Government Leadership

Regional Energy Transition Accelerator (RETA)

Waikato – Summary Report

March 2025

TE TARI TIAKI PŪNGAO
ENERGY EFFICIENCY & CONSERVATION AUTHORITY

He kupu whakataki

E tutuki ai te whāomoomo ā-pūngao me te whakawhiti kora kaitā, me whai pārongo whai mana i te taha o te mahi ngātahi pakari ā-rohe.

E whai ana te Waikato Regional Energy Transition Accelerator (RETA) ki te tuku i te māramatanga whānui ki ngā tūāoma me whai e pai ake ai te whāomoomo ā-pūngao me te whakamarutanga o te whakaratonga, waihoki te whakaheke i ngā tukunga puta noa i te rohe.

Ko tētahi aronga matua o tēnei tātaritanga ko te wāhi ki te papatipu koiora whakahou hei kāinga rua utu-pai mō ngā koropupū pāmahana-taikaha i te ahumahi.

E whakarārangi ana tēnei pūrongo i ngā ararau e whakawhiti ai ngā kaiwhakamahi pōkākā o te rohe ki ngā pūngao whakahou, i te wā tonu o te tohu i ngā arawātea e motuhake ana ki ngā rohe, pēnei i te pitomata o te pūngao ngāwhā. Ka whai hua ētahi wāhi i te pōkākā ngāwhā hāngai, i ngā papu pōkākā raro whenua, heoi anō, me tūhura tonu i konei.

E whakatauira ana a RETA me pēhea tā ngā kaiwhakamahi pūngao maha whakatau kōrero ā-rōpū e taea ai te whai urupare kotahi mō ngā wero tūāhanga, inā rā mai i te tirohanga tukutanga. E whakaatu ana te pūrongo i te whānuitanga o ngā anga whakatau kaupapa ka taea e ngā kaiwhakahaere tukatuka wera i te arotakenga o koranehe kē atu, e whakaatu ana i te kanorautanga o ngā hua ka taea.

Kei a Waikato ngā wāhi tukatuka wera nui katoa e whirinaki ana te koranehe i Aotearoa, i roto i ngā pūrongo RETA kua whakaputaina tae noa ki tēnei wā. E tuku ana te pūrongo RETA i tētahi aromatawai ā-rohe matawhānui, e whakaatu ana i ngā āheitanga me ngā ārai e pā ana ki te whakawhiti pūngao. Mā tēnei e āhei ai ngā kaiwhakamahi tukatuka wera me ngā kaiwhakarato koranehe ki te whakatau kōrero mātau ake mō ō rātou hiahia pūngao o te anamata.

E whanake ana te hōtaka RETA i ngā whāomoomotanga ā-pūngao, whakawhititanga kora anō hoki kua whakaterea kētia i Waikato. He huhua ngā pakihi i te rohe kua whai kē i tētahi ara puhanga-iti, ā, kua whakamaheretia ki EECA. Koia ko te tauira o ngā mahi e taea ana, waihoki, he nui te wāhi ki ā rātou mahi me tō rātou ngākaunui ki te tuari i tā rātou i ako ai ki ētahi atu, i tēnei hātepe.

E tohu ana tēnei pūrongo i te whakatutukitanga o te tūāoma whakamahere a RETA, e tuku ana i ngā matapaetanga me ngā mahere o te popono pūngao pōkākā tū i te rohe, i te taha o ngā aromatawai tuku pūngao whakahou.

Nā runga i ēnei mōhiotanga i āta mahi tahi ai mātou ki ngā pakihi tuku hiko o te rohe— WEL Networks, Counties Energy, Waipa Networks, The Lines Company, Powerco, Vector Limited, me Unison— tae ana ki ngā kamupene ngahere o te rohe, ngā pūtukatuka rākau, ngā kaiwaihanga hiko me ngā kaihoko, otirā ngā kaiwhakamahi pūngao ahumahi waenga, ki te nui.

E hiamo ana mātou ki te tautoko tonu i te rohe ki te tūhura i tōna pitomata whakawhiti pūngao.

1 Foreword

Achieving large-scale energy efficiency and fuel-switching requires both reliable information and strong regional collaboration.

The Waikato Regional Energy Transition Accelerator (RETA) seeks to provide a comprehensive understanding of the steps needed to enhance energy efficiency and security of supply, as well as reduce emissions across the region.

A key focus of this analysis is the role of renewable biomass as a cost-effective, reliable alternative for industrial high-temperature boilers.

This report outlines various pathways for the region's process heat users to switch to renewable energy, while also identifying region-specific opportunities, such as the potential for geothermal energy. Some sites could benefit from direct geothermal heat or ground-source heat pumps, although further exploration is required.

RETA demonstrates how collective decision-making by multiple energy users can lead to shared solutions for infrastructure challenges, particularly from a supply perspective. The report presents a range of decision-making frameworks that process heat organisations can use when evaluating alternative fuels, showcasing the diversity of possible outcomes.

Waikato has the highest number of fossil fuel-dependent process heat sites in New Zealand out of the RETA reports published to date. The RETA report provides a complete regional assessment, highlighting both opportunities and barriers to energy transition. This enables process heat consumers and fuel suppliers to make more informed decisions about their future energy needs.

The RETA programme builds on existing efforts in Waikato to improve energy efficiency and transition to low-emissions alternatives. Many businesses in the region have already mapped out or implemented low-carbon pathways in partnership with EECA, demonstrating what is achievable. Their willingness to share insights has been invaluable in shaping this process.

This report marks the completion of RETA's planning phase, offering forecasts and maps of regional stationary heat energy demand alongside renewable energy supply assessments.

Developing these insights has involved close collaboration with local electricity distribution businesses—WEL Networks, Counties Energy, Waipā Networks, The Lines Company, Powerco, Vector Limited, and Unison—as well as regional forestry companies, wood processors, electricity generators and retailers, and medium to large industrial energy users.

We look forward to continuing to support the region in unlocking its full energy transition potential.

Dr Marcos Pelenur
Chief Executive, EECA

EECA

2 Acknowledgements

This RETA project has involved a significant amount of time, resource and input from a variety of organisations. We are especially grateful for the contribution from the following organisations:

- Process heat users throughout the Waikato region
- Local Electricity Distribution Businesses WEL Networks, Counties Energy, Waipā Networks, The Lines Company, Powerco, Vector Limited, and Unison
- National grid owner and operator Transpower
- Regional forestry companies
- Regional wood processors
- Electricity generators and retailers

This RETA report is the distillation of individual workstreams delivered by:

- **Lumen** – process heat demand-side assessment
- **Whirika and Margules Groome** – biomass availability analysis
- **Ergo Consultants** – electricity network analysis
- **EnergyLink** – electricity price forecast
- **Sapere Research Group** – report collation, publication, and modelling assistance

Photo Credit: Tatua Co-operative Dairy Company

> *The RETA programme builds on existing efforts in Waikato to improve energy efficiency and transition to low-emissions alternatives.*

Dr Marcos Pelenur, Chief Executive, EECA

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Waikato is the focus for New Zealand's twelfth Regional Energy Transition Accelerator (RETA).

4 Waikato overview

This report provides a snapshot of the planning phase of the Regional Energy Transition Accelerator (RETA) prepared for the Waikato region (shown in Figure 1).

The report brings together information on the demand for fossil fuels for process heat in Waikato, along with information on electricity network and biomass availability in the region, in order to:

- Provide process heat users with coordinated information specific to the region that can be used to make more informed decisions on fuel choice and timing.
- Improve fuel supplier confidence to invest in supply side infrastructure (including electricity and biomass).
- Surface issues, opportunities, and recommendations.

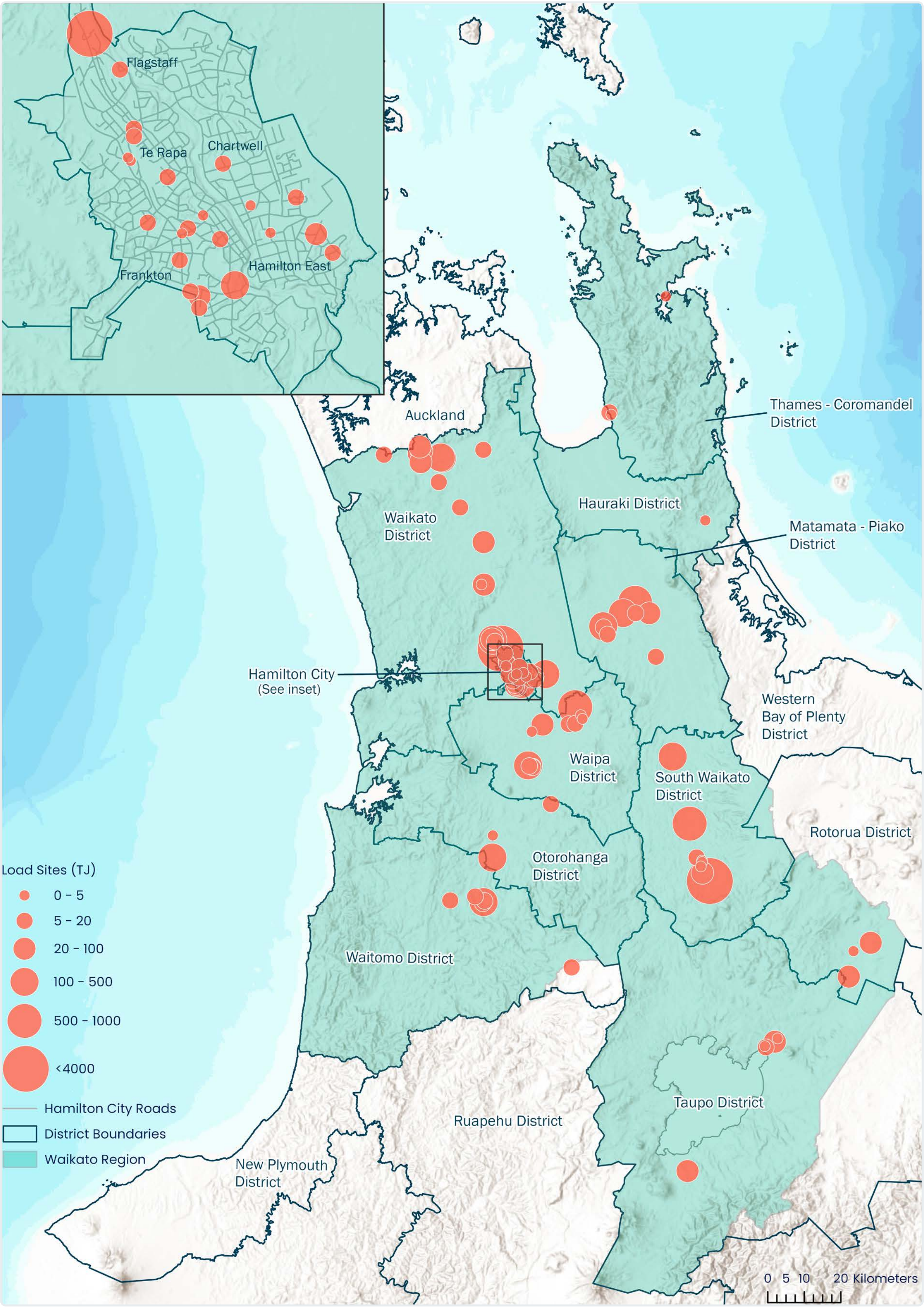
The next phase of the RETA programme focuses on implementing recommendations from phase one to remove barriers or accelerate opportunities to switch to renewable energy for process heat.

Our analysis of energy requirements in Waikato uses year 2022 as baseline. We note that since then, constraints in gas supply have affected prices and availability of fossil gas, and as a result have altered fossil gas consumption patterns.[1] This means that it is increasingly important for organisations to understand their options for alternative fuels for their processes, ensuring a secure and affordable supply.


Credit: EMA

[1] MBIE notes that gas production forecast is expected to fall below demand https://www.mbie.govt.nz/about/news/gas-production-forecast-to-fall-below-demand.

Figure 1 – Process heat demand sites in the Waikato region

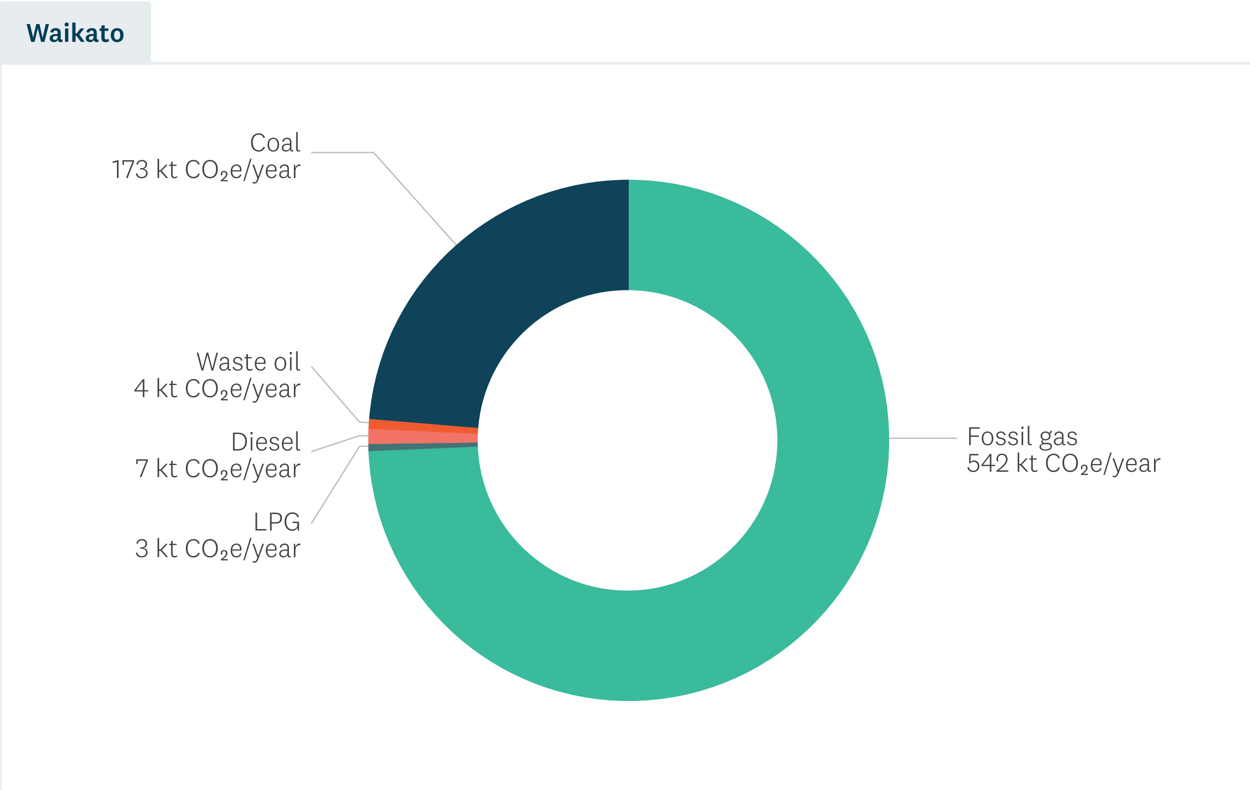


There are 91 sites covered in the report, spanning the dairy, meat, industrial and commercial sectors.[2] These sites have fossil-fuelled process heat equipment larger than 500kW and include sites for which EECA has detailed information about their potential projects to reduce energy use and switch to renewable fuels.[3] The sites, shown in Figure 1 by location and size of their annual energy requirements, collectively consumed 12,204TJ of process heat energy, predominantly in the form of fossil gas, and produced 730kt per year of carbon dioxide equivalent (CO_2e) emissions. Table 1 shows that most of the thermal demand is from the industrial sector, and for Waikato, particularly the dairy sector.

Table 1 – Summary of Waikato RETA sites fossil fuel process heat demands and emissions

Sector	Sites	Thermal capacity (MW)	Thermal fuel consumption (GWh/yr)	Thermal fuel consumption (TJ/yr)	Thermal fuel emissions (kt CO_2e/yr)
Dairy industry	15	587	1,776	6,393	396
All other industry	47	496	1,516	5,457	315
Commercial	29	95	98	354	19
Total	**91**	**1,178**	**3,390**	**12,204**	**730**

Figure 2 – Annual emissions by process heat fuel, 2022. Source: EECA



[2] The industrial sectors include dairy, meat, food & beverage, and wood processors. The commercial sector includes schools, hospitals, and accommodation facilities.

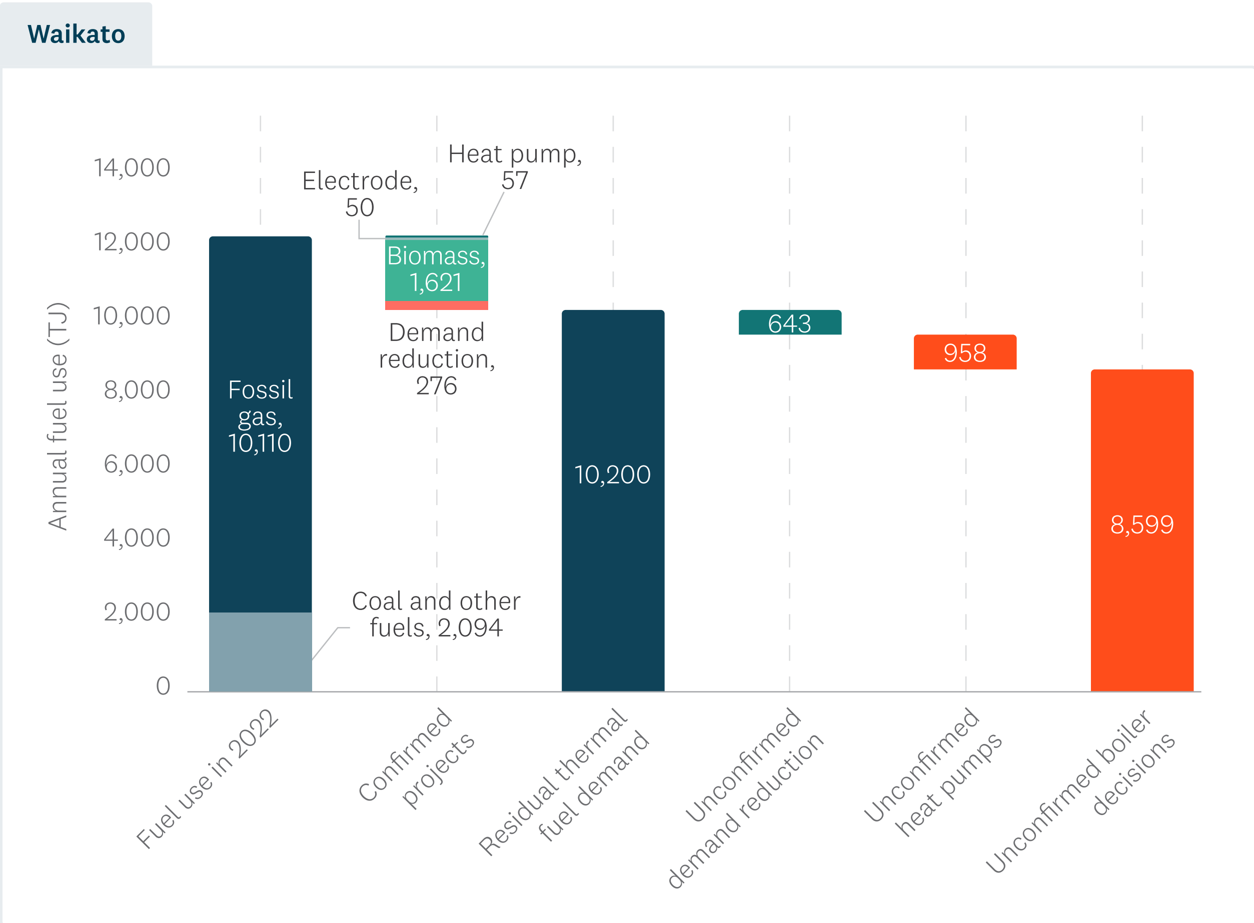
[3] For many large process heat users in New Zealand, process heat fuel-switching opportunities have been captured in an EECA Energy Transition Accelerator (ETA) report.

The objective of the Waikato RETA is to demonstrate pathways that eliminate as much of these process heat emissions as possible. It does this by supporting organisations in their consideration of:

- Demand reduction (for example reducing heat demand through process optimisation).
- Heat pumps (for heat requirements <100°C, which may be integrated with heat recovery).
- Fuel-switching (from fossil-based fuels to a renewable source such as biomass and/or electricity).

Figure 3 illustrates the potential impact on Waikato's regional fossil fuel demand of process heat demand reduction and fuel-switching decisions for those investments that are already confirmed and those where decisions are yet to be made.

Figure 3 – Potential impact of demand reduction and fuel switching on fossil fuel usage. Source: EECA



Based on our analysis, 8,599TJ of the residual thermal demand could be considered for fuel switching (referred to as unconfirmed fuel switch decisions). The RETA analysis looks at the pathways by which these fuel switches could occur, considering both biomass and electricity as potential fuel sources. EECA's assessment focuses on the key issues that are common to all RETA process heat sites contemplating fuel-switching decisions. This includes the availability and cost of the resources that underpin each fuel option, as well as the capacity of the networks to deliver the fuel to the process heat users' sites. This assessment is unique to the Waikato region and has been used to simulate possible fuel-switching pathways under different sets of assumptions. This provides valuable information to individual process heat decision makers, infrastructure providers, resource owners, funders, and policy makers.

4.1 RETA site summary

Across the 91 sites considered in this study, there are 194 individual projects spanning the three categories discussed above – demand reduction, heat pumps and fuel switching.

Table 2 shows the current status of the Waikato RETA process heat projects. Sixteen projects have been confirmed by the process heat organisation (i.e. the organisation has committed to the investment and funding allocated). The other 178 projects are unconfirmed (i.e. the process heat organisation is yet to commit to the investment).

Table 2 – Number of projects considered in Waikato RETA: Confirmed vs Unconfirmed. Source: Lumen, EECA.

Status	Demand reduction	Heat pump fuel switch	Boiler fuel switch	Total
Confirmed	3	5	8	16
Unconfirmed	71	57	50	178
Total	**74**	**62**	**58**	**194**

Demand reduction and thermal efficiency are key parts of the RETA approach and, in most cases, enable (and help optimise) the fuel-switching decision. This RETA report has a greater level of focus on the fuel-switching decision, due to the higher capital and fuel intensity of this decision.

Table 3 shows the expected fuel demands remaining at each site after any demand reduction projects and/or heat pump projects are accounted for. The table presents biomass demands both in TJs and green tonnes (55% moisture content) and reports the peak demand from the boiler, should it convert to electricity.

Twelve sites have already confirmed their fuel of choice (shaded in blue), representing a demand for 8.21 MW of electricity in five sites, 4,587 TJ of biomass in six sites. One additional site has switched to using biogas since 2022.

For unconfirmed projects, the cells shaded green indicate the preferred fuel option according to our commercial decision-making criterion, described in Section 5.

Table 3 – Summary of Waikato RETA sites with fuel-switching requirements

Site name	Industry	Project status	Bioenergy required TJ/yr	Bioenergy required kt/yr	Electricity peak demand (MW)
AFFCO Horotiu	**Industrial**	**Confirmed**	**84**	**12**	
Donelley Sawmillers Reporoa	**Industrial**	**Confirmed**	**51**	**7**	
Fonterra Hautapu	**Industrial**	**Confirmed**	**590**	**82**	
Fonterra Waitoa	**Industrial**	**Confirmed**	**850**	**120**	
Ministry of Education Hillcrest High School	**Commercial**	**Confirmed**	**10**	**1.5**	
Silver Fern Farms Waitoa	**Industrial**	**Confirmed**	**5.8**	**0.8**	
Health NZ Tokoroa Hospital	**Commercial**	**Confirmed**			**0.2**
Health NZ Waikato Hospital Stage 1	**Commercial**	**Confirmed**			**3.0**
Health NZ Waikato Hospital Stage 2	Commercial	Unconfirmed			**6.5**
Lilies by Blewden Cambridge*	**Industrial**	**Confirmed**			**0.3**
Ministry of Education Mercury Bay Area School	**Commercial**	**Confirmed**			**0.1**
University of Waikato Hamilton	**Commercial**	**Confirmed**			**4.6**
Turners & Growers Reporoa (Great Lake Tomatoes)	**Commercial**	**Confirmed**	**Using biogas**		
A & G Price Thames	Industrial	Unconfirmed	**10**	**1.5**	1.3
Alsco New Zealand Hamilton	Industrial	Unconfirmed	**8.5**	**1.2**	1.8
Bowers Brothers Concrete Horotiu Masonry Plant	Industrial	Unconfirmed	**6.7**	**0.9**	1.3
Dairy Goat Co-operative	Industrial	Unconfirmed	**93**	**13**	10
Downer New Zealand Hamilton Asphalt Plant	Industrial	Unconfirmed	**8.6**	**1.2**	
Evonik Peroxide Morrinsville	Industrial	Unconfirmed	**290**	**41**	8.1
Fonterra Canpac	Industrial	Unconfirmed	**5.0**	**0.7**	0.4
Fonterra Lichfield - Stage 1	Industrial	Unconfirmed	520	72	**16**
Fonterra Lichfield - Stage 2	Industrial	Unconfirmed	**210**	**29**	15
Fonterra Morrinsville	Industrial	Unconfirmed	**150**	**21**	10

* Company in receivership, 2024

Site name	Industry	Project status	Bioenergy required		Electricity peak demand (MW)
			TJ/yr	kt/yr	
Fonterra Te Awamutu - Stage 1	Industrial	Unconfirmed	**390**	**55**	22
Fonterra Te Awamutu - Stage 2	Industrial	Unconfirmed	**25**	**3.5**	19
Fonterra Te Rapa - Stage 1	Industrial	Unconfirmed	240	34	**7.1**
Fonterra Te Rapa - Stage 2	Industrial	Unconfirmed	160	22	**5.1**
Fonterra Te Rapa - Stage 3	Industrial	Unconfirmed	**660**	**91**	31
Fonterra Te Rapa - Stage 4	Industrial	Unconfirmed	**320**	**45**	54
Fonterra Tīrau - Stage 1	Industrial	Unconfirmed	220	31	**8.1**
Fonterra Tīrau - Stage 2	Industrial	Unconfirmed	**96**	**13**	12
Fulton Hogan Hamilton	Industrial	Unconfirmed	**8.6**	**1.2**	13
Graymont Ōparure Quarry	Industrial	Unconfirmed	**17**	**2.4**	1.0
Graymont Ōtorohanga	Industrial	Unconfirmed	**310**	**43**	15
Graymont Te Kuiti Plant	Industrial	Unconfirmed	**200**	**28**	8.1
Green Valley Dairies Mangatāwhiri	Industrial	Unconfirmed	8.0	1.1	**0.5**
Higgins Contractors Waikato	Industrial	Unconfirmed	**19**	**2.7**	10
Higgins Rotokawa Asphalt Plant	Industrial	Unconfirmed	**1.5**	**0.2**	10
Humes Hamilton Pipe and Precast Plant	Industrial	Unconfirmed	**9.0**	**1.3**	0.6
Inghams Cambridge	Industrial	Unconfirmed	**6.7**	**0.9**	2.1
Ixom Morrinsville	Industrial	Unconfirmed	**7.5**	**1.0**	1.1
Laminex Taupō	Industrial	Unconfirmed	**22**	**3**	2.4
Lumbercorp Ōhinewai	Industrial	Unconfirmed	98	14	**0.4**
Mercer Mushrooms Tuakau	Industrial	Unconfirmed	**15**	**2.1**	0.7
Milkio Foods Hamilton	Industrial	Unconfirmed	**4.8**	**0.7**	0.4
Oceana Gold Waihi	Industrial	Unconfirmed	**4.0**	**0.6**	0.5
Oji Fibre Solutions Kinleith Mill**	Industrial	Unconfirmed	**3700**	**520**	
Open Country Dairy Horotiu	Industrial	Unconfirmed	**280**	**38**	16
PGG Wrightson Seeds Te Awamutu	Industrial	Unconfirmed	**5.7**	**0.8**	4.0
PGG Wrightson Seeds Walton	Industrial	Unconfirmed	**7.3**	**1.02**	3.0

** Our analysis was undertaken before the announcement that Oji will stop producing paper at Kinleith Mill in mid 2025.

Site name	Industry	Project status	Bioenergy required TJ/yr	Bioenergy required kt/yr	Electricity peak demand (MW)
Quality Mushrooms Ōhaupō	Industrial	Unconfirmed	**3.6**	**0.5**	0.4
Roundwood NZ Tokoroa	Industrial	Unconfirmed	**24**	**3.3**	2.3
Sealed Air Hamilton	Industrial	Unconfirmed	**3.7**	**0.5**	0.5
Shinagawa Refractories Australasia Huntly	Industrial	Unconfirmed	**82**	**11**	6.9
Springhill Corrections Facility	Commercial	Unconfirmed	**14**	**1.9**	2.0
Synlait Milk Pōkeno	Industrial	Unconfirmed	**170**	**23**	15
Taupō Funeral Services	Commercial	Unconfirmed	**3.6**	**0.5**	0.5
Tatua Dairy Co-operative - Stage 1	Industrial	Unconfirmed	**300**	**42**	11
Tatua Dairy Co-operative - Stage 2	Industrial	Unconfirmed	**72**	**10**	11
Twentymans Funeral Services Thames	Commercial	Unconfirmed	**1.5**	**0.2**	0.9
Waikeria Prison	Commercial	Unconfirmed	**9.6**	**1.3**	1.5
Yashili Pōkeno - Stage 1	Industrial	Unconfirmed	**150**	**21**	12
Yashili Pōkeno - Stage 2	Industrial	Unconfirmed	**4.7**	**0.7**	6.3
Sites where demand is assumed to be met by heat pumps					
AgResearch Ruakura	Commercial	Unconfirmed			**0.1**
Blooming Hill Flowers Pukekohe	Industrial	Unconfirmed			**0.2**
Burwood Nurseries Tamahere	Industrial	Unconfirmed			**0.4**
Claudelands Event Centre	Commercial	Unconfirmed			**0.3**
Crusader Meats Benneydale	Industrial	Unconfirmed			**0.6**
Grainhub Tuakau	Industrial	Unconfirmed			**1.0**
Greenlea Premier Meats Morrinsville	Industrial	Unconfirmed			**0.2**
Greenlea Premier Meats Waitoa	Industrial	Unconfirmed			**0.2**
House of Taste Pukekohe	Industrial	Unconfirmed			**0.6**
Inghams Te Aroha	Industrial	Unconfirmed			**1.1**
Ministry of Education Cambridge High School	Commercial	Unconfirmed			**0.2**
Ministry of Education Fairfield College	Commercial	Unconfirmed			**0.2**

Site name	Industry	Project status	Bioenergy required		Electricity peak demand (MW)
			TJ/yr	kt/yr	
Ministry of Education Forest View High School	Commercial	Unconfirmed			0.2
Ministry of Education Fraser High School	Commercial	Unconfirmed			0.3
Ministry of Education Hamilton Boys High School	Commercial	Unconfirmed			0.4
Ministry of Education Hamilton Girls High School	Commercial	Unconfirmed			0.3
Ministry of Education Huntly College	Commercial	Unconfirmed			0.2
Ministry of Education Ōtorohanga College	Commercial	Unconfirmed			0.2
Ministry of Education Reporoa College	Commercial	Unconfirmed			0.2
Ministry of Education Tainui Primary	Commercial	Unconfirmed			0.1
Ministry of Education Taupō Nui A Tia College	Commercial	Unconfirmed			0.3
Ministry of Education Te Awamutu College	Commercial	Unconfirmed			0.3
Ministry of Education Te Kuiti High School	Commercial	Unconfirmed			0.2
Ministry of Education Tokoroa High School	Commercial	Unconfirmed			0.1
Ovation New Zealand Te Kuiti	Industrial	Unconfirmed			0.5
Passion Fresh Pukekohe	Industrial	Unconfirmed			0.6
Pukete Wastewater Treatment Plant Hamilton	Industrial	Unconfirmed			0.1
Quack A Duck Cambridge	Industrial	Unconfirmed			0.02
Riverton Nurseries Hautapu	Industrial	Unconfirmed			1.0
Tongariro Prison	Commercial	Unconfirmed			3.6
Turners & Growers Geraghty	Industrial	Unconfirmed			3.0
Turners & Growers Ōhaupō	Industrial	Unconfirmed			1.5
Turners and Growers Harrisville	Industrial	Unconfirmed			1.5
Universal Beef Packers Te Kuiti	Industrial	Unconfirmed			0.3
Waikato Rugby Stadium	Commercial	Unconfirmed			0.2
Te Awamutu Events and Aquatic Centre	Commercial	Unconfirmed			0.3
Waterworld Pools and Spa	Commercial	Unconfirmed			0.3

Photo Credit: Tatua Co-operative Dairy Company

5 Simulated fuel-switching pathways

There are a range of decision criteria that individual organisations may apply to determine the timing of their investments. Decisions are impacted by available finance, product market considerations, strategic alignment and other factors.

Rather than attempting to model all these factors for individual process users, we have developed a range of different scenarios, referred to as pathways, that reflect different decision-making criteria that process heat users (who have not confirmed their fuel choice) might use. The pathways are summarised in Table 4.

The Biomass Centric and Electricity Centric pathways represent 'bookends' that focus exclusively on one of the two fuel options (biomass or electricity) for unconfirmed projects. It is acknowledged that these are artificial scenarios, but in the absence of information about confirmed plans, it serves to provide an indication of the possible total future fuel demand for each type of fuel considered.

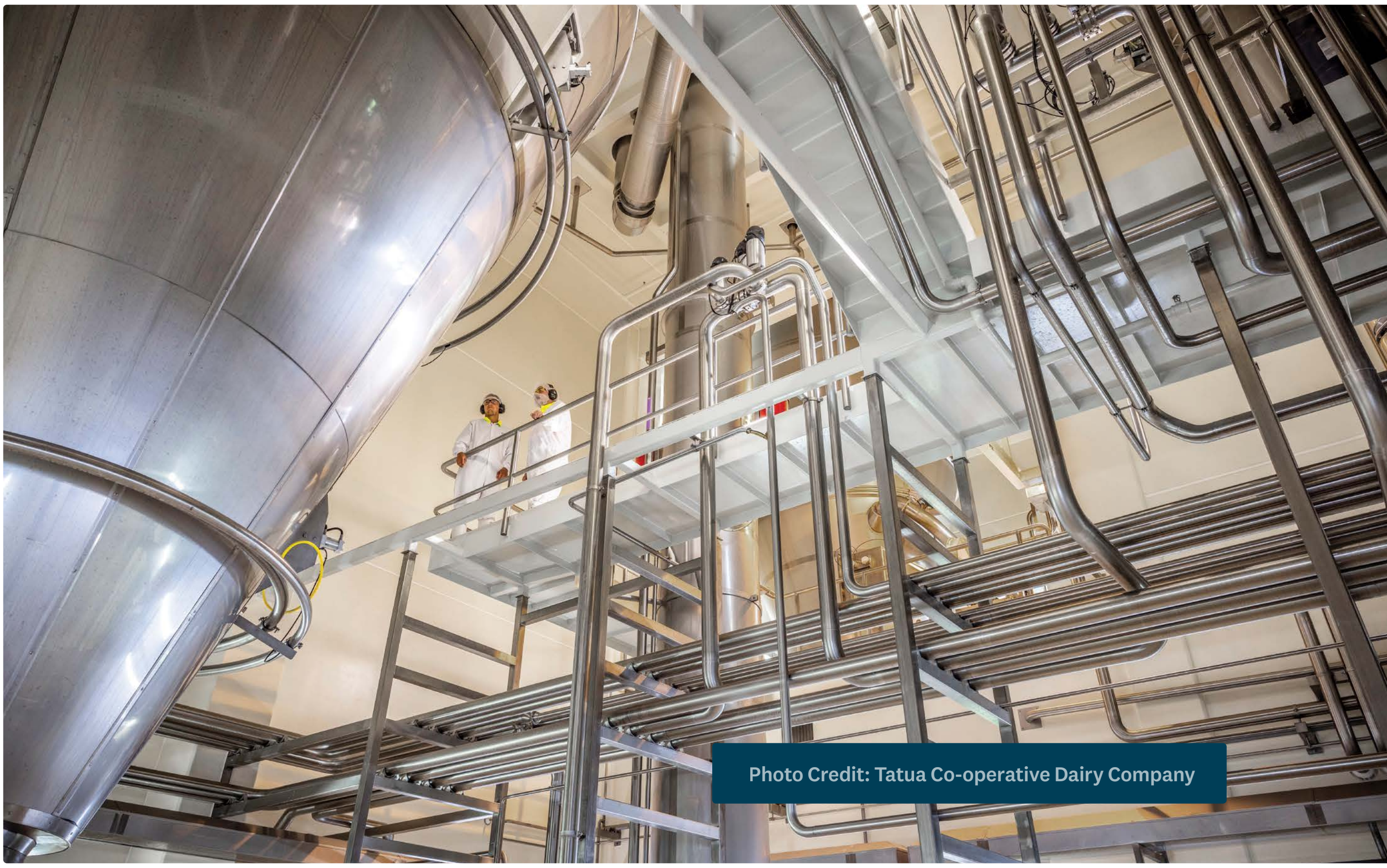


Photo Credit: Tatua Co-operative Dairy Company

For the BAU Combined and MAC Optimal pathways, the fuel switch decision is based on a global standard 'marginal abatement cost' (MAC), that quantifies the cost to the organisation of fuel-switching their process heat, expressed in dollars per tonne of CO_2e reduced by the investment. A MAC allows us to determine what the lowest cost investment is (electricity or biomass), as well as the best timing of the investment. In the MAC Optimal Pathway, the timing of the fuel switch is chosen to be the earliest point when a decision saves the process heat user money over the lifetime of the investment – the point in time that the MAC of the project is exceeded by the expected future carbon price.

Table 4 – Fuel-switching pathways used in the RETA analysis

Pathway name	Description
Biomass Centric	All unconfirmed site fuel-switching decisions proceed with biomass, where possible, either in 2036 (for sites using coal)[4] or in 2049 (in line with New Zealand's target of net zero greenhouse gas emissions by 2050 in the Cli-mate Change Response (Zero Carbon) Amendment Act.
Electricity Centric	All unconfirmed fuel switching decisions proceed with electricity, where possible, either in 2036 (for sites using coal) or in 2049 (in line with New Zealand's target of net zero greenhouse gas emissions by 2050 in the Climate Change Response (Zero Carbon) Amendment Act
BAU Combined	All unconfirmed fuel-switching decisions (i.e. biomass or electricity) are determined by the lowest MAC value for each project and take place in either 2036 or in 2049 (i.e the same timing as for the fuel-centric pathways).
MAC Optimal	Each site switches to a heat pump or switches its boiler to the fuel with the lowest MAC value for that site. Each project is timed to be commissioned in the first year when its optimal MAC value first drops below a ten-year roll-ing average of the future NZ Treasury's shadow carbon prices. If the MAC does not drop below the ten-year rolling average before 2049, then the timing based on the fuel-centric pathway is used.

Geothermal energy for process heat

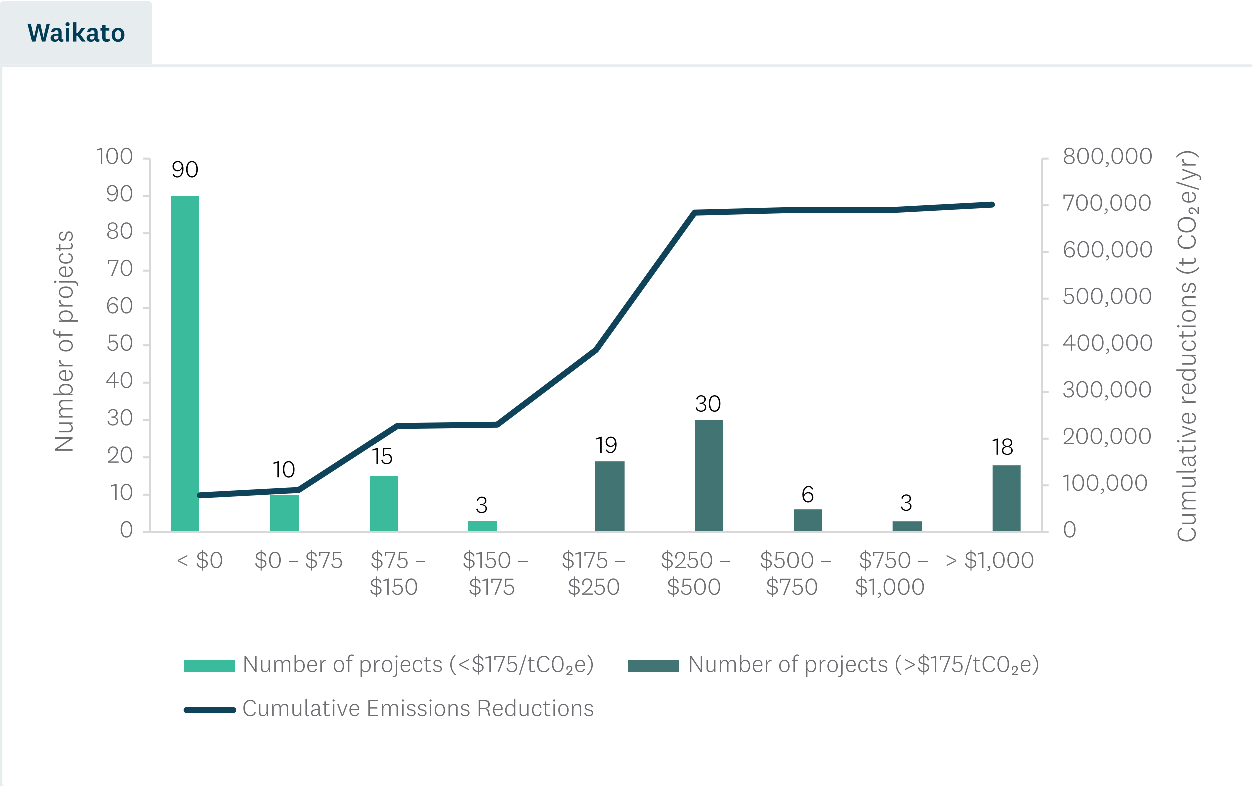
There are significant geothermal energy sources within Waikato, and geothermal energy is utilised for process heat at a number of sites located within the Taupō Volcanic Zone. We have not modelled a separate geothermal pathway for this RETA analysis as there are no large process heat users in the zone not already using geothermal energy. Smaller geothermal systems distributed throughout the region could be utilised for process heat, either directly or via ground source heat pumps, where they are situated close to a process heat user. Such detailed analysis was beyond the scope of this report but it is recommended that process heat users consider this as an option when investigating fuel switching from fossil fuels.

4 The timing for coal boiler fuel-switching projects is in line with national direction that came into effect in July 2023, as detailed here: https://environment.govt.nz/assets/publications/climate-change/National-Direction-for-Greenhouse-Gas-Emissions-from-Industrial-Process-Heat-Industry-Factsheet.pdf

5.1 Estimated MAC values for Waikato projects

Using the biomass and electricity costs outlined in Section 6 and Section 7, Figure 4 summarises the resulting MACs associated with each decision, and the potential emissions reduced by these projects.

Figure 4 – Number of projects and cumulative emissions reductions by range of MAC value. Source: EECA



Out of 730kt of process heat emissions from Waikato RETA sites, 79kt CO_2e (11%) have MACs less than zero, meaning they are economic now, even without a carbon price,while a total of 229kt (31%) have MACs less than $175/t$CO_2e$.[5] Using a commercial MAC decision-making criterion, combined with expected future carbon prices (MAC Optimal), it would be commercially favourable to execute these projects over the next three years.

Compared to a scenario where each of these projects was executed based on the organisations' current plans (a BAU pathway), the MAC Optimal scenario would accelerate fuel-switching, and reduce emissions by a cumulative 5,225kt over the period of the RETA analysis to 2050, as shown in Figure 5.

5 By 'economic', we mean that at a 6% discount rate these projects would reduce costs for the firms involved over a 20-year period (i.e. the Net Present Value would be greater than zero, at the assumed trajectory of carbon prices).

Figure 5 – Simulated emissions reductions under fuel-switching pathways. Source: EECA

The MAC Optimal pathway proceeds faster, with the majority of emissions reductions economic immediately, primarily as a result of a large number of demand reduction and heat pump projects which are economic at today's carbon prices. Note that the Electricity Centric and Biomass Centric pathways are obscured in the chart by the BAU Combined pathway. This is because the project timings, and therefore the emissions reductions associated with these three pathways, are identical until fuel switching occurs in 2049.

Photo Credit: Nature's Flame

5.2 Pathway implications for electricity and biomass demands

The MAC Optimal pathway sees fuel decisions that result in 8% of the region's energy needs in 2050 supplied by electricity, and 92% supplied by biomass (Figure 6). We expand further on these fuel-switching outcomes in the sections 6 and 7.

Figure 6 – Electricity and biomass demand in the fuel-switching pathways. Source: EECA

It is important to recognise the impact that demand reduction has on the overall picture of the Waikato region's process heat. As show in Figure 3, investment in demand reduction meets 7.5% of the process heat demands[6] from Waikato process heat users in 2022, which in turn reduces the necessary fuel-switching infrastructure required: thermal capacity from new biomass or electric boilers would be reduced by around 94MW if these projects were completed. We estimate that demand reduction would avoid investment of between $104M and $113M in electricity and biomass infrastructure.[7]

[6] This is true for both energy consumption and the peak thermal demand required from biomass or electric boilers.

[7] On the assumption that the capital cost of electrode boilers is $1.1M and biomass boilers is $1.2M. The electrode boiler cost does not consider the connection cost of electrode boilers, which average $1.2M for Waikato, but are very site specific.

5.3 Sensitivity to gas price

A range of sensitivities have been tested in the modelling, including electricity, biomass and carbon prices and are discussed in the main report. Given the importance of fossil gas in Waikato and the current constraints in supply, additional analysis of the sensitivity to gas prices was undertaken.

The modelling assumed a base gas price of $18/GJ ($0.065/kWh) for industrial process heat users (based on the mid-point of MBIE estimates for commercial and industrial users). As shown in Figure 7, we found that halving the annual escalator for natural gas from 3% to 1.5% resulted in 38 fuel-switching decisions being deferred, and causing 1,789kt CO_2e of additional emissions on a cumulative basis through to 2050. By contrast, doubling the escalator to 6% accelerated 46 projects, delivering 6,122kt CO_2e of emissions reduction by 2050. A significant increase in the natural gas price to $45/GJ by 2035 (excluding ETS charges) changed three fuel switch projects from biomass to electric and accelerated 42 projects with a cumulative additional reduction of 6,241kt CO_2e by 2050.

Figure 7 – Sensitivity of emissions reductions pathways to different gas price assumptions. Source: EECA

6 Biomass – resources and costs

To assess the total availability of harvestable wood in the Waikato region, both a top-down and bottom-up analysis has been undertaken. The bottom-up analysis is based on interviews with major forest owners, as forest owners' actual intentions will often deviate from centralised forecasts due to changes in log prices and other dynamic factors. It also provides an assessment of where the wood is expected to flow through the supply chain – via processors to domestic markets, or export markets, as well as volumes that are currently being utilised for bioenergy purposes. This analysis allows us to estimate practical levels of sustainably recoverable woody residues.

A top-down analysis suggests that an average of around 4,200kt pa (30,400TJ pa) of wood will be harvested in the Waikato region over the next 15 years.[8]

Figure 8 shows that there is some annual variation in total available wood resource, with a visible decline in the early 2030s and 2040s. The annual variation occurs due to the age distribution of the existing forests, and yield assumptions combined with assumptions on how forests are harvested.

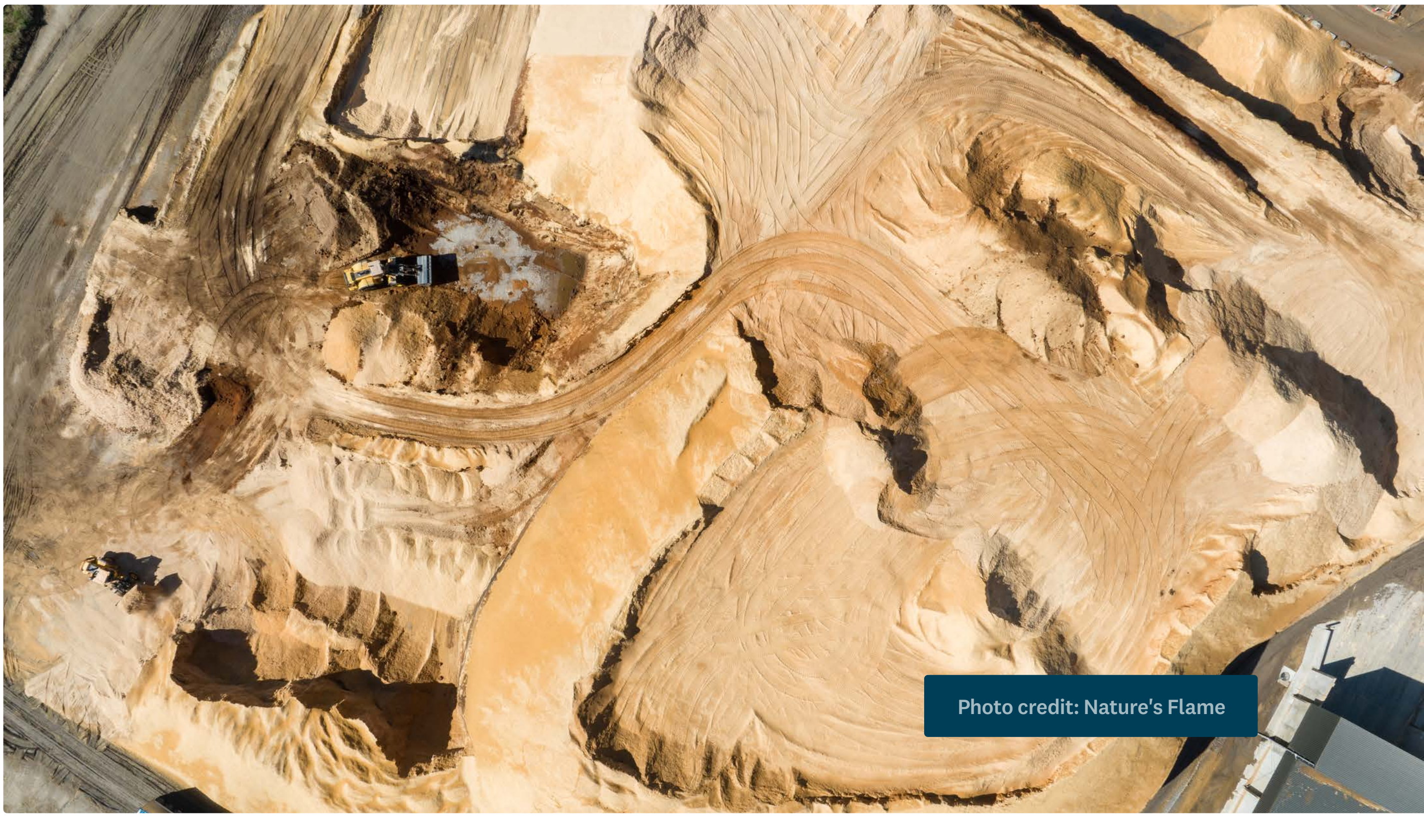
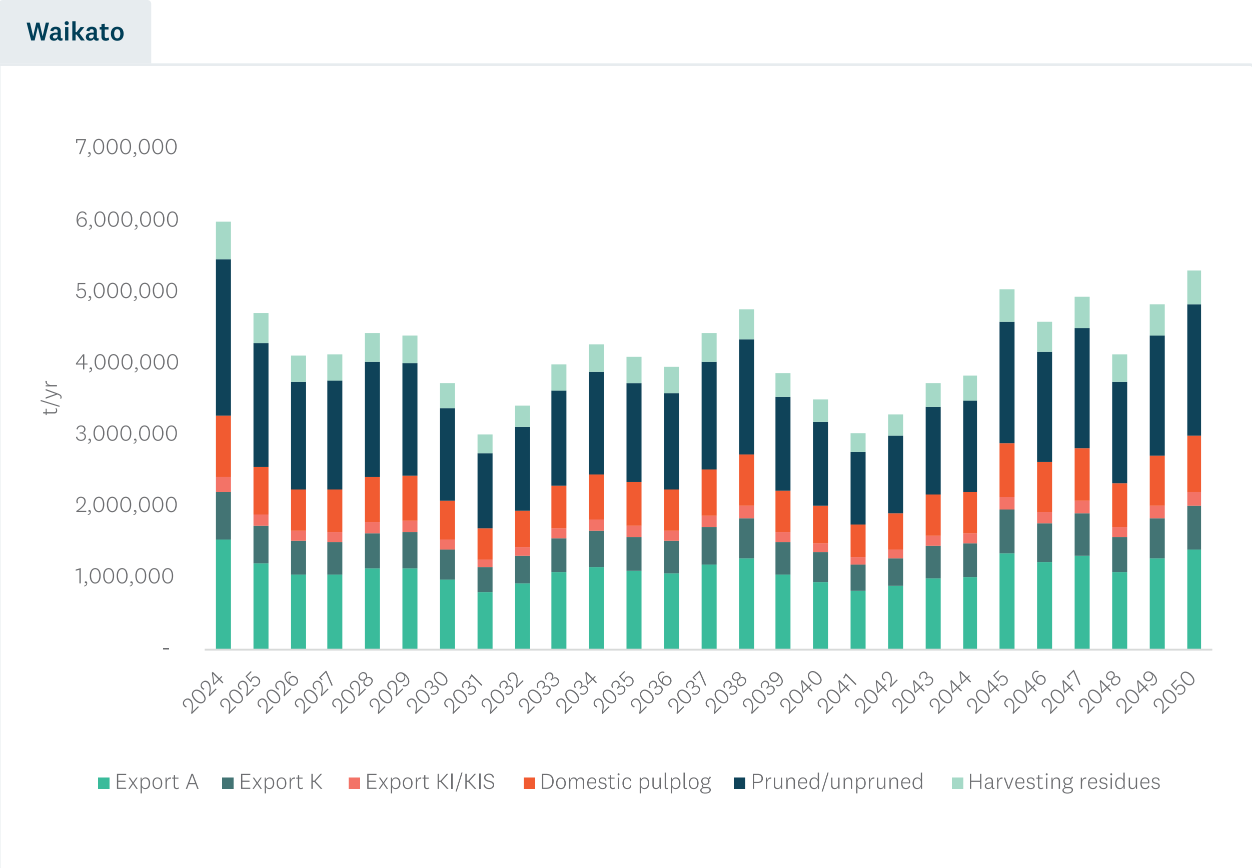


Photo credit: Nature's Flame

8 We use 15 years as a reasonable assessment of the near-term period that process heat users considering biomass would likely want to contract for, if they were making the decision in the next few years.

Figure 8 – Forecast of Waikato wood availability, 2024-2050.



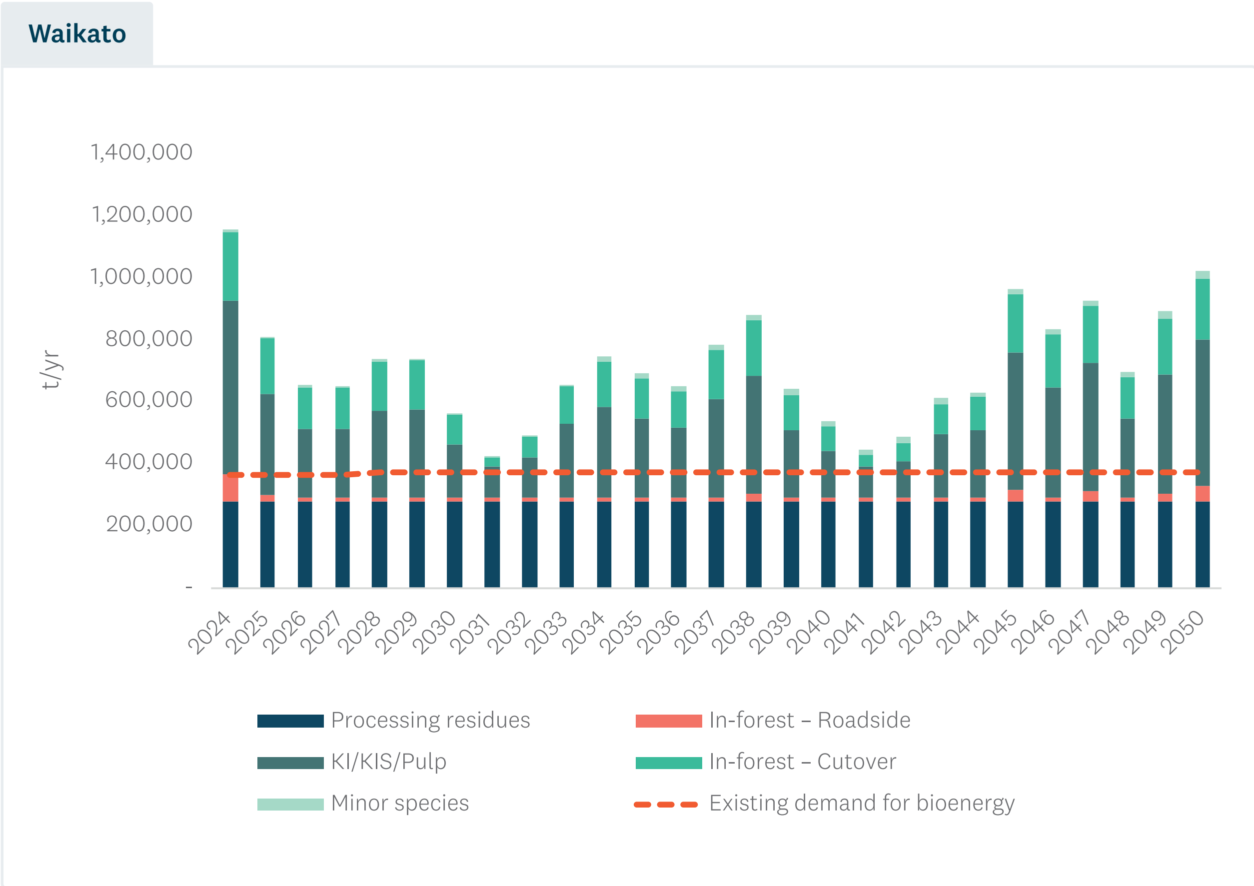
A more comprehensive view of resource availability, that combines the top-down and bottom-up analyses reveals:

- On average, 380kt of harvest residues can be economically recovered. Around 221kt (1,591TJ) per year of roadside residues is currently being recovered and used for the production of pulp (202kt or 1,452TJ) and bioenergy (13kt or 93TJ). The remaining available residues, mainly cutover residues (23kt or 164TJ) are not currently utilised, and could be available for new bioenergy demand.
- Interviews with sawmills suggested that around 601kt (4,313TJ) per year of processing residues are produced. Out of this, 415kt (2,981TJ) per year is woodchip used by Oji[9] and 139kt (995TJ) per year is already used for bioenergy (mainly bark, sawdust and shavings). The remaining 47kt (337 TJ) per year are used for animal bedding or landscaping.
- Another 138kt (991TJ) of processor residues produced on Oji site are used for its own internal bioenergy needs. This implies a total of 739kt (5,304TJ) per year of processing residues (sawmills and pulp mills) are being produced in Waikato.
- On average through to 2038, the K log resources is 485kt (3,486TJ) per annum, the KI/KIS log resource is 150kt (1,074TJ) per year, and the total pulp resource is 615kt (4,417TJ) per year. Out of the total within-region pulp volume, 428kt per year is used by Oji, with the remainder 187kt (1,343TJ pa) of pulp logs is unutilised.
- On average through to 2038, the minor species resource is 9kt (65kt), all of which is currently unutilised.

[9] Note that the impact of Oji ceasing paper production at Kinleith Mill at the end of June 2025 is not included in this analysis.

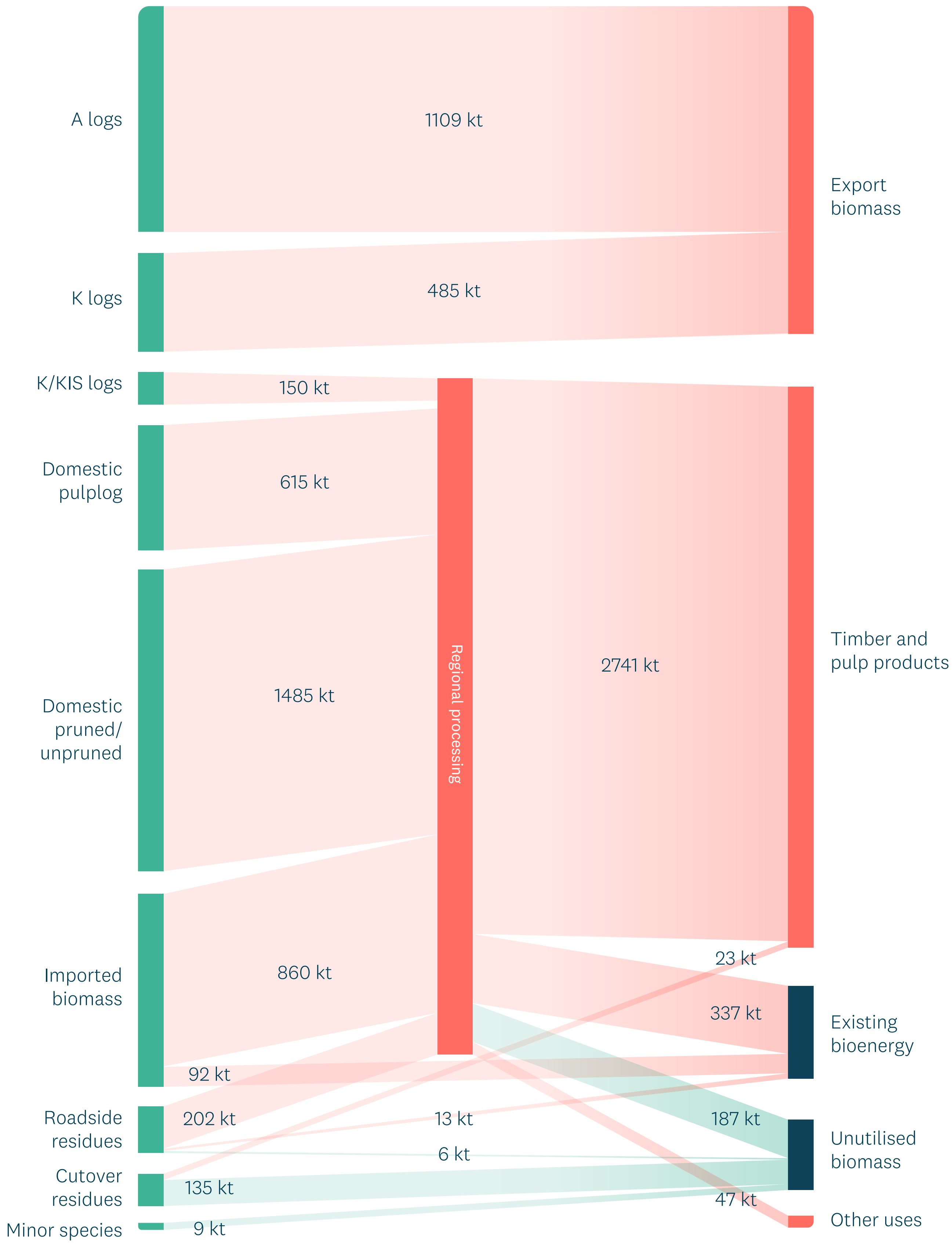
The resulting potential volume for bioenergy is shown in Figure 9.

Figure 9 – Woody biomass available for bioenergy in the Waikato region. Source: Whirika and Margules Groome



The overall analysis of the Waikato region is summarised in Figure 10.

Figure 10 – Average wood flows in the Waikato region, 2024-2038. Source: Whirika and Margules Groome



Overall, EECA estimates that, on average over the next 15 years, **approximately 338kt per year (2,425TJ per year) of woody biomass (cutover, processor residues and pulp) is currently unutilised and could be recovered for new boiler demands without disrupting low grade export markets or existing bioenergy consumers.** However, this average disguises the significant variance in the annual availability shown Figures 8 and 9.

The costs of accessing this biomass, and delivering it to the process heat user's site, is presented in Figure 11.

Figure 11 – Average estimated delivered cost of potential bioenergy sources ($/GJ and $/green tonne). Source: Whirika and Margules Groome.

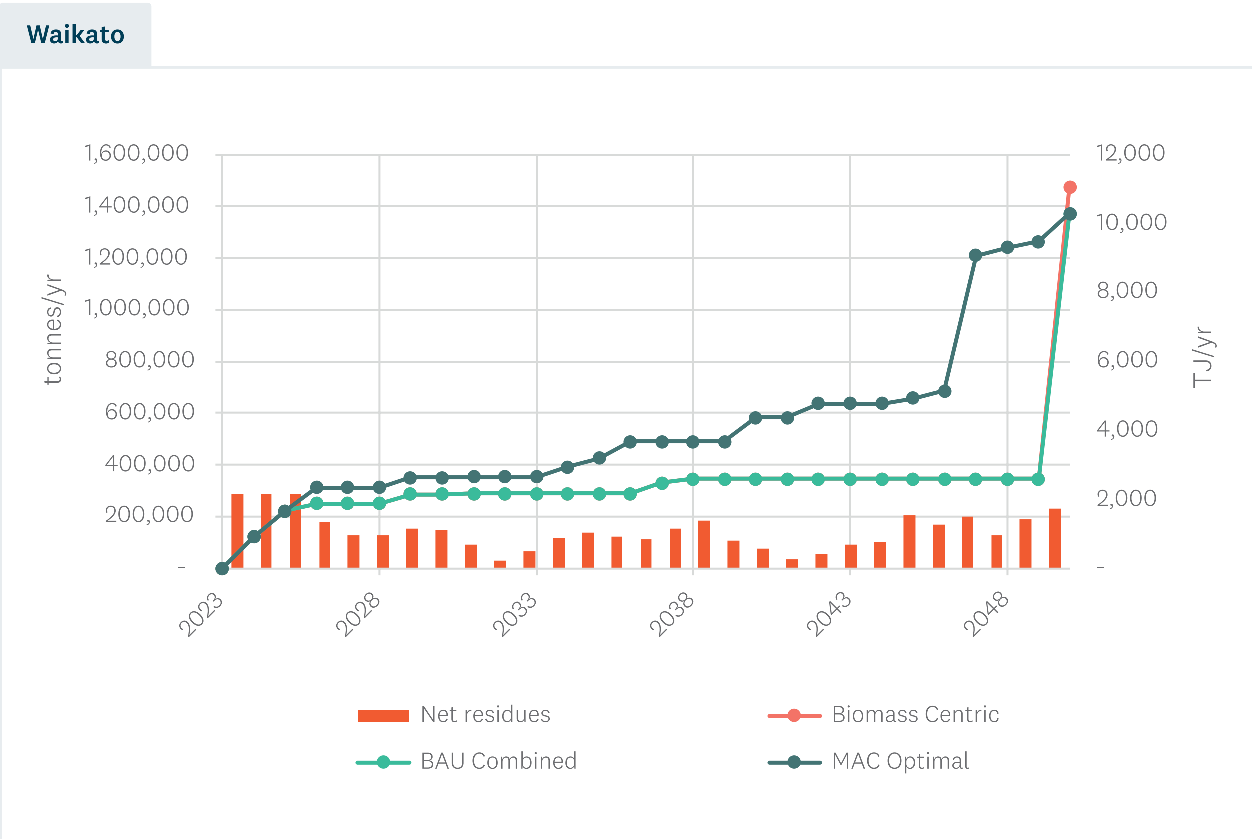
Export grade K and A logs have been retained in the analysis to represent 'scarcity values' if our scenario analysis indicates that other more plausible and sustainable sources of bioenergy are insufficient. However, we do not believe these are sustainable or practical sources of bioenergy.

6.1 Impact of pathways on biomass demand

Our analysis shows the growth in biomass demand (in both tonnes and TJ per year) arising from each of the fuel-switching pathways against the expected available residues (net of existing demand, Figure 12).

Expected harvesting and processor residues are no longer sufficient to meet the MAC Optimal biomass demand from 2025. To meet demand, either more expensive local sources (e.g. diversion of export timber) needs to be used, or biomass needs to be imported from other regions.

Figure 12 – Potential growth in biomass demand and available residues. Source: EECA



The degree to which these resources are used is a commercial decision, which would include a comparison with alternatives in terms of cost, feasibility, and desirability. Depending on the process heat users' preference of fuel type some types of resources may not be suitable. In some situations, higher cost pellets may be required, which in turn require higher-grade raw material.

7 Electricity – network capacity and costs

The availability of electricity to meet the demand from process heat users is largely determined at a national 'wholesale' level. Supply is delivered to an individual site through electricity networks – a transmission network owned by Transpower, and a distribution network, owned by electricity distribution businesses (EDBs), that provides power to individual consumers. The EDBs connect to the transmission network at grid exit points, or GXPs. There are six EDBs serving the Waikato region - Counties Energy, The Lines Company, Powerco, Unison, Waipā Networks and WEL Networks.

The price paid for electricity by a process heat user comprises two main components plus a range of smaller components include metering and regulatory levies. The main components are:

- A price for 'retail electricity' – the wholesale cost of electricity generation plus costs associated with electricity retailing.
- A price for access to the transmission and distribution networks.

As shown in Figure 13, the forecast price of retail electricity (excluding network charges) is expected to increase (in real terms) from 10c/kWh in 2026 to 11.3c/kWh in 2040 under a 'central' scenario. However, different scenarios could see retail prices higher or lower than that level.

Photo credit: Transpower

Figure 13 – Forecast annual average electricity price for large commercial and industrial demand in the Waikato region (real $2022). Source: EnergyLink

Beyond 2040, this forecast sees more significant increases in electricity prices. However, it is difficult to predict pricing out to 2050. Some New Zealand market analyses suggest real prices may remain constant after 2035, due to the downward pressure on generation costs (especially solar and wind) as technology and scale increases. Other analyses see continued increases. We cannot be definitive about electricity prices 20 years into the future and suggest business cases consider a range of scenarios.

On top of retail charges, EDBs charge electricity consumers for the use of the existing distribution network. Relevant EDBs set their distribution charges for large commercial and industrial customers based on the size of the connection (kVA) and peak coincident demand (kW). As such, distribution prices will vary per site. In addition, transmission charges are a combination of capacity (kVA) and average demand (kW) charges. Our modelling approximates these charges for each site.

An approximation of the potential charges faced by process heat users who electrify is presented in Table 5. These are based on each of the EDB's announced prices for the year 2024/2025.

We note that the Commerce Commission's final decision on allowable revenue for EDBs for the period 2025-2030, announced in December 2024, will result in significant increases in network charges. In our modelling, we have assumed increases of around 60% by 2030, over and above the levels in Table 5.

Table 5 – Estimated and normalised network charges for Waikato large industrial process heat consumers, by EDB for April 2024–March 2025 pricing year; $/MVA per year. Source: EECA

EDB	Distribution Charge $/MVA per year	Transmission Charge $/MVA per year	Total Charge $/MVA per year
Powerco	$91,000	$51,000	$142,000
WEL Networks	$141,000	$35,000	$177,000
The Lines Company	$116,000	$59,000	$175,000
Counties Energy	$154,000	$18,000	$173,000
Unison Networks (Taupō)	$52,000	$20,000	$72,000
Vector (Lichfield)	$85,000	$55,000	$140,000
Waipā Network	$157,000	$73,000	$230,000

Finally, where the connection of new electric boilers requires EDBs to invest in distribution network upgrades, the cost of these can be paid through a mix of ongoing network charges, and an up-front 'capital contribution'.

Transpower and the relevant EDBs are experiencing an increasing need for investment as a result of continued population and business growth, distributed generation, and the electrification of transport and process heat. While this RETA analysis only examines demand from process heat electrification, this broader context of potentially rapid growth in demand is important to understand the challenges associated with accommodating new load. The timing of demand growth (that drives this investment) is uncertain, which results in a challenging decision-making environment for network companies. As we recommend below, it is important that process heat users considering electrification keep relevant EDBs abreast of their intentions.

The primary considerations for a process heat user considering electrification are:

- The current 'spare capacity' (or headroom) and security of supply levels in Transpower and EDBs' networks to supply electricity-based process heat conversions.
- The cost of any upgrades required to accommodate the demand of a process heat user, considering seasonality and the user's ability to be flexible with consumption, as well as any other consumers looking to increase electricity demand on that part of the network.
- The timeframe for any network upgrades (e.g. procurement of equipment, requirements for consultation, easements and regulatory approval).
- The price paid for electricity to an electricity retailer (or direct to the wholesale market, for large sites), and any other charges paid by electricity consumers (e.g. use-of-network charges paid to EDBs and Transpower).
- The level of connection 'security' required by the site, including its ability to tolerate any rarely occurring interruptions to supply, and/or the process heat user's ability to shift its demand through time in response to a signal from the network or the market. This flexibility could reduce the cost of connection, and the supply costs of electricity.

For the majority of sites considering electrification, the 'as designed' electrical system can likely connect the site with minor distribution level changes and without the need for substantial infrastructure upgrades. Our estimates suggest most of these minor upgrades would have connection costs under $300,000 and experience connection lead times of less than 6 months.

More substantial upgrades to the distribution network are required for 17 of the sites, with higher costs (up to $20m, dependent on the level of security) and longer lead times (up to 48 months).

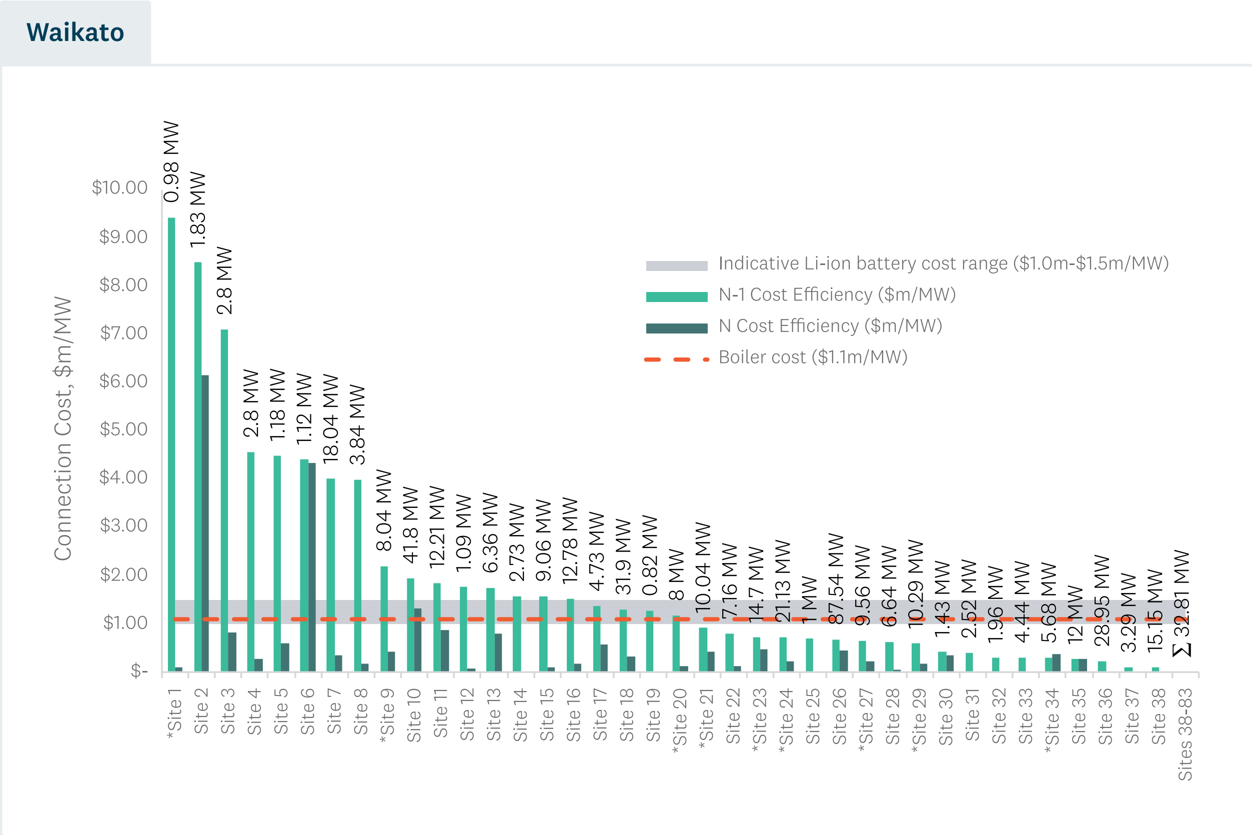
Fourteen sites may require major distribution and transmission upgrades, depending on level of network security required. The cost of the upgrades may reach $80m for one site (which includes a number of stages). These upgrades may take up to 48 months per stage to execute.

The costs of connection can be a significant part of the overall capital cost associated with electrifying process heat demand, and process heat users need to engage with EDBs to discuss connection options and refine the cost estimates we have included in this report.

As highlighted above, a majority of sites considering electrification can be connected to the network at minimal cost. For the remaining sites, Figure 14 shows each site's connection costs expressed in per-MW terms, i.e. relative to the capacity of the proposed boiler. It also shows that there are 22 sites which are likely to have connection costs that are very low.

Photo credit: EMA

Figure 14 – Normalised cost of network connection vs boiler cost, Waikato RETA sites. Source: Ergo, EECA



The red dashed line in Figure 14 compares these per-MW costs to the estimated cost of an electrode boiler ($1.1million per MW). We note that these costs represent the total construction costs of the expected upgrades. The degree to which process heat users need to make capital contributions to these upgrades depends on a variety of factors and needs to be discussed with the relevant EDB.

The timeframes for connection above assume these investments do not require Transpower or the relevant EDB to obtain regulatory approval. We note that if connections also rely on wider upgrades to the network, EDBs would have to seek regulatory approval for these investments, which could also add to the timeline.

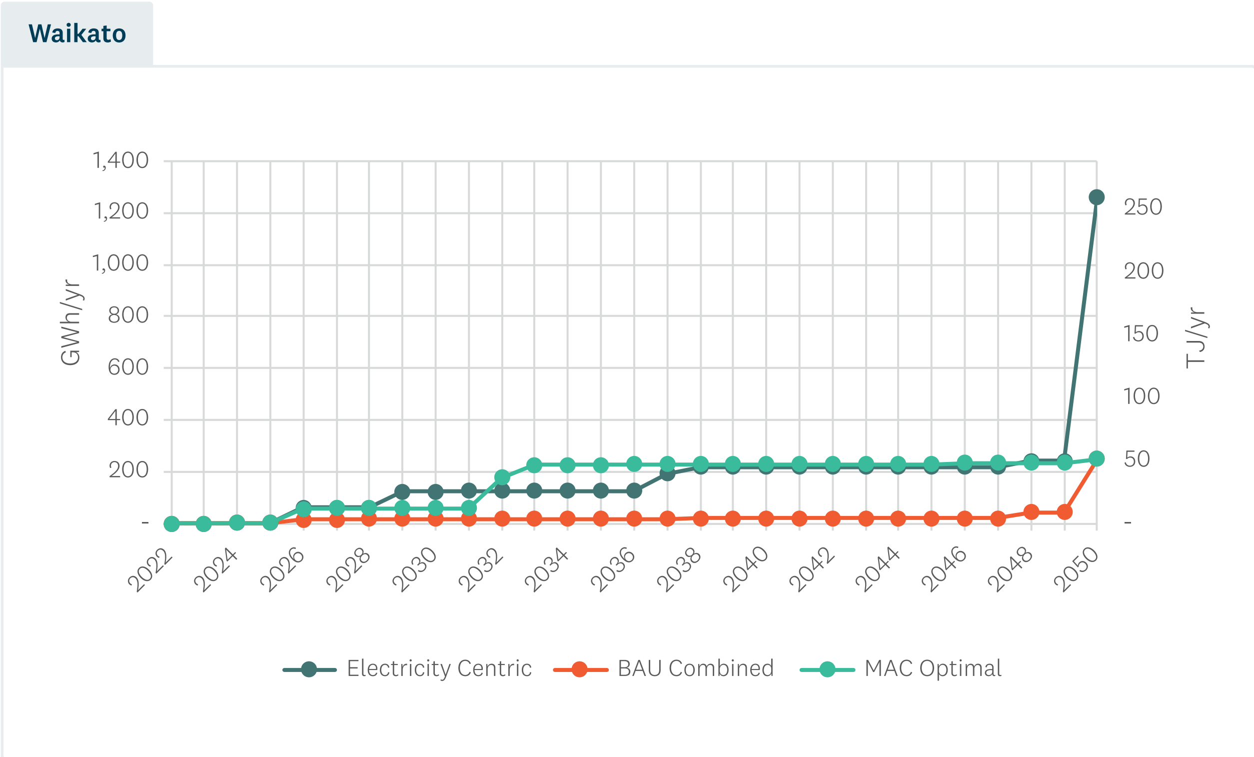
The costs provided above are indicative and appropriate for a screening analysis. They should be further refined in discussion with network owners, and the final costs in some situations will depend on the collective decisions of a number of sites who may require access to similar parts of the network.

Photo credit: Waipā Networks

7.1 Impact of pathways on electricity demand

Figure 15 shows the pace of growth in electricity consumption under the different pathways.

Figure 15 – Growth in electricity consumption from fuel-switching pathways. Source: EECA



The Electricity Centric pathway, where all unconfirmed sites choose electricity, would result in a significant increase in the annual consumption of electricity in the region. Figure 15 shows this occurring in 2050, as that is the assumption made in the pathway, but in reality it is unlikely to occur all at once. In the MAC Optimal pathway, electricity consumption in Waikato would grow by 226GWh (around 4% of today's demand) by 2033. Very little additional investment in electricity as a fuel occurs between 2033 and 2050.

EDB investments will be driven more by increases in peak demand than by growth in consumption over the year. Figure 16 shows how the different pathways affect peak demand across the local network.

Figure 16 – Potential increase in peak electricity demand under fuel-switching pathways. Source: EECA.

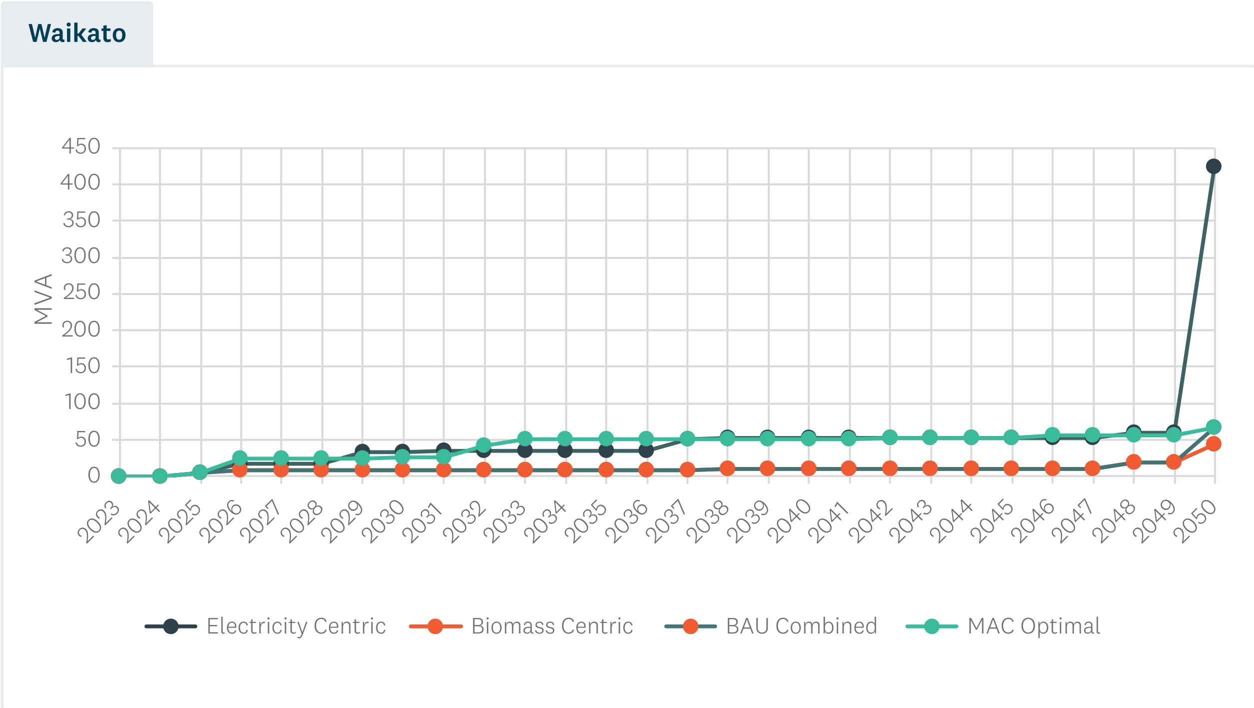


Figure 16 shows that should all unconfirmed process heat users in Waikato convert to electricity (the Electricity Centric pathway), the increase in demands could be significant - an increase in peak demand of 420MVA by 2050 (an increase of 34% compared to today's peak demand) assuming all electricity projects are at peak usage at the same time.[10] However, in the MAC Optimal pathway, the increase would only be 68MW (5%), most of which would occur by 2026.

[10] This chart shows the cumulative increase in peak demand assuming all electricity projects peak at the same time. The main report discusses a more realistic view which considers the natural diversity between process heat users in terms of when each is likely to peak. This results in a slightly lower peak demand requirement from the networks.

EDBs are responsible for any upgrades required to accommodate process heat users who electrify. Table 6 breaks down these costs under the two pathways.

Table 6 – New connections (MW) and customer-driven connection costs under Electricity Centric and MAC Optimal pathways.

EDB	Electricity Centric pathway		MAC Optimal pathway	
	Connection capacity (MW)	Connection cost ($m)	Connection capacity (MW)	Connection cost ($m)*
Powerco	72.1	$106.3	11.6	$2.4
WEL Networks	182.0	$80.8	21.4	$6.0
The Lines Company	39.9	$51.2	5.3	$19.0
Counties Energy	40.4	$4.2	6.2	$0.2
Unison Networks Limited	4.3	$0.5	1.8	$0.0
Waipā Networks Limited	54.4	$55.8	5.6	$0.3
Vector	31.2	$20.9	15.8	$3.5
Total	**424.2**	**$319.60**	**67.7**	**$31.31**

Up to $320m will be spent connecting new process heat plant to the local networks, depending on the pathway.

Table 6 may not necessarily reflect the connection costs paid by process heat users, as they may be shared between the relevant EDB and the new process heat user. The degree of sharing of capital contributions to upgrades depends on the policies of individual EDBs.

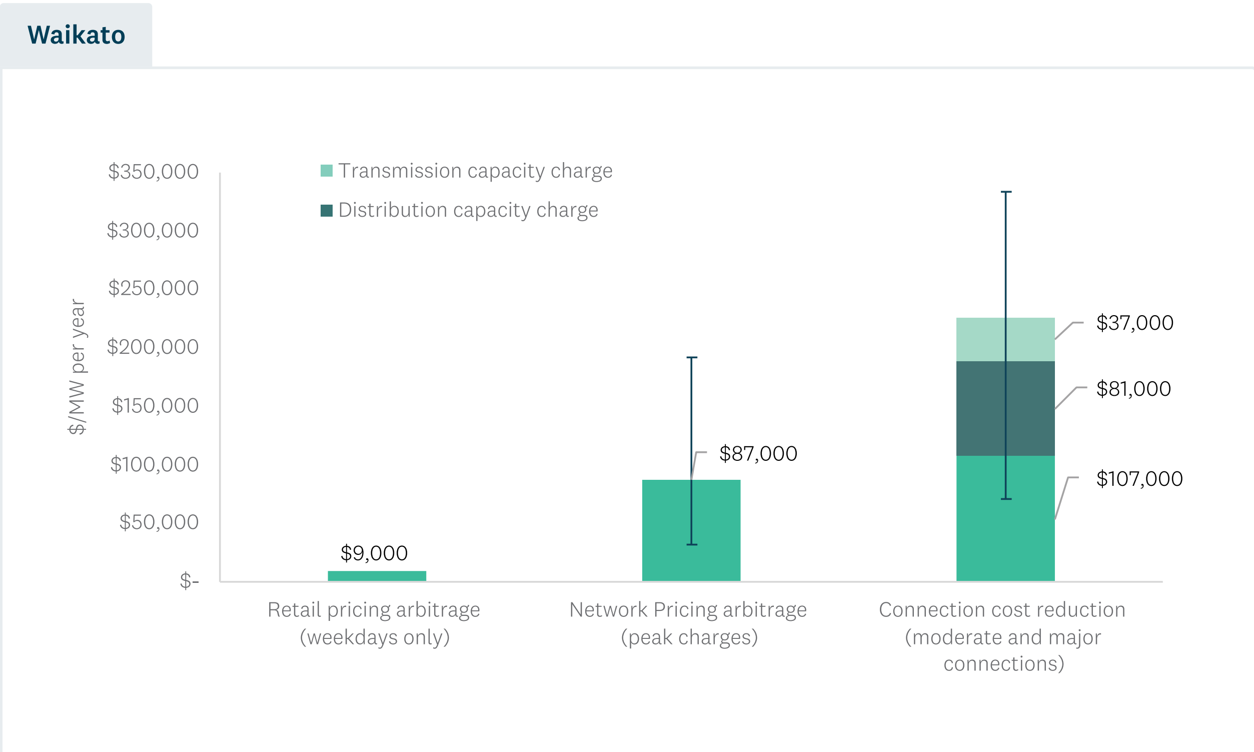
7.2 Opportunity to reduce electricity-related costs through flexibility

Process heat flexibility can improve system resilience and reduce both electricity system costs and process heat electricity-related costs.

Analysis was carried out to illustrate the potential cost savings associated with enabling flexibility in process heat demands.

As shown in Figure 17, Waikato process heat users could potentially reduce their electricity procurement costs by up to $96,000 per MW of flexibility deployed every year. In addition, at the planning stage, they could also reduce costs associated with the size of their connection to the electricity network, both the investment required in the physical connection and any network charges from the relevant EDB that relate to the size of the connection.

Figure 17 – Estimates of the value of flexibility in Waikato RETA. Source: EECA
Note: The error bars indicate the 10th and 90th percentile values calculated across the different projects.



Some process heat users may find it challenging to alter their underlying process to achieve this. Even then, onsite batteries could be used to extract these cost savings. Over a 20-year timeframe, the cost savings above could be sufficient to underwrite an investment in a battery. Onsite battery storage also provides extra resilience in network failure scenarios. EECA is working with process heat users to better understand the value streams associated with batteries that are integrated into their electrification plans.

8 Recommendations

Our analysis has highlighted a range of opportunities and recommendations which would improve the overall process heat fuel-switching ‘system’. These recommendations are summarised here.

Recommendations to improve the use of biomass for process heat fuel-switching:

- Although information is improving as a result of the RETA programme , there may still be opportunities to refine the understanding of residue costs, volumes, energy content (given the potential susceptibility of these residues to high moisture levels) and alternative methods of recovering harvesting residues.
- Work should be undertaken with forest owners to understand the logistics, space and equipment required for harvesting residues.
- The development of an ‘energy- grade’, or E-grade would greatly assist in the development of bioenergy markets. Further, clarity regarding the grade and value of biomass should help the development of an ‘integrated model’ of cost recovery, achieving the best outcomes in terms of recovery cost and volumes.
- Investigate and establish mechanisms to help suppliers and consumers within and outside the region to see biomass prices and volumes being traded and have confidence in being able to transact at those prices for the volumes they require. These mechanisms could include standardised contracts which allow longer-term prices to be discovered, and risks to be managed more effectively. The analysis for Waikato showed that the cost of biomass can significantly affect investment decisions; given the significant potential demand for biomass relative to available residues in the region (processing and harvest), process heat users would benefit from a mechanism that could help identify opportunities for inter-regional trade of biomass resources.
- EECA to collaborate with process heat users to develop their biomass options.
- National guidance or standards should be developed, based on international experience tailored to the New Zealand context regarding the sustainability of different bioenergy sources, accounting for international supply chain effects, biodiversity, carbon sequestration and the risk of forest fires.
- Undertake research into the likely competing demands for wood fibre from other emerging markets, such as biofuels and wood-derived chemicals.

Recommendations to improve the use of electricity for process heat fuel-switching:

- EDBs to proactively engage on process heat initiatives to understand intentions and help process heat users obtain a greater understanding of required network upgrades, cost, security levels, possibilities for acceleration, use of system charges and network loss factors. EDBs should ensure Transpower and other stakeholders (as necessary) are aware of information relevant to their planning at an early stage especially since, in Waikato, several GXPs may need to be upgraded as a result of process heat user decisions.

- Process heat users to proactively engage with EDBs, keeping them abreast of their plans with respect to fuel-switching, and providing them with the best information available on the nature of their electricity demand over time (baseload and varying components); the flexibility in their heat requirements, which may allow them to shift/reduce demand, potentially at short notice in response to system or market conditions; the level of security they need as part of their manufacturing process, including their tolerance for interruption; and any spare capacity the process heat user has onsite. While the costs associated with network connection used in this report have been estimated based on the best publicly available information available to us, when process heat users provide the information above, it will allow EDBs to provide more tailored options and cost estimates.
- EDBs to develop and publish clear processes for how they will handle connection requests in a timely fashion, opportunities for electrified process heat users to contract for lower security, and how costs will be calculated and charged, especially where upgrades may be accommodating multiple new parties (who may be connecting at different times).
- To support this early engagement, EDBs to explore, in consultation with process heat users and EECA, the development of a 'connection feasibility information template' as an early step in the connection process. This template would include a section for process heat users to provide key information to EDBs, and a network section where EDBs provide high-level options for the connection of the process heat user's new demand. Information provided by EDBs would include the potential implications of each option for construction lead times, capital contributions, network tariffs and the use of the customer's flexibility.
- Retailers, flexibility aggregators, EDBs and the Electricity Authority should assist by sharing information that helps process heat consumers model the benefits of providing flexibility.
- The electricity sector and process heat users should collaborate to explore and demonstrate flexibility. This is consistent with steps in the FlexForum's Flexibility Plan.
- EDBs and retailers should ensure that the tariffs they offer process heat users are incentivising the right behaviour.
- EECA to work with process heat users to better understand the value and operability associated with batteries that are integrated into their electrification plans.

Recommendations to assist process heat users with their fuel-switching decisions:

- EECA to work with the Treasury and Ministries (such as Ministry for the Environment) to create an easily accessible centralised portal that publishes up-to-date carbon price assumptions and scenarios that are used to guide policy and regulatory decisions, e.g. Treasury's shadow carbon prices used for cost-benefit analysis, Treasury's ETS price assumptions for fiscal forecasting etc.

March 2025

Government Leadership

Regional Energy Transition Accelerator (RETA)

Waikato – Summary Report

TE TARI TIAKI PŪNGAO
ENERGY EFFICIENCY & CONSERVATION AUTHORITY