The California Electricity Market:

What a long strange trip it’s been
Market Organization in California

- ISO operates but does not own the grid
  - Runs transmission market
  - Acquires ancillary services
  - Runs an ‘imbalance’ energy (spot) market
- Power Exchange (PX) runs day ahead and hour ahead energy markets
- Other firms also run energy markets in parallel to the PX
- IOUs will become (mostly) Distribution Companies
- All customers can ‘choose’ a supplier
  - But for now it really makes no difference
Transmission Pricing Models

• Fixed cost pricing models (cost recovery)
  – Contract path
  – Impacted MW mile

• Marginal cost pricing models
  – ‘Nodal’ models
    » Schewppe, et al., Hogan
    » New Zealand, PJM
  – ‘Path’ based models
    » Chao and Peck
    » California

• No price pricing models
  » Decentralized (Wu and Varaiya)
Point: PoolCo and the Nodal Pricing Framework

• Energy prices are set by ISO at various locations (nodes or zones)
• Transmission prices are implicitly defined as the difference between locational energy prices
• Price of power in one location equals
  
  System wide marginal generation costs
  + additional cost of congestion from injecting power at that location
  + additional marginal cost of losses from injecting power at that location
Counter Point: a Decentralized Model

• Goal is to avoid a poolco, minimize the economic decisions made by the ISO
• ISO must still enforce reliability standards and ration transmission where necessary
• Under full decentralization, ISO would randomly curtail proposed schedules and then allow firms to make deals to revise schedules
End Point: Path Based Pricing

• Adopted in California as a compromise between nodal and decentralized approaches
• Firms bid for use of transmission, rather than for the supply or consumption of energy
• Users pay uniform prices for transmission rather than uniform prices for energy
  – Nodal proponents argue that ISO is forced to ignore some inefficiencies in schedules
  – Decentralized proponents complain that they are forced to use a confusing process administered by the ISO
Current California System

- Firms submit energy schedules to the ISO
  - There is a day-ahead iteration to this process
- Schedules can include ‘adjustment’ bids for reducing supply or increasing demand in a zone
  - SCs do not *have* to submit adjustment bids, but risk high prices if they do not
- ISO adjust schedules using these bids in order to relieve congestion at least cost
  - These adjustments must be ‘balanced’ - cannot swap adjustments across schedule coordinators
  - ISO can only adjust when schedules are infeasible, it must stop adjusting once feasibility is reached
Firm Transmission Rights

• How to mesh FERC order 888 and nodal or path based pricing?
• Firms want cost certainty in transmission
  – Some firms also do not want to submit adjustment bids
• Financial vs. Physical Rights
  – Concern over withholding of physical rights
• How many rights should be issued?
  – Market power concerns
  – Incentives to submit adjustment bids
  – What about loop flow?
Ancillary Service Markets in California

- Very disaggregated
  - Hourly markets for four services
  - Limited demand flexibility
- Not enough suppliers
  - Physical constraints
  - Geographic limits
- Conflicting Incentives
  - Asymmetric regulation of suppliers
  - RMR contract distortions