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The Future of Utilities: Extinction or Re-Invention?
A Transatlantic Perspective

by Susanne Fratzscher

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by Susanne Fratzscher

Utilities are experiencing an unprecedented change in their operating environment, which requires a broad reinvention of business models. Historically, a centralized and grid-connected power generation structure positioned utilities in the center of the power system, with a culture focused on regulators and mandates rather than innovation and customer service expectations. This utility business model is now profoundly questioned by the accelerated deployment of distributed energy resources and smart grid technologies, as well as profound changes in market economics and regulatory frameworks. This is a global trend, to which utilities and regulators around the world seek to find adequate solutions.

The utility business model is now profoundly questioned by the accelerated deployment of distributed energy resources.

The devastating results of Germany's 'Big 4' utilities during the past years show that a variety of disruptive trends pose existential threats to the utility industry. Pushed by the country's ambitious energy transition – or Energiewende – Germany's utilities had to take a head start in the global utilities transformation process. As a most far-reaching precedent, E.ON, the world's largest utility in terms of revenues, announced a break up in December 2014. By 2016, E.ON plans to create a holding of old coal and nuclear assets along with newer natural gas plants, and to start an 'innovative' new business focusing entirely on renewables, smart customer services and distribution. Having opposed renewable energy policies for many years, and having seen a 70% capitalization loss and several credit downgrades, E.ON management finally decided to develop a new strategy and culture. In the US, several utilities have similarly started to adopt more innovative business models, whereas others still resist change and try to cling on to their century-old mandate and protection.

What are the **transformative trends** that challenge the utility industry on both sides of the Atlantic? What opportunities for **business model innovation** can utilities develop to adapt to these changes?

Facing the convergence of various disruptive technology, policy and market trends, such as more distributed renewable energy, lower power demand, smarter distribution and regulation, as well as more engaged customers and competitors, utilities need to pursue more **distributed and integrative busi-**

ness models, as well as more **customer- and service-oriented approaches**.

This paper first looks at the current power market landscapes in the US and Germany to understand the respective potential for business model innovation. It then draws a picture of the transformative trends to which the industry has to adapt over the next years. Finally, we highlight some pioneering approaches to business model innovation in the US and Germany, which show that utilities can become 'motors in the engine room'[1] of a low-carbon energy transition.

A. The Current Power Market Landscapes in the US and Germany

The current power market landscapes in the US and Germany show that approaches to business model innovation will be diverse. Utilities operate under different regulated or deregulated market models, varying ownership structures and in a complex value chain of generation, transmission, system operations, distribution and retail sales. Market models differ in their degree of regulation and competition in the value-chain, framed by varying policy and regulatory settings.[2]

The current power market landscapes in the US and Germany show that approaches to business model innovation will be diverse.

In the US, electricity markets are highly diverse. Ownership structures vary from 192 investor-owned utilities (IOUs) serving over 73% of all US customers, to 2,009 publically owned municipal utilities (14% of US customers), and 871 electric cooperatives (13%). **Regulated markets** dominate most of the Southeast, Northwest and much of the West (excluding California). Here, vertically integrated monopoly utilities cover the entire value chain with oversight from a public regulator. New business models in regulated markets require regulatory changes[3] that provide more performance-based incentives for greater efficiency and innovation.

In 24 US states, such as California, Texas and most states in the Northeast, **deregulated markets** have opened up generation for competition from independent power producers. 15 of these states and Washington, D.C. have also introduced retail choice,[4] which allows residential and/or industrial consumers to choose their supplier. The role of utilities in deregulated markets is focused on owning, maintaining and operating distribution infrastructure, and depending on their business model, on procuring and marketing power

1 Leprich, Uwe, Transformation des Stromsystems: die Akteursrollen im Maschinenraum der Energiewende, Institut für ZukunftsEnergieSysteme (IZES), 2014.
2 Shively, Bob / Ferrare, John, Understanding Today's Electricity Business (2012), 101-116.
3 Lehr, Ronald, Utilities and Regulatory Models for the Modern Era, 2013.
4 In the US, numerous retail choice models exist, varying mainly by their degree and duration of (price-regulated) default service procurement. – Kim, Young, Unfinished Business: the Evolution of US Competitive Retail Electricity Markets, in: Sioshansi, Fereidoon P., Evolution of Global Electricity Markets, 2013.

for retail sales. Deregulated markets provide more competitive pressure and more flexibility to foster business model innovation.

The German energy transition has forced the electric industry into a pole position for developing new business models, as the market has now a large number of citizens and energy cooperatives that produce electricity.

In **Germany**, the power market is **fully deregulated**[5] and characterized by a high degree of diversity, with four large integrated utilities and about 900 regional and local municipal utilities. The energy transition, in conjunction with the Renewable Energy Act that introduced feed-in tariffs in the early 2000's, has **forced the electric industry into a pole position** for developing new business models, as the market has now a large number of citizens and energy cooperatives that produce electricity.

The **German Energiewende**[6] is transforming the energy system of Europe's most populated and industry-heavy country from traditional coal and nuclear to energy efficiency and renewable energy[7] (see Figure 1). Germany is committed to phasing out nuclear by 2022, and targets a minimum share of 50% renewable power by 2030 (80% by 2050), and a 50% reduction of primary energy consumption by 2050 (compared to 2008), particularly in the building sector.[8] The main drivers for this transition are: Germany's objective to reduce its energy import dependency and its reliance on dirty coal and nuclear, its ambition to fight climate change, and the aim to stimulate technology innovation and employment[9] in a green economy. As renewables become increasingly cost-competitive, there is no doubt that the Energiewende is here to stay.

The Energiewende affected Germany's three utility groups in a different way. The **four large centralized utility conglomerates, the 'Big 4'**, (see Figure 2) were the worst hit. Having dominated the market for a long time, E.ON, RWE, EnBW and Vattenfall owned and ran about 80% of Germany's generation capacity, predominantly centralized fossil- and fissile-fueled power plants. They reduced the historically prominent role of the local municipal utilities to mere re-distributers of electricity. The generation share

5 Following EU directives, Germany fully opened electricity generation and retail sales for competition in 1998. Transmission has been unbundled completely from generation since 2005. Four transmission system operators own and operate the assets, and serve as system and market operator. The Federal Network Agency (BNetzA) regulates the national grid. The regulation of revenues is divided between federal (BNetzA) and state regulatory authorities. - Agora Energiewende, Report on the German Power System, 2015.

6 Detailed background information on the German Energy Transition is available at http://energy-transition.de.

7 For a concise overview of broader lessons to US policy makers and electric industry from Germany's experience, see a recent Brookings study by Ebinger, Charles / Banks, John P. / Schackmann Alisa, Transforming the Electricity Portfolio: Lessons from Germany and Japan in Deploying Renewable Energy, Sept. 2014.

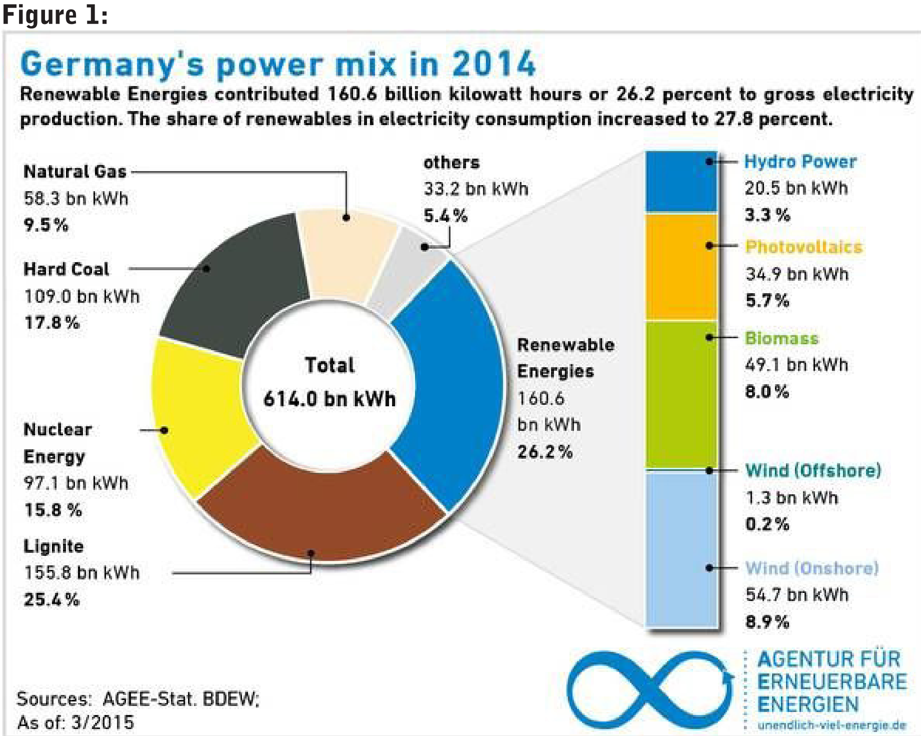
8 Federal Ministry of Economic Affairs and Energy, Second Monitoring Report 'Energy of the future', 2014.

9 Around 380,000 Germans work in the renewables sector – far more than in the conventional energy sector.

of the 'Big 4' has, however, dropped to 47% since 2011, when the German government decided on a nuclear phase-out by the year 2022 and eight reactors were immediately taken off the grid. Underestimating the improving economics for renewables and the persistence and dynamics of the Energiewende policies, the four large centralized utility conglomerates were very slow in investing in and adopting renewables, and now own only 5% of Germany's installed capacity.[10] Instead, they invested heavily in coal- and gas-fired power plants in the mid-2000's. This has left them with significant overcapacities that are now unprofitable due to the low marginal costs of renewables and their related merit order advantage of lowest-cost power sources being dispatched first. In addition, renewables have caused wholesale power prices to drop by half and peak premia by almost four-fifths, erasing the utilities' 'bread-and-butter' revenue source.[11] What at the time may have looked like a prudent business decision to protect investor interests, in hindsight has to be qualified as clear mistake of the 'Big 4': leaving the 'small-sized' business with decentralized renewable energy to others, in particular to citizens and renewable energy cooperatives.[12]

Renewables have caused wholesale power prices to drop by half and peak premia by almost four-fifths, erasing the utilities' bread-and-butter revenue source.

Figure 1:

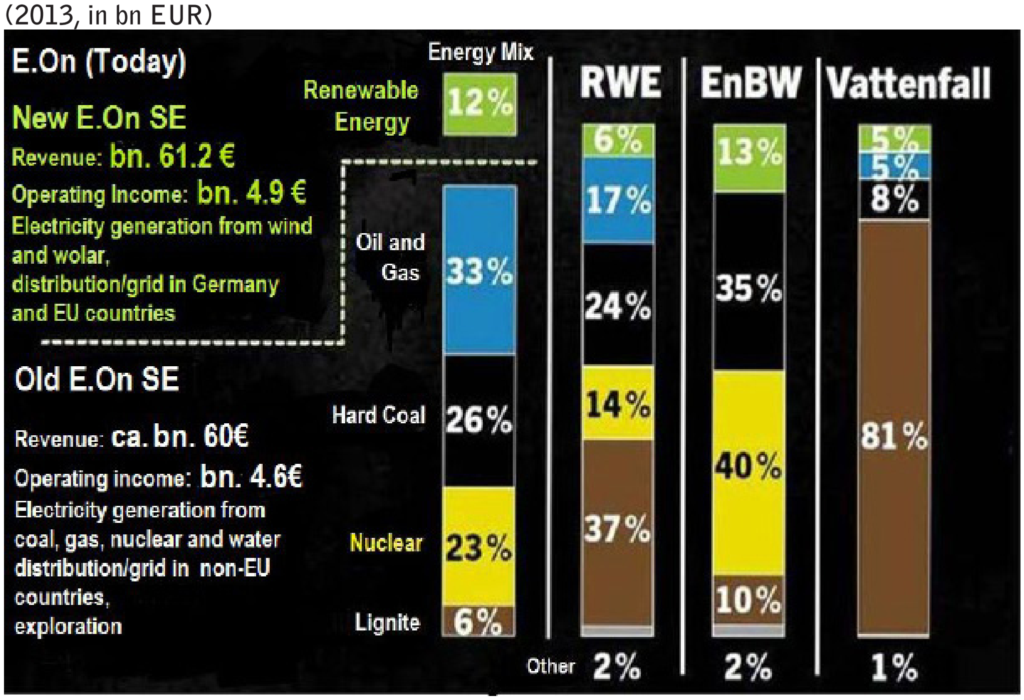


Source: AEE (Agentur fuer Erneuerbare Energie), 2015.

10 Bontrup / Marquardt analyze in detail the economic situation of the 'Big 4', their crisis response and future perspectives. Bontrup, Heinz-Josef / Marquardt, Ralf-Michael, Die Zukunft der großen Energieversorger, 2015.
11 Tenbrock, Christian, Riesen Taumeln im Wind, Zeit Online, Sept. 17, 2013.
12 Wildhagen, Andreas, Die letzte Schlacht der Stromkonzerne, WirtschaftsWoche, June 24, 2014.

The **German generation market** is now highly fragmented and localized, with over 50% of the supply companies being owned by citizens, rural communities or by regional and local municipal utilities.[13] The same trend is occurring in the retail sales market. With over 900 electricity suppliers, this market is very fragmented and competitive, and the retail market share of the 'Big 4' has been continuously decreasing to below 44% in 2013, down by over 10% since 2011.

Figure 2: Generation mix of the German 'Big 4' electricity conglomerates (2013, in bn EUR)



Source: WirtschaftsWoche, Aufspaltung des Energieriesen: Kommt E.Ons Not-bremse zu spät?, Dec. 10, 2014 (translated).

The crisis has triggered significant reorganization plans and write-offs and an intense search for new business models.

As a result, the 'Big 4' have lost 70% of their market capitalization since 2008 on average and carry huge liabilities[14] (see Figure 3). This crisis has triggered significant reorganization plans and write-offs and an intense search for new business models.[15] Germany's largest utility E.ON[16] announced plans to get rid of its core business of commodity-driven conventional power generation by 2016, which will be part of a new 'Uniper'

13 Municipal power plant capacities in 2013: 22,623 MW (13.5% renewables, 44.4% CHP, 42.1% conventional power).
14 The Economist, European utilities: How to lose half a trillion euros, Oct. 12, 2013.
15 Bontrup, Heinz-Josef / Marquardt, Ralf-Michael, Die Zukunft der großen Energieversorger, 2015.
16 2013-revenues in billion USD: E.ON (D): 162.6; GDF Suez (F): 118.6; ENEL (I): 106.8; EDF (F): 100.4; RWE (D): 68.2; Tokyo Electric Power (JP): 66; Korea Electric Power (SK): 49.4; […]; ENBW (D): 27.3; Exelon (US): 24.6; Duke Energy (US): 24.6; Huaneng Power Intl (China): 21.8 – Statista, 2014.

company.[17] E.ON itself will focus entirely on renewables, distribution and smart energy services.[18] E.ON's strategy is by far the most radical one, stripping the company down to a fraction of its former business and completely changing its nature. RWE, Germany's second largest utility, has announced considerable layoffs, the closure or sale of generation assets and of other parts of the company, as well as a stronger focus on new business fields and customers. Germany's third largest utility EnBW, which is almost fully publicly owned by the state of Baden-Wuerttemberg, has to shut down 40% of its fleet due to the nuclear phase-out and is thinking along the same lines as E.ON, focusing entirely on renewable energy generation, distribution and energy services. For political reasons, the Swedish energy giant Vattenfall is considering selling its coal facilities and eventually exiting the German power market altogether.

One of the Big 4, the Swedish energy giant Vattenfall, is considering selling its coal facilities and eventually exiting the German power market altogether.

Figure 3: Share Price of selected German Utilities vs. DAX 2006-2015 (Index May 2006 = 100%)

Source: www.finanzen.net[19]

Regional utility service companies (Regionalversorger) have **adapted well** to the Energiewende. These mid-sized regional utilities, such as MVV Energie in the Mannheim region, mainova in the Frankfurt/Main region and SWM in the Munich region,[20] cover all competitive functions of the elec-

17 E.ON press release, E.ON moves forward with transformation: key organizational and personnel decisions made, April 27, 2015.

18 Several commentators provide some sharp analysis of the E.ON announcement, comparing the 'outsourcing' of conventional generation with a 'bad bank' approach and doubting about the legacy costs of the nuclear phase-out: Schäfer, Ulrich, E.on und E.off: Zukunft der Energiekonzerne, Süddeutsche Zeitung, Dec. 2, 2014; Böhmer, Reinhold, Zehn Lektionen aus E.ONs Radikalumbau, WirtschaftsWoche, Dec. 2, 2014.

19 Taken from Oberserver Research Foundation http://www.orfonline.org/cms/sites/orfonline/modules/enm-analysis/ENM-ANALYSISDetail.html?cmaid=81608&mmacmaid=81609

20 www.mvv-energie.de; www.mainova.de; www.swm.de

tric value chain either directly or through partners. They represent over 8% of German retail sales, and are either investor-owned (with a considerable share of public shareholders) or fully publically owned. They have focused on meeting their clients' needs and expectations through investments in renewable energies and offer innovative energy services. Many of them intelligently use cogeneration to rely on power and heat for balancing their budget. They use their size, local proximity and emotional ties to their customers to their competitive advantage. They focus on quality of service instead of excessive price competition with discount retailers. Being decentralized in their structure and focus, regional utilities are well positioned to respond to the increasingly distributed power generation and consumption that the Energiewende asks for.

Local municipal utilities (Stadtwerke) are **preparing for vast changes** in their business models after a period of significant downturn that resulted from the previously dominant market position of the 'Big 4' and from increased competition by new discount retailers. While municipal utilities constitute the majority (700) of Germany's 940 local distribution system operators (DSOs) and of its over 1,100 retail suppliers, they are highly dependent on buying power from the 'Big 4'. Many Stadtwerke are struggling with a lack of investment capacity and with adopting a new business culture that focuses more on energy services than kWh-sales. Despite these challenges, a 're-municipalization' trend is noticeable in Germany[21]: communities and cities such as Hamburg are buying back expiring local grid operating concessions, which they had previously sold to the 'Big 4'. Since 2005, over 120 local municipal utilities have been founded.

In Germany, an increasing number of communities have taken over their own energy supply.

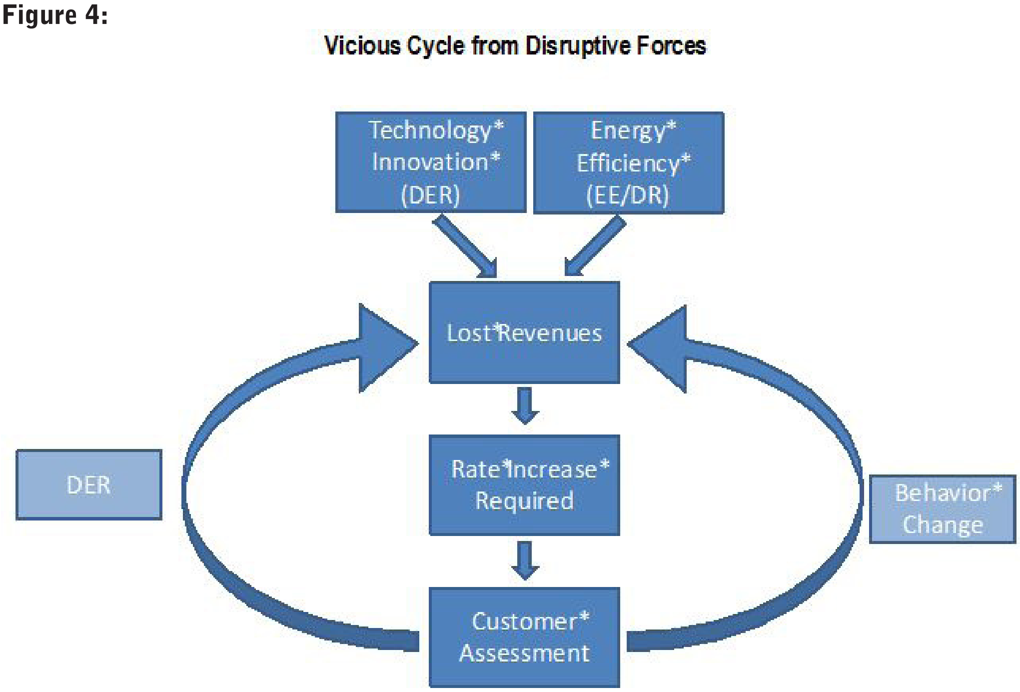
In addition to the traditional utility industry, an increasing number of **communities have taken over their own energy supply**. In Germany, 146 communities and regions, ranging from 1,000 to 1 million inhabitants, are implementing 100% renewable energy strategies: major cities such as Frankfurt and Hannover, smaller cities like Schwäbisch-Hall, or even small towns like Schönau.[22] Several of them are already fully energy independent in their power and heat supply. The EU undertakes significant efforts to strengthen these so-called '100% renewable energy communities'. In the US, too, a growing number of communities are engaging in distributed energy generation: 56 villages, cities and counties across the country are considered as 'Green Power Communities'.[23]

21 Berlo, Kurt / Wagner, Oliver, Stadtwerke-Neugründungen und Rekommunalisierungen, Wuppertal Institute for Climate, Environment and Energy, Sept. 2013.
22 www.kommunal-erneuerbar.de/de/energie-kommunen/kommunalatlas.html; http://www.100-ee.de/projekt; www.100-res-communities.eu/eng/communities2
23 www.epa.gov/greenpower/communities

B. Transformative Trends – What Future Power Landscapes Could Look Like

In the US as in Germany, utilities face a convergence and acceleration of very similar transformative trends related to changing technology, policy and market developments. The following trends will profoundly alter the current power market landscape and require business model innovation on both sides of the Atlantic. The next few years will be a decisively pivotal period for utilities to adapt and reinvent their future rather than being drawn into a 'vicious cycle from disruptive trends' (see Figure 4) or, as others call it, the 'utility death spiral.'

Figure 4:



Source: Peter Klein, Disruptive Challenges: Financial Implications and Strategic Responses to a Changing Retail Electric Business, EEI, 2013.

The next few years will be a decisively pivotal period for utilities to adapt and reinvent their future rather than being drawn into the utilities death spiral.

1. Supply will be increasingly decentralized

Even if the market share of renewable generation is still comparatively limited, small-scale distributed capacity represented about one third of new global investments in clean energy in 2014, approx. US$ 80bn.[24] Overall, renewable energy (excluding large hydro) made up 48% of the new power capacity added globally in 2014, the third successive year in which this figure has been above 40%.[25] These investments are still strongly driven by

24 Bloomberg New Energy Finance (BNEF), Global Trends in Clean Energy Investments: Rebound in Clean Energy Investments Beats Expectations, Jan. 2015.
25 Frankfurt School-UNEP Centre / BNEF, Global Trends in Renewable Energy Investment 2015, 2015.

government mandates and policy incentives, such as feed-in tariffs or quota systems (Renewable Portfolio Standards). However, decreasing costs, particularly for onshore wind and solar photovoltaics (PV) (see Figure 5), continue to improve the economics of renewables even without incentives. As a global trend, the national average price of an installed PV system in the US decreased by 63% between 2010 and 2014, reducing costs for a residential rooftop system to US$3.48 per watt.[26]

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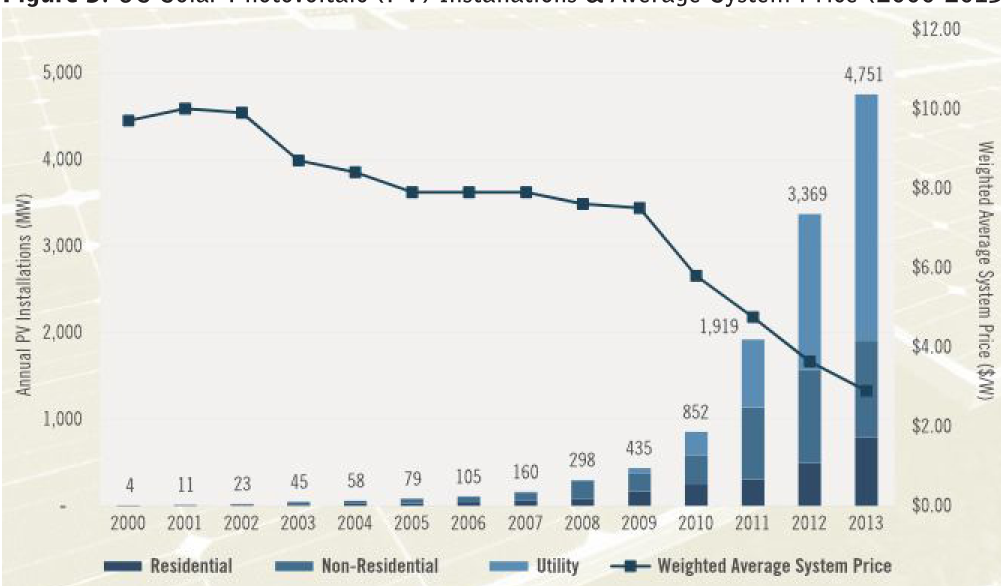
Figure 5: US Solar Photovoltaic (PV) Installations & Average System Price (2000-2013)



Source: GTM Research and Solar Energy Industries Association (SEIA), US Solar Market Insight Report: 2013 Year-In-Review, 2014.

While decentralized large-scale wind projects by independent power producers initially led the way in the US and now account for 65,900 MW,[27] customer-sited distributed generation, particularly rooftop solar, has significantly increased – a trend expected to accelerate as costs for PV decrease even further. The US added about 6,201 MW of PV in 2014, totaling 18,300 MW, a 30% increase over 2013 and more than 12 times the amount installed five years earlier.[28] In Germany, thanks to the Energiewende, decentralization is well advanced: In 2014, 157 TWh (of 610 TWh in total) were generated from decentralized renewable sources, accounting for almost 28% of domestic electricity consumption.[29]

On both sides of the Atlantic, many incumbent utilities are still slow in adapt-

26 Solar Energy Industries Association (SEIA), Solar Market Insight Report Q4 2014, Dec. 2014.
27 American Wind Energy Association (AWEA), US Wind Industry Fourth Quarter 2014 Market Report, Jan. 2015.
28 SEIA, Solar Market Insight Report Q4 2014, Dec. 2014.
29 Association of the German Energy and Water Industry (BDEW), Jan. 2015.

ing to this trend of competitive renewables and prefer to stick with their accustomed model of centralized and large-scale, fossil- and nuclear-fuel generation. For the majority of US utilities, renewables still constitute just 0.1-3% of retail sales. Only the utilities that serve sunny or windy states and/or are forced to by ambitious state policy mandates have renewables accounting for 12-21% of their retail sales.[30] In Germany, the 'Big 4' still only own 5% of the renewables capacity.

Increasingly favorable market and regulatory conditions will lead to an acceleration of this trend towards decentralization of electric supply (and demand). This will pressure utilities to profoundly change their centralized way of thinking and doing business. However, it will also increase the financial pressure for these utilities to make significant investments in grid infrastructure and system operations to enable the integration of distributed and variable renewable energy generation.

2. OECD energy demand will continue stagnating or declining

While the economic slowdown has been the main reason for declining electricity demand since 2008, better energy efficiency measures, particularly from stringent building codes and appliance standards[31], will decrease the importance of kWh sales as utility business drivers. In Germany, electricity demand has declined since 2011, and energy efficiency, expressed as final energy consumption per unit of real GDP, has increased annually by 1.67% on average since 1990.[32] The US EIA foresees electricity growth of only 0.9% annually until 2040.[33]

Better energy efficiency measures, particularly from stringent building codes and appliance standards, will decrease the importance of kWh sales as utility business drivers.

Moreover, distributed and auto-consumed electricity will decrease the power demand cake even further. Many individual power producers will still need some grid electricity to balance the variability of their renewable energy system or to sell excess power back to the grid. However, complete grid defection, where customers will fully disconnect from the grid, could increase with the growing adoption of customer-sited distributed storage. In Germany, grid defection is on the rise, with more and more retail customers consuming their self-generated power. Today, around 25,000 companies are already self-sufficient and produce roughly 9% of Germany's total energy capacity for their own usage.[34] Continuously slow economic growth in OECD

30 Ceres, Benchmarking Utility Clean Energy Deployment: 2014, July 2014. - Spurred by abundant and inexpensive natural gas, the US Energy Information Administration expects natural gas-fired plants to account for 73% of capacity additions from 2013 to 2040, compared with 24% for renewables. – US EIA, Annual Energy Outlook, 2014.
31 IEI, Factors Affecting Electricity Consumption in the US (2010-2035), 2013.
32 AG Energiebilanzen, Ausgewählte Effizienzindikatoren zur Energiebilanz Deutschland (1990-2013), 2014.
33 US EIA, Annual Energy Outlook, 2014.
34 According to a study of the German Association of Chambers of Industry and Commerce, 25,000

Data collection and analytics, smart and interconnected devices, and time-of-use price signals will allow advanced energy management and smarter energy use, reducing utilities' kWh sales even further.

countries and the rising but slow adoption of electric vehicles (EVs)[35] will not reverse the trend of lower power demand in the mid- to long-term.

Decreasing revenues from declining demand will thus continue to impact utilities on both sides of the Atlantic. With already eroded credit ratings, utilities' cost of capital risks will rise even further. In the US, credit rates decreased from AA on average in the 1980s to BBB today, with a threat of slipping to non-investment grade ratings.[36] This level deteriorates utilities' financial metrics and reduces their access to low-cost capital to enhance the energy system.

3. The distribution grid will become a smart, interconnected and interactive platform

Smart meters and smart grid technologies, which provide digital processing and communications to the power grid, fundamentally change the dynamics of the lower-voltage distribution system (below 60 kV) by allowing a two-way flow of information and power. The power grid used to be a unidirectional system where only the utility delivered electrons to the consumer. Increasingly, the increase of distributed energy supply and demand from renewables, demand response, batteries and electric vehicles (EVs) will make the grid an integrated and multi-directional platform that interconnects a variety of devices, consumers and producers. This platform will be the basis for a new way of thinking about the power sector. 43% of US households are already equipped with smart meters[37] (see Figure 6). In Germany, smart meters are still less deployed, and discussions are ongoing about how to set the institutional and regulatory framework to develop the distribution grid into a smart, interconnected and interactive platform.[38]

Data collection and analytics, smart and interconnected devices, and time-of-use price signals will allow advanced energy management and smarter energy use, reducing utilities' kWh sales even further. For utilities this means that, in addition to lower sales, they will be confronted with rising costs to implement these new technologies. Given utilities' deteriorating financial metrics, these investments will become more risky and difficult to realize.

companies generate and use their own decentralized power (60% CHP, 8% renewables) (est. 25,000 more to come), 2014.

35 The Institute of Electric Innovation estimates that electric transportation will only add 33 TWh (0.9%) by 2035 to a total electric US demand of 3,805 TWh. - IEI, Factors Affecting Electricity Consumption in the US (2010-2035), 2013.

36 Kind, Peter, Disruptive Challenges: Financial Implications and Strategic Responses to a Changing Retail Electric Business, for: Edison Electric Institute, Jan. 2013.

37 Banks, John P. / Wood, Lisa V., The Flexible and Evolving Power Distribution Grid, Brookings, Dec. 2014.

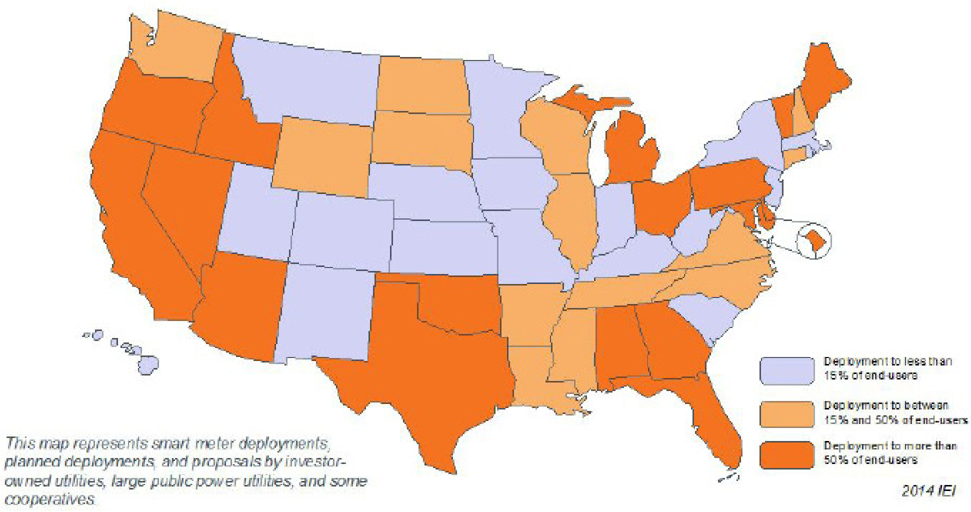
38 German Federal Ministry of Economic Affairs and Energy, Baustein für die Energiewende: 7 Eckpunkte für das 'Verordnungspaket Intelligente Netze', Feb. 2015.

4. Customers will become active power agents

Customers will increasingly become active power agents – consuming, generating and balancing power – and will have to be situated at the heart of utility operations. Technology changes, particularly in the rooftop PV sector, as well as regulatory modifications will revolutionize their role from passive kWh consumers to customers of diversified energy products and services, and eventually even to proactive 'prosumers' who produce, consume and trade power at the same time. Thanks to the favorable feed-in tariff policy and priority access to the grid for renewables, Germany already has a large number of such active prosumers: individuals and farmers own 46% of its 72,900 MW renewable energy capacity, commerce and industry own 14%.[39] In the US, the PV uptake has been considerable with a total installed capacity of 18,300 MW and another 8,500 MW expected in 2015, of which most rapid growth is anticipated in the residential market.

The 'millennials generation' wants products and services that meet the criteria of the three 'C's: cheap, convenient and cool.

Figure 6: Smart Meter Deployment in the US (2014)



Source: Institute for Electric Innovation (IEI), 2014.

Moreover, generational mentality changes will create new customer expectations: the 'millennials generation', born after 1982 and one-third of the adult population in 2020, "wants products and services that meet the criteria of the three 'C's: cheap, convenient and cool."[40] Utilities will hence need to even actively engage customers on an individualized basis with an emphasis on personalized and tailored marketing, communication, and product and service packages. To do so, they will need to change their mindset from selling one commodity to captive customers towards offering more service orientation. Partnerships particularly with innovative data analytics provid-

39 Agentur für Erneuerbare Energien, 2013.
40 Banks, John P., Millennials and the Future of Electric Utilities, July 2014.

ers will help better explore customer expectations and design customer-centric services. The approach to tailored service packages in the wireless communication industry can serve as an example.

5. Innovative market entrants will increase competition in the power sector

In the US as in Germany, innovative and agile providers of energy services up to and behind the meter will continue expanding their market position. Service-oriented offerings will proliferate.[41] Up to the meter, for example, third party developers offer leasing services for residential PV or storage systems. Behind the meter, many energy service providers help commercial customers to save energy or to make money from reducing their demand during peak times. These new market entrants will explore and even further expand customer needs and fill the gap with new services. This will accelerate grid defection and endanger utilities that hold on to operating under the old business model of exclusively centralized generation.

New market entrants will explore and even further expand customer needs and fill the gap with new services.

The regulated utility business of providing basic power to customers will be relatively shielded from competitors. The electric marketplace will remain regulated to ensure that utility customers and service providers are protected from the lack of competition where utilities are granted exclusive service territories and monopolistic structures persist, such as for transmission. Utilities will nevertheless want to convince regulators to tap more into the market-based business of providing new energy services up to and behind the meter, and benefit from growth opportunities. This service market, however, is very competitive. Utilities, which as per their original monopolistic model are not used to face competition, may avoid the risk of being outcompeted by establishing innovative partnerships with agile competitors.

6. System optimization will require significant investments and regulatory changes

System optimization takes two dimensions: market design to remunerate power flows and flexibilization services, and technical optimization of grid infrastructure and system operations to manage and balance the power system. These two dimensions of system optimization keep industry, regulators and policy makers busy on both sides of the Atlantic. Firstly, revenue generation and long-term investment decisions will be profoundly influenced by the future market design if utilities are to be paid for just providing electrons in energy-only markets or if they are also to be remunerated in capacity and

41 Deloitte, The new math: Solving the equation for disruption to the US electric power industry, 2014.

ancillary services markets for reserving generation capacity in case it is needed to balance demand and supply. Secondly, and as the other side of the same coin, technical optimization of system operations and infrastructure will continue to require significant regulatory adjustments and substantial regional planning for more flexible grid management and the integration of distributed energy resources.

Huge investments are needed to upgrade or replace aging or overhauled generation, transmission and distribution infrastructure. In the US for example, investor-owned utilities are expected to invest $100 billion in annual capital expenditures over the next few years, with more being spent on the distribution system and less on generation.[42] These investments pose tremendous stress on financially strapped utilities. Beyond low interest rates, the solution will require innovative financing and regulatory models to allow utilities to realize these investments.

Huge investments are needed to upgrade or replace aging or overhauled generation, transmission and distribution infrastructure.

Germany is facing considerable challenges to optimize its system and to ensure the required investments in grid infrastructure. Heated debates on the appropriate market design[43] and on transmission expansions are ongoing on the federal and state level as well as in industry and civil society.

7. Energy policy and environmental regulation push towards cleaner power generation

34% of carbon emissions in the US and 33% in Germany are attributed to the power sector. As the evidence of climate change and the need for greater resiliency against its impacts become a publically supported reality, energy policy is seen as *the* key instrument to tackle climate change and to address geopolitical considerations.

In the US, the proposed Clean Power Plan gives states flexibility to choose their measures for achieving pre-defined emission reduction targets. Moreover, state mandates and policies as well as market-driven carbon reduction mechanisms, such as the Regional Greenhouse Gas Initiative (RGGI) for power generators and California's cap-and-trade system, will keep on encouraging a shift in the generation mix. Despite its world largest coal reserves, the US gears towards replacing significant parts of its coal fleet with lower-carbon gas-fired generation, which benefits from more operational

42 Banks, John P. / Wood, Lisa V., The Flexible and Evolving Power Distribution Grid, Brookings, Dec. 2014.
43 The Federal Ministry for Economic Affairs and Energy has issued a position paper 'Ein Strommarkt für die Energie-wende' ('Green Paper') on the future market design http://www.bmwi.de/EN/Topics/Energy/Electricity-Market-of-the-Future/green-paper,did=679748.html, which is broadly discussed. A subsequent more detailed 'White Paper', expected in June 2015, will be the basis for public consultation until September 2015, and lead towards drafting of legislation.

flexibility and presently low fuel prices, as well as with renewables.

Just as in Germany, ambitious government targets on the German and EU level call for cleaner power generation. In addition, the European Emission Trading Scheme (EU ETS) pushes energy generators to reduce their emissions. For utilities on both sides of the Atlantic, investing early in low-carbon generation capacity helps avoid compliance costs to meet increasingly stringent environmental and energy policy and regulation.

C. Business Model Innovation – Lifeline for Survival in a Reinvented Clean Energy Future

Against the backdrop of the convergence of these multiple disruptive trends, utility executives on both sides of the Atlantic want to adapt; yet it is still largely unclear *how*.[44] Examples in the US and Germany show that sound business can be derived from pursuing new business models that embrace two key features: a **more distributed and integrative approach to generation and/or distribution**, and greater **customer and services orientation** when it comes to **retail sales**. This analysis focuses on deregulated power markets so as to allow for a better comparison between Germany and the US.[45]

Against the backdrop of the convergence of these multiple disruptive trends, utility executives on both sides of the Atlantic want to adapt; yet it is still largely unclear *how*.

A more **distributed and integrative approach** to generation can play out on two levels: either as decentralized utility-scale generation (large grid-connected wind or solar farms, or flexible and fast-ramping gas-fired plants) or as distributed customer-sited generation (rooftop PV, small off-grid wind turbines, on-farm biogas digesters, etc.). Government mandates and policies as well as falling technology costs for renewables and low natural gas prices in the US favor the deployment of both decentralized and distributed generation over large-scale centralized power generation from coal or nuclear.

Two examples of **decentralized utility-scale generation** provide an innovative approach to the changed business environment. The Florida-based NextEra Energy, a holding and Fortune 200 company,[46] owns and operates North America's largest wind and solar capacity of over 11,000 MW through its subsidiary NextEra Energy Resources. NextEra also owns Florida Light and

44 Utility Dive, 2015 State of the Electric Utility, Jan. 2015.
45 Utilities in deregulated markets have a larger choice of specializing on core competencies or diversifying their offerings. Vertically-integrated utilities in regulated markets only have the option, if enabled by revised regulation, to fully convert into an 'Energy Service Utility' (ESU), offering a broad range of energy services up to and behind the meter but in a much more customer-centric way. - Fox-Penner, Peter, Smart Power: Climate Change, the Smart Grid, and the Future of Electric Utilities, 2010. According to Fox-Penner (May 2015), Seattle City Light, Austin Energy, and Sacramento Municipal Utility District SMUD and Fort Collins Utilities are US utilities moving towards the ESU model.
46 www.nexteraenergy.com

Power, one of the largest rate-regulated and vertically integrated utilities in the US serving approx. 4.7 million customers. This example shows that **conventional and new business models on the generation side can co-exist** and thrive within one company, ranked by analysts as "best-in-class" in the US energy sector.[47] In Germany, the publicly listed regional utility MVV Energie pursues a slightly different model. MVV has taken majority stakes in highly successful independent power producers (IPPs) Juwi and Windwärts.[48] Both subsidiaries together have a track record of planning, building and operating renewable systems with a total capacity of around 3,400 MW. This approach shows that **interlinkage between traditional utilities and IPPs** can be done.

In addition to generating large-scale decentralized power by themselves or through partners, utilities can also develop new business models in **facilitating and integrating smaller-sized distributed generation**. One such option in the US are **utility-led community solar programs** where multiple customers buy into a utility-operated solar installation in their community and share the upfront costs and long-term benefits on their utility bills. 58 community solar programs are already active in 22 US states.[49] Another option in the US are **leasing models**, where utilities lease customers' rooftops for installing solar or they lease 'solar plus storage systems' in return for being able to control and use the power for grid balancing. In Germany, where those retail customers who install a PV system on their roof prefer owning over leasing it, large utilities such as E.ON start offering to **handle solar projects on behalf of municipal utilities**.[50] This allows smaller utilities to add renewables to their mix and meet expectations of customers who cannot have a solar roof. Other German utilities, such as the innovative Schwäbisch-Hall local utility, **offer citizens the opportunity to become investors** in solar and wind projects.[51]

In the US, utilities lease customers' rooftops for installing solar PV.

A variety of service models can also be developed around providing **technical and financial support for customer-sited distributed generation** given the rising interest from citizens, communities and businesses.[52] In the US, pioneered by the City of Austin's utility Austin Energy and applied state-wide by Minnesota, new remuneration models are being tried out.

47 MorganStanley, Global Utilities: Conviction Ideas for 2015, Jan. 2015.
48 www.mvv-energie.de/en/mvv_energie_gruppe/mvv_energie_gruppe_1.jsp
49 Trabish, Herman K., Why utilities across the nation are embracing community solar, Utility Dive, Jan. 22, 2015.
50 Weinhold, Nicole / Morris, Craig, Eon to become PV service provider for municipals, Renewables International, April 2015
51 www.stadtwerke-hall.de / www.solar-invest-ag.de
52 A growing number of corporations on both sides of the Atlantic engage in decentralized energy. US EPA Green Power Partnership: http://www.epa.gov/greenpower; CERES' BICEP initiative: http://www.ceres.org/bicep; WWF Climate Savers: http://wwf.panda.org/what_we_do/how_we_work/businesses/climate/climate_savers/

Value-of-solar tariffs, for example, base rates on a number of factors (e.g. avoided infrastructure costs, environmental benefits, negated fuel costs and energy price hedging value). They allow a fairer and more holistic approach than net metering, a billing mechanism that credits PV system owners at retail rates for the kWh they add to the grid without accounting for other benefits or grid-connection costs.

In Germany, innovative companies are exploring new business models as **virtual power plant (VPP)** operators. Through powerful control software, Next Kraftwerke, e2m and Lichtblick[53] virtually bundle multiple customer-sited generation systems, mainly distributed renewables. Bundling allows these smaller systems to reach a size where they can become players in the lucrative market for balancing power, producing and selling electricity at higher prices when demand rises unexpectedly. The VPP operators not only share these high sales margins with their customers but also provide grid operators with fast ramping flexibility to balance the variability of renewables, creating a win-win situation for all.

Considerable opportunities for **new integrative business models** are also cropping up on the **distribution side**.[54] As more distributed generation and demand are prompting the lower voltage distribution grid to transform into a smart and interactive platform, utilities can take a "central enabling role as grid builders, operators, and service providers".[55]

Utilities are increasingly considering turning into Smart Integrators.

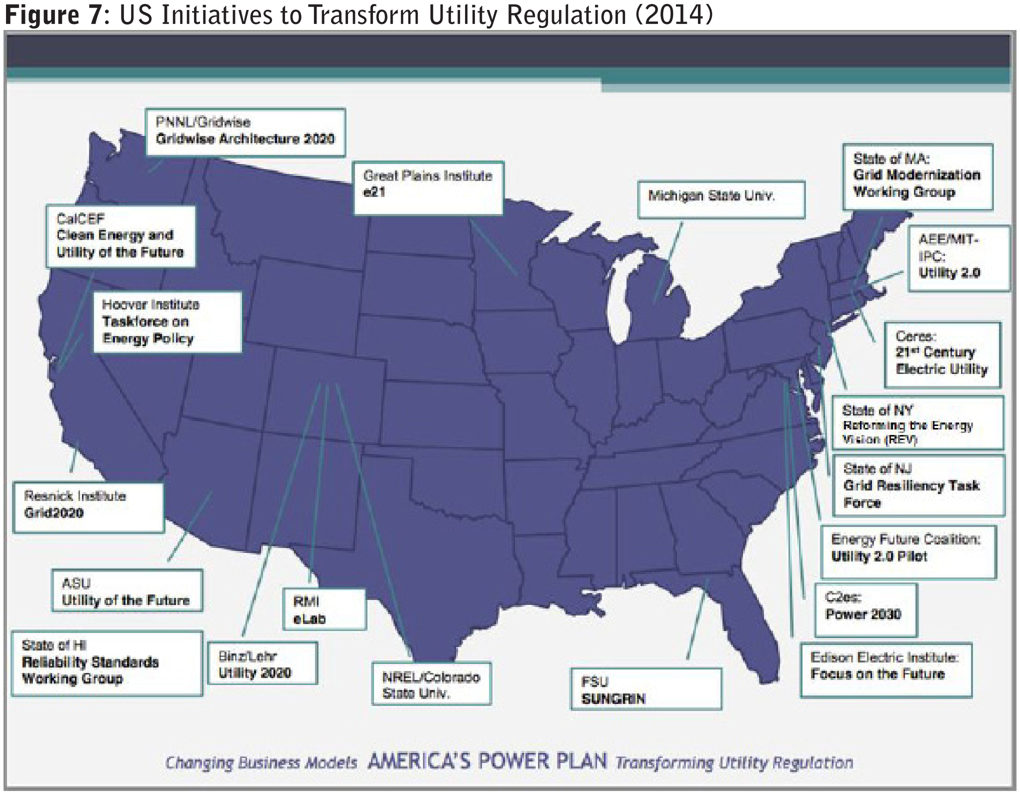
Utilities are hence considering turning into **Smart Integrators**.[56] This could become a valued business model because it builds on distribution as a utility core function. As a Smart Integrator, a utility would neither own generation facilities nor sell power, but focus exclusively on operating the distribution grid as an open platform. This would enable a variety of generators, service providers and consumers to interconnect based on prices set by the market. In the northeastern US, UK-based National Grid LLC has adopted a strategy of becoming such a Smart Integrator. As laid out in its latest Fifteen-Year Plan, National Grid's subsidiary Niagara Mohawk Power Corp. in New York State sees its role as a facilitator and provider of network services, strongly emphasizing grid infrastructure upgrades and the integration of smart technology and customer needs.[57]

53 www.next-kraftwerke.com; www.energy2market.com; www.lichtblick.de/en/schwarmenergie
54 In this context we do not consider new business models on the bulk power transmission side, such as Transcos or Merchant Transmission Providers that exclusively focus on developing, owning and maintaining high-voltage lines.
55 Banks, John P. / Wood, Lisa V., The Flexible and Evolving Power Distribution Grid, Brookings, Dec. 2014.
56 Fox-Penner, Peter, Smart Power: Climate Change, the Smart Grid, and the Future of Electric Utilities, 2010.
57 http://us.nationalgridconnecting.com/connect21; www.transmissionhub.com/documents/2014/09/national-grid-plan-sep-5-2014.pdf

However, this kind of business model can only work if institutional, regulatory and competitive frameworks, and pricing models are designed to ensure that a grid platform interconnects all generators, emerging technologies and services equally. In the US, New York State is leading the way with its 'Reforming the Energy Vision' (REV) proceedings.[58] It defines a new revolutionary framework for a flexible distribution grid platform and the role of utilities as Distributed System Platform Providers. The purpose of this proceeding is to transform all of the New York utilities into Smart Integrators.[59] This approach is followed very closely by other US states that are considering a transformation of their power utility regulation (see Figure 7).

In the US, New York State is leading the way with its 'Reforming the Energy Vision' (REV) proceedings.

Figure 7: US Initiatives to Transform Utility Regulation (2014)



Source: America's Power Plan, 2014.

In Germany's highly fragmented distribution system, regional and municipal utilities are discussing new ways of doing business, too. Bundling strengths and resources in **purchasing networks**, such as the Trianel Group,[60] is seen as solution for smaller utilities to aggregate their buying power to achieve better pricing for their customers. Furthermore, **regional networks**, such

58 www3.dps.ny.gov/W/PSCWeb.nsf/ArticlesByTitle/26BE8A93967E604785257CC40066B91A?OpenDocument
59 Exchange with Peter Fox-Penner, May 2015.
60 www.trianel.com

as the local utility group SUN that serves 290,000 customers in Northern Hesse,[61] help improve the integration of distributed variable generation of renewables. By overcoming resource limitations of smaller players, networks are able to deliver technically complex flexibility options and localized portfolio management.[62]

While generation and distribution offer many opportunities for business model innovation, **more customer and service orientation** on the **retail sales side** will open up a great number of new business approaches. Certain regulatory changes will be required to allow utilities to enter into free market competition or partnerships with third party providers.

A big area for value-added services on the retail side arises from **diversifying power sales** offerings. One option is to provide different **retail electricity packages**. German and US utilities in markets, which allow retail choice, have already started to offer a variety of green power packages where customers can opt for wind or solar power procurement. They also propose special pricing packages where customers can choose amongst different tariffs or contract terms. EnBW's subsidiary Yello Strom or WGL Energy in the US are typical utility examples for this on both sides of the Atlantic.[63] They compete with private green power providers, such as Licht -blick or Greenpeace Energy in Germany or suppliers of 'green-e' certified Renewable Energy Certificates (RECs) in the US.[64]

Another option for utilities to diversify their retail offering is to develop new distributed energy services around powering electric vehicles.

Another option for utilities to diversify their retail offering is to develop **new distributed energy services** around powering electric vehicles or facilitating customer installations of distributed energy. An outstanding example in the US is NRG Energy, with its innovative eVgo and Sunora subsidiaries, and its green power packages.[65]

In Germany, just as in the US, a variety of new business models also evolves around **energy management services**. Utilities explore these opportunities mainly by contracting with innovative providers. Large IT companies, such as IBM, Oracle and Google, offer a broad service spectrum of data collection, monitoring and analytics used by utilities to better understand customer needs. Specialized providers like Opower interpret customer data on behalf of utilities to drive residential and commercial energy efficiency.[66] Demand response service companies, such as Enernoc and Viridity Energy,

61 www.sun-stadtwerke.de
62 Leprich, Uwe, Transformation des Stromsystems: die Akteursrollen im Maschinenraum der Energiewende, Institut für ZukunftsEnergieSysteme (IZES), Oct. 2014.
63 www.yellostrom.de; www.wglenergy.com
64 In Germany: www.oekostrom.com; in the US: www.epa.gov/greenpower/pubs/gplocator.htm
65 www.nrg.com
66 www.opower.com

give commercial and industrial customers the opportunity to manage and sell demand-reduction capacity to their utility or on the wholesale market.[67] New energy management services are also increasingly developed with regards to energy efficiency contracting, storage and the deployment of smart grid devices, such as intelligent meters and thermostats.[68] The US IPP AES is taking a lead in offering storage solutions by contracting with various providers.[69]

Demand response services give customers the opportunity to manage and sell demand-reduction capacity to their utility or on the wholesale market.

Finally, utilities are increasingly setting up new business models that address special customer needs. In Germany, for example, **direct marketing** of customer-sited renewable power is already well developed by providers, such as Clean Energy Sourcing or Statkraft,[70] to facilitate decentralized energy to be sold on the wholesale market. Other approaches provide **reliability services** that meet special customer needs, such as specific voltage requirements for highly sensible IT equipment. Moreover, utilities with big balance sheets, such as Germany's 'Big 4', increasingly offer domestic and international **energy contracting** to industrial customers. In a turnkey approach, they provide them with financing, development and construction of generation facilities along with operation and maintenance services. Energy contracting is used to develop gas-fired combined heat and power plants (CHP) that fit well into industrial operations.

D. Conclusion

Utilities are the most affected by the energy transitions in Germany and the US. The interaction between the seven disruptive trends in technology, policy and market dynamics drives this similar transatlantic, if not global[71] phenomenon, which is likely to further accelerate over the next few years.

Utilities that embrace change will have a future in a more decentralized and low-carbon economy. This change, however, needs to happen proactively. As a US industry expert recently put it: "Things in this industry change very slowly and then they change very fast. We are pivoting toward that fast change right now."[72] The convergence of more decentralized energy resources on the supply and demand side, of more system flexibility and intelligence and of more engaged and demanding consumers will require utilities

67 www.enernoc.com, www.viridityenergy.com
68 Energy efficiency contracting: http://energy.gov/eere/slsc/energy-savings-performance-contracting; storage services: www.teslamotors.com/powerwall; www.younicos.com; smart grid devices: www.siemens.com; www.nest.com
69 www.aesenergystorage.com
70 www.clens.eu; www.statkraft.com
71 Pwc, Energy transformation: The impact on the power sector business model (Power & Utilities Survey), Oct. 2013. – Also in emerging markets, particularly in Asia, utility leaders foresee a significant market transformation by 2030.
72 Cisco DeVries, in: How utilities are transforming their fuel mixes, Utility Dive, Feb. 2015.

to deeply change their structure and mindset. The creation and adoption of **more distributed and integrative business models** on the generation and distribution side and of more **service- and customer-oriented approaches** on the retail sales side will be needed. Promising examples exist on both sides of the Atlantic.

The German Energiewende has fundamentally changed the old operating environment of the 'Big 4'. Their strategic response will likely prove important precedents on how new and more innovative approaches to business can evolve. **Two key lessons** for utilities can be drawn **from Germany's case**: (1.) proactively embrace distributed energy from an early stage, and (2.) foster a decentralized structure and culture oriented towards customers' needs. Germany's regional utility service companies, such as MVV Energie, mainova and SWM, show that their size and strong focus on customer proximity can provide advantages over other types of utilities. **Network strategies** with like-minded utilities in a regional context or as a purchase aggregation can help jointly handle an increasingly complex electricity system.

The new role for utilities will be to help scale up emerging energy products and services.

Partnerships with innovative service providers in the fields of data analytics, energy management, distributed generation and storage can facilitate the build-up of new capacities and the expansion of new products and services. A lack of innovation culture in this sector may make it challenging for traditional utilities to initiate new business models. They should hence engage in partnerships with market entrants to collectively come up with the best business solutions. The new role for utilities will be to **help scale up emerging energy products and services**.[73]

Nevertheless, utilities cannot walk the walk alone. They will **need a revised regulatory, institutional and financial framework**. Policymakers and regulators are called on to introduce more performance-based ratemaking and new temporal and locational pricing structures that appropriately value the grid benefits of decentralized energy resources. This will incentivize change. The farsighted 'REV' proceedings in New York State are likely to pave the way in the US. In addition, new innovative financial mechanisms need to be developed, such as 'YieldCos', which bundle renewable energy assets into one investment structure tradable on the stock exchange. Also, long-term investors, such as pension funds, sovereign wealth funds and municipalities, must be engaged to benefit from continuous positive cash flows of renewables once initial investments have been made.[74]

73 Nillesen, Paul / Pollitt, Michael / Witteler, Eva, New Utility Business Model: A Global View, in: Sioshansi, Fereidoon P., Distributed Generation and its Implications for the Utility Industry, 2014.
74 Nelson, David, Roadmap to a Low Carbon Electricity System in the US and in Europe, Climate Policy Initiative, 2014.

Ultimately, the overall societal goal is a reliable, resilient, affordable and low-carbon energy system. Hence, it will be important to **align the interests** of customers, technology and service providers and utilities.[75] Only then can the transformative trends be managed effectively and new utility business models be sustainable. The electric industry along with policymakers, regulators and citizens will need to find answers to the fundamental question: What does the low-carbon energy transition need from utilities? Only if the utility transition supports and advances the energy transition will utilities have a long-lasting essential role to play.

A **transatlantic exchange on these issues** will be helpful when rethinking innovative ways in which utilities can flourish and become catalysts for an innovation-driven and clean energy economy.

75 Mandel, James / Guccione, Leia / et.al., The Economics of Load Defection, Rocky Mountain Institute, Feb. 2014.