Otago Wood Energy Project Scoping Study

Report prepared

for

The Bioenergy Association

The Energy Efficiency and Conservation Authority

Otago Mayoral Forum

by:

ahika

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Revision	PROJECT	Date	Author	Reviewed
1	Wood Energy Scoping Study FINAL DRAFT	29 Nov. 17	LM	BANZ
2	Final draft issued to DCC for feedback	13 Dec 2017	LM	All Councils
3	FINAL Report Issued	12 Feb 2018	LM	

Executive Summary

The purpose of this study is to develop a collaborative regional project (Wood Energy Otago Project) that will assist in reducing greenhouse gas reductions and leverage significant Central Government funding into the Otago Region. The following items summarise the findings of this assessment:

- There is absolute support from all Otago Councils for a collective approach that builds on the previous work and resources from Wood Energy South in Southland.
    - Due to the vastness of the Otago Region and the locations of plant, the best option is to provide technical hubs in Queenstown and Dunedin. The Queenstown hub will service Central Otago and the Dunedin hub will service Coastal Otago.
    - A total 2.1 FTEs are required for the Wood Energy Otago Project. This includes two technical staff roles (1.3 FTE), administration (0.5 FTE) and management (0.3 FTE).
    - Venture Southland has agreed verbally to make the Wood Energy South website available for this project.

- There are approximately 125,085 Ha of planted production forestry in Otago. There are more than sufficient volumes in the Region to meet demand over the next 45 years. Opportunities include:
    - The Clutha District could serve as a fuel hub for the region due to the large volume of forestry in their district.
    - There are well established wood suppliers in Otago. However, there is an option for a co-operative fuel hub where anyone with waste wood could contribute and be paid for their waste.

- There are approximately 367 boilers operating in the Otago Region. They range in size from small commercial scale (<100kW) to large industrial (>10MW) boilers. Several opportunities have been identified in this study:
    - The Ministry of Education in Otago has estimated that at least 50 boilers are due for replacement in schools over the next 5 years. Further, the Ministries replacement policies favour renewable fuel options.
    - A list of 26 high priority sites have been identified for first engagement and represent more than 70 MW, 1,000,000 GJ of energy and 84,000 t CO_2-eq per annum.

- The project expects to deliver the following outcomes for the Region:
    - Promote economic development in the Region by leveraging funding from Central Government for boiler upgrades that will displace 325,000 GJ of energy, equivalent to 640,000 tCO_2-eq (removing 237,000 cars from the road).
    - Councils will take the lead and undertake assessments of their own boiler assets.
    - Promote Otago as the key region in NZ for biomass wood energy by continuing to grow and promote the sector, developing local case studies, providing funding and technical support and holding an annual wood energy event.
    - Improve air quality in the Region.

- A project budget has been estimated at $3.3M and includes:

PROJECT BUDGET	Annual cost	3-year Budget
Staffing	$183,000	$549,000
Project costs	$50,000	$150,000
Contract management	$17,000	$51,000
Funding for feasibility studies	$100,000	$300,000
Funding for capital projects (Crown sector)	$200,000	$600,000
Funding for capital projects (Private sector)	$400,000	$1,200,000
Advisory services for specific work/tasks	$100,000	$300,00
Contingency	$50,000	$150,000
TOTAL PROJECT FUNDING	**$1,100,000**	**$3,300,000**

The Mayoral Forum need to discuss how best to meet this cost. There are a couple of options:

- **Option 1 (preferred)-** The Councils agree to meet staffing costs ($550,000) and seek support from Central Government for the balance. Staffing costs could be divided according to rating units and the following amounts would be required:

Council	Proportion	Annual	3 year
CDC	7%	$12,810	$38,430
CODC	10%	$18,300	$54,900
DCC	35%	$64,050	$192,150
ORC	25%	$45,750	$137,250
QLDC	15%	$27,450	$82,350
WDC	8%	$14,640	$43,920
		$183,000	**$549,000**

- **Option 2**- The Councils approach Government (via the Minister for Climate Change Issues) with the initiative and ask for their full support and contribution. The timing for this project is good as the new government has objectives to reduce greenhouse gas emissions and this project could demonstrate early progress being made by government.

- To make the most of this opportunity, the Mayoral Forum could write to the Minister for Climate Change Issues James Shaw outlining the project, confirming commitment from the Councils and request their feedback and financial support for the project. The Bioenergy Association to provide support in drafting the letter to the Hon James Shaw.

- While developing this project, informal arrangements have been made with organisations such as the Otago Chamber of Commerce, Venture Southland and the Bioenergy Association. These should be formalised and letters of support sought to include with the letter to the Minister.

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1. Introduction

Wood Energy South was a joint venture between the Energy Efficiency and Conservation Authority (EECA) and Venture Southland. The programme promoted wood energy in Southland for three years (2014-2016) and resulted in numerous benefits for the Southland Region including:

- Conversion of 12 boilers to wood fuel (despite being in close proximity to available and relatively cheap lignite coal); greenhouse gas reductions of 80,400 tCO_2-e over the lifetime of the boiler (equivalent to 29,800 cars off the road)
- regional engagement with heat plant users
- expansion of the wood fuel supply market including the establishment of a new wood fuel manufacturing plant
- a locally focused wood energy website; and
- development of a specifier practice paper and Southland specific information, resources and case studies.
- The project was a success, and this was acknowledged when it was announced as the winner of the Deloitte Large Energy Users Award in 2017.

The next step in the success of Wood Energy South (WES) is to extend the programme into Otago. This led to a process of engaging with, initially, Dunedin City Council (DCC) and then with all district councils in Otago to gauge their interest. Support for the programme was positive and a meeting, in Southland, with the DCC, Bioenergy Association and EECA secured funding to undertake this assessment and development of a business case for consideration.

The purpose of this document is to evaluate the potential for wood energy in Otago and show how WES could be extended into the Otago Region. Ahika had discussions with representatives for all the Councils to get a better understanding of their motives and drivers for such a project, their knowledge of the sector and their willingness to taking a leading role to combat climate change through bioenergy opportunities. Support for the project is overwhelmingly positive from Councils.

Ahika also interviewed heat plant users in Otago to get their perspective of the sector and gauge their interest and concerns. In addition, regional energy statistics were updated and utilised to extract district and regional energy information. This approach identified where opportunities for the use of wood energy.

2. Who are the project partners?

Ahika made direct contact with representatives from the Councils to discuss the project, opportunities and to gauge interest, funding options, understand internal drivers and to get feedback on how this project might operate and any potential issues or conflicts. The main points of contact were:

- Clutha District Council – Ken Murray, Facilities Asset Officer
- Queenstown Lakes District Council – Peter Harris, Economic Development Manager
- Waitaki District Council – Neil Jorgensen, Assets Group Manager
- Central Otago District Council - Peter Greenwood, Capital Works Programme Manager
- Otago Regional Council – Fraser McRae, Executive Officer
- Dunedin City Council - Jeremy Baker, Energy Coordinator
- Bioenergy Association- Brian Cox, Executive Officer
- Otago Chamber of Commerce- Dougal McGowan, Chief Executive

Where possible face to face meetings were held and there was a lot of useful discussion and feedback provided. This has been summarised below:

Clutha District Council

The Clutha District covers 6,400km² and has a population of 16,890[1]. The main industries in Clutha are agriculture, forestry and fishing, manufacturing, retail trade and education. The district has a number of sawmills and more than 83,135 Ha of planted production forestry[2] available as a source of wood fuel. Clutha District has the largest area of commercial forestry in the Region and is a key district for wood fuel supply across the Region.

In addition to supply, Clutha District Council (CDC) has a number of existing wood boilers in their district, mostly sawmills who have their own source of wood fuel from processing, but also heat plant owners who need to purchase wood fuel. There is also interest from a large energy user in the Clutha District to switch to wood fuels and this site will be a flagship example for the Wood Energy Otago Project and a cornerstone for developing the wood fuel supply market in the district.

CDC in its economic development planning has considered opportunities for wood boilers and the potential for extracting wood residues from forestry harvesting in the past. However, at that time, the wood energy sector was only beginning to emerge, and this may have contributed towards not pursuing the opportunity. This suggests that the potential for wood energy is still relatively unrecognised at a Council level. Nevertheless, the CDC has strong strategic plans for the district's economic development and the Wood Energy Otago Project will help to meet objectives within:

- The Living and Working in Clutha District Strategy
- Long Term Plan (LTP) to drive economic activity in the district
- Development of the Rosebank Industrial Site to encourage growth and investment

Some potential barriers were identified by CDC:

- Financially, CDC maintains a desire to retain reserves and generally not borrow externally which could make funding a challenge. However, Council's economic development strategy and draft LTP decisions show CDC is willing to invest in the right economic development opportunities.
- CDC have little understanding of the sector and the potential opportunity in their district.

Key points and recommendations

- **The district has the largest forest supply in the Region and potentially the largest source of wood fuel so there are opportunities for Council to leverage this economically as it is the ideal geographic location for fuel suppliers**
- **Financial support for the project may be difficult to achieve as CDC's focus is toward minimal costs to ratepayers. However, where clear value and benefit can be demonstrated Council has proven it is prepared to provide financial support**
- **Council strategies and plans align well with the project**
- **Several existing and new projects involving the need for heat in the district could be economic opportunities for the Council**
- **CDC staff may not fully understand the potential of wood energy in their district. Professional development with staff including a "Forest to furnace" supply chain tour is recommended**

[1] 2013 Census data from Statistics NZ.

[2] https://www.southernwoodcouncil.co.nz/#

Central Otago District Council

The Central Otago district covers an area of 9,960 km² and has a population of 17,895. The main industries are horticulture, fruit growing and viticulture, tourism, agriculture, food product manufacturing and wood product manufacturing[3]. The Central Otago district has 7,050 Ha of planted production forestry which includes large Douglas-fir estates in Naseby.

Pioneer Energy, a wood fuel supplier, operate a wood fuel hub from Naseby and have established fuel supply chains into Central Otago and Dunedin. There are several wood boilers in Central Otago at a range of sites including wineries, schools, hospital and a hostel. There are also several sites in the district where wood energy heat plant may be applicable. Some of these sites are Council-owned buildings.

The Central Otago District Council (CODC) understand the impact of climate change and is aware of wood energy and its potential to assist greenhouse gas emissions, so are supportive of this project. A local CODC business network is available for disseminating information and reaching businesses. The Council would be happy to receive enquiries and redirect them back to the main contact for follow up.

Key points and recommendations

- **There is support from CODC for a Wood Energy Otago Project as they are committed to their responsibilities for combating climate change**
- **There are several CODC owned buildings where wood boilers are likely to be an attractive financial option**
- **There is an established fuel supplier based in Naseby with several users throughout the district**

Dunedin City Council

The Dunedin City district covers an area of 3,300 km² and has a population of 120,250. The main industries are manufacturing, social and business services and retail trade. The district has 14,500 Ha of planted production forestry and the Dunedin City Council (DCC) has a direct interest in the forestry sector via a council owned forest company- City Forests.

The DCC is aware of wood energy and climate change and recently joined the UNs Compact of Mayors. By doing so, the council has committed to a process of reducing carbon emissions, so the Wood Energy Otago Project is a potential tool for meeting future commitments. In 2015, the council developed its own energy plan which includes an action plan for biomass energy and engaging with stakeholders in switching to biomass fuels. The council's energy plan sits within the Economic Development Unit (EDU). The EDU have the Grow Dunedin Partnership fund and an extensive business network database. This database will be available for promoting and identifying leads for the project.

The district has the largest number of wood boilers in the Region so there are numerous examples for schools, hospitals, rest homes, agricultural and research institutes. Because of the considerable number of boilers in the district, there are two established fuel suppliers being Pioneer Energy and Lumbr.

Some of the boilers in the district are almost 10 years old and this brings with it new issues related to a developing sector. Most of these issues are related to boiler parts, maintenance and support. This project will need to consider the next step in developing the service industry supporting the

[3] BERL, 2015 Economic Profile of Central Otago District

wood energy sector, but this will be a nationwide issue as wood energy becomes a main stream energy solution to climate change.

There are numerous opportunities for boiler conversions in the district including the Dunedin Energy Centre- a Pioneer Energy asset located in the middle of town and supplying steam to Cadbury, Dunedin Hospital, Alsco Laundry Services and the University. This site has large coal boilers that operate on wood fuel during summer when demand is lower. The Council also own heating plant that would be economic to convert to wood fuels.

Key points and recommendations

- **There is support from DCC for a Wood Energy Otago Project as they are committed to their responsibilities for combating climate change**
- **There are council owned buildings where wood boilers are likely to be an attractive financial option**
- **There are two fuel suppliers based in the district and numerous boilers**
- **As boilers are getting older, maintenance and equipment support has been identified as a concern for boiler owners and this project could facilitate the expansion of existing service businesses.**

Otago Regional Council

The Otago Regional Council (ORC) is responsible for managing the region's water, air and land resources. In 2004, the government introduced national air quality standards requiring councils to meet standards by 2020. In 2015, the ORC developed the Air Quality Strategy for Otago and highlights the need for cleaner heating options.

From the perspective of this project, air quality improvements that can be achieved when switching from coal to wood fuel would be of interest to the council. For some towns such as Cromwell, Alexandra, Arrowtown and Milton, where it has been difficult to improve air quality, a centralised district heating solution may be an option.

The ORC does not own large heat plant but are supportive because of the potential to provide solutions for air quality. The ORC is aware of wood energy and anecdotal evidence from their air quality scientist suggest improvements, seen in Dunedin over the last 10 years, can be correlated to the introduction of wood boilers in the district. The ORC has a database of air discharge consents throughout the Region and this is available for identifying sites where conversion from coal to wood fuel may assist heat plant owners keep emissions to air within their consent conditions.

Key points and recommendations

- **There is support from ORC for a Wood Energy Otago Project**
- **The Council has a mandate for improving air quality and this project could assist positively**

Queenstown Lakes District Council

The Queenstown Lakes District covers 8,700km² and has a population of 28,200[4]. This population is expected to increase at a steady rate of 2.6% per annum or 1,130 people per annum. The main industries in the district are tourism, accommodation and food, retail trade and construction. There are several examples of wood boilers in the district and an established supply chain.

Queenstown Lakes District Council (QLDC) are familiar with wood energy and several studies have already been undertaken, most notable *Developing a wood energy industry in Central Otago*[5]. This

[4] 2013 Census data from Statistics NZ for usual resident

[5] Ahika's Report for EECA and QLDC (2013)

report outlined a pathway for developing the industry and identified specific sites for conversion and supply options from commercial and managed wilding forestry. Unfortunately, very little progress has been made towards developing an industry and it is important to understanding why there has been no progress including the perceived barriers, public and private sector perception of the industry and incorrect assumptions about wood energy in the district.

The district has 740 Ha of planted commercial forestry[6], 280 Ha of scattered woodlots and 380 Ha of managed wildings including the Douglas-fir forest at Coronet peak[7] which is due for harvesting over the next few years - the total of 1,400 Ha of forestry is the smallest biomass source in the Region. This doesn't include the unmanaged wilding pine forestry.

There are concerns that the wood energy message in the district is not consistent and this needs to be addressed because there are numerous new and pending projects that need to know if wood fuel is going to be consistently available at an economic price. Like the rest of the region security of supply concerns will need to be addressed across the region as the messages, are mixed.

There are a large number of commercial accommodation providers in Queenstown and most of these sites would utilise expensive LPG fuel for boilers. These sites in normal circumstances would be low hanging fruit for wood conversion if it wasn't for the space issue in Queenstown. Space is a premium in Queenstown and a local district heating system that pipes hot water to buildings from another location (outside of the town centre) could see large uptake. Several other demand side projects in the district have been identified but these organisations are just not sure of the next steps.

Key points and recommendations

- **There are mixed messages about wood energy relating to economics, costs and supply in the district that need to be addressed**
- **There is support within Council for a Wood Energy Otago Project**
- **There is potential for large scale uptake via a district heating system, but it would need significant support from Council and businesses**
- **Several large projects have been identified by a local champion. These projects are aware of wood energy but need support to get to the next stage**

Waitaki District Council

The Waitaki district covers an area of 7,150 km² and has a population of 20,830. The main industries in the district are agriculture, forestry and fishing, manufacturing, retail trade and education. The Waitaki district has almost 19,000 Ha[8] of planted production forest which is the second largest potential source of wood fuel supply in the Region. There are no established fuel suppliers in the district and wood fuel supply is from Dunedin or South Canterbury. Ahika is not aware of any wood fuelled boilers in the district.

Nevertheless, there are opportunities in the district. Waitaki District Council (WDC) offices are closely grouped alongside the Aquatic Centre, the Opera House and the Hospital and offer an opportunity for a small-scale cluster heating solution. In addition, there are industrial scale meat processors in the district and one is currently operating a boiler that is due for replacement. There is also an opportunity for Whitestone Contracting, a council controlled organisation, to establish a local wood-fuel supply operation.

[6] https://www.southernwoodcouncil.co.nz/#
[7] Ahika's Report for EECA and QLDC (2013)
[8] https://www.southernwoodcouncil.co.nz/#

Council staff are not familiar with the wood energy sector, plant and supply chain so it would be worthwhile providing professional development for staff. WDC does not have its own economic development unit but would be able to provide a business contact list from internal databases that could be used for promoting the project. WDC would be happy to promote the project via its business networks and receive enquiries before redirecting these back to the main contact for follow up.

Key points and recommendations

- **The district has an opportunity to develop a local fuel supplier and supply chain if additional local wood fuelled boilers can be established.**
- **There is support within Council for a Wood Energy Otago Project**
- **There is potential for a cluster heating scheme that would supply heat to numerous nearby buildings.**
- **Training and upskilling staff is recommended**

Otago Chamber of Commerce

The Otago Chamber of Commerce (Chamber) is an access point for business information and resource with its main driver to encourage business growth and opportunity throughout the Otago region. Members join from all sectors and industries, in all shapes and sizes of organisations and from many towns throughout the Otago region. The Chambers membership database will be a key source of engagement for the project including dissemination of information on wood energy.

The Chamber has a dedicated energy committee and are proud to be signatories to the Dunedin City Council's Energy Leaders accord. The Chamber is proud to work with many partners and relishes the opportunity to contribute to the future of wood energy as well as other projects including district heating plans, carbon emission target setting, energy metabolism and electric vehicle uptake in Otago Region.

The Chamber will play a key role in implementing the Otago Wood Energy Project and is the preferred partner by Councils as it is independent and is removed from Council processes which is required for this type of project. The Chamber also has offices throughout Otago and has established relationships with all Councils.

Bioenergy Association

The Bioenergy Association is a national sector organisation able to support regional wood energy initiatives. Members of the Bioenergy Association include equipment suppliers, consultants, government departments, wood fuel suppliers, plant owners and individuals. Member benefits include access to information via the Bioenergy Knowledge Centre and the Associations web portal, latest news and updates in the sector, professional development via courses and webinars, opportunities to participate in interest groups and attending regular meetings to discuss any opportunities, concerns, issues that need addressing for the sector as a whole.

The Association has established and continues to develop a number of best practice guides, a Wood Fuel Supplier Accreditation Scheme and a Register of Wood Energy Advisers. All these tools and resources would be available for this project, thus avoiding the need for duplication. The Bioenergy Association works closely with central government departments and has a collaboration agreement with the Energy Efficiency and Conservation Authority.

3. Heat plant

Regional heat plant statistics have been collected and developed into a database for this project. The majority of the data was provided from the Bioenergy Association's and Ahika's own databases. There are no other up-to-date boiler databases available for the Region and this list will change continuously as businesses and plant come and go. The data used in this report is, to our knowledge, the most accurate data available at the time but it is not an exclusive list and could be inaccurate with regard to boiler sites and capacities.

There are approximately 367 boilers operating in the Otago Region. They range in size from small commercial scale (<100kW) to large industrial (>10MW) boilers operating on a range of fuels such as coal, diesel, LPG, electricity, wood and light fuel oil (LFO). Figure 1 shows boiler numbers by fuel source and estimated capacity (MW). Figure 2, 3, 4 and 5 provides various breakdowns of the data by district, fuel and sector types.

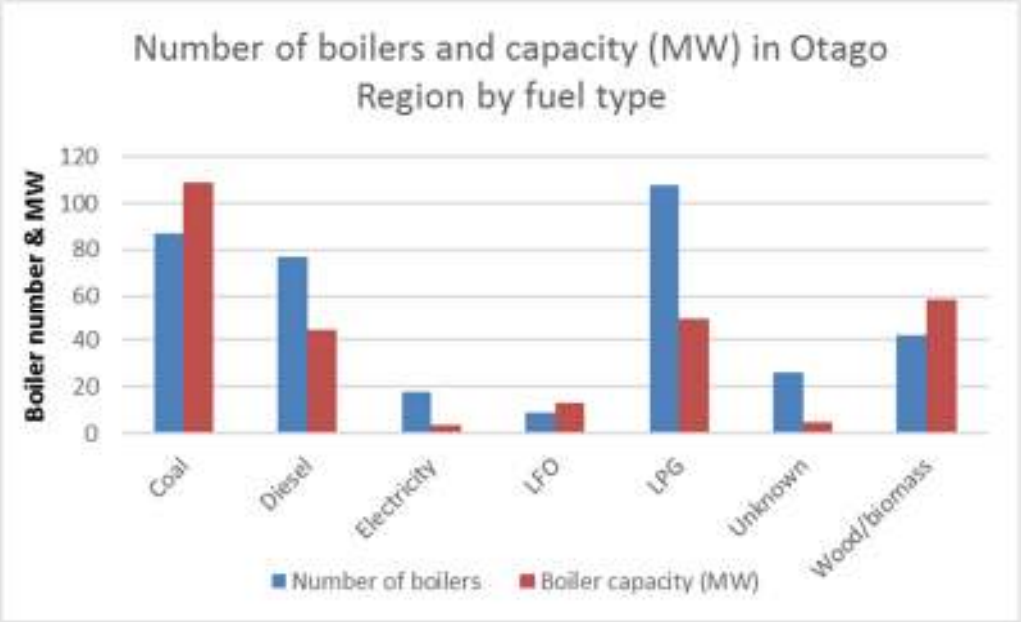

Figure 1. Coal, diesel and LPG boilers represent more than 70% of all boilers in the Region by capacity

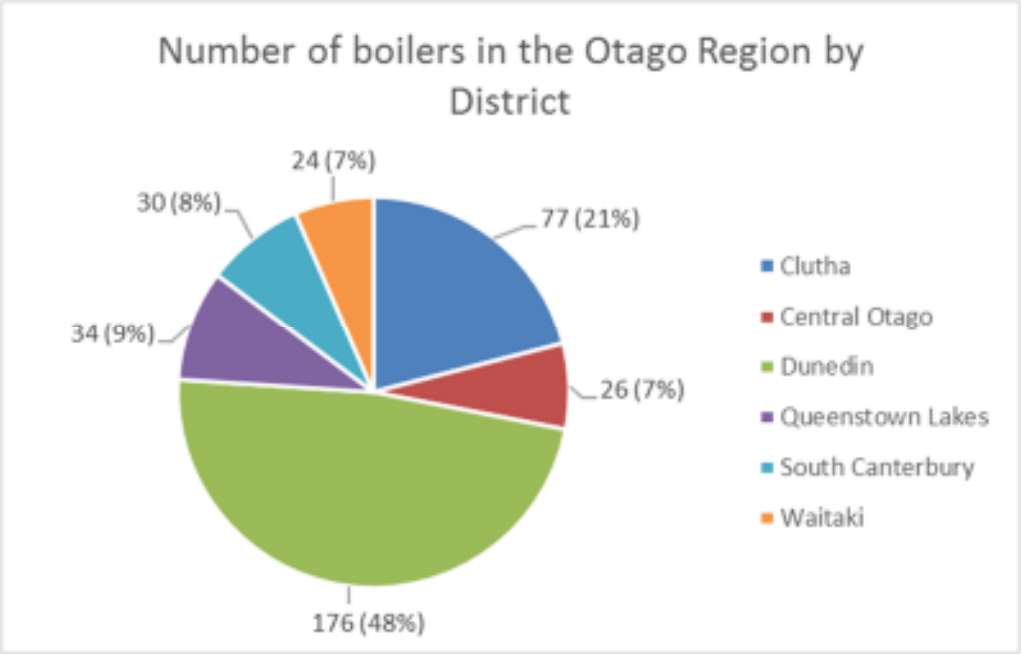

Figure 2. Almost 50% of all boilers are in the Dunedin district

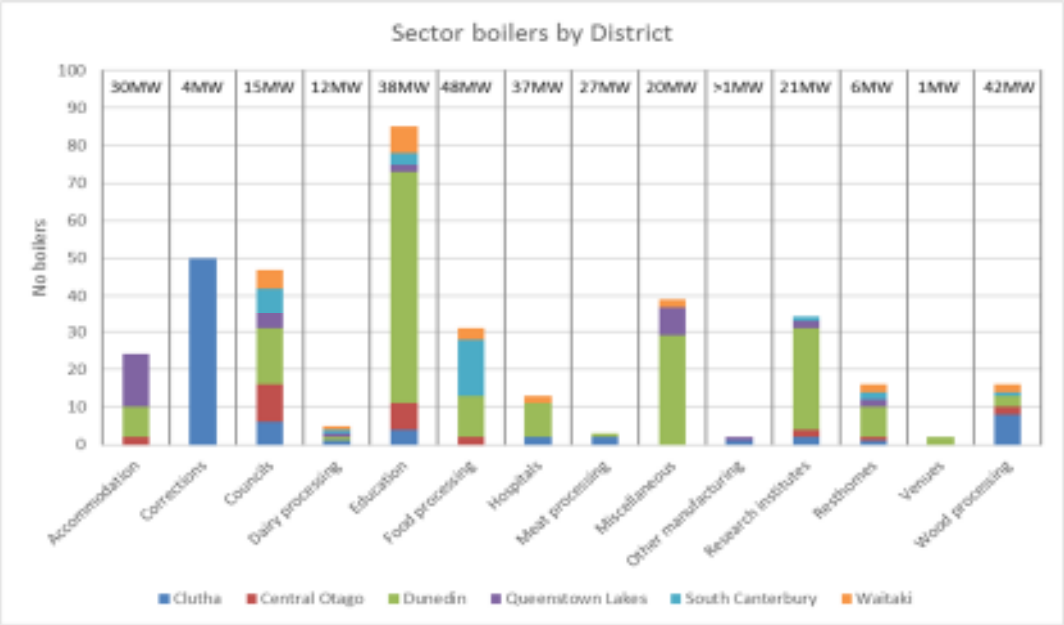

Figure 3. The dairy and meat processing sectors have a small number of boilers (<5) but large capacity (27MW)

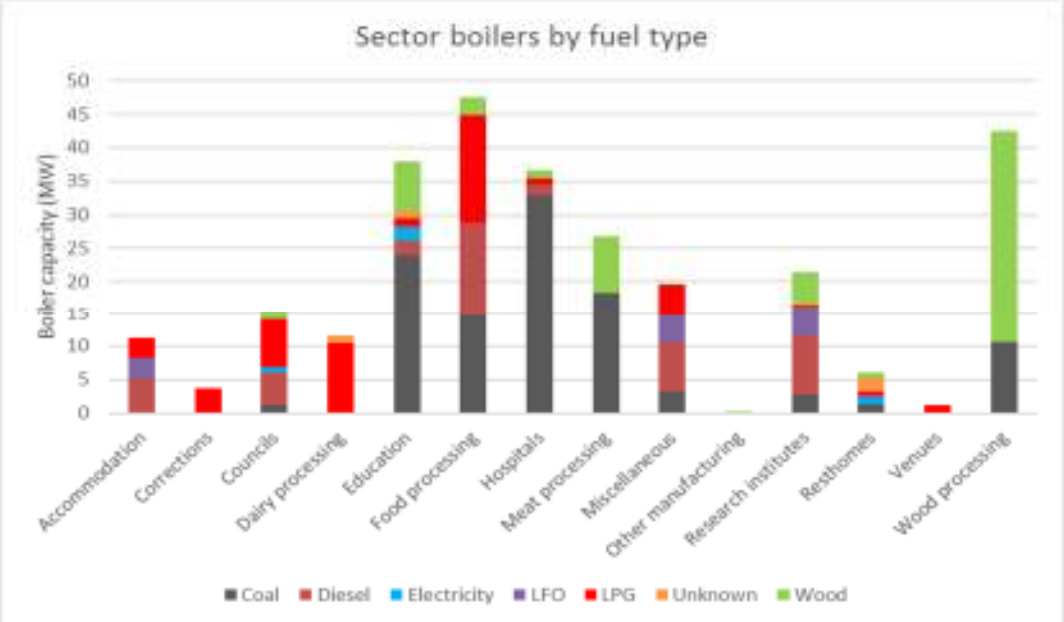

Figure 4. Coal represents 40% of boiler capacity across all sectors followed by wood (21%), LPG (17%) and diesel (16%)

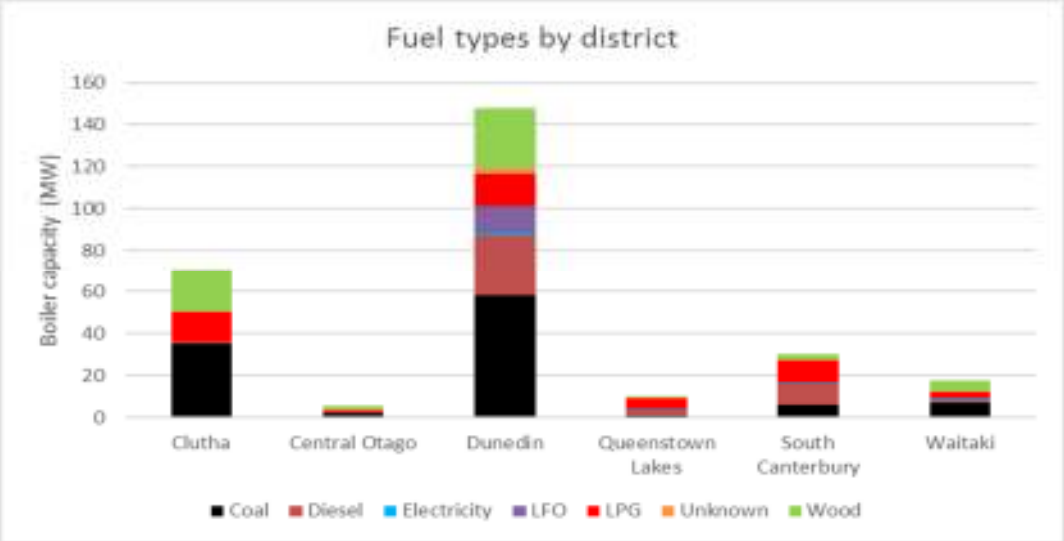

Figure 5. Coal, wood and LPG feature strongly in district fuel profiles

4. Where are the opportunities?

This data provides some useful insights to where opportunities may exist for wood energy and are outlined below.

4.1. Greenhouse gas emissions reduction

The government has set a target of reducing greenhouse gas emissions to 30% below 2005 levels by 2030. The government cannot deliver a low carbon economy without the support of the regions and projects like this can delivery very cost-effective outcomes especially when comparing against the current price of carbon ($20.50/tCO$_2$)[9]. If this project is successful at delivering its reduction targets of 640,000 tCO$_2$ over the lifetime of the boiler, this equates to a carbon cost below $6/tCO$_2$.

Wood is considered a carbon neutral fuel and is not subject to a carbon tax. Emissions factors from all fuel types are outlined below:

Fuel type	Unit	Emission factor (kgCO2-e/unit)
Wood	kg	0.015
Coal - Sub-Bituminous	kg	2.00
Coal - Lignite	kg	1.43
Diesel	Litre	2.68
LPG**	kg	3.02
Light Fuel Oil	Litre	2.95
Electricity	kWh	0.12

Table 1. Emissions for wood and electricity are much lower due to their renewables component

4.2. Carbon taxes for non-renewable fuels

Carbon taxes on non-renewable fuels will make wood energy a lot more attractive, even against coal. Until recently the government subsidised 50% of the carbon charge to emitters. However, from January 1st 2017, the government began phasing out this subsidy over the subsequent two years as follows:

ETS share	2016	1-Jan-17	1-Jan-18	1-Jan-19
Government subsidy	50%	33%	17%	0%
End user	50%	67%	83%	100%

Table 2. ETS subsidy phase out 2017-2019

The effect of this phase-out is being passed on to the end user as price increases, which will continue for the next two years. From Jan 1st 2019, the full costs of carbon will be paid for by the end user.

4.3. Fuel switching from expensive fuels

The business case for investing in a new wood energy boiler system is usually related to savings achieved from fuel switching. Expensive fuels such as LPG, diesel and electricity provide a greater business case for fuel switching and the Wood Energy Otago Project would target and engage these individual sites, which represents more than 200 boilers[10] and 97MW of capacity.

4.4. Aging coal boilers and increasing coal costs

Coal represents almost 40% of all boilers in the Region and many of these boilers are large and aging. Figure 5 shows the greatest demand for coal in Clutha and Dunedin, which is not surprising as these districts are close to the Kai Point mine. This makes it economic, especially for commercial and industrial users but it is unlikely to be the case for the other districts. This means wood fuels may be able to compete with coal prices especially in Waitaki and South Canterbury districts.

[9] www.commtrade.com

[10] Includes 50 small boilers at Corrections Milton

From Ahika's experience in the sector, South Canterbury's industrial users are paying approximately $235-$245 per tonne for Kai Point coal which is equivalent to $10.20-$10.65 per gigajoule. These prices are expected to increase further as carbon tax subsidies are removed and the carbon price increases. At this price, and taking into account the cost of ash removal, wood fuels are likely to become the cheapest fuel option for these districts. This will be a consideration for coal boiler owners when investigating fuel options. The Wood Energy Otago Project would identify Waitaki and South Canterbury coal boiler plant and develop a plan for promoting wood energy to these sectors via direct engagement, industry associations or events.

4.5. Education sector

The education sector has the largest number of boilers in the region and more than 60% of these are coal fired. Wood boilers are the next most common fuel in schools, representing almost 20% of boilers. The trend of wood boilers will continue to grow, assisted by Ministry of Education (MOE) recent policy update.

The MOE recently released a policy document that supports sustainable heating options[11]. The document states "Boilers can be fuelled with a variety of fuels, including natural gas and biomass such as wood chip or wood pellet. Carbon emissions from fossil fuel use are an important issue and high greenhouse emission fuels such as coal, LPG and fuel oil boilers should be avoided."

Natural gas is not available in Otago leaving wood fuels as the preferred fuel for centralised heating systems in existing schools. The policy also gives guidance on evaluating whole of life costs for heating and ventilation systems, which is useful when comparing a high capital/low operating cost wood boiler against a low capital/high operating LPG boiler system.

During this assessment, Ahika engaged with Otago's MOE office and discussed the expected schedule of boiler replacements over the next 5 years. Otago's MOE Regional Property Advisor Barry Sleeman indicated that age stock of Otago school boilers is very old and more than 50 boilers are due for replacement in the next 5 years.

Electric low temperature heating is another potential heat source for schools that currently operate boilers and central heating systems. This will certainly be appropriate for schools where line charges are not excessive or upgrading power supply is inexpensive. For the purpose of this assessment it is assumed that 20% of these boilers in the next 5 years will meet this criteria and be suitable for conversion to electricity while the balance will convert to wood energy.

Based on feedback by MOE, the best support this project could provide is:

- Concentrate funding support on feasibility studies for schools and streamline the application and reporting process
- Develop additional local school case studies and a resource booklet for Boards of Trustees on heating options for schools
- Educate school service providers such as School Support Ltd and others on wood energy funding available for feasibility funding
- Capital funding is less attractive to the MOE because the paperwork is time consuming, they already have the capital available and capital depreciation will reduce on the books, which is a main source of future funding. Capital funding for schools will not be pursued unless under special circumstances where a project may need extra support to get across the line.

[11] Section 5.5 Boiler Options, http://education.govt.nz/school/property/state-schools/design-standards/flexible-learning-spaces/designing-quality-learning-spaces/

4.6. Wood processing sector

The wood processing sector, with its large boilers, are very familiar with utilising waste residues as boiler fuel. This can be seen in Figure 4, where wood fuels account for 75% of boiler capacity. Nevertheless, the remaining 25% of boilers (10MW) represent an opportunity for utilising their residues. These sites are exclusively using coal for several reasons:

- Coal is perceived as being cheap and easy
- They already have an outlet for their residues which is generating an income (usually to the dairy sector as animal bedding)
- They are aware of their resource as a boiler fuel but don't realise its value or how to convert it to a suitable fuel

From Ahika's experience, engaging with these users is well received and owners are very open to undertaking a pre-feasibility assessment. This assessment usually shows that, despite receiving an income from their residues, it is more economic to utilise residues as boiler fuel. The next stage of trialling wood fuels and converting boilers is where it gets difficult.

The key to converting these boilers is to provide a turnkey solution that can convert waste wood into a suitable boiler fuel, provide a fuel handling system and ensure reliable and efficient combustion and heat. The Wood Energy Otago Project would work with industry to develop a joint solution and promote this via industry associations or key industry events.

4.7. Converting coal boilers that are not due for replacement

As Figure 5 shows, coal represents nearly 40% of all boilers in the Region. Coal boilers have a long life and can be more than 50 years old before needing replacement. Many of these boilers could be converted to operate on wood pellet or chip. The conversion process from coal to pellets is well understood and there are demonstration sites in Otago. The conversion to wood chip fuels is more technical and specific coal boilers can be converted but there are not many examples, nor guidelines for these conversions. An opportunity exists, within this project, to target these boilers for conversion, especially woodchip conversion and develop guidelines for converting a range of coal boilers to wood chip and making this available to the industry and coal boiler owners.

4.8. Collaboration

A major barrier to increasing the use of wood energy in Otago is the lack of information and demonstration in some districts. Yet there are a number of wood energy facilities already in operation which can provide demonstration to potential investors. There is also misinformation on the long term consistent availability of wood fuel in some districts. By collaboration across the region, the existing knowledge and experience can be utilised to assist potential investors make the transition from to wood energy. To achieve the desired collaboration requires facilitation and this can be achieved through this project

4.9. Encouraging additional fuel supply

There are two established wood fuel suppliers in the Region and both have well established supply chains. An additional option is to develop a co-operative fuel hub where anyone with waste wood could contribute and be paid for their waste. This could work well with the governments initiative to plant one billion trees over the next 10 years.

5. Identifying sites for engagement

While developing this document, Ahika identified sites for engagement which show potential for switching to wood fuels. The decision process for switching to wood boilers requires a long lead time so this project will engage with these sites early and provide the necessary support to ensure a successful outcome. The following sites are not extensive and there will be new sites added to this list as the project progresses. Estimated annual energy (GJ) and carbon reduction (tCO_2-eq) are included along with the likelihood of the project proceeding. Likelihood of project proceeding has been graded according to probability with high (70-100%), medium (40-70%) and low (10-40%).

Company	District	Project type	Current fuel	Boiler capacity (MW)	Annual energy use (GJ)	Annual carbon reduction (tCO2eq)	25 year carbon reduction (tCO2eq)	High (70-100%)	Med (40-70%)	Low (10-40%)	Unknown
Danone Nutricia	CDC	New	LPG	10	325,000	21,199	529,970	x	x		
Stuart Timber	CDC	Conversion	Coal	1.2	1,985	176	4,410		x		
Stuart Timber	CDC	Conversion	Coal	4	15,380	1,367	34,172		x		
Otago Corrections	CDC	Fuel switch	LPG	3.75	29,565	1,928	48,211				x
Telford Rural Polytechnic	CDC	Replacement	Coal	0.84	5,300	471	11,776		x	x	
Cromwell Pool	CODC	Fuel switch	LPG	0.3	1,500	98	2,446	x	x		
CODC Offices	CODC	Replacement	Diesel	0.3	1,620	114	2,846	x	x		
Moana Pool	DCC	Fuel switch	LPG	1.2	20,000	1,305	32,614	x	x		
Alsco Dunedin	DCC	New	Coal	4	21,000	1,866	46,659			x	
Dunedin Energy Centre	DCC	Conversion	Coal	28.7	495,936	44,076	1,101,896				x
University of Otago- Arana Hall	DCC	Replacement	Coal	1	9,442	839	20,978	x	x		
Mercy Hospital	DCC	Replacement	LPG	1	7,767	507	12,665	x	x		
Southern Lakes Laundries	QLDC	Fuel switch	LPG	1.1	3,400	222	5,544		x	x	
Mount Aspiring College	QLDC	Conversion	Coal	1	1,470	131	3,266				x
Remarkables Park School	QLDC	Fuel switch	LPG	0.8	3,750	245	6,115		x	x	
Real Journeys- TSS Ernslaw	QLDC	Conversion	Coal	-	31,504	2,800	69,997				x
QLDC- Lakes Leisure	QLDC	Fuel switch	LPG	0.4	13,320	869	21,721				x
Queenstown Airport	QLDC	Fuel switch	LPG	0.4	1,235	81	2,014				x
QLDC- Wanaka Pool	QLDC	Fuel switch	LPG		13,320	869	21,721				x
Sanfords- Timaru	SC	Conversion	Coal	4.7	11,999	1,066	26,659	x	x		
Oceana Gold	WDC	Fuel switch	LPG	1	19,710	1,286	32,141		x	x	
Lean Meats Oamaru	WDC	Replacement	Coal	4	21,773	1,935	48,376		x	x	
WDC- Library, museum	WDC	New	Electricity	0.36	1,250	57	1,432	x	x		
WDC_ Opera House	WDC	New	LPG	0.36	1,040	68	1,696	x	x		
Oamaru Hospital	WDC	Replacement	LPG	0.3	3,330	217	5,430				x
Great Southern- Oamaru	WDC	Conversion	Coal	-	5,806	516	12,900	x	x		
Otago Schools Boiler Replament	All Otago	New	Various	8.8	22,800	1,045	26,116			x	
			TOTAL	**79.51**	**1,090,201**	**85,351**	**2,133,770**				

Table 3. Opportunities for wood fuels are spread throughout the Region and not concentrated in one district

6. Long term availability of wood fuel in the Region

There are three main sources of wood for bioenergy being production forestry, timber processors and municipal waste. The long-term availability of wood fuel in the Otago Region is relatively well understood from production forestry and sawmills due to supply studies previously undertaken. Very little is understood on the availability from municipal sources such as green waste and demolition timber from landfills and how this could be utilised as bioenergy wood fuel.

As already discussed, there are approximately 125,085 Ha of planted production forestry in Otago. Residues from harvesting of production forestry is a key source of fuel supply for the bioenergy sector so there is a direct relationship between harvesting and fuel availability. In addition, these forest companies continually replant and harvest their estates over a 25-year cycle so the long-term availability is consistent and guaranteed.

This main bodies of publicly available work already undertaken on wood availability in Otago are listed below and include estimated tonnes of wood and equivalent energy content expressed in gigajoules (GJ) for useful comparison against Table 1 demand figures.

- *The South Otago Residue Supply Assessment*

  This report was prepared for Wood Energy South, Venture Southland and the Energy Efficiency Conservation Authority in July 2015 by Ahika. The report was commissioned to provide certainty to industrial wood energy users within South Otago about the ongoing availability of wood residue as an energy source. The report estimates current annual volumes of 150,000 t (915,000 GF), increasing steadily to 350,000 t (2,135,000 GJ) per annum over the next 45 years.

- *Developing a Wood Energy Cluster in Central Otago*

  This report was prepared for QLDC and EECA in 2013 by Ahika. The report outlines a path for establishing a wood fuel sector in Central Otago and identifies potential sites for conversion and fuel supply options from forestry and wood processors. The report indicates a lumpy harvesting profile over 45 years with an average volume of 11,000 t (67,100 GJ) per annum over this period.

- *Residual biomass fuel projections for New Zealand*

  This report was prepared for EECA and BANZ in August 2017 by Scion. The report describes the woody biomass residue resources in New Zealand by volume, type, energy content and region over time from 2017 to 2042 (25 years). The report estimated the total volume of recoverable residue volumes for Otago-wide is more than 200,000 t (1,220,000 GJ) per annum over the next 25 years.

- *National exotic forest description 2016*

  This report is prepared annually for the Ministry of Primary Industries (MPI) and provides a detailed description of New Zealand's production forests as at 1 April 2016. It represents an estimate of the net stocked area of the planted production exotic forest estate with the primary intention of producing wood or wood fibre. Wood residue volumes are not reported but it provides product volumes and plantings.

7. Feedback from boiler plant owners

As part of the development of this document, Ahika made direct contact with a range of boiler owners/operators to gauge their interest, understanding of the technology, concerns and issues with wood energy. This provided further insights about where the Otago Wood Energy Project could assist boiler owners. A summary of their feedback is provided below:

Correctional and Detention	Department of Corrections is not supportive of full life cycle cost analysis which makes wood difficult to compete.
	Department is more interested in cheapest upfront cost.
	All prisons throughout NZ are pumping out CO_2. In the last 10 years, more than 60,000 tCO_2 emitted from prison boilers.
	Some prison boilers have been specified for coal with the option to convert to biomass. But none have been converted yet. Invercargill is designed as dual fuel.
	Tongariro is removing their wood pellet boiler in preference of LPG.
Councils	Wood has been considered for the site and it looks favourable on paper. However, site is space constrained so need to address this issue.
	There are at least two other sites in close proximity and a clustered heating option could work but this adds complexity to the solution.
	Government funding support for feasibility and capital will always help get ideas considered.
	There are no concerns with the supply or expertise in the sector.
Dairy processing	Fuel supply for large dairy is the greatest barrier.
	The volumes of wood fuels for a site such as Edendale is staggering and understanding the supply chain and wood volumes need careful consideration.
Meat Processing	Currently considering boiler options as plant is aging but had no idea about wood energy.
	Under the belief that wood fuel price is turbulent and changing (which it is not).
	Would be absolutely interested if subsidies were available.
	Concerns with the lack of supply and quality of fuel.
Research Institutes	At least three more sites would like to convert but it is difficult getting these across the line so funding support would be welcomed.
	The sector (from a maintenance and service perspective) is still in the early stages of development and is disorganised and cannot provide the aftermarket support.
	One boiler supplier has recently left the market so getting support for these boilers is difficult now without an NZ service provider.
	There is a need to provide a better support/maintenance service for existing boilers as it is currently non-existent.
	Capital funding support will assist with new projects and there are a few new developments coming up.
	Maintenance support for their new wood boiler is lacking since Living Energy has stopped providing this service.
	The more funding the better, even $100k is better than nothing.
Miscellaneous	Had considered wood for their site but it is difficult due to space constraints.
	Wood requires large footprint and commercial space is a premium in Queenstown.
	Reticulated gas is convenient and easy but very expensive- current spend $50k per month.
	Funding may not help their situation unless they moved to a new site.

These interviews were undertaken before the change of Government in 2017 and do not reflect post 2017 Government policies. None of the interviewees made any reference to Government policies as set out in the New Zealand Energy Efficiency and Conservation Strategy 2017-2022 and little heed was being made of the Government's stated desire to achieve the Paris Climate Change Targets.

In general, the regional wood energy market can be separated into facilities that have their own source of wood fuel (for example a sawmill or wood processor) and facilities which have to purchase wood fuel. The barriers in the sector generally relate to those facilities which have to purchase wood fuel, as the business risk from the current under developed and uncertain wood fuel supply market is generally the biggest barrier to transitioning from coal to wood fuel.

To help address some of these issues, the Wood Energy Otago Project would provide the following:

- Compile and disseminate wood energy market information specific to the Otago Region so that decision makers are properly informed of their heating options.
- Utilise existing resources and develop region specific resources to assist decision makers. Most of these resources are already developed and it is a matter of promoting and making these available via sector associations and direct contact.
- Assist individual heat plant owners to evaluate opportunities for transitioning from fossil fuels to wood fuel.
- Establish and work with the local advisory groups to make business in their locality aware of maintenance and service issues for boiler plant that is more than 10 years old and identify where improvements can be made.
- Develop or utilise existing resources for space constrained sites and make these available for developers and interested businesses.

8. Other support

8.1. Utilisation of existing local website and brand

Venture Southland developed the Wood Energy South website and currently host the website. Venture Southland has offered to make the website available for the Otago Project. In return, the Wood Energy Otago Project could maintain the website and continue to update resources and add Otago related content to the website.

8.2. Access to tools and resources

Bioenergy Association has offered to work with the region to allow access to its suite of tools and information in the Bioenergy knowledge Centre.

8.3. Lessons learnt from the Wood Energy South project

Venture Southland will have some valuable feedback on lessons learnt and time should be spent engaged with them and keeping them informed.

9. Expanding Wood Energy South into Otago

This section will outline what is required for setting up the Wood Energy Otago Project and a budget has been developed in Section 10. To provide economies of scale of effort and avoid duplication it is important that this project operates collectively but with local drivers and support. From a geographic perspective and the location of heat plant owners it is recommended that the project be managed around two technical hubs operating in Queenstown (servicing Central Otago) and Dunedin (servicing coastal Otago). The role of the technical hubs is to engage with local energy users and wood fuel suppliers and provide a location for all parties to come together. These discussions can lead on to pre-feasibility assessments, identifying and resolving barriers, visits to demonstration facilities, matching the user to a solution/service provider and assisting with applications for funding support.

The coordination could be provided by an umbrella organisation which for this project would be the Otago Chamber of Commerce (Chamber). The Chamber will be responsible for ensuring a collective project is maintained, administering the project including project reporting to funders and partners, managing the funding process, issuing work orders and organising an annual wood energy event. All Councils and the Chamber will be expected to promote the programme and all enquiries will come back to the Chamber for follow up via the technical hubs. The Chamber administration role will require a 0.5FTE.

A feasibility study is usually the first step in investigating wood energy. Funding support is very attractive to organisations and this project would seek to leverage off EECA's current feasibility funding programme of 40% of the costs. However, for this project, there will be no criteria to meet and the funding should be made available to any business interested in wood energy regardless of their energy spend or annual turnover.

An even better sweetener for businesses is funding support for capital projects. EECA has some funding streams that provide capital for new technology, usually 40% of capital costs up to $100,000. For this project, capital funding should be made available for boiler upgrades, replacements, conversions and fuel switching at the same vales, at least, as EECAs Technology Grants.

There is still a lack of knowledge and information in the wood energy sector and this project will look to continue the good work of Wood Energy South in developing local case studies and resources, disseminating information via the website, running local workshops and working collectively with the Bioenergy Association to provide courses, events and workshops.

At a strategic level, a Regional Steering Group will be convened and will consist of project partners and may include select individuals that will add value to the project. The role of this group is to provide guidance for the project and ensure objectives and responsibilities are being met. Quarterly meetings will be held. Bioenergy Association has offered to join the Steering Group to provide a national perspective and guidance from other similar projects. (Travel costs would need to be covered). Funders may also wish to have a presence on the Steering Group.

At a district level, local Advisory Groups will be convened in all districts. Local Advisory Groups will consist of locals with an interest in wood energy and could include forestry representatives, wood fuel suppliers, heat plant owners, local boiler maintenance and installers. It is important that these groups include locals with mana in their communities. Quarterly meetings will be held at a district level with an annual regional meeting to ensure collectiveness is maintained.

9.1. Main outcomes

It is important to have outcomes and targets to measure the success of the project. The main outcomes and targets of the Otago Wood Energy Project would be:

- Complete pre-feasibility reports for at least 100 organisations in Otago.
- Councils will show their commitment to the project by undertaking at least five pre-feasibility reports and undertake detailed feasibility studies (of these sites) if the initial report is favourable and meets their investment criteria.
- Fund at least 50 feasibility studies for Otago organisations.
- Displace 325,000 GJ of energy with wood fuels within the three years of the project
- Remove 25,600 t CO_2-eq per annum (640,000 t CO_2-eq over the lifetime of the boiler)
- Disseminate information such as case studies, research, funding and sector relevant information to sectors via:
    - Attending or presenting at sector events
    - Utilising industry magazines to promote case studies and write articles
    - Utilise media and video to promote the project via media outlets
- Continue to grow the knowledge base of wood energy in Otago and New Zealand by:
    - Developing resources for the sector
    - Undertaking research into areas where information is lacking such as supply studies, converting coal boilers to wood-fuels and fuel switching for sawmills and timber processors
    - Expansion and continued development of the Wood Energy South website
- Engage with the Education sector, particularly the Ministry of Education, Boards of Trustees and School property service providers to ensure they are aware of funding and opportunities for feasibility funding assistance.
- In partnership with the Bioenergy Association, organise an annual symposium event aimed at sharing information to the sector about the latest advances, information and case studies including site tours and project updates.
- Improve air emissions throughout Otago and engage with the Regional Council on areas of concern.

10. Project budget

The estimated project budget has been developed based on a three-year timeframe. Over this period, specific funding would be required for the following activities:

Staffing- The project will consist of two technical (1.3FTE), an administration (0.5FTE) and a management (0.3FTE) roles. The main hub, and staff, for the project will be based in Dunedin except for a technical role in Queenstown. Office options are yet to be confirmed.

Feasibility funding- Feasibility studies are a first step in investigating wood energy options and decisions are made based on the outcome of this assessment. Prior to this, the Project Technical Support Team will assist with the preparation of pre-feasibility assessments. Pre-feasibility assessment has three effects on subsequent feasibility funding:

1. Limits unlikely projects from applying for feasibility funding as the initial assessment looks unfavourable, so the project does not proceed.
2. Clarifies the project assumptions and risks which are then subject to detailed assessment.
3. Some projects will undertake their own assessments or use services provided by boiler suppliers and the pre-feasibility becomes a second review process. For these types of projects, the client is satisfied with the proposal and will skip straight to capital funding

A full feasibility study would provide a detailed conceptual description of the project; identify technology options; identify wood fuel supply sources; consent requirements; present a business case and risk analysis.

The cost of a feasibility assessment varies depending on the complexity of the project (for example, school boiler ($4,000-$8000), large hot water boiler ($10-30,000) and industrial steam processes (>$100,000)). Due to the large number of school boilers due for replacement in Otago, this project would expect a large number of feasibility studies to be undertaken in Year 1 and 2. Based on assumptions for a number of feasibility projects being undertaken and a 40% funding contribution, the budget for feasibility studies is estimated at **$300,000.**

Funding support for capital projects- Funding support for capital grants was available for the Wood Energy South project and this will need to continue for the Otago project as access to capital is often a major barrier to a financially attractive project proceeding. Councils are also expected to take a lead in this process and investigate their own heat plant. This is likely to lead to an increase in Crown Loan funding. Based on Southland experience an annual application of **$200,000** for Crown Loans can be expected. For private sector projects an ideal budget to achieve the outcomes of the project could be **$400,000** in the form of Capital Grants.

Advisory services- During this project, perceived barriers will be identified and depending on the issue, advisory services will be necessary for specific pieces of work. This could include, for example, wood supply assessments to address security of supply concerns (usually a key piece of work to be initiated though most of Otago is well researched), support to establish a wood trading platform and research and development. An annual funding allowance of **$100,000** is recommended.

A summary budget is outlined below.

PROJECT BUDGET	Annual cost	3-year Budget
Staffing		
Technical staff	$117,000	351,000
Admin staff	$30,000	$90,000
Management	$36,000	$108,000
Project costs Hosting events, case studies, attending conferences, website hosting, professional development and steering and advisory group costs	$50,000	$150,000
Contract management	$17,000	$51,000
Funding for feasibility studies	$100,000	$300,000
Funding for capital projects (Crown sector)	$200,000	$600,000
Funding for capital projects (Private sector)	$400,000	$1,200,000
Advisory services for specific work/tasks	$100,000	$300,00
Contingency	$50,000	$150,000
TOTAL PROJECT FUNDING	**$1,100,000**	**$3,300,000**

Table 4. Estimated budget for the Wood Energy Otago Project

11. Recommendations

The purpose of this study is to develop a collaborative regional project that will assist in reducing greenhouse gas reductions and leverage significant Central Government funding into the Otago Region. In order to progress this to the next stage, the following should be considered by the Mayoral Forum:

- The project cost has been budgeted at **$3.3M**. The Mayoral Forum need to discuss how best to meet this cost. There are a couple of options:
    - **Option 1 (preferred)-** Councils agree to meet staff costs ($183,000 per annum) and seek support from Central Government for the balance. Staff costs could be divided according to rating units and the following amounts would be required:

Council	Proportion	Annual	3 year
CDC	7%	$12,810	$38,430
CODC	10%	$18,300	$54,900
DCC	35%	$64,050	$192,150
ORC	25%	$45,750	$137,250
QLDC	15%	$27,450	$82,350
WDC	8%	$14,640	$43,920
		$183,000	**$549,000**

    - **Option 2**- The Councils approach government with the initiative and ask for their full support and contribution. The timing for this project is good as the new government has objectives to reduce greenhouse gas emissions and this project could demonstrate early progress being made by government.

- To make the most of this opportunity, the Mayoral Forum should consider writing to the Minister for Climate Change Issues James Shaw outlining the project, confirming commitment from the Councils and request their feedback and financial support for the project. The Bioenergy Association to provide support in drafting the letter to the Hon James Shaw.

- While developing this project, informal arrangements have been made with organisations such as the Otago Chamber of Commerce, Venture Southland and the Bioenergy Association. These should be formalised and letters of support sought to include with the letter to the Minister.

Appendix A- Feedback from Councils

The following feedback and comments/responses were received from various Councils. This feedback was incorporated into the main report where applicable.

- It is a thorough piece of work and I think has merit – however getting Councils to commit this level of funding will be a challenge - some suggestions and questions…*I didn't think the funds being requested were large, but I guess any unplanned funding has to come from somewhere. An ORC contribution will reduce this cost further and I will amend the table. We need to look at it from the economic perspective that the govt will also be contributing nearly $3M to the project that will get spent in the Region. I guess if its too much funding to ask for, we go back to government with a request for full funding support and maybe Councils can offer in-kind?*

- Southland experience – you mention in 3 years southland achieved 12 conversions at a lifetime reduction in greenhouse gas of 80400t. The Otago goals seem to suggest removing 640000t – am I comparing the same figures and is it feasible to aim for 8x the impact in Otago? *Yes it is more ambitious but we have a lot more opportunities for conversions because we do not have the access to low cost lignite. There is a lot more high cost fuels such as LPG and diesel use in Otago.*

- The report mentions lessons learnt by Venture Southland – it would be good to know more about these so that we learn from their experiences. *Agree and will see if I can get comments from VS.*

- What is happening with that Southland project now – is the amount of funding carrying on or is it winding down? What interaction would you see happening with Otago and Southland staff working on this – is there any overview/collaboration potential beyond a shared website that could increase effectiveness and decrease costs? *I would see the projects as independent. VS are continuing the wood energy south project but only at a much smaller scale. VS are self-funding some wood feasibility reports where its applicable.*

- The Southland project was a JV – what would EECAs role be in the Otago version? *EECA would have a seat at the table and assist with funding, promoting the project and communications. They wouldn't be involved in the day-to-day operations of the project. EECA will also need to report back to Government*

- Project needs – there is no budget for comms yet it seems preconceptions about wood as an energy source is a common barrier – how will case studies and comms be paid for and was there consideration of having a comms person on the team rather than 2 technical people? *The comms role is provided by EECA and also by the project's Admin person. Costs associated with case studies and promotions are covered within the project budget. Maybe this could be covered in-kind by Councils?*

- Funders – why was ORC left out of the mix – does the carbon emission reduction not link to their air quality goals? Is there any role for suppliers to the industry as aren't they going to profit from the initiative? *Amended funding table to include ORC.*

- Are there examples of funding models where external investors fund conversion and take a slice of the savings for a period of time – there is a social impact fund that has links to Queenstown that is looking for investment that achieves both a financial and

social/environmental benefit and I wondered whether this could be a useful partner? *The only funding model I can think of is the warm homes grants where the cost of insulation etc is added to the rates of a property.*

    - The funding models I was wondering about was whether there is a return from conversion investors might be interested in? This is the fund I was thinking of - http://www.newground.co.nz/impact-enterprise-fund/ A long shot but maybe worth thinking about?

- Coordination – the Otago Chamber of Commerce covers most of Otago, but not Queenstown as there is a strong chamber here that is independent. This could cause some tension if someone is based in Qtown? *Need to consider how this will operate and maybe include the Queenstown Chamber.*

- Feedback from Clutha Council has been incorporated in the main report.