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Germany Reveals the Foundation for a Renewable Future

By John Kelly

While many scholars and experts debate the approach Germany utilized to achieve a non-high head hydro renewable energy goal of 30%, a recent UL research study uncovers how they built the foundation for this accomplishment[1]. The footing for this transformation is a restructured electricity market and the foundation walls include an independent system operator (ISO) and distribution system operators (DSOs) that encourage, value and leverage customer generation and demand response.

> "The Story of Germany's experience is essentially one about balancing the grid and keeping it stable by enabling grid operators, renewable energy suppliers, and customers to work together to ensure grid stability"

These ISO and DSO foundational elements enabled distribution level community and customer response in real-time to stabilize the grid during large changes in renewable power output or customer demand. This included a real-time energy market platform and self-healing distribution which enabled innovators to create a system wide network of virtual power plants (VPPs) that correct grid imbalances in seconds. There are now more than 30 active VPPs using artificial intelligence to control massive amounts of local generation and load in real-time. A solar eclipse in March of 2015 verified the VPPs ability to manage grid stability when 80% of the sun's light was blocked for about 3-hours. Overall German grid reliability continues to get better with increasing amounts of renewable generation[1].

Yet a widespread mentality with the large utilities in the US is that it is not possible to put more than 10% renewables without jeopardizing grid stability. How did Germany overcome these seemingly insurmountable concerns regarding high penetration of local renewable power? They completely reimagined and redesigned a regulatory and operating model to create a competitive and price responsive grid. This included:

1. Generation restructuring which releases consumers from the monopoly generation model that protected older and outdated coal, nuclear, and natural gas technology.
2. ISO markets that allow for competitive long term bi-lateral contracting so that customers can choose their generation supplier while also offering real-time hourly power-pools that enable customers and generators to compete to address system imbalances in real-time.
3. Modernization of electricity distribution systems to embed automated smart switching and redundancy that provides for real-time self-healing distribution and two-way power flow.
4. Ancillary service payments to generators and customers that value transmission and distribution level services including demand response, power quality services, and voltage support.
5. Standards that enable optimization of this new electricity marketplace while also holding new private sector entrants accountable to rigorous performance criteria. For example, The US Green Building Council created Performance Excellence in Electricity Renewal (PEER), to provide stakeholders with a framework, roadmap, and verification scorecard for working together to build the foundation for a renewable energy future.

[1] http://library.ul.com/wp-content/uploads/sites/40/2015/10/ULEnergy-Study-Template_FINAL_low-res.pdf

How did electricity restructuring build the foundation for renewable power?

As long as utilities maintain a monopoly to provide generation, local solar erodes the utility business model and is at odds with the utilities mandate for fair, low cost service. Historically, the electricity system is built and operated by vertically owned utilities that are granted a monopoly to build generation, transmission, and distribution to supply power to buildings and industry. Under this governance model, fossil fuel generation is built to cost effectively meet user demand. These fossil fuel generation assets are financed over 30 or more years and become the defacto lowest cost option for three to five decades and, therefore, a barrier to new cleaner and renewable technology.

For example, China[2] and India[3] are currently building out massive coal generation fleets to meet growing demand. This will become the default generation source for 30 or more years to enable the utility to recover investment costs. Even after capital costs are recovered, vertically integrated utilities argue rightly that the coal plant output is the lowest cost option for consumers when compared to new capital investment for renewable power that must be recovered through increasing rates.

Electricity restructuring moves utility generation into competitive markets where older technologies are forced to compete on equal footing with renewable and more efficient generation. This establishes a solid foundation for progress and innovation. It also enables, the private sector to risk capital with no guarantee of a rate of return. In competitive generation markets, new generators can and have put existing generation out of business. This is evident in the US where the private sector has invested billions[4] in wind and ultra-efficient combined cycle (CCCT) natural gas power that is driving existing low efficiency coal and natural gas generation into retirement[5]. In the US alone restructuring of generation markets attracted private investment into over 60 GW of wind and 200 GW of high efficiency combined cycle natural gas fired generation[5].

However, restructuring of generation markets was only the footing. Competitive generation markets only become stable when supported by bi-lateral, ancillary service, and real-time markets that enable and encourage long term contracting for renewables, local generation, price response and demand response. Distributed energy and demand response provide for real-time demand and price stabilization through participation in real-time price markets. This also establishes an elastic electricity market place which lowers costs for all users. There are only a few other places in the world that are following in Germany's footsteps regarding real-time customer and local generation participation. This includes three Independent System Operators in the U.S. – PJM, New York ISO, and New England ISO – that provide competitive generation and real-time market access at all customer levels – residential, commercial, and industrial.

[2] China plans to add 350 GW to their existing fleet of 900GW of coal fired generation, here
[3] India is planning to add about 500 GW to their existing fleet of coal fired generation, here
[4] Achieve cheaper, cleaner electricity now through restructuring, by John Kelly, here
[5] US Annual Energy Outlook 2016, Table A9 and A16, here

Why are performance standards important in these new competitive markets?

Regulators, investors, operators, and customers can benefit from the establishment of performance standards that enable optimization of this new electricity marketplace while also holding new private sector entrants accountable to rigorous performance criteria. European Electricity Quality Standard EN 50160 establishes standards for Germany. The US Green Building Council worked with industry leaders and stakeholder over the past eight years to create Performance Excellence in Electricity Renewal (PEER), a rigorous design and rating system for electricity generation and delivery systems. PEER provides stakeholders with a framework, roadmap, and verification scorecard for working together to build the foundation for a renewable energy future. This includes:

- A framework that enables cities and utilities to work together to create utility microgrids with nested private microgrids and resilient buildings
- Specific distribution self-healing criteria and rating system
- Specific resiliency criteria for helping cities, utilities, microgrids, and buildings create improved operating models and building a business case for islanding of critical facilities
- A comprehensive energy efficiency and environmental scorecard that holds projects accountable for other key performance metrics in addition to carbon including water consumption, SO2, NOx, local emissions, waste recycling, and power energy efficiency
- A platform for customer engagement and contribution to accelerate investment in distributed generation and renewable power

Summary

Some were quick to attribute Germany's success solely to feed-in tariffs, missing the critical foundation that was built quietly over the past two decades through innovative leadership and policy. Leaders worldwide can learn and benefit from Germany's achievements by looking deeper into the foundational steps that made these achievements possible. This included generation restructuring, real-time participation by customers, self-healing electricity systems, ancillary service payments to customers, and performance standards (e.g. PEER).