The Economics of Utility Regulation

How are renewable energy and distributed resources changing things?

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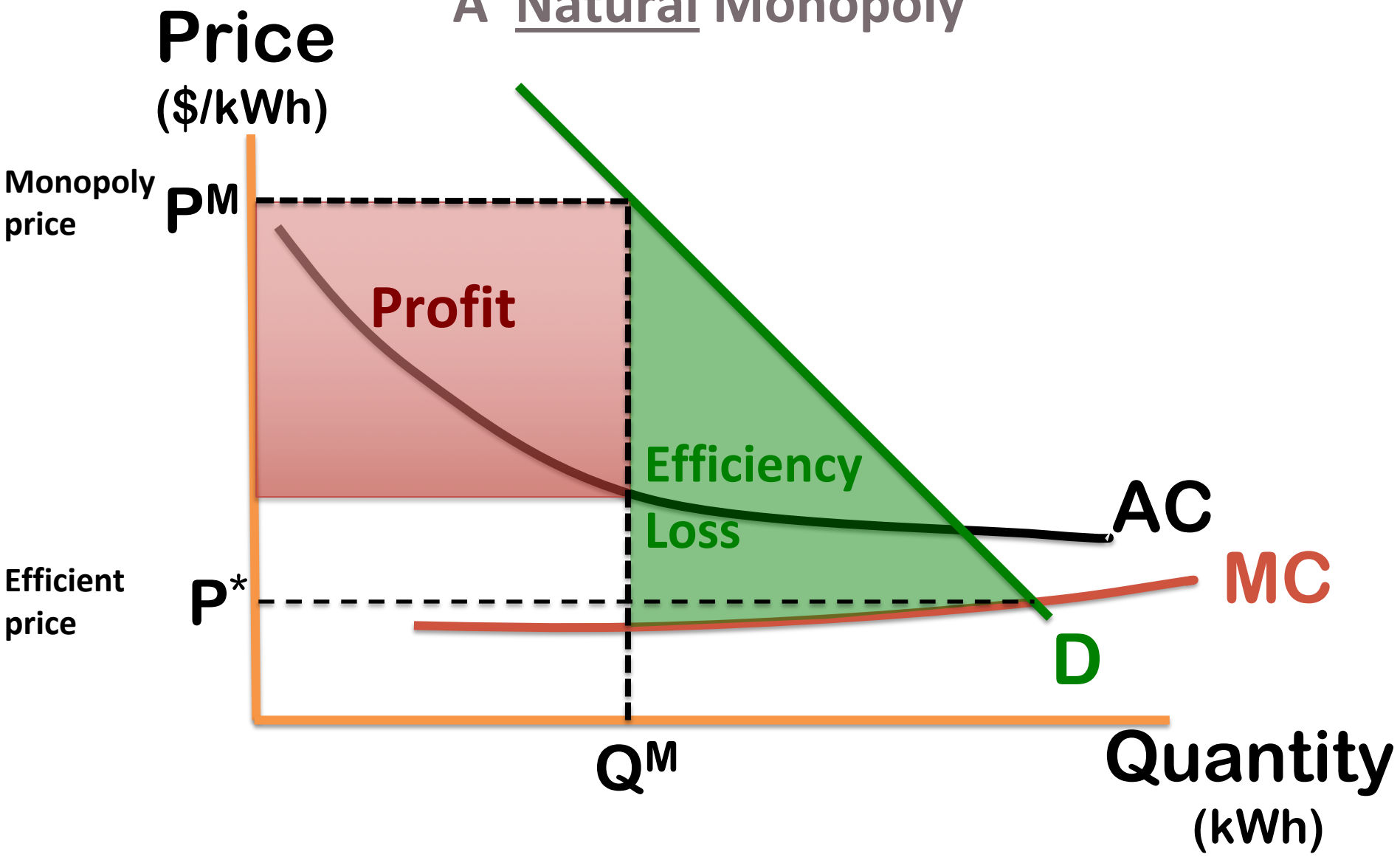
What is a *natural* monopoly ?

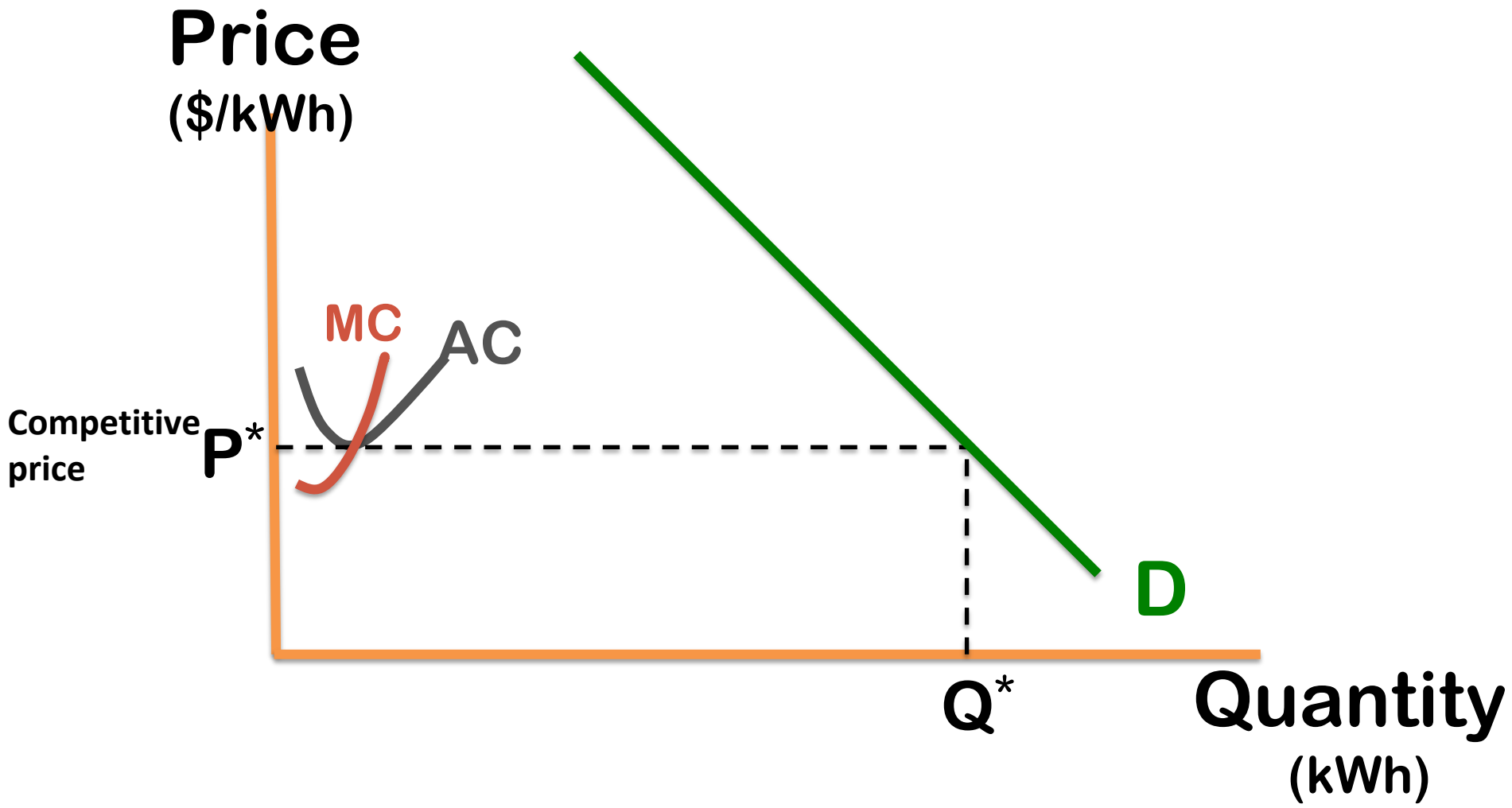
Answer:

The most efficient way to produce the good is with one firm

A Natural Monopoly



Not a natural monopoly



Usual Policy Conclusions

When there is a natural monopoly:

allow monopoly but regulate it to prevent it from monopolistic pricing.

When there is not a natural monopoly:

prevent the growth of monopolies and the exercise of monopoly power.

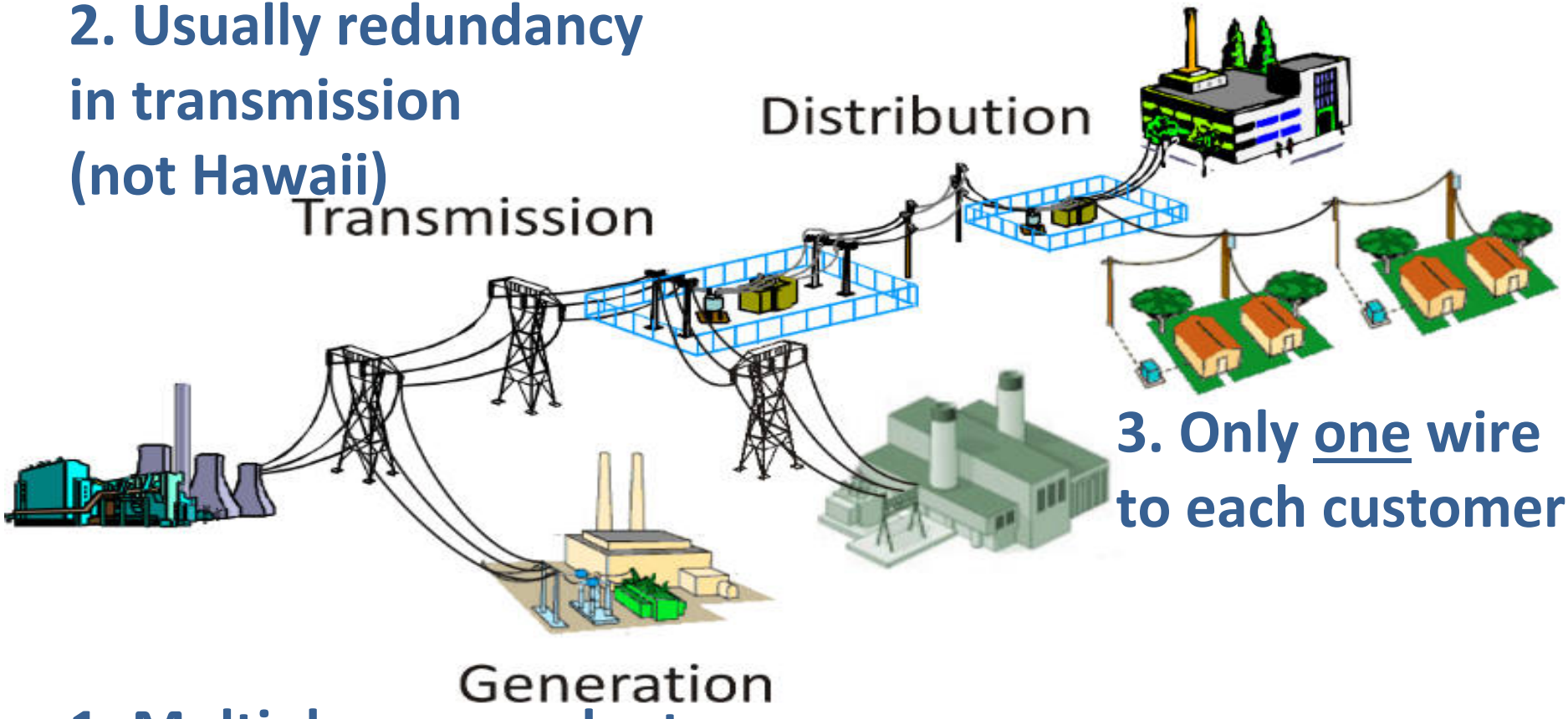
Utilities: the classic natural monopoly

Three pieces

1. **Production of the good.**
2. **Delivery to local area (Transmission).**
3. **Delivery to customer (Distribution).**

Today, distribution is the main natural monopoly

2. Usually redundancy in transmission (not Hawaii)



3. Only one wire to each customer

1. Multiple power plants for a service area

Main Regulatory Frameworks

1. Cost of Service
   a. Operation cost allowance
   b. Capital costs approved by PUC get allowed ***rate-of-return***
2. Price Cap or Revenue Cap Regulation
   a. PUC sets price cap at or above AC
   b. Firm gets to keep some or all of cost reductions
   c. Optional ratchet: adjust allowed price down with cost reductions
3. Targeted "performance based" metrics
   a. Heat rates
   b. Outages
   c. Environmental performance

Elon Musk at recent Governors' meeting

"You can't do these cost-plus sole-source contracts, because then the incentive structure is all messed up… you're incenting the contractor to maximize the cost of the program because they get a percentage….

[it's] Economics 101: Whatever you incent, that will happen…"

Cost of service VS. Performance

Like an employee contract: Salary VS. Bonus

Cost of service: best if appropriate actions are clear to regulator and easy to enforce.

Performance based: best if appropriate actions ambiguous to regulator and room for innovative solutions.

Does the old regulatory model fit?

1. Only true natural monopoly is grid management and real-time balancing.
2. Multilateral flows of energy & grid services
   - -Customers buy and sell too
3. Vanishing fuel costs
   - -All fixed costs, zero marginal costs.
   - -New “marginal cost” will reflect scarcity value of energy on hand and speculation about future supply and demand.

How does this change the regulatory problem?

1. Storage, uncertainty, and speculation.

   Implication: More complex dynamic management.

2. A lot more complexity at every level.

   Implication: Performance contracts more attractive.

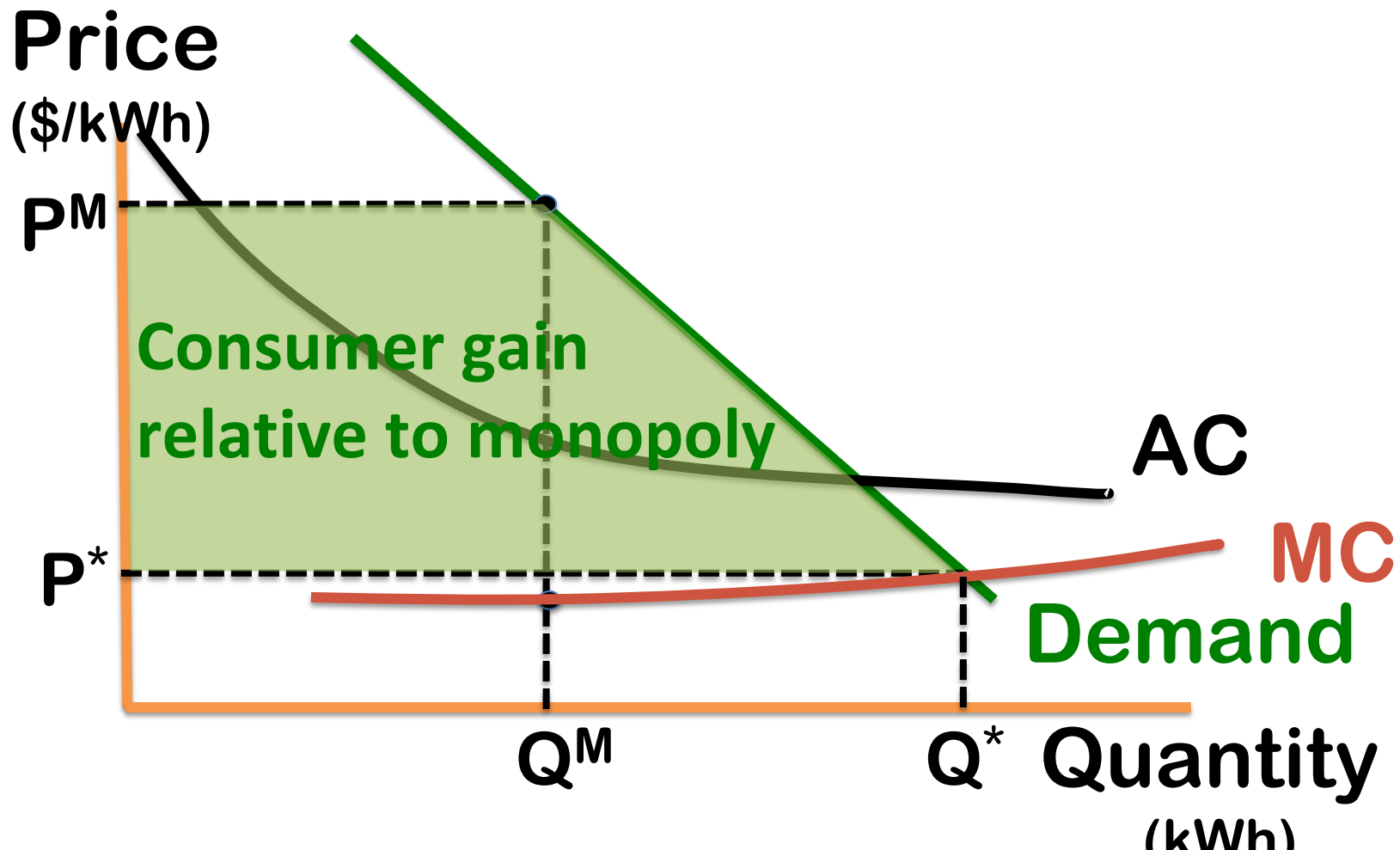
3. Multilateral trade of energy and grid services.

   Implication: Non-utility costs and benefits matter.

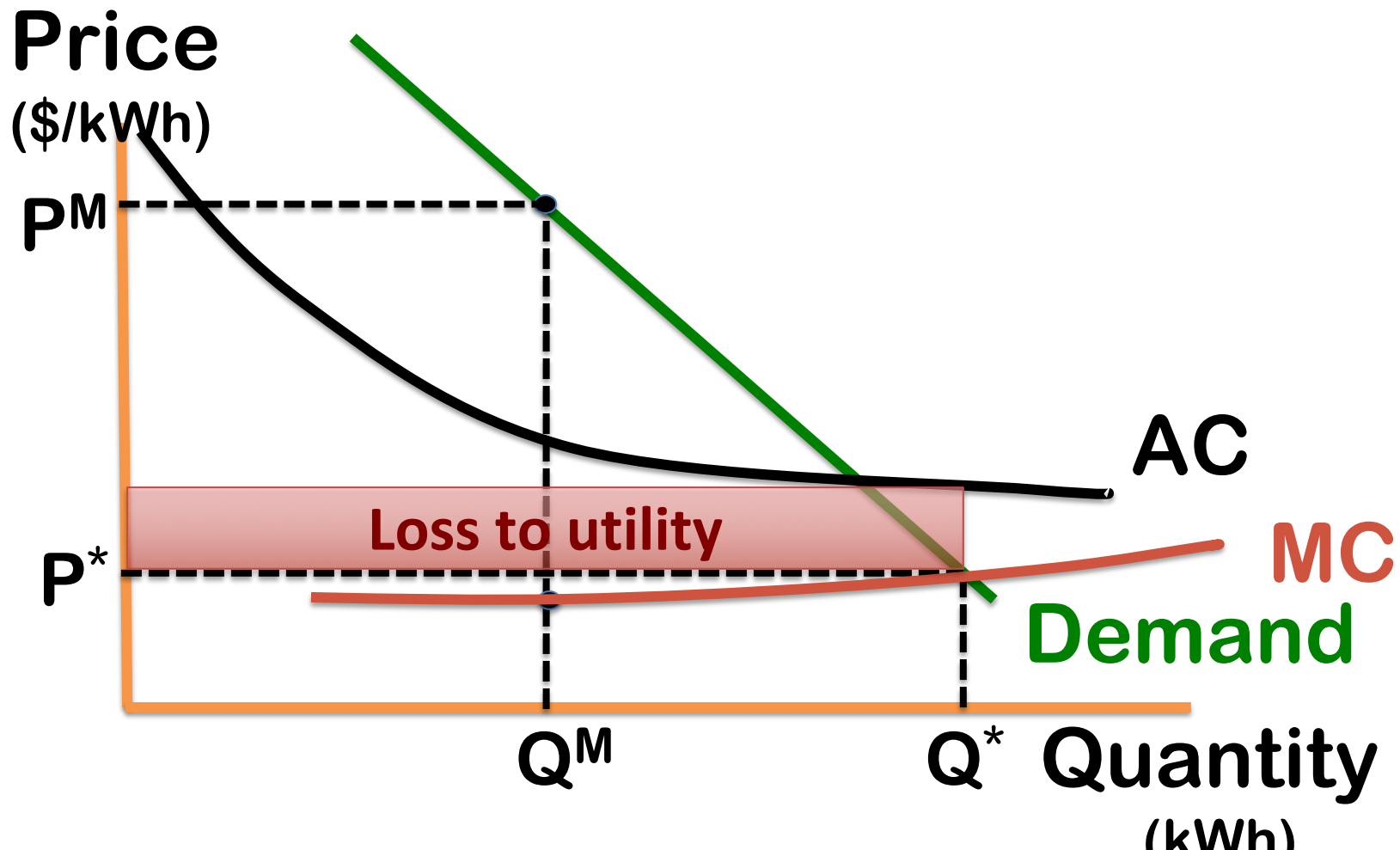
EXTRA SLIDES

Not Presented at GGP 2

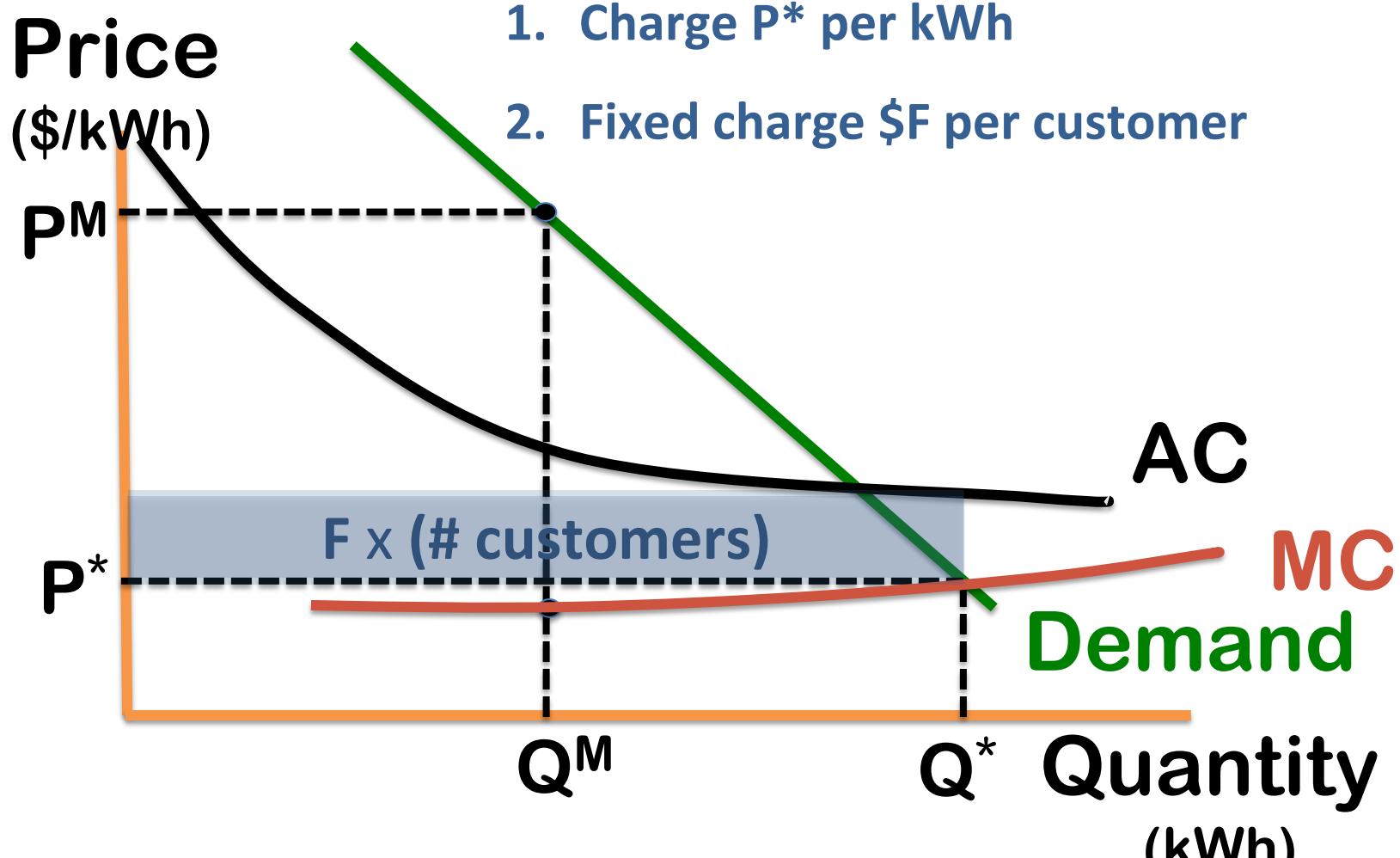
Efficient marginal-cost pricing (P^*)



Efficient, marginal-cost pricing (P^*)

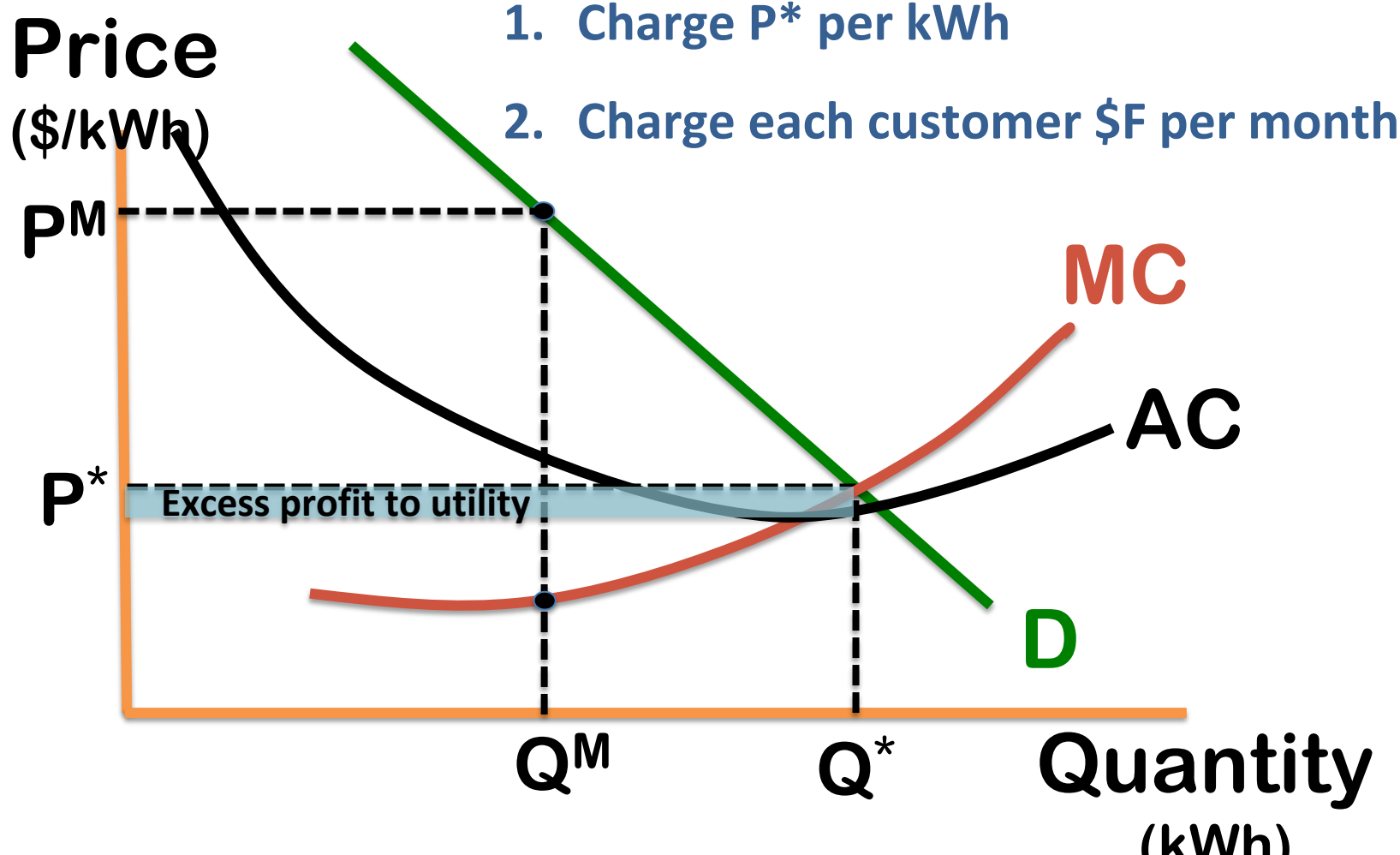


Solution: Two-part tariff



A fixed *rebate* instead?

1. Charge P* per kWh
2. Charge each customer $F per month



MC Pricing is nice in theory. What about practice?

Key Challenge

Hard to get a regulated firm to minimize costs

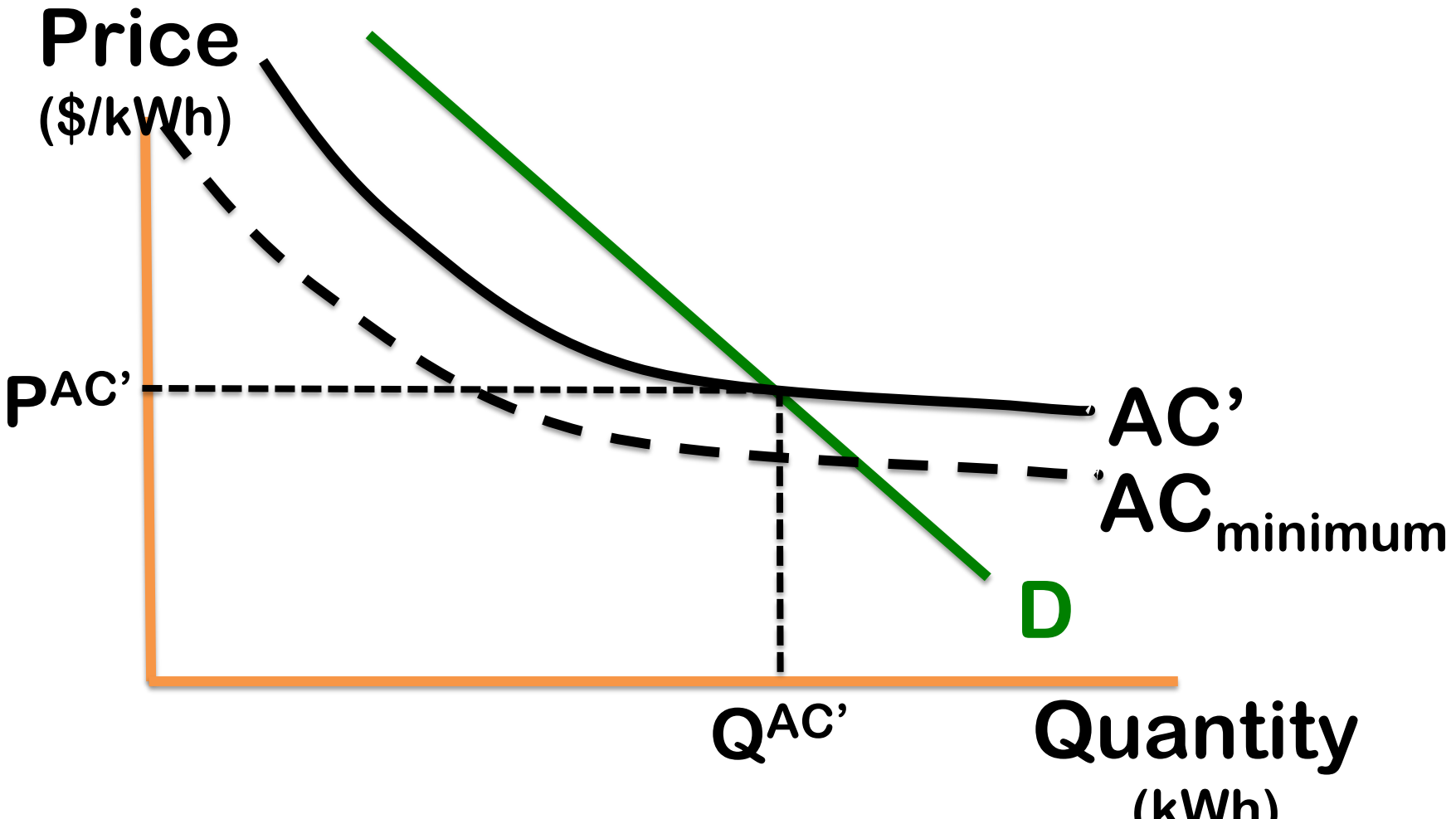
Regulator forces

$$P^* \times Q^* + \text{fixed charges} = AC \times Q^*$$

Firm has no incentive to <u>minimize</u> cost like a competitive firm would.

Quality of service at issue, not just price.

Imperfect Cost of Service Regulation (with no fixed charge)

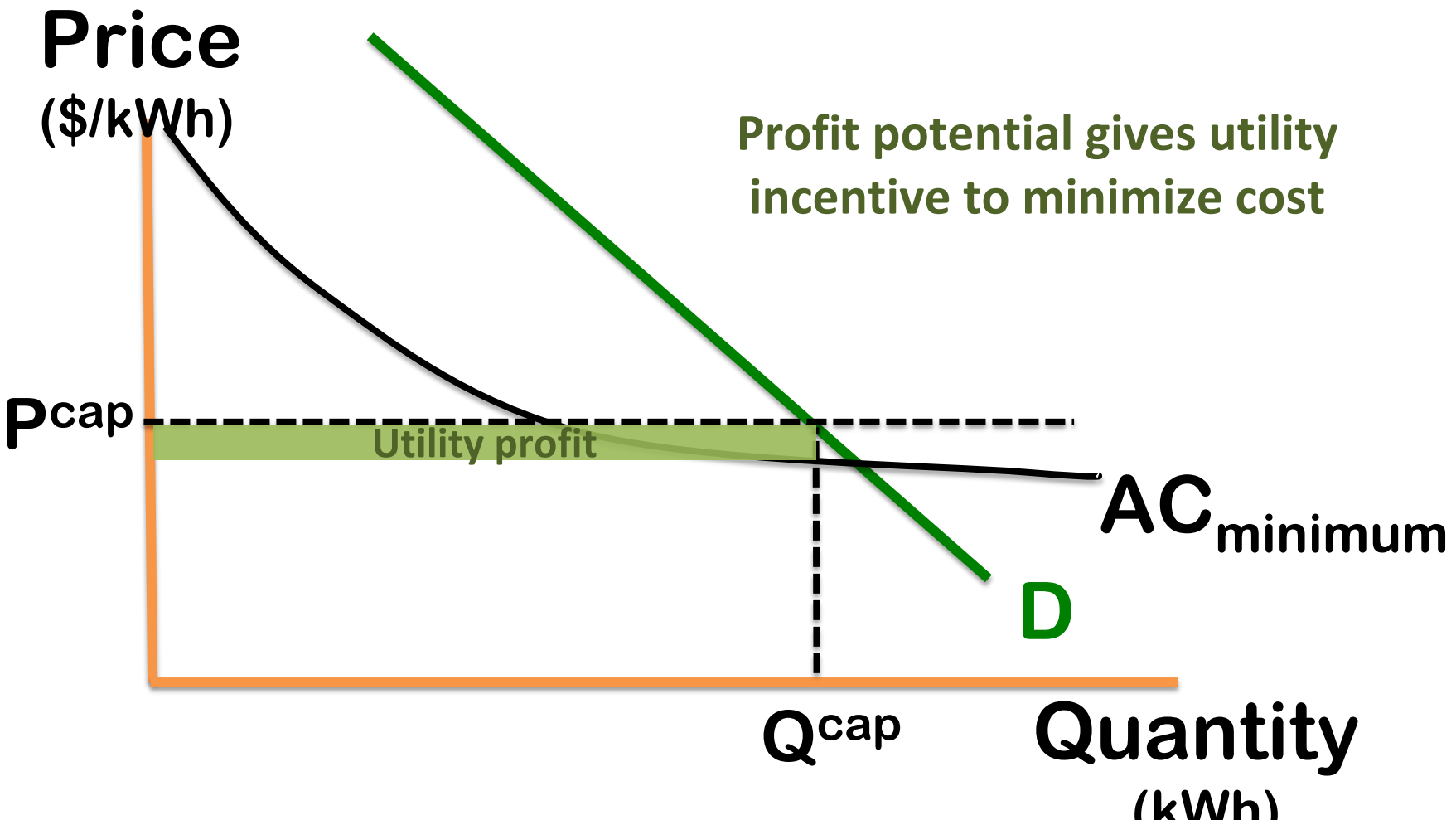


Regulator does not know true cost of capital

Suppose regulator sets "fair" return

- **At true cost of capital:**
  - **P = true AC**
  - **Monopoly has no incentive to minimize cost.**
- **Above true cost of capital:**
  - **P > true AC**
  - **Monopoly has incentive to use too much capital.**
- **Below true cost of capital:**
  - **P < true AC**
  - **Monopoly becomes insolvent.**

Price Cap regulation (with no fixed charge)

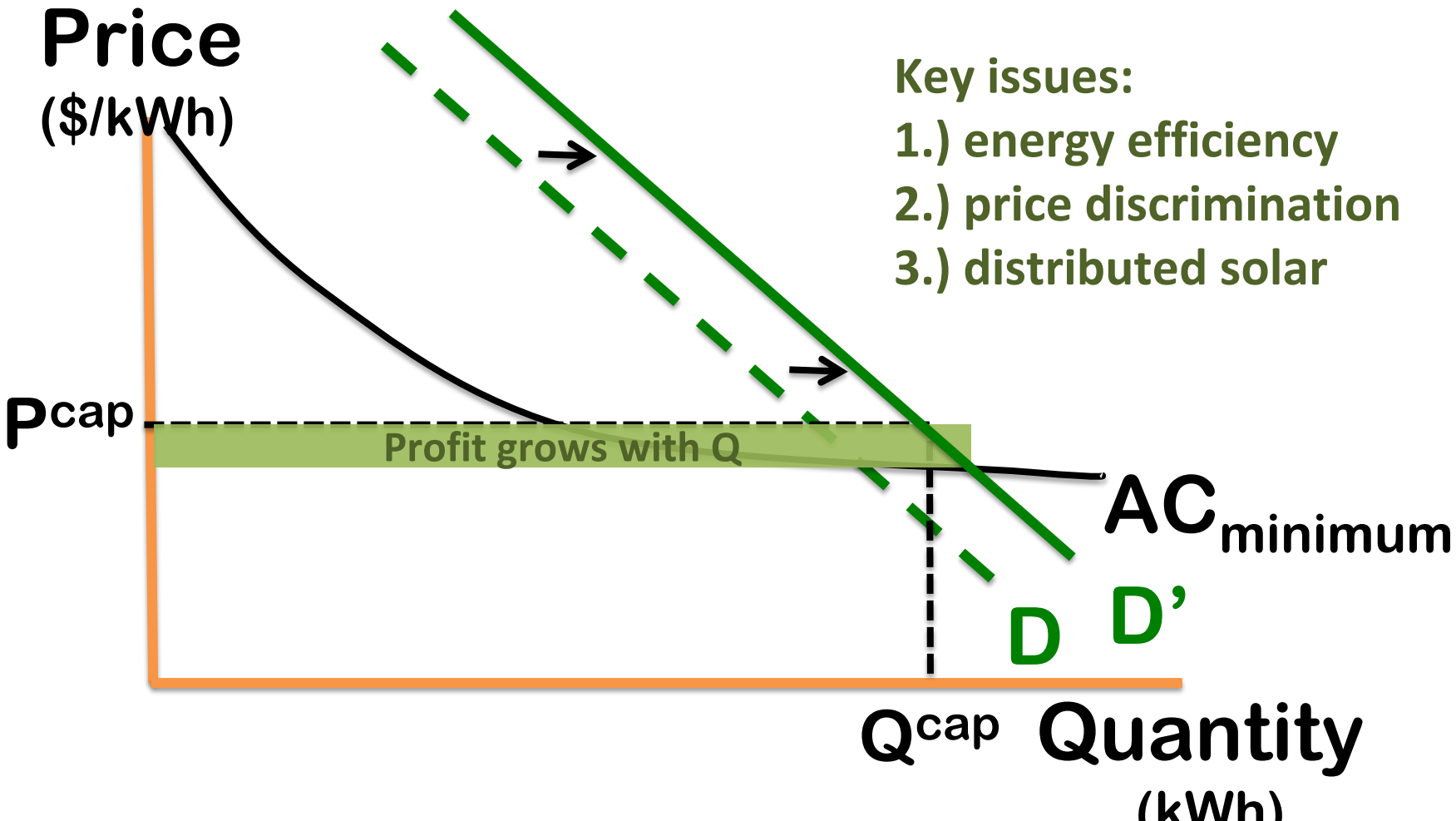


Problems with Price Cap Regulation

1. Quality of service may go down
   a. Utility won't lose customers for bad service
   b. Utility may fear that cost reductions will lead to lower future cap – better to just exaggerate costs?
2. Incentive to grow demand
   a. Increasing returns to scale -> lower cost -> higher profit
   b. Discourage energy efficiency
   c. Discourage distributed solar
   d. Price discrimination

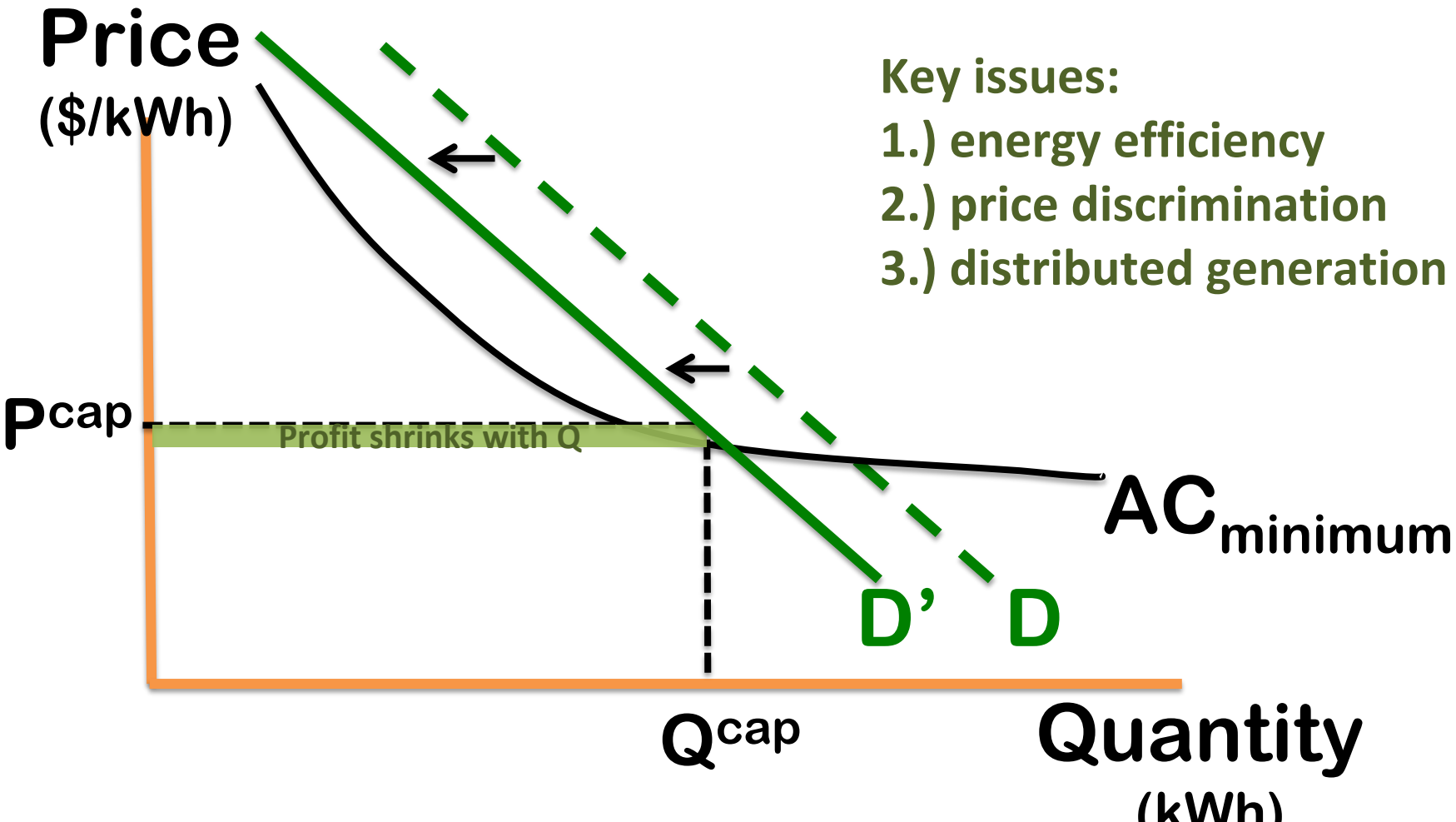
Problem with price cap regulation?

Incentive to grow demand



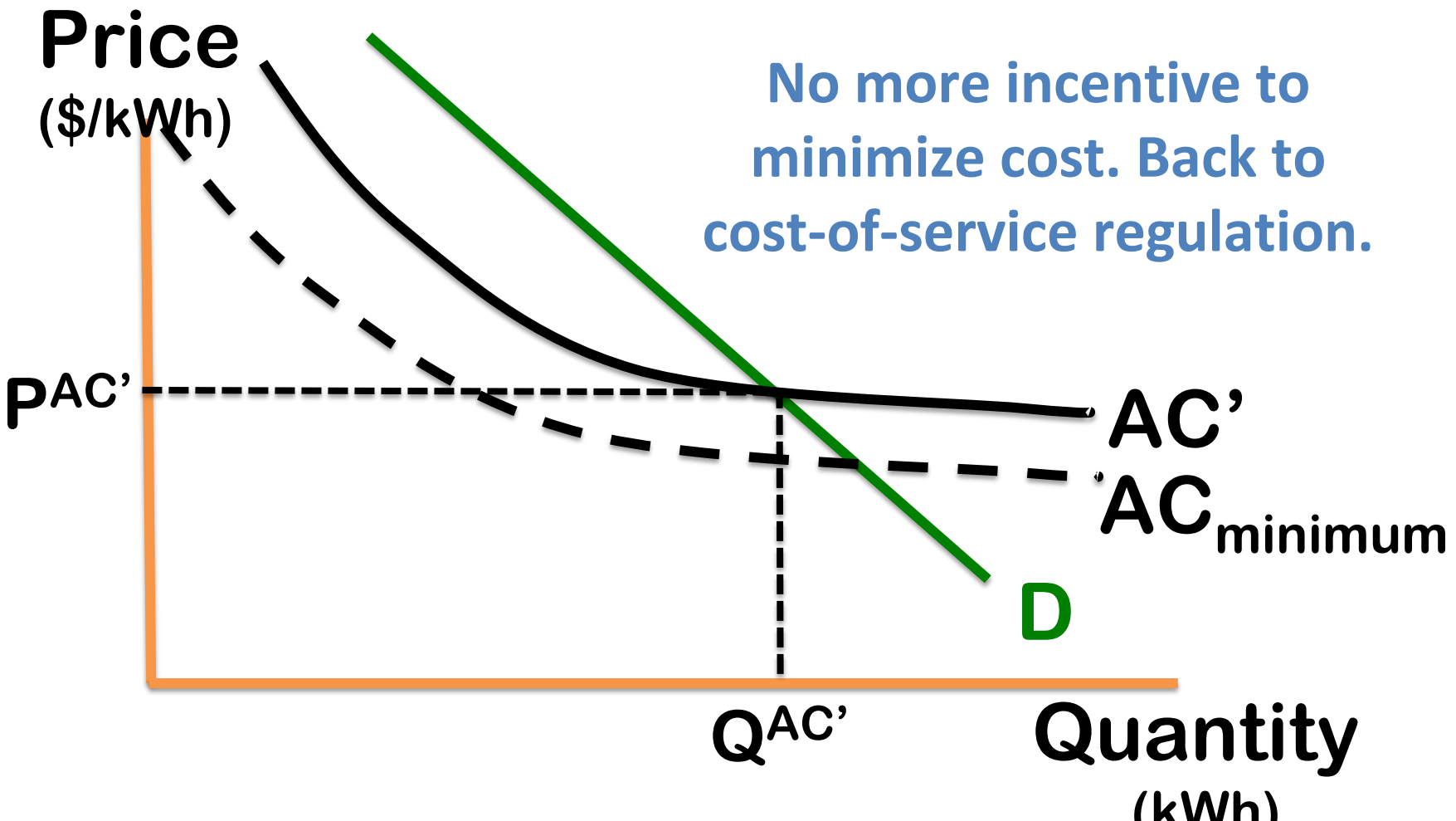
Problem with price cap regulation?

If demand falls, profit falls



Revenue Decoupling

Cap revenue instead of price



Alternatives

1. Markets or competitive bidding where viable
    a. Mainly generation
    b. Transmission?
    c. What is the minimum viable scale? Has it changed?
2. Customer-oriented performance metrics
    a. Share of cost reduction
    b. Pollution reduction
    c. Service quality metrics
3. Alternative ownership models
    a. Government municipality
    b. Cooperatives

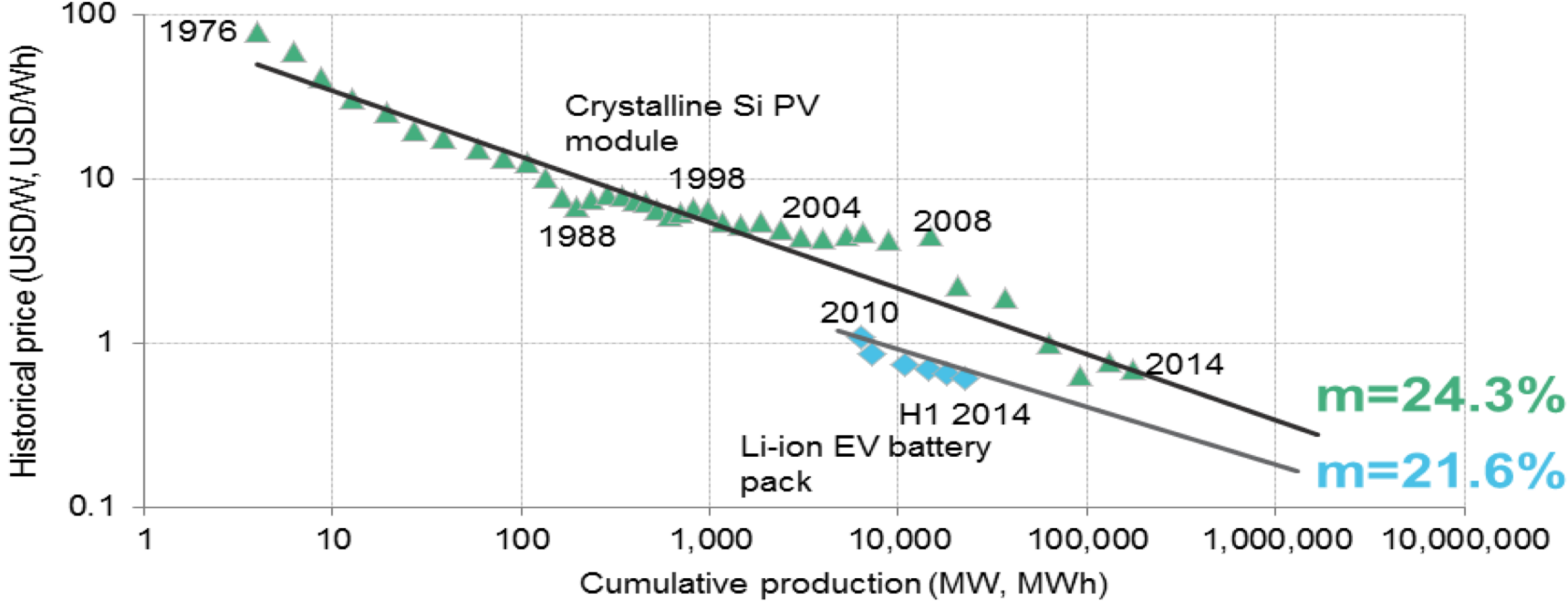
Things are about to change….
…..faster than you may think

https://www.bloomberg.com/news/videos/2017-09-13/the-way-humans-get-electricity-is-about-to-change-video

Experience curves compiled by Bloomberg New Energy Finance

LITHIUM-ION EV BATTERY EXPERIENCE CURVE COMPARED WITH SOLAR PV EXPERIENCE CURVE

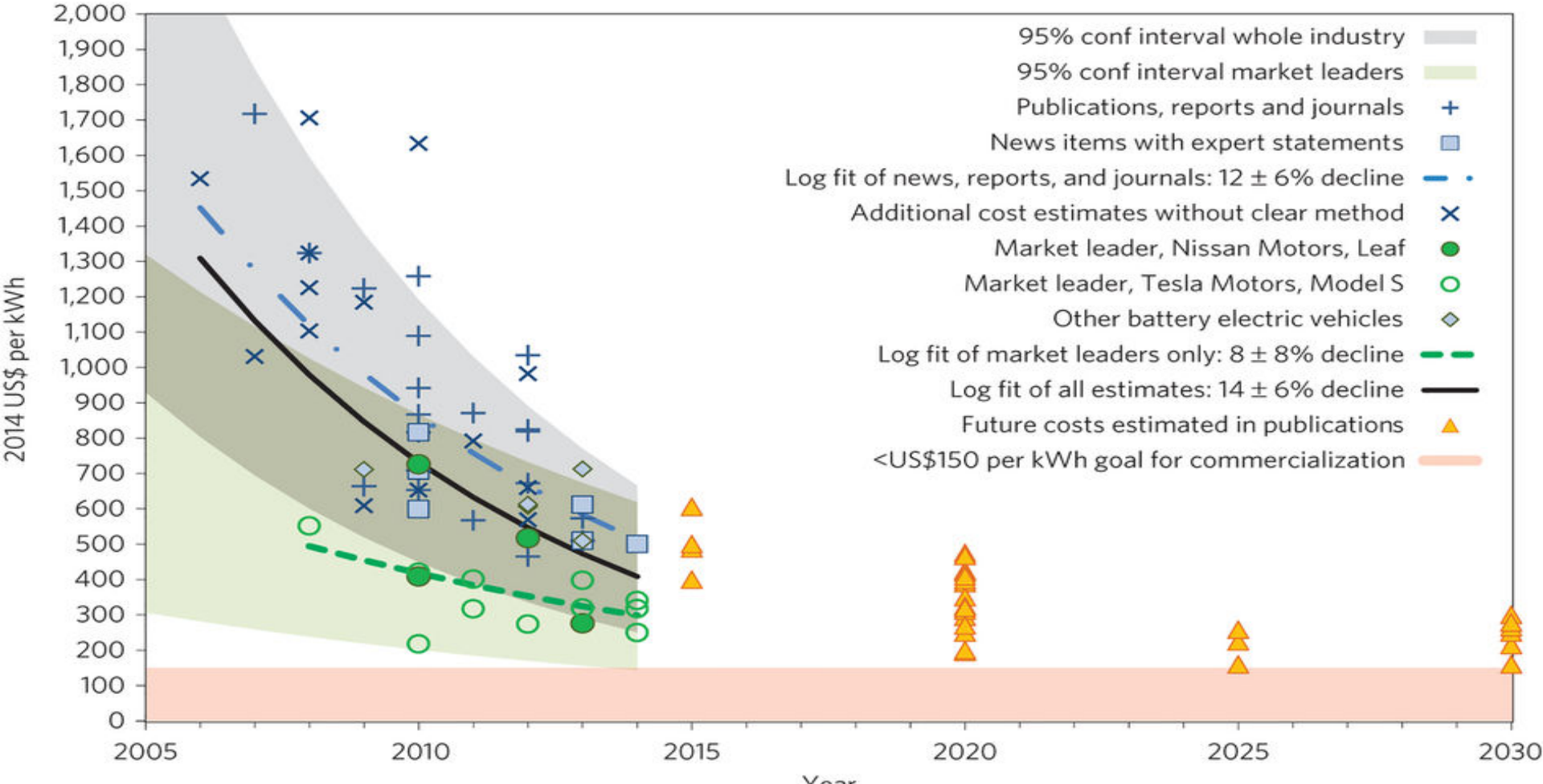
Bloomberg NEW ENERGY FINANCE



Note: Prices are in real (2014) USD.

Source: Bloomberg New Energy Finance, Maycock, Battery University, MIT

Nykvist & Nilsson report rapidly falling battery costs in 2014 (14%/yr). Costs fell additional 50% by 2016.



Utility-scale PV with Battery

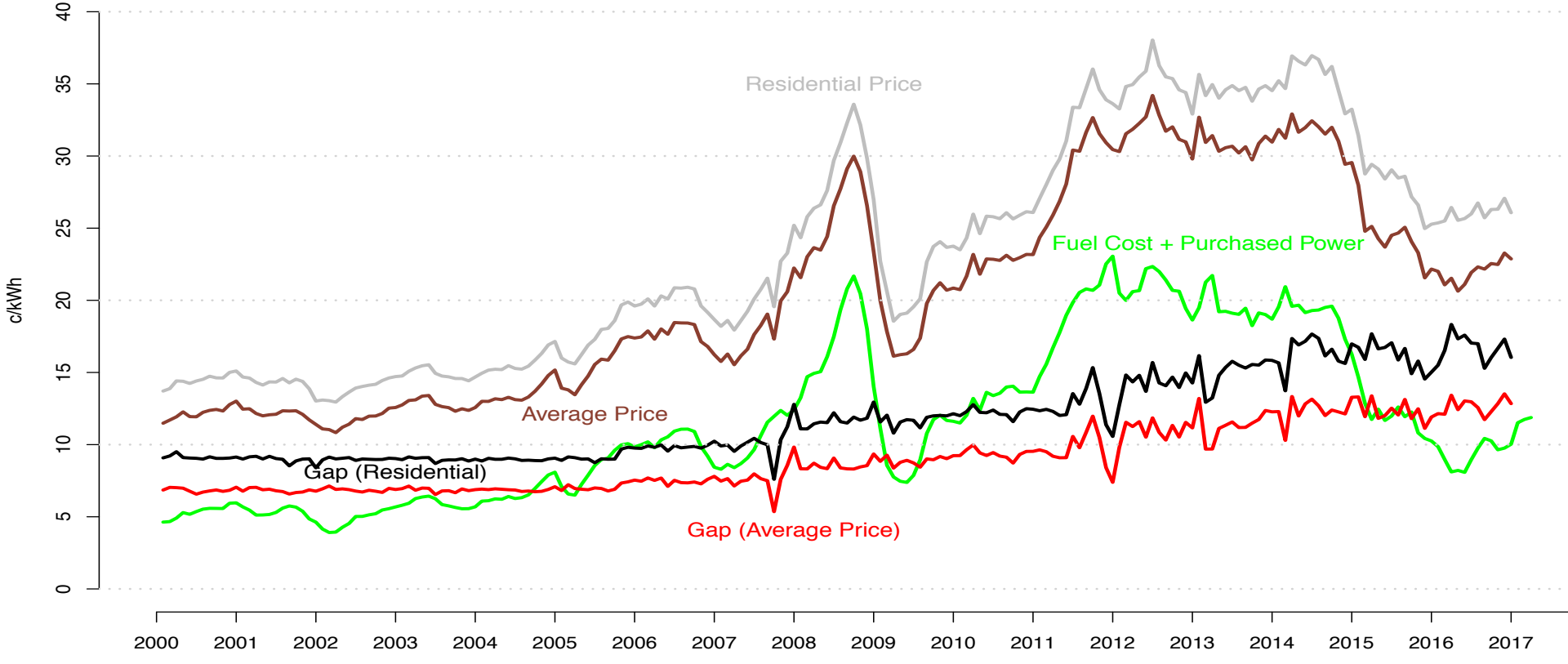
Tesla installation on Kaua`i: 13.9 cents/kWh

New AES installation on Kaua`i: 11 cents/kWh

NextERA installation in Arizona: 4.5 cents/kWh

These are subsidized rates. Still, unsubsidized, the Arizona project ~ 8 – 9 cent/kWh

Oahu Electricity Prices



Should we worry more about grid defection?

Two Futures

1. **Smart Grid**

   Mix of distributed and centralized generation, smart appliances, building control systems and storage. Exchange of power managed by utility in vast variable pricing scheme.

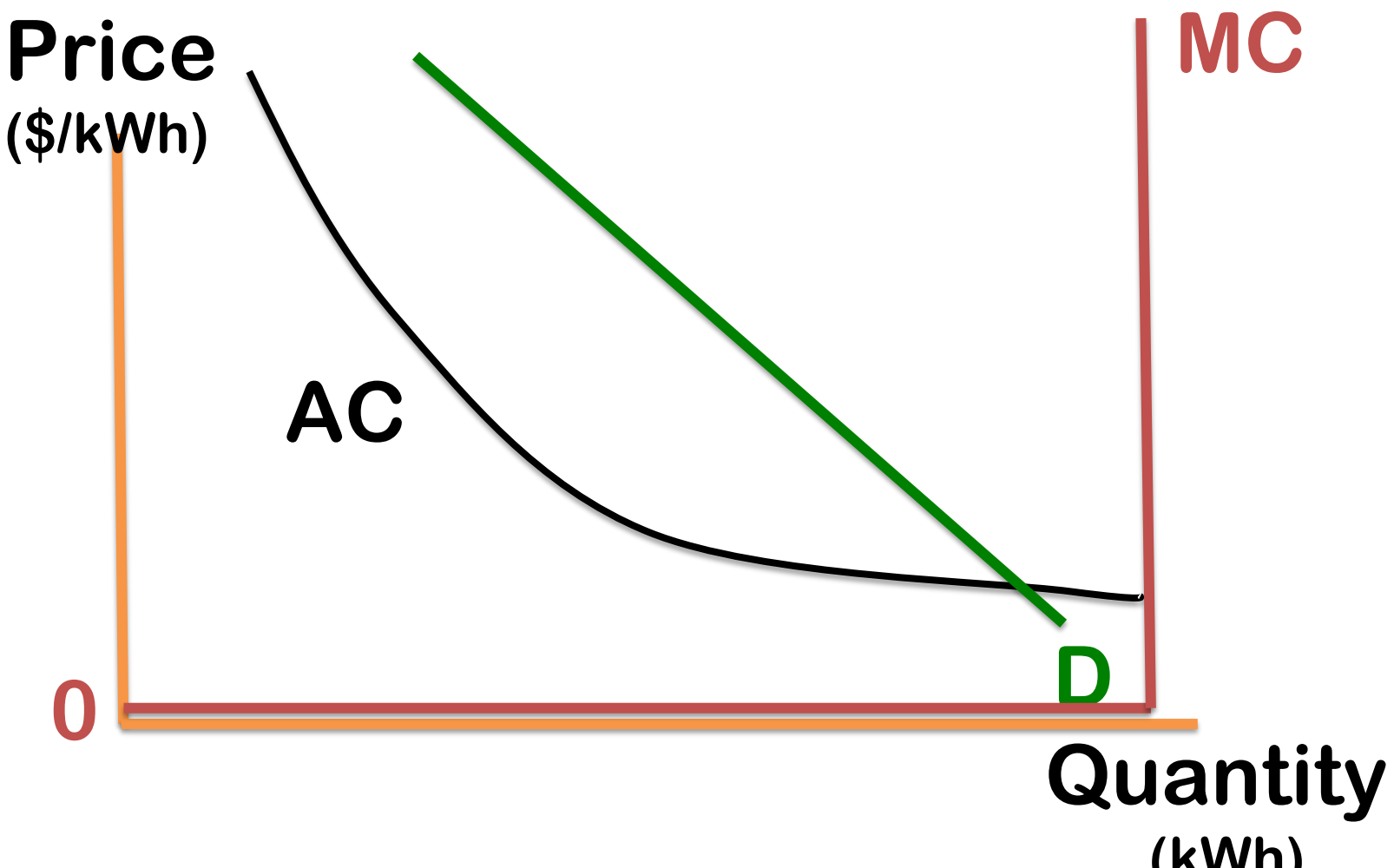
2. **Self Supply and Self Storage**

   Economies of scale in generation and storage overwhelmed by costs and possible vulnerabilities of managing a smart grid.

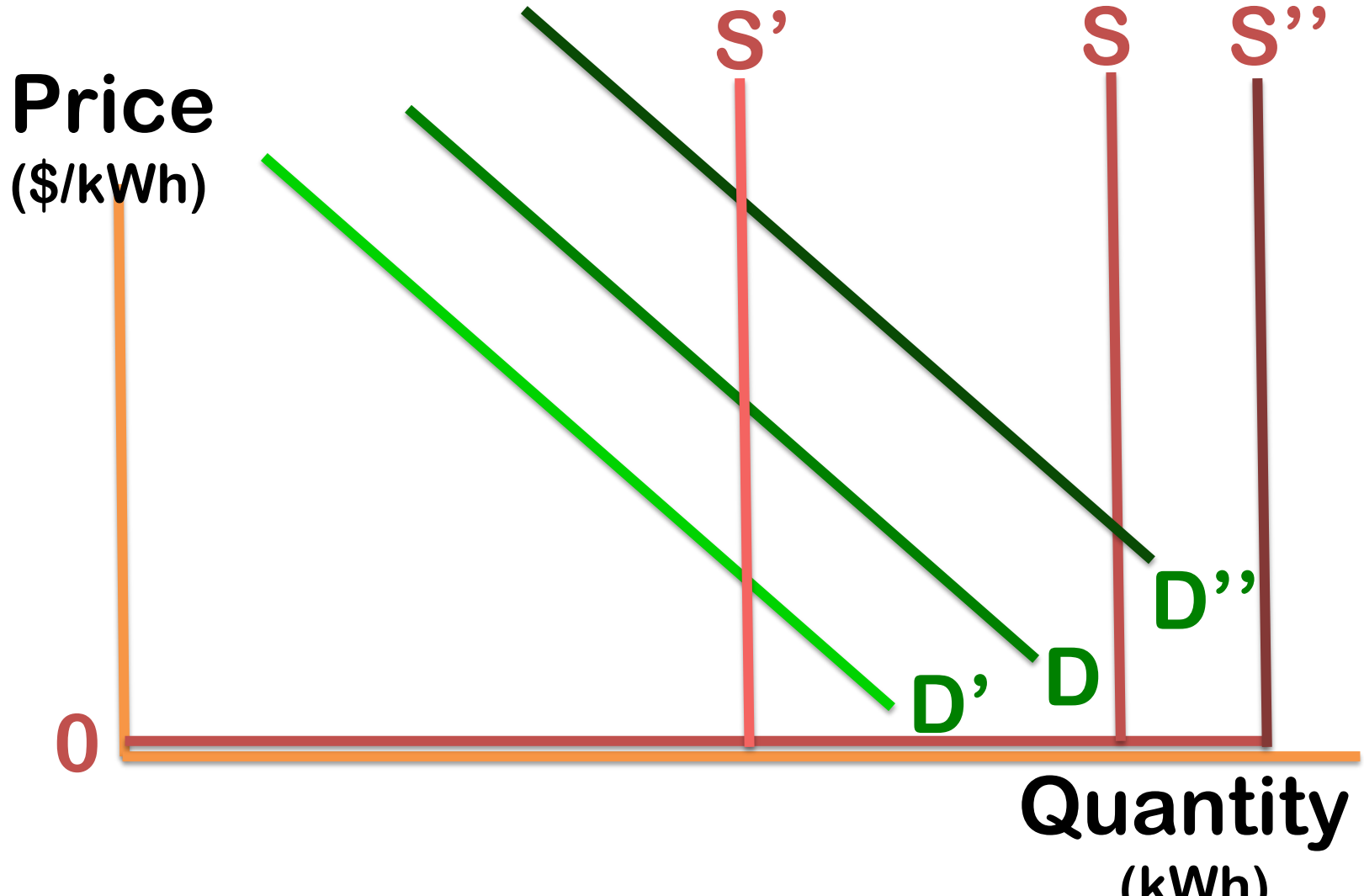
Hybrid?

Self-supply and self-storage backed up by old, dumb grid?

When all costs are fixed



All costs are fixed, & supply and demand vary



Choices, and regulation, much more complex

- Centralized vs. distributed generation.
- Centralized vs. distributed storage.
- Major grid upgrades or minor ones.
- Smart meters for all, or only those with large, flexible loads?
- Information asymmetry between PUC and utility more acute.
- Planning and management software built for the past, not the present or future.