Overcoming the Barriers to Renewable Embedded Generation in Tasmania

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Cover Photo: *Bruny Island Health Centre, Tasmania, August 2010.*
See also video: http://www.youtube.com/watch?v=mgjCK_WeI7w

Disclaimer

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Executive Summary

This report examines the opportunities for overcoming the barriers to the wide scale adoption of commercial scale renewable embedded generation in Tasmania. For the purpose of this report, Embedded Generation (EG) is a term that describes an electricity generator, which is electrically connected to the load side of a customer's billing meter, within a customer's installation.

This report specifically focuses on "commercial scale" embedded generation, which is defined as being from 10KW to 3MW. At the bottom end of this scale is, for example, the Bruny Island Health Centre embedded generation plant, through the Marine Board Building wind turbines, to the mid-size Nichols Poultry wind turbine and above. Embedded generators of this scale are above the size (10KW) where "Feed-In Tariffs" are generally available in Tasmania to incentivize the uptake of small scale renewable technology.

This report aims to assist the Tasmanian Renewable Energy Industry Development Board (TREIDB) to influence policy and decision makers, through highlighting and exploring the experiences of the pioneering embedded generation stakeholders in Tasmania. Revealing current policies, practices and their application in a practical context, to highlight the hurdles end use customers face in the implementation of embedded generation projects.

Most of Tasmania's electricity is supplied by large hydro-electric schemes, the Tamar Valley natural gas fired generator and imports from Victoria, across the Basslink interconnecting cable.

Whilst there are economies of scale from these large centralised energy plants, around the world the response to climate change and technological advances in renewable energy generation are leading to strong uptake of smaller scale generation plants known as “Distributed Generation”, located closer to customer loads.

Distributed Generation, the parent category of Embedded Generation, has been identified by the CSIRO’s Intelligent Grid report as having a significant welfare gain ($130Bn) and a key role to play in the early action response to a carbon constrained future (CSIRO, 2009, P. 314.).

The research commenced with a literature review which identified key local, national and international themes. Key in these themes was the increasing take up rate of renewable generation, driven by the global response to climate change. The literature review also revealed the implications of this growing trend, specifically in its impact on the investment required by electricity distribution network providers to manage the move from centralised to distributed generation.

Thirteen interviews and one focus group were held with local embedded generation pioneers and stakeholders. The drivers for embedded generation identified included:

1. A sense of responsibility by business owners to take a lead role in responding to climate change;
2. An expectation that embedded generation would lead to reduced electricity costs;
3. To exhibit an environmentally sustainable business;
4. A risk management response to climate related policy initiatives (I.e. NABERS);

5. To help meet state government internal targets for reduced energy consumption and greenhouse gas emissions.

6. That embedded generation allowed a business to “take back control” and to be “energy independent”.

Despite the relative cost leadership position enjoyed by wind turbines compared to other commonly available renewable energy technologies, the only commercial scale embedded generation projects commissioned in Tasmania had benefitted from government grants or had been undertaken by a government department.

The lack of a price on carbon and the complexity in setting equitable policies to return the most cost efficient early action response to climate change, were both seen as significant challenges. In particular that, economic signals from some climate change policies appear to have been misinterpreted by consumers and may have masked the true cost of the transition to a lower carbon electricity supply.

The report sets out 16 recommendations to overcome the barriers to renewable embedded generation, summarised as follows:

1. Reviewing the distribution pricing model in light of the move from centralised to decentralised generation and demand side response.

2. Seeking reforms to the planning and approvals process for wind turbines, promoting consistency and reducing elapsed time.

3. Facilitating improvements to the embedded generation supply chain, improving confidence and simplicity for consumers.

4. Promoting case studies and other fact based information on the physical and financial performance of local embedded generators.

5. Leveraging any future embedded generation grants by requiring recipients to provide performance data to support R4 above.

6. Providing Distribution Network Service Provider (DNSP) pricing signals for embedded generation.
7. Publishing DNSP network constraints and opportunities.
8. Improving DNSP connection agreements and processes.
9. Investigating inequities in the DNSP connection point definition for agri-business and other dispersed connection point industries.
10. Addressing customer knowledge gaps, which lead to market failures (identified in the “Wedges Report”), in the efficient early response to climate change.
11. Promoting the role of REC’s in supporting investment in renewable embedded generation.
12. Pursuing “Scale Efficient Network Extension” policies.
13. Seeking alternate retail energy products with longer reconciliation periods for seasonal businesses.
14. Developing a social license for Tasmania’s renewable energy industry based on community consultation, earned trust and confidence.
15. Improving Retail energy agreements and processes.
16. Pre-empting the technical issues of system security and inertia, likely to arise from increased adoption of renewable energy.

The report concludes that much work remains to be done to facilitate the adoption of renewable embedded generation projects.

To this end we encourage the Tasmanian Renewable Energy Industry Development Board and other stakeholders, to set about using the findings and recommendations contained herein, to influence policy and decision makers, in order to overcome the barriers to renewable embedded generation in Tasmania.

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List of Acronyms

AEMC	Australian Energy Markets Commission www.aemc.gov.au
AEMO	Australian Energy Market Operator www.aemo.com.au (Formerly NEMMCO)
ANM	Active Network Management (See Glossary)
CAP	Consumer Advocacy Panel www.advocacypanel.com.au
CPRS	Carbon Pollution Reduction Scheme http://www.climatechange.gov.au/en/government/initiatives/cprs.aspx
CSIRO	Commonwealth Scientific and Industrial Research Organisation www.csiro.com.au
DAPR	Distribution Annual Planning Report
DG	Distributed Generation (Not necessarily “Embedded”)
DMIS	Demand Management Incentive Scheme
DMIA	Demand Management Innovation Allowance
DNIS	Distribution Network Impact Study
DNSP	Distribution Network Service Provider
DSP	Demand Side Participation (/Demand Management)
DSR	Demand Side Response, sometimes called DSM (Management)
DUoS	Distribution Use of System (Industry name for
EG	Embedded Generation (generation connected to the load or customer side of the electricity billing meter)

EUAA	Energy Users Association of Australia www.euaa.com.au
FIT	Feed In Tariff (For a summary of Australia's FIT's see http://www.energymatters.com.au/government-rebates/feedintariff.php#fit-table)
FRC	Full Retail Contestability (All users including households have choice of electricity retailer).
GWh	Giga Watt hour, a measure of electricity consumption. (Giga = 1,000,000,000)
kW	Kilo Watt, A "Point in Time" measure of electricity demand or capacity. (Kilo = 1,000)
kWh	Kilo Watt hour, a measure of electricity consumption over time.
LGAT	Local Government Association of Tasmania www.lgat.tas.gov.au
MRET	Mandatory Renewable Energy Target (See also REC)
MW	Mega Watt, a "Point in Time" measure of electricity demand or capacity. (Mega = 1,000,000)
MWh	Mega Watt hour, a measure of electricity consumption over time.
NABERS	National Australian Built Environment Rating System. *Building Energy Efficiency Disclosure Act 2010.* http://www.comlaw.gov.au/comlaw/Legislation/Act1.nsf/0/C4D275497FCD641BCA257754002D7706?OpenDocument
NECF	National Energy Customer Framework http://www.ret.gov.au/Documents/mce/emr/default.html
NEM	National Electricity Market (Includes states physically connected to the electricity transmission system being Qld, NSW, ACT, Vic, Tas & SA). (Note the UK also refer to their electricity market as the "NEM"). See also AEMO

NER	National Electricity Rules (NER) http://www.aemc.gov.au
Ofgem	United Kingdom's Office for Gas and Electricity Markets
OTTER	Office of The Tasmanian Economic Regulator www.economicregulator.tas.gov.au
ORER	Office of the Renewable Energy Regulator www.orer.gov.au
REC	Renewable Energy Certificate (See also MRET) (E.g. 1 unit of Electricity + 1 REC = 1 Unit of "Green Power")
RET	Renewable Energy Target, See MRET
SENE	Scale Efficient Network Extension
SME	Small Medium Enterprise
TCCI	Tasmanian Chamber of Commerce and Industry www.tcci.com.au
TEC	Tasmanian Electricity Code http://www.economicregulator.tas.gov.au
ToU	Time of Use. Eg. Different Peak and Off Peak pricing
TREIDB	Tasmanian Renewable Energy Industry Development Board http://www.development.tas.gov.au/about/retas
TWh	Tera Watt hour, a measure of electricity consumption over time. Terra = (1,000,000,000,000)

1 Introduction

1.1 Report Overview

This report firstly sets out the research question, “What are the barriers to renewable embedded generation in Tasmania and how they can be overcome”. The report is then structured to introduce the reader to a background of the energy market and the response to climate change both of which are driving investment in distributed renewable energy technologies. The report provides a definition of “Embedded Generation” and its parent category “Distributed Generation”, before providing a contrast of the significant economic differences that currently exist between these two categories.

The report explores a broad range of literature relevant to embedded generation, including environmental, political and economic issues as well as technical and social factors.

The report then describes the findings of the primary research from thirteen interviews with Tasmanian embedded generation pioneers and stakeholders (Appendices 1 – 13). The findings are organized into several categories that broadly follow our pioneer’s decision making processes as they have set out to commission embedded generation projects.

Following this, the findings are discussed and explored, drawing out the barriers and issues raised and contrasting this to the literature. Finally the report makes 16 recommendations for improvements to the economics, policy, planning and technical frameworks to help overcome the barriers to renewable embedded generation in Tasmania.

1.2 The Research Question

The key question to be addressed by this project is, "What are the barriers to renewable embedded generation in Tasmania and how can they be overcome".

This report specifically focuses on "commercial scale" embedded generation, which is defined as being from 10KW to 3MW. Embedded generators of this scale are above the size (10KW) where "Feed-In Tariffs" are currently available in Tasmania to incentivize the uptake of small scale renewable energy technologies.

The research motivation came from a recognition that embedded generation projects in Tasmania were on the cusp of a step increase in activity due to a confluence of factors. In particular that a wind turbine installed in an embedded configuration could in some circumstances, deliver up to double the revenue equivalent, when compared to the same turbine installed as a stand-alone wind farm. That technology, policy, regulatory settings and social changes would alter the relative merits of embedded generation. Together with a concern that, existing customer knowledge, systems and policy regime promoted less than fully informed end use customer decision making.

The case study investigations for the report followed the early progress of several 225KW Wind Turbine proposals. However several of the report's findings also apply to other embedded generation technologies, including co-generation, tri-generation and other renewable energy technologies.

1.3 The Report Audience

The immediate target market for this research piece is the Tasmanian Renewable Energy Industry Development Board (TREIDB). TREIDB has been established under the Tasmanian Development Act 1983 to advise the Tasmanian Government on, and proactively promote the development of, the renewable energy industry in Tasmania.

Other beneficiaries of this research are likely to include the State Government Departments of, Economic Development, Infrastructure Energy and Resources and the Tasmanian Climate Change Office.

In the long run the intended beneficiaries are Tasmania's commercial, industrial, government and agri-business electricity customers.

We all face the rising cost of energy and exposure to the cost of carbon.

Together we must shoulder the burden for the response to climate change in order to reduce the risk that: "the failure of our generation on climate change mitigation would lead to consequences that would haunt humanity until the end of time" (Garnaut, 2008, xlv).

2 Background

2.1 Introduction

This chapter aims to provide a global and local context for embedded generation, introducing the increasing connectedness of the world energy market. This Chapter aims to introduce the factors which are driving embedded generation, specifically electricity price increases, reducing cost of renewable energy technologies and the response to climate change. It describes the economic size of the electricity market in Australia and the rising costs of energy faced by all users.

This chapter aims to explain what an “Embedded Generator” is and how it fits under the parent category of Distributed Generation, providing some examples of what these generators look like and how they differ from other forms of electricity generation.

Another purpose of the chapter is to describe in some detail, how the economics of embedded generation differ significantly from distributed generation, making embedded generation particularly attractive to some end use customers.

Finally to describe the phenomenon of social leadership in the response to climate change and how Tasmanian business leaders are increasingly prepared to invest in climate response.

2.2 A Global and Local Energy and Climate Context

Climate response policies will create new winners and losers as Australia moves to de-carbonise the electricity generation sector. Sir Nicholas Stern noted: “complex policy challenges involved in managing the transition to a low-carbon economy and in ensuring that societies can adapt to the consequences of climate change that can no longer be avoided”. Stern concluded that: “Climate change presents a unique challenge for economics: it is the greatest and widest-ranging market failure ever seen” (Stern, 2006. P. 1).

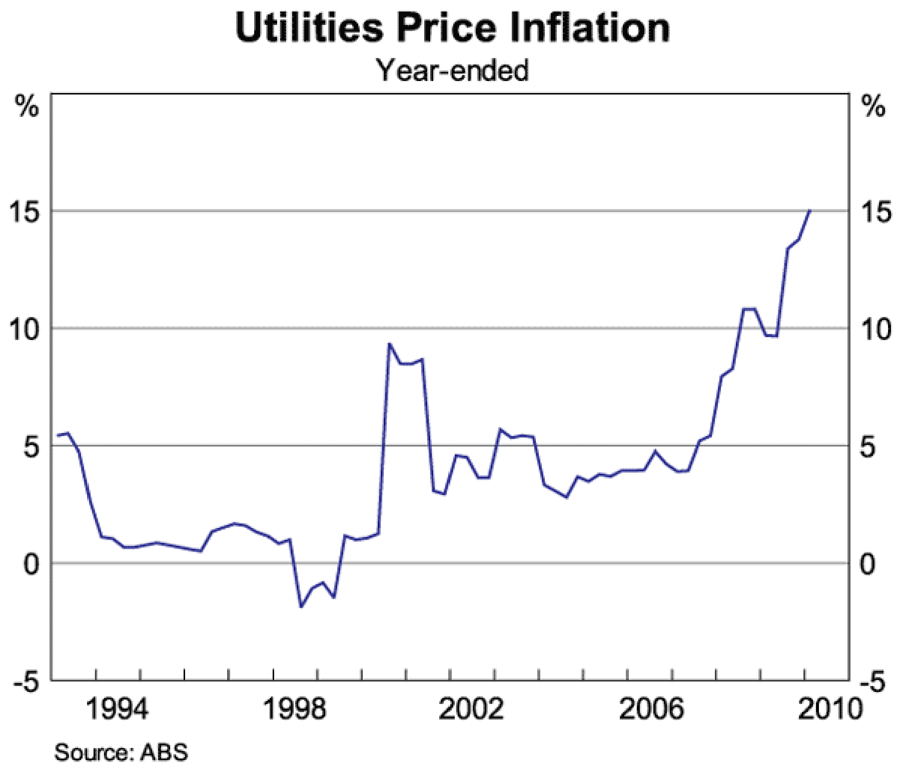
Renowned Australian Demographer, Bernard Salt of KPMG, puts forward that Australia has a role to play in delivering resources, food and energy at ‘Peak Humanity’ in 2070 (Salt, 2010). One clear example of this role is the once isolated Eastern Australian natural gas market, which will soon be connected to the global energy market. Coal Seam Methane gas wells are being drilled in Queensland at an ever increasing rate, to fill enormous gas processing trains at Liquefied Natural Gas plants to be constructed in Gladstone (Santos, 2011). The significance for the Australian market, as foreshadowed by Origin Energy, is that LNG exports from Queensland could be larger than Eastern Australia’s total domestic gas demand, driving prices to export parity (Origin Energy, 2010, Slide 8.).

According to Kent Moors from American investment news company Money Map Press: “the natural gas market is about to go global”. He argues that, “what has been a fragmented, local set of markets is about to become one global market, shattering volatility as everyone tries to adjust, then lower prices, followed by a total shakeup of the energy equation, as oil, coal, solar, wind, nuclear, biomass and wind power are re-evaluated, re-priced and radically reorganized” (Moors, 2010).

Locally, sales of electricity in Australia are in the order of $12b - $14b per annum. In Tasmanian the market size is around $1B per annum. Nationally, electricity costs have grown strongly over the past decade.

“Over the past year, the price of electricity is up by 18 per cent” (Lowe 2010). Utility cost increases have been highlighted by the Australian Bureau of Statistics Utility Price Inflation graph (Lowe, 2010/ABS, 2010), reproduced in Figure 1. below:

Figure 1. ABS Utilities Price Inflation (Lowe 2010).



“The federal government forecasts that the electricity industry will need to spend $100 billion this decade to keep up with demand, while curbing its environmental footprint and improving reliability and quality of supply (Orchison, 2010, P.4.).

Australia's Ministerial Council on Energy has noted that these price rises are expected to occur in coming years due to required investments to meet the challenges of ageing infrastructure, growing demand and policies to reduce greenhouse gas emissions. The Energy Network Association estimates over $42 billion (of network capital expenditure alone), has been approved by energy regulators to help meet these needs over the next five years (Blyth, 2010).

Tasmania has not escaped this trend recording price growth of over 50% between 2002/03 to 2008/09 alone (Brown, 2010 P. 7). This trend is set to continue with the Tasmanian Economic Regulator flagging further increases of some 21% from July 2010 through to July 2012 (Richards, 2010, "*Heat rises*" P. 7).

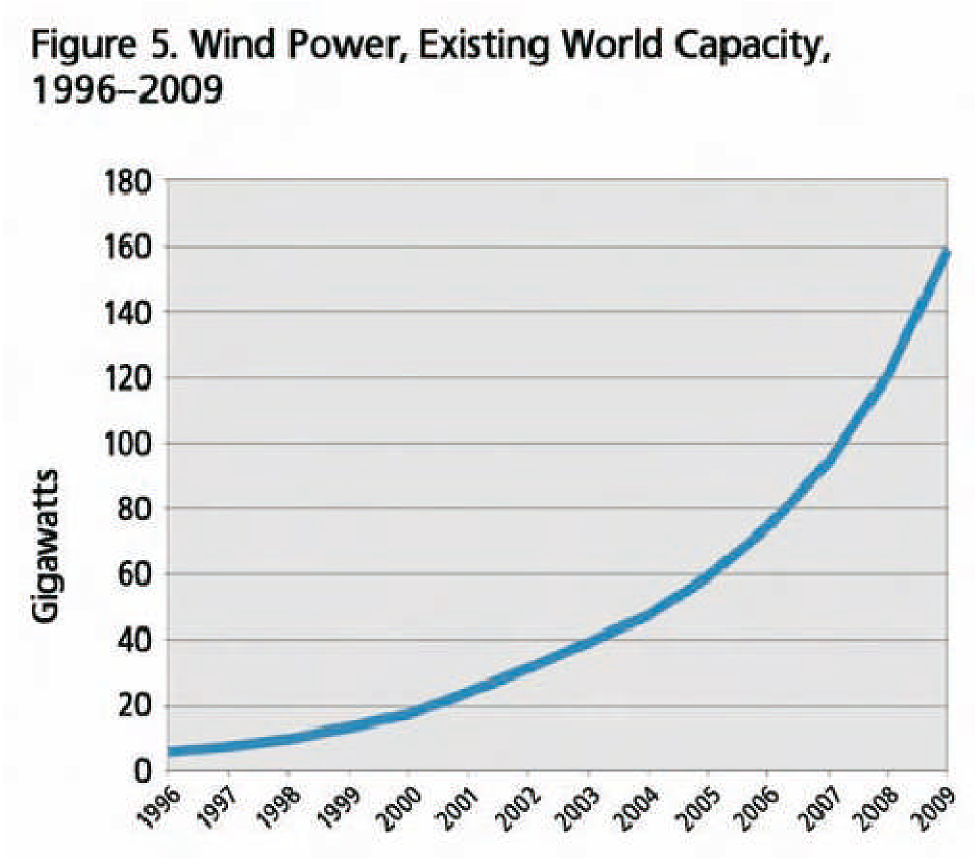
Massive investment in upgrading and maintaining Tasmania's electrical infrastructure is required (Adair, 2010), to replace aged infrastructure and to meet an insatiable increase in peak demand growth. With Transend's $900M transmission works program over five years (2009 – 2014), as highlighted in the EUAA's 2008 Submission: "Transend has applied for total expenditure over the period from 2009 to 2014 of $961m (in 2008$). This is an increase of 71% (in constant 2008$) on the total expenditure that was allowed by the ACCC in its 2004 to 2009 revenue decision" (EUAA, 2008). An Aurora Energy spokesperson was quoted by the Mercury Newspaper as saying that Aurora is also facing a massive, "$588M program of work" (Brown, 2010, 11 Oct. P. 2). In addition to this, uncertainty continues to plague the Federal Government's expanded Renewable Energy Target, with increased targets for 2011 to 2013 announced (EUAA, 2011).

The speed and magnitude of these price rises is forcing businesses to re-think their cost control strategies, with an increasing number prepared (or forced) to invest in innovative efficiency and technology solutions.

2.3 Renewable Energy – Technologies and costs improving

At the same time as electricity prices are growing, the costs of renewable energy products, particularly wind turbines and solar power technologies, are in decline as China and India's manufacturing might grows (REN21, 2010. P 30. & Orchison, 2010, P. 8). The resulting growth in the world capacity of wind power has gone exponential, as renewable energy companies compete fiercely to lower the cost of renewable energy. For example: "Vestas aims to provide its customers with the lowest cost per MWh produced, Cost of Energy" (Vestas, 2011). See Figure 2. Below:

Figure 2. Wind Power, Existing World Capacity 1996 – 2009. Source: REN21, 2010



Internationally, original wind farm developments from the 1990's are being replaced by new higher capacity turbines, often in the same footprint, which sees low cost second hand units enter the market (Joule Logic, 2010).

The Australian Energy Market Operator's October 2010 Electricity Statement of Opportunities Report noted the dominance of wind generation: "As the lowest-cost REC generation with unlimited resources, wind generation will provide the bulk of the necessary generation for the national RET scheme target in the short-medium term, making its economics key to driving the REC price" (AEMO, 2010).

The combination of these factors along with the business communities increasing recognition and preparedness to act on Climate Change (Duddles, 2010) has created a strong commercial motive for businesses to pursue renewable Embedded Generation opportunities.

2.4 Distributed Generation – The Parent

The 2009 CSIRO "Intelligent Grid" report modeled four carbon mitigation strategies using their Energy Sector Model. Results of this modeling showed "Distributed Generation", the parent category of "Embedded Generation", had a "significant role to play in a carbon constrained future" and further that: "distributed energy is found to be an attractive early action response to climate change" (CSIRO, 2009, P. 20-21).

This is because distributed generation can play a bridging role, before large scale, low or zero emission generation technologies can be proven and implemented. The CSIRO sought to value the welfare gain of distributed energy under the Garnaut 450ppm scenario, a scenario in itself, which was found to have benefits which exceeded the costs (Garnaut, 2008, P. xxv), by comparing net energy costs with and without distributed energy over a 40 year period. The result showed distributed energy provided a $130b present value welfare gain, whilst noting the model did not take account of structural change in the economy over time.

However, the quandary, between who should pay for renewable energy and the associated system costs in the short term and the longer term beneficiaries, was highlighted by a speaker from the floor at the 2010 Annual EUAA Conference, who commented that: "The vast majority of consumers are being led to believe that renewable energy technologies are essentially free, through cross subsidies from the REC market and premium Feed in Tariffs" (Anon., 2010).

This comment was said to be in reference to the, "Five for One REC scheme subsidy for Solar Hot Water in NSW", commonly known as the "Solar Credits Scheme" (Anon., 2010).

The message being that the very same legislative support driving renewable energy investment, is also unfortunately obscuring the true cost of this technology from the majority of consumers, who have over time, come to expect individual renewable energy products should be either free and in some cases even present a tax free retirement income.

When questioned in private about these comments, the anonymous speaker added: “I don’t object to the policy, I just think the government should be clear and honest about the true cost and who will end up paying for these schemes. It’s another example of where good public policy and politics collide” (Anon., 2010).

This issue of the cost of Feed In Tariffs (FIT’s) compared to the carbon mitigation effect, was highlighted in a recent news report which stated: “There's no doubt FITs are an expensive way to cut emissions. The ACT government recently estimated the cost of abatement was $195 to $434 a tonne — well over the assumed carbon price, under the government's proposed emissions trading scheme, of about $23 a tonne” (Manning, 2010).

A situation noted in one of our own interviews, which produced the comment: “The climate science says we have limited time to deal with these challenges but I’m not sure we are making the most gainful use of this time” (Appendix 6).

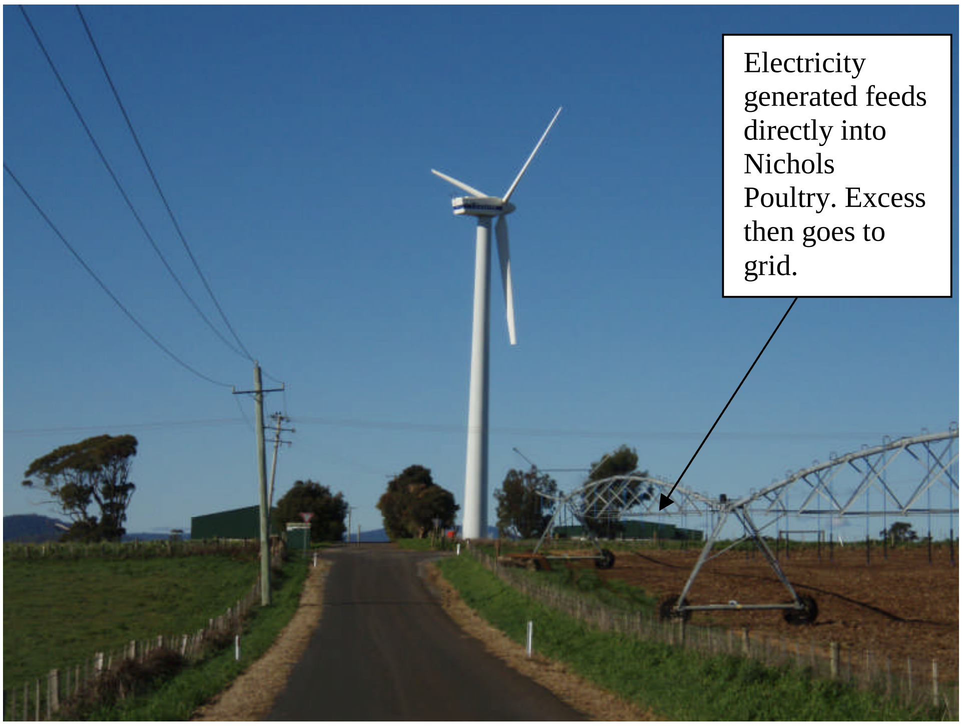
This brings us to the crux of the Embedded Generation economic challenge. The welfare gain of distributed energy over 40 years is impressive (CSIRO, 2010, P. 314), however, “Clearly, whilst the sun and the wind may be free, renewable energy is not” (EUAA, 2010).

2.5 What is Embedded Generation

One of the commercial responses to rising electricity costs and/or climate change is for businesses to install their own electricity generation plants, onsite at their factories and offices. These plants are known as "Embedded Generators". Commercial scale energy users such as Rob Nichols, of Nichols Poultry and Robert Rockefeller owner/operator of commercial and retail buildings at Nekon P/L, have pioneered the adoption of renewable embedded generation in Tasmania.

Robert Nichols suggests renewable embedded generation of electricity can: "act as a security shield against rising electricity prices" (Mounster, 2010). See Figure 3.

Figure 3. Nichols Poultry, Sassafras, Tasmania. 225KW Vestas V27 Turbine.



Embedded generation is a term that describes an electricity generator which is electrically connected to the load side of a billing meter within a customer installation. For another more obvious example of this configuration, see Figure 4., below.

Figure 4. Marine Board Building, Hobart. Showing two of the original four 12KW Muce Vertical Axis Turbines

For the purpose of this report the definition of Embedded Generation is a more narrow definition than that contained in the National Electricity Rules (NER), which merely specifies the generator is connected to the Distribution Network, not the (extra high voltage) Transmission Network.

Although embedded generation falls under the parent category of Distributed Generation, distributed generation does not necessarily have to be connected within an existing customer installation. The economic impacts of this distinction are described in the next section.

2.6 The Economics, Embedded V's Non-Embedded Generation

Distributed Generation (DG) examples include a biomass generator located at a local landfill site and feeding directly into the distribution network, or a micro hydro generator located at a local creek or dam, where again the energy is fed directly into the distribution network, notionally feeding the local township. To make the distinction, neither of the above distributed generator examples are related to any specific customer load.

The National Electricity Market and Network policies treat "embedded" generation quite differently to "distributed" generation. The resulting economics are therefore quite different, as noted by the New South Wales Department of Environment, Climate Change and Water, Workshop (2010, P. 2):

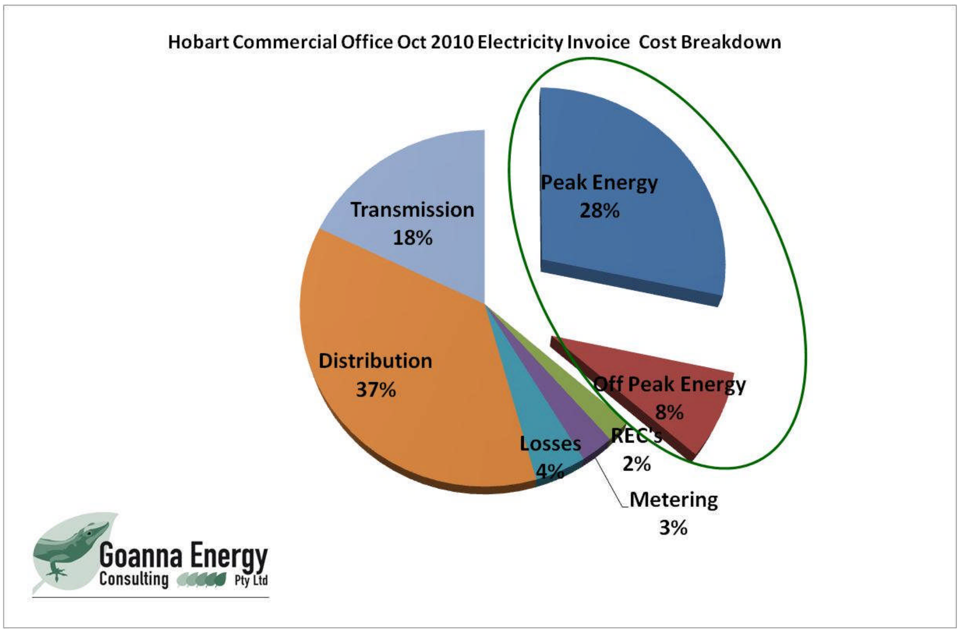
> **Embedded Generation** "need to sell directly to customers in the same building or development to realise the full commercial benefits of co-generation (or the generator may use the electricity itself, thereby offsetting the costs of purchasing the electricity)".
>
> **Distributed Generation** "Selling electricity to a retailer or into the NEM wholesale market yields a lower return and may undermine the commercial opportunity of co-generation technologies".

These economic differences are explained as follows. A wind farm derives its income solely from the sale of energy and Renewable Energy Certificates (REC's). Due to the intermittent nature of energy generated by wind turbines, (operating 90% of the time but often with a capacity factor of between 20% – 40%) and the inability to plan their dispatch, the value of the energy produced is generally discounted by wholesale energy buyers to somewhat less than the wholesale market rate for a continuous 24/7 or firm energy supply contract.

At the time of writing a would be buyer (Electricity Retailer) was willing to offer between 4-6 cents per kilowatt hour for “Peak Energy” and between 2-4 c/kWh for Off Peak Energy (Aurora Energy, 2010, P. 2). Whilst in recent times, the Tasmanian Wholesale market for firm standard contracts has rarely been seen below 6c and 3c respectively. In addition to this, the late 2010 spot market price for REC’s is equivalent to around 3.5 c/kWh ($35/REC), with prices for future years increasing out to 4.7c/kWh ($47/REC) in 2014.

Using the above figures the total revenue from the hypothetical wind farm distributed generator, is currently in the order of 6-9 c/kWh. The wind farm derives its revenue from sales of energy Figure 5. (shown in the exploded pie graph inside the green ring) plus the additional and separate sale of REC’s.

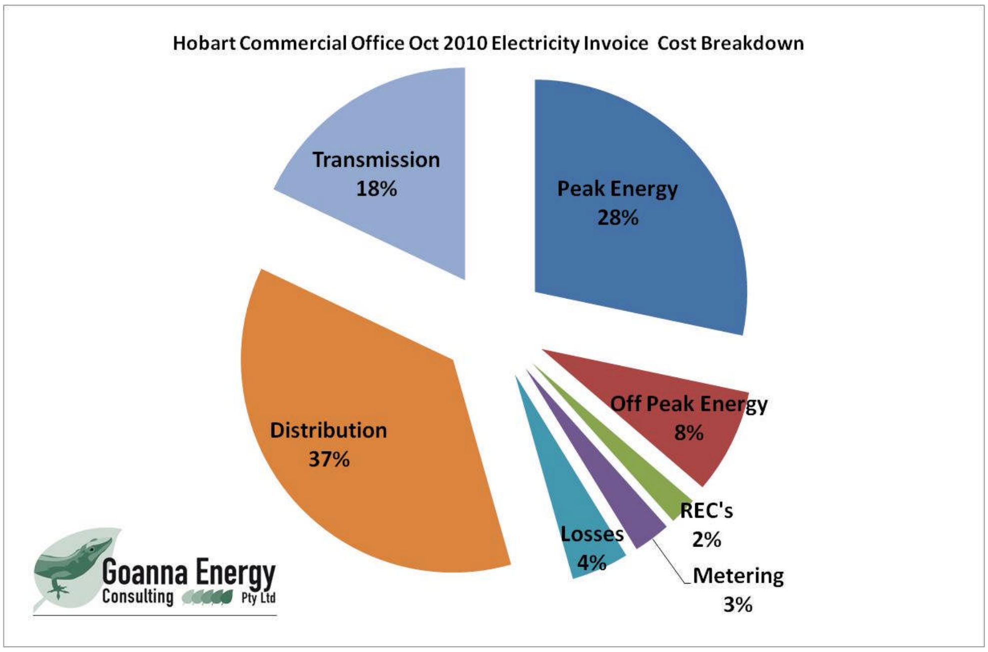
Figure 5. Goanna Energy Consulting, Breakdown of contestable electricity Invoice, Energy Component 2010.



However, electricity produced by an Embedded Generator (EG), effectively displaces electricity, which would otherwise be purchased by the customer through the billing meter, at rates which are generally above those available to a stand-alone wind farm.

Figure 6. Below, shows a breakdown of each of the cost elements of a Hobart office electricity account. An embedded generator not only offsets the majority of these cost elements, but will also generate renewable energy certificates, which can be sold separately on the REC market.

Figure 6. Hobart Commercial Office Electricity Account Breakdown.



The effective cost offset by an embedded generator at the hypothetical Hobart office, is dependent upon the Network tariff elected and the contracted energy rates, but could total around some 14c/kWh. In addition to this, the REC's may still be sold separately for some 3.5c/kWh, giving a notional equivalent total revenue of 17.5c/kWh, more than double the revenue available from the stand-alone wind farm (a distributed generator).

In some cases and at some times of the day, electricity generated onsite by an embedded generator can exceed the customers own demand. Depending on the energy reconciliation period, often monthly, from time to time excess electricity can be “sold back” to the grid. However in this case, like the stand alone wind farm, the relative value of this excess energy is likely to be reduced to the discounted wholesale rate for Peak and Off Peak energy. The actual price depends on the agreed contract but in some cases may be at the sole discretion of the incumbent electricity retailer.

At this point it is worth noting that the Transmission and Distribution system costs (and losses), whilst avoided to the extent of the embedded generation by this individual embedded generation customer, have not disappeared from the total cost of running the electrical infrastructure.

Consequentially, these residual costs, a negative externality, will be borne by the remaining network customers, in the form of higher overall Network Use of System Tariffs. These residual costs triggered by embedded generation, represent one of the economic challenges for the wide scale adoption of renewable energy and are discussed further in this report.

Of particular relevance for wind power in Tasmania was the CSIRO study which identified that: “Small scale wind turbines are more competitive in non-urban areas where alternatives are more expensive or better wind resources are available” (CSIRO, 2009, P. 26). The latter certainly being the case in Tasmania’s “Roaring 40’s”, which is widely recognized as a significant and suitable wind resource: “Tasmania, from a climatic point of view is ideal for wind generation, providing ample available land, an excellent wind resource, and generally a mild climate” (Joule Logic, 2010, P. 6). Joule Logic identified the potential for some 200 wind based embedded generation projects in Tasmania, whilst currently only a handful exist (Fulton, 2010, P. 3).

2.7 Response to Climate Change and Social Leadership

On 15 September 2010, The Australian newspaper reported BHP Billiton CEO Marius Kloppers, as telling a Sydney conference, that: “There is a need for a clear price signal on carbon emissions” (The Australian, 2010). Whilst BHP is likely to be one of the companies most impacted by a carbon price, the message from the business community was clear, that the uncertainty and delays are worse for business than the tax itself!

Mr. Kloppers was reported as saying: "The world is going through a process of rapid change, and it is only by anticipating and responding to this change, rather than resisting, that Australian businesses and the country as a whole can succeed. In short, carbon emissions need to have a cost impact in order to cause the consumer to change behavior and favor low carbon alternatives. Australia needs to anticipate a global price for carbon when taking decisions with long dated impact (The Australian, 2010).

In Tasmanian, business people are increasingly aware of climate change but are also increasingly prepared to invest, to address the risks posed (Duddles, 2010). This is an important development in a cultural sense as it demonstrates that the climate debate has, at least for the business innovators and early adopters, moved on from the debate of its existence and significance, to what level of response is prudent. This increasing acceptance on the need to act on climate change is also providing business leaders with the additional motive to independently explore renewable energy options in their own right.

2.8 Conclusion of Background

Rising electricity prices, which appear set to continue, together with the response to climate change are driving businesses to seek innovative methods to reduce energy costs and take a leadership role in climate response.

Distributed generation and to some extent embedded generation, are set to play a key role in Australia's early response to climate change over the next several decades. In particular the cost competitiveness of wind generation is expected to see this technology deliver the bulk of the Renewable Energy Certificates required to meet the Mandatory Renewable Energy Target (MRET).

The business case for embedded generation is different than that for stand-alone distributed generation, such as wind farms. The current relative cost leadership of wind power in Tasmania, over other forms of renewable energy generation, has seen embedded wind turbines emerge as a logical choice.

Under the current electricity industry charging regime, as the uptake of embedded generation increases, the costs of operating and maintaining the electricity network must be spread across a lower volume of sales. Under a high uptake embedded generation scenario, this consequence gives rise to an as yet unresolved economic challenge for electricity network tariffs.

3 Literature

3.1 Introduction Literature

This chapter explores current thinking and current practices in connection to renewable embedded generation and how others are taking action to overcome these barriers. The report looks at several recurring categories including, environmental concerns which have triggered a response to climate change, leading to development of Policies, Legislation and Regulations.

In market based energy systems like Tasmania, these regulations alter the relative economics of renewable energy technologies, leading to changes in investment decisions toward renewable and distributed energy investments. These decisions ultimately have, social consequences, as well as technical and operational impacts.

In all over 100 individual pieces of relevant literature were identified and reviewed. These covered industry magazine articles through to major works, such as the high level Stern 2006 Review on “The Economics of Climate Change” (Stern, 2006), the Garnaut Report (2008) and the more specific report by Paul Breeze on, “Future renewable power generation technologies” (Breeze, 2006).

In fact the daily arrival of new market developments and literature is overwhelming. REN21 acknowledges that changes in renewable energy markets, investments, industries, and policies have been so rapid in recent years that perceptions of the status of renewable energy may lag years behind reality (REN, 2010. P. 9.).

3.2 Environmental and Policy Literature

The key themes to arise out of the environmental and policy literature review are that:

1. To reduce the chances of catastrophic climate change the global power sector must be drastically decarbonised by 2050 (Stern, 2006, p. 13.).
2. Switching to renewable sources of electricity comes at a price because currently renewable energy technologies are more expensive than conventional electricity generation.

In market based systems, such as Australia, legislation and systems of subsidies encourage the use of renewable energy technology. These measures are now in place in many parts of the world and renewable generating capacity is growing (Breeze, 2006, p. 11.).

However, market systems are difficult and problematic to influence because of conflicting interests. Such that, increasing embedded generation has implications for electricity network charges, which gives rise to the issue of, who should carry these costs and risks, and the timing of these (Seaton, 2002, p. 22 & EUAA, 2011).

Embedded generation faces significant barriers to growth, including onerous planning and permitting processes. Even where a support framework exists, it often contains significant uncertainty that may lead to investments being delayed (Masokin, 2007, p. 13).

However, there is some positive encouragement for policy makers, in that state policies that aim to reduce economic barriers, standardize interconnection procedures, and increase competition in the electricity sector have thus far been rather effective at obtaining their policy objectives (Carley, 2009, p. 1658).

Kaye reported that October 2010 was the month in which the first Australian State based renewable incentive scheme was significantly wound back. When NSW Premier Kristina Keneally announced that the NSW Solar Bonus Scheme would be wound back from 60c/kWh to 20c/kWh a figure, whilst still more than double the combined energy and REC rate available to our notional wind farm, was much more in line with the delivered price of electricity to NSW households (Kaye, 2010).

Two barriers to distributed (and embedded) generation posed by the current Australian regulatory regime are the, “First mover disadvantage”, where the embedded generator is required to cover network connection costs, and the “regulatory regime”, which is designed to ensure network companies are not rewarded for building excess capacity (Garnaut, 2008, p. 448).

The policy issues of overcoming the cost disadvantage of renewable energy technologies are critical. Stern argues that policy to reduce emissions should be based on three essential elements: carbon pricing, technology policy, and removal of barriers to behavioral change (Stern, 2006, p. 18).

From the researchers’ perspective, the most significant piece of environmental work in Australia is by far the Garnaut Report (2008). Garnaut discusses market failures in transmission network extensions. He believes that the current transmission networks are:

- Geared to handle increments of supply, especially those near the established grid;
- Have consistent supply;
- Are on a large scale; and,
- Are highly centralised. (Garnaut, 2008, p. 448)

In contrast, Garnaut argues the new technologies tend to be far from the grid (geothermal, thermal solar and wind), have intermittent supply (wind and solar), operate on a smaller scale (tidal), and can be decentralised or embedded (Garnaut, 2008, p. 448).

Garnaut acknowledges the significant physical differences between the current state of electrical infrastructure in Australia, which has been developed over many decades on the basis of a centralized generation mode and the challenges faced by the need to integrate many smaller scale low emission distributed generators (Garnaut, 2008, p. 448).

Specifically Garnaut notes that without major changes in the transmission infrastructure, new technologies will find it difficult to compete, even in circumstances where compatible infrastructure is established. The two barriers he notes are to successful network augmentation - free-rider problems and first-mover disadvantage (Garnaut, 2008, p. 448).

If the current regulatory regime requires those seeking connection to cover the cost up to the point of connection, then for a single remotely located generator the additional cost of connection is likely to be insurmountable. When the costs are shared between multiple generators, the likelihood of a successful network extension increases. But the extension may not eventuate due to the strong incentive to free ride on the efforts of early movers (Garnaut, 2008, p. 448).

Garnaut acknowledges that the first party that connects to the network is faced with all the cost of extending the network. Thus, not only does the current regulatory regime pose cost barriers for distributed generation but also that there are inadequate price signals to reflect the positive externalities of embedded generation (Garnaut, 2008, p. 448).

Garnaut goes on to identify the cause of these market failures. Essentially, the investor in the embedded energy infrastructure cannot appropriate the benefits created for others from deferred network augmentation or transmission losses (Garnaut, 2008, p. 452).

According to Garnaut the current regulatory framework prevents these externalities from being internalised. Distribution businesses receive revenue based on the value of the asset base, creating the incentive to build more distribution infrastructure. Rewarding embedded generators for the benefits of deferred network augmentation is in direct conflict with this arrangement (Garnaut, 2008, p. 452).

As stated by the then Energy Minister David Llewellyn: "Undoubtedly the biggest factor affecting energy policies and planning everywhere is the need to reduce greenhouse gas emissions" (Llewellyn, 2009, P. 7.). "In a carbon-constrained world, alternative and renewable energy sources are going to be relied upon in order to keep greenhouse gas emissions down" (McKim, 2010, P. 2).

In this case the "problem" is the relatively low uptake of renewable embedded generation in Tasmania, when compared to other parts of the world: "…clean energy investment globally has experienced growth of 230 percent since 2005, but Australia is lagging behind other G-20 nations" (Energy Matters, 2010). As Nick McKim noted: "Tasmania lags behind Australia, which lags behind the world" (McKim, 2010, P. 2).

The Tasmanian Government has supported a number of complimentary climate response initiatives. These include the King Island Integrated Renewable Energy Project (DIER, 2010) and the Climate Connect Grants program (DPAC, 2010).

The Tasmanian Government policy, to reduce Greenhouse Gas Emissions by 60% by 2050, has led to State Government Departments investing in renewable energy. One example is the Department of Health and Human Services, Bruny Island Health Centre, embedded generation wind and solar system, (Appendix 10.), which can be viewed operating online along with the project stakeholder acknowledgement at: http://www.youtube.com/watch?v=mgjCK_WeI7w

In Tasmania's December 2009 Energy Policy Statement Minister Llewellyn stated: "Tasmania will cooperate with other states for setting clear terms and conditions for the connection of small and medium sized embedded generators to an electricity distribution network. The owners of small and medium sized generators who connect directly to a distribution system will be assured of being treated fairly, openly and consistently. The policies and rules for this are already being progressed as part of the national energy markets reform agenda" (Llewellyn, 2009, P10).

Under these energy market reforms, on 27 October 2010 a new bill was introduced to the South Australian Parliament, which if legislated will result in a new Rule being passed, known as "the National Electricity (Retail Connection) Amendment Rules 2010".

This new rule will be added to the National Electricity Rules (NER) and is known as Chapter 5a. Chapter 5a deals with "Electricity connection for retail customers". The additional rules provide for obligations for Embedded Generators and Networks, including those of the size relevant to this study, named in Chapter 5a as "non-registered embedded generator". The amended rules provide for connection of Non-Registered Embedded Generators under either the "Standard Connection Services" rules, known as Division 2, or if elected by the applicant, a "Negotiated Connection" known as Part C in the Rules (MCE, 2010).

In response to the "MMA Wedges Report 2009" (Geradi, 2009) and in support of the States commitment to Renewable Energy, the Tasmanian government formed the Tasmanian Renewable Energy Industry Development Board (TREIDB).

TREIDB has the following charter, summarised as: “The Tasmanian Renewable Energy Industry Development Board will prepare advice to the Tasmanian Government in 2010 on a strategy to develop Tasmania’s renewable energy industry”. “… including recommendations on, maximizing the economic benefits from developing Tasmania’s renewable energy resources, improving the regulatory and policy framework, stimulating investment in the sector, overcoming constraints to development and growth, planning for a second electricity interconnector across Bass Strait” (TREIDB, 2010).

3.3 Costs, Economics and Regulation of Market Based Systems

Australian electricity sales volume is anticipated to grow by 5.3% to 257TWh between 2008 and 2013. During this same period, the value of the market is expected to grow by almost 40% to $36.3B (Datamonitor, 2009, p. 3). O'Young contends that: "Many factors will drive a doubling of electricity prices in many states by 2015" (O'Young, 2009, p. 1). CEO of Origin Energy, grant King goes further in suggesting that electricity prices across Australia are likely to triple over the next 10 years (Korporaal, 2010).

The Tasmanian Chamber of Commerce and Industry (TCCI) "Tasmanian Survey of Business Expectations, December Quarter 2010" results, showed that the "Cost of Energy" had risen to the number one "Constraint on Business Growth". The move, up from 7th place in the previous quarter, was the highest level seen by the survey over the past three years, with 30% of respondents acknowledging energy costs as a "Critical Constraint" (Wallace, 2010, Slide 15-16).

Unfortunately 2010 offered little respite from rising costs for Tasmanians, as the Mercury newspaper reported further price rises of "26% over the next 3 years" (McNaught, 2010).

Another theme to arise was the complexity of the economic challenge posed by climate change, "in as much as it is the greatest and widest-ranging market failure ever seen" (Stern, 2006. p. 1). Indeed it is the complexity of this economic challenge, which makes the search for solutions attractive yet frustrating as each potential solution seems to be met with opposing economic problems.

The evidence of this complexity can also be seen in Australia in the introduction and in some cases subsequent alteration of legislation, be it for Renewable Energy Certificates or Feed In Tariffs that were “Incredibly successful” (Kaye, 2010, p. 1).

Economic solutions to expedite renewable energy need to be, “equitable to all players, not impose excessive costs on consumers and preserve security of electricity supplies”. (NEM Review UK, 2001, p. 1). Distribution connection charges for embedded generators are a potential barrier to adoption, however there are differing opinions on how these are best regulated.

Some argue that distribution connection charges should be averaged, regulated, and shallow (i.e. Pay for only the onsite connection assets, rather than any upgrades required along the main power line). With the remaining reinforcement costs socialized and recovered via Use of System tariffs. Negotiation between Distribution Service Operators and Embedded Generators promoters ought to be avoided at all costs to prevent conflicts (Cossent, 2009, p. 1152).

Whilst the above “negotiation” advice is somewhat at odds with Australia’s recently released draft of the National Electricity Rules, Chapter 5a. Which caters for “Negotiated Connection Agreements” for commercial scale embedded generation, so long as all Connection Offers are consistent with the principles set out in the Rules. (MCE, 2010 “National Electricity (Retail Connection) Amendment Rules 2010”. P. 13).

The ENA Discussion paper goes to the crux of several of the embedded generation dilemmas. These include the potential for and treatment of cross subsidies. For example, driving un-economic or over engineered network assets, the method of cost recovery and limitations inherent in current tariff regimes (ENA, 2008, p. 20 & 23).

3.4 Technical and Operational Literature

The 2010 REN 21 report on Global Renewable Energy Status, identified "ongoing market and industry trends", including the growing popularity of distributed, small-scale grid-connected turbines, and new wind projects in a much wider variety of geographical locations around the world and within countries (REN, 2010, Slide 10).

The European Commission acknowledged the impact of these trends noting that whilst current electricity networks presently have fulfilled their function effectively, more of the same will not be sufficient to meet current challenges and policy imperatives (European Commission, 2006, p. 1).

Breeze (2010, P. 37.) makes the case that integration of renewable energy into a grid involves identifying a complex range of interacting factors and then developing strategies to cope with them. He argues that the two most important factors are the geographical dispersion of renewable energy and its intermittency. Wind energy, he suggests, exemplifies these most clearly and acutely because wind is the most intermittent of the renewable resources and because the best wind resources are often found at sites, which are geographically remote both from centers of demand and from the main skeleton of a grid network. Breeze believes strategies adopted and the lessons learned from wind integration should therefore provide a basis for dealing with all types of renewable energy (Breeze, 2006, P. 10.).

As an example Lise explains the situation, as it exists in Turkey, where the distribution grid is designed to receive electricity and to pass it on to the consumers. Turkey has a relatively weak distribution grid that does not expect local production and is not ready to return the generated surplus back into the transmission grid (Lise, 2009, p. 4328).

Looking forward from such a limiting infrastructure situation, the US counterpart of SmartGrids, known as Gridwise has a vision, which rests on the premise that information technology will revolutionize planning and operation of the power grid just as it has changed business, education and entertainment (Gridwise, 2008, p. 7).

Here information technology can form the nervous system that integrates new distributed technologies demand response, distributed generation and storage with traditional grid generation, transmission and distribution assets. Gridwise posits that the responsibility for managing the grid will be shared by a society of devices and system entities (Gridwise, 2008, p. 7).

In support of this view, is Lehtonen and Nye who argue that the lack of progress in network control has only recently – largely because of the combined needs to provide greater reliability and ‘green’ electricity within liberalized markets – emerged as a ‘reverse-salient’ that will prevent the further development of the LTS (Large Technical Systems) of electricity supply industry towards desired direction (Lehtonen, 2009, p. 2338).

Attempting to find innovative solutions to these challenges Ochoa, Dent and Harrison’s research clearly shows that, compared to the widely used passive operation of distribution networks, very high penetration levels of new variable generation capacity can be reached by strategically adopting ANM (Active Network Management) schemes (Ochoa, Dent & Harrison, 2010, p. 93).

ANM schemes include “coordinated voltage control, adaptive power factor control and energy curtailment”. This active management solution is supported by Clarke, who makes the case that passive distribution networks will need to become actively controlled, with network operators acting more like transmission systems (Clarke, 2010, p. 14).

In essence, the same dilemmas are faced in Australia and Tasmania today as network providers look to “Smart Grid” technologies to solve some of the physical infrastructure limitations.

One of the most challenging barriers to the adoption of embedded generation is the physical and technical impacts on the electricity distribution network, created in the connection of distributed and embedded generation (Lise, 2009).

For well over 50 years the Tasmanian electricity and control systems have been built to deliver energy from centralized hydro generators, with voltages and conductor sizes cascading down to meet local town and country needs.

The vast majority of these local transformers have only a manually operated voltage “Tap”, to allow for occasional increases (or decreases) to the voltage delivered to homes and businesses, as customer load in the area grows over time.

The installation of significant scale embedded generation in a small town has the potential to create substantial flows of electricity back into the grid.

For example if the wind is blowing but the embedded generator’s load side plant is idle, this “back-flow” of electricity into the local grid has the potential to create voltage level fluctuations along the local power line, “the tail wagging the dog”. Unfortunately the manual tap change method employed in local transformers was never intended to cope with this potentially regular voltage fluctuation. This was noted in one of our interviews, as follows: “On the network you may have created a need for additional voltage control and more complex safety procedures for maintenance activities” (Appendix 11).

Tasmanian Electricity Transmission provider, Transend in their 2009 report noted the following local conditions:

> Wind generation is more difficult to integrate into the Tasmanian power system than conventional generation due to a number of technical issues including:
> (a) The variable nature of wind generation;
> (b) Wind generators do not provide inertia to the system;
> (c) They generally provide a reduced level of, or no frequency control ancillary services (FCAS);
> (d) Some wind turbine types provide reduced voltage control capability;
> (e) They provide a reduced contribution to system fault levels;
> (f) Some wind turbines cannot ride through network faults;
> (g) They often connect into weak parts of the network; and
> (h) They can cause power quality problems.
> (Transend, 2009, P. 5.)

It is worth noting that the above issues outlined by Transend are said to apply predominantly to utility scale wind farms and are likely to present less of a concern to embedded generation where the size of the generator is balanced to the size of the onsite customer load (Fulton, 2010, Pers. Disc.).

The challenges of increased renewables has also been recognized internationally as noted in the Utility Week article discussing the UK House of Commons report: “The House of Commons report recognizes that one of the biggest challenges for network owners over the next decade will be the need to make changes to the configuration of the network to enable the government's renewable energy targets to be met” (Goodman, 2004).

Wright also noted these issues: “Local generation sounds a good idea, but the costs of connecting to the network, plus poor prices for exporting excess power, are significant disincentives”. “Distributors are also heavily penalised by the regulator for failures in supply to customers. As a result, they tend to favor investment in highly reliable distribution hardware over depending on a local generator to reduce the local peak demand, since even the best generators are far less reliable than modern distribution systems” (Wright, 2000).

Whilst locally the CSIRO Intelligent Grid report had a different tone, and found that Embedded Generation technologies were considered unlikely to represent “a significant source of flicker, rapid voltage change or phase imbalance” (CSIRO, 2009, P. 406). However, the CSIRO report also noted that: “The results of the generator distribution model as applied to the DNIS (Distribution Network Impact Study) indicate that large numbers of grid-connected inverters are projected to connect at low voltages. In such scenarios, DNSPs (Distribution Network Service Providers) will need to consider the impacts of large amounts of real power being offset by these generators under high availability factors. This may result in a poor overall power factor seen by the wider network. It may become important in the future to provide dynamic reactive support in order to locally supply reactive power. Alternatively, it may be a matter of future policy that grid-connected inverters provide in-built reactive support in the manner described by Section 9.4.5” (CSIRO, 2009. P. 459).

Not all agree with the build bigger approach, as highlighted in the UK national electricity market article by Janet Wood: “The electricity grid "could carry more power, with the right innovations and incentives" and could connect renewable and embedded generation much more quickly” “it was currently assumed that all new generators must have 100 per cent access to the grid so they could export their power at all times”.

“System operators were incentivised to minimise "constraint" costs, where overloaded wires stopped generators exporting. He said that instead, they should be incentivised to connect new generators to the network. "That may mean we have to accept some constraint costs," he said, "but it would mean network operators had a more positive approach" to new generators. Nicholson also argued that grid standards were out of date and there was a danger they would be over specified.

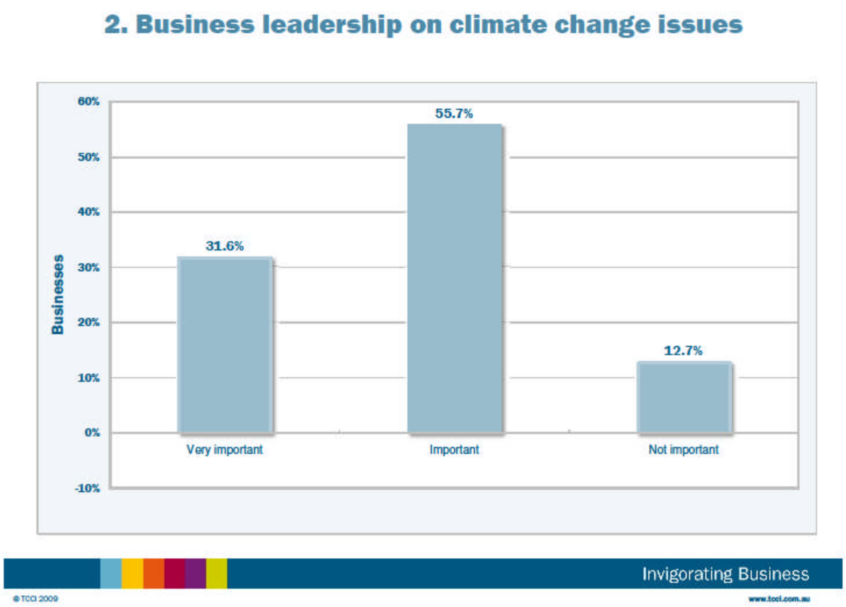
For example, grid capacity was partly set by the heating effect of the current in the wires…. What is more, the code took no account of circumstances: for example, wind power could be added because it coincided with the cooling effect of high winds. Nicholson said current standards discriminated against new types of generation, but offering constrained connections and adding to power line loading could reduce upfront costs for new generators and speed up connections. He called for a new analysis of connection options.” (Wood, 2006).

However with every challenge comes an opportunity and electric vehicles could well form part of the solution. ActewAGL is a partner of Electric vehicle service and infrastructure provider, Better Place Australia. ActewAGL General Manager Dianne O’Hara says, “If electric vehicles can be charged predominantly at night, when electricity demand is lowest, this will significantly improve the efficiency of generation and network assets. It will help reduce carbon emissions by removing petrol vehicles from the road and we believe it could well have an important impact on development of wind and solar power” (Orchison, 2010, P. 50.).

3.5 Social and Behavioral Literature

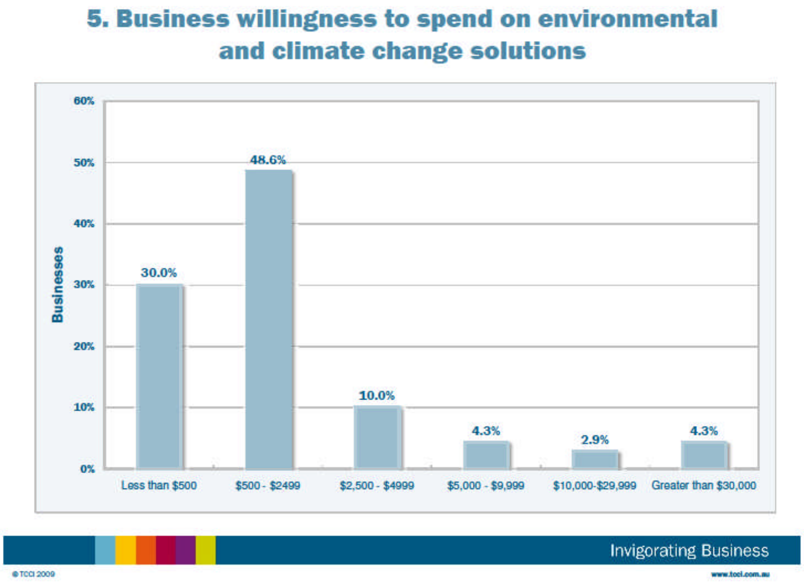
In conjunction with the 2010 September Quarter Tasmanian Chamber of Commerce and Industry (TCCI) Survey of Business Expectations, Jonathan Duddles CEO, Greening Australia – Tasmania undertook a research piece known as, "Hot Topic – Environment and Climate Change". The research piece found 67% of respondents rated themselves as having a, "High" or "Very High", "Understanding of Environment and Climate change issues". Whilst 87% claimed "Business leadership on climate change issues", were either "Important" or "Very important" (Duddles, 2010, Slide 22). See Figure 7. Below.

Figure 7. Duddles (2010) "Tasmanian Survey of Business Expectations, September Quarter 2010. Hot Topic". TCCI. Slide 22.



The TCCI research question, "Business willingness to spend on environmental and climate change solutions", found that 10% of businesses were prepared to spend $2,500 - $4,999 and almost half were prepared to spend $500 - $2,499 (Duddles, 2010, Slide 25). See Figure 8.

Figure 8. Duddles (2010) “Tasmanian Survey of Business Expectations, September Quarter 2010. Hot Topic”. TCCI. Slide 25.



This is an important development in a cultural sense as it demonstrates that for some businesses the climate debate has, moved to the question of what level of response is prudent.

The importance of “Social License” was raised by Toke who uses a folk tale from Denmark and Germany to illustrate that smaller wind plants were more likely to get off the ground, but it's not the size of the wind farm or the turbines that matter. They are more successful because there is often a very local focus, so much that in Germany, the big utilities are hardly involved in wind (EU Energy, 2005, p. 1).

In Scotland in 2004, the Enterprise & Culture Committee puts forward that public support (for renewable generation), will be maintained provided that projects are developed in a responsible and sustainable manner, employment benefits are maximized, a range of technologies are deployed and those who wish to are supported in developing renewable or investing in renewable (Enterprise & Culture Committee, 2004).

Certainly in Tasmania the media continues to cover an absolutely polarized community debate on the merits of embedded generation wind turbines, which have been front page news on more than one occasion.

In fact, no clearer example of the significance of “Social License” for renewable energy projects exists than the example provided by the erection of wind turbines on the Marine Board Building located on Hobart’s waterfront in an area known as Sullivans Cove. During the research phase of the project, hardly a week would transpire without polarized media coverage of the embedded wind generators atop this city building. See Figure 2. Marine Board Building.

The 12 June 2010 Mercury News (Stedman, 2010) highlighted the benefits of the (at the time proposed) Marine Board Building Wind Turbines. The article brought together several themes including economic prosperity, employment growth and town planning. Two days later the Mercury Editorial article (Mercury Editorial, 2010), highlighted the death of Wedge-tailed eagles at the Woolnorth Tasmania wind farm whilst noting that within the next month wind farms will become part of the urban landscape (in Hobart).

Danielle McKay’s 17th July article (McKay, 2010) titled, “Aerial show puts city in a spin”, in the Mercury Newspaper, marked the 16 July 2010 wind turbine installation noting four of Australia's largest vertical wind turbines were successfully mounted atop the Marine Board building on Hobart's waterfront, generating more than 10 per cent of the building's energy use.

A few days later on the 20th July the media coverage soured when a Hobart City Council Alderman (Christie, 2010) penned his letter to the editor titled, “Turbines add new dimension to Hobart ugliness”.

The article included evocative phrases such as, “The circus has arrived in town and it’s here to stay”, “four giant Hills hoists”, “visual scar on our city”, “great structural blunder” and “destroy the heritage”.

This was followed on the 21st July with (Ward, 2010) “Turbines generate some positive street feedback” where it was noted that, “The Marine Board Building’s new wind turbines seem to be generating as much talk as electricity”. However in Letter to the Editor on the same day (Walker, 2010), called to, “End disastrous experiment”, describing, “Unrelenting visual agitation”, from the Marine Board Building turbines.

In a blow to Tasmania’s renewable energy industry, on 11th August 2010 the nay-sayers appeared to have their day, as “blustery conditions were enough to wreck two (of the four) wind power turbines on top of the Marine Board building” (McNaught, 2010). The article fed local concerns, where it was revealed that, “the wind speed (reported to be 54km/h) was only a quarter of what the turbines were meant to be tested to withstand (216km/h)”.

By the 17th August 2010, Mercury Newspaper Letters to the editor “Go solar in city and put turbines out to pasture”, had started to demonstrate how controversial change could be, claiming: ‘there is only one place for wind turbines: On a hill, in the clear where the wind blows. A city building is not the place’ (Tompson, 2010).

The article went further to describe the turbines as “wind-driven monstrosities” (Tompson, 2010). By the 24th August the Mercury reported an article entitled, “Turbine safety fury”, in which a Hobart City Council Alderman was reported as saying. ‘Hobart people are being used as guinea pigs in an experiment to test untried wind turbines’ (Paine, 2010).

On 29 October 2010, in response to the turbine upgrade plan, architect Keith Drew is quoted as saying new wind turbines would be installed in January 2011 and “they would be superior to the turbines that controversially failed in August” (Smith, 2010).

The media coverage of this project alone leaves no doubt as to the importance of “social license” in the consideration of embedded generation developments.

The Hon Peter Rae AO, Chairman, International Renewable Energy Alliance, Chairman Tasmanian Renewable Energy Industry Development Board and Vice Chairman – REN21, in his August 2010 Presentation on “Global and Local Outlooks and Ideas for Energy and Renewable Energy” posed a timely social question to Tasmanians: ‘How do we respond? Community awareness, political will - or political resistance, engender the spirit of reform – even adventure, reduce fear, understand sustainability - and a new but not radically changed way of living’ (Rae, 2010).

As can be seen by the above almost continual stream of media coverage, proponents of embedded generation should be well aware of the public interest in high visibility renewable energy developments.

However there is another side to the social impact of the embedded generation model. Walker (2008) in his article on “Decentralised systems and fuel poverty” makes the case that distributed generation is of little significance for the creation or resolution of fuel poverty. He argues that while making households more energy efficient may be the primary way of reducing fuel poverty, micro generation has future potential to further improve access to affordable energy for low-income households.

In this case if a model of development focuses on households paying for and installing micro generation technologies is pursued, then the potential will not be realised, and low-income households will become even more of an energy ‘underclass’ (Walker, 2008).

Whilst Walker’s focus is on the first round effects of such schemes, presumably more affluent and owner occupied households may invest spare capital in micro-generation to secure a long term lower energy cost.

What may be even more significant is the second round economic and social consequences of these schemes, which were highlighted in this report’s Appendix 12., where the interview data suggests that the more affluent households have now, to some extent, avoided paying for the network infrastructure that services their homes by having a micro-generator, these network costs have not gone away and therefore the remaining consumers have to pick up a greater share of the overall costs, despite not having triggered this change.

Another social issue which has attracted media attention in Tasmania is the potential for adverse health impacts from wind turbines. The Australian Government, National Health & Medical Research Council, (Australian Government NHMRC, 2010) “Wind Turbines and Health, A Rapid Review of the Evidence”, concludes the health effects of many forms of renewable energy generation, such as wind farms, have not been assessed to the same extent as those from traditional sources. However, renewable energy generation is associated with few adverse health effects compared with the well documented health burdens of polluting forms of electricity generation (Markandya & Wilkinson, 2007).

The NHMRC “Wind Turbines & Health Public Statement” (NHMRC, 2010) concern regarding the adverse health impacts of wind turbines focuses on infrasound, electromagnetic radiation, shadow flicker and blade glint produced by wind turbines, as discussed above. While there is currently no evidence linking these phenomena with adverse health effects, the evidence is limited (NHMRC, 2010).

From this information it is clear that proponents of wind turbines must take account of public health concerns in their deliberations, as yet the medical jury appears to remain open to further evidence.

3.6 Conclusion of Literature

History may show that the timing of this research was almost ideal. In that the period of the research coincided with a time in which international experience in embedded generation for some markets had reached a point of maturity, whilst Tasmania’s was just starting out.

From a national perspective two key themes emerge. Firstly, the 2009 Port Jackson Partners report (O’Young, 2009) flags a massive doubling of the future price of electricity nationally. Prior to this, messages of electricity price rises had been sporadic, somewhat out of the mainstream public eye, limited to special interest groups and large industrial users.

In 2010 these dire price predictions are not only echoed by the prominent CEO of Origin Energy (Korporaal, 2010) but are speculated to be conservative. These statements preceded the annual increases in energy costs for domestic users, which for most states represented double digit percentage rises. In combination these events produce a massive increase in media coverage of the state and national energy markets.

The second key national theme came in the form of the CSIRO Intelligent Grid Report (CSIRO, 2009. P. 21 & 314). The CSIRO report finds that Distributed Energy is an attractive early response to climate change and further that there is a notional $130b “welfare gain” available to be shared by all consumers of electricity from the adoption of this technology.

Tasmania, in stark contrast to other states and countries, has over the past 12 months, just commissioned the State’s first small number of commercial scale embedded generators. Two in particular, which were often said to, “have generated far more public debate than electricity”.

Despite the value of the existing national and international research, on apparent similarities, none of these focused on the “first time buying process” for proponents of embedded generation. Therefore this research aims to uncover:

- Customer motives for pursuing embedded generation,
- Barriers in the search for information and evaluation of alternatives,
- Identification of the policy and economic issues confronted by embedded generation proponents,
- Issues with planning and council approvals processes,
- Factors which influence technical design and difficulties experienced in the negotiation of Network Connection Agreements,
- Difficulties experienced in the negotiation of energy agreements and the sale of “Renewable Energy Certificates”.
- Social implications faced by proponents of embedded generation.

Leading to a comprehension of how these issues can be addressed to improve customer decision making.

4 Findings

4.1 Introduction

This Chapter highlights the various end use customer motives in pursuing embedded generation, how the proponents have undertaken their search for and evaluation of energy alternatives.

The Chapter looks at the Policy and Economic challenges identified by stakeholders as well as the Planning and Approvals processes. Although not an engineering study, the Chapter covers findings on Technical Design as well as the Network, Energy and Renewable Energy Certificate arrangements.

The Chapter also captures the Social elements that play a role in how embedded generation is perceived in the wider community.

4.2 Motive Findings

As the first step in understanding embedded generation drivers, the research sought to probe the underlying motives of the local pioneers and stakeholders.

Customers interviewed each demonstrated unique motives for pursuing embedded generation. Rob Nichols (Appendix 2) and Tim Terry's (Appendix 5) quest for "self-sufficiency" is clearly a driving force, whilst the notion of "something for nothing" is also attractive to Rob Nichols, who was named the "Canny Farmer" (Mounster 2010).

Greg Cooper now Department of Health and Human Services was previously involved in the Bruny Island Health Centre, Renewable Embedded Generation project. Greg noted three elements to the motivation for the project, being the Tasmanian State Government's target for a 60% reduction in greenhouse gas emissions by 2050. The opportunity presented by the building upgrade project and a personal interest in energy efficiency and renewable energy (Appendix 10.).

Common themes to emerge from the pioneers, Rob Nichols of Nichols Poultry (Report Appendix 2) and Robert Rockefeller of Nekon P/L (Appendix 6), was the significance of international travel and personal experiences, which introduced these local pioneers to the demonstrable possibilities of renewable embedded generation. Also the common theme of a personal interest in renewable energy technologies was expressed.

An interesting motivator for Rob Nichols was the electricity account over-billing error at Nichols Poultry, where Robert described: "One of the first elements to our motivation came about over a billing dispute with Aurora, which we felt powerless to resolve" (Appendix 2).
Two emotive terms arose being the use of the words, Dispute and Powerless, which were immediately followed by the comment, "desire to be independent and to have a, green and clean business".

For Rob Nichols the wind turbine has an obvious and satisfying connection to his past in the UK, where his grandfather's windmill, (a photo of which now enjoys pride of place in his modest office), demonstrates the "Graceful appeal in the simplicity and industrial art of a wind turbine fulfilling in its engineered operation" (Appendix 2). Whilst Tim Terry also noted that his support for his "son's interest in renewable energy was a catalyst" (Appendix 5.).

Another telling feature of both Rob Nichols and Tim Terry's interview was the "sustained interest" demonstrated. Both described several occasions over a 5 – 15 year period, where the topic had been pursued in the lead up to an eventual commitment.

For Rockefeller risk mitigation and asset protection drivers appeared top of mind and were reflected in his comments regarding the NABERS (National Australian Built Environment Rating System) legislation, which came into effect on 1 November 2010. The NABERS legislation requires mandatory disclosure of energy efficiency ratings for buildings with lettable areas above 2,000m2 (Appendix 6.).

Rockefeller describes how the Tasmanian market for large commercial office space is dominated by government tenants and that these tenants would commence stipulating minimum NABERS ratings when renewing their tenancies in the future. Any failure to meet the market demand for high efficiency buildings would impact on rental yields and valuations (Appendix 6), given "environmental performance is now such an intrinsic part of the value of a building" (Fitz-Gerald, 2010, P. 160.).

Rockefeller, highlighted the limited options in responding to the NABERS Legislation, stating: "you quickly discover how few tools you actually have to battle this problem" and "you realize you have both hands tied behind your back" (Appendix 6.).

The research interview with an anonymous provider of renewable embedded generation systems identifies the motive for the majority of his clients as: "To offset the critically rising electricity costs" adding that, "a lot of our clients are passionate about the environment and they see this choice as a conscience decision" (Appendix 4. Q1, Q2. & Q3.).

Similar to Rockefeller the renewable energy provider added: “Our clients often feel that they lack options for making energy cost savings through efficiencies alone. This prompts them to look at solar, solar & wind, micro hydro, biomass and forest waste” (Appendix 4.).

Whilst Lipscombe notes that: “People seem to think electrical energy is a right and the government should pay for it. But if you turn up at the fuel pump you don’t have the same point of view, so there is a cultural concept that clean energy should be treated as a right for everybody” (Appendix 9. Q1.).

The comments above are similar to those of the speaker from the floor at the 2010 Annual EUAA Conference who comments that: “The vast majority of consumers are being led to believe that renewable energy technologies are essentially free, through cross subsidies from the REC market and premium Feed in Tariffs” (Anon., 2010).

In summary the motives identified from the primary research, included social motives, such as, a sense of responsibility to take a lead role in responding to climate change, i.e.:

- To demonstrate active leadership, in the response to climate change.
- To portray an environmentally sustainable business model.
- A desire to take back control, to be energy independent and self-sufficient.

The commercial motivations include:

- An expectation that embedded generation would lead to reduced electricity costs, or at least reduce the risk of further cost increases.
- To meet State Government targets for reduced energy consumption and reduced greenhouse gas emissions.
- To mitigate the commercial risk posed by the NABERS legislation.

4.3 Search & Evaluation - Findings

The research sought to explore each customer's process and experiences in their search for and evaluation of electricity generation alternatives. Each customer demonstrated different techniques and depth in their search for alternatives. Rob Nichols followed a highly self-sufficient, "We essentially went alone", pragmatic approach when he described how he "looked at energy efficiency inside our existing plant first", but also notes: "We did not initially consider any other technology, the wind turbine seemed to offer the most bang for the buck" (Appendix 2.).

Rob Nichols individual quest for self-sufficiency is also demonstrated in his individual quest for knowledge, to the point of gaining the "Nuffield Scholarship" (Mounster 2010) for research into biomass energy generation. However Rob also notes a "Danish Mentor", the "Learning" process and a "Business Model".

Tim Terry attempted to access professional assistance but found it lacking, when he notes: "We didn't do any wind monitoring and we couldn't find any consultants to help with this issue" (Appendix 5). Rockefeller accessed a suite of specialist providers during his search and evaluation process and noted mixed experiences with this search for information (Appendix 6.).

Tim Terry notes: "I considered solar and very quickly learnt that it wouldn't give me a commercial return at all." A position echoed by Greg Cooper (Appendix 10.) who also notes the relatively lower economics of solar photo-voltaic in his comment: "Set aside a budget for a 5KW Solar and 5KW of wind but once we recognized the wind potential of the site we changed to 1.5KW solar and 10KW wind and that this would produce a much better bang for buck return and lead to a zero energy building" (Appendix 5.).

Both Nichols Poultry and Nekon Pty Ltd embedded generation proposals benefited from government funding. In the case of Nichols it was a “Clean Biz” grant and Rockefeller states: “We made a deliberate effort to access the governments Green Building Fund as a way to give ourselves options” (Appendix 6.). Terry relayed how he had attempted unsuccessfully to access government assistance (Appendix 5.).

The research interview with an anonymous provider of renewable embedded generation systems yields the sage advice: “Wind monitoring is important. You need to know you have the wind resource to support your investment” (Appendix 4. Q9.).

In summary the research into the search and evaluation process, yielded the following findings:

- Proponents exhibited different levels of involvement in the search and evaluation process, from highly self-sufficient to a highly outsourced process. This involvement appeared correlated to the size and resources available to the business, but also to the level of personal interest in the subject.
- Most proponents reported experiencing some level of difficulty accessing professional assistance.
- Solar photovoltaics were assessed as either uneconomic or unsuitable for the proponent’s applications.
- In most cases wind monitoring of the site, a key input into the project economics, was either, not conducted, based on assumptions or at best, based on extrapolated data.

- Two of the three commissioned embedded generation projects benefited from significant Government grants. The third was a State Government Department funded project. The other renewable generation project which has so far failed to attract any government financial support, is at the time of writing, reported to have been halted, due to a lack of economic feasibility (Appendix 5.).

4.4 Policy Findings

The Report took on a broad definition of policy in looking for categories of impediments to embedded generation.

When asked about the barriers to embedded generation in Tasmania, John Devereaux of Energy Advisory Services acknowledged the economic “Elephant in the Room”, with his acute response: “The lack of a price on carbon. Without a pricing mechanism to reward reduction in electricity consumption, which results in a reduction in carbon emissions, there is a reduced incentive to invest in alternative energy sources. The major barrier is the cost of embedded generation compared to the savings generated. The business case does not currently stack up” (Appendix 12.).

Whilst Lipscombe notes his policy concerns, stating: “It is a sad indictment on the way we do things when a customer walks into the shop and asks for 2KW of solar to offset their power bill and the government is prepared to subsidise this rather than subsidise energy reduction strategies” (Appendix 9. Q1.).

This comment highlights the findings of the Tasmanian Government commissioned “Wedges Report” which found “Energy efficiency” strategies were more cost effective, on a “Dollars per Tonne of CO2 Offset” basis, than investing in “Renewable Energy” (Gerardi, 2009. P. 5).

A statement from the floor of the 2010 EUAA Brisbane conference was that: “many state based premium feed in tariffs represented little more than a transfer of cash from government to installers and suppliers of small scale renewables, for little environmental benefit” (Anon., 2010).

Indeed the implication is that (premium residential scale) Feed in Tariffs (whilst politically popular) have not demonstrated an economically efficient means of reducing carbon emissions.

This concern appears consistent with the ACT Government Study, quoted by Paddy Manning who states that: “There's no doubt FITs are an expensive way to cut emissions. The ACT government recently estimated the cost of abatement was $195 to $434 a tonne — well over the assumed carbon price, under the government's proposed emissions trading scheme, of about $23 a tonne” (Manning, 2010).

Whilst Lipscombe also notes the apparent lack of behavioral change resulting from premium feed in tariffs and the somewhat perverse price expectation that these schemes have cemented in the public mind, commenting: “but what really has to happen is that the cost of this commodity (Electricity) has to deliver behavioral change, not expecting solar is a government incentivized free or discount coupon, fully paid for by the government. This just doesn’t make sense, feed in tariffs don’t seem to be delivering the change, rather it attracts people who seem only motivated by greed and the opportunity of something for nothing" (Appendix 9. Q. 4.).

Feed In Tariffs are not the only area where policy initiatives are fraught with complications. So too is Embedded Generation (Seaton, 2002. p. 22-24), where EG proponents seek “Reduced connection costs”, whilst those customers who are not EG candidates, expect network operators to avoid “un-economic network development”.

Fulton noted that the: “Network Tariff Application Guide does not contain the policy or guidelines on NUoS Offset calculations”. Aurora Energy commented that they: “are looking at formulating tariffs for generators being connected to the distribution system”, in recognition of increasing interest in embedded generation (Appendix 1 Q. 4.).

Nichols noted that he was: “uncertain as to the percentage Offset on Network Use of System (NUoS) costs, as we are yet to receive our first invoice as a contestable customer” (Appendix 2. Q. 7.).

Aurora Energy Networks noted differences between the Embedded Generator policy and the Stand-alone Generator policy and commented that: “These rules are NER & Tasmanian Electricity Law and the difference is between a load customer and a Generator. Aurora is working on upgrade of documentation for embedded generation, with a target date of end 2010.” (Appendix 7.).

A substantial body of work is currently underway in Australia looking at the policy alternatives for Scale Efficient Network Extensions (SENE’s). The purpose of this work is, “To allow the efficient connection of multiple generators with multiple owners in proximate areas over time and to charge an efficient price for that service” (AEMC, 2010, Slide 15.).

None of the proponents interviewed identified network connection costs as an issue. This may be due to a mixture of good fortune, in the local infrastructure capabilities, and a degree of goodwill. However, as embedded generation continues to grow, neither of these elements can be assumed to exist indefinitely.

In summary, the policy issues that have caused barriers to embedded generation include:

- The lack of a price on carbon, detracting from the economic feasibility of embedded renewable generation projects.
- The potential for a low level of understanding of the REC's market and the economic value of these from renewables.
- Inability of some proponents to access funding schemes.
- The network connection policy in Tasmania may be under developed for embedded generation.
- Whilst not directly noted by the research participants, "Scale Efficient Network Extension" policies are likely to play an important role in the longer term facilitation of embedded generation.

Although not directly a barrier for embedded generation, from the point of view of an economically efficient response to climate change the following points are worthy of note:

- The $/Tonne of Carbon offset, or Carbon merit of various policies and incentive schemes may not be well understood by the public at large.

- A lack of price signals leads to a lack of behavioural change. To this extent some policies tools such as, premium Feed in Tariffs, may actually be detracting from signals required to effect an economically efficient response to climate change.
- The level of breadth and rigor in assessing practical alternatives on both a commercial basis and a $/Tonne Carbon basis, as an efficient individual response to climate change, is for the main part under-developed.
- To this end it is not always entirely clear that "renewable embedded generation" is for each individual circumstance, the most cost effective response.

4.5 Economic Findings

As the most likely motive for commercial scale embedded generation this Report sought to explore the financial viability of the proponent's projects and the key factors applied in developing each business models.

Rockefeller identified the key economic driver for his investment, as the embedded generation model, rather than a stand-alone wind farm. This was consistent with the explanation provided in Chapter 1.4, "The Economics, Embedded V's Distributed Generation") and is reflected in his comment: "The 100% Offset of electricity costs was one of my main criteria. I could of erected (larger) wind turbines in a paddock somewhere, and in retrospect had a lot more sleep filled nights. However, this would not of qualified for the 100% energy offset, so rather than achieving a 15 – 20c/kWh benefit, I would only get 3 or 4c/kWh for the energy produced" (Appendix 6.).

The embedded generation pioneers exhibited different levels of rigor in their economic modeling. Nichols noted that. “In terms of the business case and financial modeling, because we didn't undertake wind monitoring, we essentially took the risk. We planned on a 3-5 year payback and so far we are on track for this expectation. We would advise others considering a turbine to do the wind monitoring first and take some of the risk out of the process” (Appendix 2.).

Whilst Terry noted, “The expectation is that as a long term investment the unit will pay for itself and then be cash flow positive” (Appendix 5.).

The Anonymous provider of renewable embedded generation systems identified the assessment of relative technologies, for the majority of his clients in the comment: “Inevitably in Tasmania we always end up back at wind generation because of the economics, which are generally twice as competitive as solar” (Appendix 4. Q3.).

The provider went on to agree that Energy offsets, REC’s and Network cost offsets were all important considerations in developing the business case for Embedded Generation. Noting that: “People are starting to realize that both solar and wind are very good investments. Solar panels for instance are guaranteed for 25 years and wind turbines, when properly maintained, for 20 years. People are creating companies to invest in the wind turbine and the superfund can own the company as an excellent long term investment” (Appendix 4. Q.4.).

However, not all projects were reliant on the economic benefits of embedded generation, some were more focused on emissions reduction.

Cooper for instance noted: “we looked at a simple payback and estimated the cost of the turbine and external works to total of around $50-$60,000. Based on the electricity Tariff rate we calculated a 3 year payback. We worked with what we were offered (by Aurora Energy) and it was not a critical element in our decision making” (Appendix 10.).

In summary the economic findings included:

- Wind turbines are assessed as the most cost effective form of renewable embedded generation in Tasmania.
- Not all projects were reliant solely upon economic returns.
- The veracity of all project economics appeared hampered by a lack of robust and site specific wind resource information.
- It was not clear that the value and longevity of REC’s had been fully factored into the economic assessment by some of the end user customers.

4.6 Council Planning, Applications and Approvals

Town planning systems were outside the anticipated scope of this Report (and even further out of the author's experience). However, based on the recurrence of issues and weight given to the subject by our pioneers and stakeholders, it would have been remiss not to explore these issues further.

All except one of the proponents interviewed saw the planning process as a barrier to a greater or lesser degree. Nichols commented: "The level of planning and complexity required was the first hurdle. Planning approvals were a perceived hurdle but compiling the actual document was the hardest part, not the Council approval itself" (Appendix 2.).

Terry also noted difficulties in the planning process: "The barriers started one and a half years ago when I went to council and submitted my Development Application". Objections were lodged against this development and council policy on confidentiality meant that we could not be privy to the reasons for the objection, so we have no way of understanding the nature of the objections. Unfortunately whilst the good will and communications have improved I still don't have council approval to erect this development" (Appendix 5.).

Rockefeller noted: "The current Planning Schemes simply do not allow for this type of development. We have faced well publicized hurdles with each of these projects. The Hobart City Council took our Marine Board Building proposal to the tribunal, but once we had met the height limitations they had no grounds for their dispute" (Appendix 6.).

Whilst Cooper had a positive experience quoting: "We found council very good to deal with, they basically spelt out the process and we chose to go through a separate process for the turbine to ensure it did not hold up the progress of the building itself. There were two or three objections at the time of planning however the council found that these were unjustified and approval was granted" (Appendix 10.).

The research interview with an anonymous provider of renewable embedded generation systems stated: "The number one impediment is the environmental approvals process for wind turbines. The fact that all councils have different requirements, for instance, the restrictions on turbine height varies between councils, and each project requires a unique set of documents, means the minimum cost is $38,000. Assuming there are no follow up questions, queries or changes, the DA (Development Application) process alone takes at least 6 months" (Appendix 4. Q. 6.).

Research with four Tasmanian Town Planners, all of whom had experience with wind turbine planning processes, yielded an interesting comparison between wind turbines and mobile telephone towers, in the following comments: "The current planning issues with wind turbines are quite similar with the issues faced in the 1990's regarding mobile phone towers and how councils and communities evolved to cope with these developments" (Appendix 8. Q.6.).

Town Planners appeared to have some flexibility in interpretation of the development application, evident in the Town Planner comment: "Council could either take the view that a Wind Turbine Application is a Prohibited Development or that is a Permitted Development, Ancillary to the Principal Use of the site. Depending on this view will determine how complex the Development Application becomes" (Appendix 8. Q. 6.).

The Town Planners also noted the multi-jurisdictional issues: “Depending on the structure of the States 50 different planning schemes, will also impact on how these developments are viewed” (Appendix 8. Q. 6.).

The Town Planners also showed a degree of empathy for individual turbine proponents, acknowledging the time and cost hurdles posed by the process.

For example, the need for Avian Studies and the apparent lack of proportionality: “No council would be expert on birds. An Avian Study on species and flight paths is quite an involved study. Cattle Hill (a large multi turbine wind farm proposal) was a two year study where they monitored both the species and the flight path. How can you go to a farmer and suggest that they spend thousands or tens of thousands of dollars on such a major study. Where the risk of ten turbines is not proportional to the risk of one turbine”. (Appendix 8. Q. 6.).

Some Planners were critical of the fairness and equity of the Tasmanian Planning Appeal Tribunal: “The Tribunal is a free for all, with legal opinion and outcomes of the day. Some proponents can afford to invest in the tribunal process, some can’t” (Appendix 8. Q. 6.).

The difficulties posed by Tasmanian Planning Schemes have been highlighted in the Tasmanian Chamber of Commerce and Industry media release, “TCCI calls for urgent action on planning reform”, identifying planning reform as one of three “pillars to securing Tasmania’s economic future” (TCCI, 2010).

In addition a recent ABC Stateline Television program also publicised the systemic planning issues (Ward, 2010).

Several extracts from Airlie Ward's interview of Simon Cooper, Chairman of the Tasmanian Planning Appeal Tribunal and Emma Riley of the Planning Institute, are reproduced below:

> AIRLIE WARD: "How many different planning schemes does Tasmania have"?
> SIMON COOPER: "Probably 35. Or it could be more. It's never always entirely clear".
>
> AIRLIE WARD: "So many schemes cause many problems"?
> SIMON COOPER: "It's difficult for the tribunal to actually be consistent and coherent almost in its approach because in many of the planning schemes, same expressions will mean different things. So if it's hard for us, it's I think almost impossible for the ordinary members of the community".
>
> EMMA RILEY, (PLANNING INSTITUTE): "The value of improving the planning system is underestimated" (Ward, 2010).

Whilst Peter Fischer, Director of the Tasmanian Planning Commission, noted the formation of an expert group of stakeholders to address the issue of renewable energy installations in buildings, commenting: "The State Government have recognized the lack of clarity and guidance in the current planning system with respect to renewable energy installations on buildings. From a commercial perspective the Committee are looking at renewable energy applications such as the (Vertical Muce) turbines on the Marine Board building to see if this type of structure can be permitted in planning schemes consistently across the State. The Tasmanian Planning Commission has also undertaken a review of Planning Directive Number 1. (PD1) which sets the framework for all new planning schemes in the State.

The revised PD1 has exemptions for small scale renewable energy. If PD1 is approved in its current form, as each councils update their planning schemes this mandatory inclusion will therefore be picked up by all 29 Tasmanian Councils by the end of 2011" (Appendix 13. Q. 1.).

The author has, at best, only a laypersons' knowledge of town planning. Therefore the findings for the planning and approvals process carry a caveat. However, the interpretations included:

- The planning and approvals process is broadly perceived as the most significant barrier to wind turbine developments in terms of both time and cost.
- The dissatisfaction with current planning systems extends to a wider cross section of stakeholders than simply the Wind Turbine Applicants themselves.
- Current planning schemes may not specifically cater for wind turbine developments and in these cases there may be wide scope for interpretation.
- The State Government has acknowledged difficulties in the current planning system and has established an expert group to address the approach to renewable energy in urban areas.
- The Tasmanian Planning Commission have undertaken a review and the revised "Planning Directive One" now includes exemptions for small scale renewable energy.
- However the above two initiatives may not cover rural and commercial scale developments respectively.
- Riley's assertion: "The value of improving the planning system is underestimated" (Ward, 2010).

4.7 Technical Design & Network Connection Agreement Findings

The Report investigated the factors which proponents considered in their selection of the generators physical energy output capacity.

In terms of the capacity of the wind turbine deployed by Nichols Poultry, Nichols commented that: “The turbine size matched the discussions with Aurora on allowable offset for load, but also (the Vestas V27) was the largest 415Volt machine, which enabled it to be direct connected into the distribution network without a step down transformer and other costly equipment” (Appendix 2.).

Rockefeller noted: “Our first proposal for the Marine Board Building was knocked back due to height restrictions. To meet this criteria, the four units have a capacity of 12KW each*”* (Appendix 6.).

In determining the unit sizing at Bruny Island Health Centre, Cooper noted they: “Assessed against what we could afford and had budget for and how we could maximize the output with these funds (Appendix 10.). Details of the actual energy output can be viewed online at: http://www.datacall.net.au/dhhsBruny/portal.htm?offset=0&period=week&site=&var=power)

Whilst Terry noted: “Unit sizing was determined by Tas Cranes as the cranes in the area cannot lift anything higher than 30M. This unit was the largest unit we could fit with the logistical constraints” (Appendix 5.).

The research interview with an anonymous provider of renewable embedded generations systems noted: *"*Sizing is a function of both the current electricity consumption onsite that the owner is wanting to offset and then how much more the owner wants to invest to produce additional income” (Appendix 4. Q. 5.).

The Report also investigated and observed experiences with Aurora Energy Network (the DNSP), i.e. The Aurora, “Application for Connection of an Embedded Generator” and the mandatory “Connection Agreement”.

The AEMC Report “Scale Efficient Networks Options Paper”, noted that: “The arrangements for connecting new generation to the national grid are likely to be tested over the next few years as the patterns of generation investment are expected to change”. “The frameworks that govern the terms and conditions under which generation can access the grid must be robust to the challenges that are likely to arise from the increased number, changing technologies and different locations of generation connections. The frameworks must allow these changes to occur while continuing to promote efficient outcomes in the NEM in the long term interest of consumers” (AEMC, 2010).

Nichols mentioned he had had: “two or three goes at the Aurora connection agreement”. The fact that it took until 2008 before anyone in Tasmania actually attached a cheque to their Aurora Energy, Application for Connection of an Embedded Generator in Tasmania, is in itself quite a telling observation (Appendix 2.).

Rockefeller had transferred responsibility for the Network Connection agreement to the Turbine installation company (Report Appendix 6.). Whilst Lipscombe highlighted the challenges of a Negotiated Network Connection Agreement, in his comment: "The connection agreement is an interesting beast. Just the notion of having a commercially negotiated agreement with a monopoly is interesting” (Appendix 9. Q. 7.).

Terry, who at the time of the interview was considering installing the wind turbine in a “Stand alone” wind farm configuration as opposed to embedded configuration, noted: “I considered offsetting my electricity consumption from the irrigation of the farm and domestic use, but I didn’t get any detail from Aurora of what this would entail”. Notably at the time of writing, Terry’s proposal has reportedly been shelved due to a lack of project economics (in the Stand-alone configuration) (Appendix 5.).

The research interview with an anonymous provider of renewable embedded generations systems yielded the comment: “The rules and costs around access to the electrical network also need to be developed. Now that we are entering into the user pays society, the cost of any infrastructure upgrade has to be borne by the wind turbine proponent. These renewable proposals are often in remote locations and at the end of the line where voltage drop issues are important. The utility is gaining the benefits of better quality of supply through the addition of embedded generation” (Appendix 4. Q. 6.).

The CSIRO report found that: “Due diligence assessment of each individual embedded generator connection, could become impractical …as the rate of connection requests increases” (CSIRO, 2009, P. 31). Whilst delays to the local assessment process were also evident in discussions with Nichols, despite the fact that in Tasmania in 2008, EG proposals had apparently not increased much at all (Appendix 2.).

However, by 2010 anecdotal evidence from discussions with Aurora Energy Networks, suggests that the rate of inquiries has certainly increased from 2008 levels.

Nichols commented that: “The connection agreement requires very tight technical parameters for producing electricity, such as voltage range, frequency range and harmonic distortion levels” (Appendix 2.).

Whilst Paul Breeze found that: “grid operators are beginning to demand more grid support services from renewable power plants such as the ability to provide spinning and regulation reserve and reactive power support. Grid codes of this type will become more important as the proportion of renewable capacity integrated into a grid increases” (Breeze, 2010, p. 10).

Notably, the Distribution Network Service Provider (DNSP) appears currently unable to exercise any flexibility in rural type cases where the optimal wind turbine location is separate from the customers’ load or at least the customers’ main load.

An example of this is a dairy farm where the main dairy load is separate from, say a remote but smaller and intermittent irrigation load, which happens to have an ideal wind resource. Connection of the wind turbine at the irrigation load will not qualify for network cost offsets at the Dairy, despite them being on the same property.

To contrast this situation in another way, the same wind turbine erected at a business with the identical electricity consumption as the combined dairy and irrigation load above, but operating at a single electrical installation, would derive a substantially greater economic benefit under the current embedded generation rules.

This inflexibility was confirmed by Aurora Network where the researcher sought clarification on the potential for a “Hybrid Model”. Aurora ruled out any room for negotiation on this point. Indicating that they were operating under National Electricity Rules and Tasmanian Electricity Law (Appendix 7.).

In summary the findings of the technical design included:

- As a rule of thumb matching the generators output capacity to the customer load is seen as one way to optimise the economic benefits that the embedded generation model offers.
- As a rule of thumb, matching the generators voltage and output capacity to both the customer and network infrastructure is seen as one way to minimise additional connection costs.
- Local conditions and local capacity for civil works may limit the size of any proposed wind turbine, specifically the crane height and site access.
- Council height restrictions, particularly in urban settings are likely to remain a limiting factor in turbine sizing.
- The project budget was also a determinant of turbine sizing.

Apart from stating these observations, this Report does not intend to further pursue these issues.

The summary of the Network Connection agreement findings included:

- Network connection agreements for mid-size embedded generators in Tasmania are relatively new for both proponents and the Network provider.
- A level of scepticism exists toward the notion of a “negotiated” connection agreement with a monopoly provider.
- An observation that if an embedded generator has to pay for the connection they should also enjoy the benefit of reduced line losses and deferred investment in infrastructure upgrades.

- An important part of the network connection agreement is that any new generator meets stringent output specifications.
- As the level of renewable energy on the system grows technical requirements are likely to become more demanding.
- The definition of embedded generation as opposed to (stand-alone) generation and resultant rules appear in some cases to lead to potentially inequitable outcomes. This may be particularly true for rural or geographically dispersed businesses.

4.8 Energy Agreement Findings

In addition to the Network Connection Agreement the Report sought feedback on the Retail Energy Agreement. This agreement constitutes the other significant electricity cost offset opportunity available from the embedded generation model.

Lipscombe summed up his experience with Energy Agreements in his comments: "There is a long way to go with these agreements. Aurora have a tough job to do with limited resources. But it is as though they have woken up shocked with the concept that they suddenly have feedin's (Embedded Generators) coming on. They don't seem to have resources to cope with this and the processes are driven by lawyers, not practical people. The concept that they have a piece of paper that says they can do whatever they want is not realistic they are playing catch up and picking easy systems to pick holes in a new wind installation rather than a new solar system. Energy buy back arrangements are relatively easy to negotiate but getting to the right people can be difficult especially when you have one person in the state who can do this and they are on holidays, things stop" (Appendix 9. Q. 7.).

During the meeting of 19th July 2010, Aurora Energy Retail noted that they were working on producing a: "Standard Small Scale Embedded Generation Contract for contestable customers" (Appendix 3. Q2.).

The research interview with an anonymous provider of renewable embedded generations systems, Noted that both Aurora Retail and Aurora Network were: "Very easy to deal with" (Appendix 4. Q.7.).

Terry noted: “I didn’t look in detail at the energy cost offsets. Aurora mentioned a number of around 4c/kWh. This sounded very low considering we pay around 20c/kWh. The buy-back price just doesn’t seem fair, particularly for a renewable energy product. We are part of the national grid and the buy-back price needs to be a nationally consistent price. If I’m going to invest serious money into wind turbines why would I do it in Tasmania” (Appendix 5.).

From the observation it is apparent that the Retail treatment of Energy produced is more flexible than the Network Connection Agreement, in that energy produced in one location by an embedded generator is able to be notionally transferred to another of the clients’ contestable sites, for an offset of up to 100% and apparently, without “additional” losses or other cost impost within Tasmania (Appendix 3. Q1.3 & 1.5).

The one restriction on the notional transfer of energy between the clients’ sites within Tasmania noted appears to be the different treatment of Non-Contestable sites (Appendix 3. Q1.6).

However, it is clear that end users who have seasonal business electricity consumption profiles, such as Dairy Farms and Irrigation are at a relative economic disadvantage due to the relative inflexibility of monthly reconciliation between the energy consumed and produced, when compared to a constant electricity consumption business (Appendix 3. Q1.1).

In summary the energy agreement findings included:

- Aurora Energy Retail's "Energy Agreements" could benefit from further development (which Aurora noted was underway)
- There was some concern expressed at the level of resources and practicality involved in this aspect of the process.
- Some proponents questioned the value of the energy buy-back pricing.
- Aurora Energy Retail are prepared to notionally transfer energy produced by the consumers embedded generator from one site to another in Tasmania without additional costs or losses, provided that both sites are contestable and operating under the same commercial entity. (This applies to the energy only, not network cost offsets).
- Monthly reconciliation (as opposed to quarterly or annual reconciliation) of embedded generation imports and exports of Peak and Off Peak energy, poses challenges for seasonal businesses such as irrigators and dairies, who would likely enjoy lower economic returns from embedded generation compared to a continuously operating business, all other things held equal.

4.9 Renewable Energy Certificates Findings

Of the four end user customers interviewed who had commissioned or were in the process of installing embedded generation, two demonstrated an understanding of the process for applying for Renewable Energy Certificates (RECs) and the approximate current commercial value of these certificates.

Of the three commissioned embedded generators, one had registered the renewable generator for REC's in their own right. In the remaining two cases, REC's had been assigned or otherwise left for the benefit of the installer, presumably for the life of the project. In these latter two cases, it was unclear whether or not any commercial analysis of the economic value of this concession to the installer had been undertaken.

The research interview with an anonymous provider of renewable embedded generations systems noted that: *"We found Aurora were not providing competitive buy pricing on our REC's so we have chosen to register the REC's ourselves and work with our clients on the sale of REC's. We receive five different REC purchases bids every week for our REC's"* (Appendix 4. Q. 7.).

Lipscombe notes: *"REC's are an ongoing commercial process. As a registered power station we bring all the REC's back under our banner and then manage the sale and trading of them"* (Appendix 9. Q. 7.).

Summary of the findings on REC's included:

- In some cases it was unclear whether or not the end use customer had undertaken a commercial analysis of the economic value of the REC's produced by the embedded generator.
- As in any market, the value of REC's changes over time and between potential buyers and sellers.

4.10 Social Findings

The Report noted economics as only one of several motives for installing embedded generation. To this end the report also looks at several of the social aspects and issues confronted by the pioneers.

Terry noted: "The opportunity to promote Truffles Australis as the only Truffle farm in the world to be fully energy self-sufficient was a definite consideration of our project. The opportunity to stay ahead of the pack is a strong incentive for me to pursue the wind turbine" (Appendix 5.).

Whilst Rockefeller said: "We understood these proposals were always going to polarize opinion and no one holds more concern over the issues of heritage, noise, birds and safety than me. However, we want to be seen as leaders in sustainability and to provide strong moral leadership as we do at all of our properties" (Appendix 6.).

Cooper commented: "The local community concerns were the first to arise on noise, birds and most strongly the visual impact. The adjoining neighbors' were very concerned with the impact of amenity and property values" (Appendix 10.).

The research interview with an anonymous provider of renewable embedded generation systems identifies marketing benefits as part of the value equation, in the comment: “There is no question there is a marketing angle. Rob Nichols has proven this” (Appendix 4. Q4.).

Whilst the Town Planner Focus Group yields the insights: “NP Power have handled their process very efficiently with, significant Avian studies and well thought out and executed PR. Visual impact can be a very polarizing and subjective. The public won’t see any issue with remote wind farms, where they can’t see or hear them. Musselroe wind farm has been made into a tourist attraction with viewing platforms” (Appendix 8.).

Lipscombe notes: "There is only one barrier that we confront and that is misunderstanding. Once people understand what we are doing the barriers seem to drop very quickly. Take the Bruny Island Health Centre turbine, at first there was some community concern about it, we met with them and discussed the issues with the community, but now they have adopted it, own it and they love it. It is their turbine now. We have been the trail blazers to some extent and have seen the changes to perceptions which make a difference” (Appendix 9. Q.6.).

The education theme was also picked up by Devereaux who says: “Most Tasmanian customers believe the energy they use is from renewable sources already, so some customers who might otherwise be incentivized to invest in renewable generation are not” (Appendix 12).

4.11 Conclusion of Findings

Key findings from this primary research included discovering the motives for embedded generation. These included a sense of responsibility by business owners to take a lead role in responding to climate change. An expectation that embedded generation would lead to reduced electricity costs, or at least reduce the risk of further cost increases to the business.

That embedded generation could satisfy the desire to demonstrate climate leadership and portray an environmentally sustainable business. In some cases embedded generation is a risk management response to climate related policy initiatives and that in others, it can assist meeting company targets for reduced energy consumption and greenhouse gas emissions. Furthermore, in some cases embedded generation represents a desire to take back control and to be energy independent.

Most proponents report experiencing some level of difficulty accessing professional assistance during various aspects of their search and evaluation process. One consistent theme to emerge was recognition of the current cost leadership position enjoyed by wind turbines when compared to other commonly available renewable technologies.

In most cases wind monitoring of the site, a key input into the economics of the wind turbine, is either not conducted, is based on assumptions or at best, based on extrapolated data.

Of the three renewable embedded generators commissioned, two had benefitted from Government grants and the third was a State Government Department project. That the lack of a price on carbon is likely to be detracting from the economic feasibility of other embedded renewable generation projects.

One clear theme to emerge is the complexity and challenges faced by climate change policy makers, which has been highlighted by both the literature (Seaton 2002) and the interviews, where the incentives available create their own issues of inequity. Not all Climate Change policy initiatives represent equal or efficient returns on a "dollar per tonne of Carbon reduced" basis.

Some policies, such as premium Feed in Tariffs appear to have either been misinterpreted by consumers and/or have masked the true cost of the transition to low emission energy sources. This in itself appears to have led to unrealistic electricity price and renewable energy price expectations among consumers.

To some extent, these policies may have perpetuated the lack of an economic price signal for reduced consumption and as such have failed to motivate behavioral change.

Some embedded generation proponents find the network connection policy in Tasmania unclear in terms of its application and methodologies. Aurora Energy has noted that this policy is undergoing further development.

The AEMC are considering ways to improve "Scale Efficient Network Extension" policy in light of the changes to generation occurring as a result of the response to climate change.

Planning has been well documented as a barrier to the take up of embedded generation and the State Government are undertaking initiatives to improve this situation. The level of concern directed at the Planning Process, would appear to support Emma Riley's assertion that: "The value of improving the planning system is underestimated" (Ward, 2010).

The Network Connection Agreement is currently undergoing revision. For end use customers in rural settings, to optimally locate wind turbines to best use the available local wind resource creates a currently irresolvable conflict with the definition of embedded generation and stand-alone generation for the Network Connection Agreement.

The energy agreement findings include that Aurora Energy Retail's "Energy Agreements" could benefit from further development (which Aurora Energy notes is underway) and there is some concern expressed at the level of resources and practicality involved in this aspect of the process.

Monthly reconciliation (as opposed to quarterly or annual reconciliation) of embedded generation imports and exports of Peak and Off Peak energy, poses challenges for seasonal businesses such as irrigators and dairies.

Some gaps in the knowledge of the REC's market may exist with consumers making it more difficult for them to undertake robust economic assessment of the viability of embedded generation.

The emergence of turbines in both rural and urban settings is "always going to polarize opinion" and with "one key barrier of misunderstanding" involvement and education are identified as two significant social tools to move forward in the debate.

5 Discussion

5.1 Introduction

The purpose of this chapter is to identify the implications of the barriers identified to embedded generation in Tasmania and the potential improvements in policies and practices to overcome them.

5.2 Motive Discussion

The research identified active leadership in the response to climate change and a desire to portray an environmentally sustainable business model, as strong motives for all of the embedded generation pioneers and stakeholders.

In fact, the linkage between a “response to climate change” and the adoption of “renewable energy” technologies was so strong and accepted among those interviewed that none felt the need to explain their embedded generation linkage to climate change much beyond the responses, “personal Interest”, “passionate about the environment”, “a conscience decision” and a “green and clean business”.

The erection of a wind turbine on a business premise has become an increasingly accepted symbol of leadership on climate response within Tasmania’s business community. This conscious and deliberate investment in highly visible renewable energy technology confirms these pioneers as innovators in the adoption of this new social symbol. This emerging badge of pride has received significant media exposure and as with any new trend, this has of course attracted a wide range of commentary and debate.

One man in particular looks set to make a further leap on his lead in the climate leadership quest. Driven be a burning desire for energy independence and self-sufficiency, Rob Nichols, the “canny farmer”, is now seeking to further reduce his dependence on the electricity network by adding a farm bio-waste facility to produce heat and electricity to his already wind turbine equipped poultry farm (Mounster, 2010). Such a move has the potential to turn the electricity network connection into little more than a reliable “clearing house” for instantaneous supply and demand imbalances, signaling consequences for the current network cost recovery regime (Appendix 11. Q. 1.).

The research also identified, “electricity cost savings” as a solid motive for most of the embedded generation pioneers and stakeholders. With comments including, “something for nothing” and “lack options for making energy cost savings through efficiencies alone”. The “State Government target” for reducing greenhouse gas emissions was also identified as a motive, as was “reduced energy consumption”.

Whilst the underlying motives of climate response, rising electricity costs and state government targets, exist, there were also a number of “triggers” identified which converted these underlying motives into tangible actions. The triggers to undertake action included, the Nichols Poultry billing “dispute” with Aurora Energy and subsequent feeling of “powerlessness”, which resulted in an increased desire to be “independent” by attaining energy “self-sufficiency” (Appendix 2).

The Bruny Island Health Centre “building upgrade” was a trigger to consider energy alternatives (Appendix 10), as was the “policy Interaction” with the NABERS Legislation (Appendix 6).

Another observation is the difference in purposefulness and intent, between the Nichols and Nekon examples, when it comes to the accessing of Government grants. On one hand Nichols, stated: "The clean biz grant helped get the project over the line" (Appendix 2). Whereas the Nekon example was a distinctly purposeful search for government support, reflected in the statement: "The NABERS legislation poses a significant business risk, what support exists to counter this threat" (Appendix 6.).

The "powerless" and "graceful appeal" comments remind us that overcoming the barriers to embedded generation is not simply a matter of economics and technology (Appendix 2.). As with all of the responses to climate change, we must take into account human nature and social motives. Only when we investigate the underlying values and beliefs will we understand where the true barriers and stimuli for adoption exist.

In summary the motives that lead to embedded generation include:

- The linkage between a response to climate change and the adoption of renewable energy technologies is already strong. Therefore, as the business community increasingly accepts the need to invest in its response to climate change, the pursuit of renewable embedded generation is likely to increase.
- On site highly visible renewable energy technologies are a new social icon, representing business leadership on the response to climate change. The ultimate expression of this icon, minimal reliance and finally disconnection from the grid, may be closer for some businesses than previously assumed.

- As or if electricity prices continue to rise, the business community will increasingly look to solutions such as embedded generation to stave off energy cost pressures. However it is noteworthy that the actual economics of an individual embedded generation proposal may actually play a somewhat variable role in their significance in this decision making, at least for the innovators.

- Government grants for renewable embedded generation have provided significant assistance to individual businesses to adopt embedded generation.

- Overcoming the barriers to embedded generation is not simply a matter of economics and technology a number of other triggers exist including the desire to take back control.

5.3 Search, Evaluation of Alternatives and Assistance

Despite the different approaches and levels of involvement in the search and evaluation process, most proponents reported experiencing some level of difficulty accessing professional assistance. In terms of industry development, if this experienced is widespread then it is likely to translate to level of unmet demand.

Indeed the TREIBD workshop itself identified “information assimilation and access” as a major opportunity and priority for the development of renewable energy projects in Tasmania (TREIDB, 2010).

A key input into the modeling of wind turbine project economics and turbine selection is reliable data on the onsite wind resource, usually recorded with specialized equipment over a period of 12 months or more (Neales, 2010, 1 Dec). Given wind monitoring of the researched sites was either, not conducted, based on assumptions, or at best, based on extrapolated data, evaluation of project economics has in these instances been based on estimations and probabilities.

The pioneers are likely to be natural risk takers by nature, are shown to be motivated by a range of non-economic factors and some were beneficiaries of government grants. Therefore uncertainty in the economic model has not deterred their pursuit or investment in embedded generation. However, for adoption of embedded generation to increase beyond these innovators, barriers such as economic uncertainty must be mitigated.

The pioneers demonstrated a “sustained” determination was required to commission their projects. To increase adoption the “time taken” which leads to a “loss of interest” must be compressed (Appendix 4).

“Business case certainty” and “Predictable competitive cash flows” are both identified in the Vestas CEO online presentation, as “critical issues” (Engel, 2010). The challenging economics of the wind power industry were highlighted in the recent Tasmanian parliamentary scrutiny committee hearing, where it was reported that, “Hydro Tasmania’s wind-farm business, Roaring 40s, had run at a loss for the past five years because there had not been enough wind”. Significantly that, the 2000 evaluation of the Woolnorth site, “had predicted wind speeds and therefore power production, would be 8 to 14 percent higher than had been recorded” (Neales, 2010, 1 Dec).

Whilst industry sources claim this level of forecast accuracy is actually a reasonable achievement, investors are unlikely to share the sentiment. Therefore reliable wind resource data, accurate modeling capabilities and case studies are likely to be critical success factors for wider technology adoption.

Two of the three commissioned embedded generation projects benefited from significant Government grants. The third was a State Government Department funded project. The other renewable generation project, which has so far failed to attract any government financial support, is at the time of writing, reported to have been halted due to a lack of economic feasibility (Appendix 5.).

Therefore it may also be possible, that as the current circumstances prevail, the economics of embedded generation in Tasmania are by themselves insufficiently attractive or inadequately understood, to generate wide scale adoption (Report Appendix 12.).

In order to overcome some of the economic uncertainty during the evaluation phase, it is likely to be important that Tasmania captures and makes available a suite of local evidence demonstrating the facts of the outputs achieved by locally installed embedded generation technologies.

It is apparent that Premium Feed in Tariffs from other states have been misinterpreted by some consumers to mean that renewable energy should be free or at least very cheap (Anon., 2010). Of course nothing could be further from the truth. Unfortunately one of the consequences of this interpretation is the confusion it creates in the mind of consumers as to the relative merit of available energy cost saving options.

Reports such as the MMA Wedges report provide a yardstick for the relative commercial ($/Tn CO2 Offset) merit of various Green House gas reduction measures over time. This report has been useful in confronting common misconceptions, where for instance the report shows that energy efficiency measures, such as improved efficiency in commercial air conditioning, provide a positive return on investment as opposed to investing in a hybrid car which has an overall economic cost (Geradi, 2009).

Whilst the interviews demonstrated that this search for commercial alternatives did occur to some extent, it was also clear that in the main this was an instinctive process. Rather than a fact based, lowest cost first investigation, from housekeeping type activities, such as switching off unnecessary appliances, professional energy auditing and educating staff on energy efficiency, before investing in higher cost per ton of carbon offset activities, such as installing high efficiency lights and motors.

The Wedges Report notes: “There is significant evidence that energy efficiency opportunities that are cost-effective in the sense of reducing the overall cost of greenhouse gas emission abatement are not currently undertaken because of a range of market failures and other barriers to their development and adoption.

These market failures and barriers include information failures, transaction costs, incentive misalignments, public good aspects of information and R&D, capital constraints and behavioral and organisational barriers. They give rise to a strong prima facie case for government intervention. Overcoming the market failures preventing adoption of energy efficient practices could result in the realization of over 1 Mt CO2 per annum of abatement of imported mainland electricity generation emissions in Tasmania” (Gerardi, 2009. P. 92.).

In summary the search, evaluation and assistance issues that may have caused barriers to embedded generation include:

- Due to a level of difficulty accessing professional assistance there is a level of unmet demand for independent advice on embedded generation, including wind turbines.
- The lack of robust site specific wind resource information means project economics in the past have been based on estimations and probabilities. Whilst this has not deterred the pioneers, broad adoption is likely to be more reliant upon mitigation of key economic uncertainties.
- As the only commissioned projects have either benefitted from government grants or been undertaken by a State Government department, the economics of embedded generation in Tasmania may be insufficiently attractive or inadequately understood, to generate wide scale adoption.
- Development and communication of a suite of local evidence demonstrating the facts of the outputs achieved by various local embedded generation technologies may help to overcome this information gap.
- It is important to educate the business community in good faith on the relative commercial and climate response merit ($/Tn CO_2e) of a wide range of policies and early response initiatives.
- As a generalisation, investing in energy efficiency measures, rather than promoting renewable energy as a broadly applicable silver bullet, is in all likelihood a more economically efficient early response to climate change and electricity cost pressures (Geradi, 2009).

5.4 Policy - Economic and Efficient Discussion

The CSIRO Intelligent Grid report identified “a hierarchy of conditions that need to be met before distributed energy achieves wide scale uptake”. The report stated: “Policy and regulation needs to allow proponents to capture the value of distributed energy. Especially where it reduces emissions or costs that are otherwise socialized – primarily seen as costs of peak demand infrastructure” (CSIRO, 2009, P. 38).

The interpretation of this reveals that removal of barriers to embedded generation requires both a price on carbon and a regulatory regime where the network is obliged to pay the embedded generator the equivalent cost of capital of any network investment which can be deferred as a result of the commissioning of the embedded generator.

The earlier Garnaut report also found that, not only did the current regulatory regime pose cost barriers for distributed generation but also, that there were inadequate price signals to reflect the positive externalities of embedded generation and provided additional detail of this, as follows: “There are two main positive externalities created by embedded generation that may not be adequately priced. These could lead to inefficient investment decisions. Network externalities arise from: Deferred augmentation of the transmission and distribution systems (and) reduced transmission losses” (Garnaut, 2008).

The Garnaut report went on to identify the cause of these market failures: “The market failure arises because the investor in the embedded energy infrastructure cannot appropriate the benefits created for others from deferred network augmentation or transmission losses.

The current regulatory framework prevents these externalities from being internalised. Distribution businesses receive revenue based on the value of the asset base, creating the incentive to build more distribution infrastructure. Rewarding embedded generators for the benefits of deferred network augmentation is in direct conflict with this arrangement" (Garnaut, 2008).

A different angle on this direct conflict was also highlighted by Devereaux, in his comment: "The regulatory regime currently in place delivers a return on assets to investors in electricity networks, with guaranteed revenues based on asset values, and therefore a reduction in volume would translate to an increase in per unit price in order to maintain those revenues" (Report Appendix 12).

Devereaux then went on to point out the second elephant in the room, announcing: "The looming challenge and barrier to investment in embedded (renewable) generation is therefore that of servicing the costs and return on investment associated with existing electricity infrastructure, via the existing regulatory regimes, at the same time as electricity volumes delivered via the existing infrastructure reduce as volumes delivered via embedded generation increase. Electricity customers will potentially be required, in the short to medium term, to fund both existing and new investments. Addressing this challenge will require a major reconsideration of existing market frameworks" (Report Appendix 12).

Significant changes to policy and network pricing regimes are required to support the long term equity and adoption of distributed generation in light of climate change, particularly as this relates to network investments. The magnitude of this task and complexity should not be taken lightly.

The Wedges report noted a role for the Tasmanian Government to play in facilitating embedded generation: "…there will still be an important role for the Tasmanian Government to facilitate the development of complementary measures that improve the effectiveness of broad based policies to reduce emissions. Recommended actions over the short-term include advocate for changes to market arrangement that recognise the full benefits of embedded generation such as cogeneration, including appropriate allocation of network benefits" (Geradi, 2009).

Unfortunately what each of these market commentators are alluding to is that:

1. The physical infrastructure or smart grid that will be required to connect and function with high penetration levels of renewable and distributed generation appears inescapably expensive.
2. As penetration levels increase, under the conventional tariff regime, the cost per unit also increases, as the total cost is spread over less unit sales.
3. Given 1. & 2., the only questions left are how do we best (most equitably) recover this cost, from whom, how and when?

This is where the "politics and policy collide", as the expectation of cost savings from the wider business community receives a healthy dose of caution, as it relies heavily upon a number of assumptions, expectations and inter-dependencies, which are clearly at odds with the current electricity industry model (Anon., 2010).

The danger as we move forward is in maintaining not only economic efficiency but also economic equity. As Franklin commented: "The jury is out as to whether autonomy or community is playing out" (Franklin, 2010, P. 20).

To this end the Anonymous Electricity Industry Insider added a plea to this dilemma, in his comments: “The challenge is that we actually need a more equitable pricing model to share the costs and benefits, where good investment decisions are rewarded. Where is the plan to develop these pricing mechanisms? We can’t just expect people to cope with these known cost increases. Just like heat pumps, in the early days when the technology was expensive and only a few people could afford them they created little nuisance. It was when the cost curve changed and the uptake increased that the aggregate impact became clear. Today we face the same market dynamics with wind turbines, but we don’t seem to have developed the strategy to cope with these changes” (Appendix 11. Q. 1.).

In addition to these broadly acknowledged issues this Report also identified the potential of a low level of understanding of the REC’s market and the economic value of these from renewable generation sources by the end user customers. To the extent that it was unclear to what level the value and life time of the REC’s likely to be produced by the generator had been taken into account in the customers’ business model.

Clearly the inability of some proponents to access funding schemes has deterred progress on embedded generation particularly as the stand alone economics and veracity of the business model remains to some extent unproven in Tasmania.

The network connection policy in Tasmania remains under developed at best it could be described as adequate for system and technical needs. However, in order for it to play a positive role in facilitating embedded generation in the longer term, goodwill is unlikely to be sufficient. This appears to be the case, where just prior to going to print (early 2011) more recent embedded generation proponents have reported facing connection costs ranging in the order of $10,000 to $100,000.

Network price signals are required to move the connection agreement from playing a passive role, to an active role in the economics of embedded generation. In other words to allow proponents to “capture the value” of embedded generation where and how it exists (CSIRO, 2009, P. 38). Unfortunately there appears little or no motive for networks to pursue such changes in their own right.

In summary, the policy issues that cause barriers to embedded generation include:

- Policy and regulation needs to allow proponents to capture the value of distributed energy where it reduces emissions. (CSIRO, 2009, P. 38). Embedded generators need a price on Carbon for the business case to become more economical. This statement is made as an observation only.
- Policy and regulation needs to allow proponents to capture the value of distributed energy where it reduces costs that are otherwise socialized – primarily the costs of peak demand infrastructure (CSIRO, 2009, P. 38). i.e. The network should pay the embedded generator the cost of capital saved through any deferral of investment triggered by the commissioning of that embedded generator.
- Development of “Scale Efficient Network Extension” policies will minimise the long term cost of connecting distributed generation and therefore improve the economics of embedded generation.
- Need to improve the level of understanding of the REC’s market and value derived, among end user proponents of embedded generation, to ensure they can appropriately value the business case.

5.5 Council Planning, Applications and Approvals Discussion

The planning and approvals process is broadly perceived as the most significant barrier to wind turbine developments both in terms of time and cost. Notably this dissatisfaction extends to a much wider cross section of stakeholders than simply wind turbine proponents.

Planning systems and processes play a critical role in ensuring public health and safety, environmental protection and equitable public amenity and the significance of this cannot be trivialised. However the dissatisfaction with the current state of affairs remains broad and well documented.

In terms of the embedded generation pioneers, Terry Noted: “More certainty is required in terms of what is and is not permitted and what can and can't be done. It seems ridiculous that each proposal must be submitted and evaluated in its own right. There should be some broad permissions in a Councils planning scheme, rather than developers having to start from scratch. Councils should identify this as an allowable activity in some areas and a discretionary activity in other areas, in order to simplify the process” (Report Appendix 5.).

Evidence of the growing disconnect between climate objective and the capability of councils to allow these developments is also highlighted in the Town Planners Focus Group which noted, it is: “Important to have a renewable energy department to look at the holistic strategy as to how these renewable energy objectives flow down into planning schemes to help local councils” (Appendix 8. Q.8).

The REN21 Global Status Report on renewable energy noted that: "City and local governments around the world are also enacting renewable energy promotion policies. Hundreds of cities and local governments have established future targets for renewables; urban planning that incorporates renewables into city development; building codes that mandate or promote renewables" (REN21, 2010, Slide 12.).

Unfortunately Tasmania appears to be lagging well behind this trend which presents a strong case for change. It may be an opportune time for a Tasmanian multi-stakeholder delegation to visit some of these more advanced countries and cities. Indeed the author would contend that Emma Riley should be seated in a prominent location on that carbon neutral flight. As one can only surmise that Riley's assertion that, "The value of improving the planning system is underestimated", is well founded (Ward, 2010).

5.6 Network & Network Connection challenges

As the cost of developing and maintaining the electricity network infrastructure grows, Time of Use (TOU) pricing, which signals when demand for energy is at its greatest, can encourage a demand response, such as investment in distributed generation.

To this end Kane Thornton and Dr Jeff Washusen (Thornton, 2005) findings are supportive of Szatow, who identifies: "a lack of planning information, and, time of use pricing. Planning information can help level the playing field for alternative energy supply options by providing accurate forecasts of network constraints and opportunities for investment" (Szatow, 2008).

AEMO's Annual Electricity Statement of Opportunities (AEMO, 2010), known as ESOO, informs the market of economic prospects for generation and demand side investment. Whilst the "National Transmission Network Development Plan" (AEMO, 2010, NTNDP) provides the market with information around transmission investment opportunities. At the distribution scale, network operators could also publish this type of information, acting more like transmission companies (Clarke, 2010, p. 14). The MCE Response to the AEMC, notes "The MCE supports distribution planning arrangements that facilitate the more active involvement of DSP proponents in network planning processes" (MCE, 2010, June, P. 7.). This report is known as a Distribution Annual Planning Report (MCE, 2010, Sept. P 3.).

Whilst Butler & Peter (2009) had mainly positive findings for network price signals, a note of caution is in order, for these price signals have also shown that they are not always positive and can depend on certain technical parameters" (Joode, 2009).

In Tasmania Transend have noted that, due to technical issues of "System Inertia", the electricity network, in its current form, has a "finite capacity to support additional wind generation" (Transend, 2010, "*Reliability Review Workshop*"). Barton hammered home this point, claiming that in the UK: "wind power is the fastest-growing renewable energy source and poses the most immediate grid connection problems" (Barton, 2004).

In Australia, not everyone agrees with who should pay for these infrastructure upgrades. The 2008 Energy Networks Association noted "Key Messages" including, those summarized below:

- Regulators need to ensure that an EG's connection is not subsidised by those not directly benefiting from the EG.

- Access cannot be guaranteed to be firm. (Wood, 2006).
- The regime should be “cost reflective” of all costs.
- Further consideration be given to the application of DUoS charges, first mover issues and feed in tariffs.
- Where network users embed generators to reduce their network load, requests for preserving capacity in the network (standby) should be subject to an appropriate charging regime.
- Alternatively, a once off fee should apply which would reflect all network related costs in accommodating a new EG unit including stand by capacity for delivery of purchased energy” (ENA, 2008).

The ENA Key Messages demonstrates a strong desire for User Pays pricing of “all costs”. Whilst the Nera Economic Consulting review found that potential barriers to DG included: “(DNSP) Management predilection for investment in own assets so as to grow business and/or reinforce market power. Geographic tariff averaging prevents DNSPs from sending efficient pricing signals. Negotiation arrangements for DG connection and usage charges gives rise to potential for inequitable regulatory treatment of distribution connected generators relative to transmission connected generators. Pricing of negotiated connection charges may be affected by misuse of market power. Payment of avoided TUOS charges to DGs creates a double incidence of costs to DNSPs with no corresponding benefit and may thereby motive DNSPs to impede DG uptake” (Houston, 2007).

The MCE response to the AEMC, notes "On balance, the MCE, considers it appropriate to expand the Rules allowing for the DMIS to explicitly cover a second purpose, being innovation in the connection of embedded generators" (MCE, 2010, June, P. 6.).

On the one hand a user pays system based on key Network cost drivers such as “Installed Capacity” or “Anytime Any-Direction Maximum Demand” sounds logical. However, another complexity arises where a move toward increased “capacity based” price signals, may correspondingly reduce the magnitude of any “energy based” charge component and therefore may reduce the incentive available from Time of Use energy price signaling.

One other complexity identified applies to an end use customer in a rural setting, where to optimally locate wind turbines, to best use the available local wind resource, creates a currently irresolvable conflict with the definition of embedded generation for the Network Connection Agreement. (Appendix 1. Item 4).

This situation places the embedded generation proponent in an unenviable dilemma where only three options exist.

1. Co-locate the turbine with the customer load in the embedded configuration to enjoy the full economic benefits, whilst potentially reducing the turbine output from an inferior wind resource.
2. Locate the turbine for optimal wind resource, as a stand-alone wind farm and forego around half of the revenue benefits that could accrue, under an embedded configuration.
3. Acknowledge that neither of the above configurations lead to an economically viable proposal.

Therefore DNSP’s hold one of the economic keys for either incentivizing or dis-incentivising the take up of embedded generation in agri-business or similar multi-connection point customers. However the research tends to suggest that the DNSP is at best ambivalent to the take up of embedded generation.

Garnaut describes that, “Resolution of the prisoner’s dilemma requires communication, to find a division of costs and benefits of cooperation that is acceptable to all essential participants in a solution” (Garnaut, 2008). To this end a more strategic overview of the broad goals and objectives must prevail in order to overcome the barriers to embedded generation.

In summary to facilitate embedded generation Network improvements include:

- Networks cost recovery regimes must be re-assessed in light of the response to climate change and the likely wider scale uptake of distributed generation and to some extent embedded generation.
- Distribution Networks should be obliged to provide accurate forecasts of network constraints and opportunities for investment to support decision making.
- Where network connection costs are levied on embedded generators there should be some entitlement to the economic benefits that result from the embedded generator.
- The Aurora Distribution Network Connection Agreement requires further development and this should include stakeholder inputs.
- The definition of embedded generation in respect to the ability to offset DUoS costs, may warrant review in light of rural and distributed business operations and recognition of the physical efficiencies in optimal location of wind turbines or micro hydro.

5.7 Energy Agreement Discussion

Aurora Energy Retail's "Energy Agreements" could benefit from further development (which Aurora noted was underway). Similar to the lack of commercial motive to incentivise networks to actively seek out embedded generation opportunities, so to embedded generation off-take agreements are likely to offer little in the way of commercial benefit to retailers. It is also worth noting that despite electricity market contestability, the incumbent retailer has an effective monopoly on the purchase of excess energy during the term of any pre-existing retail electricity supply contract.

In fact, non-scheduled and intermittent generation, such as wind, exposes the retail energy portfolio to additional risk. Considering energy trading often takes place in standard 5MW parcels, even the relatively large Nichols Poultry turbine at 0.225MW (225KW) offers little more than nuisance value, when compared to the core business or any major retailer. It is therefore little wonder that some proponents experienced a lack of resources and little practicality when attempting to negotiate these agreements (Appendix 9. Q. 7.).

Some proponents questioned the value of the energy buy-back pricing. This may relate to a misunderstanding of the components of delivered electricity costs, as shown in Chapter 2.6, and Figure 6., the discount applied to reflect the risk premium posed by intermittent energy supply and a mismatch with consumer expectations, which are based on the "delivered price for energy", such as those discussed in Chapter 5.2 (Anon, 2010).

Monthly reconciliation (as opposed to quarterly or annual reconciliation) of embedded generation imports and exports of Peak and Off Peak energy, poses challenges for seasonal businesses such as irrigators and dairies, who would likely enjoy lower economic returns from embedded generation compared to a continuously operating business, all other things held equal.

The current policy of monthly reconciliations could be examined for potential to offer an alternate buy back product with a longer reconciliation period, or “banking” provision. Such an examination could look at the actual out of pocket cost and risks for the retailer in managing an extended balancing service. Given that the value of this excess energy has already been discounted below a wholesale contract rate to reflect intermittency, it may be argued that the actual cost of offering a longer reconciliation period, or “banking provision”, such as is common in large natural gas contacts, could be based on the cost of working capital, credit risk and a potential two-way adjustment for seasonal differences in energy value.

5.8 Renewable Energy Certificate Discussion

In some cases it was unclear whether or not the embedded generation customer had undertaken a commercial analysis of the economic value of the REC's produced by the embedded generator. If this is the case then naturally this revenue stream will not be adequately reflected in the business model leading to a significantly diminished assessment of the overall project economics.

It was noted from a review of residential scale embedded generation sales material, that disclosure of the assignment of REC's to the installer or seller of renewable technology is made (in the fine print). However, it was also noted that no details of the magnitude of the value of this assignment is provided.

The price of REC's changes daily and it is logical that residential users can benefit from simple, risk free transactions offered in the above method. However to improve the economics of embedded generation for commercial scale embedded generators, it is likely that additional awareness, knowledge and evaluation would produce a more robust decision making process.

It is worth noting the current "Net" metering configuration offered by the DNSP does not automatically provide for separate metering of the actual embedded generator output. For renewable generators who wish to separately account for REC's, or where third party commercial terms exist, separate generator metering configurations may be advantageous (Appendix 1. Item 3.).

5.9 Conclusion of Discussion

The linkage between a response to climate change and the adoption of renewable energy technologies is quite strong within the Tasmanian business community, to the point where the erection of a wind turbine has become a social icon of leadership.

As electricity prices continue to rise, businesses will increasingly look to embedded generation as a solution. In some cases this may be irrespective of whether or not this represents the most cost effective response to their unique circumstances.

To accomplish an efficient response to climate change it is important to overcome common misconceptions and educate the business community on the relative merits of various initiatives.

Due to the developing nature of the embedded renewable energy industry in Tasmania, there appears to be a level of unmet demand in the business community for a range of services, from planning and evaluation through to maintenance. In particular the time taken during the early stages of the search, evaluation and planning process has contributed to a loss of interest and early exit for some potential candidates.

A lack of robust site specific wind resource information and scant information on the actual performance of existing systems means embedded generation in Tasmania may suffer from insufficiently attractive, or inadequately understood, economics that would be required in order to generate wider scale adoption. We echo the need to demonstrate “Business case certainty” and “Predictable competitive cash flows”, as “critical issues” (Engel, 2010).

In Tasmania, Government grants have provided significant assistance to individual businesses to adopt embedded generation. In the absence of further price signals, such as a price on carbon, it is likely that the demand for such incentives will remain.

Tasmania's planning system has come under criticism from several angles. Proponents of wind turbines have also made it clear that they view the difficulties posed by the current state of affairs as the most prominent barrier, both in terms of time and cost.

Significant changes to policy and pricing regimes are required to support the equitable adoption of distributed generation, particularly as this relates to network investments, pricing and pricing signals. Unfortunately both the cost and complexity of these policy challenges is almost overwhelming and remains to be confronted. Compounding this challenge is the realization that piecemeal policies can create unintended consequences and some fail to pass the most basic test of cost efficiency.

Further development of the Retail Energy Agreement combined with education of the cost elements in electricity supply may bring potential buyers and sellers expectations closer together. Products with alternate reconciliation cycles may also be attractive to seasonal businesses, such as Agri-business. Additional awareness of the REC market may also assist proponents to undertake a more robust commercial analysis of the economic value of a renewable embedded generation proposal.

The analysis has identified a range of opportunities to assist in overcoming the barriers to renewable embedded generation in Tasmania, some fairly straight forward, others quite complex and not without their own implications and consequences.

6 Recommendations

This chapter sets out the recommendations for overcoming the barriers to embedded generation in Tasmania.

6.1 Recommendation 1

Tasmanian and indeed Australia faces significant increases to the cost of maintaining and augmenting the electricity network to meet the current and impending challenges described throughout this report. The present regime of cost recovery and Network Use of System (NUoS) tariffs, built up over decades of the centralized generation model, is showing flaws in its ability to deliver equitable and economically efficient price signals into the future, as Demand Side Response (DSR), distributed and embedded generation grow in popularity.

Adding to the complexity of this economic challenge for network service providers, will be policy initiatives designed to incentivise the uptake of renewable energy technologies, which may inadvertently detract from efficient use network pricing signals.

Whilst development of an ideal economic model for a, “user pays electricity network pricing model of the future”, may be complex, as in any major change, the transition phase will be the most traumatic.

The recommendation is for the MCE and AEMC together with DNSP’s and stakeholders to engage in debate of the distribution pricing model under a low carbon, DSR and distributed generation future. Setting out the complexities and identifying the equity issues in order to agree upon the pathway to a new network cost recovery regime in a carbon constrained future. (See AEMC, DSP Stage 2 Final Report, Future Stage 3 Review).

6.2 Recommendation 2

Several of the pioneers exhibited a sustained determination to pursue their projects. However, to accomplish wider scale adoption a reduction in the early exit or “drop out” ratio, of enquiries is also required. One factor noted for these early exits, was the perceived time delays, which reportedly results in a loss of interest by key decision makers. To improve these conversion rates, key phases of the process are likely to benefit from initiatives which compress the current time taken to progress the project.

The planning and approvals process is broadly perceived as the most significant barrier to embedded generation wind turbine developments, in terms of time (and also cost).

This dissatisfaction with the current state of affairs extends to such a wide cross section of stakeholders (other than simply wind turbine proponents) that it appeared likely that more universal planning reforms would be triggered at some point.

However, in the absence of events which overtake this study, the recommendation is for TREIDB and proponents of wind turbines to engage with the State Government, Tasmanian Planning Commission, Councils and Town Planners, including the three regional planning bodies, to work through the time and cost issues as a matter of some priority.

6.3 Recommendation 3

Another factor noted for the early exit of potential embedded generation proposals, was the level of difficulty accessing professional assistance for advice and services on embedded generation. Therefore a level of unmet demand for these services exists.

Whilst some of our pioneers invested years in developing their projects, wide scale adoption requires a far more timely, streamlined and efficient supply chain response to consumer enquiries.

The recommendation is for TREIDB to play an active role in promoting and facilitating the renewable embedded generation dialogue between buyers and sellers.

Such initiatives could include the expansion and use of existing Tasmanian business information web portals and encouraging the role of the Clean Energy Council in promoting customer access and confidence in the embedded generation supply chain (See Also R.14.)

6.4 Recommendation 4

The lack of robust site specific wind resource information means project economics in the past have been based on estimations and probabilities. Whilst this has not deterred the pioneers, broad consumer level adoption is likely to be more reliant upon mitigation of key economic uncertainties.

The recommendation is for TREIDB to play a role in facilitating the provision and availability of fact based embedded generation information.

This could include consolidating the available information on operational embedded generators, developing and publishing case studies and their performance metrics. Highlighting available solar and wind mapping data, and providers of these services, as key resources and inputs into the economics of renewable embedded generation projects.

6.5 Recommendation 5

As the only commissioned embedded generation projects have either benefitted from government grants or been undertaken by a State Government department, the economics of embedded generation in Tasmania may be insufficiently attractive or inadequately understood, to generate wide scale adoption.

During this interim period of business case uncertainty, particularly output uncertainties, government grants are likely to play a role in overcoming the resulting commercial uncertainties. However, existing grant programs could be made more broadly beneficial if they were granted, in return for access to information that overtime would reduce the information gaps for future business case proposals.

The recommendation is for TREIDB to negotiate with grant program coordinators to include this “access to information” as a requirement in future Grant agreements, whist preserving commercial confidentiality.

6.6 Recommendation 6

To support the adoption of embedded generation, policy and regulation needs to allow proponents to capture the value of distributed energy where it reduces costs that are otherwise socialized – primarily the costs of peak demand infrastructure (CSIRO, 2009, P. 38).

This is to say that, the network should pay the embedded generator the cost of capital saved through any deferral of investment triggered by the commissioning of that embedded generator.

The recommendation is for TREIDB to take part in advocacy activities aimed at raising and debating the merits of a move to provide transparent price signals from the DNSP to embedded generators, including where relevant pricing signals from any deferred cost of capital.

6.7 Recommendation 7

If the network pricing signals from Recommendation 6., are adopted then it will also become important that Distribution Networks become obliged to provide accurate forecasts of network constraints and opportunities for investment, so as to signal in advance the likely level of incentives or disincentives that may become available in specific geographic locations. See also, Distribution Annual Planning Report (DAPR), under the AEMC Distribution Network Planning and Expansion Framework Review.

The recommendation is for TREIDB to take part in advocacy activities aimed at encouraging the adoption of the obligation for the Network operator to provide forecasts of network constraints and opportunities.

6.8 Recommendation 8

The Aurora Energy Distribution Network Connection Agreement requires further development and this is likely to benefit from stakeholder input.

The recommendation is for TREIDB to advocate for the opportunity for stakeholders to provide input into the development of Aurora's embedded generation Network Connection Agreements and their related processes.

6.9 Recommendation 9

A level of dissatisfaction exists regarding the definition of a connection point for the purpose of offsetting NUoS costs for businesses with multiple electricity connection points such as Agri-business.

Notwithstanding this, there exists a range of equity issues and conflicts which arise where the current lines between embedded generation and distributed generation exist.

The recommendation is for TREIDB to advocate for debate into the definition of Embedded Generation connection point’s, as they relate to the potential inequity faced by rural and distributed connection point businesses.

6.10 Recommendation 10

Whilst somewhat of an aside to the objectives of this report, the efficient and effective early response to climate change would benefit from far more community awareness and transparency in the relative cost benefit merits of various carbon mitigation strategies. The findings from the State Government commissioned “Wedges Report” (Gerardi, 2009), specifically the cost effectiveness per tonne of CO2e reduction of “Energy Efficiency” measures, appear to be not well understood by the majority of consumers.

The broad application of limited resources in a timely and cost effective response to climate change is reliant upon asymmetry of information. Each individual case is different and embedded generation is unlikely to be the most cost effective response to climate change or rising energy costs, for every business. Professional assessment of each individual businesses circumstance identifying the relative merits of resulting opportunities would likely yield a far better return on both an energy cost saving and a $/Tn CO2e mitigation basis.

Therefore it is important to echo the sentiments of Gerardi, who reported: “There is significant evidence that energy efficiency opportunities that are cost-effective in the sense of reducing the overall cost of greenhouse gas emission abatement are not currently undertaken because of a range of market failures and other barriers to their development and adoption. …They give rise to a strong prima facie case for government intervention. Overcoming the market failures preventing adoption of energy efficient practices could result in the realization of over 1 Mt CO2 per annum of abatement of imported mainland electricity generation emissions in Tasmania” (Gerardi, 2009. P. 92.).

The recommendation is for the Tasmanian Climate Change Office to continue to pursue initiatives which address the market failures identified by Geradi (2009) in the Wedges Report.

In particular, those that relate to professional assessment of each individual businesses circumstances. Assisting them to identify their unique opportunities for carbon mitigation and the relative financial and "$/Tn CO2e" merits of these.

More broadly, to develop community awareness and a shared knowledge of what constitutes an efficient and effective early action response to climate change. Promoting everyday examples and an easy to understand language such as "$/Tonne" of carbon mitigation.

6.11 Recommendation 11

The REC's market was legislated to financially incentivize the uptake of renewable electricity generation. As such REC's are an important commercial attribute of any renewable generation project. However, in some cases with our pioneers, it was unclear as to how rigorous the commercial analysis of the value of these REC's had been.

Whilst financial considerations were not the only motivation for our pioneers, broad consumer level adoption is likely to be more reliant upon clear project economics.

The recommendation is for TREIDB to play a role in facilitating the provision and availability of fact based information on the purpose and market for REC's and their relationship to the business case for renewable embedded generation. This initiative could be undertaken in conjunction with Recommendation 4.

6.12 Recommendation 12

The network connection process in Tasmania remains under developed. In order for it to play a positive role in facilitating embedded generation in the longer term, the combination of good luck and goodwill experienced by our pioneers (who faced minimal network connection costs) is unlikely to be sufficient.

For future proponents (some who just prior to print reported facing connection costs in the order of $10,000 to $100,000), "Scale Efficient Network Extension" (SENE) policies are likely to play an important role in minimizing their upfront contributions, or at least presenting an avenue for future revenues.

The recommendation is for TREIDB to take part in advocacy activities aimed at debating the merits of "Scale Efficient Network Extension" policies with the AEMC's SENE consultation process which has been extended to 30 June 2011. SENE's are not without controversy and their own set of implications, therefore it is important to engage stakeholders in this endeavor. This initiative could be undertaken in conjunction with Recommendation 6.

6.13 Recommendation 13

Monthly reconciliation (as opposed to quarterly or annual reconciliation) of embedded generation imports and exports of Peak and Off Peak energy, poses challenges for seasonal businesses such as irrigators and dairies, who would likely enjoy lower economic returns from embedded generation when compared to a continuously operating business, all other things held equal.

The recommendation is for TREIDB to take part in advocacy activities aimed at examining the current Retailer policy of monthly embedded generation reconciliations. In particular to explore the potential to offer an alternate product with a longer reconciliation period, or energy “banking” provision. Such an examination could look at the actual out of pocket costs and risks for the retailer in managing an extended balancing service.

6.14 Recommendation 14

The emergence of wind turbines in both rural and urban settings has polarized opinion. Social license has been shown through planning bodies and the media, to be as important to embedded generation as it is to any other commercial endeavor.

Whilst the phrase "beauty is in the eye of the beholder" tells us that the aesthetics of a wind turbine is a subjective experience, no such latitude exists with the communities right to have faith in the engineered quality and safety of the same wind turbine.

The recommendation is for TREIDB to play an active role in developing the social license for Tasmania's renewable energy industry. In particular, activities aimed at building trust and confidence through community consultation and education initiatives. Examples of the latter could include "Trade Fairs" and "Open Days" and possibly involvement of the likes of the Clean Energy Council.

6.15 Recommendation 15

Further development of the Retail Energy Agreement combined with education of the cost elements in electricity supply may bring potential buyers and seller's expectations closer together.

The recommendation is for TREIDB to advocate for stakeholder input into the development of Retail Energy Agreements for Embedded Generation and to include disclosure of the makeup of delivered energy pricing within these processes.

6.16 Recommendation 16

Finally, the issue of electricity system inertia, a matter of the operational resilience and integrity of the electricity grid, has been raised as a limitation to the capacity of the network to cope with wide spread adoption of renewable energy technologies in Tasmania.

This Report recommends that the State Government Department of Infrastructure Energy and Resources establish a multi-stakeholder group to review the facts, limitations and susceptibility of the network to the issue of system security and inertia, in order to plan for the likely increased penetration of distributed and renewable energy generation.

Potential stakeholders would include, the Office of the Tasmanian Economic Regulator, Transend, Hydro Tasmania, TasGas, Aurora Energy Network, AETV Power, TREIDB, the EUAA and other energy and renewable energy stakeholders.

7 Conclusion

If you have made it to this point without skipping too many pages you will probably now share a degree of empathy for the challenges faced by our pioneers of commercial scale renewable embedded generation in Tasmania. Indeed their resilience and tenacity has proven them to be both innovative and resourceful.

It has been a gift and rare pleasure to capture their experiences, interpret, contrast and summarise them. Our involvement reminiscent of the words of Bernard of Chartres, who referred to teaching philosophy as being like, “dwarves sitting on the shoulders of giants”.

Whilst reading this text may induce feelings of immense progress, this is likely to be related to the acquisition of knowledge as opposed to results which are obtained from the implementation of initiatives. It is worth noting that at the time of writing it was a mere three years ago that Rob Nichols reportedly telephoned the Network Service provider to enquire as to the progress of his connection application. Only to be told that, “we’re both in uncharted territory”, because no one had ever attached the cheque before (Appendix 2.).

To this end whilst our pioneers have cut a path through the undergrowth, much remains to be done before the high speed optical fiber link of embedded generation projects is operational, let alone fine-tuned.

Therefore we encourage the Tasmanian Renewable Energy Industry Development Board and other stakeholders, to set about testing our findings and recommendations and where in agreement, to set about using this document to influence policy and decision makers, in order to overcome the barriers to renewable embedded generation in Tasmania.

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Appendix 12 Interview – John Devereaux, Associate Director, Energy Advisory Services.

Appendix 13 Discussion – Peter Fischer, Director, Tasmanian Planning Commission

Appendix 16 Research Project Timeline

Glossary of Terms

Active Network Management (ANM. See also SmartGrid). An electricity distribution system which incorporates communications and automated (as opposed to manual or reactive) voltage and other system controls.

Contestable When customers have choice of retailer, they are said to be "contestable". Customers who do not have choice of retailer are supplied through regulated tariffs and are said to be Non-Contestable.

Distribution The local electricity system of "Low Voltage" and "High Voltage" "street mains" type or "poles and wires" supply. Distribution Company (Eg. Aurora Energy Network), Distribution Assets (local poles and wires) or Distribution System (local street mains system).

Feed in Tariff The fixed rate at which an embedded generator earns income from the electricity produced. Feed in Tariffs can be **Gross**, i.e. The rate is payable for all energy produced. Or **Net,** i.e. The rate is only payable on the energy exported to the grid, This is the excess of energy generated over the energy consumed onsite. A **Premium** Feed in Tariff, is where the Feed in Tariff rate is greater than the regular price at which the customer would purchase electricity from the grid. Therefore a **Premium**

Gross Feed in Tariff usually offers the greatest incentive for embedded generation. I.e. The rate is above the regular buy price and it applies to all energy produced.

Smart Grid An electricity distribution system which is designed to optimise two way flows of distributed and renewable energy generation, which incorporates communications to control system functions, including some customer loads and delivers pricing signals. (See also CSIRO, 2009, P. 34 for further explanation.)

Spot Market or Pool Where electricity Retailers and in some cases customers (through the Deemed Fallback Contract > 750MWh pa) do not enter into fixed price contracts, they instead pay the half hourly Spot market price, this is also known as taking on “Pool exposure”.

Whilst electricity contracts may historically be available in the magnitude of $50/MWh, the spot market can range between negative $1,000/MWh and positive $12,500/MWh.

Tranche In order to affect an orderly market start, customers are deemed contestable in rafts. This normally commences with a small number of large customers, and then in the following years, larger numbers of smaller customers and so on until all customers have choice of retailer. At this point the market is said to have Full Retail Contestability (FRC).

Transmission The “Extra High Voltage” electricity system of “Lattice” type “Tower Lines”. Transmission Company (Eg. Transend in Tasmania), Transmission Assets (Tower lines and regional substations) or Transmission System (backbone of the electricity system between large generators and major cities and towns), as opposed to local poles and wires “Distribution”.

References

Adair Roy, Hydro Tasmania News Release 24 Sept 2010 "*Hydro Tasmania rejects MP Claims*". Downloaded September from http://www.hydro.com.au/about-us/news/2010-09/hydro-tasmania-rejects-mp-claims

Anonymous. (2010) "*EUAA Annual Conference*", Brisbane 22 & 23 October, Questions from the floor. (Name withheld by request).

Aurora Energy (2009) "*Aurora Energy Annual Report 2008/09*". P. 39. Downloaded Oct 2010 from http://www.auroraenergy.com.au/about_aurora/corporate_profile/annual_report.asp

Aurora Energy (2010) "*Aurora Energy Annual Report 2009/10*". P. 33. Downloaded Nov 2010 from: http://www.auroraenergy.com.au/about_aurora/corporate_profile/annual_report.asp#current_annualreport

Aurora Energy (2010) "*Embedded Generation Information Sheet*" Version 1.6., August. P. 2.

(AEMC) Australian Energy Markets Commission (2009), "*Review of Energy Market Frameworks in light of Climate Change Policies: Final Report*", September 2009, Sydney. Commissioners Tamblyn, Ryan & Woodward. 30 September. Downloaded Nov 2010 from http://www.aemc.gov.au/Market-Reviews/Completed/Review-of-Energy-Market-Frameworks-in-light-of-Climate-Change-Policies.html

(AEMC) Australian Energy Markets Commission (2010) "*Electricity Market*". Downloaded Nov 2010 from http://www.aemc.gov.au/Electricity/Electricity-Market.html 8 Nov.

AEMC (2010), "*Scale Efficient Network Extensions, Options Paper"*, (SENE) 30 September, Sydney". Downloaded Nov 2010 from http://www.aemc.gov.au/Electricity/Rule-changes/Open/Scale-Efficient-Network-Extensions.html

(AEMO) Australian Energy Market Operator (July 2009). "*An introduction to Australia's National Electricity Market*". www.aemo.com.au

(AEMO) Australian Energy Market Operator (2010) "*Electricity Statement of Opportunities*". October. P.(i). Downloaded Nov 2010 from http://www.aemo.com.au/planning/esoo2010.html

AEMO (2010) "National Transmission Network Development Plan" Downloaded from http://www.aemo.com.au/planning/ntndp.html

Australian Government, Department of Climate Change and Energy Efficiency (2010) "*Commercial Building Disclosure Program UPDATE – JULY 2010*". Downloaded Nov 2010 from: http://www.cbd.gov.au/

Australian Government, National Health & Medical Research Council, (2010) "*Wind Turbines and Health, A Rapid Review of the Evidence".* July. Downloaded Nov 2010 from http://www.cleanenergycouncil.org.au/dms/cec/factsheets/evidence_review__wind_turbines_and_health

Blyth, Andrew (2010) "*CEO Message: ENA Statement on Energy Prices*". March 11, Electricity Networks Association (Aust). Downloaded November 2010 from: http://www.ena.asn.au/?m=201003

Breeze, Paul (2006) "*FUTURE RENEWABLE POWER GENERATION TECHNOLOGIES, The future costs, impact and growth of green energy*". Business Insights Ltd. P. 10- 11.

Breeze, Paul (2010) "*Renewable Integration and Balancing Issues Energy storage, structural costs, grid integration, operational considerations, and the future outlook*" Business Insights. P. 10-37.

Brown, Damien (2010) "*Aurora payroll spiral claims*". Mercury Newspaper, 8 September. P. 7. Downloaded in Nov 2010 from: http://www.themercury.com.au/article/2010/09/08/171465_tasmania-news.html

Brown, Damien (2010) "*Shock cost blowout at power bodies 485% rise*". Mercury Newspaper, 11 October. P. 1&2.

Business Insights Limited (2010) "*The Asia Pacific Electricity Market Outlook*". P. 124 – 132.

Butler, Tom. Peter, William (2009) "*Impacts and Benefits of Highly Distributed Embedded Generation in Australian Distribution Networks (IBEG)".* Econnect Project No: 2175 Prepared for Geoff James: CSIRO. P. 11.

Carley, Sanya. (2009). "*Distributed generation: An empirical analysis of primary motivators*". Energy Policy, 37(5), 1648-1659. doi:10.1016/j.enpol. 2009.01.003. Department of Public Policy and Center for Sustainable Energy, Environment, and Economic Development, University of North Carolina at Chapel Hill, CB#3435, ChapelHill,NC27599, USA

Clarke, Martin (2010) "*Distributed Generation Markets in Europe Expansion, investment and future opportunities*" Business Insights. P. 14.

Cossent, R., Gómez, T., & Frías, P. (2009). "*Towards a future with large penetration of distributed generation: Is the current regulation of electricity distribution ready? Regulatory recommendations under a European perspective*". Energy Policy, 37(3), 1145-1155. doi:10.1016/j.enpol.2008.11.011. Instituto de Investigacio´n Tecnolo´gica, Escuela Te´cnica Superior de Ingenierı´a, Universidad Pontificia Comillas C/Quintana21, 28008 Madrid, Spain

Christie, Ron (2010) "*Turbines add new dimension to Hobart ugliness*". Mercury Newspaper, Letters to the Editor. 20th July.

CSIRO (2009) "*Intelligent Grid: A value proposition for distributed energy in Australia*". CSIRO Report ET/IR 1152. P. 21, 38 & 314. Downloaded Nov 2010 from: www.csiro.au

Datamonitor (2009) "*Electricity in Australia Industry Profile*" Reference Code: 0125-0663. Publication date: October 2009. P. 3.

de Joode, J., Jansen, J., van der Welle, A., & Scheepers, M. (2009). "*Increasing penetration of renewable and distributed electricity generation and the need for different network regulation*". Energy Policy, 37(8), 2907-2915. doi:10.1016/j.enpol.2009.03.014. Energy Research Centre of the Netherlands (ECN), Amsterdam, the Netherlands. Elsevier Ltd.

Dept Infrastructure Energy and Resources (DPaC) (2010), "*King Island - Integrated Renewable Energy Project*". http://www.dier.tas.gov.au/energy/renewable_energy#4

Dept Premier and Cabinet (DPaC) "*Climate Connect*" http://www.earnyourstars.tas.gov.au/grants/climateconnect_grants

Domanski, Roman (2009) "*Key Challenges Ahead for Tasmanian Energy Users*". Energy Users Association of Australia, Tasmanian Energy Forum. 30 March. Launceston Tasmanian.

Duddles, Jonathan (2010) "*Tasmanian Survey of Business Expectations, Hot Topic – Environment and Climate Change*". TCCI. September Quarter www.tcci.com.au

Energy Matters (28 March 2010) http://www.energymatters.com.au/index.php?main_page=news_article&article_id=822

(ENA) Energy Networks Association (2008) "*Embedded Generation ENA Policy Framework Discussion Paper*" November 2008. P. 20, 23 45 & 56.

(EUAA) Energy Users Association of Australia (2005) "*NEM End User Advocacy Arrangements Comment on Options proposed by the MCE*". July.

(EUAA) Energy Users Association of Australia (2008) "*EUAA Submission to the AER on Transend's 2009 to 2013 Revenue Proposal*" August.

(EUAA) Energy Users Association of Australia (2010), "*The Sun and the Wind are Free, But Renewable Energy isn't*". Press Release. 12/09.

EUAA (2011) "*Federal Renewable Energy Scheme – Another Day, Another Dollar to Pay*", Press Release 1/11. 20 January.

Engel, Ditlev (2010) "CEO online presentation", Vestas website. http://worldofwind.vestas.com/

EU Energy (2005) "*Wind developers urged to involve community, overcome hostility*", RENEWABLES: UK. 18 November, EU Energy EUENRG 27, McGraw-Hill, Inc.

Enterprise and Culture Committee (2004) "*Evidence Received for Renewable Energy in Scotland inquiry. SUBMISSION FROM THE SCOTTISH RENEWABLES FORUM*". 10 February. Downloaded Nov 2010 from: http://www.scottish.parliament.uk/business/committees/enterprise/inquiries/rei/ec04-reis-scottishrenewab.htm

European Commission (2006) "*EUR 22040 — European Technology Platform SmartGrids — Vision and Strategy for Europe's Electricity Networks of the Future*". Luxembourg: Office for Official Publications of the European Communities. P 1. ISBN 92-79-01414-5

Fitz-Gerald, Keith (2010) "*Fiscal Hangover*", John Wiley & Sons, Hoboken, New Jersey, USA. P. 160.

Franklin, Peter (2010) "*The Post Carbon Landscape Alternative pathways to a low carbon landscape*" Business Insights. P. 20.

Fulton, Paul (2010) "*Pathways toward a wind technology embedded generation industry in Tasmania. A report for the Tasmanian Renewable Energy Industry Development Board*". October. Joule Logic Energy Advisors. Limited quotations available. TREIDB Confidential Document until public release expected during 2011.

Fulton, Paul (2010) *Personal discussion*. December.

Garnaut, Ross (2008) "*The Garnaut Climate Change Review: Final Report*" Cambridge University Press. 477 Williamstown Road, Port Melbourne, VIC 3207, Australia. © Commonwealth of Australia. P. Xviii & 448.

Gerardi, Walter., Parisot, Liisa., Knapp, Simon., (2009) "*Report to Tasmanian Climate Change Office, Department of Premier and Cabinet Tasmanian Greenhouse Gas Emission Reduction Project - Understanding the Potential for Reducing Tasmania's Greenhouse Gas Emissions*". **McLennan Magasanik Associates**. Also known as "***The Wedges Report***". Exec Table 2: P. 5.

Goodman, David., Ockenden Karma (2004) "*The Lines of most Resistance*". Utility Week. Reed Business Information. 23 April.

GridWise, The. Architecture Council (2008) "*GridWise® Interoperability Context-Setting Framework*", March. The GridWise® Interoperability Context-Setting Framework is a work of the GridWise Architecture Council. P. 7.
http://www.gridwiseac.org/pdfs/interopframework_v1_1.pdf

Kaye, Dr John (2010) "*NSW GOVERNMENT REVAMPS SOLAR BONUS SCHEME*". NSW Legislative Council Hansard, 20 October.
Downloaded November 2010 from:
http://www.industry.nsw.gov.au/__data/assets/pdf_file/0005/360194/nsw-govt-revamps-solar-bonus-scheme.pdf

Korporaal, Glenda (2010) "*Energy Prices to triple, Says Origin Chief*". The Australian. 18th April. Downloaded Nov 2010 from:
http://www.theaustralian.com.au/business/energy-prices-to-triple-says-origin-chief/story-e6frg8zx-1225853385647

Lehtonen, M., & Nye, S. (2009). "*History of electricity network control and distributed generation in the UK and Western Denmark*". Energy Policy, 37(6), 2338-2345. doi:10.1016/j.enpol.2009.01.026. Elsevier Ltd.

Lise, W. (2009). "*Towards a higher share of distributed generation in Turkey*". Energy Policy, 37(11), 4320-4328. oi:10.1016/j.enpol. 2009.05.046. Elsevier Ltd.

Llewellyn, David. Hon, Tasmanian MP Minister for Energy (2009) *Energy Policy Statement*, 3rd December.

Lowe, Philip. Assistant Governor (Economic) Reserve Bank Australia. (2010) "*Recent Economic Developments*", Keynote Speech to Colonial First State Investment Forum. Sydney - 13 May 2010. Referring to ABS Graph 11.http://www.rba.gov.au/speeches/2010/sp-ag-130510.html

Manning, Paddy (2010) "*Not yet the best thing under the sun*"
The Age, 10 April. Business - Opinion & Analysis. Copyright John Fairfax Holdings Limited. G-BIZ - Perspectives

Masokin, Mikhail (2007) "*THE FUTURE OF COGENERATION IN EUROPE, Growth Opportunities and Key Drivers of Success*" Business Insights Ltd. P. 13.

McKay Danielle, (2010) "*Aerial show puts city in a spin*" Mercury Newspaper 17 July 2010

McNaught, Megan (2010) "*Wind blows up turbines scare*". Mercury newspaper. 12 August. P. 2.

McNaught, Megan (2010) "*Power Prices through the roof*". Mercury newspaper. 30 October.

Mercury Editorial (2010) "*Blowin' in the wind*". 14 June 2010. P. 12.

MCE (Ministerial Council on Energy), (2009) "Review of Demand-Side Participation in the National Electricity Market, Final Report", November. http://www.aemc.gov.au/Media/docs/Stage%202%20Final%20Report-4a1e98cd-c630-467f-80f0-6339073b3ad0-0.PDF

MCE (2010) "DEMAND-SIDE PARTICIPATION IN THE NATIONAL ELECTRICITY MARKET", June. Downloaded from: http://www.ret.gov.au/Documents/mce/_documents/2010%20bulletins/No.%20181%20-%20MCE%20Response%20-%20AEMC%20DSP%20Stage%202%20Report.pdf

MCE (2010) "NATIONAL FRAMEWORK FOR ELECTRICITY DISTRIBUTION NETWORK PLANNING AND EXPANSION", Sept. Downloaded from: http://www.ret.gov.au/Documents/mce/_documents/2010%20bulletins/No.%20184%20-%20MCE%20Response%20to%20AEMC%20Final%20Report%20Sep%202010.pdf

MCE (2010) "*Standing Committee of Officials - Bulletin No. 185, National Energy Customer Framework Update*". 5 November.

MCE Ministerial Council on Energy (2010) "NATIONAL ELECTRICITY (RETAIL CONNECTION) AMENDMENT RULES 2010". 5 November. http://www.ret.gov.au/Documents/mce/_documents/2010%20bulletins/No.185-10-National_Electricity_(Retail_Connection)_Amendment_Rules_2010.pdf

Moors, Kent (2010) "*Energy Advantage*", Money Map Press. Downloaded October 2010.
http://moneymappress.com/category/members-only/energy-advantage/

Mounster, Bruce. (2010) "*Power to the canny farmer*". Mercury News 26 Oct. P 4. (Nuffield Scholarship for Rob Nichols to investigate bio-energy).

Neales, Sue (2010) "*Energy inquiry panel named*" Mercury newspaper, 28 September. Downloaded Nov 2010 from:
http://www.themercury.com.au/article/2010/09/28/175531_print.html

Neales, Sue (2010) "*Wind fails to turn a profit*", Mercury newspaper, 1 December, P. 9.

New South Wales (NSW) Department of Environment, Climate Change and Water (2010) "*23 June 2010 National Co-generation and Tri-generation Workshop Report*". Published August 2010. P. 2.)

NHMRC (2010) "*Wind Turbines & Health Public Statement*". July.

Nichols, Robert (2010) "*Notes for TREIDB meeting 30th April 2010*"

Orchison, Keith and Arlidge, John (2010) "*Powering Australia Volume 4 – Securing Australia's Energy Future*", Commstrat, Focus Publishing. North Sydney. P. 4, 8 & 50.

O'Young, Edwin (2009) "*NOT JUST A CARBON HIT ON ELECTRICITY PRICES*" Port Jackson Partners Limited.
http://www.pjpl.com.au/090817%20Electricity%20prices.pdf Downloaded Nov 2010.

Ochoa, L., Dent, C., & Harrison, G. (2010). "*Distribution Network Capacity Assessment: Variable DG and Active Networks*". IEEE Transactions on Power Systems, 25(1), 87-95. doi:10.1109/TPWRS.2009.2031223. VOL. 25, NO. 1, FEBRUARY. P. 93.

Ofgem (2001) Embedded Generation Working Group - sponsored by the Department of Trade and Industry - on transparent access to regional distribution networks for smaller generators.

Origin Energy (2010) "*UBS Australian Utilities Conference Sydney*" 29 April. Slide 8.

Paine, Michelle (2010) "*Turbine safety fury*". Mercury Newspaper, 24 August . P. 3.

Rae, Peter (Hon AO) (2010) "*Global and Local Outlooks and Ideas for Energy and Renewable Energy*" August 2010 Presenation Quamby Estate Tasmania.

REN21. (2010). "*Renewables 2010 Global Status Report*" (Paris: REN21 Secretariat). Copyright © 2010 Deutsche Gesellschaft für. Slide 10. Technische Zusammenarbeit (GTZ) GmbH. Downloaded in November 2010 from: http://www.ren21.net/Portals/97/documents/GSR/REN21_GSR_2010_full_revised%20Sept2010.pdf

Richards, Blair (2010) "*Heat rises over power costs surge*", Mercury, 7 Sept. P. 7.

Salt, Bernard (2010) "*Property Council of Australia, Tasmanian Growth Summit, Opportunities and Challenges for Tasmania in a bigger Australia*". 21 September. KPMG. Slide 3.

Santos (2011) "*GLNG project sanctioned*" 13 Jan. News Release. http://www.santos.com/Archive/NewsDetail.aspx?p=121&id=1244

Seaton, A. (2002). "*Embedded generation and distribution*". Power Economics, 6(10), P. 22-24. Retrieved from Business Source Complete database.

Smith, Matt (2010) "*Undamaged turbines set to go again*". Mercury newspaper, 8 September. P. 14.

Smith, Matt (2010) "*Turbine upgrade plan*", Mercury newspaper, 29 October. P. 3.

Stedman, Michael (2010) "*Blowin' in the wind to save Tassie Jobs*" Mercury Newspaper, 12 June P. 9.

Stern, Sir Nicholas. (2006) "*STERN REVIEW: The Economics of Climate Change*". Executive Summary. P. 1 - 13.

Szatow, Tosh (2008) "*Beyond Free Market Assumptions: Addressing Barriers to Distributed Generation*" Consumer Utilities Advocacy Centre.

Tasmanian Renewable Energy Industry Development Board (TREIDB) (2010) "*Renewable Energy Resources / Capability Mapping Workshop*". 9 November. New Town, Tasmania.

TCCI (2010) "*TCCI Calls for urgent action on planning reform*", 8 Dec. http://www.tcci.com.au/upfiles/tcci/cont/media_releases/101208__planning_reform.pdf

The Australian (2010) "*BHP CEO Marius Kloppers calls for revenue-neutral carbon price*" 15th September. Dow Jones Newswire.

Thornton, Kane & Washusen, Dr Jeff (2005) "*Impediments to Grid Connection of Solar Photovoltaic: the consumer experience*". Alternative Technology Association. P. 6.

Tompson, Phillip (2010) "*Go solar in city and put turbines out to pasture*". 17th August 2010, Mercury Newspaper, Letters to the Editor, P. 16.

Transend (2009) "*Future wind generation in Tasmania*". TNM-GR-809-0874-001 Issue 1.0, May 2009.

Transend (2010) "*Reliability Review Workshop*". 19 Oct, Hobart, Regulators Office. Group Discussion).

Transend (2010) "*Wind power modelling and analysis of simulated output for regions in Tasmania*". P. 1.

Vestas (2011) "*Vestas Strategy*" Downloaded January from: http://www.vestas.com/en/about-vestas/strategy.aspx

Walker, Gordon. (2008) "*Decentralised systems and fuel poverty: Are there any links or risks?*" Department of Geography, Lancaster Environment Centre, Lancaster University, Farrer Avenue, Lancaster LA14YQ, UK, Energy Policy 36, 4514–4517.

Walker, Stephen (2010) “*End disastrous experiment*”, Mercury newspaper, Letters to the Editor. 21 July. P. 19.

Wallace, Robert (2010) “*Tasmanian Survey of Business Expectations, December Quarter 2010*”, Tasmanian Chamber of Commerce and Industry (TCCI). Slides. 15 & 16.

Ward, Airlie. (2010) “*Planning reforms urgent*”. ABC Stateline Tasmania. Published Friday, November 12. Transcript & Video downloaded Nov 2010 at: http://www.abc.net.au/news/video/2010/11/12/3065305.htm

Ward, Brian (2010) “*Turbines generate some positive street feedback*”, Mercury Newspaper. 21st July.

Wood, J. (2006). "*Electricity Grid is 'over-specified and could carry more*". Utility Week, 25(21), 7. Retrieved from Business Source Complete database.

Bibliography

Allen, Eric and Marija Ilić. (1999) "*Price-based commitment decisions in the electricity market*". London Springer.

Assael, Henry (1995) "*Consumer Behavior and Marketing Action*". South-Western College Publishing, Cincinnati, Ohio, USA.

Baldi, F. (2007). "*Bank Lending to Energy Services Companies: a real options valuation of third-party financing*". Banque et Marchés, (86), 21-39. Retrieved from Business Source Complete database.

Barton, J., & Infield, D. (2004). "*Energy Storage and Its Use With Intermittent Renewable Energy"*. IEEE Transactions on Energy Conversion, 19(2), 441-448. doi:10.1109/TEC.2003.822305.

Barry, M., & Chapman, R. (2009). "*Distributed small-scale wind in New Zealand: Advantages, barriers and policy support instruments*". Energy Policy, 37(9), 3358-3369. doi:10.1016/j.enpol.2009.01.006.

Bodell, Tanya (2009) "*Understanding Obama's Energy Policy: Definitions for the Armchair Economist*" CRA International Inc. Electric Light & Power, March/April P. 16.

Bouffard, F., & Kirschen, D. (2008). "*Centralised and distributed electricity systems*". Energy Policy, 36(12), 4504-4508. doi:10.1016/j.enpol.2008.09.060.

Brennan, Palmer, Kopp, Krupnick, Stagliano and Burtraw (1996) "*A Shock to the System, Restructuring America's Electricity Industry*". Washington. Resources for the Future.

Brewerton and Millward (2001) "*Organisational Research Methods*". Sage: London.

Brown, D (2010) "*Dealing with Aurora becomes a saga*", Mercury Newspaper. Letters to the Editor. P. 22. February 2nd

Braun, Marcel. 2009. "*The evolution of emissions trading in the European Union – The role of policy networks, knowledge and policy entrepreneurs".* Accounting, Organizations & Society 34, no. 3/4: 469-487. Business Source Complete, EBSCOhost (accessed July 28, 2010).

Business Insights Limited (June 2009) "*The Top 10 European Utility Companies*"

Carreras, I., Miorandi, D., Saint-Paul, R., & Chlamtac, I. (2010). "*Bottom-Up Design Patterns and the Energy Web*". IEEE Transactions on Systems, Man & Cybernetics: Part A, 40(4), 815-824. doi:10.1109/TSMCA.2010.2048025.

Carr Nicholas (2008) "*The Big Switch: Rewiring the World, from Edison to Google*" W. W. Norton.

Chaurey, A., Ranganathan, M., & Mohanty, P. (2004). "*Electricity access for geographically disadvantaged rural communities—technology and policy insights*". Energy Policy, 32(15), 1693. doi:10.1016/S0301-4215(03)00160-5.

Committee of Inquiry into Sale of the NSW Electricity Assets (1997) *Report [of the] Committee of Inquiry into Sale of the NSW Electricity Assets*.

Crew and Schuh (2002) "*Markets, pricing, and deregulation of utilities*". Boston, MA: Kluwer. Academic Publishers.

Edward Elgar, (2006) "*Deregulation and its discontents: rewriting the rules in Asia"*. edited by M. Ramesh, Michael Howlett. Cheltenham, UK.

Energy Action Group (2002) "*Provider of last resort: can vulnerable customers be protected in de-regulated electricity markets: discussion paper"* / Energy Action Group. North Melbourne, Vic.

Energy Users Association of Australia (2009) web site www.euaa.com.au

Faruqui and Eakin (2002) "*Electricity pricing in transition*" Boston: Kluwer Academic.

Fairhead, Quiang, Melanie, Ahammad, Holmes and Schneider. (2002) "*Deregulating Energy Markets in APEC*". Canberra. APEC Secretariat. P. 63-64 Impacts of Reforms.

Felder, F., & Haut, R. (2008). "*Balancing alternatives and avoiding false dichotomies to make informed U.S. electricity policy*". Policy Sciences, 41(2), 165-180. doi:10.1007/s11077-008-9061-3.

Furong, L., Tolley, D., Padhy, N., & Ji, W. (2009). "*Framework for Assessing the Economic Efficiencies of Long-Run Network Pricing Models*". IEEE Transactions on Power Systems, 24(4), 1641-1648. doi:10.1109/TPWRS.2009.2030283.

Griffin and Puller. (2005) "*Electricity deregulation: choices and challenges*". Chicago: University of Chicago Press.

Gilbert and Kahn (1996) "*International comparisons of electricity regulation*". Cambridge University Press.

Hibbert, L. (2005). "*Plugging renewables into the grid*". Professional Engineering, 18(4), 24-25. Retrieved from Business Source Complete database.

Hinchy, Mike and Low, John. (1993) "*Electricity Transmission and Bulk Pricing under Deregulation*". Canberra. ABARE.

Hodge, Graeme A. (2004) "*Power progress: an audit of Australia's electricity reform experiment*". Melbourne: Australian Scholarly Publishing, 2004.

Houston, Greg. McMillan, Robert. (2007) "*Part One: Distribution Rules Review – Network Incentives for Demand Side Response and Distributed Generation",* NERA Economic Consulting. P. 82.

Hydro Tasmania (2009) "ELECTRICITY IN TASMANIA: A HYDRO TASMANIA PERSPECTIVE"

Hyman, Konolige, Lapson, Miller, O'Conner, Sayers & Tilles (1997) "*Deregulation of the Electric Utility Industry*". AIMR. Virginia.

Kalecinski, Lukasz, Kolacz, Izabela (2004) "*THE POLISH GREEN ENERGY OUTLOOK, Profiting from a dynamic renewable energy market"*, Ecofys BV, Business Insights.

Keane, A., & O'malley, M. (2005). "*Optimal Allocation of Embedded Generation on Distribution Networks*". IEEE Transactions on Power Systems, 20(3), 1640-1646. doi:10.1109/TPWRS.2005.852115.

Kiernan, Peter (2010) "*Green Energy in Emerging Economies Renewable investment, capacity growth, and future Outlook*" Business Insights. P. 13.

Kiesling, Lynne L. (2008) "*Deregulation, innovation and market liberalization: electricity regulation in a continually evolving environment*". New York, NY: Routledge.

Killick, David (2010) "*Cash cloud over wind farms*" The Mercury, 29 Dec. P. 20.

Kotler, Chandler, Brown & Adam (1994) "*Marketing Australia & new Zealand*", Prentice Hall Australia.

Kumar, A., Shankar, R., Momaya, K., & Gupte, S. (2010). "*The market for wireless electricity*" The case of India. Energy Policy, 38(3), 1537-1547. doi:10.1016/j.enpol.2009.11.037.

Lewis, Phillip & Braatvedt, James (Vaasaett Report), (Oct 2008) "*Utility Customer Switching Research Project: World Energy Retail Market Ranking*" VaasaETT and Peace.

Lomas, K. (2009). "*Decarbonizing national housing stocks: strategies, barriers and measurement*". Building Research & Information, 37(2), 187-191. doi:10.1080/09613210802645874.

Maiden, Samantha (2011) "*Green with envy at theatre funding*", Sunday Tasmanian. P. 14.

Martin, A., and R. Coutts. 2006. "*Balancing act [demand side flexibility]".* Power Engineer 20, no. 2: 42-45. Business Source Complete, EBSCOhost (accessed July 28, 2010).

McKim, Nick MP (2010) "*Electrifying Tasmania, Introducing a Gross Feed-In Tariff*" The Greens Tasmania. Parliament Tasmania. March

Nair, N., & Zhang, L. (2009). "*SmartGrid: Future networks for New Zealand power systems incorporating distributed generation*". Energy Policy, 37(9), 3418-3427. doi:10.1016/j.enpol.2009.03.025.

Navarro, Peter (1996) "*Electric Utilities: The Argument for radical deregulation*" Harvard Business Review. Jan-Feb P.112-125.

Negnevitsky, M., Nguyen, T. D. and de Groot, M. (2010) "*Novel Business Models for Demand Response Exchange*". Michael Negnevitsky and Thanh Duy Nguyen are with the Centre for Renewable Energy and Power Systems (CREPS), University of Tasmania, Australia.

Nelson, Kenneth. (Spring 1999) "*The New World of Power Marketing*" Management Quarterly, Gale Group.

NEW REVIEW, (2001) "*WORKING TOWARDS A BETTER DEAL*", The Quarterly Renewable Energy Newsletter. UK, Issue 48, May.

Ngo, Annie (2008) "*Electricity Pricing Trends and Outlook*", Energy Users Association of Australia, Tasmanian Energy Forum. Hobart Tasmania. 31 March.

Office of the Tasmanian Economic Regulator, OTTER (2008) "*ESI Performance Report 2007-08*". P. 193 – 214 http://www.economicregulator.tas.gov.au/domino/otter.nsf/LookupFiles/08_4370%20_ESI_Performance_Report_2007_08.pdf/$file/08_4370%20_ESI_Performance_Report_2007_08.pdf

Office of the Tasmanian Economic Regulator, OTTER (2009) "*Fact Sheet 8 Fallback Contract Arrangements".* http://www.power.tas.gov.au/domino/power.nsf/v-lu-factsheets/Fallback+Contract+Arrangements/$file/Fact-Sheet-8-Fallback-Contract-Arrangements.pdf

Office of the Tasmanian Economic Regulator, OTTER (2010) "*PROJECTS ON THE GO, Activities of OTTER, prepared for the OTTER Customer Consultative Committee*". February.

OECD (2001) "*Competition in electricity markets*" International Energy Agency. Paris.

Olsina, F., Garcés, F., & Haubrich, H. (2006). "*Modeling long-term dynamics of electricity markets*". Energy Policy, 34(12), 1411-1433. doi:10.1016/j.enpol.2004.11.003.

PB Associates (2006) "A NATIONAL CODE OF PRACTICE FOR EMBEDDED GENERATION CONSULTATION PAPER". Prepared for THE UTILITY REGULATORS FORUM (EMBEDDED GENERATION WORKING GROUP).

Pearce, J., & Harris, P. (2007). "*Reducing greenhouse gas emissions by inducing energy conservation and distributed generation from elimination of electric utility customer charges*". Energy Policy, 35(12), 6514-6525. doi:10.1016/j.enpol.2007.08.029.

Pepermans, G., Driesen, J., Haeseldonckx, D., Belmans, R., & D'haeseleer, W. (2005). "*Distributed generation: definition, benefits and issues*". Energy Policy, 33(6), 787-798. doi:10.1016/j.enpol.2003.10.004.

Phillipson & Willis (2006) "*Understanding Electric Utilities and Deregulation*". Taylor & Francis

Range, Jackie (2011) "*TRUenergy chief flags power price surge*" Australian Financial Review. 6 January. P 1 & 14.

Resource Planning and Development Commission (RPDC) (2003) "*Guide to the Resource Management and Planning System*" March 2003. ISBN 0 7246 7403 9. Production by Artemis Publishing Consultants, Hobart, Tasmania. Downloaded Oct 2010 from: www.rpdc.tas.gov.au

Rivkin, Jeremy (2002) "*The Hydrogen Economy*", Penguin Group. USA.

Roaring 40s' (2010) "*Roaring 40s' and Tasmanian Land Conservancy Eagle Nest Protection Program*". Download Nov from: http://www.tfga.com.au/files/documents/Of%20Interest/August%202010/Eagle%20Nest%20Information%20Sheet.pdf

Ropenus, S., & Jensen, S. (2009). "*Support schemes and vertical integration—Who skims the cream?*" Energy Policy, 37(3), 1104-1115. doi:10.1016/j.enpol.2008.11.006.

Rutherforda, J.P. Scharpfb, E.W & Carringtona, C.G. (2007) “*Linking consumer energy efficiency with security of supply*”. Energy Policy 35, 3025–3035.

Salman, S., & Rida, I. (2001). "*Investigating the Impact of Embedded Generation on Relay Settings of Utilities*" Electrical Feeders. IEEE Transactions on Power Delivery, 16(2), 246. Retrieved from Business Source Complete database

Sekaran, Uma. (1992) “*Research methods for Business*”. Second Edn. Canada. John Wiley and Sons.

Senergy EConnect (2010) “*Impacts and Benefits of Embedded Generation*” (IBEG), CSIRO Supplementary Work / Revised Scope. Proposal 0140 / 4187.

Sharon Beder. (2003) “*Power play: the fight for control of the world's electricity”* Carlton North, Vic.: Scribe Publications.

Schiffman, Bednall, Watson and Kanuk (1997) “*Consumer Behavior*”. Singapore. Prentice Hall Australia.

Smith, Matt (2011) “Turbine upgrade up in the air” The Mercury. 5 January. P. 12.

Sovacool, B. (2007). "*Coal and nuclear technologies: creating a false dichotomy for American energy policy*". Policy Sciences, 40(2), 101-122. doi:10.1007/s11077-007-9038-7.

Stanon, Miller and Layton (1991) “*Fundamentals of Marketing*” Second Edn. Sydney. McGraw-Hill Book Company.

Stuart, E. (2006). "*Energizing the island community: a review of policy standpoints for energy in small island states and territories*". Sustainable Development, 14(2), 139-147. doi:10.1002/sd.299.

Studebaker, John M. (1998) “*Slashing utility costs handbook*”. Lilburn, GA: Fairmont Press.

Walker, G. (2008). "*Decentralised systems and fuel poverty: Are there any links or risks?".* Energy Policy, 36(12), 4514-4517. doi:10.1016/j.enpol.2008.09.020.

Wei, L., Joós, G., & Jean, B. (2010). "*Real-Time Simulation of a Wind Turbine Generator Coupled With a Battery Supercapacitor Energy Storage System*". IEEE Transactions on Industrial Electronics, 57(4), 1137-1145. doi:10.1109/TIE.2009.2037103.

Welfens, Paul J.J. (1997) "*Telecommunications and energy in systemic transformation: international dynamics, deregulation, and adjustment in network industries*". George Yarrow, eds. Berlin; New York: Springer.

Wilcox, J. (2009). "*Taking a smarter approach to energy".* Modern Power Systems", April, 29(4), P. 8. Retrieved from Business Source Complete database.

Wilks, Neil. (2003) "*Heading off a gridlock*". Professional Engineering, 7 May, P. 29 – 30.

Wu, J., Zhu, J., Chen, G., & Zhang, H. (2008). "*A Hybrid Method for Optimal Scheduling of Short-Term Electric Power Generation of Cascaded Hydroelectric Plants Based on Particle Swarm Optimization and Chance-Constrained Programming*". IEEE Transactions on Power Systems, 23(4), 1570-1579. doi:10.1109/TPWRS.2008.2004822.

Yajima, Masayuki (1997) "*Deregulatory reforms of the electricity supply industry"* Westport, Conn.: Quorum Books.

Zaccour, Georges (1998) "*Deregulation of electric utilities*" Boston, Mass. Kluwer Academic.

Appendix 1 Meeting Observation - Joule Logic & Aurora Energy Network

Date Thursday 15th July 2010, Moonah, Tasmania.
Participants Paul Fulton, MD, Joule Logic (JL) & Craig Wilson, CRM, Nick Beltz, & Eric Lown, Aurora Energy Network.
(Consent for CAP 430 report and MBA granted & minutes reviewed, revised & approved by Craig Wilson)

Project Topic:
Proposed implementation Wind Turbines at Anonymous Embedded Generation Client (EG CLIENT) Installations. EG CLIENT has 23 installations located contiguously in the North West corner of Tasmania. EG CLIENT wish to install 3 Vestas V27 Wind turbines, each expected to generate 450,000kwh per annum. Each turbine is capable of producing some 3 times the load required by the average Client Installation.

EG CLIENT notionally would prefer to locate the 3 turbines in one geographic location, to reduce both infrastructure and Development Application costs, maintenance and operations costs. However as the Installations are 2 km apart Aurora connection arrangements and NUoS offsets are unclear.

Questions & Answers
(1) **Joule Logic provided an overview of the intended EG CLIENT projects for consideration.**

(2) **Aurora to provide a the up-to-date connection process documentation.**
Aurora provided this information via email on the 12/07/10. It included application forms for micro units up to 3kW, as well as the application forms for larger or multiple units. It also included Aurora's policy documents, technical guidelines and customer guidelines for the process.

Aurora follow Chapter 5 connection agreement, except that the Tasmanian Electricity Code (TEC) (mainly Ch 8) prevails in Tasmania. Where TEC is more specific.

(3) **Implications of the different metering arrangements for the new installations**.

Typical embedded generation installation has a new, communications enabled, import/export meter. This is a "Net" metering arrangement and is not capable of recording the actual energy generated by the wind turbine, for instance for the calculation of REC's.

An additional meter (could also be a net meter in some configurations/cases) could be installed (on the turbine side) to record generated electricity for the purpose of metering REC's.

This needs to be investigated by the Large Connections team and Aurora's metering department. It will also be impacted by the regulatory implications, which are to be investigated by Aurora's Regulatory Manager Leigh Mayne.

(4) **Implications of having the wind turbines at one Client Installation versus three different EG Client sites.**

Joule Logic is seeking a separately metered wind turbine which, whilst located on the property of one of the Client Installation loads, is not connected to the "load" side of the meter. Rather the EG CLIENT proposal is to locate the turbine in the most economic (wind effective) area and export this onto the Aurora (LV or HV?) network

Creation of a separate installation for the wind turbine would result in a new NMI. EG CLIENT may be unlikely to get a full DUoS Offset agreement due to the location assets required and distance to the Transend substation.

The Network Tariff Application Guide does not contain the policy or guidelines on NUoS Offset calculations. (Leigh Mayne is responsible for the NUoS Offset calculations and agreements. Craig to discuss with Leigh NUoS Offset opportunity, Transformer costing and contribution model).

JL proposal to site wind turbines together, rather than one at each Client Installation. Then to come to a commercial arrangement with Aurora to offset NUoS at other agreed loads/sites.

Once JL provide the information on the type, size and location of the generators, as well as the proposed connection assets, Aurora will be in a position to assess the system impacts and any offsets that are to apply.

Note: AE are looking at formulating tariffs for generators being connected to Distribution system (in recognition of the rise of embedded generation).

(5) **Provision by Aurora of the distribution network drawings for the area being considered and flagging of any thermal and voltage profile capacity issues**.
As advised, once JL provide the information on the type, size and location of the generators, as well as the proposed connection assets, Aurora will be in a position to assess.

(6) **Potential Network augmentation costs - new transformers at least are required**.
JL to provide detailed proposal, then Aurora will review & revert, as per 3 above.

(6) **Any on-going fees that would need to be paid.**
As above, plus note Aurora annual Connection Agreement review fee.

(7) **Identification of the NER chapters (and clauses if possible) that are applicable to the decisions and points of view that Aurora are presenting**.
Note TEC as per item 1. This information was provided to Paul via email on the 12/07/10.

Meeting closed.

Appendix 2 Research Interview Robert Nichols, Nichols Poultry

Date Friday 16th July 2010, Sassafras Tasmania.
Participants Robert Nichols, MD, Nichols Poultry & Marc White.
(Consent for CAP 430 report and MBA granted)

Question 1: When did the idea of installing a wind turbine at your poultry farm in Sassafras first enter your head?
"My Grandfather had a wind mill in the UK in the early 1900's, (said Rob pointing to a faded windmill photograph behind his desk), which was eventually knocked down to clear the runway approach for the Lancaster Bombers. Since then the idea that you could have something for nothing has always appealed to me.

Back in 1984 Dad contacted Bob Brown (a Tasmanian Greens Politician) to ask if he had ever considered wind energy in Tasmania. Whilst Bob was supportive, Hydro Tasmania (then a monopoly electricity supplier) scuttled the idea. Since this time Nichols have had a plan to install a wind turbine onsite at the farm.

We visited Europe in 2004 and saw several wind turbines at farms and from this awareness we started investigating our own options. We were fortunate to make an excellent contact in Denmark who has mentored us and taught us all he knows, including the business model, which we have implemented".

Question 2: What was your motivation for the project?
"One of the first elements to our motivation came about over a billing dispute with Aurora, which we felt powerless to resolve. Eventually it was identified that the overbilling was the result of an incorrect meter multiplier being recorded in Aurora's system, which saw us paying double what we should have paid.

This experience drove our desire to be independent and combined with our wish to have a green and clean business. There is also something, I can't properly put into words, but there is a graceful appeal in the simplicity and industrial art of a wind turbine fulfilling in its engineered operation".

(We take a few seconds to gaze out of Rob's office window and reflect on this observation, as the now almost stationary turbine blades are framed by a brilliant clear blue Tasmanian sky. For the first time I glimpse Rob's sentiment for this functional grace and beauty and acknowledge to myself that, prior to this point I had not taken the opportunity to view a wind turbine from this angle. As Carl Gustav Jung (Swiss psychiatrist, Psychologist and Founder of the Analytic Psychology, 1875-1961) famously said, "It all depends on how we look at things, and not on how they are themselves").

Question 3: What other options did you consider & Why did you choose a wind Turbine?

"We first looked at energy efficiency inside our existing plant. We went to quite some effort over a weekend to reconfigure the operation, in order to understand the bare minimum consumption the plant could operate under. We found that at least 30% of the consumption was essential background load, even with no processing underway. This told us that, energy efficiency alone was not the full answer we were looking for. We did not initially consider any other technology, the wind turbine seemed to offer the most bang for the buck".

Question 4: Who did you turn to for help?

"We essentially went alone. For the energy cost offsets, Renewable Energy Certificates (REC's) and Network cost offsets. I went directly to Aurora and asked what they could do for me.

Fortunately for us the project took 3-4 years to put together and in the final year the Clean Biz grant arrived and the project met the requirements and attracted a $65,000 grant.

I initially didn't pay much attention to the marketing value of the wind turbine but in retrospect the timing was perfect, although unintended. The prominence of the project together with the Clean Biz promotion gave Nichols a market edge, which we gratefully accepted.

The other unintended value has been the business credibility and the feeling of pride in the workforce for what we do and how we do it. This credibility and our now proven ability to successfully deliver projects may have also contributed to us winning a grant for redevelopment of the processing plant under the regional stimulus package".

Question 5: How did you determine the unit sizing?
"The turbine size matched the discussions with Aurora on allowable offset for load, but also (the Vestas V27) was the largest 415Volt machine, which enabled it to be direct connected into the distribution network without a step down transformer and other costly equipment.

The project has now opened up a more broad interest in renewable energy. We are now considering installing a bio-digester plant to recover all the nutrients from our waste products and potentially a cogeneration plant using the methane to generate power and hot water for use inside the plant.

We are unlikely to have considered this option without the initial project but the interest has grown. We are now looking at heading towards 100% self sufficient by 2020, but we may well achieve this ahead of time". (At which point I piece together some of the life experiences Rob has described and how these lead to a logical desire to be fully self sufficient ... or better!)

Question 6: What barriers did you confront in the process?
(As Rob looked to the ceiling for answers, I found myself sympathetic as I recognized that whilst this question sounded logical from my own desk, Rob's turbine had taken 4 years to go from commitment to reality and many more years had elapsed prior to this in the dreaming and believing phases of entrepreneurship. With the acceptable time delay from recognition of need, to gratification shrinking for every subsequent generation, expecting Rob to recall the barriers he had encountered over the past 4 years in a two hour interview was optimistic at best).

"The level of planning and complexity required was the first hurdle. Planning approvals were a perceived hurdle but compiling the actual document was the hardest part, not the Council approval itself.

The lack of wind availability data required a judgment call (normally wind farm developers would install wind monitoring equipment for 12 months and use this data in both the financial modeling and turbine selection) The class of machine had to be matched to the actual wind regime onsite. Even engineering of the foundation slab was complex".

Question 7: In terms of the commercial agreements, how do you perceive the fairness or equity of these arrangements?
"As a tariff customer the first agreement with Aurora allowed up to a 60% offset against the total bill. In addition to this we chose to sell the Renewable Energy Certificates (REC's) separately to get a better understanding of this market.

Now as a contestable client the offset is up to 100% on energy costs only. At this stage I'm uncertain as to the percentage Offset on Network Use of System (NUoS) costs, as we are yet to receive our first invoice as a contestable customer. The NUoS cost offset may or may not be as attractive as the previous arrangement.

We had two or three goes at the Aurora connection agreement. Initially I filled out the forms and attached the $2,000 cheque and posted it off. The form said they would have an answer to us in 14 days, but after 1 month I hadn't heard anything. I rang them to find out what was happening, only to learn we were both now well and truly into uncharted territory. (Apparently Rob was the first person in Tasmania to attach the Aurora Embedded Generator Application Fee. Refer AURORA ENERGY NETWORK DIVISION PROCEDURE EMBEDDED GENERATION SYSTEMS NP R PD 08, Appendix 3, P. 18.).

The connection agreement requires very tight technical parameters for producing electricity, such as voltage range, frequency range and harmonic distortion levels. As our turbine is a second hand machine none of the original output specifications could be backed up.
The operation and maintenance of the generator, for us, is probably the least of our worries. Having our own in house engineering capability and being confident with the nature of the actual hardware we chose to wear the O&M ourselves.

For us there has been no discussion with Aurora regarding reserve capacity network costs. The metering arrangements and costs were alarming but we just accepted the situation as part of the overall package. We got there in the end but metering did cause some eleventh hour issues. We found very good will throughout the process, from the builders, Aurora and the political will to succeed.

In terms of the business case and financial modeling, because we didn't undertake wind monitoring, we essentially took the risk. We planned on a 3-5 year payback and so far we are on track for this expectation. We would advise others considering a turbine to do the wind monitoring first and take some of the risk out of the process".

Question 7: What would you most like to see changed?
"The Environmental Planning. More certainty is required in terms of what is and is not permitted and what can and can't be done. It seems ridiculous that each proposal must be submitted and evaluated in its own right. For instance, if we wanted to put another turbine in or one on an adjacent property, we have to go through the whole process again.

There should be some broad permissions in a Councils planning scheme, rather than developers having to start from scratch. Councils should identify this as an allowable activity in some areas and a discretionary activity in other areas, in order to simplify the process. The current uncertainty around cultural and heritage issues and potential costs of these, could be addressed by these planning scheme amendments.

I totally agree that you should need to prove the suitability of your individual proposal including shadow flicker, noise and visual amenity, so long as these can be proven to be correct. The reality is the installation footprint is smaller than a water trough and I don't need permission to put one of these in my farm!

Another apparent inequity is the obligation to report bird strikes. If I drove my truck down the road and hit a wedge tailed eagle I wouldn't have to submit a report, but if one hits my wind turbine I must. This just doesn't make sense to me".

Question 8: What advice would you give to others who are considering following in your footsteps?

"If it is appropriate for you and you have researched it well, understand what you are doing, then do it.

Having a knowledge of what you are doing yourself, rather than accepting someone else's advice. Understand fully what you are committing yourself to. For instance, the fact that this was a 3-4 year process without the 12 months of wind monitoring says something about the level of commitment required. Thinking about the impact on other peoples' lives. There are a lot of factors to take into consideration, it's not just putting up the tower itself".

I thanked Rob for his time. (The return trip allowed time to reflect on Rob's unique and passionate journey on the pathway to self sufficiency and sustainability).

Appendix 3 Meeting Observation - Joule Logic & Aurora Energy Wholesale

Date Monday 19th July 2010, Battery Point, Tasmania. Transcript edited to take account of Aurora follow up clarifying comments of 29th July 2010.
Participants Paul Fulton, MD, Joule Logic & Darren Brown, Aurora Energy, Wholesale.
(Consent for CAP 430 report and MBA granted subject to Darren's review and confirmation of the minutes. Provided 29/7/2010.)

Project Topic:
(As per Appendix 1), Proposed implementation of wind turbines for EG CLIENT sites in North West Tasmania.

Questions
Q1: Ability to use excess energy produced at one connection point for other EG Client sites in the Client group.
"If all EG CLIENT sites were contestable, Aurora Retail would allow a complete offset (up to 100%) of all energy only across all contestable EG CLIENT Tasmanian sites"

Q1.1 Can this Offset be on an annual reconciliation basis?
No, needs to be by (monthly) billing period to correctly value the seasonality of energy production and pricing. For any net export, the rate offered would not be the contracted buy energy rate, it would be a (likely lower) wholesale energy rate.

Q1.2 Where the sites are Tariff or Non-Contestable sites, because the retail tariffs are bundled Tariffs, the Offset is up to 60%, to recognize in part, that the Network costs still need to be recovered. Where the wind generation exceeded the 60% Offset Cap on the embedded site, could the net export be applied to other EG CLIENT Non-Contestable sites, up to their individual 60% Offset caps? (The Aurora Retail Embedded generation Information sheet is largely silent on the 1 generator for 1 site issue.)

Answer: No, but Aurora may be prepared to 'unbundle' tariff sites and roll them into the contract for the contestable sites. The energy rate in the contract for the now larger no. of sites would be likely to be higher to account for the higher energy rate underlying the tariff sites that have been rolled in. They would also pay the appropriate network, metering, market charges, etc. Generation output could then offset all sites in the contestable contract.

Q1.3 The specific EG CLIENT example, with contiguous properties under sole ownership may be able to apply for and qualify for contestability under the aggregation rules. If this were to happen could Aurora then be able to include these now contestable sites into the 100% energy only offset?
Answer: Yes, as they will be treated as per any other contestable site.
(This is a notional improvement over the alternative, which was the sale of excess energy to Aurora at the lower wholesale rate).

Q1.4 Where contestable EG CLIENT sites are remote from the embedded generator which they are notionally taking their offset energy from, does this also offset their Market fees and Ancillary services costs?
Answer: Yes, as these would be billed on net consumption basis.

Q1.5 How would different Loss Factors be treated?
Answer: Calculation of net consumption would account for different loss factors.

Q1.6 Where the wind energy generated exceeded the consumption of the contestable EG CLIENT sites, can the excess then be notionally directed to the Non-Contestable EG CLIENT sites for the 60% tariff Offset?
Answer: "No, but may be prepared to 'unbundle' tariff sites and roll them into the contract for the contestable sites. The energy rate in the contract for the now larger no. of sites would be likely to be higher to account for the higher energy rate underlying the tariff sites that have been rolled in. They would also pay the appropriate network, metering, market charges, etc. Generation output could then offset all sites in the contestable contract".

Q.2 General contractual terms and conditions – ie length and form of contracts etc.

"The maximum length of contract would ideally be lined up with the Retail Electricity Supply Agreement contracts, this may be for 1 - 3 years, possibly up to a 5 years, beyond 5 years would requires a higher level approval process".

"Aurora is working on a standard small scale Embedded Generation Contract for contestable customers, which is based on the Aurora standard Tranche 4 contract". Aurora has no existing contract for multiple embedded generators and/or for multiple sites"

Q3. Metering Arrangements:

"Darren is not the decision maker on metering configuration"

(Researchers note: There was apparent good will from both sides to see these projects implemented).

Appendix 4 Interview Anonymous, MD, Tasmanian Renewable Energy Provider

Date Friday 23rd July 2010
Participants Anonymous, Managing Director, Tasmanian Renewable Energy Product supplier & Marc White
(Consent for CAP 430 report and MBA was originally granted for the interview, however approval of the interview transcript was not forthcoming, therefore the source remains confidential).

The company offers a suite renewable energy solutions from 30KW's to 850KW's.

Question 1: What are the most common motivations for your clients to install renewable embedded generation?
"To offset the critically rising electricity costs".

Q 2: What other options do your clients usually consider?
"Our clients often feel that they lack options for making energy cost savings through efficiencies alone. This prompts them to look at solar, solar & wind, micro hydro, biomass and forest waste. However the cost per tonne of collecting and carting biomass waste is often prohibitive”.

Q3: Why do clients choose Embedded Wind generation?
"Inevitably in Tasmania we always end up back at wind generation because of the economics, which are generally twice as competitive as solar. Plus a lot of our clients are passionate about the environment and they see this choice as a conscience decision”.

Q 4: In determining the business case for these projects how/do you value the following elements:
. **Energy cost offsets?** "Yes very highly"
. **Sale of REC's**? "Yes"
. **Network cost offsets**? "Yes, this is an issue"
. **Government Grants**?
"They use to be very important (RRPG diesel pump irrigation replacement 50% offset. PVRP Replacement plan has finished, could get up to $8,000 replacing diesel or grid connection) now they are non-existent”.

. **Marketing benefits**?
"There is no question there is a marketing angle. Rob Nichols has proven this. The Client Installation industry can also see the marketing benefits of renewables"

. **Other attributed value**?
"People are starting to realize that both solar and wind are very good investments. Solar panels for instance are guaranteed for 25 years and wind turbines, when properly maintained, for 20 years. People are creating companies to invest in the wind turbine and the superfund can own the company as an excellent long term investment".

Q 5. How do you determine the unit sizing?
"Sizing is a function of both the current electricity consumption onsite that the owner is wanting to offset and then how much more the owner wants to invest to produce additional income".

Q 6: What barriers do you often confront in the process?
"The number one impediment is the environmental approvals process for wind turbines. First there is a requirement for an EIS (Environmental Impact Statement), this is followed by the EIA (Environmental Impact Assessment), then the EMP (Environmental Management Plan).

The fact that all councils have different requirements, for instance, the restrictions on turbine height varies between councils, and each project requires a unique set of documents, means the minimum cost is $38,000. Assuming there are no follow up questions, queries or changes, the DA (Development Application) process alone takes at least 6 months.

The State government bodies are also trying to introduce restrictions such as no wind turbines within 5-10km of a Wedge Tailed Eagles nest.

The rules and costs around access to the electrical network also needs to be developed. Now that we are entering into the user pays society, the cost of any infrastructure upgrade has to be borne by the wind turbine proponent.

These renewable proposals are often in remote locations and at the end of the line where voltage drop issues are important. The utility is gaining the benefits of better quality of supply through the addition of embedded generation".

Q 7: In terms of the commercial arrangements, how do you perceive the fairness or equity of the:

. Connection Agreement?

"We found Aurora Network very easy to deal with".

. Energy cost offsets?

"We found Aurora wholesale very good to deal with, no problem at all".
"For retail tariff customers, we would prefer to be able to install larger units than 10kw, say up to 30KW, and still qualify for the 1:1 retail input tariff, preferring a gross feed in tariff, like NSW/ACT"

. Limitations on energy output/buy back arrangements?

(See above. No additional comments)

. Sale of REC's?

"We found Aurora were not providing competitive buy pricing on our REC's so we have chosen to register the REC's ourselves and work with our clients on the sale of REC's. We believe that the REC price will increase in the longer term. We receive five different REC purchases bids every week for our REC's. These are from companies like Green Bank and Enviro Bank".

. Network cost offsets? (As above)

. Reserve network capacity costs?

"No. Infrastructure upgrade costs have been the major issue, but most of the time we are only looking at a transformer upgrade"

. Government Grants

"Nil"

. Operation & Maintenance of the generator?

"(Company) includes a service agreement with the turbine order"

. Other costs Eg. metering

"No issue with metering it is straight forward"

. Other issues of fairness and equity?

"No".

Question 8: What would you most like to see changed?

"The existing Council approval process for turbine installation, turns a 6 month project into an 18 month project and the customers can lose interest during this time as they continue to pay utility costs.

The State government need to get behind manufacturing of renewable energy technologies in Tasmania, for both wind and solar (tracking). They could be providing No or Low interest loans. We are yet to get any support for this and this speaks of the lack of any real commitment behind the rhetoric".

Question 9: What advice would you give to others who are considering embedded generation?

"The consumer needs to be very careful ensuring that the installer is qualified to do the work and that the people onsite doing the work are also qualified. Wind monitoring is important. You need to know you have the wind resource to support your investment. Renewable energy is not a silver bullet but it does go a long way to doing the right thing.

I believe that the renewable energy industry will only get better as people who get in on the ground floor will get the benefit of the upswing when it eventually comes".

(Thank you & The interview was concluded.)

Appendix 5 Interview Tim Terry, MD, Truffles Australis

> "Tim Terry is a Tasmanian who has pioneered the Australian truffle industry since he first became involved in 1993. In 1999 he was the first grower in Australia to produce black truffles (Tuber melanosporum) and showed his own confidence in the enterprise by expanding his operations to create Australia's largest truffle growing operation (Tasmanian Truffle Enterprises)".
> www.trufflesaustralis.com.au

Date Friday 6th August 2010
Participants Tim & Marc
(Consent for CAP 430 report and MBA granted)

Interview Note: Tim Terry's proposal at the time of interview was to connect the wind turbine directly to the Distribution Network on his property in a "Stand-Alone" (Distributed Generation) wind farm configuration, as opposed to an embedded generator configuration.

Question 1: When did the idea of installing wind turbine on your property first enter your head?
"About 5 years ago".

Question 2: What was your motivation for the project?
"I have always wanted to be self sufficient in energy and my son's interest in renewable energy was a catalyst".

Question 3: What other options did you consider? & Why did you choose a wind Turbine?
"I considered solar and very quickly learnt that it wouldn't give me a commercial return at all. We don't have the water for micro hydro".

Question 4: Who did you turn to for help?
Once you had made the decision to pursue a wind turbine, did you arrange wind monitoring for the site?
"We didn't do any wind monitoring and we couldn't find any consultants to help with this issue".
In determining the business case for the project how/did you value
. Energy cost offsets?

"I didn't look in detail at the energy cost offsets. Darren Brown from Aurora mentioned a number of around 4c/kWh. This sounded very low considering we pay around 20c/kWh"

. Sale of REC's? "I looked at the REC market on the internet and spoke to Darren Brown at Aurora. Darren sent me some information on REC's which at the time were around $40 each. I also spoke to some other consultants and started to put a picture together".

. Network cost offsets? "Yes, I considered offsetting my electricity consumption from the irrigation of the farm and domestic use, but I didn't get any detail from Aurora of what this would entail".

. Government Grants? "I wrote to Nick McKim and Bryan Green multiple times, with specific questions regarding available assistance for installation of the wind turbine. To date over three months have passed, and whilst they have acknowledged receipt of my letters, I have not had any response to the actual questions raised regarding government support".

. Marketing benefits? "The opportunity to promote Truffles Australis as the only Truffle farm in the world to be fully energy self sufficient was a definite consideration of our project. The opportunity to stay ahead of the pack is a strong incentive for me to pursue the wind turbine".

. Other attributed value? "The expectation is that as a long term investment the unit will pay for itself and then be cash flow positive".

How did you determine the unit sizing?

"Unit sizing was determined by Tas Cranes as the cranes in the area cannot lift anything higher than 30M. This unit was the largest unit we could fit with the logistical constraints".

Question 5: What barriers did you confront in the process?

Planning approvals? "The barriers started one and a half years ago when I went to council and submitted my Development Application. Initially for a small domestic wind turbine of 15m, with 4m blades & a 10KW domestic size output. Objections were lodged against this development and council policy on confidentiality meant that we could not be privy to the reasons for the objection, so we have no way of understanding the nature of the objections. We had to do a noise survey of the highway and a survey plan of all the houses in the vicinity of the turbine site. Despite the Turbine manufacturer's noise rating, Council wanted an Australian engineering certificate confirming the noise output.

Also the footings diagram from the manufacturer had to be confirmed by an Australian engineer. Then we had to do a soil survey. We had to provide access maps, an independent wildlife survey including identification of active eagle nests within 5KM of the site, despite this information being readily available from a state government entity website. As there was currently no turbine of its kind in Australia we had no way of getting a local engineering certificate. So the process stalled and I thought, If I have to go through all this effort for a 10KW unit, I may as well do a 225KW unit. So I resubmitted a revised Development Application and moved the tower location further away from the highway to minimize the possibility of any further local objections. Around this time there were changes in the local council staff and a good example of the renewed commonsense was a visit by the Town Planner to the Nichols Poultry Wind Turbine, which is less than an hours' drive away. The Nichols unit is the same as my new proposal and this visit seemed to allay some of the fears regarding noise that the council previously held. Unfortunately whilst the good will and communications have improved I still don't have council approval to erect this development".

In terms of the commercial arrangements, how do you perceive the fairness or equity of the:

. Connection Agreement?

"I have not yet seen the connection quote to install a transformer and connect into the grid nor the actual connection agreement itself".

. Energy cost offsets?

"I spoke to Darren Brown about energy buy back and a number of around 4c/kWh was mentioned. Which seems to be about a quarter of the cost we currently pay on our tariff".

. Limitations on energy output/buy back arrangements?

"At the 4c there didn't appear to be any restrictions on buy back volume and this is not surprising".

. Sale of REC's?

"I haven't made any decision about how I sell or trade the REC's apart from getting a rough prices estimate of $40/REC".

. Network cost offsets? "I haven't really discussed these yet".

. Network capacity costs?

"At this stage I'm not aware of any ongoing network capacity or haulage costs to get the turbine output onto the grid".

. Operation & Maintenance of the generator?

"We expect to conduct scheduled maintenance of the unit every six months and have sourced a contractor to perform this work".

. Other costs Eg. Metering?

"I have not looked at metering costs yet".

. Other issues of fairness and equity?
“The buy-back price just doesn’t seem fair, particularly for a renewable energy product”.

Question 6: How did you overcome these (Planning) barriers?
“I moved the turbine site to overcome the objections. But still don’t know if this will be a satisfactory solution to the objections”.

Question 7: What would you most like to see changed?
“We are part of the national grid and the buy-back price needs to be a nationally consistent price. If I’m going to invest serious money into wind turbines why would I do it in Tasmania. As a director of a licensed investment scheme we can raise capital for projects but why would anyone invest here in Tasmania when the returns are not as good as mainland states?

Whilst I can understand that we are all learning as we go, the council process is far too slow and cumbersome and the original Town Planner was lacking in solutions. The contrast example was Maroochydore Council who in an unrelated Development Application really demonstrated how pro-development they are by providing lists of all local contractors and other registered parties involved in developments (Surveyors, Concreters and Builders). Without recommending any specific provider they were actively promoting investment in the local community and trying to make it easy for investors to progress their developments, as opposed to creating barriers through a lack of information and clarity”.

Question 8: What advice would you give to others who are considering following in your footsteps?
“I’d encourage others to consider renewable energy but we must improve the DA system to slicken up the process. For instance if my (farm) neighbor wants to erect another Turbine he must go right back to square one. He would need to get his own independent wildlife assessment completed not simply use our one”.
I thanked Tim for his time and insights and the research phase of the research was concluded.

Addendum to Appendix 5. Interview.
During November 2010 follow up contact was made with Tim Terry, regarding project progress. Tim indicated the project had halted due to unsatisfactory project economics, including costs and a lack of economic return in the “Stand-Alone” (DG) wind farm configuration.

Appendix 6 Interview Robert Rockefeller, Director, Nekon P/L

Date Tuesday 17th August 2010
Participants Robert Rockefeller & Marc White
(Consent for CAP 430 report and MBA, reviewed & granted)

Question 1: When did the idea of installing wind turbines on your buildings first enter your head?
"In December 2008 my brother had returned from an overseas trip where he had seen wind turbines on high rise buildings and this had intrigued him. We then contacted the U.S. turbine distributor, followed by a Sydney based firm but found this largely unhelpful to our particular needs. Later Bruce Lipscombe from local Hobart firm Iwantenergy contacted us and from this we developed proposals for both the ANZ Building in Hobart and the Marine Board Building down on Hobart's waterfront at Sullivan's Cove. "

Question 2: What was your motivation for the projects?
"The Federal Governments has introduced legislation for mandatory disclosure of building energy efficiency, for lettable areas of greater than 2,000 m2. (Australian Government, 2010) This legislation, known as the Building Energy Efficiency Disclosure Act 2010, is due to come into effect on 1 November 2010. In Tasmania, the market for commercial space over this 2,000 m2 size, is dominated by government tenants. Currently Federal and soon State Government decision makers, in their efforts to reduce greenhouse gas emissions, will stipulate minimum NABERS (National Australian Built Environment Rating System) ratings for their tenancies.

For developers of new buildings this legislation creates a ready and influential market. However for owners of older buildings, this legislation creates somewhat of a quest, as to how best to meet these mandated efficiency levels. To ignore this quest is to create a two tier market for office space, placing downward pressure on the rental yield of older buildings and effectively impacting the value of the building stock, as you are left with buildings you can't lease to government.

Once you come to this conclusion you realize you can't be left as a dinosaur, so you seek out your available options and this is where you quickly discover how few tools you actually have to battle this problem.

Firstly you look to the internal mechanical plant, but the older the building the harder and more costly it is to improve the efficiency of central plant.

Then you look to refurbishing the building with a high efficiency fit out, floor by floor. Unfortunately this means costly tenant movements and no source of income during the renovation.

If your building is in Melbourne or Sydney CBD and can be leased for $1,000 m2 the renovation is an inconvenient disruption, but in Hobart at $300 m2 the relativity is quite different and you just can't support that type of investment. At this stage you realize you have both hands tied behind your back".

Question 3: What other options did you consider? & Why did you choose a wind Turbine?

"We made a deliberate effort to access the governments Green Building Fund as a way to give ourselves options. Due to the assessment criteria, the Marine Board Building with its higher percentage in energy reduction, qualified for funding but the larger area of the ANZ Building failed to qualify. We looked at solar power but simply didn't have enough roof space on either building to generate the amount of renewable energy we needed to meet our goals. This left wind turbines as the only real technology left to meet our needs".

Question 4: Who did you turn to for help?

Once you had made the decision to pursue a wind turbine, did you arrange wind monitoring for the site?

"Yes, as part of our Green Building Fund application we arranged a short period of wind monitoring and then extrapolated this data"

In determining the business case for the project how/did you value:

. Energy & network cost offsets?

"The 100% Offset of electricity costs was one of my main criteria. I could of erected (larger) wind turbines in a paddock somewhere, and in retrospect had a lot more sleep filled nights. However, this would not of qualified for the 100% energy offset, so rather than achieving a 15 – 20c/kWh benefit, I would only get 3 or 4c/kWh for the energy produced. This is where I see the duplicity in the policy arena, no one seems to be looking at the whole picture. This is where I decided to push back and to see where people sit, by undertaking what in essence was the only commercially viable alternative we were left with, to erect wind turbines on our buildings. "

. Sale of REC's?
“I still haven’t got around to doing anything with these”. (Robert hastily scrawls a note on a piece of paper!)”.

. Marketing benefits
“We understood these proposals were always going to polarize opinion and no one holds more concern over the issues of heritage, noise, birds and safety than me. However, we want to be seen as leaders in sustainability and to provide strong moral leadership as we do at all of our properties”.

. How did you determine the unit sizing?
“Our first proposal for the Marine Board Building was knocked back due to height restrictions. To meet this criteria, the four units have a capacity of 12KW each”.

Question 5: What barriers did you confront in the process?
Planning approvals
“The current Planning Schemes simply do not allow for this type of development. We have faced well publicized hurdles with each of these projects. The Hobart City Council took our Marine Board Building proposal to the tribunal, but once we had met the height limitations they had no grounds for their dispute”.

In terms of the commercial arrangements, how do you perceive the fairness or equity of the:
. Connection Agreement?
“I haven’t been directly involved in these. Iwantenergy has handled these”.

Question 6: What would you most like to see changed?
“Being one of the business operators directly impacted by these market changes, I get to see how these policy instruments interact in a holistic sense, effectively discriminating against older buildings. What I see is the diversion of capital resulting from these policies. For instance old buildings will be demolished to make way for higher efficiency buildings, but the additional carbon emitted in these demolition and construction processes will far exceed the carbon differential between the old and new buildings.

Whole new industries are springing up to deal with the new complexity but I don’t see the additional productivity resulting from these activities. The climate science says we have limited time to deal with these challenges but I’m not sure we are making the most gainful use of this time”.
I Thanked Robert and concluded the interview.

Appendix 7 Meeting Observation - Joule Logic & Aurora Energy Network

Date Tuesday 24th August 2010, Moonah, Tasmania.
Participants Paul Fulton, MD, Joule Logic & Craig Wilson, CRM, Nick Beltz, Leigh Mayne & Eric Lown, Aurora Energy Network.

(Consent for CAP 430 report and MBA granted & minutes reviewed, revised & approved by Craig Wilson)

Project Topic:
Follow on meeting (from Appendix 1) for proposed implementation of Wind Turbines at EG CLIENT installations in Northern Tasmania. Refer also Joule Logic e-mail and supporting documents dated 9/8/2010.

PF: "Can we site technically site the three turbines 3 * 225KW units at this (single Client Installation) location".
EL: "Yes with Transformer installation/ upgrade (750kVa) and potential local conductor upgrade. Main line is 19/3.25 Aluminum which is generally capable of 8-9MW".

EL: "Are you wanting to connect the turbines Embedded or a stand-alone wind farm?"
PF: "Prefer to install as wind farm configuration, but the economics is quite different from the Embedded model".

MW: "If Client Installation at a point in time is consuming 100kVa and the wind is blowing and the turbine is producing 225kVa and therefore exporting 125kVa, is there any DUoS payable?"
LM: "No, at this point in time there is no DUoS payable". It was also discussed that **when installed as a wind farm installation, there is scope for an avoided TUOS charge**, but this is dependant on the size, location, distance from the terminal substation, and any fixed charges from that terminal between Transend and Aurora.

LM did note that most agreements with Transend are for fixed based charges, whether Aurora uses all of the energy or not. This will impact the level of this avoided TUOS charge.

Also need to note that the buy rate for a wind farm type installation is between the generator and their nominated retailer. This is not an agreement between the generator and Aurora Network, who is making the connection to the distribution system available. “The Client Installation is free to elect any of the available tariffs as per the Tariff application guide, when embedded into the installation”

LM: “If you build a grid connected wind farm (Non-Embedded) on Distribution assets, there are no DUoS fees payable as consumers pay for DUoS, Aurora Policy (may be able to reference). This gives an incentive to new generators. The connection point assets will be a dedicated or sole use asset and can either be a privately owned asset or an Aurora asset. If an Aurora asset then a fee would be struck for the O&M”.

MW: “Is there any hybrid model (between an embedded generator and a wind farm) available where the turbine is still on the Client Installation property but direct grid connected on its own transformer, but can still attract DUoS offset for the Client Installation as if it was embedded?”
LM: “No”.

PF: “This position does not support the least cost technically appropriate turbine design and location, as it will force the Client Installation to install smaller wind turbines across multiple locations”.

PF: “For the upgrade of the transformer at the Client Installation who would pay?”
LM: “The customer/generator would pay as they are the beneficiary”.

LM: “Be aware that Aurora would only have one connection agreement with the Client Installation. If the Wind Turbine wanted a separate connection agreement it would then fall under the Wind Farm model and attract the associated costs”.

LM: “These rules are NER & Tasmanian Electricity Law and the difference is between a load customer and a Generator. Aurora is working on upgrade of documentation for embedded generation, with a target date of end 2010”.

LM: “Currently generators do not pay for DUoS but as the system of the future will need to cope with two way energy flows, it is possible that the additional costs of building in this system flexibility may need to be met through generator DUoS tariffs”. Meeting closed.

Appendix 8 Focus Group - Town Planners

Date Thursday 26th August 2010.
Participants Clive Bridges & Ally Mercer, Dorset Council. Georgia Palmer, Local Government Association of Tasmania. Ian Stanley, Hobart City Council. Robert Higgins, Brighton Council. Marc White.
Welcome, Thanks & Intro's. Outline of the research project.

(Consent for CAP 430 report and MBA granted)

Open & Marc Provided Definition of "Embedded generation" Eg. Nichols Poultry, Marine Board Building & Bruny Island Hospital.

Question 1: What do you hope to get out of today?
"Find out more about the benefits to the parties of embedded generation and why there are different economics between these and wind farms".
"Understand what is the threat to Hydro Tasmania revenues from embedded generation?"
"Interest in new technologies and the barriers to take up, such as the community wind farm in Victoria and how we can never have to buy power again. How to put energy back into the grid"
"How the remote wind generation works"
"Different types of wind turbines, rather than current designs, such as the new design on the ANZ building in Melbourne".
(Polarized discussion ensued on the visual aesthetics of the wind turbines on the marine Board Building).

"Are certain councils in a position to understand and embrace renewable energy and are the planning schemes up to date to handle these projects"
"The variety of projects that pop up are so different that it is difficult to keep up with the differences, This is highlighting a lot of flaws in our current planning system. Example of one Micro Hydro system that is running without any council approval at all".
"Hope to see lessons learnt from Nichols Poultry experience"

Question 2: Who has been involved in the planning process for a wind turbine?
All attendees had.

Question 3: For those who raised their hands, is the turbine commissioned or otherwise?
Around half are now operating.

Question 4: How many embedded wind turbines do you think will be erected in Tasmania over the next 10 years?
"Mainly bigger rural industries may rely on these in the future".
"Growth will be exponential as technology cost is reducing".
"More as electricity costs increase so will the economics of this technology".

Question 5: What are the barriers to erecting more than this?
"The current planning issues with wind turbines are quite similar with the issues faced in the 1990's regarding mobile phone towers and how councils and communities evolved to cope with these developments".

"Back in the 90's there were some 85 planning schemes in existence at the time, over half of them prohibited mobile phone towers, based on the structure and age of the planning schemes. Technology was advancing well ahead of the planning schemes and this looks to be the case again".

"The Victorian backlash against ugly turbines, where the State Government eventually got involved. Where as in Tasmania individual planning schemes currently take control"

"Only Large wind farms are domain of State"

"NP Power have handled their process very efficiently with, significant Avian studies and well thought out and executed PR, etc"

"Visual impact can be a very polarizing and subjective".

"Public won't see any issue with remote wind farms, where they can't see or hear them".

"Musselroe wind farm has been made into a tourist attraction with viewing platforms".

"Need to make a planning scheme amendment to cope with the Nichols Poultry type turbine on private property"

“Where will the leadership come from for planning schemes to cope with turbines? PD1 process? It is not being picked up at the moment”

“As more pop up it will become a larger issue. As salesmen start visiting farms and offering these projects up”

“Environmental issues are the biggest barrier, particularly noise”

“The supersonic noise of the turbines coming from Woolnorth is quite significant. Followed by the visual impacts”

"Council could either take the view that a Wind Turbine Application is a Prohibited Development or that is a Permitted Development, Ancillary to the Principal Use of the site. Depending on this view will determine how complex the Development Application becomes. Depending on the structure of the States 50 different planning schemes, will also impact on how these developments are viewed”.

“The Turbines mainly need building approval due to height restrictions”.

“No council would be expert on birds. An Avian Study on species and flight paths is quite an involved study. Cattle Hill was a two year study where they monitored both the species and the flight path. . How can you go to a farmer and suggest that they spend thousands or tens of thousands of dollars on such a major study. Where the risk of ten turbines is not proportional with the risk of one turbine”.

Question 6: If I told you every proponent of embedded wind turbines in Tasmania that I have interviewed so far has named “The planning process” as either “The” biggest barrier or “a” significant barrier to embedded generation, what would you say?
"Not surprised at all”.

“It’s horses for courses, some people don’t realize they even need a planning approval, so it comes as a surprise to them”.
“The ANZ Hobart proposal was located adjacent to a heritage site therefore and height was also a discretionary issue under the scheme. The turbine itself was not the issue it was just classified as a structure”.

“I would disagree that the planning process is a barrier, as Turbines are a permitted application. Therefore a Non-Level 2 process, it has been as simple as possible and has not even required public notification”.
“I agree entirely”

“It is worth noting the need for an education process. The planning recommendation was to approve the wind turbines, but this recommendation failed to gain council approval. These are two different things”.

Question 7: What would you like proponents of wind generators to say about the planning process?
"They need to be able to say there is consistency in approaches, although rural and city approaches may need to differ”.
“No room to play one council off against another”.
“Staff attitudes to these developments should be the same”.

Question 8: What needs to be changed for this to happen?
"Costs for these developments should be subsidized to assist with the process”.
“Some bigger developments could be taken away from council”.
“Important to have a renewable energy department to look at the holistic strategy as to how these renewable energy objectives flow down into planning schemes to help local councils”.

Question 9: What else would you like to see changed?
"A consistent approach or model template for planning schemes”.

“PD 1 or standard schedule”

“Pragmatic approach to help an individual proposal is good but if it gets knocked back it costs everyone time and money”.

“The Tribunal is a free for all, with legal opinion and outcomes of the day. Some proponents can afford to invest in the tribunal process some can’t”

Question 10: What other comments would you like to make about wind turbine developments?
"Our council has shown that they support these types of developments. The issue is meeting all of the environmental and other assessment criteria”.

Thanked participant & closed the meeting.

Appendix 9 Interview Bruce Lipscome, Director, I Want Energy/I Want Solar

Date Tuesday 31st August 2010
Participants Bruce Lipscombe & Marc White
(Consent for CAP 430 report and MBA granted)

Background: I Want Solar Started in 2007, "I Want Solar was created as a business. The initial plan was to supply products into the solar sector of the renewable energy market. In a short time that scope has widened and the company is already involved in the import, supply and installation of solar and wind based products" www.iwantsolar.com.au/index-1.html

Tell me about your Renewable Energy Business?
"There is no such thing as renewable energy. There is a finite amount of energy in the universe and it is how we harvest it that makes a difference. It's all to do with the way that we deal with the process.

We have over 30 machines operating in Tasmania at the moment, many of these greater than 30KW. We also have units going in interstate.

People seem to think electrical energy is a right and the government should pay for it. But if you turn up at the fuel pump you don't have the same point of view, so there is a cultural concept that clean energy should be treated as a right for everybody, where energy that is more polluting should be ostracized and thrown out.

I think most people treat energy based upon a bill. People still want to buy more plasma TV's and the electrical infrastructure is aging and needs to upgraded".

Question 1: What are the most common motivations for your clients to investigate & install renewable embedded generation?
"We have clients coming to us saying I want to reduce my energy bill by putting in alternative energy. But we say to them you have to take a longer term view and look at your overall energy consumption and what you are doing with your energy".

It is a sad indictment on the way we do things when a customer walks into the shop and asks for 2KW of solar to offset their power bill and the government is prepared to subsidise this rather than subsidise energy reduction strategies.

Large consumers have different motives such as increasing the energy star ratings of their building and also some have sustainability motives and a lot of goodwill.

A desire to have a neutral impact on the environment, such as the Eastern shore Medical Centre which is effectively neutral and a healthy building is expected to support a healthy lifestyle. Proactive people like these are the ones that show other people the way forward which leads to change.

Occasionally we find people who are motivated by securing government grants and other incentives but these don’t fit our model. We are a solutions provider rather than just a retailer. We don’t just sell product we have in house engineering capability, for example we are discussing fuel options for public transport at the moment that will reduce emissions. As well as looking at total cost energy solutions. "

Q 2: What other options do your clients usually consider?
"We first look at our clients sites and investigate what the goals are and not start with an end goal in mind. We first seek to understand the problem and then devise an appropriate solution. We have access to the full range of alternate energy including, solar, wind, geothermal, micro-hydro, fuel cell and the capability to install a combination of these to meet the clients needs”.

Q 4: In determining the business case for these projects how/do you value the following elements:

. **Energy cost offsets?**

"The end result is the combination of many things, not just now but in the long term. For example, the desire to offset the consumption. Also most of our clients have a long term view, they are not necessarily seeking a short run payback. There is much more at stake than a commercial business case. The companies that have entered this industry just to make a profit whilst the government incentives were available have closed down and disappeared.

In some cases leaving clients wanting. Some companies trivialize the sale of these products by adding in a free stay at a hotel in the same way as you might sell a Fridge or TV. Energy generation is a source and whilst the (outcome) energy may be a commodity we should not treat the source as a commodity. What drives this view is the long term nature of for instance a solar array with a 25 year life, every watt generated by this unit is offsetting something, but what really has to happen is that the cost of this commodity has to deliver behavioral change , not expecting solar is a government incentivized free or discount coupon, fully paid for by the government. This just doesn't make sense, feed in tariffs don't seem to be delivering the change, rather it attracts people who seem only motivated by greed and the opportunity of something for nothing. "

Q 6: What barriers do you often confront in the process?
"There is only one barrier that we confront and that is misunderstanding. Once people understand what we are doing the barriers seem to drop very quickly. For example with bird strike or noise, once people understand that these issues are mostly associated with large wind farm type turbines and they can stand near an actual small commercial turbine, understand what it looks, sounds and feels like, then they gain understanding and their concerns usually disappear quite quickly. Take the Bruny Island Health Centre turbine, at first there was some community concern about it, we met with them and discussed the issues with the community, but now they have adopted it, own it and they love it. It is their turbine now. We have been the trail blazers to some extent and have seen the changes to perceptions which make a difference. There can also be some issues about being Tasmanian and some interstate views that we need to be part of a larger group, whilst the reality is probably that we are moving ahead more quickly than many of the mainland companies. We are a market leader and would like to set up a manufacturing arm in Tasmania at some stage".

Q 7: In terms of the commercial arrangements, how do you perceive the fairness or equity of the:

. Connection Agreement?

"The connection agreement is an interesting beast. Just the notion of having a commercially negotiated agreement with a monopoly is interesting. Particularly if you buy a property with a solar array, you automatically inherit the connection agreement is interesting. Some installations will never export the energy but you have to sign an agreement, how does this affect Aurora?"

. Energy cost offsets?

"There is a long way to go with these agreements. Aurora have a tough job to do with limited resources. But it is as though they have woken up shocked with the concept that they suddenly have feedin’s coming on. They don’t seem to have resources to cope with this and the processes are driven by lawyers not practical people. For example the number of solar installations going in each have to be inspected but they don’t seem to have staff to do this. The concept that they have a piece of paper that says they can do whatever they want is not realistic they are playing catch up and picking easy systems to pick holes in a new wind installation rather than a new solar system. "

. Limitations on energy output/buy back arrangements?

“Energy buy back arrangements are relatively easy to negotiate but getting to the right people can be difficult especially when you have one person in the state who can do this and they are on holidays, things stop”

. Sale of REC's?

"REC’s are an ongoing commercial process. As a registered power station we bring all the REC’s back under our banner and then manage the sale and trading of them”.

. Other costs Eg. metering

"$2,000 meter change over cost seems over the top. Is it fair that you have to wear this additional cost even where you are unlikely to ever be a net exporter of energy. "

. Other issues of fairness and equity?

"No".

Question 8: What would you most like to see changed?
"I would like to see people better understand the value of energy but this is unlikely to happen. The concept that we have a massive infrastructure with a massive cost and that infrastructure is dated and we don't yet have a smart grid (see Glossary), but we have a large geographic area to serve and we can't expect to have costs comparable to other parts of the world with higher density populations. I also think the word energy is misused and not well understood as a concept. An education system that teaches kids the fact that we have wonderful options if they wish to take them up, or dreadful options if we ignore our problems ".

Question 9: What advice would you give to those who are considering embedded generation?
"My advice is that they need to understand that any form of energy generation is an alternative and not a right. Is an option to make a difference to the future, not today. It is an option to make good things great or great things bad".

(Thank you & The interview was concluded.)

Appendix 10 Interview Greg Cooper, Manager, Major Projects, DHHS

Date Tuesday 31st August 2010
Participants Greg Cooper & Marc White
(Consent for CAP 430 report and MBA granted by Greg, who held a previous capacity in relation to this Embedded Generation project.)

Department of Health and Human Services (DHHS)
Bruny Island Health Centre.

Question 1: What was the motivation for the DHHS Bruny Island embedded generation project?
"Firstly the regulatory perspective, the State Government target of a 60% reduction in GG by 2050. The second motivator for Bruny was building upgrade from 200SQM and 40,000 kWh pa to 750SQM and not wanting the linear increase in consumption, so we knew even with good energy efficient engineering we would struggle to hold that type of consumption level. So we knew onsite generation would be required. Set aside a budget for a 5KW Solar and 5KW of wind but once we recognized the wind potential of the site we changed to 1.5KW solar and 10KW wind and that this would produce a much better bang for buck return and lead to a zero energy building. Plus the building design incorporated solar hot water. The third factor was a personal interest in energy efficiency and as part of that renewable. The group within DHHS that manages Capital projects, asset management services has as part of the overall DHHS policy a goal to reduce energy consumption across the department".

Q 2: What other options do your clients usually consider?
"As above "

Q3: Why choose Embedded Wind generation?
"We learnt anecdotally about the local wind regime, where we were told it was a windy site and we then did some monitoring which showed around 8M/s and from this did the calculations to produce 70,000kWh pa with potential for up to 100,000kWh, which would make the building zero energy. Within building zero energy is the idealistic scenario to aim for".

Q 4: In determining the business case for these projects how/do you value the following elements:

. **Energy cost offsets?**

"Yes, we looked at a simple payback and invested the cost of the turbine and external works to total of around $50-$60,000. Based on the electricity Tariff rate we calculated a 3 year payback. The solar was installed as an opportunity to test the technology and integration. As the unit was allowed the small generator status (10KW), Aurora have allowed the 100% offset to apply (where larger units are capped at 60% offset)".

. **Sale of REC's**?

"Did not look at REC's and only understand broadly how these work" I.e. We do not fully appreciate how REC's are claimed on an annual basis. "

. **Network cost offsets**?

"tariff all inclusive "

. **Government Grants**?

"No".

. **Other attributed value**?

" The Department have picked up the state environmental award for leadership in climate change action for 2010. The project has now been submitted to the national banksia awards ".

Q 5. How do you determine the unit sizing?

"Assessed against what we could afford and had budget for and how we could maximize the output with these funds ".

Q 6: What barriers do you often confront in the process?

"The local community concerns were the first to arise on noise, birds and most strongly the visual impact. The adjoining neighbors' were very concerned with the impact of amenity and property values. We found council very good to deal with, they basically spelt out the process and we chose to go through a separate process for the turbine to ensure it did not hold up the progress of the building itself. There were two or three objections at the time of planning however the council found that these were unjustified and approval was granted".

Q 7: In terms of the commercial arrangements, how do you perceive the fairness or equity of the:

. Connection Agreement?

"We worked with what we were offered and it was not a critical element in our decision making".

“We wanted to maximize the commercial value but felt the Aurora allowance to slightly exceed the 10KW and still retain the 100% offset was generous. It is just a shame that the state does not have a gross feed in tariff as most other states do. “.

. Energy cost offsets?

"As above bundled in the tariff. "

. Limitations on energy output/buy back arrangements?

“As above allowed to creep in”.

. Government Grants

"Nil"

. Operation & Maintenance of the generator?

"We have an agreement with I Want Solar for O&M which is quite modest and as the system is sealed it only requires servicing every three years. "

. Other costs Eg. metering

"We designed the system with both a separate meter on the turbine and solar so we could monitor the actual generation and send this information to the internet as well as the import/export billing meter. "

. Other issues of fairness and equity?

"No".

Question 8: What would you most like to see changed?

“No we found the early discussions with Aurora very supportive and proactive. The suppliers are very proactive. The biggest negative was the capability of the contractors to install the actual product. The physical installation of these larger units clearly created some challenges. These led to delays in erecting and commissioning the unit as well as data connection issues and the ratios of the generation metering and it’s interface with the website.

The State Government should consider developing a state wind resource map and make this publically available”.

Question 9: What advice would you give to others who are considering embedded generation?

“Do the early investigation. Solar is relatively easy to assess, but wind is very different, you need to do the wind monitoring first to ensure you have an appropriate resource to tap into. You also need to do the background acoustics checks as well as the bird checks with the government birds unit who have a database on endangered birds and their flight paths”.

(Thank you & The interview was concluded.)

Appendix 11 Interview – Anonymous Electricity Industry Insider.

Date September 2010
Participant The interviewee could be best described as a long term Tasmanian electricity industry insider.

(Consent for CAP 430 report and MBA was originally granted for the interview, however approval of the interview transcript was not forthcoming, therefore the source remains confidential.)

Question 1: What do you see as the barriers to embedded generation in Tasmania?
"If you currently have grid connected power to your home or business and hypothetically you were the only customer, you would acknowledge that there are investors in electricity generation, network and retail that exist to serve you energy and the related services.

Facing a rising cost of this served energy, you recognize the need to reduce your carbon footprint and the incentives (REC's) available for renewable energy, so naturally you are motivated to install a renewable embedded generator, be it wind, solar or other.

You do your business case and based on your available capital you invest in an embedded generator to produce, say, half of your annual energy needs and your business case shows a 10 year payback period.

Your expectation is that as soon as you switch on the new system, your energy costs will reduce accordingly by 50%. Of course this assumes all the existing investors in the energy supply chain take an immediate 50% cut in their revenues from the day you turn on your new embedded generator. However, the reality is that because embedded generation does not operate 100% of the time, you still rely on your grid connection because you are not fully self sufficient.

In the case of wind and solar you are using the grid as a clearing house for any under's and over's, or import and export requirements. However you have not reduced any of the other investments in the supply chain. In fact, in many cases you have actually triggered additional investment.

For instance in generation there may now be an increased requirement for frequency control services. On the network you may have created a need for additional voltage control and more complex safety procedures for maintenance activities. For the retailer you have created a more complex billing process.

So in the hypothetical example, at best you have created a revenue hole for the existing supply chain participants and at worst you have also forced them to invest further funds to cope with these changes.

(See also CSIRO, 2009, P. 34-37. Regarding cost recovery of Shallow versus Deep connection costs. Plus OFGEM UK 2009)

One of the challenges we face is that if we were starting from a blank sheet and the incentives for distributed and embedded generation were known, we would invest differently and in this way we would capture savings along the way. However from where we are now to deliver the benefits of a distributed generation or two way system flow model over the next 25 years means someone has to pay today.

This scenario is being played out all around the world today as historically low energy prices, below the long run marginal cost of supply, have resulted from government funded investment in lumpy energy infrastructure assets, for the greater public good.

We now face the situation where after 15 to 20 years of privatization these major assets are aging and will have to be replaced over the next 20 years. The problem is governments will not be funding this massive maintenance program and we face a huge bow wave of investment which due to inflation is, in many cases, larger than the original investment and will drive virtually unavoidable and significant cost increases. These costs will be borne by consumers irrespective of whether they have embedded generation or not.

A good example of this is when heat pump technology costs decreased and cheap units flooded the market. Consumers looked at these new products and combined with the prevailing energy price it seemed to make good sense to invest in home cooling and heating.

However to cope with this additional peak load on the electricity system has required additional investment in generation and network capacity and today everyone pays 50% more for their electricity than they did five years ago regardless of whether they bought a heat pump or not. There is obvious inequity in this outcome.

Cheap wind turbines and renewable energy subsidies will drive investment in network upgrades to cope with two-way energy flows and force up electricity costs, just like heat pumps, whether you own one or not.

The challenge is that we actually need a more equitable pricing model to share the costs and benefits, where good investment decisions are rewarded. Where is the plan to develop these pricing mechanisms? We can't just expect people to cope with these known cost increases.

Just like heat pumps, in the early days when the technology was expensive and only a few people could afford them they created little nuisance. It was when the cost curve changed and the uptake increased that the aggregate impact became clear. Today we face the same market dynamics with wind turbines but we don't seem to have developed the strategy to cope with these changes".

Thank you & concluded interview.

Appendix 12 Interview – John Devereaux, Associate Director, Energy Advisory Services.

Date Thursday 2nd September 2010
Participants John Devereaux was previously General Manager Network, for Aurora Energy. (Consent for CAP 430 report and MBA granted, subject to John's review, granted).

Question: What do you see as the barriers to embedded generation in Tasmania?

"There are current barriers and longer term barriers.
Current barriers for domestic customers include:
As a generality, electricity is still a relatively cheap commodity – most of us can afford it and can afford to pay more. That, coupled with the relatively high cost of the relevant alternative technology and the lack of incentive to generate "off grid" (which in other jurisdictions and countries is achieved via feed in tariffs which are much higher than normal tariffs or direct subsidies), does not encourage most customers to actively look at alternatives.

The lack of a price on carbon. Without a pricing mechanism to reward reduction in electricity consumption, which results in a reduction in carbon emissions, there is a reduced incentive to invest in alternative energy sources.

Tasmania produces most of its electricity from renewable (hydro) generation, a fact which is promoted as part of Tasmania's "clean green" image. Most Tasmanian customers believe the energy they use is from renewable sources already, so some customers who might otherwise be incentivized to invest in renewable generation are not.

There is substantial scope for most customers to reduce their energy consumption by a range of simple measures such as turning down thermostats, turning off lights, installing energy efficient globes, plus a range options such as installing double glazing when building a new home.

Those measures and options are usually much easier and cheaper to implement than installing alternative (embedded) generation and therefore can be expected to be implemented before alternative generation options explored by most customers.

For larger customers:
The major barrier is the cost of embedded generation compared to the savings generated. The business case does not currently stack up.
A reliance on/preference for traditional network (wires) solutions when considering options for addressing supply constraints.

Longer term barriers:

In considering the barriers to embedded generation it is opportune to look at the drivers for embedded generation, the most significant of which is the escalating cost of electricity. Costs are increasing for a number of reasons, including:

- the need to replace ageing network infrastructure;
- the increased per capita use of electricity (to service increasingly energy hungry lifestyles requiring air conditioners, heat pumps and large televisions) which requires larger delivery networks and therefore investment in those networks;
- increasing fuel and construction costs; and
- the emerging costs associated with climate change response.

A second driver is the increasing environmental awareness of many customers, domestic and business, many of who are prepared to pay more for energy than the current market dictates in order to play a part in reducing greenhouse gas emissions.

A barrier to the widespread adoption of embedded renewable generation, at the micro level (home and business) as well as the macro level (larger scale plant such as wind turbines, solar arrays and small scale wind farms) will be the as yet unrecognized market (pricing) implications.

The costs of producing and delivering electricity are mostly fixed, based on large scale capital investments in long life assets, requiring return of (depreciation) and return on investment. Electricity infrastructure across Australian is currently valued at in excess of $60 billion, and the prevailing regulatory regimes deliver a regulated return on assets to a large part of that investment (in electricity networks).

State governments continue to be major shareholders in the companies which produce and deliver electricity in Australia.

Any customer, large or small, who invests in renewable embedded generation will be expecting to reduce their consumption of electricity produced by non-renewable sources and reduce the cost of purchasing electricity produced and delivered by the current electricity supply chain. Most will be expecting the cost of their investments to be offset over time by reductions in their energy costs and other offsets such as renewable energy certificates.

If any shift to renewable, embedded generation were to be widespread, with a material impact on the volume of electricity delivered by the current electricity supply chain, then there would be a corresponding material reduction in revenues to the electricity companies involved in order to match the expectations of those who invested in renewable energy generation. Such a reduction would however have a corresponding impact on the returns to shareholders with investments in the current infrastructure, and therein lies a huge challenge.

The regulatory regime currently in place delivers a return on assets to investors in electricity networks, with “guaranteed” revenues based on asset values, and therefore a reduction in volume would translate to an increase in per unit price in order to maintain those revenues. Investors in generation assets will also continue to expect a return on their assets. The challenge (and future barrier to investment in embedded generation) is therefore that expectations of reductions in total electricity costs as a result of reducing the consumption of electricity delivered via the existing electricity supply chain will not be realized.

It is foreseeable that in fact total costs of electricity delivered via the existing electricity supply chain might well increase as a result of investment in embedded generation, as the existing networks will need to be substantially modified to be able to cope with the two way energy flows which will occur as a result of widespread investment in embedded generation, requiring additional investment in the existing networks, and such investment will require return of and return on investment, funded by increased prices.

Such widespread investment in embedded (renewable) generation would have long term benefits by way of deferral or avoidance of investment in generation and network infrastructure, however the existing infrastructure will still be in place and required in the short to medium term.

The looming challenge and barrier to investment in embedded (renewable) generation is therefore that of servicing the costs and return on investment associated with existing electricity infrastructure, via the existing regulatory regimes, at the same time as electricity volumes delivered via the existing infrastructure reduce as volumes delivered via embedded generation increase. Electricity customers will potentially be required, in the short to medium term, to fund both existing and new investments. Addressing this challenge will require a major reconsideration of existing market frameworks".

Appendix 13 Discussion – Peter Fischer, Director, Tasmanian Planning Commission

Date Thursday 10th September 2010
Participants Peter Fischer & Marc White

(Consent for CAP 430 report and MBA granted)

Question 1: The proponents of Embedded Wind Generation in Tasmania have identified the Planning process as one of the significant barriers to Embedded Generation, what comments would you make regarding this?

“The State Government have recognized the lack of clarity and guidance in the current planning system with respect to renewable energy installations on buildings. The previous Minister Assisting the Premier for Climate Change, Lisa Singh said that Tasmania, as the renewable energy state, makes the most of its opportunities to lead on this issue.

Ms Singh called for an expert group to be established to address this issue with representatives from planning, climate change, energy generation and local government interests.

Since then a Renewable Energy Committee headed up by Architect Peter Scott and including representation from Heritage Tasmania, Local Government Association of Tasmania, Tasmanian Planning Commission, Hydro Tasmania and the Planning Institute of Tasmania, have been looking at the Planning System and the approaches to renewable energy in urban areas.

The Committee has looked at planning scheme examples around the world, particularly noting Scotland’s advanced planning system for residential applications and are now looking at examples of allowable residential scale micro generators.

From a commercial perspective the Committee are looking at renewable energy applications such as the (Vertical Muce) turbines on the Marine Board building to see if this type of structure can be permitted in planning schemes consistently across the State.

The Committee have considered parameters including visual impact, visual amenity and flicker in residential areas, bulk including form and size, noise and line of sight for communications links.

Once the Committee has completed its investigations it will prepare a report to the relevant Minister for consideration.

The Tasmanian Planning Commission has also undertaken a review of Planning Directive Number 1. (PD1) which sets the framework for all new planning schemes in the State. The revised PD1 has exemptions for small scale renewable energy. If PD1 is approved in its current form, as each councils update their planning schemes this mandatory inclusion will therefore be picked up by all 29 Tasmanian Councils by the end of 2011".

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