Competition in Electricity: Where Do We Go from Here?

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Agenda

Some General Economic Principles

Common Problems and Fundamental Causes

The Major Electricity Market Problems Worldwide

- Productive Efficiency: Defining/Pricing Grid Capacity
- Dynamic Efficiency: Paying for Peaking Capacity
- Allocative Efficiency: Reducing Retail Transaction Costs

Conclusions and Evaluation

The Not-So-Subtle Message

Competition in Electricity Has Had Real Benefits; But:

- It was easy to improve on bloated or bankrupt monopolies
- There have been problems everywhere, and more will emerge

The Key To Success Has Been and Will Continue To Be:

- Conscious design of centralized market, eg, pools
- A focus on the needs of consumers and producers, not middlemen

Improved Competition Will Require Markets in Which:

- Prices from dispatch-based markets reflect reality, SO THAT:
- It is safe to let competitive players make more of their own decisions and live with the consequences

Some General Economic Principles

Competitive Markets Require a General Framework of:
- Law and property rights that define the rules of the game
- Monopoly essential facilities, e.g., courts, roads, market places, …

Markets Can Efficiently Manage Scarcity Where There Are:
- Well-defined property rights in all significant scarce resources
- Practical ways to trade rights and/or price significant interactions

Where Rights/Markets Do Not Just "Happen", Society Must:
- Define property rights and/or develop pricing mechanisms OR
- Provide/Regulate monopolies to provide essential services OR
- Leave scarcity unmanaged as the lesser of evils

The Development of Competitive Markets

Economic History Is Largely the Story of:

- Common-property resources becoming scarce and "privatized"
- More sophisticated trading arrangements being developed

A Resource Can Become Property Only When:

- The amount and allocation of it can be clearly defined
- It can be defended and traded/priced in practical ways

Market Trading Can Be Efficient Only When:

- Unpriced effects (externalities) are small enough to be ignored
- Market-clearing Ps/Qs can be found without "too much" time/cost

Why Competition Came Late to Electricity

The Traditional "Natural Monopoly" in Electricity Is:
- Often attributed to scale economies in generation/transmission
- More due to inability to define property rights and clear markets

Technical Realities Make Rights and Markets Difficult
- Network externalities are pervasive and complex
- Production must equal consumption "instantaneously"

Efficient and Effective Competition in Electricity:
- Was not possible before modern computing and communications
- Has made great strides in the past fifteen years; but
- Still has a long way to go in theory, systems and institutions

Rights vs. Prices; Physical vs. Financial

A Single Issue Has Dominated/Distorted Debate:
Should Markets Be Based On:

Decentralized trading of "physical" rights to use scarce "capacity"	**OR**	Centralized pricing of physical effects with "financial" rights/hedges

This Should Be a Pragmatic/Empirical Question That Turns On Whether or Not "Physical" Rights Can Be Defined That:

Reasonably reflect actual physical constraints	**AND**	Can be efficiently traded in decentralized markets

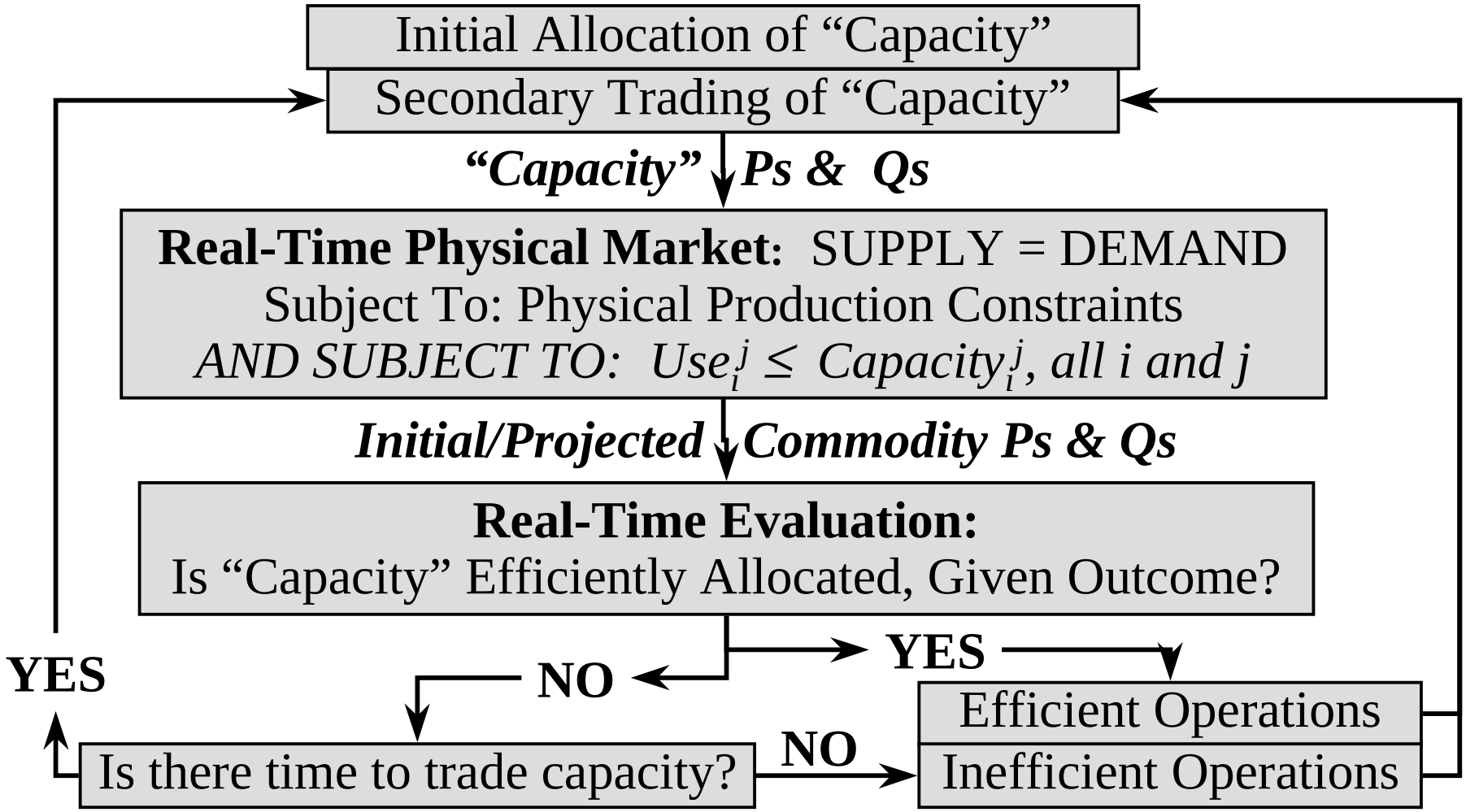
What Is the Real Difference/Issue?

In a Market Based on "Physical" Rights To Output/Capacity:
- Nobody can use output/capacity without prior agreement of owner
- Efficient Ps/Qs <==> Efficient *ex ante* trading of output/capacity

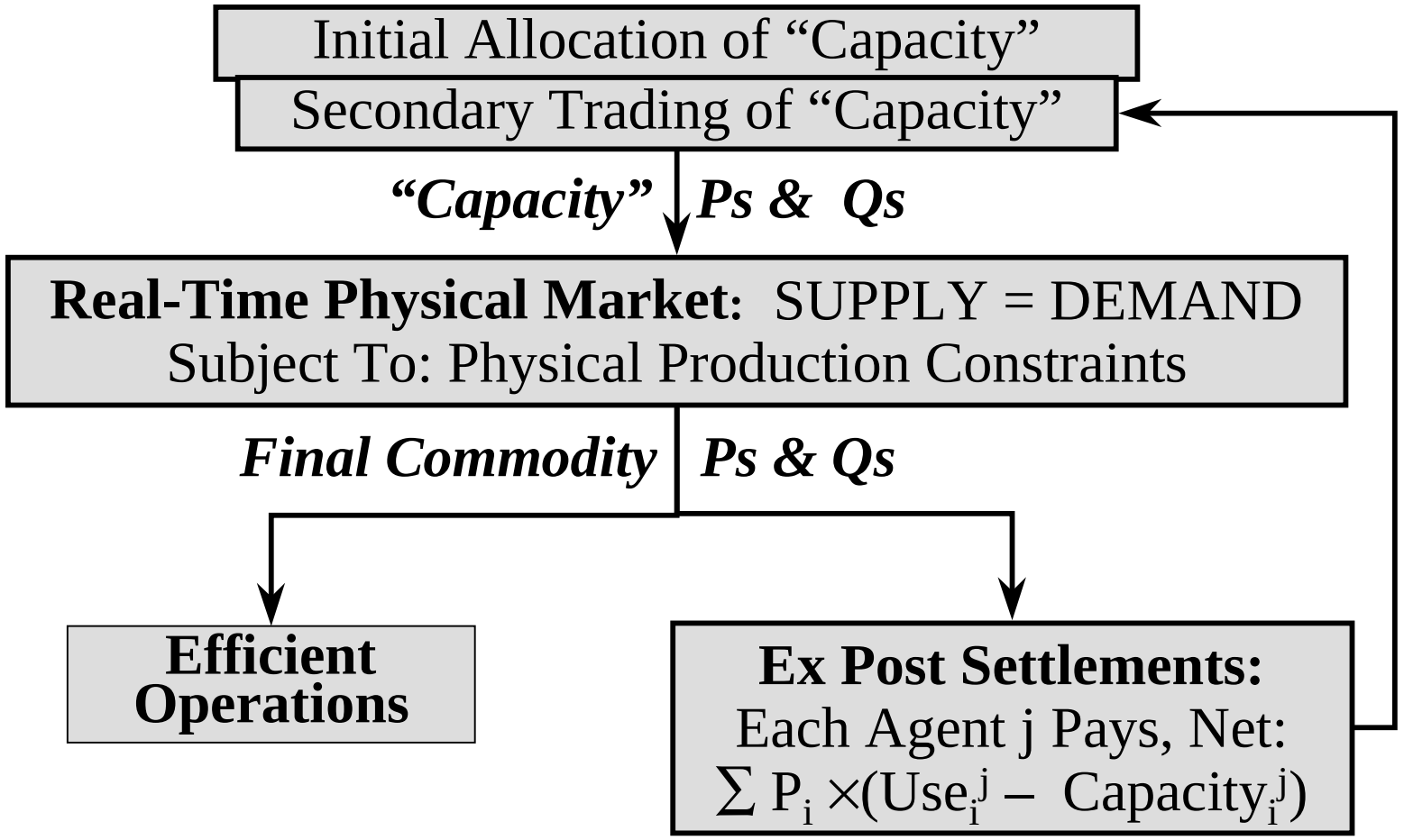
In a Market Based on Centralized Pricing & Financial Rights:
- Owners and non-owners alike bid to use physical output/capacity
- Central market finds Ps/Qs consistent with actual physical reality
- Non-owning users pay non-using owners the market-clearing Ps

On an Electricity System, Actual Physical Outputs/Capacities:
- Are not known in advance, depend on entire (constrained) dispatch
- Must be traded/priced centrally, with financial rights (e.g., CFDs)

Markets Based on Trading "Physical" Rights



Markets Based on Trading "Financial" Rights



The Fundamental Dilemma/Trade-Off

On an Electricity System:

- Decentralized trading of "physical" rights is not good enough
- Even centralized market clearing cannot solve all problems

If Markets Are Kept "Simple" When Reality Is Complex:

- Middlemen and traders may thrive, for a time
- But serious reliability and cost problems will emerge
- A monopoly -- NGC in E/W -- will have to assume more control.

If Markets Are To Push/Hold Back Monopoly:

- More, not less, sophisticated markets must be carefully designed
- Some of these markets must be integrated with system operations

Successes/Problems/Causes: Summary

Efficiency	Success	Problem	Causes
Productive	Lower Costs at Business Level	System Coord. & Congestion	Network Externalities
Dynamic	Generation Investment	Gen. Amount/Mix Grid Investment	Externalities, Slow Clearing
Allocative	Cost-Reflective Price *Levels*	Little Demand-Side Role	Transaction Costs

Causes of the Problems: Summary

Productive Efficiency/System Coordination Problems:
- Network externalities → Hard to Define/Enforce Property Rights
- Monopoly controls physical ops with little help from markets

Dynamic Efficiency/Investment Problems (Peaking Capacity):
- Markets cannot clear fast enough to compensate/penalize actions
- Monopoly sets/enforces/prices reserve requirements outside market

Allocative Efficiency/Demand-Side Response Problems:
- (Small) consumers do not get (want?) real-time price signals
- Costs involved in retail transactions can (but need not) be huge

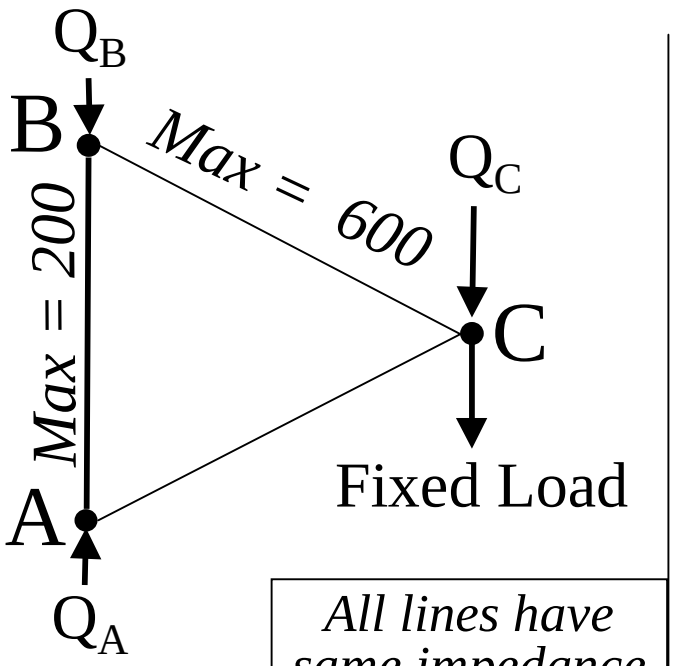
Productive Efficiency Problems: Congestion

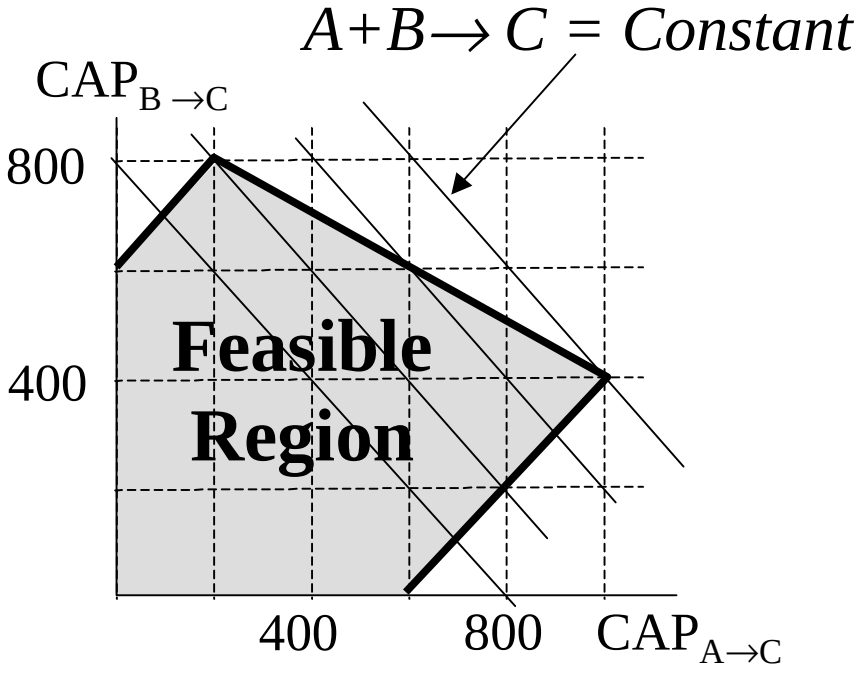
Competition Has Clear Benefits within Business Units
- Dramatic decreases in costs, increases in performance
- Innovative financing and commercial arrangements

But Network Externalities Will Not Go Away
- No way to direct power or to restrict physical access to the grid
- Transmission capacity depends on entire dispatch
- Energy/Transmission trading must be integrated with system ops

The Less Energy Pricing Is Integrated with Ops, the More:
- The monopoly ISO (eg, NGC) must interfere in the market
- Competition is inefficient and distorted (towards larger players)

What Is "The Capacity" At Any Place/Time?





Terms of trade between the transmission capacities A→C and B→ C cannot be known until the entire market solution (Q_A, Q_B, Q_C) is known, which depends on all transactions

Defining Transmission Capacity Rights

It Is Impossible to Define Transmission Capacity Rights That, Over Some Range of Likely Operating Conditions:

- Are consistent with physical constraints, AND
- Use the full capacity of the transmission grid, AND
- Can be traded in realistic decentralized markets

This Reality Creates an Unavoidable Choice Among:

- Pricing congestion/energy jointly in a central market
- Giving the grid operator the information, powers and incentives needed to manage congestion efficiently(?) as a monopolist
- Ignoring the problem and hoping for the best

Related Problem: Transmission Investment

Energy Prices that Do Not Reflect Constraints:

- Give no locational signals to generation and loads
- Provide no help for grid investment planning and payment
- Require a monopoly and/or regulators to make grid investment decisions and allocate their costs

Grid Investment Will Soon Become a Serious Issue

- Even overbuilt grids will start being congested
- There is no well-defined decision process in most places
- Monopoly obligations and desires will conflict with market
- Only Argentina (which uses locational pricing) has managed to get a "market-driven" grid investment started

Examples of Poor System/Congestion Pricing

California Split the Power Exchange from the ISO
- Congestion management is undefined, *ad hoc*
- Ancillary service costs are about 11 percent of energy prices

New England Power Pool Has No Locational Pricing
- ISO "solves" problems by forbidding new connections, in effect granting *nontradable* rights to incumbents
- New entrants want congestion pricing so they can buy in

Proposed E/W Pool Reforms May, Depending on Details:
- Reduce NGC's ability to manage congestion "efficiently"
- Provide no markets or rights that might help manage congestion

Worldwide Trend: Locational Energy Pricing

Economic Logic Clearly Requires Locational ISO Prices
- Value of energy depends on where it is relative to constraints
- ISO must price energy/congestion as integral part of dispatch
- Financial transmission rights (FTRs) can hedge price risks

Some Version Is/Will Be Used (Almost) Everywhere
- Chile "did it" in 1982, Argentina did it better in 1992
- Nordpool uses locational pricing when constraints arise
- New Zealand determines 600 nodal prices every hour
- OZ has different prices in state markets (with "hedges)
- PJM has sophisticated nodal pricing system (with FTRs)
- Even California uses zonal pricing in some (unclear) form

Dynamic Efficiency Problems: Preview

Investment in New (and Existing) Generating Capacity:
- Has been enough (too much?) in some cases, inadequate in others
- Is biased against peaking plants in all cases (e.g., Victoria)

These Problems Are Caused Primarily By:
- Inability to define/defend physical rights to power on a grid
- Inability to price energy every "minute" even centrally

Solution (As Always) Requires a Trade-Off Between:
- More (not less) sophisticated central system pricing
- More monopoly interference in the market

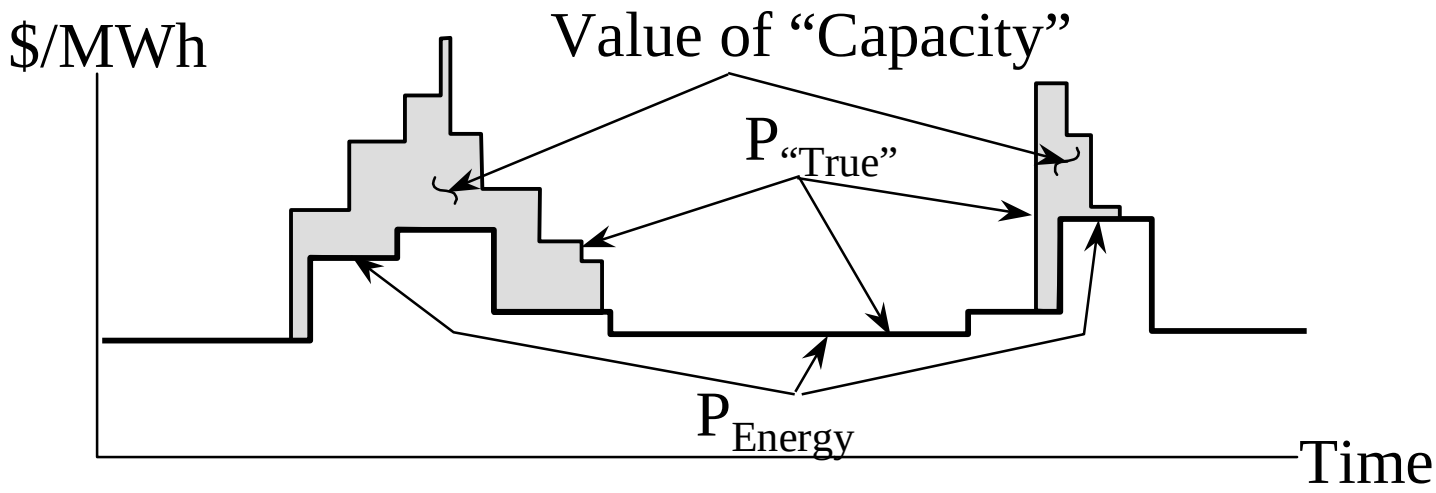
Dynamic Efficiency: Peaking Capacity

If the Market for Energy (MWh) Could Clear Every "Minute":
- The price ($/MWh) would be very high during critical minutes
- Seldom-used capacity/load management would be paid "enough"
- There would be no need for separate capacity or reserve payments

Decentralized Markets Cannot Possible Clear Fast Enough
- Cannot limit MWh to those with "rights" to energy generated
- "Rights" to energy cannot be traded fast/efficiently enough

Centralized "Hourly" MWh Markets and CFDs Help, But:
- Cannot price within-hour events ==> Need reserve payments
- Reserve payments keep energy prices below market-clearing

The Capacity Pricing Problem



How Can the Price Get "High Enough" at Critical Times?

- Cannot stop actual takes being > actual inputs on individual basis
- Can impose "penalties" (i.e., prices?) for excess takes above …?
- Can use "capacity adder" on energy price (e.g., LOLP*VoLL)
- Can let ISO/NGC pay for as much reserve as the market "needs"
- Can hope that "the market" will solve the problem somehow

Examples of Capacity (Pricing) Problems

Argentina, Peru, Chile, …: Non-Market Capacity Payment
- Payment set high to solve historic capacity shortages
- Excess capacity now appearing (mostly w/o contracts)

Victoria: Price Goes To VoLL Only After Lights Go Out
- (Large) reserve plant cannot cover its costs @ expected prices
- ISO has been directed to contract to keep reserve plant open

Alberta: Price Depressed by Reserves, VoLL ~£0.5/kWh
- Problem compounded by excess vesting contracts
- Critical shortage, with load being shed, no/little investment

Worldwide Trend: Recognition of Problem

Nobody Has a "Perfect" Solution to the Problem

- Relying on energy market alone has led to capacity shortages
- Administratively-set capacity payments have created surplus
- E/W system "works" -- due to LOLP*VoLL or oligopoly??

Various Approaches Are Being Proposed/Tried

- US: PJM, NYPP, NEPOOL imposing capacity requirements
- California: market-determined "standby reserve" price
- Nordpool and New Zealand: rely on hydro -- OK so far
- Peru, Argentina: considering annual auction of capacity contracts settled against hourly capacity prices
- E/W Pool reform: ?? rely on energy market, NGC payments??

Allocative Efficiency Problems: Preview

Consumer Benefits Are Primarily Lower Price LEVELS

- Large consumers can (and always could) use real-time prices
- For small consumers, costs of getting and responding to real-time price signals are (still) too high to justify much

Near-Term Objective: Competitive Energy Price Levels

- Prevent local distribution company (LDC) from capturing rents
- Make it easy for competitive retailers to offer risk-management
- Do not tie competition in energy to metering technology, etc.
- Do not spend huge sums on centralized settlement systems with no clear (or likely?) benefit to consumers

Allocative Efficiency: Transaction Costs

For Large Consumers, Spot Prices Provide Good Signals

- Transaction costs of metering, etc., are small part of total costs
- Consumers can respond to (actual or expected) spot prices
- Prices and supply (eventually) reflect consumer responses
- Little consumer response? Maybe it is not (yet) cost-effective!

Small Consumers Have Yet To Benefit from Spot Prices

- Local distribution company (LDC) controls access
- Competitive retailing can involve huge transaction costs
- Consumers can be *de facto* captives of LDCs who do not pass through benefits of wholesale competition or spot prices
- Costs of imposed centralized solution can outweigh benefits

Defining "Competitive Retailing"

Monopoly LDCs Should Not Be in "Competitive" Activities

- At least: Ring-fencing and arms-length dealing must be required
- Better: Complete separation of businesses

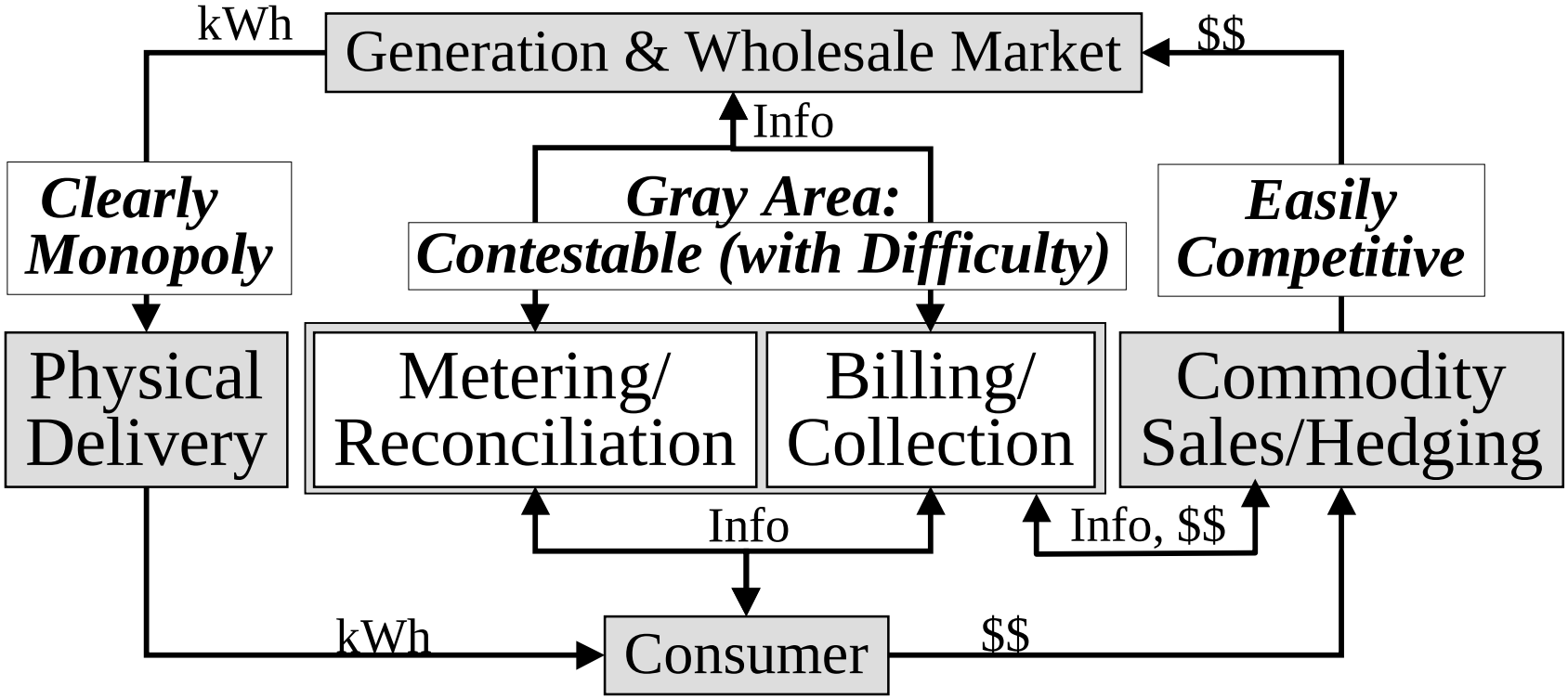
But If Natural Monopoly Functions Are Forced To Compete:

- Real economies of scope and scale may be lost
- The new "competitors" may become *de facto* monopolists
- The (small?) benefits of small-customer competition will be lost

A Proposal: Recognize the Competition/Monopoly Continuum

- Make competition quick, easy and cheap where it is natural
- Go slow where competition is unnatural, unproven, costly

What Is "Competitive"? What Is "Retailing"?



Why Link (Easy) Competition in the Commodity With (Difficult) Competition in the "Gray Area"?

Small-Customer Sales: How Easy Can It Get?

A Customer Has "Access" To the Wholesale Market If She:

- Gets physical energy delivered at reasonable (regulated) cost
- Pays the spot price for estimated (metered/profiled) takes

A Customer with Such "Access" Through Her LDC Has Many Choices (Most of Them w/o Interval Metering):

- Pay the average spot price on average, without looking/thinking
- Pay the LDC's spot bill and buy a "hedge" against the spot price
- Pay a competitive retailer to pay the LDC's spot price bill
- (If she thinks it is worth the cost and trouble) buy an interval meter and respond to hourly spot prices

A Fast-Start (but Long-Lived?) Approach

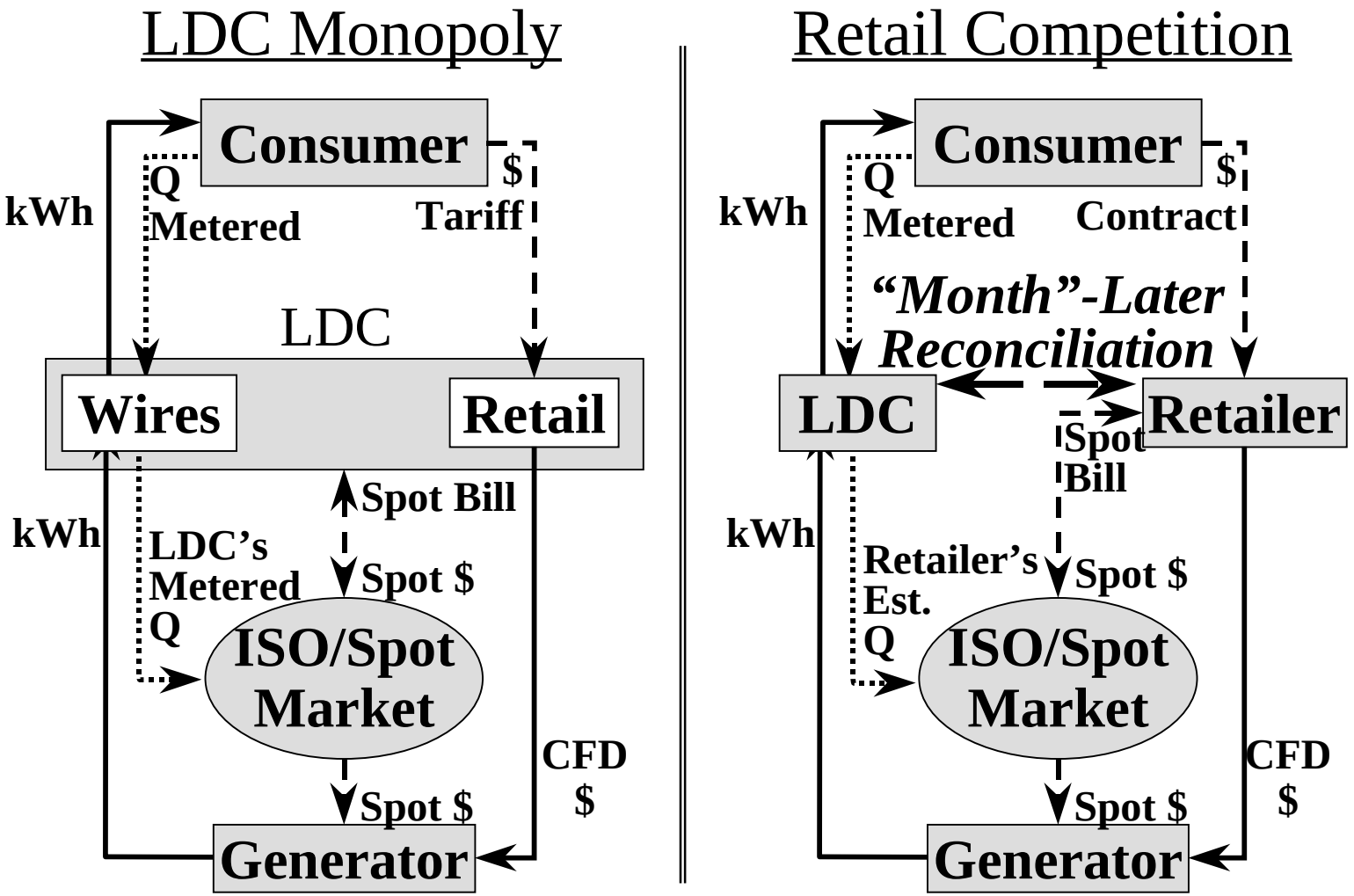
Require LDCs, in Their Regulated Delivery Business, To:

- Bill consumers for (metered or profiled) spot energy takes
- If asked by a consumer, redirect her bill to a qualified retailer
- Establish credit arrangements to protect against default risk
- Provide interval metering to those willing to pay for it
- Make intelligent "make or buy" decisions in "gray areas"

Such an Approach To Retail Competition:

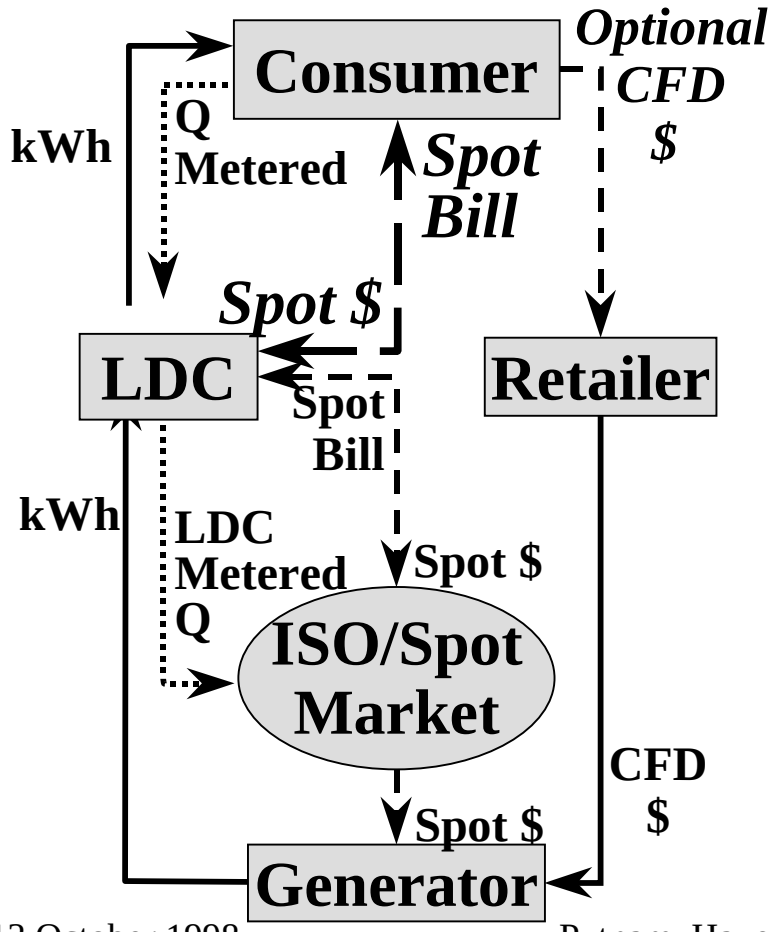
- Does not solve all problems; profiling, etc. is still hard
- Leaves the LDC in control of "gray areas" initially
- Makes retailing a highly competitive (low margin) business
- Gives consumers (relatively) fast/cheap wholesale access

Centralized Retail Settlement

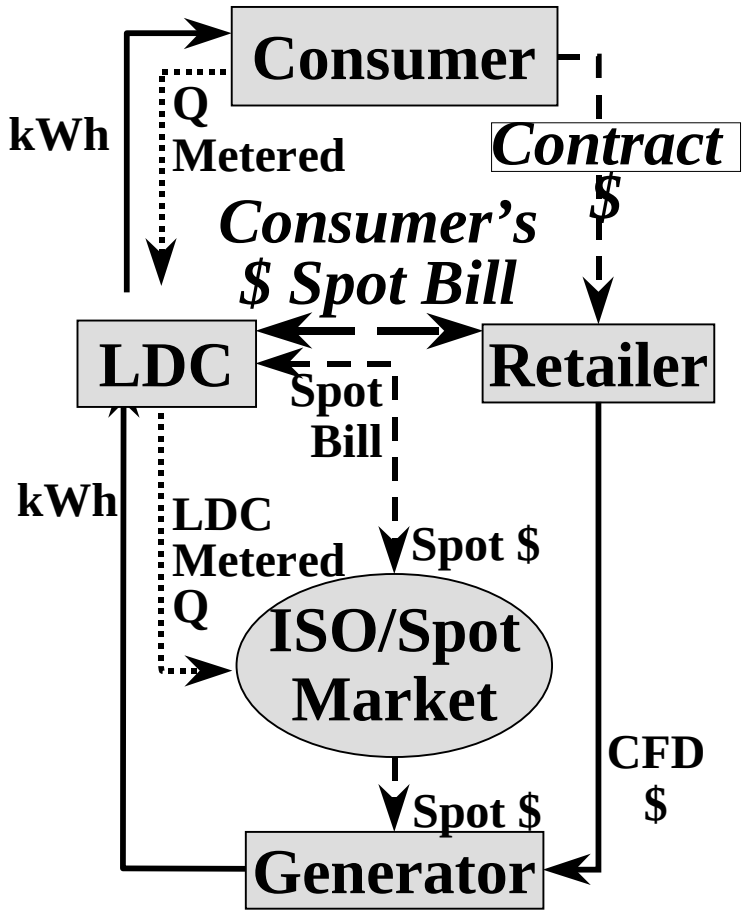


Decentralized Settlement

Spot-Price Passthrough



"Physical" Retailer



Status of Competition for Small Customers

Few Systems Have Begun Competition for Small Consumers
- Interval metering, central settlement are usually assumed
- Costs are seen to be too high relative to likely benefits
- Concerns about stranded costs are strong in US, Europe, Japan, ...

Where It Is or May Be Allowed, Progress Has Been Slow
- Norway may be an exception: Began early and seems to work well
- NZ: Legal, but metering standards and distcos block progress
- OZ: Studying, debating costs/benefits of settlement systems
- E/W: After £X00,000,000 and Y years, complex system "works"?
- California: Legal, but retailers (eg, Enron) find it hard to compete

Evaluation and Conclusions

Wholesale Competition Has Had Real Benefits "Everywhere"

- Monopoly control and cost insensitivity have been reduced in overbuilt systems
- Investment has been stimulated in previously deficit systems
- Costs have come down in competitive business units

"Pooling" Has Been a Key To This Initial Success

- Bilateral "physical" trading could never operate a complex system
- Centralized market clearing integrated with dispatch is essential

Improving on Bloated/Bankrupt Monopoly Is Easy, Initially. Problems Are Arising That Will Be More Difficult To Solve

Evaluation and Conclusions (Continued)

The Emerging Problems Have Fundamental Causes

- The residual monopoly assets and constraints are fading away
- It is difficult/impossible to define "physical" property rights that can support efficient market trading
- Sophisticated, centralized pricing/trading systems, integrated with dispatch, are necessary to deal with physical reality

"Simple" System/Energy Pricing of a Complex Reality:

- May create (temporary) competition among middlemen
- Will require more non-market monopoly control of operations
- Will not improve competition in the energy market itself