RAP Energy solutions for a changing world

The Power Sector – The Future

Vermont House Natural Resources & Energy Committee
Montpelier VT

Presented by RAP

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Agenda for Day 3

- Trends
- Considering Change and Risk
- A service-oriented power sector industry
- Role of Utility and compensation
- Role of Regulator
- Animating Consumers

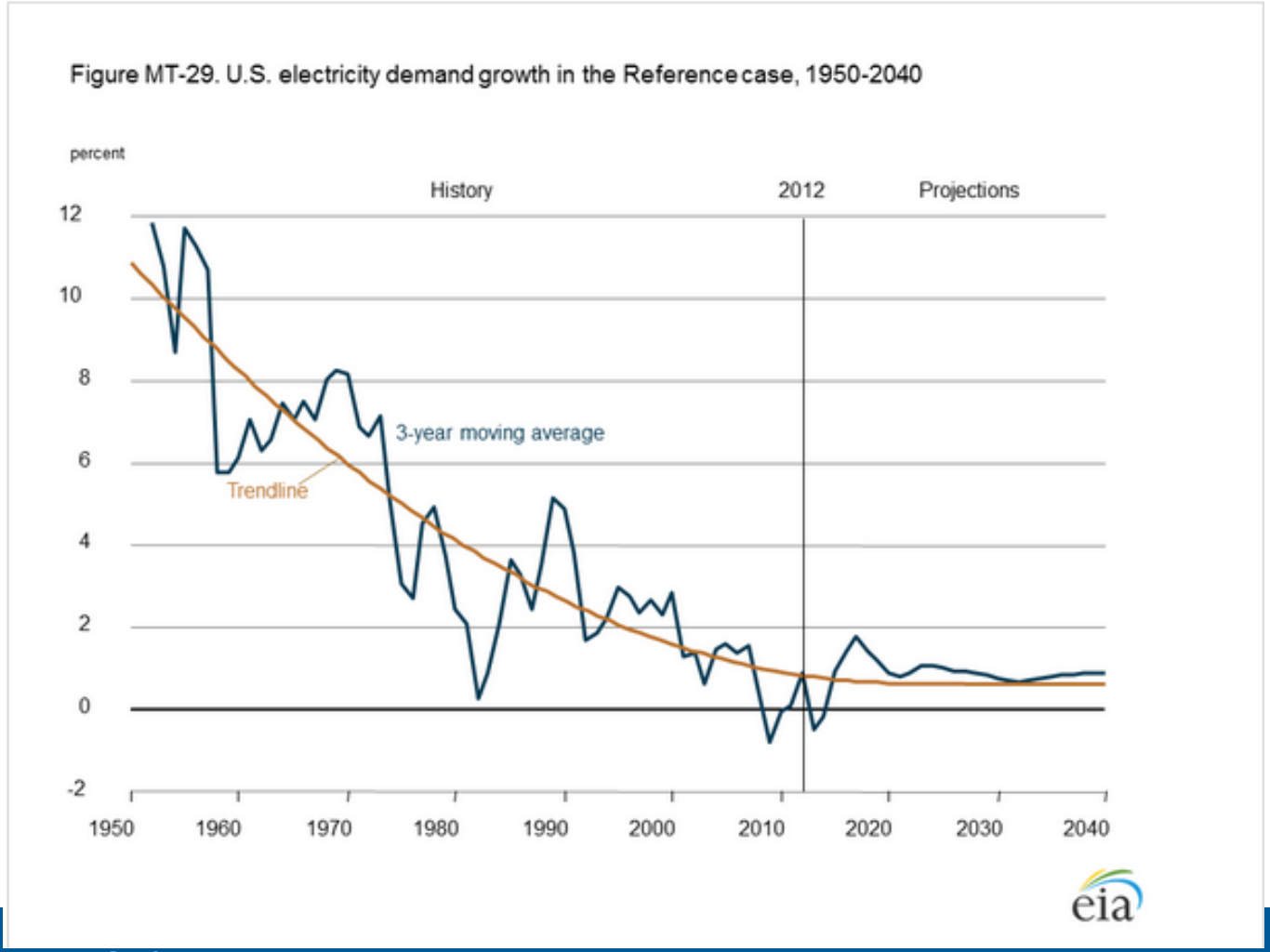
Why States Regulate Utilities

- Classic regulation has managed
  - Costs
  - Big decisions
  - Priorities
- New challenges and opportunities are here
  - Adapt classic regulation

Trends

- Low to zero sales growth
  - Historically, high growth rates have produced revenues that have covered for mediocre management and regulation
  - Good news! The US economy is more productive! Growth requires less electricity
  - Low or zero sales growth, or even a decline in sales changes utility attitude and flexibility about spending and surprises

US Electric Growth Rates Historic, Forecasted 1950-2040

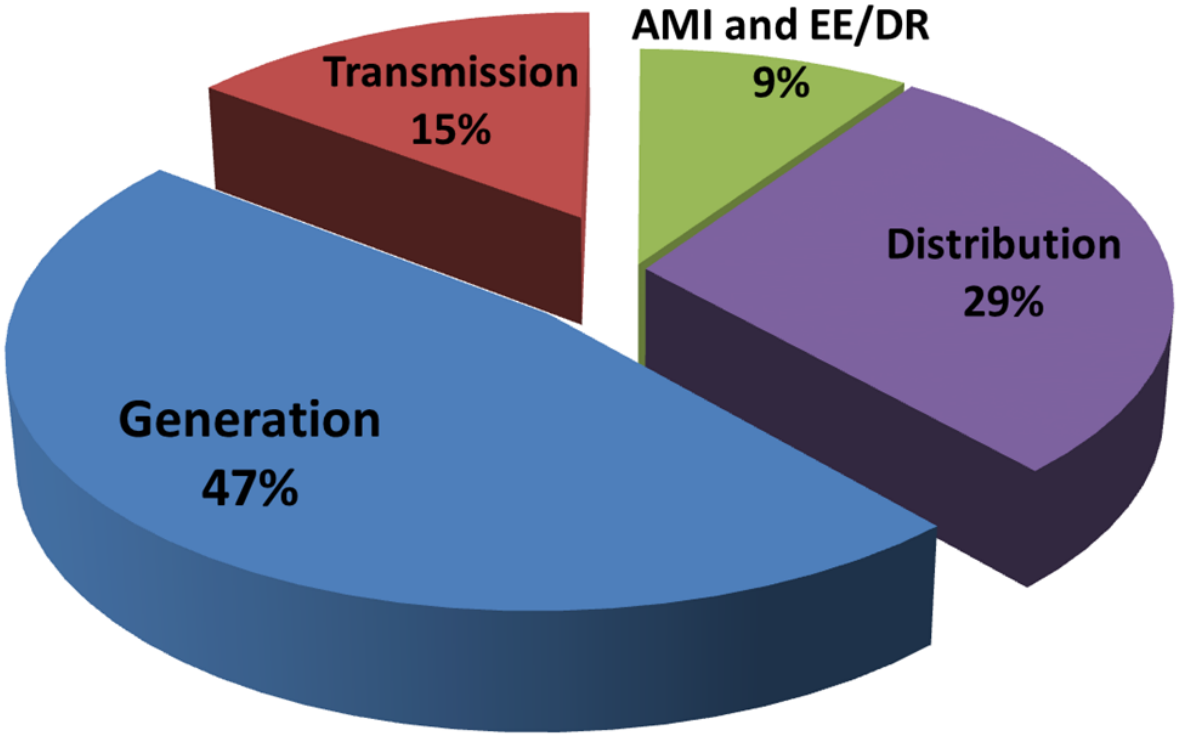


With upside potential for DG, many consider this forecast on the high side of likely

Trends

- System investment needs seem to be growing
  - Maintenance and replacement of older facilities
  - Overhaul to new technologies
    - How fast will happen?
    - Where will capital come from?

Breakdown of Brattle's $2.0 Trillion Investment Requirement



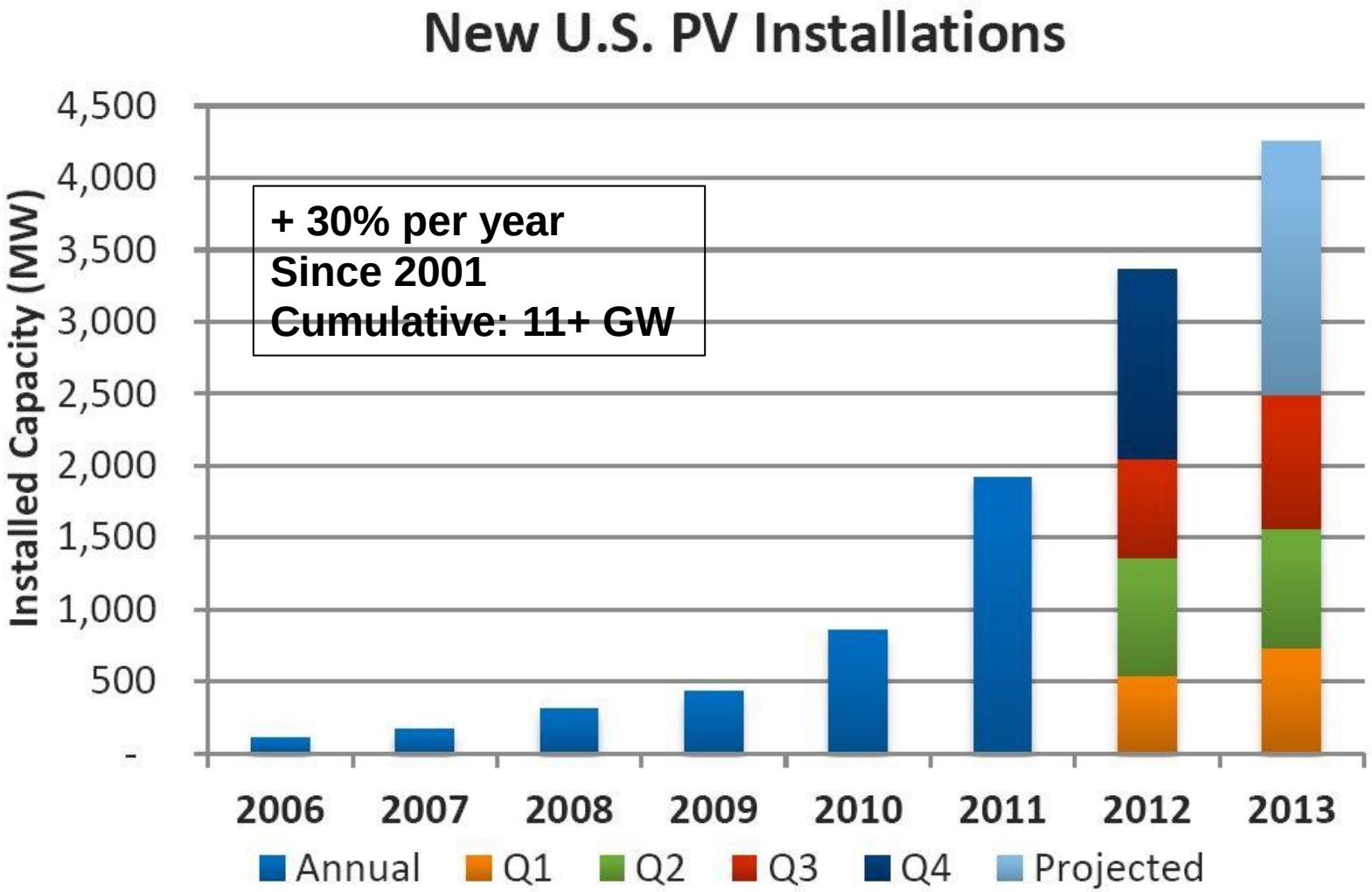
Trends

- Low natural gas prices – an outcome of
  - New extraction practice (fracking)
  - High to moderate market prices of oil extracted with natural gas
    - Gas is a by-product
- Driving coal out of the merit order dispatch in parts of the country
  - And causing some less competitive coal units to close
- How long with low natural gas prices last?

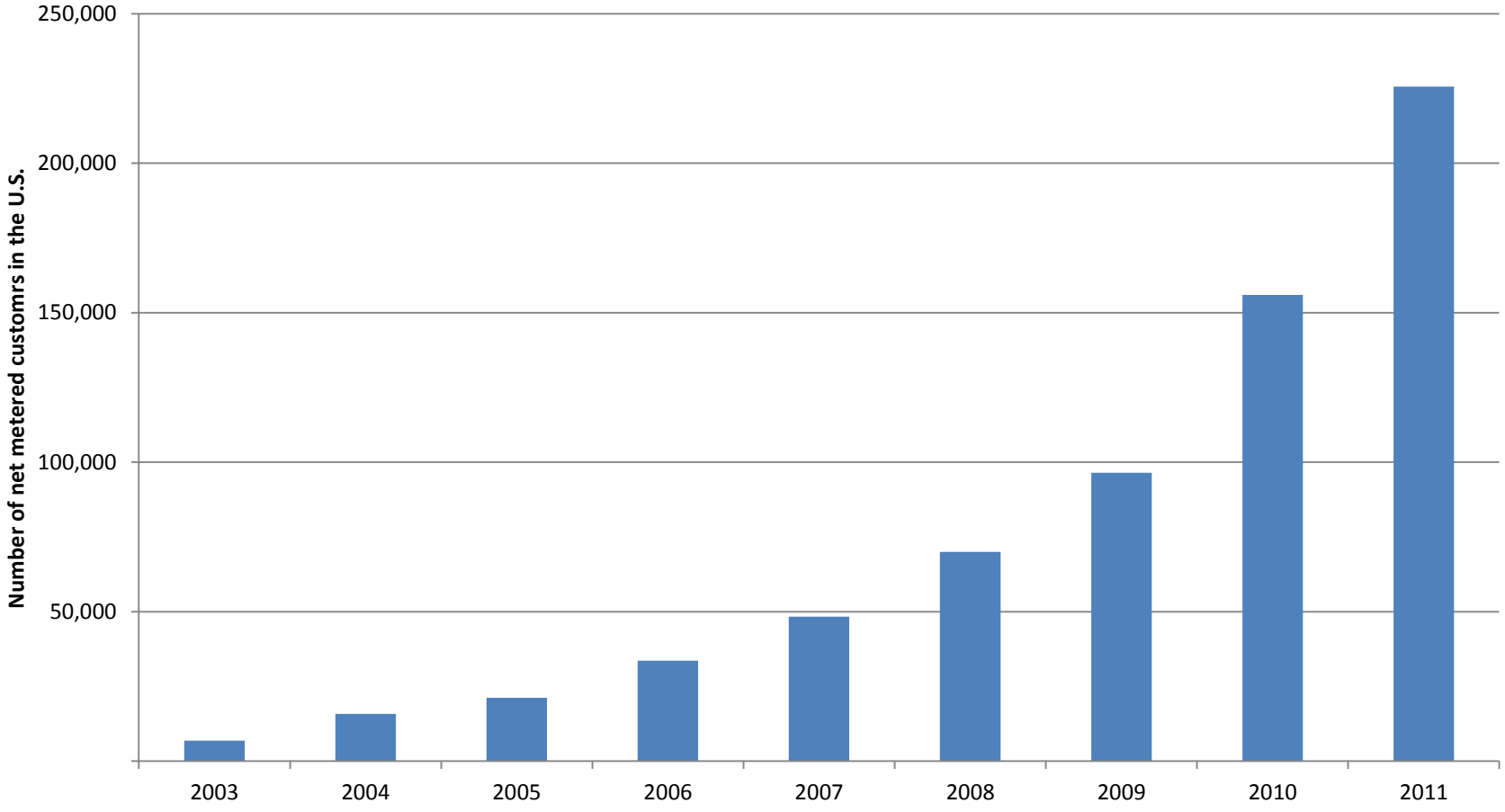
Trends

- Reducing clean energy costs
  - Declining costs of the equipment (PV, wind, EE, DR)
    - Improved material science
  - Improved regulation and markets reduce “soft costs”
    - Soft costs cam be lower
  - Storage showing promising signs
    - game changer

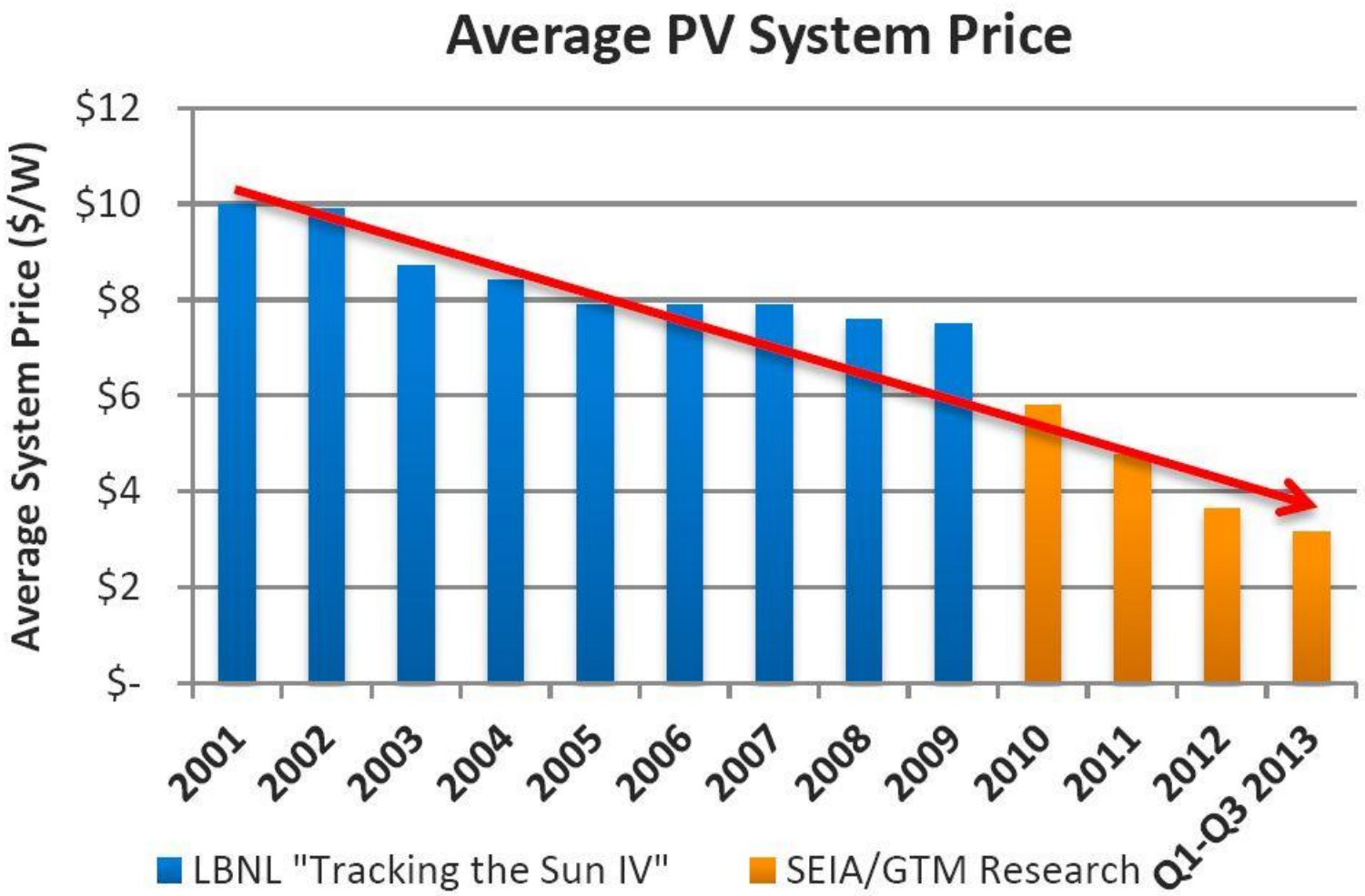
Distributed Generation is Growing



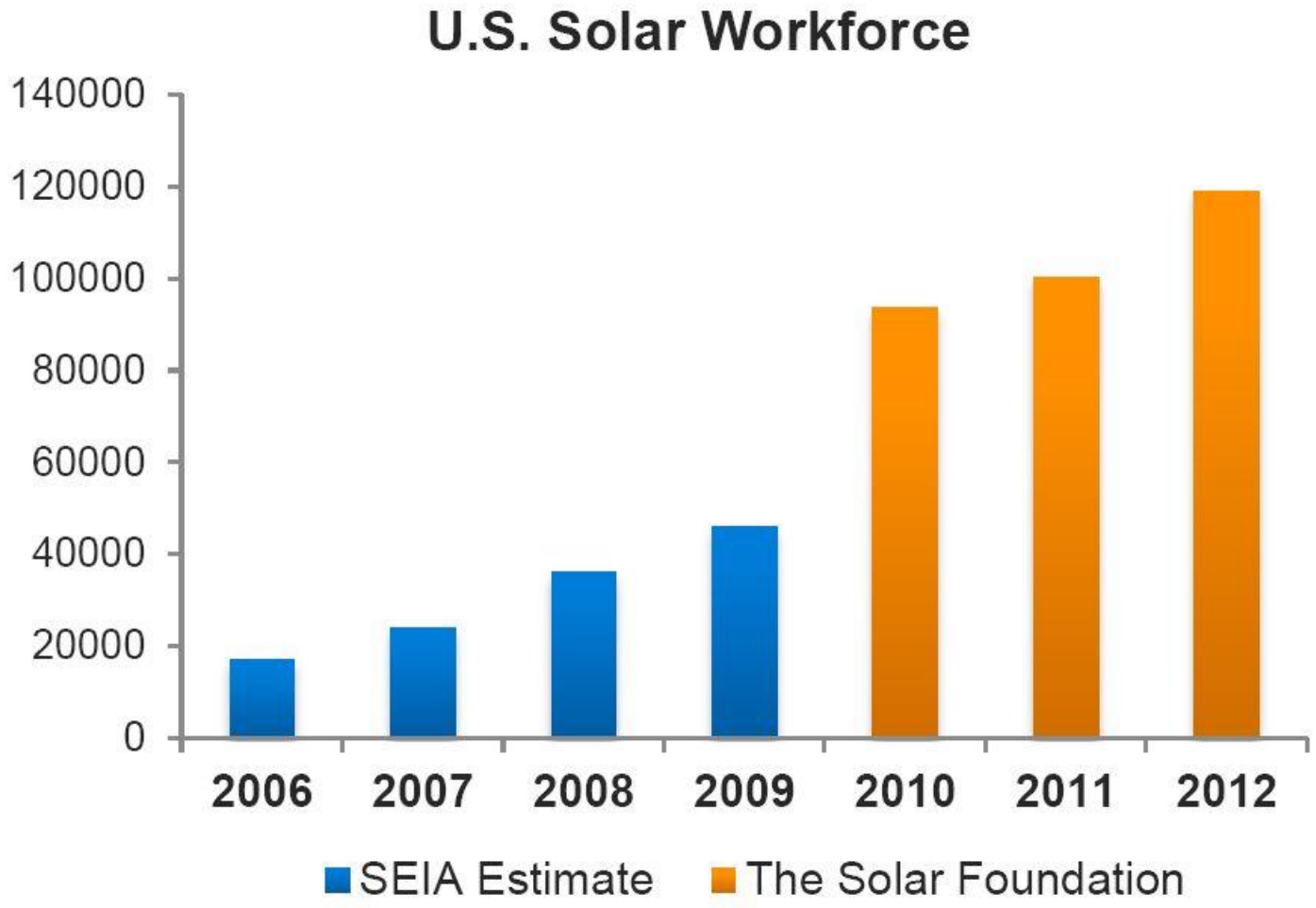
Net metering growth



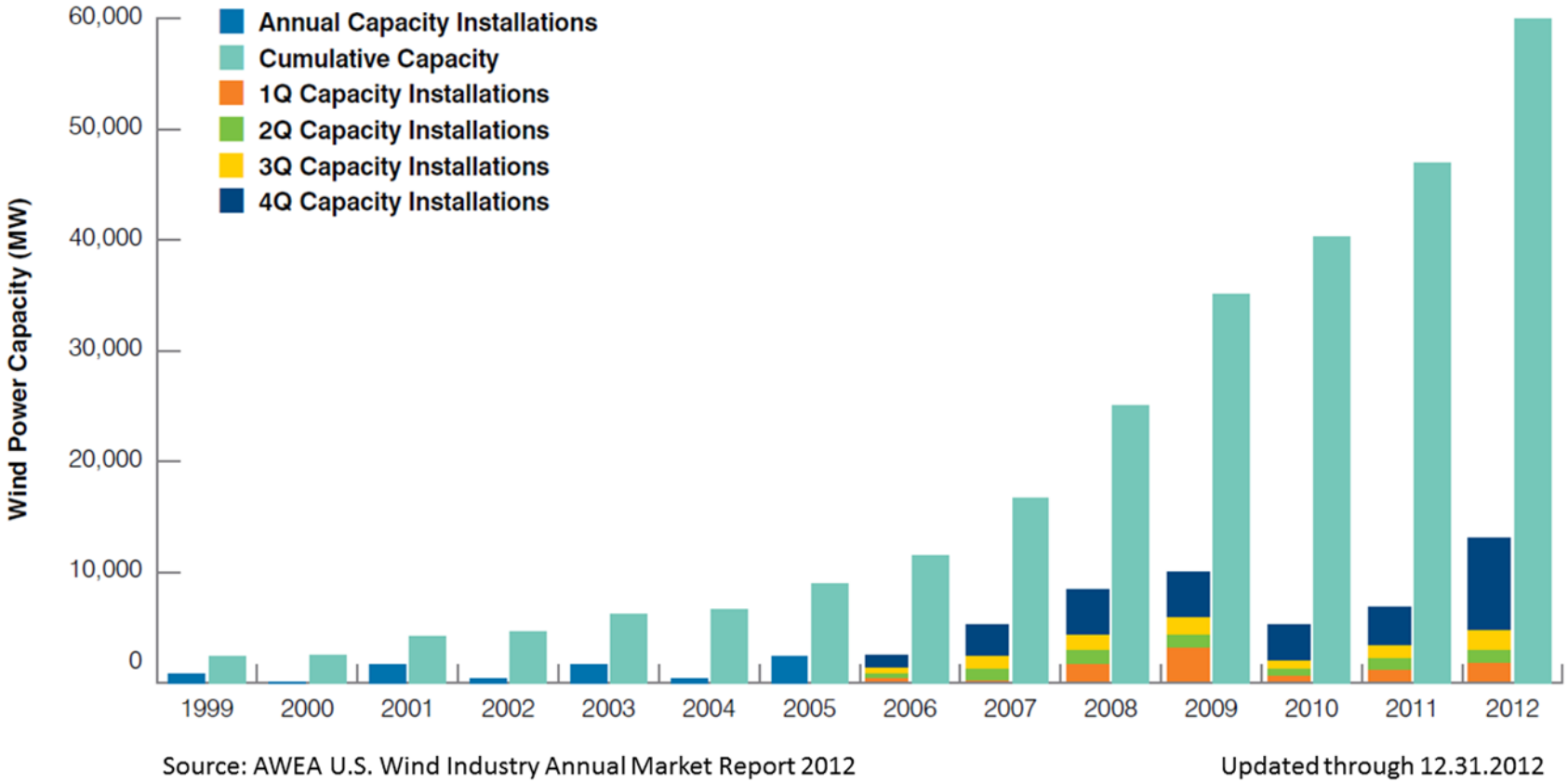
Costs Continue to Decline



Solar Has Become a Big Business

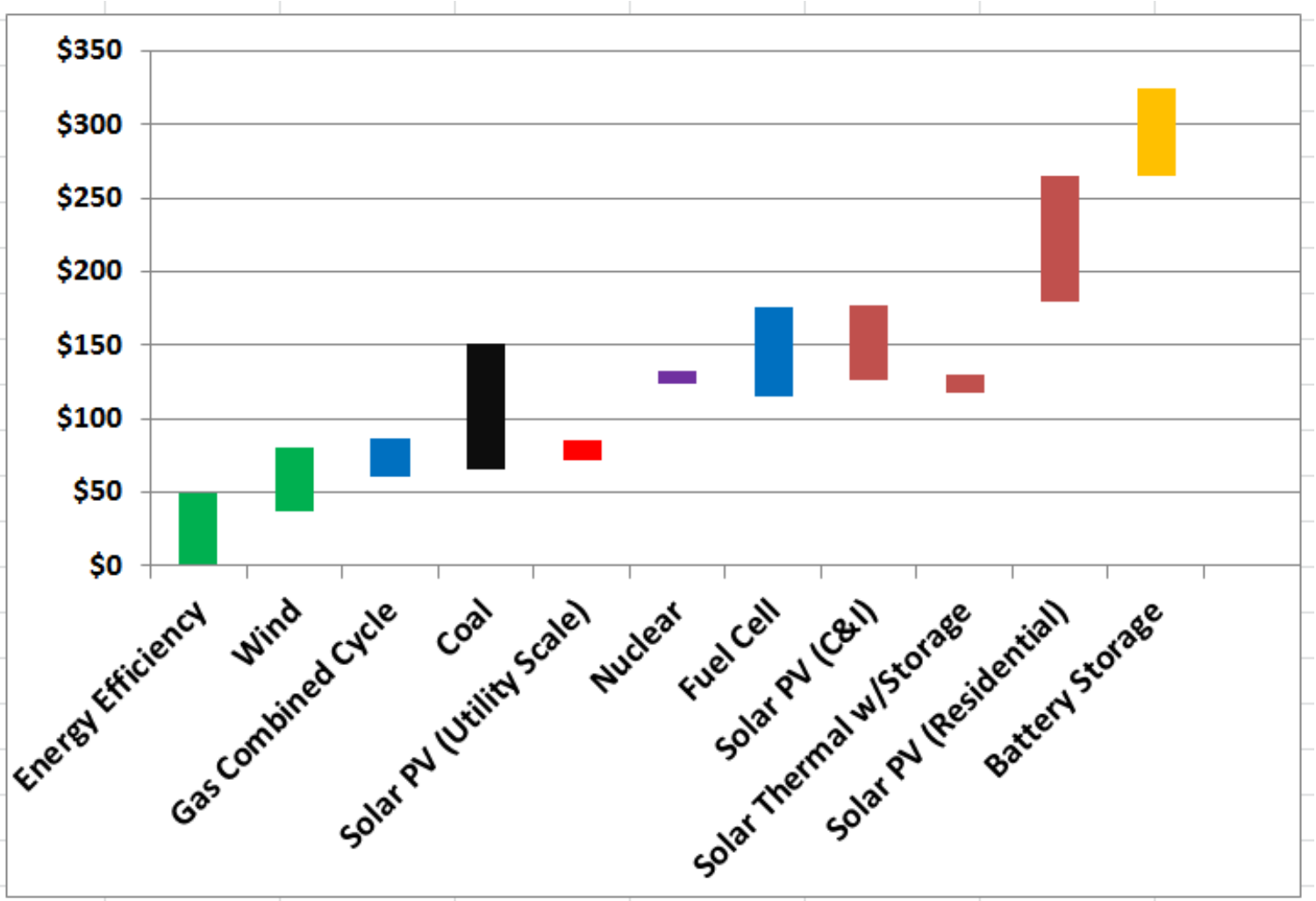


Wind Generation Is Also Growing



Long run cost of energy

Lazard (2014)



Trends

- Climate change mitigation imperative

Reports from the World

Change

- In the midst of changing forecasts, which tend to be wrong anyway

At a time of Innovation
Pay attention to how change happens

- Existing priorities
  - Cost, risk management, reliability, etc.

At a time of Innovation
Pay attention to how change happens

- Added forces driving change today
- Technology
  - Information and communications enable more
  - New generation systems cost less
  - Public interested in Apps and Clean Energy

At a time of Innovation
Pay attention to how change happens

- Added forces driving change today
- Environment and decarbonization
  - Cleaning of the power grid
  - Electrification of thermal and transportation
  - Public interest in addressing climate change

At a time of Innovation
Pay attention to how change happens

- Added forces driving change today
  - Natural Gas
    - Availability
    - Price
  - Natural gas as a Bridge to the future of RE
    - How wide? (how much gas do we need to use while the renewable energy future is developing?)
    - How long? (for how many years does natural gas need to support the grid until it is no longer needed for all but essential end uses?

Paying for Change

- Growth has paid for growth
- What/who will pay for change?
  - When growth is no more

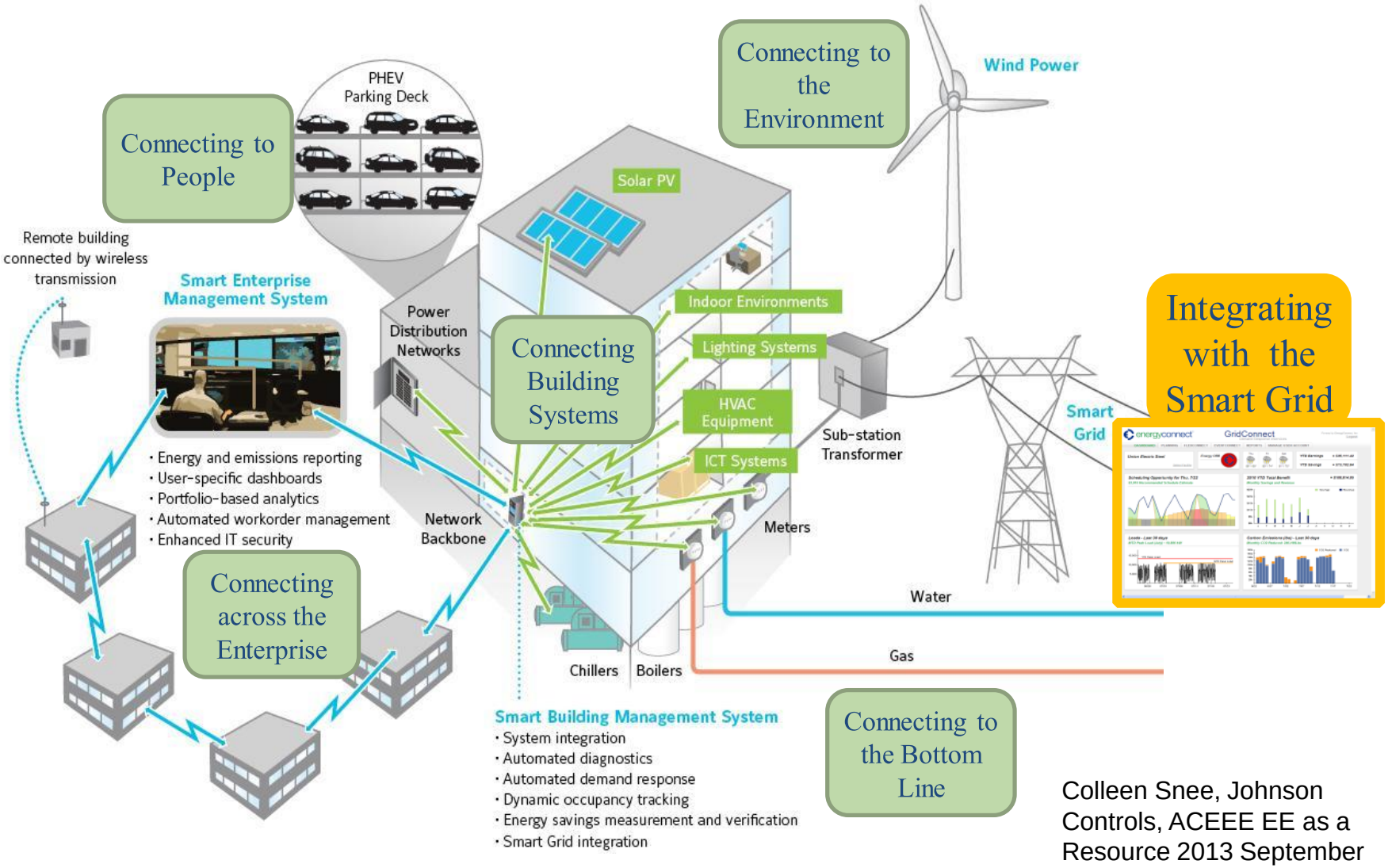
Risk

- Utilities will be compensated for the risk they take
  - In the calculation of their return on equity
  - Unless…
- Attention to whether change will disrupt the risk – return balance

Toward a Service-Oriented Industry

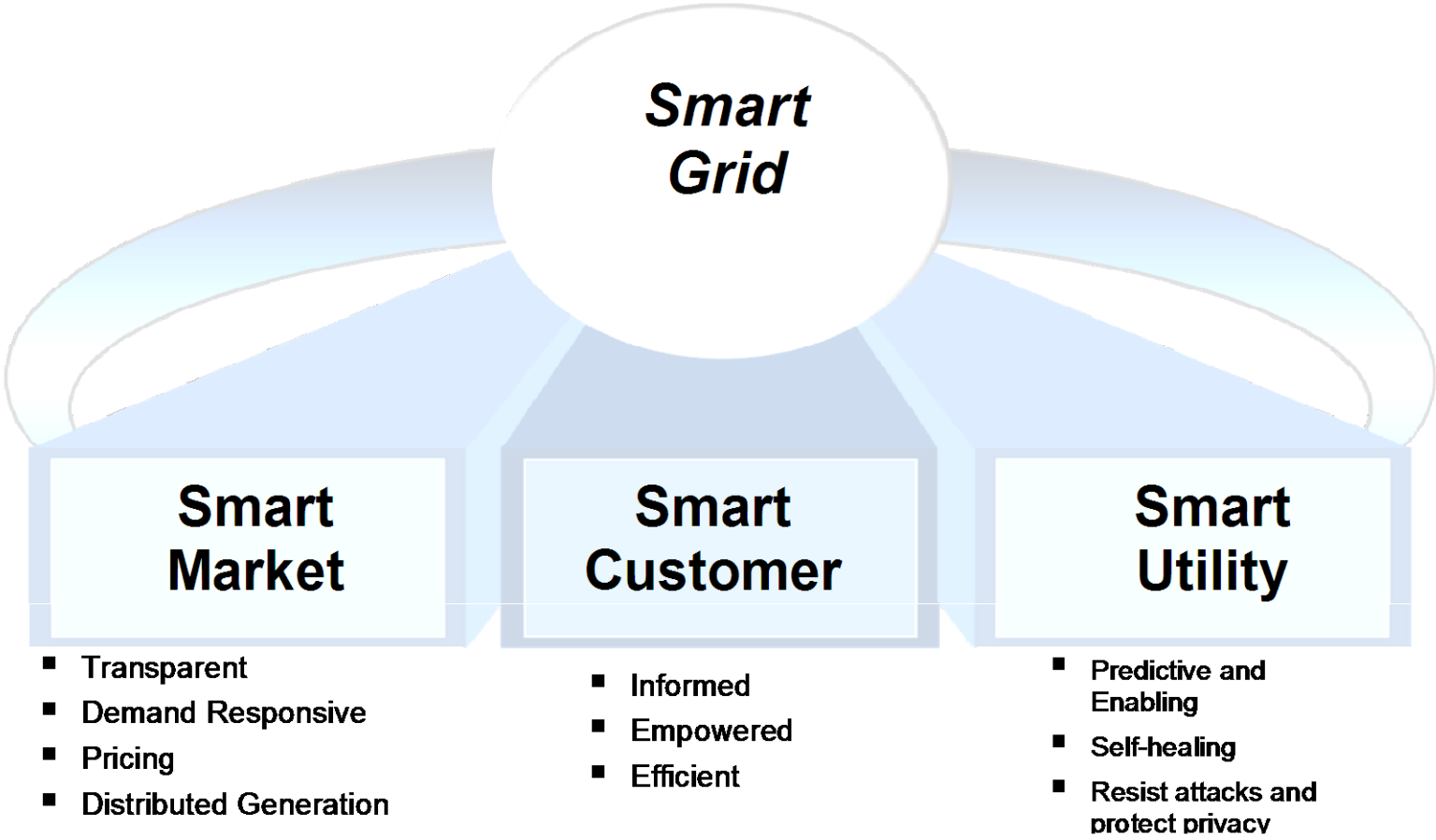
- Services?
  - Vermont chose not to engage in retail energy competition in 1998.
    - Good idea – not enough value there
    - We have benefitted from wholesale competition
  - More compelling nudge now
    - How to help customers manage buildings, onsite generation and processes and end uses using new tech
      - ENERGY MANAGEMENT PLATFORM
    - Demand response to enable big renewables
  - The internet of things and innovation

Integrating Smart Buildings with the Smart Grid



Colleen Snee, Johnson Controls, ACEEE EE as a Resource 2013 September

Vision


Smart Grid
Smart Market
Transparent
Demand Responsive
Pricing
Distributed Generation
Smart Customer
Informed
Empowered
Efficient
Smart Utility
Predictive and Enabling
Self-healing
Resist attacks and protect privacy

Toward a Service-Oriented Industry

- Value
  - All this innovation is important if it reveals value to society, to the grid, to people
  - More information from the utility to consumers
  - Requires better planning and system operation
  - Wholesale system also needs improvement prompted by state advocacy
- Bypass
  - How big of a threat is customers exiting?
  - Why should government care?

How to raise capital for power sector of the future

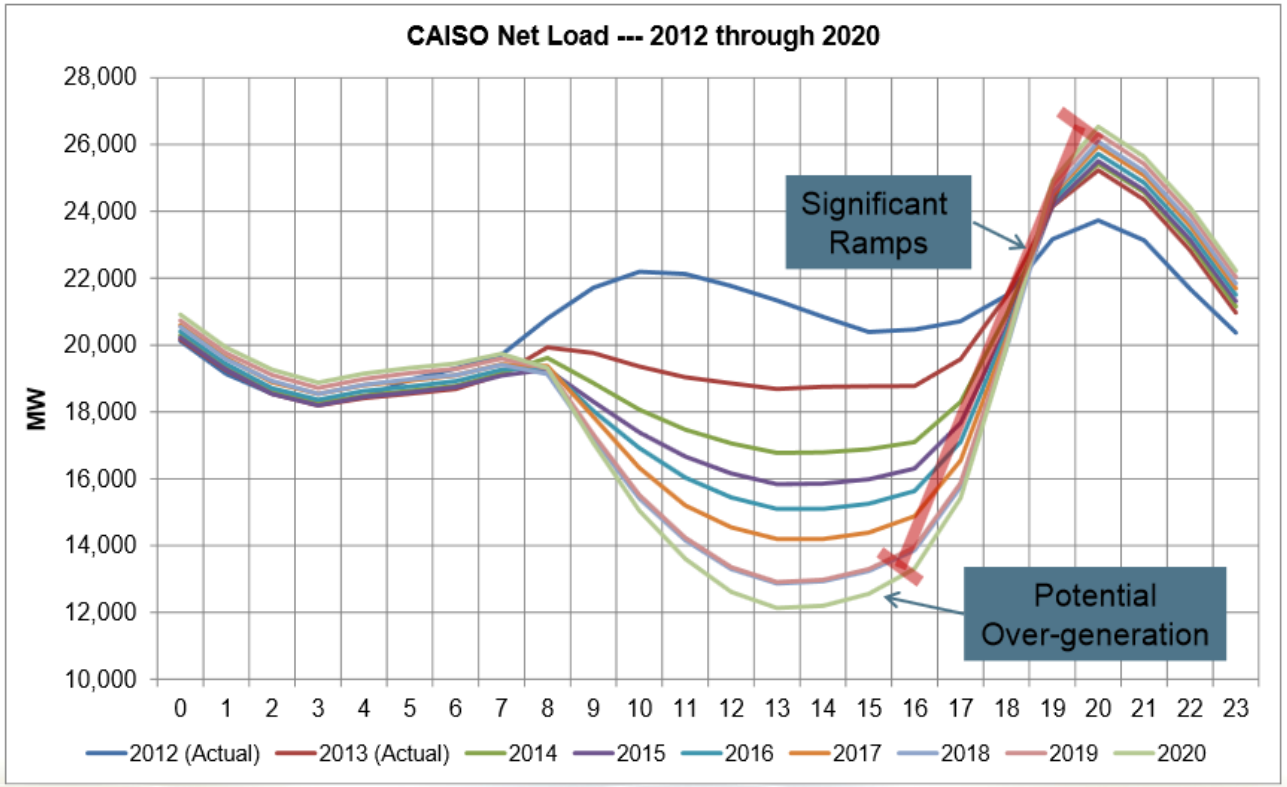
- How does capital come from private sources?
  - End users, beneficiaries, as with net metering
- How does capital create the front end (the APPS) to engage customers?
  - Nest
- How does the physical change of the grid get accomplished and paid for?
- How to pay for essential grid services?

Areas for Action

- Resetting the role of the utility and compensation
  - Delivery
  - Operation
  - Planning
  - Resource evaluation
  - Procurement
  - Public interest imperatives
  - Platform for innovation

One operating challenge ahead as solar power grows

Non-Summer Months - Net Load Pattern Changes Significantly Starting in 2014



How shall the utility of the future Earn?

- On capital invested? Certainly
- On performance?
  - What categories?
  - In what proportion compared with capital
  - Is public willing to pay supernormal return in exchange for exemplary service and innovation?
- On services in competition with others?
  - Or should the utility be purely enabling?

UK Performance Regulation Scorecard

(a) Scorecard for all output categories

Output category	Low	Middle	High
Customer satisfaction			
Reliability and availability			
Safety			
Conditions for connection			
Environmental impact			
Social obligations			

(b) Scorecard for bread and butter outputs

Output category	Low	Middle	High
Reliability and availability			
Safety			
Conditions for connection			

(c) Sustainable development scorecard

Output category	Low	Middle	High
Customer satisfaction			
Environmental impact			
Social obligations			

How to pay for the utility of the future?

- Revenue adequacy is essential for whatever the monopoly service turns out to be
- Prices signal customer behavior
  - Time of use matters, will prices show value?
- How to charge for new kinds of services
  - Should we have new classes of customers?
  - What does a new service cause on the system?
    - PV
    - EV

Role of the regulator

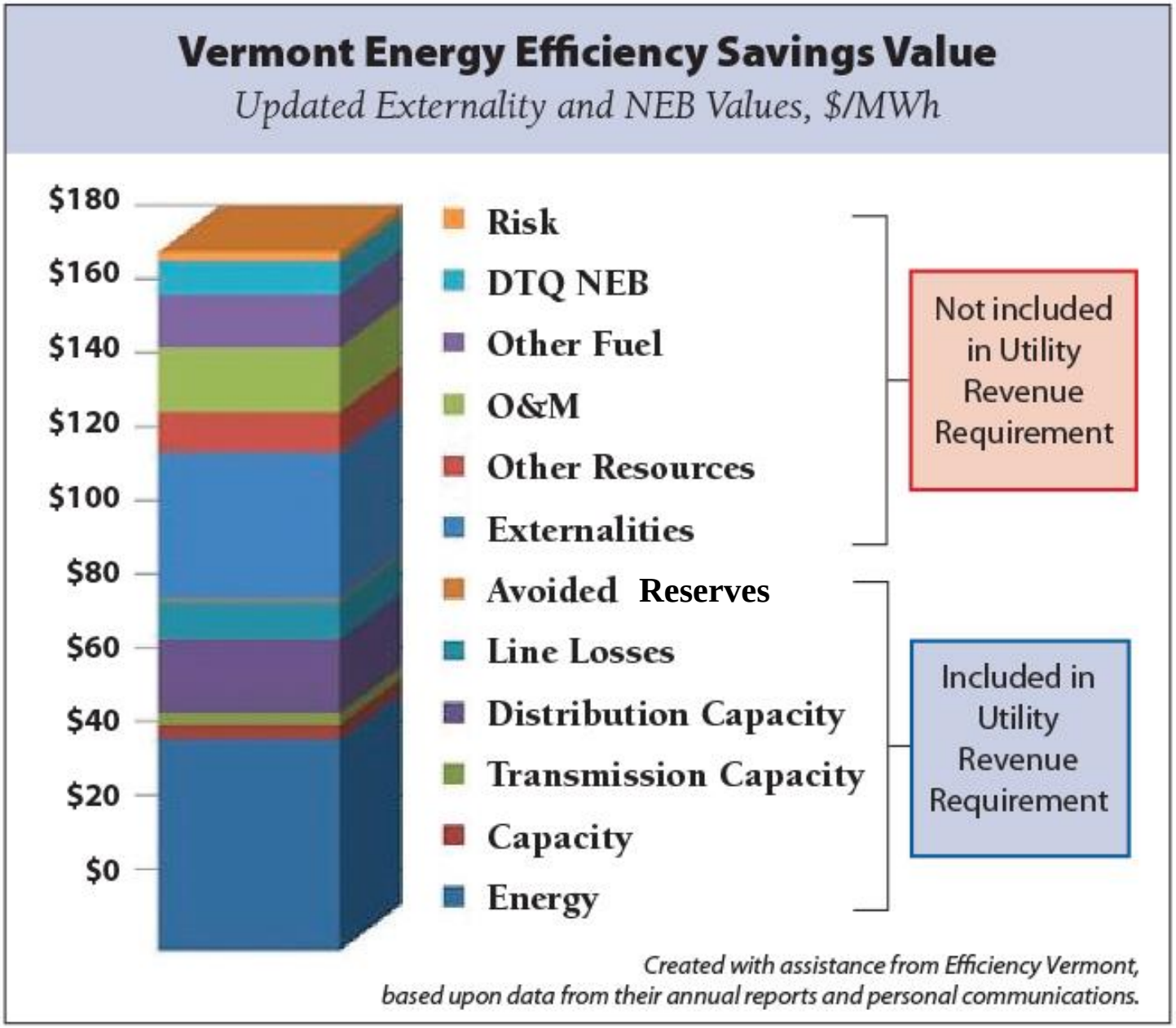
- The power sector of the future
  - the regulator and
  - the utility are changing
  - Regulation should match future circumstances

Role of the regulator

- The market the regulator supervises should deliver public interest outcomes
- Protection of the public interest
  - At risk, hard to reach customers should see benefits or at least be left alone
- Public interest purposes explicit
  - And represented in regulation
- Accountability

Role of the Regulator

- In search of VALUE
  - Monetizing values everywhere in the system
    - Planning, market rules
  - Supporting markets and regulation in balance to maximize gains
  - Value = costs and benefits, plus all public goals (climate change mitigation)
    - Regulator supervises Benefit - Cost assessment



Difficult to Quantify non-Energy Benefits

Performance Regulation

- Can regulation be more effective for focusing more on outputs associated with the public interest
  - And less on inputs, which may easier to see and count?
  - Remove any capital bias
- Consider the need to manage change
  - Present mostly manages routine

At-a-Glance

Con Ed will pay customers $150 million to save $1.1 billion

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Quick Take: *You already know that demand is flat or even falling in some parts of the United States. But you may not know that some utilities want it that way. So badly that they will pay their customers to use less electricity.* – ***Jesse Berst***

Consolidated Edison is seeking regulatory approval to give customers incentives to use less power. The programs would delay or defer the need for a new substation to handle growth – a substation that would cost an estimated $1.1 billion.

Gentrification is spurring growth in Brooklyn and Queens, consuming the capacity of existing substations. Con Ed determined it would cost $1.1 billion to build a substation to keep up with that population growth.

Instead, it will spend $100-$150 million to delay construction of the substation until at least 2024. It hopes to expand existing energy efficiency programs such as controlling home air-conditioners. And to add new initiatives, most of which have yet to be determined.

The utility will issue a request for information (RFI) for 52 MW of power production or reduction. Up to 10 MW of that amount must come online no later than June 2016.

"This is a very big step in a very different direction," said Robert Schimmenti, vice president of engineering and planning **as quoted by Bloomberg**.

Regulation and Customer Resources

- Address barriers to entry
- Markets should work for consumers
  - How can utility help?

Data, and Availability

- Markets work when participants have information
- Utility consumers have not been given quality and actionable information from their utility
- Technology, “big data” will make it easier for customers and vendors
  - New business opportunities

Data Issues

- *Can* market actors get data about customers?
- Ownership
- Privacy
- Cybersecurity
- *How* will market actors get data about customers?

Electrification

- Transport
- Thermal

How much does climate change weigh on regulation and their oversight of utilities?

What Vermont does will matter to the US.

About RAP

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power and natural gas sectors. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

Learn more about RAP at www.raponline.org

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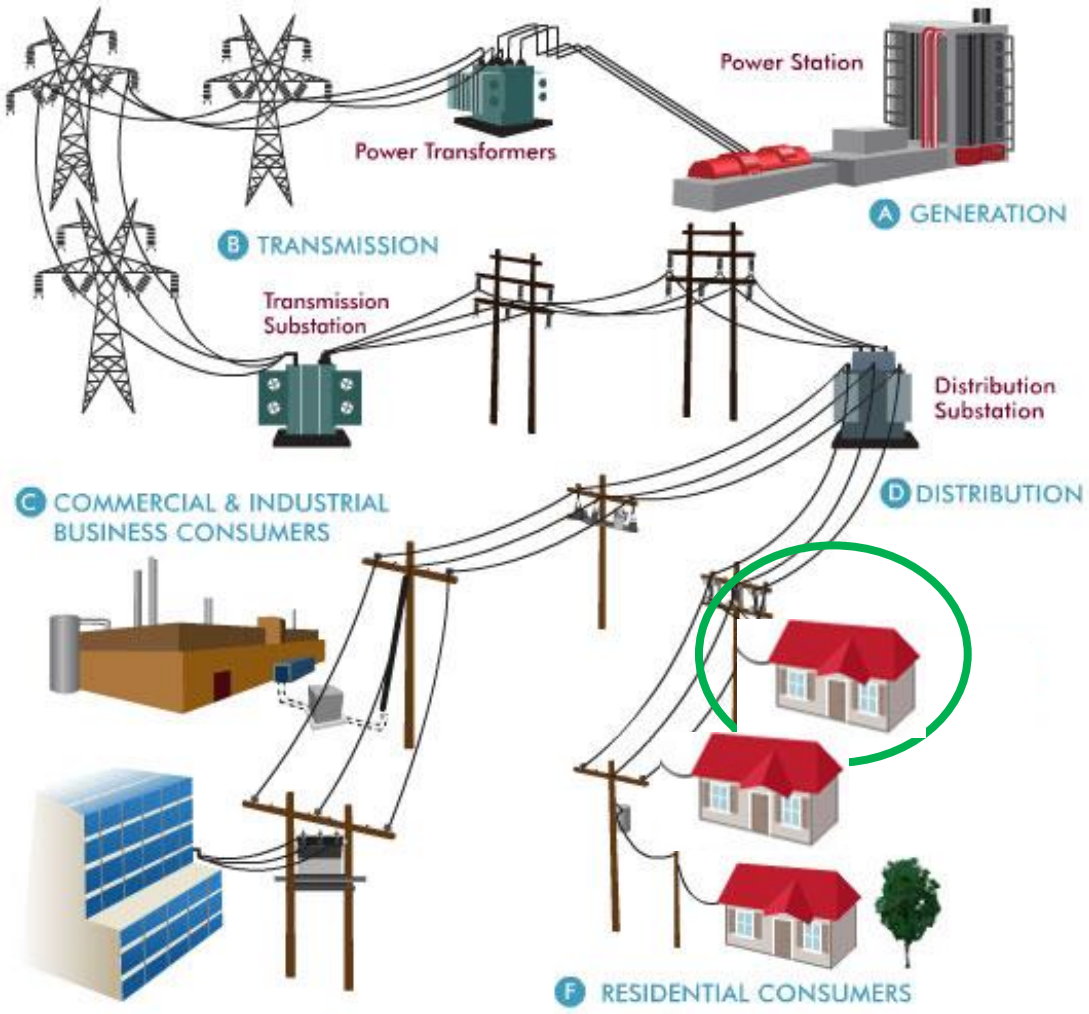
Recovery of Local Distribution Costs What Belongs in the Fixed Charge?



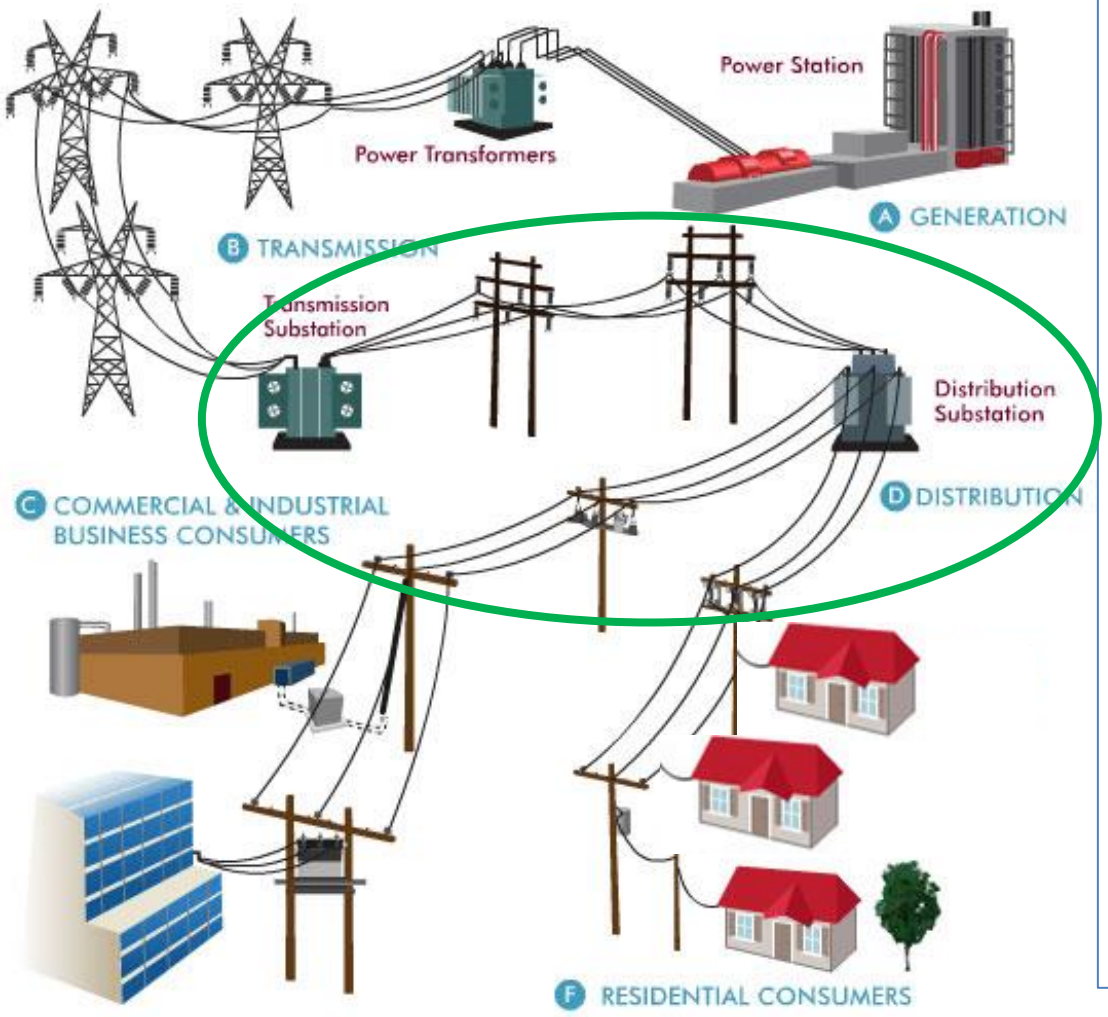
The only distribution costs that are attributable to any particular customer are the meter and service drop, and billing costs.

A fixed charge that covers more than this diverges from long regulatory traditions.

The transformer must be sized to the combined load of a few customers.

The rest is sized to the combined load of many customers.

How Should Poles and Wires Costs Be Recovered?



The distribution infrastructure is sized to the combined loads of all customers.

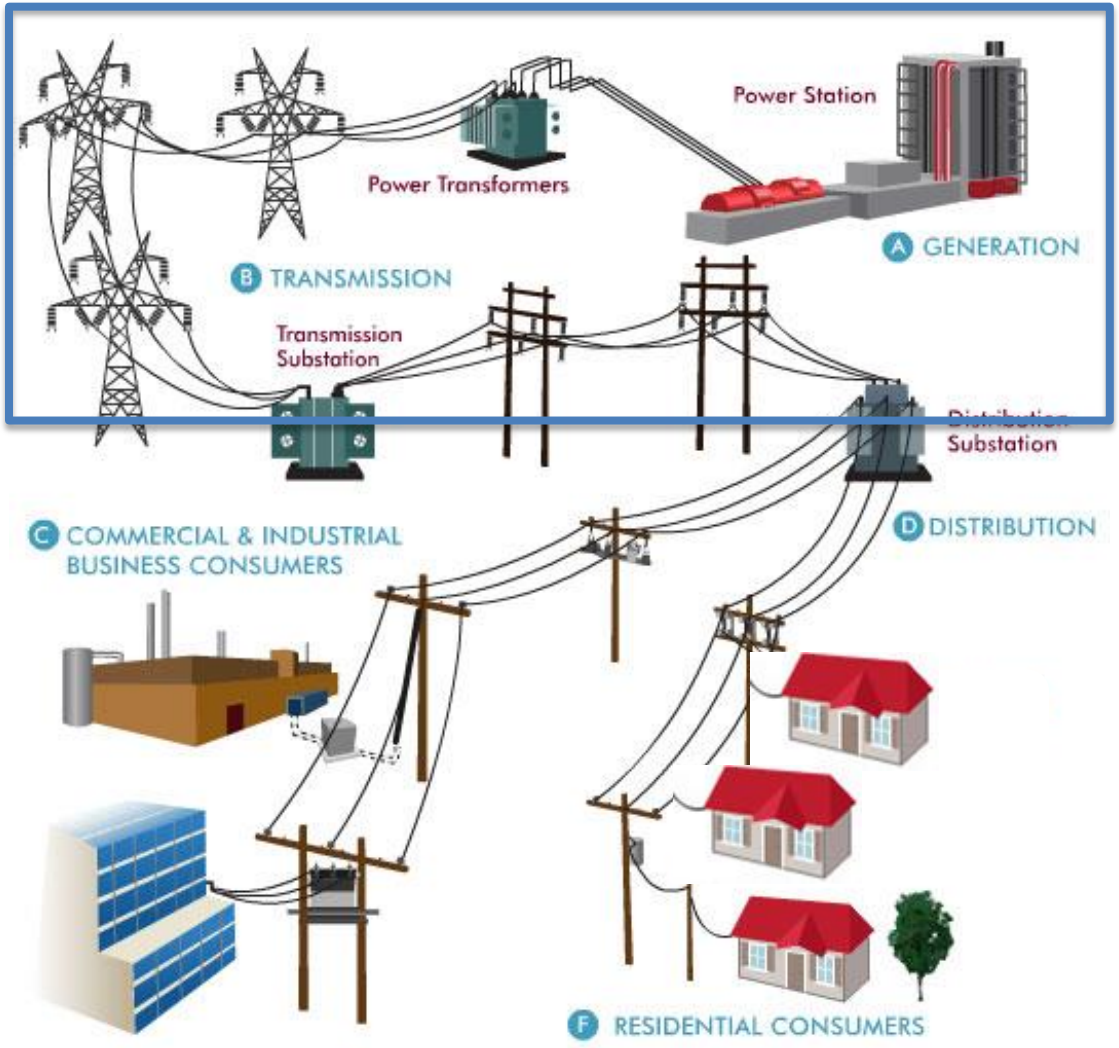
Adding (or losing) a customer does not change these costs.

They are built to deliver electricity (kWh). All customers using them should share in the cost.

If combined peak demand changes, the system design would change.

Bi-directional kWh or a kW charge is appropriate.

Recovery of Bulk Power Costs?



Capacity requirements are driven by peak demand.

Baseload resources are built for energy.

Transmission is mostly associated with remote (baseload and renewable) generating plant.

TOU Energy Charge best follows the cost causation.