REVIEW OF THE BAY OF PLENTY POLICY AND PLANS, TO ASSESS IMPEDIMENTS TO THE DEVELOPMENT OF RENEWABLE ENERGY RESOURCES

PREPARED FOR:	Environment Bay of Plenty
BY:	Bridget Robson
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1 EXECUTIVE SUMMARY

This report reviews Bay of Plenty regional policy and plans to identify impediments to the development and use of renewable energy resources in the Bay of Plenty.

The report commences with an overview of New Zealand's energy scenario showing a high proportion of renewable sources, but identifies that to maintain a high renewable ratio requires actively positive regional policies, not merely neutral ones. A mix of renewable sources is also regarded as important, so that timing or climatic factors that are idiosyncratic to individual types of renewable sources can be offset.

An overview of the potential renewable energy resources in the Bay of Plenty suggests that currently viable sources include geothermal, hydro, biomass and solar. In future tide and wave may also become viable.

An assessment of the Regional Policy Statement and Regional Plans indicates the policy and regulatory profile for renewable energy is as follows:

Renewable energy feasibility in the Bay of Plenty at present

Renewable energy source	Technically feasible?	Economically feasible?[1]	Sufficient resource	Regulatory environment
Hydro	demanding	around 16c/kW	yes	difficult
Geothermal	yes	yes	yes	Neutral to positive
Wind	yes	no	no	NA
Biomass	yes	>10c/kW	yes	Neutral to negative
Marine	no	no	yes	NA
Solar (as water heating)	yes	around 12c/kW	yes	Ignored

i.e. Hydro, Biomass and Solar are the energy sources that need positive attention in the Regional Policy Statement and regional plans.

An assessment of the electricity supply chain from generation, through distribution to use indicates that mini / micro generation and distribution are not given any useful consideration. Mini and micro generation (generally hydro or wind powered) are exposed to the same regulatory hurdles as large plant. This creates significant uncertainty and economic barriers to small-scale generation uptake.

Distribution is referred to for reverse sensitivity reasons but otherwise its strategic significance is not dealt with in the planning documents. Transmission limitations mean the Bay of Plenty region is vulnerable to circuit overload. Environment Bay of Plenty needs to be proactive in making transmission upgrades as straightforward as possible.

[1] East Harbour 2005

2 INTRODUCTION

2.1 Study Purpose

The purpose of the study is to:

> Review relevant regional statutory resource management policy and planning instruments and identify any unnecessary impediments to the development and use of renewable energy resources.

This will assist Environment Bay of Plenty to have particular regard to the benefits to be derived from the use and development of renewable energy. [Resource Management Act s7(j)] where "*renewable energy" is defined as "energy produced from solar, wind, geothermal, hydro, biomass, tidal, wave, and ocean current sources".*

2.1.1 EXPLANATION

In the Sustainable Energy Summary[2], resource management reform was one core area the government tackled, by acting on problems with the way the RMA operates in practice. Areas that have now been addressed include amendments to the RMA, introducing a limited notification process and emphasising the national value of energy efficiency and renewable energy, substantial reductions in Environment Court delays, and development of national environmental standards to promote consistency across regions. Proposals for further reform focus on achieving the right balance between local and national interests, improving local policy and plan making, improving the consent decision making process and allocation of natural resources (including water and geothermal) and supporting best practice in local government implementation of the law.

This report picks up on a number of the proposals for further reform, giving an assessment of whether there are <u>any unnecessary impediments</u> to the use and development of renewable energy resources in the regional policy and planning instruments of the Bay of Plenty. In order to do this requires that the present policy and plans are considered in the context of New Zealand's present energy mix and the projected demand and supply environment, and with assumptions about future demand and the likely source of supply. The first section of this report endeavours to do that.

The second section gives a thumbnail sketch of the likely availability of the resource within the Bay of Plenty, thus giving perspective on how important any impediments are, compared to any particular renewable source type. The third section then assesses the policy and plans for their impact on each energy type.

What constitutes an "unnecessary impediment" is deliberately loose. "Unnecessary" in a planning sense relates to a certain extent to the expectation people in the Bay of Plenty have about the appropriate use of resources. If the general view is strongly preservationist or strongly use-oriented, either bent should be apparent in the plans. That view will change over time and the degree to which each resource is regarded as

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[2] Sustainable Energy Summary 2004 (MED)

useful or to be preserved will also vary in relation to each other. Crises may trigger a change in view on whether planning impediments are necessary or not.

The approach taken is therefore to assess the Regional Policy Statement and regional plans to:

- identify inconsistencies of approach between resources,
- discuss changes in such things as resource availability, technology, and regional growth, that may affect renewable energy development and use, and
- highlight threats or opportunities that have not been explicitly addressed in the plans

2.2 Scope

Documents reviewed

- Bay of Plenty Regional Policy Statement
- Proposed Regional Water and Land Plan
- Regional Coastal Environment Plan
- Rotorua Geothermal Regional Plan
- Bay of Plenty Regional Air Plan
- Regional Plan for the Tarawera River Catchment

District Plans within the Bay of Plenty have not been reviewed in this paper; however they are regarded as also having a significant influence in the implementation of RMA section 7(j).

Energy types reviewed

- wind
- hydro
- geothermal
- solar
- tide
- wave
- biomass

Caveats

- The use and development of renewable energy is considered only for applications other than transport related energy use.
- The degree to which energy sources are reviewed is relative to the known presence or value of that type of energy source in the Bay of Plenty.

Disclaimer

The author works for an SOE with significant actual and potential interest in the development and use of renewable energy in the Bay of Plenty.

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Terminology

Technical concepts and abbreviations are explained in the Glossary.

3 IMPORTANCE OF RENEWABLE ENERGY

3.1 Electricity Demand Growth

Detailed modelling[3] of New Zealand's electricity demand predicts an increase of about 2%, or 180MW each year, excluding decommissioning of any existing generating plants. Once replacement requirements are added, the demand predictions are for over 200MW of new generation capacity required each year for the foreseeable future.

The only sector in which electricity is not the dominant form of energy is transport where liquid petroleum products dominate, but it is predicted that the role of electricity will continue to increase here. This is discussed briefly in section 3.5.

The New Zealand indigenous fossil fuel resource is limited and the cost of extracting it continues to increase. The implication is that for affordable energy, either greater amounts of renewable energy will have to be harnessed, or increased quantities of fossil fuel imported.

Relevance to policies and plans

The proportion of renewable energy in New Zealand's electricity supply mix is high (approximately 70%), but many renewable energy sources have significant local effects compared to the minimal local effects of using fossil fuels, creating a more difficult resource consent environment. To maintain a high renewable ratio in the face of these impediments requires actively positive national and regional policies, not merely neutral ones.

For example, the footprint of a thermal site is small compared to a wind farm. The effects of using fossil fuels in a thermal plant are not obvious locally, in either space (a thermal plant has a small footprint, mainly discharging not-very-obviously to the atmosphere) or time (thermal plant rapidly uses fossil fuels that were formed over millions of years).

3.2 Renewable Energy

Renewable energy can be described as energy obtained from an energy resource that is replaced by a natural process. It is thought of as "clean" - producing few or no hazardous emissions.

Most renewable forms of energy originate from the sun (exceptions are geothermal and tidal). The length of time from source of origin can be short, as in solar energy stored in rainfall or wind, or it can be medium term, as in biomass, which is accumulated over months (straw) to years (wood, animal by-products).

[3] The Electricity Commission and the Ministry of Economic Development

Renewable Energy Advantages

- Lack of (net) greenhouse gas emissions.
- Reduced dependence on fossil fuels
- Once operating, some control over input costs as ongoing fuel costs are not dependent on international feedstock prices.
- Multiple uses of resources. E.g. water used for hydro generation is not "consumed" and is thus available for use for further generation, irrigation or supply of other water needs.
- Creation of recreational resources (lakes behind hydro dams)

Renewable Energy Disadvantages

- Environmental impact – Many renewable options have a large physical footprint (wind). Some create amenity or aesthetic issues (wind) or noise (wind, geothermal). Others have an impact on biological systems and change recreational opportunities (hydro).
- Irregular supply of electricity – discussed in detail in section 3.2.1.
- Generally remote from demand; requiring considerable transmission infrastructure to get to point of use. This disconnect creates greater NIMBY effects as those exposed to the generation source are often not the apparent beneficiaries of the energy supply from that source.

Table 1: Renewable Energy in New Zealand (June Year, 2005) East Harbour 2006

Renewable Energy Source	Useable Energy (Net) at Source			Consumer Energy (Net) * PJ pa
	Electricity PJ pa	Heat PJ pa	Transport PJ pa	
Hydro	93.5			84.7
Geothermal (Electricity)	60.8	2.8		11.0
(Direct Use)		14.6		14.6
Wind	1.9			1.7
Bio-energy (Woody Biomass)	5.0	31.3	0.0	35.9
(Municipal landfill, sewage)	0.1	0.2	0.0	0.3
(Food processing/ Agricultural)	0.0	1.6	0.0	1.6
Solar (Hot Water)		0.2		0.2
(Photovoltaic)	0.01			0.0
(Space Heating)		Not Measured		
Sea Energy (Wave)	0			0
(Tidal / Ocean Current)	0			0
SUBTOTAL RENEWABLE ENERGY	161.4	50.6	0	150.0
GRAND TOTAL RENEWABLE ENERGY	212.0			

* Electrical transmission and distribution losses of 9. 5%.

3.2.1 RENEWABLE ENERGY – STORAGE CAPACITY

The requirement for a tactical mix of energy sources does not seem to be commonly understood. I.e. it is not well understood that several of the renewable energy sources need to be supported by "stored" fuel sources which are often fossil fuel derived. Wind turbines only work when the wind is blowing, and cannot be totally relied on to supply power to the grid in a pattern that matches energy demand. Wind and tide driven devices cannot be stored for later use, and will still be operating at night and other times when demand is low and so potential energy may be lost. This means that installed capacity (apparent generation capacity) will be considerably greater than actual output.

Although some time in the future it may be possible to create some energy storage bank, it is not viable now. For the renewable options that provide uncontrollably variable supply (such as wind) some form of back-up generation capacity is required. The back-up generation must also fit these two criteria:

1. be able to provide similar capacity to the grid as the renewable option it is supporting, and
2. be able to supply it almost instantaneously into the grid, to maintain continuous supply

This problem, of not being able to store some forms of renewable energy once generated, highlights the strategic importance of renewable energy sources that can be stored in their fuel form - such as hydro which can be stored in a dam, for "on-tap availability".

In 2000 (which was a near-mean hydro year) hydro energy made up 36% of the total supply of renewable energy. Geothermal accounted for 48%, with biomass making up the remainder. By 2025 this is projected to change to 23% hydro, 61% geothermal, 13% biomass and 2% wind. Source East Harbour 2005.

Relevance to policies and plans

Not all renewable sources are of equal strategic value. Hydro dams, because of their ability to turn stored energy into instantly available electricity, are a very strategic asset. New Zealand's primary electricity storage technique is in the form of hydro lakes. These investments have already been made, but the value of such storage will be enhanced or diminished by catchment management policies, e.g. lake level operating range.

A mix of renewable sources is also important, so that timing or climatic factors that are idiosyncratic to individual types of renewable sources can be offset (avoiding having "all your eggs in one basket"). Policies and plans should therefore be considering all renewable sources available to the region.

3.3 Security of Electricity Supply

As the amount of electricity from renewable energy sources increases, there has to be a corresponding increase in plant that can rapidly come on stream to counter the natural variability in output from the renewable sources. This "firming"- or quick start support is usually supplied by hydro or thermal power stations. Fuel for thermal stations is generally from sequestered carbon (coal, gas or diesel). However it is possible to design thermal stations that run on biomass (derived from non-sequestered carbon, thus not actively adding to the carbon component of greenhouse gas load).

Ideally thermal plants that run on sequestered carbon would only be used as companion generation, to provide backup to electricity generated from renewable sources. But over the investment cycle for new generation the importance of thermal plants increases and decreases - increasing in importance prior to new significant plant, and decreasing post the addition–

Increasing the proportion of non-carbon based renewable energy will increase the percentage of our energy that comes from renewable sources, which should mean a reduction in the overall discharges of carbon dioxide and particulate emissions over time, as our reliance on thermal plants reduces. This will also reduce the effects associated with heat dissipation, which is a requirement of thermal generating plants. Increasing the proportion of renewable energy is a demanding target. Merely increasing the amount of renewable energy generated may not change the absolute proportion, if new thermal plant using sequestered carbon is also commissioned.

Relevance to policies and plans

There is scope to promote or encourage thermal plants that use non-sequestered carbon (biofuels) as back-up support for the renewable energy sources that either do not have high reliability (e.g. wind) or a good match to energy demand (e.g. wind or tide based) in order to maintain the ongoing security of supply, under a scenario of demand increasing at 2% per year.

3.3.1 CURRENT ENERGY SUPPLY CONCERNS[4] (FROM 2007 SKM REPORT)

- Transmission and/or distribution constraints. These may directly lead to supply disruptions and thus affect economic activity, or have the potential for supply disruption, limiting confidence in future growth and inward investment.
- Liquid fuel and electricity costs. The Bay of Plenty regional economy is heavily dependent on agriculture and forestry; both sectors consume large amounts of electricity for processing. Increases in energy costs therefore have the potential to cause serious regional economic downturns.
- Embedded supply. This is a power station that feeds the electricity it produces directly into a local distribution network or directly to high electricity use plant rather than into the national transmission grid. Increases in embedded supply

[4] This list was taken from the 2007 SKM report for Bay of Plenty. Those not considered very relevant to the Bay of Plenty were deleted and further commentary added to those with known specific relevance to the Bay of Plenty.

are based on the assumption that there is substantial renewable resource which could still be harnessed. Likely sources in the Bay of Plenty are geothermal, biomass and possibly hydro.

- Remote consumers. In 2013 lines companies will no longer be required to continue supplies to (uneconomic) rural customers. There are a large number of these, in the eastern Bay of Plenty in particular.

Relevance to policies and plans

Secure, reliable supply of electricity is an enabler of economic growth, so of the list above, transmission is the biggest issue. The major supply circuits into the Bay of Plenty are close to capacity, and, in summer, circuit temperature restrictions reduce the amount of energy that can flow through the circuit. The overall circuit capacity and the summer constraints both limit the total electricity that can be supplied to the Bay of Plenty from outside the region. The geothermal plant presently under construction at Kawerau will alleviate the problem for a while, but continued population growth in the Bay of Plenty means that even if there is some increased local generation feeding directly into local industry or local supply lines, transmission upgrade will also be inevitable.

Transmission limitations mean that further generation within the Bay of Plenty region is of great value, as it reduces the overall vulnerability to circuit overload. Environment Bay of Plenty needs to be proactive in making transmission upgrades as straightforward as possible.

3.4 Relative costs of Renewable Energy

Table 2: Electricity Generation Cost Profile by Technology (electricity costs, $15/t carbon tax)

Electricity Cost supply curves by Technology – (GWh/annum)						
2015	c/kWh	Hydro	Geothermal	Wind	Biomass[5]	Solar
	2-4	-	200	-	-	-
	4-6	-	1,656	880	100	-
	6-8	260	1,459	5,170	-	-
	8-10	3,995	110	2,710	-	-
	10-12	615	-	1,750	283	-
	12-14	2,275	-	1,280	283	120
	14-16	1,725	-	840	707	300
2025	c/kWh	Hydro	Geothermal	Wind	Biomass	Solar
	2-4	-	200	-	-	-
	4-6	-	1,656	4,110	100	-
	6-8	260	2,129	3,880	-	-
	8-10	3,995	229	2,315	283	-
	10-12	615	-	1,490	283	-
	12-14	2,275	-	945	1061	350
	14-16	1,725	-	700	-	350

Source: East Harbour 2005

[5] Woody biomass, landfill gas and other biomass options have been aggregated for this table.

Electricity Cost Supply Curves[6]

Table 2 above, based on assessed resources at 10% WACC (weighted average cost of capital) and medium confidence levels, suggests that:

- Hydro resources are fixed in quantity and in price.
- Geothermal resources are significant at 6-8c/kWh. These include a number of high temperature field developments. The quantity available is greater in 2025 because this gives more time for staged development.
- Some wind resource becomes available at 4-6c/kWh to 2015. More of the resource could be at 4-6c/kWh by 2025, but by then much of the prime resource in this cost band may have already been developed.
- Biomass can make a small contribution at 4-6c/kWh (landfill gas). In 2015, the woody biomass resource is 10-12 c/kWh. Price of woody biomass developments should drop with time, due to maturing technology. There is likely to be a large resource, especially if the increase in timber cut in this period is processed locally, so potentially the use of this resource could increase. It would also be useful if the mills processing the timber use this resource, rather than using grid electricity, which will create more network pressure. A key benefit is that it would be embedded in the local network.
- Solar hot water heating is seen to make a small, but significant contribution above 12 c/kWh. As this technology competes at the retail end of the market, where it is currently competitive, any increases in electricity market prices could significantly increase uptake.
- Marine does not feature as being price competitive on current technology knowledge.

Relevance to policies and plans

Knowledge of the supply cost profiles, coupled with knowledge of the available resource in the Bay of Plenty allows Environment Bay of Plenty to future-proof its policy and plans with methods that are relevant to the nature of resource and the likely timing of its use.

3.5 Future Transport Energy Supplies

Alternative transport fuels to petroleum are the focus of considerable research and intense interest. The alternatives are likely to be biofuels, hydrogen or electricity. All three options are already available on the market and each has a significantly growing uptake.

Biofuel production, which could be used for electricity or direct fuel, will probably end up being mostly used as transport fuel. This is because the New Zealand Government expects transport biofuels to be available to New Zealand motor vehicle users by 2008 and mandatory use of biofuels, blended with petroleum products, will absorb a large

[6] East Harbour 2005

proportion of what biofuels can be produced in order to diminish greenhouse gas production.

Biofuel is expected to initially come from tallow and whey, but other feed-stocks are expected to be economic to use within a few years.

Some new generation vehicles will use hydrogen fuel cells. Hydrogen appears to be an ideal energy storage medium for renewable energy, but it must be created using other energy sources and it is far from mainstream affordable technology at the moment. However, direct use of electricity, either in the form of the hybrid vehicles presently available or with rechargeable batteries and plugged in to a power source, will also increase the amount of electricity used by the transport sector.

These increases in the use of electricity in the transport sector are going to add to the increased need for new electricity generation capacity in New Zealand.

Bay of Plenty has biofuel sources from agricultural by-products such as whey and tallow. It also has large timber by-product resources which could be more extensively utilised as biofuels. Although biofuels could be grown on arable land in the Bay, intensive agriculture and horticultural land use create higher value produce than biofuels, so this scenario is unlikely.

Relevance to policies and plans

Policies and plans should be considering how collation (transport and storage) of biofuels could be done (particularly for very high volume types such as wood waste) and how processing plants for biofuels can be accommodated (associated with agricultural, horticultural and forestry processing). Relevant regional plans would be the RPS, land and air plans.

3.6 Generation, Transmission and Use

The current feasibility of generating from each of the main energy sources present in the Bay of Plenty is discussed in section 3.4.

Relevance to policies and plans

Although transmission and use are outside the scope of this report, policy and plans should also be considering how to actively support effective transmission of energy.

This requires express consideration in policy making in regional and district planning, by explicitly considering how infrastructure will get energy from source to point of use. Although the RPS does consider infrastructure to include network utilities, often the "infrastructure" sections of plans consider roads, water and sewerage provision and the objectives and policies reflect that strong link to the physical direction and location of regional or district growth.

3.7 Distributed generation

Most emphasis by potential electricity generators and by regulators has been on large scale generation development. Large scale plant will automatically be exposed to the full scope of any council regulatory regime, and will be of a size that automatically means it will become part of the national or local grid supply. However, there is considerable scope for distributed (small scale) generation using mini or micro generation plants. These will be very important for remote users, who may have no other option but to generate their own power in future. Mini (10-15 MW output) or micro plants (around 1MW) may also make some contribution to local network power, especially once metering technology and frequency control[7] issues are resolved. The Sustainable Energy Strategy Summary identifies the rise in distributed generation as a long term trend, whereby smaller power plants producing power for use on site, supplying other uses through local line networks or connecting to the grid through local lines are likely to become more common. Removing barriers to distributed generation, including small scale generation is also an objective of the Draft New Zealand Energy Strategy.

Relevance to policies and plans

Large scale generators are likely to have to consider significant environmental effects, and the full scope of discretionary consent processes, which include full Part II assessment of effects. This process is arduous, expensive, and often exposes the applicant to a further range of costs and expectations from submitters, not all of which are related to core RMA matters. Although these costs are unwelcome, they are usually not so significant as to make a project uneconomic. This concern is also mentioned in the 2007 SKM report under the heading of high "mitigation" fees. Council needs to be considering how these can be moderated, possibly by review of certain phases of the consent implementation process.

Generators proposing mini or micro systems may have a finer balance between a project being economic or not. There are plants for which the size of plant or the nature of the plant effects is relatively small. Energy sources that should be considered for a restricted discretionary category in this sense are wind, hydro, geothermal and biomass. It would be very helpful for these smaller sized systems if there was a category of discretionary restricted consents, as that would serve to corral and constrain the matters over which council were making a judgement. This would serve to give more certainty to potential developers. Use of limited notification provisions is also important. Lack of certainty over the cost and time to process a consent for a project can be a significant impediment to even contemplating it.

[7] "Frequency control" is ensuring any additions to the circuit do not cause power spikes or surges

4 RENEWABLES - FEASIBILITY IN THE BAY OF PLENTY

The major renewable energy resources are discussed very briefly below, in order to describe their feasibility in the Bay of Plenty. Some resources are discarded as options because of insufficient resource; others are not feasible with present day knowledge or technology, but may become so in future. There are a number of reports that discuss resources in more depth, the most recent one being the 2007 SKM report. There are several recent East Harbour reports that also collate considerable material on investigations into resource availability and feasibility.

4.1 Hydro

Throughout New Zealand there is just over 5,300 MW[8] of installed hydro capacity. This is assessed as being about 50% of the total developable resource. About two-thirds of this theoretically available developable resource could be developed at a cost of up to 16 c/kWh[9] . The remainder would cost more than16c/kWh.

Confidence levels are treated cumulatively, e.g. medium confidence resource includes that available with high confidence also:

High Confidence - Attractive, with few apparent issues

Medium Confidence - Attractive, but with some significant issues

Low Confidence - Possible, but with many issues

Factors influencing assessment include: elimination of remote sites or sites for which consents will not be obtained, practicality of installing options, previous expressions of interest/commitment, current utilisation. Schemes where there are likely to be significant geotechnical related risks leading to cost uncertainty have not been included.

Table 3: Bay of Plenty Hydro Resources up to 16 c/kWh - at 10% WACC

Region	Potential for Development MW			No. of Potential Schemes	Potential Output GWh/y
	High Confidence	Medium Confidence	Low Confidence		
Bay of Plenty	55 (6%)	87(10%)	25 (2%)	11	821 (5.2%)
Total New Zealand	923	865	1,344	103	15,573

Source: East Harbour 2005

Table 4: High & Medium Confidence Hydropower Opportunities by Catchment.

Catchment Number & Name	MW	GWh (p.a.)	#of Projects	% of GWh p.a.
#29 Rangitaiki	40	195	2	1.6%
#339 Raukokore	35	145	2	1.2%
#48 Whakatane	9	40	1	0.3%
NZ GRAND TOTAL	2460	11700	65	100%

Source: East Harbour 2004

[8] Energy Data File, January 2006

[9] 10% weighted average cost of capital in $ 2004

From the East Harbour reports it appears that approximately 10% of New Zealand's potential hydro resource that could be developed with high to medium confidence is in the Bay of Plenty. However, despite the tables being collated quite recently, the locations shown in the second table do not correlate strongly with projects actively being investigated by energy generators in the Region.

Prospect for hydro development in the Bay of Plenty

The potential hydro systems that have not yet been developed in the Bay of Plenty are because the technical and/or the perceived or actual environmental effects are demanding. To offset these difficulties, hydro systems are likely to be small, and use diversions or run-of-river technology rather than the more traditional large dams of the past. This means that any future hydro plants are likely to have very limited buffering from prevailing climatic conditions and thus very limited capacity to act as support to other non-firm renewable options.

4.2 Geothermal

New Zealand's geothermal resource base is large. About 6.5% of total electricity generation for the year ended March 2005[10] (approximately 2,650 GWh from 470 MW) and 11% of primary energy supply for 2004 was from geothermal energy. The Bay of Plenty has significant resources of high energy geothermal fields.

Indications are that up to approximately 350 MW[11] of new geothermal generation is possible by 2015 at a high confidence level.

Prospect for geothermal development in the Bay of Plenty

There are very good prospects for further geothermal development in the Bay of Plenty, from a resource presence point of view. Difficulties of development generally relate to gaining agreement from the owners of the land adjacent to or above the resource, to develop it. Geothermal resource is strategically valuable, as it is one of the reliable sources of renewable power

4.3 Wind

New Zealand as a country has a very significant wind power resource; however none of the 9 areas thought of as having a significant potential for high speed wind power development (wind speed of 7-10m/s at 50m Above Ground Level (AGL)) are in the Bay of Plenty.

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[10] Energy Data File, January 2006

[11] Source: East Harbour 2005

Prospect for wind development in the Bay of Plenty

Unless technology for low speed wind development makes it more economically viable than it is now, the prospect of significant wind development in the Bay of Plenty is very unlikely.

4.4 Biomass

In the Bay of Plenty there is abundant woody biomass stock. This is a growing resource as the forestry industry increases the annual cut. There are also feedstocks from the agricultural processing industry – tallow from meat works and ethanol from dairy processing. It is possible that there are sources from the horticulture industry that could provide useful feedstock (e.g. reject kiwifruit). Feasibility and quantity is unknown.

Electricity generation is associated with the largest users of wood processing residues, mainly at the major pulp and paper mills at Kawerau.

Table 6 shows wood waste-fired plant in the Bay of Plenty[12]. (In 1998 approximately 45% of all timber that was kiln-dried used wood or bark as the fuel source (EECA 2001)).

Table 5: Wood Waste-Fired Cogeneration Plant

Plant	Location	Year Commissioned	Turbine Size (MW)	Typical Output (GWh/year)
?CHH	Waipa	1985	3.5	30
Norske Skog	Kawerau	1954, 1973	12.5, 23.0	?, 114

Source: East Harbour 2005

In the past 20% of resource energy from process residue was used for electricity generation, with the remainder largely for process industry use. It is unknown if that is still so.

Additional resources would largely be available for electricity generation (or could be directed to heat supply if a market outside forestry develops).

Future electricity generation is likely to be via gasification, rather than simple combustion. On this basis, there should be sufficient resource for 20 MWe and 40 MWe stations in the southern/eastern Bay of Plenty[13].

Prospect for biomass development in the Bay of Plenty

The prospect for viable fuel to be created from biomass is high, especially from animal by-products. Whether this becomes electrical energy is questionable as it is likely to be used directly for transport fuel as the biofuel component. Wood waste is the more likely energy source to be used as feedstock for thermal plants.

[12] Extracted from the Heat Plant Database maintained by the Bioenergy Association of NZ website

[13] Source: East Harbour 2005

4.4.1 LANDFILL GAS

Landfill gas is an extremely low efficiency way of recovering energy from municipal solid waste. In the long run, as the rate of filling of landfills dwindles, landfill gas will also decline as a resource (EECA/CAE 1996). However, methane emissions from 19 of the larger landfills in the country are estimated to be around 105,000 tonnes annually. Collection systems could capture up to 76,000 tonnes (MfE June 2000). This represents a potential of around 330 GWh of electricity generation. However, some of this gas will be flared or used for heating thus reducing the potential electricity generation. Electricity generation from landfills is estimated to be approximately 120 GWh pa for the whole of New Zealand.

In 2015, the potential electricity generation from landfill gas is conservatively estimated to be 210 GWh of new generation (0.75 PJ pa) if efforts to reduce the amount of organic matter being landfilled are successful. It could be less again as some gas will be flared and used for heating.

Prospect for landfill gas development in the Bay of Plenty

There is only one landfill of any significant size in the Bay of Plenty, at Rotorua, as Tauranga transports all its waste to the Waikato. Thus the only potential for landfill gas energy generation is at Rotorua.

4.5 Marine

4.5.1 TIDAL FLOW

Tidal energy opportunities are very site specific. In New Zealand there are areas of coast around headlands, Cook Strait, Foveaux Strait, as well as the 'narrows' at the exits of some harbours, providing opportunities for tidal current devices that could be used for electricity generation.

4.5.2 WAVE ENERGY

New Zealand has a long coastline with good potential wave energy in comparison with other parts of the world.

Assuming typical wave energy of 20 kW/m of wave front around many locations in New Zealand, the potential wave energy would exceed our current level of installed capacity.

Prospect for marine development in the Bay of Plenty

Tidal and wave power technologies are emerging technologies with demonstration plants and prototypes operating but no commercial plants are available. As they are not yet commercially viable options, they have not been assessed in a site specific way for the Bay of Plenty. However, any policy and plan development should endeavour to "future proof" by considering these as future options.

4.6 Solar

Solar electricity via photovoltaic cells does not yet compete on price with wholesale generation from other sources, but is a viable option for remote locations where retail price is very high. Solar energy used directly for heating (e.g. solar hot water systems) is a technically and economically viable option in the Bay of Plenty, if its price is compared where it enters the market: retail electricity pricing rather than wholesale. It is more price competitive in new houses than as retrofits.

Prospect for solar development in the Bay of Plenty

The solar resource in the Bay of Plenty is significant, in terms of annual hours of radiation available and the intensity of incident solar radiation (heat output). The present use of the resource is not significant, and there is considerable potential for uptake, particularly in new housing starts. Given that the western Bay of Plenty is an area of rapid new housing growth, this would be a prime area to ensure that any institutional barriers (planning and plan implementation) to the uptake of this technology are minimised.

MIGHTY RIVER POWER

5 REGIONAL POLICY AND PLANS

5.1 Regional Policy Statement

The Bay of Plenty Regional Policy Statement (RPS) is the umbrella policy for the region. Regional and district plans must give effect to it. It became operative in December 1999. Since 2003 it has become subject to five-yearly reporting on its efficiency and effectiveness. A review of it must commence not later than 2009.

Many sections of the RPS are relevant to developing new generation sources.

Overarching chapters, such as Resource Management Practice (discussing how plans should be written), and Energy (outlining the direction the region intends to take regarding energy) give broad direction for the more detailed expression in plans. Subject chapters give more detail on a per-energy-type basis. Chapters regarded as relevant are reviewed below in the order they appear in the RPS.

5.1.1 RESOURCE MANAGEMENT PRACTICE

The monitoring provisions of section 5.3.11 are broad enough to pick up opportunities to assess the effectiveness of policy in addressing *the effects of resource use, development and protection and measurement of progress towards the sustainable management of the natural and physical resources of the region*. However, until the 2005 RMA amendments the regional council scope did not extend to explicit consideration of renewable energy.

Methods such as:

[Environment Bay of Plenty and City and District Councils are encouraged to:]

5.3.11(c)(i) "*Assess information needs and undertake special investigations and research as required*"

5.3.11(c)(v) *Include, in monitoring programmes, social, economic and cultural indicators in relation to their functions*

5.3.11(c)(viii) "*Use the information provided by monitoring programmes to assess their performance in terms of meeting the policies and objectives in the Statement, any relevant plans, and their overall responsibility to promote sustainable resource management*".

all give generic scope, but no direction to assess policy effectiveness. The list of subjects to assess -considered for the Natural Environment Regional Monitoring Network - only allows indirectly for consideration of the effect of energy.

The next Change to the RPS needs to develop some monitoring measures that explicit consider renewable energy, firstly to establish some baselines, and then to start assessing policy effectiveness against those.

5.1.2 LAND

There are no policies that expressly consider the use of land for energy production or distribution. The only policy that could be seen as relevant is the catch-all:

"6.3.1(b)(viii) *To manage the use and development of land resources in a way which enables people and communities to provide for their social, economic and cultural wellbeing.*"

It would be helpful to have a method that functions in the same way as:

"6.3.l(c)(vi) *Recognise known mineral deposits and consider whether the potential for access to those mineral resources could be compromised.*"

I.e. "*Recognise known renewable energy sources and consider whether the potential for access to those resources could be compromised.*"

It would also be helpful to add a function for city and district councils to be encouraged to give heed in the provisions of district plans to the generation and distribution of energy – e.g. avoiding reverse sensitivity issues around transmission (covered to some extent in the air plan), and ensuring that sites likely to be suitable for energy generation are zoned appropriately (e.g. as geothermal resources are considered). This includes ensuring solar radiation is available for use at individual site level.

5.1.3 AIR

There is only one policy that expressly notes the difference in fuel source between fossil fuels and other fuels (7.3.1(b)(iv)) and one method (7.3.1(c)(viii)).

All thermal plants produce greenhouse gases. However, those run on biofuels, and the use of biofuels for transport is considered less problematical as they do not create a net CO_2 emission - they are not adding previously sequestered carbon into the atmosphere, they are merely re-circulating carbon that is already in the biosphere.

Some biofuels are more usefully targeted as substitute transport fuels than as energy sources for electricity production. Animal by-products – tallow and ethanol are quite dense biofuels and therefore suit a transport application. Wood waste is not, and therefore needs to be converted to ethanol or be used in stationary thermal plants.

All greenhouse gasses are not created equal. It would be valuable if the policy statement encouraged processes that convert methane into CO_2, such as landfill gas plants, and other thermal plants that burn fuel that would otherwise produce methane in the process of decay (generally anaerobic decomposition).

In order to remove impediments to – or, better still, actively support the use of biofuels as a renewable energy resource, the air chapter needs to differentiate between sequestered and non-sequestered carbon in the policies and methods, and actively support the use of thermal plants that use non-sequestered carbon.

5.1.4 FRESH WATER

The objective and policies of the water allocation section are weighted heavily towards protection, rather than contemplating use. The structure of this section therefore creates a difficult regulatory environment for hydro generation. It creates policy and regulatory impediments to the development of renewable hydro energy resources by having a preservation slant and by not distinguishing in any way among water bodies so as to regard some being more likely to be "used" than others.

Are these impediments necessary? Both the land and air sections of the plan have a focus on use. The policies and methods of these sections then concentrate on avoiding, remedying or mitigating the effects of that use. The geothermal section distinguishes resource for protection and resource for use, so it would not be introducing a new principle to the RPS if the freshwater allocation section took a similar approach in contemplating some "use" of the freshwater resource for its energy value. It could also use the approach of the coastal environment chapter. The coastal chapter goes some way to clarifying those areas with high natural values, thus signalling they are unlikely to be available for development, in policy 9.3.1(b)(i).

5.1.5 COASTAL ENVIRONMENT

Overall the coastal environment section takes a protection approach, but does give guidance on what to protect, rather than having a blanket protection of the entire coastal environment. It is silent on any use of the coast as a productive resource, whether it is for aquaculture or energy. Although commercial tide and wave energy generation is thought to be some way off, it would still be useful to define where such resource may exist and develop policies and methods that give guidance on how such developments would be viewed. The geothermal chapter could be used as a model of how to make these distinctions.

5.1.6 GEOTHERMAL RESOURCES

The geothermal chapter is a good example of how to look at a resource from multiple points of view, ranging from preservation to use, with clear policies and thorough methods on how each subset will be managed. It meets the tests posed in the Resource Management Practice section (5.3.5) of having clear and unambiguous provisions, setting priorities, co-ordinating the scope and coverage of the plan that will stem from this section of the RPS, as well as establishing a programme for information gathering, and research. It gives good guidance to those contemplating development of this resource and explicitly considers such development. However, the Geothermal Protection Level III of the RPS is then split into a further three groups in policy 102 of the Proposed Water and Land Plan. Group 3 of the Plan appears more restrictive than the wording suggested in the Geothermal Protection Level III of the RPS. The way it is described in the plan creates uncertainty for development of mid-sized plant.

5.1.7 HAZARDOUS SUBSTANCES AND WASTE MANAGEMENT

This section could address waste to energy in more detail. Policy 12.3.3(b)(ii) and method 12.3.3(c)(xvii) do touch on energy recovery, but with the future need for biofuels, what was formerly "waste" could be regarded as feedstock for thermal plants based on biofuels.

5.1.8 PHYSICAL RESOURCES/ BUILT ENVIRONMENT

As discussed in section 3.6, although the RPS does consider infrastructure to include network utilities, often the "infrastructure" sections of district plans consider roads, water and sewerage provision and the objectives and policies reflect that strong link to the physical direction and location of regional or district growth. Energy can be quite different, in that source of supply can be unrelated to and a considerable distance from location of use, so the polices and methods that suit roads and water supply do not necessarily champion the need to provide infrastructure for energy. The RPS endeavours to address this with a policy promoting consistency of regulation of network utilities (13.3.1(b)(xi). Ideally energy is generated close to where it is used, to reduce transmission losses, although there can be an economic tradeoff. Where this cannot occur, a double NIMBY situation can arise; those at both the source of supply and in the transmission path have no personal benefit and can see (and respond to) only the personal disadvantages. The RPS does address this problem with reverse sensitivity policy (13.3.1(b)(iv) and method 13.3.1(c)(xiii)).

Another factor to consider is that many utility providers are in competition with each other, so for the RPS to "*encourage utility owners to [cooperate]*" (13.3.1(c)(ii)) or limply suggest that it will "*be available to participate in investigations*" (13.3.1(c)(ix)) will be quite insufficient to surmount the problem of supplying a common good in a competitive environment.

There are a policies and methods that would appear to support use of solar heating, both for passive design and water heating. However none of these: 13.3.1(b)(ix), 13.3.1(b) (x) and 13.3.1(c)(iii), (iv), and (v), explicitly refer to solar possibilities. The RPS methods encouraging district councils to consider aspects of the built environment could militate against creating conditions that suit the use of solar energy, as it is not explicitly referred to as a valuable resource, and other methods discussing physical development emphasise compactness, without any proviso to preserve a solar energy asset. Solar uptake presently occurs at the individual level; it is not congregated or championed by network utility owners. Policies and methods must provide for renewable energy benefits that are best achieved at the individual site level, without being compromised by either a need to be represented by or sourced through aggregated interests or overly compact development.

5.1.9 ENERGY

The introduction to this section focuses almost entirely on the adverse effects of various forms of energy production – hydro, geothermal and electromagnetic fields (EMF), which would be better covered in the issues, not the introduction. It doesn't adequately consider projected demand and how that will be managed or met to support projected regional growth. Nowhere does it use the opportunity to give direction on what is considered an appropriate vision or course of action for energy supply and transmission. For example, a strategic overview/planning mechanism for renewable energy and associated infrastructure is not evident. Such a direction would give a sound planning background to the issue, and would give direction to district and regional rules. The third of the subheadings of this section demonstrates the focus of thought about energy: it creates problems. The question that has not been addressed and needs to be is: "*We need energy to function; how do we plan for and secure an efficient, effective energy future?*"

There is no link from policy 14.3.1(b)(ii) "*to advocate energy efficiency considerations in urban land form and building design, and improved energy efficiency in the work and domestic environment" (*and its associated method 14.3.1(c)(viii)), to the policies and methods of the previous chapter on the built environment.

"Efficient Use" needs to encompass the whole energy supply chain, not just end use. Although there is a policy "*advocating the efficient use of the total energy resource*" this is not explicit enough to trigger methods on generation and transmission that:

- Encourage efficient generation. This could encompass streamlining opportunities for plant upgrade.
- Encourage embedded local generation. Having supply close to use (load) significantly reduces transmission losses, thus increasing efficiency. This would also link in with mini and micro plant.
- Encourage efficient transmission, e.g. promoting and supporting circuit/line upgrades that would mean more of the energy produced actually gets to where it is used.

Because the policy statement is silent on efficient energy <u>provision</u>, this reduces its ability to promote it through regional and district plans. Without actual advocacy, the barriers to improving efficiency will be outweighed by retaining the status quo.
"Renewable Resource Use" has a good range of policies, which set a useful direction,
Objective
Reduced reliance on fossil fuels and increasing use of renewable energy resources.

Policies

> *(i) To promote the transfer from non-renewable to renewable sources.*
> *(ii) To advocate that renewable energy sources within the region be managed sustainably.*
> *(iii) To promote the utilisation of solar, wind, waste and other renewable energy resources.*
> *(iv) To minimise the use of fossil fuel for energy production.*
> *(v) To reduce fossil fuel use through the promotion of effective public transport.*

but the methods associated with them are weak, and directed to central government doing something, instead of a regional impetus being generated.

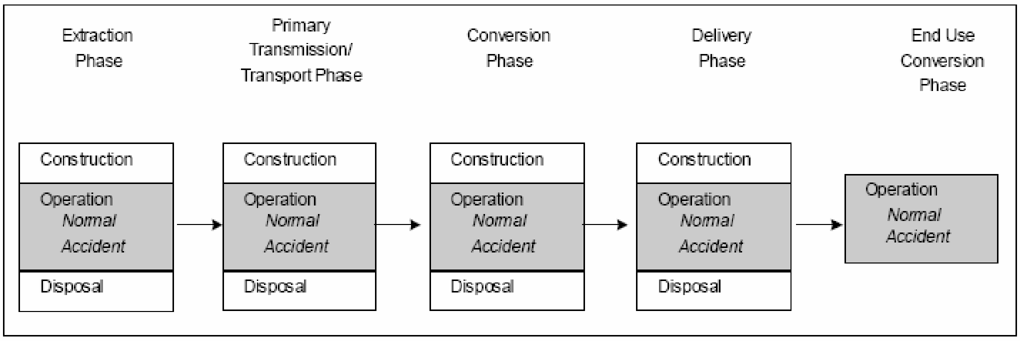
They were written at a time when Environment Bay of Plenty's energy mandate was not as clear as it is now, but the effect is that this section has very little value. As noted earlier in the report, without <u>active and positive</u> policy and methods, creating renewable energy generation and distribution systems is often harder than creating generation from thermal sources, and definitely harder than importing it from outside the region. There is considerable scope to build this section so that it addresses Environment Bay of Plenty's mandate under RMA section 7(j), but the scope should be increased beyond use, to include development and transmission.

The "Adverse Effects" section should be deleted. Adverse effects are not specific subsections in any other chapter of the RPS and the vast majority of generation developments will be going through a full discretionary consent process where all Part 2 matters are considered. To give adverse effects a further fillip here confirms a view that the focus is on making any future generation difficult to implement.

The review of the RPS needs to consider these elements of the physical energy system as prompts for constructive policy development:

- the environment from which fuels and renewable energy are derived
- extraction plants, which recover energy from the environment
- storage plants (including hydro lakes and fuel depots)
- conversion plants (including power stations and co-generation)
- transmission and distribution networks
- end-use equipment, which uses energy
- the environment, which receives waste products (for example CO2)
- the energy lost in conversion and reticulation.

Or in more graphic form, a generalised production and use path of the energy system



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5.1.10 HERITAGE PROVISIONS

The broadness and all-encompassing nature of this section (including Proposed Change No 1), meant that it provided very little guidance and created considerable uncertainty in its interpretation. This level of uncertainty is a significant impediment to proposed renewable generation projects in the Bay of Plenty as the lack of focus would make it very difficult to develop a sound resource consent application, with good knowledge of the effects considered to be of significance. It is anticipated that these concerns will be largely addressed in the resolution of appeals on Proposed Change No. 1.

5.1.11 NATURAL CHARACTER AND INDIGENOUS ECOSYSTEMS

As above, it is anticipated that similar concerns with this chapter will be largely addressed in the resolution of appeals on Proposed Change No. 1. The more targeted policy under consideration in the appeal process would provide more certainty for those implementing or responding to the RPS and would serve the purpose of guiding and assisting regional and district plans to identify these subsections of matters of national importance in an identifiable way.

5.1.12 GROWTH MANAGEMENT – RPS CHANGE NO.2

This identifies the potential and projected growth patterns in the Bay of Plenty. It mentions the need for transport and energy provision (17A.3.1(b)(v)), and the problems of reverse sensitivity of badly planned growth (17A.3.1(b)(xi)(a)), but the core focus is on the physical location and sequencing of development. Proactive engagement with energy suppliers is absent; the only direct methods are:

> *17Aa(xii) Liaise with network utility operators on cross boundary infrastructure issues,*
>
> *17A.4(xiii) require that structure plans:*
>
> > *(l) show how other adverse effects on the environment and infrastructure are to be avoided, remedied or mitigated*
>
> *17A.4(xix) Identify infrastructure corridors that are potentially affected by urban growth and establish objectives, policies and methods (including rules) to manage such effects.*

5.2 Regional Plans

Of Environment Bay of Plenty's regional plans, the following are considered relevant to an assessment of RMA section 7(j) - impediments to the development of renewable energy resources:

- Regional Coastal Environment Plan (July 2003)
- Regional Air Plan (December 2003)
- Proposed Regional Water and Land Plan – currently subject to appeals
- Regional Plan for the Tarawera River Catchment (February 2004)
- Rotorua Geothermal Regional Plan (July 1999).

5.2.1 REGIONAL COASTAL ENVIRONMENT PLAN

This plan distinguishes various areas of the coastal environment by using zones, so that those zones and those areas within zones for which "use" is possible, are identified. It identifies that at present the coastal management zone is relatively unmodified, but there may well be uses or developments which would be appropriate.

None of the sections that would be relevant for dealing with activities and effects of wind or wave based electricity generation appear to contemplate energy production as a likely activity, as it is not mentioned at all in:

- Taking, Using, Damming or Diversion of Coastal Water;
- Occupation of Space;
- Structures; or

- Disturbance, Deposition and Extraction.

Having said that, the rules that would relate to such structures being put in place seem appropriate to the likely effects that they would have, i.e. the development of tidal or wave generation structures would have to be dealt with as discretionary activities, and provision is made for these.

5.2.2 THE REGIONAL AIR PLAN

The Air Plan is mainly relevant to thermal and geothermal plant.

Air discharges are often considered and managed on a Best Practicable Option basis, rather than a purist effects basis, due to the difficulty of directly measuring effects. However, even with a BPO approach, there should be scope to directly address the effect of fuel source on reducing net emissions, particularly those relevant to greenhouse gas production. These are not apparent in the plan at present. A 2004 amendment to the RMA specifies that the use or development of renewable energy, enabling a reduction in greenhouse gas emissions, is an exception to the provision that otherwise precludes regional council considering the climate change effects of greenhouse gas emissions:

70A Application to climate change of rules relating to discharge of greenhouse gases

> *Despite section 68(3), when making a rule to control the discharge into air of greenhouse gases under its functions under section 30(1)(d)(iv) or (f), a regional council must not have regard to the effects of such a discharge on climate change, except to the extent that the use and development of renewable energy enables a reduction in the discharge into air of greenhouse gases,* [emphasis added]*either—*
>
> *(a) in absolute terms; or*
>
> *(b) relative to the use and development of non-renewable energy.*

The Air Plan predates section 70A. It seems that s70A would give considerable scope to encourage bio-fuelled thermal plants, for their capacity to reduce absolute emissions (if they are fuelled by methane) and their ability to substitute for thermal plant based on sequestered carbon (i.e. create a net reduction). This benefit must be addressed in the next air plan, and, given the significant changes to the Act regarding greenhouse gases, it would seem appropriate that this plan is either changed or reviewed well before the statutory review limit of ten years. (RPS Policy Review 5.3.9(b)(i) *To ensure resource management policies and plans reflect and stay abreast of contemporary statutory requirements …).* A draft change to the Air Plan is being consulted on at present.

For the 2003 Air Plan, Policies 4 and 9 seem relevant:

> 4: "*Promotion of the BPO approach including the efficient use of resources e.g. raw materials and energy, whenever it is the most efficient and effective means of preventing or minimising adverse effects on air quality"* and
>
> 9: *Encourage the development of land use and transport network design to assist in the promotion of energy efficiency and the reduction of discharges of contaminants into air.*
>
> Policy 5 is strangely worded, but appears to have a primary intent of dealing with reverse sensitivity issues.

Methods that could be seen as supporting renewable energy by addressing or favouring the value of using non-sequestered carbon include:

> Method 13 "*advocacy to minimise emission of greenhouse gases*", Environment *Bay of Plenty can now take this further.*
>
> Method 17 [national initiatives, policies and standards] "*avoid remedy and mitigate emission of greenhouse gases.*"
>
> Method 18 *Quantify and report on regional discharges of greenhouse gases, and* *implement steps to avoid, remedy and mitigate such discharges*
>
> *Meth*od 21 *Advocate the adoption of activities that have the opportunity to:*
>
> - *use energy and resources more efficiently;*
> - *avoid or reduce the amount of wastes produced;*
> - *produce environmentally sound products and services and*
> - *achieve less waste, fewer costs and higher profits.*

Method 21 gives a lot of scope to consider a very wide range of proposals. It could be seen as supporting waste-to-energy in particular, but as the advisory note says "*advocacy involves actively supporting ideas and initiatives*". How this advocacy role is interpreted and implemented may be evident through the LTCCP. It is not evident in the Air Plan itself.

> Method 26 *"make submissions as appropriate on all draft and proposed district plans advocating the consideration of fuel efficiency and energy use on urban planning and design".*

This is another method that could be interpreted widely, although obvious choices may be to interpret it as supporting passive solar design and solar hot water use; both are technologically and economically feasible in the Bay of Plenty. Again the Air Plan does not tease out how this will be interpreted or implemented. If this interpretation is not expressed in the LTCCP, the value of the method is diminished, raising the question of why have methods if there is no expectation of implementing them.

Rules 3 and 4 are both Clean Air Act derived, in that they initially categorise and restrict the size of the operation that will be permitted, not based on its actual effects, but based on its heat output generation capacity. Further conditions placed on the discharges are then effects based. Both of these rules have been modified in a 31 August Draft Proposed Change to the Air Plan, but those changes do not remove the size restriction. These rules should be re-thought to be effects based only, in the manner of Rule 16 – venting geothermal gas and steam or rule 17 – general activities. There could be some provision made to encourage the use of non-sequestered carbon as a fuel source (provided products of combustion due to using that fuel source were not greater), but to have all thermal plants generating 5MW as full discretionary consents demonstrates a non-effects based focus (as different plants operate at different burn efficiencies, so plant size has limited value in predicting effects) and creates an unnecessary impediment to installing thermal plant. Reducing these impediments could be achieved by introducing a restriction on the discretion of those requiring consents, and/or expanding the scope of activity that can be dealt with as permitted.

5.2.3 THE ROTORUA GEOTHERMAL REGIONAL PLAN

This plan was developed and implemented in response to a crisis caused by overuse of the Rotorua geothermal field (energy produced from geothermal sources is defined by the RMA to be renewable energy). The provisions of the plan use regulation, technology improvements and economic instruments to improve the efficiency with which the field is used, thus ensuring the resource is used within its capabilities and continues to be a renewable rather than a degraded resource. In this sense it is a particularly focused example of section 7(j) in action.

The principles applied to the Rotorua geothermal field could be applied more widely: e.g. continue to improve information to develop more robust models of how the resource reacts to different stressors. The management of the Rotorua resource is likely to continue to be more minutely focused than that of other resources, because of the economic and cultural importance of the surface features, and the relatively small changes in use that significantly affect those. Because of the very specific and focused nature of the management of the resource covered by this plan, it is not seen as having wider implications for electricity generation in the Region.

5.2.4 REGIONAL PLAN FOR THE TARAWERA RIVER CATCHMENT

This plan was originally developed to address particular problems of water quality and use in the Tarawera Catchment, ahead of the development of the Water and Land Plan. This now creates some interpretation impediments, in that its provisions must be cross referenced with those of the Proposed Water and Land Plan, thus potentially creating some confusion as to which prevails. This overlap is noted in an appendix in the Water and Land Plan, but it would be useful if a similar appendix was put in the Tarawera Plan.

It is not clear why rules that appear to be generic to the Region: those for river and lake beds, groundwater and geothermal resources, are still in this plan, rather than being transferred to the Proposed Water and Land Plan. To avoid confusion and duplication it would be helpful to make a Change to the Tarawera and the Water and Land Plan, removing all rules generic to the region from the Tarawera Plan, so they are all covered in the Water and Land Plan.

5.2.5 PROPOSED REGIONAL WATER AND LAND PLAN

Land

> The RMA Amendment of 10 Aug 2005 adds to the roles of regional councils:
> *30(1) (gb) the strategic integration of infrastructure with land use through objectives, policies, and methods:]*

This is a concept that is not explored in the Proposed Water and Land Plan at present at all. The integrated water and land section (Chapter 3) focuses almost totally on the life-supporting capacity of soil resources and its impact on water quality. The only objective that ventures beyond this is 19A

> *"Recognition of the beneficial effects of the use and development of water, land and geothermal resources on the social, cultural and economic wellbeing of people and communities."*

This is picked up by policy 29C

> "*To allow resource use and development where there are beneficial effects on the social, cultural and economic wellbeing of people and communities; and adverse effects on the environmental are avoided, remedied or mitigated.*"

It is not picked up by any methods.

This suite is enabling, but does not take a regional overview or give particular direction on how infrastructure could be provided for. In Chapter 5 - Water Quantity and Allocation there is a suite of methods that are categorised as "long term strategic overview". This category of method does not exist for the integrated water and land chapter. Infrastructure for distributing generated power is thus dealt with in the regional policy statement and then in the district plans, but is not considered in any regional plans. Prior to the RMA amendments, particularly those of 2005, the regional role for land sustainability could have been seen as being restricted to its physical health. Given that the Proposed Regional Water and Land Plan was publicly notified prior to the 2005 amendment to the RMA, it was limited to regional council's functions as at 2002. Now it is clear that the regional council should be providing some strategic advice on the location and distribution of such things as infrastructure within a region. Is the Proposed Land and Water Plan the appropriate place to do this, via a Change or review?

The Regional Policy Statement tends to regard issues and reactions to those at a conceptual level, rather than defined on maps[14]. The RPS is also limited to non-regulatory methods. Both of these factors suggest that at least some infrastructure considerations will need to be expressed in a regional plan that has methods with links to the physical landscape. If such concepts are to be fitted in to an existing plan rather than a new plan being developed, then the obvious choice would be the Proposed Water and Land Plan, by creating a new section that deals with infrastructure.

<u>Water</u>

The lakes and harbours and the geothermal resources of the region are thoroughly physically characterised in the setting of policy and methods in the Proposed Water and Land Plan. However, running water is only characterised for quality (RMA section *30(1)(f)*), and only in general, not by catchment or sub-catchment. The plan expresses an intent to characterise catchments for abstraction pressure (no deadline date), but no intent to assess running water for its value as an energy resource *30(1)(fa) and 30(4)(f)*. Objective 33A recognises water allocation for hydro electric generation as a renewable energy resource and Policy 56(c) mentions water used for hydro electric purposes, in the context of managing instream values. Policy 56(d) and Policy 56C provide for existing hydro electric general schemes, but none of these extend the objectives and policies to a physical characterisation of the potential resource in the Bay of Plenty in the way that the geothermal resources have, for example. Since water's value as an energy resource is not yet covered, method 112A may miss a crucial element of water use by considering commercial, industrial, horticultural and agricultural organisations, but not specifically

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[14] Although Proposed Change No. 2 (Growth Management)—publicly notified after the section 30(1)(gb) (the strategic integration of infrastructure) amendment to the RMA—relies on maps to show the proposed urban limits

identifying energy generation as a potential, and possibly competing, water use. Water and Land Plan - Method 112A

> "*Develop a long term water sustainability strategy in conjunction with territorial local authorities, stakeholders and the community (including representatives from commercial, industrial, horticultural and agricultural organisations) to manage future water use requirements in areas of high water demand. The strategy will:*
>
> *(a) Determine the potential long-term requirement for water resources in the region according to future population growth projections, possible horticultural and agricultural land use changes, and possible industrial growth.*
>
> *(b) Investigate:*
> *(i) Surface water and groundwater resource quantities, availability and reliability.*
> *(ii) Water quality, and the suitability of surface and groundwater quality for various uses.*
> *(iii) The capacity of those surface and groundwater resources to meet expected future water demand.*
> *(iv) Water resources that are likely to come under abstraction pressure.*
>
> *(c) Identify appropriate mechanisms to manage future water use to ensure water is allocated in a fair and equitable manner.*
>
> *(d) Integrate long-term development and the protection of the Bay of Plenty's water resources in relation to Policy 54 and 57.*
>
> *(e) Identify areas in the region where:*
> *(i) There is a lack of water resources that may limit land use intensification or urban growth, as increased water abstraction may cause significant adverse effects on the environment.*
> *(ii) The area is suitable for non-consumptive uses based on the availability of water resources.*

The absence of any assessment of running water for its energy value is seen as a shortfall that needs rectifying in order that all competitive pressures on water can be fairly assessed. It is recommended that RMA section 30 functions are fully explored during the development of water sustainability strategies, regardless of the apparent limitations in Method 112A. Although the RMA section 30 energy provisions post-date the plan's main development (introduced in RMA Amendment of 10 Aug 2005), they need to be considered as a Plan Change, so that section 30(1)(fa) and 30(4) can be included.

> *30(1)(fa) if appropriate, the establishment of rules in a regional plan to allocate any of the following:*
>
> *(ii) the taking or use of heat or energy from water (other than open coastal water):*
>
> *30(4) A rule to allocate a natural resource established by a regional council in a plan under subsection (1)(fa) or (fb) may allocate the resource in any way, subject to the following:*
>
> *(f) the rule may allocate water, or heat or energy from water, as long as the allocation does not affect the activities authorised by section 14(3)(b) to (e).*

Geothermal

This chapter contemplates use of the resource for its energy value and provides some very thorough policies to guide potential users as to which resources are available for what level of use, and the parameters considered to avoid, remedy or mitigate effects of use on the fields. Policy 102 provides guidance on the protection levels of geothermal fields in the Bay of Plenty. Method 196 is significant to potential users of geothermal management group 3, in that without modification to the RPS heritage provisions, it would have made assessment for development rely on a very broad and uncertain assessment process. The geothermal section looks at land based geothermal systems, but it is highly likely that there will be some fields under the sea, continuing the track of the Taupo Volcanic Zone out to Whakaari. It is not economic to assess or develop such fields now, but some thought on if or how to develop them may be appropriate.

Geothermal resources in the coastal marine area are not covered by the Proposed Regional Water and Land Plan as the Regional Coastal Environment Plan controls activities in the CMA. However, there are no provisions to specifically manage use and development of under-sea geothermal resources in the Coastal Plan.

Water and Land Plan Rules

These are assessed as they are thought to affect hydro, geothermal and biomass generation.

Hydro: Rules 33B, 41, 47, 47A, 47B, 53, and 78. Rule 47B provides for existing hydro electric power schemes as controlled activities.

For new hydro activity, the addition of rule 33B making the discharge of water to water permitted is helpful. For all other aspects of the establishment of a hydro electric scheme the process is likely to be full discretionary. Mini schemes producing 10-15MW and even micro schemes of 100kW will generally be a full discretionary consent for water take. Exceptions would be for a tiny micro scheme that can operate on 2.5l/s and no greater than 15 cubic metres per day, which would be permitted, or meets the water allocation policy (Q_5 – instream minimum flow requirement) for the stream (controlled activity). Small scale dams in streams under 150l/s daily flow are permitted up to 1.5 metres high, and discretion is restricted for dams on streams up to 300l/s daily flow where the combination of a max dam height of 1.8m and max volume impoundment of <5000m^3 water or max dam height of 1.5m with a max volume impoundment of 10,000m^3 exist. These parameters would only apply to some micro schemes. If Environment Bay of Plenty wants to support renewable hydro power, it needs to reconsider the suite of consents that mini and micro schemes would require, and assess whether it is possible to deal with these as restricted discretionary, and/or with limited notification, otherwise the regulatory impediments, (including the large uncertainties of full discretionary consents) will outweigh the potential benefits of pursuing such schemes.

Geothermal: rules 72-77. These rules are quite clear, with all geothermal power production as full discretionary. This may well be the most appropriate consent category, but concerns still remain in the implementation of the resource consent process regarding the "mitigation fees" (mentioned in section 3.7) so consideration of restricted discretionary for some classes of activity .

Biomass: this will generally be covered by Air Plan rules. It is understood from Environment Bay of Plenty that the storage of large quantities of wood waste for use in a biomass thermal plant does not trigger Rule 33, which only relates to wood waste disposal. The permitted criteria for this rule would not be suitable for storage (requiring 3m depth maximum before adding a layer of soil- which would not be good in a thermal plant).

5.2.6 RESOURCE CONSENT PROCESSING

Obtaining resource consents for projects is necessary for those with significant adverse effects. The purpose is to ensure that such effects have been thoroughly considered and the tests of how to avoid, remedy or mitigate them have been thoroughly canvassed – and expressed in conditions. How that process is carried out can range from clumsy and unwieldy, to streamlined and swift. This report does not extend into the assessment of Environment Bay of Plenty's resource consent processing techniques, but Methods such as Method 36 which specifically recognise the value of inter-agency cooperation to:

> *"...avoid conflicting management policies, methods and responses, by developing and implementing processes (such as joint consent processing, hearing and protocols) to manage areas of overlapping functions, including but not limited to issues such as earthworks, heritage values, indigenous vegetation, and geothermal matters.*

is seen as a valuable contribution to reducing the impediments that can be associated with resource consent processing.

6 SUMMARY

	Feasibility in the Bay of Plenty			
Renewable energy source	Technically feasible?	Economically feasible?	Sufficient resource	Regulatory environment
Hydro	demanding	In the 16c/KW range	yes	difficult
Geothermal	yes	yes	yes	Neutral to positive
Wind	no	no	no	NA
Biomass	yes	Above 10c/KW range	yes	Neutral to negative
Marine	no	no	yes	NA
Solar[15]	yes	In the 12c/KW range	yes	Ignored

[15] As heating, not as photovoltaic

APPENDICES

Appendix : RMA Renewable Energy Amendments

RMA 2005 amendment

31(1)(e) The control of the taking, use, damming, and diversion of water, and the control of the quantity, level, and flow of water in any water body, including—

(i) The setting of any maximum or minimum levels or flows of water:

(ii) The control of the range, or rate of change, of levels or flows of water:

(iii) The control of the taking or use of geothermal energy:

31(1) (f) The control of discharges of contaminants into or onto land, air, or water and discharges of water into water:

[(fa)if appropriate, the establishment of rules in a regional plan to allocate any of the following:

(i) the taking or use of water (other than open coastal water):

(ii) the taking or use of heat or energy from water (other than open coastal water):

(iii) the taking or use of heat or energy from the material surrounding geothermal water:

(iv) the capacity of air or water to assimilate a discharge of a contaminant:]

31(1) (gb) the strategic integration of infrastructure with land use through objectives, policies, and methods:]

31(4) A rule to allocate a natural resource established by a regional council in a plan under subsection (1)(fa) or (fb) may allocate the resource in any way, subject to the following:

(g) the rule may allocate water, or heat or energy from water, as long as the allocation does not affect the activities authorised by section 14(3)(b) to (e).]

Glossary

Energy is measured in joules (or multiples of joules)

1 joule is approximately the energy required to heat one gram of dry, cool air by 1 degree Celsius.

Name	Symbol	Multiple
joule	J	Base unit
kilojoule	kJ	10^3 One thousand joules
megajoule	MJ	10^6 = One million joules
gigajoule	GJ	10^9 = One billion joules
petajoule	PJ	10^{15}

1 joule is approximately equal to 2.7778×10^{-7} kilowatt-hour (KWh)

1 Petajoule (PJ)= 278 Gigawatt hours (GWh) of energy

Power is measured in watts (or multiples of watts)

1 watt is one joule per second

Name	Symbol	Multiple
watt	W	Base unit
kilowatt	kW	10^3 = One thousand watts
megawatt	MW	10^6 = One million watts.
gigawatt	GW	10^9 = One billion watts

1GWh = 1 million kilowatt hours (kWh).

Watt electrical (abbreviation: We) is a term that refers to power produced as electricity. SI prefixes can be used, for example megawatt electrical (MWe) and gigawatt electrical (GWe).

Installed capacity = power that a power station could generate if it was working 100% of the time, is measured in Megawatts.

Output = actual energy produced is measured in Gigawatt hours per year

Service factor = amount of energy actually produced by a power plant, as a proportion of installed capacity. e.g. geothermal is generally about 70%

Energy consumed (a power bill) is measured in Kilowatt hours.

Firm, and Non-firm = is how reliable a power source is. E.g. a thermal plant is regarded as firm, as the plant can be relied on to produce power all the time (provided the gas/coal source is secure!). A hydro system would be regarded as semi-firm, in that there are times of low rainfall that it may not be completely available, but generally there is stored water that can be turned into electrical energy. A wind source is non-firm, in that the operator is at the mercy of the whether the wind is blowing or not.

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