WWW.D-CYPHATRADE.COM.AU

WEPI

WHOLESALE ELECTRICITY PRICE INDEX™

To provide the market and commentators with a more meaningful indicator of the effective wholesale value of electricity, d-cyphaTrade and the Commonwealth Department of Industry Tourism and Resources (DITR) developed the Wholesale Electricity Price Index (WEPI™). The WEPI is calculated daily from publicly available information and provides an indicative value for wholesale electricity in New South Wales (NSW), Victoria (VIC), Queensland (QLD) and South Australia (SA). The WEPI is published on the d-cyphaTrade website each day for the previous day's value. Please visit www.d-cyphatrade.com.au for more information. This is in turn republished by several industry sources to communicate the WEPI to a wider audience.

The research for this project was carried out in conjunction with the Allen Consulting Group.

DELIVERING EXCHANGE TRADED ENERGY DERIVATIVES TO THE AUSTRALIAN MARKET

The Allen Consulting Group

BACKGROUND

The spot (pool) price of electricity, in a competitive wholesale electricity market, reflects the instantaneous balancing of demand and supply. However, this is not what electricity retailers and generators acknowledge as the wholesale price of electricity. Viewed in isolation, the spot price does not account for the existence of electricity hedge contracts (forward price agreements). Further, the retail electricity price to consumers is a function of a range of factors, only one of which is the wholesale price. For this reason, the spot price on its own can give a misleading picture of the wholesale value of electricity and of the ultimate retail price of electricity to consumers.

METHODOLOGY

The WEPI is intended to provide an effective measure of the wholesale value of electricity in each region in the NEM as it is composed of a combination of spot and contract electricity prices. Hedge contracts complicate the calculation of the effective wholesale price of electricity because:

> Individual electricity retailers and generators use different hedging strategies, so the effective wholesale price of electricity differs between electricity market participants; and
> The prices and quantities of many bilaterally traded hedge contracts are not publicly disclosed.

The WEPI uses available market information combined with a set of simplifying assumptions about the market to produce an index that reasonably reflects the effective wholesale value of electricity across each NEM state.

Therefore, the WEPI takes the following key elements into account:

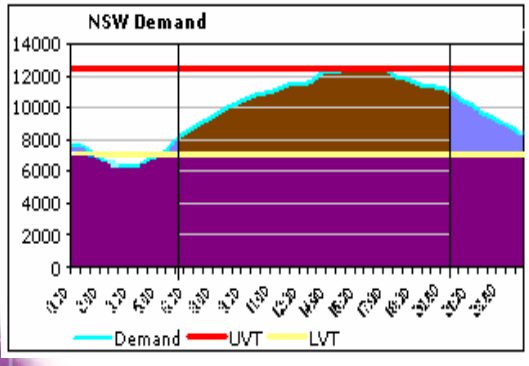
> The spot price of electricity in the NEM (Spot market prices and demand volumes published by the National Electricity Market Management Company (NEMMCO))
> Publicly available contract prices (Settlement prices for the d-cypha SFE Australian Electricity Futures Contracts listed on the Sydney Futures Exchange.)

An amalgamation of these two inputs, spot and contract prices, with several assumptions, is then used to calculate the WEPI.

ASSUMPTIONS

The WEPI methodology makes the following assumptions regarding levels of hedge contract cover:

> Hedge contract cover is sought for demand up to a level which represents 90% of the highest ever demand for a particular region, over each quarter. This level is referred to as the Upper Volume Threshold (UVT) indicated by the red line.
> Base-load contracts cover the majority of the load over a 24-hour period up to a certain level of demand. This level is equivalent to the average of the previous day's off-peak demand as shown in yellow. This is referred to as the Lower Volume Threshold (LVT). All demand below this threshold is covered by base load contracts (purple shaded area).
> To account for the additional demand expected during the peak period, further hedge contracting occurs. It is assumed that any demand above the LVT is covered by peak period contracts during peak times. As the initial assumption states there is no hedge cover above the UVT, the peak contracts cover demand above the LVT and below the UVT (brown shaded area). If demand is lower



than the UVT then the peak contracts cover the demand above the LVT.

> Any demand above the UVT during peak time, plus any demand above LVT during off-peak time, is assumed as uncontracted cover and is priced against the spot price (blue shaded area).

The above assumptions are based on a rational expectation that market participants manage their exposure to spot prices based on previous market outcomes. More generally, it is assumed that expectations of future demand are based on the past.

LIMITATIONS

The WEPI is calculated for working weekdays. That is, the WEPI is not calculated for Saturdays, Sundays or public holidays, as there is no trading of Electricity Futures Contracts on these days.

For the purposes of calculating the WEPI, it is assumed that electricity retailers and generators would hold peak and base load contracts to limit their spot rate exposure. Prices for over-the-counter (OTC) contracts and other forms of bilateral hedge agreements are not taken into account as the available market data on these products is limited to indicative prices and there is no verifiable data on contract volumes. Futures contract prices are used as a proxy for all potential hedging arrangements. It is reasonable to assume that these prices would be consistent with the prices of OTC or bilateral hedge market contracts (ignoring counterparty default risk considerations).

The WEPI is calculated with reference to an average price of Electricity Futures Contracts over a forward-looking 12-month (or 4-quarter) period. Rolling 4-quarter weighted averages are calculated for peak and base load electricity futures contracts.

CALCULATING THE WEPI

Mathematically, the WEPI for each region is a time-weighted average of the effective peak and off-peak wholesale electricity prices for NEM trading periods, expressed as follows:

$$WEPI = [P_{peak} * \frac{30}{48}] + [P_{offpeak} * \frac{18}{48}]$$

Where:

> P_{peak} is the effective wholesale price of electricity during the peak period of the day - defined as weekdays between 7am and 10pm excluding public holidays.

> $P_{off\text{-}peak}$ is the effective wholesale price of electricity during the off-peak period of the day - defined as all hours outside of the peak period.

The effective wholesale price for electricity during peak periods (P_{peak}) is calculated as:

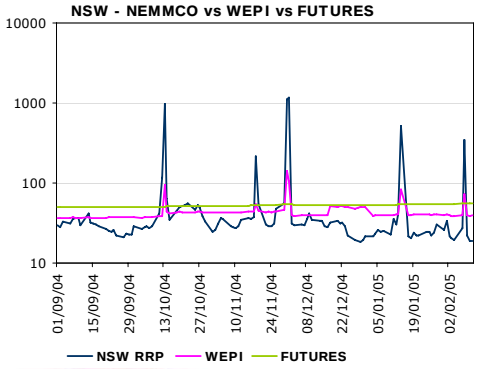
> Demand weighted average of spot price, plus peak and base load contract prices; with

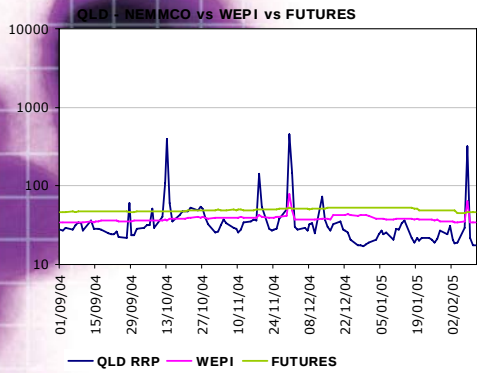
> Demand weights corresponding to uncontracted volume, peak contract volume, and base load contract volumes, as shown below.

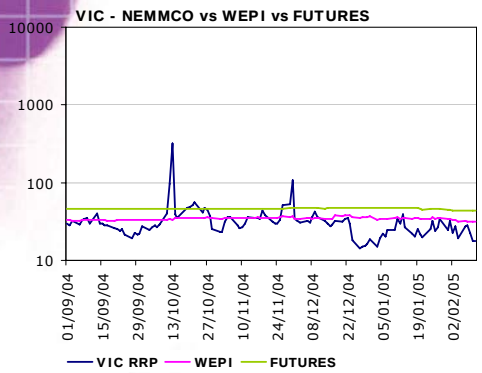
$$P_{peak} = \frac{\sum([D_a * S] + [D_b * F_{peak}] + [D_c * F_{base}])}{\sum D}$$

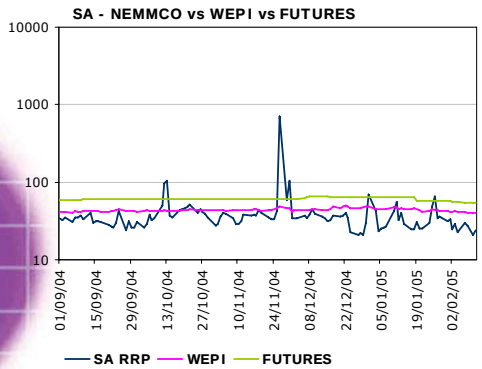
Where:

> D is the total regional demand for each trading interval in the peak period.









- D_a is the uncontracted volume for the trading interval, that is the demand in excess of the upper volume threshold (if D > U then D_a = D – U, otherwise D_a = 0).
- D_b is peak contract volume for the trading interval, that is the demand in excess of the lower volume threshold but lower than the upper volume threshold (if D > U then D_b = U - L, otherwise D_b = D – L. If D < L, then D_b = 0).
- D_c is base load contract volume for the trading interval, that is the demand below the lower volume threshold (if D ≤ L then D_c = D, otherwise D_c = L).
- L is the lower volume threshold (LVT).
- U is the upper volume threshold (UVT).
- S is the spot price of electricity for the trading interval.
- F_{peak} is the price of a peak load electricity futures contract averaged over the first 4 listed quarters.
- F_{base} is the price for a base load electricity futures contract averaged over the first 4 listed quarters.
- If a new record demand is reached intraday, a new UVT will be created and used in ongoing calculations from the beginning of that day.

Similarly, the effective price for electricity during the off-peak period ($P_{off\text{-}peak}$) is calculated as:

- Demand weighted average of spot price, plus base load contract prices; with
- Demand weights corresponding to uncontracted volume and off-peak contract volume, and as shown below.

$$P_{offpeak} = \frac{\sum([D_c * S] + [D_d * F_{base}])}{\sum D}$$

Where:

- D is the total regional demand for each trading interval in the off-peak period.
- D_c is the uncontracted volume for the trading interval, that is the demand above the off-peak contract volume threshold (if D > L then D_c = D – L, otherwise D_c = 0).
- D_d is base load contract volume for the trading interval, that is the demand below the lower contract volume threshold (if D ≤ L then D_d = D, otherwise D_d = L).
- L is the lower contract volume threshold.
- S is the spot price of electricity for the trading interval.
- F_{base} is the price for a base load electricity futures contract averaged over 4 quarters.

PERFORMANCE OF THE WEPI

The charts to the left plot the performance of the WEPI over time. This is achieved by comparing movements in the WEPI over time to movements in both the spot price of electricity and the price of electricity futures contracts (for the purpose of this example, implied CAL05 futures prices have been used).

The WEPI combines contract prices and spot prices in proportions of contract and uncontracted quantities. Hence, the WEPI displays some degree of volatility, but not as much as the spot price itself.

These charts compare daily movement in the WEPI with the daily movement in both the spot price of electricity and the price of Electricity Futures Contracts over the period November 2003 to February 2004. As expected, in each of the four regions, the WEPI has less volatility due to the stabilising effect of contract prices.