ELECTRICITY AUTHORITY
TE MANA HIKO

Managing electricity price risk

A guide for consumers

About

the Electricity Authority

The Electricity Authority is an independent Crown entity tasked by the Electricity Industry Act 2010 to promote competition in, reliable supply by, and the efficient operation of, the electricity industry for the long-term benefit of consumers.

The Authority's core functions are to:

- make and administer the rules governing the New Zealand electricity market (called the Electricity Industry Participation Code 2010 or 'Code')
- undertake and monitor market-facilitation measures, such as providing education, guidelines, information, and model arrangements
- monitor and enforce compliance with the Code, the Act and regulations made under the Act
- undertake industry and market monitoring and make information relating to the electricity industry publicly available
- contract service providers to operate the New Zealand electricity system and market in accordance with the Code.

More information on the Authority can be found at www.ea.govt.nz/about-us.

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Welcome

to this guide

For some medium and large electricity consumers, an electricity supply contract linked to wholesale electricity market prices (or spot prices) can be an attractive option. It may allow them to save money compared with the alternative of a fixed price contract and/or gain a financial reward for actively managing their energy usage.

However, spot prices are volatile and cannot be known in advance, so buying on terms linked to spot prices carries financial risk. Experience suggests that many parties do not fully understand the size of these risks or how likely they are to occur. Spot prices can sometimes spike to very high levels with little or no warning or rise to high levels for a sustained period such as during a drought. Conversely, they can also fall to very low levels, for example, during a prolonged wet period.

Without negotiating insurance-style contracts in advance (often called hedge contracts) and/or actively reducing their electricity usage when spot prices spike, consumers who buy electricity at spot prices can find themselves with large cost increases that could conceivably lead to financial distress or even bankruptcy. This is evident from media reports that were released during the droughts in 2001 and 2008.

Media reports

> "The company was having to pay 'astronomically' high spot prices."

Food processor, *Nelson Mail*

> "The big bill was a surprise when it arrived last Friday."

School, *NZ Herald*

> "It had refused to pay its latest bill, which leaped to $11,000 from a monthly average of $2,300."

Hotel, *NZ Herald*

> "Very high spot prices were having a big impact on the company's costs."

Manufacturer, *Nelson Mail*

This guide aims to provide information about the benefits and risks of buying electricity under a contract linked to spot prices (referred to as spot price exposure) compared with alternative purchasing options. It complements other steps the Authority is taking to improve understanding about the benefits and risks of spot price exposure, such as the introduction of the stress testing regime for wholesale market participants.

It also complements broader actions the Authority is taking to improve the electricity market, such as measures to strengthen hedge market activity and steps to make it easier for some consumers to actively manage their electricity use.

While this guide is primarily aimed at electricity consumers that have or are considering supply contracts linked to spot prices, some of the issues covered may also be useful to other consumers, both small and large.

This guide is not a substitute for professional advice, and consumers that have or are considering supply contracts linked to spot prices are encouraged to speak to a financial adviser or an authorised futures dealer able to provide advice in relation to electricity contracts. Page 27 provides details on where additional information can be found.

Different ways

to buy electricity – the basic choices

Electricity costs are made up of several components including charges for the electrical energy that has been used, transaction costs, distribution network charges, taxes and levies. The distribution charges, taxes and levies will essentially be the same for a consumer irrespective of the way they buy their electricity. However, the cost of the electrical energy can vary considerably depending on the nature of a consumer's supply arrangement.

Most consumers buy their electricity under contracts that include an electricity charge that is set in advance by their retailer on a price per unit basis. This may be a single price applying to all use or a more complex pricing structure with separate prices for different times and/or locations. However, the key point is that prices are known in advance and do not vary with spot market conditions or with the amount of electricity purchased. These arrangements are often referred to as fixed price variable volume contracts.

While fixed price variable volume contracts remain the most common contract type, some consumers (especially large commercial and industrial consumers) buy their electricity on terms where the energy component of the total price is not set in advance but is instead linked, partly or wholly, to spot prices.

How does

the spot market work?

In essence, the wholesale spot market works as an auction where generators make offers to produce electricity for half-hour time blocks (called trading periods). The system operator (Transpower) ranks these offers and computes the lowest cost mix of generation from different sources that will satisfy overall demand for each half-hour. The offer price of the highest-priced generator actually required for each half-hour is the key determinant of prices for a trading period (referred to as marginal pricing).

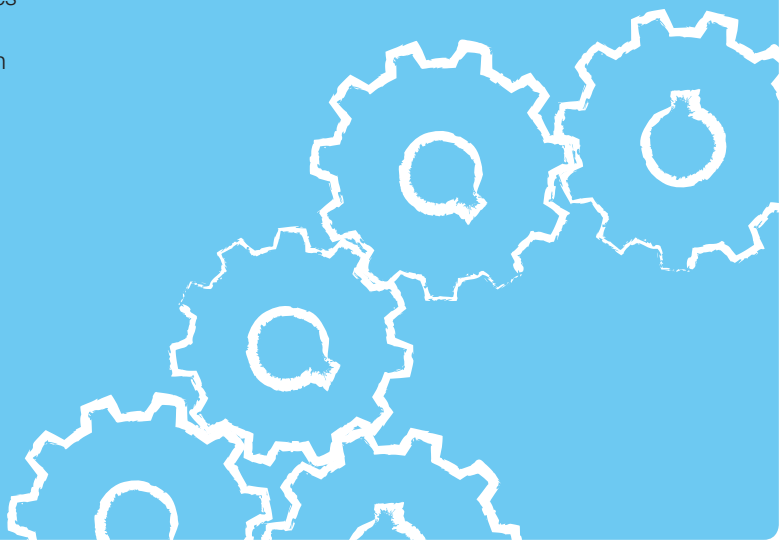
Spot prices vary over time because the underlying demand and supply conditions change over time. For example, spot prices are generally higher in winter when demand increases and lower in summer. Similarly, spot prices are typically lower at night when electricity usage is reduced and rise during the day when electricity usage increases, especially during the morning and evening peaks.

As well as reflecting these predictable patterns, spot prices can change in response to unexpected movements in demand or supply. For example, spot prices can be much higher during droughts, reflecting the reduction in hydro generation in these periods, so that the market needs to turn to more expensive generation sources. Conversely, spot prices can be relatively low during wet periods when the hydro lakes are full.

Spot prices also vary by location, with distinct prices being simultaneously computed for approximately 280 different points on the national grid for each half-hour. The spot price differences between locations reflect the effect of electrical transmission losses and constraints on the grid. This means that spot prices are typically higher in parts of the grid that are further from power stations and vice versa.

It is also important to note that spot prices can, on occasion, be many times higher than the offer price for the highest cost generator that was required to run in a trading period. This can arise for a variety of reasons but generally reflects a situation where part or all of the supply system is getting close to its physical limit.

Readers wanting more detail on how the spot market works should see www.ea.govt.nz/about-us/documents-publications/electricity-nz.

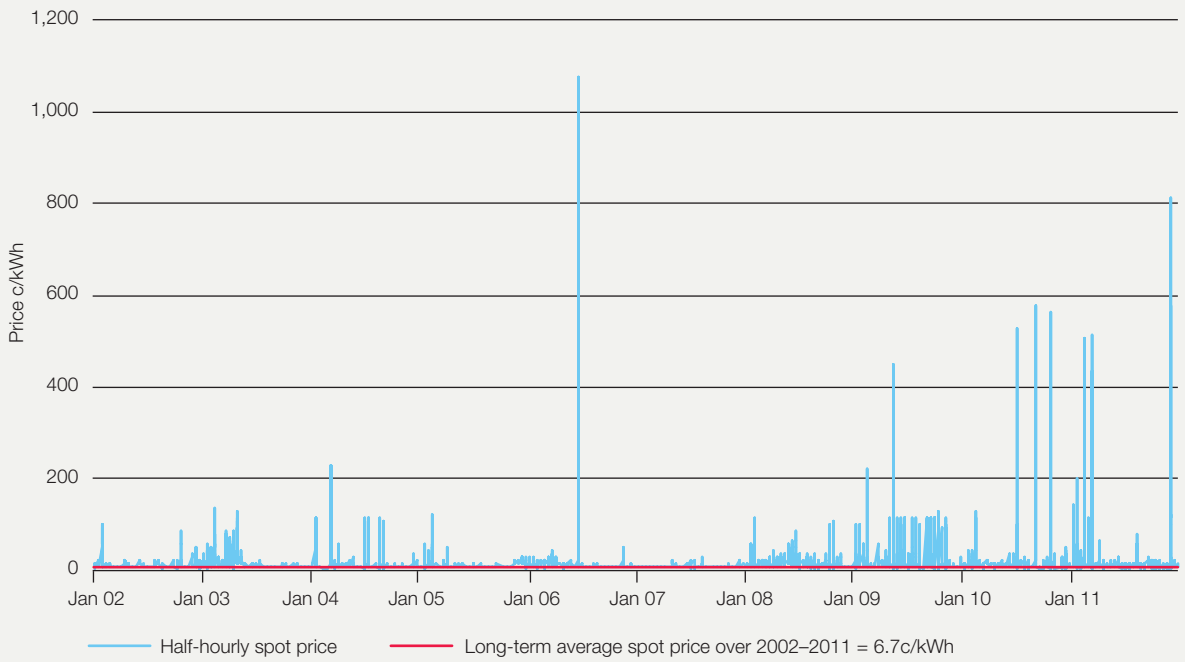


How volatile

are spot prices?

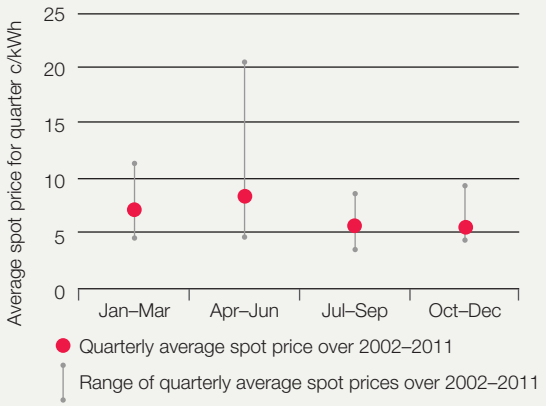
Spot prices are determined for every half-hour for around 280 points across the country. Spot prices can be very volatile, with significant variations over time and by location. In fact, electricity spot markets across the world are widely considered to be among the most volatile of all markets, with more than 10 times the volatility of share markets or foreign exchange markets.

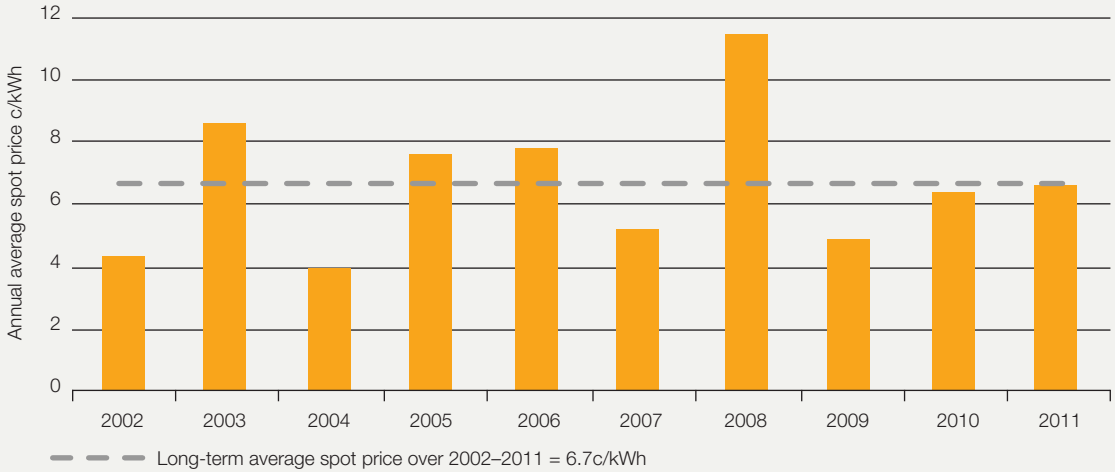
This volatility is illustrated in the graph below, which shows half-hourly spot prices at a supply point in Otahuhu (South Auckland) over the 10 years to December 2011. The average spot price over the entire period was 6.7c/kWh, but spot prices reached many times this level in some half-hours, while at other times, they were close to zero.



While spot price volatility is greatest when assessed at the half-hourly level, even when considered over longer periods, spot prices are very volatile. For example, the graph on the right shows data on quarterly average spot prices at Otahuhu since January 2002 (10 years of data). Significant variability in spot prices is apparent for all quarters, with maximum quarterly spot prices being more than 50% above the respective quarterly average in each case.

The graph below demonstrates that annual average spot prices are also volatile. Since 2002, these have varied between 3.9c/kWh and 11.4c/kWh, a range of -41% to +71% compared with the average spot price for the entire period.





What does

spot price volatility mean for electricity consumers?

All electricity traded on the wholesale market in New Zealand is based on half-hourly spot prices. When buying electricity on a fixed price variable volume contract, the retailer effectively accepts the full financial risk associated with spot price volatility and the risk that the consumer increases its consumption during times of high spot prices. A retailer typically charges a price premium in exchange for accepting these risks. Consumers buying electricity under contracts linked to spot prices avoid this price premium but also take the price risk on themselves.

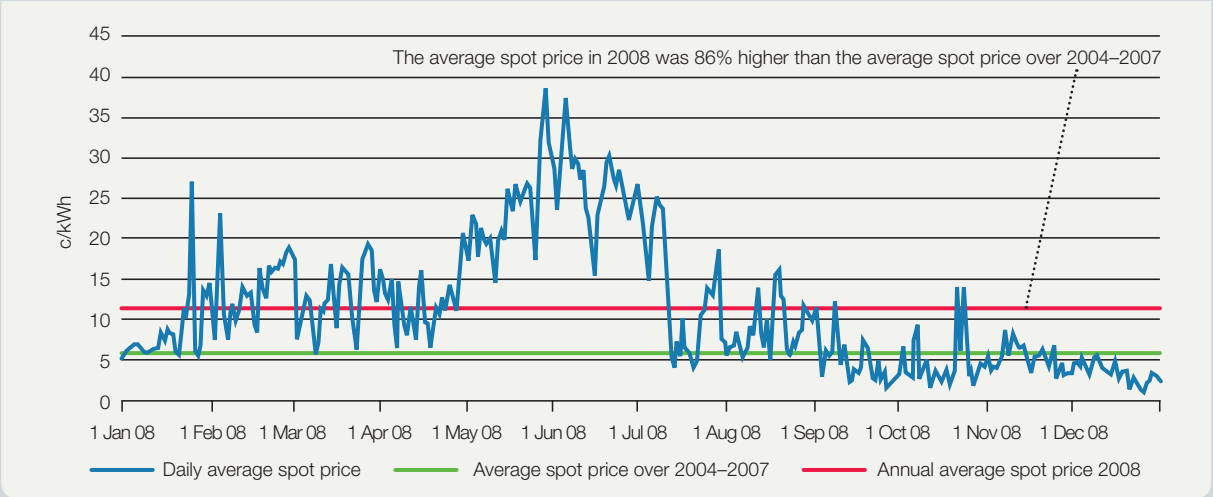
Consumers buying their electricity on arrangements linked to spot prices should be conscious of the financial risks involved with this approach. A rise in spot prices will feed through into their electricity bill, and it is important that consumers can tolerate any such cost increase. The risks are easily seen by considering a couple of hypothetical consumers and data from recent years.

Example 1
Manufacturer buying at spot prices in 2008 drought

Consider a hypothetical manufacturing firm in Otahuhu making plans for the 2008 year. It decides to buy all its electricity at spot prices and uses the average spot price over the previous four years as its guide. On this basis, it budgets for electricity costs to be $2 million (20% of its total revenue of $10 million) and to make an expected profit of $1 million.

In fact, there was a sustained drought in 2008, which reduced hydro generation and led to a significant and prolonged rise in spot prices as shown in the graph opposite.

As a result, the average spot price for 2008 was 86% above the average spot price over the previous four years (used by the manufacturer for its budgeting).



For this firm, the exposure to spot prices would mean that, instead of making an expected $1 million profit in 2008, it would record a $700,000 loss.

Example 1 – Hypothetical manufacturer in 2008

$000	Budget	Actual	
Revenue	10,000	10,000	Same as budget
Electricity cost	2,000	3,700	86% increase due to drought
Other costs	7,000	7,000	Same as budget
Profit/(loss)	1,000	(700)	

Of course, with the benefit of hindsight, it is easy to say the firm would have been better off by taking a different approach, but that misses the real issue – whether the manufacturer could tolerate large changes in its profitability, including the possibility of making a loss. Provided it could cope with these swings, spot price exposure *may* be a sensible choice. However, if such variation is not acceptable, it should use other approaches to buying electricity that involve less financial risk (see the next section on ways to limit exposure to spot price risk).

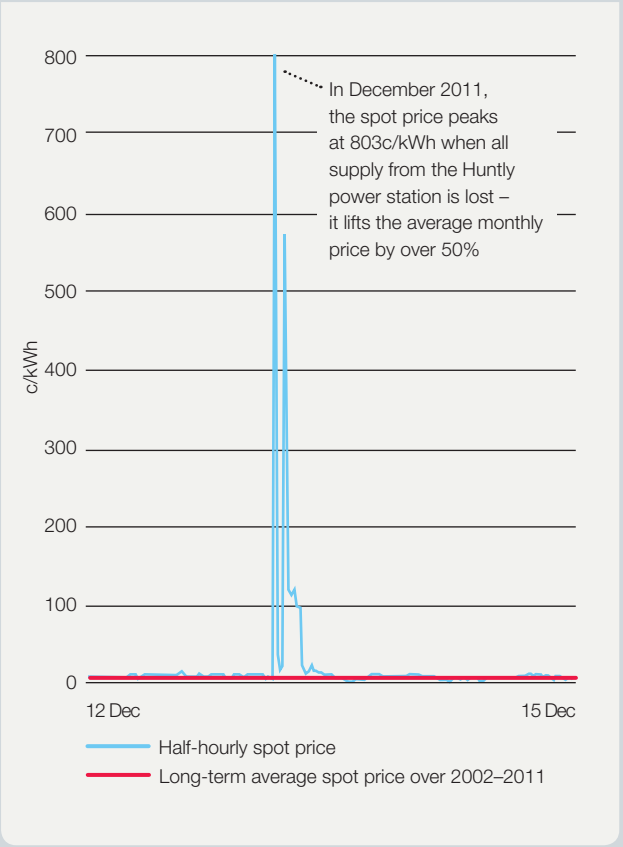
Example 2

Not-for-profit organisation buying at spot prices in December 2011

Another example is a hypothetical not-for-profit organisation (also in Otahuhu) operating on a very tight budget. It decided to buy its electricity at spot prices, believing that this should save it money over time.

In mid-December 2011, there was a complete loss of supply at the large Huntly power station for a few hours. Electricity spot prices peaked at over 800c/kWh during the power station outage. Even though the price spike was limited to a few hours, it raised the average price for the month of December 2011 by over 50% (compared to historic average levels).

Clearly, the organisation would have avoided the spike in its electricity bill if it had not chosen to buy at spot prices, but this can only be known with hindsight. The more relevant point is whether the organisation is prepared for large swings in its electricity costs and can ride through those swings. If it could not easily tolerate such swings, it should use alternative approaches that provide more certainty about electricity costs.



Some consumers may find they are comfortable accepting the risk associated with volatile spot prices, while others may find it is too difficult to budget for big spikes in their electricity bills. Consumers buying electricity under contracts linked to or considering contracts linked to spot prices need to consider how material spot price volatility could be to their business.

The three broad approaches to dealing with the risk associated with spot price exposure are:

- to accept risk
- to transfer risk
- to mitigate risk.

Consumers who are not comfortable accepting the full price risk associated with exposure to spot prices should look to limit or completely remove their exposure.

How can I

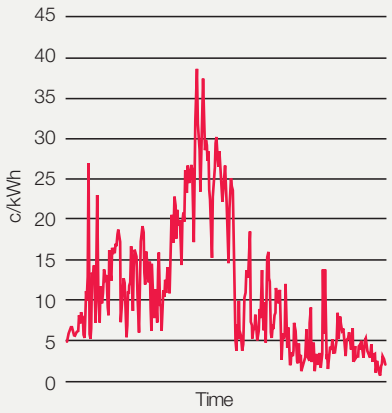
limit my exposure to spot price risk?

The previous section discussed the financial risks associated with buying electricity under contracts linked to spot prices. Consumers can use a number of different tools to reduce these risks.

At one end of the spectrum, spot price risk can be avoided altogether if a consumer purchases electricity using a traditional form of contract that provides a pre-agreed price[1] for all usage (the fixed price variable volume contract type described on page 3).

However, some consumers may prefer some exposure to spot prices. For these consumers, a variety of tools can be used to reduce their exposure to spot price risk to an acceptable net level. These tools can involve contractual and/or physical mechanisms to mitigate spot price risk.

Spot price risk



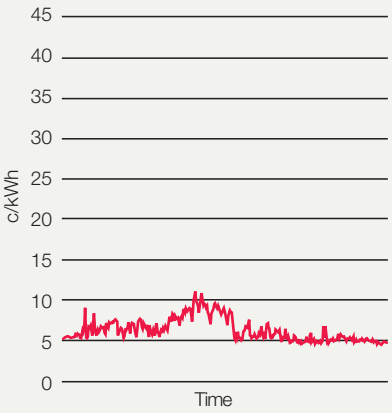
Risk reduction tools

Fixed price supply contract
Pass risk on to a retailer through fixed price variable volume contracts

Financial contracts (hedges)
Contracts for differences
Futures contracts
Options contracts

Physical arrangements
Reduce consumption
Increase generation
Switch to back-up generation

Net risk exposure



1 Or provides a set of prices for different time blocks and/or locations where usage occurs.

Fixed price supply contracts

These fully or partially insulate the consumer from the financial consequences of high (and low) spot prices.

The most common form of fixed price supply is a fixed price variable volume contract where an electricity retailer buys electricity in the spot market on behalf of the consumer, and the two parties enter into a contract that specifies a fixed price for all electricity supplied to the consumer, regardless of the prevailing spot prices. This provides full price-risk insulation for the consumer.

In some cases, the parties may agree to some proportion of spot price risk being passed on to the consumer. For example, the contract might have a fixed price for a base volume of usage, with the balance of usage in any half-hour purchased at the spot price. Alternatively, the contract might state that a percentage of usage in each half-hour is purchased at a fixed price, with the balance at prevailing spot prices. The consumer's net exposure to spot prices will be determined by the level of base volume or the percentage split between fixed and spot prices. These types of arrangements come and go in popularity and may not be offered by all retailers.

Financial contracts (hedges)

Financial or hedge contracts are also used to insulate the consumer from the financial consequences of high (and low) spot prices. In this case, the consumer buys all its electricity at spot prices (either directly from the wholesale market or via a retailer) and enters into a separate supplementary insurance-type contract to mitigate the associated risk. These insurance-type contracts do not involve any physical obligation to supply or consume electricity but instead provide for payments to be made between the contract buyer (typically a consumer) and seller, depending on prevailing spot prices relative to the contract price, and a defined contract volume. These arrangements come in a variety of forms:

- *Contracts for differences*, also called swaps. These are the most common form of hedge contracts. These typically involve the consumer receiving a payment under the contract for difference of the difference between the spot price and the contract price when the spot price is higher than the contract price and paying the difference to the contract seller when the spot price is lower than the contract price (see the example on the next page). These contracts are agreed via a negotiation between consumer and seller and are tailored to reflect specific requirements in relation to duration and other contract features.

- *Futures contracts*. These are a standardised form of contract with buy (bid) and sell (ask) prices quoted on the Australian Securities Exchange (ASX). Similar to contracts for differences, these contracts provide a mechanism to hedge spot price volatility. Futures contracts are a relatively recent addition to the suite of available mechanisms and have been growing in popularity. They require regular attention and a detailed understanding of financial market products and how they trade on exchanges and are not generally suitable for most consumers. However, financial intermediaries can access futures, deal with the complexity and use them to underpin offers of simpler derived products to consumers.
- *Options contracts*. These have a variety of forms, but in essence, the consumer pays an upfront fee to the supplier of the contract for the right to a predefined spot price insurance mechanism. For example, a consumer who is exposed to the spot price could enter into an option contract that provides a right for the consumer to receive the difference between the spot price and, for example, 15.0c/kWh. In this simple example, this option would act as a cap that limits the extent of spot price exposure for the consumer. As with futures contracts, options may not be suitable for most consumers.

While futures and options contracts may not be suitable for small to medium-sized consumers to purchase themselves, they are still relevant to these consumers' risk management decisions. This is because retailers and financial intermediaries (such as banks and other institutions) may offer simpler products targeted directly at small to medium consumers and access futures and options products in order to underpin these offers and reduce the risk of supplying the simpler products.

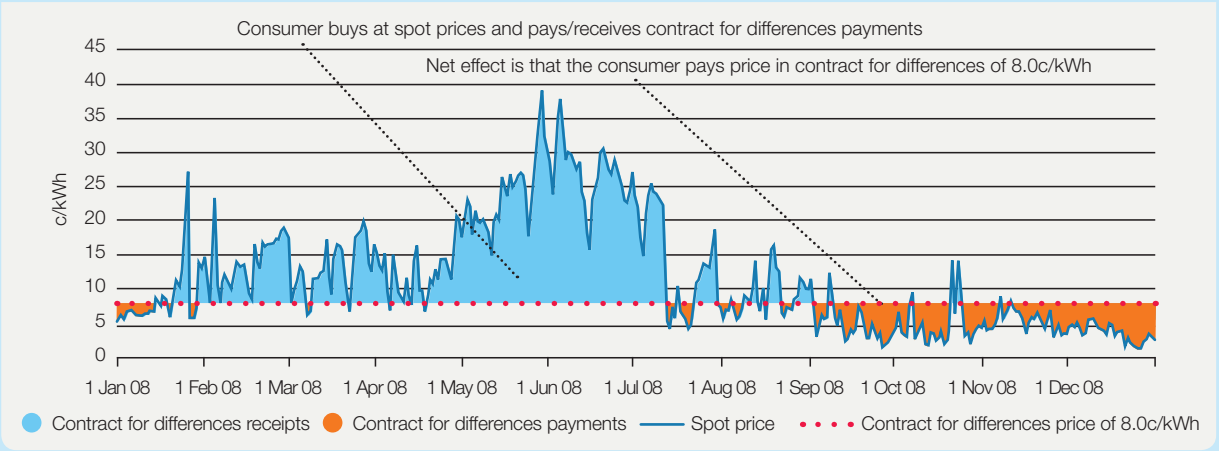
Futures and options contracts will also be useful for all consumers for monitoring future price expectations and for assessing quotes for contracts for differences or fixed price contracts (noting that any contracts negotiated with a third party will also add in administrative and other handling charges). Futures and options contracts will also potentially open up the contracts for differences market to greater competition.

Example 3
Contract for differences (a form of hedge contract)

The graph opposite shows the same spot price data as used for example 1 (a hypothetical manufacturer in Otahuhu buying at spot prices during 2008). In this example, the manufacturer is buying electricity at spot prices but has also entered into a contract for differences covering all of its usage at a price of 8.0c/kWh.

This means the manufacturer pays the spot price for its electricity but then, under the contract for differences, receives the difference between the spot price and 8.0c/kWh when the spot price is higher than 8.0c/kWh (shown in blue) and pays the difference when the spot price is lower than 8.0c/kWh (shown in orange). The combined impact of spot price exposure and the contract for differences is that the effective electricity cost is 8.0c/kWh.

The effect on the firm's financial performance of hedging its spot price exposure is shown. By entering into a hedge contract, the firm locks in a known electricity cost of $2.6 million and makes a profit of $400,000, as shown in the table. This compares with a loss of $700,000 if it had chosen full exposure to spot prices.



An important point to note about a contract for differences is that difference payments are calculated based on the fixed volume defined in the contract, not the amount actually consumed. Consumers need to ensure that this contracted volume is sufficient to reflect their actual expected electricity usage, otherwise they will be under-hedged against spot price volatility.

This means that consumers with a contract for differences will benefit from reducing their usage during high spot price periods because they will continue to receive the contract for differences payment but their spot purchase costs will be lower. Essentially, the difference between the spot price and the contract price is profit for any avoided electricity usage. This is an important difference compared to a fixed price variable volume contract.

Example 3 – Hypothetical manufacturer in 2008 with contract for differences

$000	Budget	Actual (on spot)	Actual (with contract for differences)
Revenue	10,000	10,000	10,000
Electricity spot purchases	2,000	3,700	3,700
Contract for differences receipts/(payments)	–	–	1,100
Net electricity costs	2,000	3,700	2,600
Other costs	7,000	7,000	7,000
Profit/(loss)	1,000	(700)	400

Example 3 is highly simplified. In reality, there are a number of complications with contracts for differences that need to be considered:

- For most consumers, electricity usage varies through the day and week. A contract for differences based on a flat demand profile may not fully insulate a consumer from spot prices at times when demand is high and may over-insulate from spot prices when demand is low. Further, a production failure or reduced electricity usage could lead to a consumer being over-hedged because the contract is not tied to their actual electricity usage.
- The price of a contract for differences will be determined by the price of electricity at a certain location, such as Otahuhu, but the consumer may pay the price of electricity at a different location (noting, as stated earlier, that prices are set at around 280 distinct locations around the country). In this situation, any difference in the price between the two locations would not be covered by the contract.
- Not all consumers may be able to purchase contracts for differences. Certain restrictions may apply depending on the particular circumstances of the consumer and the seller of the contract for differences.

To find out how contracts for differences could work for your business, you should talk to an independent financial adviser.

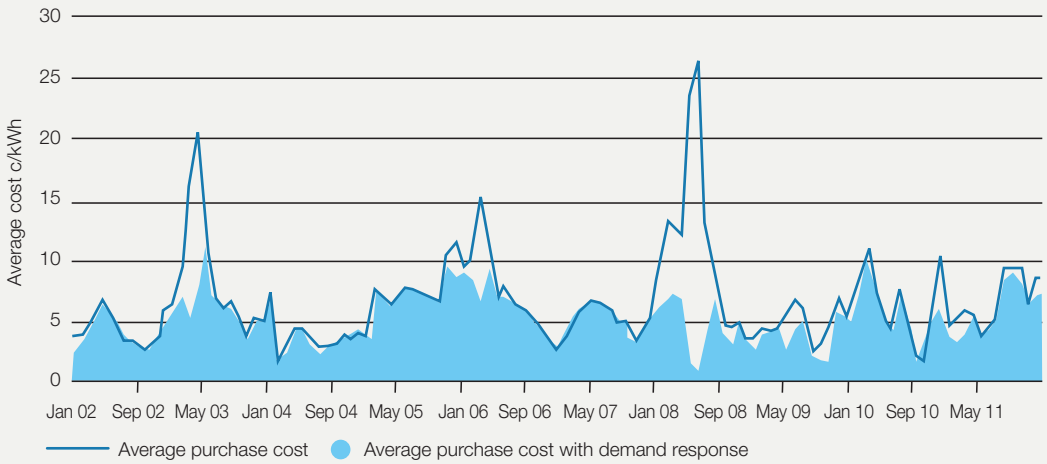
Demand-side management

This largely revolves around consumers reducing their usage when spot prices are high and vice versa (also called demand response).

Consumers with their own generation may also be able to increase generation levels or temporarily switch to back-up supply during high price periods. In these cases, the effect is to reduce the consumer's net exposure to high spot prices.

Example 4
Active demand response

Imagine a hypothetical electricity consumer at Otahuhu that was buying its electricity on the wholesale spot market in the 10 years to December 2011. If it had a steady level of use, it would have paid an average purchase cost of 6.7c/kWh – the average spot price over the period.



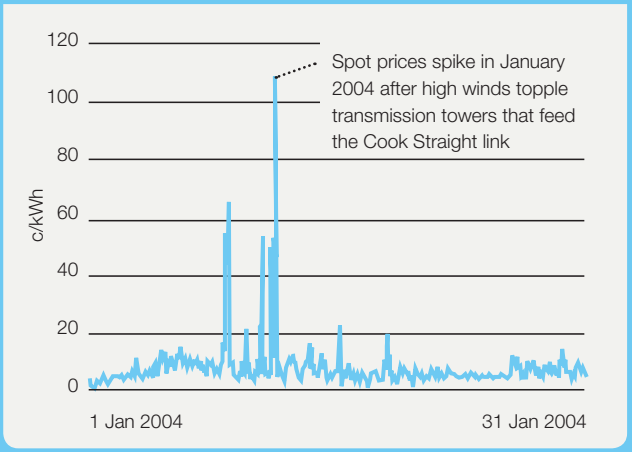
Now imagine that it had cut its usage to zero during the 5% of trading periods with highest spot prices. By avoiding usage in those periods, it would reduce the average spot purchase cost to 5.3c/kWh – a saving of around 20% for the energy component of electricity costs.

Of course, to benefit from active demand response or back-up generation, consumers need a high degree of confidence that they can take action at the right times. This is where understanding the underlying causes of volatility can be important.

In New Zealand, two key reasons for sustained high spot prices are droughts affecting hydro generation and shortages of thermal fuel. In these shortages, spot prices may be high for many months. Some consumers may be able to respond by reducing their electricity usage, for example, by meeting orders from stockpiled inventory or other sources. However, not all consumers are able to reduce usage, and even those who can temporarily reduce usage will have some limit to their demand response.

The other key reason for spot price volatility is the temporary loss of a large power station or part of the grid, which can result in a sudden price spike. These are often referred to as capacity shortages and typically have a duration measured in hours.[2] Some consumers may be able to easily tolerate the need to briefly reduce usage during such events. For example, temporarily reducing chiller usage in a cold store may be feasible for a few hours because it does not compromise storage.

While it may be relatively easy for some consumers to temporarily reduce usage or rely on back-up generation in capacity shortages, these events tend to be more difficult to predict ahead of time. In addition, the extent of spot price increases can be much greater than during an energy shortage. This is illustrated in the graph on the right, which shows spot prices in January 2004, when supply between the North and South Islands was cut for a few days because high winds toppled some transmission towers that carry a part of the Cook Strait cable that supplies electricity between the two islands.



Because these types of price spikes can occur with little or no prior warning, consumers may not be able to reduce their electricity usage sufficiently to entirely avoid paying higher prices. It also means that spot prices need to be monitored very closely, and not all consumers are able or willing to do this. Even for consumers who monitor spot prices, decision-making based on indicative prices may prove to be less than ideal when assessed against the final spot prices. This is because spot prices are not known in advance, with final prices[3] normally determined several days later.

It is important to note that consumers buying electricity under a fixed price variable volume contract will generally not have a financial incentive to reduce demand during periods when spot prices are high, such as during a drought or other supply shortage. This is because the price they pay for electricity is fixed regardless of prices in the spot market. This is sometimes seen as a disadvantage from a national benefit perspective.

2 Although they may repeat over a series of days during the periods of peak demand. 3 These are based on metered rather than forecast demand.

What level

of spot price risk exposure is the best for me?

The best approach will depend on a range of factors specific to each consumer and may well vary through time. Given the complexity of the issues, it is not possible to explore them in great detail in this guide.

Instead, this guide sets out some of the key questions that parties should consider. Consumers who want to take this further are strongly recommended to obtain advice from a suitably qualified independent financial adviser.

A consumer reviewing its electricity purchasing arrangements should consider:

- its ability to absorb spot price risk within its business
- the time period over which it is prepared to act to minimise electricity purchase costs
- the expected costs of the different arrangements
- the risk associated with different arrangements
- how the ability to manage electricity usage affects the choice of purchasing arrangements
- the management time and effort required under the different arrangements.

How material is price risk and what is the time period?

The first thing for consumers who are exposed to spot prices to consider is their ability to absorb volatility in prices. Consumers need to be able to absorb or otherwise adjust their demand in response to significant fluctuations in their electricity bills over the long and short term, ie sustained high spot prices due to a drought lasting months and short-term spot price spikes following an outage or technical disruption.

Exposure to volatile spot prices may work for some consumers if they are able to bank savings during low spot price periods to compensate for periods of high spot prices. Consumers exposed to spot prices generally need to maintain a long-term view of their purchasing decision, and these consumers should treat spot price exposure as an intention to self-insure. In other words, they should hope to pay less for their electricity over the long term, than if they were buying electricity under fixed price variable volume or other fixed price arrangements, rather than expect or hope for large and continued savings year to year.

Those consumers who would find it difficult to account for or justify large spikes in their electricity bills should consider a purchasing arrangement that will allow them to reduce the risk of large spot price spikes via a hedging strategy or fixed price contract.

Importantly, however, all consumers should aim to formulate an approach to buying electricity that can be maintained consistently over time, rather than changing the approach from time to time based on recent experiences. Experience suggests that parties that maintain a consistent approach to purchasing or hedging electricity tend to see better results over the long term.

What are the expected costs of different arrangements?

Consumers also need to consider the expected cost of purchasing electricity under different arrangements. To calculate the cost of buying under fixed price variable volume contracts, consumers should shop around and seek offers from a range of competing retailers.[4] For any given level of expected usage, it should be possible to calculate a projected cost estimate under these contracts by multiplying the best offer with the expected electricity usage.

Determining the expected costs of arrangements linked to spot prices is more complicated because it requires a forecast of future spot prices. While modelling techniques are sometimes used to generate these kinds of estimates, the results are sensitive to input assumptions and therefore are subject to some uncertainty. Another approach is to use historical spot prices, but this approach is not recommended because past conditions are not a reliable guide to the future. The underlying factors that cause spot prices to rise, such as droughts, occur relatively irregularly. If the historical data does not properly reflect the likelihood of these types of events, the forecast may tend to favour purchasing electricity at spot prices.

This is illustrated in the simple example below. The graph shows annual average spot prices at Otahuhu for 2004–2008. A buyer in late 2007 might have used spot prices for the previous four years as a guide, noting that these averaged around 6.1c/kWh. However, average spot prices for the 2008 year were nearly double this level as a result of a drought in the middle of the year.

The closing prices quoted on the ASX for electricity futures contracts is one source of information about expected spot prices (see www.asx.com.au/products/asx-nz-electricity-futures-and-options.htm). The ASX quotes prices for quarterly futures contracts at Otahuhu and Benmore for the next four years. These contract prices should provide an indicator of the quarterly average spot prices expected by buyers and sellers on the ASX. The quarterly price data can be assembled to provide a 'forward price curve' over the coming four years.

4 The Electricity Authority, as part of its What's My Number campaign, has developed a business comparison tool to allow small to medium-size businesses to shop around for electricity. This business tool allows these businesses to compare and switch electricity retailers. See www.whatsmynumber.org.nz/MyBusiness.

Another source of information is the price that other parties have recently paid for electricity hedge contracts. This information is published on the hedge disclosure website (www.electricitycontract.co.nz) provided by the Authority. This website reports (on an anonymous basis) the prices of hedge contracts (referred to on the website as risk management contracts) that have been struck between parties[5] (including on ASX) to hedge their electricity price risk.

A number of independent advisers also prepare forecasts and indices of future spot prices. While detailed forecasts from these parties will generally come at a cost, there is some publicly available information as well. See page 27 if you are interested in finding more information.

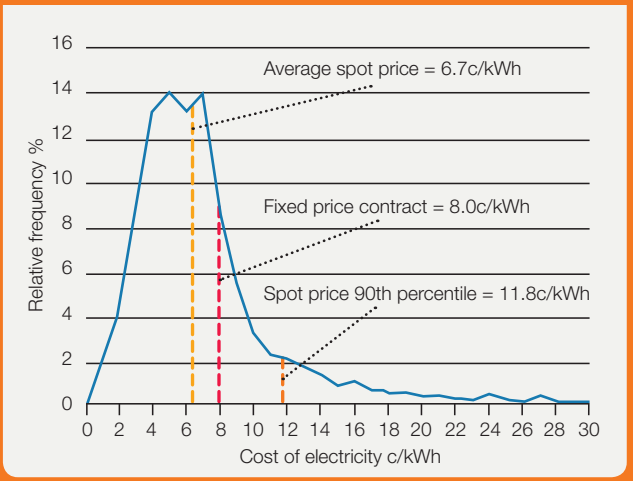
How much risk is there with different arrangements?

Another key question to consider is the level of risk that is associated with different purchasing arrangements. In other words, how much uncertainty is there about purchase costs for each type of arrangement?

In the case of a fixed price variable volume contract, the uncertainty is limited to the level of future electricity usage.

For arrangements linked to spot prices without corresponding hedge arrangements, the degree of uncertainty will be greater, as spot prices cannot be known in advance. Ideally, parties would consider the full range of possible spot price outcomes and estimate how likely some extreme outcomes are to occur. Again, modelling techniques and historical data can be used to generate these estimates, and independent advisers can assist with this. However, the caveats noted on page 19 also apply here. Indeed, even more caution is warranted because historical data and models may not reflect the full variability in the range of possible outcomes.

Whatever arrangement is chosen, the aim is to understand the broad magnitudes of the relative rewards and risk of different arrangements. This is illustrated in simplified form in the graph below, which plots a distribution of daily average spot prices over the last 10 years (blue line). The higher the relative frequency (y-axis), the more often prices are at the level indicated (x-axis).



The graph illustrates two options – purchasing at spot prices and entering into a fixed price arrangement (such as a fixed price, variable volume contract or fully hedging the spot price exposure). The key points to note from the graph are:

- the option with full spot price exposure has a lower average cost (6.7c/kWh versus 8.0c/kWh), but there is significant potential variability above and below this average level
- the fixed price arrangement has a cost of 8.0c/kWh – but no cost variability (assuming a fixed volume).

5 Where at least one side of the deal is a participant in the market.

This example illustrates two key points:

- There is more upward than downward variability in spot prices relative to the average. This is because the lowest that spot prices can get is zero in most cases,[6] but they can rise to 1,000% or more above the average level since spot prices are currently not capped.[7]
- There is often a trade-off between risk and reward. In the long term, a party might save money on average by buying at spot prices (1.3c/kWh in this case) but must take on exposure to the possibility that costs could be much greater than expected. For example, the 90th percentile for spot purchase costs is 11.8c/kWh. This means that there is a one in 10 chance of purchase costs being almost double the average level. The question for the consumer is whether it is worthwhile taking on this risk to make the expected saving.

For each purchaser, how it views the overall relationship between risk and reward will determine its 'best' arrangement. Some parties may be able to tolerate considerable variability in electricity purchase costs and may therefore choose significant spot exposure if this will provide an expected saving against a fixed price alternative. Other consumers may be very sensitive to any change in electricity purchase costs and have a strong preference for certainty.

How does the ability to manage electricity usage affect choosing purchasing options?

The previous section focused on the level of exposure to spot prices, assuming that a purchaser has little or no ability to reduce its electricity use at times of high spot prices.

However, some consumers can actively manage their purchase volumes by cutting electricity usage and/or switching on stand by generation when spot prices are high. A fixed price variable volume contract provides a much reduced reward for consumers that can actively manage their electricity use. Instead, these consumers may benefit from a supply arrangement that links to spot prices for the portion of usage that can be actively managed and for fixed prices on the balance that is unresponsive to spot market conditions. This split between the levels will depend in part on the extent to which a consumer can respond to spot prices and its appetite for risk.

The framework for analysing these kinds of arrangements is basically the same as set out on page 20, except that the cost curve in the relative frequency graph will shift left relative to an arrangement where there is no demand response (ie average prices will be generally lower if electricity usage during high prices is avoided). Ultimately, the consumer will need to consider the balance of risk and costs of the various arrangements that are available to it.

6 Spot prices can be negative in very rare circumstances.
7 From July 2013, spot prices will be capped on the very rare occasions that either national or island-wide electricity capacity shortages occur, referred to as scarcity pricing events.

How much effort is required under the different arrangements?

The costs of establishing, monitoring and managing the different types of arrangements need to be considered as well as the expected costs of buying electricity under the different arrangements.

Fixed price variable volume contracts generally require the least administrative effort, as the price is pre-set irrespective of the level of usage. Aside from periodic retendering or renegotiation, these types of contracts should not require significant effort to put in place or operate.

Arrangements linked to spot prices require more effort to set up and manage because there are more choices to be made. Some consumers may also need to establish new arrangements or systems to manage these approaches. For example, if the consumer intends to actively manage its electricity use, it may need to carry out some staff training or install new equipment to support this capability. Likewise, management time and effort is required, and if a consumer utilises a new form of hedge contract, it might need to obtain specialist advice on how the contract should be treated for accounting and tax purposes.

Arrangements linked to spot prices also typically require more active monitoring than fixed price variable volume contracts because market conditions can change rapidly and require consumers to adjust their level of exposure or usage.

Arrangements linked to spot prices require more effort to set up and manage because there are more choices to be made

When should I

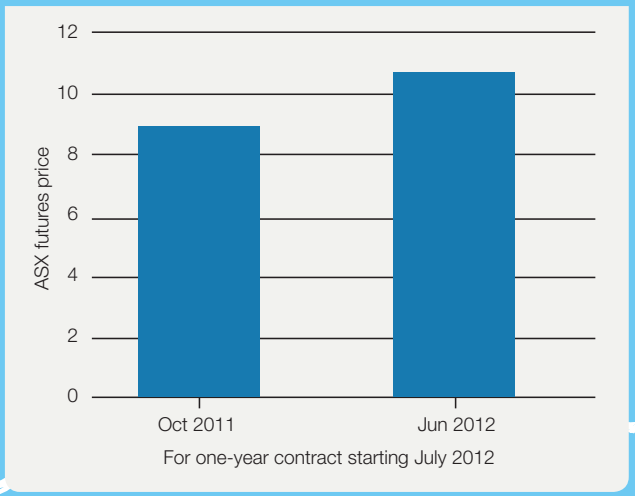
arrange my electricity contracts?

It is important for consumers to arrange their electricity contracts and consider how much electricity price risk they would like to cover well before the point that they are needed (at least six months beforehand is commonly assumed to be necessary to avoid current hydrology risk being priced in). In particular, consumers should be especially careful about arranging follow-on cover for existing contracts that expire in the autumn or winter periods because hedge contract prices at these times of the year can be very sensitive to current hydro conditions. As a result, consumers seeking to renew or extend hedge contracts can find that the prices are much higher than if normal hydro conditions applied.

For example, a consumer buying a one-year hedge contract (from July 2012) at a Benmore supply point (in the Waitaki Valley in the South Island) would have likely faced a higher price if it arranged it in June 2012 (when conditions close to contract start were dry) than if it arranged it much earlier (when hydro conditions for the contract period were more unknown). This is illustrated by the ASX futures prices in the graph below, which shows the prices for a one-year contract (starting July 2012) that would have applied in October 2011 and in June 2012.

Companies with larger exposures often attempt to stagger their contract maturities (when using hedges) to avoid risk associated with the time of recontracting.

Furthermore, at times of high prices, sellers of hedge products can be less willing to sign up new consumers and take on additional exposure to high spot prices. If a consumer leaves it too late to obtain risk cover, it may be unable to find a retailer willing to offer it a deal that it considers reasonable.



Using stress tests

to assess spot price exposure

While consumers considering spot price arrangements are strongly recommended to seek advice from a suitably qualified independent adviser, there are some simple checks a consumer can undertake for itself to help gauge exposure to spot price risk.

One useful tool is to apply a stress test. In essence, this involves calculating what a consumer's electricity purchase cost will be if spot prices are high due to a market stress event. The results of these tests can provide a yardstick for comparing the financial risks associated with different arrangements.

To help apply this approach, consumers can use the stress tests that the Authority publishes on a regular basis (see below).

Stress testing regime for wholesale market participants

Electricity retailers and national grid-connected consumers must apply standardised stress tests to their spot market positions and report the results to their respective boards and an independent registrar appointed by the Authority.

The registrar collates the information into a form that doesn't allow individual participants to be identified and provides it to the Authority.

The regime does not place any mandatory reporting requirements on consumers other than those who are directly connected to the national grid. However, retailers selling electricity to consumers on contracts linked to spot prices must provide those consumers with information to enable them to consider the outcomes of applying the stress tests.

More information on the stress testing regime is available at www.ea.govt.nz/industry/security-of-supply/stress-testing-regime.

The stress tests published by the Authority describe potential spot price outcomes during various market stress scenarios.[8] Below are some examples of the tests.[9]

Examples of stress test scenarios

Energy shortage scenario	Capacity shortage scenario	Base case scenario
An extended drought	Sudden supply loss from major power station or part of grid	'Normal' conditions (to provide reference point)
Average spot price is $250/MWh[10]	Spot price rises to $10,000/MWh	Average spot price of $100/MWh
Whole of a winter quarter	Eight hours on one day	Whole of a winter quarter

8 Note that the prices included in the tests are not forecasts of actual or expected spot prices but rather hypothetical scenarios of potential outcomes.
9 These were the tests for the third quarter of 2012 and will be updated by the Authority from time to time.
10 1MWh is equivalent to 1000kWh. Therefore, $250/MWh is equivalent to 25c/kWh.

Consumers with supply arrangements linked to spot prices can use the stress tests to help in assessing their risk exposure. A simple example is shown below for the energy shortage test. In this case, a hypothetical large consumer is considering the risks associated with buying all its electricity at spot prices versus an approach where it buys a contract for differences to cover 95% of its electricity usage.

For this example, the consumer would lose $2 million in the stress test scenario if it was entirely exposed to spot prices, compared with an $850,000 profit if it entered into a contract for differences to cover 95% of its electricity purchases. Of course, whether it should enter into a contract for differences or not will depend on its risk appetite and the relative costs of hedge contracts versus the alternatives.

Another important point to note is that the scenarios represent *potential* outcomes. Actual spot prices could be higher or lower than the simulated levels during a real market stress event, and the actual events could be more severe than assumed in the scenarios. For example, a drought could last longer than three months, meaning that spot prices reach higher levels and for longer than in the published stress test scenarios. Nonetheless, the stress test scenarios should provide a reference point for consumers who are considering supply arrangements that are linked to spot prices.

Consumers wanting to use the current set of stress test scenarios can find them at www.ea.govt.nz/industry/security-of-supply/stress-testing-regime.

Example 5 – Using stress test scenario to assess risk

	Units	Stress test (no hedge contract)		Stress test (95% hedged at $100/MWh)	
Business sales revenue	$		10,000,000		10,000,000
Energy use	MWh	20,000		20,000	
Average spot price	$/MWh	250		250	
Electricity spot purchase cost	$		5,000,000		5,000,000
Hedge contract volume	MWh	–		19,000	
Hedge contract price	$/MWh	–		100	
Hedge receipts/(payments)	$		–		2,850,000
Net electricity costs	**$**		**5,000,000**		**2,150,000**
Other business costs	$		7,000,000		7,000,000
Profit/(loss)	**$**		**(2,000,000)**		**850,000**

Business loses $2 million in stress test scenario if it buys all electricity at spot prices

Business makes $850,000 profit in stress test scenario if it hedges 95% of spot price exposure

Governance

principles for deciding spot price exposure

Past experience indicates that some consumers have not been aware of the level of financial risk associated with their earlier decisions about spot price exposure. For these reasons, consumers should give careful consideration to the governance principles set out in the box below.

Governance checklist for managing spot price exposure

1. Does my organisation have a clear policy about the level of acceptable exposure to spot price risk – if not, should it adopt a policy?
2. If my organisation has a policy in relation to spot price risk, is it appropriate in terms of the following:
    - The allowable level of risk compared to the organisation's risk appetite and ability to manage price volatility over time?
    - How far ahead risk mitigation cover needs to be put in place, given that the cost or availability of mitigation instruments will change once a risk has emerged?
    - Who, within the organisation, makes decisions on risk exposure?
    - Who, within the organisation, monitors the outcomes of risk management decisions?
3. Is my organisation's current risk position regularly reported to key decision makers? For example, does the level of exposure to spot price risk get reported to the board on a monthly basis?
4. If my organisation does not have a clear policy in relation to exposure to spot price risk, what assurance is there that the board is comfortable with the actual level of exposure?
5. How does my organisation's approach to determining the acceptable level of exposure to spot price risk compare to other financial risks that it is managing, such as movements in interest rates or losses from fire and other catastrophes? Is there a consistent approach to risk and reward across these issues?
6. Is there a separation of duties between the people making the spot price exposure decisions and the people who monitor and report on the results of these decisions to the senior management or board?
7. Is there a process to ensure regular review of decisions and to test the results against expected outcomes?

Where can I

get more information?

For more information on electricity price risk management issues, you should contact a financial adviser or an authorised futures dealer.

There are a few pieces of legislation that regulate the giving of financial advice, which together mean that most advisers lawfully giving such financial advice will be authorised in one way or another by the Financial Markets Authority. The specific authorisation required will depend on the nature of the advice being given.

In addition to general financial adviser requirements, advising or assisting somebody with entry into many electricity price risk management products will be regulated as dealing under the Securities Markets Act 1988. The consequence of this is that, if advice is required in relation to the entry into specific contracts (as opposed to general advice about the type of product to enter into), it is likely that you will only be able to get that advice from an authorised futures dealer or from somebody authorised by a futures exchange (if the contracts are traded on an exchange).

Further information on financial advisers and authorised futures dealers that provide advice on electricity price risk management issues is available at **www.ea.govt.nz/our-work/programmes/market/hedge-market-development/managing-price-risk**.

There are also a number of free information sources that you can draw on:

- Current ASX futures and options contracts www.asx.com.au/products/asx-nz-electricity-futures-and-options.htm.
- Monthly and daily ASX reports of futures and options contracts www.asx.com.au/sfe/daily_monthly_reports.htm.
- Historical and recent prices of electricity risk management contracts www.electricitycontract.co.nz.
- Historical spot price data www.ea.govt.nz/industry/monitoring/cds/centralised-dataset-web-interface.
- Alternative source of historical spot price data www.report.ea.govt.nz/home.htm.
- Recent spot price data as well as other operational data, including demand, current hydro storage levels and transmission constraints www.electricityinfo.co.nz.
- The Wholesale Information Trading System (WITS) is the electricity market wholesale information and trading platform used by electricity market participants to upload their bids and offers. WITS also delivers pricing, scheduling and other market data. The information within the WITS system is available to participants who trade in the electricity wholesale market or via application www.ea.govt.nz/industry/market/wholesale-information-trading-system/access-policy.

  Please note, WITS is intended for people who require more detailed regular market information than what is currently available via electricityinfo.co.nz. Casual users are encouraged to continue accessing information via www.electricityinfo.co.nz.
- Independent advisers on price risk management issues. One example is Energy Link, which publishes regular short reports on price indices www.energylink.co.nz/publications.
- Information on the current stress tests published by the Authority www.ea.govt.nz/industry/security-of-supply/stress-testing-regime.
- Information on how the spot market works www.ea.govt.nz/about-us/documents-publications/electricity-nz.

Glossary

Authority	Electricity Authority
Contract for differences (swaps)	A form of insurance contract that insulates the holder from spot price volatility. The difference between the contract price and the eventual spot price is payable.
Code	Electricity Industry Participation Code 2010 administered by the Authority.
Demand-side management (demand response)	Action by a consumer to reduce electricity usage during periods of high spot prices (and vice versa).
Financial (hedge) contract	Generic term used to describe contracts that insulate the holder from spot price volatility.
Fixed price variable volume contract	The most common form of electricity supply contract. It provides the buyer with certainty about the per unit price for electricity.
Forward price curve	A series of prices for future time periods at which the market is willing to transact today.
Futures contract	A form of insurance contract that insulates the holder from spot price volatility. A buy and sell price for these contracts is quoted each business day on the ASX.
Options contract	A form of insurance contract that insulates the holder from spot price volatility. Provides the holder with the option to activate the contract on or before an agreed date.
Spot price	Price in wholesale electricity market that varies each half-hour across around 280 locations.
Spot price exposure	Results from contractual arrangements where either the amount a party pays or receives is linked to spot prices.
Spot price risk	The possibility that a party with spot price exposure may lose money (either increased purchase costs for consumption or reduced payment for generation).
Spot price volatility	The relative rate at which spot prices move up and down.

Where can I get more copies of this guide?

An electronic version of this guide is available at www.ea.govt.nz/consumer/guides.

If you would like a printed version, please email the Electricity Authority at info@ea.govt.nz or phone us at 04 460 8860.

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