

# Case Studies from the UK

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# Topics

- Initial market design
- Price formation
- Demand in the Pool
- Constrained-on (Reliability Must Run) Plant
- Profiling for retail competition
- Pressure for reform

# Initial Market Design: Objectives

- Establish trading place for virtually all power sales
  - There would be little vertical integration
- Level playing field
- Retain merit order
- Get it done!

# Failed Attempts

- Bilateral contracts plus two Pools
  - Generators and buyers swap contracts among themselves to restore merit order in actual operation
- Unified Energy Pool plus Capacity Tickets
  - What happens when they run short?
  - Fears of “junk generators”

# The Answer (?)

- “Truly Unified Pool”
- Single Price with two components
  - Energy
  - Capacity
- No free riding

# Most Pool Trades are Hedged

- Contracts for Differences
- Buyer pays (Strike price - Pool price)  
on a fixed quantity
- Can remove most price risk
- Still gives price signals

# Price Formation - Objectives

- Retain merit order
- Ensure generators would accept dispatch
- Get it done on time

# Solution

- Use existing software, where possible
- GOAL was the CEGB's scheduling LP
- Used start-up, no-load, 3 running rates and dynamic constraints
- Change inputs from costs to prices

# Operating procedure

- Stations submit bids by 10 a.m. day ahead
- NGC runs GOAL
  - optimises operation for 48 hours ahead
  - issues provisional schedule and half-hourly prices for the next day by 4 p.m.
    - suppliers may fax prices to customers
    - prices published in the *Financial Times*

# Energy Price formation

$$\text{Price per MWh} = \frac{\text{Total cost of running episode}}{\text{MWh generated}}$$

$$\begin{aligned} & \text{Start - up price} \\ & + \text{no - load} \times \text{length of run} \\ & + \text{running rates} \times \text{output} \\ = & \frac{\quad}{\text{MWh generated}} \end{aligned}$$

- Most expensive station in normal operation sets price
- Ensures generators cover costs
  - “No regrets”
- Payments based on unconstrained schedule
  - GOAL ignores transmission constraints
- Station’s own bid used to settle deviations from schedule
  - transmission constraints
  - demand changes
  - generator errors

# Pros and cons

- Could be made to work quickly
- Generators willing to follow dispatch
- Link between bids and prices is obscure
  - GOAL is a “black box”
- Average, not marginal, costs used
- Almost no demand side participation

# Price Spikes

- GOAL chooses high-cost plant
  - Bigger problem in the past with GOALPOST
- Sensible choice of plant gives high prices
  - Price setting rule is imperfect
- GOAL can't cope with crazy bids
  - Station asked to do the impossible
  - GOAL let it try and set a price of £865/MWh

# Capacity Payments

- Calculates Loss of Load Probability using
  - Maximum Availability over previous 8 days
  - Historic Outage rates
  - Demand forecast and variability
- Value of Lost Load set by Government
  - indexed, hard to change (downwards)
- Payment is LOLP (VOLL - SMP)
  - net value of capacity

# Pros and Cons

- Efficient signal for availability
  - at least in theory
- No free riding on capacity costs
- Variable
- Peaks seen as excessive

# Other costs - “Uplift”

- Deviations from Schedule
  - payments based on bids
- Reserve
- Ancillary Services
- Capacity payments to unscheduled plant
- Spread across all non-trough output

# Pros and Cons

- Simple recovery mechanism
- Only one auction - reduces market power
  - Exception is newish market for reactive power
- No geographic signals

# Must-run Generation

The problem:

- Grid constraints limit dispatch choices
  - Thermal limits
  - Voltage limits
- Some stations have no local rivals
- These could charge high prices

# Other solutions

- Contracts with customers for demand reduction
- Investment in transmission system
  - May need some financial incentive
  - NGC shares savings against a target cost level
  - “Ratchet effect” implies multi-year agreement gives the strongest incentives

# Demand in the Pool

- NGC base forecast on weather and the past
  - includes any past response to prices
- Not allowed to consider explicit response to prices
- A few demand-side bidders
  - large customers treated as “negative generation”
- “Only half a market”

# Demand-side bidding

- Customers bid demand reduction blocks
- They don't pay capacity charges when they are scheduled to take demand
- NGC tells them when to self-dispatch the reduction
- Monitoring is somewhat imperfect
- No-one likes this scheme
- Can't agree on a better one

# Profiling for retail competition

- Large customers have half-hourly meters
- Impractical for small customers
- Need to “profile” their demand
  - How much were they deemed to take in each half-hour?

# The problem

Cust. 1	X	X	X	X	X
Cust.2	X	X	X	X	X
Cust. 3	X	X	X	X	X
Total	S	S	S	S	S

# Two Methods

- “By the customer”
- “By the half-hour”

Cust. 1	X	X	X	X	X	
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Cust.2	X	X	X	X	X	
		└──────────────────┘				
Cust. 3	X	X	X	X	X	
			└──────────────────┘			
Total	S	S	S	S	S	

# E&W Approach

- “By the half-hour”
  - The Pool must balance financially
- Eight different profiles
  - Two domestic, six non-domestic
    - Existing tariffs assume different load factors
- Give relative consumption at different times
- Re-run program several times over 2 years
  - New meter readings imply different customer shares

# Profiles have many critics

- Not as accurate as meters
- Won't give time of day signals

But...

- Its very hard to get a significant error
  - Law of Large Numbers
- And its what we've used for 100 years!

# Pressures for Reform

- “Prices are too high”
- “Because all generators get the same”
- “Pool discriminates between generators”
  - Some submit zero bids but still get high price
- Government asked regulator to review

# Regulator's proposals

- Accept accusations of bias
- Replace Pool with bilateral markets
- Long-term, day-ahead
- Traders inform grid of positions
  - grid has to dispatch them if possible
- Balancing market with grid in final 4 hours
- This also settles physical imbalances ex post

# Will this help?

- Not in my opinion
- “Bias” is due to bilateral contracts ignoring price signals in the Pool
- “Pay-bid” will just make bids converge to “the going rate”
  - Little reason for average bid to fall
- Risky, non-transparent market deters entry