

# Industry structure for efficient coordination of transmission and distribution infrastructure

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# What we'll talk about today:

The market rules that shape how electricity market participants interact

1. Trade-offs in industry structure
2. Two emerging industry structure questions
3. Structural options for enabling non-wires alternatives

# Today's content is primarily derived from two papers

These papers were co-authored with Jesse Jenkins, Ignacio Perez-Arriaga, and Carlos Batlle

## Restructuring Revisited Part 1: Competition

*The Energy Journal* ([link](#))

Restructuring Revisited Part 1: Competition in Electricity Distribution Systems

Scott P. Burger, Jesse D. Jenkins, Carlos Batlle, Ignacio J. Pérez-Arriaga

### Abstract

This paper addresses the implications of the emergence of distributed energy resources (DERs) for competition in the electricity distribution systems. The regulations on industry structures in place today were designed in an era characterized by centralized resources and relatively price inelastic demand. In light of the decentralization of the power sector, regulators and policy makers must carefully reconsider how industry structure at the distribution level affects competition, market development, and cost efficiency. We analyze the economic characteristics of distribution network owners and operators, DER owners, and aggregators and retailers. We translate the foundational theories in industrial organization and the lessons learned during the previous wave of power system restructuring to the modern context to provide insight into three questions. First, should distribution system operations be separated from distribution network ownership in order to ensure the neutrality of the DSO role? Second, should DNOs be allowed to own and operate DERs, or should DER ownership be left exclusively to competitive actors? Third, does the emergence of DERs necessitate a reconsideration of the role of competition in the provision of aggregation services such as retailing? This paper is the first part of a two-part series on competition and coordination in rapidly evolving electricity distribution systems.

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## Restructuring Revisited Part 2: Coordination

*The Energy Journal* ([link](#))

Restructuring Revisited Part 2: Coordination in Electricity Distribution Systems

Scott P. Burger, Jesse D. Jenkins, Carlos Batlle, Ignacio J. Perez-Arriaga

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### Abstract

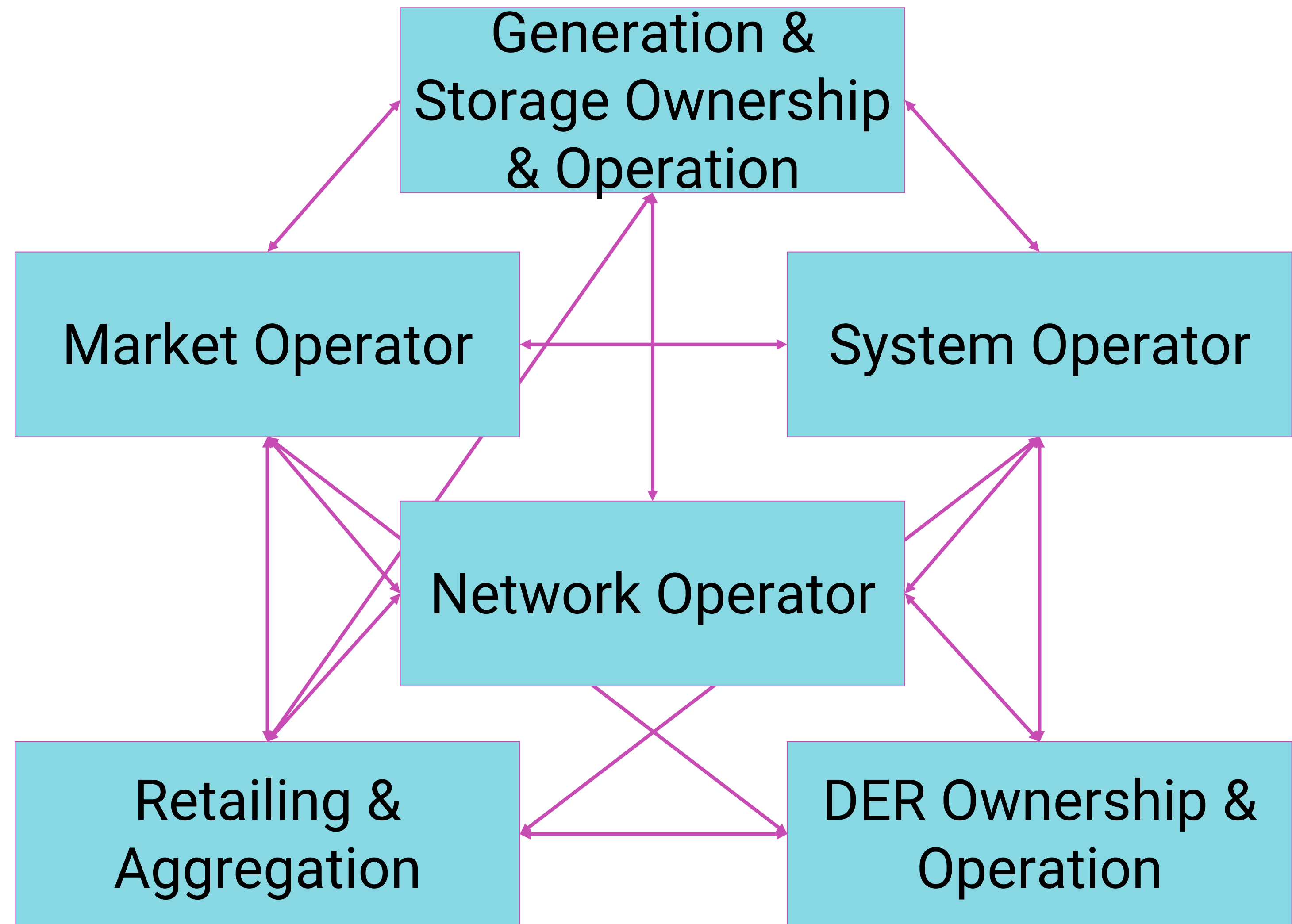
This paper addresses the mechanisms needed to coordinate vertically and horizontally disaggregated actors in electricity distribution systems. The mechanisms designed to coordinate planning, investments, and operations in the electric power sector were designed with minimal participation from either the demand side of the market or distributed energy resources (DERs) connected at distribution voltages. The emergence of DERs is now animating consumers and massively expanding the number of potential investors and participants in the provision of electricity services. We highlight how price signals - the primary mechanism for coordinating investments and operations at the transmission level - do not adequately coordinate investments in and operations of DERs with network infrastructure. We discuss the role of the distribution system operator in creating cost-reflective prices, and argue that the price signals governing transactions at the distribution level must increasingly internalize the cost of network externalities, revealing the marginal cost or benefit of an actor's decisions. Price signals considered include contractual relationships, organized procurement processes, market signals, and regulated retail tariffs. This paper is the second part of a two-part series on competition and coordination in rapidly evolving electricity distribution systems.



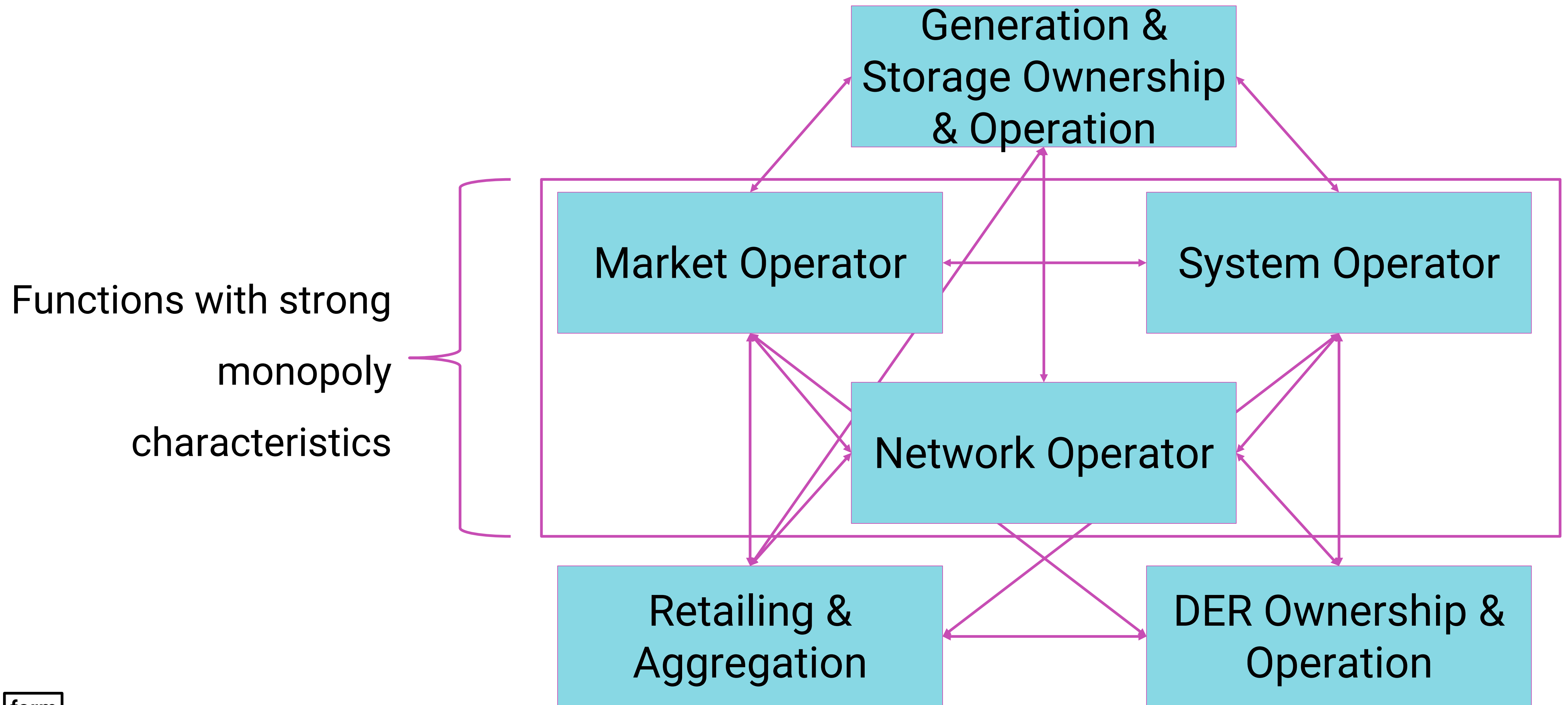
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# Industry structure determines which actors perform which roles in the power sector

The power sector is characterized by a variety of actors with complex interactions



# Many roles have monopoly characteristics, requiring strong regulatory oversight and special considerations for integration



# Vertical integration can be the most efficient organization when market transactions can't efficiently coordinate actors

## Firm boundaries

Generation

Transmission  
and Distribution

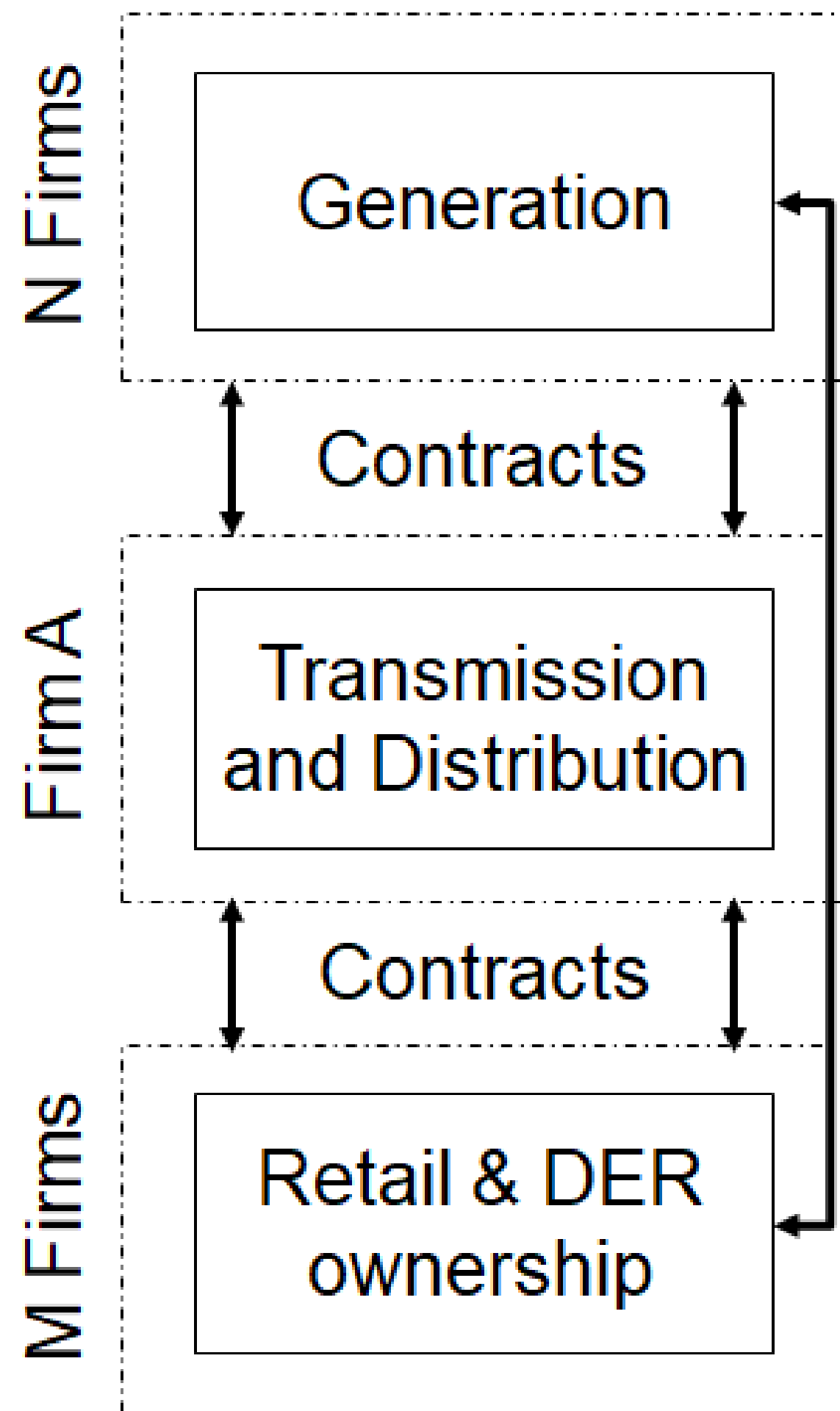
Retail & DER  
ownership

**Vertical integration may be efficient when coordinating two segments characterized by:**

1. Complex, infrequent transactions
2. Durable assets with limited resale value
3. Uncertain asset value
4. Counterparty performance cannot be easily monitored

**These conditions often lead to incomplete contracts and high transaction costs. Economies of scope, scale, & coordination must be weighed against the potential for the firm to exercise market power and the ability to regulate the firm.**

# Vertical disaggregation can be efficient when arms-length transactions can substitute for internal coordination



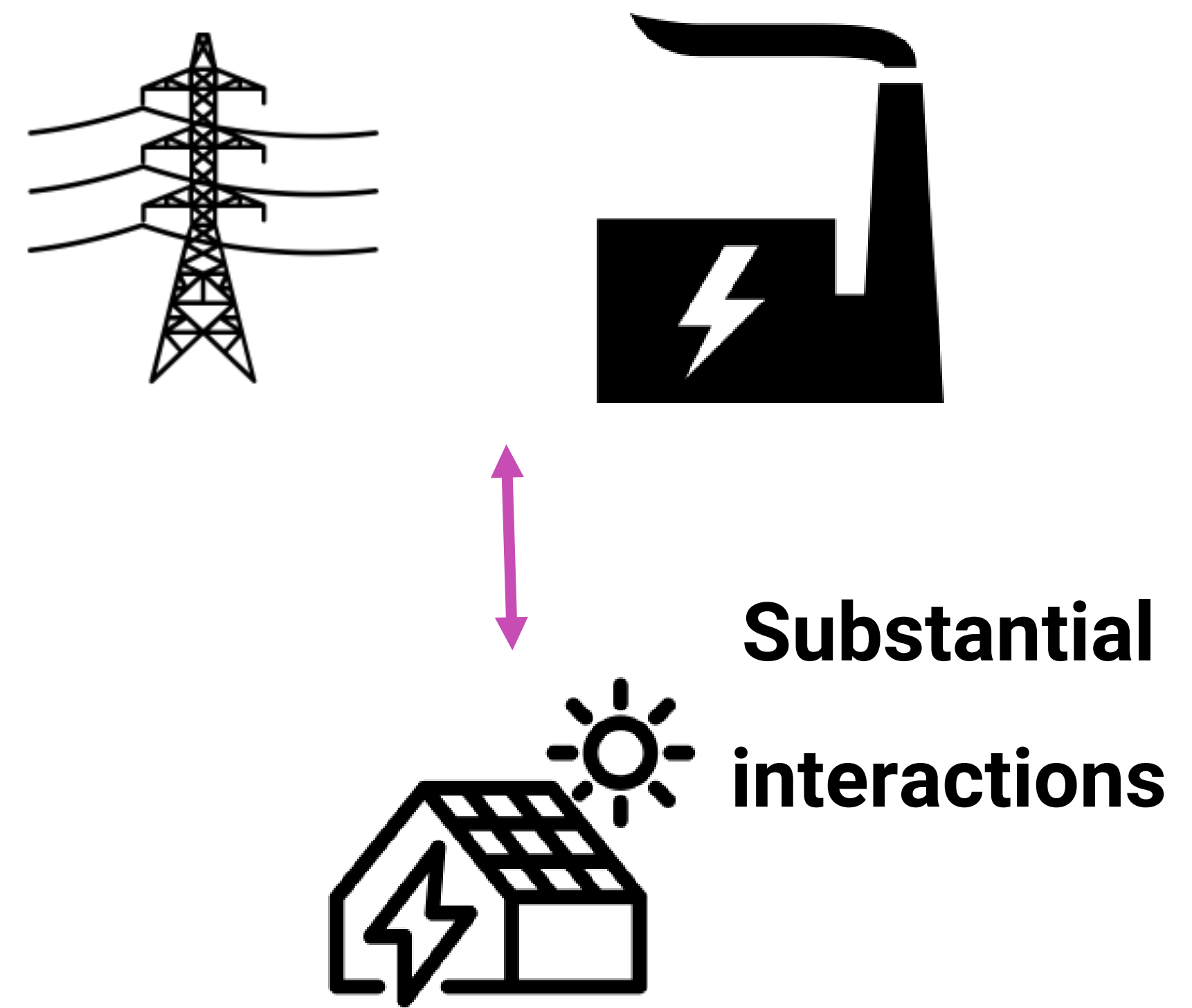
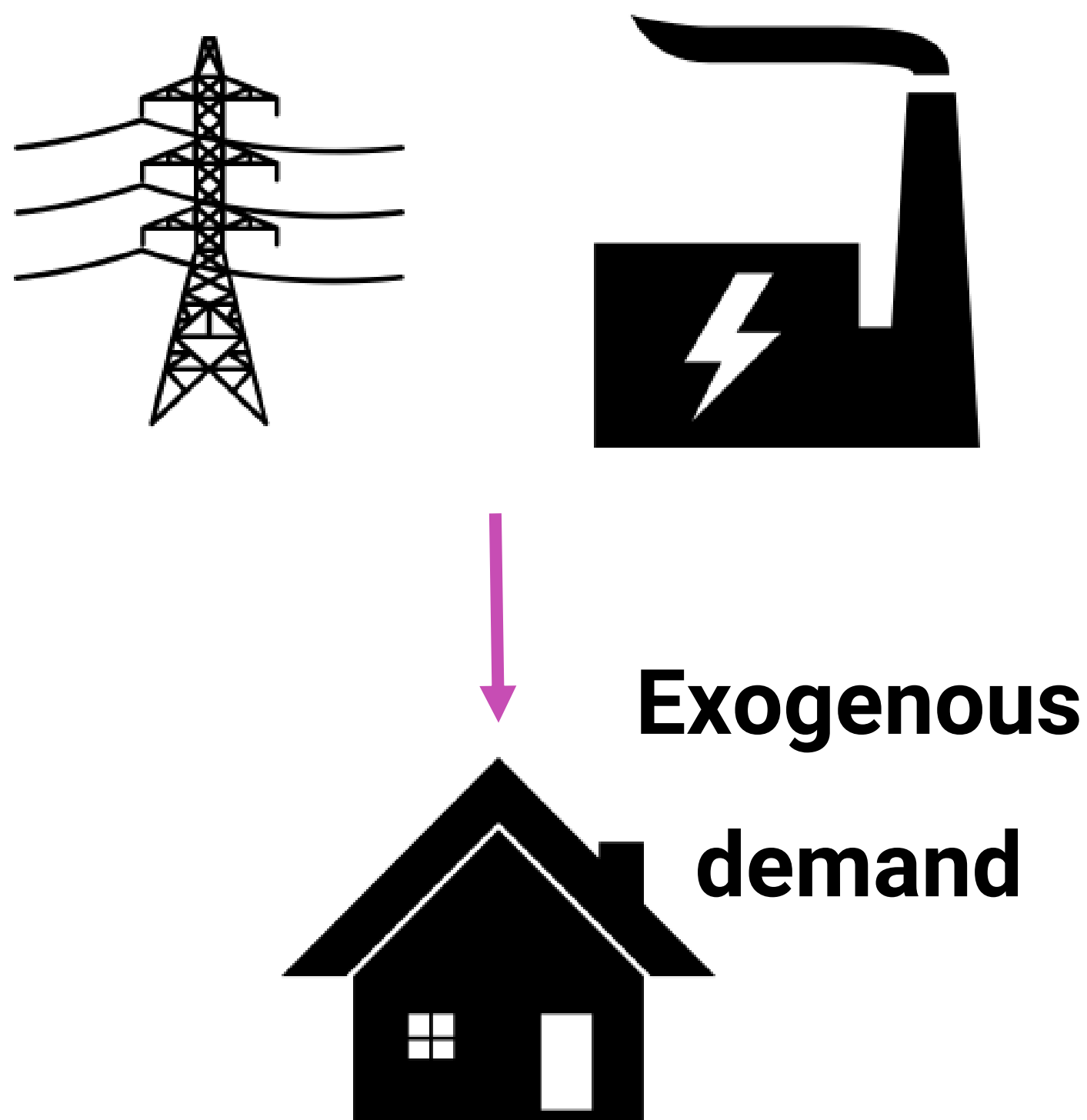
**Vertical disaggregation & competition may be preferable where:**

1. Contracts can be (near) complete
2. Transactions are frequent and entail standardized goods
3. Market sizes substantially exceed minimum firm sizes
4. Counterparty performance can be easily monitored

**Where feasible, markets create well documented competitive incentives for efficiency.**

# Traditional planning and coordination mechanisms have to grapple with greater influence over demand and DER adoption

Yesterday's power infrastructure planning    Tomorrow's power infrastructure planning





# As a result, the power sector is grappling with a new set of questions regarding industry structure

1. Should transmission and distribution utilities be allowed to own and operate DERs, should DER ownership be left to competitive actors, or a combination of both?
2. What regulatory mechanisms are needed to enable non-wires alternatives?

# Where distribution operators are empowered to build and own DERs, they must coordinate investments internally *and* externally

## Efficient coordination rests on three key pillars:

1. Pricing for efficient behind-the-meter investments
2. Equalizing incentives for tradeoffs between CAPEX and OPEX in remuneration
3. Improved planning mechanisms that account for the potential network value of DERs

# In vertically disaggregated contexts, distribution utilities rely on the same core competencies

## Efficient coordination rests on three key pillars:

1. Pricing for efficient behind-the-meter investments
2. Equalizing incentives for tradeoffs between CAPEX and OPEX in remuneration
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# Pricing of distribution network costs is critical in all regulatory environments

**Tariff/ subsidy based  
marginal pricing**

**Long-term contracting**



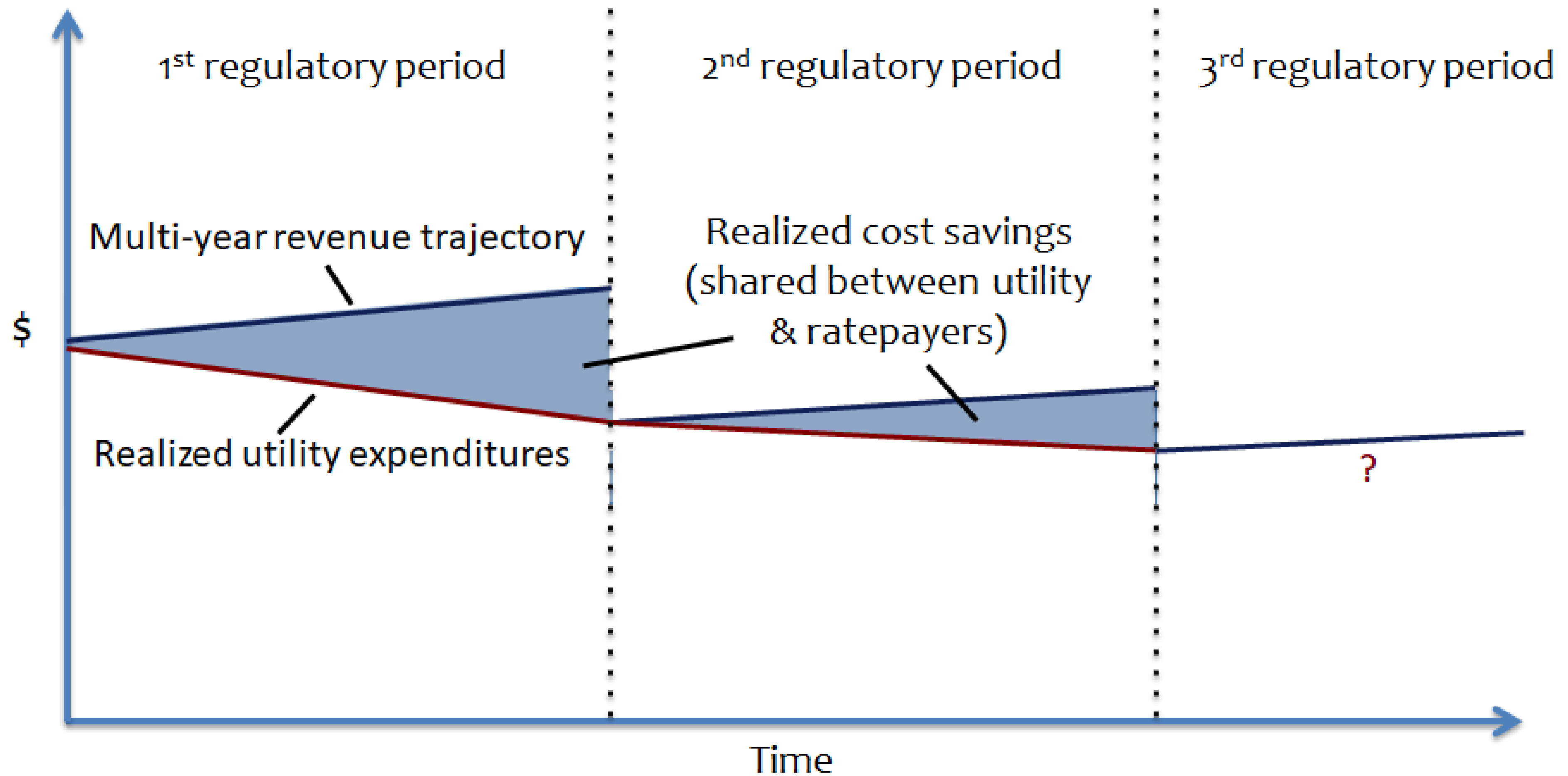
## **Short-term pricing/ incentives for distribution network deferral:**

1. No markets or clearly defined marginal network - potentially less efficient price discovery
2. Prices will require frequent/ constant updating and significant geographic variation
3. Simple revenue models for DER providers
4. Lower potential regulatory burden

## **Long-term contracting for distribution network deferral:**

1. Higher potential regulatory burden (places a higher burden on performance based regulation)
2. Higher transaction costs
3. May enable more efficient price discovery due to complexities of the arrangements

# T&D utilities must be directly rewarded for cost savings, with forward-looking multi-year revenue trajectories



# Distribution utilities must be incentivized to make efficient tradeoffs between capital and operational expenditures



**CAPEX**

**OPEX**



**Thank you!**

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