Importance and Evolution of Forward Markets in Electricity

ISCR Conference Wellington

Paul Quilkey
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“…forward prices also comprise the most vital decision parameters when planning energy linked projects.”

‘Managing Energy Price Risk’
Perspective

- Electricity market deregulation commenced in the 1990’s
- Geographies evolved at different rates as a function of market design and market attributes
- Credibility of electricity markets damaged by Enronitis
- Electricity markets evolved and regressed in a short period of time – part of a natural cycle
- Electricity price risk management is as new as the market itself
- Fundamental to price risk management is the concept of a forward market
When is a Market a Market?

Term is often misunderstood and misapplied in electricity.

Characteristics of a market:

- Multiple buyers
- Multiple sellers
- Hedgers and speculators
- Relatively low barriers to entry
- Set of consistent rules and contracts
What is a Forward Market?

- A forward contract is a bilateral agreement between a buyer and seller to execute a trade at some date in the future.
- Buyer and seller agree on the quantity and price of the commodity or instrument to be traded.
- Difference between a forward and spot transaction concerns the timing of the trade.
- Forward markets have been around for centuries and many basic sales agreements can be viewed as types of forward agreements.
- Forward contracts are fundamental to financial markets.
Why is a Forward (and Futures) Market Important?

- Price and volume risk management
- Credit risk management
- Transparent price signals
- Appropriate long-term investment
# Challenges with Electricity

<table>
<thead>
<tr>
<th>Issue</th>
<th>In Financial Markets</th>
<th>In Energy Markets</th>
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<tbody>
<tr>
<td>Maturity of market</td>
<td>Several decades</td>
<td>Relatively new</td>
</tr>
<tr>
<td>Fundamental price drivers</td>
<td>Few, simple</td>
<td>Many, complex</td>
</tr>
<tr>
<td>Impact of economic cycles</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Frequency of events</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Impact of storage and deliver; the convenience yield</td>
<td>None</td>
<td>Significant</td>
</tr>
<tr>
<td>Correlation between short and long term pricing</td>
<td>High</td>
<td>Low, ‘split personality’</td>
</tr>
<tr>
<td>Seasonality</td>
<td>None</td>
<td>Key to natural gas and electricity</td>
</tr>
<tr>
<td>Regulation</td>
<td>Little</td>
<td>Varies from little to very high</td>
</tr>
<tr>
<td>Market activity (‘liquidity’)</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Market centralization</td>
<td>Centralized</td>
<td>Decentralized</td>
</tr>
<tr>
<td>Complexity of derivative contracts</td>
<td>Majority of contracts are relatively simple</td>
<td>Majority of contracts are relatively complex</td>
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Price Forecasts v Forward Markets

- Under regulated regimes, all price forecasting was cost forecasting.
- In electricity markets it is less clear what is meant by a forward curve.
- Forecasting prices involves understanding the uncertainties surrounding the drivers of price e.g. fuel.
- Forward curves are made up of forward prices which reflect what people are willing to pay today for delivery in the future.
- The two concepts have and continue to be confused.
## Price forecasts v forward markets

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<th><strong>Forward curve</strong></th>
<th><strong>Price forecast</strong></th>
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<td>A snapshot of where market participants are currently willing to transact.</td>
<td>A prediction of what might happen in the future.</td>
</tr>
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<td>Either market-observed or derived based on arbitrage relationships between prices and rationality bounds.</td>
<td>Based on economic/engineering analyses of future supply and demand, regulatory and technological trends, etc.</td>
</tr>
<tr>
<td>The market is always right. The whole exercise of the forward curve is to portray where the market is.</td>
<td>The market can be wrong.</td>
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</table>

- Used for marking positions to market and determining liquidation value.
- Forward prices can be locked in today.
- Can be used for deal pricing, to the extent that one expects to offset exposure in the open market.
- Uniform for all market participants.

- Should not be used for mark-to-market purposes.
- Price forecasts may not be locked in today.
- Can be used for deal pricing, to the extent that one does not look for an offset but uses the transaction as a bet on future prices.
- Each market participant may have a different forecast.

Source: Leong, ‘The Forward Curve in the Electricity Market’
Forward Markets v Price Forecasts

**Forward curve**

A snapshot of where market participants are currently willing to transact

Either market-observed or derived based on arbitrage relationships between prices and rationality bounds.

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Source: Leong, ‘The Forward Curve in the Electricity Market’
The Australian Forward Market

Electricity Price Curve ($/MWh)

Date: 29/8/03

Historical Spot Prices

Forward Swap Rates


Source: Westpac Analysis
Australian Electricity Trading Activity

- 168TWh traded; 30 players including two intermediaries

- Trading activity obscured by large volume of un-reported direct deals

- Major concerns cited for illiquidity include:
  - Credit
  - Legal (mainly ISDA)
  - Regulatory Risk

- However, volumes are increasing in the forward markets
Trading Activity – SFE Electricity Futures

Weekly Volume

Source: d-cypha Trade
Trading Activity – Reuters

Number of Weekly Electricity OTC Trades

Source: Energy Bank Link, Reuters
The NSW Forward Market

Calendar 03 NSW Flat Daily Price

Trading Date

29.00
30.00
31.00
32.00
33.00
34.00
35.00
36.00
37.00

$/MWh

02/01/02
02/02/02
02/03/02
02/04/02
02/05/02
02/06/02
02/07/02
02/08/02
02/09/02
02/10/02
02/11/02
02/12/02

Westpac Institutional Bank
NSW Forward Market Price Change

- Daily step changes:

![Graph showing frequency distribution of $/MWh shift for NSW Flat Daily Shift, with bars indicating frequency range and corresponding $/MWh values.]
Market Volatility

- Not such a volatile forward market
  - 12 month swaptions trading at 5%-7% volatility
  - Lower volatility than interest rates and selected equity markets
  - Volatility only seems extreme if you only see a price every 3 years
  - Price changes normally distributed
  - Most price spreads between 1-5%
YTD Daily Return on 1 yr Forward

AUD Int Rate  USD Int Rate  AUD/USD  Gold/USD  NSW Elec
## 2003 YTD 1 yr Forward-Volatility Comparison

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<th>AUD/USD</th>
<th>Gold/USD</th>
<th>NSW Elec Flat</th>
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<td>Volatility: 2003 YTD</td>
<td>17.39%</td>
<td>41.82%</td>
<td>10.15%</td>
<td>14.49%</td>
<td>29.59%</td>
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How is wholesale risk managed in the market?

- Swaps (70%) – fixed price/volume contracts
- Swaptions (8%) – options on swaps
- Caps/Floors (10 %) – half-hourly options
- Asian Options (2 %) – option over a period
- Exotics – (1%) – weather/demand/AS
- Compliance products – (1%) – REC’s, NGAC’s
- Exchange Traded Products (8%) - futures
But Isn’t New Zealand’s Different?

- Hydro based, low storage capacity, long skinny transmission system, fuel supply issues
- Is relatively small (37TWh pa)
- Significant vertical integration and concentrated (no independent retailers)
- Majority owned by the state
- A “gross” pool-based spot market
- No real OTC activity
- No futures market
- No price transparency
- No medium or long term price signals
- No new entrants
- Vertical integration
So why Bother with Financial Energy Markets

- Inability to manage and price risk for all participants
- Excessive transaction costs and margins
- Inappropriate / incorrect investment decisions
- Non-competitive behaviour
- Vertical integration
- Government intervention and re-regulation
Challenges for New Zealand

- Stabilise the regulatory environment
- Create changes to market rules which encourage trading activity and transparency
- Create incentives for participation
- Explore disincentives for anti-market behaviour
- Participate and embrace the financial market...liquidity is self reinforcing
“...significant attention has been given to the role of regulators in mitigating excessive price levels in electricity markets...a quantitative analysis of the long-term effects of regulatory intervention through the use of price caps....[shows] how such short term fixes can lead to long term deficits in the available generation capacity, and ultimately to market failures...”

Skanntze and Illic, ‘Valuation, Hedging and Speculation in Competitive Electricity Markets: A Fundamental Approach’
Market Model

Physical Market
- Immediate Price Discovery
- Volume = 1

Exchange Traded
- Short to Medium Term Price Discovery
- Volume = 5-20 times physical

OTC Market
- Short, Medium & Long Term Price Discovery
- Volume = 2-5 times physical