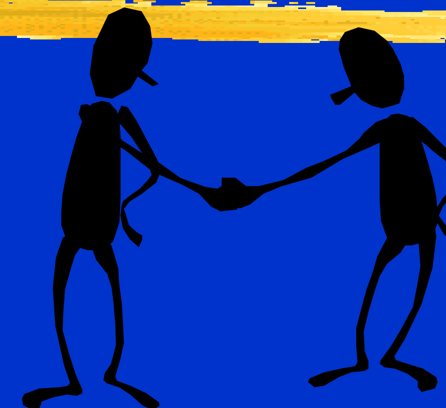
Property Rights and the Federal Power Act



Richard O'Neill
Federal Energy Regulation Commission
richard.oneill@ferc.gov

Harvard Electricity Policy Group
Cambridge, MA
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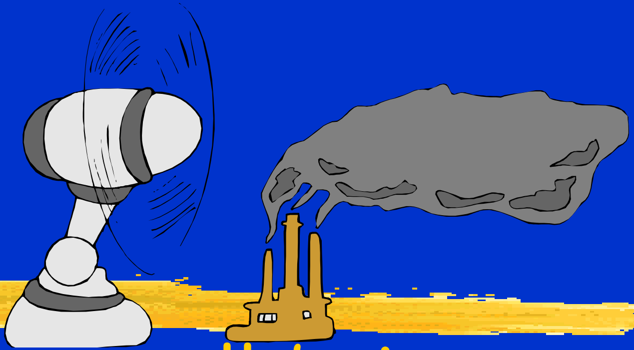
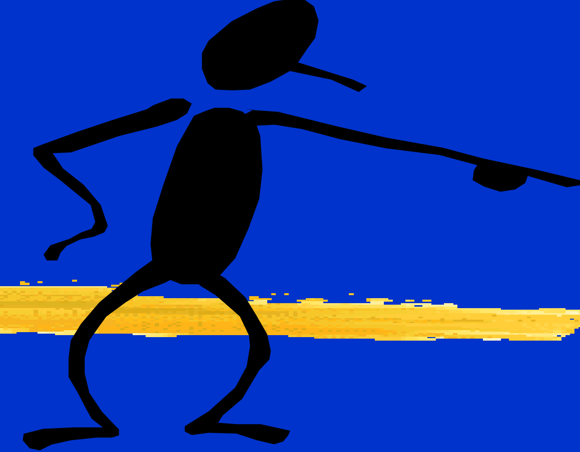
Views expressed are not necessarily those of the Commission

Externalities and competition

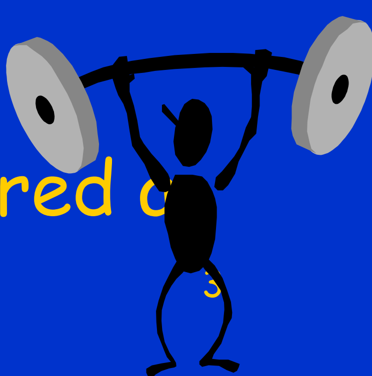


- An externality: whenever consumer well-being or a firm's production possibilities are directly affected by the actions of another market participant (MWG). This definition is broad
- Acceptable in competition:
  - business stealing and
  - 'creative destruction'
  - involuntary takings via eminent domain
- Unacceptable in competition:
  - excessive market power
  - Some dirty air and water (not FERC's problem)
  - uncompensated loop flow???

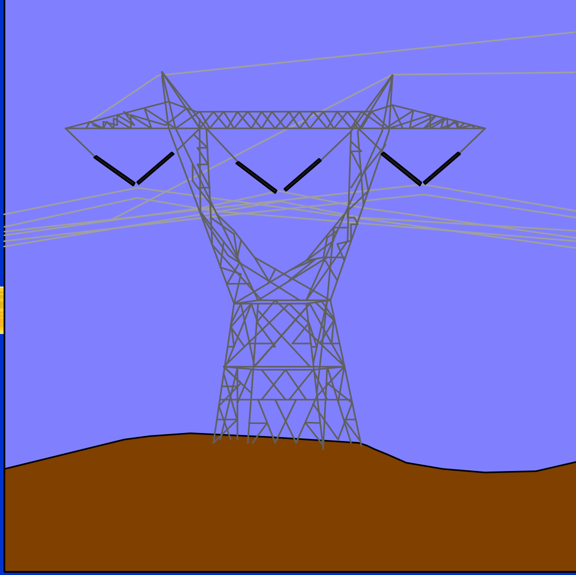
All markets are regulated the policy question is how?



- History: story of forced exchanges
- Economics: story of voluntary exchanges
- Property rights : contracts and common law
  - eminent domain
- Institutional rules: SEC, CFTC, DOJ, FTC, FERC,…
- Antitrust (monopoly): collusion; ex post
  - Does Nash behavior violate antitrust law? No or maybe
- **property rights and ‘unregulated’ markets**
  - no just and reasonable requirement
  - strong property rights
- the obligation to offer power would required a contractual commitment: a call option.



electric markets



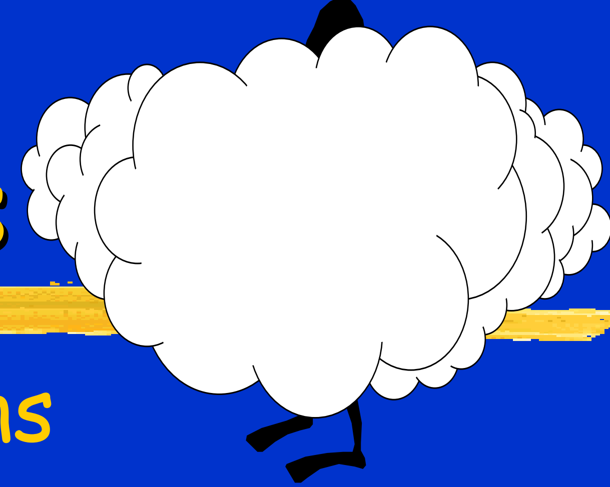
- Energy network markets begin with
  - eminent domain for right of way and
  - environmental externalities
- Entry is not easy
- Networks have large sunk costs; Investments are lumpy
- Electric network has unusual externalities
  - Kirchhoff's law and blackouts
  - reliability rules work against scale economies

- The electric culture
  - Because there is no effective demand response,
  - unpredictable events happen fast and response must be fast
  - we value the continuous supply of electricity,
  - measures are necessary to prevent market power

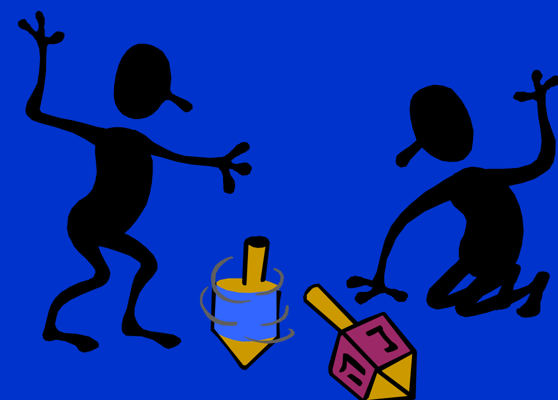
property rights and Federal Power Act

- **core mission** in **both** transmission and wholesales
  - **prevent** undue discrimination
  - **establish** just and reasonable rates
  - The law is Not optional
- Rate design
  - cannot be confiscatory (the opportunity to recover costs of efficient investments) and
  - must prevent monopoly rents
- Result: Weaker property rights
- No franchised monopoly!
- no explicit obligation to serve or offer!
- The analysis of market power has led to a loosening of regulation where market forces can play a greater role in disciplining the market.
- obligation to offer is a condition of the MBR authorization.

Unlearning Neoclassical Economics



- General equilibrium assumptions
  - Price takers
  - Continuous differentiability
  - convexity
- Nash equilibrium
  - omniscience
  - Mixed strategy for non-convexity
- Real world
  - Uncertain, discontinuous, non-convex, collusion



Who said this?

- "All exchanges regulate in great detail the activities of those who trade in these markets
- these exchanges often used by economists as examples of a perfect competition,
- It suggests ... that for anything approaching perfect competition to exist, an intricate system of rules and regulations would be normally needed.
- Economists observing the regulations of the exchange often assume that they represent an attempt to exercise monopoly power and to aim to restrain competition.
- an alternative explanation for these regulations: that they exist in order to reduce transaction costs
- Those operating in these markets have to depend, therefore, on the legal system of the State."

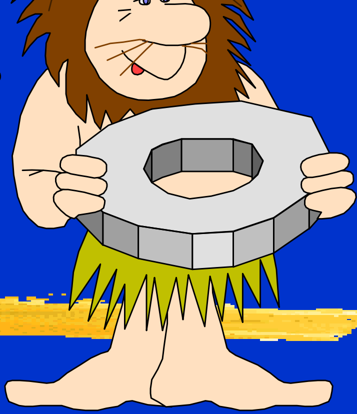
ISO markets

- Compensatory rates thru the market design.
  - must price all products
  - mitigate market power and
  - have good scarcity pricing.
- flaws and lumpiness require that 'out-of-market' actions
- should be priced into the market
- Last resort: RMR contracts may be necessary in certain situations

Dynamic Mitigation

- test for anticompetitive bidding
- scarcity prices for shortage conditions.
- allows highly sculpted supply offers.
- mitigates excessive bids
- better explanation just and reasonable prices.
- a rationale for not intervening in forward markets.
- Ex-post mitigation is often a very expensive and ineffective

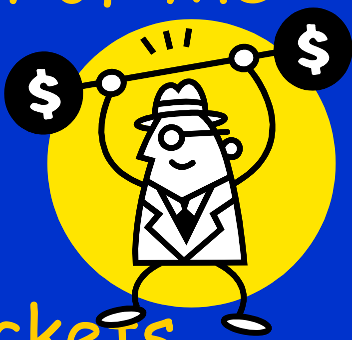
scarcity prices : use market power or demand curve



- conceptually different.
- The first sends mixed signals about the exercise of market power.
- during scarcity conditions, market power potential is great
- market power issues are
  - causing reluctance for some to join RTOs and
  - make the promise of benefits for joining more uncertain.
- Like Lucy and the football, the argument that it will not happen again is viewed with some degree of skepticism.
- Guard rails are necessary.
- absent actual demand response, the demand curve for reserves (a public good)
  - protects the bidder and
  - allows the resulting price to be justified as just and reasonable.

Merchant Generation Portfolios

- Irrational expectations
- Long-term contracts should have been part of the portfolio
- In excess capacity markets price signals should deter entry
- Lumpy investments, mitigation and load pockets

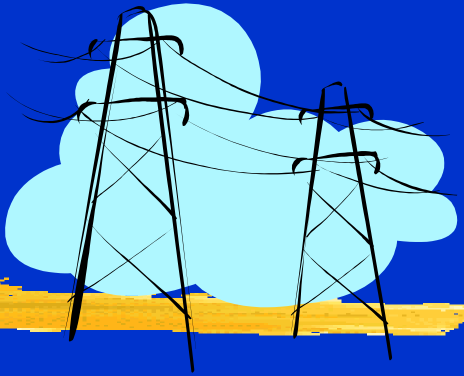


- Efficient Withholding
  - Demand growth: 50 MW
  - Lumpy generation choices: 30 MW
  - Marginal cost bidding is confiscatory
- what is efficient mitigation?

where are the HARD constraints? Reality has hills, but few walls

- System in N-? before blackout
- X% for operating reserves
  - X-ε is unreliable!!!???
  - X+ε is no more reliable!!!???
- Nominal transmission constraints
  - Thermal limits
  - Wear and tear: let the owner decide
  - Bid: X% of nominal for y hours
- Bid: a capacitor for a day or week

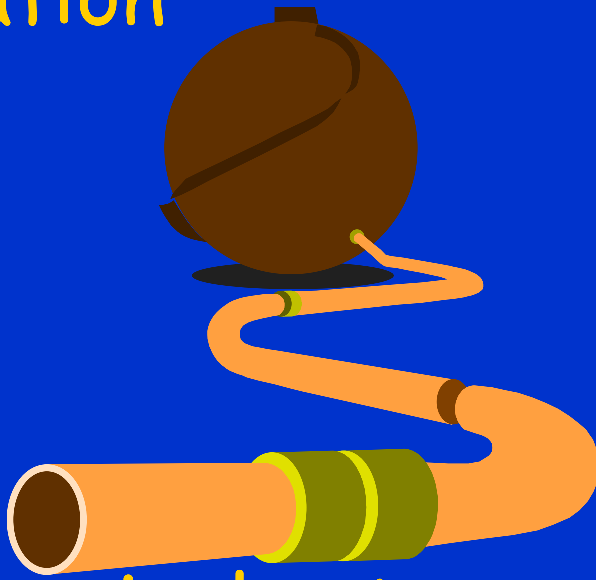
Network Investments



- Public good or private good?
- Congestion creates a private good
- Quasi public/private good
- Dispatchable transmission

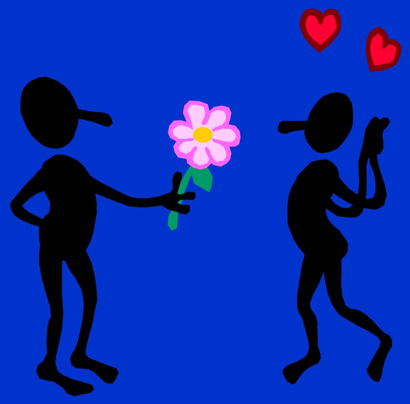
The gas pipeline 'merchant' model

- Open season (prior to construction) for a no undue discrimination determination
- Ex-post corrections are costly
- PCN: eminent domain
- Negotiated rates (contracts)
- Backstop rate: firm SFV rate
- Performance incentive: fixed nominal rates (RPI-RPI) with optional rate case
- Firm service creates virtual pipeline

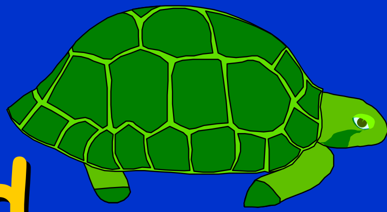


The electric transmission 'merchant' model

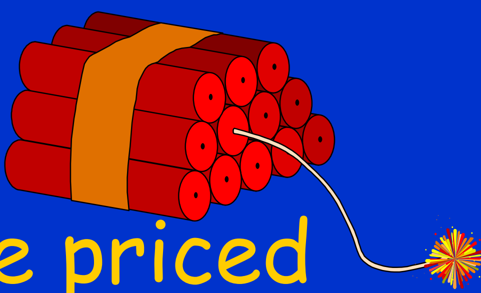
- Open season prior to construction for a no undue discrimination determination
- No PCN: no eminent domain
- Negotiated rates
- No backstop rate: firm SFV rate
- Rationale: relies on entry
- Lumpiness and the free rider
- Max reservation bid in DAM and RTM (now = 0)
- Firm service creates virtual transmission element



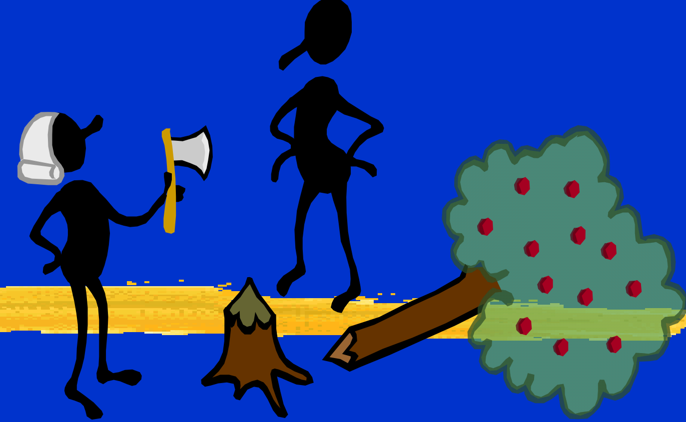
Transmission rights and liabilities are underdeveloped



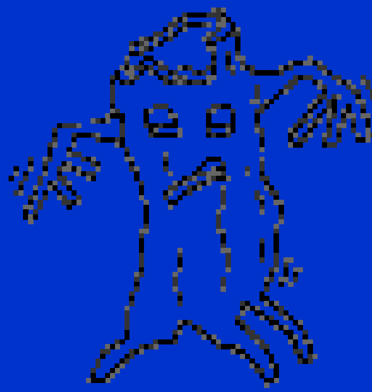
- Without physical failure: physical = financial
- with physical failure need priority rules
- obligations, options hybrids and granularity
- no withholding of capacity
- dormant secondary markets
- reliability markets: CBM should be priced
- Entry: Conn says no to Cross Sound!
- Admittance pricing on the margin



Liability standards



- Outages: unruly vegetation; trips by trees
- Customers now bear most of the risk
- No transmission liability insurance
- What should the standard be?
  - Negligence
  - gross negligence
  - willful misconduct
- Which describes Homer Simpson?



Active transmission providers

- Offer dispatchable transmission
  - forward markets
  - Real-time market
- Two-part tariff (similar to generation)
  - Option commitment price
  - FMP (thermal limit) and admittance price
- Sell FTRs and FGRs in forward markets
- FGRs can be traded offline
- X% of nominal for y hours
- Install a capacitor for a day or week

Dispatchable transmission

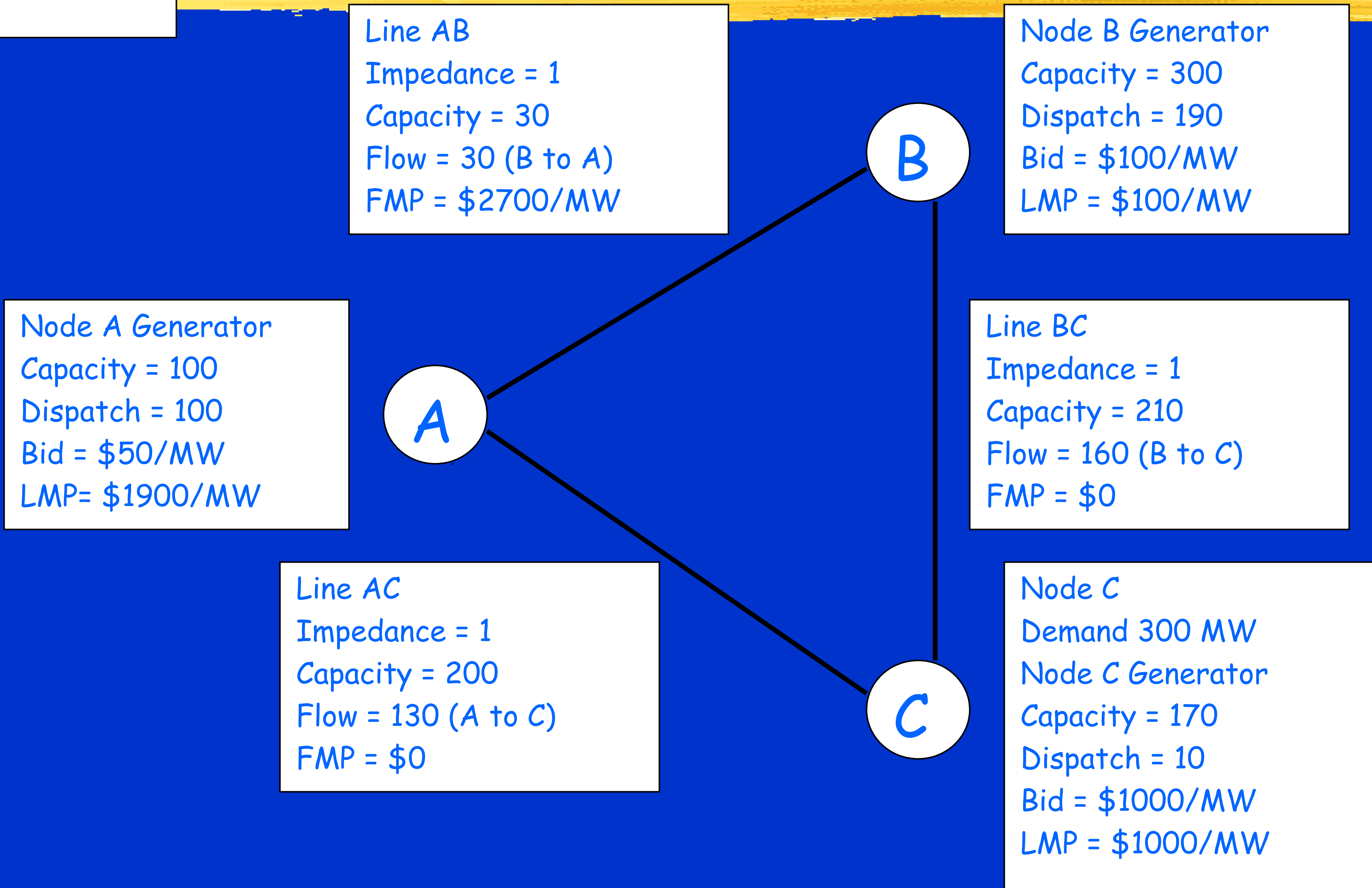
Node A
Generator 1: 90 MW
bid =$10/MW
Generator 2: 100 MW
bid =$20/MW

Flowgate AB
bid =$0/MW
capacity: 96 MW
bid =$5/MW
capacity: 10 MW

Node B
demand: 105 MW
bid =$10/MW
Generator : 100 MW
bid =$40/MW

Node/element	A		AB		B	
	dispatch	LMP	dispatch	FMP	dispatch	LMP
Without dispatch	96	$20	96	$20	9	$40
With dispatch	105	$20	105	$5	0	$25

What if one MW of thermal capacity on AB is offered to the market at $2000/MW?

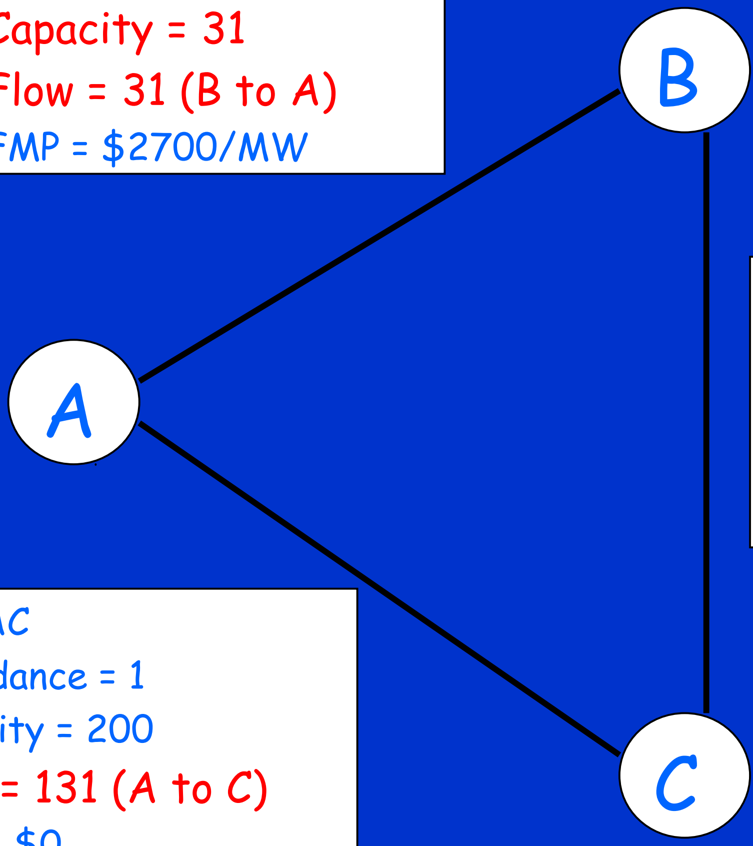


What if one MW of capacity on AB is offered to the market at $2000/MW?

Save $2700 in generation costs

Line AB
Impedance = 1
Capacity = 31
Flow = 31 (B to A)
FMP = $2700/MW

Node B Generator
Capacity = 300
Dispatch = 193
Bid = $100/MW
LMP = $100/MW



Node A Generator
Capacity = 100
Dispatch = 100
Bid = $50/MW
LMP= $1900/MW

Line BC
Impedance = 1
Capacity = 210
Flow = 162 (B to C)
FMP = $0

Line AC
Impedance = 1
Capacity = 200
Flow = 131 (A to C)
FMP = $0

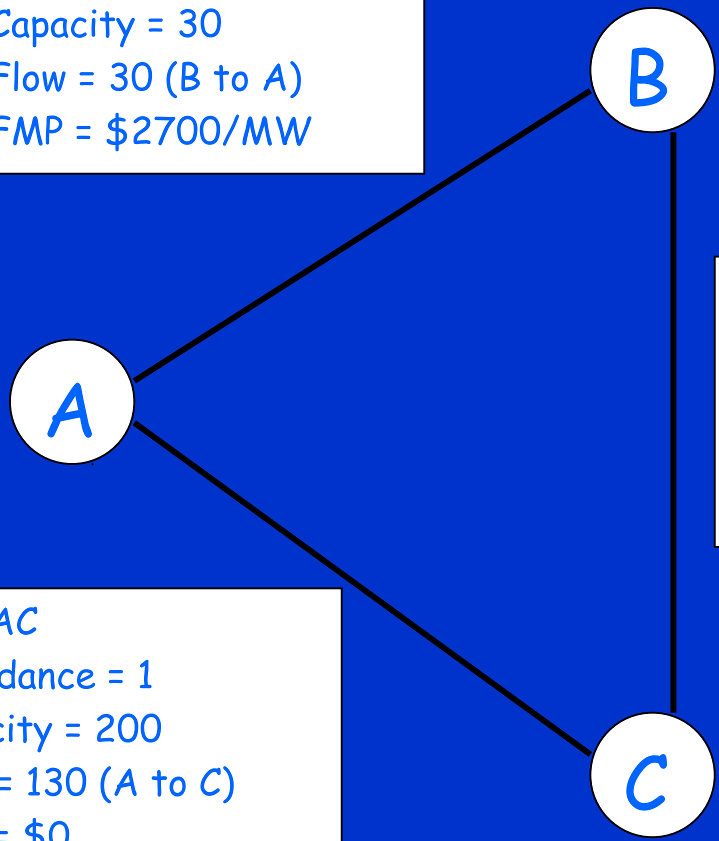
Node C
Demand 300 MW
Node C Generator
Capacity = 170
Dispatch = 7
Bid = $1000/MW
LMP = $1000/MW

The system is reliable without AB. What if AB was dispatchable?

Line AB
Impedance = 1
Capacity = 30
Flow = 30 (B to A)
FMP = $2700/MW

Node B Generator
Capacity = 300
Dispatch = 190
Bid = $100/MW
LMP = $100/MW

Node A Generator
Capacity = 100
Dispatch = 100
Bid = $50/MW
LMP= $1900/MW

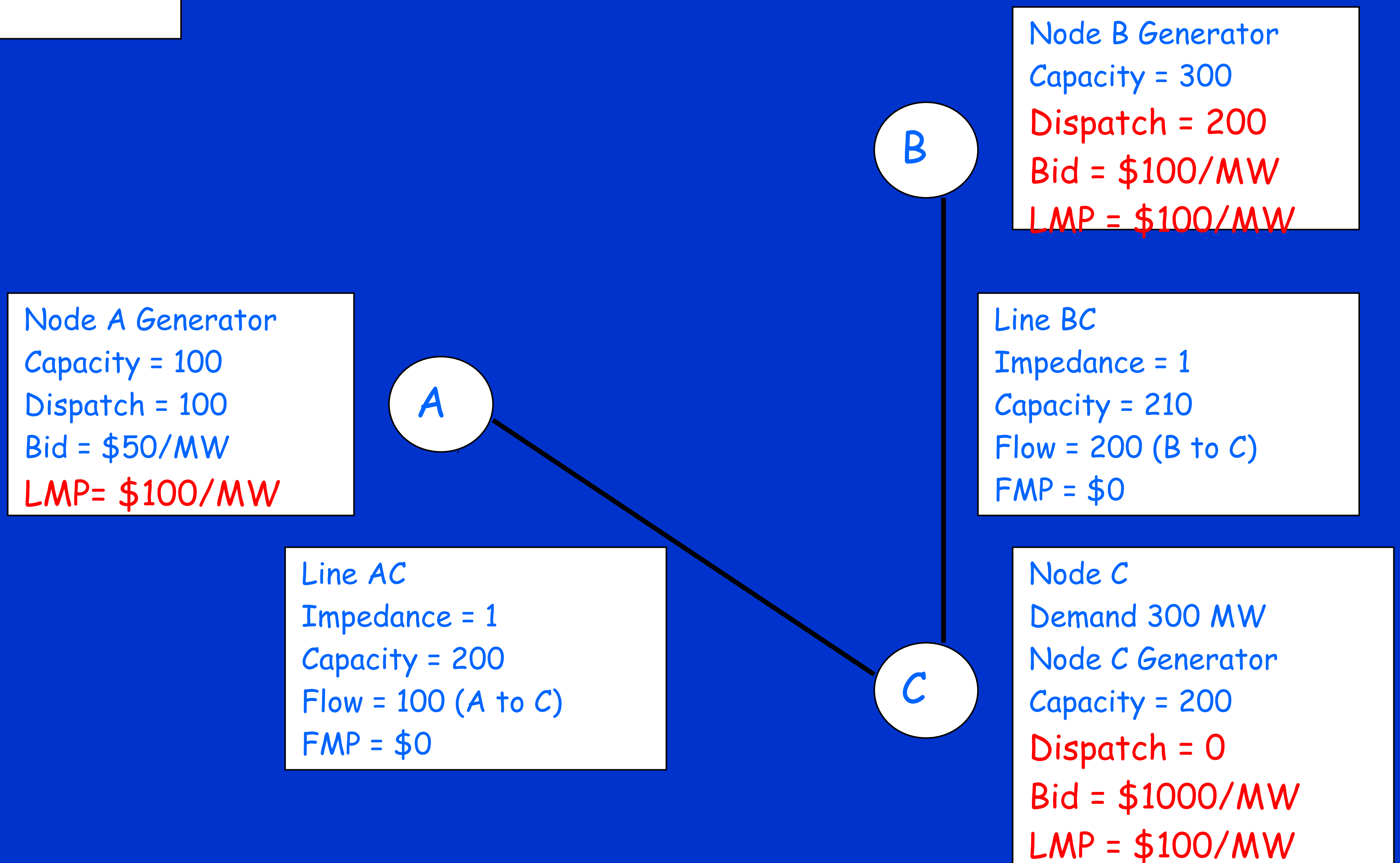


Line BC
Impedance = 1
Capacity = 210
Flow = 160 (B to C)
FMP = $0

Line AC
Impedance = 1
Capacity = 200
Flow = 130 (A to C)
FMP = $0

Node C
Demand 300 MW
Node C Generator
Capacity = 200
Dispatch = 10
Bid = $1000/MW
LMP = $1000/MW

What if AB was dispatchable? save $9000 in generation costs and load saves $170,000



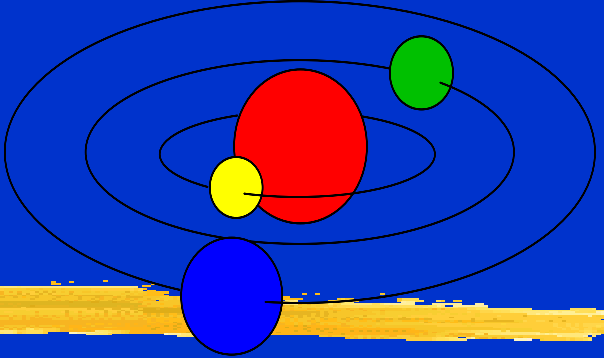
Reliable market design

- Reactive power pricing
  - Get incentives right
  - Price relative to real power
- Reserve pricing
- Admittance pricing
- Dispatchable transmission
- MIP opens up the modeling possibilities

Computational considerations

“perennial gale of creative destruction” Schumpeter

- 1996: LMP in NZ
  - 300 nodes
  - transmission constraints are manual
- 1990s: linear programs improved by 10^6
  - 10^3 in hardware
  - 10^3 in software
- 2000s: mixed integer programs already 10^2
  - Hardware: parallel processors and 64 bit FP
  - Software: ?
- New modeling capabilities in MIP
- 2006: 30000 nodes
  - 10000+ transmission constraints
  - 1000 generators with n-part bids



"Almost every generally accepted view was once deemed eccentric or heretical."

Everett Mendelson, Stephen Jay Gould, Gerald Holton and other leading scholars in a Supreme Court brief