QUEENSTOWN LAKES DISTRICT COUNCIL

NPS-Renewable Electricity Generation

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Executive Summary

This study was commissioned by the Queenstown Lakes District Council to consider implementation methods for the National Policy Statement for Renewable Electricity Generation **(NPS-REG)** in the Queenstown Lakes District, specifically focused on small and community scale renewable electricity generation **(REG).** The objective was to recommend how REG could be better accommodated within the District Plan in order to encourage uptake and contribute to meeting the objective of the NPS-REG. The scope of the report has extended to include solar hot water systems which while not electricity generation, off-sets electricity consumption.

The District Plan rules are currently "silent" on the issue of small and community scale REG activities. In most locations associated buildings and structures require resource consent. The District Plan does not contain any specific assessment criteria to assist in assessing the effects of installations or recognise the benefits of REG.

This study reviews the type of generation in terms of its scale and availability of renewable resources locally. Growth in solar installations is considered the most likely of the type of generation due to the District wide availability of solar radiation and the decreasing cost of the installations (and therefore the payback period). In rural areas with access to streams or rivers mini / micro hydro is the most viable option. The wind resource is disturbed by the mountainous environment and to-date there are no examples of this technology being used locally. Biomass generation is emerging technology and is limited by availability of fuel material.

Adopting more permissive standards in the District Plan is aimed at removing barriers to uptake of renewable energy technologies, in particular solar. Solar PV and hot water systems at a domestic scale (up to 150m^2), subject to meeting performance standards are proposed to be permitted.

For hydro, wind and biomass technologies restricted discretionary activity thresholds are proposed allowing for any adverse effects to be assessed on a site specific basis along with the benefits of REG.

Not all locations in the District can accommodate small and community scale REG and a discretionary activity status is recommended for 'sensitive' sites.

PART 1

THE NPS-REG AND BACKGROUND TO RENEWABLE ELECTRICITY GENERATION IN THE QUEENSTOWN LAKES DISTRICT

1 Scope of Work

The Queenstown Lakes District Council **('QLDC')** is reviewing the District Plan. The Council has commissioned this study to assist the Council in giving effect to the National Policy Statement for Renewable Electricity Generation 2011 ('**NPS-REG'**) into the revised Plan.

Figure 1: Scope of Work

The project key objective stated within the Request for Proposal is:

> *To meet the requirements of the NPS-REG, specifically related to the development of methods and rules to provide for the development, operation, maintenance and upgrading of new and existing renewable electricity generation activities using solar, biomass, hydro and wind.*

The project deliverables are:

4.1 Define the nature and scale of renewable electricity generation that can be permitted, controlled, and discretionary within the current framework of the District Plan.

4.2 Provide specific permissive standards by zone to accompany the nature and scale provisions for small and community scale REG. Examples …

The NPS-REG defines Renewable Electricity Generation **('REG'**) as meaning "*generation of electricity from solar, wind, hydro-electricity, geothermal biomass, tidal, wave or ocean current energy sources*"[1]. The Queenstown Lakes District has no coast and tidal, wave and ocean current resources are not available and therefore discounted from the study.

It has been agreed with the project manager that "solar" for the purpose of this study includes both solar photovoltaic's (**'PV'**) and solar water heating. Solar hot water heating is not electricity generation but has significant benefits in terms of reduction in electricity consumption. It is estimated that household electricity demand accounts for approximately one third of electricity consumption and that hot water heating accounts for approximately one third of a households electricity use.

2 National Policy Statement - Renewable Electricity Generation (NPS-REG)

Central Government has a strategic target that 90 per cent of electricity generated in NZ should be derived from renewable energy sources by 2025[2]. The NPS-REG has been developed to support this target by providing guidance to resource management policy and decision-makers about the national significance and benefits of renewable electricity generation.

The matters of national significance stated within the NPS-REG are:

[1] NPS-REG, Interpretation Renewable electricity generation, page 4

[2] New Zealand Energy Strategy 2011-2021.

"a) the need to develop, operate, maintain and upgrade renewable electricity generation activities throughout New Zealand; and

b) the benefits of renewable electricity generation"[3].

The NPS-REG sets out an objective and policies to enable the sustainable management of renewable electricity generation (REG) under the Resource Management Act (RMA). The objective is:

"To recognise the national significance of renewable electricity generation activities by providing for the development, operation, maintenance and upgrading of new and existing renewable electricity generation activities, such that the proportion of New Zealand's electricity generated from renewable energy sources increases to a level that meets or exceeds the New Zealand Government's national target for renewable electricity generation"[4].

Policy F requires District Plans to include objectives, policies and methods (including rules) for small and community scale REG activities.

"F. Incorporating provisions for small and community-scale renewable electricity generation activities into regional policy statements and regional and district plans

POLICY F

As part of giving effect to Policies E1 to E4, regional policy statements and regional and district plans shall include objectives, policies, and methods (including rules within plans) to provide for the development, operation, maintenance and upgrading of small and community-scale distributed renewable electricity generation from any renewable energy source to the extent applicable to the region or district."[5]

3 Defining "Small and Community Scale" REG Activities

Small and community-scale distributed electricity generation is defined as meaning: "*renewable electricity generation for the purpose of using electricity on a particular site, or supplying an immediate community, or connecting into the distribution network*"[6].

To understand the limitations on what is 'small and community scale' reference must be made to the following defined terms:

Distribution network means *"a distributor's lines and associated equipment used for the conveyance of electricity on lines other than lines that are part of the national grid"*[7].

National grid means "*lines and associated equipment used or owned by Transpower to convey electricity*"[8].

[3] NPS-REG, Matters of National Significance, page 4.

[4] NPS- REG, Objective, page 4.

[5] NPS-REG, Policy F, page 7.

[6] NPS-REG, Interpretation "Small and community-scale distributed electricity generation", page 4

[7] NPS-REG, Interpretation "Distribution Network", page 4

[8] NPS-REG, Interpretation "National Grid", page 4

Small and community scale does not include generation connected to the Transpower national grid, which is typically large scale, commercial development – hydro dams, wind farms, geothermal plants etc.

Currently most of New Zealand's electricity is generated in large centralised power stations. The electricity is transported around the country through transmission lines, and then carried through local distribution networks to where it is needed. The power stations can be a long way from where the electricity is used.

There is only one Transpower line in the Queenstown Lakes District. This is known as "CML-FKN-A" and runs between Cromwell and Frankton (110kv AC double circuit towers). Any generation that connects directly into the Transpower line falls outside the definition of "small and community scale REG".

This is different to 'distributed generation' where electricity is generated from small-scale systems and is used on-site or nearby. Distributed generation projects may be connected to the local distribution network. In the Queenstown Lakes District the local electricity network is owned by Aurora Energy Limited with Delta providing contract services.

The benefits of generating and using electricity locally include "*reduce transmission costs and increase the proportion of renewable energy we use with less impact on the environment.*"

The definitions of 'small and community scale' REG is silent on generation capacity and does not specify a maximum kW generation. Energy Efficiency and Conservation Authority (**'EECA'**) approach has been to group generation according to its scale as shown in **Figure 2** below.

Figure 2: Summary of types of Electricity Generation by Scale

Concepts	Scale	Category	Approx. power rating	Examples and notes
Distributed electricity generation (DG) Electricity generation projects which are connected to the local electricity network instead of the national grid.	Small-scale	Micro	0–5kW	A house could have a 2kWp photovoltaic array or a 1.5kW micro wind turbine. These could typically offset a portion of a house's power bill.
		Mini	5-20kW	Generation in this range could offset a portion of a large household's or small farm's power bill, with some export back into the network.
	Large-scale	Small commercial	20-1000kW	Generation plant of this size is usually used to sell electricity to retailer, other purchaser, or into the market. Some electricity may be used on site. An example is the Southbridge wind turbine (100kW) in Canterbury.
		Large commercial	>1000kW	Large commercial DG, for example the proposed Weld Cone windfarm (1.2MW) in Marlborough, or Mangipihi hydro (1MW), connect to the local network and sell electricity commercially.
Off-grid generation (also known as stand-alone power system - SAPs). Generation not connected to the electricity network.	All sizes	Off-grid generation	0 - unlimited	The size of off-grid generation can range from a domestic-scale SAPS, to much larger systems which provide electricity for whole communities which are not connected to the electricity network. In some situations, such as on Stewart or Chatham Islands, generation sources are connected into 'mini-grids' on the islands which distribute electricity to households and businesses on the 'network'.
Grid-connected generation Large-scale centralised generation is directly connected into the national grid.	Large-scale	Large-scale generation	Usually >10MW	Most of New Zealand's electricity comes from large, centralised, generation plants. Electricity is transmitted around the country via the transmission grid, and distributed to households and businesses via distribution networks. Examples include the Wairaki geothermal plant (162MW), Te Apiti Wind Farm (91MW), or Manapouri hydro (728MW).

Source: EECA, Guide - Domestic-scale distributed generation, page 5.

Adopting the ECCA categories this study focuses on:

- off-grid generation also known as stand-alone power systems ('**SAPs'**).
- distributed electricity generation – Micro (0-5kw), and Mini (5-20kW) and small commercial (20-1000kW) that are connected to the local electricity network.

Distributed large scale / large commercial (>1000kw) fall outside the scope of this study.

4 Small and Community Scale REG technologies and resources in the Queenstown Lakes District

4.1 Solar PV

Solar electricity systems convert energy in light directly into electricity. They differ from solar thermal systems as rather than simply absorbing energy to heat water they generate electricity.

The most common device used is Photovoltaic's (or '**PV**'). PV cells convert sunlight into electricity by an energy conversion process. In most PV cells, photons in the sunlight hit the cells, where electrons are excited in the atoms of a semi-conducting material. Silicon is the most commonly used semi-conductor. The energised electrons result in the generation of an electrical voltage, where electrons flow to produce a direct (DC) electric current[9].

Figure 3: Photographs of Solar PV

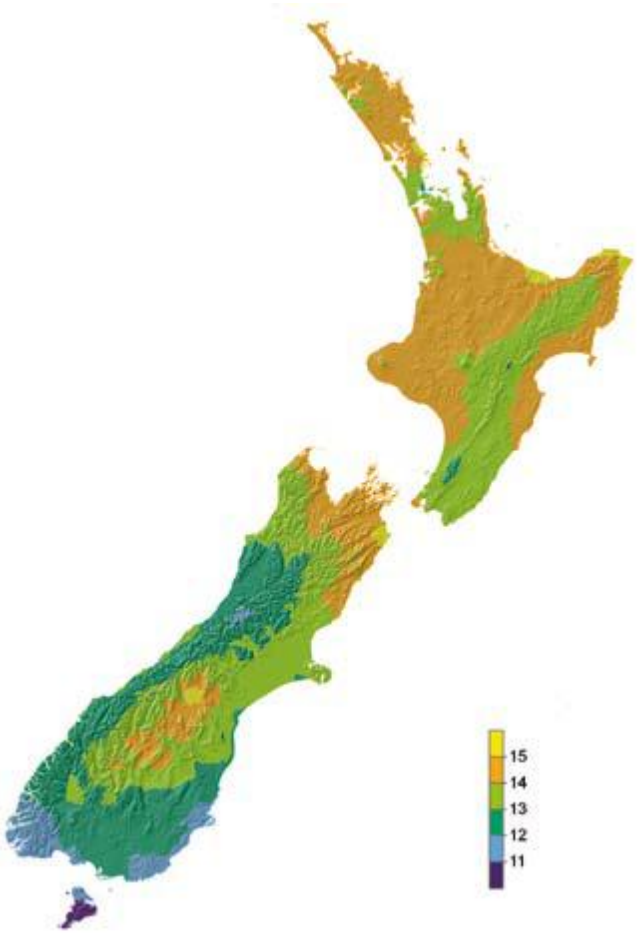
Source: EECA Energywise, Power from the people: a guide to micro-generation

Figure 4 below shows the average solar radiation for the whole of NZ. The ECCA / SKM Renewable Energy Assessment for Otago estimate that *"Solar radiation for the Otago region is approximately 1350 kWh/m²/yr, with some variations across the region"*[10].

[9] EECA Domestic-scale distributed generation: Guidance for local government, 2010, page 16.

[10] Source: ECCA Renewable Energy Assessment for Otago Region prepared by SKM for EECA, 2008

Figure 4: Solar Radiation - Map showing NZ average solar radiation



Source: NIWA, published Water & Atmosphere 13(4) 2005. (MJ/m^2/day)
Derived from climate station data.

NIWA have developed a model 'solar view' available on the internet called that calculates the solar energy that can be collected at a given address, panel direction and roof slope (refer www.solarview.niwa.co.nz)

The Renewable Energy Assessment for Otago report (2008) states that the high cost of solar PV has been the impediment to uptake rather than the amount of solar radiation. Consequently *"uptake has predominantly been for remote power suppliers, enthusiastic users and commercial developments where renewable energy has additional value as a corporate strategy or image statement."*[11]

This is however, changing with as the cost of solar PV falls and continues to fall. This is summed on Aurora Energy's website:

"PV systems can be expensive to install and, as a consequence, the electricity produced can be more costly than the electricity delivered to your home or business through Aurora's distribution network. The cost of PV systems, however, is declining. In 2008,

[11] Source: ECCA Renewable Energy Assessment for Otago Region prepared by SKM for EECA, 2008, page 50.

The Energy Efficiency and Conservation Authority (EECA) reported that the installation of a 2kW PV system had dropped to around $18,000 to $26,000; down from $40,000 in 2004 - a decline of 35%.[12]"

More recent estimates are that the cost has fallen up to 50%. The Solar Energy Association of NZ (`**SEANZ'**) stated in a recent media release: "With the price of solar power technology falling more than 50% in the past 12 months, home generated power is now a viable option for ordinary kiwis…"[13]

Energy Efficiency and Conservation Authority website states the following in respect of the costs of Solar PV:

"Typically, solar power costs somewhere between $6 to $9 per watt peak, so a 1kWp system will cost somewhere between $6,000 and $9,000. The cost of generating one unit (kWh) of electricity from a solar panel is calculated to be around 35c/kWh to 50c/kWh, although this can vary considerably. The cost of installation and related equipment for stand-alone power systems, such as a battery bank, can increase the cost of the system significantly."

EECA expect that the cost of solar power systems will fall as production expands and technologies improve. At the same time, the price for grid electricity is expected to rise, so the *"cost-effectiveness of solar power should continue to improve".*[14]

In the Queenstown Lakes District there is potential to significantly increase the use PV and solar hot water systems.

4.2 Solar Hot Water

Visually photovoltaic's and solar water heating appear relatively similar. PV panels are lighter (weighing on average up to 10 kg per panel, or less than 20 kg/m^2) than solar water heating panels and impose lower gravity loads on the roof of buildings or structures. They are however quite different technologies.

Solar water heating means devices that heat water by capturing the sun's energy as heat and transferring it directly to the water or indirectly using an intermediate heat transfer fluid. There are two types of systems 'Open loop' and 'closed loop', the latter being more suited to colder climates (and more expensive).

Figure 5 illustrates the different types of solar water heating panels.

The EECA "A guide to buying solar water heating" estimates that for an average household an effective system will provide 50% of annual hot water needs, cut about 2200kWh from annual electricity use and on average cost between $5,500 - $7,300 to install.

[12] Aurora Energy website, distributed generation, solar electricity tab.

[13] SEANZ, media release by Brendan Winitana, 19 April 2012.

[14] ECCA Energy Wise website, Solar Electricity Generation, costs of PV (note same quote on EECA business website).

Figure 5: Solar water heating panels

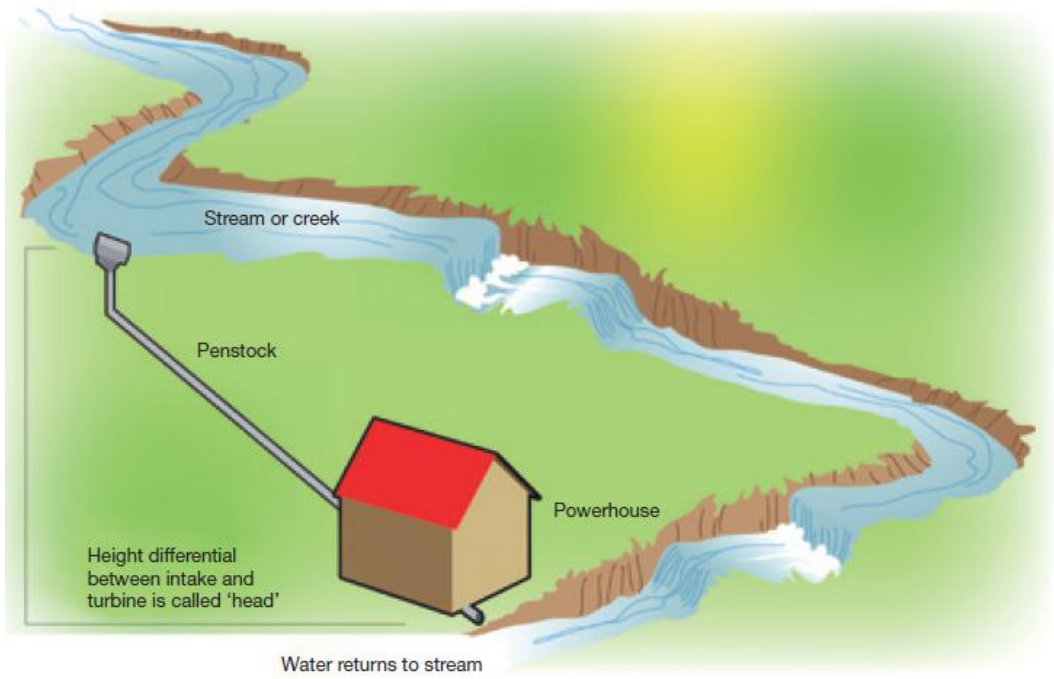
Source: EECA: A guide to buying solar water heating, 2009, page 4.

4.3 Hydro

Micro-hydro systems work in a similar way to the large-scale hydro schemes that produce most of New Zealand's electricity: they convert the kinetic energy in moving water into mechanical energy to spin the turbine and generator, which produces electrical energy to be used directly, stored on site, or exported into the electricity network[15].

While large-scale hydro developments require dams to store water, micro-hydro is often run-of-river which means minimal or no storage is required, reducing the environmental impact. If storage is required, it is usually in the form of a small weir and/or a small storage tank. **Figure 6** shows the components of run-of-river micro-hydro schemes.

Figure 6: Overview of a run-of-river micro-hydro scheme



Source: ECCA Energywise "Power from the people: a guide to micro-generation", page 39.

Micro and mini-scale hydro systems are best suited to rural sites close to a source of flowing water. They can be set up wherever water falls from a higher level to a lower

[15] EECA Energywise, Power from the people: a guide to micro-generation, page 38.

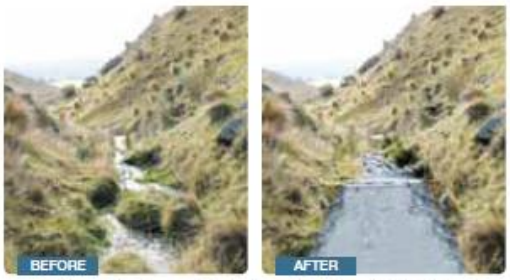
level, such as a waterfall, hillside, stream or where a reservoir discharges into a river. The type of turbine used will depend on the head and flow of the site. Impulse turbines (Pelton wheel) are usually used in high-head schemes, while reaction turbines are normally used on low-head schemes.

Figure 7: Photos of components of micro and micro-scale hydro.

Close-up of a Pelton wheel impulse turbine. The water returns to the same catchment that it was diverted from.
Photo: EcoInnovation

Simulation of the impact a micro (2-5kW) hydro scheme could have, looking upstream. A small weir is constructed to divert a portion of the stream into a penstock.
Photos: Genkit Nelson Ltd.

A Turgo impulse micro hydro turbine.
Photo: Alternative Power NZ Ltd.



Simulation of the impact a the impact a micro (2-5kW) hydro scheme could have, looking downstream.
Photos: Genkit Nelson Ltd.

Source: EECA, Domestic-scale distributed generation: Guidance for Local Government", page 31.

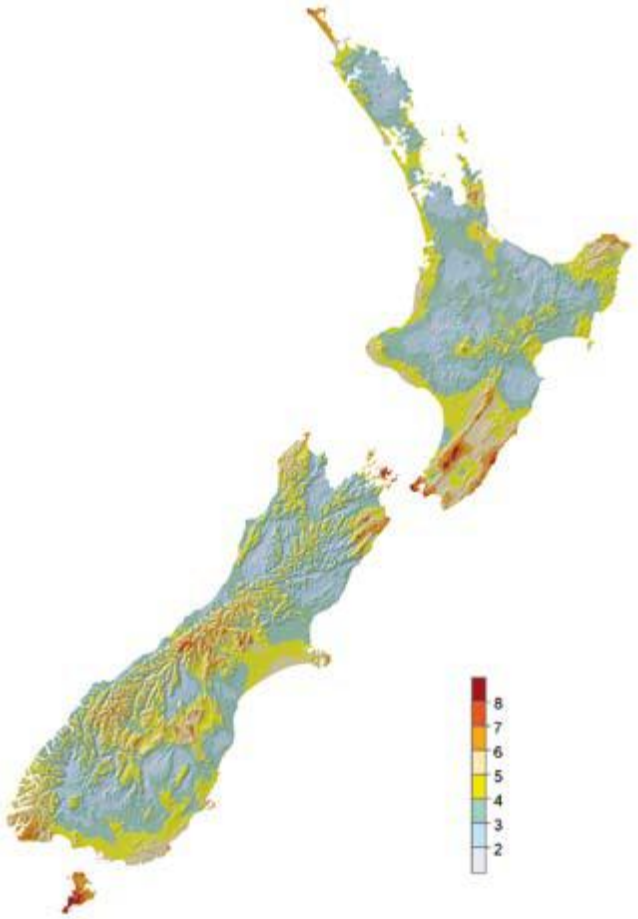
The advantages of hydro are that output is generally more consistent than that solar or wind with the main variable being rainfall. Hydro has a much higher capacity factor usually greater than 50% compared to other micro-generation technologies. It is also the technology with the lowest cost of generation. For a remote property with a stream or river suitable for a micro-hydro turbine, this will usually be the first choice.

4.4 Wind

Wind turbines harness the energy in the wind to generate electricity. The wind turns the rotor blades of the turbine, which then spins a shaft connected to a generator. The generator uses magnetic fields to convert the rotational energy into electricity.

New Zealand has an excellent wind resource and is described in the industry as the "Saudi Arabia" of wind**. Figure 8** is a NIWA published map showing NZ annual average wind speeds.

Figure 8: Map of NZ showing average annual wind speed



Source: NIWA, published Water & Atmosphere 13(4) 2005.
Derived from climate station data.

While the map shows parts of the Queenstown Lakes District as having high wind speeds this has to be considered in the context of the turbulent wind flows associated with mountainous environments.

In order to be efficient generators wind turbines need to above the turbulent air at ground level as wind quality and speed increases with height.

Currently there are no examples of wind turbines operating in the District that I am aware of. To demonstrate visually what a domestic scale turbine would look like I refer

to an EECA case study example of two small wind turbines at Taurikura Lodge in Canterbury shown in **Figure 9.**

Figure 9: Two Skystream wind turbines at Taurikura Lodge (Canterbury)

Source: EECA Case Study, Taurikura Lodge installs wind turbines, June 2009.

These Skystream wind turbines are rated at 2.4 kW each and a total capacity of 4.8 kW. The blades have a 3.7m diameter mounted on a 10m high pole.

4.5 Biomass

Biomass is biological material derived from living, or recently living organisms. In the context of biomass for energy this is often used to mean plant based material, but biomass can equally apply to both animal and vegetable derived material[16].

Bioenergy is energy from the sun which is captured in organic material (biomass). Biomass captures and stores solar energy using the process of photosynthesis. This energy can then be used to create heat, electricity, light or transport fuel.[17]

Bioenergy can be generated from:

- Trees and crops which may be grown specifically for their energy content or a by-product of another activity such as wood residue from forest harvesting.
- Biomass in waste products which results from industrial, commercial, agricultural and domestic activities such as animal manure, animal fat and municipal solid waste.

Different types of bioenergy can be used for different purposes including:

- Wood energy – energy from wood pellets or wood residue used for industrial or commercial heat and/or electricity generation (e.g. wood pellet boilers).

[16] Website - biomassenergycenter.org.uk, what is biomass".

[17] ECCA Business website, Renewable Energy, Bioenergy.

- Biofuel – energy from plant and animal matter (often blended with petrol or diesel) used for heating or transport fuel (e.g. bioethanol used in a commercial vehicle).

- Biogas – the combustible gas (mainly methane) given off during the breakdown of biomass used to generate energy (e.g. methane from pig manure used to create electricity for a farm).

Electricity generation from incinerating biomass is increasing in other parts of the world. Biomass is, in contrast to water, wind and sun, is the only renewable energy source that does not depend on the weather and guarantees a continuous energy generation.

In the Queenstown Lakes District potential biomass fuel sources in include forestry, green waste, Council landfills and waste management facilities, and food waste (for example from restaurants).

In the Queenstown Lakes District there are examples of wood pellet burner systems for domestic heating however I have not found any examples biomass systems operating to generate electricity.

In order to demonstrate what the physical appearance of this technology at a domestic scale may be I have referred to overseas examples. One example of a system available on-line from America is system called the "Power Pellet" marketed by a company call "Gekgasifer". [18]

Figure 10: Example of American domestic scale Biomass System

Source: www.gekgasifier.com, All Power Labs Catalogue, page 1.

New Zealand examples in the EECC case studies are larger scale commercial or heat transfer systems.

[18] Website – gekgasifer.com

5 Queenstown Lakes District Plan

The majority of the energy related provisions in the District Plan pre-date the 2004 RMA amendment which introduced a new Section 7 matter to have regard to: *"the benefits to be derived from the use and development of renewable energy"*[19].

Part 4.5 District Wide issues include objectives and policies relating to energy. Objective 1 – "Efficiency" refers to the "*the use of renewable energy sources"* with supporting policies including references to active and passive solar energy. Objective 2 is specific to "hydro-Electricity".

Hydro generation activity is defined as:

> *"Means activities associated with the generation of hydro electricity and includes the operation, maintenance, refurbishment, enhancement and upgrade of hydro generation facilities".*[20]

Part 12, Section 6 of the District Plan contains a special Hydro Generation zone. This only applies to land shown on the planning maps as zoned hydro generation and includes Contact Energy's sites at Hawea, Gladstone Gap and land originally designated for the Luggate power project on the Clutha River along with Pioneer Generation sites at Wye Creek, Oxburn and Roaring Meg. As all these are commercial scale generation facilities they fall outside the scope of this study of "small and community scale REG".

The District Plan does not refer to "Renewable Electricity Generation" in the definitions. The definition of "Utility" specifically excludes "structures or facilities used for electricity generation". Therefore Part 17 of the District Plan is not applicable to REG.

Solar, wind, hydro generation activities all involve structures and would fall under the District Plan definition of "structure" and in most cases "building".

Structure is defined as "*Means any building, equipment device or other facility made by people and which is fixed to land and includes any raft"*.[21]

Building is defined as *"Shall have the same meaning as in the Building Act 1991, but does not include – fences or walls of 2m in height or less…- Structures less than 5m^2 in area and in addition less than 2m in height above ground level… Building includes the construction, erection, alteration, relocation or placement on a site of a building".*[22]

Attachment A matrix contains a full assessment of the District Plan rules by zone and summarises the status of activity for solar, hydro, wind and biomass generation.

5.1 Lakes Environmental Resource Consent and Compliance Information

A search of Lakes Environmental database for "solar" and "hydro" provided a small number of recent examples of installations that have been consented and subsequently built. These include:

[19] RMA, Section 7 – Other Matters – (j).

[20] QLDC District Plan, Definitions, pD-6.

[21] QLDC District Plan, Definitions, pD-12.

[22] QLDC District Plan, Definitions, pD-2.

5.1.1.1 Grid Connected Solar PV Panel Installation

Mountain View Road, Dalefield dwelling has had 45 solar panels installed (ref: RM120017). This system has been mounted on the roof of an existing dwelling. The system is connected to the local distribution network. Of the 45 solar panels the majority are for electricity generation with a smaller number of panels for solar hot water heating.

The installation was in the Rural Lifestyle zone and assessed as a discretionary activity. In the processing of the consent the Lakes Environmental Planner and Landscape Architect raised the issue of potential glare from the solar panels. This was resolved and the application processed on a non-notified basis and consent granted subject to conditions.

5.1.1.2 SAPS Solar System

Motatapu Station has installed a free standing solar PV array as part of SAP on the station (ref: RM070149). The panels are located on a steep north facing bank near the dwelling and stables. The remote station is zoned Rural General and the application for a discretionary activity was processed on a non-notified basis.

5.1.1.3 Grid connected Hydro-electric scheme

Waterfall Creek, Wanaka Mt Aspiring Road (ref: RM090771 & RM110688). This is a proposed run of river hydro-electric scheme currently under construction. Waterfall Creek is a stream that falls steeply from the mountains across a fan and into Lake Wanaka.

Zoned Rural Lifestyle a Certificate of compliance for the "hydro" activity was issued. Subsequently consent was sought for a small building to house the power equipment. This was assessed as a discretionary activity. Regional Council consent was also required and granted.

5.1.1.4 Solar Hot Water

The most common type of installation in the District is solar hot water panels.

5.1.1.5 Wind and Biomass

No examples of wind or biomass for electricity generation were found.

5.1.1.6 Compliance Data

A review of the Lakes Environmental Compliance database registered two complaints regarding electricity generation activities:

- 2008 - Installation of a small windmill– concern over height of structure and noise emission. In low density residential zone, deemed to be compliant with height and noise rules and no further action taken.

- 2009 - Solar Panels- concern over addition of panels onto the roof of a new garage and whether this was approved as part of the resource consent. In low density residential zone, deemed to be a permitted activity and no further action taken.

5.2 Solar

Although the District Plan does not identify REG activities, the associated physical works are caught by generic building rules. This results in solar panels (both solar hot water systems and Photovoltaic's) requiring resource consent in most locations.

The zones where solar hot water systems and/or Photovoltaic's can be installed without resource consent is the low, medium and high density residential zones, where they are associated with a residential activity and comply with bulk and location standards such as setback and height rules. If the same system was associated with visitor accommodation or non-residential activity then minimum controlled activity resource consent would be required for "building" and be subject to external appearance assessment.

The majority of Greenfield residential areas are within a 'Special Zone' with detailed structure plans. The majority of the 'Special Zones' require a minimum of controlled activity resource consent for "building" and are subject to external appearance assessment.

The plan does not contain REG specific assessment criteria for Planners processing resource consents.

5.3 Hydro

The term 'hydro generation' is only used in Part 12, Special Hydro Generation zone. For the purpose of the hydro generation zone the terms are "operation", "maintenance", "refurbishment", "enhancement" and "upgrade" are defined in Part 12.

Run of river hydro scheme without a generator shed or other structure may be permitted activity. This is demonstrated by the Waterfall Creek Rural Lifestyle example.

In most cases hydro activities will include a building such as a generator shed. As with solar in the majority of zones "buildings" require at a minimum a controlled activity resource consent and in Rural General a discretionary activity.

In addition, in the Rural General Zone the following rule applies:

> *"5.3.3.4 Non-Complying Activities*
>
> *iv Power Generation Facilities*
>
> *Power generation facilities outside the areas scheduled under Rule 20.2, other than small hydro (1.5 to 2 k) inverter based systems for residential and non-residential activities.*[23]*"*

The reference to "areas scheduled under Rule 20.2" is assumed to mean reference to the Hydro Generation Zone. It is assumed that the reference in the rule to "k" means "kW" and that inverter based systems means Stand Alone Power systems.

The term "power generation facilities" is not defined and could be interpreted to include generation from any power source – REG (solar, wind, hydro and biomass) and other non-REG – at any scale from "small and community REG" through to say a large coal fired plant. This is probably not the intention however the rule as currently drafted is a "catch all".

In addition to the District Plan resource consent is required under the Otago Regional Council Water Plan. This is demonstrated by the Waterfall Creek example below.

[23] QLDC District Plan, Rural Area Rules, 5.3.3.4 Non-Complying Activities, page 5/14.

5.4 Wind

Wind turbines are generally going to be higher than buildings they are attached to or adjoin. They therefore typically exceed the maximum building height rules in the District Plan. In the majority of zones building height is a zone standard and triggers a non-complying activity resource consent.

As with solar, a wind turbine may also require resource consent as a "building" and subject to external appearance / visual / landscape assessment.

In the Rural General Zone all "buildings" are a discretionary activity and the zone standard specifies a maximum building height 8m or 10m if ancillary to farming or viticulture activities. In the Rural General Zone in most cases a wind turbine would be a non-complying activity. Each zone has noise standards. For example in the Rural General Zone:

> *v Noise*
>
> *(a) Sound from non-residential activities measured in accordance with NZS 6801:2008 and assessed in accordance with NZS 6802:2008 shall not exceed the following noise limits at any point within the notional boundary of any residential unit, other than residential units on the same site as the activity:*
>
> *(i) daytime (0800 to 2000 hrs) 50 dB $L_{Aeq(15\ min)}$*
>
> *(ii) night-time (2000 to 0800 hrs) 40 dB $L_{Aeq(15\ min)}$*
>
> *(iii) night-time (2000 to 0800 hrs) 70 dB L_{AFmax}* [24]

Following Plan Change 27a the noise standard was amended to include the following exemption: *"The noise limits in (a) shall not apply to sound associated with airports or windfarms. Sound from these sources shall be assessed in accordance and comply with the relevant New Zealand Standard, either NZS 6805:1992, or NZS 6808:1998."*[25]

"Small and community scale" wind generation will in most cases are able to comply with the noise standard

5.5 Biomass

Domestic scale biomass electricity generation is a permitted activity in most zones where generation is associated with an existing or permitted activity on site and it is fully contained within an existing building (including fuel storage). Resource consent would be triggered where a building is involved, outdoor storage and larger scale operation involving a connection to the local distribution network. In the Rural General zone the power generation facilities rule (5.3.3.4) rule would make it a non-complying activity.

5.6 Sensitive Sites

There are a number of zones and sites which are identified in the District Plan for their special values. 'Sensitive Sites' identified in Appendix 1 include: Heritage items in Part 13, Residential Arrowtown Historic Management Zone, Town Center Special Character Areas, Open Space Zones (part 20 and within special zone structure plans), sites of significant indigenous vegetation and ONF's.

[24] QLDC District Plan, Rural Area Rules, page 5/20-21.

[25] QLDC District Plan, Rural Area Rules, page 5/21.

REG activities have the potential to impact on sensitive sites and their special values / character. These sites need to be specifically addressed in any proposed standards. An approach requiring site specific assessment would be consistent with the Part 17 Utility provisions.

5.7 QLDC reflectivity guideline

The Council publication "A guide to reducing glare and reflection in the Queenstown Lakes District" is a non-regulatory guideline of relevance to REG, in particular solar. The guideline is used to assist with resource consent assessments in the rural zone and to assess compliance with "non-reflective finish" rules in the District Plan.

The guide states that materials with a non-shiny, textured or matt/powder finish are preferable to glossy or shiny finishes:

> *"Emphasis should be given to low reflective materials that tend to scatter the light rather than bounce it back. The following materials should be avoided as outer cladding if possible:*
>
> - *zincalume*
> - *Any material with a reflectance greater than 35%*
> - *Any shiny, highly reflective materials, even for small surfaces*
> - *Large expanse of glass*
> - *Large smooth surfaces*[26]

5.8 Legal Instruments

Covenants and Consent Notices are two legal instruments commonly used in the District as an additional means of controlling development. At the time of subdivision consent notices are often registered in favour of Council and require a variation for any changes. For example:

- In the Rural General zone when RBP are registered on the title they are typically accompanied by a Covenant constraining all building development within the RBP.
- Jacks Point and Millbrook covenants require design panel approval for buildings. These provisions also apply to building additions and therefore 'catch' REG activities such as solar.

Where a variation to the covenant in favour of Council or consent notice is required the application is processed by Lakes Environmental. Lakes Environmental use the District Plan provisions as a guide.

6 Connected Systems – Delta / Aurora Energy Limited Requirements and Retailer agreements

Other than SAP's, systems connected to the local distribution network need approval from the lines company and an agreement with a power retailer. With connected systems the owner becomes a "co-generator" exporting surplus power.

In the Queenstown Lakes District the distribution network is managed by Delta on behalf of the lines owner Aurora Energy Limited **("Aurora"**). Delta processes distributed

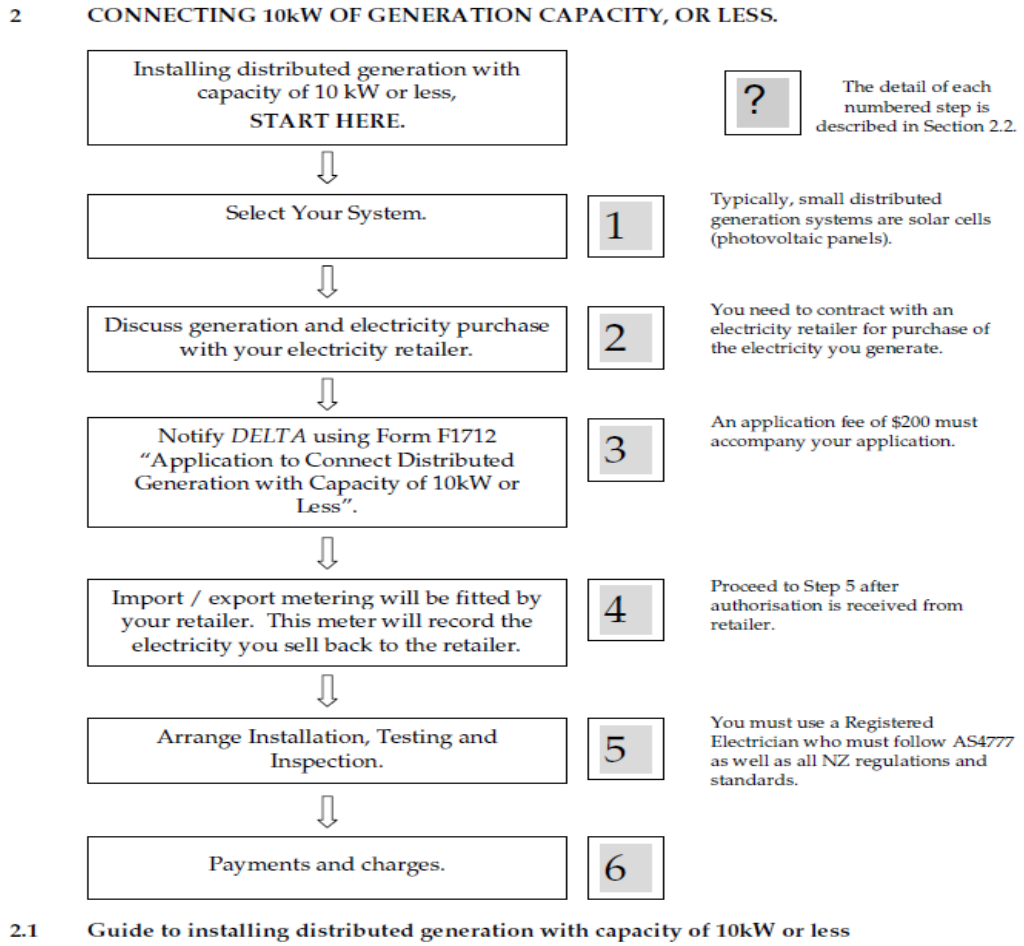
[26]QLDC, "A guide to reducing glare and reflection in the Queenstown Lakes District", page 2

generation connection applications on behalf of Aurora. Delta records indicate that there have been 10 domestic scale connections since 2008 (Wanaka 4, Hawea Flat 1, Luggate 1, and Queenstown 4)[27]. While the frequency of distributed generation connection applications is increasing there are no network capacity issues of current concern to Delta.[28]

The Aurora website includes guidance on the connection and technical requirements for small distributed generation[29]. Connection applications must be made on the appropriate form and an application fee paid. The connection applications are divided into systems with generation capacity of 10kW or less and systems with generation capacity greater than 10kw.

The steps in the connection process for 10kW of generation capacity or less are outlined in **Figure 11** below.

Figure 11: Aurora Energy Ltd Connection process for 10kW of generation capacity or less



Source: Aurora Energy Limited, Distributed Generation Connection Requirements (QP1720), Version 1, 22 November 2010.

27 Delta, Information provided by phone - Simeon Dwyer, 22 June 2012.

28 Delta, Information provided by phone - Simeon Dwyer, 22 June 2012.

29 www.auroraenergy.co.nz/content/distributed generation

Distributed generation systems must conform to the appropriate legislation and standards, including:

- Electricity Act 1992 / Electricity Industry Act 2010
- Electricity Governance (Connection of Distributed Generation) Regulations 2007
- Electricity (Safety) Regulations 2010
- AS/NZS 3000:2007 Australian / NZ Wiring rules.
- Aurora's Network connection Requirements.

Under Step 2 a contract with the owners chosen electricity retailer to purchase the electricity generated is required. To date Meridian has offered the best price and therefore have been the preferred provider. Meridian have offered a 1:1 ratio – they buy the power at the same price as the consumer would pay i.e. they pay a retail rate as opposed to a wholesale rate. Recent media reports indicate this arrangement is under review due to the increase in the number of connections in the South Island. If Meridian changes its policy for example offer a wholesale rate this will increase the payback period of future systems.

Under Step 5 the installation must be undertaken by qualified tradespersons to ensure compliance with all required building and electrical codes and standards. All wiring associated with the system must be undertaken by a Registered Electrician, and comply with AS/NZS 3000. Registered Electricians are also required to comply with AS4777.1 when installing equipment.

An important safety requirement is a safety "cut-out" if the Aurora supply fails. If a generator continues to operate during a power cut, this could make Aurora's electricity network live at a time it was assumed to be dead. This has the potential to cause a serious accident to anyone working on the network. To provide isolation and prevent this happening Aurora requires systems to be manufactured to AS4777.2 with protection systems installed in accordance with the AS7777.3.

A tiered fee system applies based on the generation capacity:

Scale of Distributed Generation	**Application Fee**	**Observation Fee**
Less than 10kw	$200	$60
Greater than 10kw but less than 100kW	$500	$120
Greater than 100kw but less than 1 MW	$1000	$1,200
Greater than 1 MW	$5000	$1,200

Source: Compiled from Aurora Energy Limited, Distributed Generation Connection Requirements (QP1720), Version 1, 22 November 2012.

Aurora is responsible for ensuring its plans and records of distributed generation installations are maintained at its control rooms so contractors working on the Aurora network can be advised appropriately. Aurora is required to notify Transpower of the existence of any generators connected to the Aurora network with a maximum capacity greater than or equal to one MW[30].

[30] Aurora Energy Limited, Distributed Generation Technical Requirements, 10 August 2009, page 10.

In terms of the District Plan Aurora are a Network Utility Operator and Requiring Authority. The definition of "utility" includes: "*transformers, lines and necessary and incidental structures and equipment for the transmissions and distribution of electricity".* Any physical works on the Aurora network that falls within this definition would be subject to the provisions of Part 17 Utilities.

The distributed generation connection application process addresses issues of meeting appropriate standards (including AS4777 / AS/NZS 3000), safety and preventing exporting during outage. The costs of the application process are tiered in terms of the scale of distributed generation and are proportional to the capital investment involved.

Neither the Aurora connection process nor the District Plan utility provisions are considered an impediment to the connection of small and community scale REG.

7 Summary

The uptake of renewable technologies in the District has been relatively low. The main impediment appears to be economics / cost. This is however, changing in respect of solar where the price of has fallen considerably and continues to fall. As the costs come down and electricity prices continue to rise solar options will appeal to a broader spectrum of people.

In general terms, the regulatory barriers to REG under the District Plan include:

- No specific definition or recognition of REG in the rules;
- Application of generic building rules resulting in the majority of cases REG requiring resource consent;
- No assessment framework (in terms of assessment matters for resource consents and objectives and policies); and
- Non-complying activity status, particularly as a result of height rules, resulting in the benefits of REG being unable to be balanced against the adverse effects under the "threshold test[31]".

The non-regulatory reflectivity guideline does not specifically consider materials of technologies designed to absorb energy from light.

Resource consent processes add cost and time to REG projects and do little to promote the outcomes sought by the NPS-REG for small and community scale REG.

[31] "Threshold test" – Section 105x of the RMA

PART 2

NATURE AND SCALE OF RENEWABLE ELECTRICITY GENERATION AND PROPOSED STANDARDS

1 Solar Electricity Generation

7.1 Nature and Scale

PV systems typically comprise the following key elements:

- PV modules, frames, cables and mounting or fixing hardware
- an inverter and charge controller
- In off-grid situations, batteries are also required, and PV is often used in conjunction with other generation technologies and small back-up diesel generators.

Figure 12: Features of Typical Solar PV Modules.

Solar PV parameters	Comments
Size of typical residential application	Residential PV systems are often between 1 and 5kW in capacity. A good rule of thumb is between 6 and 14m² is required per kW installed, depending on the type of PV modules used.
Size of typical commercial application	Commercial PV systems tend to range in size from 5kWp up, although many commercial applications are in the 10s or 100s of kW. The largest PV array in New Zealand is 52kWp, and it covers 416m².
Size of typical industrial application	Industrial-scale PV arrays can be very large. Some international PV arrays on industrial roofs are greater than 1MW in size.
Power	Each solar module has a rating specifying its peak electrical output under standard test conditions. Modules are available in sizes from 5Wp to 200Wp. A 1kW PV array could have 6 x 175Wp modules connected together.
Weight	A PV array usually weighs less than 20kg per m² of panel.
Reflectivity	While PV panels may cause some reflectivity, this is generally minor. PV manufacturers generally put an anti-reflective coating on the glass to increase the absorption of sunlight and thus the performance of the solar modules. This, in turn, reduces the reflectivity of the panels.
Construction	PV cells are made of several different materials, mainly silicon. PV modules are made up of cells and sandwiched between glass laminate and tedlar, or polyvinyl fluoride. Some newer type of PV cell are created by depositing semiconductor layers as 'thin films' directly onto glass, metals, roofing sheets, or even plastics of various types, including flexible sheets.
Colours	Black, dark blue, grey or brown.
Array types/ configurations	There are many different types of PV arrays and configurations. See the photos and diagrams opposite.
Fixing	There are many different methods of fixing PV to roofs, depending on the roof type. (Note that the Building Code acceptable solution G12/AS2 covers some of these.)

Source: EECA Domestic-scale distributed generation: Guidance for local government

PV array is the term used to describe a number of modules joined together. PV arrays may be configured and constructed in a number of ways:

- Free standing – panels on free standing frame.
- Roof top flush mounted panels not elevated by a frame
- Roof top panels attached to frame (on a flat or low pitched roof the frame is used to achieve an efficient angle)
- Building integrated PV – PV materials used in place of conventional building cladding materials such as roofing or walls.

PV arrays can be mounted on roofs either flush or on a frame. The determining factor in how PV arrays are configured is the angle to the sun to optimise energy

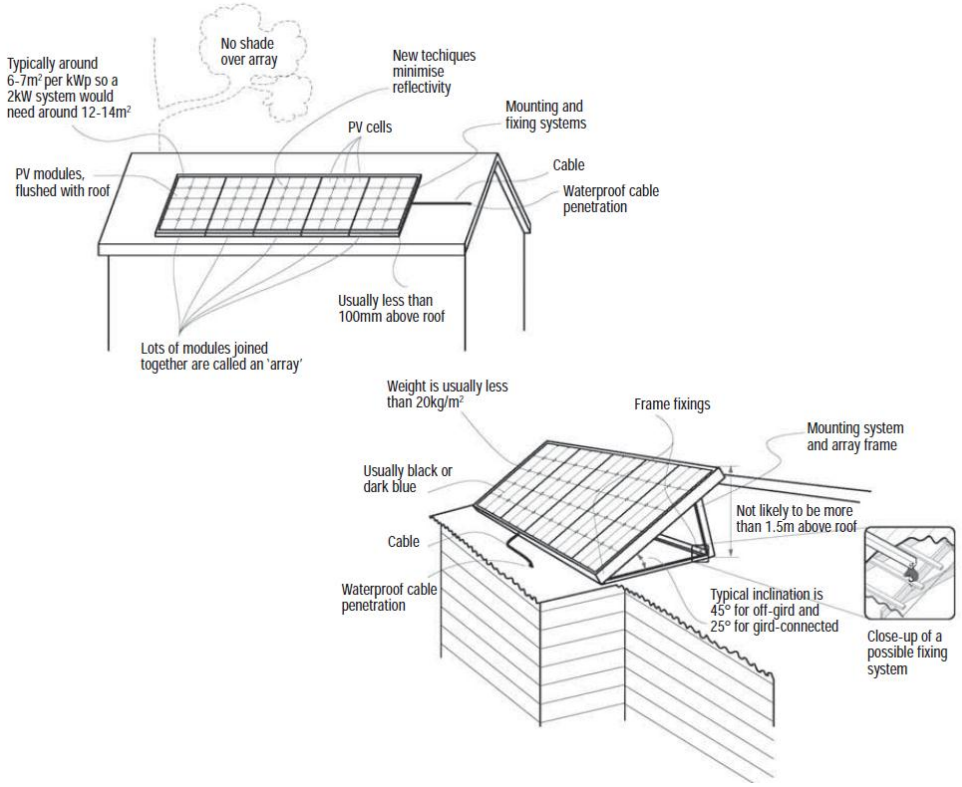
efficiency. The 'rule of thumb' is this angle should equal the latitude south (45^0 for Queenstown) however this varies between SAPs and grid connected (+/- 10^0).

One of the advantages of ground mounted systems is that much easier to change the angle setting. Installers can put a series of bolts on the frame and the client can then change the setting as the sun angles change with the seasons. Changing the panel angles though out the year optimises efficiency.

Frames attached to roofs are typically no more than 1.5m above the roof.

Figure 13 below shows the main components of PV arrays.

Figure 13: Main Components of PV Arrays



Source: EECA, Domestic-scale distributed generation: Guidance for local government, page 17.

The area of panels required for an average dwelling can be worked out by multiplying the rated output (each PV model has a rating specifying its peak electrical output) by 8,760 (the number of hours in a year) by the capacity factor. The capacity factor for Solar PV is low – they only generate 12% to 15% of their rated power output on average, over a year.

An average 3 bedroom dwelling installing a 3kW rated PV model would require approximately $120m^2$ of solar panels.[32]

Allowing some flexibility for larger than average dwellings it is recommended that solar panels up to $150m^2$ in area be considered for permitted activity status.

[32] Based on phone interview EECA, Rose Feary, 17 May 2012.

7.2 Potential Effects on the Environment

7.2.1 Sensitive sites

Sensitive sites identified in Part 1 above (5.6) include heritage items, special character areas, open space zones, sites of indigenous vegetation and ONF's. The District Plan seeks to protect their special values and character. Even small modifications to these environments can result in adverse effects. It is recommended that REG on these sites be subject to resource consent assessment.

7.2.2 Visual Effects

The main potential effect of solar is visual. Their purpose to generate electricity requires them to be orientated north, designed to maximise exposure to the sun and avoid screening for example by trees or buildings. Planting often required as visual mitigation of buildings and structures would be counterproductive.

Setting a size limit of 150m^2 panel area would enable domestic scale generation while maintaining visual amenity values of the Queenstown lakes built environment.

In rural environments it may not practical to locate free standing arrays within residential building platforms. Cabling adds to the balance of plant costs and this would dictate installations being located in relatively close proximity to the activity for which they are generating power for (residential or business). Taking into account the benefits of efficient systems and low visual impact it is not considered necessary to constrain their siting to within RBP's.

Roof top flush mounted panels can be designed to look part of the building and visually form part of the structure to which they are attached. They can appear very similar to a series of skylights from a distance. They need to be contained within the building roof plan envelope and not overhang the edge of the building. On larger buildings it is proposed that these be allowed to cover up to 80% of the roof area.

Roof top panels attached to frame are typically used on buildings with flat or low pitched roofs in order to achieve optimal sun angles. The framing makes them more visual however provided they are set-in from the edge of the building proportional to their height they will not overshadow or be dominant. The urban roof scape is 'busy' for example in Queenstown town centre there is a multitude of rooftop structures – air conditioning units, ventilation chimneys, satellite dishes etc. Roof top panels would blend into this urban roof scape.

Assuming the building to which they are attached is permitted in the zone or has been approved by way of resource consent the addition of a PV arrays will have a minimal visual effect.

Building integrated solar PV can be used in place of traditional building materials on roofs resulting in a very similar visual effect. On walls from an urban design perspective uniformity or overuse of one material can be an issue. Use of different materials contributes to breaking up the form of larger buildings and a limit of 150m^2 of integrated solar panels on walls is recommended.

With the exception of on "sensitive" sites PV arrays up to 150m^2 could be appropriately provided for as a permitted activity, subject to meeting performance standards.

7.2.3 Colour

PV panels are designed to absorb light and as indicated in figure 12 above are manufactured in black, dark blue, grey or brown. A performance standard is recommended that the colour be selected to be the closest to the building to which they are attached or adjoin. Frames and mounting or fixing hardware should also be finished in recessive colours the same or similar to the building to which they are attached or adjoin.

7.2.4 Reflectivity

PV panels are designed to absorb light and generally are less reflective than a glass window[33].

SEANZ require their members to comply with IEC standards which include reflectivity standards[34]. Auckland International Airport large 300m^2 PV array is designed and installed in accordance with IEC standards. This installation is successfully operating in the sensitive receiving environment of an airport.

7.3 Proposed Standards

The following District Plan standards are proposed:

- On sensitive sites require resource consent.
- Permitted activity status for small and community-scale Solar REG subject to performance standards.
- Use site standards so that any non-compliance triggers a restricted discretionary activity.
- Maximum permitted area of PV arrays on a site:
  - (i) Free standing – 150m^2
  - (ii) Roof top flush mounted panels – 150m^2 or 80% of the roof area, whichever is the greater.
  - (iii) Roof top panels attached to frame – 150m^2
  - (iv) Building integrated Photovoltaic (Photovoltaic materials used in place of conventional building cladding materials such as roofing, or building facades) - 100% of the roof area or 150m^2 on building facades.
- Roof top flush mounted panels contained within the building roof plan envelope and not overhang the edge of the building.
- Roof top panels attached to frames no more than 1.5m above the roof and setback from the edge of the building a minimum of 1.5m.

[33] EECA Domestic-scale distributed generation: Guidance for local government, 2010, p19.

[34] Phone interview with SEANZ chairman Brendan Winitana.

- Apply building setbacks from internal boundaries and roads in the zone in which they are located.
- Maximum building height and recession planes as per the zone in which they are located with an exemption from maximum building height for roof top panels to exceed by up to 0.5m.
- Colour to be similar to roof or building it is associated with.
- Include Interpretative diagram.
- The following non-regulatory methods are proposed:
- Promote solar arrays be designed and installed by a SEANZ accredited practitioner or SEANZ member in accordance with the SEANZ code of practice and renewable energy standards.
- Amend reflectivity guideline to include reference to solar panels materials.

8 Solar Water Heating

8.1 Nature and Scale

Solar water heaters may include a solar thermal collector, a water storage tank or cylinder, pipes, and a transfer system to move the heat from the collector to the tank.

Solar water heating systems are sized according to demand for hot water. The number of occupants in a house can be used as a guide – see **figure 14** below.

Figure 14: Solar water heating size guide

Number of occupants	Cylinder size (litres)	Collector panel area (m^2)	Evacuated tubes
3 or fewer people	Up to 200	1.5 to 3.5	10 to 20
4-5 people	200-350	2.5 to 6	15 to 40
6 or more people	300 or more	4 upward	40 upward

Source: ECCA Energy Wise, A guide to buying solar water heating, 2009, page 5

The ECCA guide to buying solar water heating states: "*In general there should be no more than 1m^2 of collector per 50 litres of water and no less than 1m^2 of collector per 100 litres of water.*"[35]

An average 3 bedroom dwelling installing a model would require approximately 6m^2 of collector panels.

[35] ECCA Energy Wise, A guide to buying solar water heating, 2009, page 5

Allowing some flexibility for larger than average dwellings, visitor accommodation and commercial activities it is recommended that 20m^2 of solar panels be considered for permitted activity status.

8.2 Potential Effects on the Environment

8.2.1 Visual

The visual appearance of solar hot water panels is similar to PV although the collector panel area is smaller. Some models can have round tanks at the top however, these are not common in colder climates

8.2.2 Colour

As with PV solar hot water collectors are dark colours to maximise heat absorption. The same colour provision as for PV would be appropriately applied to solar hot water.

8.2.3 Reflectivity

The Auckland International Airport example in addition to solar PV also includes solar hot water panels. As discussed above this is successfully operating in the sensitive receiving environment of an airport.

8.3 Proposed Standards

The following District Plan standards are proposed:

- On sensitive sites require resource consent.
- Permitted activity status for solar water heating subject to performance standards.
- Use site standards so that any non-compliance triggers a restricted discretionary activity.
- Maximum permitted area of solar water heating collector panels 20m2.
- Roof top flush mounted panels contained within the building roof plan envelope and not overhang the edge of the building.
- Roof top panels attached to frames no more than 1.5m above the roof and setback from the edge of the building a minimum of 1.5m.
- Apply building setbacks from internal boundaries and roads in the zone in which they are located.
- Maximum building height and recession planes as per the zone in which they are located with an exemption from maximum building height for roof top panels to exceed by up to 0.5m.
- Colour to be similar to roof or building it is associated with.
- Include Interpretative diagram.

The following non-regulatory methods are proposed:

- Promote Solar water heating systems to be designed and installed by a Solar Association of NZ accredited practitioner or Solar Association member in accordance with the "Code of Practice for Manufacture and Installation of Solar Water Heating Systems in New Zealand (2004 or any subsequent revisions thereof)" and technical standards.

- Amend reflectivity guideline to include reference to solar panels materials.

9 Hydro

9.1 Nature and Scale

Most run-of-river schemes comprise of the following key elements:

- an intake and diversion structure

- headrace and/or penstock (channel or pipe); and

- a generator

Figure 15: Components of Micro and Mini-scale Hydro

Micro and mini-scale hydro parameters	Comments
Turbine types	The two main types of micro-hydro turbines are 'impulse turbines', (such as the Turgo or Pelton wheel) or 'reaction turbines'. In an impulse turbine, a high-speed water jet strikes and rotates the turbine buckets (runner), while a reaction turbine has the runner fully immersed in the water flow.
Power	Micro-hydro turbines tend to be sized from a few hundred watts to a few kilowatts. The amount of electrical energy able to be generated depends on the flow of the river, and the available head. Turbines less than 5kW in rated capacity are less likely to require water storage, meaning that they are run-of-river schemes.
Maximum flow diverted	Generally, the maximum flow diverted from the stream should be no more than 50% of the minimum flow of the particular water source.
Required head and flow	Both head and flow can vary considerably. Generally, the higher the head (or the vertical drop between the intake and the turbine), the more effective the hydro scheme will be. However, even a small head of less than 5m could be adequate, as long as there is sufficient flow in the stream.

EECA, Domestic-scale distributed generation: Guidance for Local Government, 2010, page 29.

9.2 Potential effects on the environment

9.2.1 Water

The main effect of hydro schemes is on the flows and volume of water within streams and rivers and impact on fish and aquatic invertebrates. Water resource management is a function of Regional Councils.

The Otago Regional Council Water Plan contains rules relating to damming and diverting water. These rules trigger a requirement for resource consent. These assessments typically cover issues around maintaining minimum stream flows, the impact on fish and other aquatic invertebrates. Intake protection structures can be used to mitigate effects on fish. It is also important to ensuring water is returned to the same catchment as it was diverted from.

9.2.2 Landscape and Visual effects

The structures of an intake and headrace and/or penstock may be small enough to avoid being classified as a building under the District Plan and therefore may be permitted. This exemption applies to structures *"less than 5m^2 in area and in addition less than 2m in height above ground level."*

In most cases some form of housing for the generator is required and the building triggers resource consent. The streams in the District that have sufficient "head" for micro and mini-scale hydro systems are predominantly located in the Rural General zone and Rural Areas. There is limited opportunity for small and community scale hydro generation in the District. Due to the sensitivity of the Rural General zone landscapes a resource consent assessment for small buildings associated with a mini / micro hydro is necessary.

9.3 Proposed Standards

The following District Plan standards are proposed:

- On sensitive sites require resource consent.
- Permitted activity status for small and community-scale Hydro REG subject to performance standards.
- Use site standards so that any non-compliance triggers a restricted discretionary activity.
- Include rules for buildings in Rural General and Rural Lifestyle along with tailored assessment criteria to assist with the processing of resource consents.

10 Wind

The main components of small scale wind turbines are summarised in Figure 16 below.

Figure 16: Components of Micro and Mini-scale Wind turbines

Some common micro- and mini-scale wind turbine parameters	Notes
Size	Micro- and mini-scale wind turbines range in size from those that have rotors of less than 1m in diameter to much larger devices that have rotors between 8m-10m in diameter. Most household-scale wind turbines have rotor diameters of less than around 5m.
Rotor blades and configuration	Wind turbines need only one blade to convert wind energy; however, most wind turbines these days use two or three blades. The blades are usually made from composites of fibreglass, carbon fibre, or wood.
Rated power output	The rated power output of micro turbines ranges from a few hundred watts up to around 20kW. Typical micro-scale turbines have a rated power output of 1kW-3kW.
Mounting locations	Micro wind turbines are most commonly mounted on top of towers or poles in rural areas with good wind resources. Some new designs can be mounted directly onto buildings or other structures. It is important that the wind turbine is sited away from obstructions in clear, uninterrupted wind flow.
Tower type and height	Towers are usually either free-standing tubular or lattice towers, or tubular masts supported by guy wires. The height is usually between 9m-20m above ground level. Performance improves dramatically with height so most towers are at least 10m high, and towers around 20m in height are preferable. Some towers can be 'tilted' up and down to make it easier to install and service the turbines.
Survival wind speed	All turbines need a mechanism to prevent damage in extremely high wind speeds. This is sometimes called 'overspeed control'. Some turbines are designed to continue operating in high winds, or have a feature that allows the blades to twist (or 'feather') out of the wind for protection (passive overspeed control). Other mechanisms are electrical breaking and pitch control (active overspeed control).
Wind speeds	Most micro wind turbines require at least 3m/s (11km/h) of wind before they generate electricity; however, at least 4.5m/s (16km/h) is usually required to start working effectively.

Source: EECA Energy Wise, Power from the People: a guide to micro-generation, 2010/EEC1449, page 27.

Wind turbines generally operate best on:

- "areas with smooth, steady wind flows, as opposed to locations with irregular, turbulent flow;
- Gaps, passes, gorges, and valleys extending down from mountain ranges
- High elevated plains and hilltops, ideally with gentle surrounding contours;
- Exposed ridges and mountain summits
- Coastlines and inland strips with minimum wind barriers and vegetation."[36]

Turbines need to be located away from obstructions and not be sheltered by trees or buildings. Disturbed wind flow reduces the performance of wind turbines. When wind encounters obstacles and features on the ground the quality of airflow is disturbed, creating a zone of turbulence around the object. *"In general, the affected zone extends to about twice the height of the obstruction and can stretch downwind to a distance of about 20 times the object's height."*[37]

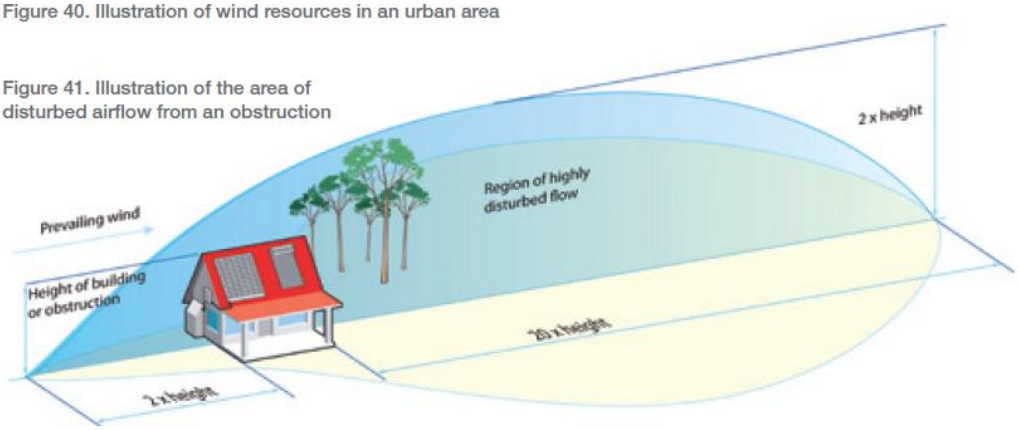
[36] EECA Energy Wise, Power from the People: a guide to micro-generation, 2010/EEC1449, page 28.

[37] EECA Energy Wise, Power from the People: a guide to micro-generation, 2010/EEC1449, page 31.

Figure 17: Disturbed wind flow

Figure 40. Illustration of wind resources in an urban area

Figure 41. Illustration of the area of disturbed airflow from an obstruction



While micro- and mini scale wind turbines can be used in both urban and rural environments they generally work better in rural environments.

10.1.1.1 Rooftop or Building Integrated Turbines

Rooftop-mounted or wall mounted micro wind turbines are a new and emerging type of wind turbine. There are designs being trialled with some commercially available.[38] For example Auckland Sky City has installed a Swift micro turbine on its tower as part of a Vector trial. This is approximately 5.5m above the roof of the sky deck[39].

10.2 Potential Effects on the Environment

10.2.1 Landscape and Visual Amenity Effects

By the nature of their operational requirements wind turbines are usually highly visible. They have potential to adversely affect landscape and visual amenity. Location, design and height of turbines are the key triggers.

In rural environments (as with free standing solar) it is unlikely to be practical to locate a turbine within a residential building platform. Cabling adds to the balance of plant costs and this dictates installations being located in relatively close proximity to the activity for which they are generating power for (residential or business). Provided they are not within setbacks (road or internal boundary) the efficiencies gained out weight the adverse effects.

Slim line pole designs are less visible than lattice towers. Pole designs should be promoted over lattice towers, the latter being subject to resource consent assessment.

The height of a turbine is measured from the ground level to the tip of the blade when in vertical position. Turbines that are significantly higher than the building heights in the zone in which they are located require a site specific assessment. In the Rural zone they could be 'matched' to buildings for farming and viticulture as opposed to residential thereby providing an additional 2m of flexibility.

[38] EECA Energy Wise, Power from the People: a guide to micro-generation, 2010/EEC1449, page 33.

[39] Sky City, website, about us / environmental.

As with hydro, due to the sensitivity of the Rural General zone landscapes resource consent assessment for any associated small buildings is necessary.

10.2.2 Noise

Turbines give rise to aerodynamic and mechanical noise, although the latter has been largely eliminated with technological improvements.

New Zealand Standard NZS 6808 recommends limits on noise from wind farms. The 2010 edition replaces the earlier edition published in 1998. NZS 6808:2010 provides suitable methods for the prediction, measurement and assessment of sound from wind farms that takes into account the factors that are specific to that sound. It also recommends limits on the level of sound that can be heard from locations near wind farms.[40]

The Standard generally applies to wind turbines with a swept rotor area greater than 200 m^2 (for example, individual blade lengths greater than approximately eight metres). Wind turbines with a smaller swept area are generally covered by the provisions of Standards relating to general environmental noise (NZS 6801 and NZS 6802); although they may require special measurement procedures to account for the effects of wind noise.[41]

10.2.3 Effects on Avifauna from Turbine Strike

Wind turbines, as vertical structures with mobile elements, may represent a risk to birds.

This is an issue often raised in respect of commercial scale wind farms. Small turbines are unlikely to result in risks to avifauna due to their location in close proximity to human activities such as dwellings and buildings.

10.2.4 Shadow Flicker

Shadow flicker occurs when the blades of a wind turbine move through the sunlight and cast intermittent shadows that appear to 'flicker' as the sun passes behind the turbine blades. The "rule of thumb" for shadow flicker is up to a distance of approximately 10 rotor diameters from a turbine. Beyond this the shadow is typically sufficiently diffused.

Shadow flicker is unlikely to be an issue with micro wind turbines due to their small diameter. It is proposed to include setback rules which ensure the structures would be sufficiently setback for visual reasons, and in addition allow sufficient shadow diffusion.

10.3 Proposed Standards

The following District Plan standards are proposed:

- On sensitive sites require resource consent.

[40] NZ Wind Energy Association, website, wind farm noise standard.

[41] NZ Wind Energy Association, The NZ wind farm noise standard fact sheet, page 2.

- Permitted activity status for small and community-scale wind REG subject to performance standards.
- Use site standards so that any non-compliance triggers a restricted discretionary activity.
- Noise – cross reference to zone standards in the zone in which they are located.
- No lattice tower construction.
- Turbine height to be measured to the tip of blade when in vertical position.
- Turbines, including rooftop and wall mounted turbines, up to the maximum building height in the zone in which they are located (except rural environments).
- Turbines in rural environments – Rural General, Ski area subzones, Gibbston Character, Rural Residential and Rural Lifestyle: 10m maximum.
- Ancillary buildings for equipment as per hydro standards.

11 Biomass

11.1 Nature and Scale

Biomass technologies are not covered in either of the two EECA guidelines (Domestic-scale distributed generation: Guidance for local government or Power from the People: a guide to micro-generation), quoted above in respect of solar, wind and hydro.

Information can be found on the EECA business and the Bio Energy Association of NZ (BEANZ) websites. The bioenergy examples published by EECA business are commercial and industrial scale for heating and fuel as opposed to small and community scale electricity generation.

In order to demonstrate what the physical appearance and effects of this technology at a domestic scale may be I have referred to overseas examples.

One example of a system available on-line from America is system called the "Power Pellet" marketed by a company call "Gekgasifer". [42] The "Power Pellet" is available in 10 kW and 20 kW sizes.

The key components of this system include a stainless steel hopper, a chimney, piping and engine and controller that sit on a pellet. The dimensions of a 20 kW "Power Pellet" are 1.2m x 1.3m x 1.8m. **Figure 18** below provides an illustration and specifications.

[42] Website – gekgasifer.com

Figure 18: "Power Pellet" specifications

POWER PALLET SPECS	10 kW	20 kW
Power Output	3-10 kW	5-20 kW
Biomass Consumption	12 kg / 26 lbs per hour at 10 kW	22 kg / 50 lbs per hour at 20 kW
Fuel Moisture Tolerance	Up to 30%	Up to 30%
Dimensions	1.2m x 1.2m x 1.8m 48" x 48" x 72"	1.2m x 1.3m 1.8m 51" x 52" x 72"
Weight	499 kg / 1100 lbs	658 kg / 1450 lbs

Source: www.gekgasifier.com, All Power Labs Catalogue, page 6.

The preferred fuel for the GEKgasifier is chunky, dry, carbon-dense woody biomass such as wood chips, wood chunks, nut shells and pelletized coffee grounds. It takes approximate 1.2kg of biomass to generate 1kWH of power output. Figure 19 below show the fuel consumption for the "Power Pallet".

Figure 19: "Power Pellet" Biomass Fuel Consumption

BIOMASS FUEL CONSUMPTION				
	10 kW Engine (@ 75% load)		20 kW Engine (@ 75% load)	
	Biomass Weight	Power Output	Biomass Weight	Power Output
1 Hour	9 kg	7.5 kWh	18 kg	15 kWh
8 Hours	72 kg	60 kWh	144 kg	120 kWh
24 Hours	216 kg	180 kWh	432 kg	360 kWh

Source: www.gekgasifier.com, All Power Labs Catalogue, page 10.

The nature and scale of systems will be directly related to the fuel source. Larger systems with greater power generation capacity require a larger volume of biomass material. Larger systems would need to be co-located or close proximity to industry, waste management facility, intensive agricultural or forestry.

11.2 Potential Effects on the Environment

11.2.1 Air Quality and Odour

Discharge to air from the incinerating process has potential for adverse effects on air quality and odour. Air quality is a function of Regional Councils. The Otago Regional Council Air Plan regulates the effects of discharges to air from incinerating biomass.

11.2.2 Noise

The operation of the systems has the potential to generate noise, along with any vehicles associated with the transportation of biomass materials. Any noise generated from the activity should comply with the relevant noise standard in the zone in which it is located. If located in close proximity to residential neighbours the plant may need to be housed within a building to meet the noise rules.

Transportation of biomass materials to a site has the potential to generate traffic noise. This could be avoided if the system is co-located on with the biomass source.

11.2.3 Visual and amenity effects

A domestic scale system would have relatively small dimensions, similar to a garden shed. If operated outside of a building they have the potential to have adverse visual effects, particularly if associated fuel materials are stockpiled. To mitigate potential visual effects it is recommended that any outdoor component be screened from public places and neighbouring properties.

The key trigger for biomass systems is fuel source. Systems with a fuel source on site would have minimal impact on amenity values. Larger scale systems are likely to be associated with a fuel source for example forestry, intensive farming or waste management facility. Larger scale operations have the potential to adversely affect residential amenity and landscape values. They are aligned to industrial and rural activities and it is recommended that the District Plan provisions reflect this.

11.2.4 Traffic Generation

Biomass material sourced remotely and transported to a generation plant has potential for traffic generation effects. Traffic generation can have potential adverse effects on amenity values and should be subject a resource consent.

11.3 Proposed Standards

- On sensitive sites require resource consent.
- Permitted activity status for small and community-scale biomass REG subject to performance standards.
- Use site standards so that any non-compliance triggers a restricted discretionary activity.

- Noise – cross reference to zone standards in the zone in which they are located.
- Biomass material to be sourced on the same site as the generation plant. Material being collected and transported to generation plant triggers a restricted discretionary assessment except zones where industrial activities are permitted.
- Any outdoor storage to be screening from adjoining sites and public places
- Buildings as per hydro standards.

12 General Comments

12.1.1 Objectives and Policies

In order for the recommended standards to be effective supporting objectives and policies are required. It is noted that this is beyond the scope of work of this study which focuses on the technical standards only.

12.1.2 Definitions

It is recommended that the NPS definitions of "small and community scale REG", "distribution network" and "national grid" be incorporated into the District Plan.

These definitions are silent on the generation capacity - "small and community scale" definition does specify a maximum number of kW generation capacity.

In terms of SAP's the size of the system will correspond to the activities which it is supplying. In most cases in the Queenstown Lakes District the activities which a SAP would supply would either have resource consent or be subject to resource process and an appropriate scale of activity established. The power output required from the SAP is determined by the demand of the activity being supplied. It is therefore considered unnecessary to limit SAPs power output.

For systems that are connected to the local distribution network the definition is silent on what is "small scale". For the avoidance of doubt a threshold of "small" could be incorporated into either the definitions or Part 17b rules. It is proposed that a threshold "less than 1MW" be included in the definition to provide certainty.

Definitions of the four types of generation and solar water heating would also need to be included in District Plan:

- Biomass: means energy derived from biomass (recently living organisms such as wood, wood waste, by-products of agricultural processes and waste) and for the purpose of Section 17B shall be limited to biomass systems used to generate electricity.
- Solar electricity generation: means the conversion of the sun's energy directly into electrical energy. The most common device used to generate electricity from the sun is Photovoltaic's (PV).
- Photovoltaic's (PV): means a device that converts the energy in light (photons) into electricity, through the photovoltaic effect. A PV cell is the basic building block of a PV system, and cells are connected together to create a single PV module (sometimes called a 'panel'). PV modules can be connected together to form a larger PV array.

- Solar water heating: means devices that heat water by capturing the sun's energy as heat and transferring it directly to the water or indirectly using an intermediate heat transfer fluid. Solar water heaters may include a solar thermal collector, a water storage tank or cylinder, pipes, and a transfer system to move the heat from the collector to the tank.

12.1.3 Proposed Standards

Attachment B illustrates how the proposed standards could look in District Plan format. The proposed rules need to be tested by full Section 32 analysis to determine whether they are the most efficient and effective method.

If would be difficult to insert these provisions zone by zone and it is recommended consideration be given to creating a district wide chapter. This could be an extension of Part 17 Utilities chapter.

12.1.4 Residential Building Platforms

Consideration was given to the residential building platform ('RBP') tool in the District Plan which seeks to contain domestic elements to a defined area. This tool is used in the Rural General zone, Rural Lifestyle and some special zones. For example in Rural General Zone an area of between 70m^2 and 1000m^2 on a site may be defined at the time of subdivision for a residential dwelling.

For a system to be efficient it may not be practical to constrain the siting to the RBP. A SAP system in a rural environment may include a combination of technologies. Assessment to the energy resource and efficiency would dictate the optimal layout.

Provided that REG is not considered part of the permitted baseline as the installations have benefits directed by the NPS-REG to be taken into account.

12.1.5 Legal Instruments – Covenants

Covenants and Consent Notices are a potential barrier to REG installations, particularly at a domestic scale. On future Covenants and Consent Notices Council may wish to advocate for flexibility to allow for REG, in particular solar installations.

12.1.6 Building Code Compliance

All micro generation installations should be safe, strong, and durable. Regardless of whether or not a building consent is required, all systems need to comply with the Building Code. The Building Code requirements for individual micro generation systems will vary depending on specific technologies and various factors associated with the installation. Common considerations will be whether electrical installations are safe (G9 – Electricity), that systems and supports are structurally sound (B1 – Structure), and that components meet durability requirements (B2 – Durability). Where photovoltaic panels are installed on a roof, it is important to ensure that weather tightness is maintained E2 (External moisture). Other clauses may occasionally be relevant depending on the installation being considered.

13 Summary

This study has described the nature and scale of small and community scale REG activities. Following from the assessment of potential effects proposed standards have been developed. When taken in context of the benefits of REG as identified by the NPS-REG a combination of permitted activity status and where site standards are not meet restricted discretionary activity status.

These proposed standards need to be tested by full Section 32 analysis to determine whether they are the most efficient and effective method.

Attachment A- District Plan Assessment

Note: This table is a summary that addresses the key rules in each zone and does not record every rule or exemption. Any proposed REG should be assessed on a site specific basis.

Abbreviations

PERM = permitted activity
CON = controlled activity
RDIS = restricted discretionary activity
DIS = discretionary activity
N-C = non-complying activity
PRO = prohibited activity

RBP = residential building platform
VA = visitor accommodation

GFA = Gross floor area
ONL = outstanding natural landscape
ONF = outstanding natural feature

Assumptions

All systems domestic scale and associated with a permitted activity on a site such as a dwelling.

Solar – PV or water heating systems attached to a building or freestanding with panel area in excess of $5m^2$

Hydro – run of river system with new generator building larger than $5m^2$ in area.

Wind – turbine in excess of 10m in height.

Biomass - contained within a new or additional building in excess of $5m^2$ in area.

Part ref / Zone	Definitions / Activity Rules	Site Standards	Zone Standards	Resource Consent required? Status	Commentary
Part 4 – District Wide issues	Part 4.5 District Wide issues include objectives and policies relating to energy. Objective 1 – "Efficiency" refers to the "the use of renewable energy sources" with supporting policies including references to active and passive solar energy. Objective 2 is specific to "hydro-Electricity".				The majority of the energy related provisions in the District Plan pre-date the 2004 RMA amendment which introduced a new Other Matter under Section 7 (e) *"the benefits to be derived from the use and development of renewable energy"*.
Part 5 – Rural Rural General Zone	5.3.3.2 – CON i buildings (a) additions / alteration to existing building within RBP (b) new buildings within RBP. 5.3.3.3 - DIS i building outside of RBP. 5.3.3.4 N-C iv Power Generation Facilities: *"Power Generation facilities outside the areas scheduled under Rule 20.2 other than small hydro (1.5 to 2 k)*	5.3.5.1 - RDIS iii Scale and Nature of Activities – max GFA 100m^2. Equipment stored outside a building vi Minimum Setback from Internal boundaries – 15m	5.3.5.2 i Building Height 8m ii Setback from Roads: 20m v Noise Specific reference to wind farm NZ standard.	Yes Solar – DIS Hydro – DIS Wind - N-C Biomass - DIS	The rural general zone is the most extensive zone in the District Plan. It includes ONL and ONF, areas of significant indigenous vegetation and water bodies. It is a sensitive receiving environment. Includes remote areas requiring SAPs. The Power Generation Facilities rule could be interpreted to make all but small hydro non-complying activities –

Part ref / Zone	Definitions / Activity Rules	Site Standards	Zone Standards	Resource Consent required? Status	Commentary
	inverter based systems for residential and non-residential activities."				this rule needs to be reviewed.
Part 5 - Gibbston Character Zone	5.7.3.2 – CON i buildings (a) additions / alteration to existing building within RBP (b) new buildings within RBP. 5.7.3.3 - DA i building outside of RBP. ii Winery Buildings.	5.7.5.1 – RDIS ii Scale and Nature of Activities – max GFA 100m^2 Equipment stored outside a building iii Minimum Setback from Internal boundaries – 6m.	5.7.5.2 – N-C i Building Height 8m / 10m ancillary to viticulture or farming. ii Setback from Roads: 20m iii Noise Specific reference to wind farm NZ standard.	Yes Solar – CON or DIS Hydro – DIS Wind - N-C Biomass - DIS	Special character area based on viticulture development. Contains some large winery buildings and within vineyards frost fighting towers with blades.
Part 6 Queenstown Airport mixed-use	6.2.3.2 – CON The addition, alteration, and construction of all buildings in respect of location and external appearance. 6.2.3.5 – list of PRO includes residential and VA.	6.2.4 – RDIS i Maximum site coverage 75% i Building setback from zone boundary 10m /from road 6m.	6.2.5.2 – N-C i maximum building height 9m.	Yes Solar - CON Hydro – N/A (no waterway) Wind – N-C Biomass - CON	Airport related activities with potential for buildings with large roof areas. Could accommodate solar installation of similar scale to Auckland Airport.
Part 7 – Residential Areas Low and High Density	7.5.3.1 – CON i VA in HDR & LDR VA subzone iii buildings for non-residential activities 7.5.3.3 – RDIS i Multiunit & ii Building footprint in HDR subzones.	7.5.5.2 – RDIS ii Scale and nature of activities – max GFA 100m^2. Equipment stored outside a building. iii Setback from Roads 4.5m iv Setback from internal boundaries 4.5m / 2m	7.5.5.3 – N-C v Building height (a) Flat sites 8m and recession line. (b) Sloping sites 7m	No/Yes Solar: PA on sites as part of complying residential activities. CA if associated with building for non-residential activities or VA. RDIS if part of larger	Zone covers established residential areas in Queenstown, Wanaka, some of Arrowtown and Lake Hayes Village. Potential for solar within existing rules.

Part ref / Zone	Definitions / Activity Rules	Site Standards	Zone Standards	Resource Consent required? Status	Commentary
		except features. ix Non-Reflective Buildings "all metal cladding, roofing or fences shall be painted or otherwise coated with a non-reflective finish.		scale residential development (multiunit) Hydro: PA Wind: N-C Biomass: PA N-C - if non-residential activity i.e. standalone generation.	
Part 7 – Residential Areas Residential Arrowtown Historic Management Zone	7.6.3.3 – DIS ii Buildings iii VA (except VA subzone = CA).	7.6.5.1 / 7.6.6.1 – RDIS i Setback from roads 6m Setback from internal boundaries 3m Nature and scale (b) 40m^2 GFA	7.6.5.2 / 7.6.6.2 – N-C ii Maximum height for buildings: 5m. iii / i Maximum building coverage: 30%	Yes – all buildings a DA. Solar: DA Hydro: N/A no waterways Wind: N-C Biomass: DA	Small zone covering inner residential area of Arrowtown with historic character. Sensitive sites for REG.
Part 8 – Rural Living Areas Rural lifestyle (RL)and Rural Residential (RR)	8.2.2.2 – CA i Buildings - addition, alteration or construction. 8.2.2.3 – DA i VA (except VA subzones = CA) v Structures – within 10m of road. 8.2.2.4 N-C vi Residential Units in the Rural Lifestyle zone not contained within RBP.	8.2.4.1 – RDIS I Building coverage 15% ii Internal boundary setbacks: RL 10m, RR 6m, RR Lake Hayes 15m, RR Bobs Cove 10m. v Nature and scale RR 40m2 GFA RL 100m2 GFA	8.2.4.2 N-C ii Maximum building height 8m. iii Noise - Specific reference to wind farm NZ standard. x Roof Colours – Ladies Mile / Lakes Hayes – browns, greens, greys and blue greys. xii Ferry Hill RR Lots 9-15 – limits on roof pitch 20-30^0 and roof finishes limited to slate shingle, cedar shingle, steel roofing (long run corrugated) specified colours.	Yes – all buildings CA. Solar: CA / Ferry Hill lots 9 -15 N-C Hydro: CA Wind: N-C Biomass: CA	The RL and RR zones generally contain larger sections 1 -2 ha / 4000m^2 respectively, located between urban and Rural G environments. The larger lot sizes could accommodate REG. The Ferry Hill area has restrictive rules and being north facing would be ideal for solar. Bobs Cove includes open space and 'undomesticated' areas which should be

Part ref / Zone	Definitions / Activity Rules	Site Standards	Zone Standards	Resource Consent required? Status	Commentary
					considered sensitive sites for REG.
Part 9 – Townships Hawea, Luggate, Albert Town, Makarora, Glenorchy, Kingston and Kinloch.	9.2.3.3 – DA i VA (except Commercial prescient or VA subzone = CA).	9.2.5.1 – RDIS ii Building coveage:35% ii Road setback 4.5m, Makarora SH 8m, Glenorchy main thoroughfare 10m. iii Internal boundary setback front sites 4.5m/3m/2m. Rear sites 2m. x nature and scale of non-residential activities 40m^2 GFA	9.2.5.2 N-C ii Maximum building height Flat sites 7m & recession line. Sloping sites 7m. vii nature and scale of non-residential activities – (a) 60m^2 GFA	No / Yes Solar: PA on sites as part of complying residential activities. CA or DA if VA. Hydro: PA Wind: N-C Biomass: PA	Township zones have larger residential sections and have capacity to accommodate REG.
Part 10 – Town Centres Queenstown	10.6.3.2 – CA i Buildings in Town Center (except Special character areas) iv VA 10.6.3.3 iii Buildings within Special character areas	10.6.5.1 RDIS i Building coverage: 70%/80%/95%.	10.6.5.2 I Max building height: 12m (refer plan for exemptions). iii Glare (d) all roofs of buildings shall be finished or treated so they do not give rise to glare when viewed from any public place or neighbouring property.	Yes – buildings CA or if in Special Character DA.	Queenstown Town Center is a built up area with a significant number of heritage buildings and special character precincts. When looking down on the built environment there exists a lot of "clutter" on the roofline e.g. air conditioning units, ventilation etc. Solar panels could be accommodated in this environment.
Part 10 – Town Centers Wanaka	10.7.3.2 i Buildings ii VA	10.7.5.1 i Building coverage:80%	10.7.5.2 i Maximum building height 8m to eave, 10m to ridge line.	Yes – CA for building.	As above.

Part ref / Zone	Definitions / Activity Rules	Site Standards	Zone Standards	Resource Consent required? Status	Commentary
			iii Glare (d) all roofs of buildings shall be finished or treated so they do not give rise to glare when viewed from any public place or neighbouring property.		
Part 10 Arrowtown Town Center	10.8.3.2 - CA ii VA 10.8.3.3 - DA ii Buildings	Setbacks: 3m.	Height:8m	Yes – DA for buildings, Wind N-C.	Forms part of historic precinct and should be considered a 'sensitive' site for REG.
Part 11 Business Areas	11.2.3.2 – CA i Buildings	11.2.5.1 ii Road setbacks 2m to 8m depending on road. iii building coverage – 75% iv internal boundary setbacks 4.5m where adjoining other zones. Vi Building height 7m	11.2.5.2 iii Glare (b) Roofs of buildings shall be finished to avoid glare when viewed from any public place.	Yes – CA for building.	Has potential to accommodate REG.
Part 11 – Industrial	11.3.3.2 – CA i Buildings	11.3.5.1 ii Road setbacks 2m to 10m depending on road. iii building coverage – 75% iv internal boundary setbacks 7m where adjoining other zones. vi Building height 6m	11.3.5.2 iii Glare (b) Roofs of buildings shall be finished to avoid glare when viewed from any public place.	Yes – CA for buildings	Has potential to accommodate REG including biomass with imported fuel material.
Part 12 Special Zones	Refer Structure Plans				
Resort Zones –	12.2.3.2 – CON	Setbacks from roads	Height: 8m hotels,	Yes – CA for buildings	Resort with VA and

Part ref / Zone	Definitions / Activity Rules	Site Standards	Zone Standards	Resource Consent required? Status	Commentary
Millbrook.	vii – buildings (external appearance).	and internal boundaries.	residential etc. 12m filming towers. 4m other. Nature and Scale – (a) outdoor storage (b) processing of material outside of a building. Atmospheric Emissions No solid fuel fires.	Solar: CA Hydro: Mill Creek - PA Wind: N-C Biomass: N-C	residential development around golf courses. Issue of atmospheric emissions in this catchment – not suitable for biomass. Has detailed covenants restricting development.
Resort Zones - Waterfall Creek	12.2.3.2 – CON ii VA vii – buildings (external appearance). v Dams and other structures N-C vii buildings within 7m of Mill Creek.	Setbacks from roads and internal boundaries.	Height: 8m hotels, residential etc. 12m filming towers. 4m other. Atmospheric Emissions No solid fuel fires.	Yes – CA for buildings. Solar: CA Hydro: CA or N-C Wind: N-C Biomass: N-C	Zone provides for 100 residential units and VA. Mill Creek runs through site and plan contains rules that would constrain hydro. As above, not suitable for Biomass.
Resort Zone - Jacks Point	12.2.3.2 – CON vii – buildings (external appearance).	Setbacks from roads and internal boundaries.	Height 4m, 7.5m, 8m, 10m.	Yes – CA for buildings. Solar: CA Hydro: N/A no natural streams. Wind: N-C Biomass: CA	Golf course, club house and some residential established. Substantial volume of residential and VA development yet to be constructed. Structure plan has large areas of open space. Has detailed covenants restricting development and a design review board.
Rural Visitor Zones	12.4.3.2 – CON i Structure Plans	Setbacks from roads and internal	Building height: VA 12m, residential 8m,	Yes – CA for buildings.	Located some distance from main urban

Part ref / Zone	Definitions / Activity Rules	Site Standards	Zone Standards	Resource Consent required? Status	Commentary
	iii Buildings vi VA	boundaries: 6m / 10m / VA 20m.	other 7m.		centers and may need to be self-sufficient and require SAP's.
Penrith Park	Refer Structure Plan 12.7.3.2 – CON i Buildings (external appearance) DA i VA	12.7.5 ii Visual amenity (d) – "skyline" rule.	Building height: 7m Setbacks 6m / 6m / 9m.	Yes – buildings a CA.	Small low-medium residential zone located edge of Lake Wanaka / Clutha outlet. Includes areas high ecological value which should be considered as 'sensitive' sites.
Bendemeer Park	Refer Structure Plan 12.9.3.2 – CON i Buildings DA – i Buildings AA(11)	Internal boundaries:6m	Building height: 5m/7m/8m/9m.	Yes – buildings a CA.	Ice-sculptured landscape located above Lake Hayes. Has been developed into approximately 40 residential lots as opposed to structure plan 75 residential units. Has detailed covenants restricting development.
Remarkables Park	Refer Structure Plan 12.11.3.2 CON i Buildings (external appearance, solar orientation and prevailing winds); ii Residential Activities, Commercial Recreational Activities, Commercial Activities, Educational Facilities,	iv Height: 12m, 15m. Setbacks – various.	ii Height: 7m / 10m / 18m / 21m. (i) Additional height restrictions for cross-wind runway.	Yes – buildings a CA.	Mixed use urban zone with substation volume of development yet to be constructed. Requires further analysis.

Part ref / Zone	Definitions / Activity Rules	Site Standards	Zone Standards	Resource Consent required? Status	Commentary
	Retirement Villages, Hospitals, Health and Day Care Facilities & Visitor Accommodation.				
Hydro Generation	Hydro generation activity is defined as: *"Means activities associated with the generation of hydro electricity and includes the operation, maintenance, refurbishment, enhancement and upgrade of hydro generation facilities".* Definitions specific to hydro generation zone: operation, maintenance, refurbishment, enhancement.	These rules only apply to land shown on the planning maps as zoned hydro generation. 12.13.3 *"Any activity Any activity not defined as a hydro generation activity for the purposes of this Plan shall be subject to Part 5, Rural General Zone provisions."*		As per Rural General for solar, wind, and biomass. Hydro: new Hydro DA.	Zone includes Contact Energy's sites at Hawea, Gladstone Gap and land originally designated for the Luggate power project on the Clutha River along with Pioneer Generation sites at Wye Creek, Oxburn and Roaring Meg.
Quail Rise	Refer structure plan 12.15.3.2 CON iv Dams and other structures vi Buildings (external appearance) N-C –vii buildings within Open space G, R2 outside of RBP and areas annotated building restriction area.	i Structure Plan ii Setbacks from roads and internal boundaries: 6m/10m/4m. iv External appearance of buildings - *The principal roof of all buildings must be designed with a minimum pitch from the horizontal of 25°.* v Buildings R2 (D) AA – within RBP.	ii Building height: 7m / 5m. viii Arrow Irrigation Race	Yes – buildings a CA. Solar: CA Wind: N-C Hydro: Arrow Irrigation N-C	Comprehensively designed Low density residential. Has potential for solar installations on residential dwellings.

Part ref / Zone	Definitions / Activity Rules	Site Standards	Zone Standards	Resource Consent required? Status	Commentary
Meadow Park	Refer structure plan 12.17.3.2 – CON i Buildings 12.17.3.4 N-C I Any activity other than provisions of Open Space in AA ...OS-HL (W).	Setbacks from roads and internal boundaries: 2m / 4.5m and exceptions 10m / 15m.	ii Height: 7m / 6m / 4.5m.	Yes – buildings a CA. Solar: CA Wind: N-C Hydro: Only water is Arrow Irrigation race within OS-HL(W) – N-C Biomass: CA	Arrowtown zone either side of Manse Road – west developed as Butel Park. Structure plan includes balance open space areas and Feehly's Hill ONF which are 'sensitive' sites.
Frankton Flats	Refer structure plan 12.18.3.3 RDIS Buildings.	Setbacks: 4m/10m/50m.	12.18.5.2 v Height: 9m / 12m.	Yes – building a RDIS Solar: RDIS Wind: N-C Hydro: N/A (no streams) Biomass: RDIS.	New shopping center. Potential for large buildings that could utilise integrated solar technologies or rooftop solar panels.
Mount Cardrona Station	Refer structure plan 12.22.3.2 – CON ii VA iv & vi Buildings in specified AA.	Setbacks from roads, secondary rear access lanes and internal boundaries: varies depending on AA.	12.22.5.2 Height: 4m / 5.5m/7m/10m/15m. 12.22.5.2 xi Protection of stream bed and riparian margins in Homestead gully. Xii Protection of water races.	Yes – N-C until walkway established.	Cardrona Valley greenfield zoning with Structure Plan. Subdivision rules include "orientation of lots to maximise solar gain". Building N-C until walkway established. Development will be subject to a design board review process.
Ballantyne Road Mixed Use Zone	Refer Structure Plan 12.24.3.2 CON ii Buildings	Height: 8m - 10m Setbacks: various	Height: 10m - 12m	Yes Solar: CON Wind: N-C Hydro: N/A (no waterways)	Wanaka yard based industrial.
Three Parks	Refer Structure Plan Various.	Road & internal boundary setbacks:	LDR Height: 8m. MDR 11m. Recession planes	No - in association with low & medium density	Wanaka greenfield mixed use zone

Part ref / Zone	Definitions / Activity Rules	Site Standards	Zone Standards	Resource Consent required? Status	Commentary
		various 1.5m 3m, 4.5m, 5.5m, 10m.	25^0 (S), 40^0 (E/W), 55^0 (N).	residential. Yes - if building in other AA's. Hydro: N/A (no waterways).	including low and medium density residential. Includes QLDC site for Wanaka Sports Facility (subject to a NOR)
Kingston Village	Refer Structure Plan 12.28.3.2 CON i VA within precinct ii Buildings AA2 iii Education AA3 12.28.3.3 DA Buildings 4a	Road & internal boundary Setbacks: various - 4.5m, 3m, 2m Height 3 and 4a: 8m.	Height: 7m, 8m, 10m in 3 and 4a. Recession planes $35^0/45^{0-}$.	No in association with residential activities in AA 1A, 1B, 1C. Yes if building in AA2, 3, 4a, VA prescient.	Kingston greenfield development south of existing village and includes low, medium & higher density residential.
District Wide					
Part 13 Heritage	Refer Appendix 3 – Inventory of Protected Features. Alteration *"includes any work which involves the addition, alteration or removal and replacement of any part of any heritage feature, building structure, memorial or precinct, either internally or externally.*	13.2.3.1 CON Alteration Category 3 Heritage Items. 12.2.3.2 DA Alteration Category 1 & 2 Heritage Items.		Yes	District wide rules aimed at protection of heritage. These should be considered 'sensitive' sites for REG.
Part 14 Transport					District wide rules
Part 15 Subdivision					District wide rules
Part 16 Hazardous substances					District wide rules
Part 17 Utilities	Definition of "Utility" specifically excludes "structures or facilities				This chapter is not applicable to REG. It is logical location for

Part ref / Zone	Definitions / Activity Rules	Site Standards	Zone Standards	Resource Consent required? Status	Commentary
	used for electricity generation".				District Wide REG provisions.
Part 18 Signs					District wide rules
Part 19 Relocated buildings, Temporary Buildings and Temporary Activities					District wide rules
Part 20 – Open Space Zone, Landscape Protection.	20.2.2.5 N-C Buildings and Structures (not listed) 20.2.2.6 PRO Residential, VA, telecommunication and farm buildings.	No site standards	No zone standards	Yes	This zone seeks keep the area in a natural state, free of buildings and structures. This zone is a 'sensitive' site.
General Comments					
Noise			Noise rule specified as a zone standard in all zones. Includes Specific reference to wind farm NZ standard.		Relevant to REG activities.
Earthworks		Earthworks rule specified as a site standard in all zones.			Relevant to REG activities.

Attachment B - Proposed new District Plan Provisions

Note: This attachment illustrates how the proposed standards could look in District Plan format. The proposed rules need to be tested by full Section 32 analysis to determine whether they are the most efficient and effective method.

17B RENEWABLE ENERGY

17B.1 Issues, Objectives and Policies

[Outside the scope of works for this study]

17B.2 Renewable Energy Rules

17B.2.1 Purpose

This section addresses renewable electricity generation and solar water heating activities. In 2011 the Government issued a National Policy Statement for Renewable Electricity Generation. The National Policy Statement defines renewable electricity generation as meaning the generation of electricity from solar, wind, hydro-electricity, geothermal, biomass, tidal, wave, or ocean current energy sources. In the Queenstown Lakes District tidal, wave, or ocean current energy sources are not available.

... [Outside the scope of works for this study]

Small and community scale renewable electricity generation means renewable electricity generation for the purpose of using electricity on a particular site, or supplying an immediate community, or connecting into the distribution network. For the purpose of Section 17B small and community scale generation is limited to systems with a capacity of up to 1 MW.

The purpose of the following provisions is to enable, where appropriate, small and community scale renewable electricity generation in recognition of the benefits to be derived from the use and development of renewable energy.

17B.2.2 General Provisions

i The rules contained in this Section take precedence over any other rules that may apply to small and community-scale distributed electricity generation and solar water heating in the District Plan except:

(a) Where the following District Wide rules are not met then resource consent will be required in respect of that matter.

(i) Heritage – Refer Part 13

(ii) Transport – Refer Part 14

(iii) Subdivision, Development and Financial Contributions – Refer Part 15

(iv) Hazardous Substances - Refer Part 16

(v) Signs – Refer Part 18

(vi) Relocated & Temporary Buildings and Temporary Activities – Refer Part 19

(b) Sites zoned Hydro Generation and covered by Part 12.12 Hydro Generation Special Zone.

ii The existence of small and community scale renewable electricity generation and solar water heating shall not be considered a permitted baseline for development, other than renewable energy subject to the Rules in Part 17B.

17B.2.3 Activities

17B.2.3.1 Permitted Activities

Solar, hydro, wind and biomass small and community-scale distributed electricity generation and solar water heating is a **permitted activity** where the following site standards are met.

17B.2.3.2 Restricted Discretionary Activities

Solar, hydro, wind and biomass small and community-scale distributed electricity generation and solar water heating which does not comply with one or more of the following site standards shall be a **restricted discretionary activity.**

The matters in respect of which Council has reserved discretion for Solar are:

- Visual effects
- Nature and scale of the installation
- Design and relationship to building and activities on site
- Impact on outlook and shading of adjoining sites
- Design and installation standards

[*Insert matters in respect of which Council has reserved discretion for hydro, wind, and biomass*]

17B.2.3.3 Discretionary Activities

Solar, hydro, wind and biomass small and community-scale distributed electricity generation and solar water heating in any of the following areas:

(i) Residential Arrowtown Historic Management Zone

(ii) Town Center Special Character Areas

(iii) Open Space Zones (part 20)

(iv) Any open space and landscape buffer areas identified on Special zone structure plans

(v) Sites of significant indigenous vegetation

(vi) Outstanding Natural Features.

[Insert matters in respect of which Council has reserved discretion]

17B.2.4 Standards

17B.2.4.1 Site Standards - Small and Community-scale distributed electricity generation and solar water heating

i Solar Electricity Generation

(a) The maximum area of Solar Photovoltaic arrays on a site shall be:

(i) Free standing – 150m^2

(ii) Roof top flush mounted panels – 150m^2 or 80% of the roof area, whichever is the greater.

(iii) Roof top panels attached to frame – 150m^2

(iv) Building integrated Photovoltaic (Photovoltaic materials used in place of conventional building cladding materials such as roofing, or building facades) - 100% of the roof area or 150m^2 on building facades.

(b) Roof top flush mounted panels shall be contained within the building roof plan envelope and shall not overhang the edge of the building.

(c) Roof top panels attached to frames shall be:

(i) no more than 1.5m above the roof

(ii) setback from the edge of the building a minimum of 1.5m.

Refer interpretative diagram

ii Solar Water Heating

(a) The maximum area of solar water heating collector panels on a site shall be:

(i) $20m^2$

Where solar water heating is installed on the same site as solar electricity generation the maximum area specified in rule i above shall not cumulatively be exceeded.

(b) Roof top collector panels shall be contained within the building roof plan envelope and shall not overhang the edge of the building.

(c) Roof top collector panels attached to frames shall be:

(i) no more than 1.5m above the roof;

(ii) setback from the edge of the building a minimum of 1.5m.

Refer interpretative diagram

iii Colour

(a) Solar arrays, modules cells and collector panels shall be recessive colours: black, dark blue, grey or brown. The colour shall be selected to be the closest colour of the building to which they are attached or adjoin.

(b) Structures, frames and mounting or fixing hardware shall be finished in recessive colours the same or similar to the building to which they are attached or adjoin.

iv Setbacks

Any buildings or structures shall comply with road and internal boundary building setbacks in the zone in which they are located.

v Earthworks

Any earthworks shall comply with the earthworks rules specified in the zone in which the activity is located.

vi Noise

Noise shall comply with the noise rules specified in the zone in which the activity is located.

vii Height

(a) Buildings and structures in excess of the maximum building height specified in the zone in which they are located except:

(i) Roof top solar panels and frames may exceed the maximum building height by up to 0.5m;

(i) In the Rural General and Gibbston Character Zones the maximum building height shall be that specified for non-residential building ancillary to viticultural or farming activities (10m).

(b) Buildings and structures shall not protrude though a recession line specified in the zone in which they are located (if applicable).

The maximum height for a wind turbine shall be measured to the tip of blade when in vertical position.

Refer interpretive diagram

viii Buildings (excluding solar panels)

(a) Buildings in excess of $10m^2$ in area, except buildings that would be a permitted activity in the zone in which it is located.

(b) Any building in the Rural General Zone.

(c) Any building that would be a non-complying activity in the structure plan area or zone in which it is located.

ix Wind Turbines

(a) Wind turbines shall be pole construction and there shall be no lattice towers. Wind turbines may be attached to buildings

provided they do not exceed the maximum building height specified in the zone in which they are located.

x Biomass

(a) Biomass fuel material shall be sourced on the same site as the generation plant, except:

(i) sites where industrial activities are permitted in the zone.

(b) Any outdoor storage shall be screening from adjoining sites and public places.

17B.3 Resource Consents – Assessment Matters – Renewable Energy

[Outside the scope of works for this study]

Definitions

BIOMASS	Means energy derived from biomass (recently living organisms such as wood, wood waste, by-products of agricultural processes and waste) and for the purpose of Section 17B shall be limited to biomass systems used to generate electricity.
PHOTOVOLTAICS (PV)	A device that converts the energy in light (photons) into electricity, through the photovoltaic effect. A PV cell is the basic building block of a PV system, and cells are connected together to create a single PV module (sometimes called a 'panel'). PV modules can be connected together to form a larger PV array.
RENEWABLE ELECTRICITY GENERATION	Means generation of electricity from solar, wind, hydro-electricity, geothermal, biomass, tidal, wave, or ocean current energy sources. In the Queenstown Lakes District tidal, wave, or ocean current energy sources are not available.
RENEWABLE ELECTRICITY GENERATION ACTIVITIES	Means the construction, operation and maintenance of structures associated with renewable electricity generation. This includes small and community-scale distributed renewable generation activities and the system of electricity conveyance required to convey electricity to the distribution network and/or the national grid and electricity storage technologies associated with renewable electricity.
RENEWABLE ENERGY	Means energy that comes from a resource that is naturally replenished, such as wind, hydro or solar energy. In the context of Part 17b it includes both renewable electricity generation and solar water heating activities.
SMALL AND COMMUNITY-SCALE DISTRIBUTED ELECTRICITY GENERATION	Means renewable electricity generation for the purpose of using electricity on a particular site, or supplying an immediate community, or connecting into the distribution network
SOLAR ELECTRICITY GENERATION	Means the conversion of the sun's energy directly into electrical energy. The most common device used to generate electricity from the sun is Photovoltaics (PV).
SOLAR WATER HEATING	Solar water heating means devices that heat water by capturing the sun's energy as heat and transferring it directly to the water or indirectly using an intermediate heat transfer fluid. Solar water heaters may include a solar thermal collector, a water storage tank or cylinder, pipes, and a transfer system to move the heat from the collector to the tank.

5.3.3.4 Non-Complying Activities

iv Power Generation Facilities

Power generation facilities outside the areas scheduled under Rule 20.2, other than ~~small hydro (1.5 to 2 k) inverter based systems for residential and non-residential activities.~~ small and community-scale distributed electricity generation under Part 17b.

Attachment C - Proposed new District Plan Provisions

Note: This attachment illustrates how the proposed standards could look in E-Plan District Plan format. This should be read in conjunction with memo dated 12 August 2012.

17B RENEWABLE ENERGY

17B.1 Issues, Objectives and Policies

[Outside the scope of works for this study]

17B.2 Renewable Energy Rules

17B.2.1 Purpose

This section addresses renewable electricity generation and solar water heating activities. In 2011 the Government issued a National Policy Statement for Renewable Electricity Generation. The National Policy Statement defines renewable electricity generation as meaning the generation of electricity from solar, wind, hydro-electricity, geothermal, biomass, tidal, wave, or ocean current energy sources. In the Queenstown Lakes District tidal, wave, or ocean current energy sources are not available.

... [Outside the scope of works for this study]

Small and community scale renewable electricity generation means renewable electricity generation for the purpose of using electricity on a particular site, or supplying an immediate community, or connecting into the distribution network. For the purpose of Section 17B small and community scale generation is limited to systems with a capacity of up to 1 MW.

The purpose of the following provisions is to enable, where appropriate, small and community scale renewable electricity generation in recognition of the benefits to be derived from the use and development of renewable energy.

17B.2.2 General Provisions

i The rules contained in this Section take precedence over any other rules that may apply to Small and Community-scale Distributed Electricity Generation and Solar Water Heating in the District Plan except:

(a) Where the following District Wide rules are not met then resource consent will be required in respect of that matter.

(i) Heritage – Refer Part 13

(ii) Transport – Refer Part 14

(iii) Subdivision, Development and Financial Contributions – Refer Part 15

(iv) Hazardous Substances - Refer Part 16

(v) Signs – Refer Part 18

(vi) Relocated & Temporary Buildings and Temporary Activities – Refer Part 19

(b) Sites zoned Hydro Generation and covered by Part 12.12 Hydro Generation Special Zone.

ii The existence of small and community scale renewable electricity generation and solar water heating shall not be considered a permitted baseline for development, other than renewable energy subject to the Rules in Part 17B.

17B.2.3 Activities

17B.2.3.1 Permitted Activities

Solar, hydro, wind and biomass small and community-scale distributed electricity generation and solar water heating is a **permitted activity** where the Site Standards 17B.2.4.1 are met.

17B.2.3.2 Restricted Discretionary Activities

Solar, hydro, wind and biomass small and community-scale distributed electricity generation and solar water heating which does not comply with one or more of the following site standards shall be a **restricted discretionary activity.**

The matters in respect of which Council has reserved discretion for Solar are:

- Visual effects
- Nature and scale of the installation
- Design and relationship to building and activities on site
- Impact on outlook and shading of adjoining sites
- Design and installation standards

[*Insert matters in respect of which Council has reserved discretion for hydro, wind, and biomass*]

17B.2.3.3 Discretionary Activities

Solar, hydro, wind and biomass small and community-scale distributed electricity generation and solar water heating in any of the following areas:

(a) Residential Arrowtown Historic Management Zone

(b) Town Center Special Character Areas

(c) Open Space Zones (Part 20)

(d) Any open space and landscape buffer areas identified on any of the Special zone structure plans (Part 12)

(e) Sites of significant indigenous vegetation

(f) Outstanding Natural Features and Outstanding Natural Landscapes (Wakatipu Basin)

[Insert matters in respect of which Council has reserved discretion]

17B.2.4 Standards

17B.2.4.1 Site Standards - Small and Community-scale distributed electricity generation and solar water heating

i Solar PV – Free Standing Arrays

(a) The maximum area of Free Standing Solar Photovoltaic arrays on a site shall be 150m^2.

(b) Any associated building (housing electrical equipment) shall:

(i) not exceed 10m^2 in area, except in the Rural General Zone;

(ii) In the Rural General Zone not exceed 5m^2 in area, except where it is contained within a residential building platform approved by resource consent it shall not exceed 10m^2 in area;

(c) Free Standing Solar Photovoltaic arrays and associated building shall not exceed 2.5m in height.

(d) Free Standing Solar Photovoltaic arrays and associated building shall comply with Road and Internal Boundary Building Setbacks in the zone in which they are located.

(e) Any earthworks shall comply with the earthworks rules specified in the zone in which in which they are located.

(f) PV cells, modules and panels shall be recessive colours: black, dark blue, grey or brown. Frames, mounting, fixing hardware and any associated Building shall be finished in recessive colours.

Refer interpretative diagram

ii Solar PV – Roof Top Arrays

(a) The maximum area of Solar Photovoltaic Roof Top Arrays on a site shall be:

(i) Roof top flush mounted panels – 150m^2 or 80% of the roof area, whichever is the greater.

(ii) Roof top panels attached to frame – 150m^2.

(b) Roof top flush mounted panels shall be contained within the building roof plan envelope and shall not overhang the edge of the building.

(c) Roof top panels attached to frames shall be:

(i) no more than 1.5m above the roof

(ii) setback from the edge of the building a minimum of 1.5m.

(d) Roof Top Arrays may exceed the maximum building height specified in the zone in which they are located by no more than 0.5m;

(e) Photovoltaic cells, modules and panels shall be recessive colours: black, dark blue, grey or brown. Frames, mounting and fixing hardware shall also be finished in recessive colours. Recessive colours shall be selected to be the closest colour to the building to which they are attached.

(f) Any new or additional Building, other than Solar Photovoltaic Arrays (cells, modules, panels, frames, mounting and fixing hardware), and associated physical works shall comply with the rules in the zone in which it is located or be approved by resource consent.

Refer interpretative diagram

iii Solar PV – Building Integrated Arrays

(a) The maximum area of Solar Photovoltaic Building Integrated (Photovoltaic materials used in place of conventional building cladding materials such as roofing, or building facades) on a site shall be up to 100% of the roof area or 150m^2 on building elevations.

(b) PV cells, modules and panels shall be recessive colours: black, dark blue, grey or brown. Recessive colours shall be selected to be the closest colour to the building to which they form part of.

(c) Any new or additional Building, other than Solar Photovoltaic Arrays (cells, modules, panels, frames, mounting and fixing hardware), and associated physical works shall comply with the rules in the zone in which it is located or be approved by resource consent.

Refer interpretative diagram

iv Solar - Water Heating

(a) The maximum area of solar water heating collector panels on a site shall be: 20m^2.

(b) Collector panels shall be contained within a building roof plan envelope and shall not overhang the edge of the building.

(c) Roof top collector panels attached to frames shall be:

(i) no more than 1.5m above the roof;

(ii) setback from the edge of the building a minimum of 1.5m.

(d) Roof top collector panels and frames may exceed the maximum building height specified in the zone in which they are located by up to 0.5m;

(e) Collector panels shall be recessive colours: black, dark blue, grey or brown. Frames, mounting and fixing hardware shall also be finished in recessive colours. Recessive colours shall be

selected to be the closest colour to the building to which they are attached.

(f) Any new or additional building, other than Solar Water Heating (collector panels, frames, mounting and fixing hardware), and associated physical works shall comply with the rules in the zone in which it is located or be approved by resource consent.

Refer interpretative diagram

v Mini and Micro Hydro

(a) Any earthworks shall comply with the earthworks rules specified in the zone in which the activity is located.

(b) Mini and Micro Hydro Structures and associated Building shall comply with Road and Internal Boundary Building Setbacks in the zone in which they are located.

(c) Any associated Building (housing electrical equipment) shall:

(i) not exceed $10m^2$ in area, except in the Rural General Zone;

(ii) In the Rural General Zone not exceed $5m^2$ in area, except where it is contained within a residential building platform approved by resource consent it shall not exceed $10m^2$ in area;

(d) Mini and Micro Hydro Structures and associated Building shall not exceed 2.5m in height.

(e) Structures and associated Buildings shall be finished in recessive colours.

(f) Noise shall comply with the noise rules specified in the zone in which the activity is located.

Note: Reference should also be made to the Otago Regional Council Water Plan Rules.

vi Wind Turbines

(a) Wind Turbines shall comply with the maximum building height (including recession planes if applicable) specified in the zone in which they are located, except:

(i) In the Rural General and Gibbston Character Zones the maximum building height shall be that specified for non-residential building ancillary to viticulture or farming activities (10m).

The maximum height for a wind turbine shall be measured to the tip of blade when in vertical position.

Refer interpretive diagram for free standing and roof top wind turbines.

(b) There shall be no more than two wind turbines on a site.

(c) Wind turbines shall be pole construction and there shall be no lattice towers.

(d) Any associated Building (housing electrical equipment) shall:

(i) not exceed $10m^2$ in area, except in the Rural General Zone;

(ii) In the Rural General Zone not exceed $5m^2$ in area, except where it is contained within a residential building platform approved by resource consent it shall not exceed $10m^2$ in area;

(iii) not exceed 2.5m in height.

(e) Wind Turbines and associated Building shall comply with Road and Internal Boundary Building Setbacks in the zone in which they are located.

(f) Structures and associated Building shall be finished in recessive colours.

(g) Any earthworks shall comply with the earthworks rules specified in the zone in which the activity is located.

(h) Noise shall comply with the noise rules specified in the zone in which the activity is located.

vii Biomass

(a) Biomass fuel material shall be sourced on the same site as the generation plant, except:

(i) Industrial Zones (and Industrial Activities Areas within Structure Plans).

(b) Any outdoor storage shall be screened from adjoining sites and public places.

(c) Any earthworks shall comply with the earthworks rules specified in the zone in which the activity is located.

(d) Noise shall comply with the noise rules specified in the zone in which the activity is located.

(e) Any new or additional Building, other than a chimney, and associated physical works shall comply with the rules in the zone in which it is located or be approved by resource consent.

Note: Reference should also be made to the Otago Regional Council Air Plan Rules.

17B.3 Resource Consents – Assessment Matters – Renewable Energy

[Outside the scope of works for this study]

Definitions

BIOMASS	Means energy derived from biomass (recently living organisms such as wood, wood waste, by-products of agricultural processes and waste) and for the purpose of Section 17B shall be limited to biomass systems used to generate electricity.
PHOTOVOLTAICS (PV)	A device that converts the energy in light (photons) into electricity, through the photovoltaic effect. A PV cell is the basic building block of a PV system, and cells are connected together to create a single PV module (sometimes called a 'panel'). PV modules can be connected together to form a larger PV array.
RENEWABLE ELECTRICITY GENERATION	Means generation of electricity from solar, wind, hydro-electricity, geothermal, biomass, tidal, wave, or ocean current energy sources. In the Queenstown Lakes District tidal, wave, or ocean current energy sources are not available.
RENEWABLE ELECTRICITY GENERATION ACTIVITIES	Means the construction, operation and maintenance of structures associated with renewable electricity generation. This includes small and community-scale distributed renewable generation activities and the system of electricity conveyance required to convey electricity to the distribution network and/or the national grid and electricity storage technologies associated with renewable electricity.
RENEWABLE ENERGY	Means energy that comes from a resource that is naturally replenished, such as wind, hydro or solar energy. For the purposes of Part 17b it includes both Renewable Electricity Generation and Solar Water Heating activities.
SMALL AND COMMUNITY-SCALE DISTRIBUTED ELECTRICITY GENERATION	Means renewable electricity generation for the purpose of using electricity on a particular site, or supplying an immediate community, or connecting into the distribution network. For the purposes of Part 17b the rated capacity on any site shall be less than 1 MW.
SOLAR ELECTRICITY GENERATION	Means the conversion of the sun's energy directly into electrical energy. The most common device used to generate electricity from the sun is Photovoltaics (PV).
SOLAR WATER HEATING	Solar water heating means devices that heat water by capturing the sun's energy as heat and transferring it directly to the water or indirectly using an intermediate heat transfer fluid. Solar water heaters may include a solar thermal collector, a water storage tank or cylinder, pipes, and a transfer system to move the heat from the collector to the tank.
i SOLAR PV – FREE STANDING ARRAYS	(add definition)
ii SOLAR PV – ROOF TOP ARRAYS	(add definition)
iii SOLAR PV – BUILDING INTEGRATED ARRAYS	(add definition)
iv SOLAR – WATER HEATING	(add definition)
v MINI AND MICRO HYDRO	(add definition)
vi WIND TURBINE	(add definition)
vii BIOMASS	(add definition)

5.3.3.4 Non-Complying Activities

iv Power Generation Facilities

Power generation facilities outside the areas scheduled under Rule 20.2, other than ~~small hydro (1.5 to 2 k) inverter based systems for residential and non-residential activities.~~ small and community-scale distributed electricity generation under Part 17b.

FERGUSON PLANNING

MEMO

To: Scott Figenshow

From: Shirley Ferguson

Date: 12 August 2012

Re: **DRAFT REG RULES FOR E-PLAN**

Please find attached the "Proposed new provisions for small and community scale Renewable Electricity Generation" re-drafted into a format aligned with the Policy Teams proposed E-Plan. I have called this "Attachment C".

Further to our meeting, I note the Arrowtown Example is now on-line and I have been able to access this.

The purpose of the re-drafting is to enable ease of access to a complete set of rules for any given activity – a "one stop shop". I understand this will include better linkages to definitions with defined terms highlighted through use of capital letters (or similar).

In "Attachment C" we have:

- Retained the General Provision (unmodified) stating that the REG provisions take precedence.
- Retained the Permitted, Restricted Discretionary and Discretionary Activity Rules.
- Modified the Site Standards so all applicable rules are specified under each type of installation, as follows:

    i. Solar PV - Free Standing Arrays

    ii. Solar PV - Roof Top Arrays

    iii. Solar PV – Building Integrated Arrays

    iv. Solar – Water Heating

    v. Mini and Micro Hydro

    vi. Wind Turbines

    vii. Biomass

This worked well for the maximum area provisions eg Solar PV – Free Standing Arrays – maximum area on a site shall be 150$m^{2.}$

It results in the performance based standards eg colour being repeated multiple times and overall a much longer chapter.

The original proposed generic rule for buildings has required further development. Linking to a status of activity in underlying zone does not work well in the context of E-Plan format. We have deleted the generic building rule and revised the provisions based on the following:

- The rules need to target any "associated" building and not the specific generation equipment eg Solar PV Arrays (cells, modules, panels, frames, mounting and fixing hardware) being the components we are seeking to enable under the provisions (subject to a maximum area).

- It is anticipated that for Solar PV - Roof Top Arrays, Solar PV - Building Integrated, Solar – Water Heating and Biomass equipment would be attached to or form part of either an existing building or a building approved by resource consent. Electrical equipment is likely to be contained within the building rather than a small associated building. If additional building is required for the REG it is proposed that this be assessed against the rules in the zone in which it is located.

- Associated building (housing electrical equipment) is anticipated for Solar PV Free Standing Arrays, Mini and Micro Hydro and Wind Turbines. An area of up to 10m2, along with a little extra flexibility in height, up to 2.5m, should meet the requirements of most small installations.

- The Rural General Zone is the exception and we have sought to keep the provisions consistent with the Utilities rules. An additional clause is proposed for the Rural General zone limiting associated building to $5m^2$ except where it is contained within a residential building platform where it shall not exceed $10m^2$.

- The list of "sensitive sites" under the Discretionary Activity provision 17B.2.3.3 should catch sites where buildings are a non-complying activity and the cross-referencing is surplus.

We have also added a limit of two wind turbines on a site in order to reflect the "small / micro" scale being provided for.

The E-Plan layout will require a definition of each type of installation listed (i to vii) to ensure that it is clear what falls within each category. Re-drafting and additional definitions may be required. The detailed terms for i to vii may be able to be incorporated at the front of Chapter 17B rather than in the definitions (similar to Heritage alteration or Hydro Generation Chapters) depending on where the E-Plan information is sourced from? It would be helpful to discuss this before continuing with further drafting.

In the process of working through the rules more thoroughly I have noted a number of changes that would improve the Attachment B provisions. If you wish to proceed further with the original layout I can update these.