Maintaining Adequate Infrastructure on the Nation's Energy Grids:
How Economics Drives Investment

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Increasing Longer-Term Stability in Energy Markets

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How Markets Work℠

There is Rumbling Controversy over Transmission Cost Allocation

- A number of states don't seem to like the transmission hand they've been dealt
- WIRES (the non-profit trade group) issues a September 10th 2007 paper with lots of discussion and 10 relatively unobjectionable principles.
  - But it didn't tackle practical cost allocation, as such.
- The interdependence of transmission with generation—or the *independence* is still a matter of debate.
- Where electricity investment will come from and who will pay for it is still somewhat of a mystery.

What Kind of Grid?

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- The US has three nationwide, FERC-regulated energy grids:
  - The Crude Oil and Oil Products Grid
  - The Gas Pipeline Grid
  - The Electricity Grid
- Few study these grids together
  - What economics drives them?
  - How has regulation adapted to those economics?
  - Who invests in the infrastructure?
  - How are their respective costs allocated?

Grid #1: Oil Pipelines

- The oldest of the energy grids
- Regulated in 1906 with railroad-style regulation by the Interstate Commerce Commission (ICC)
- The ICC left it alone until the 1940s
  - No rate base, no ratemaking, no nothing
  - The oil industry concentrated in the meantime, with almost all pipelines affiliated with producers
  - Congress, in frustration, finally handed oil pipelines to the FERC in 1978
- The product is easy to ship and store at either end of the lines
- The major lines in the US are vertically-integrated joint ventures, and cost allocation is a not a visible controversy.

Grid #1: Oil Pipelines

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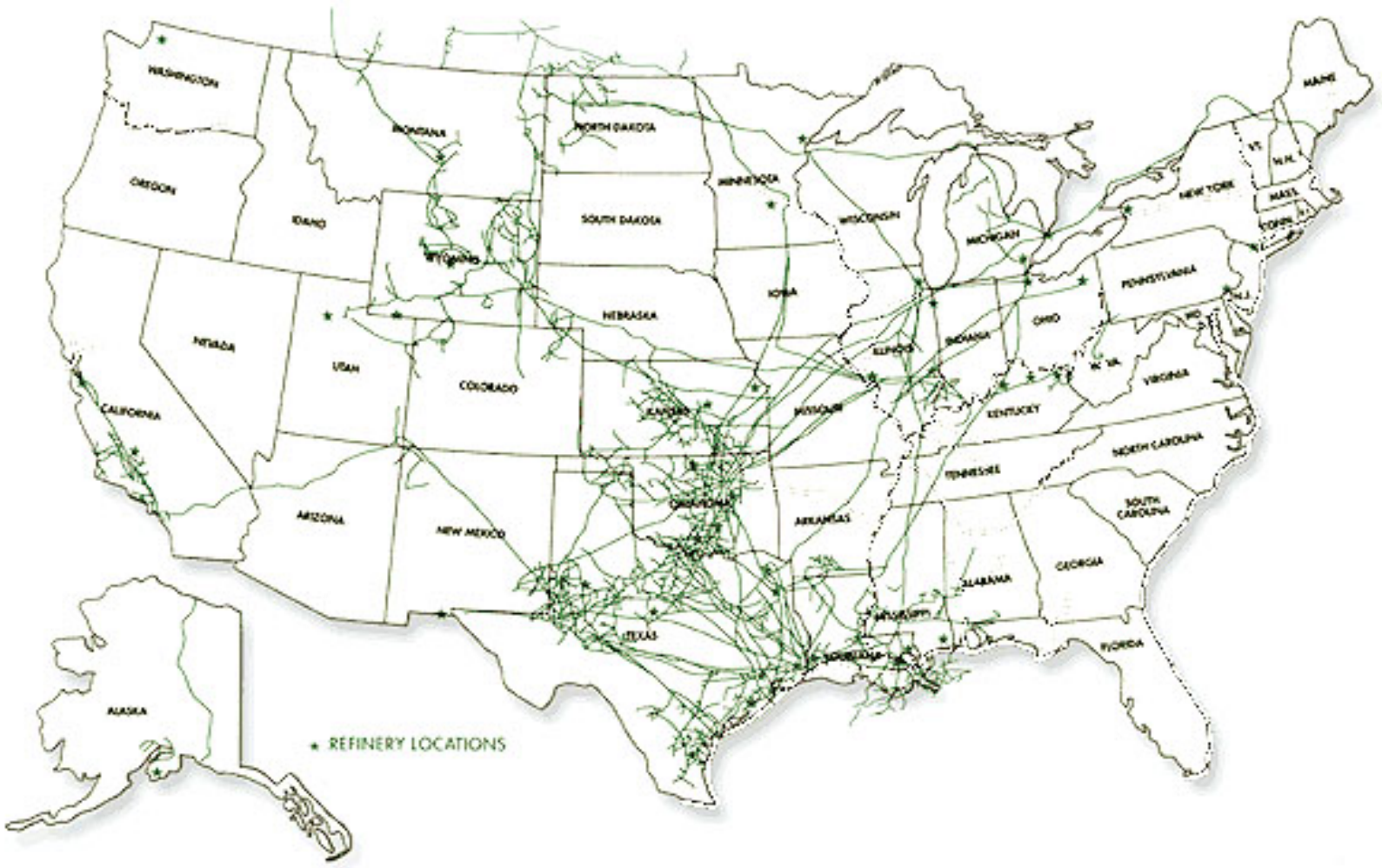
Major Crude Oil Pipelines



Grid #2: Gas Pipelines

- Saved from ICC regulation in 1906 by a far-sighted Ohio Senator
- Finally regulated in 1938 by Congress after the country had spent two decades learning how to regulate utilities
  - Accounting regulation, rate base valuation
  - The greatest ownership unbundling in history (the Holding Company Act of 1935)
- Product is easy to ship, although storage is limited to suitable geological sites
- Allocation seemed a straightforward affair of distance on the pipeline from the origin
- The network has been “contractualized” with an unregulated secondary market—and massively streamlined licensing
- It’s now the *Stradivarius* of inland transport systems for gas—transparent, competitive and flexible to support gas competition

Grid #2: Gas Pipelines

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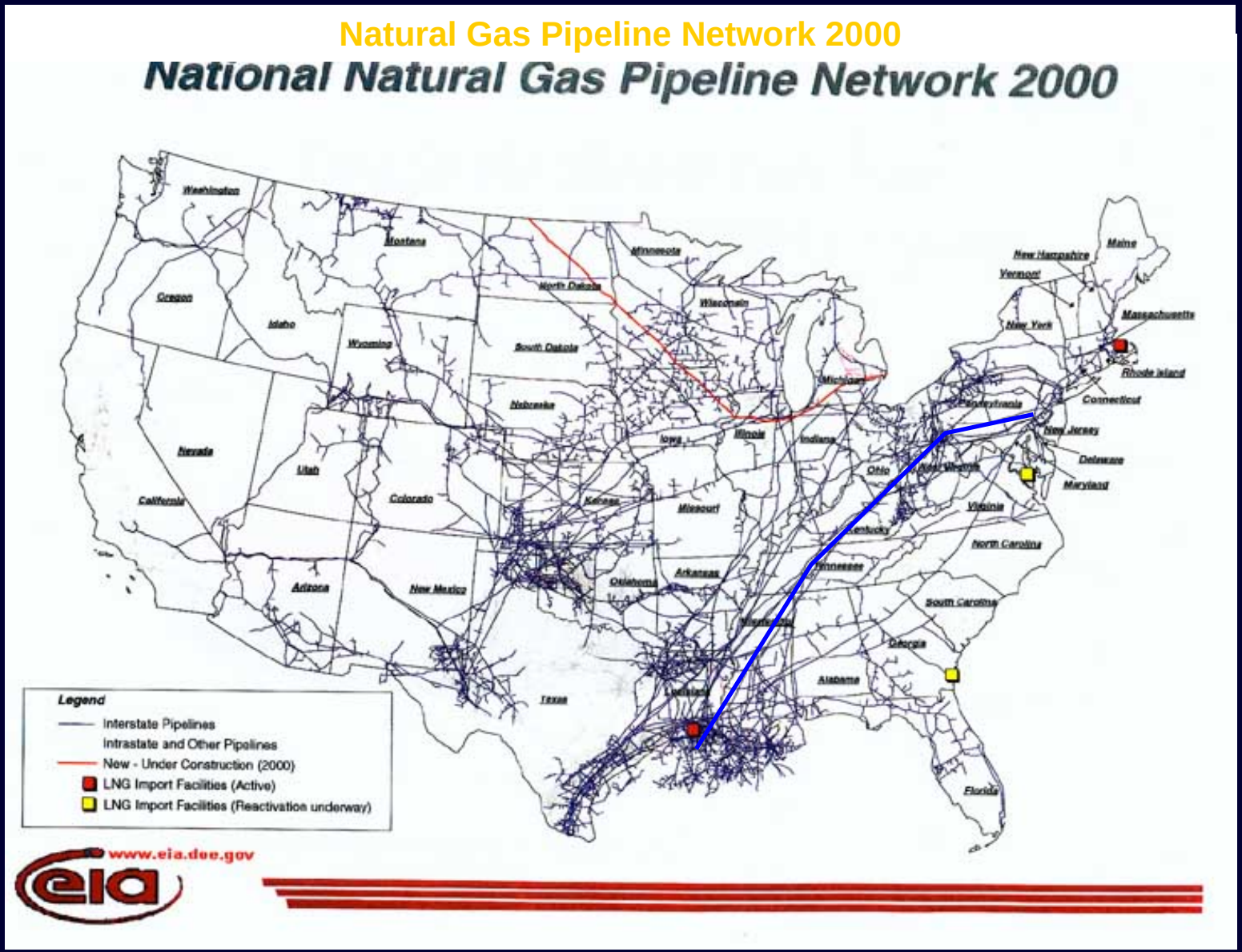
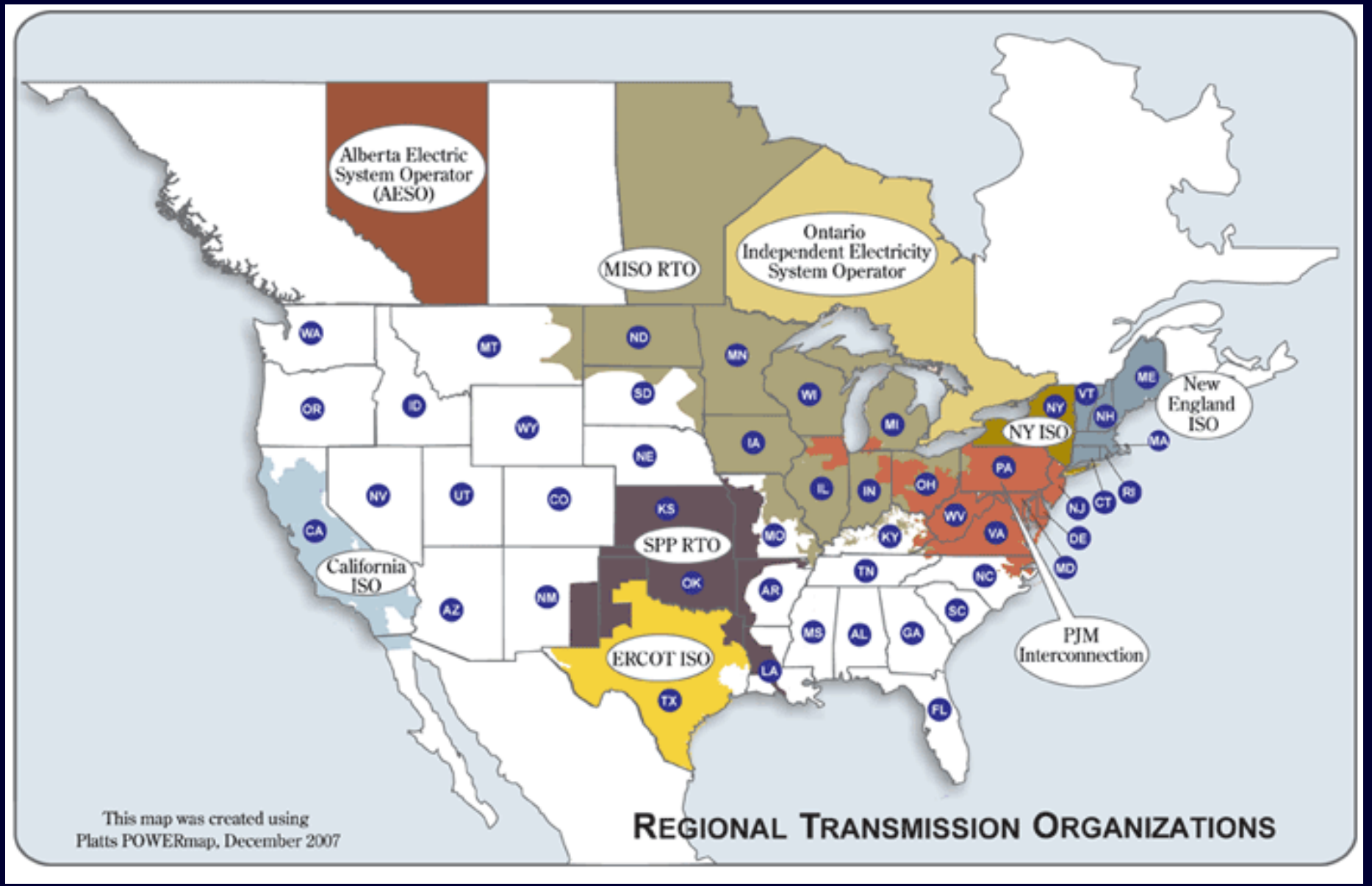
Natural Gas Pipeline Network 2000



Grid #3: Electricity Transmission

- A more recent, small scale and patchwork affair
- Largely separate among integrated utilities until the 1965 blackout
- A “balkanized” system of sort-of bundled, state-regulated, independent transmission systems
  - Stitched together for reliability purposes
  - Not intended as the backbone for power competition
  - “Wheeling” rates to credit the local utility’s cost of service
- No definitive shipping routes or storage, disjointed pricing until and unless systems are ceded to the FERC for ratemaking

Grid #3: Electricity Transmission



Economics of the Three Grids

- Economics of Production Cost
- Economics of Transaction Cost

Economics of Production Cost

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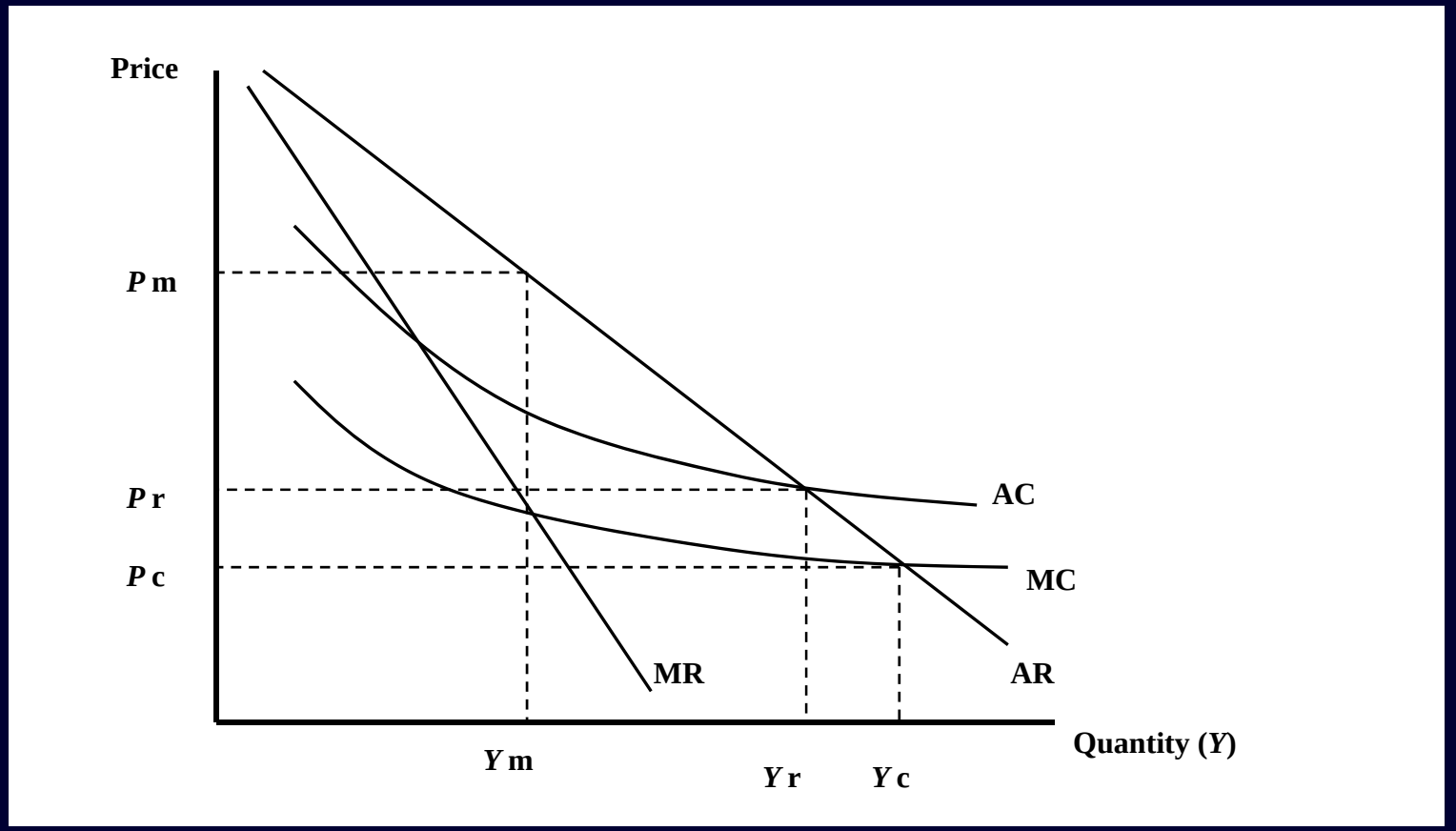
Cost Function for Transmission



A Picture of Natural Monopoly

(no congestion)

Economics of Production Cost

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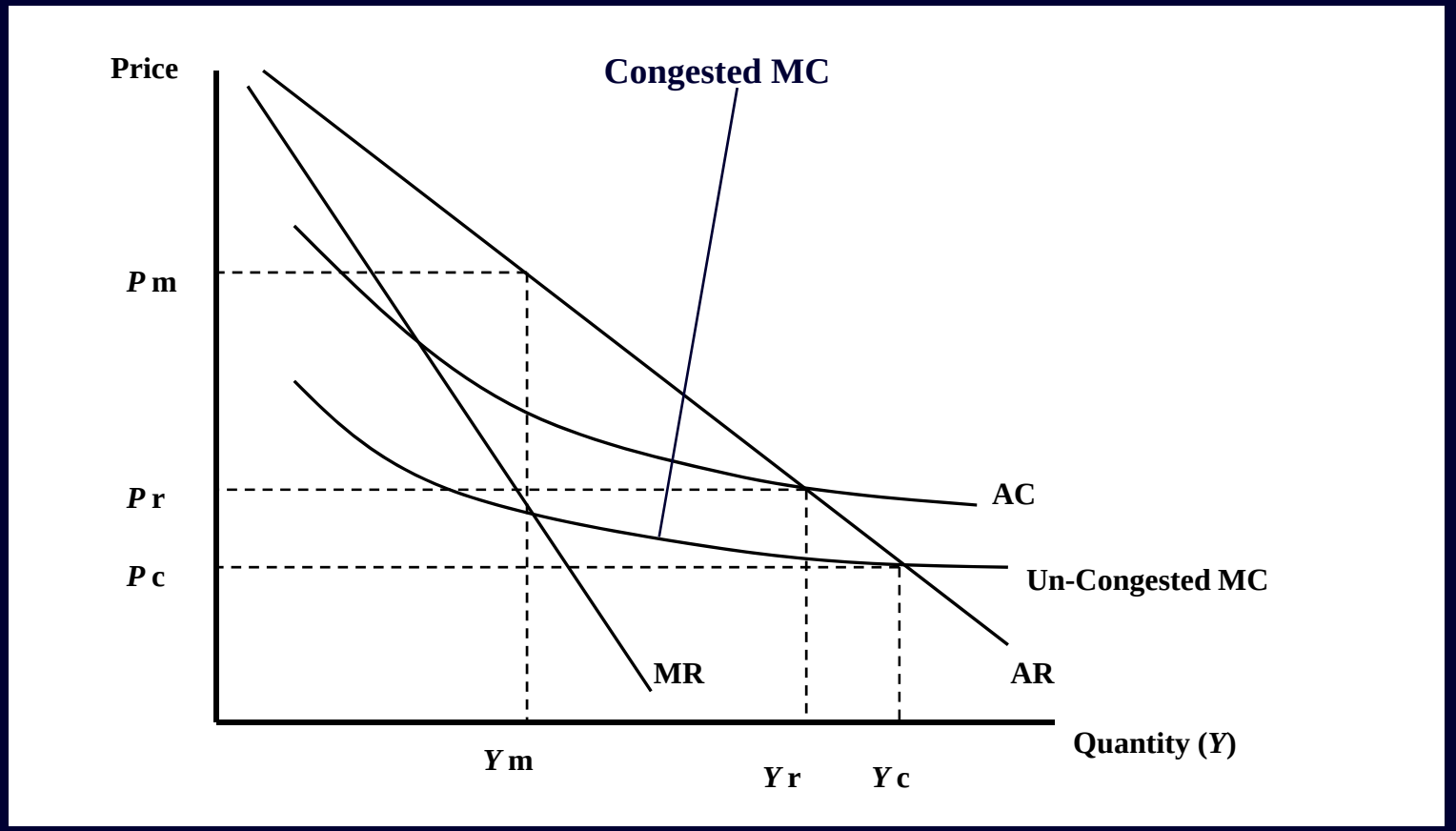
Cost Function for Transmission



A Picture of Natural Monopoly

(with congestion)

Economics of Production Cost

- The Production Cost economics for transmission systems isn't really very telling
- Economies of scale point to the building of the biggest lines—*but* smaller lines are consistently built
  - WHY?
- The economics of congestion costs would point to rapidly rising transmission pricing whenever there's a bottleneck—*but* most unregulated markets (which see bottlenecks) don't do that
  - WHY?
- The answer is that there is more to the economics of transmission than just the cost of production

Economics of Transaction Cost

- This is where the interesting economics is for transmission systems
- Grid elements (pipelines, high voltage wires) are “relationship specific assets”
  - They are no good by themselves without the generators/producers and users at either end
- The “relationship” presents opportunities for “hold-up” which either contracts, formal vertical integration, or regulation has to deal with
  - Oil pipeline use vertical integration
  - Gas pipelines used contracts for shipments
  - Electricity transmission used to use vertical integration, but now that link has been upset (with the FERC oversight of pricing)

Who Manages/Builds Electric Transmission Now?

- State regulators?
  - That is the link that's been broken in the new transmission regions
- Merchants?
  - Merchant transmission has worked splendidly in gas transmission
  - But gas transmission supports physical capacity that forms the basis for stable and highly predictable repayments of capital (some few highly dedicated electricity lines have such a property)
  - Financial transmission rights on the integrated grid cannot support finance—too quixotic and unpredictable a source of funds
- Regional planning and regulated cost allocations?
  - This is the regime that the various ISOs have inherited
  - It sounds sort of like the pre-open-access regime for gas pipelines

Pre-Open-Access Gas Pipeline Cost Allocation

- Prior to 1986, interstate gas pipeline companies allocated costs on a "pooled" gas supply network
  - Pipelines bought and re-sold the gas they shipped
  - Expansions met an "economic need" test before the FERC
- The pipelines themselves were not terribly concerned about the allocation schemes
  - It was the various customers, located in different places, that battled out the issues
- Various theories of cost allocation competed with one another:
  - Mcf/mile method
  - Zone-gate method

Added Complexity to "Pooled" Pipeline Cost Allocation

- "Commodity loading" of pipeline fixed costs
  - All sorts of reasons were advanced for this
  - Favored cold weather zones; stifled demand during the 70's shortage
- Measurement of "distance"
  - Distances were computed from a fixed point called a "centroid" (the geographic center of pipeline gas purchases on the map)
  - Centroids moved over time, or multiple centroids would appear (as in New England with LNG imports)
- The "New England Mcf/mile method"
  - A study in how a changing theory let New England gas consumers off the hook

Demise of Cost Allocation in Gas

- Since 1992, the cost allocation fights on the gas network have ceased
  - Pipelines no longer shipped their own gas (the “centroid” evaporated)
  - SFV (fixed-cost-loaded) rates removed the “volumetric” problems
  - “Incremental pricing” limited new construction cost to new capacity rights
- These changes and the secondary market mooted allocation fights
- None of these apply to electricity transmission
  - Except perhaps the removal of the “volumetric” problems

What Have "Allocation People" Always Done?

- Start from the end and work backwards.
- If equal volumetric rates don't work, try the next complication using objectively measurable criteria:
  - Add distance
  - Add fixed charges (reflecting that capacity is everything for transmission)
  - Add priorities of services (like firm and non-firm)
  - Etc.
- Sooner or later, there's nothing else that a "finder of fact" (not an economist or engineer) will accept as ***objective*** and ***reasonably fair*** to keep the pool going as an orderly regime

A Possible Way Forward

- Can Transmission Cost Allocation Escape "Just and Reasonable" Treatment?
  - "Contractualization" is not possible (except perhaps for the giant DC lines)
- How to Narrow the Scope for Contention
  - Seek out all forms of non-common costs for direct assignment
  - Avoid volumetric pricing: See about "capacity" and "distance" ("megawatt-miles" are probably reasonably objectively measurable—and reasonably stable over a large area)
- Grasp the "just and reasonable" nettle—it has worked before for pooled transmission costs

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