Deutsche Bank

9 November 2010

Australian Renewable Energy

Blowing in the wind

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FITT Research

Fundamental, Industry, Thematic, Thought Leading
Deutsche Bank Company Research's Investment Policy Committee has deemed this work F.I.T.T for investors seeking differentiated ideas. Here our Australian utility team analyses the Australian renewable energy sector in light of the Australian Government's mandated 20% renewable generation by 2020.

Fundamental: 20% renewable energy by 2020 – where will it come from?

Industry: Renewables currently represent 6.5% of Australian generation

Thematic: Plenty of good ideas, few are commercially economic

Thought leading: Wind energy will lead the charge and capture the value

Deutsche Bank AG/Sydney

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Fundamental: 20% renewable energy by 2020 – where will it come from?
The Australian Federal Government has mandated 20% of Australia's electricity must be sourced from renewable generation by 2020. While the scheme is now in its third iteration as the Large-scale Renewable Energy Target (LRET), the legislation enjoys bipartisan political support and implies significant increases in renewable generation over the next decade in Australia. What technology will be the dominant contributor to the required growth?

Industry: Renewables currently represent 6.5% of Australian generation
In 2009, approximately 6.5% of Australia's total electricity load was generated from renewable sources. However this number is misleading given the dominance of legacy hydroelectric projects in the Snowy Mountains and Tasmania. Backing out legacy hydro assets that are only eligible for Renewable Energy Certificates (RECs) above historic generation levels we estimate the number is closer to 1.5%, further underlying the challenge that 20% by 2020 represents.

Thematic: Plenty of good ideas, few are commercially economic
If we had a dollar for every novel low carbon technology we've uncovered, we might just be able to fund one of them. Carbon Capture and Storage could keep Australia's coal fleet viable, while geothermal, photovoltaic solar, thermal solar, wave, tidal and biofuels all seem to work in the laboratory on or a small scale. We see the issue is one of economics not technology, as the timeline to 2020 is simply too short to enable the economic development of novel technology.

Thought leading: Wind energy will lead the charge and capture the value
We see three renewable technologies as economic under the current regulatory environment: hydro, geothermal and wind. While hydro and geothermal can potentially provide baseload generation, hydro expansions on the driest continent seem highly unlikely, and geothermal could still be ten years away. In our view wind is both technically and economically robust under the LRET scheme. The LRET scheme is not reliant on a price on carbon. We estimate a carbon price of at least \$60/tCO_2e is required (in isolation) to make wind cheaper than brown coal.

Buy AGL Energy for renewable energy upside
We have been buyers of AGL for some time, and see the company's exposure to renewable energy as offering further upside. Recent rains in Victoria will support its operating hydro assets, while we see AGL's wind development pipeline as sector leading. As Australia's largest electricity retailer, AGL's renewable strategy will help the company address its REC liability. Infigen Energy's pipeline offers the highest upside; funding constraints, however, remain a challenge.

FITT Research

Top picks	
AGL Energy Ltd. (AGK.AX),AUD16.23	Buy
Infigen Energy (IFN.AX),AUD0.72	Buy

Companies featured			
Origin Energy (ORG.AX),AUD16.57			**Hold**
	2010A	2011E	2012E
P/E (x)	23.8	22.1	20.0
Div yield (%)	3.2	3.0	3.0
Price/book (x)	1.3	1.3	1.3
AGL Energy Ltd. (AGK.AX),AUD16.23			**Buy**
	2010A	2011E	2012E
P/E (x)	14.9	15.3	15.4
Div yield (%)	4.1	4.1	4.1
Price/book (x)	1.1	1.2	1.2
Infigen Energy (IFN.AX),AUD0.72			**Buy**
	2010A	2011E	2012E
P/E (x)	–	44.3	18.5
Div yield (%)	1.6	2.8	2.6
Price/book (x)	0.8	0.8	0.8

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Table of Contents

Executive Summary

Government mandated 20% by 2020

20% renewable generation by 2020

The Australian Federal Government's Renewable Energy Target scheme has been through three phases, with the current Large-scale Renewable Energy Target (LRET) and Small-scale Renewable Energy Scheme (SRES) effectively mandating 20% of Australia's electricity must be sourced from renewable generation by 2020. This represents a significant increase on current levels of c.6.5%, especially because of our estimated c.5% of the current contribution is from legacy hydroelectric scheme with very limited expansion potential.

Wind the leading technology

Wind is technically proven, economic, and expandable

We see wind as the leading technology to meet the LRET scheme target. In our view there are three key characteristics required for renewable generation growth:

- The technology must be technically proven in order to meet targets over the next decade
- The technology must be economic under the existing LRET scheme
- The technology must have significant growth potential to meet annual growth in the LRET target

In our view hydro, wind, solar and possibly geothermal meet the first requirement. The second requirement removes solar and geothermal from the mix, and hydro growth in Australia, the driest habitable continent on earth, looks highly constrained. As a result, we see wind as the leading technology to meet LRET requirements.

A price on carbon offers upside, but is not required

Price on carbon could offer further upside to renewable generators

The LRET is neither reliant upon, nor beholden to a price on carbon. As a result, we regard the LRET scheme as broadly independent of the debate on a price on carbon. We believe this provides equity investors with greater certainty when making investment decisions on renewable energy companies as the uncertainty surrounding a price on carbon is not a key value driver.

However, we do recognize a price on carbon can make renewable more cost competitive, as well as offer revenue upside from higher electricity prices. We believe that at an assumed $20/tCO_2e carbon price, there is little impact on the relative cost curve for renewables. We estimate a carbon price of at least $60/tCO_2e is required (in isolation) to make wind cheaper than brown coal on an LRMC basis, and over $100/tCO_2e (in isolation) for solar and geothermal. A high price on carbon could see renewables leapfrog gas as the cheapest alternative to coal fired generation.

We also believe a price on carbon would likely result in higher wholesale electricity prices. In our view, fossil fuel powered generators would likely seek to pass on higher operating costs, resulting in an uplift in pool prices that renewable would also capture.

Investment implications

We favour AGL Energy for exposure to renewables

There are a number of listed companies in Australia with material exposure to renewable energy. We believe larger companies with significant funding capacity will benefit most from the LRET scheme given the levels of investment required to achieve 20% electricity generation from renewable energy sources by 2020.

The three largest listed Australian companies with renewable exposure are primarily focused on wind, our preferred renewable source. We favour AGL Energy given its superior pipeline and capacity to fund the construction of its pipeline. We have been buyers of AGL for some time, and see its renewable energy development pipeline as offering further upside. In addition, we believe the company's existing hydroelectric power stations should benefit from recent rains and increased dam levels in Victoria, which helps increase its margins in electricity.

We see Infigen Energy's development pipeline as strong, however funding constraints remain the biggest hurdle for the company. If the company can resolve funding issues through the use of JVs or alternative funding, we believe Infigen is best levered to growth through renewable generation.

While we recognize Origin's diversified optionality approach reduces technology specific risks, in our view wind is already the proven technology of choice to meet a substantial percentage of the LRET target. We believe the company's late adoption of a wind pipeline has resulted in lower quality development options. Although we recognize if geothermal can be proven on a commercial scale, Origin is well placed with this technology.

Figure 1: Renewable energy rating matrix

	Rating	Target price	Overall renewable rating	Technology	Pipeline strength	Capacity to fund	Development and technical expertise
AGL Energy	Buy	$17.70	**High**	**High** -Primarily wind -Solar opportunity under Federal Government's Solar Flagships Program	**High** Very strong wind development pipeline, our preferred technology	**Medium/High** Strong corporate balance sheet with $800m in debt headroom, however NSW privatisation may redirect capital	**High** Proven track record in wind and hydro development
Infigen Energy	Buy	$1.00	**Medium/High**	**High** -Primarily wind -Solar opportunity under Federal Government's Solar Flagships Program	**High** Very strong wind development pipeline, our preferred technology	**Weak** FY11 fully funded, however failed US asset sale process compromises longer term funding	**High** Proven track record in wind development as Australia's largest wind farm owner
Origin Energy	Hold	$16.70	**Medium**	**High/Very High** -Large wind pipeline -Exposure to Geothermal via Geodynamics -PNG hydro proposal	**Weak/Medium** -Wind pipeline appears less developed than competition -Geothermal opportunity appears to be sector leading, however we see geothermal as long dated and remain sceptical of PNG hydro during the RET period	**Medium/High** Very strong corporate balance sheet, however LNG and NSW privatisation may both require significant capital	**Medium** -Limited experience in wind development -Experience in geothermal via Contact Energy, but different technologies in Australia -No experience in hydro despite PNG plans

Source: Deutsche Bank

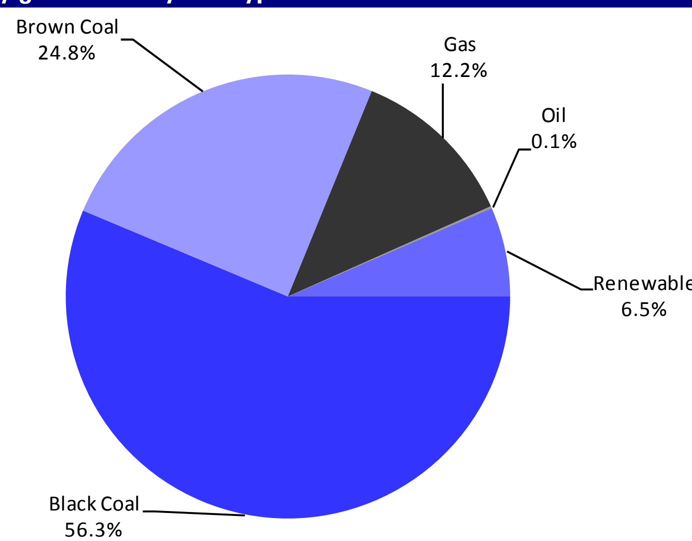
The RET scheme – an overview

Electricity generation – Australia in context

Cheap coal and gas favour fossil fuel electricity generation

Australia has long enjoyed cheap electricity from its abundant coal reserves. Major coal provinces in the Hunter Valley near Newcastle in NSW, the Latrobe Valley in Victoria, and Bowen Basin in Queensland dominate Australia's electricity supplies. Furthermore, east coast Australian domestic gas prices are well below global benchmarks providing for relatively cheap mid-merit and peaking gas fired generation. In FY09 81% of Australia's electricity generation was sourced from coal with a further 12% gas fired, bringing fossil fuel generation to nearly 94% of total electricity generation.

Figure 2: Electricity generation by fuel type in Australia FY09



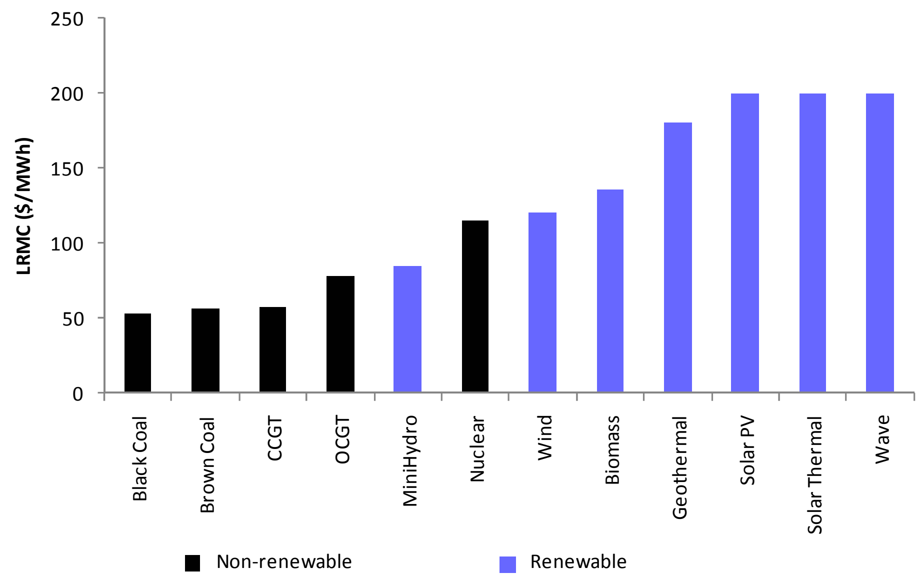
Source: ESAA, Deutsche Bank

Australia's east coast electricity market operates on a pooled system, whereby generators sell electricity into a common pool under a price-driven demand aggregation model. As a result, all operating generators receive the same price at any given point in time. This market structure ensures generators with the lowest marginal operating costs generate first, with higher cost generators operating only when demand, and hence prices, increase.

Without additional support, renewables are not economically competitive with fossil fuels in Australia

While renewable generators can effectively operate for free in the short term given there are no fuel costs associated with capturing wind, sunlight or water flow etc, high capital costs make renewable generators uncompetitive when full costing is considered. As a result, the Long Run Marginal Cost (LRMC) of generation for renewable technologies is higher than fossil fuel alternatives.

Figure 3: Long run marginal cost for various fuel sources



Source: AGL AEPR, Deutsche Bank

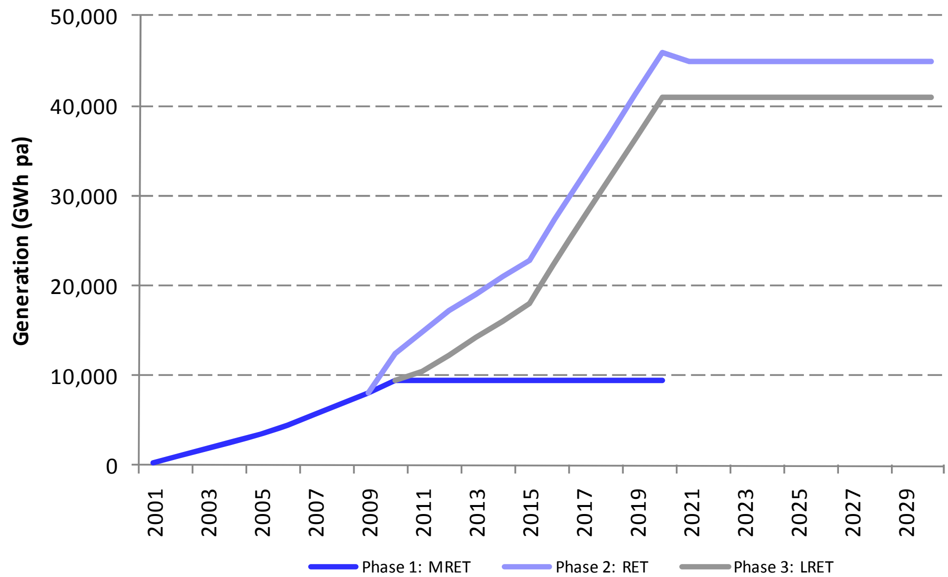
Government policy is required to support renewables

Given electricity prices alone do not provide sufficient economic support for renewable generation in Australia, Government policy is required to provide additional financial support to drive investment in renewable generation.

A number of difference support mechanisms are used around the world. European countries generally favour a fixed tariff mechanism whereby renewable generators receive a fixed price (inflation adjusted) for all electricity produced. In the USA, the Production Tax Credit scheme allows for support via tax credits.

The Australian Government has taken a third approach - mandating electricity retailers to buy a percentage of their electricity from renewable sources. The mechanism for the scheme is to provide renewable generators with a certificate for each MWh of green electricity produced. The generator can then sell these green certificates along with the electricity produced to electricity retailers. The price of the green certificates is designed to reflect the mandated level of renewable generation, and provide economic support for the development of renewables.

Figure 4: Renewable energy targets in Australia



Source: Department of Climate Change, Deutsche Bank

Three phases to date of renewable energy legislation

The Australian Government's legislation has passed through three phases. The initial MRET scheme commenced in 2001, and was expanded to the RET scheme in 2009. The impact of small scale generators on REC prices will result in the Government commencing the third LRET phase in 2011.

Phase 1: The Mandatory Renewable Energy Target (MRET) scheme

MRET was the original renewable energy scheme: 9,500GWh by 2010

The Australian Government's Mandatory Renewable Energy Target (MRET) was established on 1 Apr 2001, with the aim to achieve the generation of 9,500GWh of electricity from renewable sources by 2010. The scheme was envisaged to remain in place until 2020, effectively providing economic support to renewable generators until this time. The target represented approximately 5% of total forecast electricity demand by 2020.

The MRET scheme required electricity retailers and wholesale electricity users in Australia to acquire Renewable Energy Certificates (RECs; 1REC = 1MWh of electricity) from eligible sources to meet the renewable energy target. Liable parties had to surrender the relevant number of RECs based on their total electricity purchases to the Office of the Renewable Energy Regulator (ORER) each year to discharge their liability. Electricity purchasers could source their RECs by:

- Owning eligible renewable energy generators, and generating their own certificates
- Signing purchase agreements with eligible renewable energy sources
- Purchasing RECs on the open market

The scheme set out a list of criteria, and the accreditation process, for eligible renewable energy generators under the scheme. The scheme applied to new-build generators, and both industrial and residential scale generators were included. Key categories included:

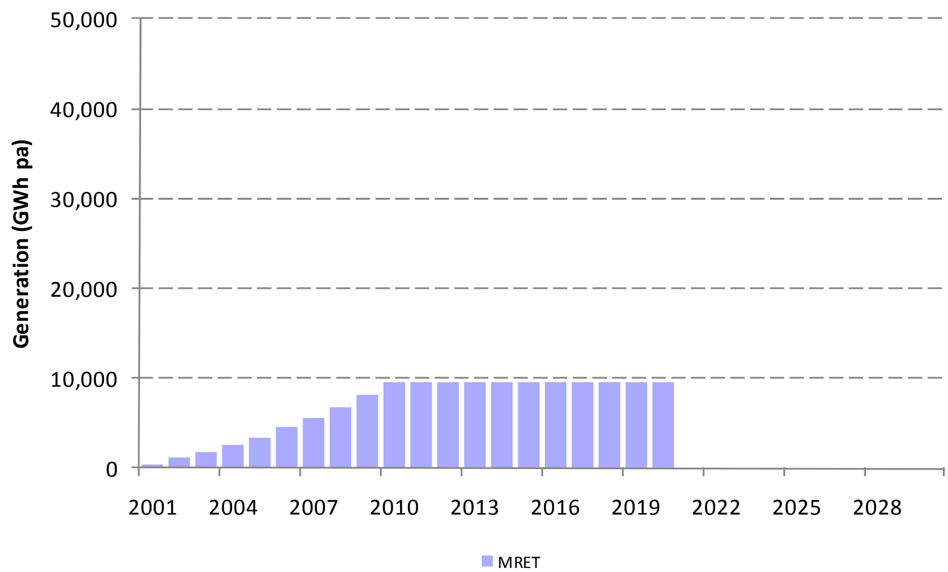
- Renewable energy based power stations such as wind, hydro, landfill gas, solar and biogas subject to certain baseline requirements
- Owners of solar water heaters and small generation units installed on or after 9 Jun 2009

- Agents of solar water heaters and small generation units
- Certain existing waste coalmine gas power station

Penalty price of $40/MWh

If electricity retailers or wholesalers of electricity failed to purchase sufficient RECs to meet their liability, a penalty rate of $40/MWh was payable for each shortfall REC. This price effectively acted as a cap for the REC price, however given the penalty was not tax deductible (unlike REC certificates), REC prices would have to exceed $57/MWh in order for retailers and wholesalers to elect to pay the penalty ahead of purchasing RECs.

Figure 5: MRET target profile



Source: Department of Climate Change, Deutsche Bank

The MRET scheme was the first of its kind globally, and by mid-2009 280 renewable energy power stations were accredited under the scheme. The scheme proved to be successful, with renewable energy generation exceeding the annual target in all years except 2007. The ability to bank excess generation credits to surrender in later years ensured the scheme had exceeded it cumulative generation targets by mid-2009.

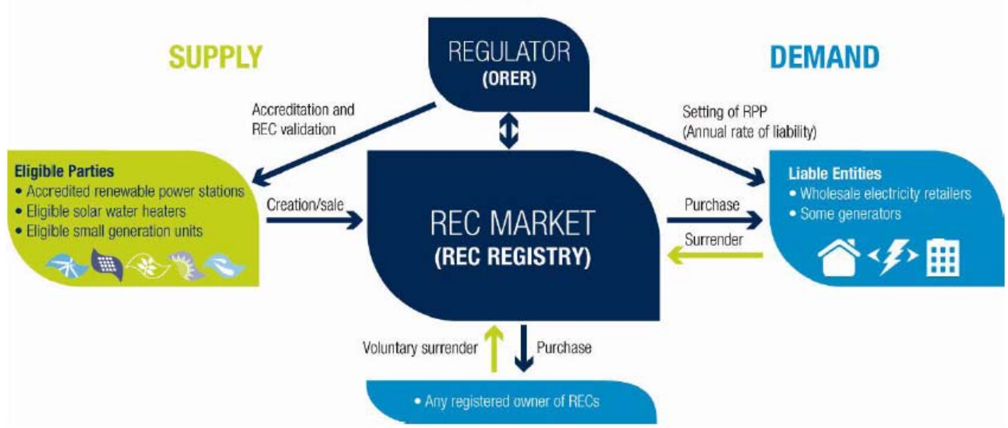
The success of the MRET scheme led to a proposal to expand the scheme to target 20% of Australia's electricity generation from renewable sources by 2020, nearly a five-fold increase over the original target.

Phase 2: The National Renewable Energy Target (RET) scheme

RET replaced MRET, targeting 20% renewable generation by 2020, or 45,000WGh pa

The Australian Government passed the national Renewable Energy Target (RET) scheme into legislation on 20 Aug 2009 as an expansion of the MRET scheme. The RET scheme aimed to encourage additional generation of electricity from renewable energy sources to meet a target of 20% of electricity supply from renewable energy sources by 2020. The scheme expanded the previous MRET scheme by c.4.7x. Based on electricity demand forecasts, 20% of total electricity generation implied 45,000GWh per annum of renewable generation by 2020.

Figure 6: Structure of RET scheme



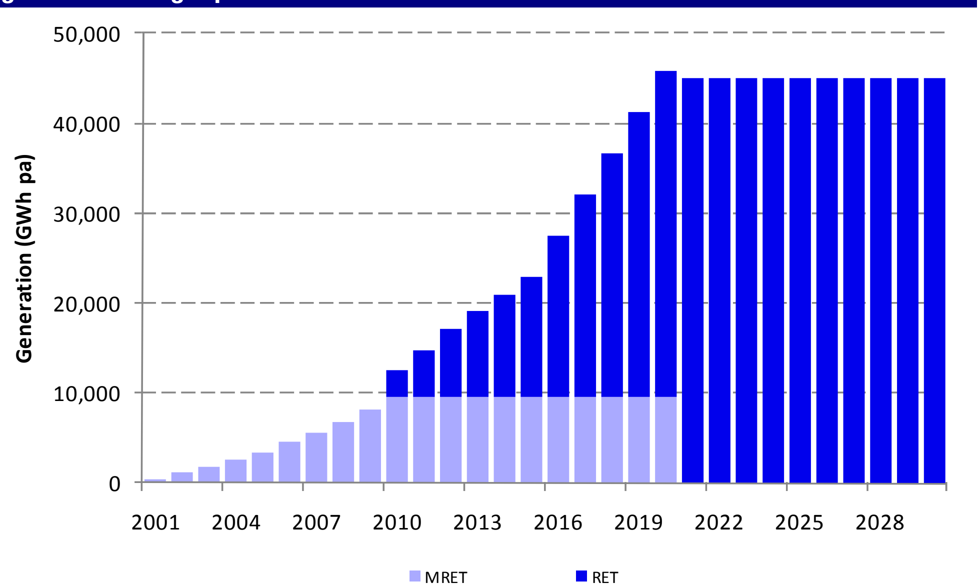
Source: ORER

Penalty price increased to $65/MWh

Furthermore, the non-compliance penalty was increased from $40/MWh to $65/MWh. The non-compliance penalty remains non-tax deductible, contrasting REC certificates that are deductable. We note the non-compliance penalty places an effective cap on pricing as REC buyers would elect to pay the penalty rather than buy RECs trading at a price higher than the penalty. The tax adjusted penalty is effectively $93/MWh.

The RET scheme was designed in cooperation with the states and territories through the Council of Australian Governments (COAG) and was designed to remain operational until 2030, absorbing existing and proposed state and territory targets.

Figure 7: RET target profile



Source: Department of Climate Change, Deutsche Bank

The distorting impact of solar hotwater and rooftop solar PV

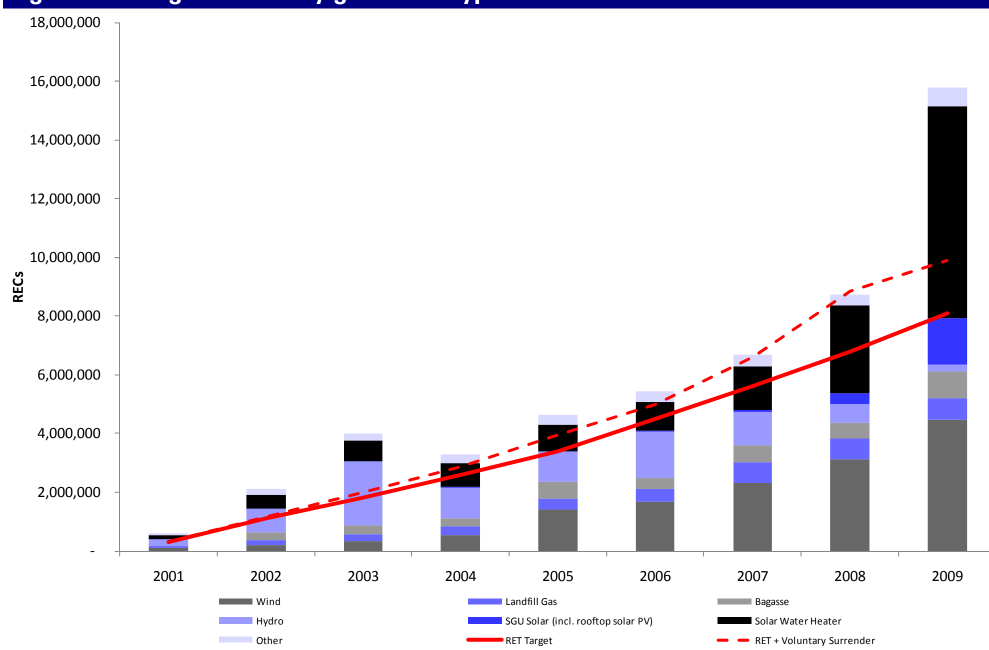
Economic stimulus supported solar hot water and rooftop solar PV

During the recent global economic crisis, the Australian Government instigated a number of fiscal stimulus measures to support the Australian economy. One such measure was generous rebates for households that switched their hot water heaters to solar powered. Furthermore, such systems were eligible for RECs, and the installer of the system received the RECs in advance. The Government also provided significant rebates for the installation of rooftop solar photovoltaic (PV) panels, which were also eligible for upfront RECs.

A side effect of these rebates was a significant increase in the number of RECs created. A typical solar hot water heater could earn 30-40 RECs at the time of installation, reflecting the expected fossil fuel generated electricity avoided across the life of the solar heater. Rooftop solar PV panels also received up-front RECs at the time of installation.

As a result, 7.2m RECs were created during CY09 by the installation of solar hot water heaters, and 1.6m RECs from the installation of rooftop solar PV panels. These figures combined represent 109% of the CY09 MRET target, and 20% of the 2020 target in one year alone.

Figure 8: REC generation by generator type



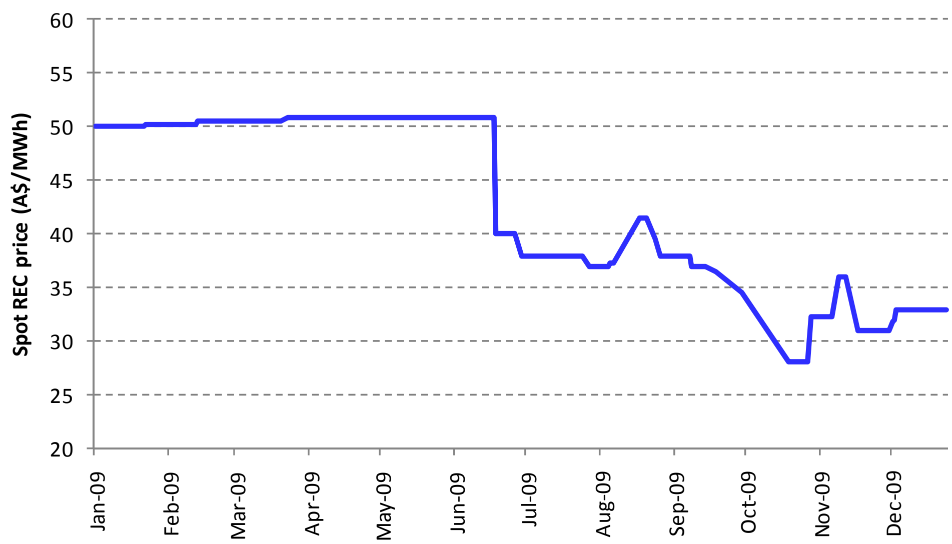
Source: Australian Government REC registry, Deutsche Bank

Given the upfront nature of solar water heater and rooftop solar PV panels RECs, units installed in 2009 contribute no RECs in 2010 or beyond. As a result, RECs generated by solar hot water heaters and rooftop solar PV panels are effectively not sustainable.

REC price collapsed in 2009 on excess supply

However, the biggest problem associated with solar hot water and rooftop solar PV panels RECs was the impact on the REC price. Given the broader economic environment, installers were motivated to sell RECs immediately into the spot market to aid their cash flow. As a result the REC price collapsed in Jun 2009 from above $50/MWh to below $40/MWh. By Oct 2009, the REC price had fallen below $30/MWh.

Figure 9: Spot REC pricing in 2009



Source: AFMA, Deutsche Bank

At these pricing levels, commercial scale renewable technologies such as wind were no longer economically viable, resulting in the need for changes to legislation to support REC prices. This led to the third phase of the REC system: LRET and SRES.

Phase 3 - Fixing RET: The LRET and SRES

As a result of the impact of solar hot water heaters and rooftop solar PV panels on REC prices, on 26 Feb 2010 the Federal Government moved to support pricing to ensure commercial scale renewable energy projects could remain economically viable.

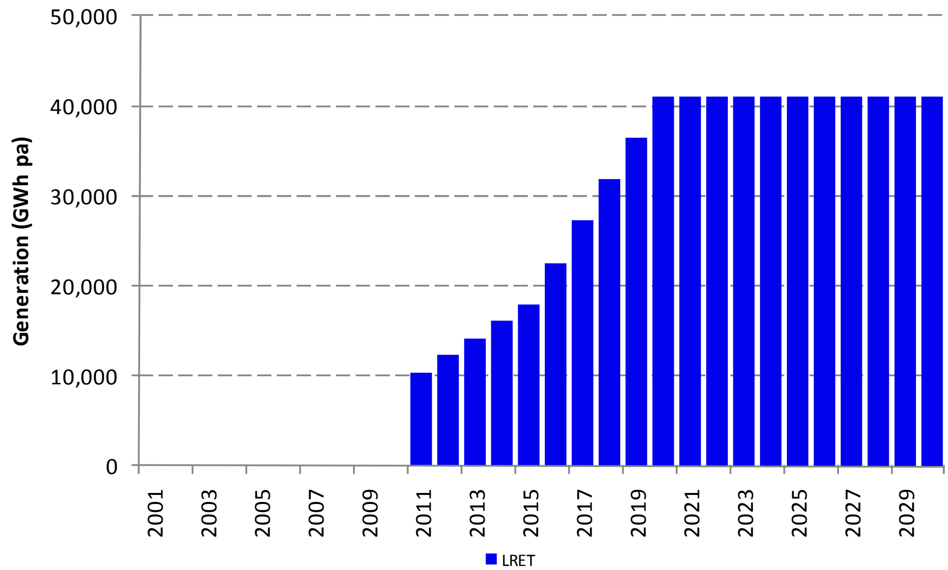
LRET/SRES separates large and small scale generators

The Government now proposes to separate small and large scale projects by establishing a separate Small-scale Renewable Energy Scheme (SRES) with an uncapped fixed subsidy of $40/MWh and reserving the annual target for major projects under a rebadged Large-scale Renewable Energy Target (LRET). The proposed changes will take effect from January 2011.

Large-scale Renewable Energy Target (LRET)

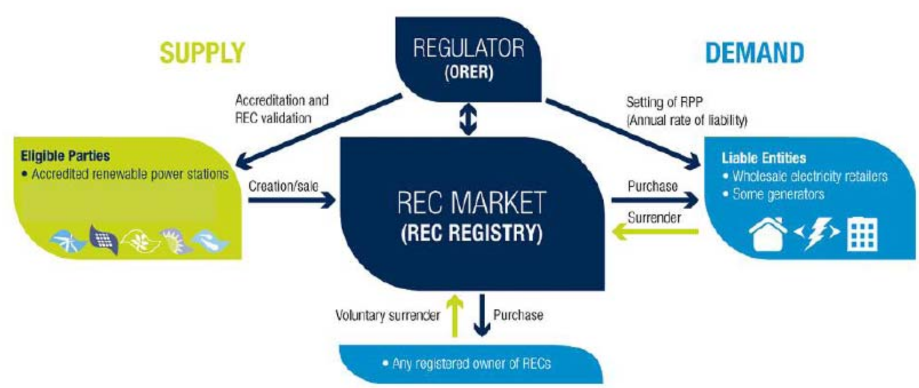
The LRET effectively preserves the key design features of the MRET and RET schemes. Wholesale purchasers of electricity remain liable to purchase RECs from accredited commercial scale renewable energy sources. The LRET target is below the previous RET targets by 3,000 to 4,850GWh pa, reflecting an expectation that small-scale units will continue to meet the balance to 2020 under the SRES discussed in the next section. The LRET target by 2020 is 41,000GWh.

Figure 10: LRET target profile



Source: Department of Climate Change, Deutsche Bank

Figure 11: Operation of the proposed Large-scale Renewable Energy Target



Source: ORER

Small-scale Renewable Energy Scheme (SRES)

Fixed $40/MWh REC price for smaller generators under SRES

Under the Government's Phase 3 changes, smaller renewable installations by households and community groups will be subsidised under a separate mechanism called the Small-scale Renewable Energy Scheme (SRES). The SRES will provide a fixed REC price of $40/MWh for small-scale technologies such as rooftop solar PV panels and solar water heaters, replicating the current multiplier and deeming arrangements to provide an upfront subsidy at the time of installation.

The SRES will be uncapped, and its certificates will not be able to be used in the large-scale market. This will ultimately leave retailers facing an uncertain liability to purchase SRES RECs, however modeling by ROAM Consulting forecasts SRES REC creation of 5,000-10,000GWh pa by 2020. As a result the SRES is a considerably smaller scheme than the 41,000GWh LRET.

The Government's changes would not impact small-scale projects installed up to 31 Dec 2010, which would still be allowed to sell RECs into the large scale market. As a result, the existing stock of small-scale RECs, plus any generated from projects installed in 2010, will continue to contribute to the LRET REC surplus. The Government argues that the stock of RECs at 1 Jan 2011 will provide an important source of liquidity, and that not allowing use of the stock of RECs could leave liable parties short, causing them to default to the shortfall (penalty) charge.

Government mandates could result in a number higher than 20%

Some state sponsored projects have elected to purchase 100% from renewables

A number of state government sponsored projects have elected to contract directly with renewable generators to source 100% of their electricity needs from renewable sources. We point to two recent announcements from desalination plants:

- The Sydney desalination plant will purchase all of its electricity, and associated RECs from Infigen Energy's currently operating Capital Wind Farm in NSW.
- The Melbourne desalination plant announced it would purchase electricity and RECs from AGL Energy's proposed 63MW Oaklands Hill wind farm in late July 2009.

As a result, these projects are purchasing a greater percentage of renewable electricity than the LRET scheme requires, with the ultimate impact that total generation from renewable sources will likely exceed 20% by 2020.

Where to for the REC price?

Spot REC pricing trends

Stable pricing 2001-2003, however excess RECs drove the price below $12/MWh by 2006

From the establishment of the initial MRET scheme (Phase 1) on 1 Apr 2001, spot RECs went through a period of stable incremental pricing until early 2004. During this time the spot REC market was relatively illiquid with retailers preferring to contract directly with suppliers, resulting in limited volatility. However, from early 2004 it became evident that the 9,500GWh target by 2010 profile was being exceeded, with REC generation in every year exceeding the target. Hydroelectric generation in 2003 of nearly 2.2m RECs alone accounted for 85% of the 2003 target. As a result, REC prices began to fall, dropping to below $12/MWh in late 2006.

Drought in 2007 supported pricing

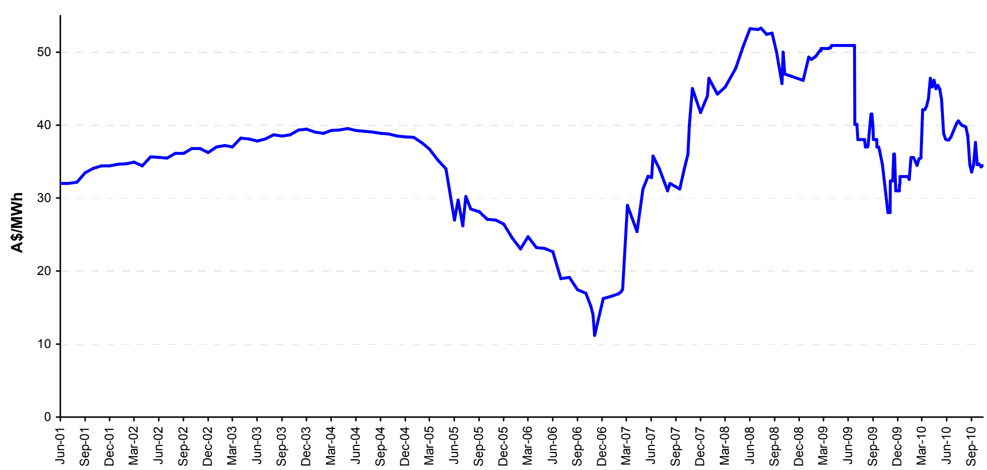
Drought conditions in 2007 led to a material drop in the number of RECs generated from hydroelectric sources, and began to help support pricing, with spot RECs rising strongly during 2007 and early 2008 to record levels above $50/MWh. However, prices did not reach the tax-effected penalty rate of $57/MWh.

Rebates impacted pricing from 2009

In mid 2009 spot REC prices declined sharply as the Government's stimulus program for solar hot water heaters and rooftop solar PV panels coupled with weak economic conditions saw very large numbers of RECs sold into the spot market. The spot REC price fell from over $50/MWh to less than $30/MWh during the second half of 2009.

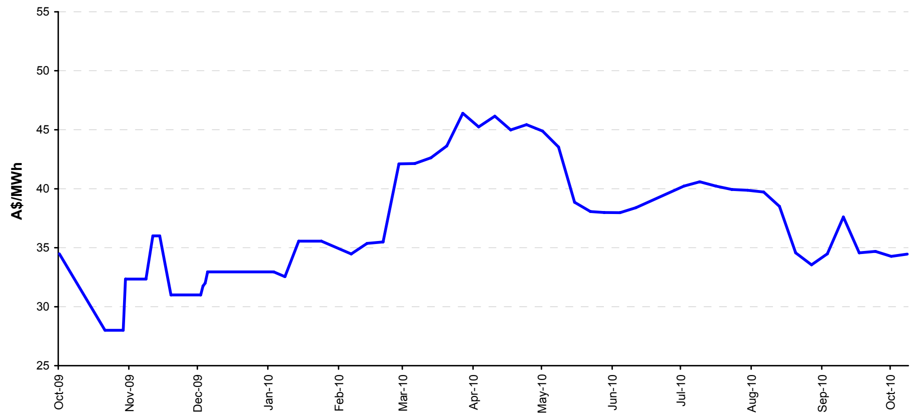
The expansion of the MRET scheme into the RET scheme (Phase 2) in Aug 2009 had a limited impact on the spot REC price given the solar hot water heater and rooftop solar PV panels overhang. The first real positive stimulus for the REC price came in Feb 2010 when the Government announced plans to split the RET scheme into the LRET and SRES (Phase 3). Spot RECs rallied to over $45/MWh, however the rally was not sustained given the significant number of solar RECs already in the market. Spot REC prices have remained below $40/MWh since this time.

Figure 12: Historic REC pricing



Source: AFMA, Deutsche Bank

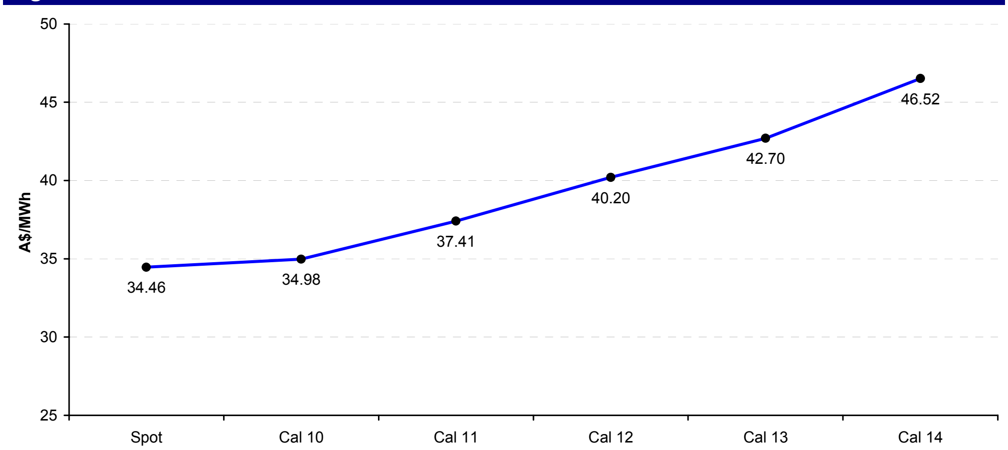
Figure 13: 12 month historic spot REC price



Source: AFMA, Deutsche Bank

The forward curve for RECs remains in upwardation, however the curve implies spot prices will not return to above $40/MWh until CY12, and by CY14 will remain below $50/MWh.

Figure 14: Forward REC curve



Source: AFMA, Deutsche Bank

Don't be fooled by the spot REC price

The spot REC market does not reflect recent offtake contract pricing

The spot REC market remains a relatively illiquid market. Furthermore, the spot market continues to be dominated by small sellers of RECs such as solar hot water heater installers, while large buyers of RECs, the electricity retailers, have shown a preference to enter Power Purchase Agreement (PPA) contracts to acquire RECs or build their own renewable generation to avoid facing spot pricing volatility.

If spot REC and electricity prices were to be believed, no Australian wind farm (or other renewable generator) is economic. However, a number of recent wind farm sanctions suggest a continued willingness to build new generation, and implies that REC buyers do not use the spot price as a measure of the fundamental supply of RECs across the spot and contract market.

As the following table details, we estimate recent PPAs suggest prices paid by offtakers represent a significant premium of 27% to 80% to spot electricity and REC prices at the time of the signing of the PPA.

Figure 15: Recent PPAs signed at a significant premium to spot pricing

Wind farm	State	Offtaker	Date PPA signed	PPA price ($/MWh)	Spot REC price ($/MWh)	Spot electricity price ($/MWh)	Combined spot price ($/MWh)	PPA premium
Hallet 4	SA	AGL	01/10/09	111	34.50	27.10	61.60	**80%**
Hallet 2	SA	AGL	29/08/08	99	41.50	36.50	78.00	**27%**
Capital	NSW	Sydney Water	28/07/08	110	53.10	27.90	81.00	**36%**

Source: Company data, AFMA, Deutsche Bank

Recent deals imply the market values RECs well above $50/MWh. The average of three recent deals at Hallet 4, Hallet 2 and Capital implies a REC price of $63.50/MWh.

Figure 16: Implied REC price in recent PPAs

Wind farm	State	Offtaker	Date PPA signed	PPA price ($/MWh)	5 year average electricity ($/MWh)	Implied REC price ($/MWh)
Hallet 4	SA	AGL	01/10/09	111	42.20	68.80
Hallet 2	SA	AGL	29/08/08	99	42.20	56.80
Capital	NSW	Sydney Water	28/07/08	110	45.10	64.90

Source: Company data, AFMA, Deutsche Bank

The current state of supply/demand of RECs

Oversupply of RECs could last until 2014, which implies new project sanctions will be needed 2011-12

We continue to see an oversupply from the excess of banked RECs primarily driven by solar hot water heaters and rooftop solar PV panels. Recent analysis by ROAM Consulting suggests it may not be until 2014 before new large-scale renewable generators are required to meet LRET requirements. This analysis assumes RECs are not banked, and surrendered as soon as possible. Should RECs be surrendered based on the creation year, ROAM estimate new generation will be required by 2012.

While these timelines appear to suggest a bearish outlook for new renewable generation in Australia, we make the following observations:

- The timeline from project sanction to first generation at greenfield wind sites has averaged 2-3 years. This implies if new generation is required in 2014, projects will require sanction by 2011-12. If new generation is required in 2012, it must have already been sanctioned.
- We do not believe it is in the best interest of electricity retailers to hold off signing new PPAs for RECs until banked supplies are exhausted in 2014. If no new generation is sanctioned until spot prices rise, there would likely result in a 2-3 year period of significant REC shortages and hence high REC pricing.

In the best interest of retailers to support new projects

As a result, while we recognise the risk of short term issues weighing on REC prices, we believe builders of renewable generation projects will need to sanction new projects within the next 12 months and beyond to ensure current LRET obligations can be met. We also note two of the leading proponents of renewable generation, AGL Energy and Origin Energy, are also the two largest electricity retailers and thus purchasers of RECs. As a result we believe they will act rationally and continue to support new projects to ensure their liabilities can continue to be met.

The political outlook – risks of further changes

We note the original MRET scheme has been significantly restructured twice with the RET (Phase 2) and LRET (Phase 3) changes. Furthermore, a number of smaller policy changes have also been made, including the treatment of small generation units such as solar hot water heaters.

As a result, we see significant risk of further policy changes to the current LRET/SRES scheme. However, in our view policy change risks point toward a positive trend in relation to producers of renewable energy given:

- All changes to date have been positive for renewable generation, with increased production targets and measures such as the LRET/SRES split to support REC pricing
- The REC scheme currently enjoys bipartisan support within the Australian parliament, and both sides of parliament have supported the scheme since its inception in 2001
- The REC scheme is an easier political solution to address carbon emissions than carbon trading or a carbon tax

The potential role of a carbon trading scheme

The LRET scheme is not reliant upon, nor beholden to, a carbon trading scheme

The various phases of the LRET scheme are not explicitly dependent on a price on carbon, indeed the Federal Government's withdrawn Carbon Pollution Reduction Scheme (CPRS) held no provisions for either cancelling or incorporating the then MRET scheme into the CPRS. As a result, we regard the LRET scheme as broadly independent of the debate on a price on carbon. We believe this provides equity investors with greater certainty when making investment decisions on renewable energy companies as the uncertainty surrounding a price on carbon is not a key value driver.

A price on carbon offers upside for renewable generators

However, we do recognize the impacts that a price on carbon could have on both the cost of competing non-renewable generation, and electricity pool prices. We note both these impacts are likely to be positive for renewable generators.

The impact of a carbon price on generation costs

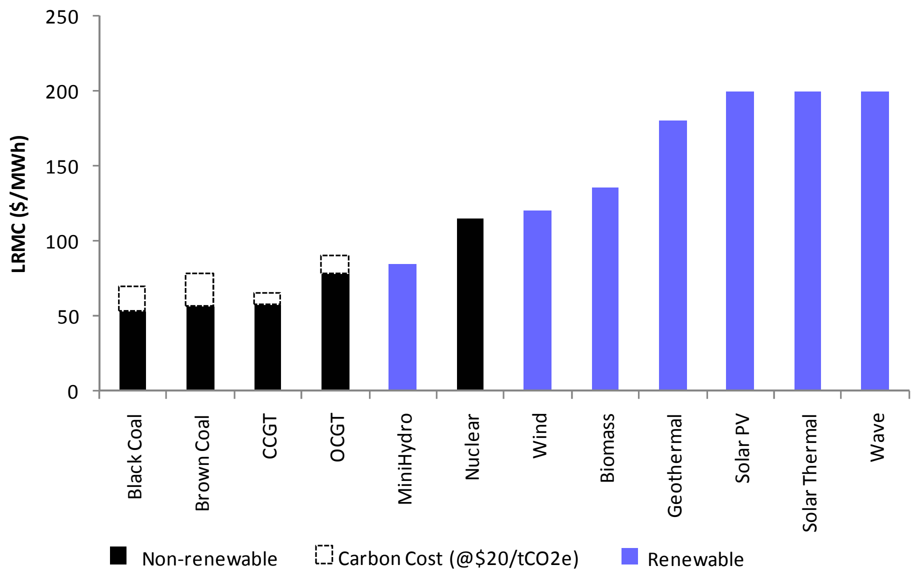
A price on carbon increases the operating costs for fossil fuel power stations, raising their LRMC. However, the direct effect of a cost on carbon is effectively zero for renewable generators. As a result, a price on carbon increases the competitive position of renewables relative to fossil fuel generators, however in our view a price on carbon is more likely to favour a fuel switch towards gas over renewables in the near term (depending on the carbon price level).

A carbon price makes renewables more competitive, but still more expensive than coal and gas

We believe that at an assumed $20/t$CO_2$e carbon price, there is little impact on the relative cost curve for renewables. Mini Hydro becomes cheaper than OCGT, but as discussed later in this report, we see limited upside for hydro generation in Australia. We note however that CCGT becomes cheaper than both black coal and brown coal fired power stations under this scenario, underlining our view that a carbon price (in isolation) predominantly favours gas over coal. We estimate a carbon price of at least $60/t$CO_2$e is required (in isolation) to make wind cheaper than brown coal on an LRMC basis, and over $100/t$CO_2$e (in isolation) for solar and geothermal.

We would also note, as discussed later in this report, several renewable energy sources such as wind, solar and wave energy are intermittent, and could not alone replace baseload coal fired generation, irrespective of relative cost positioning.

Figure 17: Long run marginal cost with $20/t carbon price



Source: AGL AEPR, Deutsche Bank

The impact of a carbon price on electricity pool prices

A price on carbon would likely result in higher electricity prices, a benefit to renewable generators

We believe a price on carbon would likely result in higher wholesale electricity prices. In our view, fossil fuel powered generators would likely seek to pass on higher operating costs, resulting in an uplift in pool prices.

Analysis undertaken for the Department of Treasury at the time of the proposed CPRS produced a wide range of potential outcomes of a cost of carbon on the wholesale price of electricity in Australia. Clearly the mechanism for a price on carbon (cap and trade vs tax), the level of support for coal fired generators, and the appetite for coal fired generators to pass on costs and potentially lose market share would all ultimately impact wholesale pool prices. As a result, without any clear indication of what a future carbon scheme will look like, the impact on renewable generators is difficult to quantify. However we would conclude that electricity prices would likely increase with a price on carbon, and renewable generators without any additional carbon costs would be beneficiaries of the higher pricing.

The current state of play for a cost on carbon in Australia

Federal Government exploring options on introducing a carbon price

The Federal Government's 2009 proposed CPRS appears to no longer be on the radar. The Australian Government announced the establishment of a multi-party climate change committee in early October 2010, with an aim to exploring various options for the introduction of a carbon price. The committee contains members from the ruling coalition government including the Labor Party, Greens and an independent MP, and will meet monthly until the end of 2011.

While the presence of the Greens in the current coalition, as well as independent MPs broadly in favour of action on climate change, points to positive momentum towards a price on carbon, the fate of the withdrawn CPRS continues to suggest significant uncertainty around the future direction of carbon pricing in Australia.

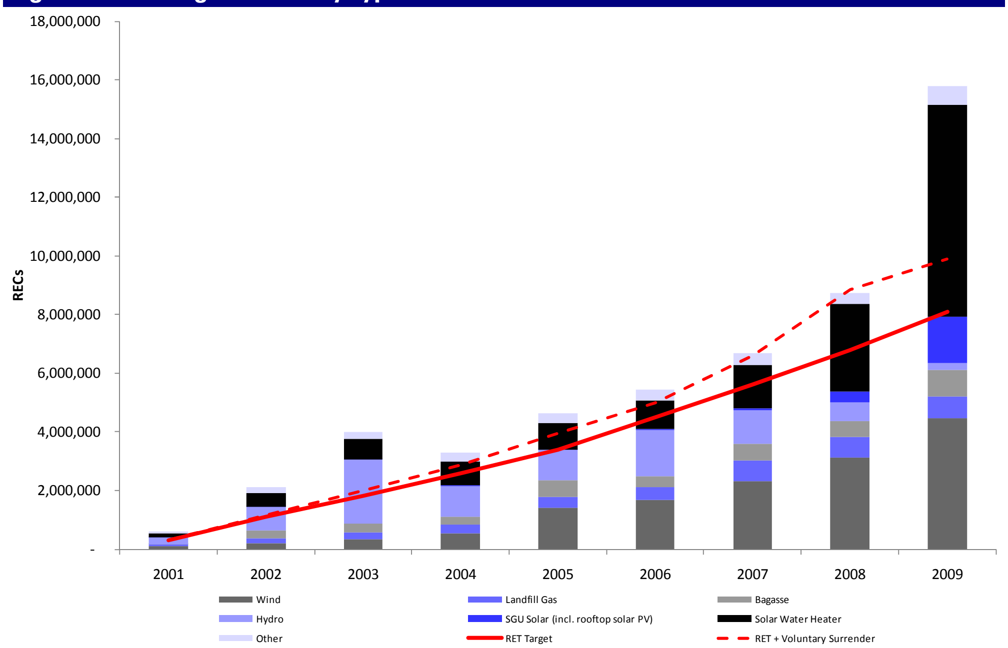
In our view uncertainty on carbon prices is impacting company investment decisions, and making equity investment all the more challenging. As a result, we believe the success of the MRET/RET/LRET scheme to date provides greater certainty on investment decisions in renewable energy companies that are not reliant on carbon trading, but do stand to benefit should a price be placed on carbon.

Reviewing the REC registry

A snapshot of the REC registry

The ORER, as the responsible body for oversight of the RET scheme, publishes a registry of RECs (https://www.rec-registry.gov.au). While the identity of counterparties is not made public, the volumes, timing, fuel source and status of RECs is detailed. We have reviewed the registry in detail, and have drawn out some key findings from the registry.

Figure 18: RECs generated by type



Source: Australian Government REC registry, Deutsche Bank

We note the absolute and relative composition of generation types has changed markedly over time. We make several key observations from the chart above and following pie charts:

Hydroelectric RECs have declined due to drought conditions and limited new construction

- **Hydroelectric generation of RECs has declined over time in line with drought conditions.** The vast majority of Australia's hydroelectric capacity was built prior to the commencement of the REC scheme, including the Snowy Hydro Scheme, Victoria's Southern Hydro (now owned by AGL Energy), and Tasmanian hydro generators. However, these assets can still generate RECs when annual production exceeds a baseline rate reflecting historic production. Furthermore, hydroelectric generation built after the commencement of the MRET scheme, such as AGL's Bogong power station, can generally generate RECs in line with total electricity output. In 2001 57.5% of RECs were generated by hydroelectric power stations, and in 2003, nearly 2.5m RECs were generated from hydroelectric sources, aided by strong rainfall and high dam levels early in the decade. However with prolonged drought, hydroelectric REC generation fell to below 0.2m RECs in 2009 or less than 1% of all RECs generated.

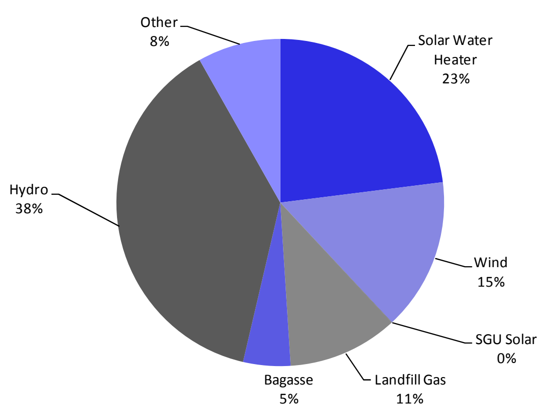
Rebates for Solar Water Heaters distorted the REC market

- **Solar Water Heaters generated 47% of all RECs in 2009, underlining the distorting effects of Government rebates.** Solar Water Heaters contributed a relatively stable proportion of total RECs from 2001 to 2007, however with the introduction of generous rebates as part of Government stimulus initiatives, REC generation from Solar Water Heaters grew by 113% in 2008 and 137% in 2009.

Wind is by far the fastest growing commercial scale energy source

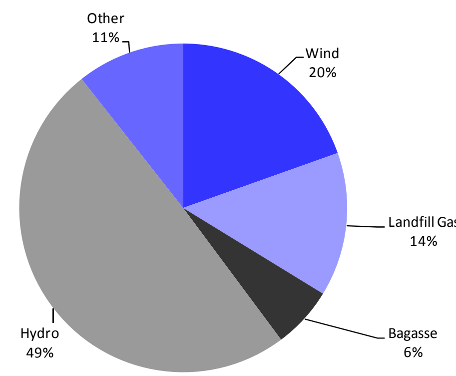
- **The fastest growing commercial scale renewable energy source is wind, returning a REC generation CAGR of 64% from 2001 to 2009.** Wind sources generated 4.2m RECs in 2009, or 64% of total commercial scale REC generation. By comparison other emerging commercial scale technologies remain very small:
  - Landfill gas: 0.7m RECs in 2009 (2001-2009 CAGR of 30%)
  - New build Hydro (excluding SGUs): 0.17m RECs in 2009 (2001-2009 CAGR of -19%)
  - Solar (excluding residential roof-top installations): 0.002m RECs in 2009 (2001-2009 CAGR of 17%)
  - Geothermal, ocean energy: 0 RECs in 2009

Figure 19: All REC generation (2001)



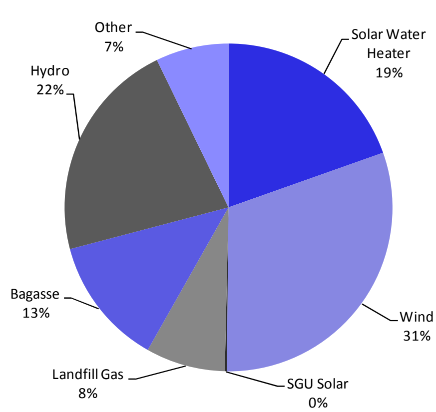
Source: Australian Government REC registry, Deutsche Bank

Figure 20: Commercial scale REC generation (2001)



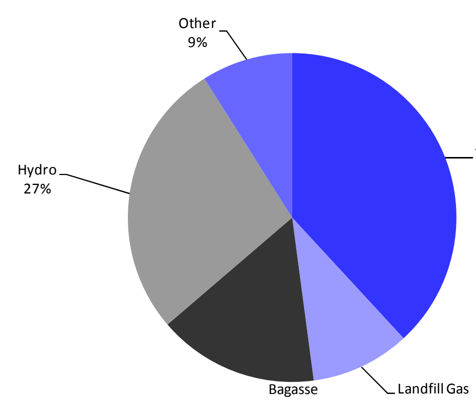
Source: Australian Government REC registry, Deutsche Bank

Figure 21: All REC generation (2005)



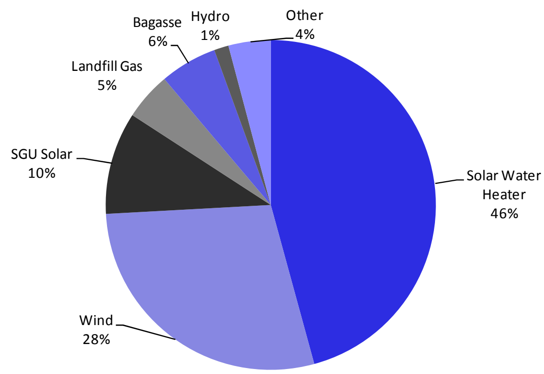
Source: Australian Government REC registry, Deutsche Bank

Figure 22: Commercial scale REC generation (2005)



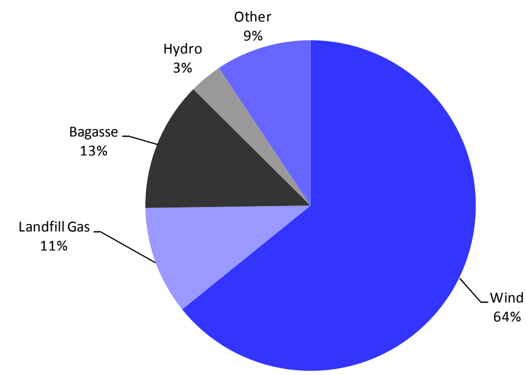
Source: Australian Government REC registry, Deutsche Bank

Figure 23: All REC generation (2009)



Source: Australian Government REC registry, Deutsche Bank

Figure 24: Commercial scale REC generation (2009)



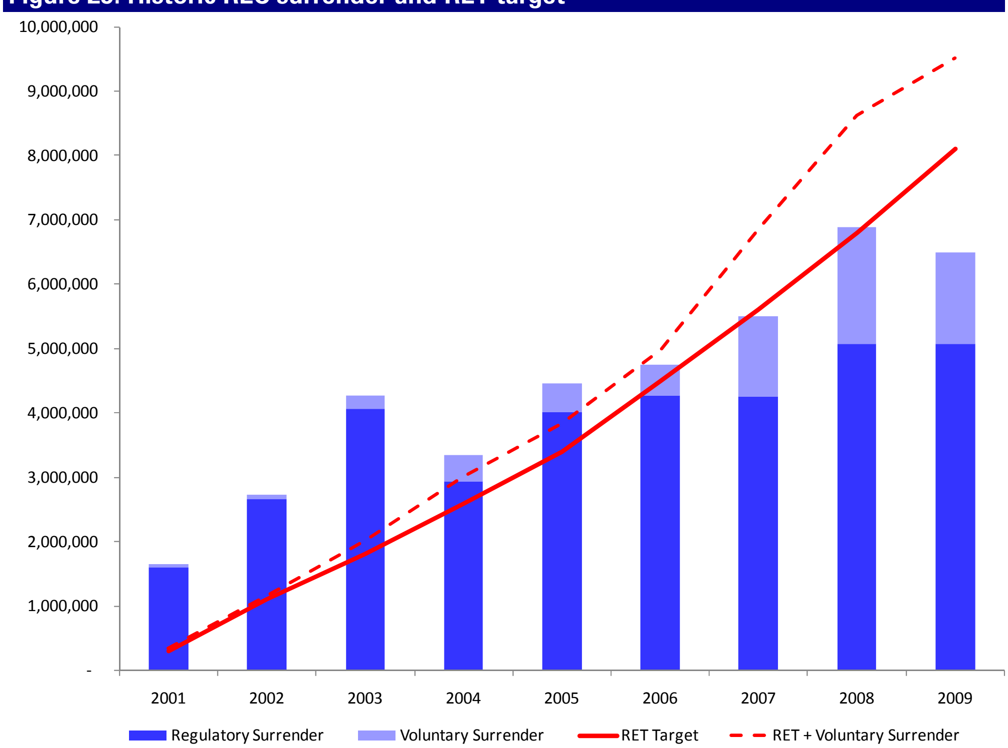
Source: Australian Government REC registry, Deutsche Bank

The role of voluntary surrender

Voluntary surrender should increase total REC demand

While the RET scheme requires 20% of Australia's electricity be generated from renewable sources by 2020, in reality if targets are met this number is likely to be higher than 20%. This is due to the voluntary surrender mechanism.

Figure 25: Historic REC surrender and RET target



Source: Australian Government REC registry, Deutsche Bank

Bars in the chart above plot the year in which RECs were generated, and not the year in which they were surrendered. Given the ability to bank RECs, a REC generated in 2001 can be banked and surrendered in a subsequent year. As a result, it is possible for the red lines to exceed the blue bars in a given year. However on a cumulative basis the sum of the blue bars must exceed the sum of the red line, any shortfall would result in the penalty rate being paid.

A number of state government sponsored projects have elected to contract directly with renewable generators to source 100% of their electricity needs from renewable sources and effectively voluntarily surrender RECs. We point to two recent announcements from desalination plants:

- The Sydney desalination plant will purchase all of its electricity, and associated RECs from Infigen Energy's currently operating Capital Wind Farm in NSW.
- The Melbourne desalination plant announced it would purchase electricity and RECs from AGL Energy's proposed 63MW Oaklands Hill wind farm in late July 2009.

As a result, these projects are purchasing a greater percentage of renewable electricity than the RET scheme requires, with the ultimate impact that total generation from renewable sources will likely exceed 20% by 2020.

Wind: The leading technology

Why wind?

We see three key reasons why wind is the leading renewable generation technology prospect to meet LRET targets. Wind is a proven technology, wind is economic under the current legislative regime, and there remains significant expansion capacity for incremental generation.

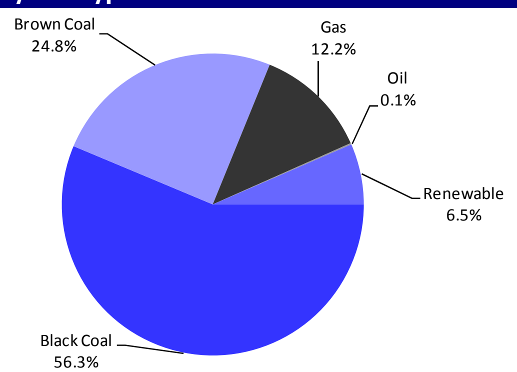
Wind is a proven technology

Wind and hydro are the two proven commercial scale renewable technologies

Only two renewable technologies are genuinely proven on a commercial scale in Australia – wind and hydroelectricity. The Energy Supply Association of Australia (ESAA) estimates renewables contributed 6.5% of total electricity generated in Australia during FY09. Coal continues to dominate the production mix, representing 186.5TWh, or 81% of all electricity generated and distributed into the National Electricity Market and the South West Interconnected System.

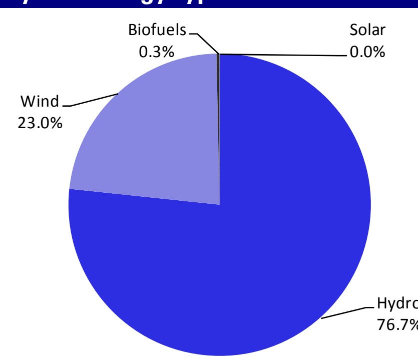
Of the 15.0TWh of renewable electricity generation in Australia in FY09, 99.7% was sourced from two technologies: wind, and hydroelectricity. While hydro represented over three quarters of this generation, the bulk of hydro generation in Australia is legacy, with little incremental growth over the last decade. As discussed later in this report, ABARE estimate hydroelectric generation in Australia by 2030 will be only 3.5% higher than 2008 levels, and lower than the current five year average.

Figure 26: Total electricity generation in FY09 in Australia by fuel type



Source: ESAA, Deutsche Bank

Figure 27: Renewable electricity generation in FY09 in Australia by technology type



Source: ESAA, Deutsche Bank

Unlike a number of proposed technologies, there are no technological barriers to overcome for wind generation. Commercial scale (>10MW) wind farms have been operating in Australia since the construction of the Windy Hill wind farm in Queensland in 2000. Globally, commercial scale wind farms have been operating since the early 1980s, with the 20 turbine, 600kW Crotched Mountain wind farm in the US generally regarded as the world's first wind farm commencing generation in 1980.

Wind is economic

Wind is the cheapest expandable renewable energy source

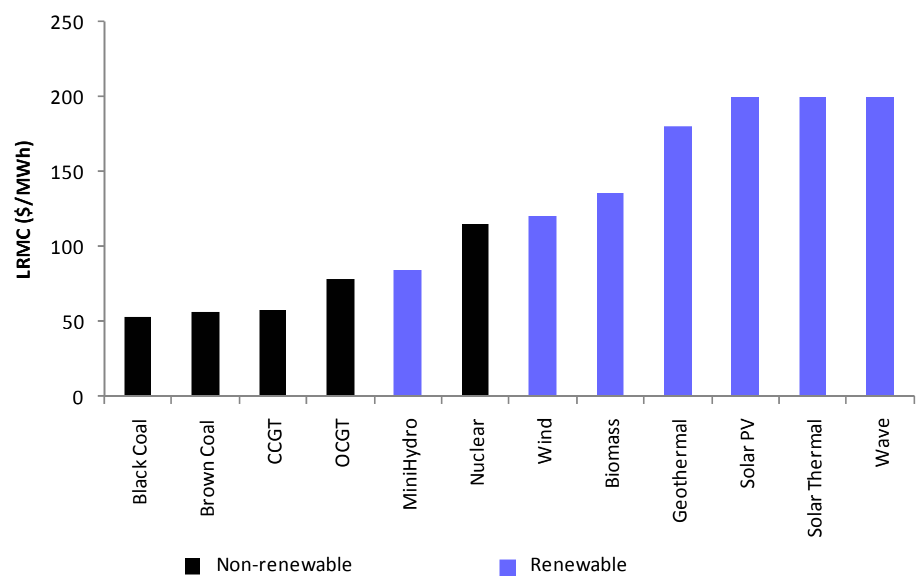
Aside from mini-hydro, we estimate wind is currently the cheapest renewable energy source that can be realistically employed in Australia. Technologies such as volcanic geothermal prevalent in New Zealand are cheaper than wind, but not realistic in Australia given a lack of appropriate volcanics. As we note later in this report, the scope of incremental hydro in

Australia is also limited, leaving wind as the clear economic leader in renewable generation in Australia in our view.

We also note that when revenue from RECs is included, wind is competitive with gas fired generation. Indeed in Western Australia, we believe wind is the cheapest marginal generation type given a lack of coal resources, and high natural gas prices.

Longer-term renewables such as solar PV, geothermal and wave remain substantially more expensive than wind at present.

Figure 28: Fuel source cost comparison



Source: AGL AEPR, Deutsche Bank

The capacity for incremental generation remains significant

At least 10,000MW of identified incremental wind capacity

As discussed later in this report, we have identified almost 10,000MW of incremental proposed wind projects in Australia, recognizing that a significant number of additional projects are likely to also exist. Assuming a 30% capacity factor, if all of these pipelines were to be built, the implied generation of c.26,000GWh pa represents 83% of the incremental LREAT target to 2020.

We note there is no other renewable technology with such growth pipelines. While geothermal may have long-term potential, amongst proven economic technologies wind is unique for its growth potential.

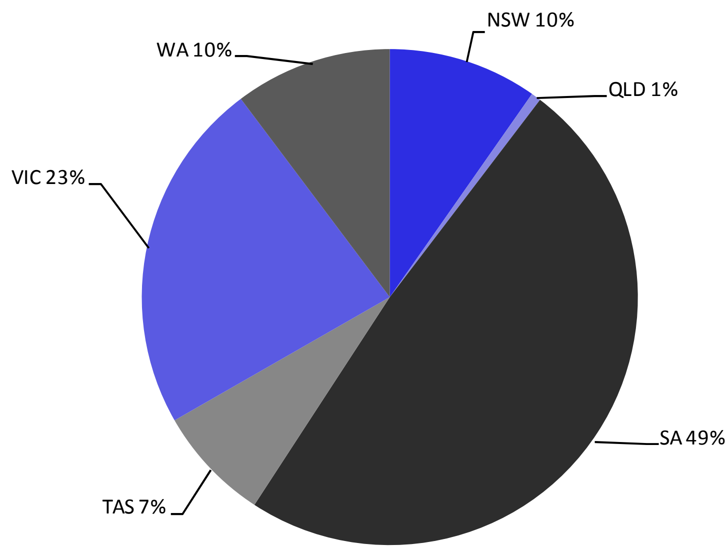
Hydro is the only other technology we regard as both technically proven and economic in Australia. As discussed later in this report, however, the scope for incremental hydroelectric generation within Australia is limited at best.

The current state of play in Australia

Almost 2,000MW of operating wind farm in Australia

Australia currently has slightly less than 2,000MW of installed wind capacity. There are twenty nine wind farms currently operating with capacity of greater than 10MW. When small scale (<10MW) and off-grid wind farms are excluded, we estimate Australia's installed and operating wind capacity at 1,858MW. Almost half of this installed capacity is located in South Australia, with Victoria representing nearly one quarter.

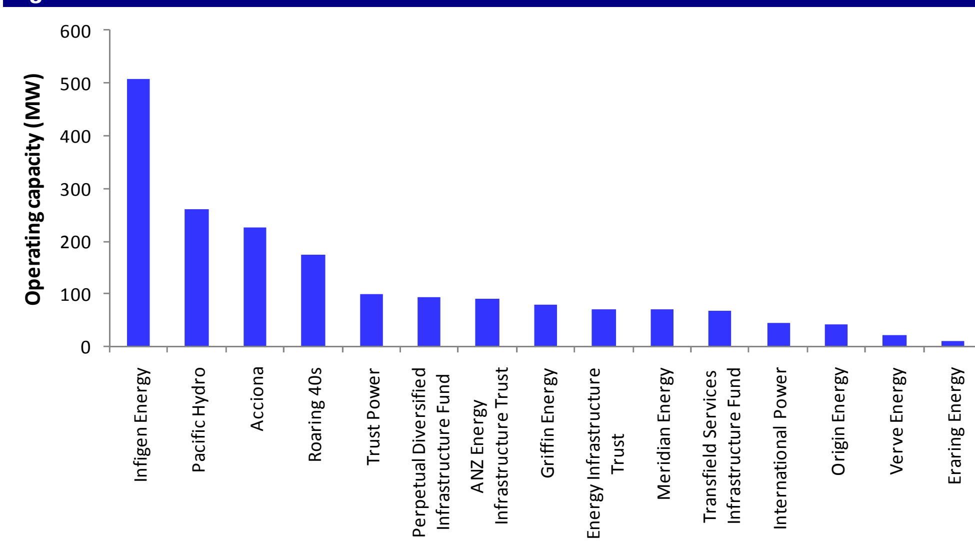
Figure 29: Installed wind farm capacity by state



Source: Company data, Deutsche Bank

The largest four wind farm owners in Australia (Infigen Energy, Pacific Hydro, Acciona and Roaring 40s) account for 63% of total large scale operations. We note AGL Energy's strategy of develop and divest results in the company not actually owning any operating wind farms at present, but with current developed capacity of 257MW AGL would be the third largest owner had it not elected to divest its assets.

Figure 30: Current wind farm owners in Australia



Source: Company data, Deutsche Bank

1,257MW of wind capacity currently under construction

At least a further eight projects have been sanctioned, or are under construction, representing an additional 1,257MW of capacity. We note this represents a 68% increase in installed capacity once these projects are sanctioned over the next 1-2 years, highlighting the strong growth rates in wind generation.

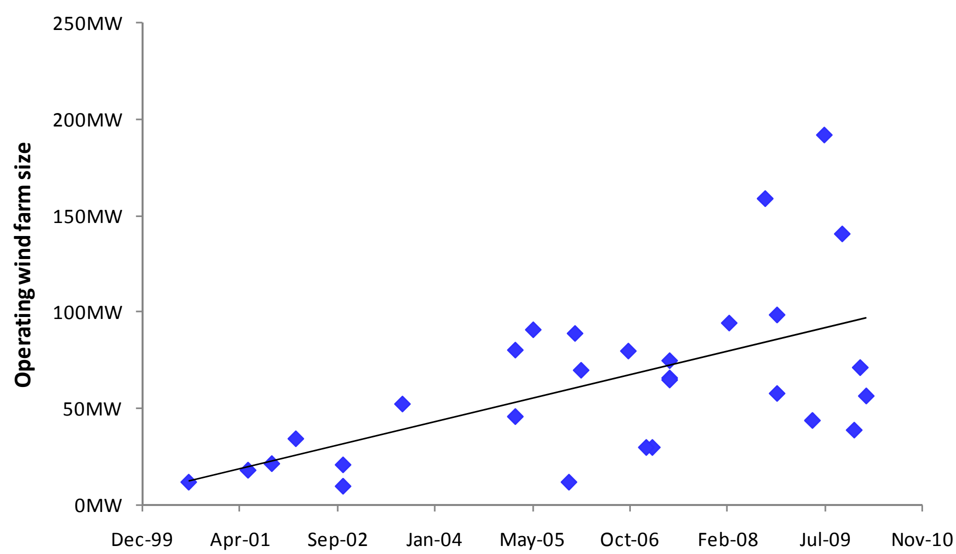
Figure 31: Wind farms under construction in Australia

Wind Farm	Capacity (MW)	State	Owner	First generation
Waterloo	111	SA	Roaring 40s	2010
Hallett 4	132	SA	Energy Infrastructure Investments	2011
Oaklands Hill	63	VIC	AGL Energy	2011
Woodlawn	42	NSW	Infigen Energy	2011
Hallett 5	71	SA	AGL Energy	2012
Berrybank	250	VIC	Gas Natural Fenosa	2012
Musselroe	168	TAS	Roaring 40s	2012
Macarthur	420	VIC	AGL Energy/Meridian Energy	2013
Total	**1,257**			

Source: Company data, Deutsche Bank

There has been a strong trend towards larger wind farms over time in Australia, reflecting a broader global trend. Improvements in turbine size, coupled with a recognition of the scale benefits associated with larger projects has driven this trend. Projects greater than 50MW were almost unheard of prior to 2005, but today represent the low end of proposed projects.

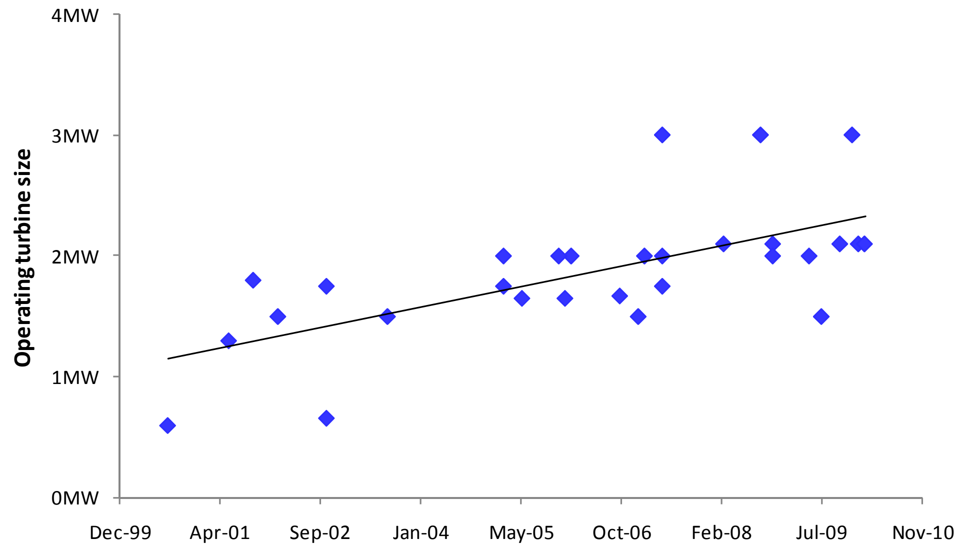
Figure 32: Evolution of wind farm size by installed capacity in Australia



Source: Company data, Deutsche Bank

Turbine sizes have also increased with time, with the majority of recent projects using turbines in the 2MW to 3MW range. We note the rate of size increase in turbines has slowed in recent years, and we expect technical improvements will be more focused on efficiency over size of turbines in the future given the maturing levels of the industry.

Figure 33: Evolution of turbine size in Australia

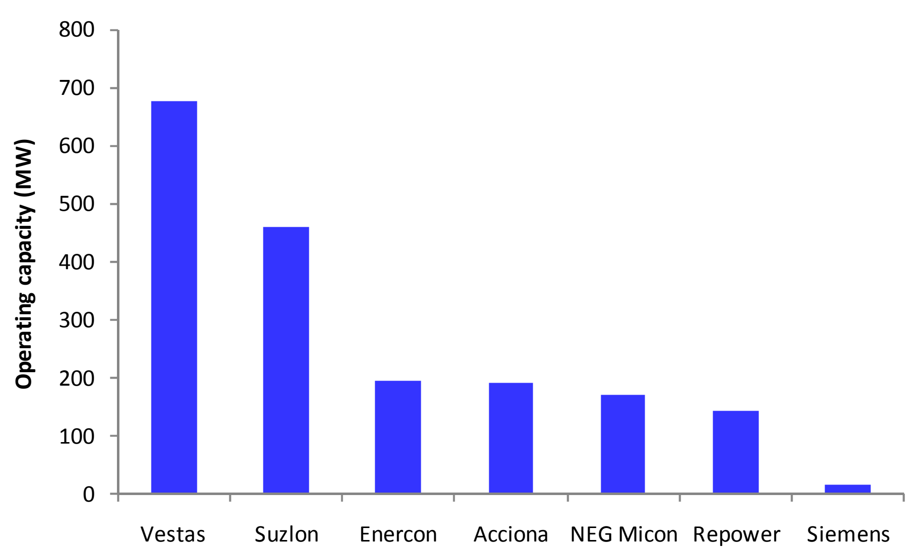


Source: Company data, Deutsche Bank

The Australian wind turbine market is dominated by makers Vestas and Suzlon, which, combined, represent c.61% of industrial scale installed capacity. Indeed we believe 12 of the last 15 wind farms to be commissioned in Australia have used Vestas or Suzlon turbines. Furthermore, two of the remaining three wind farm at the Portland Wind Energy Project, used Repower turbines, now owned by Suzlon.

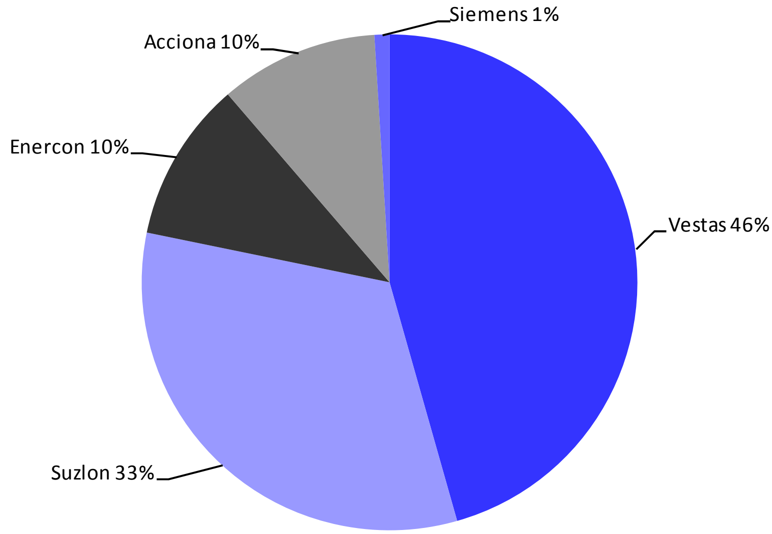
While a lack of competition amongst turbine providers may be seen as a negative for wind farm developers, we note a number of Chinese manufacturers have recently entered the market, and the price of turbines is estimated to have fallen by 10-15% over the last three years.

Figure 34: Installed capacity by turbine type



Source: Company data, Deutsche Bank

Figure 35: Installed capacity by turbine manufacturer



Source: Company data, Deutsche Bank

Development pipelines

Over 10,000MW of proposed projects are publically indentified

We have reviewed public information released by all major wind farm participants in Australia in order to determine the size, status and composition of development pipeline opportunities. We note our data set is likely to be incomplete, as there is no obligation for companies to report their development pipelines. We would expect a number of small unlisted wind site developers would possess additional opportunities not in the public domain.

We have identified wind farm opportunities at various levels of development of almost 10,000MW. The largest pipelines are owned by Origin Energy, AGL Energy and Infigen Energy. We split identified opportunities into three categories:

Under Construction projects have been sanctioned

- **Under Construction** wind farms have been sanctioned, but are yet to commence operations and thus REC generation. We regard under construction wind farms as at a very high probability of achieving operations. We estimate 1,257MW is currently Under Construction.

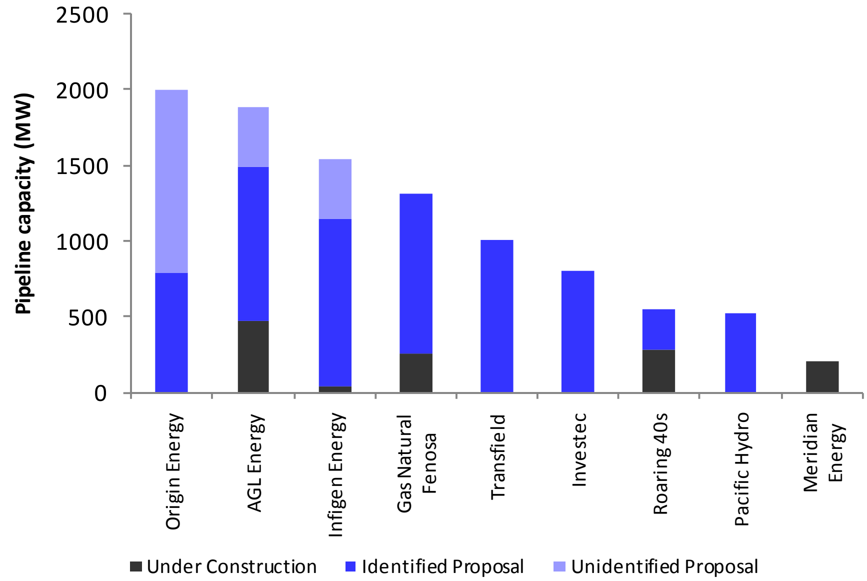
Identified Projects have a name, location and proposed capacity

- **Identified Proposals** are projects that have been explicitly identified by proponents, including project name, location, and proposed capacity. In our view once a project has been identified, it has a reasonable probability of being progressed towards sanction. We estimate 6,565MW of Indentified Proposals have been publically disclosed.

Unidentified Proposals are not separately detailed

- **Unidentified Proposals** are projects that proponents have not separately identified. We regard these proposals as the lowest probability of sanction at this stage, given an unwillingness for owners to explicitly indentify the projects. We estimate 2,012MW of Unidentified Proposals have been publically disclosed.

Figure 36: Development pipeline by company

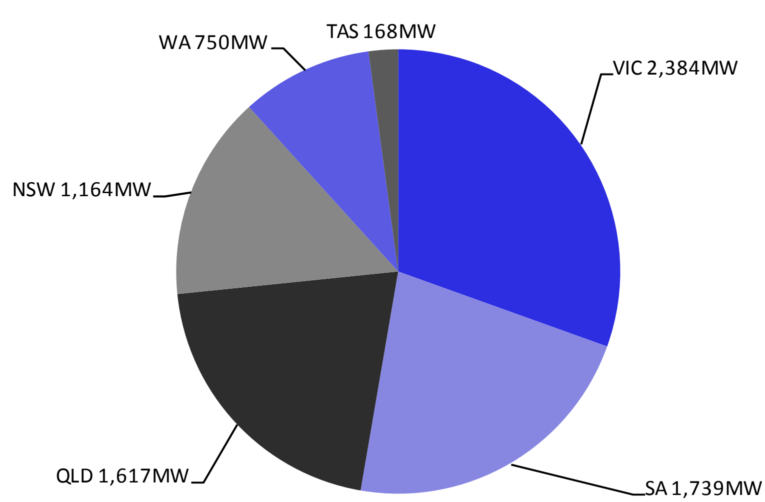


Source: Company data, Deutsche Bank

Identified development opportunities are well spread throughout Australia. Approximately one third of developments are located in Victoria, while South Australia, Queensland and New South Wales have similar size opportunities.

In our view the relatively large contribution from Victoria in comparison to its current share of existing capacity discussed earlier in this section highlights a more demanding regulatory and approvals process. By contrast, South Australia currently has half the installed capacity, but only 20% of development opportunities. In our view this suggests South Australia is the closest state to reaching wind farm saturation, but note the 1,739MW of development opportunities represent 1.9x current installed capacity. As a result, we see saturation as some way off.

Figure 37: Development pipeline by state (excluding Unidentified Proposals)



Source: Company data, Deutsche Bank

Reviewing the wind pipelines

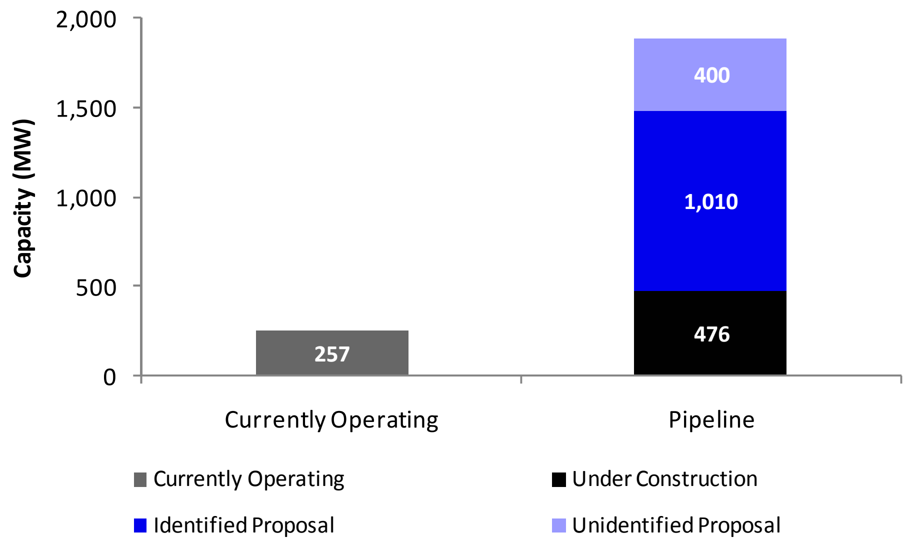
AGL Energy

We believe AGL has the best development pipeline

In our view AGL Energy (AGK.AX) holds the strongest development pipeline in Australia. The company's development opportunities are geographically diverse, with incremental opportunities at the Hallett complex in South Australia. We also note AGL has two wind farms under construction, the 420MW 50/50JV at Macarthur, and the 63MW Oaklands Hill wind farm in Victoria.

Furthermore a recent favourable decision by ratings agency Standard & Poors enables AGL to recognize only half of the debt associated with divested wind farms for credit rating purposes. As a result, we believe the company is positioned to fund an additional $800m via debt without placing current ratings at risk.

Figure 38: AGL wind farm status



Note: Currently Operating refers to wind farms developed and subsequently sold by AGL Energy
Source: Company data, Deutsche Bank

Figure 39: AGL Energy wind farm development pipeline

Project	Capacity (MW)	State
Oaklands Hill (Under Construction)	63	VIC
Macarthur (Under Construction)	420	VIC
Hallett 4 (Now owned by EII)	132	SA
Hallett 5	71	SA
Barn Hill	130	SA
Hallett 3	80	SA
Crows Nest	150	QLD
Ben Lomond	150	NSW
Coopers Gap	300	QLD
Coopers Gap Stage 2	200	QLD
Unidentified Proposals	400	Various
Total	**2,096**	

Source: Company data, Deutsche Bank

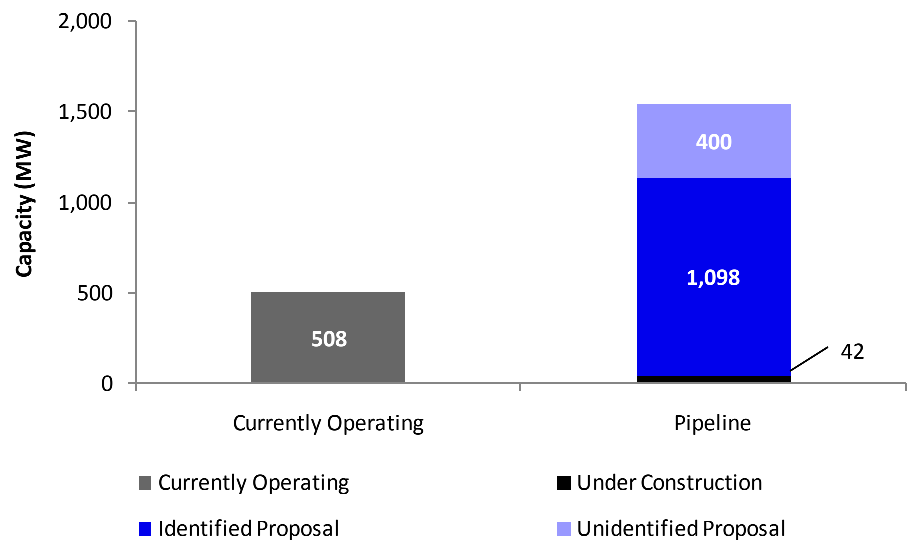
Infigen is the largest operator of wind farms in Australia and has a strong pipeline

Infigen Energy

Infigen Energy (IFN.AX) is Australia's largest wind farm operator with 508MW currently operating, and a further 42MW at the Woodlawn project under development. The company has a strong development pipeline, including brownfield expansion opportunities at the company's high capacity factor Alinta wind farm in WA (Walkaway 2 and Walkaway 3).

The key challenge for Infigen remains funding. The company's failed divestment of its US wind assets limits growth beyond 160MW earmarked for development in FY11. We understand Infigen is considering taking a JV approach to future developments, an approach we support given it enables the company to leverage its strengths of a sound pipeline and development credentials, whilst addressing funding issues.

Figure 40: Infigen Energy wind farm status



Source: Company data, Deutsche Bank

Figure 41: Infigen Energy wind farm development pipeline

Project	Capacity (MW)	State
Woodlawn	42	NSW
Flyers Creek	120	NSW
Glen Innes	54	NSW
Bodangora	45	NSW
Walkaway 2	94	WA
Walkaway 3	300	WA
Woakwine	450	SA
Cherry Tree	35	VIC
Unidentified Proposals	400	Various
Total	**1,540**	

Source: Company data, Deutsche Bank

Origin Energy

Origin has the largest wind pipeline, but it is less developed in our view

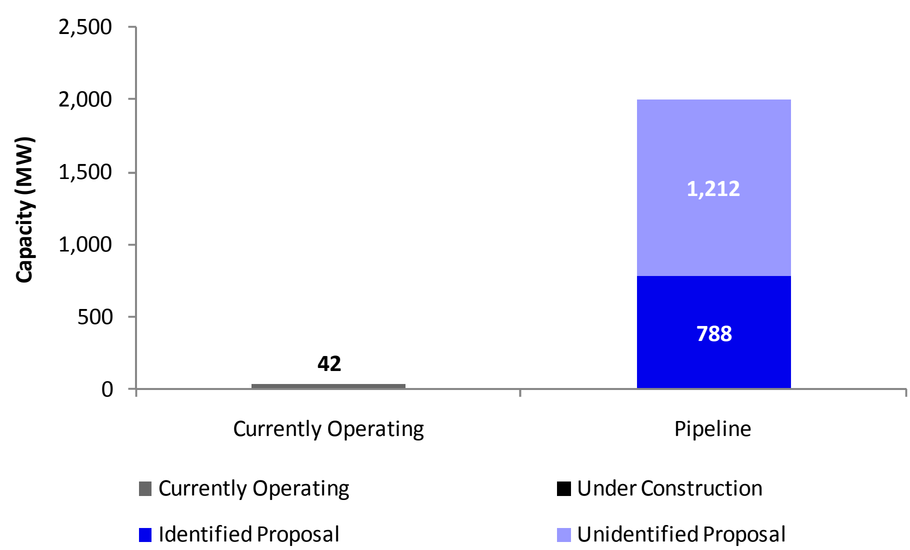
Origin Energy (ORG.AX) has been a relatively late adopter of wind as a renewable energy technology, despite its significant REC liability as one of Australia's largest electricity retailers. Origin has favoured a PPA and spot market strategy to date.

The company developed the 30MW Cullerin Range wind farm in 2007, and acquired a development pipeline (including the operational 12MW Wonthaggi Wind Farm) as part of its acquisition of Wind Power Pty Ltd in mid-2009. The company also acquired the Yass Valley Wind Farm sites from Epuron in late 2009.

While the company has the largest disclosed development pipeline in Australia, we note that over 60% of the development opportunities are not specifically identified by Origin, leading us to conclude that the bulk of the company's projects are at a relatively early stage of development.

We also note Origin has made investments in geothermal, solar and a proposal for hydro generation in PNG (these proposals are discussed later in this report). The company has previously indicated its approach to the LRET scheme is to retain optionality over its sourcing of RECs.

Figure 42: Origin Energy wind farm status



Source: Company data, Deutsche Bank

Figure 43: Origin Energy wind farm development pipeline

Project	Capacity (MW)	State
Yass Valley (Coppabella Hills)	164	NSW
Yass Valley (Mailba Hills)	140	NSW
Stockyard Hill	484	VIC
Unidentified Proposals	1212	Various
Total	**2,000**	

Source: Company data, Deutsche Bank

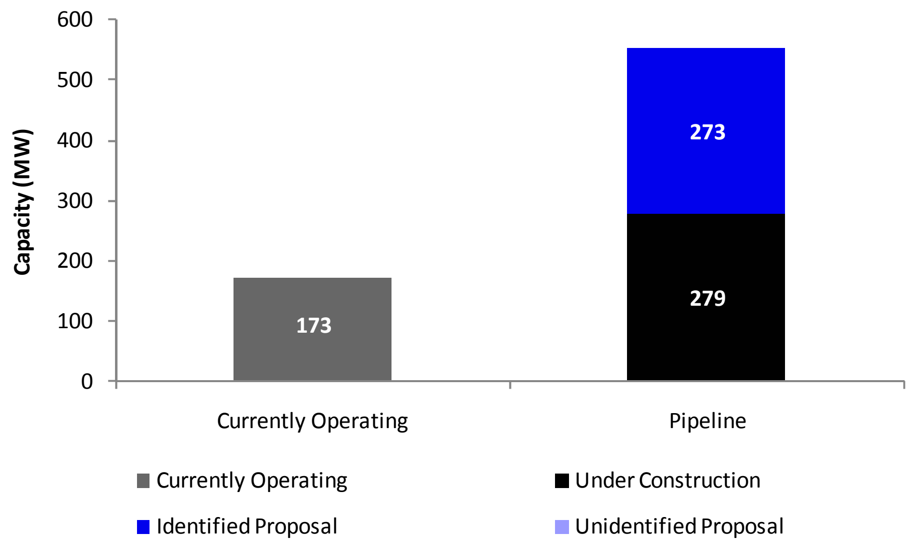
Roaring 40s has 273MW of additional options beyond those operating and under construction

Roaring 40s

Roaring 40s is a 50/50 JV between Hydro Tasmania and China Light & Power. In addition to 173MW currently operating, the company has two wind farms currently under development – the 168MW Musselroe project in Tasmania, and the 111MW Waterloo wind farm in South Australia. Once these projects are complete, the company has three additional identified projects in Victoria and South Australia totaling a further 273MW.

We see Roaring 40s as a well established player in the Australian wind energy sector. However, with limited additional identified development opportunities, Roaring 40s' expansion options do appear limited at this point.

Figure 44: Roaring 40s wind farm status



Source: Company data, Deutsche Bank

Figure 45: Roaring 40s wind farm development pipeline

Project	Capacity (MW)	State
Musselroe (Under Construction)	168	TAS
Waterloo (Under Construction)	111	SA
Sidonia Hills	68	VIC
Stony Gap	109	SA
Robertstown	96	SA
Total	**552**	

Source: Company data, Deutsche Bank

Pacific Hydro is Australia's second largest wind farm operator

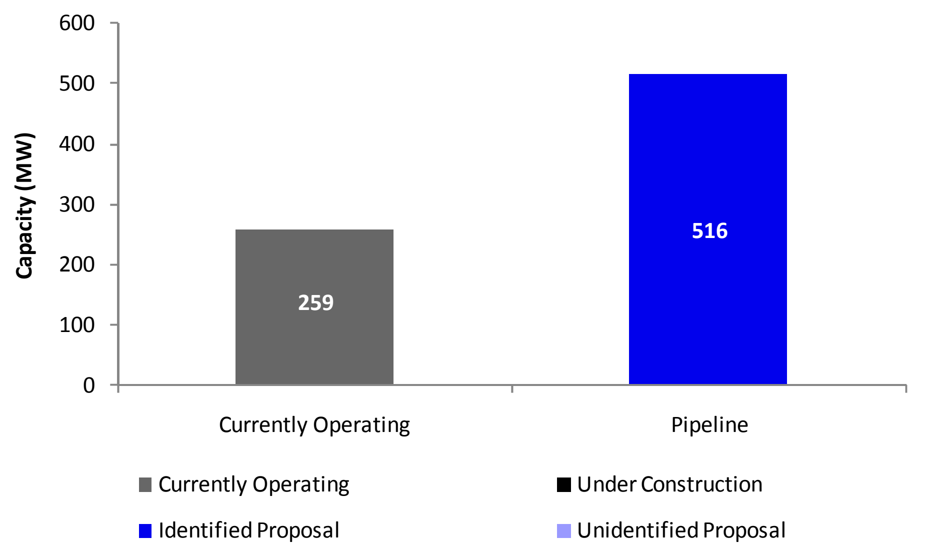
Pacific Hydro

Pacific Hydro is Australia's second largest wind farm operator behind Infigen Energy, with 259MW currently under operation, led by the 150MW multi-stage Portland Wind Energy Project. The company has a 516MW disclosed development pipeline, with five sites identified across WA, SA and Victoria.

In our view Pacific Hydro has a demonstrated track record of wind farm deliverability in Australia, with a sound portfolio of development projects, albeit smaller than some of its peers. We see funding as the main challenge faced by Pacific Hydro, noting the company is owned by Industry Funds Management, who has been seeking a co-investor for some time.

We also note Pacific Hydro has a number of offshore development opportunities in South America in both wind and hydro. As a result any wind farm development in Australia would likely need to meet investment criteria relevant to these alternative applications of capital.

Figure 46: Pacific Hydro wind farm status



Source: Company data, Deutsche Bank

Figure 47: Pacific Hydro wind farm development pipeline

Project	Capacity (MW)	State
Carmody's Hill	140	SA
Crowlands	126	VIC
Keyneton	120	SA
Nilgen	100	WA
Yaloak North	30	VIC
Total	**516**	

Source: Company data, Deutsche Bank

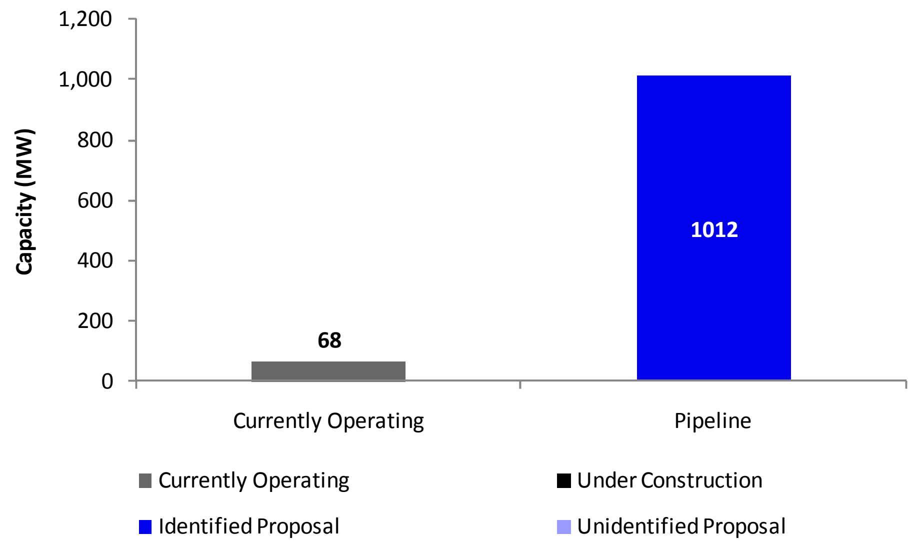
TSI's balance sheet is likely to constrain developments

Transfield Services Infrastructure Fund

Transfield Services Infrastructure Fund (TSI.AX) acquired operating wind farms and a development pipeline from the QLD State Government entities Tarong Energy and Stanwell Corporation in 2007.

TSI currently identifies 1,102MW of development opportunities spread across five states. However, given balance sheet constraints, the fund recently sold the Mt Millar wind farm to Meridian Energy. As a result, we do not see significant development of TSI's pipeline in the near-term, unless the fund divests opportunities to better funded developers.

Figure 48: Transfield Services Infrastructure Fund wind farm status



Source: Company data, Deutsche Bank

Figure 49: Transfield Services Infrastructure Fund wind farm development pipeline

Project	Capacity (MW)	State
High Road	85	QLD
Arriga	130	QLD
Baynton	130	VIC
Kulparra	100	SA
Collector	75	NSW
Kongorong	120	SA
Ben More	90	VIC
Mount Hill	80	SA
Windy Hill 2	12	QLD
Augusta	50	WA
Crediton	40	QLD
Bowen	100	QLD
Total	**1,012**	

Source: Company data, Deutsche Bank

Gas Natural Fenosa is a major global player in the wind industry

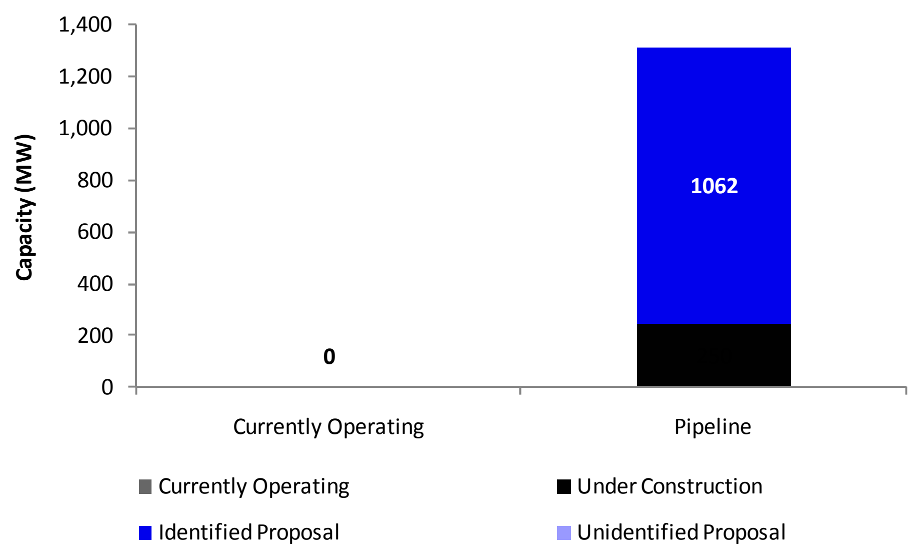
Gas Natural Fenosa

Gas Natural Fenosa is a Spanish listed utility formed by the takeover of Union Fenosa by Gas Natural with a market capitalization of c.EUR10bn. Union Fenosa has developed over 2,000MW of wind capacity globally. However, following the acquisition of Union Fenosa the company divested a number of electricity assets. The company's Australian subsidiary Union Fenosa Wind Australia owns a 1,330MW development pipeline, including the recently sanctioned 250MW Berrybank wind farm in Victoria. Berrybank will represent Gas Natural Fenosa's first operating wind farm in Australia once complete.

The company's development pipeline is focused on Victoria and NSW. We note the pipeline includes two expansion opportunities of the currently operating but sub-commercial scale 4.8MW Crookwell wind farm in NSW.

In our view, the Gas Natural Fenosa pipeline will likely result in further new sanctions given we would expect a company of Gas Natural's size would seek a more material footprint in Australia than just the Berrybank wind farm. Brownfield expansion projects such as Crookwell can often be more readily sanctioned given existing landholder acceptance of wind turbines.

Figure 50: Gas Natural Fenosa wind farm status



Source: Company data, Deutsche Bank

Figure 51: Gas Natural Fenosa wind farm development pipeline

Project	Capacity (MW)	State
Berrybank (Under Construction)	250	VIC
Crookwell 2	92	NSW
Crookwell 3	120	NSW
Paling Yards	180	NSW
Hawkesdale	62	VIC
Ryan Corner	136	VIC
Darlington	450	VIC
Tarrone	40	VIC
Total	**1,330**	

Source: Company data, Deutsche Bank

We see Investec as an opportunity developer, not a wind farm constructor

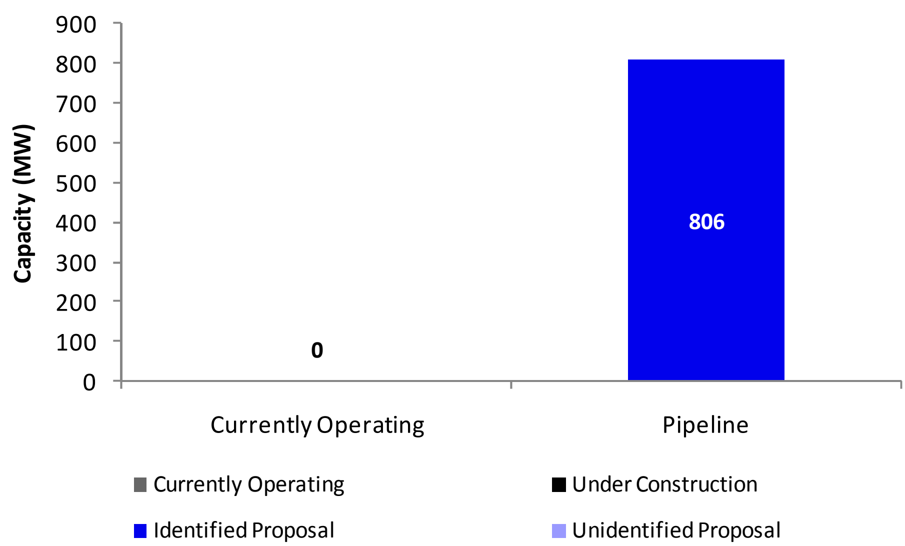
Investec

We view Investec as a wind site opportunity developer, rather than a constructor of wind farms. We note the South African-based financial institution has no history of wind farm construction or ownership in Australia. Furthermore, the company has previously sold development opportunities such as the Oaklands Hill and Coopers Gap sites to AGL Energy in late 2008.

Investec's currently publically disclosed pipeline contains two projects totaling 806MW. While the total capacity is significant we note that nearly 75% of the pipeline is dedicated to the 600MW Kennedy project in Queensland.

In our view development of Investec's pipeline is likely contingent on the sale of the prospects to a wind farm developer, and as such we do not see the pipeline as a leading near-term prospect.

Figure 52: Investec wind farm status



Source: Company data, Deutsche Bank

Figure 53: Investec wind farm development pipeline

Project	Capacity (MW)	State
Collgar	206	WA
Kennedy	600	QLD
Total	**806**	

Source: Company data, Deutsche Bank

Are all the good sites taken?

Current pipelines are probably sufficient to meet wind's share of the LRET if all are developed

We are often asked whether all the good wind sites in Australia are now taken. This is a difficult question to answer given, as discussed in the previous section, we suspect a number of wind farm development pipelines are not publically available.

However we note the following:

- The total development pipeline capacity identified in the previous section is 9,834MW
- Assuming a 30% capacity factor, if all of this capacity were to be developed, electricity of c.26,000GWh pa could be generated
- The increase in the LRET from 2010 to 2020 is 31,500GWh, not all of which will come from wind generation in our view

As a result, even before accounting for undisclosed development pipelines, we believe there is approaching sufficient capacity in current pipelines to meet demand under the LRET scheme.

Furthermore, in our view it seems logical that the best sites are developed first, and the worst sites last. Consequentially, we would argue that any company seeking to develop wind in Australia that currently lacks a development pipeline would be best served by acquiring a pipeline from a third party, rather than attempting to develop their own pipeline.

The industry has moved from site identification to site development

So we would conclude that yes, all the good sites are probably taken, but all the sites necessary to ultimately meet wind's share of the LRET scheme are probably taken too. As a result, the industry has moved from a phase of site identification to site development.

Geothermal – high potential, but long dated

Geothermal could provide baseload renewable electricity

Geothermal energy is a unique opportunity for Australia. Amongst proposed renewable energy technologies, only geothermal energy appears to have the potential to provide incremental cost effective baseload electricity. Australia has considerable geothermal energy resources, from both hot rock and hot sedimentary aquifers. However these potential resources are generally far from existing transmission infrastructure, and currently at very early stages of commercial development.

Geothermal energy is a well known source of renewable energy, and has been exploited for over 100 years. The earth's inner core is above 5,000°C, driven by radioactive decay and this heat radiates away from the core, through the mantle and ultimate towards the earth's surface. Approximately one third of this heat radiates from the earth's surface and into to the atmosphere, with the remainder trapped in geothermal reservoirs. Geothermal energy is also extracted from hydrothermal systems associated with volcanism.

The EIA estimates 0.4% of total primary energy consumption in 2007 came from geothermal sources. The agency forecasts a 4.6% annual growth rate globally to 2030, implying 0.5% of total electricity generation will be from geothermal sources by 2030.

We have run a scenario where all proposed company timelines are achieved for the five major geothermal proposals. Under this scenario, discussed later in this section, we estimate geothermal energy could represent up to 9% of the MRET target by 2020, or 1.8% of total electricity generation. However we note that company timelines to date have so far proven hard to meet, and the involvement of new technology places company timelines at risk of delay in our view.

While we recognize modeling work undertaken by MMA suggested earlier timelines, recent developments including the Habanero 3 issue at the Cooper Basin Project (discussed later in this section) and continued delayed company timelines point to the challenges of developing meaningful geothermal production prior to 2020. In our view the relatively small size of key proponents (recognizing Origin's relationship with Geodynamics and AGL's with Torrens Energy) potentially constrains investment capacity.

Two challenges for geothermal in Australia

1. Unproven technology

Proposed geothermal projects in Australia use unproven technology

While electricity has been generated from geothermal power stations exploiting volcanic heat for over 100 years, Australia lacks the necessary volcanics that are exploited in neighbouring New Zealand. Australian projects are targeting Hot Fractured Rock (HFR) technology, as yet unproven globally, and Hot Sedimentary Aquifers (HSA) which are essentially unproven in Australia. We discuss these technologies in greater detail later in this section.

As a result, we see significant technological challenges for geothermal electricity generation in Australia. While we recognize HSA projects face fewer technology issues given their operation elsewhere globally, we note proposed HSA projects in Australia are also significantly smaller than HFR projects, and therefore likely to contribute fewer RECs.

In our view it is likely that these technological challenges will be resolved over time, however from an equity investment perspective, the timelines are prohibitively long at present.

Geographic remoteness increases capital costs

2. Remote from transmission networks and demand centers

The largest proposed HSA projects in Australia are geographically remote. Geodynamic's Cooper Basin Project, Petratherm's Paralana project, and Torren Energy's Paranchilla project are all hundreds of kilometers from demand centres.

Geographic remoteness presents two significant challenges. Firstly, the cost of infrastructure to connect into the grid can be onerous, Geodynamics has indicated a proposed 400km transmission line to the Olympic Dam site could cost $400m. Furthermore, transmission assets are generally owned and operated by third parties, potentially making new geothermal projects subject to the outcomes of third party activities. Secondly, electricity transmission is not perfectly efficient, and losses from long transmission lines can be significant. Geodynamics estimate 10% of the power generated at the proposed Cooper Basin Project could be lost during transmission.

Types of geothermal generators

Geothermal generation using volcanic heat has operated for over 100 years

Conventional Volcanic Geothermal

Conventional Geothermal power stations utilize naturally occurring hot water and steam associated with volcanic activity close to the surface. Conventional geothermal is a well established technology with nearly 10,000MW of capacity across the world. Iceland and New Zealand generate a meaningful proportion of their electricity needs from conventional geothermal, while Italy, Japan, the Philippines and the US all have significant geothermal generation.

Figure 54: Conventional geothermal technology pros and cons

Pros	Cons
Heat source is very close to the surface	Can only be developed in regions of volcanic activity
Proven and relatively cheap technology	Water/steam source can contain corrosive impurities such as sulphur, and potentially significant amounts of CO_2
	Heat source can be over-exploited and diminish with time

Source: Deutsche Bank

A lack of volcanic activity in Australia effectively precludes Conventional Geothermal power generation in Australia.

HSA technology is applicable to Australia, but generally on a smaller scale

Hot Sedimentary Aquifers

Hot Sedimentary Aquifer (HSA) geothermal techniques exploit natural water reservoirs with moderate to high temperatures (150-200ºC) and high permeability. These Aquifers tend to be at depths of 2.5km to 3.5km, and are often heated by deeper hot granite layers. HSA power plants are in operation globally, including the 92MW Heber field in California.

Three of the five leading geothermal proposals in Australia incorporate HSA technology. Panax's Penola project in southern South Australia, and Hot Rock Ltd's Koroit project in Victoria are both pure HSA projects, while Geodynamic's Cooper Basin Project has an HSA component. However, we note proposed HSA projects in Australia are smaller scale relative to HFR projects.

HFR offers the largest potential in Australia, but is technologically unproven

Hot Fractured Rock

Hot Fractured Rock (HFR, or Hot Dry Rocks (HDR)) geothermal techniques utilize heat from high temperature granites located more than 3km below the earth's surface. The granite is heated through radioactive decay processes both within the granite itself, and heat transferred from deeper within the earth's core where temperatures can exceed 5,000ºC. Overlaying sedimentary rock layers effectively act as an insulator, preventing significant heat loss into shallower layers of the subsurface.

The granite layer is not waterlogged, given a lack of nature fissures. As a result, surface water is pumped down to the granite layer via an injection well in order to create steam. However, given the lack of natural fissures in the rock, artificial fracturing is required in order to create a path for cold injected water to interact with the hot rock and return to the surface as steam via a proximate extraction well.

At present there are no commercial Hot Fractured Rock power stations in operation globally, however a small 1.5MW pilot plant in north-eastern France was recently connected to the grid, with further pilot and demonstration plants at various stages of development in Europe, Australia, the US and Japan.

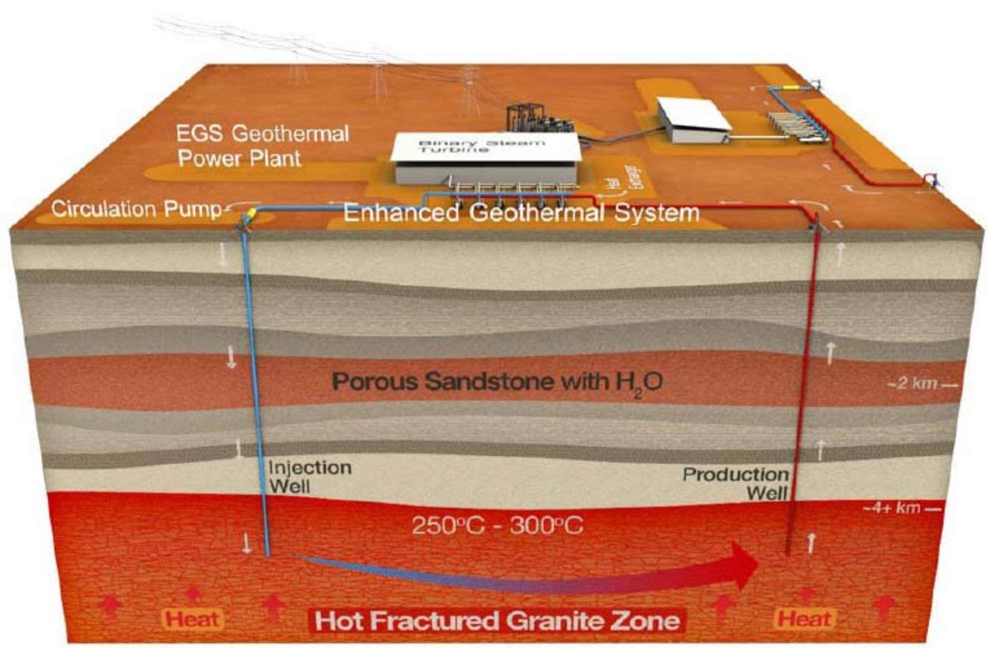
Major proposed Australian projects

Cooper Basin Project (Geodynamics, Origin Energy)

The Cooper Basin Project is one of the most advanced in Australia targeting both HFR and HSA

The Cooper Basin Project is a joint venture between Geodynamics (GDY.AX) and Origin Energy (ORG.AX). The project is targeting both HFR and HSA developments. The Cooper Basin HFR Project (70% GDY, 30% ORG) is the most advanced of proposed Australian projects, and located in central Australia near the town of Innamincka.

Figure 55: Cooper Basin Project schematic



Source: Geodynamics

The Cooper Basin Project has drilled five wells to date to depths of c.5,000m, and intersected temperatures of up to 280°C at 5,000m (HDR) and 130°C at 2,000m (HSA). Target granite layers have been found to be waterlogged.

The HFR Project achieved Proof of Concept on 31 Mar 2009 with reservoir fluid flowing between the Habanero 1 and 3 wells with steady-state flow rates of c.20kg/s achieved. We note the aim of the Proof of Concept was to prove heat could be extracted from an HFR reservoir, and did not involve any electricity generation.

However, on 27 Apr 2010, steel casing in the Habanero 3 well failed as a result of hydrogen embrittlement caused by CO_2 and H_2S dissolved in the reservoir fluid. While higher grade steel should resolve the issue, we point to this incident as reflecting the early technical development nature of HFR at this stage in Australia.

Prior to the Habanero 3 issue, Geodynamics had been targeting the commissioning of a 1MW demonstration plant by Apr 2009. The company's development timeline is now:

- 1MW demonstration plant by 2012
- 25MW Commercial Demonstration Plant (CDP) by 2015
- 500MW power station by 2020, likely providing power to the Olympic Dam project c.500km away. We note if this timeline can be met the power station would commence in the final year of increase to the LRET target.

Geodynamics has provided little detail publically on the potential for the development of an HSA project in the Cooper Basin. As a result, we presume the development timeline of an HSA project would be later than HFR.

Paralana Project (Petratherm, Beach Energy, TRUenergy)

The Paralana Project is targeting an HFR development in the Flinders Ranges in SA

The Paralana HFR Project is located in the Flinders Ranges in South Australia, a joint venture between Petratherm (PTR.AX), Beach Energy (BPT.AX) and TRUenergy. The Project drilled an initial injection well to a depth of 3,725m, with temperatures of up to 200°C recorded. A second well is planned to be drilled in late 2010 to allow proof of concept, with a 7.5MW pilot plant targeted for 2011. The project's larger near-term goal is a 30MW power plant to supply electricity to the proximate Beverley Uranium Mine, while the long-term production target from the project is 520MW. Petratherm has not made public planned timelines for the 30MW or 520MW expansions.

Penola Project (Panax Geothermal)

The Penola Project is targeting an HSA development, 5.9MW in 2011

Panax Geothermal's (PAX.AX) Penola HSA project is located in the Limestone Coast region of South Australia, proximate to Mount Gambier and electricity transmission networks including the Victoria interconnect. Temperatures of 150-200°C are estimated at depths of 3,500-4,000m in the region. The region is home to a number of petroleum wells, providing greater heat gradient data than many other proposed geothermal regions in Australia. The Project's Geothermal Resources were assets in early 2009, with a Measured Resource of 11,000PJ, theoretically sufficient heat to power 1,100MW for 30 years.

The company drilled the Salamander-1 well to a depth of 4,025m in early 2010 where a temperature of 171°C was recorded. Steam was subsequently released to the surface during testing in Mar 2010, a first for Australian HSA projects.

Panax is targeting a second well, Salamander-2 by 2011, enabling the construction of a 5.9MW demonstration plant by the end of 2011. The company has a longer-term goal of up to 60MW from the project.

Parachilna Project (Torrens Energy)

The Parachilna Project is targeting an HFR development near Lake Torrens in SA

The Parachilna Project proposed by Torrens Energy (TEY.AX) is located near Lake Torrens in central South Australia. The Project has drilled a number of shallow wells with promising temperatures recorded, however as yet no well has reached target depth of c.4,500m for the proposed HFR project. AGL Energy (AGK.AX) recently elected not to exercise an option to farm-in to the JV.

Torrens Energy has provided an aspirational goal of 300MW across three locations via 7MW demonstration plants followed by 35MW pilot plants and finally 100MW commercial plants, however timelines for development remain unclear. Given the target reservoir has not yet been drilled, nor proof of concept achieved, we see the Parachilna Project as long dated, and note the project's remote location add challenges to commercial scale development.

The Koroit Project proposes to use HSA technology, but is yet to commence drilling

Koroit Project (Hot Rock Ltd)

Hot Rock Ltd (HRL.AX) is proposing an HSA development in the Otway Basin in south western Victoria. While the project is yet to drill, the presence of approximately 180 petroleum wells in the region provides temperature and permeability data. Hot Rock Ltd estimate temperatures of 126°C to 158°C between 2,400m and 3,700m.

The project was initially targeting drilling in early 2010, however rig availability pushed this timeline out to 2011. A 1MW pilot plant is targeting commencement in 2011, with a 10MW demonstration plant in 2012 and 40MW plant by 2014.

We note the Koroit project benefits from its proximity to high voltage power lines, and population demand centres relative to more remote geothermal proposals in Australia. Furthermore, HSA is a proven technology for the geothermal generation of electricity.

Potential impact of Geothermal on the MRET scheme

The first large-scale geothermal project is due to commence in the final year of increasing LRET targets

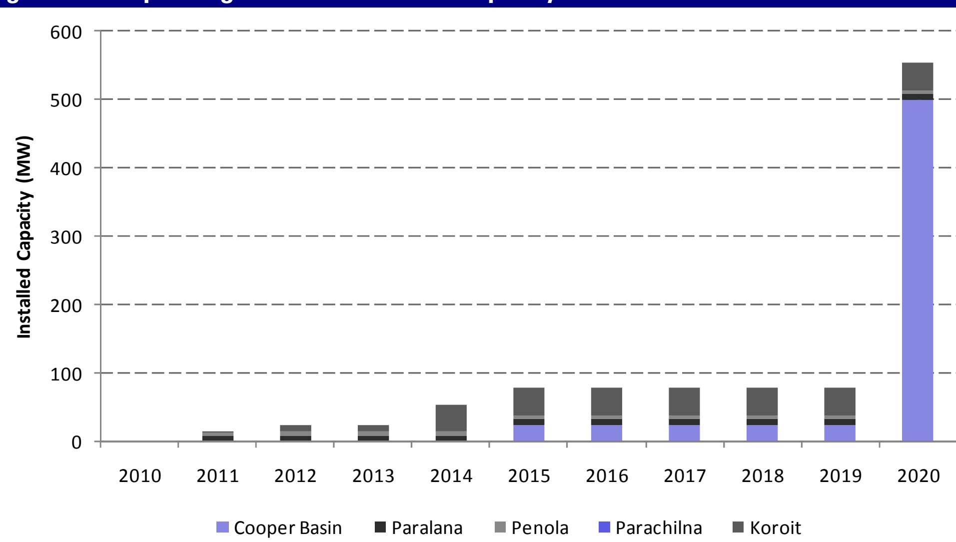
We have analysed proposed construction timelines for the five leading geothermal projects discussed in the previous section. Using company stated timelines, we estimate by 2020 Australia would have approximately 550MW of installed geothermal capacity.

In this analysis we do note:

- The Paralana Project is yet to provide a timeline for the possible expansion to 520MW
- The Penola project has no timeline in place for its 60MW expansion
- The Parachilna Project has not provided any timeline for its aspirational 300MW capacity target

Including all aspirational capacity targets for the five projects, the total installed capacity rises to 1,420MW. However we do note that the Cooper Basin Project, one of the most advanced geothermal projects in Australia does not plan to achieve full industrial generation of 500MW until 2020. As a result, we struggle to see other projects with undated aspirational targets achieving them prior to 2020 when the LRET scheme reaches the 20% target.

Figure 56: Proposed geothermal installed capacity



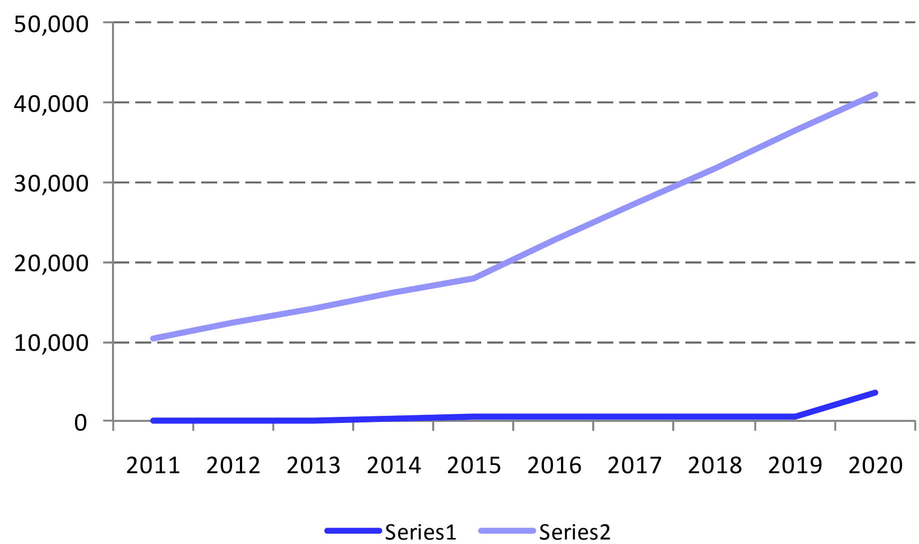
Source: Company data, Deutsche Bank

We have run a scenario to calculate the implied impact of proposed geothermal generation on the LRET and likely REC generation. Under this scenario we have assumed:

- All company stated timelines are met
- The projects have an average capacity factor of 95%
- The projects have an average availability factor of 90%
- The projects have average transmission losses of 10%

The following chart plots the impact of this scenario on the LRET target.

Figure 57: Geothermal contribution to LRET target



Source: Company data, Deutsche Bank

We do not see geothermal as a major contributor prior to 2020

We note that in each year prior to 2020, geothermal generation produces less than 3% of the LRET target. In 2020, assuming the Cooper Basin Project reaches 500MW capacity, geothermal generation would contribute 9% of the LRET target. Even when all aspirational targets are included, geothermal would represent only 23% of the 2020 LRET target. **As a result, we do not see geothermal as being a major contribution to meeting LRET targets by 2020.**

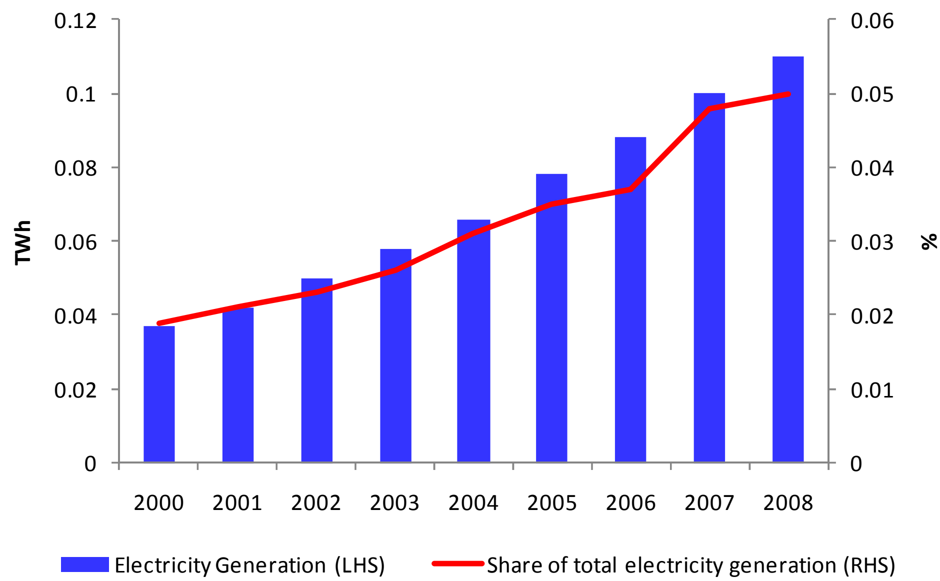
Other renewable technologies

Solar

ABARE forecast solar will be <1% of total electricity by 2020

Solar energy is a significant energy source both globally and in Australia. Australia has the highest average solar radiation levels of any continent, but the resource remains largely untapped. ABARE estimates around 0.1TWh was generated from solar sources in Australia in 2008. While this represents an annualized growth rate of 7.2% since 2000, 0.1TWh is less than 0.06% of total electricity generation in Australia. ABARE forecasts growth to 4TWh by 2020, still less than 1% of total electricity generation.

Figure 58: Solar electricity generation in Australia



Source: ABARE, Deutsche Bank

There are two main types of solar electricity generation: solar thermal, and solar photovoltaic.

Solar Thermal

Solar thermal technology converts solar radiation directly into heat

Solar thermal technology converts solar radiation directly into heat. This technology can be used to generate steam to drive generators to produce electricity, generally with the aid of mirrors or parabolic troughs in order to produce sufficiently concentrated heat to boil water.

The majority of solar thermal energy generation is used for heating, and hot water generation and not to generate electricity. Approximately 96% of the c.400PJ of total global solar energy produced during 2008 was comprised of solar thermal applications. Around 50% of this energy was used for hot water heating, with electricity generation less than 5%.

Solar Photovoltaic

Solar Photovoltaic (PV) technology converts sunlight directly into electricity

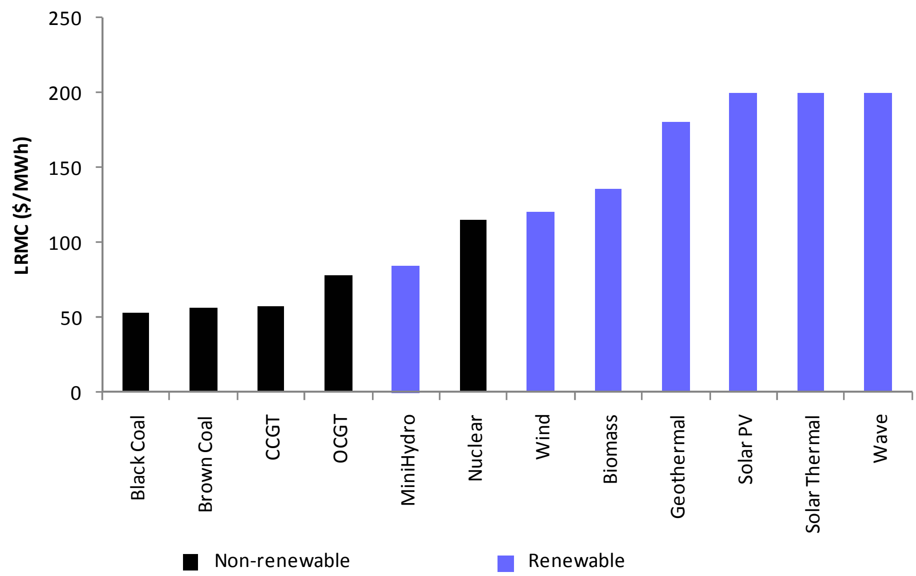
Solar Photovoltaic (PV) technology converts sunlight directly into electricity. PV technology accounted for only 4% of total energy generated from solar sources globally during 2008. At present Solar Photovoltaic capital costs are prohibitively high, with most PV applications in Australia either remote off grid, or on residential roof-tops where government grants and feed-in tariffs support investment.

Solar twice the cost of wind

Cost remains the biggest impediment

The single biggest impediment to the development of solar power in Australia remains capital costs. We estimate both Solar Thermal and Solar PV technologies remain almost twice the cost of wind in Australia on a project-life LRMC basis.

Figure 59: Long run marginal cost for various fuel sources



Source: AGL AEPR, Deutsche Bank

While we recognize that increased manufacturing capacity is likely to lower production costs, especially for solar PV technologies, we believe improved economics for solar development are dependent on significant technological developments. As a result, we remain cautious on the ability of solar to contribute meaningfully to the LRET target.

Government incentive programs

As part of its renewable energy plans, the Australian Government has created a $1.5bn Solar Flagships Program. A shortlist of eight projects was announced in early 2010, with the final two successful applications (one solar PV, one solar thermal) to be named in the first half of 2011.

Figure 60: Solar Flagships Program shortlist

Project owner	Technology	Size	Location
AGL Energy	Solar PV	up to 150MW	Across various sites in eastern Australia
TRUenergy	Solar PV	up to 180MW	Mildura, VIC
Infigen Energy/Suntech	Solar PV	up to 195MW	Up to three sites in NSW or VIC
BP Solar	Solar PV	up to 150MW	Across several sites in NSW
Acciona Energy	Solar Thermal	200MW	Single site in QLD or SA
Parsons Brinckerhoff	Solar Thermal	150MW	Kogan Creek, QLD
Wind Prospect CWP	Solar Thermal	250MW	Kogan Creek, QLD
Transfield	Solar Thermal	150MW	Collinsville, QLD

Source: Australian Government, Deutsche Bank

These eight projects will share in up to $15m in feasibility funding from the Federal Government. The final two successful projects will then be eligible for up to $1.5bn in Federal Government funding. The actual quantum of funding for each project remains uncertain, however the Government has provided guidelines on eligible expenditure. We also note that the proposed $220m Cleaner Car Rebate ("Cash for Clunkers") program is proposed to be funded out of the same $1.5bn.

The Victorian Government announced in Sep 2010 that it would provide $100m in funding for the TRUenergy project near Mildura. The State Government indicated it believe the project was a stand-out candidate for funding under the Federal Government's Solar Flagship Program, however we understand the $100m in state funding is not contingent on the project being successful in the Solar Flagship Program.

We estimate capital costs for Solar PV at c.$6m-$8m per MW, and Solar Thermal at $4m-$5m per MW. We note that a lack of existing commercial scale solar installations in Australia makes these figures uncertain. As a result, a 150MW Solar PV project could cost $900m-$1,200m, while a 150MW Solar Thermal project could cost $600m-$750m. This implies combined capex for the two project of $1.5bn-$2bn, highlighting the level of government subsidy required to make large scale solar projects economically viable in Australia.

Hydroelectricity

The largest current source of renewable generation, but expansion is limited

Hydroelectric energy is currently the largest source of renewable energy globally, accounting for 16% of world electricity production in 2009. Furthermore, the technology associated with hydroelectricity is relatively simple, and well proven. However, the IEA forecasts a growth rate of only 0.7% to 2030 in OECD countries, and 2.5% in non-OECD countries. These low growth rates reflect the mature nature of hydroelectricity, and limited undeveloped hydro energy potential. Loss of arable land to damming is also a significant issue in many countries.

In Australia, c.5% of total electricity generation is currently from hydroelectric sources. However, hydroelectric generation has declined by an average of 4.2% pa since 2000 as a result of extended drought conditions.

Figure 61: Major Australian hydroelectric schemes/regions

Scheme/Region	Owner	Location	Installed capacity (MW)	2008 generation (GWh)	2008 implied capacity factor
Snowy Mountains Scheme	Snowy Hydro	NSW	3,756	3,748	11.4%
Southern Hydro	AGL Energy	VIC	577	591	11.7%
Tasmania	Hydro Tasmania	TAS	2,274	8,182	41.1%
Queensland	Various	QLD	644	1,010	17.9%
Western Australia	Pacific Hydro	WA	30	0	0.0%
Other	Various	Various	375	195	6.0%
Total			**7,806**	**13,726**	**20.1%**

Source: ABARE, Deutsche Bank

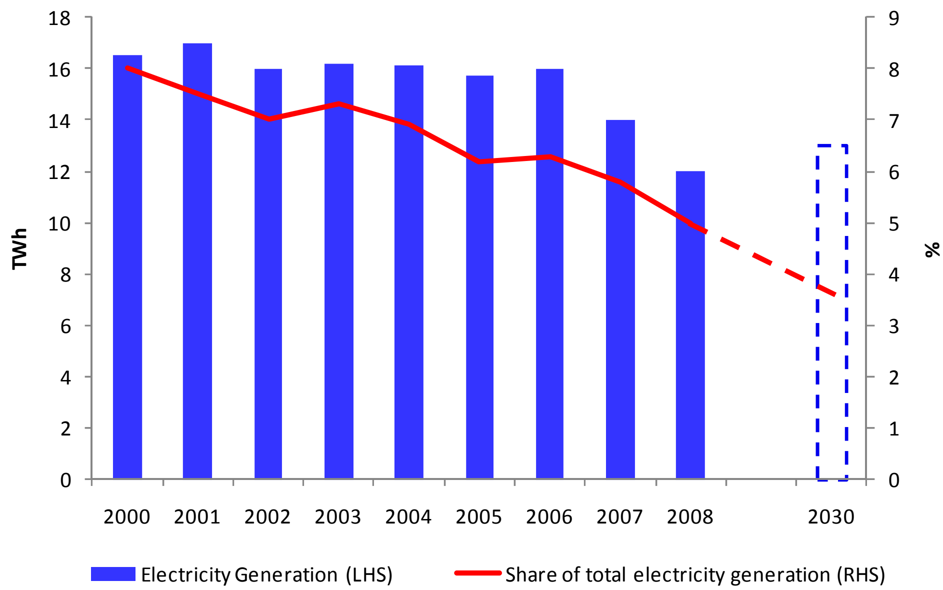
Total generation of 13.7TWh in 2008 was achieved from the country's 108 hydroelectric generators, representing 7,806MW of installed capacity. We calculate this implies a capacity factor of just 20.1% for hydroelectric generation, well below typical wind farm averages of 30-40%.

Australia is characterized by highly variable rainfall, evaporation rates, and temperatures from year to year. A number of hydro schemes also have competing demands on water from farmers and irrigators. This has a significant impact on dam storage levels, and thus electricity generation. Furthermore, water availability is likely to be a significant hindrance to new hydroelectric generation in Australia. Incremental generation is likely to come from upgrades to existing schemes, and small scale generation.

ABARE forecast an increase from 12TWh in 2008 to 13TWh by 2030 for hydroelectric generation in Australia. This implies the share of total electricity generation will fall to 3.5% by

2030. ABARE expect wind will have overtaken hydro as the main source of renewable electricity generation in Australia by 2030.

Figure 62: Hydroelectric generation in Australia



Source: ABARE, Deutsche Bank

Hydroelectricity from PNG?

Origin has proposed importing electricity from an 1,800MW hydro facility in PNG

In Sep 2010, Origin Energy announced it had signed a Memorandum of Cooperation with the Papua New Guinea and Queensland Governments to evaluate the hydroelectric potential of the Purari River at Wabo in the Gulf province of PNG. Origin believe a run-of-river hydroelectric facility could generate 1,800MW of renewable power at a capacity factor of 90%. The project proposes building a sub-sea transmission line to Australia, potentially providing power to resource projects in Weipa, and extending south to Townsville by 2018. Origin have indicated the project could cost $5bn, with the transmission infrastructure costing up to $4bn. We note at present no alumina projects have been approved or sanctioned in Weipa.

The Purari river has been investigated for over 30 years as a potential source of hydroelectric power. However, PNG's modest electricity demand (approximately the equivalent of 600MW of installed capacity) could not support a development. The current LRET legislation would not allow Origin to claim RECs from electricity generated outside Australia.

In our view, the risk of delay or cancel of the project are significant, and we note the 2018 target is only 2 years prior to the plateau point of the LRET scheme. Under the scheme, the incremental RECs required from 2018 to 2020 is 9.2m. We estimate, assuming 20% transmission losses and 90% capacity factor, that the PNG hydro plant would generate over 11m RECs, effectively crushing the market and undermining one of the project's key revenue sources.

Given the timelines and development uncertainty, we do not regard a PNG hydro facility as a key driver of the LRET scheme at this point.

Landfill Gas

Waste gas from the decay of biodegradable material

Landfill gas is a biogas generated by decomposition of waste in landfill sites. The gas is mainly methane formed as a waste product as microbes digest the waste. Landfill gas is a relatively mature technology – perforated pipes are installed into existing landfill and the collected gas is then treated and burned in smaller scale gas fired generators locate at or very close to the landfill site.

The rate of biodegradation can be accelerated using bioreactor technology. This technology accelerates the rate of decomposition by circulating water through the landfill resulting in a higher gas yield.

The largest landfill gas bioreactor in Australia is at Woodlawn in NSW. The power station is targeting an ultimate capacity of 25MW. The largest operator of landfill gas generators in Australia is Energy Developments (ENE.AX), the company operates 21 sites representing 83MW of generating capacity in Australia. There are currently 75 REC accredited landfill gas sites across Australia.

In our view landfill gas will remain a relatively niche renewable energy source in Australia. Whilst it is renewable, capacity is limited by availability of waste material. Electricity generation from landfill gas sites was approximately 0.6TWh in 2009, representing c.0.25% of total electricity generated in Australia. Landfill gas has grown at a CAGR of 10% since 2005.

Figure 63: Landfill gas power plants

Region	Operating and under construction (MW)	Proposed (MW)
Australian Capital Territory	2.0	–
New South Wales	60.8	5.5
Northern Territory	1.1	–
Queensland	11.9	–
South Australia	15.0	–
Tasmania	3.9	–
Victoria	43.9	–
Western Australia	25.8	–
Total	**164.3**	**5.5**

Source: DEWHA, and Deutsche Bank

Bagasse and Black Liquor

Bagasse and black liquor are both forms of bio-energy. While both technologies are well established, their link to an industrial process – sugar cane refining in the case of bagasse, and wood pulping in the case of black liquor – limits the growth potential to meet MRET requirements.

Bagasse

Bagasse utilizes waste sugar cane fibres

There are currently 28 Bagasse facilities accredited for REC generation in Australia. All are sugar mills that burn the waste fibres (bagasse) as a source of steam and electricity to run operations. Excess electricity is then sold into the grid and generates RECs. We note that all accredited mills with the exception of the Tableland Mill in Queensland have a baseline generation threshold. This threshold recognizes the fact that mills have been operating since prior to the Phase 1 MRET scheme, and are thus not incremental new renewable energy geneartors. However, should a mill generate beyond its threshold, the excess electricity generates RECs. In 2009, 885k RECs were generated from Bagasse in Australia, versus a total baseline of c.515MWh.

ABARE estimates for sugar production in Australia are broadly flat to 2015, with 2010 production of 4.8mt increasing slightly to 4.9mt by 2015. As a result, we see limited scope for incremental bagasse generation in Australia to meet MRET targets.

Black Liquor

Black liquor is a by-product of wood pulping

Black liquor is a liquid by-product of the kraft wood pulping process, and contains a high portion of organic material. Pulp mills have used black liquor as an energy source for over 50 years, primarily as an internal energy source. Black liquor is captured under the LRET scheme given it effectively renewable sourced, and removes the need for pulp mills to use non-renewable energy sources to power the mill process.

There are currently two accredited black liquor operations in Australia:

- Visy Pulp and Paper in NSW
- Maryvale Mill in Victoria

ABARE see limited scope for incremental black liquor generation growth in Australia to 2030 given its reliance on the pulping process.

Ocean Energy

Ocean energy technologies are immature

Ocean energy is a concept that captures several different potential electricity generation methods. Total global ocean energy generation is very small, averaging around 0.6TWh over the past 30 years (0.03% of total electricity generation), with only France and Canada generating electricity from tidal barrage power plants. The IEA projects ocean energy will remain a very small supplier of electricity to 2030, representing 0.04% of total global electricity generation.

Australia currently has a total installed ocean energy capacity of 0.77MW through four demonstration plants. There are an additional four commercial scale projects at early stages of development targeting total installed capacity of 805MW.

Figure 64: Proposed Australian ocean energy plants

Project	Owner	Location	Status	Target startup	Capacity
Victorian Wave Power Demonstration Plant	Victorian Wave Partners Pty Ltd	Victoria	Government grant awarded	na	19MW
Clarence Strait Tidal Energy Project	Tenax Energy Pty Ltd	Northern Territory	Government approvals underway	2011	450MW
Port Phillip Heads Tidal Project	Tenax Energy Pty Ltd	Victoria	Government approvals underway	2012	34MW
Banks Strait Tidal Energy Facility	Tenax Energy Pty Ltd	Tasmania	Government approvals underway	2013	302MW

Source: ABARE, Deutsche Bank

While Australia has considerable tidal energy resources around Darwin, the Northwest Shelf and southern Great Barrier Reef, and significant wave potential on the southern half of the continental shelf, we see limited development potential. Ocean energy technology is still in the development phase, and remains prohibitively expensive. The remote location of prospective energy sites is also a limiting factor. In our view, Ocean Energy is unlikely to be a significant contributor to Australia's electricity generation mix before 2020.

Tidal Energy

Tidal electricity generators capture energy from tidal movements. There are two main tidal energy technologies:

- **Tidal barrages** act in a similar way to hydroelectric dams. A barrage built across an estuary or tidal basin results in sea level differences as tides ebb and flow. Gates in the barrage allow water to flow from the higher level to lower, with turbines driven by the flow. The world's first, and largest ocean energy power station at La Rance in France is a tidal barrage power station.
- **Tidal stream** generators are placed on the sea floor, and are driven by fast moving tides. They are generally located in narrow channels or straits where tidal flows are at their strongest. The flowing water turns a turbine that drives a generator. The San Remo demonstration plant in Victoria is a 0.15MW tidal stream generator.

Wave Energy

Wave energy can be captured using a number of different technologies that are generally less developed than tidal energy. The primary mechanisms capture the short-cycle nature of waves through hinged or oscillating devices. Unlike tidal energy, wave energy technologies are generally limited to near-shore given this is the region where wave activity and energy is at its greatest. Furthermore, wave energy is dependent on favourable wave-forming weather conditions, and is thus likely to produce less continuous electricity generation than tidal technologies. The 19MW Victorian Wave Power Demonstration Plant near Portland in Victoria proposes to capture wave energy.

Ocean Thermal Energy

Electricity generation from ocean thermal energy is conceptual only at this point. The concept is to utilize temperature differentials between warmer water close to the surface of oceans, and colder water at depth.

Investing in the renewable sector

The listed names

There are many listed companies in the Australian renewable energy sector. Apart from the three largest listed players Origin Energy, AGL Energy and Infigen Energy, however, the size of listed renewable companies falls rapidly.

We see four key characteristics that investors should focus on when considering investing in the renewable energy sector. In our view, large listed companies are inherently better positioned for these characteristics given the large capital commitments associated with building new power generation, operating and technical expertise, and multiple development opportunities. Furthermore, liquidity issues are a constraint for a number of smaller listed companies. As a result we focus on the largest three listed exposures.

Figure 65: Listed renewable energy companies in Australia

Company	Ticker	Market cap	Close (8/11/10)	DB rating	DB price target	Renewable exposure
Origin Energy	ORG.AX	$14.7bn	$16.57/sh	Hold	$16.70/sh	Wind, hydro, geothermal, solar
AGL Energy	AGK.AX	$7.4bn	$16.23/sh	Buy	$17.70/sh	Wind, hydro, geothermal, solar
Infigen Energy	IFN.AX	$551m	$0.73/sh	Buy	$1.00/sh	Wind
Energy Developments	ENE.AX	$399m	$2.55/sh	Not Covered		Landfill gas
Transfield Services Infrastructure Fund	TSI.AX	$289m	$0.66/sh	Not Covered		Wind
Geodynamics	GDY.AX	$158m	$0.54/sh	Not Covered		Geothermal
Carnegie Wave	CWE.AX	$68m	$0.12/sh	Not Covered		Wave
CO2 Group	COZ.AX	$45m	$0.16/sh	Not Covered		Carbon sequestration
Solco	SOO.AX	$23m	$0.12/sh	Not Covered		Small-scale solar & wind
Petratherm	PTR.AX	$18m	$0.16/sh	Not Covered		Geothermal
Enviromission	EVM.AX	$18m	$0.06/sh	Not Covered		Solar tower
Panax Geothermal	PAX.AX	$15m	$0.05/sh	Not Covered		Geothermal
Green Rock Energy	GRK.AX	$10m	$0.02/sh	Not Covered		Geothermal
Carbon Conscious	CCF.AX	$6.9m	$0.13/sh	Not Covered		Carbon sequestration
Hot Rock Ltd	HRL.AX	$6.8m	$0.07/sh	Not Covered		Geothermal
Geothermal Resources	GHT.AX	$6.5m	$0.18/sh	Not Covered		Geothermal
Torrens Energy	TEY.AX	$6.0m	$0.10/sh	Not Covered		Geothermal
Greenearth Energy	GER.AX	$5.8m	$0.08/sh	Not Covered		Geothermal
KUTh Energy	KEN.AX	$4.2m	$0.07/sh	Not Covered		Geothermal

Source: Deutsche Bank

Key characteristic 1: The right technology

Wind will be the dominant technology under LRET

As discussed throughout this report, we believe some technologies will be more successful than others in meeting the Australia's Government's LRET scheme target of 20% renewable generation by 2020.

We favour wind given it is a proven technology, economically robust relative to other technologies, and has significant scope for expansion.

We see geothermal as a offering significant long-term potential, but would question whether company share prices will reflect value in geothermal projects over the current investment time horizon.

Key characteristic 2: A strong development pipeline

Large differences between the best and worst proposals

We see strong development pipelines as critical. As discussed above we favour wind as the leading technology, and recognize that there is likely to be a large difference between the best and worst projects amongst almost 10,000MW of publically proposed wind farm projects.

We favour companies who have developed their pipelines over time, given we believe it is logical to presume the best wind sites would have been identified and acquired first. Furthermore, in our view companies willing to provide significant detail on individual projects are likely closer to project sanction than those with unidentified opportunities.

Key characteristic 3: Capacity to fund developments

Funding capacity will be critical given the capital intensity of renewable generation

Without sufficient funding strength, development pipelines are stranded. We note corporate balance sheets are but one funding option. The annuity nature of Power Purchase Agreements enables wind farms to be highly geared, plus the use of JVs or asset divestment to third parties can free up capital.

Key characteristic 4: Development and operational expertise

Operational expertise is critical

As we note earlier in this report, with the possible exception of limited hydro opportunities, renewable energy projects are not economically viable without Government support in Australia. As a result, the ability to develop and operate projects effectively and efficiently to maximize economics and returns is critical to corporate success in the renewable energy sector. We favour companies with demonstrated experience in development and operations.

Rating the players

The following matrix summarises our rankings of the three key large listed renewable energy players in Australia across the four key investment characteristics.

We favour AGL Energy given the company performs well across all four metrics. If Infigen Energy can resolve its funding issues we see the company as very well placed given its strong pipeline and development track record.

While we recognize Origin's strategy provides significant optionality to back successful technologies, in our view wind is already the proven technology of choice, and we do believe the company's late adoption of a wind pipeline has resulted in lower quality development options.

Figure 66: Renewable energy rating matrix

	Rating	Target price	Overall renewable rating	Technology	Pipeline strength	Capacity to fund	Development and technical expertise
AGL Energy	Buy	$17.70	**High**	**High** -Primarily wind -Solar opportunity under Federal Government's Solar Flagships Program	**High** Very strong wind development pipeline, our preferred technology	**Medium/High** Strong corporate balance sheet with $800m in debt headroom, however NSW privatisation may redirect capital	**High** Proven track record in wind and hydro development
Infigen Energy	Buy	$1.00	**Medium/High**	**High** -Primarily wind -Solar opportunity under Federal Government's Solar Flagships Program	**High** Very strong wind development pipeline, our preferred technology	**Weak** FY11 fully funded, however failed US asset sale process compromises longer term funding	**High** Proven track record in wind development as Australia's largest wind farm owner
Origin Energy	Hold	$16.70	**Medium**	**High/Very High** -Large wind pipeline -Exposure to Geothermal via Geodynamics -PNG hydro proposal	**Weak/Medium** -Wind pipeline appears less developed than competition -Geothermal opportunity appears to be sector leading, however we see geothermal as long dated and remain sceptical of PNG hydro during the RET period	**Medium/High** Very strong corporate balance sheet, however LNG and NSW privatisation may both require significant capital	**Medium** -Limited experience in wind development -Experience in geothermal via Contact Energy, but different technologies in Australia -No experience in hydro despite PNG plans

Source: Deutsche Bank

Rating the upside cases

We ascribe the greatest risked value to AGL's development pipeline

We value company development pipelines using a fixed metric per MW of proposed capacity. We then apply a risk weighting to reflect our view on the likely sanction of proposed projects. Once a company has sanctioned a project, we include its impact in our DCF valuation. We do not include Unidentified Proposals in our valuation on the basis that we believe there remains a high level of uncertainty around these projects.

We ascribe the greatest risked value to AGL's pipeline as we see it as the most developed. However, we see the highest upside potential is within Infigen's pipeline given its size of identified projects. Funding constraints impact our ability to ascribe value to Infigen's pipeline.

While the de-risked upside to our NAVs for AGL Energy and Origin do not appear large, we note that both of these companies have significant retail businesses and are twice leveraged to the LRET scheme as both sellers and obliged buyers of RECs. Furthermore, with potential privatization of NSW retail assets, the company's exposures to REC liabilities could increase, further highlighting the importance of developing renewable generation.

AGL Energy

$0.31/sh risked value, upside of +5% on our NAV

We currently value AGL's wind farm development pipeline at $0.31/sh. If we derisk the company's development opportunities, we estimate a value of $0.72/sh, or +5% on our current NAV.

Figure 67: AGL Energy wind farm development pipeline

Project	State	Capacity (MW)	Probability of development	EV/MW ($m)	EV ($m)	EV/share ($/sh)
Hallett 3	SA	80	80%	0.3	19.2	0.04
Barn Hill	SA	130	70%	0.3	27.3	0.06
Hallett 5	SA	71	25%	0.3	5.3	0.01
Crows Nest	QLD	150	25%	0.3	11.3	0.02
Ben Lomond	NSW	150	45%	0.3	20.3	0.04
Coopers Gap	QLD	300	45%	0.3	40.5	0.09
Coopers Gap Stage 2	QLD	200	25%	0.3	15.0	0.03
Total		**1,081**			**138.8**	**0.31**

Source: Company data, Deutsche Bank

Infigen Energy

$0.01/sh, upside of +52% on our NAV

We currently value Infigen Energy's wind farm development pipeline at $0.01/sh. This valuation reflects the company's current funding challenges, and we only ascribe value to the Flyers Creek project given we believe this project will be funded from existing cash reserves. If we derisk Infigen's pipeline, we estimate a value of $0.50/sh, or +52% on our current NAV.

Figure 68: Infigen Energy wind farm development pipeline

Project	State	Capacity (MW)	Probability of development	EV/MW ($m)	EV ($m)	EV/share ($/sh)
Bodangora	NSW	45	0%	0.3	0.0	0.00
Glenn Innes	NSW	54	0%	0.3	0.0	0.00
Flyers Creek	NSW	120	50%	0.3	9.0	0.01
Lincoln Gap	SA	177	0%	0.3	0.0	0.00
Woakwine	SA	450	0%	0.3	0.0	0.00
Walkway 2	WA	94	0%	0.3	0.0	0.00
Walkway 3	WA	300	0%	0.3	0.0	0.00
Cherry Tree	VIC	35	0%	0.3	0.0	0.00
Total		**1,275**			**9.0**	**0.01**

Source: Company data, Deutsche Bank

Origin Energy

$0.13/sh risked value, +2% on our NAV

We currently value Origin's wind farm development pipeline at $0.13/sh. If we derisk the company's development opportunities, we estimate a value of $0.27/sh, or +2% on our current NAV.

Figure 69: Origin Energy wind farm development pipeline

Project	State	Capacity (MW)	Probability of development	EV/MW ($m)	EV ($m)	EV/share ($/sh)
Yass Valley (Coppabella Hills)	NSW	164	50%	0.3	24.6	0.03
Yass Valley (Mailba Hills)	NSW	140	50%	0.3	21.0	0.02
Stockyard Hill	VIC	484	45%	0.3	65.3	0.07
Total		**788**			**110.9**	**0.13**

Source: Company data, Deutsche Bank

Company overviews

Origin Energy (ORG.AX, , $16.57, Hold, $16.50/sh TP)

Investment Thesis

Origin Energy is Australia's second largest retail utility by customer numbers, but the company's revenues are increasingly driven by the upstream E&P business. The company now holds Australia's largest CSG reserves with APLNG JV partner ConocoPhillips. The APLNG project to develop up to four LNG trains reinforces this shift in focus; however, it is the third major LNG project in the Gladstone area and is at least 12 months behind competitors. Offtake contracts are a key milestones to derisking this project, with the company targeting results by end CY10. With a significant potential customer recently signing with a competing LNG project, we see significant risk to current timeline guidance. We question whether Origin would be better served selling gas into another LNG project, removing LNG development risk, and enabling the company to focus on its strengths as an integrated domestic gas operator. While the current share price ascribes little value to the LNG project, we believe this fairly represents the risked probability of project development. As a result we rate Origin a Hold.

Valuation

Using a DCF approach, our NAV for Origin is $16.40/sh. Using the WTI forward curve as at 28 Sep 10, our NAV is $16.12/sh. Our target price of $16.50/sh is derived from the average of the two NAVs and a risked exploration of 24cps.

We use a WACC of 11% for Origin's E&P business, in line with all E&P companies within our coverage universe. We use a 9% WACC for the company's utility business derived from the following assumptions: a Ke of 11.2% (beta of 0.80, rf of 6.5% and Rm of 6%), a cost of debt of 7.5%, and gearing of 30%.

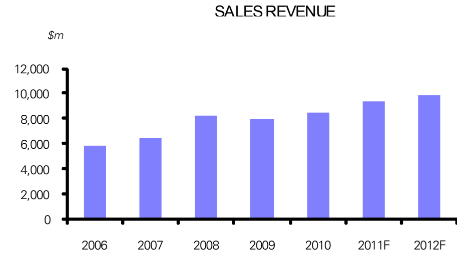
Risks

- Failure or delays at APLNG
- CSG technical risk
- Third party gas sales agreements
- Retail margins

Figure 70: Origin Energy key financials

Origin Energy Ltd $16.57 Hold

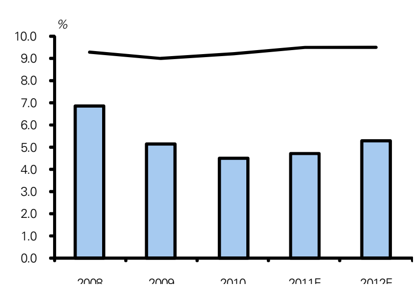
Y/E Jun							
PROFIT & LOSS ($m)	**2006**	**2007**	**2008**	**2009**	**2010**	**2011F**	**2012F**
Sales revenue	5,880	6,456	8,275	8,042	8,534	9,330	9,926
Other revenue	88	40	44	7,265	169	89	65
Total revenue	5,968	6,495	8,319	15,307	8,703	9,418	9,990
EBITDA	1,087	1,293	1,421	8,312	1,453	1,801	1,981
Depreciation/amortisation	(297)	(330)	(345)	(369)	(408)	(538)	(560)
EBIT	791	963	1,077	7,961	1,000	1,362	1,451
Net interest expense	(167)	(215)	(220)	(291)	(124)	(413)	(329)
Pre-tax profit	623	748	856	7,670	876	949	1,122
Income tax expense	(169)	(157)	(235)	(672)	(196)	(224)	(291)
Operating profit	454	592	622	6,998	680	725	831
Minorities, pref divs & associates	(122)	(135)	(105)	(57)	(68)	(57)	(82)
NPAT (inc significant items)	332	457	517	6,941	612	668	750
Net abnormals/extraordinaries	0	0	0	0	0	0	0
Significant Items (post tax)	6	87	74	6,411	27	(2)	0
EBIT (exc significant items)	791	877	963	905	896	1,204	1,355
NPAT (exc significant items)	326	370	443	530	585	671	750
NPAT (pre goodwill exc sig items)	326	370	443	530	585	671	750
DIVISIONAL REVENUE ($m)							
Exploration and Production	435	484	527	516	522	707	739
Retail and Trading	3,206	4,082	5,506	5,869	6,393	6,648	6,865
Generation	104	103	86	132	228	483	551
Networks	172	209	0	0	0	0	0
Contact	1,963	1,578	2,156	1,525	1,391	1,492	1,770
DIVISIONAL EBIT ($m)							
Exploration and Production	99.0	41.2	119.0	7,440.0	47.8	325.5	289.0
Retail and Trading	194.4	328.7	347.0	291.0	503.0	589.7	552.9
Generation	48.0	78.8	38.5	8.0	131.0	220.0	306.7
Networks	32.5	139.9	224.9	0.0	0.0	0.0	0.0
Contact	416.7	374.9	347.2	222.0	318.2	226.9	302.9
ANALYTICAL CASH FLOW ($m)							
EBITDA	1,087	1,293	1,421	8,330	1,408	1,900	2,012
Tax paid	(119)	(165)	(143)	(251)	(102)	(223)	(258)
Working capital / other	(33)	(223)	(351)	(7,098)	(289)	1,045	106
Gross operating cash flow	936	905	927	981	1,017	2,722	1,859
Net capital expenditure	(480)	(516)	(1,280)	(2,142)	(2,877)	(1,179)	(498)
Net investments	(180)	(1,124)	308	(287)	0	(1,267)	(721)
Other investing	153	0	0	6,870	(564)	453	166
Free cash flows	228	(960)	(44)	5,422	(2,424)	546	686
Change in net borrowings	65	806	269	(4,393)	2,928	38	(161)
Equity raised	4	486	19	(170)	13	177	179
Dividends paid	(163)	(183)	(232)	(593)	(409)	(445)	(451)
Other financing	(134)	(149)	(11)	(266)	(108)	(316)	(254)
Financing cash flows	(228)	960	44	(5,422)	2,424	(546)	(686)
BALANCE SHEET ($m)							
Cash & deposits	309	268	96	3,895	823	185	346
Trade debtors	875	1,610	1,438	1,297	1,381	1,491	1,553
PPE	5,225	5,776	6,403	7,018	9,168	9,839	9,807
Intangibles	1,228	2,495	2,536	2,737	2,796	2,766	2,736
Investments	78	2,802	790	5,712	5,866	5,866	5,866
Other assets	949	1,816	1,305	1,443	1,800	1,825	1,903
Total assets	8,665	14,765	12,568	22,102	21,834	21,973	22,211
Current borrowings	512	507	233	132	113	53	53
Non-current borrowings	2,208	2,719	3,146	3,494	3,373	2,773	2,773
Other liabilities	2,299	4,570	4,014	7,332	6,910	6,739	6,252
Total liabilities	5,019	7,796	7,393	10,958	10,396	9,565	9,078
Total shareholders' equity	3,646	6,969	5,176	11,144	11,438	12,408	13,134
ASSUMPTIONS							
A$/US$	0.754	0.839	0.853	0.780	0.904	0.910	0.872
Oil (US$/bbl)	70.11	72.33	99.58	62.19	78.25	80.00	85.00
Gas (A$/GJ)	2.92	3.00	3.07	3.15	3.23	3.31	3.39
LPG (A$/t)	510.3	677.3	980.7	596.9	734.6	751.0	797.9
Condensate (US$/bbl)	69.11	76.84	103.01	62.19	78.25	80.00	85.00



52-week high/low (A$)	17.73/14.11
Market value (A$m)	14,656
All Ordinaries Weight (%)	1.25%
Beta	0.70

NET ASSET VALUATION ($m) as at Jun-11		
Retail and Trading	5,150	31%
Exploration and Production	3,856	23%
Contact	2,086	12%
Generation	4,662	28%
Other	1,779	11%
Total	16,837	100%
Net Debt	(2,137)	
Valuation	14,700	
Net value per share @ 9.5% nom	16.40	
Net Value per share (forward curve prices)	16.12	
Risked exploration	0.24	
Target Price	**16.50**	

RATIO ANALYSIS	**2009**	**2010**	**2011F**	**2012F**
Diluted shares on issue	884	881	893	905
Net debt ($m)	1,507	1,197	2,652	2,560
Enterprise value ($m)	16,619	16,665	18,661	18,840
EPS pre amortisation (c)	60.0	66.4	75.1	82.9
PER (x)	27.6	24.9	22.1	20.0
EV/sales (x)	2.1	2.0	2.0	1.9
EV/EBIT (x)	18.4	18.6	15.5	13.9
EV/EBITDA (x)	13.0	12.8	10.7	9.8
PCF (x)	9.3	5.6	2.3	3.7
Dividend yield (%)	4.5	3.0	3.0	3.0
Payout ratio (%)	104.5	75.4	66.3	60.2
ROA (%)	6.7	4.2	5.5	6.2
ROE (%)	7.5	5.8	6.3	6.5
Tax rate (%)	8.8	22.4	23.6	25.9
Net borrowings ($m)	(269)	2,663	2,641	2,480
Net debt/equity (%)	(2.4)	23.3	21.3	18.9
Net debt/net debt+equity (%)	(2.5)	18.9	17.5	15.9
Net interest cover (x)	3.1	7.2	2.9	4.1
ROIC/WACC (x)	0.49	0.49	0.49	0.56



Model updated 27 October 2010, 4:47PM

Source: Company data. Deutsche Bank

AGL Energy (AGK.AX, $16.23, Buy, $17.70/sh PT)

Investment thesis

AGL Energy is Australia's largest retail utility, and operates as a vertically integrated company. The company's balance sheet is well placed to fund wind farm development opportunities, and participate in the long awaited privatisation of NSW's utility assets. We see AGL as a potential beneficiary given a lack of competition for the assets. The company is now focussed on a renewable generation expansion strategy, primarily via its windfarm development pipeline. A recent agreement with credit agencies supports the company's develop and sell strategy, with 50% of associated debt to be included in credit metric calcuations. A strengthened hydro generation capability will reduce the company's reliance on third party generation at peak periods and drive earnings growth, with hydro NPAT forecast to grow by $22m (+68%) in FY11. With AGL's hydro assets and further retail benefits driving growth, and strong positioning to make accretive acquisitions under the NSW privatisation, we retain our Buy rating.

Valuation

We use a DCF approach to determine our NAV for AGL Energy of $17.72/sh. Our price target of $17.70/sh is based on our DCF NAV. We use a WACC of 9% (rf = 6.25%, beta = 0.70, mrp 6%, cost of debt 7.45%, target debt to value ratio of 30%) in our DCF analysis.

Key risks

- Retail churn levels and retail margin contraction,
- Volatile electricity prices,
- Water levels in hydro facilities, and
- Development pipeline execution risk

Figure 71: AGL Energy key financials

Agl Energy Ltd $16.23 Buy

Y/E Jun

PROFIT & LOSS ($m)	2007	2008	2009	2010	2011F	2012F	2013F
Sales revenue	3,765	5,653	5,996	6,611	6,768	7,081	7,390
Other revenue	75	263	1,978	45	30	26	37
Total revenue	3,841	5,916	7,974	6,655	6,798	7,107	7,427
EBITDA	943	487	2,191	551	869	875	922
Depreciation/amortisation	(164)	(169)	(123)	(138)	(145)	(147)	(146)
EBIT	779	319	2,068	413	724	728	776
Net interest expense	(95)	(152)	(82)	(36)	(33)	(35)	(22)
Pre-tax profit	684	167	1,987	378	690	693	754
Income tax expense	(181)	62	(391)	(22)	(207)	(208)	(226)
Operating profit	503	229	1,596	356	483	485	528
Minorities, pref divs & associates	0	0	0	0	0	0	0
NPAT (inc significant items)	503	229	1,596	356	483	485	528
Net abnormals/extraordinaries	0	0	0	0	0	0	0
Significant Items (post tax)	0	(136)	1,199	(73)	0	0	0
EBIT (exc significant items)	779	693	643	652	724	728	776
NPAT (exc significant items)	503	365	397	429	483	485	528
NPAT (pre goodwill exc sig items)	503	365	397	429	483	485	528

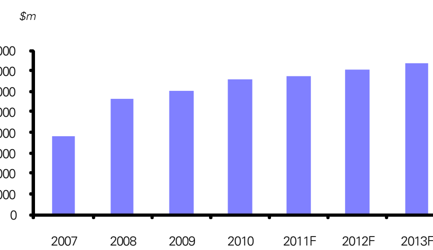
DIVISIONAL REVENUE ($m)	2007	2008	2009	2010	2011F	2012F	2013F
Retail	3,182	4,727	5,020	5,580	5,772	6,002	6,217
Merchant	1,989	3,012	3,663	4,082	3,886	4,062	4,309
Energy Investments	75	57	16	6	34	48	55
Gas & Power Development	0	121	149	78	44	55	55
Inter segment	(1,487)	(2,264)	(2,853)	(3,135)	(2,969)	(3,087)	(3,245)
Other	6	1	0	0	(0)	0	0
Total	3,765	5,653	5,996	6,611	6,768	7,081	7,390

DIVISIONAL EBIT ($m)	2007	2008	2009	2010	2011F	2012F	2013F
Retail	107	236	196	319	342	351	365
Merchant	737	108	95	386	453	419	443
Energy Investments	25	146	194	82	70	85	93
Gas & Power Development	0	(6)	1,738	6	6	17	20
Other/ Inter segment	(90)	(165)	(155)	(379)	(146)	(143)	(145)
Total	779	319	2,068	413	724	728	776

ANALYTICAL CASH FLOW ($m)	2007	2008	2009	2010	2011F	2012F	2013F
EBITDA	943	487	2,191	551	869	875	922
Tax paid	(72)	(105)	(339)	(79)	(49)	(210)	(210)
Working capital / other	(511)	118	(1,546)	(50)	(244)	56	(16)
Gross operating cash flow	360	501	307	422	576	720	696
Net capital expenditure	(102)	(109)	(453)	(331)	(545)	(304)	(291)
Net investments	(1,929)	(389)	1,899	239	0	0	0
Other investing	0	0	(4)	1	0	0	0
Free cash flows	(1,671)	2	1,749	330	31	417	405
Change in net borrowings	865	258	(1,498)	(76)	194	(178)	(180)
Equity raised	912	(2)	(2)	(2)	86	92	90
Dividends paid	(36)	(113)	(177)	(220)	(288)	(306)	(300)
Other financing	(70)	(146)	(71)	(32)	(23)	(24)	(15)
Financing cash flows	1,671	(2)	(1,749)	(330)	(31)	(417)	(405)

BALANCE SHEET ($m)	2007	2008	2009	2010	2011F	2012F	2013F
Cash & deposits	280	64	623	480	286	465	644
Trade debtors	1,702	1,171	1,210	1,235	1,248	1,299	1,357
PPE	1,673	1,998	2,438	2,997	3,397	3,554	3,698
Intangibles	3,205	3,492	3,698	3,149	3,149	3,149	3,149
Investments	5,637	2,374	621	426	786	779	767
Other assets	1,611	354	446	404	355	369	385
Total assets	14,108	9,453	9,035	8,691	9,222	9,615	10,001
Creditors	1,482	852	801	860	980	1,033	1,077
Total borrowings	2,448	2,102	1,120	901	901	901	901
Other liabilities	3,660	1,519	1,268	1,131	1,319	1,386	1,426
Total liabilities	7,590	4,473	3,189	2,891	3,200	3,319	3,404
Net assets	6,518	4,980	5,846	5,800	6,022	6,295	6,597
Total shareholders' equity	6,518	4,980	5,846	5,800	6,022	6,295	6,597

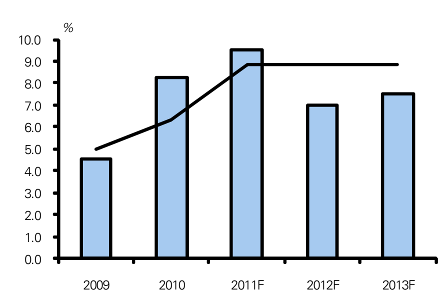
SALES REVENUE



52-week high/low (A$)	16.83/13.51
Market value (A$m)	7,437
Beta	0.70

NET ASSET VALUATION ($m) as at Jun-11		
Retail	3,615	41%
Merchant	4,706	54%
Gas & Power Development	441	5%
Energy Investments	848	10%
Other	(1,034)	-12%
Wind development pipeline	136	2%
Total	8,711	100%
Less: Net debt	(634)	
Valuation	**8,077**	
Net value per share	17.72	
Target Price	**17.70**	

RATIO ANALYSIS	2010	2011F	2012F	2013F
Diluted shares on issue	450	456	462	468
Net debt ($m)	420	615	436	257
Enterprise value ($m)	7,739	8,010	7,929	7,844
EPS pre amortisation (c)	95	106	105	113
PER (x)	17.0	15.3	15.4	14.4
EV/sales (x)	1.2	1.2	1.1	1.1
EV/EBIT (x)	11.9	11.1	10.9	10.1
EV/EBITDA (x)	9.8	9.2	9.1	8.5
PCF (x)	8.5	6.7	5.2	5.6
Dividend yield (%)	3.6	4.1	4.1	4.2
Payout ratio (%)	61.9	62.7	62.7	60.2
ROA (%)	7.8	8.3	8.1	8.5
ROE (%)	7.4	8.2	7.9	8.2
Tax rate (%)	5.7	30.0	30.0	30.0
Net borrowings ($m)	420	615	436	257
Net debt/equity (%)	7.2	10.2	6.9	3.9
Net debt/net debt+equity (%)	6.8	9.3	6.5	3.7
Net interest cover (x)	18.2	21.7	21.0	35.8
ROIC/WACC (x)	1.31	1.07	0.79	0.85



Model updated 29 October 2010, 12:16PM

Source: Company data, Deutsche Bank

Infigen Energy (IFN.AX, $0.73, Buy, $0.95/sh PT)

Investment thesis

Infigen Energy is Australia's only listed pure wind farm developer and investor. Following a recent restructure, the company is now internally managed with no management relationship with its previous parent. The company remains a stapled security to maximize taxation benefits associated with renewable energy developments. The company recently failed in its bid to divest its US wind farm portfolio. Proceeds from the sale would have enabled the company to fund an impressive Australian development pipeline beyond 2011. Despite the failed transaction, Infigen remains expossed to the rapidly growing wind energy sector. Discount to NAV drive our Buy rating for Infigen.

Valuation

We use a DCF based sum of the parts (SOTP) to derive our NAV of $0.94/sec. We use our DCF valuation as a proxy for our share price target of $0.95/sec. We employ asset specific WACCs to reflect the differing capital structures, fiscal regimes, and risk profiles of each wind farm.

Key Risks

- Wind speed variability
- Regulatory changes
- Capex blowouts and project delays

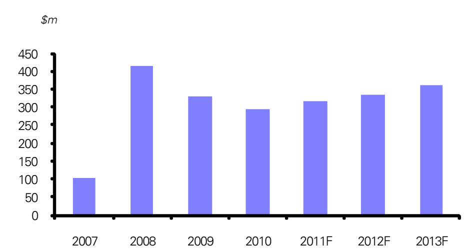
Figure 72: Infigen Energy key financials

Infigen Energy $0.73 Buy

Y/E Jun

PROFIT & LOSS ($m)	2007	2008	2009	2010	2011F	2012F	2013F
Sales revenue	104	414	331	296	317	335	360
Other revenue	15	17	23	26	8	7	8
Total revenue	118	432	354	322	325	342	368
EBITDA	83	290	163	172	200	214	229
Depreciation/amortisation	(34)	(134)	(158)	(147)	(136)	(141)	(147)
EBIT	49	156	5	26	63	72	83
Net interest expense	(42)	(129)	(104)	(81)	(80)	(72)	(61)
Pre-tax profit	7	56	(102)	(60)	4	25	52
Income tax expense	(1)	(16)	36	(13)	8	5	(1)
Operating profit	6	40	(66)	(74)	12	30	50
Minorities, pref divs & associates	(1)	(13)	0	0	0	0	0
NPAT (inc significant items)	5	27	(66)	(74)	12	30	50
Net abnormals/extraordinaries	0	0	0	0	0	0	0
Significant Items (post tax)	0	0	(25)	3	0	0	0
EBIT (exc significant items)	49	156	41	21	63	72	83
NPAT (exc significant items)	5	27	(41)	(77)	12	30	50
NPAT (pre goodwill exc sig items)	5	27	(41)	(77)	12	30	50
DIVISIONAL REVENUE ($m)							
Australia	45	70	74	106	137	146	160
US	0	127	229	159	154	163	172
Germany	14	14	23	31	26	26	28
France	0	5	6	0	0	0	0
Other	45	198	0	0	(0)	0	0
Total	104	414	331	296	317	335	360
DIVISIONAL EBIT ($m)							
Australia	24	12	13	29	64	70	80
US	21	28	36	8	12	17	17
Germany	8	3	3	6	8	7	8
Other/corporate	(4)	113	(47)	(17)	(21)	(21)	(22)
Other/ Inter segment	0	0	0	0	0	0	0
Total	49	156	5	26	63	72	83
ANALYTICAL CASH FLOW ($m)							
EBITDA	83	290	163	172	200	214	229
Tax paid	0	14	(15)	4	(15)	6	1
Working capital / other	41	(26)	88	19	241	8	(26)
Gross operating cash flow	124	279	236	195	426	228	205
Net capital expenditure	(266)	(250)	(495)	(123)	(37)	(5)	(6)
Net investments	(372)	(890)	1,740	94	0	0	0
Other investing	14	(38)	(82)	(27)	0	0	0
Free cash flows	(501)	(900)	1,399	140	389	223	199
Change in net borrowings	435	812	(1,179)	38	(76)	(121)	(125)
Equity raised	154	254	(61)	(43)	0	0	0
Dividends paid	(51)	(74)	(91)	(37)	(23)	(15)	(15)
Other financing	(38)	(92)	(67)	(99)	(291)	(86)	(59)
Financing cash flows	501	900	(1,399)	(140)	(389)	(223)	(199)
BALANCE SHEET ($m)							
Cash & deposits	442	208	409	230	182	162	164
Trade debtors	41	194	48	45	57	59	63
PPE	938	4,888	3,396	3,111	3,028	2,908	2,783
Intangibles	273	1,002	419	367	329	313	297
Investments	587	34	5	0	0	0	0
Other assets	108	249	120	161	160	160	161
Total assets	2,387	6,575	4,398	3,913	3,756	3,601	3,467
Creditors	257	296	84	74	97	103	108
Total borrowings	1,339	3,520	1,648	1,423	1,277	1,136	1,013
Other liabilities	38	1,624	1,755	1,697	1,665	1,631	1,581
Total liabilities	1,633	5,440	3,488	3,194	3,039	2,869	2,702
Net assets	754	1,135	910	720	717	732	765
Total shareholders' equity	754	1,135	910	720	717	732	765

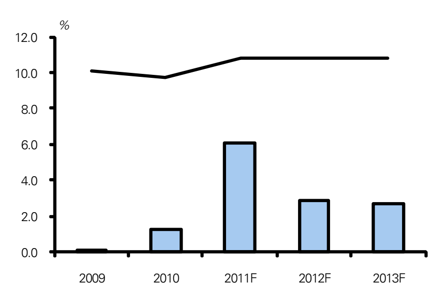
SALES REVENUE



52-week high/low (A$)	1.46/0.60
Market value (A$m)	552
Beta	1.20

NET ASSET VALUATION ($m) as at Jun-11		
Australia	518	43%
US	664	55%
Germany	8	1%
Wind development pipeline	9	1%
Total	1,198	
Less: Net coporate debt	(200)	
Less: Corporate costs	(301)	
Valuation	**697**	
Net value per share	0.98	
Target Price	**1.00**	

RATIO ANALYSIS	2010	2011F	2012F	2013F
Diluted shares on issue	760	760	760	760
Net debt ($m)	1,216	1,144	1,035	911
Enterprise value ($m)	1,725	1,695	1,586	1,463
EPS pre amortisation (c)	(10)	2	4	7
PER (x)	(7.2)	44.3	18.5	10.9
EV/sales (x)	5.8	5.3	4.7	4.1
EV/EBIT (x)	81.6	26.7	22.0	17.7
EV/EBITDA (x)	10.3	8.5	7.4	6.4
PCF (x)	(74.3)	7.4	22.1	35.3
Dividend yield (%)	2.8	2.8	2.6	3.2
Payout ratio (%)	(19.8)	122.1	48.7	35.0
ROA (%)	0.5	1.7	2.0	2.5
ROE (%)	(9.5)	1.7	4.1	6.7
Tax rate (%)	(22.2)	(209.7)	(19.9)	2.8
Net borrowings ($m)	1,193	1,095	974	849
Net debt/equity (%)	165.7	152.8	133.0	111.0
Net debt/net debt+equity (%)	62.4	60.4	57.1	52.6
Net interest cover (x)	0.3	0.8	1.0	1.4
ROIC/WACC (x)	0.13	0.56	0.26	0.25



Model updated 1 October 2010, 11:24AM

Source: Company data, Deutsche Bank

Appendix A: Glossary

Figure 73: Glossary

Acronym	Term	Description
ABARE	Australian Bureau of Agricultural and Resource Economics	An Australian Government research agency
APLNG	Australia Pacific Liquid Natural Gas	A proposed LNG project in Queensland using CSG as a feedstock. The project is a 50/50 JV between Origin Energy and ConocoPhillips
CAGR	Compound Annual Growth Rate	An average annual growth rate measure
CCGT	Combined Cycle Gas Turbine	A gas fired power station that uses both gas and steam turbines to generate electricity, both turbines are gas powered with steam generated from the waste heat. CCGT power stations are more efficient than OCGT.
CO_2	Carbon dioxide	A greenhouse gas formed during the combustion of fossil fuels
COAG	Council of Australian Governments	The peak intergovernmental forum in Australia comprising the Prime Minister, state Premiers, and Territory Chief Ministers
CPRS	Carbon Pollution Reduction Scheme	The Federal Government's 2009 proposed carbon trading scheme
CSG	Coal Seam Gas	Natural gas extracted from coal seams
ESAA	Energy Supply Association of Australia	The peak national body for Australia's energy supply sector
GWh	Gigawatt Hour	10^9 watt hours, the energy produced from one gigawatt of capacity operating for one hour
H_2S	Hydrogen Sulphide	Also called rotten egg gas, an impurity in aquifer fluids
HDR	Hot Dry Rock	A form of geothermal energy technology whereby hot dry rocks are fractured to allow heat transfer to injected water, also called Hot Fracture Rock
HFR	Hot Fractured Rock	A form of geothermal energy technology whereby hot dry rocks are fractured to allow heat transfer to injected water, also called Hot Dry Rock
HSA	Hot Sedimentary Aquifer	A form of geothermal energy technology whereby hot water is extracted from hot wet rocks
IEA	International Energy Agency	An intergovernmental energy organization
kW	Kilowatt	10^3 watts
LNG	Liquefied Natural Gas	Natural gas cooled to -162oC to form a liquid to aid transportation
LRET	Large-scale Renewable Energy Target	One half of the third phase of the Australian Government's renewable energy target: 41,000GWh from large scale generators by 2020
LRMC	Long Run Marginal Cost	A measure of the long-run breakeven cost of running a power station that captures both operating and capital costs
MP	Member of Parliament	Member of the House of Representatives, the lower house in Australia’s federal parliament
MRET	Mandatory Renewable Energy Target	The original Australian Government renewable energy target of 9,500GWh by 2010
mt	Million Tonnes	10^6 tonnes
MW	Megawatt	10^6 watts
MWh	Megawatt hour	10^6 watt hours, the energy produced from one megawatt of capacity operating for one hour
OCGT	Open Cycle Gas Turbine	A gas fired power station that uses a gas turbine to generate electricity. OCGT power stations are less efficient than CCGT.
OECD	Organization for Economic Co-operation and Development	An international economic organization of 33 nations formed to promote trade and economic progress
ORER	Office of the Renewable Energy Regulator	The Australian Government body responsible for overseeing renewable generation
PJ	Petajoule	10^{15} joules
PPA	Power Purchase Agreement	A long term agreement to sell electricity (and potentially RECs), generally between an electricity generator and an electricity retailer
PV	Photovoltaic	A form of solar technology where photons of light interact with the photovoltaic material to directly produce electricity
REC	Renewable Energy Certificate	The mechanism for recognizing 1MWh of renewable electricity generation
RET	Renewable Energy Target	The second phase of the Australian Government's renewable energy target of 45,000GWh by 2020
SGU	Small Generation Unit	A small scale renewable energy generator
SRES	Small-scale Renewable Energy Scheme	One half of the third phase of the Australian Government's renewable energy target: fixed REC price subsidies for small scale renewable generators
TWh	Terawatt hour - 1012 Watt Hours	10^{12} watt hours, the energy produced from one Terawatt of capacity operating for one hour

Source: Deutsche Bank

Appendix B: Wind Farm 101

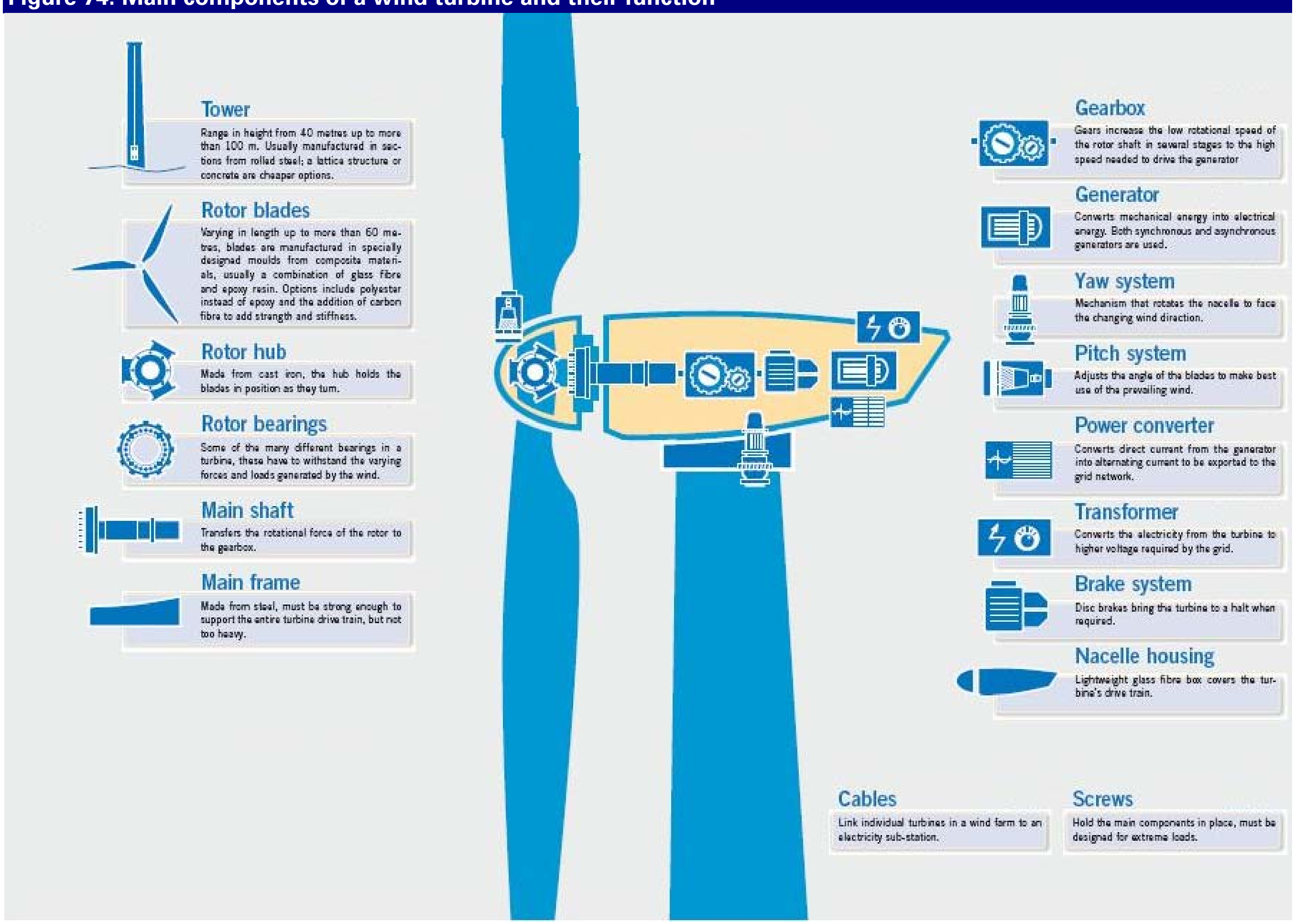
Overview

Wind turbines convert kinetic wind energy into useable electrical energy. Turbines extract some of the kinetic energy of the wind blowing through the area swept by the turbine blades, turning a rotor to drive an electrical generator.

A turbine's electrical output depends on various factors such as speed and density of wind, the blade length and generator size. Generally the greater the wind speed, the greater the electrical output, however above certain wind speeds generation output plateaus, while at extreme wind levels turbines may have to be shut down to prevent mechanical damage.

Turbine sizes have increased with time. Prior to 1990 turbines were rated at less than 500kW. The first 1MW turbines began to appear in the early 1990s, while 2-3MW are standard for onshore wind farms today, with offshore turbines of up to 5MW currently operating. The size of turbines and rotor blades are influenced by the wind characteristics at each wind farm site, the matching of compatible turbines to wind characteristics is critical to successful project development.

Figure 74: Main components of a wind turbine and their function



Source: EWEA

Types of wind farms

On the basis of location, wind farms can be categorised as onshore, offshore and near-shore.

- **Onshore** wind farms, as the name suggests are located on land at least 3km from and shoreline, generally along ridgelines as wind accelerates as it crosses ridges and wind speed generally increases with elevation. The distance between turbines plays a vital role, as inadequate spacing can result in wake and excess drag on downwind turbines. Onshore and near-shore wind farms were the first types to be developed given lower technical challenges. All wind farms currently operating or close to development in Australia are onshore or near-shore.
- **Near-shore** wind farms are located on land, within three kilometres of a shoreline, or offshore within 10 kilometres of land. Sea shores are good sites for turbine installation, as air density is generally higher than in ridgelines, enabling more energy to be generated at the same wind speed. However, near-shore wind farms can face greater approval challenges given shorelines are often regarded as scenic, or are densely populated. There are a number of near-shore wind farms in Australia such as the Portland Wind Energy Project, Cathedral Rocks and Albany, however there fewer near-shore proposals in company development pipelines given permitting challenges.
- **Offshore** wind farms are generally located 10 kilometres or more from land. They are a solution to land-constrained areas, and usually have a higher capacity than onshore or near-shore wind farms, as their rotor blades and wind towers can be much larger. Offshore turbines have the advantage of higher wind speed, due to smoother wind flow over water when compared to land. However, offshore turbines are more expensive and difficult to build than onshore farms given their remoteness. Power transmission from offshore turbines is also more expensive, given the need for undersea cables; operation and maintenance costs are also higher. Offshore wind farms tend to be larger, often consisting over 100 turbines, to reap the benefits of economies of scale. Currently offshore wind farms represent less than 2% of all installed wind capacity. There are no offshore wind projects in Australia given an abundance of onshore opportunities offering superior economics.

Figure 75: Type of wind farms

Source: GWEC

Advantages of wind energy

Wind power plants have many advantages over conventional electricity generation plants, and alternative renewable energy technologies.

No fuel costs
With the wind as its energy source, wind farms effectively have no fuel costs. Not only does this make wind farms very cost competitive to operate on a variable cost basis, but movements in commodity prices have no impact on wind farm operations.

Mature technology
Amongst renewable technologies, wind along with hydro is a proven and mature technology. Commercial scale wind farms have operated for over 10 years in Australia and several decades globally. As a result, there significantly lower technological risk associated with wind farms, increasing confidence for owners, offtakers and financiers of wind farms.

Cost competitive relative to alternative renewable energy technologies
After hydro, wind is currently the second cheapest renewable energy technology in Australia by quite some considerable margin. Given the structure of the Australian electricity market, the marginal supply dispatch mechanism favours lower cost generators. Furthermore, with effectively zero carbon emissions, wind farms also benefit from low emissions incentives along with other renewable technologies.

Greenhouse gas emissions free
While the construction of wind farms and raw material manufacture includes carbon emissions, there are effectively zero carbon emissions associated with operating wind farms. This allows renewable energy investors to reap the benefits of green energy price premiums such as RECs.

Challenges facing wind farms

More expensive than fossil fuel generation
Despite offering renewable-leading economics, wind remains more expensive than fossil fuel generators including coal and gas that dominate the generation mix in Australia. As a result, wind does remain reliant on government policy to remain competitive as a generation source.

Generation reliant on wind conditions
Clearly wind farms require wind to generate. Wind turbines operate at maximum efficiency at certain wind speeds, with low and very high wind speeds both impacting generation capacity. As a result, wind farms cannot necessarily react to periods of high electricity demand and hence high pricing.

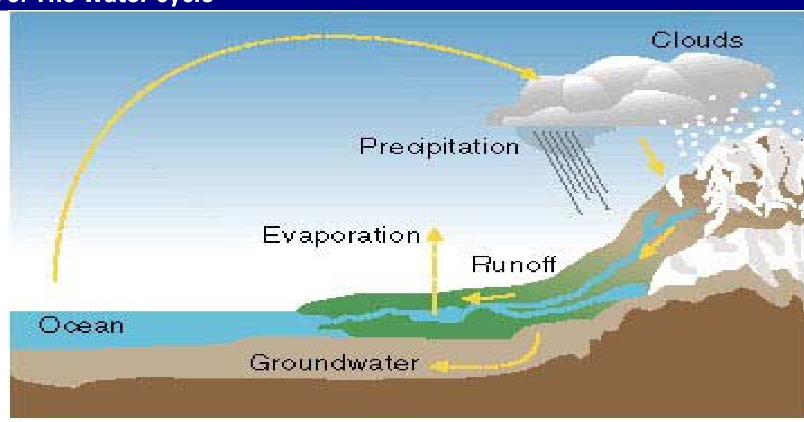
Permitting challenges
Despite offering environmentally friendly electricity generation, wind farms often face permitting challenges due to opposition from landholders. While impact on birdlife and livestock are often cited, the aesthetic impact of towers is often the cause. Permitting opposition is often the strongest in scenic coastal environments. Wind farms can, however, offer an additional and reliable source of income in the form of rent to landowners.

Appendix C: Hydroelectric Generation 101

Overview

Hydro electricity is the electricity generated from the movement of the water which constantly moves through the hydrological cycle. It evaporates from lakes and oceans, forms clouds, precipitate as rain or snow, then flows back to the ocean. The energy of this water cycle, which is driven by the sun, can be used to generate electricity.

Figure 76: The water cycle



Source: Deutsche Bank Snowy Hydro Research

Generation of hydro electricity is based on the law of gravity. When water flows downward it carries the kinetic energy, which can be converted into mechanical energy through the help of rotating turbines. Mechanical energy can be converted into electric energy in the power stations.

There are two basic models of hydro electric generation. The first uses artificial reservoirs or dams to store water at a height. The water is then flowed through pipes to drive turbines and generators when electricity is needed or when water is required to be released. The second system, the flow of river water is used to create the kinetic energy to rotate the generator turbines. This model is called Run-of-river model.

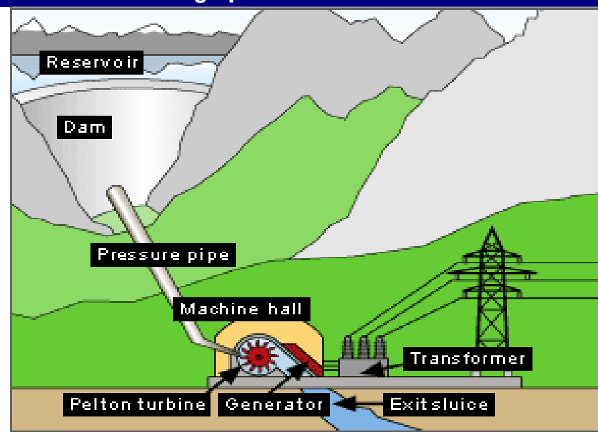
Types of hydro electric plants

Generally there are three main categories of hydro electric plants based on the source of water fuel used to run the plant. These are:

- Impoundment plants
- Diversion plants
- Pumped Storage

Impoundment: An impoundment or storage power station, usually a large hydropower system, uses a dam to store river water in a reservoir. Water released from the reservoir flows through a turbine, rotates it and in turn activates a generator to produce electricity. This type of power station is characterised by a large head of water and hence high pressure, but smaller volume. Impoundment power stations have fast start capabilities to respond to instantaneous demand and are mainly peaking generators. Snowy Hydro is an example of this type of facility.

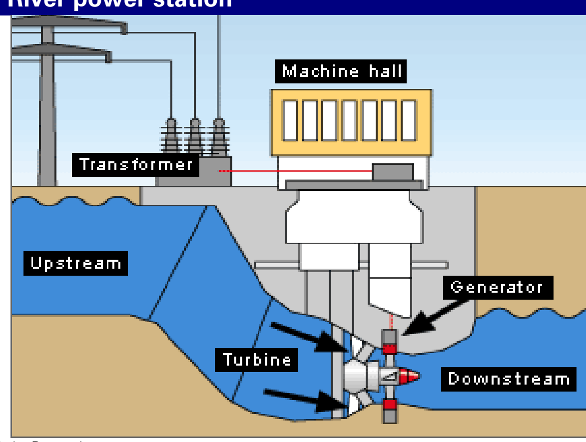
Figure 77: Impoundment or storage power station



Source: Deutsche Bank Snowy Hydro Research

Diversion or "Run of River": A diversion facility does not require a dam to store water. Instead, this system diverts the flow of river water to a desired location to produce electricity. This system is often called Run-of-river. Although the head of water between the upstream and downstream sides is modest compared to storage power stations, the volume of water available is usually greater. Run-of-river power stations usually operate continuously with the amount of electricity produced depending on the river's flow.

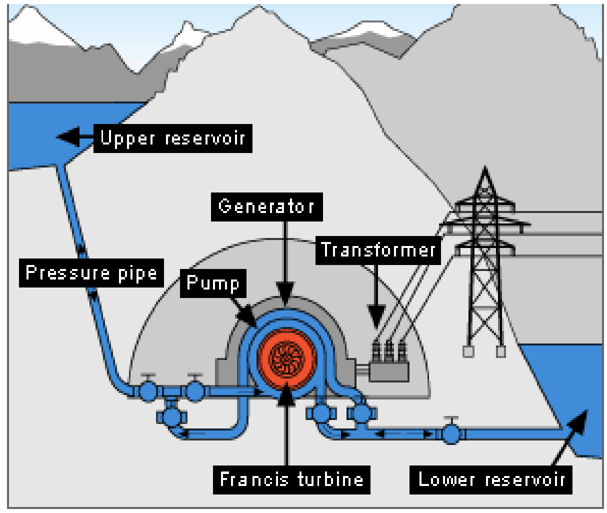
Figure 78: Run of River power station



Source: Deutsche Bank Snowy Hydro Research

Pumped storage: Under this scheme, excess electrical capacity is utilized to pump water to an upper level reservoir during the period of low demand. This pumped storage water is utilized to generate more electricity. Reversible turbine/generator assemblies play the dual role of pump and turbine. Generators spin the turbine in the reverse direction which pumps water from the lower reservoir to upper reservoir.

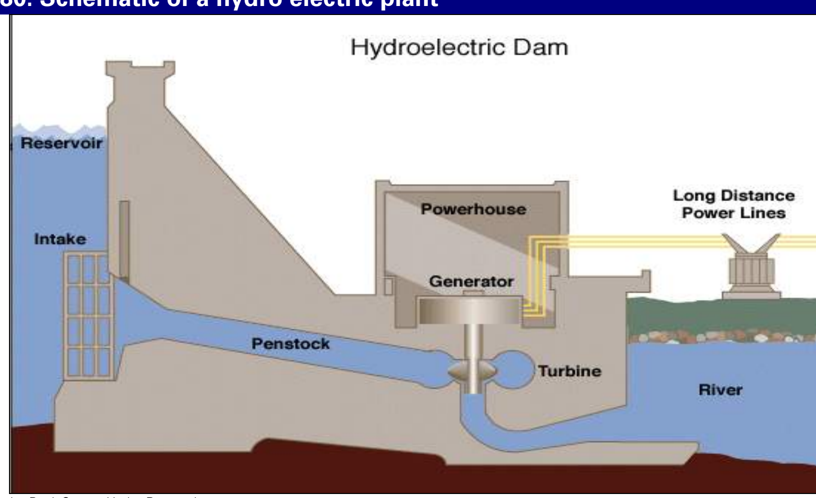
Figure 79: Pumped storage



Source: Deutsche Bank Snowy Hydro Research

Operation of hydro electric generators

Figure 80: Schematic of a hydro electric plant



Source: Deutsche Bank Snowy Hydro Research

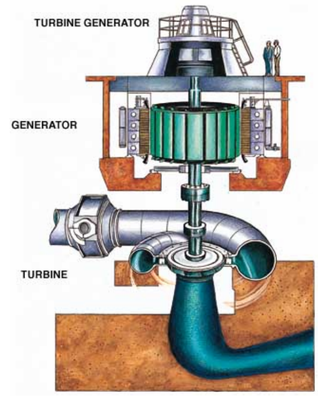
The main characteristics of a hydro electric plant are as follows:

- Water is collected and stored in the dam above the station for use when it is required. Some dams create big reservoirs to store water by raising the levels of rivers to increase their capacity. Other dams simply arrest the flow of rivers and divert the water down to the power station through pipelines.
- The Penstock is the pipe or tunnel carries the water from the dam to the turbine. The pressure of the water pushes against the blades and turns the turbines.
- The rotating turbine is connected to a generator which generates electricity. Turbines convert the kinetic energy of the flowing water in to mechanical energy.
- Transmission lines transport the electricity to be distributed to end users.

The key components of a hydro electric plant include the following:

- **Dams:** Dam is a barrier constructed across a waterway to control the flow of water or raise the level of water. Dams are made of timber, rock, earth, masonry, or concrete or of combinations of these materials and have been constructed mainly for irrigation and agricultural purposes. Most modern dams are multipurpose projects created for the purpose of hydropower generation, river management, irrigation and flood control. The dam controls the flow of water and stores the water in the reservoir to produce electricity. Some dams create big reservoir to store water by raising the water level of rivers to increase their capacity. Other dams simply arrest the flow of river and divert the water down to water station through pipelines. It ensures the continuous supply of water in the reservoir and avoids any stoppage in the production. The flow of this water can be controlled with the opening and closing of the gates or pipes. The dam wall can also create a high water level, which creates more pressure in the pipes to the turbine.
- **Water turbine:** The water turbine is a rotary engine that takes energy from moving water to rotate the blades of the turbine driving the electric generator attached to it. The amount of energy available from water depends on both the quantity of water available and its pressure at the turbine. The greater the height of the water above the turbine, the more energy water will impart to spin a turbine, greater the power output of the generators. The head and the volume of water discharged at the power site and the desired rotational speed of the generator generally determine the type of turbine to be used.
- **Intake:** Intake is typically the highest point of hydro system, from where water is diverted into the pipeline that feed the turbine. It serves two purposes. Create a smooth air free inlet of water to pipeline. Remove dirt and debris to ensure that pipeline does not get affected.
- **Penstock**: A vital part of the hydro electric system, the penstock is the tunnel through which water flows to the turbines. The diameter and slope of the penstock determines the fall of the water. The greater the diameter and slope of the penstock, larger the flow of water and more electricity production.
- **Surge tank**: The surge tank is usually utilized where the distance between reservoir and turbines are very large. It hydraulically isolates the turbine from the deviations in the head produced by the wave effects in the conduits.
- **Electricity generator**: Electric generator attached with the turbines converts the mechanical energy produced by the turbines to electrical energy. The force of the flowing water drives the rotation of turbine's blades attached to the generator shaft. As the shaft rotates the generator is spun to create electricity. After the water has given up its energy to the turbine, it is discharged through drainage pipes or channels called the "tailrace" of the power station for irrigation or water supply purposes downstream. A schematic of a water turbine is detailed in the following diagram.

Figure 81: Cross-section schematic of a hydro generation unit



Source: Deutsche Bank Snowy Hydro Research

- **Powerhouse**: This is the building that houses the turbines generator and controls. It provides a place for system components to be mounted and protects them from outside elements.
- **Drive system**: The drive system integrates the turbine with generator. It allows the turbine to spin at the required rotations per minute (rpm) that ensures best efficiency while driving the generator at a suitable rpm to produce the correct voltage and frequency.

The quantum of electricity generated from water depends upon the fall and the flow of water. The amount of water fall and flow is dependent on the distance water has to fall and volume of water falling. The height difference between source and water outflow is called the Head. When water is diverted from a stream into a pipeline to direct it downhill through the turbine, the vertical drop (head) creates pressure at the bottom end of the pipeline. The pressurised water creates the force that drives the turbines. The greater the height (or head) of the water above the turbine, the more energy each cubic meter of water can impart to spin a turbine (which in turn drives a generator). The greater the quantity of water, the greater the number and size of turbines that may be spun, and the greater the power output of the generators. This is the reason why hydro electricity plants are generally situated at the bottom of deep and steep sided valley or gorges or near base of a dam so that they can take the advantage of large fall of huge water source.

Critical factors impacting hydro generators

Hydro electricity production depends upon the nos. of variable. Some of the variables are natural and others are artificial. A brief introduction of the variables is as follows:

Rainfall in catchment areas: The area of land surrounding and sloping towards the hydro electricity plant is called catchment area. The hydropower output depends upon the rainfall received in the area concerned and the proportion of rainfall that runs off into the storage. The volume of the rainfall that moves to the storage depends upon the catchment area. Catchment area's geology structure and climatic conditions are generally taken into account while making feasibility study for the proposed hydropower plant.

Size of reservoir: Reservoir is used to store the water. It can be natural lake or pond or may be constructed artificially. Water from the stream is generally stored in the reservoir to ensure the continuous and reliable fuel supply to the power plant. The size and the depth of the reservoir determine the quantity of water that can be stored in the reservoir. Storage capacity of the water is an important determinant of amount of electricity that can be produced from the power plant.

Flow rate and head: Flow is the quantity or the volume of water, which is diverted downhill to produce the electricity. It is measured in terms of gallons per minute (gpm), litres per minute or cubic feet per second (cfs). Flow rate is directly related to electricity produced. Greater the flow rate more electricity will be produced.

Head is the height difference between source and water outflow. It determines the water pressure, which is created by the difference in elevation between water intake and turbine. Head can be expressed in terms of vertical distance (feet or meters) or pressure (pounds per square inch). The head can be static or net. Static head is the pressure available at turbine when water is turned off and net head is the pressure at turbine when water is flowing. Net head will always be less than static head because of the friction between water and turbine. Pipeline diameter also has an affect on the net head. Net head is directly related to the electricity output.

Hydrology issues: Flood and Drought: Natural forces like flood and drought also influence the productivity and economics of the hydro electric plant. During the period of flood, the production system is required to be closed to save the equipments from the severe loss. On the other hand in the period of drought, scarcity of water reduces the availability and capacity factor of the plant. Thus the hydro electric plant is not independent of the surrounding hydraulic conditions and largely influence by the vagaries of the hydrological cycle.

Environmental consciousness: Construction of dams for the purpose of electricity generation involves the unrecognized cost to people displaced and the environment. Millions of people are forcibly evicted from their homes, losing their land and livelihoods. Dams have taken huge toll on the environment. They have flooded wild life, fertile farmland, blocked fish migration and disrupted the river flow pattern. Due to the harmful affect on the environment concerned, many social organisations have raised issues against the dam construction. Thus the increasing consciousness of the society about adverse affect of dam on the environment raises the question on the potential hydropower generation capacities.

Appendix 1

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Additional information available upon request

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Company	**Ticker**	**Recent price***	**Disclosure**
Infigen Energy	IFN.AX	0.72 (AUD) 8 Nov 10	NA
AGL Energy Ltd.	AGK.AX	16.23 (AUD) 8 Nov 10	8
Origin Energy	ORG.AX	16.57 (AUD) 8 Nov 10	8,14

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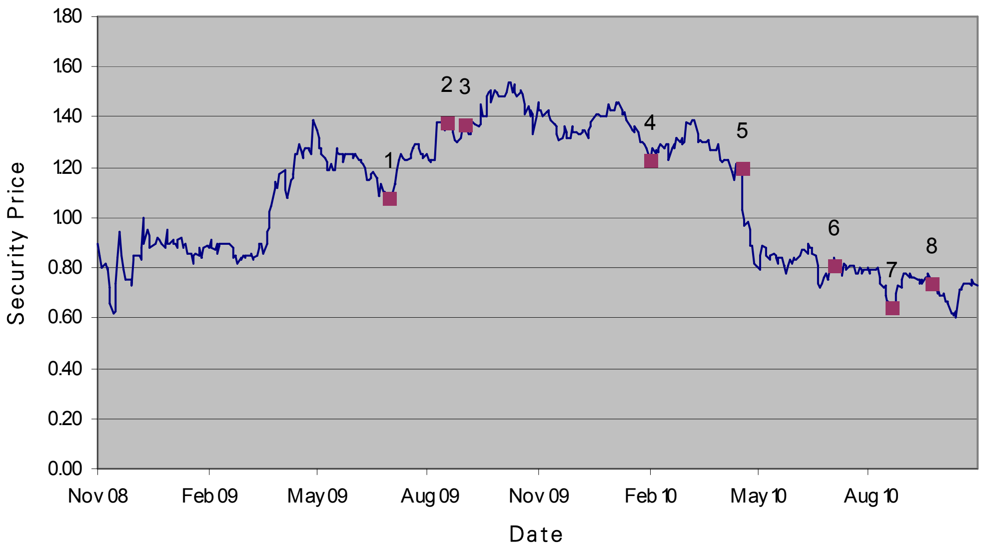
(as of 08/11/2010)



Previous Recommendations

Strong Buy
Buy
Market Perform
Underperform
Not Rated
Suspended Rating

Current Recommendations

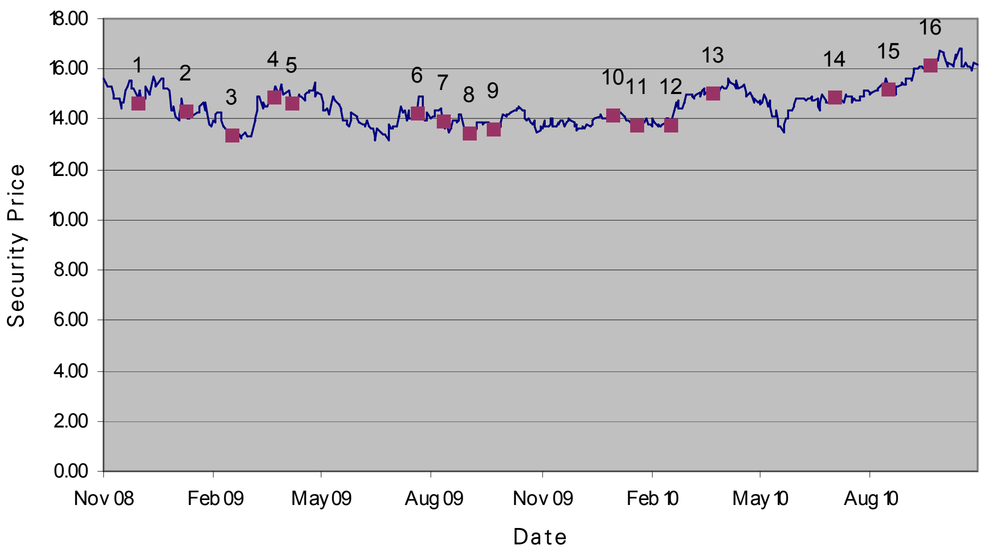
Buy
Hold
Sell
Not Rated
Suspended Rating

*New Recommendation Structure as of September 9, 2002

1.	9/7/2009:	Buy, Target Price Change AUD1.50	5.	27/4/2010:	Buy, Target Price Change AUD1.40
2.	27/8/2009:	Buy, Target Price Change AUD1.75	6.	12/7/2010:	Buy, Target Price Change AUD1.35
3.	11/9/2009:	Buy, Target Price Change AUD1.70	7.	30/8/2010:	Buy, Target Price Change AUD1.00
4.	11/2/2010:	Buy, Target Price Change AUD1.65	8.	1/10/2010:	Buy, Target Price Change AUD0.95

Historical recommendations and target price: AGL Energy Ltd. (AGK.AX)

(as of 08/11/2010)



Previous Recommendations

Strong Buy
Buy
Market Perform
Underperform
Not Rated
Suspended Rating

Current Recommendations

Buy
Hold
Sell
Not Rated
Suspended Rating

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3.	25/2/2009:	Buy, Target Price Change AUD17.90	11.	29/1/2010:	Buy, Target Price Change AUD17.40
4.	31/3/2009:	Buy, Target Price Change AUD17.60	12.	26/2/2010:	Buy, Target Price Change AUD17.35
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7.	20/8/2009:	Buy, Target Price Change AUD17.00	15.	26/8/2010:	Buy, Target Price Change AUD17.15
8.	11/9/2009:	Buy, Target Price Change AUD16.80	16.	29/9/2010:	Buy, Target Price Change AUD17.70

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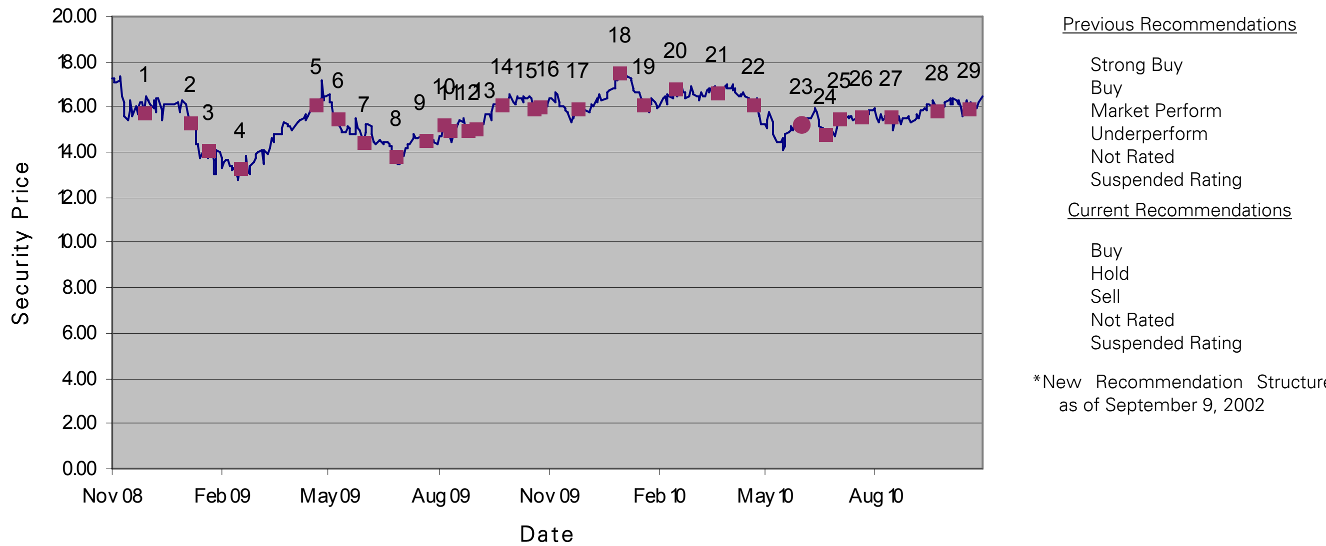

1.	8/12/2008:	Buy, Target Price Change AUD19.20	16.	2/11/2009:	Buy, Target Price Change AUD20.80
2.	14/1/2009:	Buy, Target Price Change AUD19.90	17.	4/12/2009:	Buy, Target Price Change AUD20.75
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14.	2/10/2009:	Buy, Target Price Change AUD20.45	29.	27/10/2010:	Hold, Target Price Change AUD16.70
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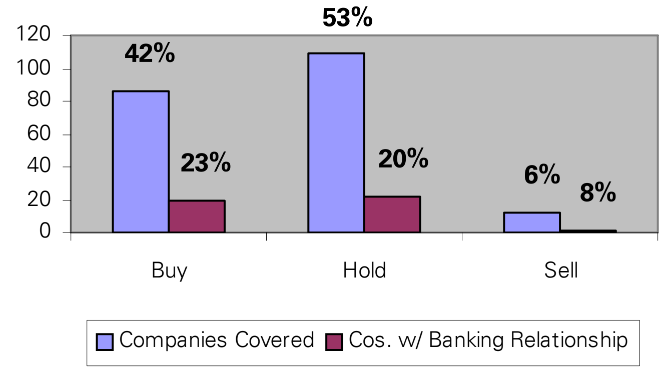

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