Natural Gas, Decentralized Energy and Disruptive Business Models

Wartsila Flexible Power Symposium
Vail, Colorado
February 6, 2014

David M. Sweet
Executive Director
World Alliance for Decentralized Energy
Everyone is Trying to Read the Tea Leaves on Future of the Utility Business
Question

- 10 years from now will the electric utility industry be substantially similar to today?
- Or will it be substantially different?
Question

What two colors are on the yield sign?
Need to Unlearn Dated Information
One of the Best Logos of All Time

FedEx
Need to Also Focus on What is Not There
Richard Sherman Epic Rant after NFC Championship Game
What Richard Sherman said to Michael Crabtree After the Play
The Illegal Can Become Legal

"Seriously, man, this Washington weed is way better than your lame Colorado weed."

THE SUPER BOWL RIVALRY HEATS UP:

WHATEVER.

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WADE
WORLD ALLIANCE FOR DECENTRALIZED ENERGY
The NBA Finally Puts An End To The Greatest Sports Deal Of All Time

- About $1 billion will be paid to the Silna brothers who were the owners of the previous ABA team, the St. Louis Spirits.

- Turned down $3 million when the ABA was folded into the NBA and instead took $2.2 million plus a 1/7 share of the four ABA teams NBA “visual media rights” in perpetuity.

- The league never anticipated the growth in TV revenues, cable and internet distribution, globalization of the game.
What Was the Point Spread on the Underdog?
Now Who is the Underdog?
Technology and Costs are Not Static -- Cost per Genome
Advancements in Micro Wind Technology

UT file for a patent on windmill that measures 2 mm across

Manufacturing can be done using technology from the semiconductor industry
So who will be your new electric utility?
Google Buys Nest for $3.2 Billion and Makani Wind

So far Google has invested around $1 billion in solar and wind projects that have a total capacity of close to a 1 GW.
ORDER GRANTING MARKET-BASED RATE AUTHORIZATION
(issued February 18, 2010)

In this order, the Commission grants market-based rate authorization to Google Energy LLC (Google Energy), effective February 23, 2010, as requested. Additionally, we find that Google Energy meets the criteria for a Category 1 seller in all regions and is so designated.
Google Self Driving Car
The world's largest electric utilities as of March 15, 2013, based on market value (in billion U.S. dollars)

<table>
<thead>
<tr>
<th>Electric Utility</th>
<th>Market value in billion U.S. Dollars</th>
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</thead>
<tbody>
<tr>
<td>Duke Energy (U.S.)</td>
<td>49.3</td>
</tr>
<tr>
<td>GDF Suez (France)</td>
<td>45</td>
</tr>
<tr>
<td>Southern Co (U.S.)</td>
<td>39.6</td>
</tr>
<tr>
<td>EDF (France)</td>
<td>35.3</td>
</tr>
<tr>
<td>Iberdrola (Spain)</td>
<td>33.6</td>
</tr>
<tr>
<td>Dominion Resources (U.S.)</td>
<td>32.7</td>
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<tr>
<td>E.ON (Germany)</td>
<td>32.5</td>
</tr>
<tr>
<td>ENEL (Italy)</td>
<td>32.2</td>
</tr>
<tr>
<td>NextEra Energy (U.S.)</td>
<td>31.6</td>
</tr>
<tr>
<td>Exelon (U.S.)</td>
<td>28.5</td>
</tr>
<tr>
<td>American Electric (U.S.)</td>
<td>23.3</td>
</tr>
<tr>
<td>RWE Group (Germany)</td>
<td>22.9</td>
</tr>
<tr>
<td>NTPC (India)</td>
<td>22.3</td>
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Market value in billion U.S. Dollars
WADE Mission

- WADE Research activities
  - Reports, market surveys and studies
  - WADE Economic Model
- WADE Advocacy activities
  - Policy advise for governments
  - Participation in legislative and regulatory proceedings
  - Cooperation with International Organisations, Institutions and NGOs
- WADE Promotion activities
  - WADE Conferences and events
  - WADE Newsletters
Natural Gas Roundtable

- Non-profit organization started over 40 years ago to educate government officials, media and industry about natural gas issues
- US natural gas industry is highly segmented
- The Natural Gas Roundtable serves as an umbrella organization bringing together all industry segments from the wellhead to the burnertip
Mission

The purposes of the Council are to:

- Provide a forum for the discussion of common concerns and policy issues that impact the production, delivery and use of natural gas on a global basis and, when necessary, seek to develop and advocate global consensus positions.
- Remove impediments to the efficient production, processing, transmission, distribution, and consumption of natural gas.
- Foster greater cooperation across the natural gas value chain in areas including, but not limited to:
  - Technology transfer and sharing of technical expertise;
  - Workforce development and training;
  - Identification and development of commercial opportunities and infrastructure needs;
  - Education of the private and public sectors on the benefits of natural gas as well as the need to develop the resource in a safe and environmentally responsible manner;
  - Development and management of contracts along the natural gas value chain;
  - Establishment of the relevant legal and regulatory framework to support production, transport and use of natural gas.
Inaugural Meeting of the Global Gas Council

His Excellency Dr. Neil Parsan, Ambassador of Trinidad and Tobago to the United States (far left) welcomes participants to the Inaugural Global Gas Council Meeting along with (from left to right) Mr. David Sweet, President of the Natural Gas Roundtable, the Honourable Kevin Ramnarine, Minister of Energy and Energy Affairs of Trinidad and Tobago and His Excellency Mohamed Bin Abdulla Al-Rumaihi, Ambassador of Qatar to the United States
“The world will soon start to run out of conventionally produced oil. If we manage somehow to overcome that shock by shifting the burden to coal and natural gas, the two other primary fossil fuels, life may go on more or less as it has been – until we start to run out of all fossil fuels by the end of this century... Even if human life does go on, civilization as we know it will not survive, unless we can find a way to live without fossil fuels.”

Out of Gas, by David Goodstein
“The raw fuels are not running out. The faster we extract and burn them, the faster we find still more.”

“The cost of energy as we use it has less and less to do with the cost of fuel.”

“The more efficient our technology, the more energy we consume.”

The Bottomless Well, by Peter Huber and Mark Mills
The first oil well drilled in the US in 1859 by Col. Drake to a completion depth of 69 feet.
National Petroleum Council Reports: Dramatic Change in Gas Supply

“North American and U.S. natural gas production is likely to lag projected demand growth over the study time frame, requiring significant growth in LNG imports....
Forecasts range from 2.5 percent of U.S. supply to 16 to 18 percent by 2030.”
- National Petroleum Council, 2007

“As a result of drilling technology advances and the emergence of the recent ‘game changing’ shale gas plays, the gap between U.S. demand and production is closing rapidly and likely to reduce greatly the future need for LNG imports.”
- National Petroleum Council, 2011
Decentralized Energy Basics
What is Decentralized Energy (DE)?

Electricity production *at or near the point of use*, irrespective of size, fuel or technology – on-grid or off-grid:

- High efficiency cogeneration (CHP)
- On-site renewable energy
- Industrial energy recycling and On-site power

- Otherwise known as:
  - CCHP (Combined Cooling Heat and Power), Distributed Generation, Captive Power, Embedded Generation, Microgeneration, CHP, Trigeneration, Recycling Energy, etc.
Decentralized Energy - Fossil-fuel Technologies

Gas Turbines

Reciprocating Engines
Large & small

Microturbines

Stirling Engines

Steam Turbines
Decentralized Energy - Renewable Technologies

- Fuel Cells
- Biomass
- On-site wind
- Municipal Waste
- Rooftop PV
The Move to Decentralized Technology
Computing
About one-third of US households do not have a land line compared with 96% 15 years ago

Cellphone ownership is at 89%

About two-thirds of households led by people ages 15 to 29 relied only on cellphones in 2011, compared with 28% for the broader population.
Decentralization of Entertainment from the Central Broadcasting System to YouTube and IPads
Decentralized Manufacturing - 3D Printing
Decentralized Financing
Decentralized Transportation
N-1-1
Crowdsourcing Emergency Response

Using Geofencing Technology to Alert Nearby Off-duty EMTs, Medical Personnel, and Other Responders to Quickly Provide Aid

James Sweet
Founder

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Confidential - do not distribute
Key Drivers for Future Growth
The Golden Age of Natural Gas

World commercial energy use

- Renewables*
- Nuclear
- Hydro
- Gas
- Oil
- Coal

Contribution to total energy growth

% p.a.

* Includes biofuels
The Need for Resilient Systems --
Super Storm Sandy: By the Numbers

- 820 miles in diameter on 10/29/12
  - Double the landfall size Isaac & Irene combined

- Caused 106 fatalities

- Total estimated cost to date - $71 billion+ (lost business)
  - New York - $42
  - New Jersey - $29

- Affected 21 states (as far west as Michigan)

- 8,100,000 homes lost power

- 57,000 utility workers from 30 states & Canada assisted Con Ed in restoring power
Declining Cost Of Renewables

Solar photovoltaic cost projections (Direct Normal Irradiation = 2445 kWh/m²/yr)
Fukushima Nuclear Disaster in Japan
Rising Cost Of Imported Oil

Inflation Adjusted Monthly CRUDE OIL PRICES (1946-Present) In December 2011 Dollars
© www.InflationData.com
Updated 1/19/2012

Dec. 1979 Monthly Average Peak $111.81 in December 2011 Dollars
Nominal Peak $38 (Mo. Ave. Price) Intraday Prices peaked much higher
Inflation Adjusted Oil Price
Nominal Oil Price

June 2008 Monthly Average Oil Price $130.28 in December 2011 Dollars

Source of Data:
Oil Prices: www.ioa.com/Special/crudeoil_Hist.htm
CPI-U Inflation Index: www.bls.gov
<table>
<thead>
<tr>
<th></th>
<th>Retirements with Scrubber &amp; SCR Mandate GW</th>
<th>Additional Retirements with Cooling Tower Mandate GW</th>
<th>Total Retirements GW</th>
<th>Percentage of Total Capacity</th>
<th>Retrofit Capital Costs for Compliance $ Billion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nationwide Total</td>
<td>40-55</td>
<td>11-12</td>
<td>50-66</td>
<td>16-21%</td>
<td>$101-181</td>
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<tr>
<td>Merchant</td>
<td>37-48</td>
<td>8-10</td>
<td>47-56</td>
<td>64-76% 11-14%</td>
<td>$5-7</td>
</tr>
<tr>
<td>Regulated</td>
<td>3-6</td>
<td>1-4</td>
<td>3-10</td>
<td>1-4% 1-2%</td>
<td>$94-177</td>
</tr>
</tbody>
</table>
Climate Change Will Impact Power Generation Decisions

Positive proof of global warming.

Thermoelectric power generation is second largest user of water in U.S.

80% of cost of treating, processing, and pumping water is for energy

Clean, Affordable Energy

Clean, Affordable Water
Examples of Wind Variability

ERCOT June 10, 2009
Decline of ~3,000 MW in < 1h
Azerbaijan

5 GW installed

+ 5 * 90 MW distributed each consisting of 10 * 9 MW units

© Wärtsilä
The Utility Business Model 2.0
Why the U.S. Power Grid’s Days are Numbered -- BusinessWeek

There are 3,200 utilities that make up the U.S. electrical grid, the largest machine in the world. These power companies sell $400 billion worth of electricity a year, mostly derived from burning fossil fuels in centralized stations and distributed over 2.7 million miles of power lines. Regulators set rates; utilities get guaranteed returns; investors get sure-thing dividends. It’s a model that hasn’t changed much since Thomas Edison invented the light bulb. And it’s doomed to obsolescence. That’s the opinion of David Crane, chief executive officer of NRG Energy, a wholesale power company based in Princeton, N.J. What’s afoot is a confluence of green energy and computer technology, deregulation, cheap natural gas, and political pressure that, as Crane starkly frames it, poses “a mortal threat to the existing utility system.”
Jim Rogers - Former Duke CEO

- “there is a place for a new utility with a new business model for the 21st century as well as a place for decentralized generation.”
- “virtually every power plant in the US will be retired or replaced by 2050.”
- This will not only create new opportunities for new generation assets but will also change the competitive dynamics as new generation will not be competing with the same existing fleet of generating assets. In that case what is the role of the grid? According to Rogers, “the utility will primarily be a battery for the entire system.”

(speaking at the WADE 2013 Annual Conference)
Disruptive Challenges:
Financial Implications and Strategic Responses to a Changing Retail Electric Business

Prepared by: Peter Kind
Energy Infrastructure Advocates

Prepared for: Edison Electric Institute
Vicious Cycle

“Utilities face a potentially dignified ‘death spiral’ in which their business model is made irrelevant by new technology and customer demands, and they will be forced to raise their prices for their least desirable customers [as] their best customers depart for more appealing options.”

-EEI, Disruptive Challenges, 2013.
The Bigger Challenge is not from PV

Due to the variable nature of renewable DER, there is a perception that customers will always need to remain on the grid. While we would expect customers to remain on the grid until a fully viable and economic distributed non-variable resource is available, one can imagine a day when battery storage technology or micro turbines could allow customers to be electric grid independent. To put this into perspective, who would have believed 10 years ago that traditional wire line telephone customers could economically “cut the cord?”

EEI, Disruptive Challenges, by Peter Kind
On the customer side, when the average delivered price of electricity is higher than the incremental cost of providing that energy, there is an incentive for “disintermediation”—reducing purchases of power from the regulated utility.
The Decentralized Energy Revolution

The value proposition offered by decentralized generation differs fundamentally from the current energy system configuration: It turns the one-way street from producer to consumer upside-down. It enables every household, as well as all types of commercial and industrial consumers to become active agents and autonomous providers of energy...
Conclusions
Conclusions

- The trend to decentralization is growing in many different areas, including energy.
- The world is undergoing massive changes in the way it uses and produces energy.
- DE is a win-win as it can reduce CO2 emissions and the overall costs of supplying power.
- The barriers to greater deployment of DE can be removed through better policies.
- The utility business model will face growing pressure from distributed resources.
- Organizations like WADE can help bridge the gap between the traditional utility business model and the utility of the future with a mix of central and distributed generation options.
Local Power is a Global Solution!

Thank you!

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