>17</sup> IBIS World Industry Report: Solar Power in the US, Dec. 2014

<sup>18</sup> Solar Energy Industry Association, Market Insight Report, Q2 2014

<sup>19</sup> International Energy Agency Technology Roadmaps for Solar Electricity, 2014 edition

<sup>20</sup> U.S. Energy Information Agency, Annual Energy Outlook 2014

and other supporting jobs. This indicates that the solar sector has added jobs at a rate 20 times<sup>21</sup> faster than US job growth rate which is 1.1% during the same period. Over the next year, another 20% increase in jobs is expected in the solar industry.

- **Investments:** Battery storage improvements will enable solar energy customers to better store power. Tesla's planned gigafactory to manufacture batteries is another significant investment that will bode well for the solar industry<sup>22</sup>. GE has invested \$100M into its battery plant in NY that opened in 2012<sup>23</sup>.
- **Regulation:** Regulation will play a key role in the growth of solar power especially for the residential and commercial sectors where solar growth is the most. Mechanisms like net metering which gives credit to the end consumers for the electricity they add to the grid will give further incentive to switch to solar power. Some utilities does perceive these mechanisms as lost revenue opportunities and penalize their customers for the use of solar power (e.g. roof-top panel fee in Arizona<sup>24</sup>). Utilities need to think about challenges like grid reliability, variable generation from customer sites, system planning, etc. to build a business model. The state of New York's Reforming the Energy Vision (REV) is getting much attention these days as it is trying to address all these problems through a market mechanism for distributed energy resources similar to wholesale power market. This could drive the future of state regulatory commissions across country.<sup>25</sup>

### Increased use of analytics in transmission and distribution

- More than 46 million **smart meters** have been installed nationwide enabling real-time communication of data between customers and providers<sup>26</sup>. Using analytics, smart meters and other digital grid assets are delivering advancements in areas such as grid optimization, demand response, distributed generation, etc.
- From a power generation stand point, **sensor data analysis** leads to patterns for equipment failure, integrate renewables and traditional generation to optimize demand response. On the transmission and distribution end, analytics help understand which components of the network are stressed and thereby aid in timely maintenance and investments.
- From an end user perspective, **analytics enables customer engagement** by enabling the customer to monitor usage and thereby offer them dynamic pricing programs to manage loading; it also reduces the need to use peak generation capacity thereby allowing the generation facilities to operate more efficiently. Having this kind of customer engagement will help firms understand their behavior better and come up with better customer segmentation.
- While the lure towards analytics sounds attractive in terms of the advantages it provides, the real challenge will be firms ability to secure the data, to implement solutions that can realize a positive ROI and to understand how the operations and the technology come together<sup>27</sup>.

### Expertise

In light of the growth in distributed power generation industry, Enite offers a collaborative working approach to identify new investment opportunities and/or grow existing opportunities based on your firm's priorities and core competencies. Enite can help you develop a business case for the use of analytics in power generation, transmission & distribution by combining a successful framework, methodology, and suite of tools with a sound understanding of industry

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<sup>21</sup> National Job Solar Census Survey, 2014 - <http://tsfoundation.wpengine.com/national-solar-jobs-census-2014/>

<sup>22</sup> [http://www.teslamotors.com/sites/default/files/blog\\_attachments/gigafactory.pdf](http://www.teslamotors.com/sites/default/files/blog_attachments/gigafactory.pdf)

<sup>23</sup> <http://www.gettransportation.com/news/ge-expand-battery-start-new-york%E2%80%99s-capital-region>

<sup>24</sup> <http://www.businessweek.com/articles/2013-11-22/arizonas-new-fee-puts-a-dent-in-rooftop-solar-economics>

<sup>25</sup> Utility Dive, State of the Electric Industry 2015, Jan, 2015

<sup>26</sup> GigaOm - Utility Industry Trends to watch this year; IEE Report, August 2013

<sup>27</sup> Predictive Analytics – Beyond the Hype, Jan. 2014: Electric Light and Power Magazine

best practices, benchmarks, and operating models. Enite will help you evaluate your specific analytics needs and use our expertise for system selection.

Our subject matter expertise, industry, functional, and execution expertise provides insight to define strategic objectives to focus resources on, driving top and bottom-line performance. We provide a structure for turning objectives into actionable items, identify potential roadblocks, establish measurements for monitoring success and support management in executing a flexible strategic plan. By partnering with Enite our clients can expect high-caliber deliverables executed on time or ahead of schedule with little disruption to daily business operations.