Renewable Energy in Australia – 20% by 2020
Can this be achieved?

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***Abstract**: The Federal Government has proposed both the Carbon Pollution Reduction Scheme and Renewable Energy Target as a means of reducing greenhouse gas emissions and increasing the deployment of clean and renewable energy technologies. As we have seen by the reduction targets proposed, the Government is still giving priority to economic considerations over environmental concerns.*

The 20% target proposed has been quantified at 45,000 GWh, an increase of 35,500 GWh above the current required target of 9,500 GWh by 2010. Whilst there is no doubt that Australia has sufficient resources to meet this goal, the questions that need to be answered are whether the policies proposed by the Government will be sufficient to drive private investment into this sector, whether the technology to be relied upon will be able to deliver within the time frame set and whether there is or will be sufficient infrastructure to meet this goal.

These issues cut across a number of disciplines including environmental, engineering and economic analysis. This paper highlights those issues which will require greater research and discussion between industry, society and all levels of government to ensure that we are able to meet the targets set and demonstrate on an international basis that as a country we are now willing to address global concerns.

Introduction

With a change in Federal Government, Australia has ratified the Kyoto Protocol and is now moving forward with the introduction of a number of policies designed to combat climate change. Focus has been on the greenhouse gas emissions from the stationery energy sector, with this paper looking at whether the targets set can be achieved.

Australia is trying to establish a renewable energy sector from a position well behind the rest of the world. Many countries have been slowly building renewable energy capacity as a way of combating energy security concerns; however with Australia's vast resource base (particularly coal, uranium and gas) our renewable energy sector is being established as a response to global climate change issues.

The Federal Government has proposed both the Carbon Pollution Reduction Scheme (CPRS) and Renewable Energy Target (RET) as a means of reducing greenhouse gas emissions and increasing the deployment of clean and renewable energy technologies. As we have seen by the reduction targets proposed (particularly with the CPRS), the Government is still giving priority to economic considerations over environmental concerns, which is further evident by the current proposal to delay the introduction of the CPRS by a further twelve months. This is further reinforced by recent announcements indicating the CPRS will be delayed by a further twelve months.

The 20% RET target proposed has been quantified at 45,000 GWh, an increase of 35,500 GWh above the current target of 9,500 GWh by 2010. Whilst there is no doubt that Australia has sufficient resources to meet this goal, the questions that need to be answered are whether the policies proposed by the Government will be sufficient to drive private investment into this sector, whether the

technology to be relied upon will be able to deliver within the time frame set and whether there is or will be sufficient infrastructure to meet this goal.

Addressing many of these issues will involve both policy measures and funding from all levels of government, but particularly at the Federal and State level. As noted above, the Federal Government have already chosen their preferred policy measures, with the States now needing to concentrate on policy that focuses on those renewable resources that are both plentiful and able to be economically utilised within their boundaries (Dodd, 2008).

These issues cut across a number of disciplines including environmental, engineering and economic analysis. This paper highlights those issues which will require greater research and discussion between industry, society and all levels of government to ensure that we are able to meet the targets set and demonstrate on an international basis that as a country we are now willing to address global concerns.

Electricity Sector

There is no doubting the fact that Australia is abundant in natural resources, with renewable energy being no exception. Considerable opportunities exist for the deployment of solar, wind, biomass and geothermal generation technologies. Our extensive coastline will also allow for wave and tidal generation opportunities to be explored.

When considering what renewable energy technologies should be utilised, decisions should reflect the need to harness those resources where they are both plentiful and cost effective (Dodd, 2008). For the purpose of this paper, emphasis has been given to the State of Queensland.

The electricity sector is the major source of greenhouse gas emissions within Australia and will therefore come under increased pressure as we try to meet both domestic and international emission reductions. As we have now committed to the Kyoto Protocol, these changes will need to be implemented within the next ten years. The Government has committed to introducing a Carbon Pollution Reduction Scheme (Emissions Trading) as well as increasing the existing Mandatory Renewable Energy Target (MRET) from 10% to 20%, effectively increasing the required generation from renewable sources from 9,500 GWh to 45,000 GWh.

To put this in context, Queensland's annual delivered electricity for the 2007-2008 financial year was forecast to be 46,000 GWh (Powerlink Queensland, 2008)

The above target will be further extended by the use of green power schemes by electricity retailers whereby consumers have the option of electing to purchase 'green power'. Any green power purchased cannot be used as part of that retailers obligations under the RET legislation.

Figure 1 indicates that Australia's total emissions have remained fairly constant over recent years; however the contribution of total emissions provided by the stationary energy sector has increased from 23% to 35%. It is not anticipated that this trend will change over the short term as new generating capacity coming online is still predominately coal based, whilst other emission intensive industries and processes are looking at measures that will create short-term emission reductions.

Within the electricity sector, these changes will need to be implemented in the short-term to achieve any significant emission reductions. This will see a shift to low-emission existing technology that is already relatively mature and commercially available. This may force the industry to look outside of its current focus of 'cleaning' up the existing coal based technology through carbon-capture and storage (CCS) or underground gasification techniques.

It is acknowledged that the Queensland Government has already legislated for electricity portfolios to increase the total amount of electricity supplied from gas-fired plant (Queensland Department of Mines and Energy, 2006), yet this may not be sufficient to meet the emission reductions that will be demanded from this sector on a national basis. The Queensland Government has further announced their intention to lift the current Gas Scheme from 13% to 18% (Queensland Government, 2007) nonetheless, proposed changes to the MRET target will also see alternative renewable generating sources required.

The research undertaken has initially looked at what technology options exist to meet increases in demand and replacement of retired plant through renewable fuel options and whether these fuel options exist with sufficient quantity to satisfy proposed legislative requirements.

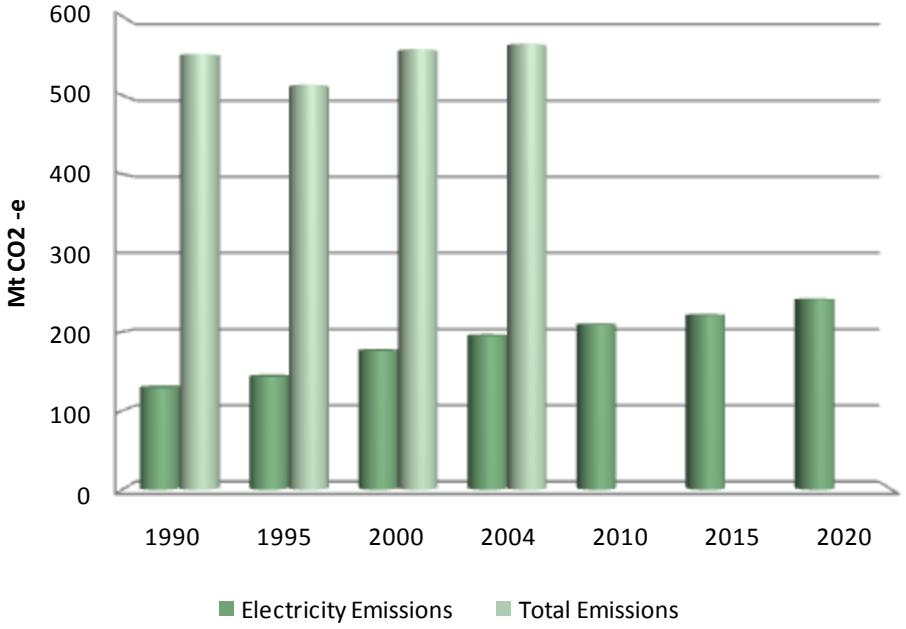

Figure 1 - Emissions from Stationery Energy
(Australian Greenhouse Office, 2006)

It is also acknowledged that mature technology utilising renewable fuel options does not have the capacity that can be provided by the current coal-fired plants. If this type of plant is introduced it will result in a larger number of smaller generating plants. This will provide a number of benefits and opportunities for the sector, including the introduction of new investors and increased competition; however timelines for deployment will be closer to 2020 than now.

The focus of power generation in Queensland will remain (at least for the short-medium term) on coal and gas-fired plant. This was re-enforced by the Government's Task Group on Emission Trading (Department of the Prime Minister and Cabinet, 2007) which commissioned a number of reports, including the effects that the proposed scheme would have on base-load generation. This report was limited to the scenario of gas-fired plant becoming cost effective against coal-fired plants. No real attention was placed upon other fuel sources taking a larger share of total generating capacity.

Whilst the aim of the scheme is emission abatement, the report highlighted research and development priorities as being in the areas of clean-coal, solar and geothermal – all areas in which Queensland has ample resources (Department of the Prime Minister and Cabinet, 2007).

The problem with the above is that none will meet any abatement goals under the proposed scheme within the time frames that are being proposed. (Note that the actual emission targets will not be set until 2010; however much of the technology referred to above may be at least 10 years away from being fully commercially developed and deployed.) This problem will now be further exacerbated through the decision taken by the Rudd Government to sign the Kyoto Protocol, which may impact heavily upon the abatement goals set, yet also, based upon recent announcements, delay the introduction of the scheme.

Under the emission trading structure it is assumed that generators will be subject to individual emission quotas based on the historical amount of electricity they have produced. The only means to overcome their initial emission hurdle is to supplement or replace their existing generation with lower emitting generation. In the absence of CCS this provides two opportunities: -

1. To establish renewable generators
2. To co-fire existing plants with low emitting fuel

The use of biomass fuel and supplementary biomass generators would provide the short-term solution, as research indicates that co-firing of coal with biomass (5% – 10%) can deliver emission savings equivalent to the biomass content (UK Department of Trade and Industry, 2005).

Ultimately, replacing coal-fired plant with natural gas as is happening in Queensland, emission reductions of approximately 50% can be achieved, which will involve long-term capital costs as will the introduction of coal-fired plants with CCS. However, also taking a long-term view, both of these processes should only be considered as transitional, as fossil fuels are still a finite resource.

The renewable or low-emission generating plant that has or is approaching the mature stage of the technology cycle will rely upon having a large number of smaller capacity generating plants. This is particularly true if these plants are to be utilised in meeting all new capacity required due to increased demand or meeting older plant retirements.

There has also been little research into the effect on distribution of whole communities converting to solar generation (roof-top PV systems) at a domestic level, where daily generation may exceed use, feeding back into the grid and the reverse occurring at night. Currently most States have introduced feed-in tariffs for this type of generation, with current proposals for a national system being investigated by a Senate committee (*Inquiry into the Renewable Energy (Electricity) Amendment (Feed-in Tariff) Bill*, 2008).

Economic Aspects and Current Electricity Generation

Technology and economic aspects of any innovation are closely interlinked which ultimately defines the level of usage of the technology. The potential of the technology can be described as either *economic*, where it is technically feasible and economically viable enabling it to be fully utilised in a market failure free environment; *techno-economic*, where conditions are similar to above, but where constraints such as consumer preference, financial, social and institutional barriers exist or *technological* where it is universally used without constraint (Painuly, 2001). It is the aim of any new technology to move from its current level of usage or market potential, through the above levels to obtain its technological potential.

The purpose of policy instruments is to provide a sustainable platform for industry to strive for technological change and introduction of innovative technology. In our current scenario, policy (such as the proposed CPRS and RET) aim to drag a new technology through the above process. The aim of the RET's to subsidise new renewable technologies during the initial years until the technology learning and economies of scale result in a comparable cost structure. At this point in time it is envisaged that the CPRS will be sufficiently mature as to ensure that future investment is targeted towards the renewable energy sector.

Irrespective of the technology, the development process goes through a number of economic phases that aid its introduction and move through the above levels.

The current generating capacity within Queensland is shown in figure 2, whilst figure 3 sets out those projects that have either been commenced or have progressed from feasibility to obtaining relevant consents (development application stage including obtaining all relevant environmental consents).

Looking initially at figure 2 (first pie), it indicates that 90% of our current generation still comes from fossil fuel generation. With the policies currently proposed this will have to reduce substantially, and based on demand estimates, all new generation will have to come from renewable sources to meet the objectives set.

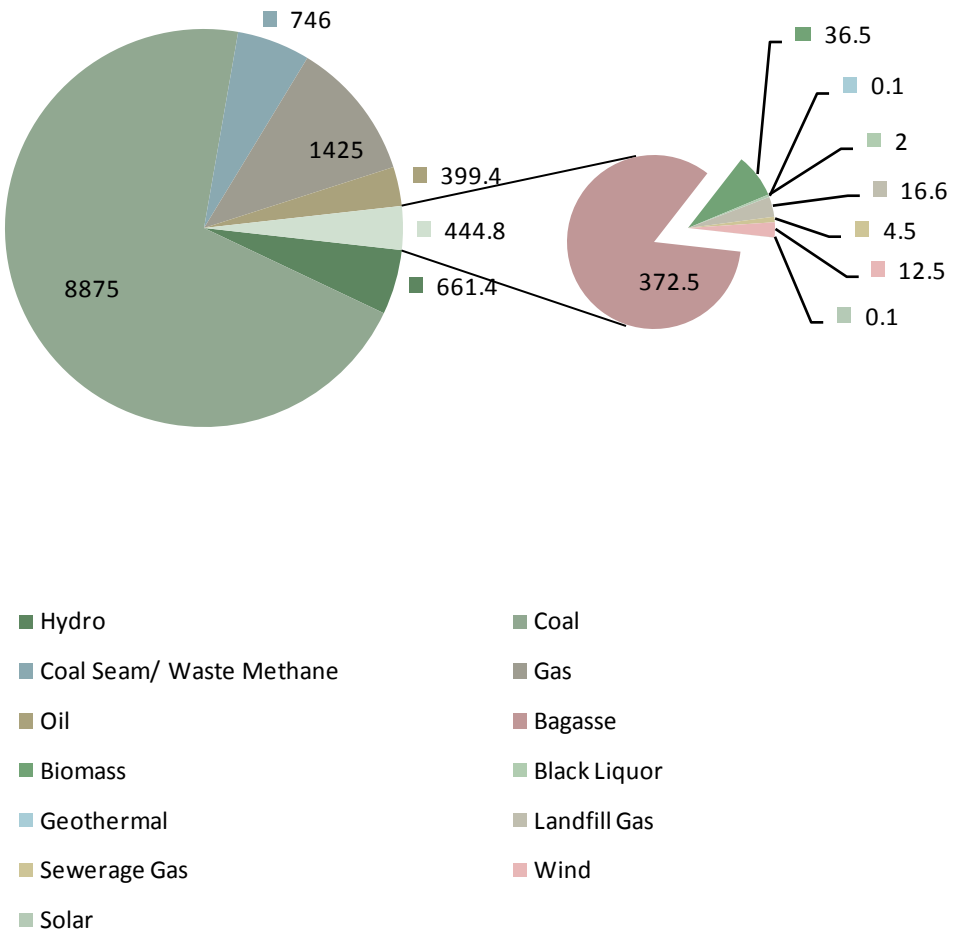

Figure 2 - Queensland Installed Generation (MW) 2008
(NEMMCO, 2008)

The research to date has indicated that there is potential within a number of areas, in both the long and short-term. Geothermal provides the greatest opportunity for base-load renewable electricity generation, with a number of potential sites currently undergoing the tender process within Queensland.

Similarly solar thermal opportunities will also arise once the technology, particularly in relation to storage options, are further developed. Over 50% of the State's lands are still under Government ownership, providing many opportunities.

Utilising existing solar PV and solar thermal applications provides a number of feasible opportunities, particularly where they are located near centres of demand. However for large applications, no government subsidies are currently available.

Revised wind mapping for the state indicates that there are a number of areas within the State with significant wind resources. Whilst many of these resources are not located near current infrastructure, it does provide the opportunity to utilise those resources that are at the commercially deployable stage of development.

Those projects that are currently committed do not reflect the renewable energy opportunities available.

The data shown in figure 3 indicates that the only renewable projects currently being contemplated within Queensland are utilising wind energy, with no time frame indicated for one of the projects.

Further research is required to consider the existing life of current generating plant compared to forecast demand and supply and how this may be met. Much of this work can be based upon research already undertaken by NEMMCO and ABARE, however, different weightings may be applied based upon current economic and environmental trends and changes to legislation.

That proportion of increased energy generation capacity will also need to be further broken down into whether it is being derived from centralised or decentralised generating plant. This distinction will be based upon the capacity, ownership and intended use of the new plant. The size and type of generating plant that is currently available will need to be looked at, and scenarios developed utilising available technology.

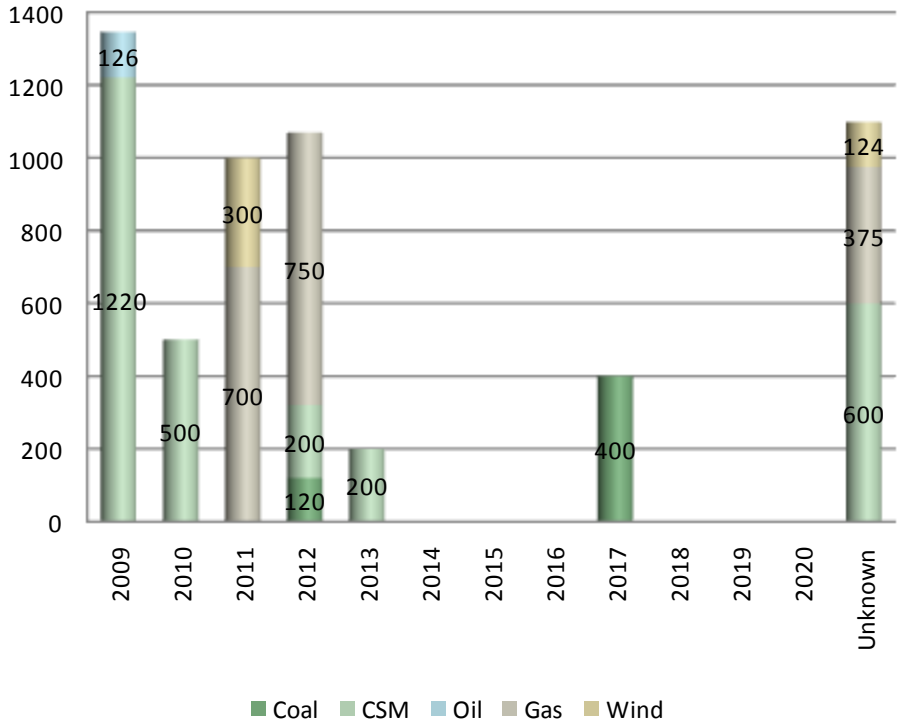

Figure 3 - Electricity Generation Projects 2009-2020 (MW)
(ABARE, 2008; Walker, 2008)

Current Technology and Application to Queensland

The technology in use in Queensland represents the markets decision to utilise those resources that are both inexpensive and abundant. The Queensland government, in its plan to reduce greenhouse gas emissions has also based legislation on economic rather than environmental grounds, prescribing the use of more gas-fired plant. Similarly, research funding has been provided to the existing fuel sector to commercialise 'clean' coal technologies rather than alternative 'cleaner' fuels. Proposed Federal legislation requiring the use of renewable fuels will see the need for changes to the generating mix; however it is acknowledged that most major additions to generating capacity over the next ten years will be either gas or coal with CCS technology (or the ability to retrofit).

The aim of this research is to look at how other renewable technologies can be introduced and help meet increased demand. Irrespective of the technology used, the use of decentralised generating plant is a major option, particularly given the size of the state and the location of energy demand.

The majority of the urban population is located in the south-east corner of the state, which will be heavily dependent upon the existing grid system. Similarly the larger urban areas in the north of the state, such as Townsville and Cairns, will also be reliant on the grid. However, it is with these outlying

areas where the ability to utilise DE systems exists providing opportunities for both current and new suppliers.

The options available to each location are site specific and research will be undertaken to consider the feasibility of renewable generation. The preliminary research to date has found that solar, geothermal, onshore and offshore wind in very limited locations and biomass provides the greatest opportunities. In most cases the technology is available, but is not economic compared to current options.

It is important to look at the availability of technology within Queensland and ease of connection to the existing grid. Suppliers of generators using renewable fuels will be contacted to obtain status of current plant (ability to meet demand) and what specifications/needs are required for grid connectivity.

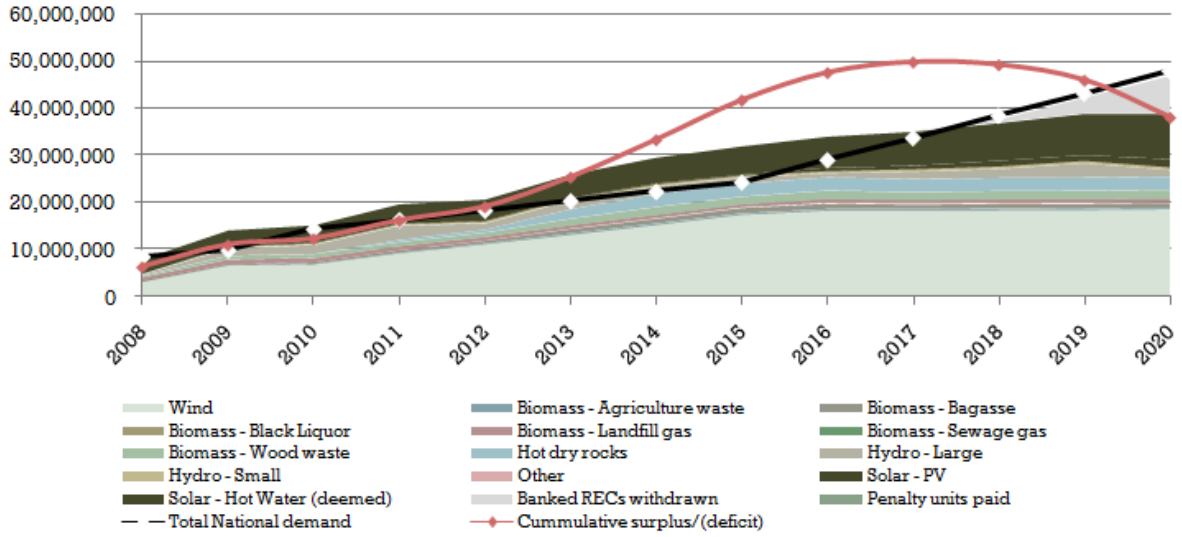

Figure 4 – National REC Supply v Demand (with Banking)
(Herd, 2009)

The Queensland State Government has announced that they will subsidise 200,000 solar hot water (SHW) services over the next three years (Office Of Clean Energy, 2009). The production of domestic hot water accounts for approximately one-third of domestic electricity, which may have a significant effect on domestic demand and initial REC projections. It is also important to note that this will only displace current electricity demand rather than create generation.

This may have the effect of further delaying renewable energy investment due to the short-term over-supply of REC's as indicated in figure 4. This shows that the REC's created through deemed SHW sit above the total national demand and provide a 'bank' that can be used in later years, which is clearly not the objective of the policy.

As SHW displaces actual electricity demand, the need for additional generation is also deferred and as noted above, all new generation will come from cleaner, if not renewable sources. This highlights the impacts that policy decisions will have on the renewable energy sector within Queensland.

Conclusion

Whilst it is evident that sufficient renewable energy resources exist, additional policy measures are required to drive the necessary investment in this sector. Further modelling is necessary to determine the extent of the measures required. Current world economic circumstances are leading to delays in policy implementation and therefore deployment of renewable energy.

This will result in the meeting of the proposed portfolio standards being extremely doubtful, with many of the REC's created during the initial portfolio establishment period expected to come from

electricity displacement (such as solar hot water systems) rather than from actual electricity generation.

Local policies will need to be established to drive investment in those areas where they have the greatest ability to harness resources where those resources are both plentiful and cost effective. In many cases this will require the co-operation of not only State, but also Local Government. These bodies need to undertake an inventory of available resources to allow for future investment.

It is also evident that government at all levels need to weigh up economic and environmental issues when looking at policy decisions, whilst one policy may stimulate the economy, the effect that it has on policy aimed at mitigating greenhouse gas emissions and other climate change issues may be significant.

Further research and modelling on the effect of policy issues is needed to ensure that the effects of proposed climate change and economic stimulus policies do not result in the stalling of investment in sectors where it is needed most, such as renewable energy.

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