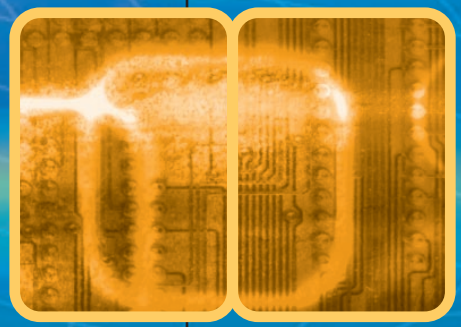
JUNE 2005

AN INTRODUCTION TO

australia's national electricity market



NEMMCO
National Electricity Market Management Company Ltd

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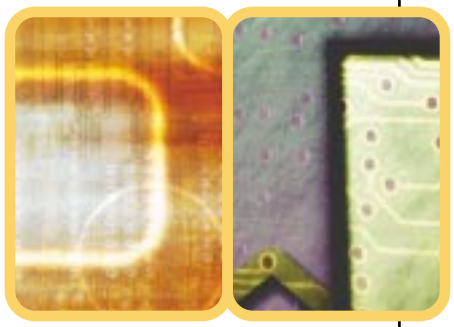


THE ELECTRICITY SUPPLY INDUSTRY

Sectors of the electricity supply industry are involved with the generation, transmission, distribution and retail sale of electricity. Australia's social, industrial and commercial success depends on the reliability of the electricity supply. In this way, the industry contributes significantly to the national economy.

What is Electricity?

Electricity is a form of energy produced by the flow of electrons in a substance known as a conductor. The best conductors are metals such as copper and aluminium, and are commonly used in electrical wiring.

Energy exists in many forms. Electricity is a secondary energy source in that it is produced by the conversion of other energy sources like the chemical energy in coal, natural gas and oil. Other primary sources of energy, like the sun and wind, are increasingly being used to produce electricity. A quantity of energy can be changed or converted, but can never be created or destroyed.

Electricity can be converted readily to heat and light and used to power machines. It can also be transported with relative ease. These characteristics make electricity a convenient and manageable form of energy, and all contribute both to its value as a commodity and its versatility as a source of power.

A unit of power is referred to as a watt. The number of watts, or wattage, of an electrical appliance indicates the rate at which the appliance converts electrical energy to another form of energy such as heat or light. One watt is equivalent to one joule of work per second. Both the electrical pressure (voltage) and the number of electrons flowing (current) determine the electrical power or rate of energy conversion. A 60-watt light globe uses 60 watts of electricity to produce light, and a typical electric kettle uses 2400 watts to produce heat.

Units Explained:

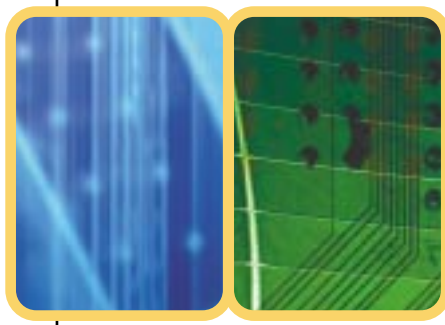
One megawatt (MW) is equal to one million watts (W).	One gigawatt (GW) is equivalent to one thousand megawatts.	One megawatt hour (MWh) is the energy required to power ten thousand 100 W light globes for one hour.	A 100 MW generator will power one million 100 W light globes simultaneously.	A 600 MW generator has sufficient capacity to service 200,000 domestic customers.

How is Electricity Produced?

Electricity can be produced by either chemical means or mechanical action. Electricity produced by chemical means relies on a flow of charged particles from cells in a battery. While this type of electricity has some very important applications in modern society, it is an expensive production process and can

meet only limited specific requirements for electricity. The generators in modern power stations produce electricity by the mechanical action of large, powerful magnets that spin rapidly inside the huge coils of conducting wire within turbines.

More than 90 percent of Australia's electricity production relies on the burning of the fossil fuels, coal, gas and oil. The chemical energy stored in these fuels is used to heat water and produce steam. The steam is then forced under great pressure through a turbine that drives a generator to produce electricity. The complete process involves the conversion of chemical energy to kinetic energy to electrical energy. In a similar way, the kinetic energy of falling water drives turbine blades to produce electrical energy at a hydro-electricity plant, and the kinetic energy of wind drives the blades of a wind-power turbine to produce electricity.

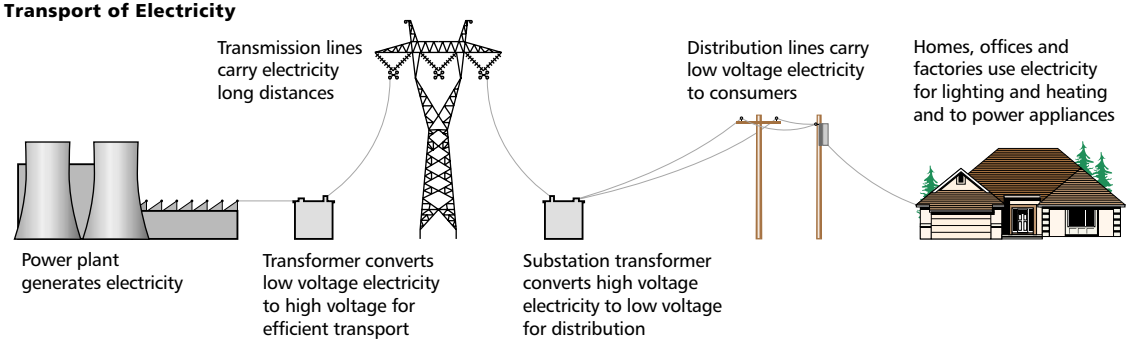


How is Electricity Transported?

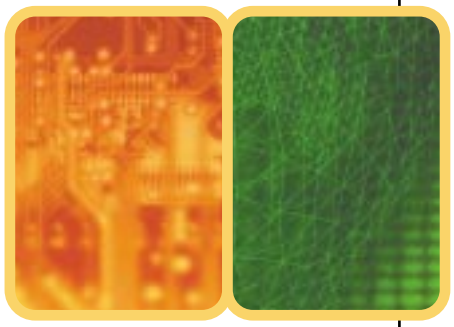
Electricity travels along a conductor at close to the speed of light. When an appliance is switched on, power is instantly transmitted from a power station to the appliance. Although this occurs instantaneously, a specific sequence of events takes place to ensure the delivery of the required electricity.

A transformer converts the electricity produced at a generation plant from low to high voltage to enable its efficient transport on the transmission system. When the electricity arrives at the location where it is required, a substation transformer changes the high voltage electricity to low voltage for distribution. Distribution lines then carry low voltage electricity to consumers who access it through the power outlets in homes, offices and factories.

Transport of Electricity



THE NATIONAL ELECTRICITY MARKET



The National Electricity Market (NEM) began operating as a wholesale market for the supply of electricity to retailers and end-users in Queensland, New South Wales, the Australian Capital Territory, Victoria and South Australia in December 1998. Operations are currently based in five interconnected regions that largely follow State boundaries. In 2005 Tasmania will join the NEM as a sixth region.

The NEM operates on the world's longest interconnected power system – from Port Douglas in Queensland to Port Lincoln in South Australia – a distance of more than 4000 kilometres. Up to $7 billion of electricity is traded annually in the NEM to meet the demand of the almost eight million end-use consumers.

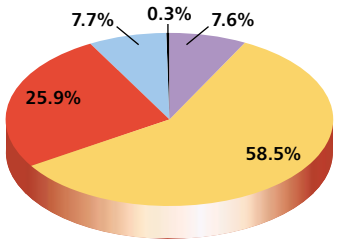
Some assets that comprise the NEM's infrastructure are owned and operated by state governments, and some are owned and operated under private business arrangements.

Exchange between electricity producers and electricity consumers is facilitated through a pool where the output from all generators is aggregated and scheduled to meet demand. The electricity pool is not a physical location; rather it is a set of procedures that NEMMCO manages according to the provisions of National Electricity Law and Statutory Rules (the Rules) and in conjunction with market participants and regulatory agencies.

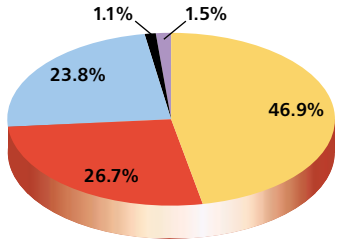
Electricity is an ideal commodity to be traded using pool arrangements because of two of its unique characteristics. Electricity cannot be stored for future use, so supply must vary dynamically with changing demand. And because one unit of electricity is indistinguishable for all other units, it is impossible to determine which generator produced which electricity.

Sophisticated information technology systems underpin the operation of the National Electricity Market. The systems balance supply with demand, maintain reserve requirements, select which components of the power system operate at any one time, determine the spot price, and thereby facilitate the financial settlement of the physical market.

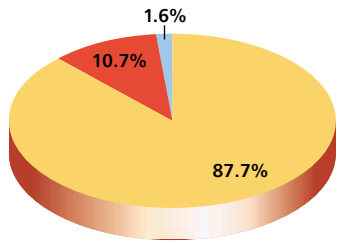
Generation by Fuel Type



Electricity Consumption by Sector

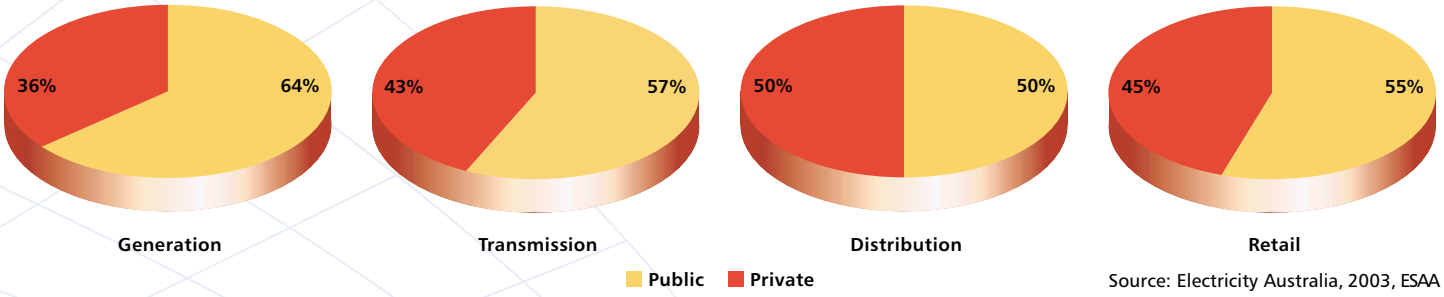


Number of Customers by Sector



Source: Electricity Australia, 2003, ESAA

Ownership of NEM Assets



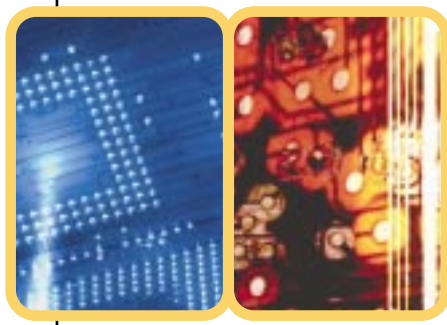
Source: Electricity Australia, 2003, ESAA

NATIONAL ELECTRICITY MARKET MANAGEMENT COMPANY LIMITED

The National Electricity Market Management Company Limited (NEMMCO) was established in 1996 to administer and manage the NEM, develop the market and continually improve its efficiency. The governments of Queensland, New South Wales, the Australian Capital Territory, Victoria, South Australia and Tasmania are members of NEMMCO. Each of these governments nominates a director to the NEMMCO board.

NEMMCO is a company under Corporations Law. It operates on a break-even basis by recovering the costs of operating the NEM and running the organisation by levying fees against market participants. The fees are complex, and comprise both fixed and variable components that take into account the type of participant and their share of trade in the market. The structure of fees payable to NEMMCO is determined periodically, while the actual fee levels are set annually.

NEMMCO manages the market and power system from two control centres in different states. Both centres operate around the clock, and are equipped with identical communication and information technology systems. The entire NEM, or individual regions within it, can be operated from either or both centres. This arrangement is a means of ensuring continuous supply despite the risks that natural disasters or other events present, and provides NEMMCO with the flexibility to respond quickly to dramatic changes in the market or the power system.



NATIONAL ELECTRICITY LAW AND RULES

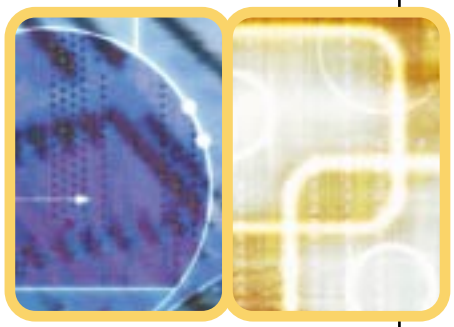
When the NEM commenced, a National Electricity Code—the product of comprehensive consultation and extensive trials conducted between governments, the electricity supply industry and electricity users as part of a government-driven deregulation and reform agenda—provided guidelines for how the market was to operate. In June 2005, the National Electricity Code was replaced by amended National Electricity Law and Rules. NEMMCO's functions are prescribed in the National Electricity Law, and procedures and processes for market operations, power system security, network connection and access, and pricing for network services in the National Electricity Market are all prescribed in the Rules.

THE SPOT MARKET

Wholesale trading in electricity is conducted as a spot market where supply and demand are instantaneously matched in real-time through a centrally-coordinated dispatch process. Generators offer to supply the market with specific amounts of electricity at particular prices. Offers are submitted every five minutes of every day. From all offers submitted, NEMMCO's systems determine the generators required to produce electricity based on the principle of meeting prevailing demand in the most cost-efficient way. NEMMCO then dispatches these generators into production.

A dispatch price is determined every five minutes, and six dispatch prices are averaged every half-hour to determine the spot price for each trading interval for each of the regions of the NEM. NEMMCO uses the spot price as the basis for the settlement of financial transactions for all energy traded in the NEM.

The Rules set a maximum spot price of $10,000 per megawatt hour. This is the maximum price at which generators can bid into the market. The maximum spot price is also called Value of Lost Load (VoLL), and it is the price automatically triggered when NEMMCO directs network service providers to interrupt customer supply in order to keep supply and demand in the system in balance.

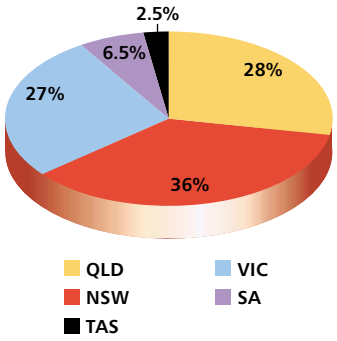


Two aspects of the transmission network contribute to varying costs of electricity supply within different areas of the NEM. Firstly, losses are incurred as power is transported from where it is produced to where it is to be consumed through electrical resistance and the heating up of conductors. Secondly, electricity being transported along certain elements of the network may encounter technical constraints on capacity or bottlenecks.

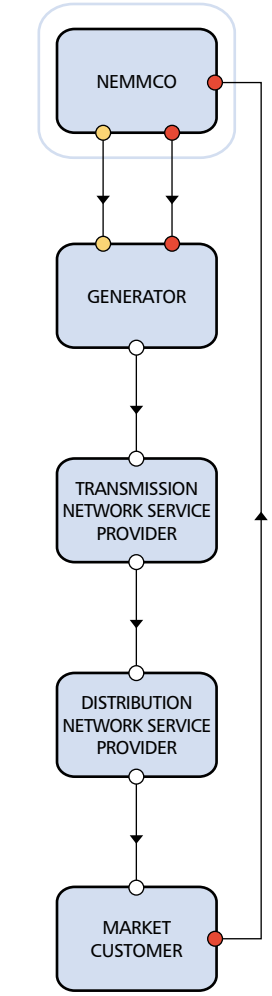
Trends in spot price movement provide signals for future investment in generation and transmission infrastructure in the NEM. As the capacity of available generation to meet demand diminishes, relative scarcity will lead to an increase in the spot price, and new generation or network capacity will be attracted into the market. High spot prices during periods of supply scarcity may also act as an incentive for consumers to reduce their demand.

It is important to remember that the NEM is a wholesale market. Only about 20 percent of the price paid by domestic and business consumers for electricity supply is accounted for by the direct cost of the energy. Additional charges are added to retail accounts for network usage, service fees, market charges, the retailer's profit margin and the GST.

Total Energy Sent Out 2003–2004



Energy and Financial Flows



KEY PARAMETERS FOR NEM OPERATION

Security of Supply

NEMMCO's highest priority as power system and market operator of the NEM is the management of power system security. Security of electricity supply is a measure of the power system's capacity to continue operating within defined technical limits despite the disconnection of a major power system element, such as a generator or interconnector.

The maintenance of power system security ensures the ongoing and reliable supply of electricity to satisfy demand at all times.

Power System Reliability

Reliability is a measure of the power system's capacity to continue to supply sufficient power to satisfy customer demand, allowing for the loss of generation capacity. The shortfall of supply against demand is referred to as unserved energy. Reliability standards are established in the NEM that determine that unserved energy per year for each region must not exceed 0.002 percent of the total energy consumed in that region that year.

Supply Reserve

The power system is required to be operated at all times with a certain level of reserve in order to meet the required standard of supply reliability across the NEM. Calculation of the minimum reserve requirements recognises reserve sharing in a national context. Under current standards, NEMMCO is required to ensure 850 megawatts of reserve is carried across the entire NEM—including during periods of extreme demand—to provide the required level of supply reliability.

Managing Security and Reliability

In all but extraordinary circumstances, market forces keep supply and demand in the NEM in balance. However, during periods of supply shortfall when system security or reliability of supply is threatened, the Rules endow NEMMCO with authority to use a variety of tools to restore supply and demand balance. The tools include the power of direction, load shedding and reserve trading.

Security and Reliability Directions

NEMMCO has the power to direct registered generators into production when a supply shortfall is expected and some generators are known to have withheld some of their total capacity from the market. NEMMCO only uses this power of direction to protect power system security or supply reliability.

Load Shedding

In the unlikely event that demand in a region exceeds supply and all other means to satisfy demand have been implemented, NEMMCO can instruct network service providers to disconnect some customers. This action is only taken when there is a need to reduce demand and return the system to balance. Load shedding implemented in this way results in serial blackouts across areas serviced by the NEM.

The load shedding process is undertaken because system security is a higher priority than reliability for the operator of the NEM in that the operating condition of the entire power system must be safeguarded as a priority to interrupting supply to part of the network. During a period of load shedding, supply is withdrawn from those NEM regions affected by the shortfall in proportion to the demand levels at the time the shortfall began. The proportioning process determines the amount of load shedding for each affected region up to the point where interconnectors are operating to their maximum transfer capacity. Once the interconnectors reach their maximum transfer capacity, the importing region must bear any additional load shedding locally.

KEY PARAMETERS FOR NEM OPERATION

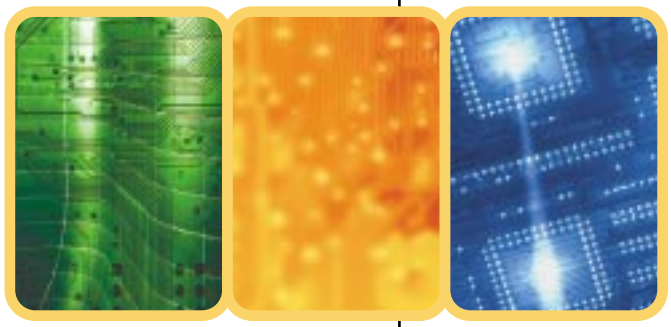
By implementing load shedding, NEMMCO protects the integrity of power system operation so that widespread and long-lasting blackouts are avoided. It also ensures that the hardship caused by a sustained supply shortfall is shared in an equitable fashion.

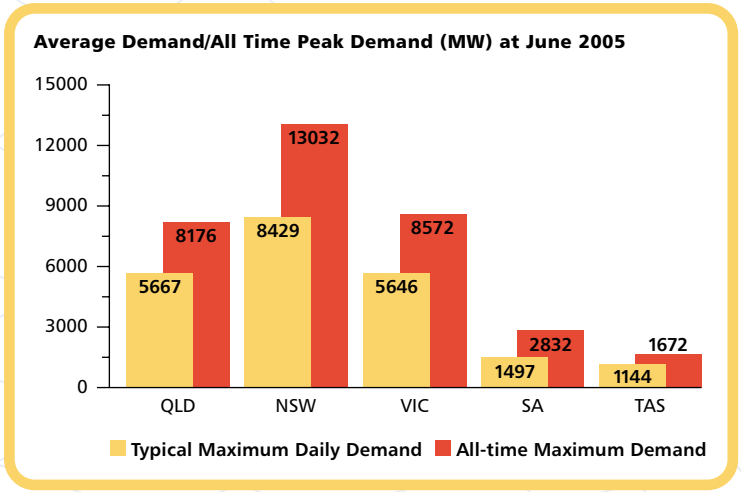
Reserve Trading

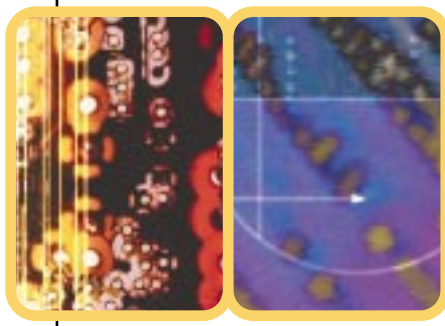
When there is sufficient notice of an upcoming shortfall of supply that threatens to compromise minimum reserve margins, NEMMCO may tender for contracts for electricity supply from sources beyond those factored into NEMMCO's usual forecasting processes. At these times, emergency generators and other generators connected directly to the distribution network who submit tenders may enter contracts to boost supply in the NEM so the widespread supply interruptions that may otherwise have occurred can be avoided. In the same way, some electricity consumers may offer for a financial consideration to decrease their demand at times of supply shortfall so that demand and supply are brought into balance.

OPERATING THE NEM

Operating the NEM involves conducting a sequence of activities to facilitate trade between the producers and wholesale consumers of electricity. These activities include establishing demand levels, receiving offers to supply from generators, scheduling generators, dispatching generators into production, calculating the spot price, measuring electricity use and financially settling the market.







Demand

NEMMCO conducts forecasts of expected electricity demand in order to operate the NEM. Demand varies from region to region depending on population, temperature, and the industrial and commercial needs. It also varies throughout the day, with daily demand peaks (driven by domestic activity) typically occurring between 7:00 am and 9:00 am and between 4:00 pm and 7:00 pm.

A typical level of demand for electricity across the NEM is approximately 21,000 megawatts on a business day of average temperatures. There is ample supply available in the system to meet this level of demand. In fact, supply only comes under extreme pressure for a few hours on just a few days of extreme high temperature that occur each year. Further, because peak demand does not occur simultaneously in all regions, total supply can be shared between regions using the interconnected power network.

Demand in the Victoria and South Australia regions of the NEM is characterised by short-term demand peaks during the summer months. It makes economic and market sense that these extreme peaks of demand be met by special arrangements rather than having excess base-load generation capacity in the system at all times. The peaks are currently being met by a combination of generators that have been specifically built to service extreme demand periods (peak generators), and demand side participation, where consumers voluntarily and temporarily withdraw from the market when the spot price reaches a threshold level.

OPERATING THE NEM

Supply

The delivery of electricity to market customers comprises a sequence of distinct processes that NEMMCO manages according to strict timetables.

Submitting Offers to Supply

To enable NEMMCO's systems to facilitate supply, scheduled NEM generators are required to submit to NEMMCO offers indicating the volume of electricity they are prepared to produce for a specified price.

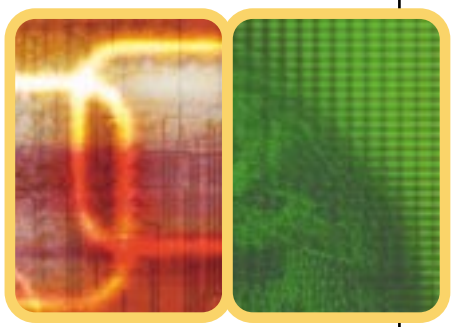
Bids or offers to supply are three types. Daily bids are submitted before 12:30 pm on the day before supply is required, and are reflected in pre-dispatch forecasts. Generators may submit re-bids up until approximately five minutes prior to dispatch. In doing so, they can change the volume of electricity from what it was in the original offer, but they cannot change the offer price.

Default bids are standing bids that apply where no daily bid has been made. These bids are of a 'commercial-in-confidence' nature and, in general, reflect the base operating levels for generators.

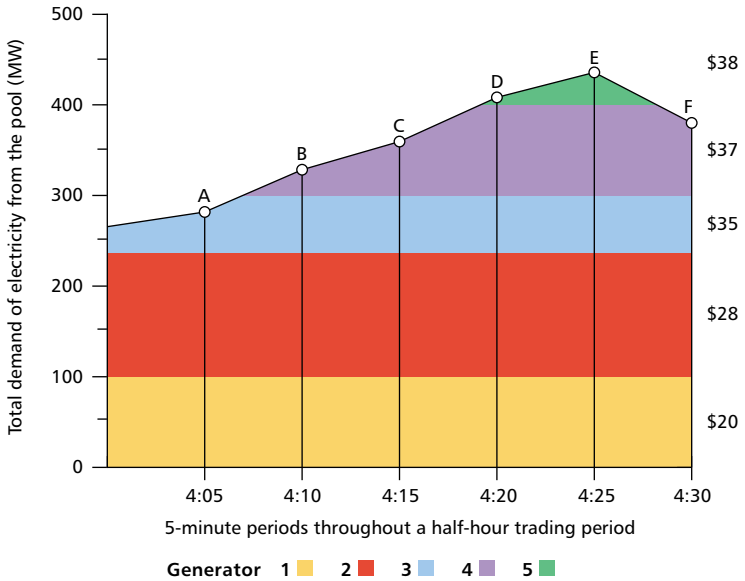
Scheduling and Dispatching Generators

From the bids submitted, NEMMCO's systems determine which generators are required to satisfy demand, at what time, and their production levels in a process called scheduling. Offers to generate are stacked in order of rising price, and are then scheduled and dispatched into production. The use of the rising-price stack means that more expensive generators are scheduled into production as total demand for electricity increases.

At times, the technical capacity of the transmission network may determine which generators are scheduled to meet demand. In such a situation, generators may be scheduled out of price order so that demand in a particular area supplied through the network may be satisfied.



Scheduling of NEM Generators



Bids to produce electricity received by NEMMCO are stacked in ascending price order for each dispatch period. Generators are then progressively scheduled into production to meet prevailing demand, starting with the least-cost generation option.

A. In order to supply demand for power at 4:05 pm, Generators 1 and 2 are dispatched to their full bid capacity, and Generator 3 is only partly dispatched. The price is $35 per MWh.

B. At 4:10 pm, demand has increased: Generators 1, 2 and 3 are fully dispatched, and Generator 4 is partly dispatched. The price is $37 MWh.

C. At point C (4:15 pm) demand has increased a further 30 MW. Generators 1, 2, 3 and 4 continue producing power and the price remains at $37 MWh.

D. By 4:20 pm, demand has increased to the point that Generator 5 is just required to meet demand, and the price increases to $38 per MWh.

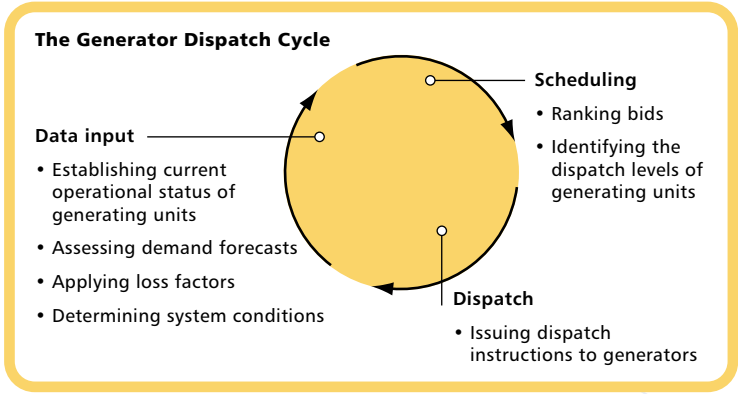
E. At 4:25 pm, Generators 1–4 are fully dispatched and Generator 5 partly dispatched. The price remains at $38 per MWh.

F. By 4:30 pm, demand has fallen. Generator 5 (the most expensive generator) is no longer required, and Generator 4 is only partly dispatched. The price returns to $37 per MWh.

The spot price for the trading period is calculated as the average of the six dispatch prices. That is, $(35+37+37+38+38+37) per MWh divided by six, or $37 per MWh. This is the price all generators receive for production during this period, and the price market customers pay for electricity they consume from the pool during this period.

Characteristics of Generators

Characteristic	Type			
	Gas and Coal-fired Boilers	**Gas Turbine**	**Water (Hydro)**	**Renewable (Wind/Solar)**
Time to fire-up generator from cold	8–48 hours	20 minutes	1 minute	dependent on prevailing weather
Degree of operator control over energy source	high	high	medium	low
Use of non-renewable resources	high	high	nil	nil
Production of greenhouse gases	high	medium-high	nil	nil
Other characteristics	medium-low operating cost	medium-high operating cost	low fuel cost with plentiful water supply; production severely affected by drought	suitable for remote and stand-alone applications; batteries may be used to store power



Setting the Spot Price

NEMMCO issues dispatch instructions to generators at five-minute intervals throughout each day based on the offers generators have submitted in the bidding process. In this way, there are 288 dispatch intervals every day. The dispatch price represents the cost to supply the last megawatt of electricity to meet demand, and applies to all generators scheduled into production regardless of the level of their original offer.

A trading interval in the NEM is a half-hour period. Hence, there are 48 trading intervals in the market each day. The spot price of electricity for all 30-minute trading intervals each day is the average of the six dispatch prices during the preceding half-hour. There is a separate spot price for each trading interval in each of the NEM's five regions.

Factors that contribute to variations in the spot price in different regions of the NEM include limits on interconnector capacity and reliance on differing fuel sources for local supply in different NEM regions. Because gas is a more expensive fuel than coal or water, electricity produced using gas will generally cost more than electricity produced by the other means. Other factors—including total system load, plant outages, frequency control, voltage control, testing and transmission outages—also affect the dispatch and spot prices. During 2004, the average daily spot price across all regions of the NEM was less than $40 per megawatt hour for well over 90 percent of trading intervals.

Measuring Electricity Use

All market customers are required to install equipment to record their electricity consumption. NEMMCO registers, accredits and audits a range of metering services provided by local network service providers. These service providers are responsible for measuring the volume of electricity supplied, validating the data from the meters, applying distribution loss factors, and forwarding the information to NEMMCO for use in calculating and preparing accounts for financial settlement.

Settling the Market

NEMMCO calculates the financial liability of all market participants on a daily basis and settles transactions for all trade in the NEM weekly. This involves NEMMCO collecting all money due for electricity purchased from the pool from market customers, and paying generators for the electricity they have produced. The spot price is the basis for all these financial transactions.

NEM financial settlement operates four-weeks in arrears and generally includes millions of dollars of trading funds. In order to ensure that generators are paid for their electricity production, NEMMCO has strict prudential arrangements and a robust risk management program in place. As part of this, NEMMCO requires the deposit of bank guarantees and security deposits against an established maximum credit limit for each market customer. NEMMCO closely monitors the activities of all participants in the market and has a firm timetable in place for the entire settlement process.

The settlement process involves determining the financial liabilities, issuing accounts, and settling amounts payable and receivable for electricity sold to and purchased from the pool. The settlement price for both generators and market customers is equal to the amount of energy produced or consumed multiplied by both the spot price that applies in the region of their operation and any loss factors that apply.

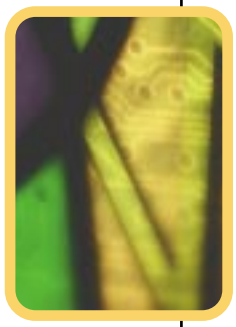
If a market participant breaches their maximum credit limit on any one day of trading, a call notice for rectification of the situation and then a default notice may be issued to ensure that NEMMCO is able to settle the market according to its fixed timetable. NEMMCO has the authority to suspend a market participant who fails to respond adequately to a default notice, and to reinstate that market participant only when their required financial position is re-established.

OPERATING THE NEM

Demand Side Participation

Demand side participation refers to the situation where market customers reduce their consumption of electricity in response to a change in market conditions, such as high spot prices. This is a deliberate action taken when demand for power drives spot prices high.

Under similar arrangements scheduled loads, such as smelters, may elect to withdraw from the market when the spot price reaches a particular threshold, and resume trading when the price falls to the level of their bids again. This strategy is beneficial to both the customer and the market in that it allows the smelter to avoid the peaks of high spot prices without damaging their production processes, and provides a short-term response to a supply shortfall in the market. A similar strategy, called load shifting, describes a process where specific demand is intentionally moved to a time when there is lower overall demand and consequent lower spot prices. Off-peak hot water arrangements are an example of the deliberate shifting of demand for electricity to a low-demand period.



ANCILLARY SERVICES

Ancillary services are those services used by NEMMCO to manage the power system safely, securely and reliably. Ancillary services maintain key technical characteristics of the system, including standards for frequency, voltage, network loading and system re-start processes.

NEMMCO operates eight separate markets for the delivery of frequency control ancillary services (FCAS), and purchases network control ancillary services (NCAS) under agreements with service providers.

FCAS providers bid their services into the FCAS markets in a similar way to generators bid into the energy market. The FCAS markets were introduced to the NEM in September 2001 and provide simpler, more dynamic and transparent arrangements that have further increased competition and contributed to improved overall market efficiency.

Payments for ancillary services include payments for availability and for the delivery of the services. The market participant or participants responsible for a situation that requires ancillary services pay for individual services whenever regulation FCAS are needed to automatically raise or lower frequency to within the normal operating band of 49.9 Hertz to 50.1 Hertz.

INTER-REGIONAL TRADE

The NEM comprises five interconnected electrical regions. There is a designated region reference node in each region where the regional spot price of electricity is set. The Queensland, New South Wales, Victoria and South Australia regions all contain both major generation and demand centres. Snowy region, on the other hand, is a major generation centre only and exports almost all of the electricity generated in its power plants to adjacent regions.

Interconnectors

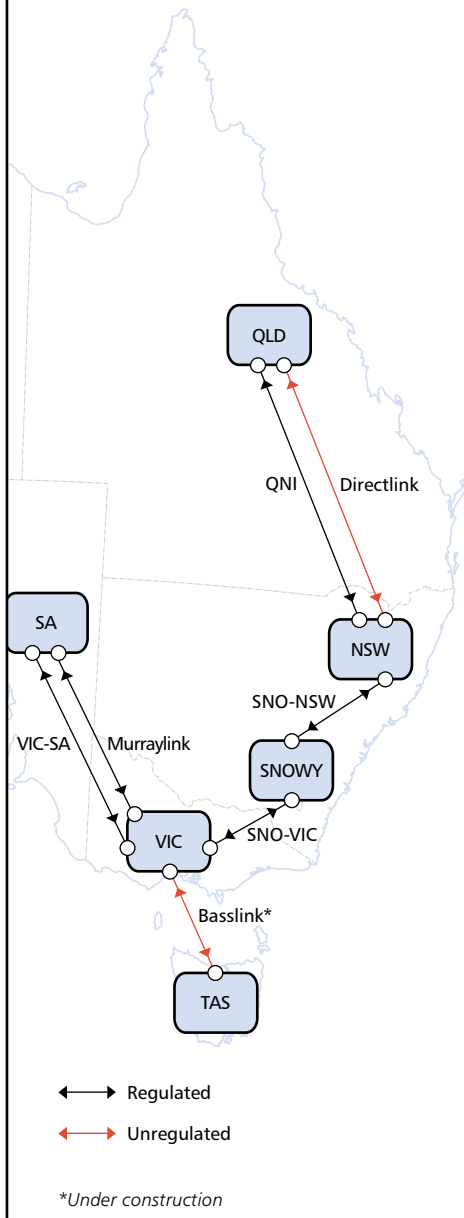
The high-voltage transmission lines that transport electricity between adjacent NEM regions are called interconnectors. Interconnectors are used to import electricity into a region when demand is higher than can be met by local generators, or when the price of electricity in an adjoining region is low enough to displace the local supply.

NEMMCO's ability to schedule generators to meet demand using an interconnector to facilitate importing electricity is sometimes limited by the physical transfer capacity of the interconnector. When the technical limit of an interconnector's capacity is reached, the interconnector is said to be constrained. For example, if prices are very low in one region and high in an adjacent region, electricity can be sent from the first to the second region across an interconnector up to the maximum technical capacity of the interconnector. NEMMCO's systems will then dispatch local generators with the lowest price offers from within the second region to meet the outstanding consumer demand.

Regulated Interconnectors

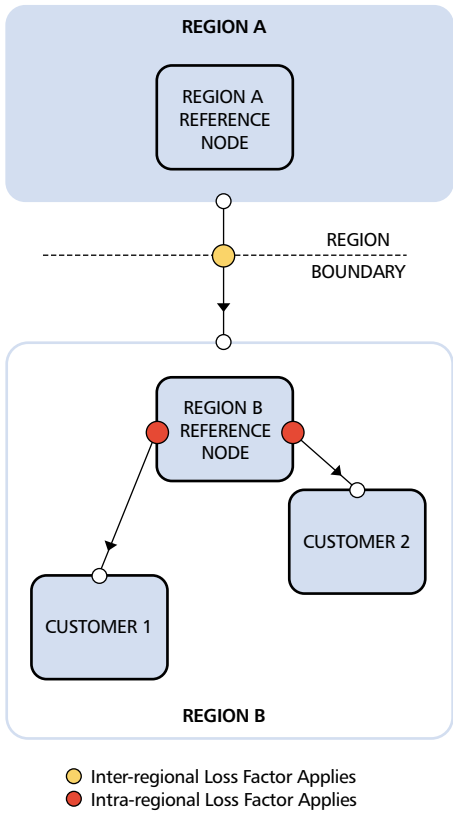
A regulated interconnector is an interconnector that has passed the ACCC-devised regulatory test and has been deemed to add net market value to the NEM. Having passed the test, a regulated interconnector becomes eligible to receive a fixed annual revenue based on the value of the asset, and set by the ACCC regardless of actual usage. The revenue is collected as part of the network charges included in the accounts of electricity end-users. At present, regulated interconnectors operate between all adjacent regions of the NEM.

Interconnectors in the NEM



**Under construction*

Loss of Energy in the Power System



Electricity losses occur between regions and within regions. Losses between regions are of the order of 10 percent of electricity transported. Therefore, to ensure that 100 MW of energy committed to be supplied to Region B (in the diagram) from generators within Region A, 110 MW of electricity must be exported from Region A.

Intra-regional losses occur between the region reference node, where the region spot price is set, and the customer's connection point to the grid. In the diagram, customer C1 would require more energy to be imported to receive the same amount of supply as customer C2, because C2 is closer to the regional reference node.

INTER-REGIONAL TRADE

Unregulated Interconnectors

Unregulated (or market) interconnectors derive revenue by trading in the spot market. They do this by purchasing energy in a lower price region and selling it to a higher price region, or by selling the rights to revenue generated by trading across the interconnector. Unregulated interconnectors are not required to undergo regulatory test evaluation.

At present, an unregulated interconnector—Directlink—operates between the Queensland and New South Wales regions of the NEM. Murraylink was built as an unregulated interconnector between Victoria and South Australia in 2002 and, in 2003, successfully applied to the ACCC for conversion to regulated status. Another unregulated interconnector—Basslink—is currently under construction to facilitate electricity trade between Victoria and Tasmania.

Loss of Energy in the System

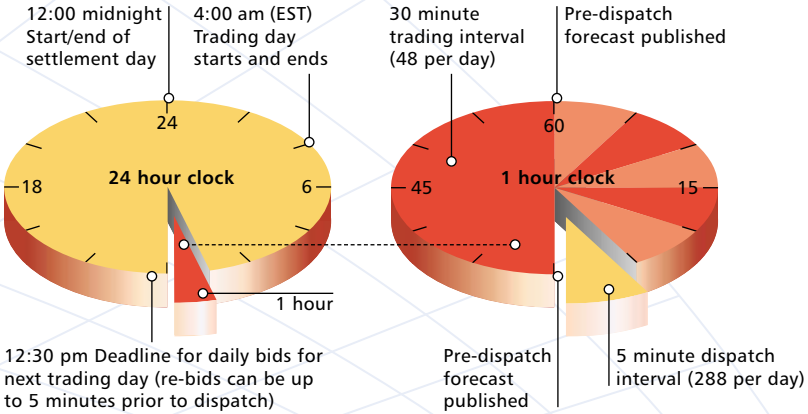
As electricity flows through the transmission and distribution networks, energy is lost due to electrical resistance, and the heating of conductors. The losses are equivalent to approximately 10 percent of the total electricity transported between power stations and market customers.

Energy losses on the network must be factored in at all stages of electricity production and transport to ensure the delivery of adequate supply to meet prevailing demand and maintain the power system in balance. In practical terms, this means that more electricity must be generated than indicated in demand forecasts in order to allow for this loss during transportation.

The impact of network losses on spot prices is mathematically represented as transmission and distribution loss factors. Loss factors within each region of the NEM are calculated based on forecast demand, and fixed for a period of 12 months to facilitate efficient scheduling and settlement processes in the NEM. Loss factors between regions of the NEM are dynamically calculated and reflect the operating conditions at the time of the transmission of the electricity.

MARKET FORECASTS

A Day in the NEM



NEMMCO uses the outcomes of a variety of forecasting processes to determine the level of demand for every dispatch interval in the NEM. Then using the submitted offers to generate electricity, NEMMCO produces a schedule or timetable of generation to ensure that the forecast demand will be met based on the requirements that the least expensive generators are dispatched into production and the power system remains in a secure operating state.

As a prerequisite for maintaining supply and demand in balance, it is important for NEMMCO's planning processes to be informed in advance of any limits on the capacity of generators to supply electricity or networks to transport electricity. This enables the remainder of market participants to respond to potential supply shortfalls by increasing their generation or network capacity to the market. Market participants are able to signal upcoming limitations on supply by means of a variety of forecasting tools designed to improve the overall efficiency of the market.

MARKET FORECASTS

Pre-dispatch Forecasting

Pre-dispatch is a short-term forecast of supply and demand in the market. It is used to estimate the price and demand for the upcoming trading day, and the volume of electricity expected to be supplied through the interconnectors between regions.

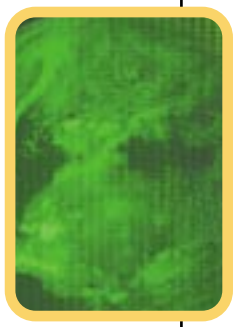
Generators and network operators are required to notify NEMMCO of their maximum supply capacity and availability, and this information is matched against regional demand forecasts. All offers to supply are then collated so that potential shortfalls of supply against demand can be identified and published. Participants in the market use this information as the basis for any re-bids of the capacity they wish to bring to the market.

Five-minute Matching of Supply and Demand

Generators are scheduled and dispatched into production to match supply with prevailing demand every five minutes of every day. This process, in turn, produces dynamic price signals that guide market participants as they bid to supply electricity to the market.

Projected Assessment of System Adequacy

NEMMCO monitors the future adequacy of generating capacity based on the predicted availability of generating units at power plants. NEMMCO produces both seven-day and two-year forecasts because of the variability of demand for electricity. These forecasts are called the short-term and medium-term Projected Assessments of System Adequacy, or PASA, respectively. They are used by NEMMCO to ensure that adequate levels of reserve are in the system at all times, and by generators and network operators to plan augmentation, maintenance and other outages.



NEMMCO produces two PASA forecasts:

Forecast	Forecast Period	Updated/Published
Short-term PASA	7 days	2-hourly from 4:00 am
Medium-term PASA	2 years	2:00 pm every Tuesday

Statement of Opportunities & Annual National Transmission Statement

NEMMCO publishes a 10-year forecast called the Statement of Opportunities (SOO) each year. This publication provides information to assist market participants assess the future need for electricity generating capacity, demand side capacity and augmentation of the network to support the operation of the NEM. The SOO contains forecasts of demand for electricity, details about the capacity of existing and committed generating plant, information about inter-regional transmission capabilities and advice on the impact of technical limits on sections of the network. It also contains forecasts of ancillary service requirements, minimum reserve levels, and economic and operational data to assist potential investors gain a full understanding of the NEM.

The SOO brings together information supplied to NEMMCO by the planning bodies in each jurisdiction of the NEM. A year-by-year annual supply-demand balance is presented for each region in the SOO as a snapshot forecast of the capacity of generation and distribution to satisfy demand for electricity into the future.

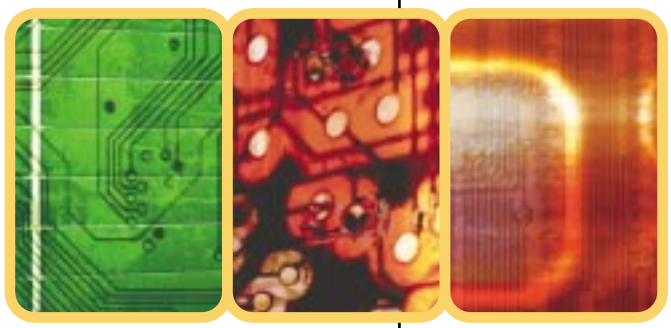
From 2004, NEMMCO has also published an Annual National Transmission Statement in conjunction with the SOO to provide an integrated assessment of the current state and potential future development of major national transmission flow paths.

FULL RETAIL COMPETITION

Since the commencement of the NEM, electricity consumers have progressively gained the right to choose their own supplier. This has meant that NEMMCO's responsibilities have extended from managing the wholesale market to providing the systems and processes to support competition and choice for all end-users in the retail electricity market. Delivering full retail competition (FRC), or contestability, has required new information technology systems to process transfers of customers between registered retailers in the NEM. The systems that facilitate this function contain one of the largest metering databases in the world. They accept data from a variety of electricity meter types and have the capacity to process information from up to 10 million meters.

NEMMCO's systems are set up to provide key meter installation details to support a simple and rapid information transfer process. Different metering processes are required for different types of meters used in the NEM, to support consumer transfer and core settlement procedures and to calculate load profiles. The cost of electricity consumed is then calculated according to a user profile that approximates the pattern of use in a typical situation.

By May 2005, in excess of one million contestable customers (from a possible 6.4 million) have moved to a retailer of their choice, and the churn rate is steadily growing. As a result of the introduction of full retail competition, electricity retailers are increasingly competing, and creating new and unique products as a means to increase their customer bases.



REGISTERED PARTICIPANTS

Registered Participants

Market Participants

Registered to participate in the National Electricity Market

- **Market Generators**
  Sell entire electricity output through the spot market and receive the spot price at settlement.
  Scheduled: aggregate generation capacity of more than 30 megawatts.
  Non-scheduled: aggregate generation capacity of less than 30 megawatts or specifically classified as non-scheduled due to intermittent nature of generation (for example wind generator).
- **Market Network Service Providers**
  Own and operate a network linked to the national grid at two terminals in different NEM regions. Pay market participant fees and obtain revenue from trading in the NEM.
- **Market Customers**
  Purchase electricity supplied to a connection point on a NEM transmission or distribution system for the spot price.
  Electricity Retailers: buy electricity at spot price and on-sell it to end-use customers.
  End-use Customers: buy directly from the market for own use.

Other Registered Participants

- **Transmission Network Service Provider**
  Owner and operator of the high-voltage transmission towers and wires that transport electricity.
- **Distribution Network Service Provider**
  Owner and operator of substations and the wires that transport from distribution centres to end-use consumers. Also provider of technical services, including construction of power lines, inspection of equipment, maintenance and street lighting.
- **Special Participant**
  System operators or agents appointed to perform power security functions. Distribution system operators and controllers or operators of any portion of the distribution system.
- **Intending Participant**
  Must reasonably satisfy NEMMCO of intention to perform activity that would entitle it to be a registered participant.
- **Trader**
  Party registered to participate in the settlement residue auction.

One of NEMMCO's responsibilities under the Rules is to register participants in the NEM. There are six main categories of registered participant, including those who participate directly in trading activities, and other participants who provide services essential for the operation of the market. The categories are generator, customer, market participant, network service provider, trader and special participant.

Market participants include market generators, market network service providers and market customers. A market participant must be separately registered in each category of the market in which it participates. For example, a business that participates as a generator (a peaking generating plant for instance) and as a market customer (retailer of electricity to end-use customers) would be required to be registered as both a generator and a market customer.

The registration of participants is a formal process, strictly defined in the Rules. Registered participants are required to pay participant fees that are levied to recover the costs associated with managing the market.

FINANCIAL CONTRACTS FOR ELECTRICITY

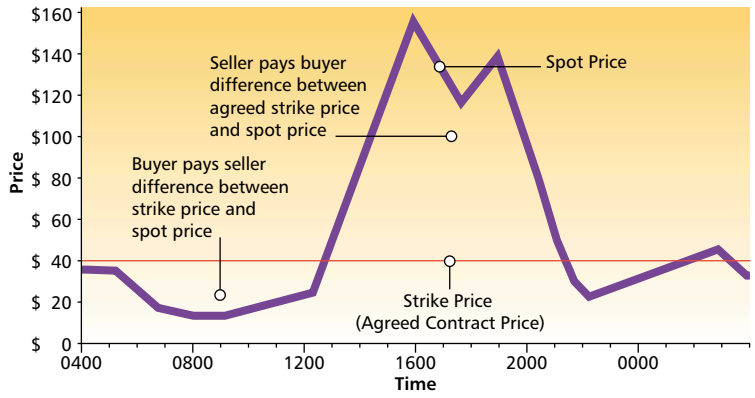
Participants in the NEM require a means of managing the financial risks associated with the significant degree of spot price volatility that occurs during trading periods. They typically achieve this by using financial contracts that lock in a firm price for electricity that will be produced or consumed at a given time in the future. These contracts serve to substantially reduce the financial exposure of market participants and contribute to spot market stability. They are known as derivatives, and include swaps or hedges, options and futures contracts.

Hedge Contracts

Hedge contracts are typically agreements between generators and customers that operate independently of both the market and NEMMCO's administration. The details of hedge contracts are not factored into the balancing of supply and demand, and are not regulated under the Rules. These contracts can be entered into under either long-term or short-term arrangements that set an agreed, or strike, price for electricity traded through the pool. In this way, hedge contracts are financial instruments that participants can use to manage the financial risk that results from potential volatility of the spot price.

The basic form of a hedge contract exists where two parties agree to exchange cash against a spot price outcome in the market. Under such an agreement, generators pay customers a premium price when the spot price is above the strike price. When the spot price is below the strike price, customers pay generators the difference between the spot price and the strike price.

Hedge Contracts in the NEM



In this example of a hedge contract, the two parties have agreed to set a price (the strike price) of $40/MWh. The graph shows the strike price and the actual spot price over a hypothetical day's trading.

When the spot price is below the strike price, the market customer pays the difference in these prices to the generator. In this case, when the spot price is $17, the market customer pays the generator $23/MWh.

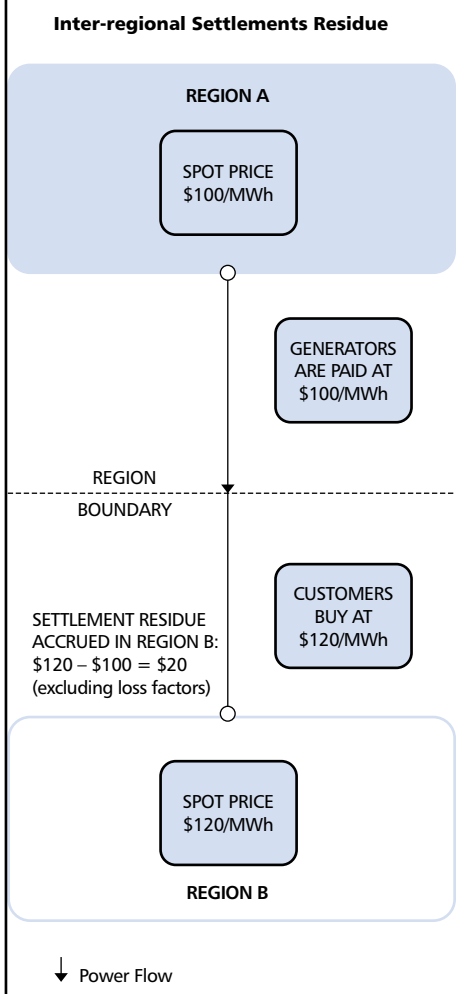
When the spot price exceeds the strike price, the generator pays the market customer the extra required to purchase electricity from the pool. In this case, when the spot price rises to $145/MWh, the generator pays the market customer the $105/MWh difference.

Auctions of Inter-region Settlement Residues

The spot price for electricity in each region of the NEM is determined by a number of factors, including supply and demand, the physical limitations of interconnectors, and the loss factors for both the transmission and distribution networks. This means that there may be significant differences in the spot price for any trading interval across NEM regions.

The difference between the value of electricity in the region where it is generated and its value if sold in another region is called the inter-regional settlement residue. The settlement residue that accumulates is made available to the market by the conduct of an auction. The auction process establishes the market value of the residue, and contributes to inter-regional trade by providing registered generators, market customers and traders with a mechanism to manage the risk associated with different price outcomes between trading regions.

Registered participants who purchase auction units obtain access to a share of the residue. In this way, the premium paid for the auction units provide protection against high prices in the wholesale market.



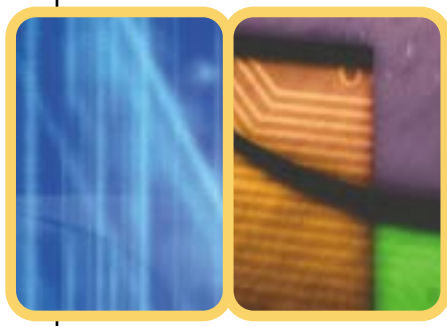
ALTERNATIVE GENERATION TECHNOLOGIES

The range of technologies for the generation of electricity is expanding to accommodate alternative energy sources such as wind energy. Currently less than 200 MW of wind generation can be dispatched in the NEM. Many additional wind projects are underway or planned for the next 12 months, and the total wind generation capacity is expected to increase in the future.

Typically wind generators are registered as non-scheduled generators because their individual output can change by as much as 50 percent in a five-minute NEM dispatch interval. The market is designed to allow intermittent generators to participate and share the same power system and the same consumers. The NEM's base-load generators are scheduled according to bids, and production from each generating unit is controlled by operators. The changeability and unpredictability of wind means that wind generators cannot be scheduled in the usual way.

The integration of wind and other intermittent generators to the NEM must take account of NEMMCO's responsibility to maintain power system security, and be managed during each five-minute dispatch interval. The variation of output associated with wind generators may cause the flows on interconnectors to vary in a way that reduces the total supply capacity available to the market.

NEMMCO expects that the diverse locations of wind farms throughout NEM regions will assist to average out the overall impact of the variability of this type of supply on the market. NEMMCO is working with the market and the wind generation industry on a range of potential issues to ensure they are addressed in a timely manner. For example, NEMMCO is examining ways of including intermittent generation in the NEM's forecasting processes so that the output of wind generators can be taken into account to the extent that it can be predicted.



NEMMCO AND THE ENVIRONMENT

NEMMCO's role as the manager of both the power system and the electricity market means that questions are often asked of it about issues of environmental management, the sustainability of the market and the electricity supply industry in general.

Under the Rules, NEMMCO's charter focuses specifically on efficiency, security and reliability of power supply, and excludes favouring one fuel source over any other. Consequently, NEMMCO has neither the power nor the authority to make decisions based on considerations of sustainability and balance in resource management.

The various state regulators ensure that environmental impact assessments are conducted as part of any power industry planning initiatives. The regulators also monitor operations at industry sites within their jurisdictions, and the industry itself operates and audits waste reduction and recycling programs.

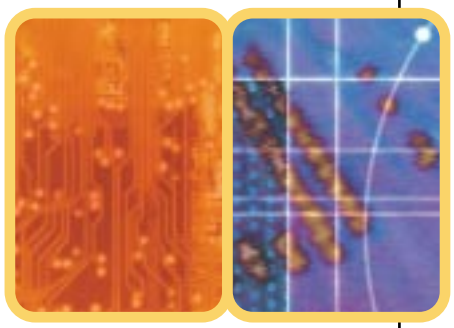
REGULATORY ARRANGEMENTS

The Australian Energy Market Commission (AEMC) and the Australian Energy Regulator (AER) are new statutory bodies created under a new regulatory regime, and from mid-2005, have responsibility for oversight and regulation of the National Electricity Market.

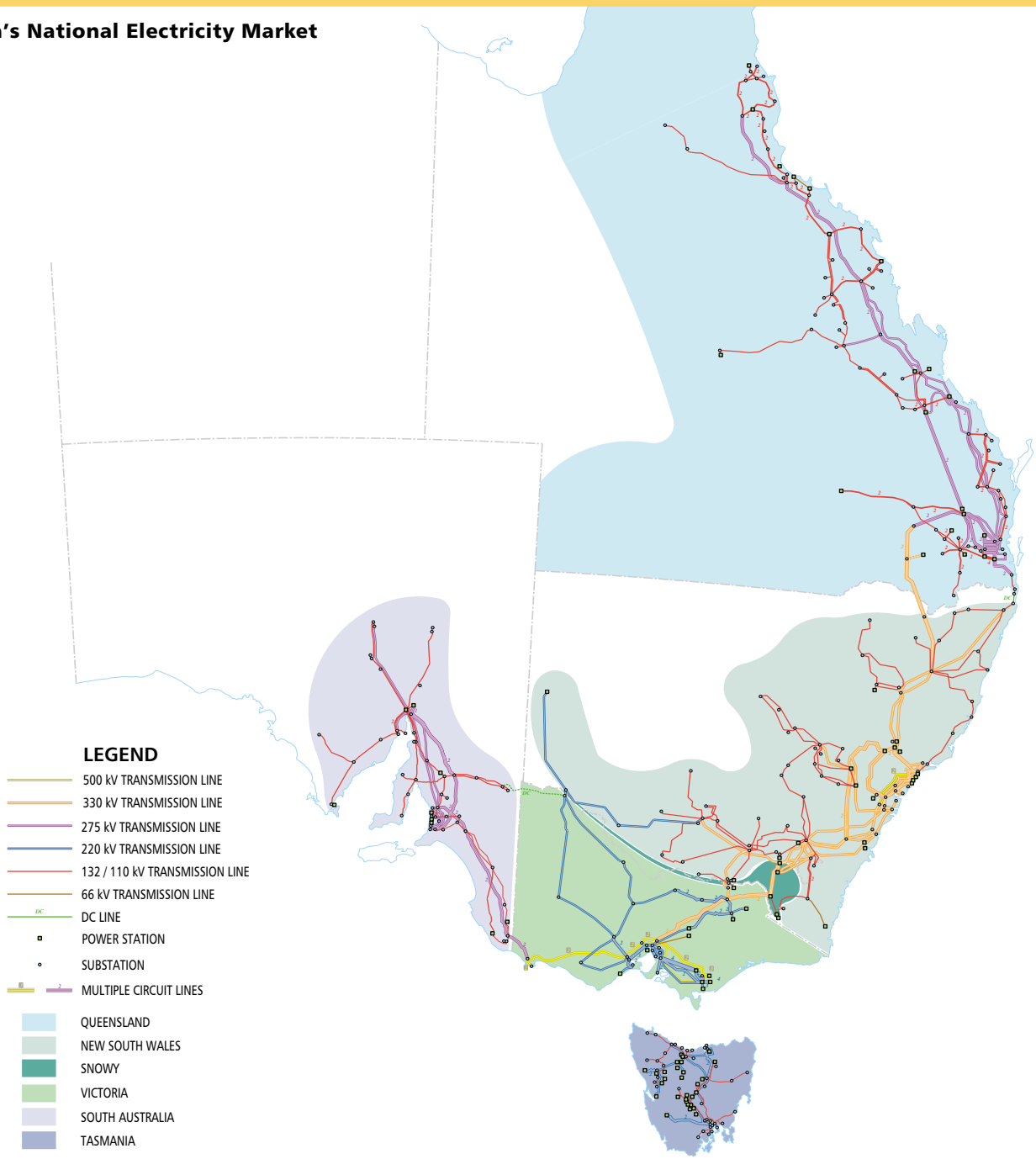
The AEMC is responsible for rule making and market development. The rule-making role does not involve initiating changes to the Rules other than where the change involves correcting minor errors or where the change is of a non-material nature. Rather, the role involves managing the rule change process, and consulting and deciding on rule changes proposed by others. In regard to its market development function, the AEMC conducts reviews at the request of the Ministerial Council on Energy or at its own volition on the operation and effectiveness of the Rules or any matter relating to them. In doing this, the AEMC relies on the assistance and cooperation of industry relationships and interested parties in its decision making.

The AER has responsibility for the enforcement of and monitoring compliance with the Rules, as well as responsibility for economic regulation of electricity transmission. The AER issues infringement notices for certain breaches of the National Electricity Law and Rules, and is the body responsible for bringing court proceedings in respect of breaches.

A Memorandum of Understanding between the ACCC, the AER and the AEMC guides interaction between these three bodies and their function in the Australian energy industry. The new regulatory bodies have been created under the auspices of the Ministerial Council on Energy and take over many of the electricity regulatory arrangements that were previously the responsibility of state government authorities.



Regions and Networks in Australia's National Electricity Market



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