IT Services to Support a Changing Utility Industry

Northwest Public Power Association
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Topics

Presentation   Electric Utility Industry Transformation

Topics

<u>Presentation</u> Electric Utility Industry Transformation

<u>Conversation</u> Implications for IT Services at NWPPA Member Utilities

Disclaimer

Information shown on the following slides was gathered from various sources. This presentation reflects the perspective of CJB Energy Economics and was developed to stimulate conversation.

IT Project Team

Industry Transformation

- Recent polls have found broad consensus that the electric utility industry is undergoing significant change
  - Utility Dive
  - PwC
  - Black & Veatch
- Agreement about how utilities should respond? Not so much.

Utility Dive 2016 State of the Electric Utility Survey

"If there's one takeaway from Utility Dive's third annual State of the Electric Utility industry survey, it's that the transformation has arrived – but a standardized approach to adapt to it has not."

www.utilitydive.com/library/state-of-the-electric-utility-2016/

Utility Dive 2016 State of the Electric Utility Survey

Respondents' most pressing challenges for their utility (descending order)

- Aging Workforce
- Existing Regulatory Model
- Aging Infrastructure
- Renewables Integration
- Stagnant Load Growth
- Physical and/or Cyber Grid Security
- Clean Power Plan Compliance

www.utilitydive.com/library/state-of-the-electric-utility-2016/

14th PwC Global Power & Utilities Survey

"We are witnessing considerable disruption in the power sector arising from a combination of policy, technological and customer change. It's creating a transformation in how we think about, produce and use electricity."

www.pwc.com/gx/en/industries/energy-utilities-mining/power-utilities/global-power-and-utilities-survey.html

14th PwC Global Power & Utilities Survey

- Nearly all respondents expect to see a medium to very high level of market disruption by 2020
- More than 7 of 10 anticipate major or very major business model transformation by 2030
- 6 of 10 say their main home market will be more than "50% transformed" by 2030

www.pwc.com/gx/en/industries/energy-utilities-mining/power-utilities/global-power-and-utilities-survey.html

Black & Veatch 2015 Strategic Directions: U.S. Electric industry Report

Disruptive Forces (Ranked by Relative Importance)

- Aging Infrastructure
- Reliability
- Environmental Regulation
- Cybersecurity
- Aging Workforce
- Economic Regulation (Rates)
- Emerging Technology

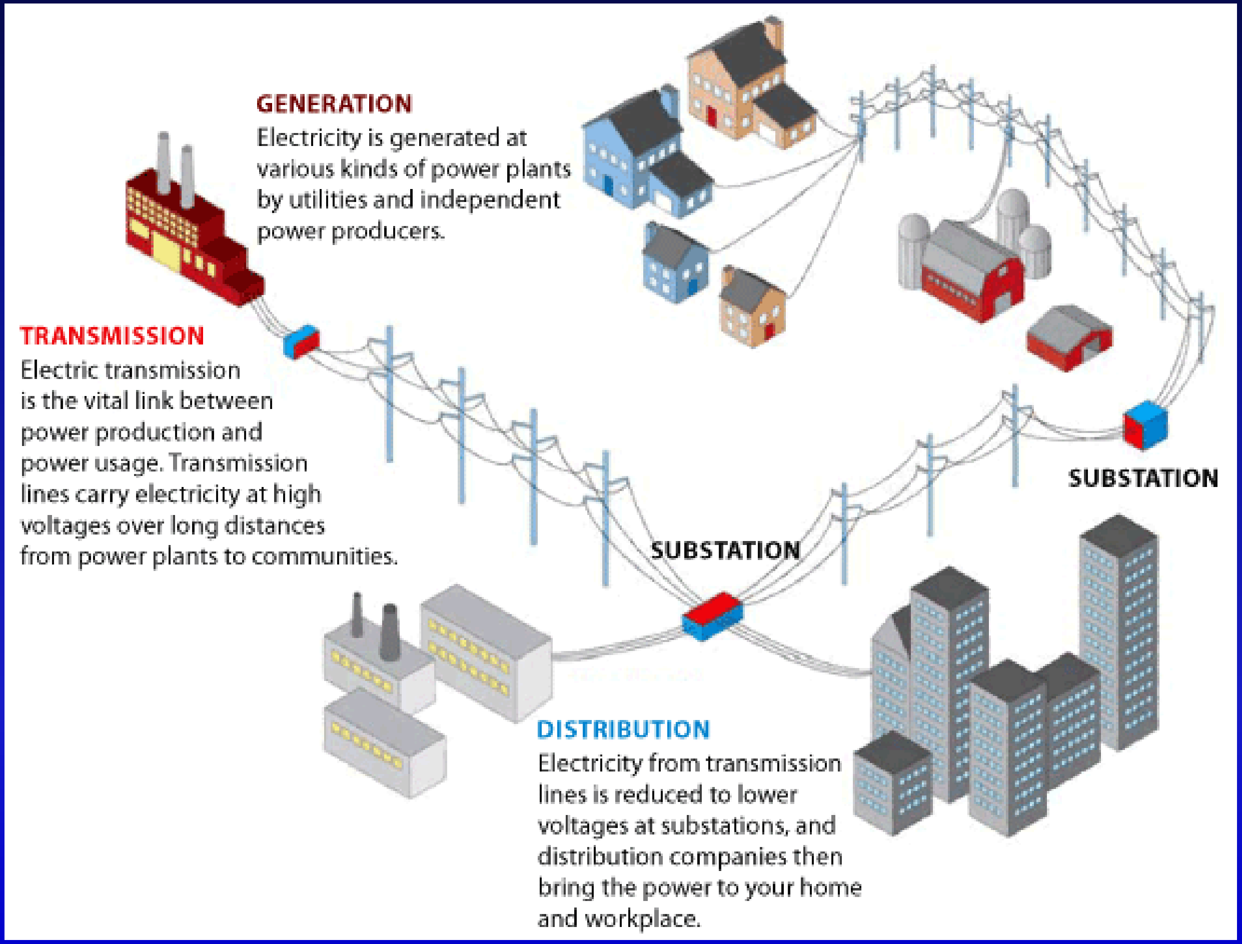
http://bv.com/reports

Black & Veatch 2015 Strategic Directions: U.S. Electric industry Report

- Three-fourths of respondents view altering the regulatory construct to reflect changing energy markets as important
- Nearly two-thirds expect modest, significant or large investment to be required to accommodate integration of distributed energy resources (e.g., solar PV)
- Half believe that by 2020, 6-10% of all U.S. power generation will come from distributed generation
- One-third view distributed generation as a moderate to major threat to their business; one-sixth view it as no threat

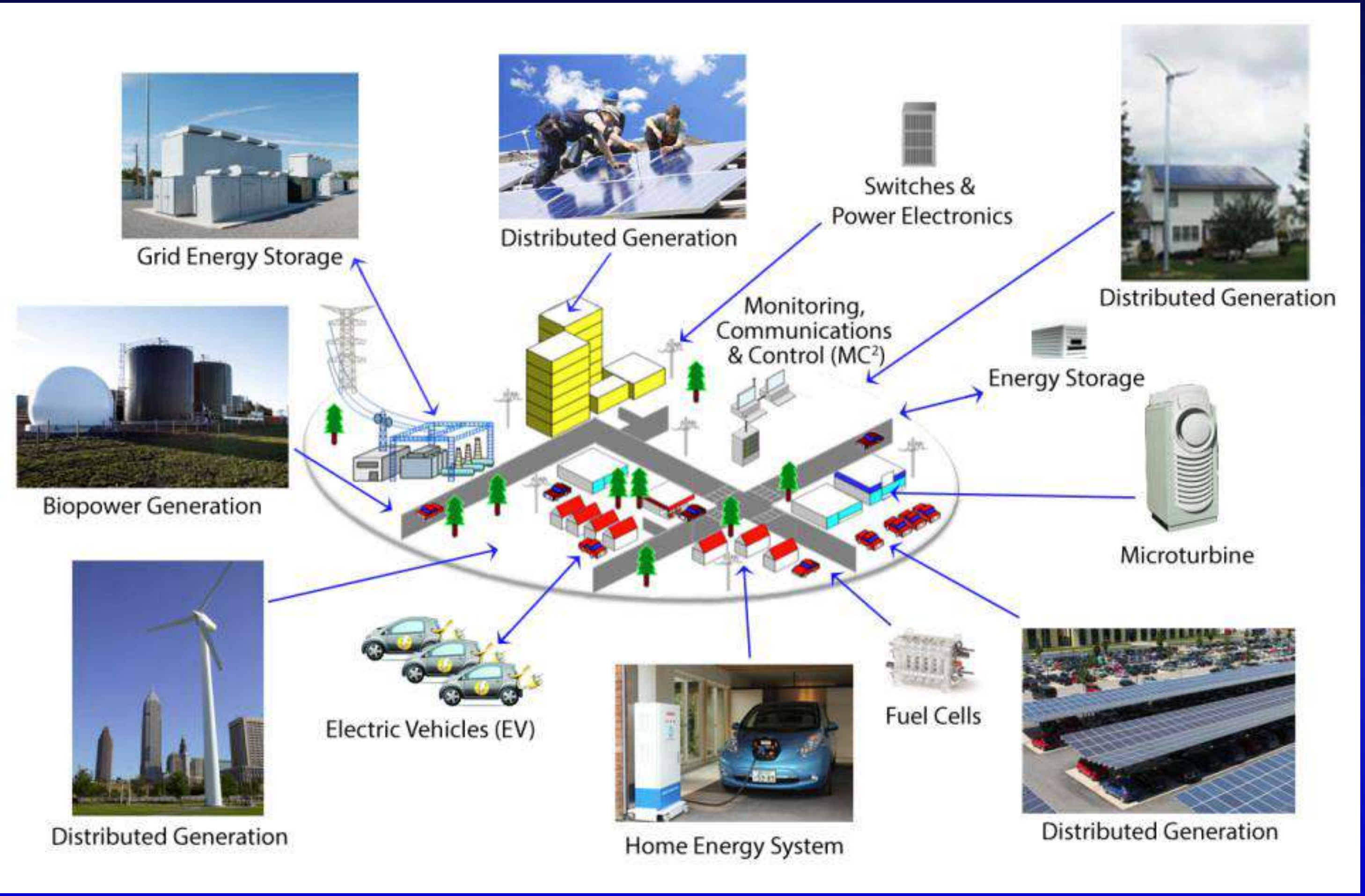
http://bv.com/reports

Traditional Electric Utility System



Graphic: Indiana University Kelly School of Business

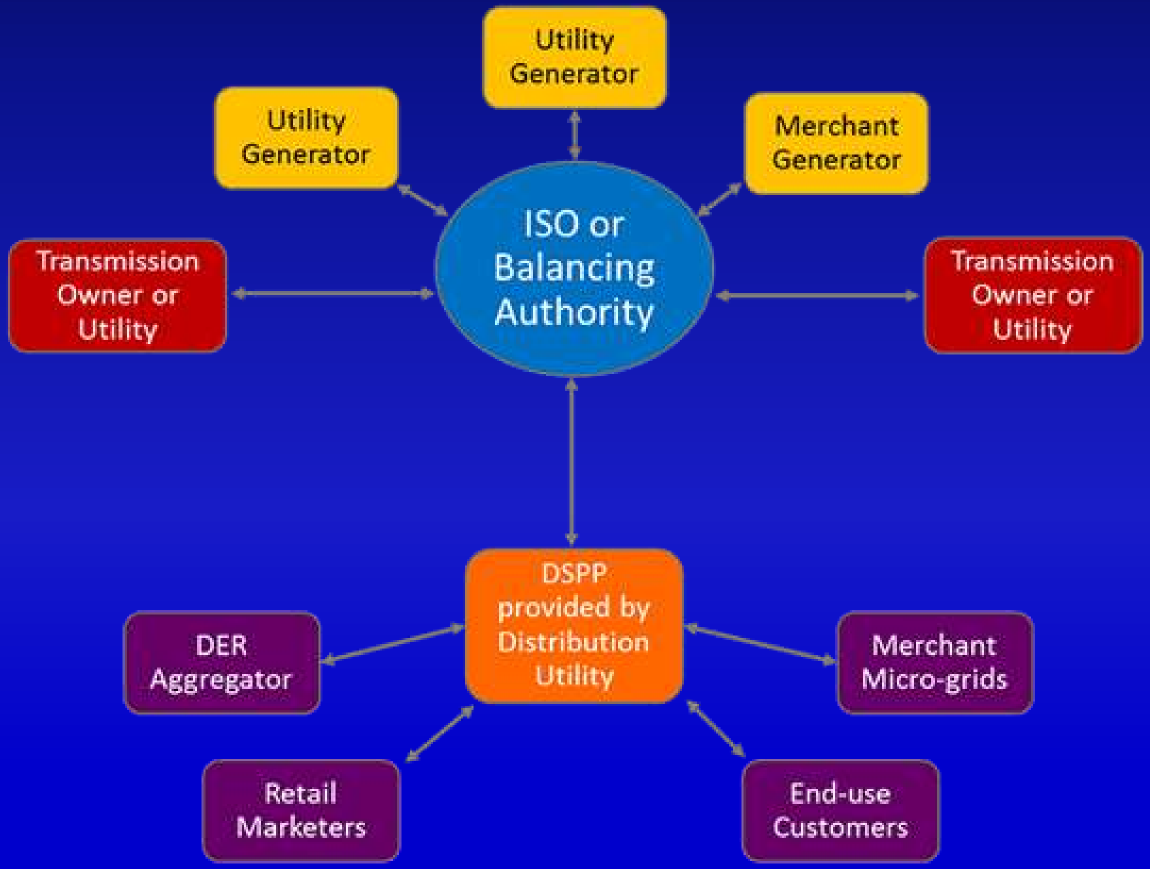
Microgrid With Distributed Generation



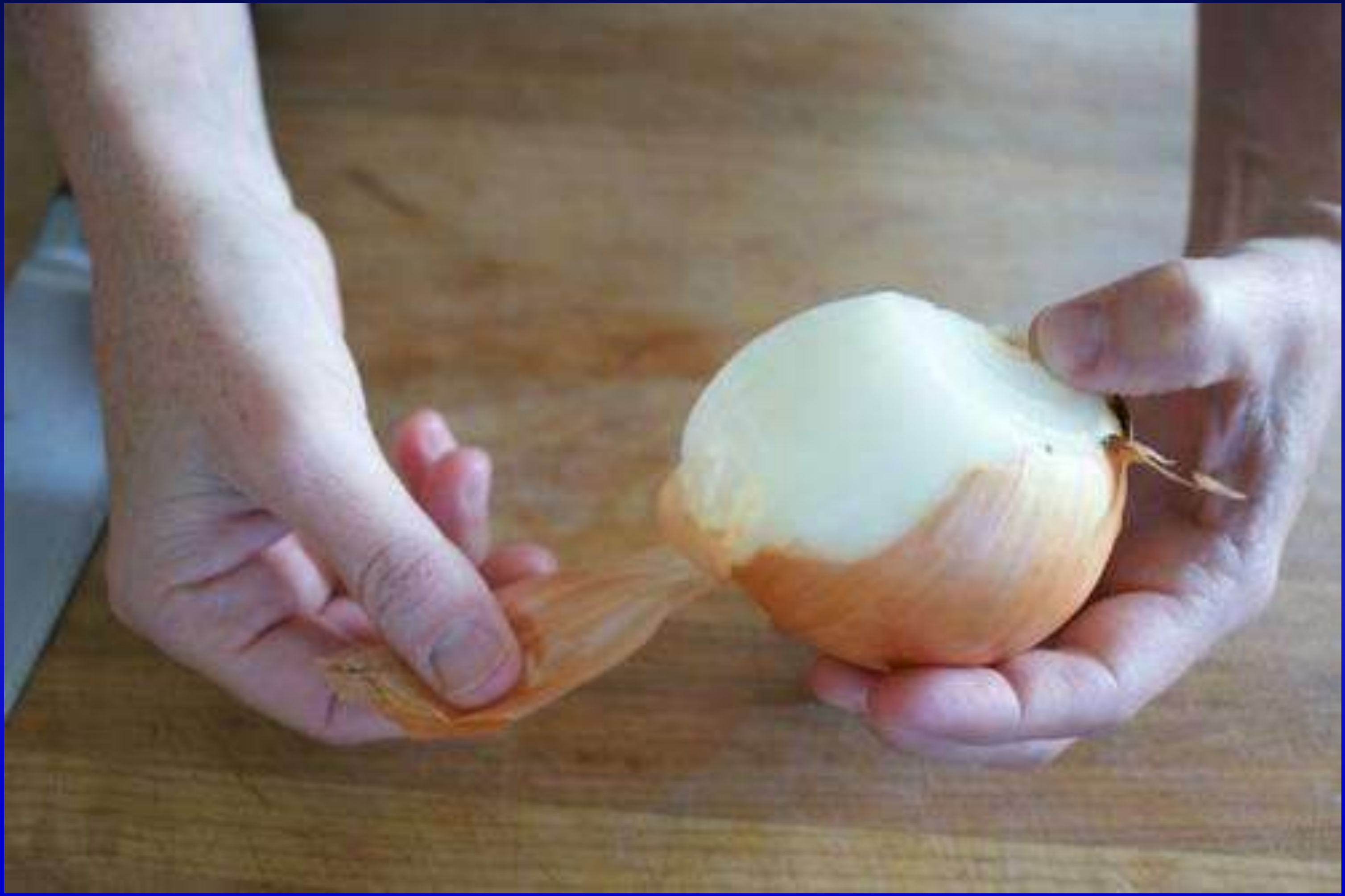
Graphic: www.clean-coalition.org

New York Reforming the Energy Vision (NY REV)

Distribution System Platform Provider Model



Driving Forces for Electric Utility System Transformation



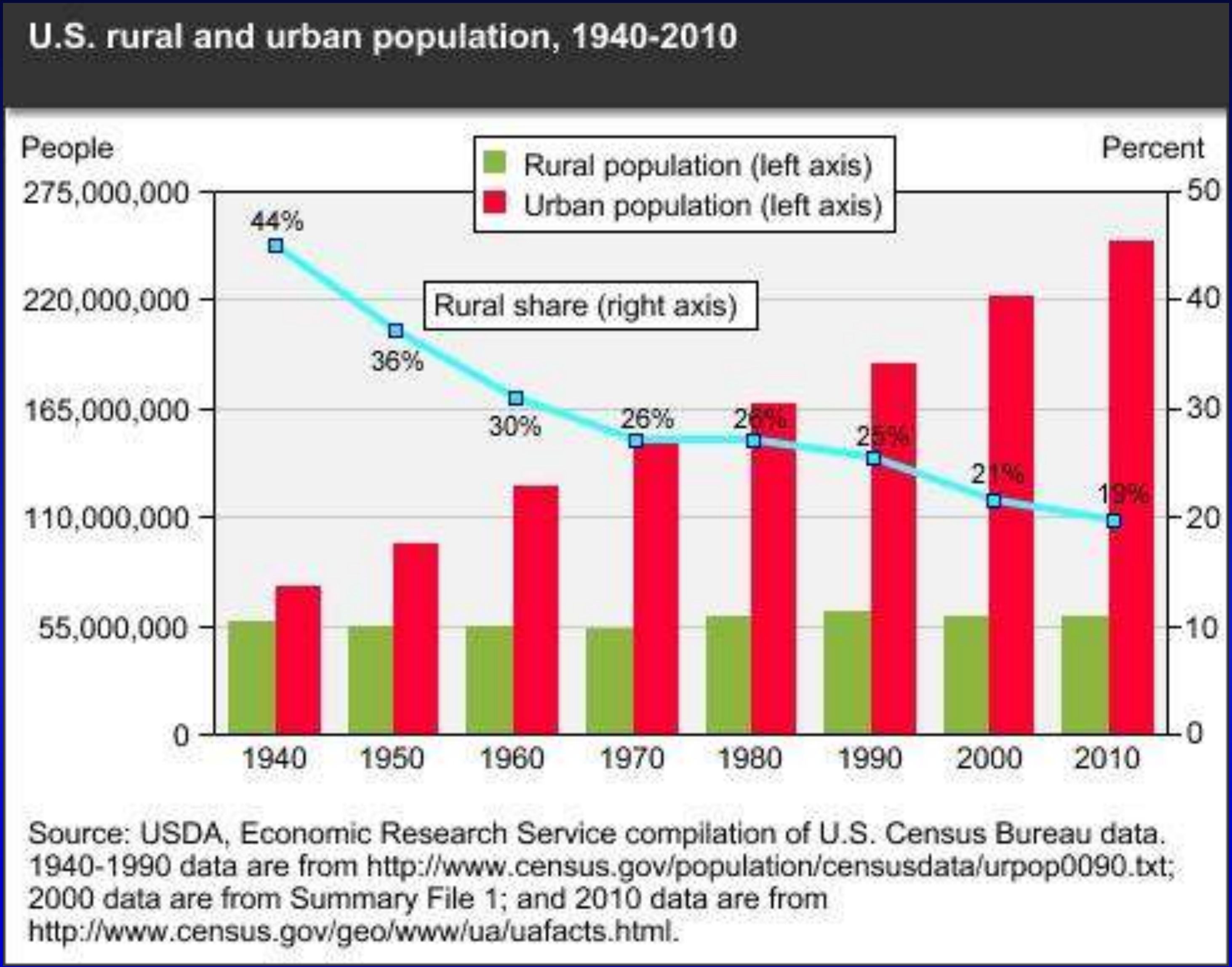
Driving Forces for Electric Utility System Transformation

1. Urbanization
2. Stagnating Energy and Electricity Demands
3. Advancing Technologies
4. Public Policies (Laws, Regulations)
5. Climate Change/Decarbonization
6. Mismatch Between Electric Utility Cost Structure and Rate Design

Driving Forces for Electric Utility System Transformation

1. Urbanization

Urbanization



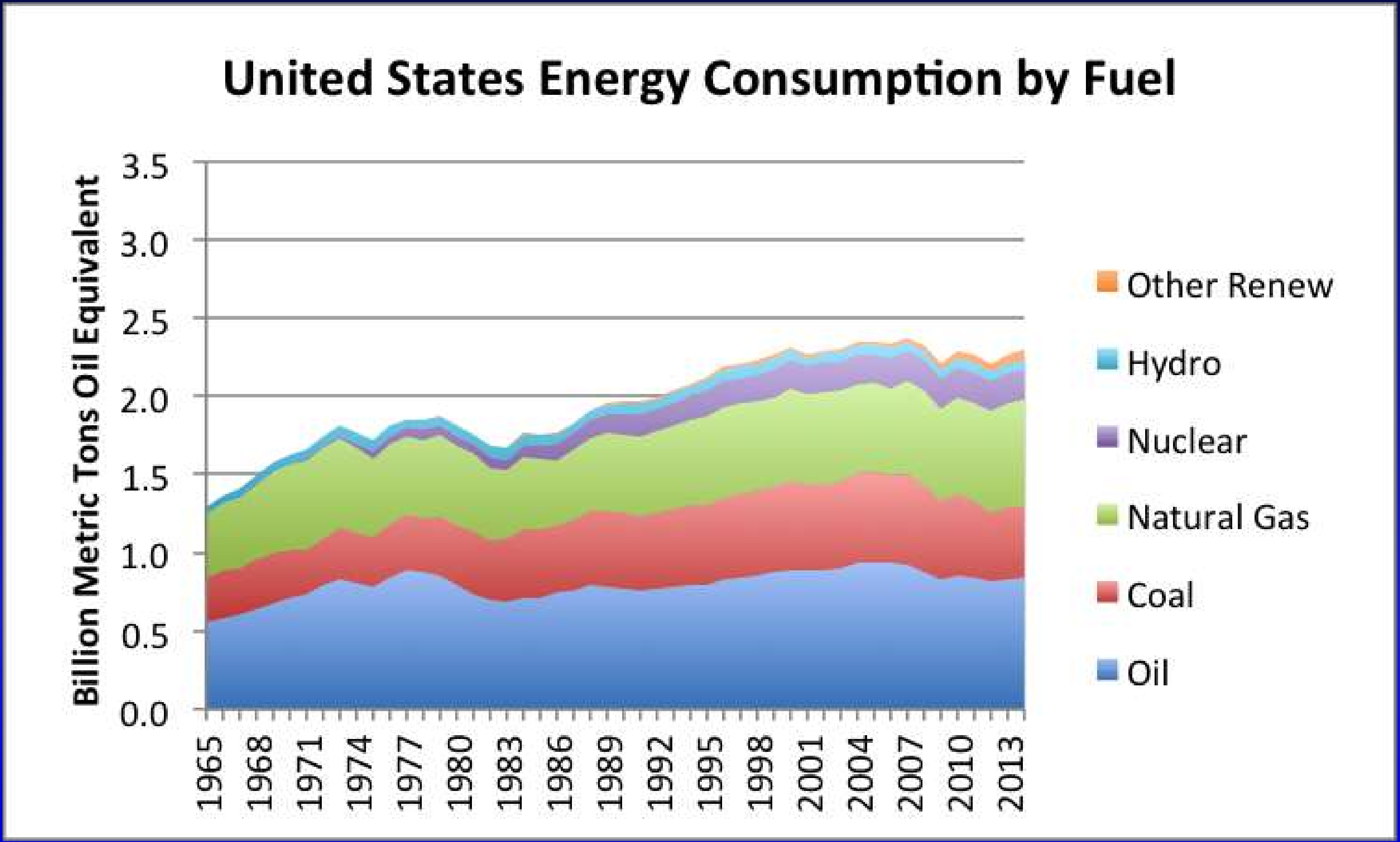
Urbanization

- As the U.S. continues to shift toward a services-based economy, the nation is becoming increasingly urban
- Population centers are growing, while rural areas are flat, both in population and economic activity
- Demographic trend is well-established and expected to continue
- Urban voters also tend to be more liberal, environmentalist than voters in rural areas

Driving Forces for Electric Utility System Transformation

1. Urbanization
2. Stagnating Energy and Electricity Demands

Stagnating Energy and Electricity Demands

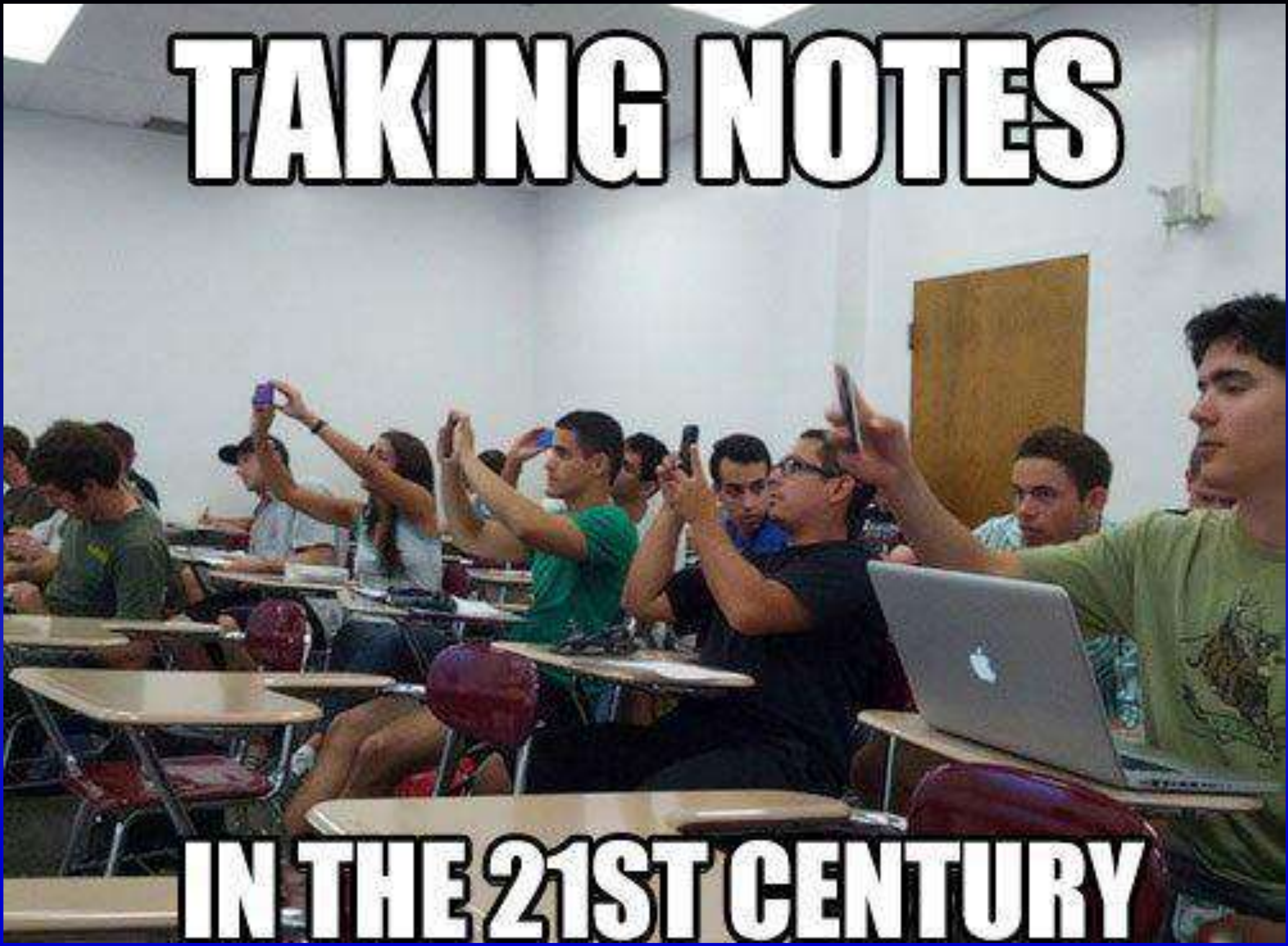


Stagnating Energy and Electricity Demands

- For decades, increasing use of electricity enabled expansion of the economy and population
- Since the 1990s, economic and population growth no longer drive growth of electric loads
  - urbanization
  - shift away from industrial, extraction economy (offshoring)
  - cost-effective energy efficiency
  - increased use of natural gas for space heating

Driving Forces for Electric Utility System Transformation

1. Urbanization
2. Stagnating Energy and Electricity Demands
3. Advancing Technologies


TAKING NOTES
IN THE 21ST CENTURY

Advancing Technologies

- LED lighting, automated controls, heat pumps

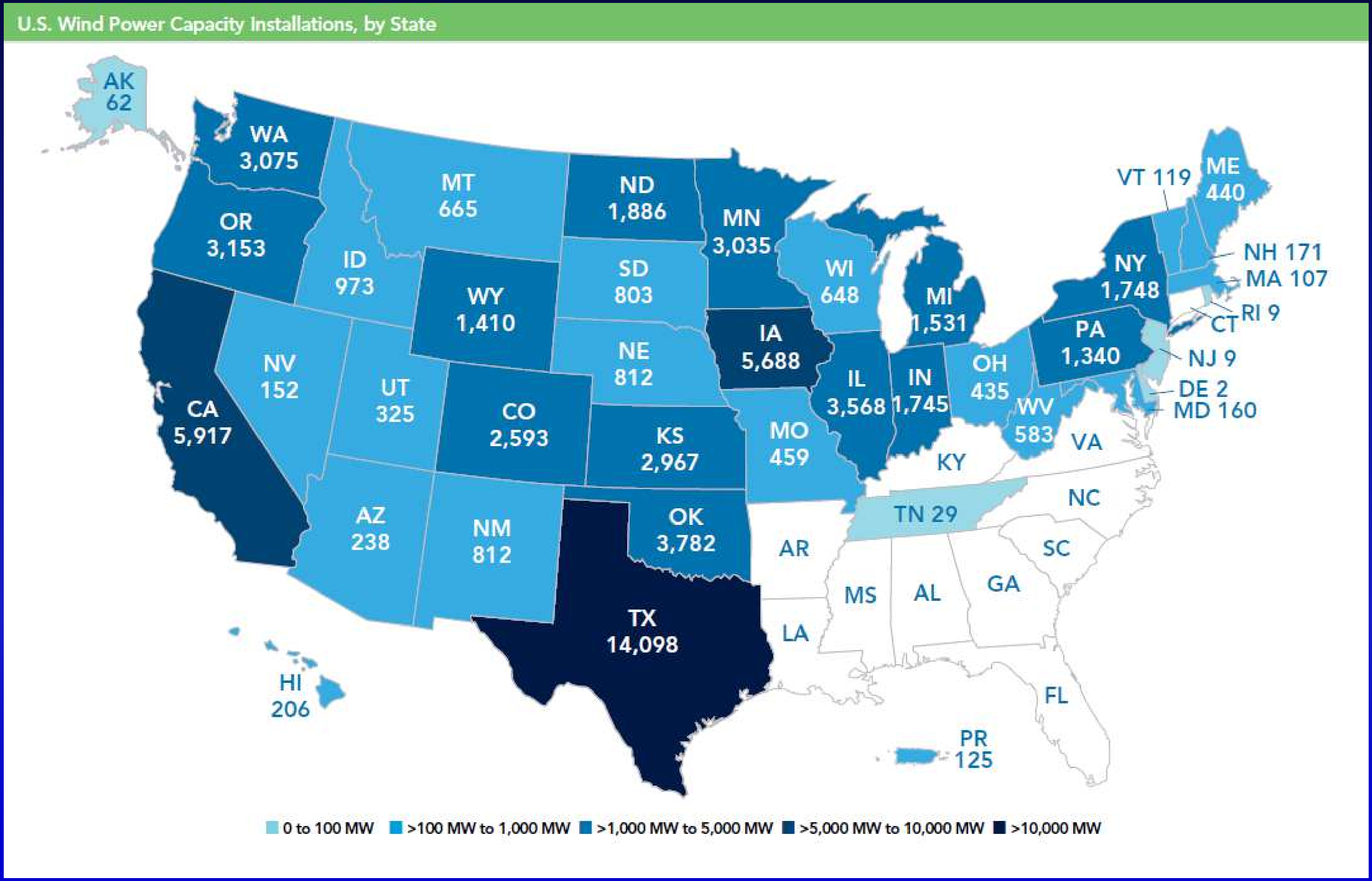
LED Lighting

Automated Controls

Advancing Technologies

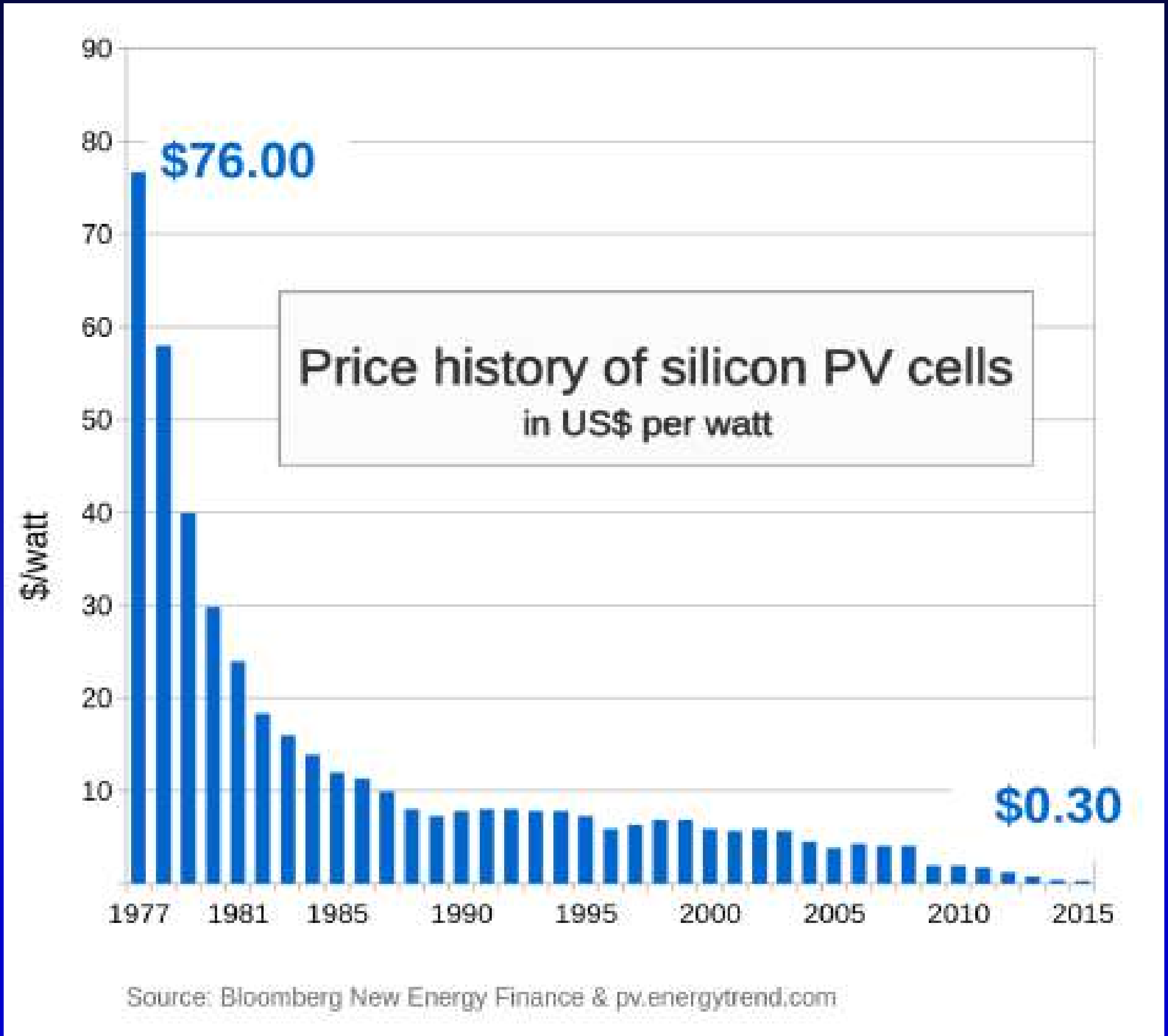
- LED lighting, automated controls, heat pumps
- Improving performance, falling costs for renewable resources (wind, solar)

Wind Power

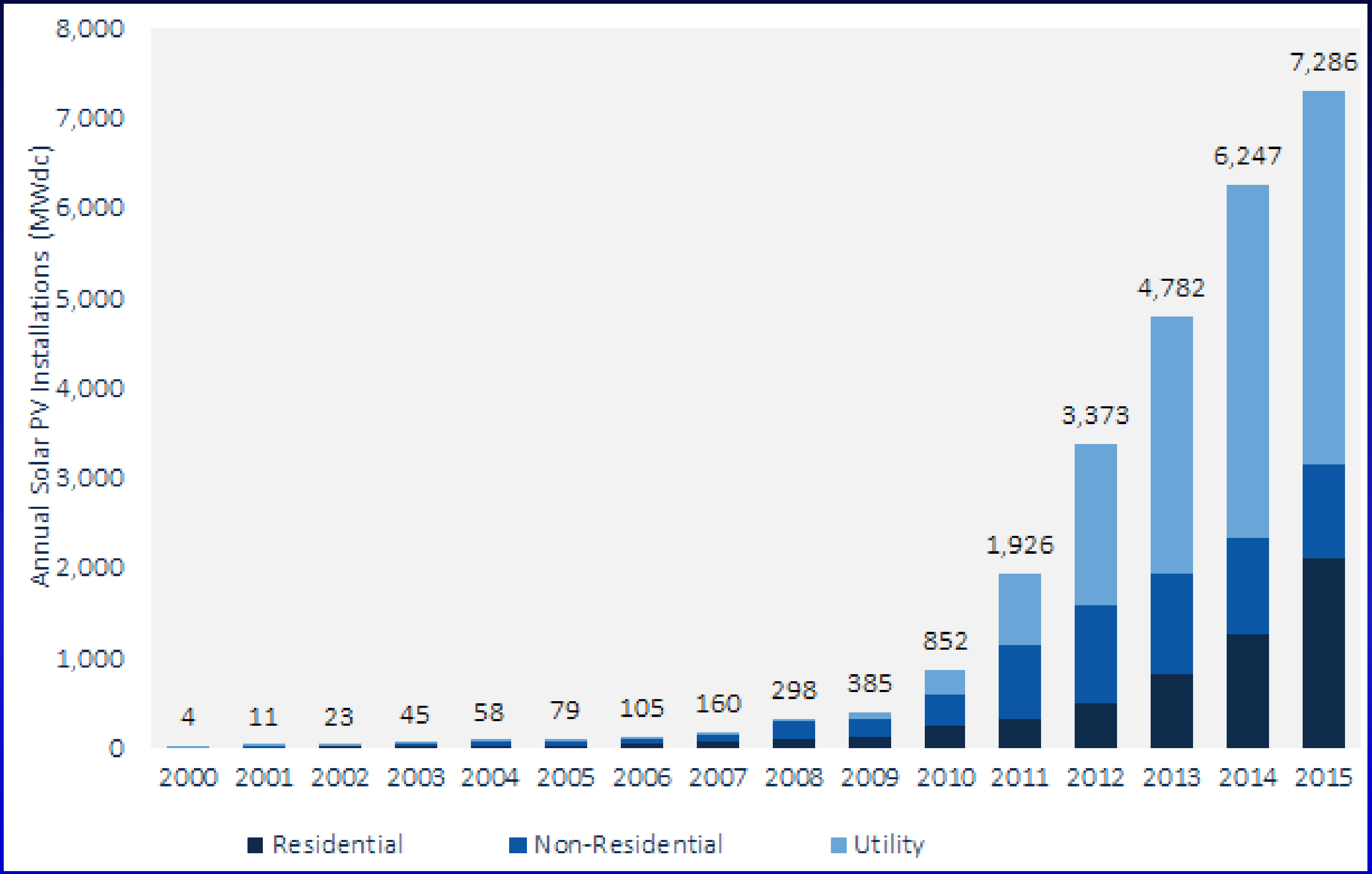


U.S. Wind Power Capacity Installations, by State
AK 62
WA 3,075
OR 3,153
CA 5,917
ID 973
NV 152
MT 665
WY 1,410
UT 325
AZ 238
CO 2,593
NM 812
ND 1,886
SD 803
NE 812
KS 2,967
OK 3,782
TX 14,098
MN 3,035
IA 5,688
MO 459
AR
LA
WI 648
IL 3,568
MI 1,531
IN 1,745
OH 435
KY
TN 29
MS
AL
GA
FL
SC
NC
VA
WV 583
PA 1,340
NY 1,748
VT 119
ME 440
NH 171
MA 107
RI 9
CT
NJ 9
DE 2
MD 160
HI 206
PR 125
0 to 100 MW
>100 MW to 1,000 MW
>1,000 MW to 5,000 MW
>5,000 MW to 10,000 MW
>10,000 MW

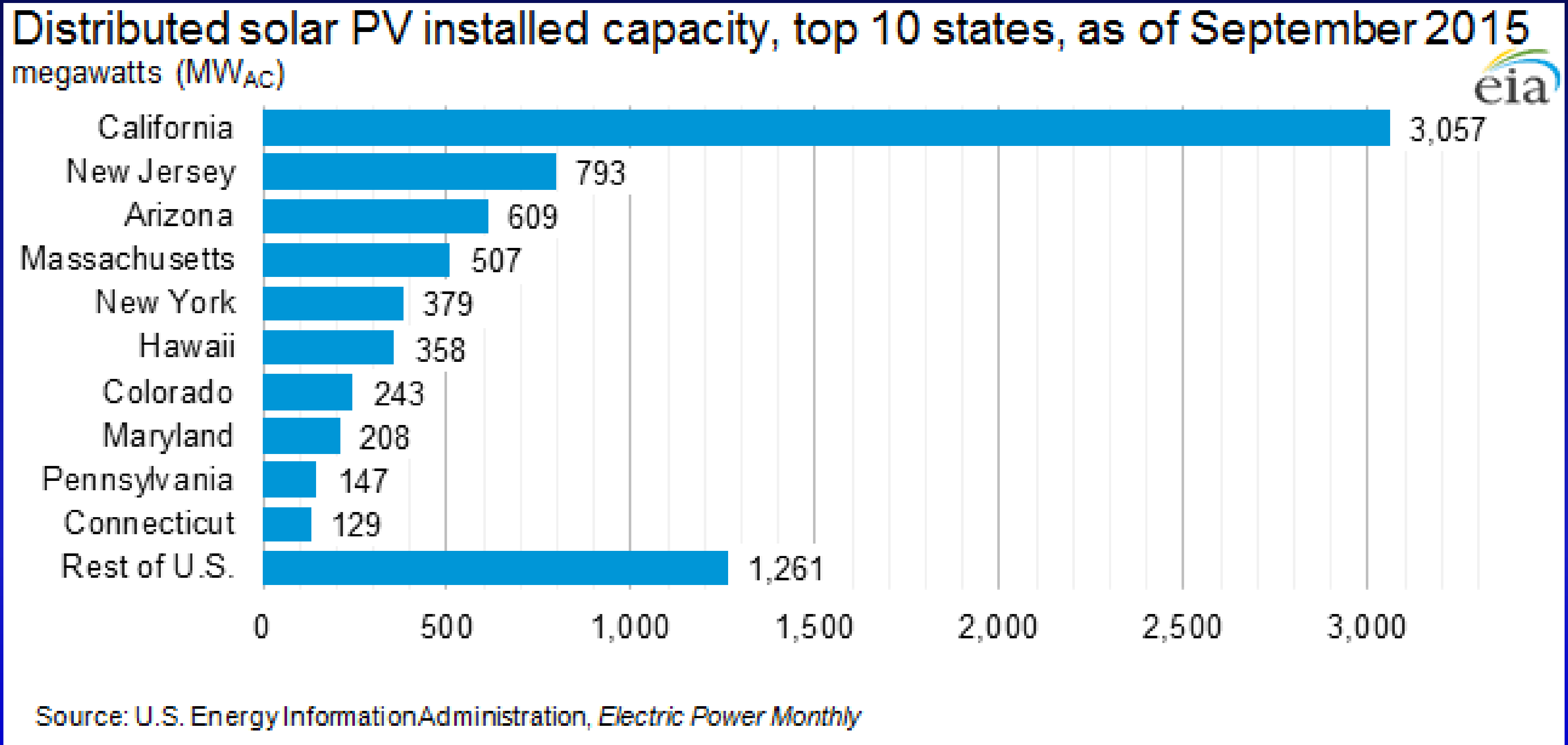
Solar Photovoltaic Generation



Solar Photovoltaic Generation



Solar Photovoltaic Generation



Advancing Technologies

- LED lighting, automated controls, heat pumps
- Improving performance, falling costs for renewable resources (wind, solar)
- Hydraulic fracturing, directional drilling

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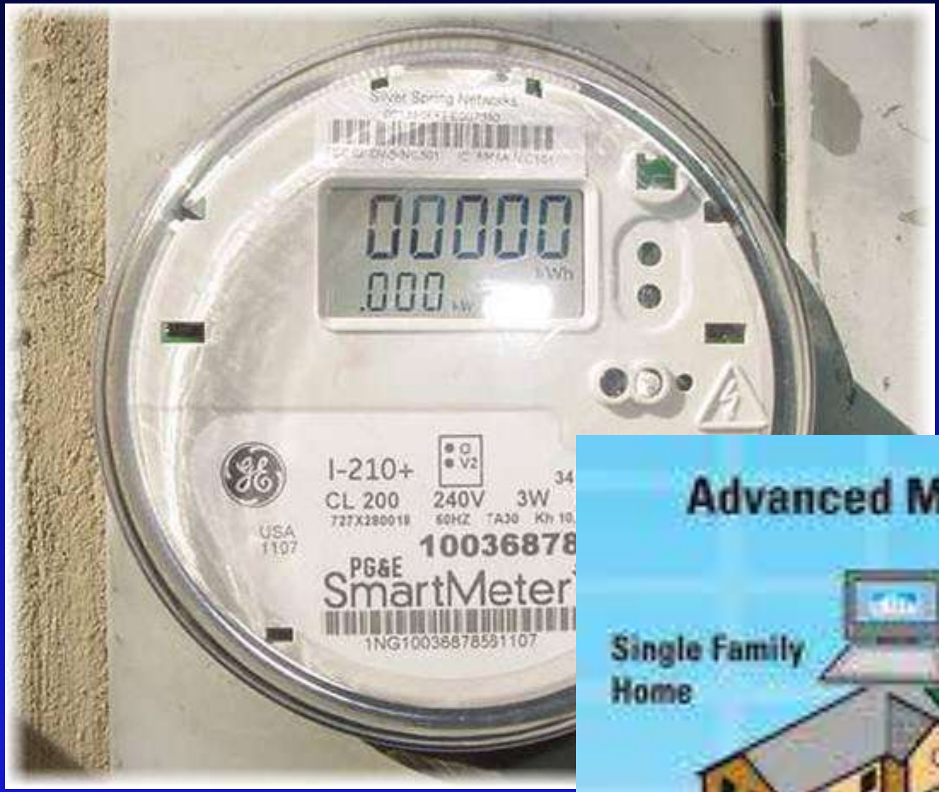
- Hydraulic fracturing, directional drilling
- High-efficiency combustion turbines

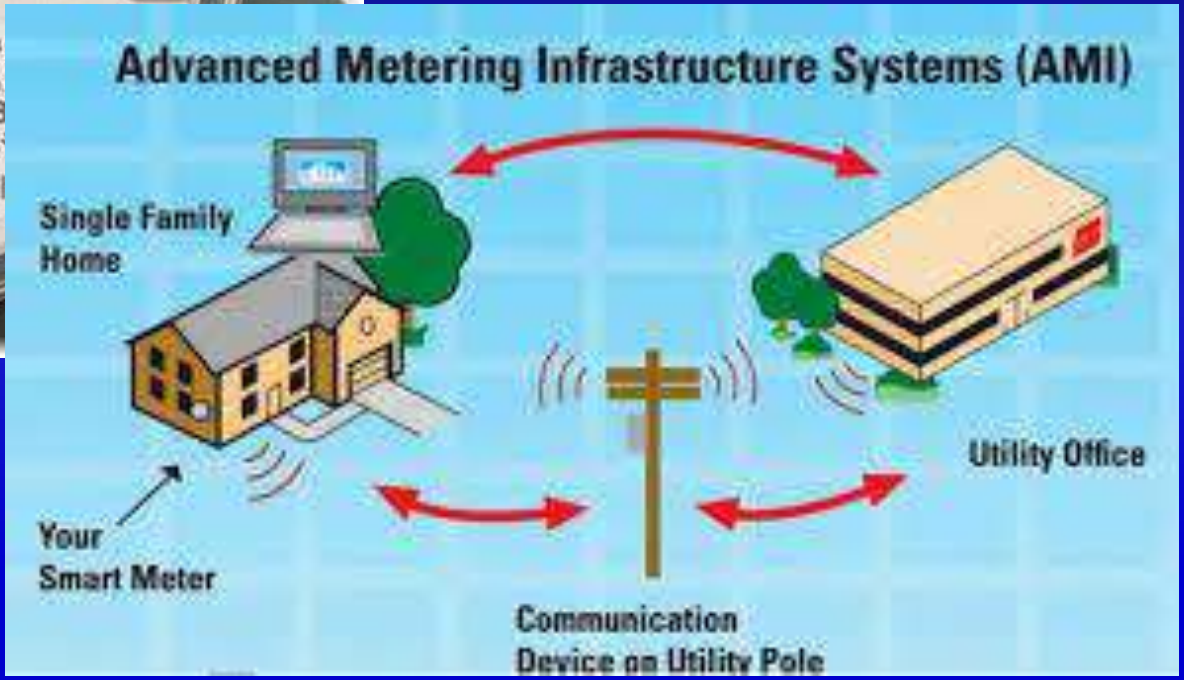
High-Efficiency Combustion Turbines

Advancing Technologies

- LED lighting, automated controls, heat pumps
- Improving performance, falling costs for renewable resources (wind, solar)
- Hydraulic fracturing, directional drilling
- High-efficiency combustion turbines
- Smart grid, grid edge, AMR/AMI

AMR/AMI


Silver Spring Networks
00000
.000
kWh
I-210+
CL 200
240V
3W
USA
1107
PG&E
SmartMeter
1NG10036878591107


Advanced Metering Infrastructure Systems (AMI)
Single Family Home
Utility Office
Your Smart Meter
Communication Device on Utility Pole

Advancing Technologies

- LED lighting, automated controls, heat pumps
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- Hydraulic fracturing, directional drilling
- High-efficiency combustion turbines
- Smart grid, grid edge, AMR/AMI
- Electric vehicles

Electric Vehicles

Electric Vehicles

Advancing Technologies

- LED lighting, automated controls, heat pumps
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- Electric vehicles
- Battery storage

TESLA Powerwall

Launched April 30, 2015

7 kWh daily cycle (~1/4 of average daily residential load)

2.0 kW continuous output

3.3 kW peak output

5.8 amp nominal

8.6 amp peak

~20% roundtrip losses

34" x 51" x 7"

220 lbs.

~$7,000 installed cost

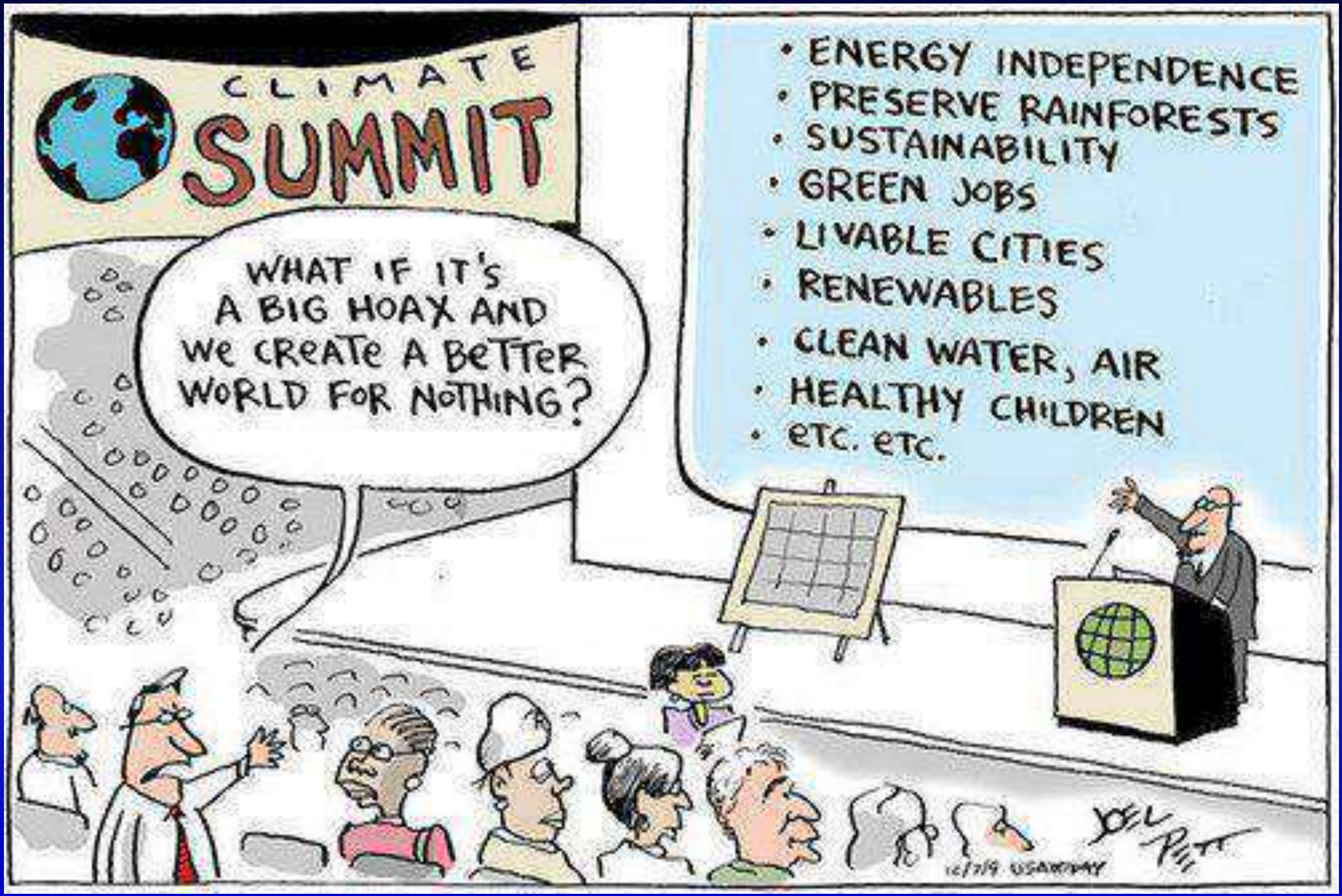
~$0.15/kWh storage cost

Source: Tesla

Driving Forces for Electric Utility System Transformation

1. Urbanization
2. Stagnating Energy and Electricity Demands
3. Advancing Technologies
4. Public Policies (Laws, Regulations)

Public Policy Motivations



Public Policies (Laws, Regulations)

- Limits on air, water emissions (NOx, SO2, particulates)
- State emissions performance standards
- Federally-funded R&D
- Renewable portfolio standards
- Federal and state tax credits (ITC, PTC)
- Net energy metering

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5. Climate Change/Decarbonization

Climate Change/Decarbonization

- Growing evidence/recognition of climate change
- Growing commitment to reduce carbon emissions

- Carbon cap and trade, carbon tax programs
- Clean Air Act Section 111(b) rule - new
- Clean Air Action Section 111(d) rule – existing
- E3, other studies of decarbonization strategies, costs

Wait, How Much Is All This Costing Ratepayers?

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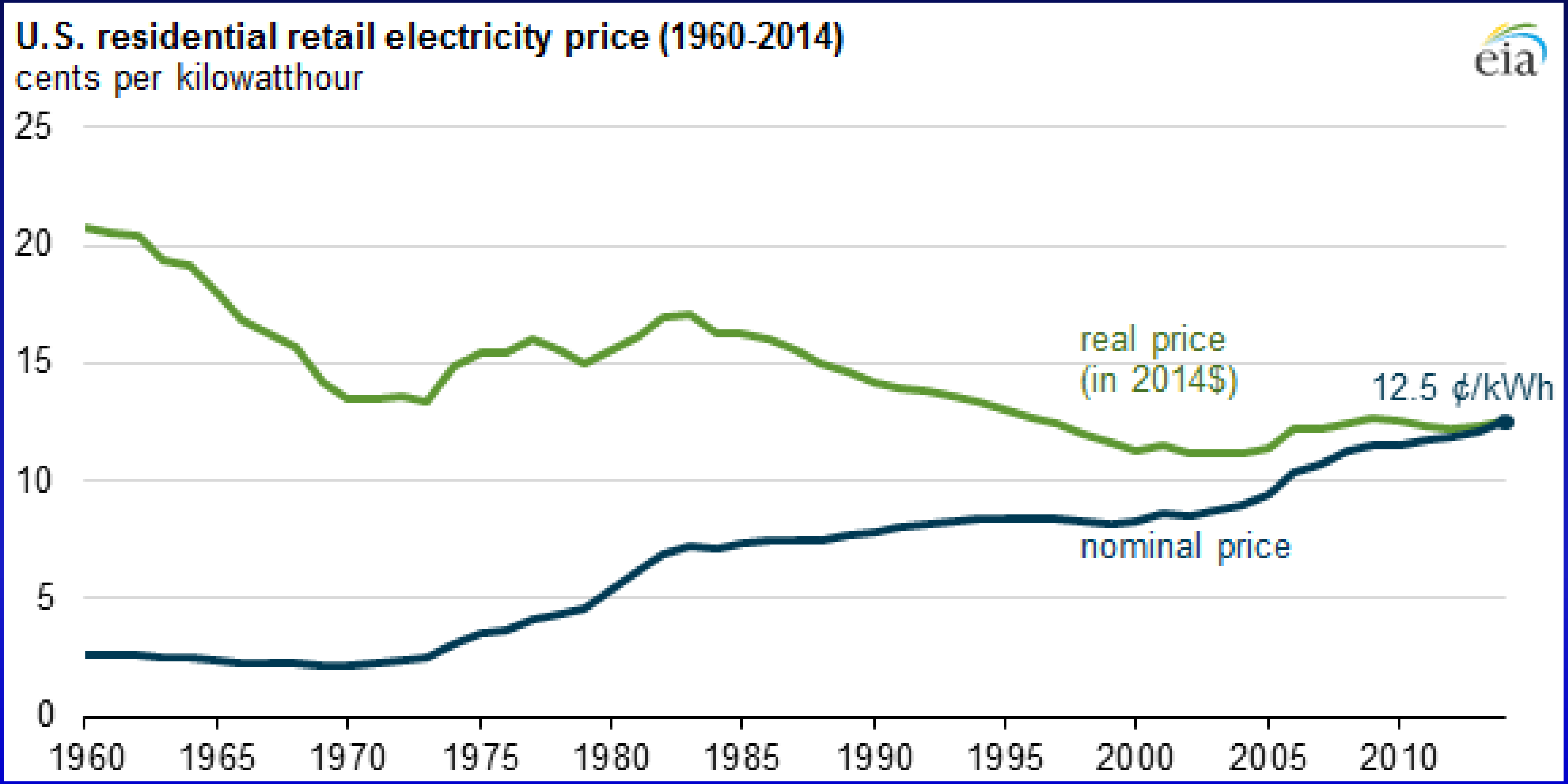

Driving Forces for Electric Utility System Transformation

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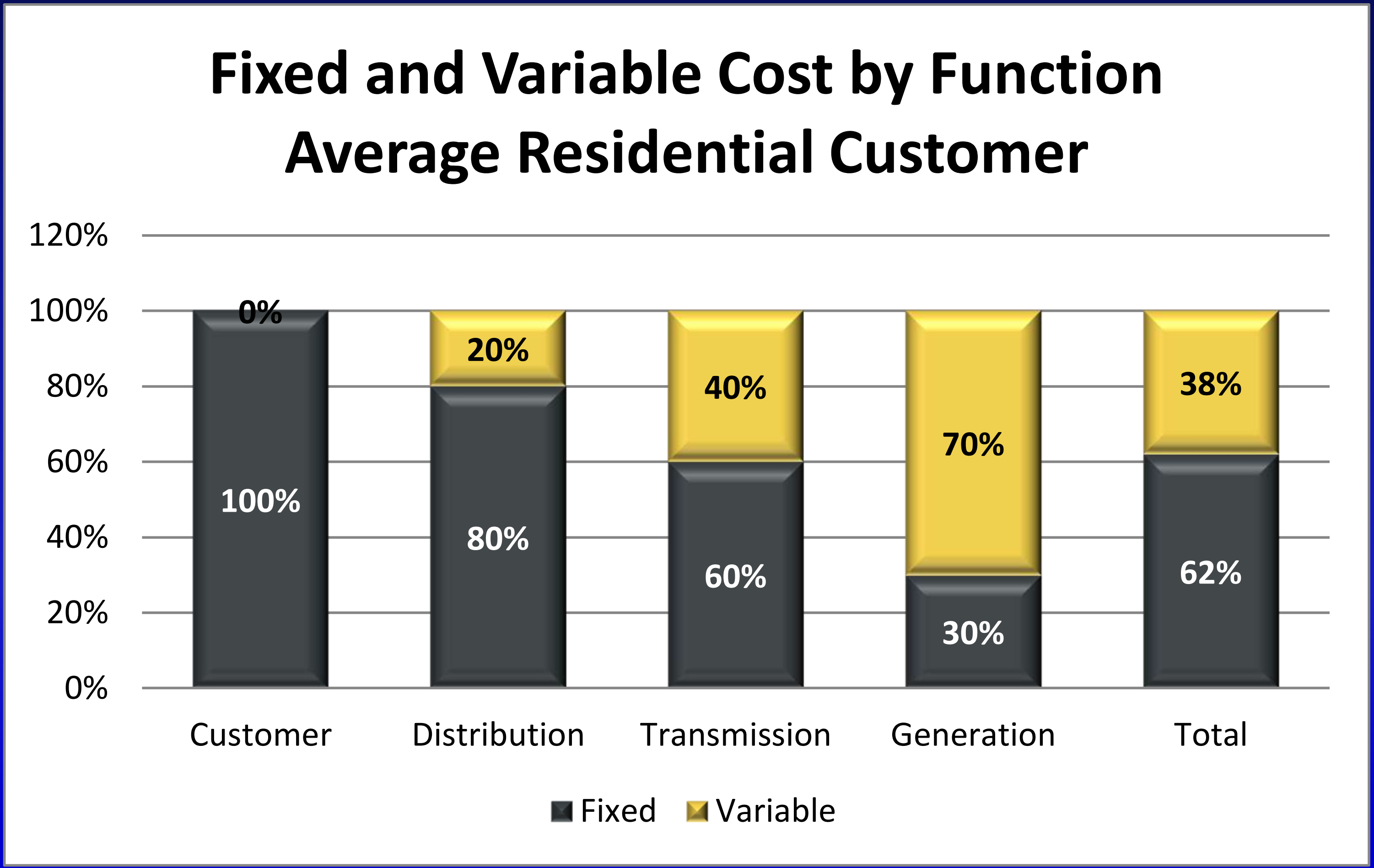
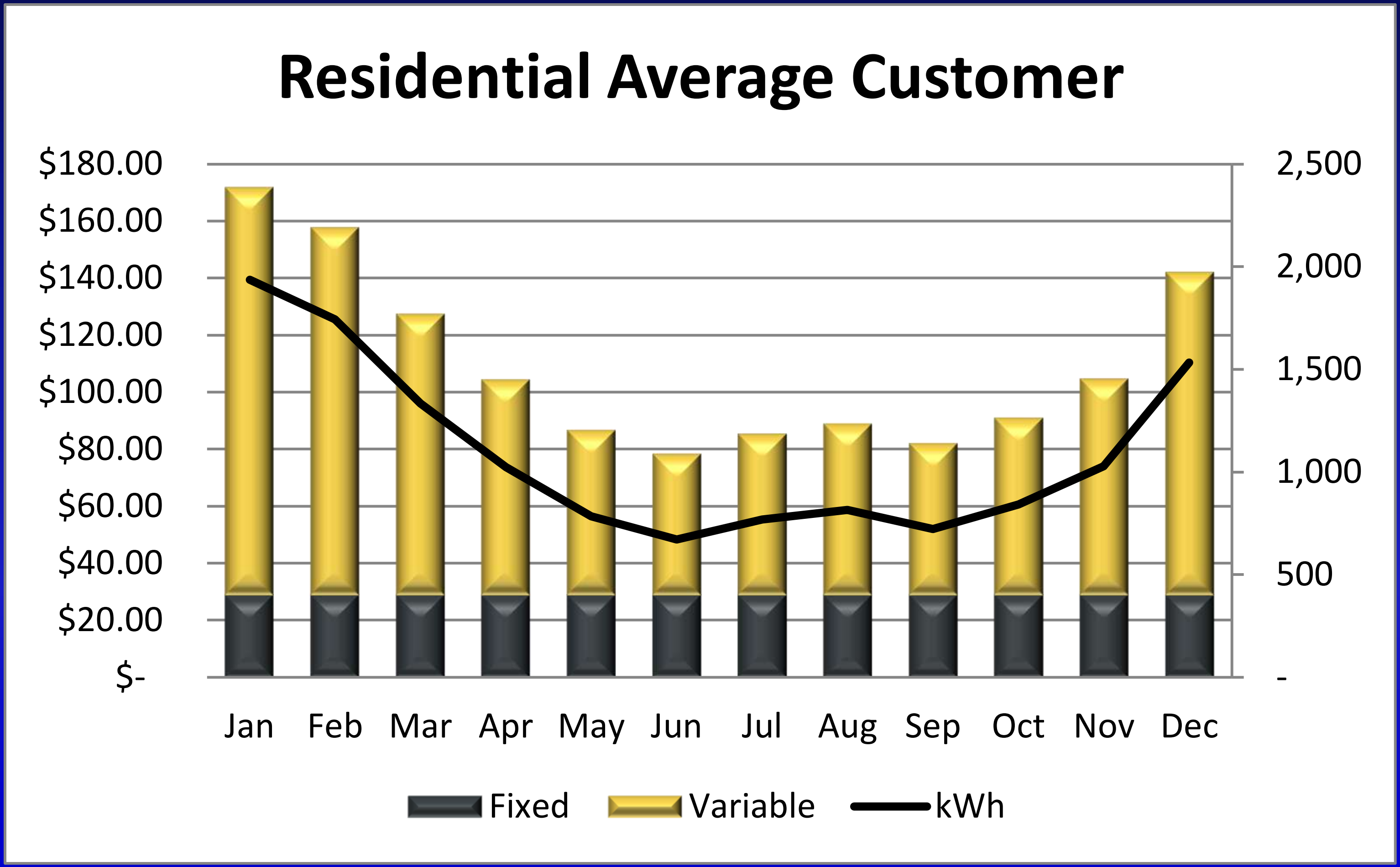
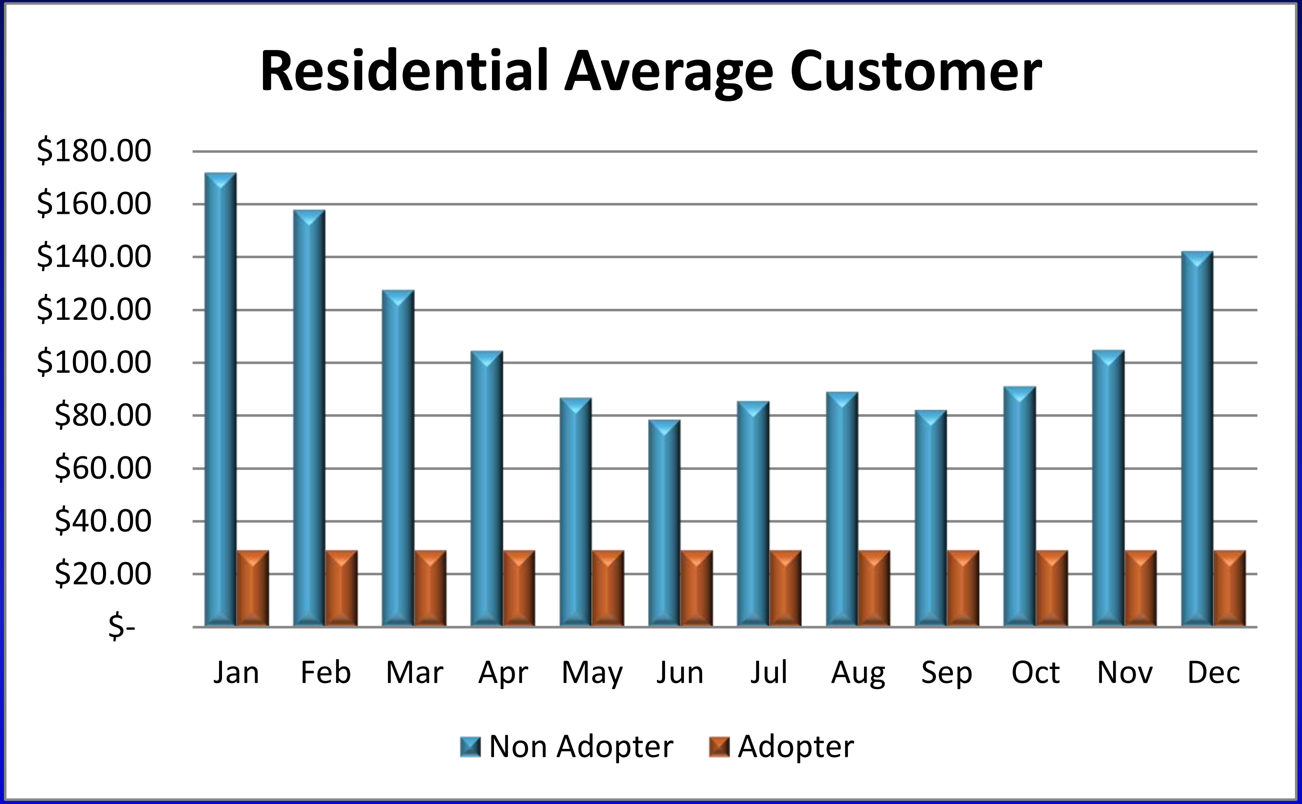
Electric Utility Cost Structure
Fixed and Variable Costs



Electric Utility Revenues from Customer and Energy Charges



Electric Utility Revenues with Net Energy Metering

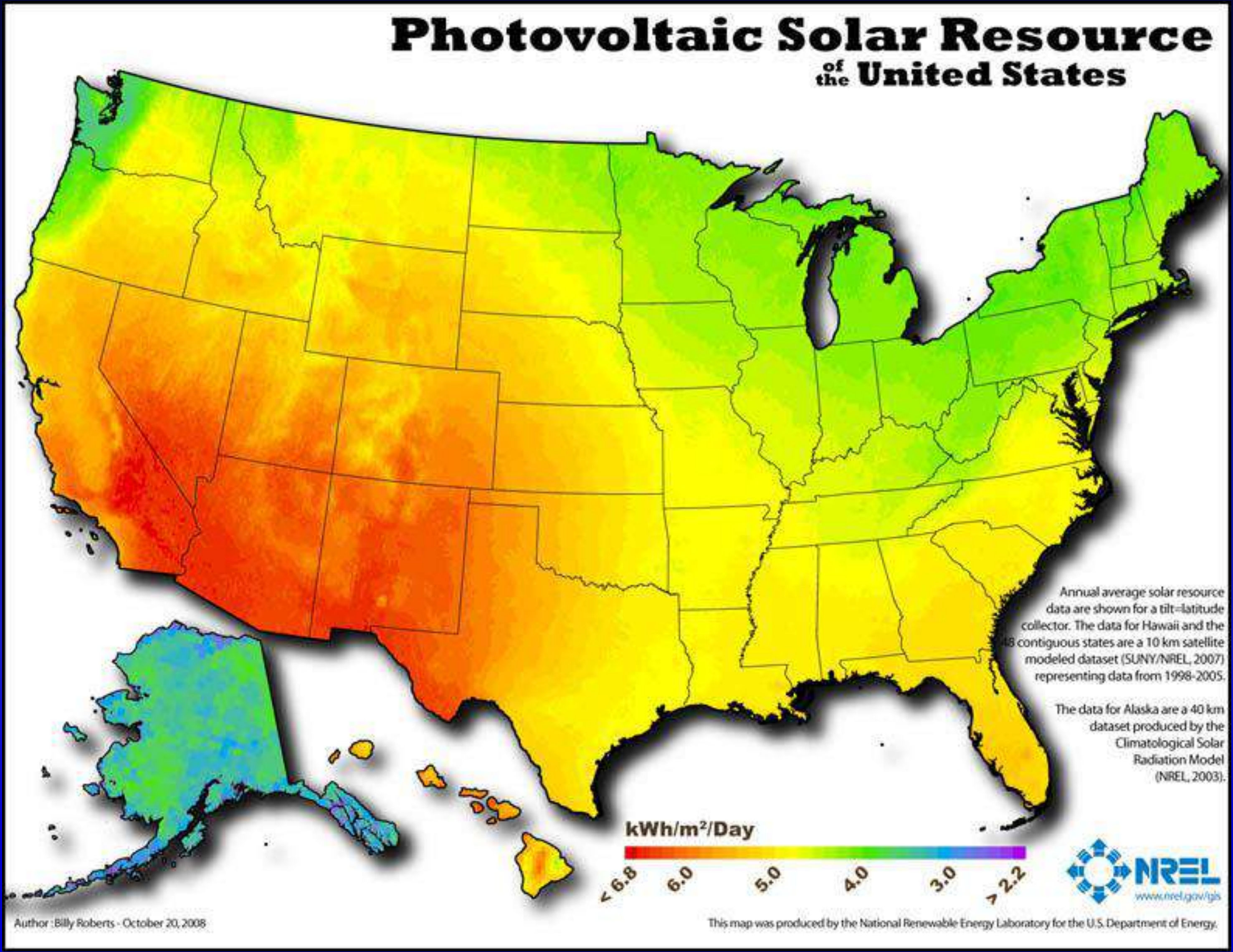


Could Rooftop PV + Batteries Kill the Grid?

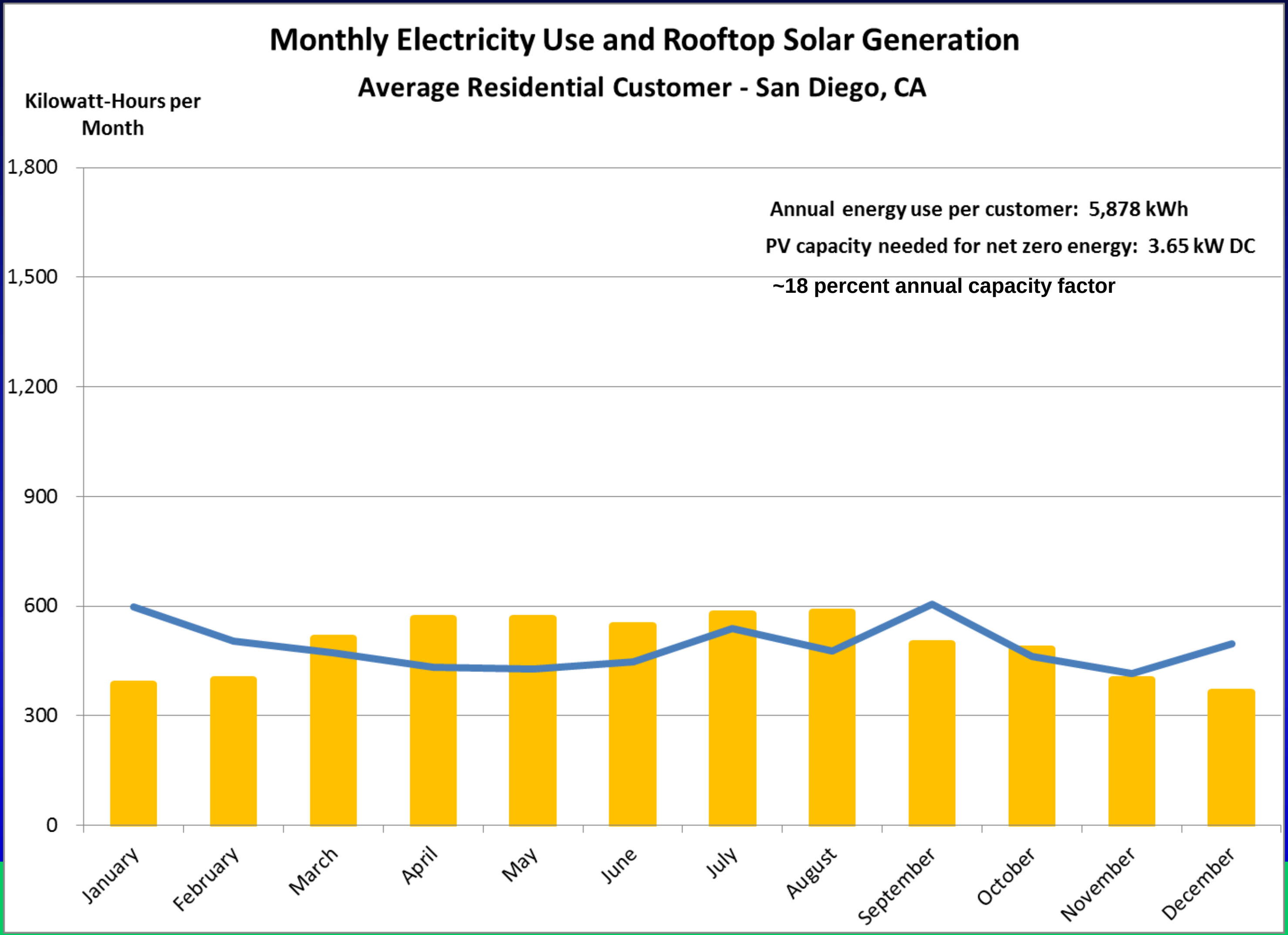
If an average Seattle home went “off grid” and generated an amount of rooftop solar power equal to their annual consumption, over 500 Powerwalls would be needed to store the seasonal imbalances between generation and load at the home.

(8,536 kWh * 0.34 / 0.8) /(7 kWh) = 518

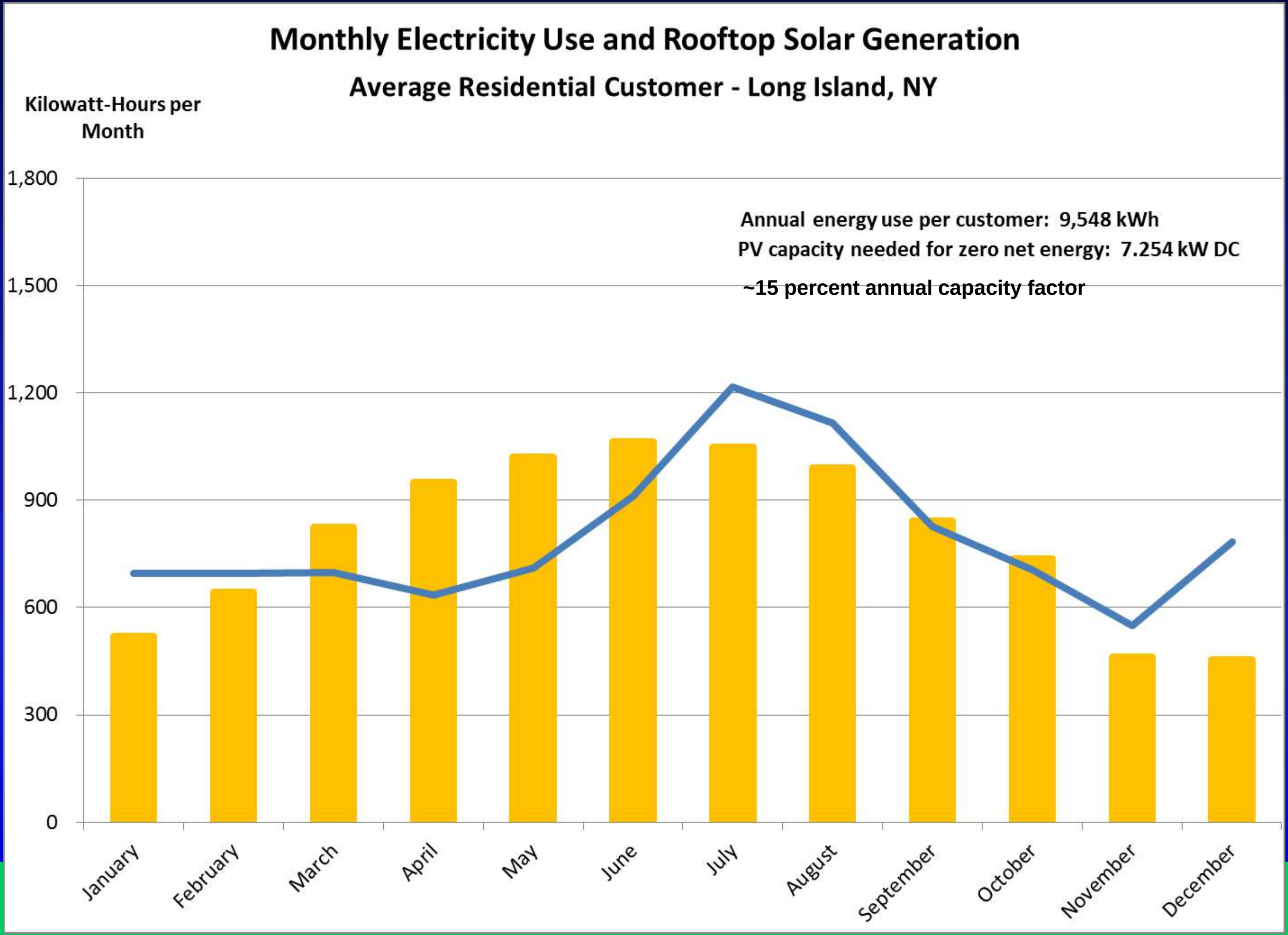
Solar Generating Potential Varies by Location



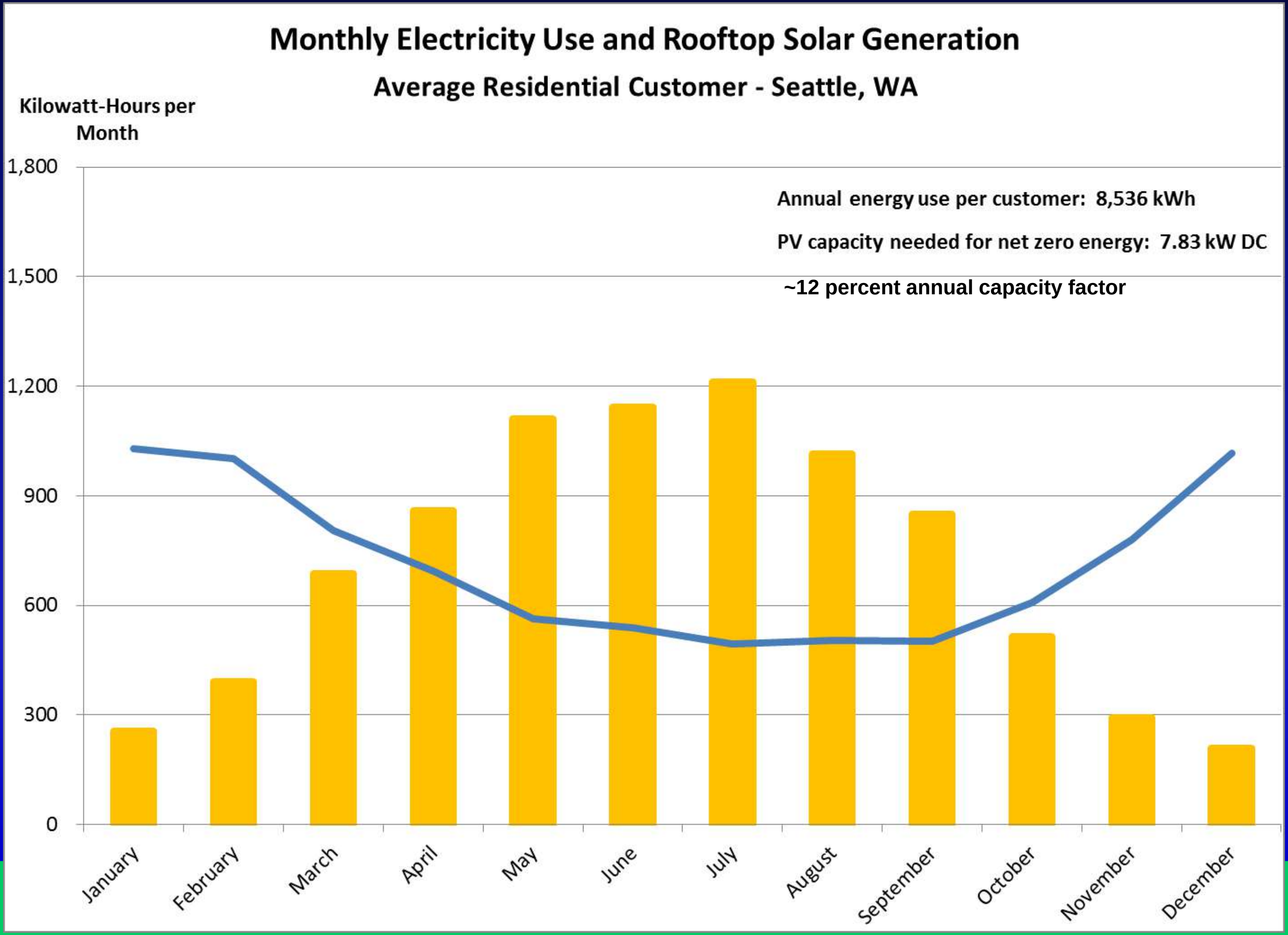
San Diego, California
10 Percent Seasonal Imbalance



Long Island, New York
10 Percent Seasonal Imbalance



Seattle, Washington
34 Percent Seasonal Imbalance



Where Does Energy Storage Fit?

- While battery technology can help with diurnal shaping, energy storage volume is limited
- Other forms of storage with longer cycles, greater energy storage volume are also needed
- Consumers will still need to rely on the utility system for energy storage
- Single-family homes not most cost-effective place for storage – network effects create opportunity for utilities or others

Traditional Electric Utility System

- Load Growth: strong and sustained; driver for economic development
- Generation: large, often CO_2-emitting; remote from major load centers
- Technologies: electromechanical, limited intelligence, manual, not well-integrated
- Utility Cost Structure: majority of costs for generation, transmission, distribution were fixed
- Utility Average Cost: declining; increasing volume reduces rates

Traditional Electric Utility System

- Competing Electric Providers: none
- Customer Behavior: passive consumption; little awareness of what utilities do to provide reliable, low-cost service
- Retail Electric Service: universal, one-size-fits-all
- Residential Rate Design: majority of costs recovered through energy changes (customer charges low)
- Utility-Customer Interaction: monthly bills, call center, outages, rate changes

Emerging Electric Utility System

- Load Growth: flat/declining; no longer a major driver for economic development; however, EVs and other forms of electrification can help achieve environmental goals
- Generation: increasingly renewable but intermittent; undifferentiated energy has low value; distributed generation and storage being located at or near loads
- Technologies: digital, smart, automated, integrated
- Utility Cost Structure: majority of costs for generation, transmission, distribution still fixed; stranded cost risks
- Utility Average Cost: flat/increasing; increasing volume no longer reduces rates

Emerging Electric Utility System

- Competing Electric Providers: solar installers and leasing companies; energy efficiency; demand response
- Customer Behavior: more active; engaging technologies and third parties; making choices to protect environment
- Retail Electric Service: still universal, but one-size-fits-all service no longer sufficient; customers still need the grid
- Residential Rate Design: recovering majority of fixed costs through volumetric energy charges no longer viable
- Utility-Customer Interaction: increasing use of meter data; growing pushback if rate changes are perceived to ‘protect monopoly by blocking competition’

How Are We Feeling?

Don’t Worry!


Lose your phone?
Didn't have your contacts backed up?
Don't worry, the NSA has them all saved for you.
(301) 688-6527

Topics

<u>Presentation</u>	Electric Utility Industry Transformation
<u>Conversation</u>	Implications for IT Services at NWPPA Member Utilities

Implications for IT Services at NWPPA Member Utilities

- General thought and observations

Implications for IT Services at NWPPA Member Utilities

- If a utility has not yet determined its response to industry transformation, how can its IT efforts help prepare for it?

Implications for IT Services at NWPPA Member Utilities

- What about rural utilities?
  - Will industry transformation happen in rural areas?
  - Will it look different?
  - If it does, how can IT respond?

Implications for IT Services at NWPPA Member Utilities

- Electric utility industry transformation is blurring functional lines within the organization (G/T/D/C&F). How will this affect IT?
  - Roles
  - Priorities

Implications for IT Services at NWPPA Member Utilities

- Will it realistically be possible to meet all IT needs?
- If not, what are the top priorities and why?
- Ideas about triage?
- Funding?

Thank You!

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