Part A: Encouraging energy efficiency and the uptake of renewable fuels in industry

This part has six sections. It seeks your views on options to:

- Address information failures and information asymmetries between industry and other stakeholders (Section 1).
- Develop biomass markets and the direct use of geothermal energy (Section 2).
- Encourage industrial innovation, de-risking technology and building capability (Section 3).
- Phase out fossil fuels in process heat (Section 4).
- Accelerate investment in energy efficiency and renewable energy technologies (Section 5).
- Introduce a levy on consumers of coal to fund administration of industrial energy efficiency and renewable fuel programmes (Section 6).

Opportunities for the Government to support greater energy efficiency in the electricity market are covered in Section 8 of Part B.

Introduction

Why is process heat important?

Process heat refers to thermal energy (heat) used to manufacture products in industry. The industrial sector is an important contributor to the New Zealand economy. Output accounts for around 10 per cent of real GDP and the sector employs around 11 per cent of the labour force. About 60 per cent of process heat is supplied using fossil fuels (mainly gas and coal) and it contributes 8 per cent of New Zealand's emissions.

Changing how the industrial sector uses energy will be a crucial component in our transition to a productive, low emissions economy. The ICCC's analysis shows that it is technically feasible to reduce industrial emissions by 2.6 Mt CO_2-e per year by 2035 through energy efficiency and electrification of low and medium temperature process heat.

Further emission reductions are possible from increasing the energy productivity of the industrial sector, and through further utilisation of biomass and the direct use of geothermal energy.

Early actions in the sector will help provide certainty for investment, and avoid abrupt, high cost transitions later. Raising energy productivity will help businesses reduce energy costs and optimise production processes. It also reduces their exposure to energy and carbon cost volatility, enabling business to more effectively manage risk.

What are the opportunities to reduce emissions from process heat?

The economics of emissions reductions in process heat are complex and can vary widely from site to site. The key factors affecting the choice of energy input are the specific process and temperature requirements, site location and availability of fuel (including transport costs and access to transmission or distribution networks), relative fuel costs, and whether investment is in a new site (greenfield) or an existing site (brownfield).

There are cost-effective, near-term measures to reduce industrial emissions, but complete decarbonisation is challenging. Efforts from industry and government will require pursuing a combination of short, medium-term and longer-term opportunities.

Short term options

In the short term, key opportunities include energy efficiency (such as waste heat recovery and better energy management) deploying heat pumps for water and space heating, using mechanical vapour recompression technology (MVR),[8] and co-firing coal boilers with biomass where biomass is readily available. These opportunities lie in the food manufacturing and government sectors,[9] such as health and education. The food processing sector currently accounts for around 31 per cent of energy emissions in the industrial sector; this is predominantly from dairy and meat processing. Up to 40 per cent of emissions in the food processing sector can be abated cost-effectively at current carbon prices.[10]

There is also an opportunity to make greater use of bioenergy in cement production and wood processing. Cement and wood processing sectors account for six per cent of energy emissions.

Medium term options

In the medium term, it is expected that a rising carbon price will unlock a large number of coal-to-bioenergy and some coal-to-electricity opportunities and could encourage the early retirement of some coal heat plants.

Biomass and electricity may already be cost-competitive with natural gas for some greenfield sites with low temperature heat applications, and depending on future gas and carbon price trends, they could also compete with natural gas for medium temperature applications.

Energy used to produce methanol, urea, refining, aluminium and steel makes up 51 per cent of energy emissions in the industrial sector. Near-complete decarbonisation of these emissions-intensive and highly integrated (EIHI) industries[11] (which have high temperature requirements) has much greater abatement costs and technical challenges. However, new technologies being developed overseas show promise and New Zealand could benefit by staying abreast of these developments.

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[8] Mechanical vapour recompression (MVR) is already widely used by New Zealand's dairy sector as it is an extremely efficient way of evaporating water from milk. The opportunity is to deploy more advanced MVR to further increase its use in the dairy industry, and other industries that need to evaporate water.

[9] Appendix 1 outlines the actions the government is taking to reduce emissions.

[10] University of Waikato (2019). *Options to reduce New Zealand's process heat emissions*. Commissioned by MBIE, MfE and EECA, https://www.eeca.govt.nz/resources-and-tools/research-publications-and-resources/business-publications-and-resources/

[11] These industries are also characterised as being single-plant and highly process heat-intensive. For this category, there are typically only limited opportunities to switch to different technologies without re-building the plant. There are, however, operational energy efficiency improvement opportunities within strategic energy management, operations and maintenance practices. The industries with in-built technologies tend to produce globally-traded commodities and are considered at risk of emissions leakage under NZ-ETS.

As well as reducing emissions from existing industrial sites, transitioning to a low-emissions economy might also involve optimising the use of emissions-intensive products, and substituting for lower emission products and materials. As part of its Building System Legislative Reform Programme, MBIE has identified some options to address drivers of risk aversion in the consenting process, which can inhibit innovative (including low-emissions) building products.

Case study: Food processing – electrification and energy efficiency[12]

As Ashburton Meat Processors (AMP) looked to replace its heating and refrigeration systems it also sought to electrify its energy sources to significantly reduce its carbon footprint.

The business worked with Christchurch firm Active Refrigeration to replace its refrigeration and heating systems with a new ammonia based heat pump. The new system provides simultaneous cooling and high temperature heating, offering a significant step-change in efficiency. The switch not only reduced emissions but also generated annual savings of over $200,000. The plant has been able to comfortably provide increased capacity and has reduced overall emissions by 42 per cent.

Why might policies be needed in addition to the Emissions Trading Scheme?

The decarbonisation of our energy system will be critical to achieving our climate change goals. Lowest cost abatement driven by the NZ-ETS may result in a heavy reliance on forestry and the purchasing of overseas ETS units in the short-medium term. The Government has choices about investing in the domestic transition rather than offsetting emissions. This may have additional benefits of economic development, employment and strengthening New Zealand's balance of payments.

As noted above, the NZ-ETS is the key mechanism for reducing energy emissions. The ICCC estimates that switching away from coal to electricity or biomass at scale will become economic with emissions prices in the range of $60-$120/t CO_2-e. Switching away from natural gas starts to become economic only above $120/t CO_2-e.

In many cases, market failures and barriers persist and reduce the effectiveness of the NZ-ETS. These barriers were identified in the Technical Paper *Process Heat in New Zealand: Opportunities and barriers to lowering emissions* [13]. Complementary measures can help to create and deploy mitigation technologies and support behaviour change in industry. In the energy sector, due to the presence of multiple energy efficiency barriers, a package of measures might be needed.

The following sections identify and seek your feedback on options to address each of the key market barriers identified in the Technical Paper. The sections, barriers and options are outlined in **Table 2** below.

[12] https://www.eecabusiness.govt.nz/resources-and-tools/case-studies/active-refrigeration/

[13] For further information on these barriers, please consult our technical paper: https://www.mbie.govt.nz/dmsdocument/4292-process-heat-in-new-zealand-opportunities-and-barriers-to-lowering-emissions

- Options in Sections 1-3 and 6 are government policy proposals, as there are minimal interdependencies or potential for negative interactions with the NZ-ETS. As such, they could be introduced immediately to support the transition in industry.
- The discussion in Sections 4 and 5 involves measures that have a greater potential to interact with the carbon price. Final government decisions to address the issues raised in these sections need to be considered alongside forthcoming broader government decisions on NZ-ETS settings, the role of complementary measures and the pace and pathways of domestic emissions required to meet the country's emission reduction target. As such, we are seeking feedback and gathering further information from stakeholders on the types of levers that could be used, and level of effort required to meet our emission reduction targets, rather than consulting on preferred options or policy proposals.

Table 2: Barriers and options for encouraging energy efficiency and renewable energy in industry

	Barriers / issue	Option
Section 1	Lack of accurate information on the emissions performance of firms or products. Information gap on the issues, costs, reliability, and process for the electrification of industrial sites. Some entities have poor information about their energy use and emissions.	**1.1** Require large energy users to publish Corporate Energy Transition Plans (including reporting emissions) and conduct energy audits. **1.2** Develop an electrification information package for businesses looking to electrify process heat, and offer co-funded low-emissions heating feasibility studies for EECA's Large Energy User partners. **1.3** Provide benchmarking information for food processing industries.
Section 2	Under-developed supply chains for bioenergy and the availability of bioenergy and geothermal resources regionally.	**2.1** Development of a users' guide on the application of the National Environmental Standards for Air Quality to wood energy.
Section 3	Firms tend to be risk averse to technologies that change or could delay their production process, and process engineers may not be familiar with new technologies.	**3.1** Expand EECA's grants for technology diffusion and capability-building. **3.2** Collaborate with EIHI industry to foster knowledge sharing, develop sectoral low-carbon roadmaps and build capability for the future using a Just Transitions approach.
Section 4	Risk of locking in new long-lived emissions-intensive heat plant. Reluctance to replace legacy fossil fuel facilities before the end of their technical lives (both power plants and industrial facilities).	**4.1** Introduce a ban on new coal-fired boilers for low and medium temperature requirements. **4.2** Require existing coal-fired process heat equipment supplying end-use temperature requirements below 100°C to be phased out by 2030.
Section 5	Competition for capital leading to prioritisation of core business spending and an underinvestment in energy efficiency and renewable energy technologies in the industrial sector.	**5.1** No new options proposed at this time.

Section 6	In order to mobilise private-sector investment and scale up efforts to achieve the Government's process heat outcomes, additional funds will be required to resource implementation of some of the policy proposals.	**6.1** Introduce a levy on consumers of coal to fund process heat activities.

How we are assessing options

In line with the Government's goals for a net zero emissions economy by 2050 and aspirational goal of 100 per cent renewable electricity by 2035 (subject to assessments relating to affordability and security), our high level criteria for assessing options is:

1. **Does the option have an impact on greenhouse gas emissions** (does it reduce emissions in an economically efficient way, is it complementary to the NZ-ETS, how much emissions reduction is expected?)

In addition to these high-level criteria, we have provided a preliminary assessment of the costs and benefits of options (where relevant) against the following sub-criteria:

2. **Wider economic effects** – impact the option has in terms of wider economic costs and benefits, such as:
    a. **Productivity impacts** – indicating if there is any positive or negative impact on productivity.
    b. **Distributional impacts –** indicating if any population groups are likely to be disproportionately impacted by the proposal e.g. rural communities, regions, workers, consumers, Māori/iwi, noting that Government will have choices to about how to mitigate these impacts.
    c. **Innovation and uptake of new technologies –** indicating to what extent the option future-proofs the energy system, and incentivises innovation and uptake of new technologies.
    d. **Health and environmental benefits and costs, e**.g., warmer homes, air quality, biodiversity
3. **Administrative and compliance costs –** impact the option has in relation to:
    e. **Administrative costs** – costs to government of delivering option
    f. **Compliance costs** – whether businesses are likely to face additional costs from options.

Analysis of options addresses these sub-criteria if (and only if) there is a non-negligible impact. For example, where no distributional impacts or effects on innovation have been identified, these sub-criteria are not noted under the option analysis.

However, the costs and benefits of each option have not yet been analysed in detail. One of the objectives of the consultation is to seek feedback from stakeholders on the likely benefits and costs, including the compliance costs on individual businesses affected by an option. Questions at the end of each section are intended to be prompts in this regard.

Section 1: Addressing Information Failures

This section explains the issues relating to information failures and asymmetries and seeks your views on options to:

- Require large energy users to publish Corporate Energy Transition Plans (including reporting emissions annually), and conduct energy audits every four years
- Develop an electrification information package for businesses looking to electrify process heat, and offer co-funded low-emissions heating feasibility studies for EECA's business partners, and
- Provide benchmarking information for food processing industries.

What's the problem?

This section responds to the following recommendations from:

- the Productivity Commission's *Low Emissions Economy* report*:*

  14.2. MBIE and EECA should review targets relating to industrial emissions reductions to determine whether a reduction in excess of that already forecast would be more helpful in driving emissions reductions.

  14.3. MBIE and EECA should review existing initiatives related to information about fuel switching, co-firing, demand reduction and efficiency improvements for process heat, to minimise any information-related barriers to mitigation opportunities.

- the ICCC's *Accelerated Electrification* report:

  3a. Deterring the development of new fossil fuels in process heat.

  3b. Setting a clearly defined timetable to phase out fossil fuels in existing process heat, with coal as the priority.

  3c. Reducing regulatory barriers to electrification.

There is a lack of accurate information available to the public, investors and the Government on the emissions performance of firms or products. This information asymmetry limits the ability to assess appropriate policy responses to meet our climate change and economic objectives in a fair and cost-effective manner.

Some entities have poor information about their energy use and emissions. There can be a lack of visibility of the costs and benefits of energy efficiency and emissions reduction projects by senior managers and directors. Energy is often managed at facility level where energy efficiency opportunities are measured in energy units rather than as sources of emission reductions, cost savings or productivity benefits.

These barriers compound so that investments that reduce energy emissions are undervalued relative to other investment options and are not prioritised.

An analysis of voluntary corporate reporting by the McGuinness Institute since 2017[14], including reporting by Climate Change Leaders' Coalition businesses, has found that there is currently a low

[14] See July 2018, Working Paper 2018/03, McGuinness Institute, Analysis of Climate Change Reporting in the Public and Private Sectors.

level of disclosure of climate-related information, and a lack of clarity of where and how information will be reported in the future, or what guidance or standards might be adopted.

What are the options?

To address these issues, we seek feedback on options to:

- Require large energy users to publish Corporate Energy Transition Plans (including reporting emissions annually) and conduct energy audits every four years;
- Develop an electrification information package for businesses looking to electrify process heat, and offer co-funded electrification feasibility studies for EECA's business partners and;
- Provide benchmarking information for food processing industries.

Corporate energy transition plans

Option 1.1	Require large energy users to publish Corporate Energy Transition Plans (including reporting emissions) and conduct energy audits

Description

This option would introduce a comprehensive procedural requirement for the largest[15] energy using businesses to publicly report energy use and emissions, carry out periodic energy and emissions audits, and publish their plans and strategies to reduce emissions to 2030. The key elements of this option are outlined in Table 3 below.

This option builds on schemes that have been implemented in Australia, the United Kingdom and across Europe.[16] An example of how this could look in New Zealand is outlined in the table below.

Table 3: Proposed requirements for Corporate Energy Transition Plans

Target group	Annual energy spend (purchased) of greater than $2 million per annum
Public reporting	Annual corporate-level energy use and emissions, split out by a range of sources including coal, gas, electricity and transport Energy efficiency actions taken that year Plans to reduce emissions to 2030
Government reporting	Businesses annually report to the Government a defined intensity metric (e.g. specific energy consumption/product emissions intensity), by plant/process. This information will be treated in confidence for statistical and policy purposes
Energy auditing	Mandatory energy auditing every four years with Boards required to review the findings

[15] We propose that largest is defined as businesses with an annual energy spend of greater than $2 million per annum. We estimate around 200 businesses would fall within scope.
[16] Australia's Energy Efficiency Opportunities (EEO) programme, the UK's Streamlined Carbon and Energy Reporting Scheme (SECR) and the Energy Savings Opportunity Scheme (ESOS), the EU's Energy Efficiency Directive (energy audits) and energy management programmes.

Compliance	Public information to be included in annual reports or in separate "corporate energy transition plan" on website Energy audits meet the government's guidelines or the company is ISO 50001 certified Boards required to review the energy audits findings and report compliance to a national scheme administrator

Analysis

Initial analysis of this proposal suggests Corporate Energy Transition Plans may accelerate the adoption of energy saving and emission reducing technologies in response to greater visibility, transparency and accountability on energy use and emissions impact.

We consider the benefits of this option (some of which would be difficult to quantify) include:

- **Businesses**: (large energy users covered by the proposal): Senior management and boards will have better information on the value of energy opportunities available to them. It should generate an increased focus on energy use and emissions. Senior management and boards are required to sign off the reporting.
- **Shareholders and investors**: Improved transparency will provide greater assurance that businesses are actively assessing, managing and disclosing climate-related risks, and taking steps to reduce their exposure to carbon costs where practicable.
- **Government**: It will enable more accurate statistical reporting, evidence-based policy-making, including informing the development of emissions budgets, and assessment of the effectiveness of existing policies.
- **Energy stakeholders:** The plans could outline businesses' plans for electrification of their sites, which would help Transpower and distributors inform the development of transmission and distribution grids and in planning for new connections.
- **The public**: Improved transparency will enhance public confidence that the largest emitting businesses operating in New Zealand are actively taking responsibility for managing their emissions. This could also increase reputational drivers on the targeted entities as improved transparency will more accurately inform public perceptions of climate change action.

The compliance costs of this proposal will vary according to the extent to which individual businesses have already conducted, and have processes in place for, measurement, reporting and energy audit activities. The compliance costs are not expected to be significant for large energy users. Compliance costs would be composed of:

- **One-off costs**: time spent at the outset on understanding requirements of the scheme, time spent determining any structural issues with compliance e.g. legal structure, and any incremental metering and software costs.
- **Ongoing costs**:
  - incremental annual costs of gathering and collating energy consumption data, record keeping
  - reporting for senior officer sign off, boardroom director sign-off and any extra costs of preparing annual reports
  - energy audit cost every four years (internal or external)
  - undertaking internal quality assurance
  - annual notification of compliance
  - external verification or compliance auditing by the regulator.

There will also be costs to government in establishing the scheme, and in monitoring and compliance activities.

This option is currently our preferred means of encouraging emitters to plan a transition to a low emissions economy. While gathering information is compulsory, the proposal increases transparency and enables firms to plan and act according to their specific circumstance.

It is preferred over the following status quo activities:

- Many large energy users already publish, or have made commitment to publish their emissions and plans to transition. There is no intention to encourage business to reduce the level of information they supply. Rather it aims to create a common format and give others (such as the public, value chain businesses and the government) information they need to make more informed decisions.
- EECA co-funds and undertakes energy audits for its Large Energy User clients. However opportunities are likely to remain unidentified as coverage of the largest energy users is not complete, audits are not undertaken on a regular basis, and – depending on the type of audit undertaken – may only cover a small segment of energy use.

Other options we considered but do not favour was to introduce individual components of the CTPs as standalone requirements (annual public emissions reporting only, or four-yearly energy audits only, etc.). Individual elements on their own will help to address discrete information barriers, but are unlikely to be sufficient to unlock energy efficiency opportunities on their own. Individual components would not provide a strategic and corporate prioritisation of energy efficiency, which evidence shows, is best practice.[17]

Related information disclosure requirements

Two other complementary information disclosure requirements have been recently introduced or are underway.

The Government is making changes to make the NZ-ETS18 more transparent to participants and the public through publishing emissions and removals data at the level of individual participants. This will allow for greater understanding of the scheme by the public and allow all participants to have access to the same level of data on which to base their decisions. Some large energy users covered by a Corporate Energy Transition plan option will be NZ-ETS participants. However in the NZ-ETS, most industrial energy users report only their non-energy process emissions. Energy emissions are reported further upstream by producers or importers of fossil fuels rather than users. This does not provide granular information on energy use and emissions at the site, process, and product level.

MBIE and the Ministry for the Environment (MfE) released a discussion document on 31 October 2019 about climate-related financial disclosures.19 Submissions will close on 13 December.

It proposes the introduction of a mandatory (comply-or-explain) disclosure regime for NZX listed issuers, banks, general insurers, asset managers and asset owners. The objective is to move to a position where the effects of climate change on businesses become routinely considered in business and investment decisions.

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[17] IEA (2012). Policy Pathway – Energy Management Programmes for Industry, https://webstore.iea.org/policy-pathway-energy-management-programmes-for-industry

[18] Further information available at https://www.mfe.govt.nz/climate-change/proposed-improvements-nz-ets

[19] *Climate-related Financial Disclosures – Understanding your business risks and opportunities related to climate change*, October 2019, https://www.mbie.govt.nz/have-your-say/climate-related-financial-disclosures/

In the event that a business has emissions reporting requirements under both proposals, the means of compliance would be the same (i.e. annual reports).Under these proposals, entities would be required to disclose information in their annual reports about the risks and opportunities to their businesses that are presented by climate change. The disclosures would need to comply with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD).20 Non-disclosure would only be permissible on the basis of the entity's analysed and reported conclusion that they see themselves as not being materially affected by climate change, with an explanation as to why.

The requirements of each proposal are largely targeted at different types of business organisations. The only overlap would appear to be large energy users that are also NZX listed issuers. The only TCFD disclosures that would appear to overlap with the proposals contained in this discussion document relate to:

- Disclosures on Scope 1, Scope 2 and, if appropriate Scope 3 GHG emissions, and the related risks
- The targets used by the organisation to manage climate-related risks and opportunities, and performance against those targets.

Questions

Q1.1	Do you support the proposal in whole or in part to require large energy users to report their emissions and energy use annually publish Corporate Energy Transition Plans and conduct energy audits every four years? Why?
Q1.2	Which parts (set out in Table 3) do you support or not? What public reporting requirements (listed in Table 3) should be disclosed?
Q1.3	In your view, should the covered businesses include transport energy and emissions in these requirements?
Q1.4	**For manufacturers**: what will be the impact on your business to comply with the requirements? Please provide specific cost estimates if possible.
Q1.5	In your view, what would be an appropriate threshold to define 'large energy users'?
Q1.6	Is there any potential for unnecessary duplication under these proposals and the TCFD disclosures proposed in the MBIE-MfE discussion document on Climate-related Financial Disclosures?

Electrification information package and feasibility studies

Option 1.2	Develop an electrification information package for businesses looking to electrify process heat, and offer EECA's business partners co-funded low-emission heating feasibility studies

[20] *Recommendations of the Task Force on Climate-related Financial Disclosures*, June 2017, p.14, https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-2017-TCFD-Report-11052018.pdf

Description

There were diverse, disparate and sometimes conflicting views from submitters on the Technical Paper *Process Heat in New Zealand: Opportunities and barriers to lower emissions* on the issues, costs and processes relating to electrification.

This option involves a package that could be jointly developed by the Electricity Authority, Transpower, MBIE and EECA to address information-related barriers to electrification. For example, on reliability, resilience, and the process and costs for deploying electrification technologies and on developing new electricity connections. This option addresses in part the ICCC's recommendation to reduce regulatory barriers to electrification (3.c) by providing clear and reliable information on the electrification process. Preliminary information on process heat electrification opportunities is shown in the map in Appendix 5.

This option complements options in section 10 on addressing regulatory barriers to electrification, and could be part of a wider guidance document. The various components of a package are each separable and scalable, and could be offered as a customised service for large sites. They include:

- regularly publishing information on electricity reliability for large sites
- providing information about ways to increase reliability and resilience of electrically- supplied plant and systems; and
- co-funding low-emission heating feasibility studies (including electrification, biomass and demand reduction as appropriate) for EECA's business partners.[21]

Analysis

The primary intended benefit of this option is to provide a reliable and cohesive set of information, and provide clarity and guidance on the electrification process. The information would help identify any hidden costs and reduce transaction costs for businesses exploring options to electrify their process heat, and could enable a wider range of energy users to consider their options for electrifying all or part of their process.

As a new initiative, the Government and Transpower would incur additional administrative costs to resource and develop the information package. The costs could be in the tens or hundreds of thousands of dollars. We have not identified any significant compliance costs associated with this option.

The costs for customised low-emission heating feasibility studies for large sites could be around $50,000 per site. This estimate is based on the costs incurred by EECA for its existing offering feasibility studies which co-funds 40 per cent or up to $50,000 for energy efficiency and renewable energy projects for larger businesses.

Questions

Q1.7	Do you support the proposal to develop an electrification information package? Do you support customised low-emission heating feasibility studies? Would this be of use to your business?
Q1.8	In your view, which of the components should be scaled and/or prioritised? Are there any components other than those identified that could be included in an information package?

[21] EECA has long term collaboration agreements with many of New Zealand's largest energy-using businesses. The list of businesses is available at https://www.eecabusiness.govt.nz/our-partners-and-suppliers/large-energy-user-partnerships/

Benchmarking in food processing

Option 1.3 Provide benchmarking information for food processing industries

Description

Food processing industries[22] usually have a large number of similar sites: for example, there are over 80 dairy processing facilities, over 85 meat processing sites, and over 40 other food processing sites in New Zealand. These groups of sites have similarities in their processes, but a high degree of variation exists between the best and worst performing sites in terms of energy and emissions performance.

Benchmarking would identify sites that are underperforming in energy efficiency and emissions intensity and would compare them to the top performing sites within the sector. This can inform businesses of feasible energy and emissions targets, and the best practice technologies and process designs within the sector.

This proposal involves facilitating and supporting specific food sectors to:

- Develop appropriate energy and emissions performance benchmarks for their processes and/or products. It would be closely aligned with any reporting requirements as part of the proposal to publish Corporate Energy Transition Plans outlined above. The Meat Industry Association[23] supports the option of benchmarking meat sites to support best practice sharing to raise overall energy and emissions performance.
- Convene learning networks to share best practices, identify clean energy projects and learn from energy experts.

Analysis

Benchmarking would identify sites where key opportunities to improve energy efficiency and reduce emissions exist. Analysis by the University of Waikato[24] shows that in the food processing sector, there is significant potential to improve energy management, implement waste heat recovery measures, deploy heat pump technologies, and co-fire coal with biomass to reduce the use of fossil fuels.

Direct costs for benchmarking include measurement and metering of energy and emissions by product or process by site. The cost will vary depending on the data management system requirements, the complexity of the site, and the extent to which a site already has information on their energy use and emissions at the level of detail required. However, the costs are discretionary as the benchmarking proposal is voluntary. If implemented alongside the Corporate Energy Transition Plans, the cost of delivering a benchmarking programme would be significantly reduced.

There are also costs associated with determining appropriate benchmarks, in analysing the performance of each participating site against the benchmark, and in identifying practices that can help to improve performance of the site. These costs would likely be shared between industry and government.

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[22] As opposed to the single plant highly emissions-intensive industries, such as steel.

[23] The meat industry has the potential to reduce emissions in a cost-effective manner due to its low-temperature heat requirements.

[24] University of Waikato (2019). *Options to reduce New Zealand's process heat emissions*. Commissioned by MBIE, MfE and EECA, https://www.eeca.govt.nz/resources-and-tools/research-publications-and-resources/business-publications-and-resources/

Questions

Q1.9	Do you support benchmarking in the food processing sector?
Q1.10	Would benchmarking be suited to, and useful for, other industries, such as wood processing?
Q1.11	Do you believe government should have a role in facilitating this or should it entirely be led by industry?

Summary assessment of options against criteria

	Corporate Transition Plans	Individual CTP components	Electrification information package	Electrification feasibility studies	Benchmarking
To what extent is the barrier addressed?	✓✓✓	✓	✓	✓	✓
Primary benefits – emissions reductions	✓✓✓	✓✓	✓	✓✓	✓
Primary benefits – EE & RE	✓✓✓	✓✓	✓	✓	✓
Wider economic effects	✓✓	✓	✓	✓	✓
Compliance costs	XX	X	-	-	X
Administration costs	X	X	X	XX	X

Key:	Option under active consideration	Option not preferred

Section 2: Developing markets for bioenergy and direct geothermal use

This section examines barriers to the use of woody biomass and direct geothermal for process heat and seeks your feedbacks on our options to:

- Develop a users' guide on application of the National Environmental Standards for Air Quality to wood energy
- Facilitate development of bioenergy markets and industry clusters on a regional basis within Industry Transformation Plans, and
- Support recent initiatives underway to grow the bio-economy and support direct use of geothermal heat.

What's the problem?

This section responds to the Productivity Commission's *Low Emissions Economy* report recommendation:

> 14.3. MBIE and EECA should review existing initiatives related to information about fuel switching, co-firing, demand reduction and efficiency improvements for process heat, to minimise any information-related barriers to mitigation opportunities.
>
> 14.4. EECA and MBIE should consider a wider roll-out of policy initiatives to support the supply and use of biomass.

Location and security of supply

The availability of an energy source is only one of multiple factors that influence the location of a new industrial site. Proximity to primary commodities, labour, transport, and market are key considerations and often take precedence over the specific type or emissions intensity of an energy source. Biomass fuel availability is location-specific. To be economic, biomass users generally need to be located close to the biomass source.

In New Zealand, there are mismatches between woody biomass supply and process heat energy demand at a regional level. The supply of woody biomass residues exceeds the energy demand for process heat in some regions (such as the Bay of Plenty and Gisborne), while it is the opposite in other regions (such as Canterbury). In the Bay of Plenty, the residual biomass supply available could potentially be used to generate about 6.5 PJ of energy per annum, while the demand for fossil fuels (including coal, gas and petroleum) for generating process heat is about 2.6 PJ per annum. More information on biomass supply and process heat energy demand in all regions is shown in the map in Appendix 4.

In addition, while the supply of woody biomass residues may appear to be abundant in some regions, economic trade-offs would need to be made when deciding whether to utilise such residues for process heat. There are alternative uses of these residues, e.g. nutrient recycling for plantation forest (in lieu of the use of fertiliser), and the use of wood chips for cattle and calf beds. The mismatches between regional woody biomass supply and process heat energy demand means that it would not be economical to replace all coal with wood energy for process heat in all regions. While there is some potential for movements of biomass between neighbouring regions to address these mismatches, the economics of such movements depends on the terrain of the biomass source and

the infrastructure for accessing the biomass. In the case of the East Coast, its comparative isolation means that the transport costs for moving wood residues to another region are high.

There is potential for densification of wood residues into pellets or briquettes to increase the energy content per cubic metre of wood fuel, thereby making it more economical to transport wood fuels over longer distances. However, there are only some small-scale plants for producing wood pellets or briquettes in New Zealand.

The geographical dependence of wood energy in combination with the under-developed wood fuel supply chain[25] means that wood fuel is yet to be widely used in sectors other than wood processing. Some potential biomass users, particularly those with large energy needs, still have concern about the security of wood fuel supply over the life of their plant (20+ years).

Direct heat from geothermal sources is also limited due to geographical dependence and can only be considered for a new-build industrial plant if the chosen site is located close to a geothermal source. New geothermal direct use opportunities are likely to leverage or "piggyback" on electricity generation projects. A key reason to piggyback on electricity generation is the de-risking and cost reductions of exploring and recovering the resource, since direct use is likely to use only a small proportion of heat compared to electricity generation (e.g. about 5 to 15%).

Industrial clusters

A region tends to develop economic specialisations often based on the region's natural resource endowment. For instance, there is a concentration of wood processing and pulp and paper manufacturing in and around Kawerau to take advantage of the Kaingaroa Forest and geothermal heat.

Regional specialisations create complex ecosystem or clusters of upstream and downstream industries, supporting services including professional and technical services, skills and training, and transport and other infrastructure configured to the needs of the industry. Through moving to lower emitting systems, the industrial clusters making use of wood and geothermal energy could also have other co-benefits, such as better health outcomes because of improved air quality. Industry clusters tend to develop organically, but once established may benefit from a more organised approach to their ongoing growth and development.

In particular, developing a shared heat or combined heat and power (CHP)[26] plant for a cluster of wood processing plants and other heat users (such as hospitals and prisons), may need a more proactive, coordinated and planned approach to their development, due to the multiple supply chain components the industry requires. Significant investment would be required to develop a shared CHP plant. It is estimated that it would cost about $280 million to build a CHP plant with an output of 135 megawatt thermal (MWth) and 15 megawatt electrical (MWe).[27] The case for such an investment would depend on the specific circumstances of the region and facilities concerned.

[25] As outlined in the Technical paper, the reasons for this include concerns over security of fuel supply over the life of their plant; the availability of parties that can contract to supply the required volumes of fuel required over the long term; and fuel suppliers reluctant to make investments in capital investment in the absence of a long-term supply contract.

[26] A combined heat and power plant is one that generates electricity as well as heat. This can allow development in areas that might otherwise have insufficient electricity supply capacity.

[27] Scion (2015) *Assessment of wood processing options for Gisborne: Wood Energy Industrial Symbiosis project - Aim 3 resource convergence opportunities*.

There have already been some relatively small-scale initiatives to establish industrial clusters. For example, EECA, in partnership with Venture Southland, implemented the Wood Energy South project in Southland. (See case study below).

Case Study: Wood Energy South

Between 2014 and 2017, EECA, in partnership with Venture Southland, implemented the Wood Energy South (WES) project to encourage Southland heat users to switch from fossil fuels to woody fuels. This project included credentialing energy specifiers (consulting engineers), subsidising feasibility studies, providing information and case studies on using wood energy, and providing capital grants and Crown loans to aid conversion to using wood energy. The WES project had a $1.5 million budget over three years, and a target of an additional 0.15 PJ of wood energy use.

Key learnings from this project include:

- It takes time to develop projects. Even after a business case has been established it can take several years for heat plant owners to make a final investment decision. (Note: WES supported early work on Danone's $40 million project to build a milk spray drying plant in Balclutha, which will be powered by forest waste. However, its construction is still not yet completed).
- A better understanding of the drivers and decision factors involved in private sector fuel switching would help uptake.
- A promising approach may be to target organisations or areas with large heat demand for fuel-switching to spur the establishment of a fuel supply chain.
- Wood Energy South identified health improvements for children in moving to wood chip boilers, and the life span of the corrugated iron on school buildings was extended with moving from coal to wood chip.

Councils' air quality planning rules applicable to wood energy

Under the Resource Management Act (RMA), councils are responsible for managing discharges to air. The Bioenergy Association has noted that some councils have developed air quality-related planning rules that may be an inadvertent impediment to the use of wood fuels. For example:

- There are concerns that some of the rules in councils' plans do not take into consideration the design of the equipment and its capacity to be operated without compromising acceptable air quality standards. For example, some councils have rules that limit the biomass fuel moisture content of wood fuel, but the Bioenergy Association considers that more sophisticated heat plant can effectively manage emissions from high moisture content wood fuel.
- Some councils' rules applicable to wood energy equipment appear to be based on outdated guidelines. For example, some councils' air quality management plans have chimney heights rules derived from the Third Edition of the 1956 Clean Air Act Memorandum on Chimney Heights, which may no longer be appropriate.

The National Environment Standards for Air Quality (NESAQ) are regulations made under the RMA that aim to minimise the adverse health impacts of air contaminants at the national level by:

- prohibiting activities that discharge significant quantities of contaminants to air, such as burning tyres, bitumen, oil and landfill waste
- setting standards for ambient (outdoor) air quality, and

- setting design standards for wood burners, including emissions and thermal efficiency standards. Note the NESAQ does not prescribe detailed technological specifications of wood energy facilities.

The resource management framework for managing air quality (i.e. RMA and NESAQ) gives councils broad discretion to set rules that are suitable for their local circumstances.

What are the options?

To address the issues, we propose the following options:

- Development of a users' guide on the application of the National Environmental Standards for Air Quality to wood energy
- Facilitate development of bioenergy markets and industry clusters on a regional basis within Industry Transformation Plans, and
- Support recent initiatives underway to grow the bio-economy and support direct use of geothermal heat.

In addition to these proposed options, there is also other work across government to grow the bio-economy, which may increase the availability of wood residue supplies for process heat. For example, EECA has begun to offer bioenergy analyses28 – working with Scion to analyse the regional and site-specific availability of biomass fuel for large process heat users with potential to switch from fossil fuels.

Guidance on RMA consenting for wood energy plants

Option 2.1	**Developing users' guide on application of the National Environmental Standards for Air Quality to wood energy**

Description

We propose to develop an official users' guide supplementary to the NESAQ. The users' guide will provide councils and businesses with technical guidance on managing the development and operation of wood energy, including information on:

- interpretation of the NESAQ requirements from a wood energy perspective
- development of planning rules that would achieve desirable air quality without creating unnecessary impediment to the use of wood energy
- air quality outcomes of various models of wood boilers, and
- good examples of planning rules suitable for wood energy facilities would be provided in this users' guide.

We expect the proposed users' guide would be jointly developed by MBIE, MfE and EECA, in consultation with key stakeholders, such as councils and wood energy experts. As MfE is currently considering amendments to the NESAQ, we propose that the users' guide be developed after the NESAQ amendments are completed. We seek your feedback on whether a guide would be useful and what it could include.

[28] https://www.eeca.govt.nz/energy-use-in-new-zealand/energy-focus-areas/process-heat/

Analysis

Through addressing unintended regulatory barriers posed by councils' air quality planning rules, the proposed users' guide could potentially make it easier for businesses to obtain resource consents for wood energy facilities, thereby accelerating the uptake of wood energy for process heat. This could also help develop the wood energy market, as growing demand for wood energy encourages more wood fuel suppliers to enter the market.

The Government would incur some costs in developing the users' guide, probably in the order of hundreds of thousands of dollars, depending on its scope and the process for developing it.

Questions

Q2.1	Do you agree that councils have regional air quality rules that are barriers to wood energy? If so, can you point us to examples of those rules in particular councils' plans?
Q2.2	Do you agree that a NESAQ users' guide on the development and operation of the wood energy facilities will help to reduce regulatory barriers to the use of wood energy for process heat?
Q2.3	What do you consider a NESAQ users' guide should cover? Please provide an explanation if possible.
Q2.4	Please describe any other options that you consider would be more effective at reducing regulatory barriers to the use of wood energy for process heat.

Amending the NESAQ

Amendments to the NESAQ are currently being considered. There will be a separate public consultation on any proposed amendments.

Nevertheless, we do not expect that any amendments to the NESAQ will exhaustively set out all the detailed specifications of the technologies that are allowed, as the resource management framework for managing air quality (including the RMA and NESAQ) is intended to give councils broad discretion to set rules for managing emissions of air contaminants, taking into account their local circumstances. Air quality issues are different in different parts of the country due to geographical and climatic differences, and it is important for councils to have the flexibility to respond accordingly.

Questions

Q2.5	In your opinion, what technical rules relating to wood energy would be better addressed through the NESAQ than through the proposed users' guide (option 2.1)?

Facilitating the development of bioenergy markets and industry clusters on a regional basis

The following section seeks your feedback to inform the development of options to support bioenergy markets and industry clusters. At this stage, we are not proposing specific options as there is ongoing work across government to grow the bio-economy. We need further information on the merits of these options before deciding whether additional work is necessary.

Industry Transformation Plans

Securing large-scale, long-term fuel supplies, such as for a shared combined heat-and-power (CHP) plant supplying a cluster of industrial and community energy users, will require long-term agreements with multiple partners, including the resource (forest) owners, contractors and the users. Given the number of parties involved, market facilitation by government may help to open up such agreements between suppliers and buyers.

We are proposing to facilitate development of bioenergy markets and industry clusters on a regional basis, as part of an Industry Transformation Plan (ITP) for the Wood Processing and Forestry sector, taking into account learnings from previous government initiatives, such as the Wood Energy South project (which was discussed earlier).

Through the Government's recently-released Industry Policy: From the Knowledge Wave to the Digital Age – Growing Innovative Industries, MBIE is leading the development of Industry Transformation Plans (ITPs) for four sectors, including the Wood Processing and Forestry sector.29

As part of this ITP, MBIE is proposing to investigate the best approach to working with and supporting the development of industry clusters, as well as developing wood energy markets from both the demand and supply side. This could be achieved through supporting bespoke cluster organisations or through improving the co-ordination of regional economic development efforts.

Initiatives to grow the bio-economy

There are a number of recent initiatives the Government has underway to grow the bio-economy, and these could stimulate bioenergy supplies for process heat.

The Forestry Ministerial Advisory Group30 is preparing advice on the role of New Zealand's forests in the transition to a bio-economy. The Advisory Group is working closely with Te Uru Rākau and MBIE to ensure alignment of research and resources.

Te Uru Rākau is developing a Forest Strategy with a broad view of forests and forestry. 'Forest' includes commercial forestry activities (e.g. growing, harvesting, processing and exporting) along with trees and forests contributing to social, environmental and cultural goals (e.g. permanent carbon forests, indigenous trees, trees in urban and farming landscapes).

[29] ITPs are proposed to set out an agreed vision for the sector and a set of actions that Government and industry will take to drive the transition to this vision. These plans will build on the range of existing sector-based work underway, but will have a strong emphasis on planning for the future, improving cohesion and clarity of overall strategic direction across Government initiatives, working through transitional issues, and understanding the workforce issues and opportunities.

[30] The Forestry Ministerial Advisory Group provides the Minister of Forestry with industry perspective and independent advice on matters agreed between the Minister and the Chair of the Advisory Group.

The Forest Strategy will broadly set out:

- an agreed shared direction for the forest sector for the next 30 years and beyond, that guides government and other participants' investment and effort
- clarity around the opportunities and different roles and responsibilities of forest sector participants
- a more joined up platform from which to grow and develop as a sector; and
- priorities for transformation to enable forest-based industries and activities to contribute to improved social and economic wellbeing for New Zealanders.

The Forest Strategy will include consideration of the role forests can play in transitioning to a low emissions bio-economy. It will also consider the role of direct overseas and government investment in wood processing facilities to improve environmental and climate change outcomes, and the promotion of regional economic growth. This initiative could help to stimulate a range of economic opportunities from forestry and may result in creating greater volumes and availability of wood energy for process heat.

Supporting the use of direct geothermal heat

The New Zealand Geothermal Association (NZGA) has developed the *Geoheat Strategy* and a complementary action plan that seeks to increase the use of direct heat in industry. The strategy outlines the opportunities and the approach to diversify the direct use of geothermal heat to create new businesses, decrease the use of fossil fuels in industry, support regional economic and social development, and carve out a role for New Zealand to promote the use of direct heat and associated technologies internationally.

MBIE continues to support geothermal stakeholders in exploring geothermal opportunities and making business-to-business connections for geothermal direct use. Where relevant and regionally-available, we will work with NZGA and other stakeholders to realise industrial cluster opportunities to also use geothermal heat directly.

Questions

Q2.6	In your view, could the Industry Transformation Plans stimulate sufficient supply and demand for bioenergy to achieve desired outcomes? What other options are worth considering?
Q2.7	Is Government best placed to provide market facilitation in bioenergy markets?
Q2.8	If so, how could Government best facilitate bioenergy markets? Please be as specific as possible, giving examples.
Q2.9	In your view, how can government best support direct use of geothermal heat? What other options are worth considering?

Summary assessment of options against criteria

	Develop user's guide for application of NESAQ to wood energy	Amending NESAQ
To what extent is the barrier addressed?	✓✓	✓
Primary benefits – emissions reductions	✓	✓
Primary benefits – EE & RE	✓	✓
Wider economic effects	Uncertain, as its impacts on consenting would be indirect.	Uncertain, as its impacts on consenting would be indirect.
Reduction in compliance costs	✓	✓
Administration costs	X	X X
Energy trilemma – security and affordability	Uncertain, as its impacts on consenting would be indirect.	Uncertain, as its impacts on consenting would be indirect.

Key:	Option under active consideration	Option not preferred

Section 3: Innovating and building capability

This section explains the issues around technology risk for process heat users, and the lack of viable low carbon solutions for emissions-intensive and highly integrated (EIHI) industries. It seeks your views on options to:

- Expand EECA's grants for technology diffusion and capability-building, and
- Collaborate with EIHI industries to foster knowledge sharing, develop sectoral low-carbon roadmaps and build capability for the future using a Just Transitions approach.[31]

What's the problem?

Technology risk and embryonic markets

This section responds to the Productivity Commission's *Low Emissions Economy* report recommendation:

> 6.3. The Government should investigate and implement any cost-effective institutional models that:
>
> - scan new low-emissions technologies around the world to identify ones with promise for New Zealand but that may need adapting to suit local conditions;
> - help firms to improve their absorptive capacity for external knowledge, including new low-emissions technologies.

Firms tend to be risk averse to technologies that change their production process. This includes energy efficiency and fuel switching technologies. A new process that saves energy but whose effectiveness in producing a safe, quality product is not proven is a risk for a business, particularly low-margin businesses that cannot afford down-time.

In addition, there may be lack of skills and capability, such as systems engineering, process design and installation, to support low emissions technology deployment at the scale needed. New Zealand has an energy efficiency market but it is small relative to the size of the opportunity.

The embryonic market for new and emerging low-emission technologies (for example, high temperature heat pumps), means that firms that are early adopters of the technology face much higher costs than firms that adopt the technology when it is used more widely.

Earlier this year, EECA published information resources including an *International Technology Scan* outlining available commercial technologies to reduce process heat emissions.[32]

Low carbon solutions for emissions-intensive highly-integrated industries

In EIHI industries, such as the manufacturing of steel, cement or methanol, emissions are typically intrinsic to the process with fossil fuels being used as a feedstock. As such, they cannot readily be abated by a change in fuels, only by changes to processes. In addition, some of these processes have high-temperature heat requirements (typically above 500 degrees Celsius) and so would be very expensive to electrify.

[31] A "just transitions" approach is about empowering those impacted by change to drive the solutions.
[32] EECA (2019). Information resources available at https://www.eeca.govt.nz/resources-and-tools/research-publications-and-resources/business-publications-and-resources/

Material decarbonising of these sectors will require long-term decisions to be made around investment in low emissions technologies, as they are developed and commercially proven internationally.

Significant investment and coordinated effort among businesses, governments and researchers will be required to identify or develop such technologies. The European Union and the United States are paying particular attention and investing significant research into decarbonising a wide range of industrial processes over the long term. New Zealand may best benefit by keeping abreast of international developments. Opportunities include innovative industrial production processes (that do not require heat), use of hydrogen as feedstock or fuel, and carbon, capture, utilisation and storage.

What are the options?

Support for demonstration and diffusion not only de-risks low emissions heating technology but helps to train, build and retain new capability for the future and overcome embryonic markets.

We seek feedback on two options:

- Expand EECA's grants for technology diffusion and capability-building
- Collaborate with industry to foster knowledge sharing, develop sectoral low-carbon roadmaps and build capability for the future using a Just Transitions approach.

Technology diffusion and capability-building

Option 3.1	**Expand EECA's grants for technology diffusion and capability-building**

Description

This option involves expanding EECA's grants for innovative technology demonstration, deployment and diffusion, and related activities (such as case studies and learning site visits). This will reduce perceived risk in the marketplace, create enhanced opportunities for training and building clean energy capability, and help overcome embryonic market barriers. This is required to accelerate diffusion of, and help transform the market for, low emissions technologies.

EECA would retain dedicated funding to support innovative projects and first-of-a-kind (in New Zealand) demonstrations under the existing Technology Demonstration criteria[33], while dedicated technology diffusion funding could then be targeted to technologies that have already been successfully demonstrated and for which public co-investment can accelerate diffusion.

To date, the Technology Demonstration Fund is relatively modest (less than $1 million was disbursed last year), and the installation of a particular technology can be funded only once. This constrains the potential for wider industry diffusion, although replication is promoted via dissemination of information (e.g. case studies from successful projects).

Even if other businesses become aware of technologies that have been supported by the Technology Demonstration Fund, its replication potential may still be limited by:

[33] Note EECA's Technology Demonstration programme is available for all energy-using technologies or process improvements that meet funding criteria. It is therefore broader than just low emissions heating.

- The Fund's criteria and quantum of funds available: low emission heat investments tend to require large upfront capital. Under current criteria, co-funding for low emissions heating projects is generally limited to $250,000. This does not make up a substantial enough proportion of the investment for co-funding to be attractive to potential applicants.
- Exposure and hands-on experience of the demonstrated technology is available only to the service provider and business involved in the demonstration. Project consultants that have not been directly involved with the demonstration may retain a bias towards technologies and processes that they see as "tried and true", so tend to replace like-for-like.

The additional support for diffusion and related activities would increase the number of low emissions heat technology deployments to reduce perceived risk for wider market uptake. This could involve one, or a combination, of the following:

- Increasing the amount of funding available, to enable a wider range of technologies to be demonstrated across multiple sectors
- Broadening the objectives to include supporting market transformation and increasing capability of clean energy services
- Funding multiple deployments in different circumstances (e.g. process, scale, or sector) to support diffusion of successful demonstrations, and
- Further knowledge-sharing mechanisms, such as learning networks, site visits and technical guidelines. Knowledge sharing and the dissemination of detailed case studies across industry will be important to effectively de-risk technology for wider deployment.

Analysis

The intended benefits of an expanded programme are:

- De-risking a wider range of technologies in a wider range of applications
- Greater familiarity of and expertise with new technologies in the energy service industry
- Overcoming embryonic markets, and
- Accelerating the rate of market diffusion of de-risked low emission technologies and help overcome the so-called technological "valley of death".[34]

These benefits are intended to support market transformation – i.e. creating lasting change in the market whereby the risks and costs of deploying low emission technologies are reduced, and these technologies are adopted as a matter of standard practice. The longer-term outcomes are that New Zealand businesses are leaders or fast followers of low emission technology deployment, are reaping competitive advantages in international markets and that New Zealand has a carbon neutral and internationally competitive economy.

While the government already supports early-stage science and technology research and development through research and innovation funds, there is currently no government support for diffusion – i.e. the gap between pre-commercialisation and full commercialisation/market transformation. An expanded diffusion and capability-building fund fills a gap in the spectrum of government support for low-emissions technology and innovation.

[34] The gap remaining between pre-commercialisation and full industrial commercialisation of a technology or process.

Due to the co-funding model, both Government and Fund applicants would share the projects' costs. The Fund is scalable to the tens (or even hundreds) of millions of dollars. Under an expanded programme, there would be increased administrative costs for resourcing and implementation.

Questions

Q3.1	Do you agree that de-risking and diffusing commercially viable low-emission technology should be a focus of government support on process heat? Is EECA grant funding to support technology diffusion the best vehicle for this?
Q3.2	**For manufacturers and energy service experts:** would peer learning and on-site technology demonstration visits lead to reducing perceived technology risks? Is there a role for the Government in facilitating this?

Industrial innovation and transitioning to a low-carbon future

Option 3.2	**Collaborate with EIHI industry to foster knowledge sharing, develop sectoral low-carbon roadmaps and build capability for the future using a Just Transitions approach**

Description

This initiative would look to create a partnership between government and EIHI industries on industrial decarbonisation. The partnership would provide a platform for collaboration on emissions reduction and knowledge sharing of existing and emerging technical opportunities. Government could support the platform as a facilitator, and bring in international energy and engineering experts.

This option could assist in achieving EIHI emissions reductions through identifying feasible technological pathways for sectors to decarbonise, and helps spread and smooth overall costs of decarbonisation to enable optimal investment over the longer-term. Collaboration and roadmap co-design could:

- Enable a first-principles investigation of long-term opportunities and challenges of EIHI industries, then help to devise strategies with them to achieve low emissions goals
- Develop a shared understanding of international R&D for "hard-to-abate" industries and identify unique issues for New Zealand R&D efforts
- Effectively address informational asymmetries between industry and government, allowing future interventions to be more effectively targeted, and
- Help ensure an optimal regulatory environment and plan for supporting infrastructure.

Analysis

The intended benefits of this proposal are longer-term and are to support industry to plan and develop their own viable solutions and business models in a low emissions future. As such, the emission reduction benefits will be small in the short-term, but could be significant in the future.

The costs would be shared between industry and government and have not yet been estimated but would involve:

- government and industry staff time and expertise to contribute to the collaborative process
- consultant time to produce background and technical papers, roadmaps, or other publications, and

- resourcing for a secretariat or other coordinating function.

Given the linkage to Industry Transformation Plans (ITPs), this proposal would work in close alignment the ITP process, and leverage (not duplicate) the many existing sector specific initiatives already underway.

Questions

Q3.3	**For EIHI stakeholders**: What are your views on our proposal to collaborate to develop low-carbon roadmaps? Would they assist in identifying feasible technological pathways for decarbonisation?
Q3.4	What are the most important issues that would benefit from a partnership and co-design approach?
Q3.5	What, in your view, is the scale of resourcing required to make this initiative successful?

Other options considered to address capability and skills barriers

In order to specifically address the capability and skills barrier, we considered a standalone industry capability development scheme, which would involve industry training and working with tertiary institutions to develop engineering courses.

However, this option is not preferred for the following reasons:

- Increasing demand for clean energy through other measures may be sufficient and more effective to trigger a market and capability response.
- If not closely integrated into measures to drive demand for clean energy, there is a risk that that the scheme will not address specific process heat user needs. In contrast, the technology demonstration and diffusion option involves applied learning and experience with real-life demonstration plants and EIHI roadmaps would involve close collaboration between industrial users on sector-specific opportunities.
- The Carbon and Energy Professionals New Zealand (formerly Energy Management Association of New Zealand, EMANZ) is already working with EECA to expand and boost its training to gear up for low-carbon future, with a focus on industrial process heat and carbon management.

Summary assessment of options against criteria

	Tech demo and diffusion	EIHI roadmaps	Industry capability scheme
To what extent is the barrier addressed?	✓✓	✓✓	?
Primary benefits – emissions reductions	✓	✓	✓✓
Primary benefits – EE & RE	✓	?	✓✓
Wider economic effects	✓✓✓	✓✓✓	✓
Compliance costs	-	-	-
Admin costs	XX	X	XX

Key:	Option under active consideration	Option not preferred

Section 4: Phasing out fossil fuels in process heat

This section explains the issues around long-lived process heat investments and emissions lock-in, and seeks your views on options to:

- Deter the development of any new coal-fired process heat, through a ban on new coal-fired process heat equipment for low and medium temperature requirements, and
- Require existing coal-fired process heat equipment supplying end-use temperature requirements below 100°C to be phased out by 2030.

What's the problem?

This section responds to the following ICCC recommendations from the *Accelerated Electrification* report:

3a. Deterring the development of any new fossil fuel process heat.

3b. Setting a clearly defined timetable to phase out fossil fuels in existing process heat, with the phase out of coal as a priority.

As highlighted in the ICCC's *Accelerated Electrification* report, if new fossil fuel plant is not deterred, efficiency gains and emission reductions made in existing plants have the potential to be outweighed by the building of new fossil fuel heat plant. There is also a risk that if the carbon price rises faster than a business's expectations, that emissions-intensive assets will become stranded before the end of their economic life.

Industrial energy investment decisions are long-term, involve high capital costs, and are highly dependent on the relative capital and fuel costs of different energy sources. At present, coal is the cheapest form of energy used to supply process heat. It is also the most emissions-intensive. Coal boilers have an economic lifespan of about 25 years, and are often repaired and maintained to be used for much longer periods (some coal boilers have been used for over 40 years). Extending the economic life of a boiler requires less upfront capital than replacing it.

Uncertainty about future carbon prices and policy has contributed to maintaining fossil fuel technologies' on-going attractiveness for investment, and carbon price expectations are often not factored into decision-making because of this uncertainty.

While it is important to maintain policy efforts on ensuring an effective NZ-ETS and carbon price signal, it is possible, for the reasons above, that the price signal alone will not be sufficient to deliver a timely transition that prevents the lock-in of high-emission and long life assets that run the risk of becoming stranded over time.

What are the options?

We seek your feedback on the following options to deter investment in new fossil fuel plants:

- Deter the development of any new coal-fired process heat, through a ban on new coal-fired process heat equipment for low and medium temperature requirements, and/or
- Require existing coal-fired process heat equipment for temperature requirements below 100°C to be phased out by 2030

It is expected that the Corporate Energy Transition Plans option outlined in section 1 would also address, at least in part, the issues outlined in this section. However the following options could be implemented on a faster timeline and would have an immediate impact, lowering the risk of locking in new coal assets. These options also provide more certainty on new coal investment decisions.

Deterring the development of any new fossil fuel process heat

Option 4.1	**Introduce a ban on new coal-fired boilers for low and medium temperature requirements**

Description

This option would introduce a ban on new coal-fired boilers for low and medium temperature requirements.

The nature of different manufacturing processes defines how the heat can be supplied and used. Temperature requirements can be classified as low, medium or high, as set out below:

- Low: less than 100°C, used for water and space heating
- Medium: between 100 and 300°C, for example drying wood products or milk powder, and
- High: Greater than 300°C, for example making steel.

Analysis

This option would ensure New Zealand avoids building new and additional long-lived and emissions-intensive assets (coal boilers). Preventing investment in new coal plant is considered a priority due to its emissions intensity. A ban is simple to administer, incurs minimal cost on the Government, and could be introduced quickly.

This option has the potential to substitute for a carbon price, and this could suppress the price elsewhere, likely reducing abatement in other areas. Some coal to biomass opportunities exist at current carbon prices, however carbon prices in excess of $60/t CO_2-e, are required to make widespread coal-to-biomass and some coal-to-electricity projects economic.

It is difficult to assess the impact of a ban as new investments in coal-fired boilers are private industry decisions. Dairy processors Synlait and Fonterra, as well as meat processor, Alliance, have announced their commitments to build no additional coal-fired boilers. As these three companies make up a large portion of the market for low and medium temperature heat, a ban may have a small impact on future emissions abatement, and therefore impose relatively low costs on industry. For low-temperature requirements, cost effective new capacity or capacity expansion can be met through good process design and electrification.

For medium-temperature requirements however, banning the use of coal for capacity expansion has the potential to impose significant costs on industry. This will depend whether or not industry is looking to expand its production capacity in the short term, and whether production of lower emissions goods is a viable option (e.g. a factory making cheese rather than milk power).

New medium temperature coal capacity is most likely be South Island milk powder drying facilities, where coal boilers are typically installed. Dairy production growth is slowing, as productivity improvements are offset by declining herd numbers and changing land use. [35]

[35] MPI (2019). *Situation and outlook for primary industries (SOPI),* https://www.mpi.govt.nz/news-and-resources/economic-intelligence-unit/situation-and-outlook-for-primary-industries/

However, there may still be dairy processing investments that compete for the existing milk pool, either by new entrants or from the expansion of existing companies.

If industry is looking to expand its production capacity in the short term, this option may have wider economic impacts. For example, it could deter additional investment in milk drying facilities, especially in the South Island. This is because current drying technologies require steam and there may be insufficient biomass available in some locations to provide this. Supplying steam using direct electricity is relatively expensive.[36] However, this is not likely to impact less emissions-intensive and potentially higher value forms of dairy processing, such as cheese manufacturing.

Other options considered, but not favoured are:

- Allowing exemptions in any ban. Exemptions have the potential to create an "uneven–playing field" and depending on application can be seen as unequitable. Those with greater resource are those likely to be best equipped and successful in being granted an exemption.
- Inclusion of natural gas (and other fossil fuels) in the ban has not been considered because carbon prices in excess of $120/t CO_2-e are required to make many gas-to-electricity projects economic. Such a broad ban would be a blunt instrument and entail very high cost on industry. It could force higher cost abatement in the sector (and the wider economy) compared to more cost-effective options available today. However, to achieve our net zero carbon 2050 target, it is possible that the phase down of gas in industry will also be required in the future.

A timetable to phase out fossil fuels

Option 4.2	**Require existing coal-fired process heat equipment supplying end-use temperature requirements below 100°C to be phased out by 2030.**

Description

This option would require process heat users to phase out existing coal assets that are being used to supply end-use requirements below 100°C by 2030.[37] We propose that a government-mandated timetable apply only to coal consumption for temperatures below 100°C due to the higher cost of transitioning existing higher temperature applications and switching away from natural gas.

Analysis

This option would ensure that low cost emission reductions in process heat occur and is intended to overcome potential perverse incentives associated with option 4.1 – whereby existing coal boilers are refurbished and maintained for decades to avoid triggering the definition of "new coal investment".

The compliance costs of this proposal would be different across low-temperature process heat users. These would vary according to:

- The emissions price: fuel switching off coal to supply low temperature heat will be the low hanging fruit for emissions reductions as the emissions price rises. However, it is uncertain whether coal will be phased out by 2030 in response to the emission price. If the phase out of coal for low temperature heat was to occur before 2030 in response to a rising emission price,

[36] Using electricity directly for steam generation (e.g. in the form of an electric boiler) is still very expensive, needing carbon prices in excess of $150/t CO_2-e to become cost effective. Using electricity via heat pumps, MVR or heat recovery is much more cost effective compared to making steam directly, achieving 14 times greater emissions reduction per unit of electricity used.

[37] The option for Corporate Energy Transition Plans outlined in Section 1 also addresses the ICCC's recommendation 3 and covers higher temperature applications and other fossil fuels.

then compliance costs are minimal. However, if the emissions price does not rise enough, then compliance costs will be higher.

- The age of equipment: having to retire equipment early creates stranded assets. However, we note that many boilers run long past retirement age.
- Sector-specific circumstances, such as production process, energy cost as a proportion of revenue, access to capital and profitability, and
- Location and access to alternative fuels including transmission and distribution capacity.

In addition, there is a risk that this option encourages switching from coal to gas when there are viable lower emission alternatives, such as biomass or electricity available. This risk would be mitigated if Corporate Energy Transition Plans for large users are also in place.

As with option 4.1, we also considered, but do not favour, inclusion of other fossil fuels, allowing exemptions, or including higher temperature requirements at this stage.

We have also identified options that could be pursued under the Resource Management Act (RMA), including:

- Exploring options as part of the comprehensive review of the resource management system beginning in 2020, which will consider the role of regulation in supporting climate change mitigation, and ensure alignment with the Climate Change Response (Zero Carbon) Amendment Act. To support the Expert Advisory Group (who will carry out the review), MBIE officials are working with MfE and other agencies to outline key issues and scope options to avoid industrial activities "locking in" high emissions methods for activities that may be consented prior to an effective price signal under the NZ-ETS and to encourage Best Available Techniques (BAT).[38]
- Developing a National Environmental Standard or National Planning Standard for cleaner industrial production requiring councils to take into account New Zealand-specific BAT and/or specifying numerical emissions limits for industrial activities. Any National Environmental Standard would need to be developed in accordance with the process outlined in the RMA.

Questions

Q4.1	Do you agree with the proposal to ban new coal-fired boilers for low and medium temperature requirements?
Q4.2	Do you agree with the proposal to require existing coal-fired process heat equipment for end-use temperature requirements below 100 degrees Celsius to be phased out by 2030? Is this ambitious or is it not doing enough?
Q4.3	**For manufacturers**: referring to each specific proposal, what would be the likely impacts or compliance costs on your business?

[38] BATs or best practicable options refer to the most effective techniques for preventing or reducing emissions or environmental effects that are technically feasible and economically viable within a sector. BAT does not necessarily prescribe that fossil fuels can or cannot be used for a particular activity. Rather, BAT represents the latest stage of development (state of the art) of processes, of facilities or of methods of operation specific to a business sector that are in operation today, which indicate the practical suitability of a particular measure for limiting discharges, emissions and waste.

Q4.4	Could the Corporate Energy Transition Plans (Option 1.1) help to design a more informed phase out of fossil fuels in process heat? Would a timetabled phase out of fossil fuels in process heat be necessary alongside the Corporate Energy Transition Plans?
Q4.5	In your view, could national direction under the RMA be an effective tool to support clean and low GHG-emitting methods of industrial production? If so, how?
Q4.6	In your view, could adoption of best available technologies be introduced via a mechanism other than the RMA?

Summary assessment of options against criteria

	Ban on new coal (low-med temp)	Ban on new coal (low-high temp)	Ban on all new fossil fuels (all temp)	Coal phase-out by 2030 (<100°C)	FF phase-out by 2030 (<100°C)	FF phase-out by 2030 (all temp)
To what extent is the barrier addressed?	✓	✓✓	✓✓✓	✓	✓✓	✓✓✓
Primary benefits – emissions reductions	✓	✓✓	✓✓✓	✓	✓✓	✓✓✓
Primary benefits – EE & RE	✓	✓✓	✓✓	✓	✓✓	✓✓
Wider economic effects	-	X	XX	-	X	XXX
Compliance costs	X	XX	XXX	XX	XXX	XXX
Administration costs	X	X	X	X	X	X

Key:	Option under active consideration	Option not preferred

Section 5: Boosting investment in energy efficiency and renewable energy technologies

This section explains the issues relating to underinvestment in energy efficiency and renewable energy technologies. It seeks your views on whether the Government should be considering these issues and how these issues could be addressed.

This section responds to key barriers identified in the submissions on the Technical Paper *Process Heat in New Zealand: Opportunities and barriers to low emissions.*

What's the problem?

Initial analysis suggests that the total potential for emission reductions from cost effective clean energy projects in industry amounts to an estimated 2 – 3.5 Mt CO_2-e per year (as outlined in Appendix 2).

Energy projects within a business compete internally with other capital investment projects. Even when these projects are privately profitable, they can remain unimplemented as other, more attractive, more easily quantifiable, or essential to core business projects are prioritised. As such, a gap exists between the carbon price that would make a project profitable and the price that would make a project a priority for implementation. This competition for capital is a major barrier to more efficient and renewable use of process heat. In addition, some businesses may have limited access to capital to allow them to implement cost-effective energy projects.

While energy investment results from what might be privately-rational investment behaviour by firms, it can also result in foregone benefits and sub-optimal outcomes for the energy system and emissions reduction efforts. Unless a business has strategic prioritisation of all cost-effective clean energy[39] technologies or has ring-fenced funds for energy technologies, significant economic energy savings and emissions reduction potential may not be realised.

What could be considered to address these issues?

The NZ-ETS and the Corporate Energy Transition Plans (if implemented)[40] are expected to increase investment in energy efficiency and renewable energy technologies. However, barriers of internal competition or access to capital could still persist, which could leave some remaining economic energy efficiency potential unrealised.

We have identified two ways of addressing these barriers, either through regulating clean energy spend or through providing incentives to stimulate investment in clean energy technologies. Both

[39] Clean energy investments includes energy efficiency technologies and technologies that enable fuel switching to low emissions sources such as electricity, biomass, and geothermal. Energy efficiency technologies and the efficiency by which fuel – electricity, coal or gas – can be converted into usable process heat (measured by the Coefficient of Performance (CoP)) can reduce the overall costs of transitioning to a low emissions energy system. For example, lower temperature processes can take advantage of commercial and industrial-scale electric heat pump technology with CoPs of between three and seven (so 3-7 units of useful energy are produced for every unit of electricity). By comparison, using a central gas or coal-fired boiler to produce steam can have a CoP of only 0.5, so only half the energy is used, and half is wasted. Source:

[40] The Corporate Energy Transition Plans option in Section 1 is considered as an important first step to enable the effective design of and support for a range of additional measures.

approaches have the potential to impose high costs on either the Government or industry and could carry significant risk if they are not well designed and targeted.

Due to the nature of these approaches and the scale of investment likely required by the Government and/or industry to achieve our climate change objectives, they need to be carefully considered alongside forthcoming broader government decisions on climate change policy. These decisions include proposals discussed in this paper, changes to the NZ-ETS, discussion on the role of complementary measures to the NZ-ETS, and the pace and pathways of domestic emissions reductions to meet the country's emission targets. As such, we are seeking feedback and gathering further information on the types of levers, rather than consulting on a preferred set of policy proposals.

We are gathering information on the both regulatory and incentive-based levers.

Regulatory approach - regulating clean energy spend

Regulation can be an effective tool in driving investments in energy efficiency and renewable energy technologies. For example, it could be a regulatory requirement that for large energy users all eligible profitable clean energy projects with a payback under a specified number of years are implemented by the business.

In the short term, such regulation could impose significant compliance costs on industry. Increased investment in clean energy projects would potentially be at the expense of investment in other more profitable or urgent core business priorities. The impact on firms is likely to vary depending on their financial position and competing priorities for investment. Firms with limited access to capital and urgent core business spend may struggle to comply with the regulations. To alleviate the upfront investment barriers (compliance costs), regulation could be supported by financial incentives as discussed below.

In addition, the scope would need to exclude projects with significant production risks, so that businesses are not dissuaded from identifying opportunities or forced into unduly risky projects.

In the medium-long term, well designed regulation may not impose excessive compliance costs on industry. Compliance costs could be outweighed by the energy and emissions cost savings that result from the increased energy investment. Regulation could result in greater energy savings and emissions abatement than delivered by the NZ-ETS alone.

At this stage, we would not recommend regulation to drive investment in clean energy is developed. Changes to the NZ-ETS, and other options discussed in this paper should be considered as first steps to drive changes in industrial energy use.

Non-regulatory approach - incentives for specified low emissions heat technologies

This section seeks your feedback on the potential use of incentives that the Government could utilise to support industry in the transition to a low emissions economy. More detailed analysis is required to determine the necessity of and the type of incentives, timing of implementation, the technologies that should be eligible, and the impact on emissions.

Poorly targeted support for low emission energy technologies may have negative interactions with the carbon price by encouraging higher cost abatement. The NZ-ETS reforms will lead to a cap and trade scheme, whereby the total volume of emissions is capped in advance and the price is allowed

to vary. If support accelerates the deployment of low emission technologies in industry, in turn reducing emissions, this could suppress the NZ-ETS price by reducing demand for NZ-ETS units by those benefitting from incentives. To avoid potential negative interactions with the NZ-ETS, incentives will need to be well designed and targeted.

Incentives would likely impose high costs on the Government and have the potential to subsidise expenditure that may occur anyway. Without additional incentives however, it may take some time for the NZ-ETS price to rise to levels sufficient to drive significant change and have a material impact on emissions reductions in the industrial sector. The internal competition for capital may persist as a significant barrier if clean energy investments are not prioritised.

At this stage, we would not recommend that incentives to drive investment in clean energy are developed. Changes to the NZ-ETS, and other options discussed in this paper should be considered as first steps to drive changes in industrial energy use.

Questions

Q5.1	Do you agree that complementary measures to the NZ-ETS should be considered to accelerate the uptake of cost-effective clean energy projects?
Q5.2	If so, do you favour regulation, financial incentives or both? Why?
Q5.3	In your view what is a bigger barrier to investment in clean energy technologies, internal competition for capital or access to capital?
Q5.4	If you favour financial support, what sort of incentives could be considered? What are the benefits, costs and the risks of these incentives?
Q5.5	What measures other than those identified above could be effective at accelerating investment in clean energy technologies?

Section 6: Cost recovery mechanisms

This section seeks your views on introducing a levy on consumers of coal to partially recover the cost of implementing any new policies in Part A that may be introduced.

Option 6.1 Introduce a levy on consumers of coal to fund process heat activities

Description

In order to mobilise private-sector investment and scale up efforts to achieve the Government's process heat outcomes, additional funds will be required to resource implementation of some of the policy proposals in Part A of this paper that are agreed by the government.

One option for funding policy proposals is through cost recovery mechanisms. We seek your feedback on introducing a levy on consumers of coal to fund EECA's process heat programmes.

Analysis

Introducing a levy on consumers of coal would provide an even treatment of levies for relevant specified activities of EECA, or could help to fund other implementation activities relevant to any proposals in this Section.

Funds are currently levied on:

- petroleum or engine fuel, to recover the cost of fuel monitoring and specified activities of EECA
- natural gas, to recover the cost of safety, monitoring and specified activities of EECA, and
- electricity, to recover the costs of the Electricity Authority, and specified activities of EECA.

These are based on consumption and sales of these energy sources. There is no equivalent coal levy. Under the Energy Resources Levy Act, the existing levy is only on coal extracted at open-cast mines, not on coal consumed in New Zealand. [41]

Determining the levy rate and the proposed activities to be funded will need to be made once in-principle policy decision have been made. However, the approach will likely be the same as for existing levies where EECA (or another agency) must describe the fuel types it is intending to levy for that year and demonstrate a logical link between its specific programmes and the levy.[42]

Table 4 below provides information on the current levies on petrol, gas and electricity to recover EECA costs, the quantum of revenue they raise for EECA.

[41] As outlined in the *Discussion Paper: Options for expanding the purpose of existing energy levies*, the existing levy is only on coal extracted at open-cast mines, not on coal consumed in New Zealand , so an expansion would not sufficiently meet the design principles and criteria that apply to using the levy for energy efficiency and emission reduction purposes. https://www.mbie.govt.nz/dmsdocument/2883-options-for-expanding-the-purpose-of-existing-energy-levies-pdf

[42] Available at https://www.mbie.govt.nz/dmsdocument/206-egi-cabinet-paper-levy-policy-decisions-final-sept-2016-redacted-pdf

Table 4: Current energy levies for EECA purposes

Levy (in 2019/20)[43]	Levy for EECA purposes	
	Levy rate	Amount levied ($ million)
Petroleum or Engine Fuel Monitoring (PEFM) levy	0.1 cents per litre	7.5
Electricity industry levy	12 cents per MWh	5.2
Gas Safety, Monitoring and Energy Efficiency (GSMEE)	1.4 cents per GJ	1.1

The Energy Resources Levy Act 1976 imposes a levy on the production of open-cast coal and natural gas produced from discoveries made before 1 January 1986. Revenue is paid into a Consolidated Fund. The levy rate is specified in legislation at rate of $2 per tonne on coal (other than South Island lignite), and $1.50 per tonne on South Island lignite. Approximately 50 per cent of coal extracted in New Zealand is exported as it is high-grade coal.

Coal users would face increased costs because of the levy. However, they are expected to benefit from the services the levy will fund. For example, coal users who pay the levy could receive co-funding from a low emissions heating feasibility study to switch off coal, trial a new technology under an expanded Technology Demonstration Fund, or benefit from a tax credit to adopt an energy efficient technology. While the total amount levied would depend on the specific activities to be funded, an initial estimate is in the order to $2 to $4 million. Levy funding would likely complement Crown funding, and any unused funds would be returned to levy payers.

The status quo would be to resource the adoption and implementation of policy proposals from general Crown revenue and existing energy levies. Another option would be to use the proceeds from the auctioning of emissions units.

Questions

Q6.1	What is your view on whether cost recovery mechanisms should be adopted to fund policy proposals in Part A of this document?
Q6.2	What are the advantages and disadvantages of introducing a levy on consumers of coal to fund process heat activities?

[43] Levy rates https://www.mbie.govt.nz/building-and-energy/energy-and-natural-resources/low-emissions-economy/energy-efficiency-in-new-zealand/energy-levies/