





# **Distribution Market Designs and Business Models: *Who will capture the value of electricity?***

**Presentation to  
United States Energy Association**

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# Washington Union Station 1908



FIRE GREATEST OF DISCOVERIES  
ENABLING MAN TO LIVE IN VARIOUS CLIMATES  
USE MANY FOODS AND COMPEL THE  
FORCES OF NATURE TO DO HIS WORK

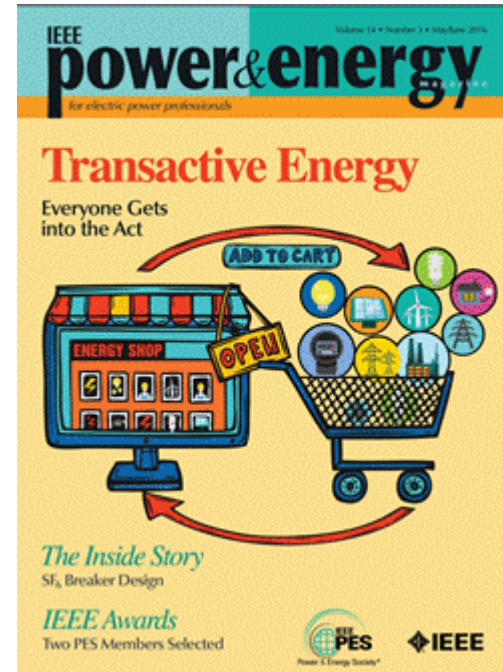
ELECTRICITY CARRIER OF LIGHT AND POWER  
DEVOURER OF TIME AND SPACE BEARER  
OF HUMAN SPEECH OVER LAND AND SEA  
GREATEST SERVANT OF MAN ITSELF UNKNOWN

THOU HAST PUT ALL THINGS UNDER HIS FEET

Some states are empowering consumers with Distributed Energy Resources (DER) to buy and sell electricity in a competitive market.

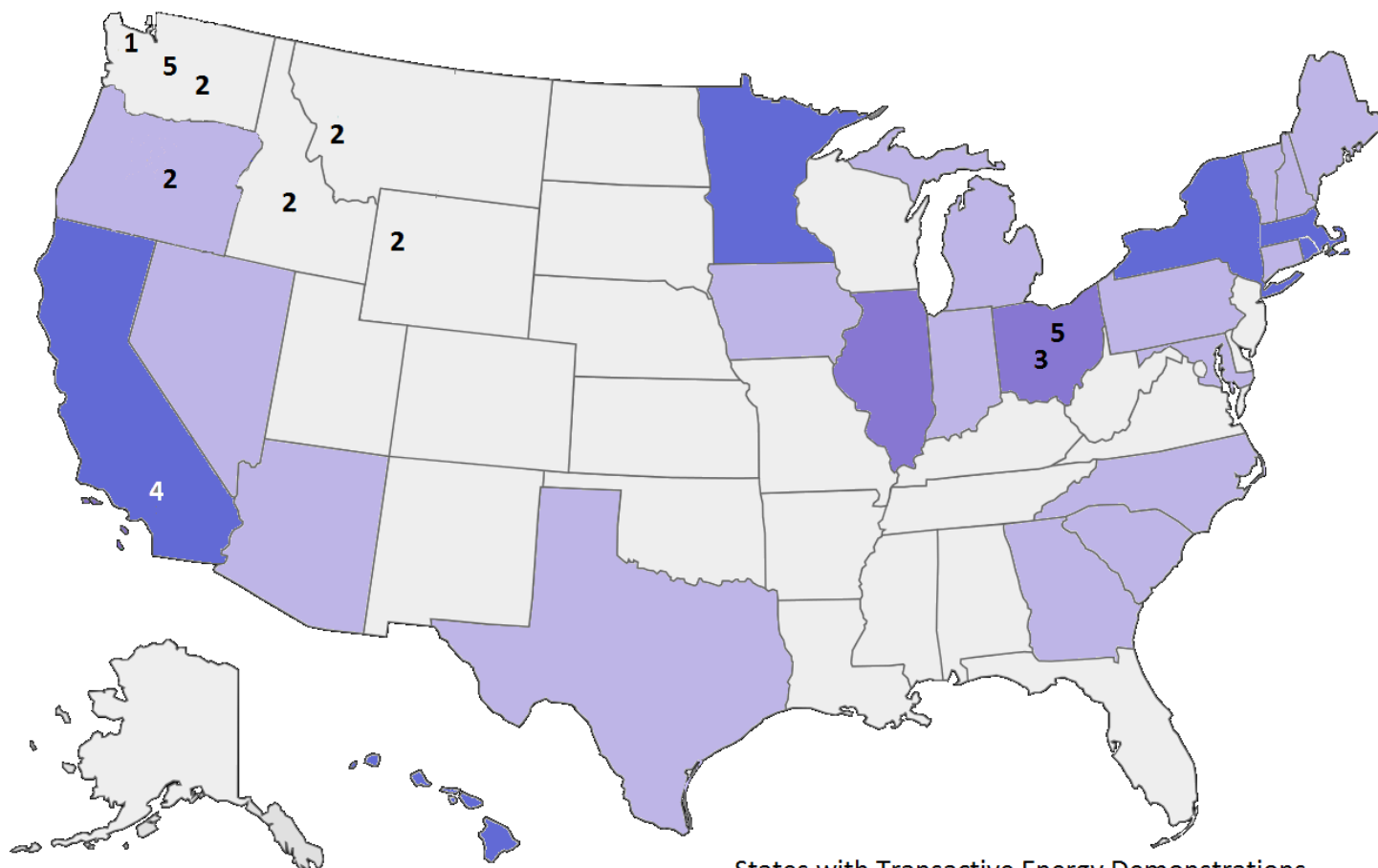
*Beyond Net Energy Metering (NEM) ...*

- Various market concepts are proposed
  - Transitional” markets
  - Transactive Energy (TE)
- Most consideration has been given to market designs and new distribution functions, but...
- Markets for DER will work only if business models are viable for both consumers with DER and electric sector businesses.



*What business models are viable for each market design?*

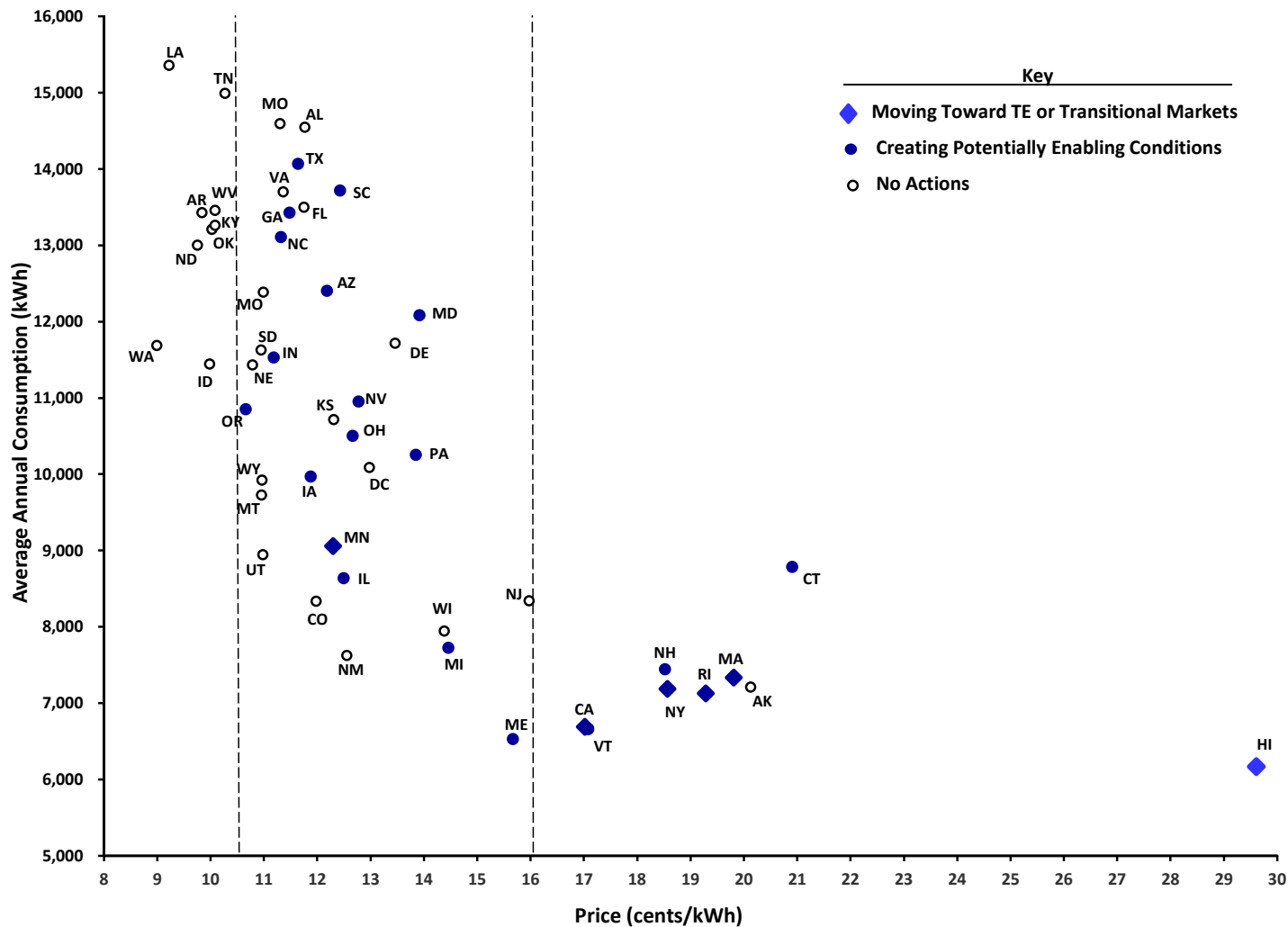
# States with activities supportive of retail DER markets.



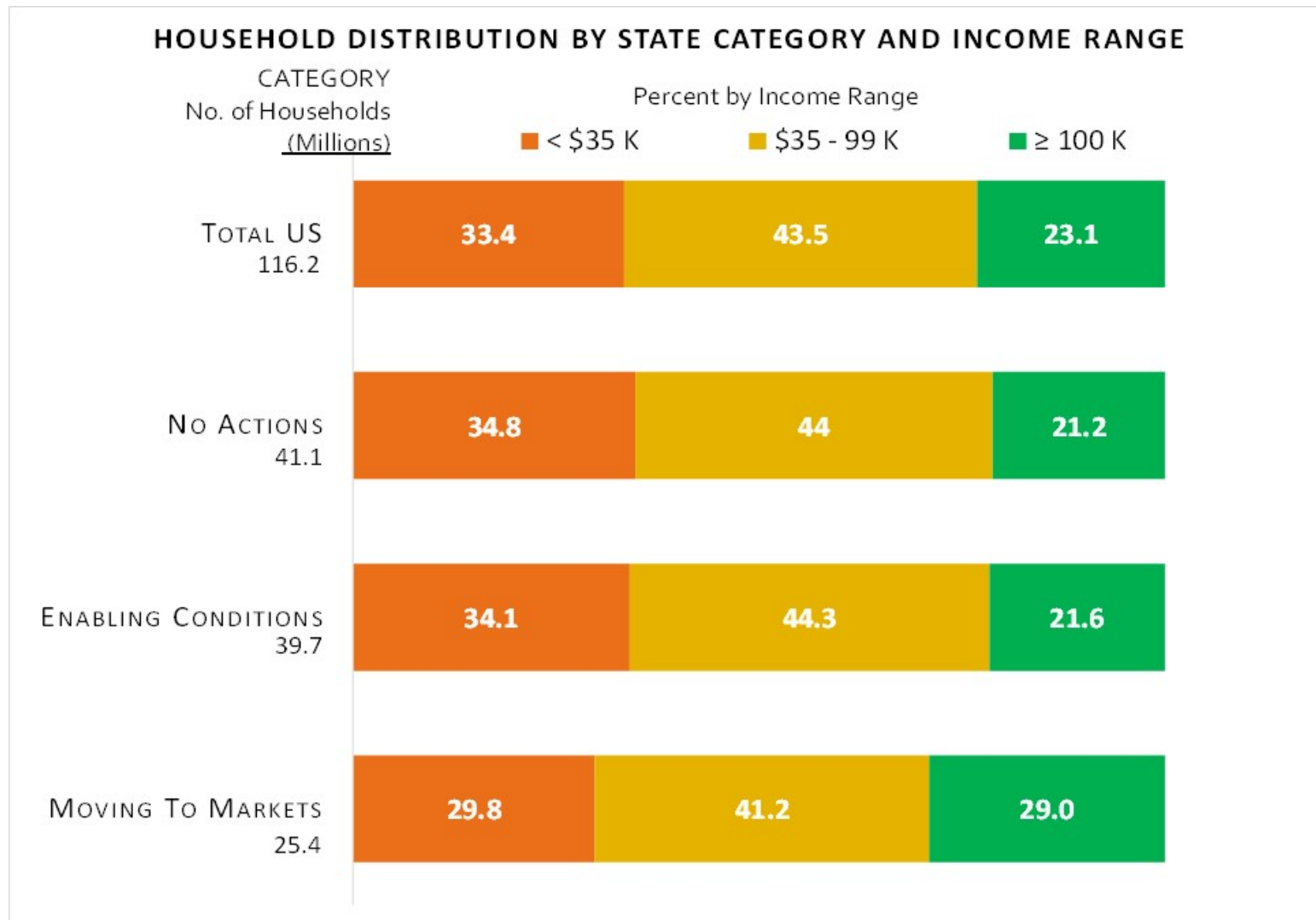
- States Moving Toward TE or Transitional Markets
- States Creating Potentially Enabling Conditions
- States Taking No Actions

- States with Transactive Energy Demonstrations
- 1 - Olympic Peninsula (2006-2007)
  - 2 - Pacific Northwest Smart Grid (2010-2015)
  - 3 - AEP GridSmart (2010-2014)
  - 4 - Peer-to-Peer (Planned Start 2017)
  - 5 - 3-Campus Transactive Demonstration (2016-)

# Average Residential Electricity Price and Annual Consumption by State, 2015



# States moving toward markets have relatively more affluent households.



# Why now?



## Consumer Participation in Power Markets



Supply push by companies that would capture value as part of prosumer value chain or as market enablers.

Demand pull by consumers

- Increasing value of electricity
- Changing consumer values
- Government policy responds



Enabling Platform of Technologies and Grid Architecture

Smart Grid

IT Telecom

Consumer Tech

The move toward customer participation is global.  
*Some examples:*



Ontario—Demand Response Auction



Australia—“Power of Choice” Program



Netherlands—PowerMatcher Pilot



Germany—Virtual Power Plants/Blockchain



Denmark—Flexible Retail Market System



EU—“New Deal for Energy Consumers”



## Policy decisions designing markets for DER will determine how much value goes to customers or others

### Some Examples

- ✓ Types of transactions and market rules?
- ✓ Centralized or decentralized markets?
- ✓ Who can participate?
- ✓ Who performs each grid and market function?
- ✓ How will the prices be determined?
- ✓ Role of economic regulation?
- ✓ Interface with the wholesale market and FERC?

# Transactive Energy (TE)

## *One type of market for DER*

### Definition

*A system of economic and control mechanisms that allows the dynamic balance of supply and demand across the entire electrical infrastructure using value as a key operational parameter. [Emphasis Added]*

- Gridwise Architecture Council, "Transactive Energy Framework version 1.0," US Department of Energy, 2015

## Visions of DER markets vary.

Type of Market	Transitional	Transactive Market	
	<u>Procurement Program</u>	<u>Peer-to-Peer</u>	<u>Centrally-Operated</u>
Products and Services Traded	DER Performance	Spot and Forward Sales of Energy and Transport	Spot or Forward Sales of Energy and Transport; grid services
Financial Transactions	Contracts for Services or Utility-Operated Market	Two-way Subscriptions	Cleared through DSO
Buyers	Regulated Utility	Consumers	Consumers
Sellers	DER Provider (Prosumer)	DER Provider (Prosumer) Central Station Resources	DER Provider (Prosumer) Central Station Resources
Market Operator	Regulated Utility <i>(Example: NY REV DSPP)</i>	Transaction Platform Provider <i>(Examples: TeMIX, PowerMatcher)</i>	DSO <i>(Several types proposed)</i>
Pricing Mechanism	Bids by DER offerors responding to solicitations Can be locational	Matching buyers with sellers in two-way auction	Model operated by DSO DMP, LMP+D+E or other Pricing

## TE Demonstrations in the United States

Demonstration	Dates	Number of Customers Involved	Pricing Mechanism
PNNL Gridwise Olympic Peninsula Project	2006-2007	112 Home water heaters 2 distributed generators 5 municipal water pumps	Congestion pricing on virtual feeder
AEP GridSmart Project in Ohio	2010-2014	100,000 Residential 10,000 Commercial/Industrial	Prices varied with PJM LMP
Pacific Northwest Smart Grid	2010-2015	60,000 customers of 11 utilities in 5 states	Modeled forward prices with 5- minute price signals
Clean Energy and Transactive Campus	2015-	3 multi-building campuses with PV , storage, and DR (3 more campuses planned)	Agent-based transactive controls
Southern California Edison/ Temix Peer-to-Peer	2017-	~200 planned	Tenders to buy, sell & transport electricity
Connected Building Challenge	2017-	TBD	Software integrating smart devices with price signals

Consumers are the source of electricity's economic value.

Business models explain how market participants capture some of that value.

Creating value for customers...

- Who are the customers
- What products and services
- What is the value proposition
- Pricing strategy
- What customer relationships
- What marketing channels

Capturing a share of that value...

- Cost structure
- Capital requirements
- Financing sources and methods
- Operational considerations
- Managing business risks
- Value chain



*What business models could be viable in a high-**DER**-participation marketplace?*

# Where are we now?

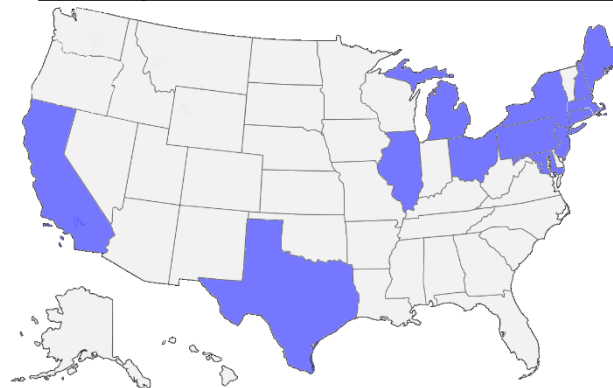
## *Current Business Models Serving Ultimate Customers*

### Retail Electric Utility Service



- Investor Owned Utility
- Distribution Cooperative
- Public Power Utility

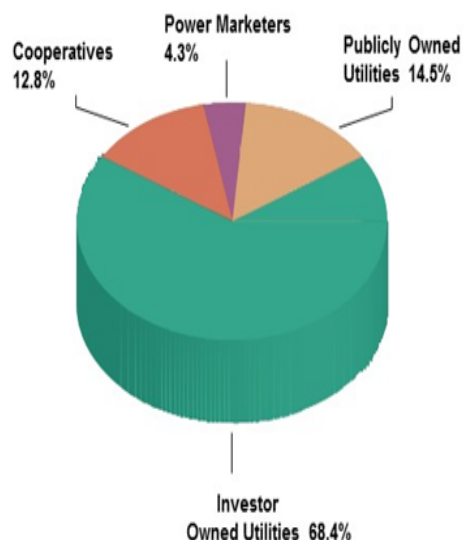
### Competitive Market Businesses



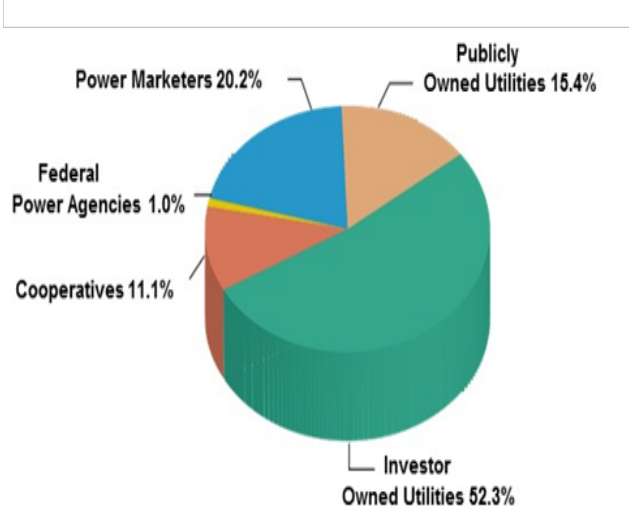
- Retail Power Marketer
- Demand Response Aggregation
- Community Choice Aggregation
- Community Solar

*Some customers already provide grid services using DER with photovoltaics, backup generators, CHP or demand response.*

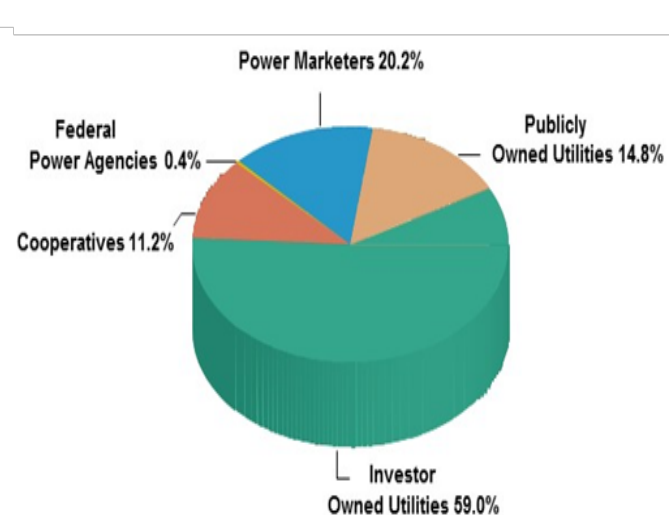
# Market Shares for Electric Services to Ultimate Customers, 2014



**Number of Customers**

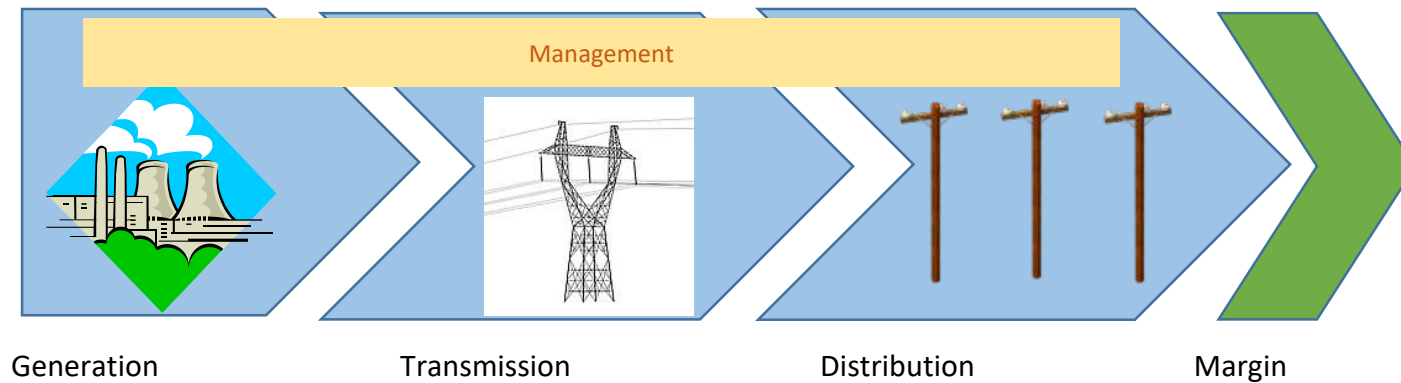


**Sales (kWh)**



**Revenue (Dollars)**

Value chains illustrate how the value of serving customers is allocated among primary and support activities to create margin.



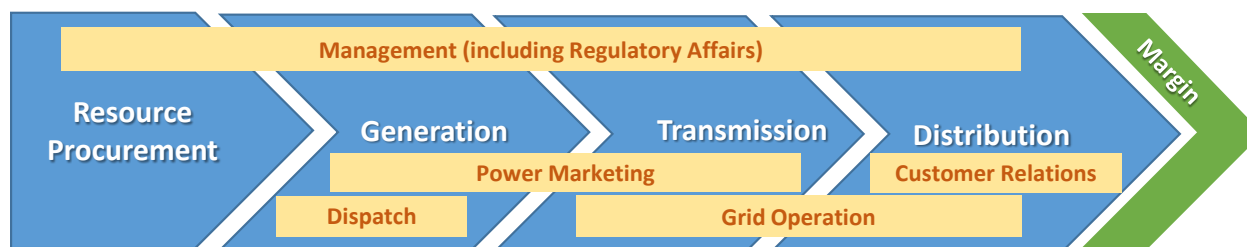
Example: Vertically Integrated Utility



# Common Utility Value Chains Now

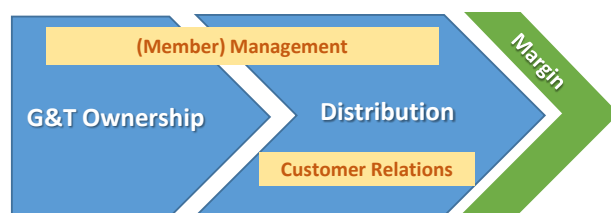
## *Some Utility Examples*

Vertically Integrated Utility—Investor Owned or Public Power

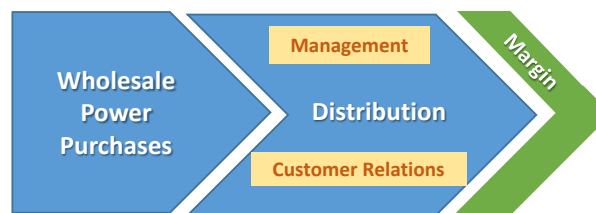


Margin determined by cost of service regulation

Distribution Company—Most are Coops or Public Power but Some Investor Owned

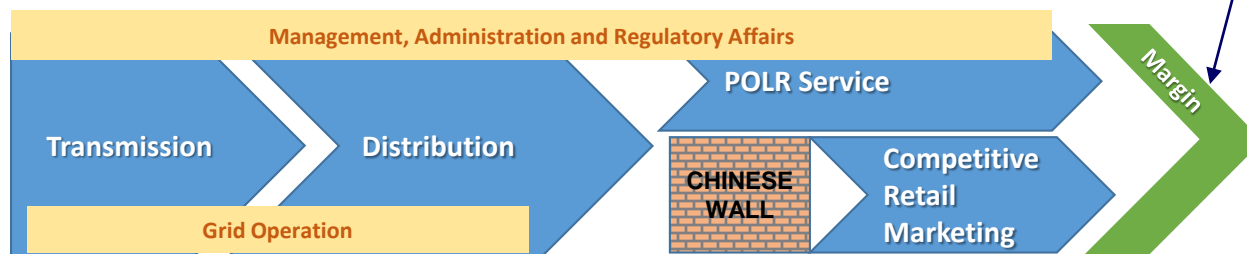


G&T Member



Non G&T Member

Generation Unbundled in a Retail Competition State



*But not for retail marketing*

## Some Possible Emerging Business Models

- Plain Old Electric Service

### Consumer Entities

### The New Electric Power Industry

#### New Market Participants

#### Market and Infrastructure

- **Prosumer**
  - Distributed Generation
  - Distributed Storage
  - Demand Response

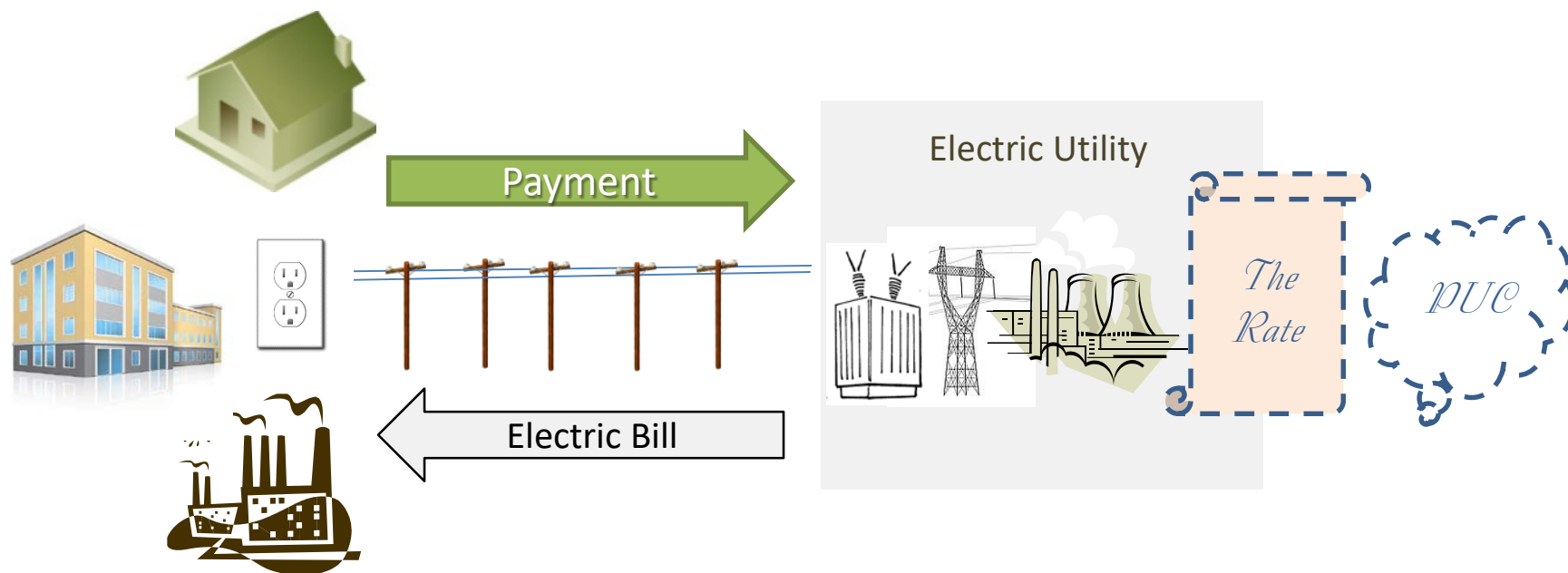
- Transaction Platform Provider
- Market Maker
- Distribution System Operator (DSO)
- Distribution Owner (DO)

#### Prosumer Combinations

- Prosumer Aggregator
- Virtual Power Plant
- Microgrids
- Community Choice Aggregation
- Community Solar

# Plain Old Electric Service (POES) Consumer

## *One-stop Shopping: It's Easy*



# Value Propositions for Prosumers Aggregation

## Economies of Scale and Financing

- Community choice aggregation
- Community solar
- Community storage?



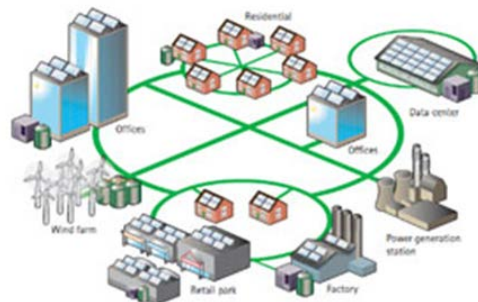
## Market Power and Responsiveness

- Demand response aggregation
- Prosumer aggregation
- Virtual Power Plant

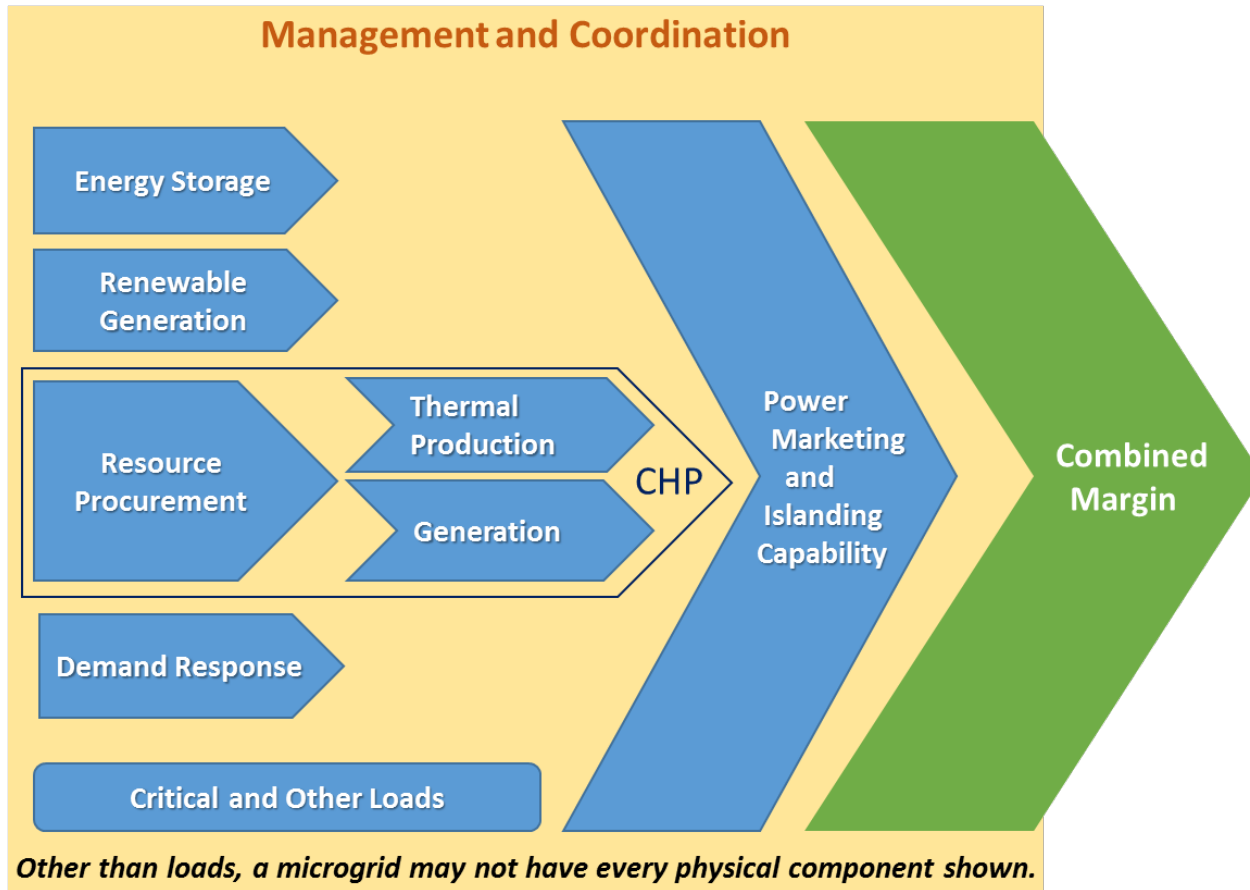


## Resiliency

- Microgrids

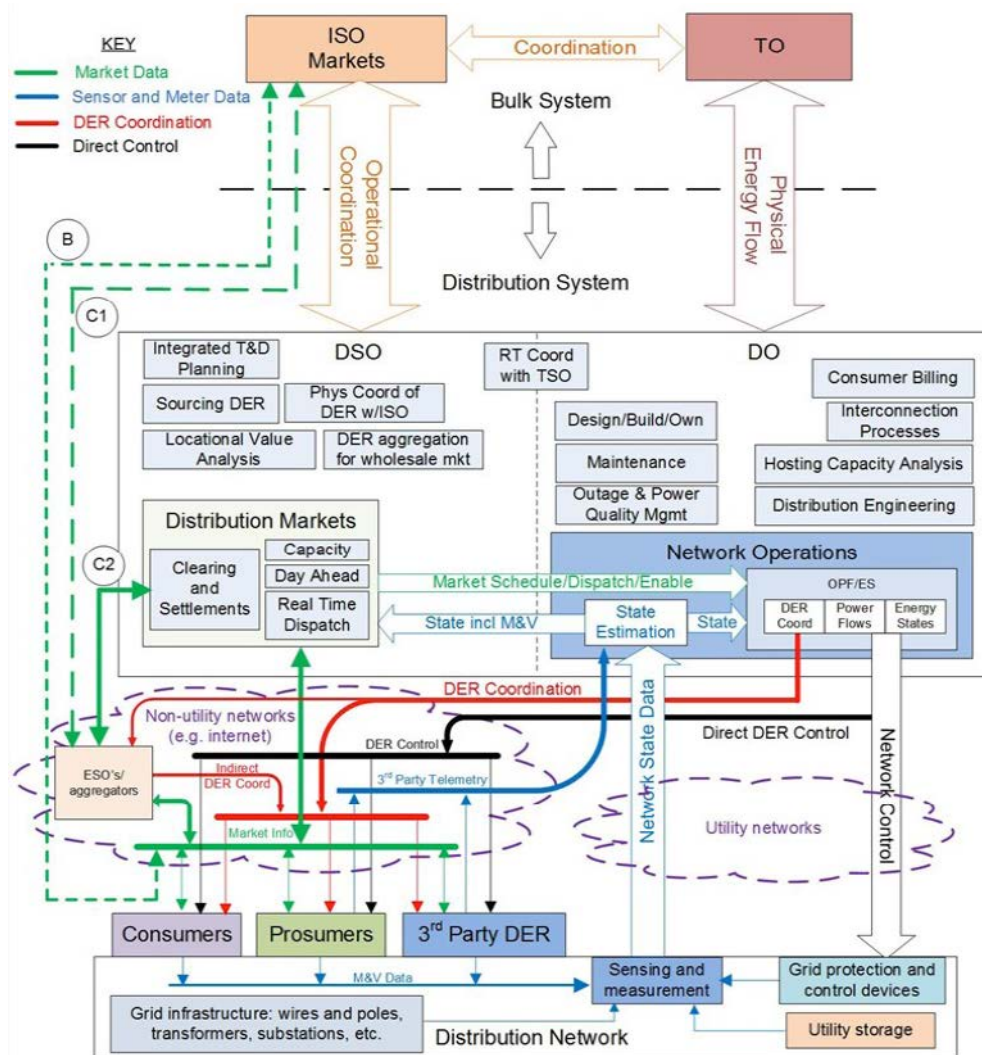


# Prototype Microgrid Value Chain



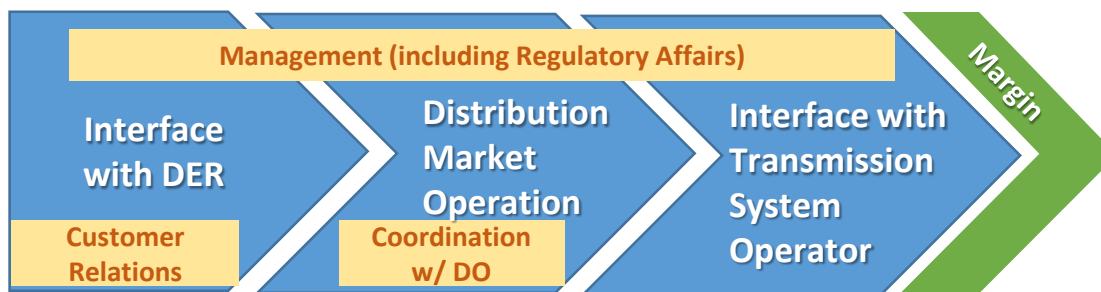
*Divergent views on how microgrids create value.*

# Lots of possible future distribution functions. Who performs them? What value does each have?



# Distribution system functions have been proposed for utilities.

## Prototype Distribution System Operator (DSO)



## Prototype Distribution System Owner (DO)



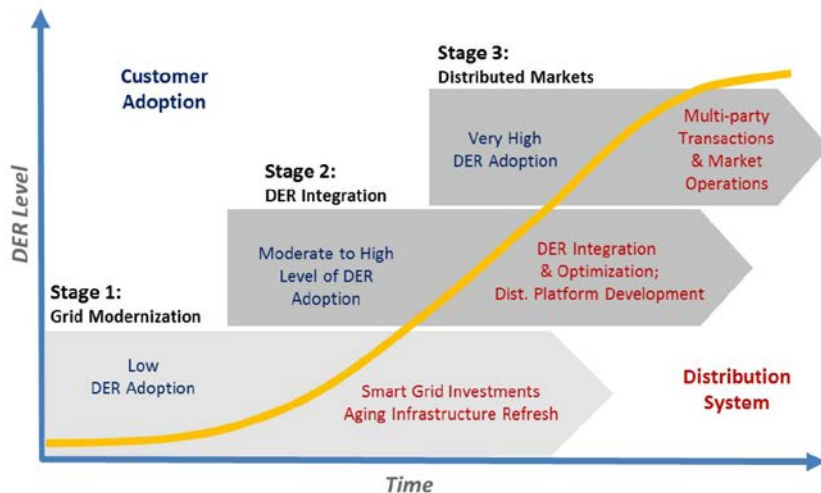
## DER markets in some form are likely, but questions abound...

- How many customers want TE and how many don't?
  - Who and where are they?
  - What exactly do they want?
- How will TE markets be designed and perform?
  - Will markets be transitional, decentralized or centralized?
  - What roles will incumbent utilities be allowed?
  - How well will the markets work?
  - What are the risks and who will bear them?
- How and when will relevant technologies advance?
  - Which technologies?
  - How will cybersecurity be addressed?
- What is the future of federal and state policy?
  - What will be the demonstration projects and incentives for TE?
  - Who will pay to upgrade the distribution infrastructure?
  - How will seams be addressed (among feeders, markets, states)?
  - What will happen to renewable and DER incentives?



# How will DER energy markets emerge and evolve?

Market activities enabled as DER penetration increases.

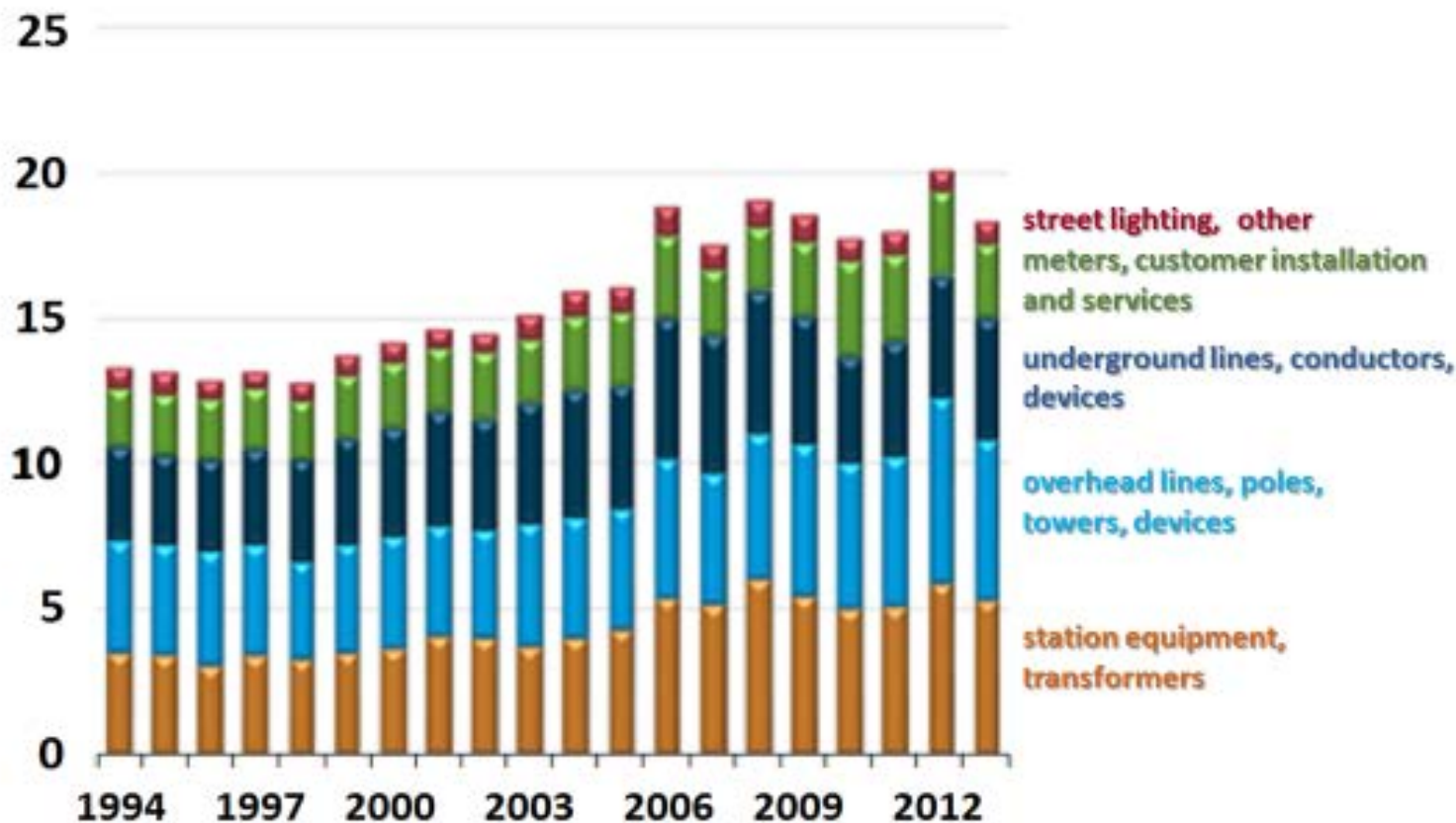


Source: Graphic Courtesy of Paul De Martini.

Advance by fits and starts into an uncertain future.

- Piecemeal by state and within states
- Balkanized decision making
- Varied market designs
- Diverse customers
- False starts and changes in direction
- Technology challenges

# Raising capital will be an evolving challenge.



Source: Energy Information Administration

# Growing Competition and Conflicts

## Evolving Competition and Conflicts

- DER vs. Central Generation and Storage
- Federal vs. State Government.
- Large vs. Small Consumers.
- Utilities vs. Others Serving Customers
- Investor-Owned vs. Coop & Public Power
- Retail Natural Gas vs. Retail Electricity

## New Competition and Conflicts

- Transmission vs. Distribution
- Prosumers vs. “Plain Vanilla” Consumers
- Affluent vs. Less Affluent Consumers
- G&T vs. Distribution Cooperatives
- Joint Action vs. Public Power Distribution
- Oil and Gas vs. Electricity
- Tech Company vs. Tech Company
- DER vs. DER
- Distribution System Operator vs. Owner

## Venues of Future Competition and Conflicts

- Power markets, wholesale and retail
- Legislatures and policy makers
- Regulatory agencies, both state and federal
- Courts, both state and federal

*Public Opinion*

Creating viable retail markets for DER will be a challenging, long-term, evolving endeavor.

### Public Policy Perspective

- What are the objectives and how do those affect both consumers and the businesses that must serve them?
  - Consumers and their needs will be increasingly diverse.
  - Industry will also become increasingly diverse.
- Visions of DER markets vary and require different organization types.
- Many uncertainties about future markets must be faced.
- Market transitions will likely proceed by state and in fits and starts.

## Realizing opportunities and managing risks in an era of value creation and destruction.

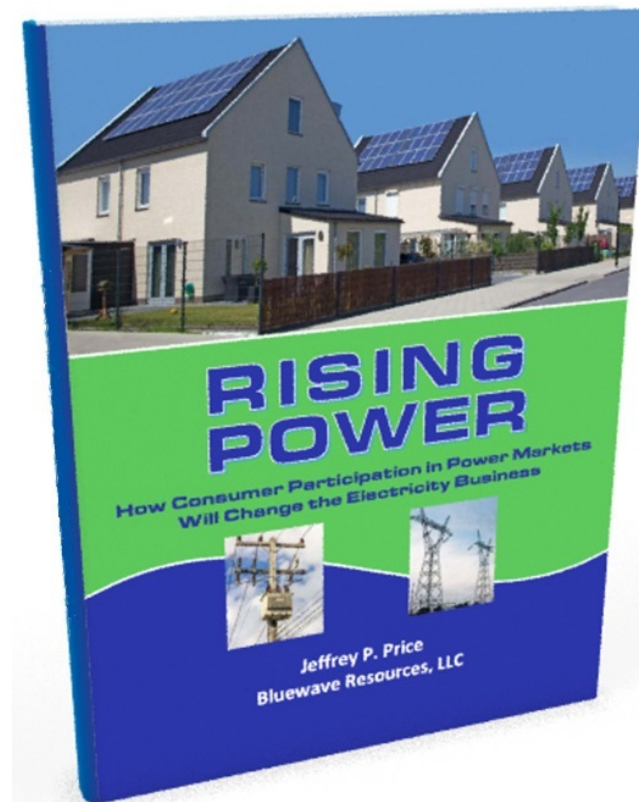
### Business Perspective

- Market design and continuing regulation will be key.
- Opportunities will become more diverse and change over time.
- Strategic market segmentation will grow in importance.
- Flexibility and market timing will be critical.
- Alliances and M&A may become increasingly important.
- Risks and risk management will become more consumer/prosumer facing.

## Electric power decision-making faces multiple challenges:

- ✓ Differences among customers and their needs
- ✓ Evolving technology options
- ✓ Unknown and changing markets dynamics
- ✓ Further balkanization of decision making
- ✓ Building viable businesses for consumer participation
- ✓ New and evolving competitions and conflicts

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