Independent Market Operator

THE SOUTH WEST INTERCONNECTED SYSTEM WHOLESALE ELECTRICITY MARKET:

AN OVERVIEW

INTRODUCTION

A Wholesale Electricity Market has been established in the South West Interconnected System (SWIS) of Western Australia. This market will facilitate greater competition and encourage private investment in the generation and retail sectors of the electricity industry. The market also includes a mechanism for ensuring that from October 2007 adequate generation and demand side management capacity is available to maintain reliability and security of electricity supply. The ultimate objective of the Wholesale Electricity Market is to minimise the cost of electricity supplied to consumers in the SWIS.

This document provides a high level overview of the Wholesale Electricity Market.

THE BASICS

Basic Concept of Markets

Most people are familiar with the concept of markets in the context of houses, shares, vegetables, and other commodities like oil and coffee. These markets are characterised by a combination of sellers making offers to sell some quantity of goods if paid more than some specified value and buyers bidding to buy some quantity of goods if offered a price less than some specified value. The price at which the amount sellers are offering equals the amount that bidders want to buy sets the market price. The benefits of these markets are that:

- Trades reflect the prices that all parties trading are prepared to pay.
- The market provides an efficient means of allocating resources so that the lowest cost supply and the highest value demand is served first, which means resources are used in a manner that maximises the benefit to society.
- Over a period of time, markets encourage development of new technologies and better management of resources so as to reduce costs, making the good supplied more attractive to purchasers.

These concepts are common to all markets, and in most markets trades can be conducted between a single buyer and a single seller without any “formalised market” being required.

Why a Formalised Electricity Market?

Electricity is different from other commodities as it:

Is Difficult to Store and Has to Be Available on Demand

Electricity cannot be stored, at least not on the scale required to supply whole communities. Apart from some small scale exceptions, it is not possible to “stockpile” electricity from low demand periods for use in high demand periods. The electricity that is consumed when a light or TV is operated in a house is produced the same instant as it is

consumed. The consequence of this is that if the demand for electricity at any moment is to be served, then there must be adequate supply available and operating at that moment.

Is Complex

The real-time management of electricity supply is complex. The power system from the turbines in power stations to the light bulbs in a house is a single system. Any action within that system has impacts elsewhere in the system.

For example, if an electricity generating turbine breaks down, the strain or "load" on the remaining turbines increases, causing those turbines to spin more slowly and causing the frequency of electricity to drop below its nominal level of 50 Hz. If the frequency drops by just a few percent, damage can be caused to generators, consumption equipment, and network equipment, so devices exist throughout the system to protect this equipment. If supply does not increase to match demand within seconds, parts of the power system will start turning themselves off, potentially causing blackouts.

These two factors mean that power system operation must be planned and coordinated both ahead of time and on a moment-by-moment basis. A system operator (called "System Management" in the SWIS Wholesale Electricity Market) must monitor the power system constantly and ensure that it is always ready to respond to unexpected events. People wishing to trade electricity cannot just do their own thing. Instead, they must co-ordinate their activities with bodies such as System Management.

In practice, parties can plan ahead of time to trade electricity bilaterally (between themselves) without involving System Management. However, events frequently differ in real-time, because of changes in demand or because of electricity generating equipment outages. Thus those who trade bilaterally must accept that in some instances the need to "keep the lights on" will require them to deviate from their original plans to satisfy their trades. While the deviations are in response to actions required to maintain the power system in a stable and reliable state, a market can compensate those who must deviate through market "balancing" processes.

Further, it is normal for electricity market designs to include a "market operator", providing a service whereby market participants can trade through a central trading mechanism (like a stock exchange) without having to deal directly with each other. These trades can be for energy to be delivered at future times, as well as for deviations that occur in real-time.

The rules governing the functions of the market operator and the manner in which market participants interact with it must be formalised to ensure participants that sell energy are properly compensated by those that buy it. In the SWIS market, the centralised market processes are managed by an entity called "the Independent Market Operator", or IMO.

It follows that a formalised electricity market design must, at the very least, include:

- Rules as to how market trades are scheduled with the operator of the power system.
- Rules as to how trades and deviations are managed and settled.

Much as a game of football has formalised rules so that the game is fair and conforms to the requirements of the game, so the electricity market needs formalised rules.

Do They Have Electricity Markets Elsewhere?

A wholesale electricity market is needed when competing generators are willing to offer their electricity output to competing retailers.

Traditionally, electricity has been delivered almost exclusively by integrated utilities that own and operate electricity generators, transmission and distribution networks, and manage the retail sale of electricity. Depending on the country, these utilities have either been state financed and owned or owned by private companies protected from competition and subject to regulated tariffs. The former approach has been the case in Western Australia.

The modern trend has been to encourage greater private investment and competition so as to reduce costs to the taxpayer for funding the production of electricity while creating downward pressure on prices to electricity consumers. The inability to store electricity and the complexity of managing electricity systems has meant, however, that this trend only began in practice when computer technology reached a level sufficient to make it possible.

Electricity markets are being developed as a result of the deregulation of electricity utilities around the world. The process began in the 90s when the UK government deregulated the UK electricity supply industry. The process has been followed in many other countries, with the electricity market in the eastern states of Australia often sighted as one of the most successful experiences.

The Difference between “Capacity” and “Energy”

When we talk about the capabilities of electricity generators we can talk in terms of their “capacity” or their “energy”. The “capacity” of a generator describes the maximum instantaneous power output that the generator can produce, which is measured in megawatts (MW). The “energy” produced by a generator describes the average power output over a period of time, and is measured in megawatt-hours (MWh). Thus if a generator with a capacity of 100 MW operates at half of its maximum output for one hour it will produce 50 MWh of energy.

The distinction between capacity and energy is important. The energy consumed in a power system every second must match the energy produced in that second. The capacity to supply energy must be sufficient to serve the peak demand on the power system, plus some margin to cover for failure of generators. This means that almost all of the time, only part of the generation capacity available to a power system will be used to produce energy.

Demand tends to grow over time. If the average level of demand grows but the maximum level of demand remains unchanged, then the power system needs more energy, which can usually be provided by the existing generating capacity. As peak demand grows,

however, a power system can reach the point where it is no longer possible to meet demand, while still maintaining a sufficient capacity margin, without acquiring more capacity.

Not all electricity generating capacity is the same. Much as airlines have different sizes and types of aeroplanes to serve different purposes, so do electricity markets. Much as airline demand varies by route and time of year, so does electricity demand over the day and year.

Some demand exists all the time, and consequently it is economic to serve this demand with large "**baseload**" generating stations that are expensive to build but inexpensive to run. The fact that they run nearly all the time ensures that their average cost per unit of energy produced is low.

Some demand only exists occasionally, with extreme loads only appearing for a few hours per year. These extreme loads may be serviced with "**peaking**" generating stations that are relatively cheap to build, but expensive to run. Their low capital costs make them a more economic choice to meet peak load given the small amount of time the market must bear their high running costs.

"**Intermittent**" generators are another source of supply. These are typically generators that use renewable fuels, and are different from other generators in that they cannot always be relied upon to produce a fixed quantity of energy at a set time. Wind farms are the most well known form of these generators, but there are other forms, such as those based on solar energy. Intermittent generators tend to have higher capital costs than other generators, but little or no energy cost. While this might be expected to make them more desirable than baseload generation, they are limited by the fact that they are only capable of producing energy when it is windy or sunny etc, depending on the type of intermittent generator.

An alternative to acquiring more generation capacity is to use demand side management, or "**DSM**". That is, rather than increasing supply, we encourage electricity consumers to reduce load – and pay compensation for this. While the capital cost for DSM is low, the usage cost can be very high, and will usually be more expensive than the running cost of a peaking generator. Consequently, DSM options will normally only be used to manage load in the highest demand hours of the year.

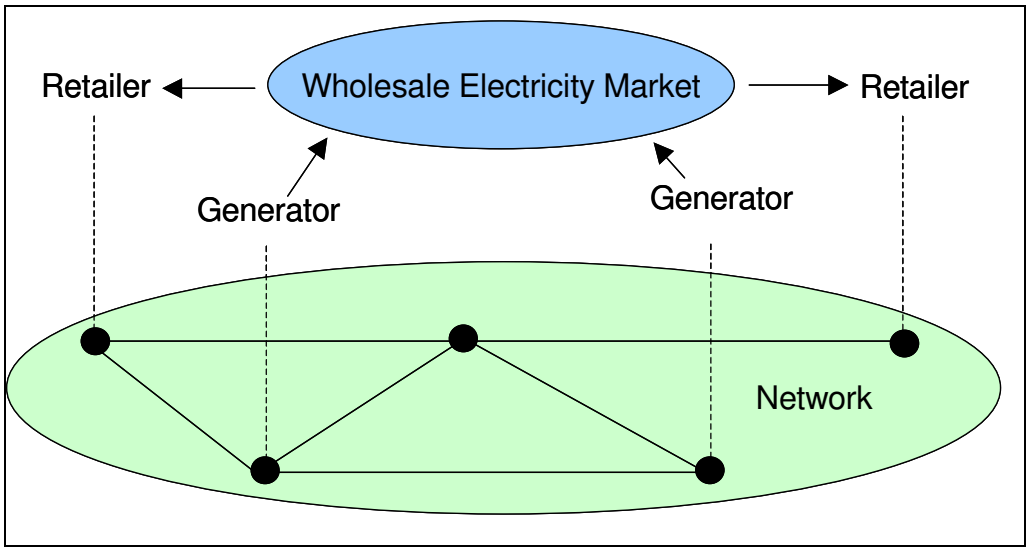
If the power system experiences high average demand growth, such that demand at all hours of the day increases significantly, then it will be most economic to invest in baseload generation and wind farms. If the power system experiences high peak demand growth only, then the increased demand will not be adequate to support new baseload generation, and it will be more economic to consider peaking generators and DSM.

The Basics of Structural Reform

Separate the "Monopoly" Activities and the "Contestable" Activities

In very simple terms, an electricity supply industry comprises:

- Generators, who supply electricity at different locations.
- Retailers, who then supply that electricity to end users, also at different locations.
- A network for transmitting power between those locations.



Generators and retailers provide services that are "contestable". This means that any generating company can serve the requirements of any retailer, and any retailer can serve the requirements of end-users. Thus retailers do not have to buy energy from just one generating company; they can buy from any generating company.

The provision of network services, by contrast, is a "natural monopoly". This means that the costs of network assets are so great, that it is only economic to have one provider of this service. While there can be multiple network companies, each company will have a natural monopoly over the network in a particular geographic area. The Wholesale Electricity Market is therefore designed to facilitate competitive trading between retailers and generators, but not network operators.

Establish a Wholesale Electricity Market

The following objectives are in legislation (the *Electricity Industry Act 2004*) for the Wholesale Electricity Market:

- to promote the economically efficient, safe and reliable production and supply of electricity and electricity related services in the South West interconnected system;
- to encourage competition among generators and retailers in the South West interconnected system, including by facilitating efficient entry of new competitors;
- to avoid discrimination in that market against particular energy options and technologies, including sustainable energy options and technologies such as those that make use of renewable resources or that reduce overall greenhouse gas emissions;

- to minimise the long-term cost of electricity supplied to consumers from the South West interconnected system; and
- to encourage the taking of measures to manage the amount of electricity used and when it is used.

To facilitate these goals, Western Power no longer simultaneously has the functions of retailer, generator and network operator. The old Western Power has been split into the Electricity Generation Corporation (trading as Verve Energy), the Electricity Retail Corporation (trading as Synergy), the Electricity Networks Corporation (trading as Western Power), and Horizon Power.

An essential component of the establishment of a Wholesale Electricity Market was the establishment of a fully Independent Market Operator (IMO). The IMO administers and operates the Wholesale Electricity Market. It is the body through which buyers and sellers transact capacity and energy, where that capacity and energy is not traded bilaterally.

The IMO is also responsible for maintaining and developing the rules and market related procedures that govern the operation of the Wholesale Electricity Market.

A second body, System Management, is responsible for the physical operation of the power system so as to ensure its secure and reliable operation. System Management is a ring fenced business unit of the Electricity Networks Corporation.

System Management plays a central role in the scheduling of generator and transmission outages, and manages the real-time operation of the power system.

The rules governing the operation of the Wholesale Electricity Market (the Market Rules) require that System Management use Verve Energy's facilities to manage any difference between supply and demand in real-time, except in special circumstances where Independent Power Producer facilities can be scheduled.

While System Management's actions are subject to the Market Rules, in extreme circumstances it has wide powers to over-ride normal market processes if that is required to maintain or restore the supply of energy to consumers.

Other entities that play a role in the governance of the Wholesale Electricity Market are:

- the Minister for Energy, who established the initial Market Rules and who appoints the board of the IMO;
- the Economic Regulation Authority, which performs regulatory and market surveillance roles; and
- the Energy Review Board, which acts as an adjudicator for appeals.

THE ROAD TO ESTABLISHING THE ELECTRICITY MARKET

The Elements of the WA Wholesale Electricity Market

Energy Market

In general it is expected that retailers will cover most of their electricity requirements through bilateral arrangements with generators outside of the formal Wholesale Electricity Market processes. This builds on the current bilateral arrangements in the SWIS. However, importantly these retailers and generators will be able to use the Wholesale Electricity Market to trade variations from their contracted quantities.

The IMO will operate a daily Short Term Energy Market (STEM), which will enable market participants to adjust their contract positions prior to each trading day. As an extension of the energy market, the IMO will also settle real-time deviations from contract positions.

Given that most energy is expected to be traded bilaterally, the IMO will only be required to settle a small proportion of the total transactions.

Reserve Capacity Mechanism

A significant feature of the design of the Wholesale Electricity Market is the central role of the IMO to ensure adequate generation capacity on the SWIS. To achieve this, the IMO will operate a Reserve Capacity Mechanism, which will require that retailers either secure adequate capacity bilaterally or purchase it from the IMO, so as to ensure that the SWIS generation capacity requirements are met.

Relationship between the Wholesale Electricity Market and the Retail Market

The supply of electricity to end-users is achieved through the retail market. There are two types of end-users in the retail market.

- "Contestable customers" are larger retail customers who can shop around for the best price for power. These customers are not required to take retail supply from Synergy.
- "Non-contestable customers" are small retail consumers covered by retail tariffs and who do not have the option to change suppliers. They are all supplied by Synergy.

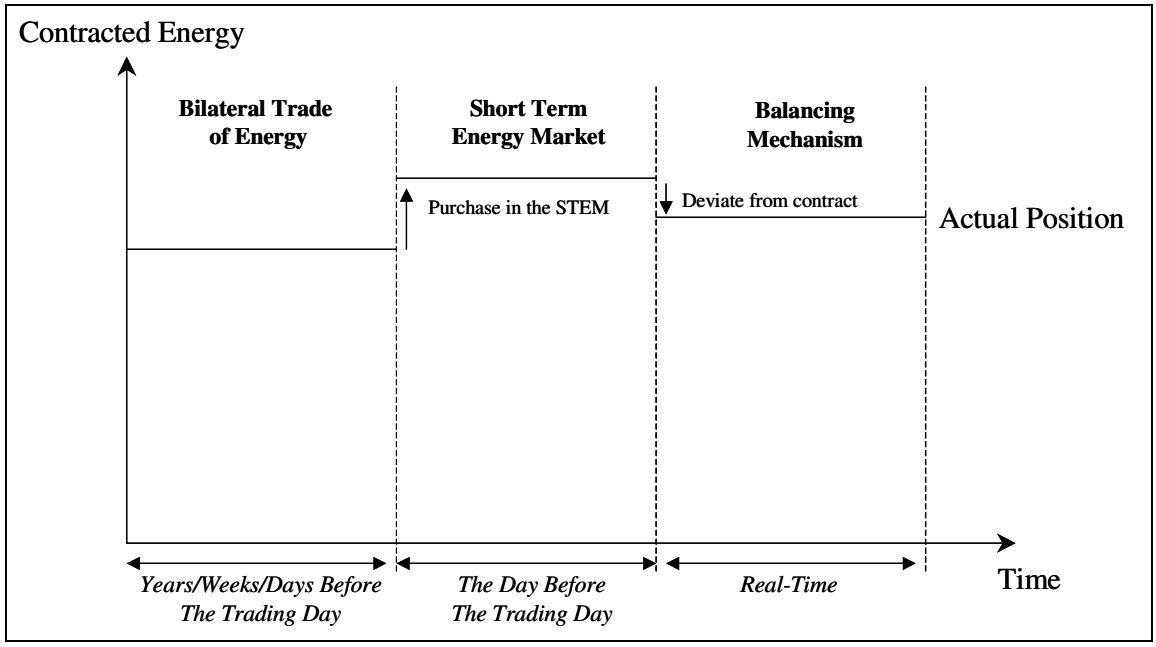
Much as retail suppliers of vegetables purchase those vegetables from wholesale markets, so those providing the retail supply of energy purchase that energy from the Wholesale Electricity Market. Thus the retail market is quite distinct in operation from the Wholesale Electricity Market. However, the two markets are linked in the sense that retailers are "market customers" in the Wholesale Electricity Market.

How Does the Energy Market Work?

The Wholesale Electricity Market comprises three mechanisms for trading energy:

- **Bilateral Trade of Energy:** Participants in the market can trade energy bilaterally with each other well ahead of time without involving third parties.
- **Short Term Energy Market:** Participants can purchase energy from the IMO or sell energy to the IMO on the day before that energy will be delivered.
- **Balancing Mechanism:** Each market participant is contracted for an amount of energy corresponding to its bilateral trades plus its STEM trades. In real-time, the actual energy provided may deviate from this net contract position. The Balancing Mechanism provides the means for trading these deviations.

The three mechanisms relate to different time frames and are discussed further below.



Bilateral Trade of Energy (Long term energy commitments –the primary method of trade)

Generators can enter into private contracts to meet the energy needs of retailers at a bilaterally negotiated price. These contracts can have terms of hours to many years, and allow the generator to cover the full costs of supplying a retailer. Each day the generator will inform the IMO as to how much energy it will be supplying, and how much energy the retailer will consume, in each half hour of the next day.

The Short Term Energy Market (STEM) (A day-ahead adjustment to contract positions)

The STEM provides a day-ahead market whereby market participants can adjust their bilateral energy contract position. Both generators and retailers can participate, and each can buy additional energy from the IMO or sell surplus energy to the IMO.

Participants in the STEM will submit prices in the morning of each day. Each day the IMO will run a STEM auction and determine a single STEM price for each half hour of the next day. The IMO will buy the same quantity as it sells, so will take a neutral position in the market.

The Balancing Mechanism (A real-time adjustment for deviations from energy contract position)

In the hours leading up to real-time, System Management will schedule Verve Energy generation and, if necessary, issue instructions to other market participants so as to enable supply to match demand in real time. That is, System Management will use these resources to "balance" the system.

The "balancing" price paid by participants that have deviated from their contract positions will generally equal the STEM price. However, if the situation has changed significantly from what was expected at the time the STEM was run then the "balancing" price would be adjusted accordingly. Further, when System Management calls on generating facilities that do not belong to Verve Energy to assist in balancing the system, these will be paid at a price previously submitted by the operator of the facility to the IMO.

When Did the Energy Market Commence?

The energy market commenced on 21 September 2006.

Why Do We Need a "Reserve Capacity Mechanism"?

A critical issue in electricity markets is to ensure that the capacity to supply demand in future years is put in place in time. Thus some markets, such as that to be implemented in the SWIS, include a market for capacity in addition to the market for energy.

This feature is not common to all markets, with some markets allowing energy prices to rise to very high levels at times so as to provide an incentive for new capacity to enter the market. The National Electricity Market allows the price of electricity to rise to $10,000/MWh, with prices rising to near this level several hours per year. These high prices provide the revenue incentive for investment in generators that only operate a few hours each year.

The capacity market therefore provides a source of revenue for generation and DSM capacity even if it rarely provides energy. This allows generation and DSM capacity to remain viable, ensuring that it is available to provide energy on those few occasions when it is needed.

In the SWIS, the capacity market will return $10/MW to $15/MW to generators and DSM options every hour of the year, irrespective of whether or not their energy is used by the market. This allows energy prices to be capped at lower levels, eg. $150/MWh instead of the $10,000/MWh used in the National Electricity Market. The capacity market in the SWIS is called the "Reserve Capacity Mechanism".

How Does the Reserve Capacity Mechanism Work?

The purpose of the Reserve Capacity Mechanism is to ensure that adequate generation and DSM capacity is available to serve load in the SWIS in most extreme situations. The capacity required for each year is set so as to be sufficient to serve the annual peak load

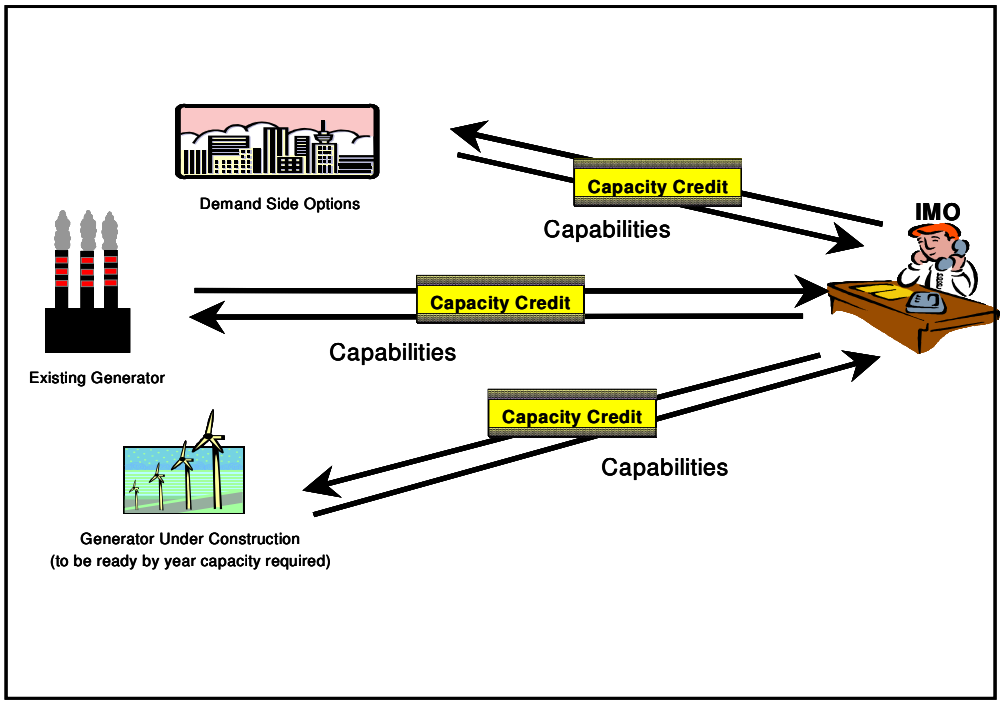
expected to occur not more than once in every 10 years while the largest generator in the SWIS (Collie) is unavailable.

To minimise their long-term costs of electricity those purchasing electricity (i.e. retailers and large loads) will commit to an efficient mix of supply options (i.e. generation and DSM capacity) far in advance of it being required. To the extent that this does not always provide adequate capacity for the market, the Reserve Capacity Mechanism provides a fall back.

The Reserve Capacity Mechanism is based around the trade of Capacity Credits between those supplying capacity to the market and those using it, i.e. retailers. Each year, the IMO will distribute the total capacity required for that year between retailers and large loads in proportion to their contribution to the system peak demand in the previous year.

Each retailer will be obliged to secure adequate Capacity Credits to meet its individual Reserve Capacity requirement. A retailer can secure Capacity Credits through bilateral trade with generation and DSM capacity providers, or it can purchase Capacity Credits from the IMO.

Generators and DSM capacity can register Capacity Credits with the IMO. The registration of these Capacity Credits imposes obligations on the providers to make that capacity available to the energy market. These obligations ensure that having paid for capacity, the market can make use of it.



The process by which generators and DSM capacity provide Capacity Credits is as follows:

- Every year the IMO will forecasts capacity requirements for the next 10 years;

- Two years prior to the year that capacity is required, operators of generation and DSM capacity will apply to the IMO to certify their Reserve Capacity. This process will define the amount of Capacity Credits available from each facility and its obligations;

- Those with certified Reserve Capacity must indicate to the IMO whether they will trade capacity bilaterally or via an auction process, if one is held;

- The IMO will vet the capacity to be traded bilaterally to ensure that the amount of capacity traded does not substantially exceed the requirements of the SWIS. However the IMO will not reject bilateral trades for facilities that already exist or are under construction. Any capacity it accepts earns Capacity Credits;

- If the full requirements of the system are not covered by bilateral trades, the IMO will run an annual auction to procure Capacity Credits from the remaining holders of certified Reserve Capacity.

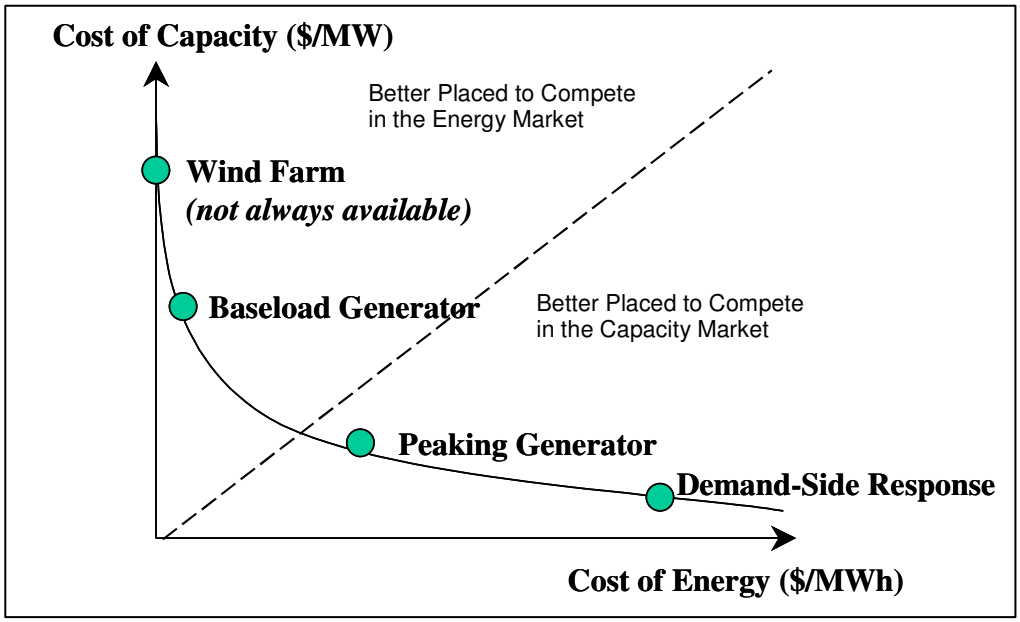
- Those Capacity Credits procured by the IMO in the auction will be used to meet the requirements of retailers who have not procured Capacity Credits bilaterally; and

- The auction will have a price cap based on the annualised costs of installing and maintaining an open-cycle gas turbine power station. While not the lowest cost source of energy, this type of generator is considered because it is relatively inexpensive to build and can be built within the period between an auction being held and the capacity being required.

- The process described above, as applied in a particular year, will determine which generation and DSM capacity holds Capacity Credits for a 12-month period starting from 1 October of the year two years hence.

How Will New Capacity be Attracted into the Market?

All generation technologies will have their place in the Wholesale Electricity Market. However, while some technologies are better placed to compete in the energy market (i.e. base-load plant) others may be more competitive in the capacity market (i.e. peaking plant).



Baseload Plant

To minimise their costs and increase their competitiveness over the long term, retailers will tend to enter into long-term contractual arrangements with low cost energy providers, such as operators of base-load plant.

For example, to fund a base load coal plant an investor will need the security of a long-term bilateral contract with a retailer. That contract is likely to be for both energy and capacity so the retailer will be able to be assigned the capacity credits held by the generator.

Therefore the retailer will be able to fully protect itself from changing prices in the reserve capacity mechanism while also ensuring lower delivered prices of energy by signing a contract with a lower cost base load generator.

The investor would be free to offer any uncontracted capacity and energy into the Reserve Capacity auction, and into the STEM and balancing arrangements.

Peaking Plant

It is expected that most generators, particularly base-load facilities, will trade their Capacity Credits bilaterally, and will link them to bilateral trades of energy. However, peaking facilities, that operate infrequently, are more likely to rely on the auction process for funding their capacity.

For new capacity, the operator of the capacity will be able to receive the auction price for 10 years without being required to participate in the auction again. This provides revenue certainty for new entrant generators.

A Wind Farm

Wind farms can participate in the Reserve Capacity Mechanism. Uncertainty as to the amount of energy a wind farm can provide on demand means that wind farms will not be able to hold the same amount of Capacity Credits as thermal stations. The Capacity Credits held by a wind farm will be based on the average output of that wind farm over the previous 3 years or, in the case of facilities that have not operated for 3 years, an estimate of that average output.

An investor in a wind farm could participate in the Reserve Capacity Mechanism and, if it chooses, take up a long-term price arrangement similar to a peaking plant. In the energy market it can simply generate, and be paid the price in balancing, which will reflect the marginal cost of energy in the market. Wind farms tend to have higher capital costs than peaking generators, so both revenues from the Reserve Capacity mechanism and from energy go towards recovering its capital costs.

A wind farm could also trade energy and Capacity Credits bilaterally, though it would occasionally have to purchase energy back at the balancing price if it lacked the wind required to cover the contract position.

DSM Capacity

The operator of DSM capacity has a number of options for participation.

- It can offer the capacity into the Reserve Capacity mechanism, and, in return, make the capacity available for dispatch by System Management.
- It can enter into ancillary service contracts with System Management to provide for use of the capacity for spinning reserve services.
- It can contract with a retailer to reduce the retailer's peak demand and hence the retailer's capacity requirements.
- If the market is short of capacity, it can contract its capacity to the IMO on a short-term basis during capacity shortages, if these occur.

When Did the Reserve Capacity Mechanism Commence?

The SWIS is experiencing growth in peak demand of more than 3 per cent per year and also faces the need to replace plant scheduled for retirement. Around 270 MW of additional capacity is estimated to be required for the summer of 2007/08. This includes the planned retirement of Muja A/B in July 2007.

As provided for under the *Electricity Industry (Wholesale Electricity Market) Regulations 2004, o*n 1 October 2004 the Minister for Energy made the Market Rules for the wholesale electricity market. These were gazetted on 5 October 2004.

The first stage of implementation of the Wholesale Electricity Market was focused on ensuring the timely provision of capacity to meet peak demand growth in the SWIS.

The Reserve Capacity Mechanism was commenced in October 2005 to meet this expected additional capacity requirement in a timely manner. The process commenced with the launch of a request for Expressions of Interest, as required under the Market Rules. The request for Expressions of Interest was launched in October 2004 and 14 companies expressed their interest in providing new capacity for 2007/08.

The results of the Reserve Capacity Mechanism process for the 2007/08 year were that the IMO assigned capacity credits to 11 companies to provide 4115.4 MW of generation and demand side management capacity during the 2007/08 year. This is a comfortable margin above the estimated capacity requirement of 4000 MW.

Much of this capacity is already in place or under construction, but it also includes a substantial commitment to additional capacity. Capacity will be provided by both traditional plant as well as generators powered by renewable energy. These include wind farms as well as landfill gas. Two companies have committed to providing a total of 131 MW of capacity through DSM arrangements

The success of this process indicates that private sector investors have confidence in the new Wholesale Electricity Market. It also meant that the IMO did not proceed with the fallback mechanism of running a reserve capacity auction in 2005.

It is important to note that the Reserve Capacity auction is a fall back mechanism and therefore is not conducted if the Reserve Capacity requirement is fully covered under bilateral trades with respect to a particular Reserve Capacity cycle.