White Paper

Quantifying the Value of Electricity Storage in Dynamic Use Environments

Part 1

Dr. Jimmie Lenz, Principal, Financial Risk Group

Financial Risk Group

Contents

A State of Disruption

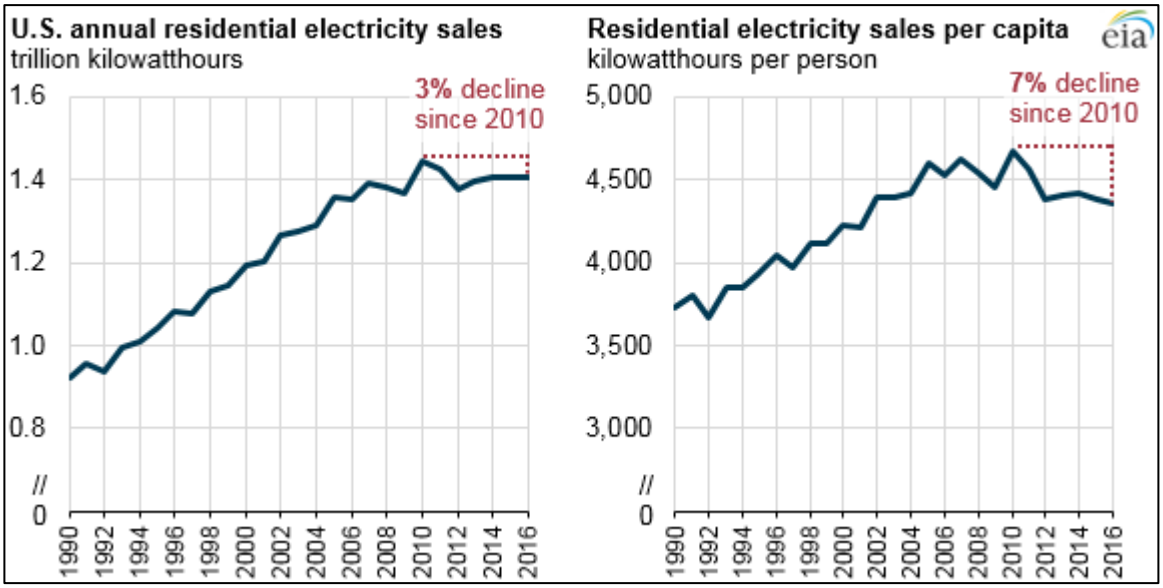
Like a number of other industries in the United States, Electricity Generation is in a state of disruption. However, unlike other industries, the velocity and magnitude of swings are extreme. Along with this disruption come a number of challenges for companies that produce and distribute power throughout the US. The need to meet peak demand during a time in which demand curve tails are lengthening is, and will continue to be, a challenge for all types and sizes of providers. In this White Paper we articulate the problem in some detail and provide insight into a search for novel solution approach.

Changes to Usage

There are significant changes in usage and generation that companies involved in electricity generation are experiencing, and the trends in play are not likely to change. One impact that is driving the search for new solutions is the basic economic principal of price.

As an example, the state of Texas is served primarily by a grid that priced one megawatt hour at about $25.00 in 2016, less than half of what a megawatt garnered ten years ago ($55.00), according to the Electric Reliability Council of Texas. Texas is not an anomaly; this is being experienced across the country and much of the developed world. And the impact has ramifications in other industries as witnessed by large scale employment reductions at Siemens AG and General Electric (some 6,000 and 12,000 respectively), both of whom produce large turbines for electricity generation.

According to the U.S. Energy Information Administration (EIA), residential sales have decreased an average of 3.0% since 2010. While remarkable on its own this decline masks the true magnitude of the issue. Per capita sales have been reduced by 7.0%, a rather staggering metric when viewed in terms of the size and maturity of the market.



Source: U.S. Energy Information Administration, *Electric Power Annual* and U.S. Census Bureau Population estimates

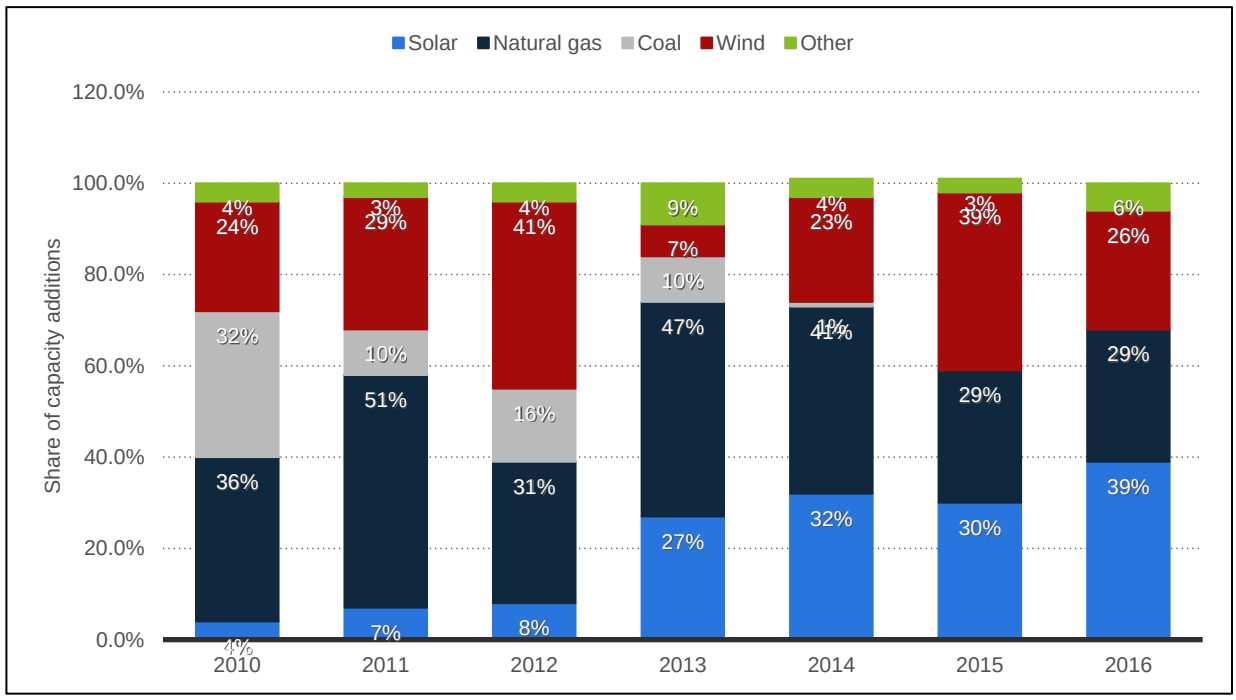
Reductions in use are the result of both the voluntary and mandated energy efficiency efforts that have been introduced to residential users, and which will very likely continue to be realized and increase in the near future. Industrial use has likewise decreased, although peaking a bit earlier in 2000, currently off 7.3% from the high. Changes realized through efficiencies are the marked increase in the utilization of

alternative sources of power. However, efficiencies that are realized on one level may generate unintended consequences at other points. Electric vehicles, specifically the charging of their batteries, are an example that will be addressed a bit later.

Increased Alternatives

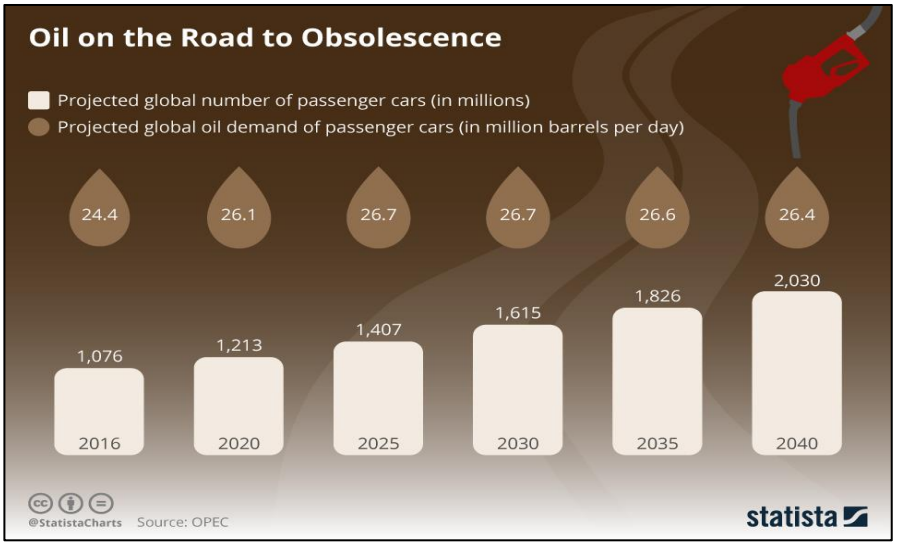
In addition to efficiency measures that are impacting the electricity generation landscape are the alternatives to traditional power generation, which will likely be the primary source of future demand reductions experienced by commercial electricity producers. It comes as no surprise that small and large scale photovoltaic (solar) use has continued to be adopted exponentially across the U.S., and in fact continues to experience dramatic improvements in terms of production and cost effectiveness. The other primary source of alternative power is the proliferation of wind-related generation facilities, both on- and off-shore. To insure the veracity of this work, research conducted for this paper utilized a number of governmental and public research sources, as well as proprietary data from different types of electricity generation and distribution organizations.

Share of electricity capacity additions in the United States from 2010 to 2016, by resource



Source: SEIA; FERC; Greentech Media, Statista

While the efficiency efforts around electricity use are pronounced, this is not an anomaly. The result of such efforts are being realized in all types of electricity usage. The chart below illustrates the effect of efficiency efforts in autos that closely parallels that being witnessed in the electricity usage environments.



The context of a soon to be released White Paper, "Quantifying the Value of Electricity Storage in Dynamic Use Environments — Modeling to Optimize Acquisition and Execution" explores how the modeling techniques developed by FRG can optimize new technologies to increase the economics for companies that generate and distribute electricity. These modeling techniques draw from work in a number of industries including capital markets, in particular, derivatives and commodities trading. While much of the perspective is that of the United States the findings and solutions devised have implications in regions across the globe. Utilizing an economic viewpoint is important for the producers and the consumers of electricity, insuring that the ability to meet changing demands, in dynamic environments, can be accomplished over the long term.

More Information

FRG would welcome the opportunity to speak with you concerning the findings of this paper, as well as how the approaches developed may fit into specific environments. For more information contact the FRG Research Institute at Research@frgrisk.com or 919.439.3819.

VISIT US ONLINE AT WWW.FRGRISK.COM

FINANCIAL RISK
GROUP

264 W CHATHAM ST CARY NC 27511 P + 1 (919) 439-3819

www.frgrisk.com | info@frgrisk.com