



# **Electricity generation**

## Major development projects – October 2009 listing

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ABARE project 3357

# Electricity generation

## Major development projects – October 2009 listing

Alan Copeland

- As at the end of October 2009, there were 18 major electricity generation projects at an advanced stage with a total generating capacity of 3569 megawatts and value of around \$5.3 billion.
- There were a further 127 projects at a less advanced stage of development.

## ABARE's list of major electricity generation development projects

ABARE has been compiling its biannual list of major electricity generation projects since October 2008. The list is only available as an electronic product and can be downloaded from [www.abare.gov.au](http://www.abare.gov.au). Information contained in the list includes electricity generation projects based on black and brown coal, oil, natural gas, coal seam gas and renewable energy sources (solar, wind, hydro, biomass and wave). The information draws predominantly on publicly available sources but, in some cases, is supplemented by information provided directly by companies.

ABARE's list provides details of each announced project where the total capacity is expected to exceed 30 megawatts. By setting a threshold of 30 megawatts, a number of electricity generation fuels are under represented on the list including solar energy and biomass. While small scale electricity generation units have an important role to play in Australia's electricity supply, it is not feasible to attempt to collect data across all potential projects.

In general, the included projects are at relatively advanced stages of planning, that is, ranging from 'planning approval underway' through to 'under construction'.

The projects list contains information on 145 projects, providing the following details:

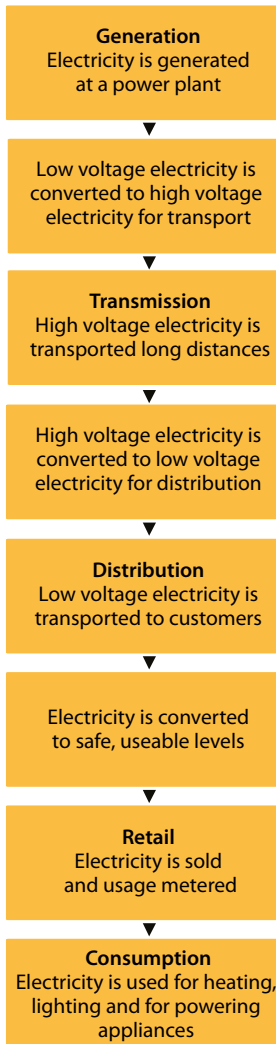
- project name
- location
- expected startup date
- capital cost of the project
- proponent company or joint venture
- project status
- additional output capacity
- additional employment at the construction and operating stages, where available.

With a focus on projects planned to commence generation over the next few years, projects at more advanced stages of planning (those identified as ‘committed’ or ‘under construction’) are grouped together and listed first within each principal energy source. These projects appear in the blue shaded areas of the list. Projects at less advanced planning stages (for example, those at planning approval stage) follow within each energy source and appear in the yellow shaded areas. The listing includes new greenfield projects as well as expansions of existing projects.

# Electricity market in Australia

The electricity supply chain begins with electricity generators, which are normally located near fuel sources such as natural gas pipelines, coal mines and hydroelectric water reservoirs. There is typically a long distance between electricity generators and consumers, requiring a

## a Supply chain



transmission and distribution network to transport power. The supply chain is completed by retailers who purchase wholesale electricity and package it with transmission and distribution services for sale to customers (figure a).

Increased investment in generation capacity is required in order to meet future growth in electricity demand in Australia and to maintain security of supply. This can include the construction of new power stations or upgrades/expansions at existing power stations.

## Market structure

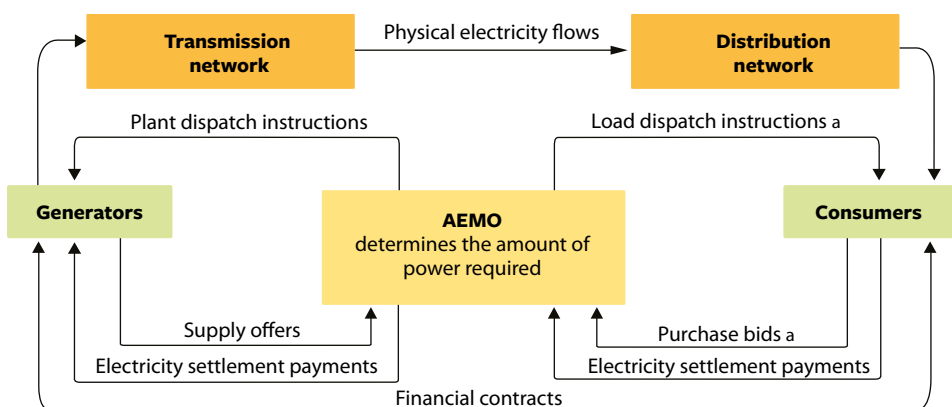
The current structure of the Australian electricity market was shaped by industry reforms in the early 1990s. Vertically integrated state-owned utilities were disaggregated into separate generation, transmission, distribution and retail supply components, where the electricity businesses were either corporatised or privatised.

A key element of these reforms was the establishment of the ‘national electricity market’ in 1998, linking the Australian Capital Territory, New South Wales, Queensland, South Australia and Victoria (Tasmania joined in 2005), allowing power to flow across state and territory borders to meet customer demand in other jurisdictions.

The market comprises a wholesale market and a competitive retail sector that promotes competition and efficiency in the production and provision of electricity and allows for choice of supplier. Most electricity retailers purchase electricity from generators on a contract basis. Additional electricity can be purchased through the spot market.

The management of the electricity spot market and the central coordination of the dispatch of electricity from generators (figure b) is the responsibility of the Australian Energy Market Operator (AEMO).

## b Structure of the national electricity market



<sup>a</sup> Currently no customers submit demand side bids.

The regulation of electricity transmission and distribution networks is the responsibility of the Australian Energy Regulator (AER). The AER is also responsible for reporting on generator bidding behaviour in the NEM. By 2010 it is anticipated that AER's responsibilities will extend to electricity and gas markets, gas transmission in eastern and southern Australia, and electricity distribution in the Northern Territory. This will allow a consistent near-national approach to regulation in the market. Western Australia will retain state-based regulation of its electricity and gas sectors.

Western Australia is not connected to the national electricity market primarily because of its geographic distance from the national market. Electricity infrastructure is organised in several distinct systems including the South West Interconnected System (SWIS), the North West Interconnected System (NWIS) and 29 regional, non interconnected power systems. SWIS is the largest network and serves Perth and the other major population centres in the south west.

The SWIS became a wholesale market (where generators sell directly to retailers) in 2006. Because of the small scale of the other systems it is impractical to introduce a wholesale market. Instead, they operate as retail markets where end use consumers purchase from competing retailers.

The wholesale market for electricity in Western Australia was deregulated in 2006. The Independent Market Operator (IMO) is responsible for the administration and operation of this market. The retail market is regulated by the Economic Regulation Authority of Western Australia.

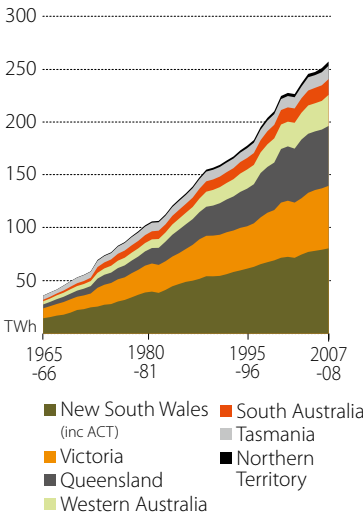
In the Northern Territory, market reforms were undertaken from 2000 to phase in competition in electricity supply and reduce Power and Water Corporation's natural monopoly. New entrants into the Northern Territory electricity market are permitted to use existing infrastructure (transmission and distribution) after signing an access agreement and payment of a network charge. The Utilities Commission of the Northern Territory is responsible for the regulation of the market.

# Consumption and generation

Australia's electricity generation sector faces a number of challenges over the medium to longer term including increasing domestic consumption, the need for investment in new energy infrastructure and policy measures aimed at reducing greenhouse gas emissions.

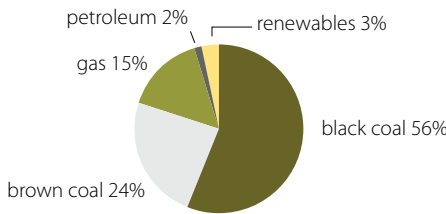
In 2007-08, Australian consumption of electricity was 257 246 gigawatt hours (GWh). New South Wales, Victoria and Queensland account for more than three-quarters of total electricity consumption because of the large population in these states (figure c). Electricity consumption in Western Australia has increased over the past few years. This largely reflects increased use of electricity in the mining industry.

**C** Australian electricity consumption by state



The majority of Australia's electricity is produced using coal (figure d), accounting for 81 per cent of fuel inputs into electricity generation in 2007-08. This is because coal is a relatively low cost energy source in Australia. It also reflects the abundance of coal reserves along the Eastern seaboard, where the majority of electricity is generated and consumed.

**d** Fuel inputs into Australian electricity generation 2007-08



## The expanded Renewable Energy Target scheme

In August 2009, the Renewable Energy Target (RET) scheme was legislated as an expansion of the existing Mandatory Renewable Energy Target (MRET). The expanded RET scheme is designed to:

- increase the renewable energy target to 45 000 gigawatt-hours in 2020, compared with a target of 9500 gigawatt-hours in 2010 under the MRET
- continue between 2020 and 2030 at a constant target of 45 000 gigawatt-hours
- provide an incentive to encourage the uptake of renewable energy sources including solar, wind, biomass and geothermal energy
- bring existing state-based targets into a single, national scheme.

The expanded RET will be based on a market for Renewable Energy Certificates (RECs) where each REC is equivalent to 1 megawatt-hour of electricity generation from a renewable energy source. Solar water heaters are also entitled to RECs, equivalent to the amount of electricity the solar water heater displaces.

Parties producing electricity from renewable energy sources and owners of solar water heaters and small renewable generation units are eligible to create RECs and subsequently trade them.

Under the RET scheme, a legal obligation is placed on wholesale purchasers of electricity to contribute toward the generation of additional renewable electricity through the purchase of RECs. The number of RECs that liable parties are required to surrender is determined by the Renewable Power Percentage set by the Office of the Renewable Energy Regulator. On an annual basis liable parties are required to surrender RECs equal to their liability in the previous calendar year.

RECs, once created by eligible parties and validated by the Office of the Renewable Energy Regulator, are traded with liable parties using a market-based mechanism. Further information on the RET scheme is available from the Department of Climate Change ([www.dcc.gov.au](http://www.dcc.gov.au)) and the Office of the Renewable Energy Regulator ([www.orer.gov.au](http://www.orer.gov.au)).

## Completed projects

During the six months to October 2009, there were seven electricity generation projects completed – one coal, one coal seam gas, two gas and three wind powered projects. The largest of these projects, in terms of generation capacity, was the 450 megawatt, coal seam gas-fired Braemar 2 power station, which had a capital expenditure of \$546 million and is located in south east Queensland. In Tasmania, the 390 megawatt gas-fired Tamar Valley power plant was completed at an estimated capital expenditure of \$451 million. The project proponent is the Tasmanian government owned Aurora Energy, which purchased the project from Babcock and Brown Power in 2008. The other gas-fired project completed in the six months to October 2009 was the Neerabup power station near Kwinana in Western Australia. The 320 megawatt project had an estimated capital cost of around \$425 million. Griffin Energy completed the \$400 million,

coal fired Bluewaters Stage 1 project, which has a generation capacity of 208 megawatts. A second stage, also with a capacity of 208 megawatts, is currently under construction.

## 1 Major electricity generation developments—projects completed April 2009 to October 2009

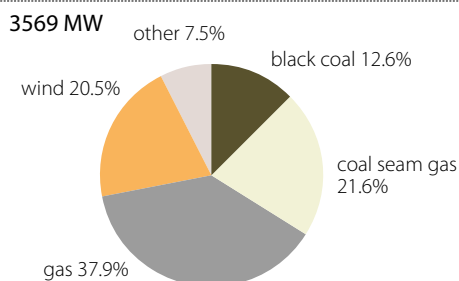
fuel	project	location	company	capacity	capital expenditure
				MW	\$Am
Black coal	Bluewaters stage 1	WA	Griffin Energy	208	400
Coal seam gas	Braemar 2	Qld	ERM Power/Arrow Energy	450	546
Gas	Neerabup	WA	ANZ Infrastructure Services/ ERM Power	320	425
Wind	Tamar Valley	Tas	Aurora Energy	390	451
	Capital Wind Farm	NSW	Renewable Power Ventures	140	220
	Cullerin Range Wind Farm	NSW	Origin Energy	30	90
	Portland stage 3	Vic	Pacific Hydro	44	na

The largest renewable energy project completed, in terms of generation capacity, was the 140 megawatt Capital Wind Farm located around 30 kilometres north east of Canberra. The wind farm had a capital expenditure of around \$220 million. Also in New South Wales, Origin Energy completed construction of the Cullerin Range Wind Farm which has a capacity of 30 megawatts and cost around \$90 million. In Victoria, the Stage 3 of the Portland Wind Farm was completed by Pacific Hydro. The project has a capacity of 44 megawatts and is one of a number of wind farms Pacific Hydro is constructing or proposing in south-west Victoria.

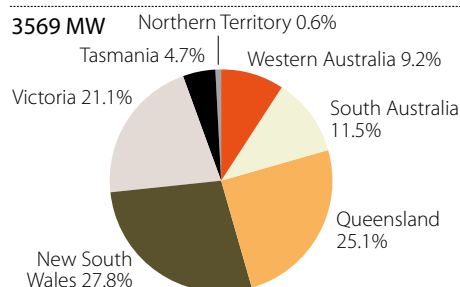
## Advanced projects

At the end of October 2009, there were 18 projects at advanced stages of development included in ABARE's project list. These projects are either committed or under construction. Total capacity of the 18 advanced projects at the end of October 2009 was 3569 megawatts (figures e and f). This is equivalent to 7 per cent of Australia's total generating capacity as at June 2008. The location of projects is widespread, with at least one advanced project in every state and the Northern Territory (table 2).

**e** Capacity of advanced projects, by energy source, October 2009



**f** Capacity of advanced projects, by state, October 2009





## 2 Advanced projects, October 2009—number, capacity and estimated capital cost by state

	non-renewable electricity projects			renewable energy projects			total		
	no.	capacity	cost \$m	no.	capacity	cost \$m	no.	capacity	cost \$m
New South Wales	2	900	745	1	92	238	3	992	983
Victoria	1	550	640	2	203	440	3	753	1 080
Queensland	3	896	1 213	0	0	0	3	896	1 213
Western Australia	2	328	520	0	0	0	2	328	520
South Australia	0	0	0	5	410	935	5	410	935
Tasmania	0	0	0	1	168	425	1	168	425
Northern Territory	1	22	130	0	0	0	1	22	130
Australia	9	2 696	3 248	9	873	2 038	18	3 569	5 286

### Non-renewable electricity projects

As at October 2009, non-renewable electricity generation projects accounted for nine of the 18 advanced projects on ABARE's list and around 76 per cent (or 2696 megawatts) of planned additional capacity (table 2). Natural gas-fired projects account for 50 per cent of the announced capacity of advanced non-renewable electricity projects, while coal seam gas accounts for a further 29 per cent.

In terms of capacity, Delta Electricity's Colongra project in New South Wales is the largest advanced project in Australia's electricity generation sector. The project has an announced capacity of 660 megawatts and is scheduled to be in operation by December 2009 at a cost of \$500 million.

Origin Energy has commenced construction of stage 1 of the Mortlake power station in Victoria, which is scheduled to be completed in 2010. The project has a capacity of 550 megawatts and a capital cost of \$640 million. A second 450 megawatt unit at the complex could be built by Origin Energy at a later date.

The other two gas projects, Kwinana Swift and Owen Springs, are in Western Australia and the Northern Territory, respectively. The Kwinana Swift power station will have a capacity of 120 megawatts and a capital expenditure of \$120 million, while Owen Springs will have a capacity of 22 megawatts and a capital cost of \$130 million. Included in the capital cost of the Owen Springs power station is the upgrade of existing transmission and distribution infrastructure.

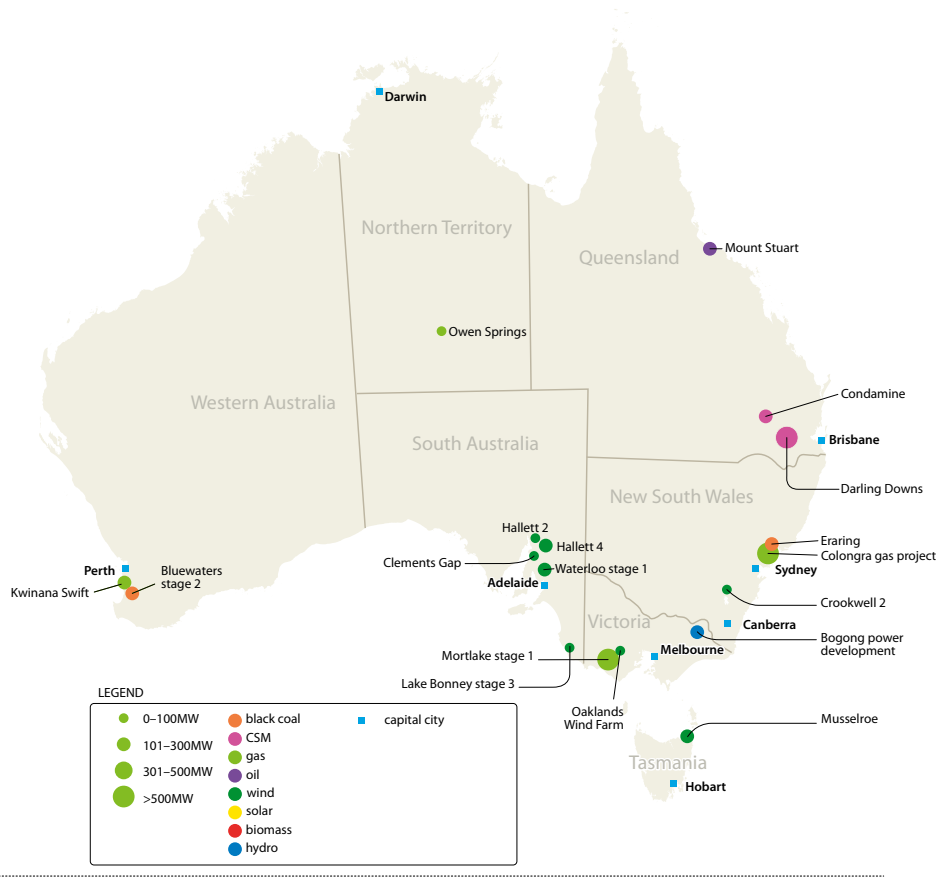
Two coal seam gas-fired projects account for 770 megawatts of committed additions to capacity. The largest of these projects is Origin Energy's Darling Downs project in Queensland. The project has an announced capacity of 630 megawatts and is scheduled to be completed in early 2010. The project has a capital cost of \$951 million, which includes the construction of a pipeline to access coal seam gas reserves in the area around Roma and Chinchilla.

In relation to black coal, stage 2 of Griffin Energy's Bluewaters project in Western Australia will have a capacity of 208MW and a capital cost of \$400m. The Eraring Power Station on

the Central Coast of New South Wales is being upgraded with construction having recently commenced. The \$245 million project will add around 60 megawatts of power to each of the 4 generation units.

In the six months to October 2009, there were no non renewable projects that were added to the advanced (those committed or under construction) list of projects.

# 1 Advanced electricity generation projects October 2009



At the end of October 2009, the average capacity for projects using natural gas and coal seam gas was around 338 megawatts and 385 megawatts, respectively (figure g). Given that a large proportion of advanced and less advanced projects will be using natural gas and coal seam gas as a fuel, these energy sources will account for an increasing proportion of baseload power generation.

## Renewable energy projects

At the end of October 2009, there were nine renewable energy projects at an advanced stage of development. Eight of these projects are wind powered and comprise 84 per cent of the committed additions to renewable energy capacity. Hydro accounted for 16 per cent of advanced renewable additions to capacity.

During the six months to October 2009, there were four wind projects added to the advanced list—Crookwell 2 in New South Wales, Oaklands in Victoria and Waterloo and Lake Bonney stage 3 in South Australia.

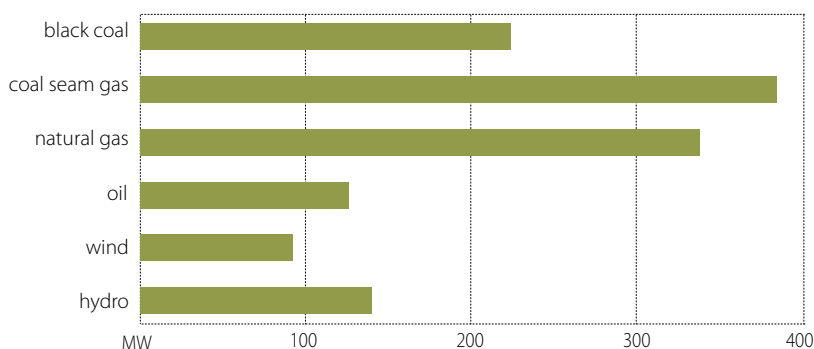
The largest of these projects, in terms of generation capacity, is Roaring 40s' 111 megawatt Waterloo wind farm in South Australia. The project has an estimated capital cost of \$300 million and is scheduled to commence operation in 2010. Also in South Australia, the Lake Bonney Stage 3 wind project is under construction, which will have a capacity of 39 megawatts when completed.

Construction has started on Union Fernosa Wind Australia's Crookwell 2 project located in the Southern Tablelands of New South Wales. The project will have an electricity generation capacity of 92 megawatts and a capital cost of \$238 million. In September 2009, AGL and Windlab Systems Australia made the decision to proceed with the Oaklands wind farm near Glenthompson. The wind farm will have a generation capacity of 63 megawatts when operational in 2011 and has an estimated capital cost of \$200 million.

There are four other wind farms under construction—Clements Gap (capacity of 57 megawatts), Hallet 2 (71 megawatts) and Hallet 4 (132 megawatts) located in South Australia and Musselroe (168 megawatts) located in Tasmania.

The average capacity of wind powered projects at an advanced stage was around 92 megawatts (figure g). The lower capacity for these projects reflects the large amount of land required for wind turbines. The capacity of the advanced hydro project was 140 megawatts. Electricity generation projects in Australia using solar energy do not feature prominently in ABARE's listing, largely because these tend to be below the 30 megawatt threshold.

### g Average capacity of advanced projects, by energy source, October 2009



## Less advanced projects

Projects in the less advanced category are either still undergoing a feasibility study (in some cases, prefeasibility study) or not subject to a definite decision on development following the completion of a feasibility study. Some of these projects may not proceed for several years. Some may confront changes in economic conditions or may be targeting the same emerging market opportunities, necessitating rescheduling. In addition, securing finance for project development may also be an issue.

Despite the uncertainty inherent to projects at these earlier stages of consideration, there is a significant number of large scale projects at less advanced planning stages. These projects, if completed, are expected to provide a firm platform for future growth in Australian electricity generation in the medium term and beyond.

Of the 145 projects in ABARE's October 2009 projects list, 88 per cent (127 projects) are less advanced. Table 3 contains a summary of the numbers and fuel distribution by state of the 127 less advanced projects, together with an aggregated capacity figure.

### 3 Number of less advanced projects, October 2009

	NSW	Vic	Qld	WA	SA	Tas	ACT	NT	Aust	potential capacity MW
<b>Commodity</b>										
<b>Fossil-fuel based</b>										
Brown coal	0	1	0	0	3	0	0	0	4	1 280
Black coal	0	0	3	2	0	0	0	0	5	1 736
Coal seam gas	4	0	3	0	0	0	0	0	7	1 720
Gas	16	4	4	1	1	0	1	1	28	9 198
Oil	1	0	0	0	0	0	0	0	1	150
TBD	2	0	0	0	0	0	0	0	2	4 000
Sub-total	23	5	10	3	4	0	1	1	47	18 084
<b>Renewable energy</b>										
Wind	14	30	4	4	17	2	0	0	71	10 672
Wave	0	1	0	0	0	1	0	1	3	786
Biomass	0	0	0	1	0	1	0	0	2	240
Solar	0	0	0	0	1	0	1	0	2	102
Geothermal	0	0	0	0	2	0	0	0	2	80
Sub-total	14	31	4	5	20	4	1	1	80	11 811
<b>Total</b>	<b>37</b>	<b>36</b>	<b>14</b>	<b>8</b>	<b>24</b>	<b>4</b>	<b>2</b>	<b>2</b>	<b>127</b>	<b>29 895</b>

## Non-renewable electricity generation projects

At the end of October 2009 there were 47 non-renewable electricity generation projects at a less advanced stage. Natural gas-fired and coal seam gas-fired plants account for 28 and seven projects, respectively. There are a total of nine coal-fired projects (brown and black coal) and

an oil-fired power plant under consideration. There are two power plants in New South Wales, Bayswater B and Mt Piper expansion, for which a decision has yet to be made as to whether they will be coal or gas-fired.

The proposed Bayswater B and Mt Piper expansion are the two largest projects on the list with a potential capacity of 2000 megawatts each. Presently, they are scheduled to be in operation around the middle of next decade.

Another potential large project is the 640 megawatt gas-fired power station ERM Power is proposing to build near Wellington in central New South Wales. AGL is also proposing to build several large gas-fired power stations including two in south east Queensland (capacity of 360 megawatts and 1150 megawatts), Townsville (360 megawatts), Sydney (350 megawatts) and Canberra (500 megawatts).

There are also a number of coal seam gas-based power stations that are at a less advanced stage. These include Braemar 3 (450 megawatts) and Spring Gully stages 1 and 2 (1000 megawatts) in Queensland and stages 1 and 2 of the Narrabri project (210 megawatts) and Richmond Valley power station (30 megawatts) in New South Wales.

## Renewable energy projects

At the end of October 2009, there were 80 less advanced renewable energy projects. Seventy one of these projects are wind farms, accounting for around 90 per cent of the proposed addition to renewable energy capacity. The significant number of proposed wind powered electricity projects, in part, reflects the Renewable Energy Target and the cost competitiveness of wind relative to other less mature renewable energy technologies.

The largest wind energy project is the Silverton Wind Farm in New South Wales with a planned capacity of 1000 megawatts. If developed, the wind farm will be the largest in the Southern hemisphere and one of the largest in the world. The project is scheduled to be completed in 2011 at a capital cost of \$2.2 billion.

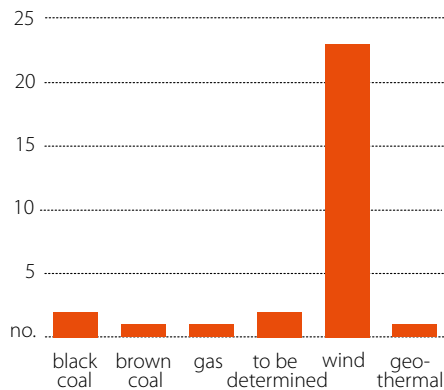
AGL and Windlab Systems' Cooper's Gap wind project in Queensland has an announced maximum capacity of 440 megawatts. The site will have up to 250 wind turbines and is scheduled to start operating in 2011. The project is expected to cost around \$1.2 billion.

## Projects new to ABARE's list

There are 30 projects (all at a less advanced stage) new to ABARE's list since April 2009. Of the new projects, 23 are wind, three are coal-fired, two are yet to determine the fuel source and one project each for gas and geothermal sources (figure h).

Three of the five non-renewable projects added to the list are located in New South Wales and significant in size. The Munmorah rehabilitation project will add 100 megawatts of capacity at

**h Projects added to list:  
six months to October 2009**  
total number = 30



a cost of \$795 million. The project will also include the upgrading of existing units at the power station.

Of the 23 new wind powered projects, 10 are located in Victoria, four in South Australia, three in New South Wales and two in Queensland, Western Australia and Tasmania. The 23 projects, if developed as currently planned, could have a capacity of more than 2670 megawatts.

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02.09

AusAid

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CRC Plant Biosecurity

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Dairy Australia

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