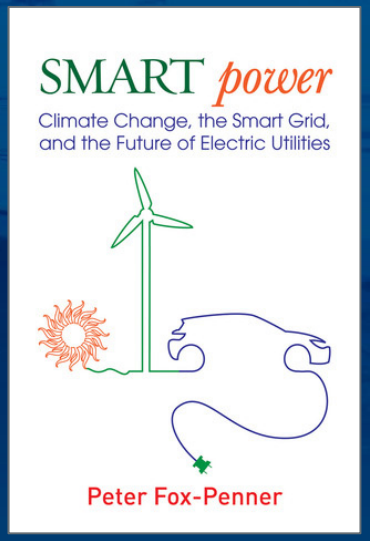
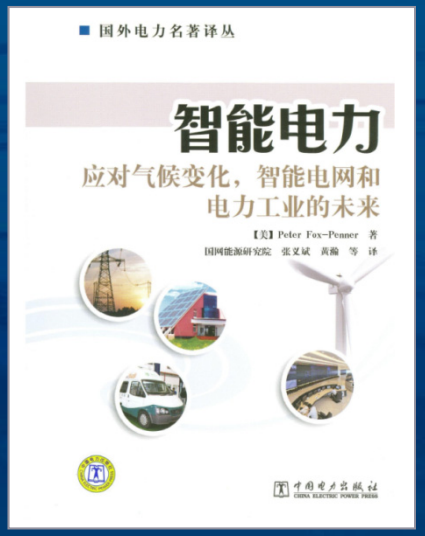
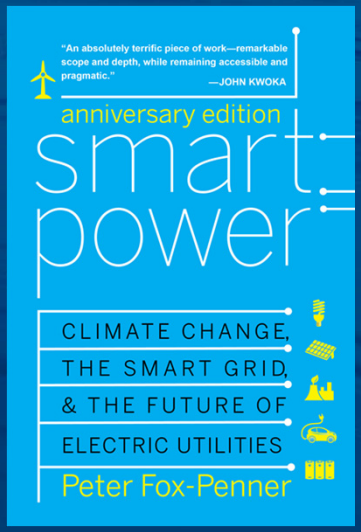
Public Power in the Age of Smart Power







Peter Fox-Penner
Presented to the American Public Power Association

October 6, 2014

Views expressed in these slides are solely those of he author unless referred otherwise.

Please visit the "other" Smart Power www.smartpower.org

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Agenda

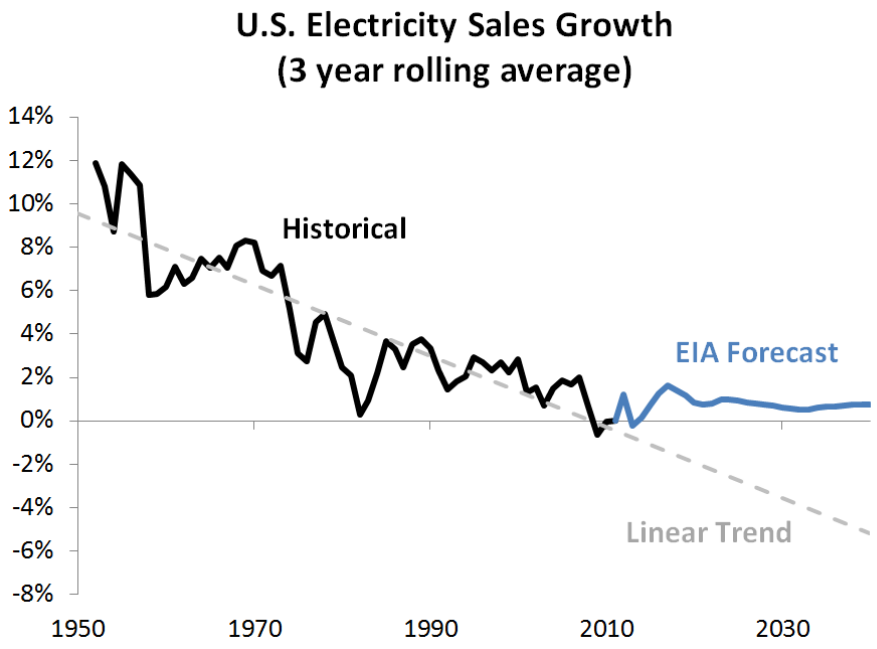
Topic 1: Change Drivers

Topic 2: The Case for New Business Models

Topic 3: Alternatives and Opportunities

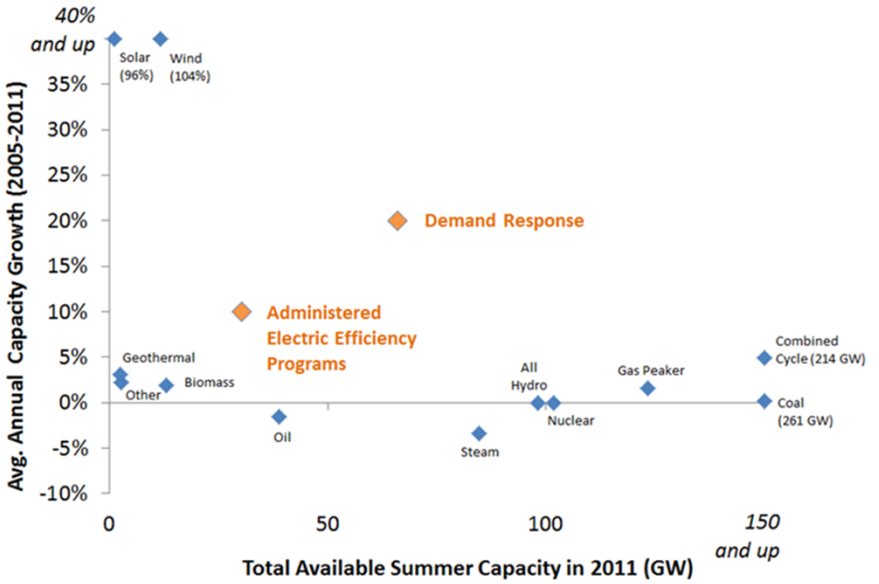
National electricity sales growth recently dipped into negative territory and is expected to grow at well less than 1% annually

Declining sales growth has been the norm since the 1950's…



Source: EIA, 2014 Annual Energy Outlook and 2012 Annual Energy Review.

… and Demand Response continues to grow as a major resource.

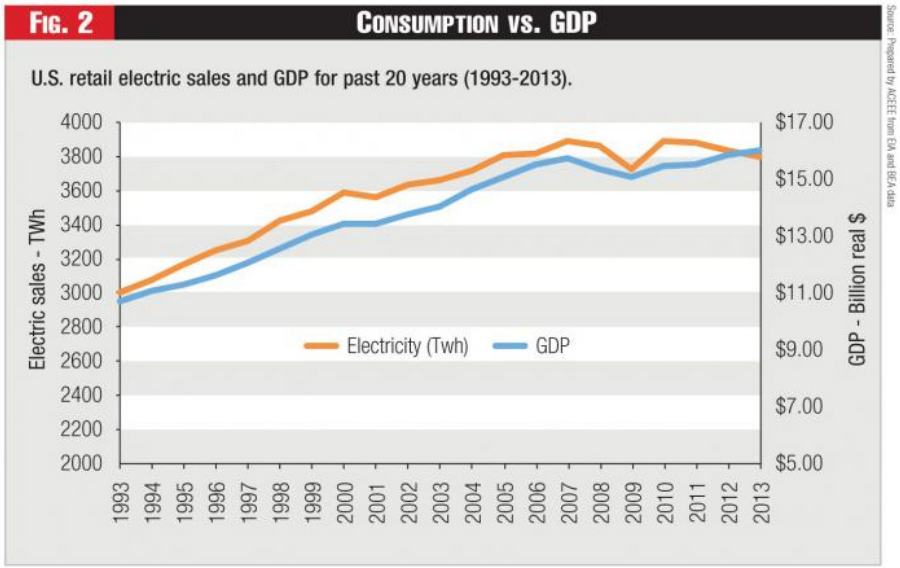


Notes:
Source of generation capacity data is Ventyx Energy Velocity Database
Demand response data from FERC 2013 Assessment of Advanced Metering and Demand Response
Energy efficiency data based on actual peak reduction estimates from EIA-861
Summer capacity is total for generating units classified as "operating" with commercial online date before January 2012
Assumes 50% peak coincidence for solar and 25% peak coincidence for wind; all other types assume 100% availability for simplicity

Source: Ryan Hledik, The Brattle Group, © 2013.

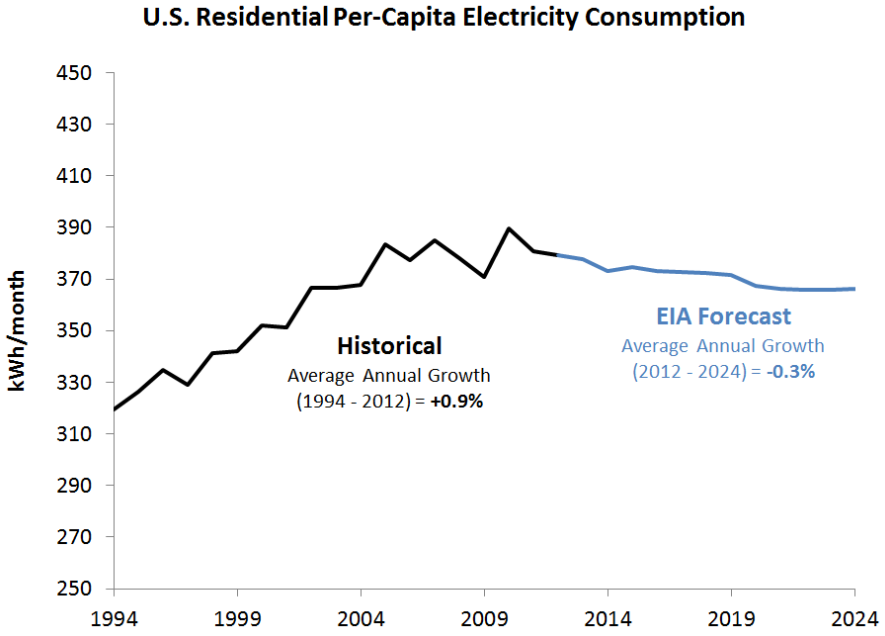
U.S. electricity sales growth declined in the recession and is expected to grow at well less than 1% annually

Declining sales growth has been the norm since the 1950's…



Source: Steve Nadel and Rachael Young, "Why is Electricity Use No Longer Growing?" Public Utilities Fortnightly, September 2014.

… but we have arrived at a point where households are consuming less each year



Source: EIA 2014 Annual Energy Outlook, 2012 Annual Energy Review, Census.

There are at least seven factors driving the slowdown in electricity sales, most of which are structural in nature

1. Post-recession **economic recovery has been slow** - this is the longest sales recovery period in the history of the electricity industry and consumer confidence still has not returned to pre-recession levels

2. **Energy efficiency and demand response** programs are growing at 10-20% per year

3. **Codes and standards** are being aggressively revised, in many cases due to concerns about the environment

4. Electricity intensive end-uses like air-conditioning were historically fast growing but are **approaching full market saturation**

5. Consumer psychology is shifting toward preferences for energy efficient products (we refer to this as "**organic conservation**")

6. In some states, electricity costs and **prices are rising**, leading to reduced demand

7. **Distributed generation and fuel switching** are on the horizon

Other factors might lead to a rebound in sales, but banking on these developments is a risky strategy

Residential lighting efficiency standards are driving much of the projected slowdown in sales growth over the next decade but will incrementally lessen in impact as the market becomes saturated with high-efficiency bulbs

- But what about the next generation of efficiency standards? The Energy Independence and Security Act will be 15 years old by the time these lighting standards have run their course

New electricity-intensive end-uses, such as plug-in electric vehicles, may emerge at high levels of adoption

- This is a possibility, but would require that significant economic, technical, and policy barriers be overcome

Industrial sales growth, which has been negative over the past few years, could return to its pre-recession growth rate of 0.7% per year

- How much confidence do we have that this will happen?
- And what magnitude of improvement would be needed in this sector to overcome the other factors we have discussed?

Cheap natural gas could depress prices and lead to an increase in consumption

- But gas has been cheap for a few years and sales growth has stalled
- And electricity rates continue to rise due to increasing grid/infrastructure investments

Smart Grid Growth

- Many "smart grid" technologies are internal to grid: outage detection, feeder management, auto-reclosers, etc. These are not disruptive. However:
  - 4 million smart meters have been installed in the past year; (Only 2% of customers on varying rates but growing).
  - The grid edges is exploding with new products:
    - Two way communication/control
    - Big data application
    - Cyber security
    - Integrating DG and Microgrids

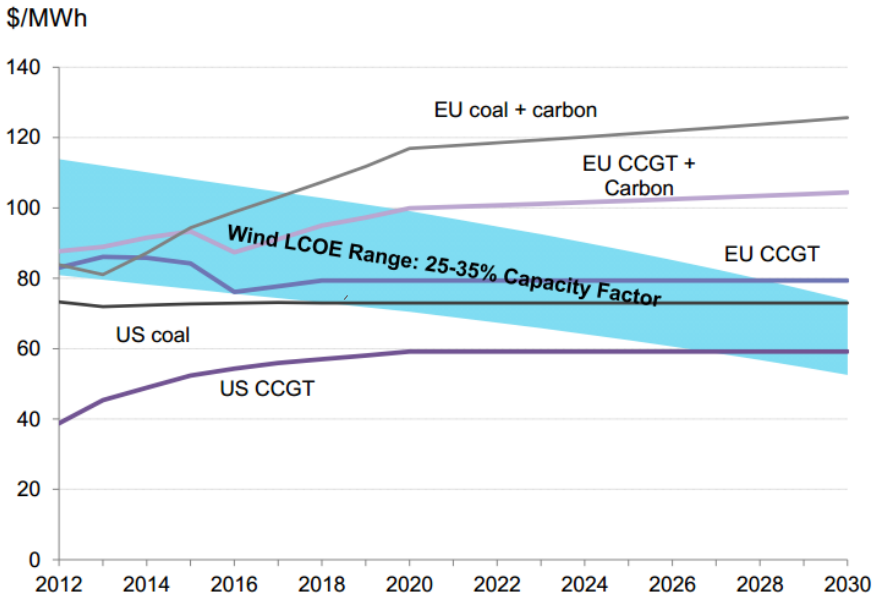
Source: Ahmad Faruqui, et al., "Smart By Default," Public Utilities Fortnightly, August 2014.

What's Important About the Smart Grid?

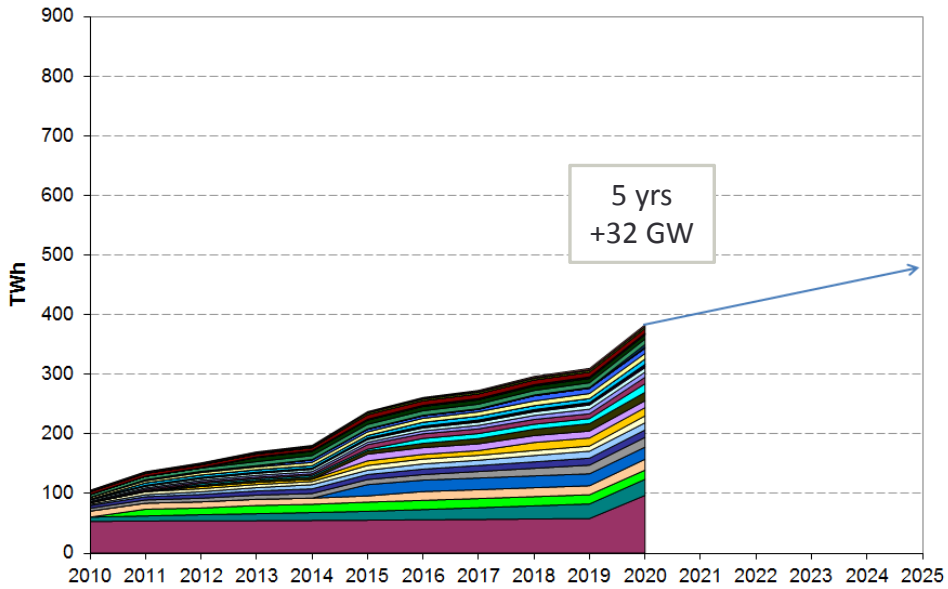
- Everyone agrees: helps you operate more efficiently. This is not disruptive.
- Raises your distribution system capex now and in future, putting pressure on per-kWh average rate
- Offers customers who want them energy-saving and energy service options
- Many customers won't want these new services, and won't pay for them, but many do and more will

Growth of Large-Scale Renewables

Projected Wind Costs



RPS Driven Capacity
(Excluding Additions Since 2011)

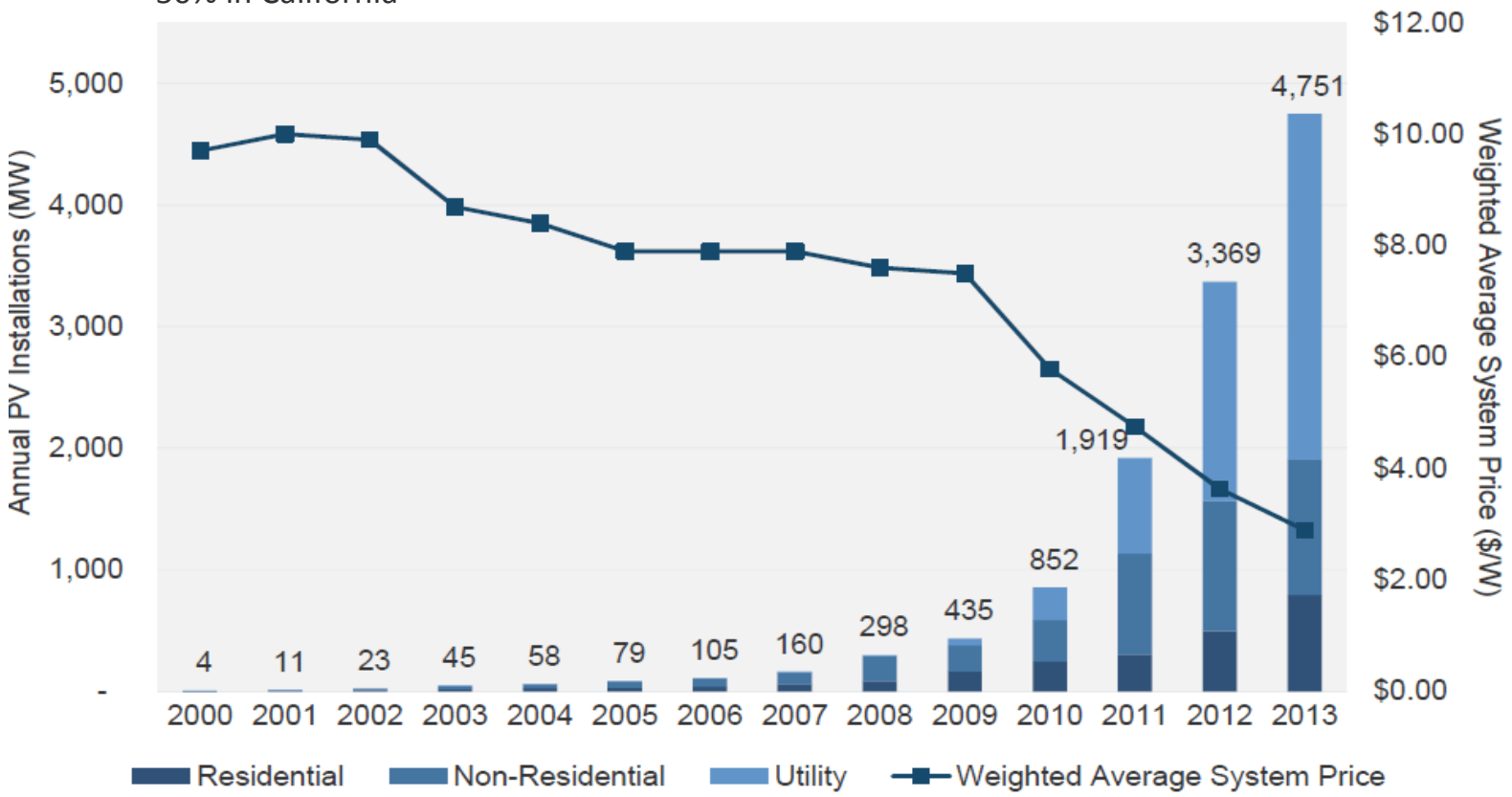


Sources: Guy Turner, Global Renewable Energy Market Outlook 2013, April 22, 2013 and The Brattle Group, © 2011.

U.S. PV Installs and System Prices

In a city of 1MM, 13,5000 homes installing PV flattens 1%/yr residential growth

- 90% of PV installs in 10 states
- 50% in California

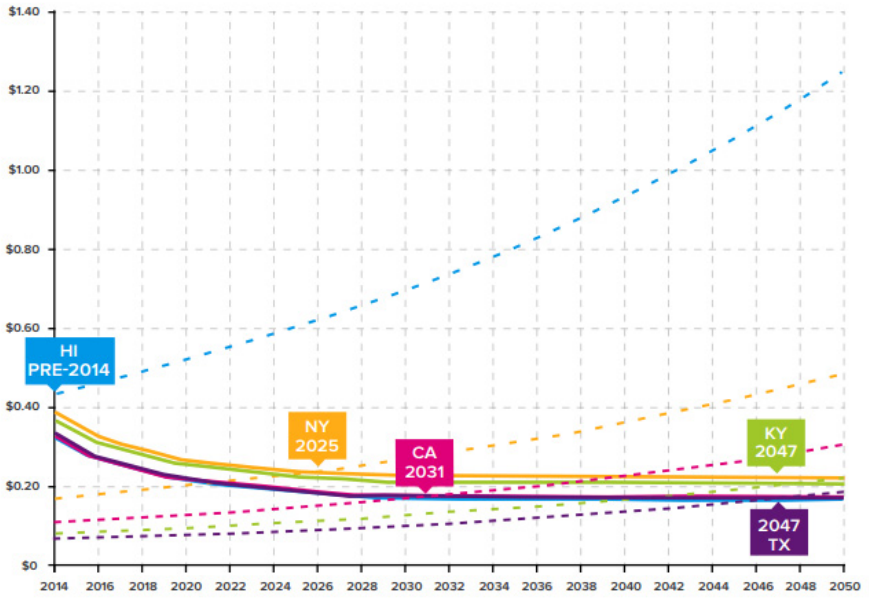


Source: "U.S. Solar Market Insight 2013," The Solar Energy Industry Association, 2014.

State Renewable Policies

- 30 states have RPS - highest is California at 33% by 2020.
- 48 states give tax incentives
- 43 states give "net metering" for small PV
- PV grew by 4,750 MW in 2013:
  - ~ 30% of all additions
  - Utility PV = 60%

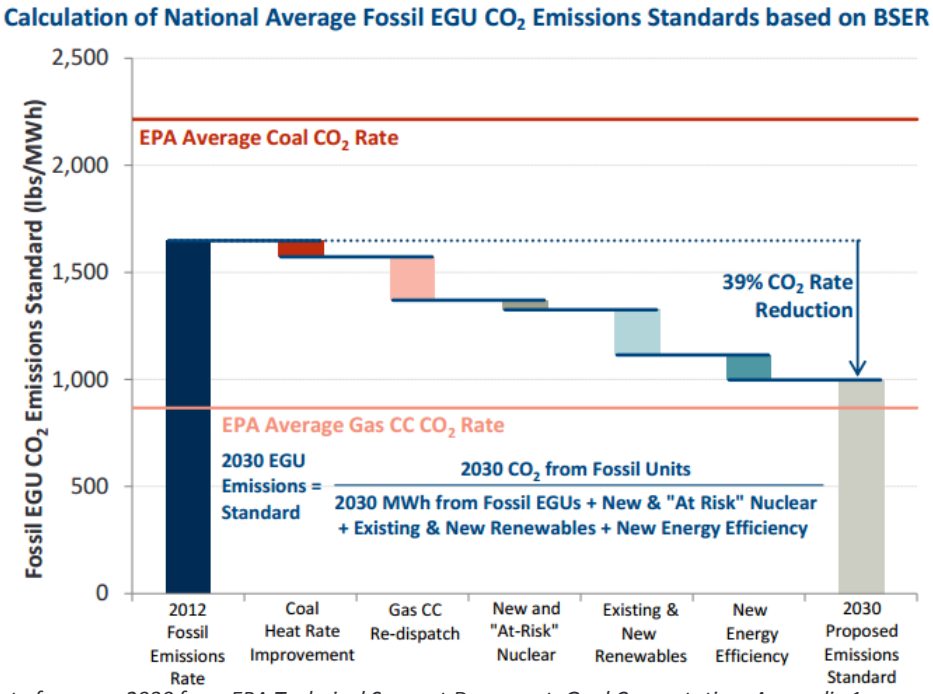
Solar is reaching grid parity across states- some quicker than others.



Source: "The Economics of Grid Defection," The Rocky Mountain Institute, 2014.

U.S. Carbon Policy = New EPA Rule + Executive Action + State Actions

- Best System of Emissions Reduction (BSER) applied to each state's current fossil generator emissions rate to set state-specific fossil emissions
- States given flexibility in how to meet the standards, including renewables and EE
- Effect on distributors: slightly higher rates and state policies for DER and EE, both lowering sales

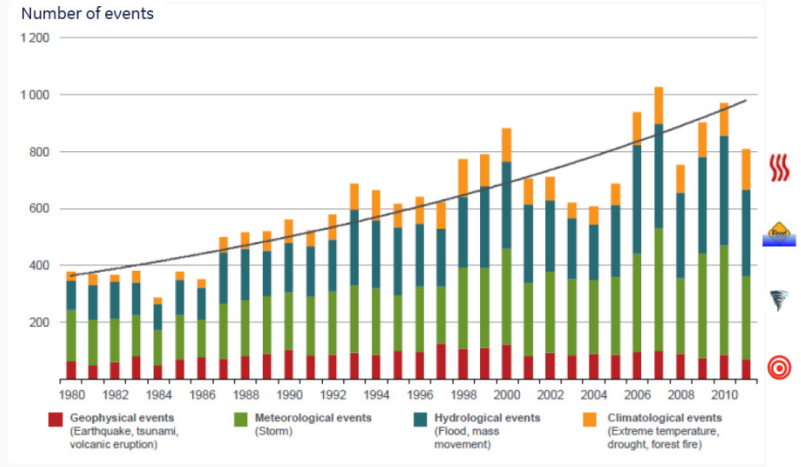


Notes: Reflects Option 1 final rate for years 2030 from EPA Technical Support Document: Goal Computation, Appendix 1.
Sources: Metin Celebi , et al., "EPA's Proposed Clean Power Plan Implications for States and the Electric Industry," The Brattle Group, 2014.

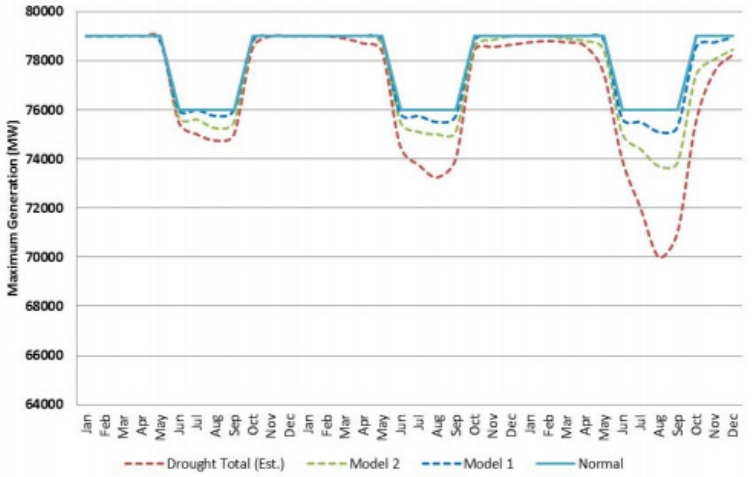
A New Driver: Resilience

- Projections for climate-driven damage increasing and utilities are facing adaption challenges:
  - Extreme weather incidents have increased tenfold since 1992
  - In 2012 there were 11 disasters that each caused $1 billion in damage; 9 in 2013
  - Droughts in 2011 covered 2/3 of the U.S. stressing several utilities
- Hurricane Sandy- the new future for utilities?
  - Several utilities asking PUCs for approval to harden their assets
  - States and cities developing cross-cutting resilience plans
  - Growing interest in microgrids as a resiliency investment

World-wide Natural Disaster Trend



Multi-Year Drought Derating Model



Source: Peter Evans, "Shocks and Global Governance Gaps," GE Energy, Presented to the University of Georgia, School of Law, February 3, 2012; "ERCOT Long Term Supply Assessment," Energy Reliability Council of Texas, 2012.

Capital Investment Needs

TABLE 2 ★ National Electricity Infrastructure Gap: Estimated at $107 Billion by 2020 *(in billions of 2010 dollars)*

TYPE OF INFRASTRUCTURE	CUMULATIVE GAP 2020	2040
Generation	12.3	401.1
Transmission	37.3	111.8
Distribution	57.4	219.0
U.S. TOTAL	**107.0**	**731.8**

SOURCES EIA, NERC, Eastern Interconnection Planning Collaborative, Phase I Report, December 2011, Renewable Energy Transmission Initiative Electric Power Research Institute and Federal Energy Regulatory Commission. Calculations by La Capra Associates and EDR Group.

NOTE Numbers may not add due to rounding.

Source: "Failure to Act," The American Society of Civil Engineers, 2011.

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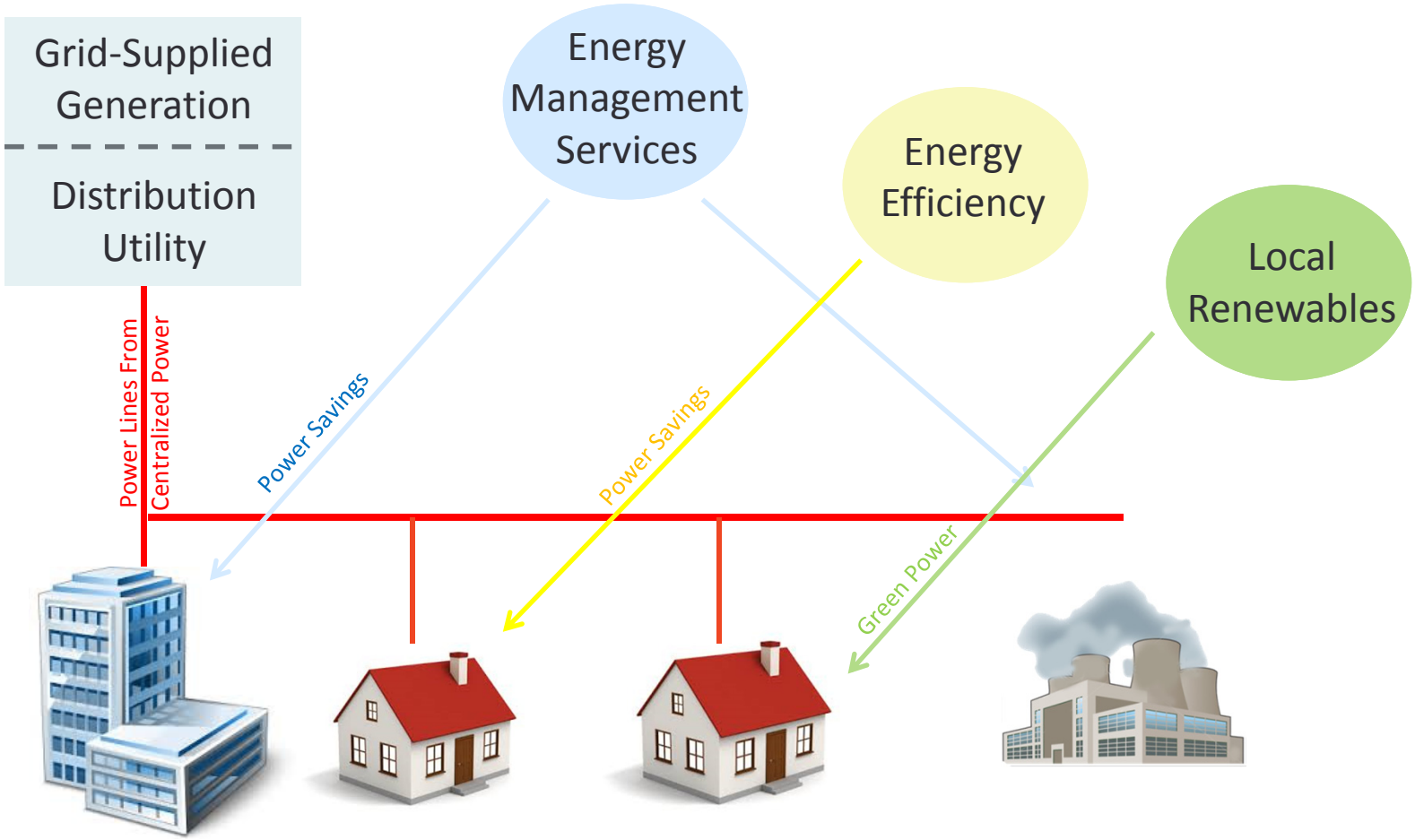
Traditional Industry Structure

Traditional Public Power

Competitively Supplied, Customer-by-Customer



The Smart Integrator (SI)

The Smart Integrator operates a regulated Smart Grid open access platform offering unbundled "distribution system services" to competitive providers of commodity power, renewables, energy efficiency, energy management, etc.

- The distribution (wires) company is incentive-regulated or publicly owned.
- The distco integrates upstream supply, local supply and storage, and operates the grid to ensure reliability.
- It may directly control some customer systems for grid management.
- Emphasis is network operator, not commodity sales.
- Energy efficiency is not a natural role of the Smart Integrator, but it can be added on.

Example: National Grid

The Energy Services Utility (ESU)

The Energy Services Utility changes the utility from a pipes-and-wires business to a customer-service-centric model:

Unlike the Smart Integrator:

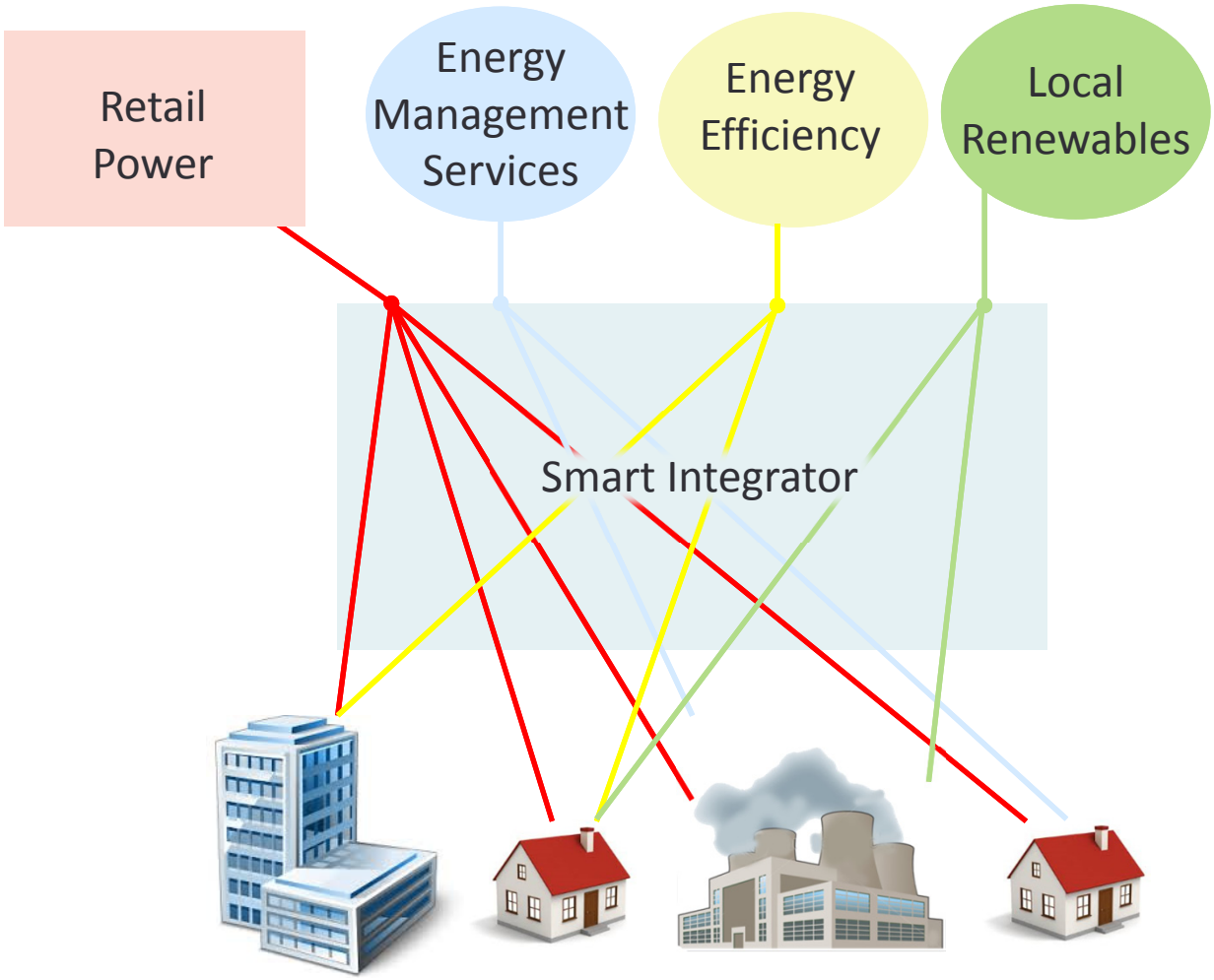
- The utility continues to produce and sell kWh, BUT…
- The utility views its products as energy services, heat, light, etc.
- The utility provides services via hardware, software, advice, and kWh in customized packages.
- Revenue is not based on kWh sold, it is based on (unit price of service) x (units of service used).

All other roles are the same as the Smart Integrator:

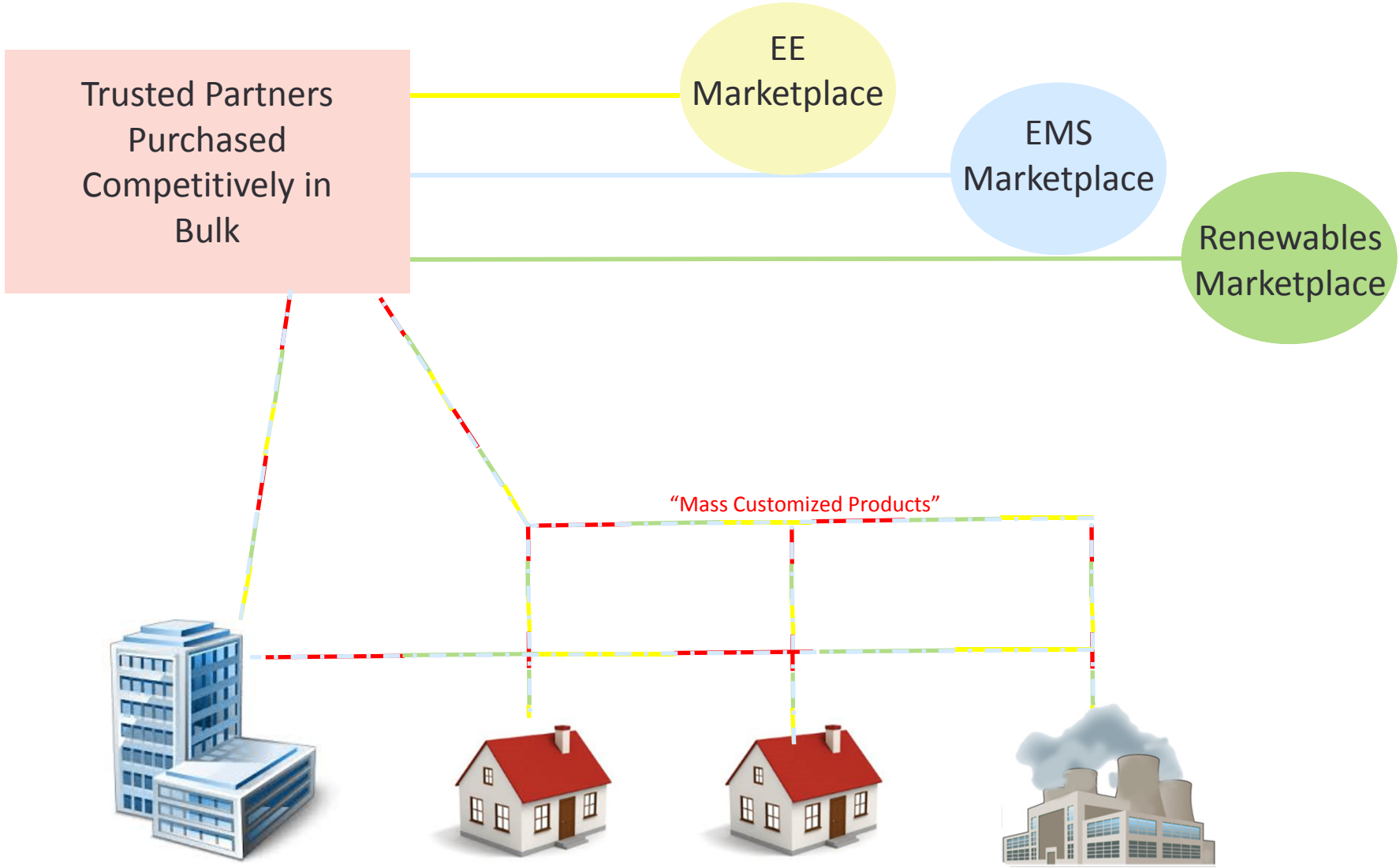
- Delivering energy.
- Operating Smart Grid.
- Dynamic pricing – possibly less nodal.

Evolving Example: Many APPA Members and Rural Cooperatives

Smart Integrator is Platform for Retail Marketplace Competitive Energy Services

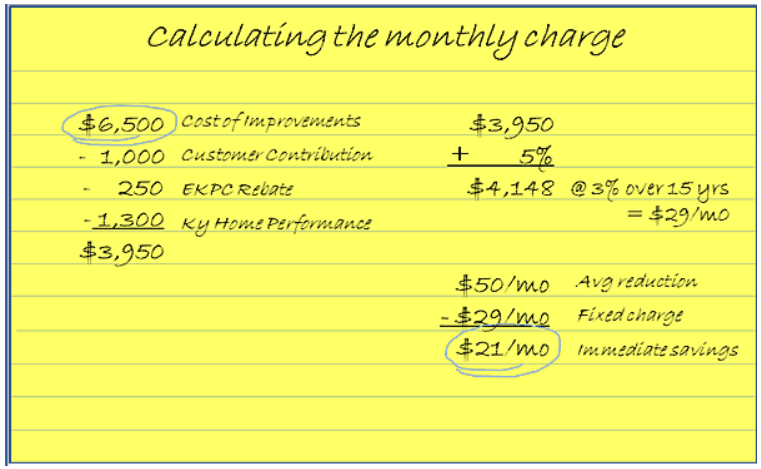


The ESU Ecosystem



How$martKY

- Four rural utility cooperatives in Eastern Kentucky (Big Sandy RECC, Fleming-Mason RECC, Grayson RECC, and Jackson Energy).
- On-bill financing of EE improvements using the opt-in Kentucky Energy Retrofit Rider (KER).
- Average Savings of $11/month.



"The program is not a loan or a subsidy, but an extension of the utility services that households or businesses are already receiving."

Emerging State (and other) Activity

Maryland:

- PBR Report (2014)
- Resiliency through Microgrids (2013)
- EFC Scopes Potential Utility 2.0 pilot (2013)
- Grid Resiliency Review (2013)

California:

- **Requiring IOUs develop Distribution Resources Plan Proposals (2014)**
- Workshop on new Business models (2013)
- Review of Rate Design (2012)

Arizona:

- Docket opened allowing utilities to file new rate designs(2014)

Targeted Dockets on Immediate Issues

2014 NY REV Docket:

- Enhancing DG and Load Management
- Identification of regulatory changes
- **Distributed System Platform Providers (DSPP) model**

2012 MA Modernization of the Electric Grid:

- Time varying rates, interoperability of devices, cybersecurity, etc.
- **Utilities file Grid Modernization Plans ("GMPs")**

Broad Guidance on Business & Regulatory Model

OFGEM Implements RIIO: Revenues = Incentive + Innovation + Output

Wellinghoff Proposes DSO- Independent System Operator for the distribution network

Overview of REV Docket

Policy Questions/Goals:	Outcomes:
1. What should be the role of the distribution utilities in enabling system wide efficiency and market-based deployment of distributed energy resources and load management? 2. What changes can and should be made in the current regulatory, tariff, and market design and incentive structures in New York to better align utility interests with achieving our energy policy objectives? Policy objectives: 1. Enhanced Customer knowledge and tools that will support effective management of their total energy bill. 2. Market animation and leverage of ratepayer contributions. 3. System wide efficiency 4. Fuel and resource diversity 5. System reliability and resiliency; and 6. Reduction of carbon emissions.	• Report on Distributed System Platform Provider issues (wholesale markets, opportunities for customer engagement). • Policy determination on regulatory design and ratemaking first quarter of 2015. • Determine how **Distributed System Platform Providers (DSPP)** will actively manage and coordinate distributed energy resources and providing a market enabling customers to optimize their energy priorities, provide system benefits, and be compensated for providing such system benefits.

Source: "CASE 14-M-0101- Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision ," New York Public Service Commission, April 25, 2014.

REV- New Functionalities for NY Utilities

STATE OF NEW YORK
DEPARTMENT OF PUBLIC SERVICE
DEVELOPING THE REV MARKET IN NEW YORK:
DPS STAFF STRAW PROPOSAL ON TRACK ONE ISSUES

Table 2

Grid	Customer/DER/Microgrid	Market
• Real-time load monitoring • Real-time network monitoring • Adaptive protection • Enhanced fault detection/location • Outage/restoration notification • Automated feeder and line switching (FLISR/FDIR) • Automated voltage and VAR Control • Real-time load transfer • Dynamic capability rating • Power flow control • Automated islanding and reconnection (microgrid) • Real time/predicted probabilistic based area substation, feeder, and customer level reliability metrics (MTTF/MTTR)	• Direct load control • DER power control • DER power factor control • Automated islanding and reconnection • Algorithms and analytics for Customer/DER/Microgrid control and optimization	• Dynamic event notification • Dynamic pricing • Market-based demand response • Dynamic electricity production forecasting • Dynamic electricity consumption forecasting • M&V for producers and consumers (premise/appliance/resource) • Participant registration and relationship management • Confirmation and settlement • Billing, receiving and cash management • Free-market trading • Algorithms and analytics for market information/ops

Source: "CASE 14-M-0101- Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision ," New York Public Service Commission, April 25, 2014.

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What's Wrong with The Status Quo?

- Waning revenues, higher and maybe stranded costs as sales flatten or decline.

- Cede new customer service opportunities to the market, passing up revenues – fade in relevance.

Most importantly:

- Your citizen-customers may prefer services procured by you as their agent.

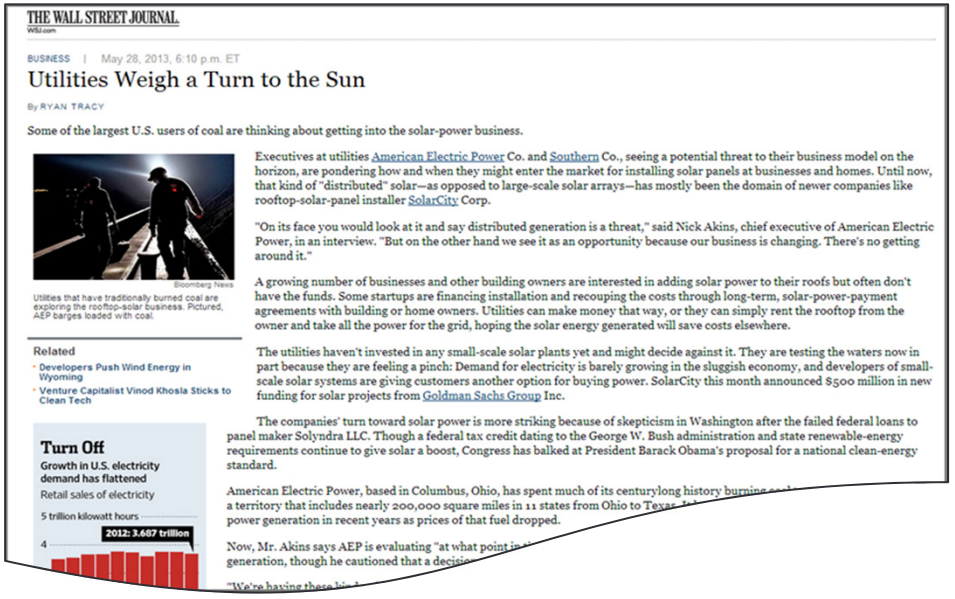
And to be clear

Public power utilities are not standing still.

Many of you are already migrating into a new business model without great fanfare

How Are Utilities Adapting?

- Changes in retail rate structure, including “decoupling”
- In some cases, trying to slow down DG or DR
- Shedding costs and shutting or selling plants
- Investing in renewables and DG
- Merging to acquire growth and diversify assets
- Investing in emerging economies
- Starting to think about new domestic business and regulatory models



THE WALL STREET JOURNAL.

BUSINESS | May 28, 2013, 6:10 p.m. ET

Utilities Weigh a Turn to the Sun

By RYAN TRACY

Some of the largest U.S. users of coal are thinking about getting into the solar-power business.

Executives at utilities American Electric Power Co. and Southern Co., seeing a potential threat to their business model on the horizon, are pondering how and when they might enter the market for installing solar panels at businesses and homes. Until now, that kind of "distributed" solar—as opposed to large-scale solar arrays—has mostly been the domain of newer companies like rooftop-solar-panel installer SolarCity Corp.

"On its face you would look at it and say distributed generation is a threat," said Nick Akins, chief executive of American Electric Power, in an interview. "But on the other hand we see it as an opportunity because our business is changing. There's no getting around it."

A growing number of businesses and other building owners are interested in adding solar power to their roofs but often don't have the funds. Some startups are financing installation and recouping the costs through long-term, solar-power-payment agreements with building or home owners. Utilities can make money that way, or they can simply rent the rooftop from the owner and take all the power for the grid, hoping the solar energy generated will save costs elsewhere.

Bloomberg News

Utilities that have traditionally burned coal are exploring the rooftop-solar business. Pictured, AEP barges loaded with coal.

Related

- Developers Push Wind Energy in Wyoming
- Venture Capitalist Vinod Khosla Sticks to Clean Tech

The utilities haven't invested in any small-scale solar plants yet and might decide against it. They are testing the waters now in part because they are feeling a pinch: Demand for electricity is barely growing in the sluggish economy, and developers of small-scale solar systems are giving customers another option for buying power. SolarCity this month announced $500 million in new funding for solar projects from Goldman Sachs Group Inc.

Turn Off

Growth in U.S. electricity demand has flattened

Retail sales of electricity

5 trillion kilowatt hours

4

2012: 3.687 trillion

The companies' turn toward solar power is more striking because of skepticism in Washington after the failed federal loans to panel maker Solyndra LLC. Though a federal tax credit dating to the George W. Bush administration and state renewable-energy requirements continue to give solar a boost, Congress has balked at President Barack Obama's proposal for a national clean-energy standard.

American Electric Power, based in Columbus, Ohio, has spent much of its centurylong history burning coal in a territory that includes nearly 200,000 square miles in 11 states from Ohio to Texas. It has cut back on coal power generation in recent years as prices of that fuel dropped.

Now, Mr. Akins says AEP is evaluating "at what point in time" it could add solar generation, though he cautioned that a decision

"We're having these kind

Source: Ryan Tracy, “Utilities Weigh a Turn to the Sun,” The Wall Street journal, May 28, 2013.

Public Power Utilities are Natural ESUs

Goal of Public Power

- Keep energy services costs (power and gas bills) low
- Good customer service
- Pay debts – healthy credit
- No on measures performance in kWh growth

Ideally Suited to Become ESUs

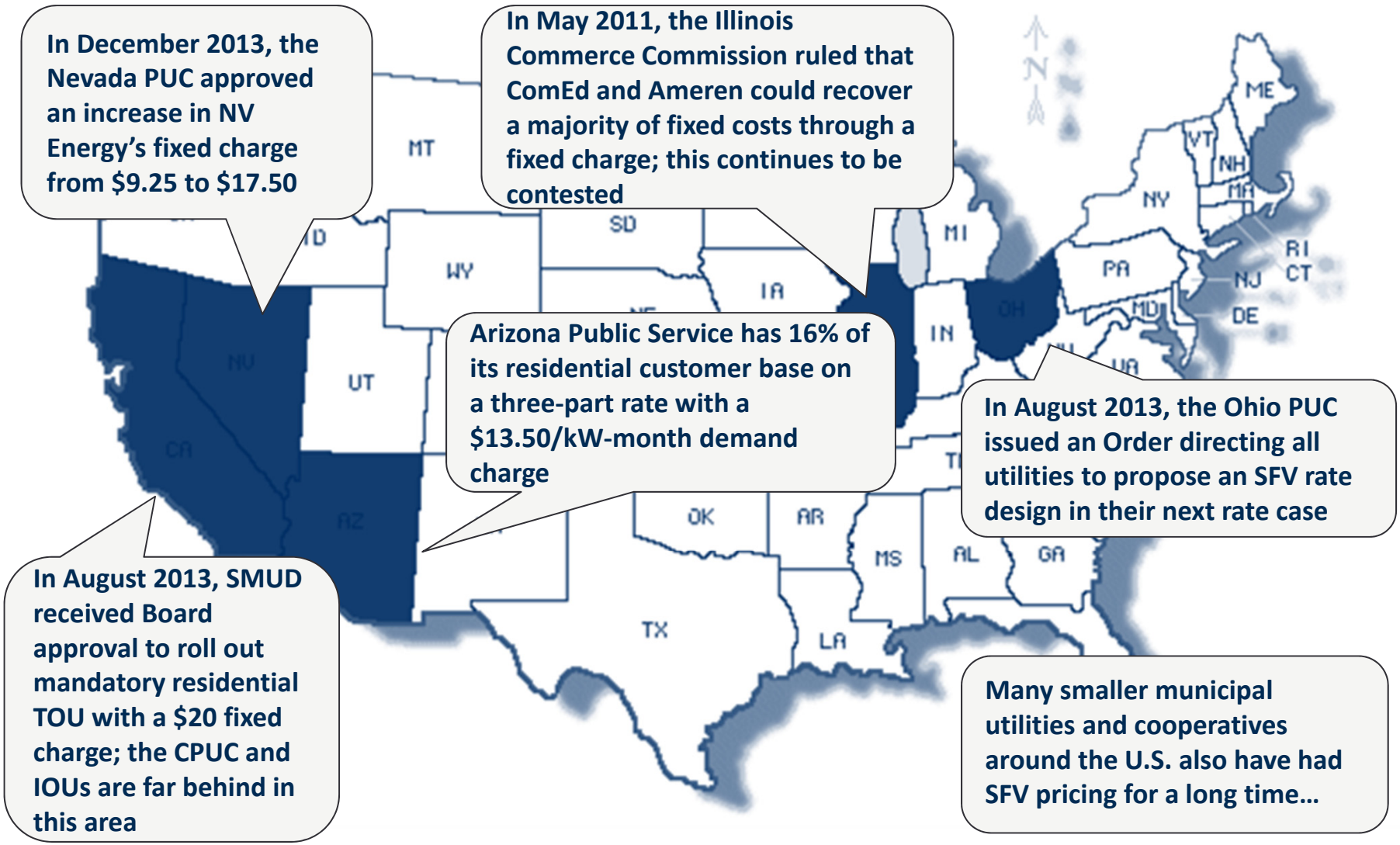
- Trusted in community as honest broker working for customers
- Many customers overwhelmed by change and new choices
- Scale economies in solar PV and other services
- Capture additional revenues as hedge against added capex and opex

Can also become – or may be forced into – Smart Integrator

Can ESUs Possibly "Beat the Market?"

- The two alternatives are atomistic competition via Smart Integrator – one customer/one service at a time, versus utility-delivered trusted-partner "mass customization" in ESUs.
- If ESUs can't or won't effectively offer grid-edge products and services as attractively and cheaply as market, this model will fail versus status quo or SI.
- However, the opposite may occur, too: if delivered well, customers may prefer a trusted, non-profit intermediary with buying power.
- ESU = extending *your* business model to synergistic services.
- Core competencies required:
  - Knowledge of fast-changing products
  - Negotiation and deals with partners
  - Marketing
  - Mass customization delivery

To Preserve Revenue, Changing Rate Structures to High Fixed Fees - A Short-term band aid



PV: Challenge to Opportunity

- Customers like solar power and it's good for the environment.
- Rooftop PV growing rapidly and expected to continue
- Yet, utility scale PV is 50% cheaper per MWh!
- Net metering is an unfair cross-subsidy
- Solution: Offer both U.S. and rooftop options via trusted partners. Viewing rooftop solar as "the enemy" is a mistake; offering fair, effective solar choices is a solution.

Figure 2.1 U.S. PV Installations, Q2 2010-Q2 2014

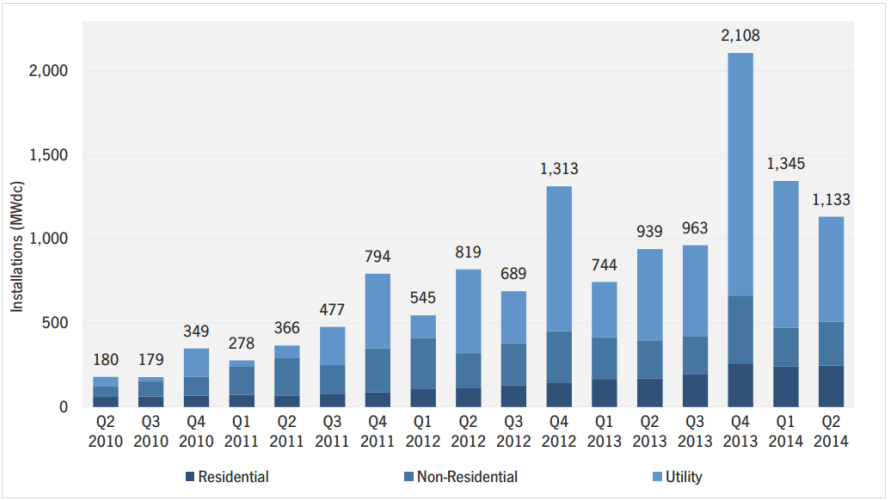
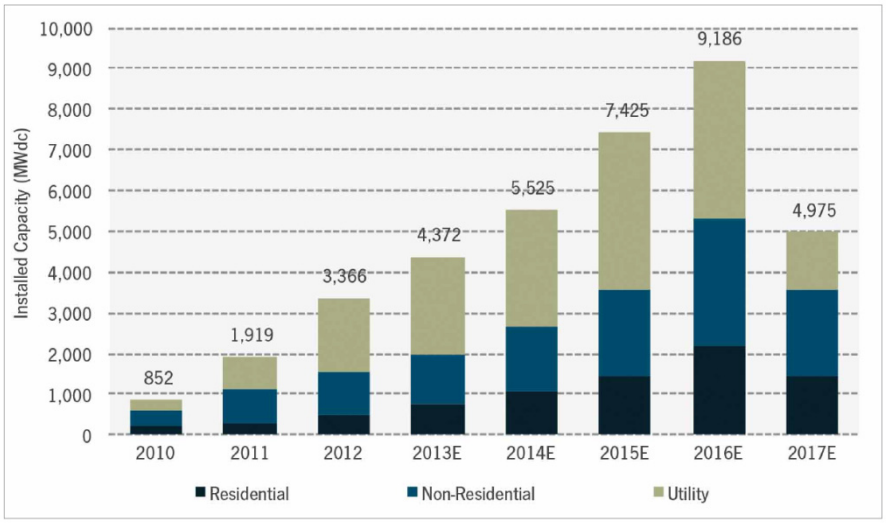


FIGURE 1-6: PV INSTALLATION FORECAST, 2010-2017[2]



SOURCE: GTM RESEARCH

Source: "U.S. Solar Market Insight Quarter 2 2014," Prepared for SEIA by GTM Research, September 5, 2014 and "Grid Edge," GTM Research, 2013.

Further Steps Along the Path to ESU

- Capability to assess customer ES needs and options – "mass customization."
- Drawing practical and sustainable business boundaries.
- Methods of financing and recovering new ES capital.
- New pricing and revenue models .
- Expanded customer care.

The Key to ESU Success:

Lowest net present value **solution to individual customer's needs**

=

Business model with:

- Revenues cover all cost and return
- **Capital available for customer and utility**
- Operational Excellence
- Mass customization of adequate service offerings

Opportunities and Challenges

- ☑ Provide customers services that lower total energy bills, help environment, create jobs.
- ☑ Help customers navigate very complex marketplace.
- ☑ New revenue streams to pay for system investments.
- ☑ New core-competencies.
- ☑ New product development costs.
- ☑ Unstoppable pressure from marketplace.

Now is the time to be proactive!

Dr. Peter Fox-Penner

Peter Fox-Penner
Principal and Director
The Brattle Group

Dr. Peter Fox-Penner is a consulting executive and internationally recognized authority on energy and electric power industry issues. He is a principal and director of *The Brattle Group*, a leading international economic consulting firm.

In his consulting practice, Dr. Fox-Penner advises energy companies, government agencies, and their counsels on energy regulatory and market policy issues. Although his work has spanned most areas within the energy field, his current primary focus is on electric industry competition and structure, global climate change, and energy efficiency policies.

Dr. Fox-Penner's background includes co-founding Environment2004, the Environmental Alliance, and Patriot's Energy Pledge; service as a senior official in the U.S. Department of Energy and the White House Office of Science and Technology Policy; and staff positions in the Illinois Governor's office. He has a Ph.D. in economics from the business school at the University of Chicago and M.S. and B.S. degrees in engineering from the University of Illinois.

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The Brattle Group

The Brattle Group (www.brattle.com) provides consulting and expert testimony in economics, finance, and regulation to corporations, law firms, and governments around the world.

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