

8-2014

Understanding Ohio's Electricity Markets: Characteristics, Structure and Price

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Understanding Ohio's Electricity Markets: Characteristics, Structure and Price

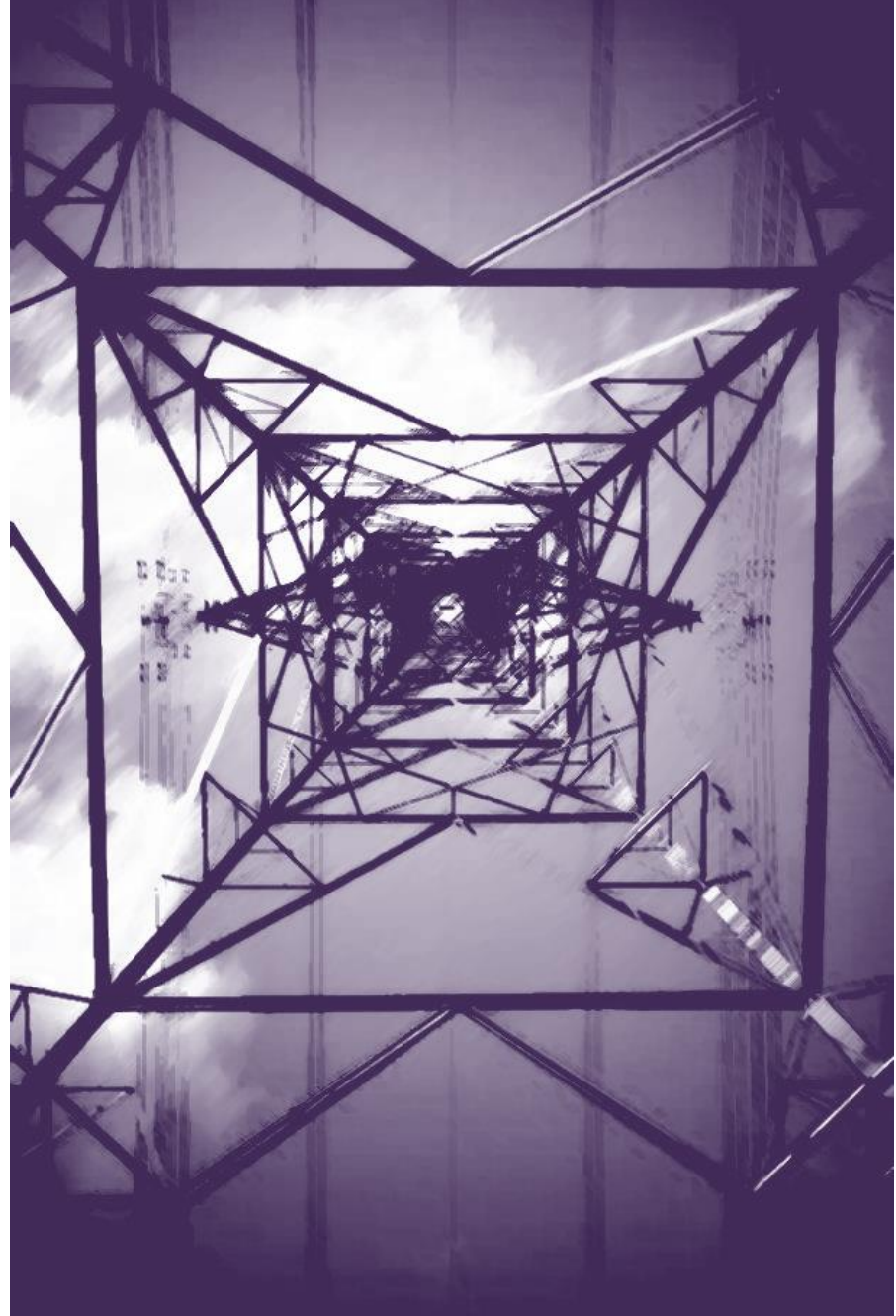
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Prepared for:

The Ohio Manufacturers' Association

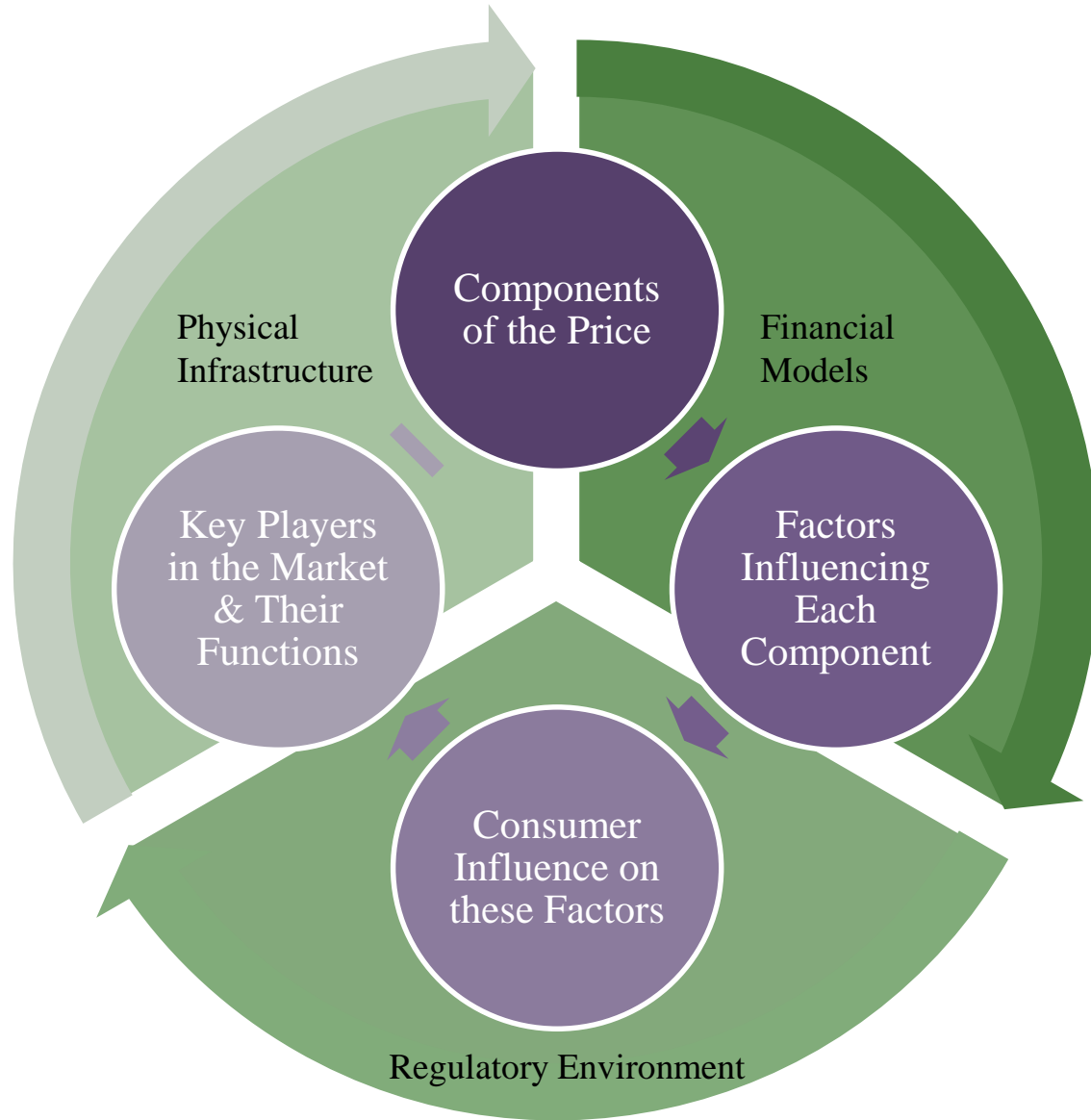
August 2014



Navigating the Electricity Market: What a Manufacturer Needs to Know

- How to simplify the complexities:
 - What are the components of the price?
 - What factors influence each component?
 - How can the consumer influence these factors?
 - Who are the key players in the market, and what are their functions?
- What controls the market:
 - Physical infrastructure
 - Financial models
 - Regulatory environment

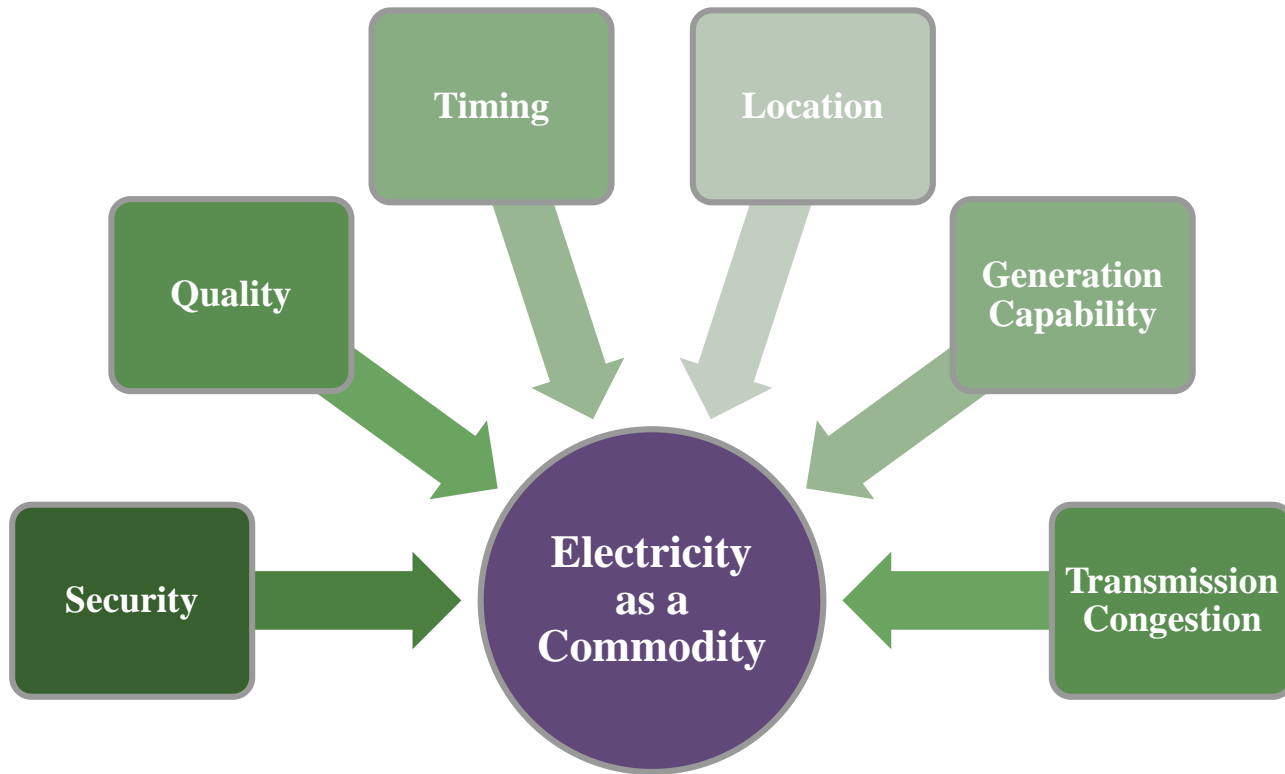
Navigating the Electricity Market: What a Manufacturer Needs to Know



Electricity as a Commodity: Physical Components Influencing Price

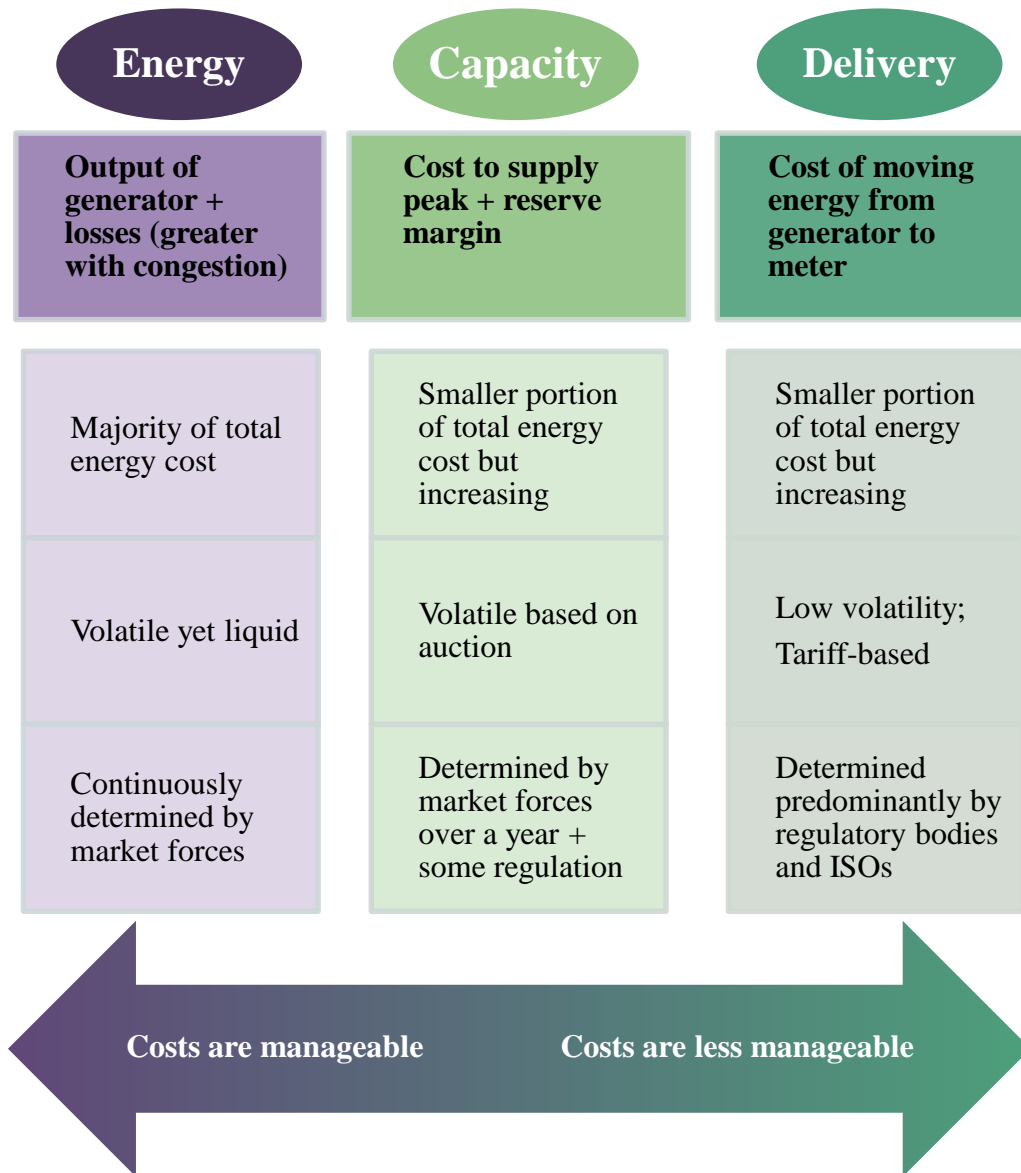
- **Security** – delivery of required volume of electrons with minimal interruption
- **Quality** – delivery of electrons with proper phase, frequency
- **Timing** – delivery of electrons at the time needed
- **Location** – delivery of electrons to desired locations
- **Generation Capability** – status of capacity to generate the load sufficient to respond to peak demands
- **Transmission Congestion** – status of capacity to transmit desired load to desired location at any given time (impedance)

Electricity as a Commodity: Physical Components Influencing Price



Principal Components of Electricity

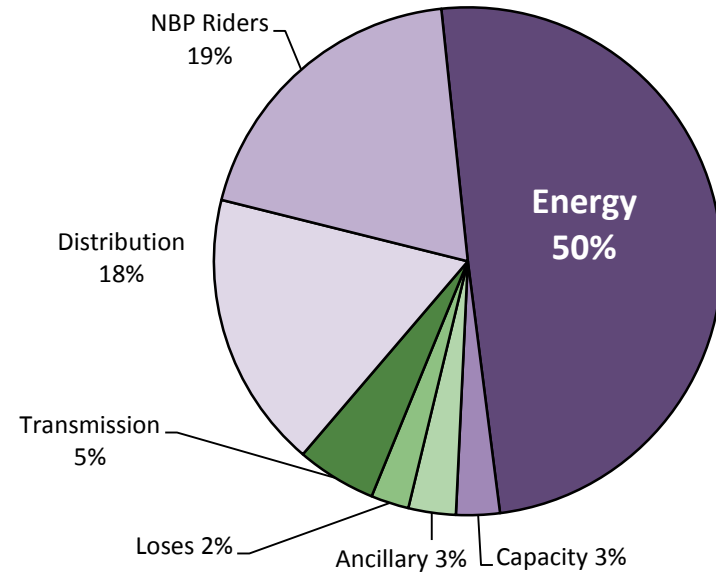
- “Energy” is commonly used to describe the generation component
 - Cannot be completely separated from other components
- “Capacity” refers to the standby generation held in reserve for peak power demands
 - Electricity cannot be stored easily
- “Delivery” includes transmission and distribution
 - Transmission: high-voltage, long-distance, lower losses
 - Distribution: low-voltage, short-distance, higher losses



Electricity as a Complex Commodity

- “Energy” is only around half of the total cost of the commodity
 - Typically line losses will be subsumed into the energy price
- Delivery includes transmission (5%) and distribution (18%)
- Ancillary charges refer to RTO charges to manage the grid and the wholesale market, among other things (3%)
- Maintaining dispatchable capacity in Ohio has been a small but growing component (3%)
- Non-by-Passible Riders are special payments for expenditures that typically reflect social and economic development programs, sometimes to address market failures (19%)

Approximate Structure of Electricity Price in Ohio, 2013 (Source: Scioto Energy)



Components of Electricity as a Complex Commodity

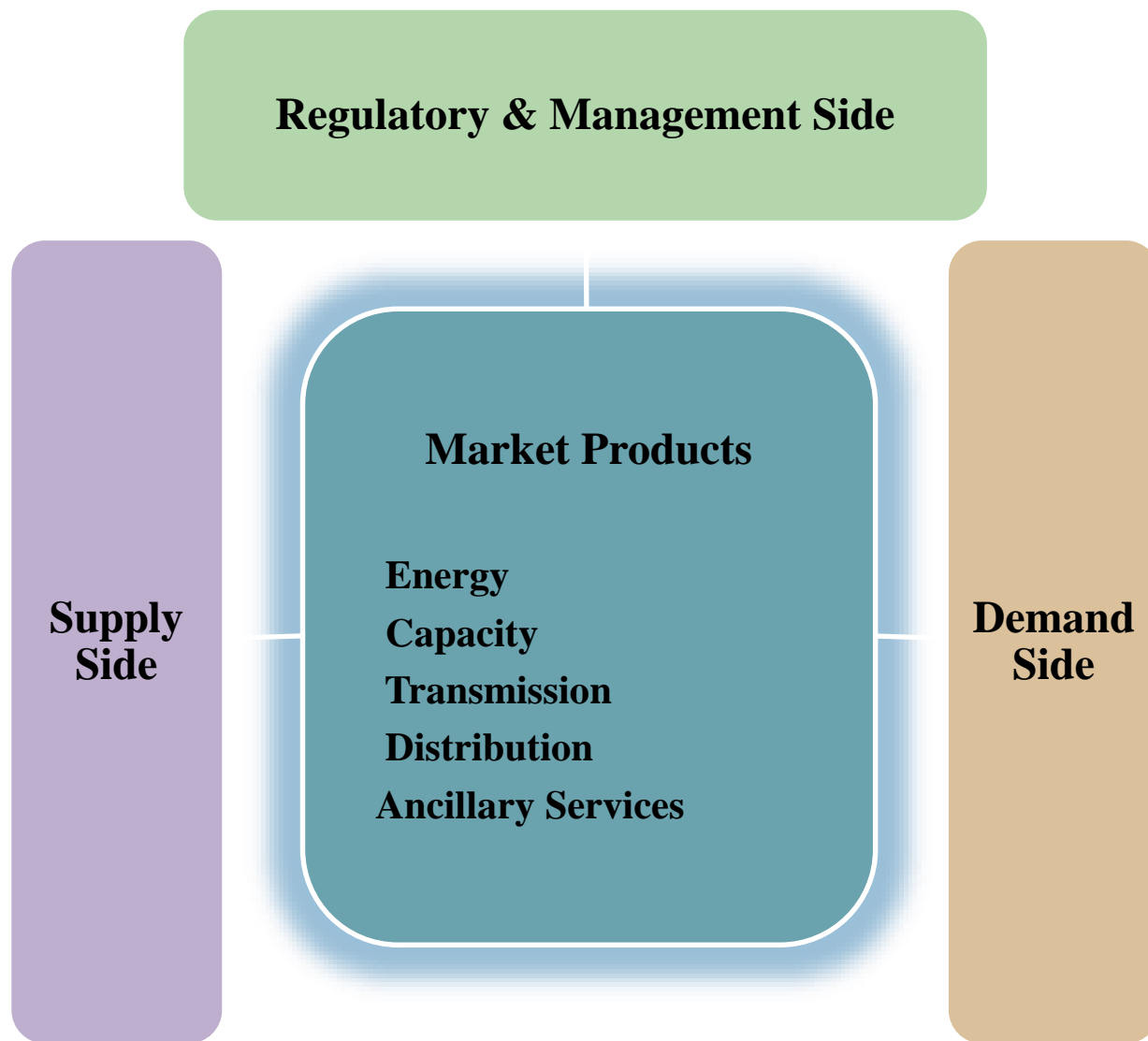
Energy and losses

Capacity

Transmission

Distribution

Ancillary Services



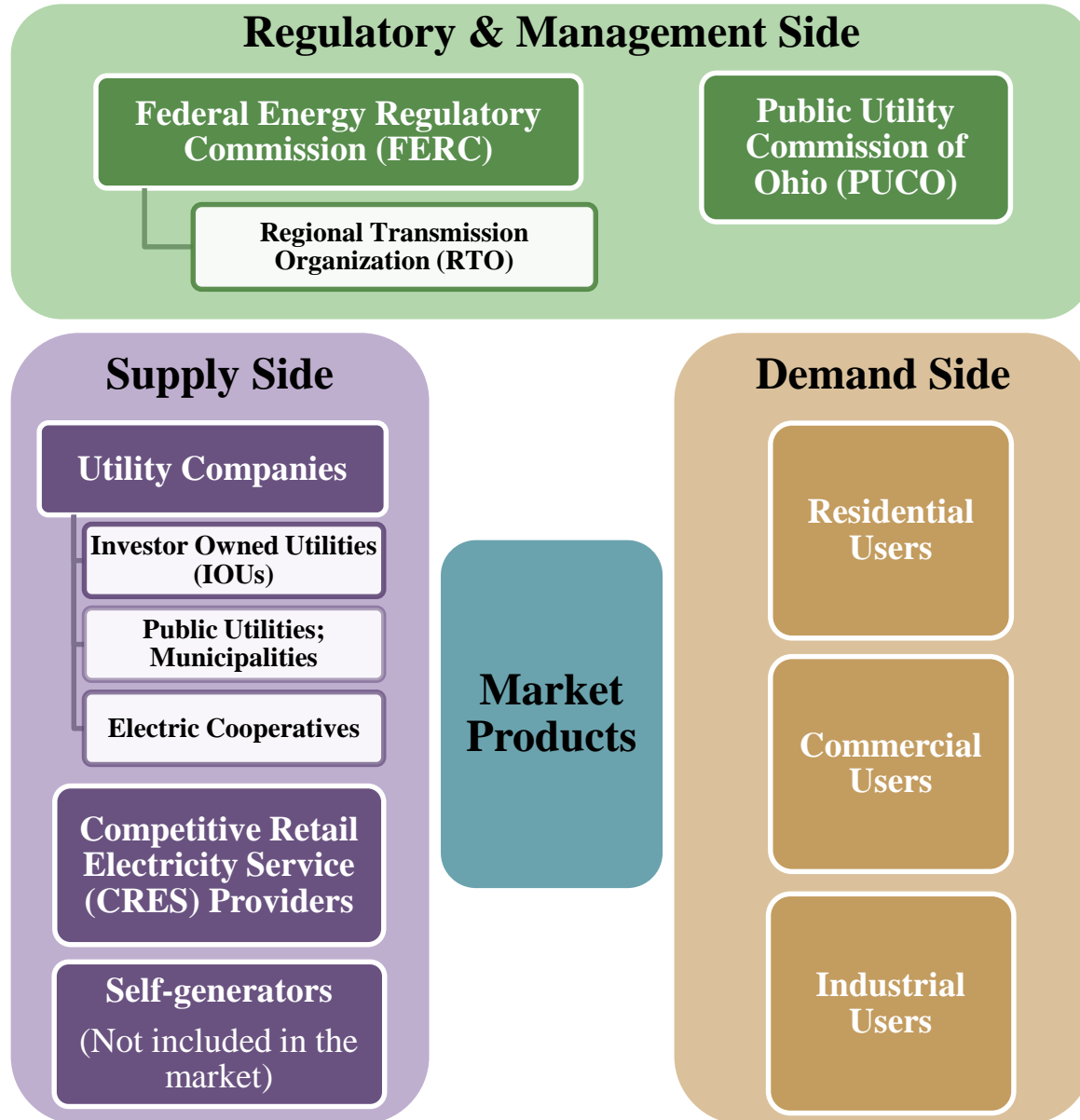
Electricity Market 101

- The electricity market allocates electricity through the principles of supply and demand. Each component of electricity has separate markets, and some such markets are competitive.
- **Electricity Demand:**
 - Individual demand can be satisfied through self-generation, through purchase of electricity on the market, or through default services from the EDUs.
 - The demand for electricity is inelastic. There are no easy substitutes for electricity as a commodity, and electricity cannot be easily stored to respond to peak demand.
- **Electricity Supply:**
 - **Generation:** the aggregate supply is the sum of individual supplies of electricity generators, together with PJM acquired demand response commitments. The infrastructure and regulations enable Ohio to import electricity from outside of Ohio and even from outside of PJM.
 - **Capacity:** stand-by generation - refers to generation capability that can be called upon in the future with short notice to satisfy peak demand. Capacity markets are determined on the base residual and incremental options as early as three years in advance.
 - **Delivery:** Transmission of electricity is limited by physical infrastructure and transmission congestion. The supply for electricity is inelastic on a short run and therefore requires stand-by capacity to satisfy peak demand. Transmission markets exist through the purchase of Financial Transmission Rights.

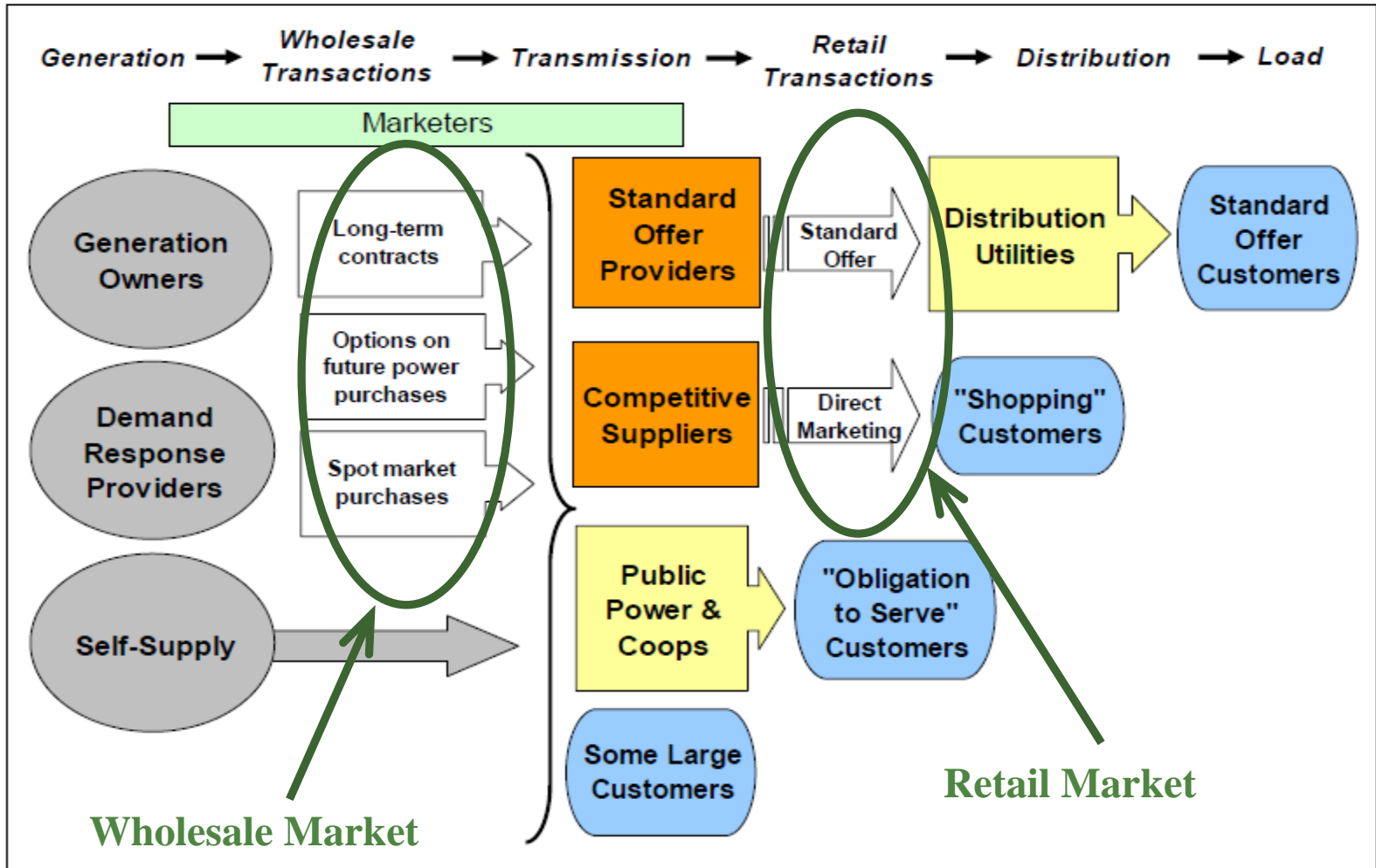
Electricity Regulation 101

- Ohio electricity markets were restructured in 2001
 - Generation was deregulated, creating a market for competitive retail electricity service (CRES) providers
 - Distribution and transmission continue to be subject to Ohio regulation by the Public Utility Commission of Ohio
 - Utilities continue to offer packaged generation and deliver through a regulated “standard service offer” as the default option for electricity consumers
 - Self generation became possible, with some forms susceptible to net metering in 2008 (frozen in 2014)
- Electric distribution continued to be subject to Ohio regulation through PUCO approved Electric Distribution Company (EDU) tariffs
- Interstate transmission and sale of electricity is subject to federal regulation through the Federal Energy Regulatory Commission
 - The FERC has delegated management of wholesale power sales and transmission to independent Regional Transmission Organizations (RTO)
 - Ohio utilities have chosen to be part of the Pennsylvania, Jersey, Maryland RTO, commonly known as “PJM”

Players on the Electricity Market



Restructured Electricity Markets



Source: Figure 1. Schematic of deregulated wholesale and retail electricity markets. Hausman, E., Hornby, R., and Smith A. *Bilateral Contracting in Deregulated Electricity Markets*. Synapse Energy Economics, Inc. April, 2008.

Main Players in Restructured Markets

- **Generation Owners** – unregulated companies that generate electricity and sell it on the market
- **Electric Distribution Companies (EDU)** – local distribution and transmission arms of the incumbent utilities, remain fully subject to PUCO regulation
- **Standard Service Offer Providers** – “default” service provided by the EDUs if a customer did not chose a competitive supplier
- **Competitive Retail Electricity Suppliers (CRES providers)** – generates or acquires electricity on the wholesale market and resells it on the retail market in Ohio
- **Public Power and Electric Cooperatives** – public utilities capable of generating and distributing electricity
- **Aggregators** – organizations that group municipalities together to aggregate load and to create leverage in acquiring wholesale power for resale to community residents
- **Demand Response Providers** – companies that collect demand response commitments and sell it to PJM under programs to reduce peak load requirements
- **Brokers** - companies that organize auctions for retail loads of customers with large loads
- **Customers**
 - Large commercial or industrial customers – those that buy large volumes of electricity and as a result have some leverage in buying power
 - Residential and small commercial customers – best leverage is through aggregation
 - Standard service offer customers – customers that receive electricity under default services with electric distribution company

Selling Energy on the Wholesale and Retail Markets

- Energy is procured by energy retailers from generation owners and energy traders for resale on the retail market or for resale into Standard Service Offer (SSO) markets
 - Commercial Retail Electricity Service (CRES) providers operate on both the wholesale and retail markets : they are buyers on the wholesale market and sellers on the retail markets.
 - Electrons may not physically move from CRES provider to the end user; electrons are fungible, and they are either dispatched directly from the load provider or they are delivered to the end user through a trade.
- The wholesale market has been created as a financial mechanism for competitive pricing on electricity load
 - Goal is for the market price converge with the marginal cost of generation and transmission
 - Locational marginal pricing (LMP) algorithm is designed to account for transmission congestion and to stimulate new generation and transmission as needed. In practice, it is uncertain if it does.
- Retail markets represent the sales from the CRES or SSO providers directly to the end users
 - SSO contracts will generally be fixed rate and year to year.
 - Large scale end users can financially hedge all or portions of their electricity load through such CRES products as block and index pricing.
- Transmission congestion charges are passed through to the end users through locational marginal pricing (LMP) construct
 - In AEP territory, direct transmission charges are passed through by PJM on the CRES or SSO provider bills. In other Ohio territories, these charges are passed to customers through the EDU bill.

Effects on Electricity Markets: Three Components



Physical Infrastructure



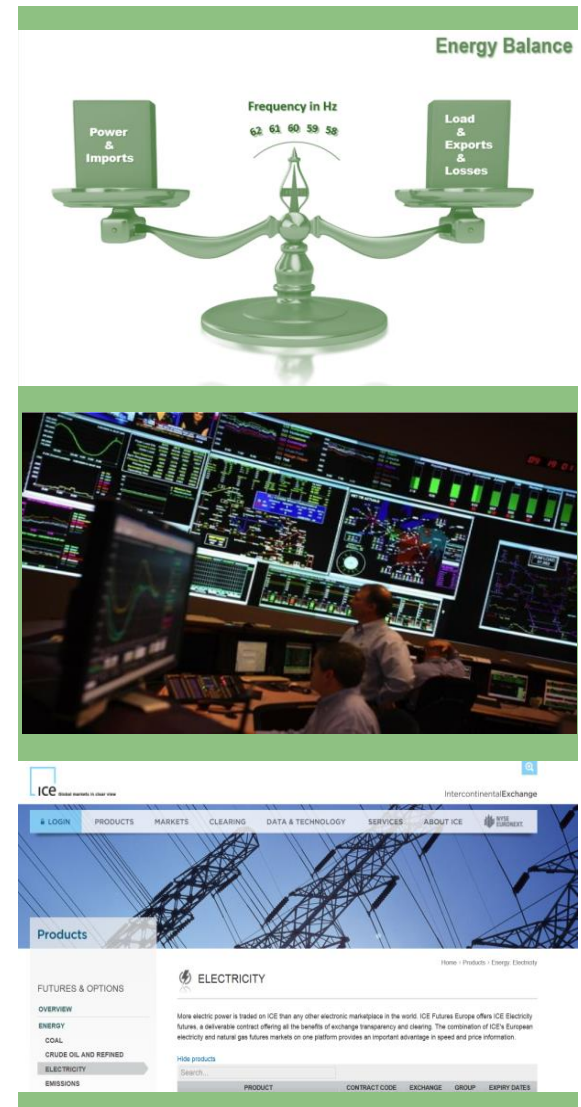
Financial Models/Systems



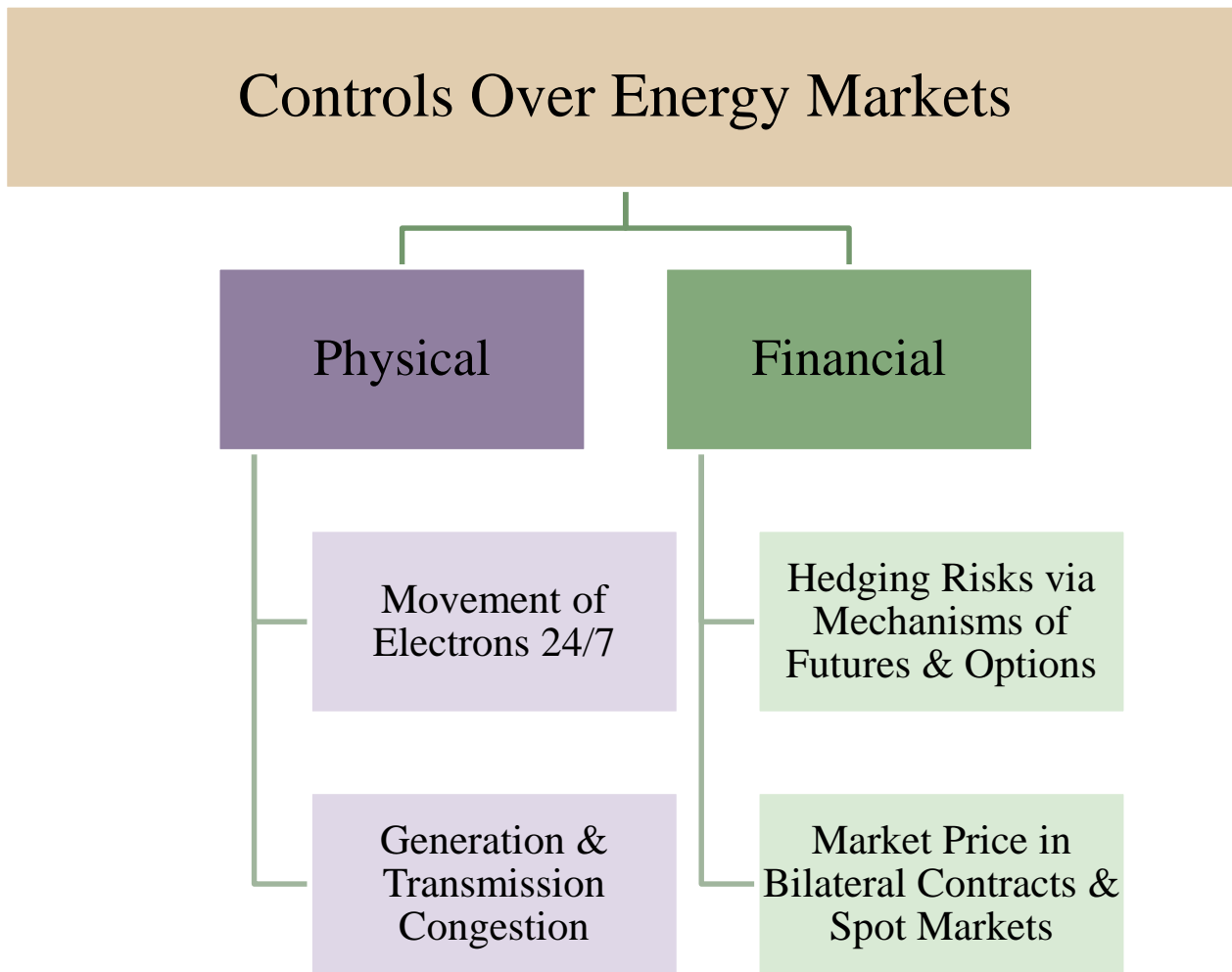
Regulatory and Management Environment

Two Controls over Energy Markets: Physical Infrastructure and Financial Models

- Physical
 - Physical movement of all electrons occur through 24/7 PJM dispatch system regardless of the financial mechanism to obtain the load (bilateral contract or the spot markets)
 - Actual physical congestion used in algorithm to develop *Locational Marginal Price (LMP)*
- Financial
 - Market transactions
 - Most of load is hedged through mechanisms of futures and options on bilateral contracts
 - Residual amount electricity requirements is balanced through purchases on PJM-administered Day-Ahead and Real-Time wholesale spot markets
 - Market price
 - Bilateral contracts: usually have fixed average price
 - Spot markets: oligopolistic *single market clearing price* for all supply for the relevant time period
 - Both bilateral and spot market prices are based on the algorithm of LMP reflecting costs of historical physical congestion



Two Controls over Energy Markets: Physical Infrastructure and Financial Models

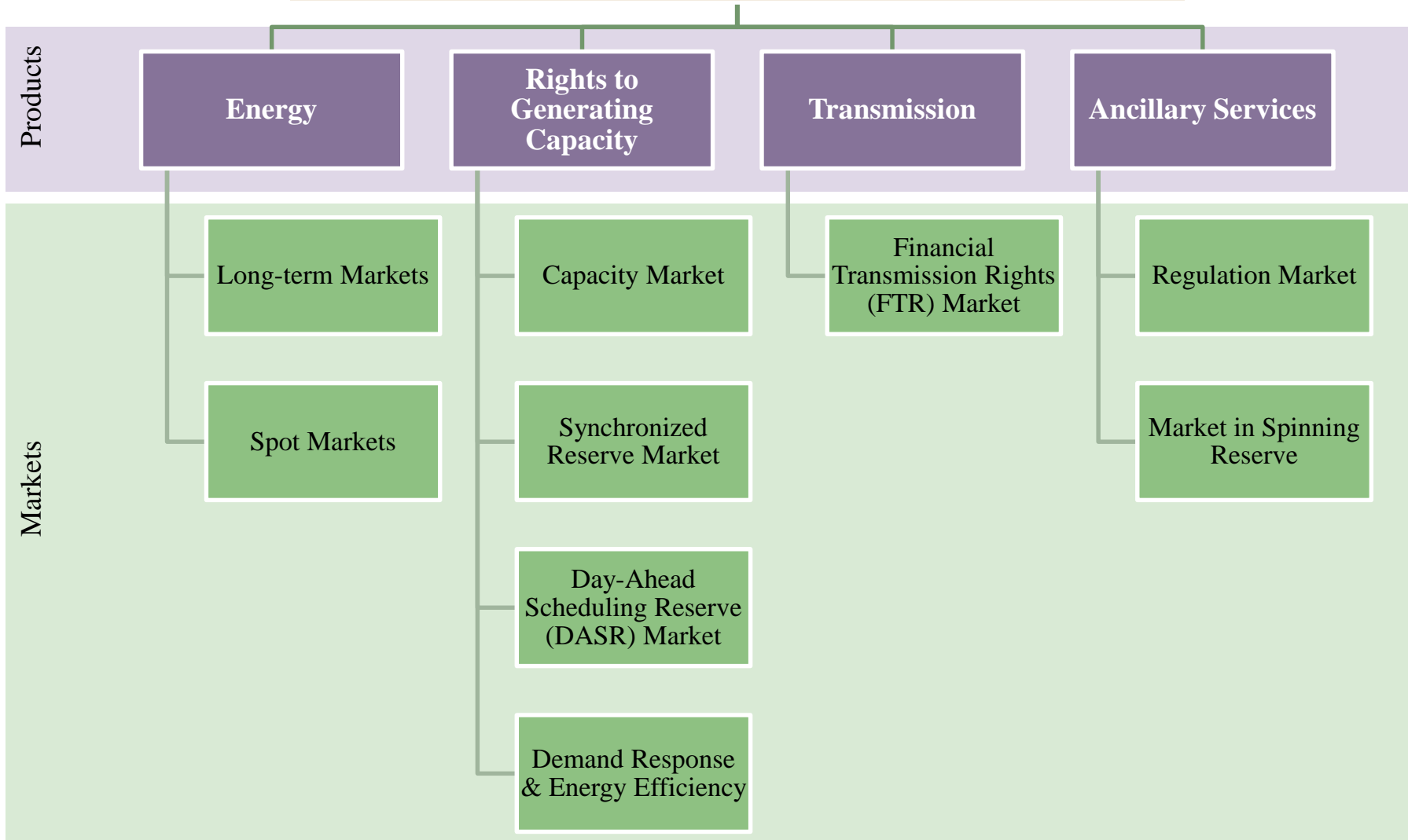


Products and Corresponding Financial Mechanisms on Electricity Markets

- **Energy:**
 - Long-term markets – NOT managed by PJM
 - Bilateral contracts
 - Through Intercontinental Exchange (ICE) and brokerage houses (using over-the-counter energy brokerage services)
 - Spot Markets
 - Day-Ahead Energy Market (DAEM)
 - Real-Time Energy Market (RTEM)
- **Rights to Generating Capacity:**
 - Capacity Market
 - Synchronized Reserve Market
 - Day-Ahead Scheduling Reserve (DASR) Market
 - Demand response and energy efficiency
- **Transmission:**
 - Financial Transmission Rights (FTR) Markets: long-term, annual, and monthly auctions
- **Ancillary Services:**
 - Regulation Market
 - Market in Spinning Reserve

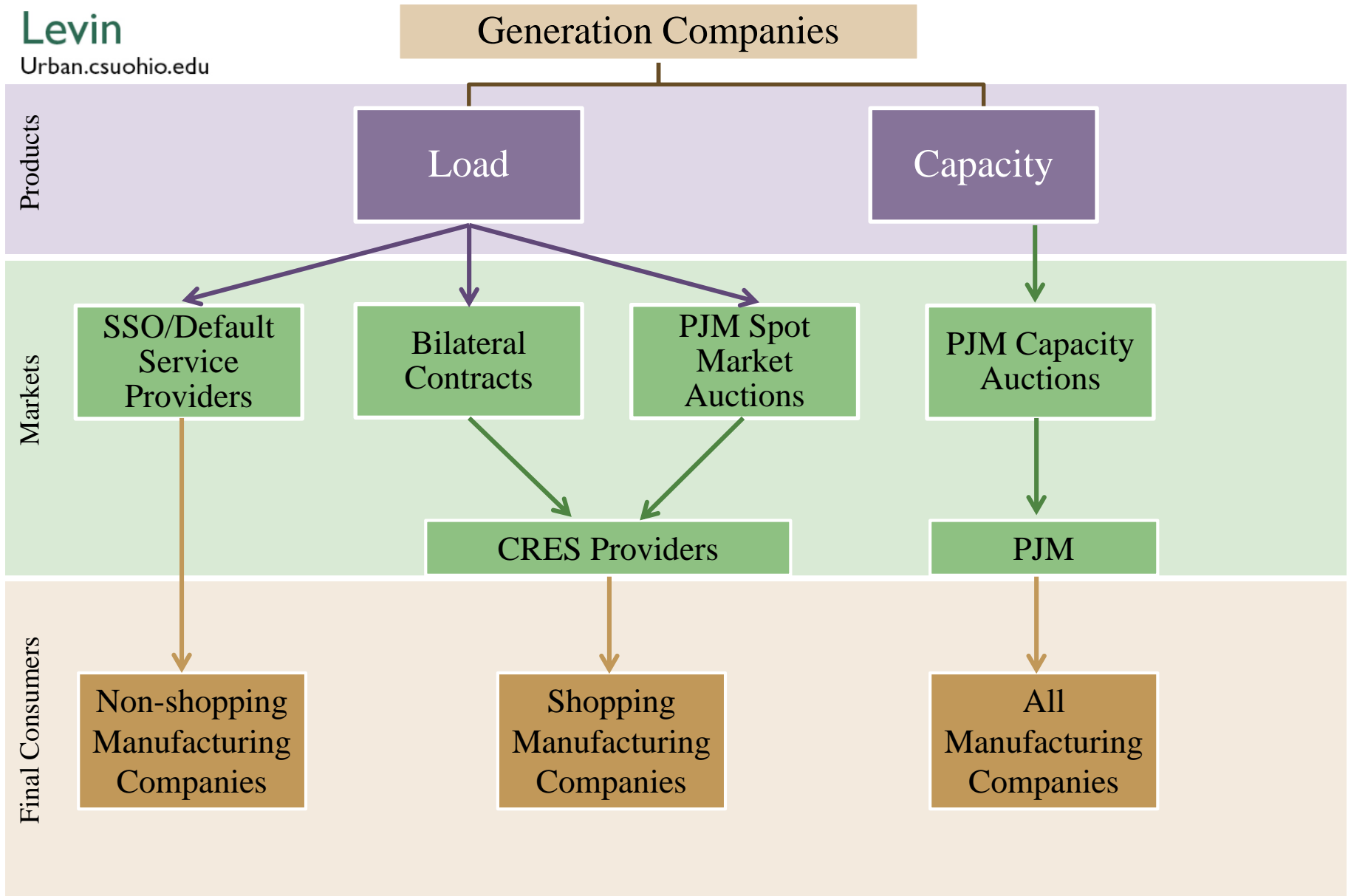
Managed by PJM

Products and Corresponding Financial Mechanisms on Electricity Markets

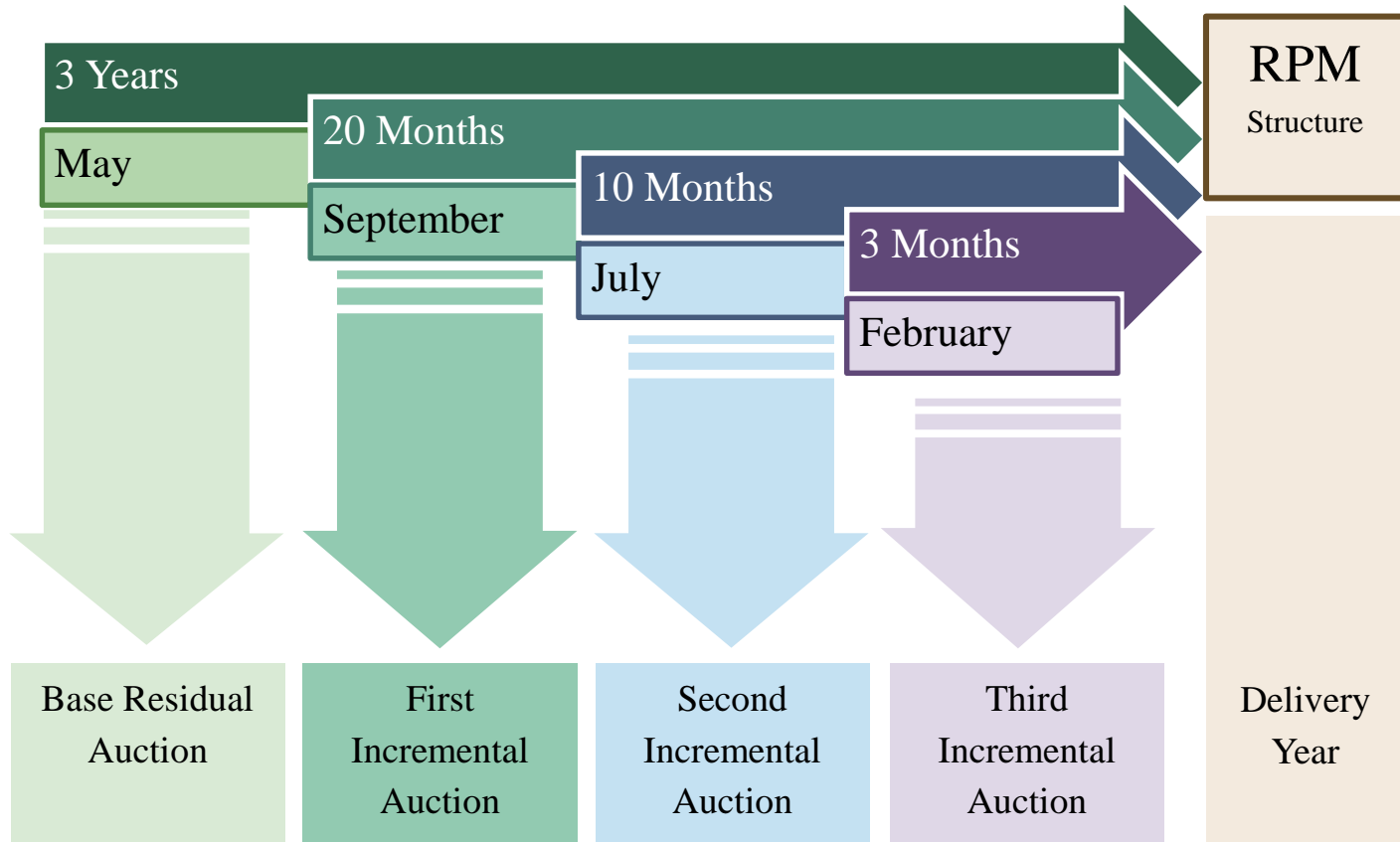


How Generation Companies Sell Power

- Operate as load sellers on the wholesale and capacity markets
- Most energy load is sold to CRES or SSO Providers through long term bilateral contracts
 - Sales are “over the counter” trades through brokerage houses or through Intercontinental Exchange (ICE) hubs
 - Sale price formed by producer as a “fuel cost plus” price
 - Sale price includes an estimated delivery cost based on historical LMP data
 - Sales contracts are, in-turn, secured by fuel contracts between owners of generation and their fuel suppliers
 - Sales price is influenced by the spot market price: the margin between the sales price under bilateral contract and the spot market price is a subject of risk since all electricity is dispatched through the spot market
 - Residual load is sold on spot markets (day ahead or real time)
 - Single market clearing price (SMP) sets the price for all sellers regardless of their bid offer. The market clearing bid ideally reflects the marginal cost of generation
 - SMP is oligopolistic price for all except the seller with the last accepted offer; his price is marginal
 - Markets run by PJM using locational marginal pricing algorithm that reflects both cost of generation and transmission congestion
- Capacity is sold through PJM capacity auctions
 - Single market clearing price is used to establish capacity costs
 - Auctions are 3 years ahead, with supplemental auctions as needed to fill in increments



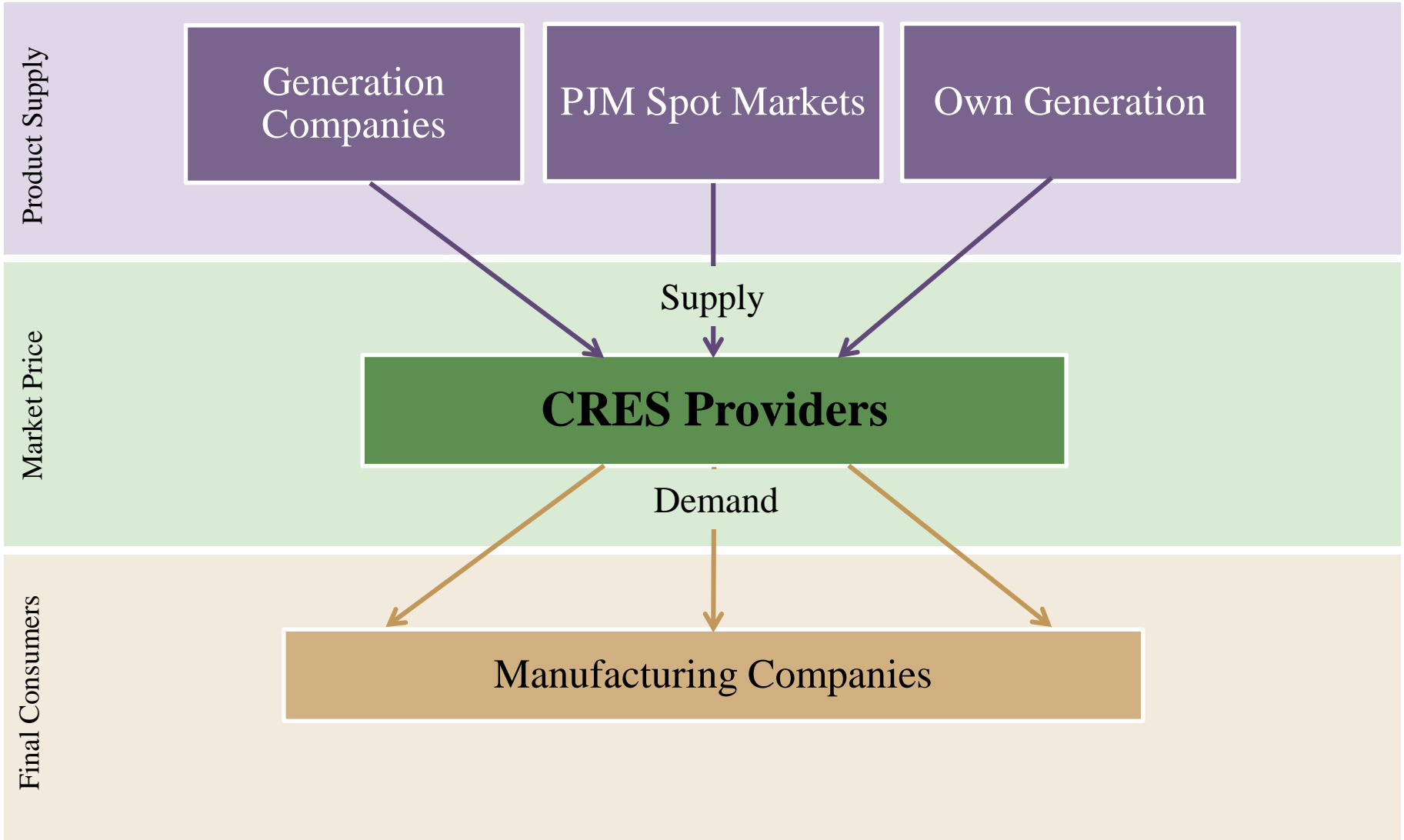
PJM Capacity Auctions (2013)



CRES Providers

- Act as buyers on the wholesale markets and sellers on the retail market
 - Maintain load inventory acquired from wholesale traders or own generation
 - Consists primarily of bilateral contracts hedged through futures and options
 - Use spot markets to make up shortfalls or to beat own generation costs
 - Maintain sales inventory based upon contracts with their retail customers
 - Sales contracts are matched to wholesale contracts as best as possible: smaller contracts are bundled and matched to wholesale contracts, larger contracts could be matched directly to wholesale contracts
- Bilateral wholesale contracts
 - Are usually obtained through brokerage houses. Contracts have different loads, start dates, and duration – should be bundled for resale, unless matching retail sale
 - Vary from as short as few weeks or one month to as long as five years; theoretically there is no duration limit to the bilateral contracts
- CRES Risk Strategy
 - The daily demand load delivered to retail customers is balanced with daily supply load
 - residual of the load between their daily demand and supply is purchased on the spot markets
 - CRES risk strategy defines the desired level of balance between the inventory of load and the inventory of retail obligations
 - CRES provider bears the risks of covering higher than estimated costs on ancillary services (from PJM) and on higher than estimated LMP price affected by transmission congestion
 - Can hedge through Financial Transmission Rights acquisitions
- Obtain customers through direct marketing of their services and therefore have additional cost (compared to traditional utility companies)

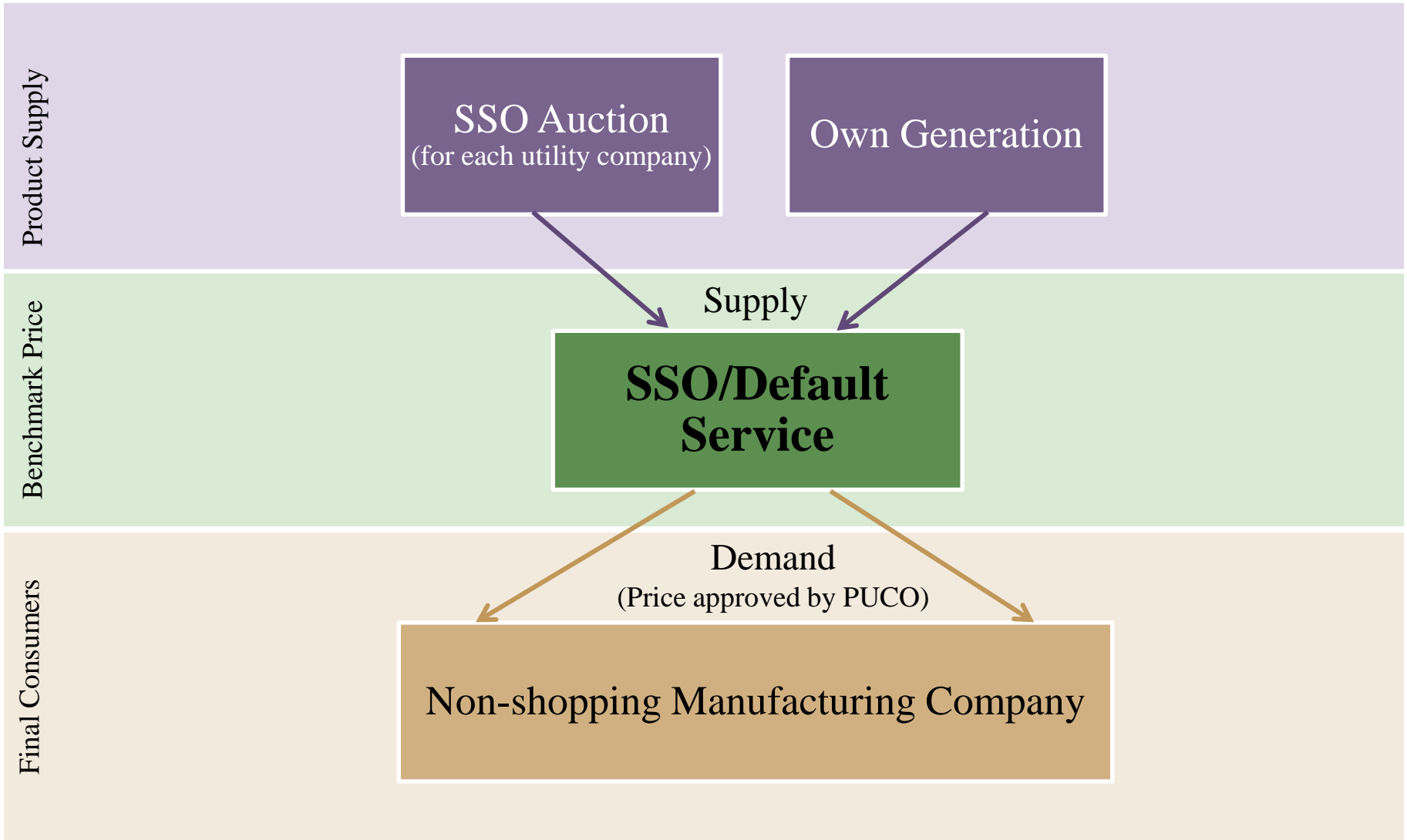
Competitive Retail Electricity Suppliers (CRES)



Standard Service Offer (SSO) Providers/ Default Service

- SSO is a mechanism that helps transitioning to deregulated market
- Still has large market share of retail customers in deregulated markets
- All utility companies that provide SSO are obligated to sell electricity by the tariff/price formed from two components (“hybrid approach”)
 - part of the load generated for delivering under SSO will be prices on a “cost plus” basis and this part will be decreasing over time
 - part of the load is based on the market mechanism of purchasing electricity through the auctions and bilateral contracts (market rate option - MRO) and this part will be growing over time
- Each utility company has PUCO approved Electric Stability Plan that defines the “cost plus” and MRO components and their changes over time
- SSO providers retain most of their customers from the before-deregulation time (accordingly SSO providers have no marketing costs)
- Price of electricity under SSO reflects the “hybrid” approach and therefore is not a true market price
- Price of the default services serves as a market benchmark for CRES providers to beat

Standard Service Offer (SSO) Providers/ Default Service



Electric Distribution Utilities (EDU)

- EDUs are the distribution arms of the incumbent vertically integrated Ohio utilities
 - Also supply SSO load through Electric Stability Plan
 - Incumbent utilities are in transition towards unbundling their electricity generation services from transmission & distribution services
- Distribution refers to the delivery of power on low voltage wires from the transmission bus to the point of delivery
 - Distribution charges are regulated by the PUCO through a tariff that is determined through a PUCO regulatory docket. It reflects the cost of the EDU's "used and useful" equipment and operational costs, plus a profit, usually around 10%
 - In all but AEP territory, the EDU also charges for transmission. In AEP, transmission charges are passed through by PJM through the CRES provider
- Each EDU has a designated certified distribution and transmission territory
- Additional costs are recovered by EDUs through non-by-passable riders
 - These usually represent the cost of social programs, such as low income support, economic development, or energy efficiency mandates under premise of a compensation due to market failure
 - market failures either reflect negative externalities (difference between lower market costs and higher social costs) or positive externalities most often affiliated with economic development projects
 - Some riders however reflect costs that cannot be recovered through the normal tariff procedure because the equipment is not "used or useful." EDUs commonly seek recovery of such things as the cost of decommissioning of old plants through special riders

Electric Distribution Utilities (EDU) Synopsis

Organizational Form

- Publically Traded Company

Product

- Transmission & Distribution (AEP-Distribution Only)
- May include generation for SSO

Price

- Conduit for Non-bypassable Riders

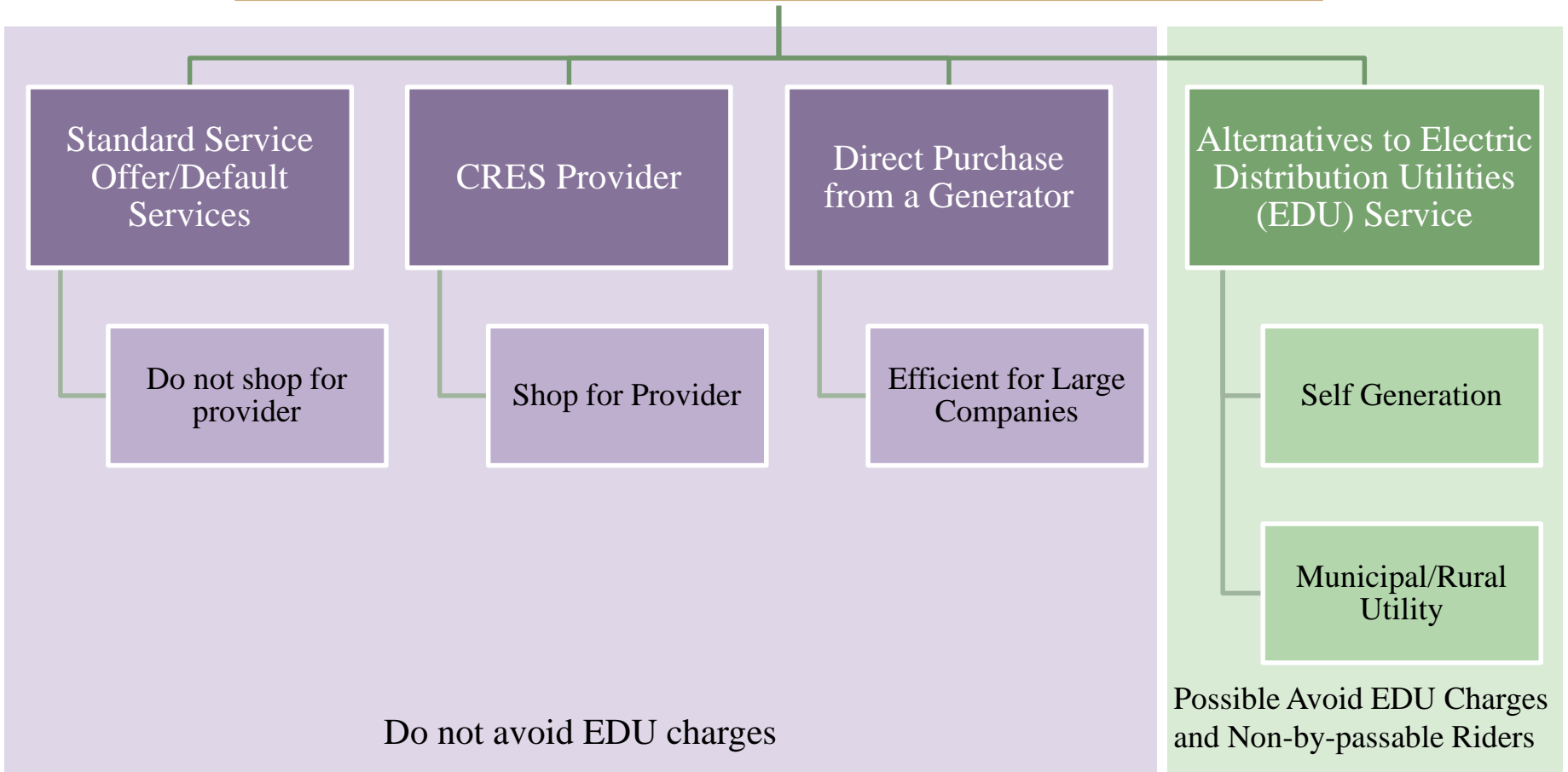
Market Position

- Operate as a Monopoly within Designated Territory

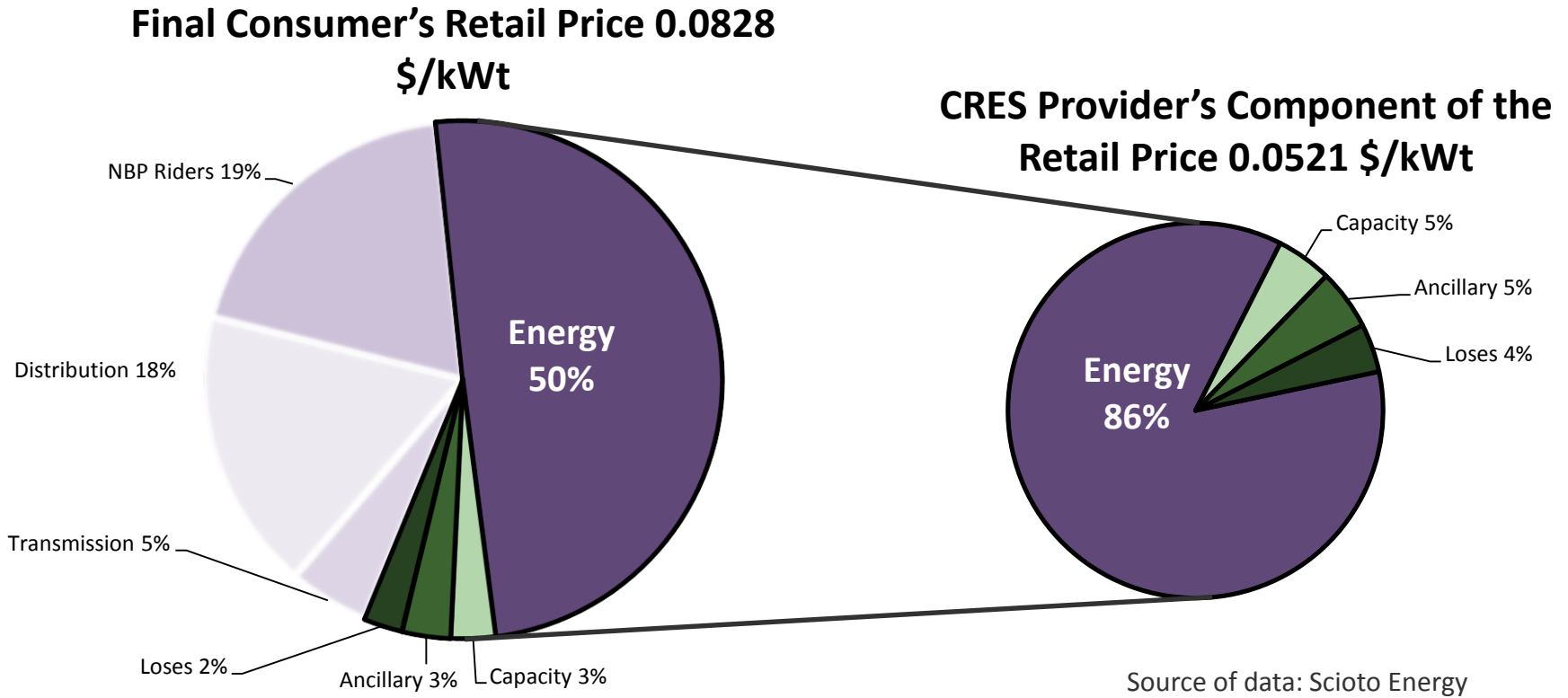
Consumer Choices for Manufacturing Company

- **SSO default market (don't do anything, you inherit this provider)**
 - Provided by utility companies to customers that did not choose to shop for electricity
 - Based upon Electric Stability Plan
 - Usually higher price than CRES or aggregator
- **Buy from CRES provider**
 - Direct negotiations, RFP, or broker
 - Broker uses RFP or reverse auction strategies, and is paid by supplier through sale price add-on
 - Provide various pricing products from fixed rates to floating rates with the ability to lock in rates for a portion of consumption
 - Must beat SSO to compete
- **Alternatives to EDU**
 - Self generation
 - Can build on site power, or have it built and operated by a third party
 - Purchase power from a municipal or rural cooperative utility
 - May avoid distribution and non-by-passable charges
- **Direct purchase from a generator**
 - Bi-lateral contract with generator
 - Uncommon for a small and mid sized manufacturing company due to high indirect cost

Consumer Choices for Manufacturing Company



Structure of Electricity Retail Prices, 2013

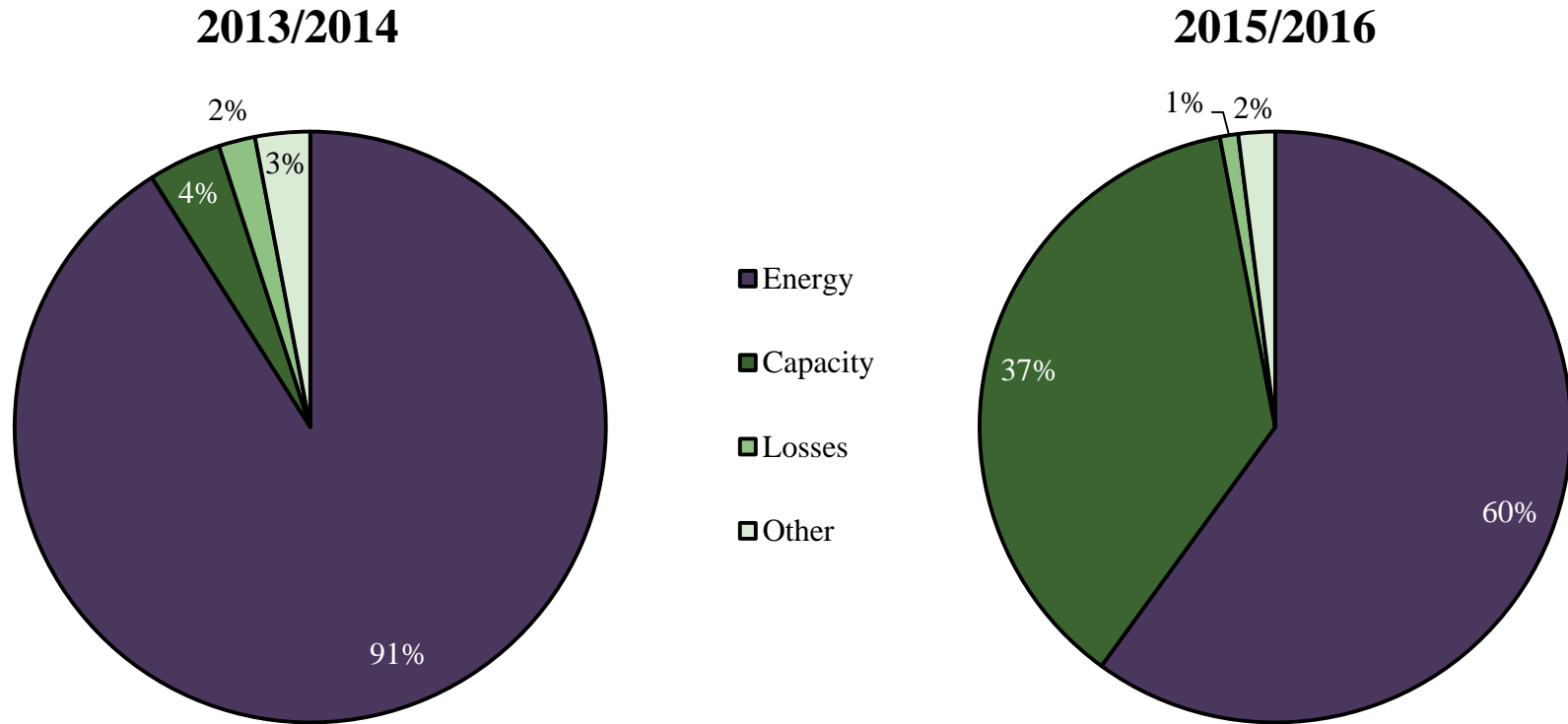


Electricity is above 80% of the CRES Provider's component of retail price, but only 50% of the final consumer's retail price.

Component of Electricity Retail Price

- First step to reducing electricity bill: understand that only about 50% of cost is for energy load. Other 50% is cost of transmission, distribution, capacity, ancillary services, losses of electricity, and non-by-passible riders.
- The price for energy load (your first 50% of the total cost) may be secured through a power purchase agreement with a CRES provider. Typically PPAs are for 1-3 years. Even for smaller users, this is a better option than default services if you shop. However it may not be lower than can be acquired through an aggregator.
- Cost of distribution, transmission, and non-by-passable charges are proportional to the amount of electricity you consume
- Ancillary services are grid support costs that PJM charges each CRES based on their overall customer portfolio. These charges are typically allocated to individual customers based on consumption and are included in the rate from the CRES provider
- The rate of capacity charges depends on 3-years-ago market auction, but can be heavily influenced by amount and time when peak consumption occurs.
 - Capacity auctions are individual to each service area. Capacity charges of two similar companies from not the same service area might be significantly different
 - Capacity costs can be managed in part through ensuring peak consumption does not coincide with five system wide peak periods.

Projected Structure of CRES Provider's Component of the Retail Price: Example of the First Energy Territory

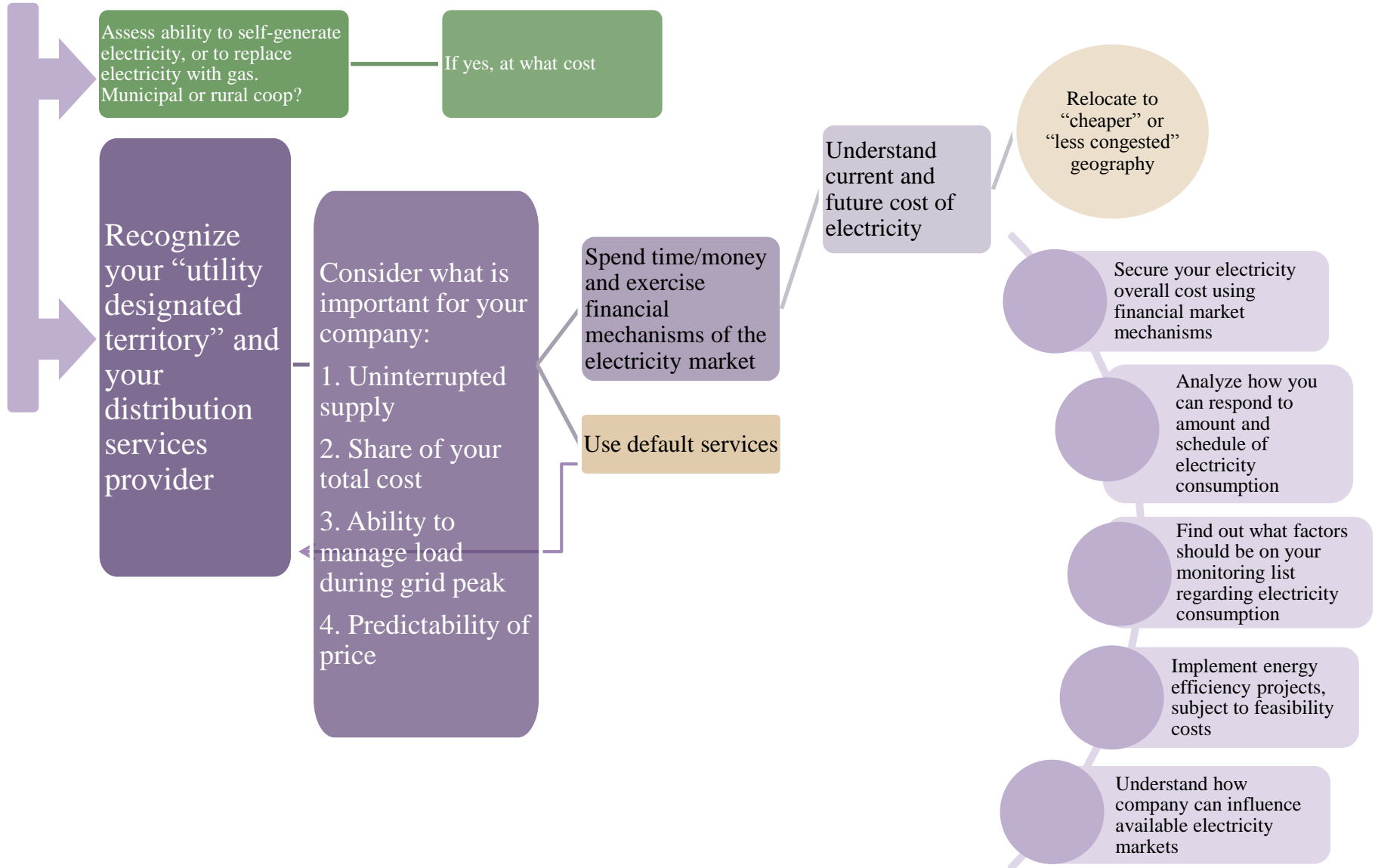


Capacity charges are on the rise

Manufacturer's Decision Making Process

- Assess ability to self-generate electricity (if yes, at what cost) or to replace electricity with direct use of gas or waste heat
- Identify “utility designated territory” and EDU; identify alternative providers, such as municipal or rural cooperatives
- Consider importance of such things as (a) supply interruption, (b) relative share electricity is of your total cost, (c) ability to reduce load during grid peaks and (d) ability to withstand risk on price change. Decide whether you can or need to spend time/money on hiring experts, such as brokers, to develop strategies for using financial mechanisms found in electricity markets, or use default services
- Understand your today and future cost of electricity (capacity charges are on a rise, especially in some designated territories)
- Decide whether a relocation to “cheaper” and “less remote” or “less congested” geography could be your option
- Secure your electricity overall cost using financial market mechanisms - starting with the largest share of your cost – energy.
- Determine what, if any, flexibility you have to reduce load during peak grid consumption, both to reduce capacity costs and to take advantage of demand response programs
- Analyze how you can respond today and tomorrow to changes in your amount and schedule of electricity consumption
- Find out what factors should be on your monitoring list regarding electricity consumption: other fuel costs, increase of consumption at certain hours, etc.
- Implement energy efficiency projects, subject to feasibility costs
- Understand your way to influence electricity markets: voice of business associations, education, alternative energy or alternative production technologies

Manufacturer's Decision Making Process



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The research team is grateful to **Susanne Buckley** from **Scioto Energy** and **Lisa McAllister** from **American Public Power** for comments on the content of the study and analytical examples.