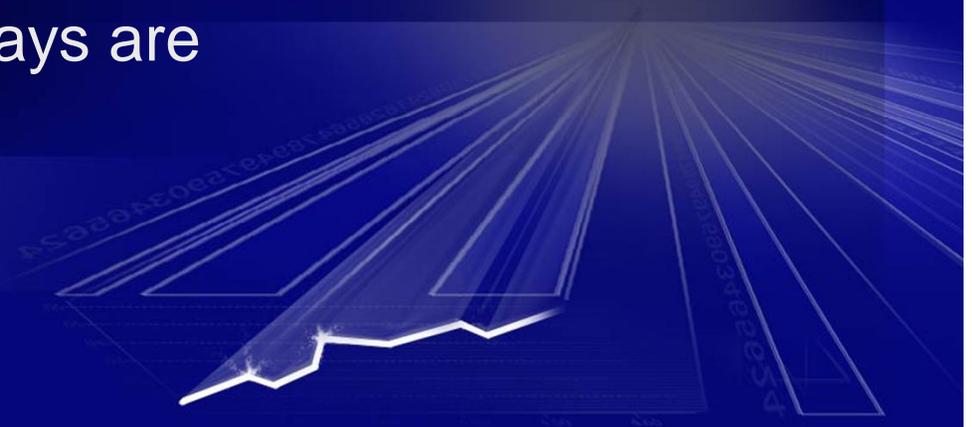


# The Existing Utility System is Doomed to Obsolescence

Why the Power Grid's Days are  
numbered

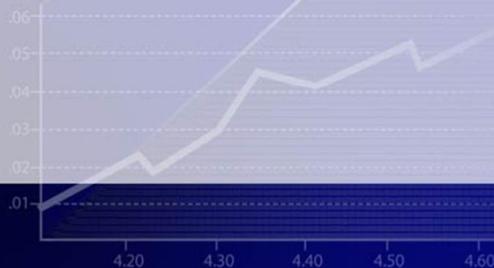


Eric Stojkovich

PQ Synergy™ 2014

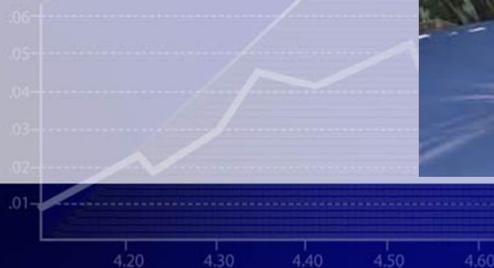
# Disruptive Challenges

Without question, we live in a vastly different world than that of Thomas Edison. However, the electrical grids, which make up the largest machine in the world, haven't changed much since the invention of the light bulb.



# Disruptive Challenges

The Utility Industry is facing a confluence of renewable energy, computer technology, a shift away from more carbon-intensive fuels, deregulation, and political pressure.



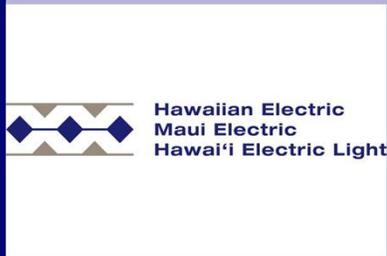
# Disruptive Challenges



# Disruptive Challenges



# Disruptive Challenges



Apr 24, 2014, 6:42am HST  
Poll: Residents think Hawaiian Electric slowing solar to protect profits

Apr 28, 2014, 1:00am HST | UPDATED: Apr 28, 2014, 9:22am HST  
Hawaii ranks as one of the top states in the U.S. for solar energy

Mar 31, 2014, 1:19pm HST  
Ala Moana Center completes one of Hawaii's largest rooftop solar energy projects

Apr 29, 2014, 12:50pm HST | UPDATED: Apr 29, 2014, 1:53pm HST  
Hawaii regulators not observing sufficient urgency by Hawaiian Electric Cos.

May 12, 2014, 7:07am HST  
Hawaiian Electric begins smart-grid program on Oahu

May 7, 2014, 2:14pm HST  
Renewable energy arises as hot topic at Hawaiian Electric Industries annual shareholders meeting

Mar 25, 2014, 7:24am HST  
Hawaiian Telecom plans to install solar energy systems on 78 facilities statewide

May 15, 2014, 11:13am HST  
Is Hawaiian Electric the Amazon.com of energy?

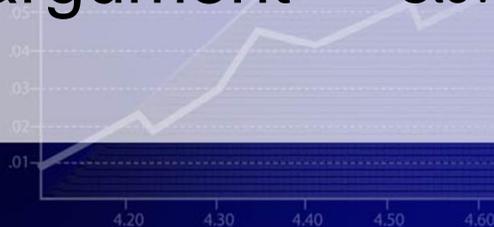


# Disruptive Challenges

Mar 24, 2014, 2:39pm HST Updated: Mar 24, 2014, 4:31pm HST

## **Former U.S. Energy Secretary Steven Chu lashes out at Hawaiian Electric**

“a Hawaiian utility has tried to slow the growth of solar,” citing “grid stability. That’s another bullshit argument” — Steven Chu



# Financial Implications

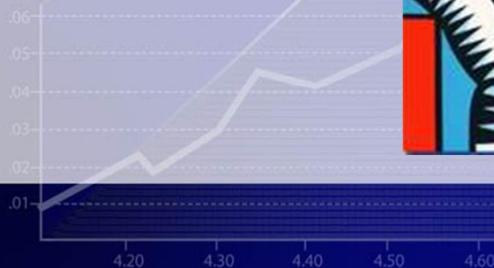
In 2011, Utility Companies worldwide generated a net of over 21 trillion KWH of electricity. Of that 66% came from fossil fuels, 12% nuclear, 17% from hydroelectric and the remaining 5% from other renewables.\*\*



\*\* U.S. Energy Information Administration (EIA)

# Financial Implications

Electricity prices vary between countries and can even vary within a single region or distribution network of the same country. However, returns on investment have been substantially guaranteed through regulation or government subsidy.



# Financial Implications

Looking into the future, the days of cheap electricity prices are coming to an end, and coming to an end abruptly. The old business model is in an economic death spiral and the Utility Industry is facing a mortal threat.

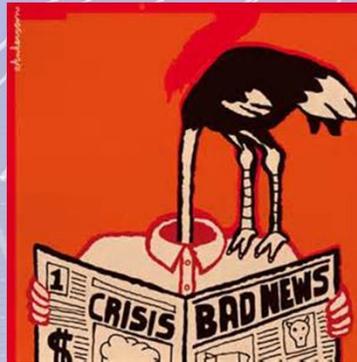


**BIG  
TROUBLE**



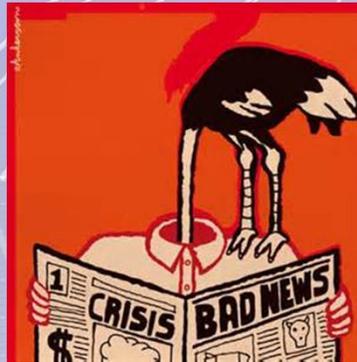
# Change Happens

This paper considers some of the financial risks and investor implications related to disruptive challenges, the potential strategic responses to these challenges, and the likely investor expectations to utility plans going forward.



# Change Happens

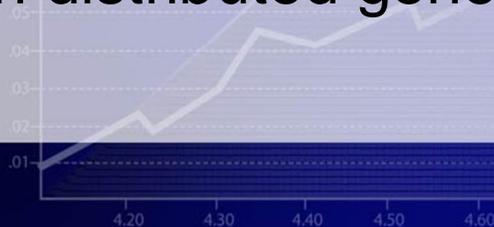
There are valuable lessons to be learned from other industries, as well as prior utility sector paradigm shifts, that can assist us in exploring risks and potential strategic responses.



# Expect the Unexpected?

In about the time it has taken cell phones to supplant land lines in most U.S. homes, the grid will become increasingly irrelevant as customers move toward decentralized homegrown green energy. Rooftop solar, in particular, is turning tens of thousands of businesses and households into power producers.

Such distributed generation is certain to grow.



# Expect the Unexpected?

The industry-funded Edison Electric Institute warned utilities of this scenario in a January 2013 report.

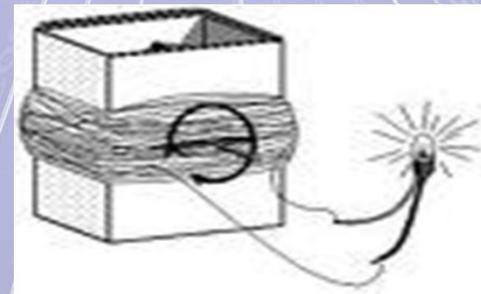
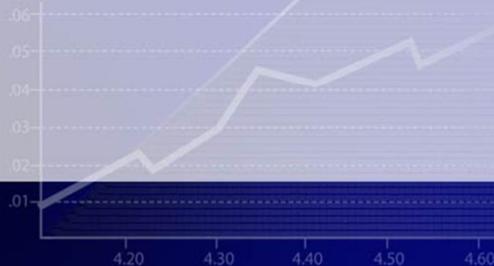
Wall Street Journal reporter Liam Denning described this scenario, in which solar becomes increasingly attractive to the customers who can afford it, as a "**death spiral**" last December and utility insiders have been echoing that phrase.



# Expect the Unexpected?

Solar power installations grew by 76% in 2012, according to the Solar Energy Industries Association.

The cost of solar power declined from \$5-\$6 per watt in 2008 to \$2 in 2012.



# Expect the Unexpected?

Some experts forecast that the cost of solar systems will drop to as low as 30-40 cents per watt by 2016.

Worldwide revenue from the installation of solar systems will climb to \$112 billion/yr in 2018.

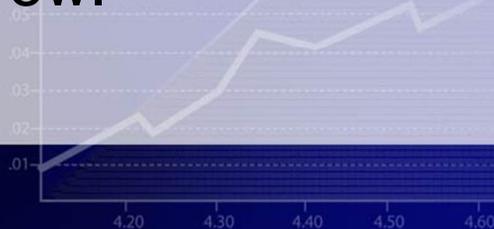
Some areas will reach grid parity – where residential solar is equal in cost to power from a utility – within 3-10 years.



# Expect the Unexpected?

Distributed generation is being pushed by a parallel revolution in microgrids, which have the ultimate potential of turning every person, company or institution with a renewable energy power system into a self-sustaining utility.

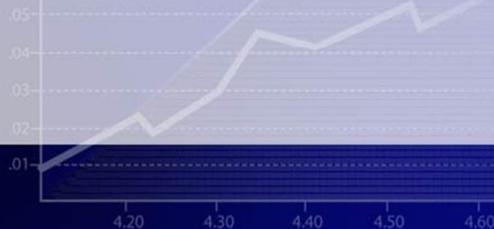
Solar is no longer sort of a “bleeding edge” technology. It is big business now and continuing to grow.



# Expect the Unexpected?

Utilities are looking to their government's regulators to save them by changing pricing structures so they can recoup more of the costs of maintaining the grid infrastructure.

If utilities charge customers more to connect to the grid, those charges will also spiral – upward – as more customers install solar.



# Expect the Unexpected?

The utility industry is in a flat to shrinking business.

They must spread their high fixed costs for things like repairing the grid over fewer kilowatt-hours, making solar even more competitive. As solar and batteries get cheaper and cheaper, they are going to see their customer base of the best customers adopt more solar in a vicious circle.



# Cost & Revenue Vulnerabilities

Most utilities have high fixed costs for maintaining a grid that was designed to deliver power from a few sources to many customers.

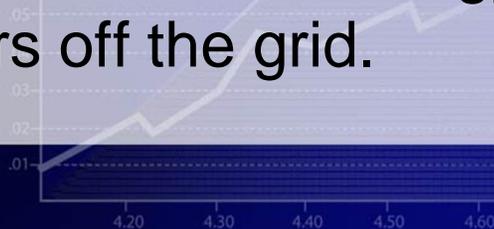
It is estimated that more than 90% of utilities' costs are fixed, but only about 35% of revenues are fixed.



# Cost & Revenue Vulnerabilities

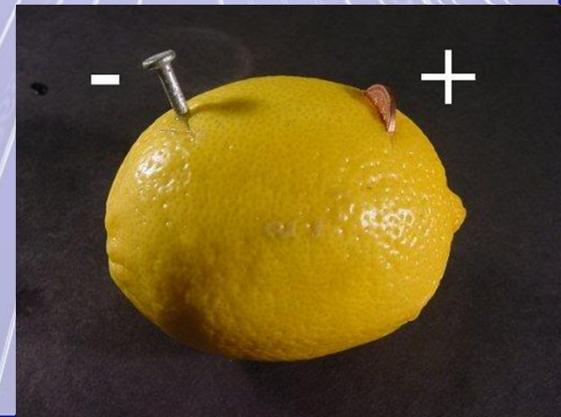
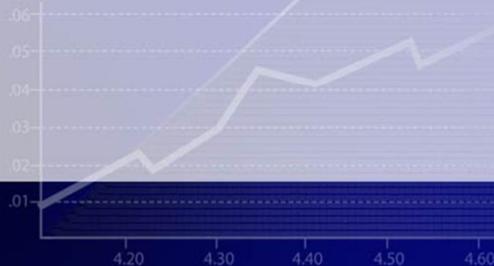
Those unfixed revenues look vulnerable in the face of the tremendous growth in solar energy.

The major concern in the existing business model is a situation where you have such a high proportion of fixed costs being recovered through a volumetric rate, and then you have a fast growth of a technology that starts pulling kilowatt hours off the grid.



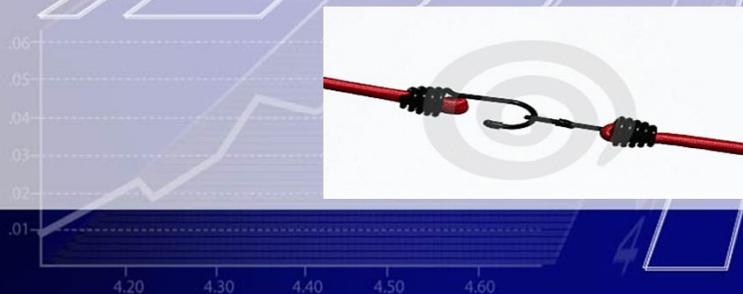
# Cost & Revenue Vulnerabilities

Even customers who produce their own solar power will need the grid either for rainy days or to sell their surplus—at least until cheap energy storage becomes viable.



# Cost & Revenue Vulnerabilities

Industrial customers have produced their own power for decades, but they still rely on the grid in ways that may not be reflected in pricing.

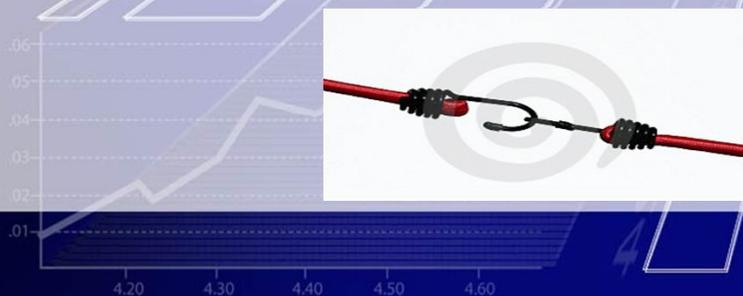


# Cost & Revenue Vulnerabilities

There is a lot of value to the grid.

There is also a lot of value to that backup spinning generation.

How do you make sure there is adequate compensation for those backup resources?



# Cost & Revenue Vulnerabilities

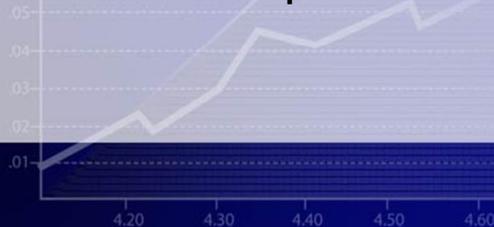
The U.S. boom in solar installations has disrupted revenue, workflow, forecasting and asset & data management at large utilities.



# Grappling with Major Disruptions

- **Lost Revenue:** Large utilities are seeing erosion in their revenues due to the rise of distributed generation, and also in the increase of deregulated markets.

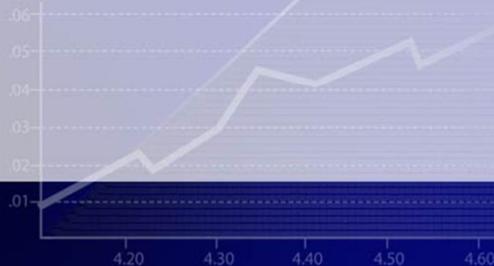
Utilities have responded largely in two ways: by beginning to shift from variable to fixed rates that will cover their cost for delivering electricity, and buying up the solar companies that are eating into their revenues.



# Grappling with Major Disruptions

- **Increased Paperwork:** The sheer volume of solar applications to both cities and utilities can overwhelm workflows.

Solar application processing has become a significant new business at utilities, which must process them within a regulated (or expected) time frame. It is not just a capacity problem, it is a volume pain point.



# Grappling with Major Disruptions

- **Forecasting:** Distributed generation, whether it is wind or solar, has a high real-time variability based on weather conditions. Yet utilities have to be able to forecast supply and demand when they make financial decisions.

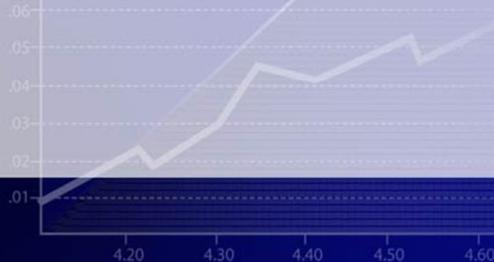
Each utility has to have accurate customer-load forecasts. Having real time visibility into the solar deployment becomes increasingly valuable as distributed generation spreads.



# Grappling with Major Disruptions

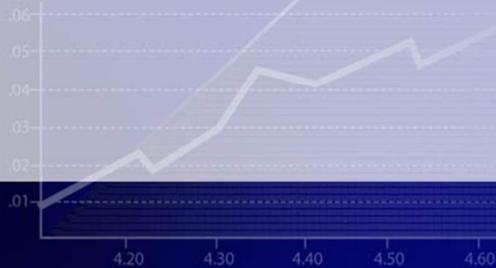
- **Asset and Data Management:** As new solar come online across the grid, they have to fit smoothly into the utilities' existing infrastructure.

The meters, distributed network, billing center and every department that may interact with a customer, a customer who now only consumes power, but generates it and sells it back.



# If THAT wasn't bad enough

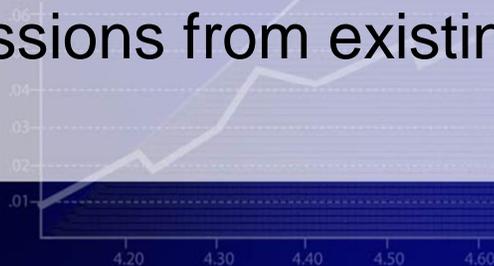
The Edison Electric Institute projected that about \$800 billion in new construction over the next 10 years will be required to upgrade generation and transmission needs just within North America.



# If THAT wasn't bad enough

The International Energy Agency anticipates that the capital investment in energy infrastructure necessary to support global demand will cost approximately \$20 trillion through 2030.

Investments will focus on alternative energy sources and their inclusion into the grid, transmission lines and retrofits to reduce carbon emissions from existing facilities.



# If THAT wasn't bad enough

The political ramifications have made allies of ideologically diverse groups.

- Conservatives, who see any government interference as a violation their rights, are demanding the right to install solar systems without the opposition of the utilities.
- Liberals, who support environmental issues, want the government to actively pursue the growth of renewable energy.



# Remember the way it was and write it off

In an unusually frank January report by the Edison Electric Institute (EEI), warned members that distributed generation and companion factors have essentially put them in a situation where if they don't change, they will face bankruptcy.

Like Postal Services, utilities will continue to serve the elderly or less fortunate, but the rest of the population moves on.



# Remember the way it was and write it off

Power use in the U.S. peaked in 2007.

There won't be much need for new large-scale transmission lines, except perhaps to gather and distribute power from remote wind or solar farms.

Some existing transmission lines are going to become stranded costs.

Most coal- and oil-fired plants are destined for extinction.



# Remember the way it was and write it off

Renewable energy is not like fossil fuel energy:

- You don't need large amounts of capital to build it.
- You don't need to produce it all in one place and high-voltage transmission lines to transport it somewhere else.
- For the technology sector, the first rule is: Costs always go down. For the energy sector and all extractive industries, costs almost always go up



# Remember the way it was and write it off

When customers have the opportunity to reduce their use of a product or find another provider of such service, utility earnings growth is threatened.

As this threat to growth becomes more evident, investors will become less attracted to investments in the utility sector.

This will be manifested via a higher cost of capital and less capital available to be allocated to the sector.



# Remember the way it was and write it off

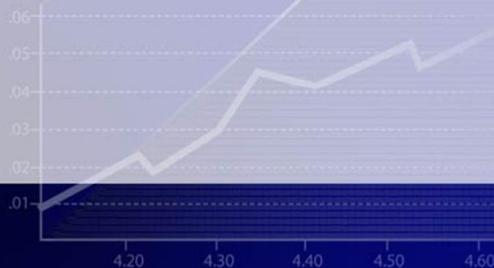
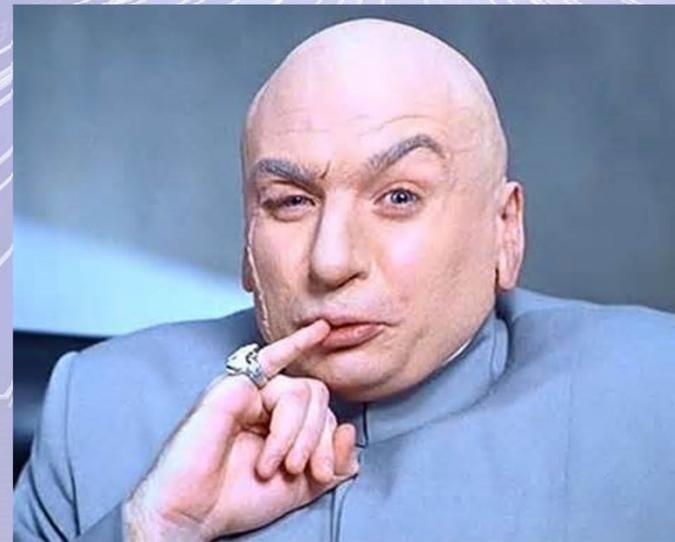
The idea that we would continue to have a centralized form of ownership and control of the grid is inconsistent with what the technology enables.

Given these trajectories, the coming tussle between solar and conventional energy is not going to be a fair fight.



# A New Business Model

If I gave you the answer, it would cost you  
100 Billion Dollars!



# A New Business Model

No industry as large, long-lived, powerful, and politically connect as the utility industry will simply roll over, disruptive technology or not.

Their arguments to why the grid will survive include:

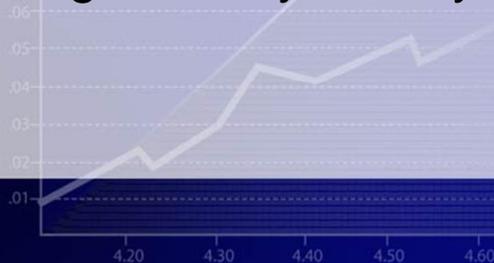
- Solar doesn't work everywhere
- Coal still makes sense in places where there is low cost sources
- Microgrids aren't foolproof.



# A New Business Model

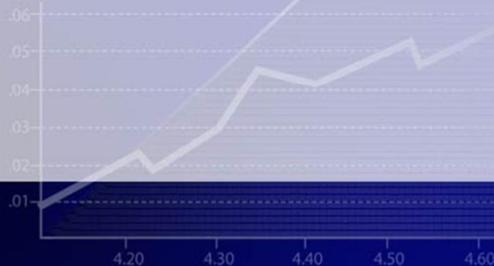
The changing world requires changing strategies.

- The grid will continue to shrink as distributed generation captures an increasing share from utility-generated power.
- Government subsidies create false economic results but are unlikely to be completely eliminated.
- Utilities can do nothing but complain about technological change or they can try to adapt.



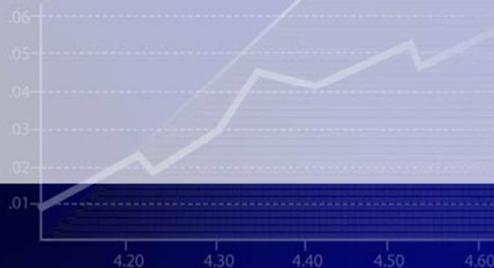
# A New Business Model

- Utilities need to change their culture to embrace renewable energy and expand their reach into the market.
- Government subsidies create false economic results but are unlikely to be completely eliminated.
- Utilities can do nothing but complain about technological change or they can try to adapt.



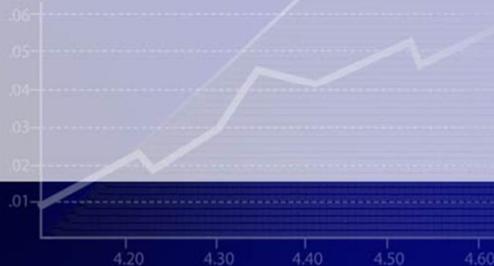
# A New Business Model

- Utility capacity will be measured against providing the “base load” – the minimum amount of power to keep essential services running – but no need for as many utilities as there are now.
- There is going to be a scramble among existing utilities to preserve market share.



# A New Business Model

- Utilities must start or continue investment and research in renewable energy as a priority, and be seen as innovators in the area.
- Utilities need to fight for pricing structures that will compensate them for the value of the grid they maintain, and preserve the integrity of the system.



# A New Business Model

Utilities need to consider the parallels from the Telecommunication sector.

- Dramatic technological change has evolved over the past 35 years, which has led to the development of a new infrastructure system;
- New services that provide abundant transfer of information; and the convergence of voice, data, and entertainment into one combined service from what had previously been viewed as separate and distinct services and industries.



# A New Business Model

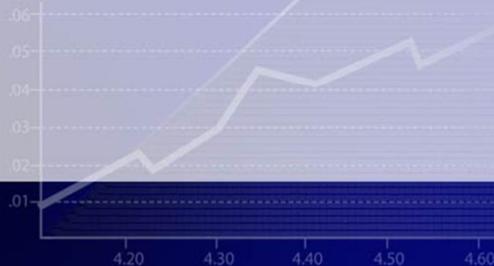
- Today, the number of customers who utilize the previously exclusive “copper wire” telephone system represents a rapidly declining percentage of the market for telephone services.



# A New Business Model

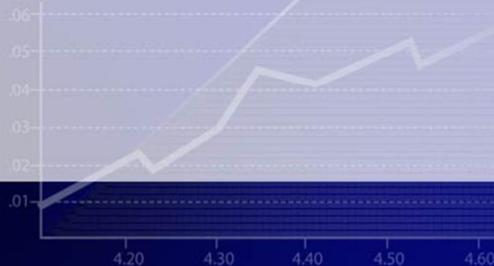
What the telephone industry did right:

- First, at the onset of the restructuring of the Bell System in the U.S., there was no vision that the changes to come would be so radical in terms of the services to be provided and the technologies to be deployed. They broke with the 'culture' of the past.



# A New Business Model

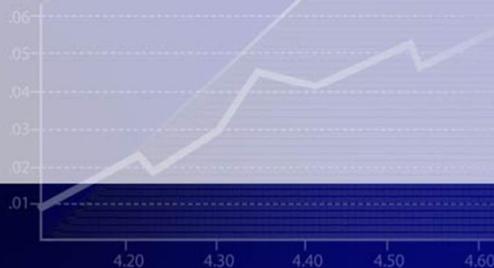
- Second, the telephone players acted boldly to consolidate to gain scale and then take action to utilize their market position to expand into new services on a national scale.
- Finally, and most important, if telephone providers had not pursued new technologies and the transformation of their business model, they would not have been able to survive as viable businesses today.



# A New Business Model

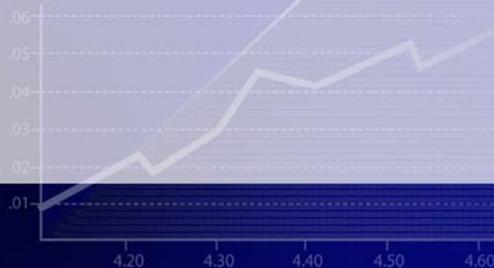
Telecom providers that have embraced new technologies and addressed the competitive threats they faced have managed to survive and to protect investors from a “Kodak moment\*\*\*.”

\*\*\*the point at which the world’s leading maker of camera film realized that consumers had gone digital, and it was too late to chase them



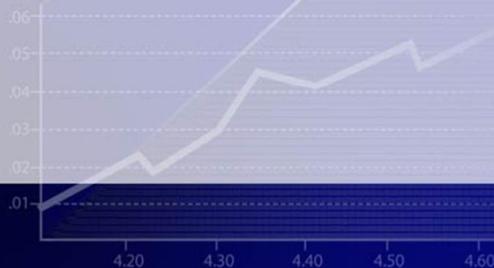
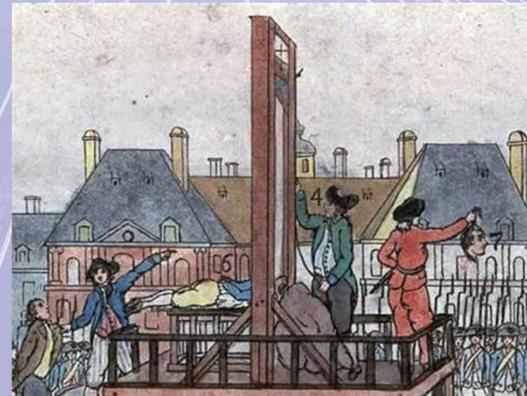
# Summary

While the threat of disruptive forces on the utility industry has been limited to date, economic fundamentals and public policies in place are likely to encourage significant future disruption to the utility business model.



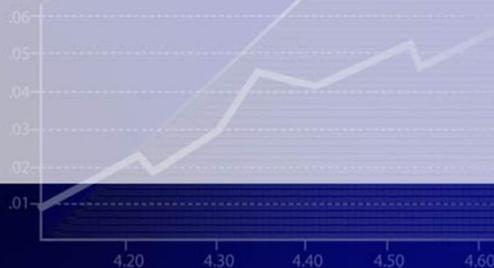
# Summary

Technology innovation and rate structures that encourages modification by customers must be addressed quickly to mitigate further damage to the utility franchise and to better align interests of all stakeholders.



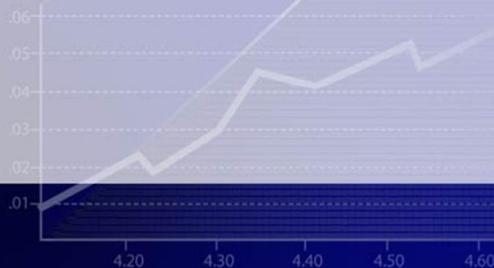
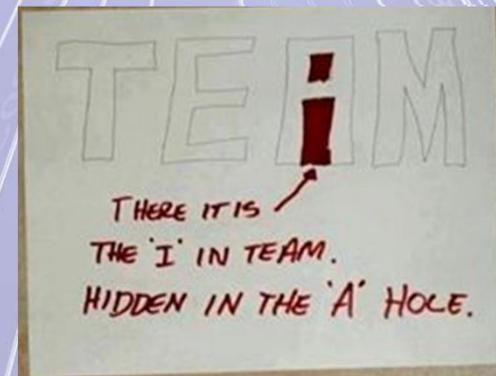
# Summary

The competitive economics of distributed energy resources, such as PV solar, have improved significantly based on technology innovation and government incentives and subsidies.



# Summary

Utilities and stakeholders must work together develop policies and strategies to reduce the risk of ongoing customer disruption, including assessing business models where utilities can add value to customers by providing new services.



# Summary

All stakeholders must embrace the changes in technology and business models in order to maintain a viable utility Industry and avoid the

**Death Spiral**

**THANK YOU!**

