Centre for Energy and Environmental Markets

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# Texas Nodal Electricity Market: Critical evaluation

*Hugh Outhred, "ERCOT Energized" Workshop*
*University of Austin, Texas, 2 May 2008*

# The electricity industry design challenge

- *Overarching objective:* to design, implement & then improve a "decision-making framework" that:
  - Appropriately allocates tasks to all industry decision-makers, with appropriate incentives & penalties
  - Delivers socially-beneficial future outcomes:
    - Evaluation & management of short- to long-term risks
    - Location-aware & can satisfy both public & private interests
- *Process objective:* implement processes that can:
  - Achieve an initial design that is adequate:
    - Consistent with long-term goal & auditable
  - Deliver sound implementation of the initial design
  - Improve the decision-making framework over time

# Critical issues in electricity industry design

- Governance & rule-change process:
  - On-going, forward-looking, monitoring & enhancement
- Temporal risk management:
  - Coherent framework from very short to very long term
- Primary energy flow-constraint risk management:
  - Wind & solar energy, natural gas
- Locational risk management:
  - Systematic combination of market representation & regulated network services
- Active end-user participation:
  - To integrate time-varying value of energy services

# Decision-making framework for a restructured electricity industry (EI)

| | |
|---|---|
| Governance regime | ▪ Formal institutions, legislation & policies<br>▪ *Informal social context including politics* |
| Security regime | ▪ Responsible for core integrity on local or industry-wide basis, with power to override |
| Technical regime | ▪ Engineering design to allow industry components to function as single, industry-wide machine when connected together |
| Commercial regime | ▪ Decentralised decision-making according to commercial criteria within a market context<br>▪ Includes formally designed markets<br>▪ *Needs adequate competitive pressures* |

# ERCOT initial design & its limitations

(Shmuel Oren, ERCOT energized symposium presentation)

- Zonal market (4 zones):
  - May be ok if each zone is near supply-demand balance, has few internal constraints & limited market power
  - Otherwise both 4 zones & nodal market replacement risky without active demand-side participation
- QSE bilateral schedules with balancing offers:
  - May reward market power that can create consistent offset between bilateral position & real-time dispatch
- Consistent over-scheduling: generation in South Zone & load in North Zone
  - May indicate ability to exploit arbitrage between bilateral trading & real-time market

# Texas nodal market design principles
(Shmuel Oren, ERCOT energized symposium presentation)

- Continue bilateral energy & ancillary services markets & allow self-arrangement - financially binding after DAM
- Continue ERCOT operated market for real-time energy & ancillary services with possible self-provision of A/S
- Voluntary day-ahead energy & ancillary services market with bid-based security constrained unit commitment & co-optimization of energy & reserves, based on 3-part offers
- Resource-specific offer curves
- Energy settlement for generators & congestion management based on nodal prices; zonal pricing for loads
- Point-to-point CRRs auctioned subject to simultaneous feasibility test with auction revenue returned to load; longer-term transmission rights

# Continue bilateral energy & ancillary service markets & allow self-arrangement - financially binding after DAM

- Self-scheduling or bilateral contracting of energy & ancillary services may not maximize economic efficiency:
  - May not respect network flow constraints & so may reward market power & act as a barrier to entry
  - Will not reflect short-term uncertainty in non-storable primary energy resources such as wind energy
- Security management made difficult by bilateral trading:
  - ERCOT will have limited notice of any shortfall in obligations or flow constraint violations
  - ERCOT may have to manage short-term wind energy fluctuations
  - What is the trigger that will allow ERCOT to intervene?
  - What resources should ERCOT hold in reserve for this eventuality?
  - Who should pay & how much?

# Continue ERCOT operated market for real-time energy & ancillary services with possible self-provision of A/S

- Real-time market is the only “physical” market in the Australian NEM:
  - Australian NEM solves for energy & frequency-control ancillary services (FCAS) in co-optimized 5-minute dispatch markets
  - Avoids distortions that might arise from other prior physical decision-making processes in the Texas Nodal Market:
    - eg bilateral trading, DAM, DRUC, HRUC
- Centralized unit-commitment shifts risk from plant owner:
  - Removes important discipline against exercise of market power
- Self-provision of A/S may not be economically efficient:
  - Co-optimized energy-FCAS markets should be more efficient & robust

# Voluntary day-ahead energy & ancillary services market with bid-based security constrained unit commitment & co-optimization of energy & reserves, based on 3-part offers

- Why have a day-ahead market?
  - If purely financial, better to structure as CfDs & call options
- Why have centralized unit commitment?
  - Commit/de-commit decisions should be left to plant owners
  - Risk of unintended de-commitment is important discipline on the exercise of market power in Australian NEM
  - Important on-day risks may then be socialized rather dealt with in commercial regime
  - Who will carry wind-forecasting risks/rewards?

# Energy settlement for generators & congestion management based on nodal prices; zonal pricing for loads

- Real-time nodal energy markets can't avoid generation/load mismatch at some or many nodes:
  - Requires network-based arbitrage between nodes to achieve overall supply-demand balance:
    - Should use resource-specific offers & network marginal losses
  - Will result in local rationing price when node(s) where load exceeds generation become constrained
    - Zonal pricing for loads will suppress load participation
- A low price cap is not a good way to control market power in real-time nodal energy markets:
  - Creates a barrier to entry to local generation or active demand
  - Better to facilitate use of call options & distributed resources

# Point-to-point CRRs auctioned subject to simultaneous feasibility test with auction revenue returned to load; longer-term transmission rights

- Inter-regional congestion revenues auctioned in the Australian NEM (similar to CRRs):
  - Payout exceeds auction revenue on average
- Point-to-point CRRs don't provide perfect hedge:
  - Nodal arbitrage revenue subject to flow constraints
  - Simultaneous feasibility test may restrict quantity
- CRRs are not a substitute for peaking capacity close to load or price-responsive load
- Longer-term transmission rights & bilateral trading may strengthen market power

# Summary of issues

- Use a systematic approach to design a coherent & effective decision-making framework
  - Governance, security, technical & commercial regimes
- Nodal market design features to reconsider:
  - Bilateral energy trading & day-ahead market may reward market power
  - Self-provision of ancillary services may be inefficient
  - Central unit commitment shifts risk from plant owner
  - Zonal pricing for loads will suppress load participation
  - Low price-caps may create barriers to entry to local peaking capacity & distributed resources
  - CRRs cannot substitute for peaking capacity close to load or active load participation

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