TRANSPOWER

Submission to the Climate Change Commission

On the Commission's first draft emissions budgets and advice to the Government

28 March 2021

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Section 1: Overview

We support the Commission's advice

Transpower endorses the analysis of the Climate Change Commission (the Commission) and agrees with its recommendations.

Our key responses to the work of the Commission are:

- the Commission has framed the challenge and the issues correctly. The analysis is consistent with our own independent work;
- the recommended policy proposals are the right ones for New Zealand to respond to the climate change challenge in the next five years. The priorities appear to accurately target both the motivators and the barriers to enable decarbonisation; and
- the recommended policy proposals are doable. New Zealand can take effective and affordable steps to achieve our Net Zero Carbon commitments.

In this submission we return to these themes as we discuss the sectors and policies considered by the Commission. We also tease out the immediate implications for the electricity sector.

As a starting point, we agree with the way the Commission has framed the challenge for New Zealand, and the challenge set by the Zero Carbon legislation. Over the last three years Transpower has undertaken research and analysis on the future of the Grid, the broader national electricity system, and the role it can play in enabling a low emission, affordable and reliable electricity system. Published in our Whakamana i Te Mauri Hiko series, our analysis supports the Commission's conclusions that:

- having targets in 2030 and 2050 means we must confront the need for social change in every sector, and confront the need for change to happen faster than it would otherwise;
- even if parts of the economy would decarbonise over time in response to existing market incentives and technology development, this transition will not be fast enough to achieve New Zealand's emission targets without increased policy support;
- the pathway to the 2030 and 2050 targets, and the decarbonisation of New Zealand's economy, can be achieved using existing technology;
- some sectors should be prioritised in the next five to ten years more than others; and
- the analysis should be data driven, both when proposing a set of policies, and discussing any changes to the policy proposals.

We have reached the point where "no" or "wait" are not options. The discussion now is about which set of changes to make. That the Government is required to enact a set of policy proposals that can be expected to meet New Zealand's emissions targets frames the dialogue between the Commission, the government, and New Zealand society.

In our view the set of policy proposals from the Commission sets the right priorities for New Zealand for the next five to ten years. In some sectors of the economy and society, change is more possible, and gains are more achievable in the immediate term. There are in fact some significant early gains to be made.

Transitioning to a low carbon energy sector will require a range of renewable fuels to contribute, including renewable electricity, biomass, biofuels, biogas, hydrogen, direct geothermal heat and others. In this submission we will focus on the role of the electricity sector in decarbonising the New Zealand economy. This is obviously the sector we know well. It is also important to New Zealand reaching its climate change targets. As the Commission stated:

Wider electrification of energy use is an essential part of the transition and will require a major expansion of the electricity system.

The grid will play an essential role in New Zealand's decarbonisation

As the owner and operator of New Zealand's electricity transmission grid, an essential part of Transpower's role is to look ahead into the future to understand how the grid may need to change to accommodate the growing demand for renewable electricity.

As New Zealand decarbonises its energy sector, we expect to see significant demand growth in urban centres driven by transport electrification. Similarly, we expect to see significant growth across the nation as New Zealand's manufacturers, hospitals, schools, universities, and commercial and public buildings increasingly look to electricity for their heating needs.

We expect that we will have to build new connections to supply to these new consumers and upgrade our existing connections as our existing customers increase their uptake of electricity. To supply this power, we will need to connect vast amounts of new generation, both from existing players and new entrants employing new generation and storage technologies.

To ensure that the power from these new generators can make its way to consumers across the country, we will need to make upgrades to the interconnected grid. This may involve upgrades to existing lines and substations or in some cases may involve building entirely new assets.

To determine how the grid must change, Transpower needs to answer three key questions:

- What investments will we need to make in the grid to connect and transport the amount of electricity required to support New Zealand's decarbonisation?
- How do we ensure that the grid remains operable, and we are able to support security and reliability of supply? And
- What changes will need to be made to the processes, regulations, and workforce that enable Transpower and the broader industry to go about our work?

To answer these questions, in 2020 Transpower released Whakamana i Te Mauri Hiko which explores how demand for electricity and the makeup of generation might change as New Zealand decarbonises. It considers the implications for the planning of the grid and the sector's ability to deliver a 55-70% increase in demand for electricity over the next 30 years.

Accommodating such a significant increase poses a significant challenge to the industry, but one that with sufficient planning, coordination, and adaptability we will be able to overcome.

Delivering new transmission assets can be a complicated and lengthy process, with regulatory investment approvals, resource consenting, and land rights acquisition sometimes stretching our lead times towards ten years. As demand for electricity ramps up through the mid-2020s, and as the pace of technological change accelerates, we will need to plan under considerable uncertainty to have a long-term view of the types of investments that might be required. We will need regulatory approval, consenting, and land rights processes which allow us to quickly move on transmission investments as demand for electricity builds and the triggers for our investments are hit, and we will need the internal processes, and the workforce to deliver them.

While Transpower is responsible for delivering these investments, it is not a task that we can do alone.

To clarify the concepts from Whakamana i Te Mauri Hiko into a more concrete forward plan of works, Transpower has started our Net Zero Grid Pathways project which seeks input from industry to help determine what specific grid investments may be required, and by when.

This process is vitally important in an investment environment that is challenged by high levels of uncertainty. As we investigate and decide on long lived investments that will serve transmission consumers for decades to come, it is essential that our decisions reflect the advice that consumers give us about their forecast future demands on the grid.

While existing electricity consumers and generators are able to provide us advice on their future plans, we expect that as New Zealand decarbonises, we will increasingly see demand for electricity coming from the transport and process heat sectors. Because of their importance to New Zealand's decarbonisation objectives Transpower has taken a deep dive into these areas with the 2021 release of our Electrification Roadmap.

The roadmap helps to clarify the magnitude of electrification that we should plan for the grid to support, and the role of other fuels in decarbonising these key sectors. It also identifies a number of key opportunities for policy and business model changes that could help to motivate and enable the transition to low emissions fuels.

Electrification of energy use is essential

We agree with the Commission that electrification of energy use is essential to the transition for a low carbon economy. When considering electrification of energy use, we also agree that there are clear priorities for the short term, where significant gains can be made. These are:

- transport, and in particular light transport;
- process heat, and in particular lower temperature activities; and

- increasing the proportion of renewable electricity, and in particular the shift to 95% renewables.

These priorities identified by the Commission are well aligned with the previous analytical and modelling work by the Productivity Commission, Transpower, and the Interim Climate Change Commission as well as with the findings of our Electrification Roadmap.

As well as being achievable, the decarbonisation of transport and process heat are two of the most cost effective and sizeable abatement choices available to New Zealand.

Collectively, they make up 54% of New Zealand's emissions covered in the 2050 Net Zero Carbon target, so electrifying these activities could materially improve our emissions reductions.

The move to 95% renewable electricity is a third area of significant, cost effective gains available in the short term which is likely to occur rapidly as a result of natural market forces.

Electrification of transport

Our analysis identifies that the electrification of light transport offers the largest and most cost-effective decarbonisation opportunity available to New Zealand. Our Electrification Roadmap finds that electrification of transport can reduce New Zealand's annual emissions by around 2.1 Mt CO_2-e while generating annual net benefits to the economy of around $600 million from 2030 building to around 6.1 Mt CO_2-e and $1.6 billion a year by 2035. Transport represents 37% of emissions covered under New Zealand's Net Zero Carbon target – of that 80% is in light passenger vehicles and light commercial trucks.

Heavy transport emissions will need to be reduced in time. Abatement in this area is higher cost, with lower technological certainty and lower potential abatement. The task here is to put the groundwork in now to unlock substantial emissions reductions from 2030.

In a priority sector like transport, choices still need to be made about the policy changes that will deliver the most gains in the near-term, and that set the sector up for even greater success in the long-term.

In transport, our analysis identified the following priorities in the next five years with a particular emphasis on the first two priorities:

- Improve immediate access and availability of EVs;
- Reduce up-front capital cost barriers, improve access to capital;
- Reduce operating cost barriers;
- Create behavioural incentives;
- Enable access to electric charging;
- Ensure uptake is supported by electricity infrastructure; and
- Support alternative fuels for heavy vehicle decarbonisation.

This aligns well with the Commission's recommendations to:

- Accelerate light vehicle uptake by introducing a package of measures to ensure there are enough EVs entering Aotearoa, a time limit on ICE vehicles entering Aotearoa, and reduce upfront cost of purchasing light electric vehicles;
- Develop a charging infrastructure plan for the rapid uptake of EVs;
- Increase the use of low carbon fuels for trains, ships, heavy trucks and planes.

Electrification of process heat

The second near term priority for decarbonisation is low and medium temperature process heat. We identify that the use of electricity and biomass in process heat can deliver the next most cost-effective opportunities. Our Electrification Roadmap finds that electrification of process heat can reduce New Zealand's annual emissions by around 0.6 Mt CO_2-e with annual costs to the economy of around $50 million from 2030, building to around 1.3 Mt CO_2-e and $100 million a year by 2035. Process heat represents 17% of emissions covered under New Zealand's Net Zero target – of that 44% is in low temperature heat (including space and water heating) and 23% in medium temperature heat.

Higher temperature process heat activities have higher abatement costs and, in many cases, require technological development. The task here will be to develop site and process specific plans that provide a path to substantial emissions reductions from 2030.

In process heat, our analysis identified the following priorities in the next five years with a particular emphasis on the first two priorities:

- Alleviate capital cost barriers for those ready to benefit from decarbonising;
- Establish and scale markets to drive clean energy costs down;
- Rapidly transition public sector coal, diesel and LPG boilers to clean energy;
- Accelerate clean heat audits and site decarbonisation strategies; improve fossil fuel boiler information;
- Build process design and process heat decarbonisation capabilities; and
- Improve network planning, coordination and connection processes.

This aligns well with the Commission's recommendations to:

- Reduce emissions from process heat;
- Maximise the use of electricity as a low emissions fuel;
- Scale up the provision of low emissions energy sources;
- Support innovation to reduce emissions from industrial processes; and
- Increase energy efficiency in buildings

Moving quickly to 95% renewable electricity

A more renewable electricity system will magnify the benefits of electrifying transport and process heat. It is possible for New Zealand to have an electricity system with at least 95% renewable generation by 2030 through natural market developments.

To achieve this, we need to prioritise displacing the use of fossil fuels for baseload generation with low cost renewable generation.

In renewable electricity, our analysis has identified the following priorities in the next five years:

- Reform the Resource Management Act (RMA) to recognise the importance of renewable electricity and streamline consenting for new renewable generation and the associated transmission lines;
- Develop of a deep Power Purchase Agreement (PPA) market in order to help drive down electricity prices and provide longer-term price certainty to purchasers;
- Further evolve markets to realise the value of distributed energy resources and demand-side participation;
- Empower regulators like the Electricity Authority and the Commerce Commission to support decarbonisation;
- Further incorporate the long-term benefits of climate change mitigation and connecting new renewable generation into the Grid Investment Test; and
- Improve Grid Investment Test processes and inputs to further enable transmission development that provides additional capacity for electrification and/or new renewable generation.

Importantly, these changes in the transport and process heat sectors, and to the composition of our electricity generation, are achievable. That is not to say they won't require effort, and they won't require change from a lot of people, because they will. But they can be done and done within the timeframe required by New Zealand's climate change targets. The technology is available, the commercial and practical problems are solvable, the industry co-ordination is possible, the right policy and regulatory mechanisms are available, and changes can be made.

This is part of the discipline brought to bear by the Commission's work. Not only is the thinking clear and the prioritisation good, but the policy proposals are achievable.

A major expansion of the electricity system is required

We agree with the Commission that these electrification and decarbonisation priorities will require a major expansion of the electricity system, and this needs to start now.

To give a sense of the scale of the expansion required, in our submission on the Ministry of Business, Innovation and Employment's Accelerating Renewable Energy and Energy Efficiency (MBIE AREEE) discussion document we estimated that the New Zealand electricity sector will need to build and deliver as much new electricity generation in the next 15 years as we have in the last 40 years. Even in the event of a potential closure of the Tiwai Point aluminium smelter, we would still need to build and deliver as much new generation in the next 15 years as we have in the last 30 years.

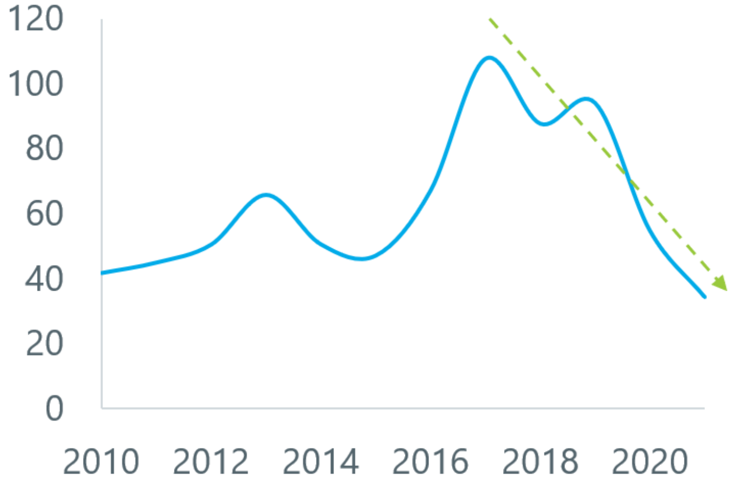
This new generation places demands on the infrastructure downstream. We estimate that 60 to 70 new grid scale connections, each requiring new lines and potentially new substations, will be required between now and 2035 (30 to 40 new generation connections and 30 new connections to accommodate the increased demand).

These new connections will get more electricity on and off the grid. We will also need to strengthen the grid to reliably and safely transport these volumes of energy. Our modelling identifies an increase in large grid upgrade projects that need to be done before 2035. This is only 15 years from now, and each one is a major infrastructure project. Again, this is a significant scaling up of our infrastructure build compared to recent years.

In short, under any scenario the Commission is right to observe a major expansion is required, starting now. However, it is important to be clear about what this major expansion of the electricity system implies and does not imply.

It does not imply a commensurate major expansion in electricity costs, nor a one for one increase in transmission build. The cost of new renewable generation is declining rapidly. New Zealand needs to build a lot more of it, but it is getting cheaper to do so. New renewable generation is already more cost effective than today's baseload thermal generation, and technology will continue to improve. By way of example, in Australia the wholesale electricity price has declined significantly in the last three years as close to 20 GW of new renewables have been built:

Figure 1: Falling wholesale price of electricity in Australia (2020 real, AU$/MWh)



In addition, the major increase in electricity delivered across the transmission grid and distribution networks does not have to imply a similar scaling up of expensive network build. Peak demand, not total energy volume drives network build. Energy volume is often how consumers' bills are charged. As a general rule of thumb, if energy volume grows at a faster rate than peak demand, network charges for consumers will decline as the cost of the network is spread over a larger number of units of electricity.

The more that electrification of new sectors of the economy like transport and process heat can be done in a way that means the new energy volume doesn't drive up the peak to the same degree, the more that can be done with the existing network. Examples of these would include electric vehicles being charged overnight or electrified dairy factories operating outside of peak winter months based on milking seasons. More generally, there will be greater variation in where and when energy is available to the grid, and greater flexibility from users in how they take energy from the grid, that will mean the grid is much better utilised outside the peak. We forecast that peak demand could grow at half the rate of energy volume growth to 2050 which could lead to reduced network charges for all consumers in time.

In short, we are talking about a major expansion in the volume of delivered electricity and that will require more network investment, but how much more depends on the path New Zealand takes to decarbonise. Our estimates above of increased large grid upgrade projects before 2035 assume the sector co-ordination and policy work is done to enable distributed energy resources and demand response to smooth the growth in peak demand as the volume of electricity delivered to the economy grows.

What the major expansion of the electricity system *does* imply is making some changes to the way we think about:

- investment decision-making; and
- project consenting and land access.

Investment decision-making

When it comes to network investment decision-making, the next 15 years, and the 15 after that, are going to be very different from New Zealand's recent experience. Or, to be more accurate, they will need to be if New Zealand is to hit its climate change targets.

Our existing system – our ways of framing an investment choice, of articulating a business case for internal approval, of consulting with stakeholders, of regulatory oversight – has evolved to support least regrets investment decisions in a world that is evolving incrementally. In this system, the task for the project manager, internal governance, and external scrutiny is to be confident that the right increment of investment is being built as late as prudently possible. There is time to wait for more information and more certainty should it be needed, and it is seen to be in consumers' long-term interests to do so.

This framework has worked well during our recent period of relatively flat demand growth with a comparatively high degree of certainty. As the pace of electricity demand growth increases, we believe that the time is right for a conversation about how we could evolve this system to reflect the role that the grid must play in New Zealand's decarbonisation. This conversation must involve both our regulators, consumers, and the broader industry to ensure that we strike the balance between the needs for consultation, scrutiny, flexibility, and pace. There is no single policy that will achieve this shift in the network investment system, but to begin the conversation, we suggest that areas of focus should include:

- Making investment decisions in the face of uncertainty;
- Considering integrated investment proposals; and
- Allow our investment decision-making framework to better consider climate change.

To be clear, we are not proposing that the investments Transpower makes on behalf of electricity consumers should be subject to less scrutiny or that the need for consultation has decreased. If anything, the coming years will require more consultation to allow us to make decisions under increased uncertainty. Investments made by Transpower in major capital projects need to be approved by the Commerce Commission, via the Grid Investment Test, to ensure that they provide net benefits to electricity consumers. This assures industry participants and consumers that there is independent scrutiny of any decision to invest. This process is critical for ensuring efficient transmission investment in the long-term interests of consumers.

We are also not proposing transformational reform of the sector's regulatory framework. The sector's regulatory framework has largely worked to date. But as the context shifts from just in time, incremental investment to integrated investment that enables the transition to net zero carbon there are a number of relatively simple, practical changes that could be made to the current framework to better align it with the Government's direction on emissions reductions.

Making decisions in the face of uncertainty

To increase our pace of delivery, we will need to make decisions and commit to investments in circumstances where, in the last two decades, we might have waited for better information. We will need to make investment decisions despite having imperfect information, with an eye on where the grid and the country needs to be in 2030 and 2050. This implies shifting the framework to:

- investing in network capability;
- creating options for further electrification and renewable generation; and
- having frameworks in place to proactively make decisions where inaction due to uncertainty is an unacceptable outcome.

To give a regulator confidence to make this shift, this should be expressly recognised and codified in the legal framework. This could be achieved through specific changes to regulators' mandates, or it could be implemented through targeted Government Policy Statements which articulate the Government's intention that regulators consider a broader range of factors when setting policy and approving investment decisions. As an example of this concept in practice, in the early months of the COVID-19 crisis the Government provided the Commerce Commission with a Government Policy Statement which under section 26 of the Commerce Act 1986 required the Commission to have regard to the economic policies of the Government as transmitted in writing.

We also suggest that the industry and government assess the relative merits of introducing a fast track approval process for major capital investments, as the Australian Energy Market Commission recently did in Australia. This process doesn't have to be used every time, but where we have investment proposals that are consistent with keeping New Zealand on track to achieve the major expansion in the electricity system required, we should have the tool available to make these decisions quickly. This variation to the Australian framework allows the regulator to undertake steps of their approval process in parallel, increasing the pace of the approval process. It follows a rigorous industry and consumer consultation process. Alternative potential processes could take inspiration from the Fast Track consenting process, which accelerated RMA approvals for specific infrastructure projects and allowed non-specified projects to be approved via Orders in Council.

Consultation, scrutiny and regulatory approvals will continue to have an important part to play in the years ahead. Possibly more so – the next 30 years will demand more judgment not less, and we need to draw upon all expertise. The key will be in the shift that everyone involved has to make, to a mindset that is reframed to keeping the sector on track to reach its 2030 and 2050 climate change targets.

Considering integrated investment proposals

A related shift is enabling decision-makers to consider investment proposals together. The transmission grid is a system, and often a series or package of investments in the grid will have a much larger impact than any individual or isolated investments.

When considering the potential benefits of network investment proposals, in a context where the Commission has identified a requirement for a major expansion in the electricity system over a challengingly short period of time, we need to be sure we are identifying the systemic and magnified benefits that can come from an integrated package of investments. We face a future where we have to make a number of significant changes to the grid – it doesn't make sense to weigh them all in isolation.

Allow our investment decision-making framework to better consider climate change

A third area of focus should be a health check of whether the framework we use for making investment decisions, and other regulatory decisions in the electricity sector, is fit for purpose in the context of the increasing importance of climate change. As outlined, we are not proposing transformational reform of the sector's regulatory framework as it has largely worked to date. This provides a strong foundation from which a number of relatively simple, practical changes can be made to better align it with the Government's direction on emissions reductions.

As the Climate Change Commission is signalling, meeting the challenge of climate change will be the overarching objective of the electricity system for the foreseeable future. We need to be sure the investment and regulatory framework we have inherited from a period where climate change was not a primary focus is fit for purpose.

Specifically, this could include:

- strengthening the mandate for the Commerce Commission and the Electricity Authority to consider climate change mitigation in their decision making. The decisions made by the electricity sector regulators on issues like investment approvals and pricing will either help or hinder New Zealand's progress toward its climate change objectives. We recommend that the Commerce Commission and the Electricity Authority both be charged with making decisions consistent with the electricity sector enabling New Zealand to reach its 2030 and 2050 climate change targets. Given the role the electricity sector must play in decarbonising the economy, and the scale of that challenge, this needs to be made explicit;

- improving how the Grid Investment Test recognises the benefits to New Zealand of emissions reduction. At present the Grid Investment Test considers the costs and benefits of the project "arising in the electricity market". Benefits of the project that fall outside of the electricity market are not considered. This limits the ability of the Commerce Commission to approve major transmission investments that would assist New Zealand's transition to a low carbon economy where the climate change benefits fall outside the electricity market. So, for example, where an investment would result in consumers switching from fossil fuels, and in so doing, save money that would have been spent on fossil fuels while also reducing emissions, the Commerce Commission is not permitted to consider these benefits when deciding whether to approve the investment – or not. Other areas of the test could also be adapted to better reflect Government direction on climate change, such as applying a social cost of carbon or a social discount rate for carbon costs which are considered in the Test; and

- incorporating forecasts into investment decision-making in the electricity sector that are consistent with New Zealand achieving our decarbonisation targets. We should avoid a situation where the Climate Change Commission is using forecasts of carbon prices, demand, etc, to set national targets and budgets, and the regulators in the sector are using different forecasts when deciding on investments and pricing in the sector. Additionally, if the Electricity Demand and Generation Scenarios (EDGS) that MBIE produce do not reflect a future in which New Zealand achieves its decarbonisation objectives, then the Grid Investment Test would suggest that we should invest in the grid accordingly.

These are examples to illustrate the broader point – we should check now that our regulators are both empowered and required to make decisions that are consistent with the electricity sector playing the role required of it to decarbonise the New Zealand economy.

Project consenting and land access

Currently, consenting and land access timeframes for large projects can be in the order of 3-7 years before the 2-3 years of build can be commenced. These timeframes are often even longer when RMA and compulsory acquisition appeal processes are exerted. This lengthy time frame is a luxury that New Zealand can no longer afford. It impacts on our ability to commission the amount of network infrastructure that New Zealand needs by 2035 and 2050. These lead times also reduce the flexibility in the system - instead of planning for smaller projects done quickly, the system leans toward large projects with longer lead times.

The hard truth is that RMA consenting and property access timeframes need to be reduced in a material way to achieve the electrification and renewable energy development consistent with New Zealand's Paris commitment and net zero carbon target.

As a nation we need to find a way to reconcile the national benefits of low carbon infrastructure services and decarbonisation with the local costs of the physical infrastructure which supports it, and we need to find ways to resolve this debate more expeditiously.

The objective: speed

The overall objective of these changes in how we make investment decisions, and how we make decisions on project consenting and land access, is speed. We need to commit to investment decisions and build the infrastructure faster than we have to date. A standard timeline of 2-3 years for investment approval and 3-7 years for consenting and land access can lead to ten years of planning before a project build even commences. This will no longer be workable if the required electrification and renewable generation is to be achieved.

At Transpower, we are implementing an improved end-to-end delivery process that is improving our efficiency and enabling us to deliver projects more quickly. By way of example, the Clutha Upper Waitaki Lines project has had its original three-year delivery timeline shortened to two years through realising efficiencies in delivery. These changes are important, and we will continue to challenge ourselves to be more efficient in our delivery. But even with these efficiencies, we will still need the changes in how we make investment decisions, and how we make decisions on project consenting and land access.

When we make these changes, and increase the speed of decision-making, there will be positive feedback loops. Faster decisions will mean New Zealand captures the benefits of each project more quickly. It will also mean the system becomes more agile – we create the potential for smaller projects done quickly, rather than unwieldy timeframes creating a bias toward larger projects and the treatment of visual amenity creating a bias towards non-renewable projects as they are easier to consent.

The future is already knocking on our door

We are already experiencing a significant increase in enquiries from potential developers of new generation. And we are committed to changing our business to meet the challenge of delivering the electricity that New Zealand needs in 2035 and 2050.

We are updating our system planning to ensure that our future grid plans remain consistent with delivering a net zero carbon future and engaging with industry through our Net Zero Grid Pathways project to ensure our future investment plans are well informed. We are collaborating with customers to help them plan for the decarbonisation of their business. We are improving our processes to accommodate the new volume of connections to our grid and refreshing the information we give to new customers on the grid connection process to make this more streamlined. We are also planning ahead for a major scaling up in our workforce which is an industry-wide challenge.

While Transpower is working to ensure it can enable this electrified future, we reiterate what we said in our MBIE AREEE submission – the challenge for the electricity industry is significant but with sufficient planning, adaptability, and commitment, it is achievable.

Where appropriate we have continued these discussions in our submission.

Section 2: Response to the Climate Change Commission's questions

Question 1: Principles to guide the Commission's advice

We support the approach that the Commission has taken in developing core principles and the principles selected. In particular our analysis supports the need to:

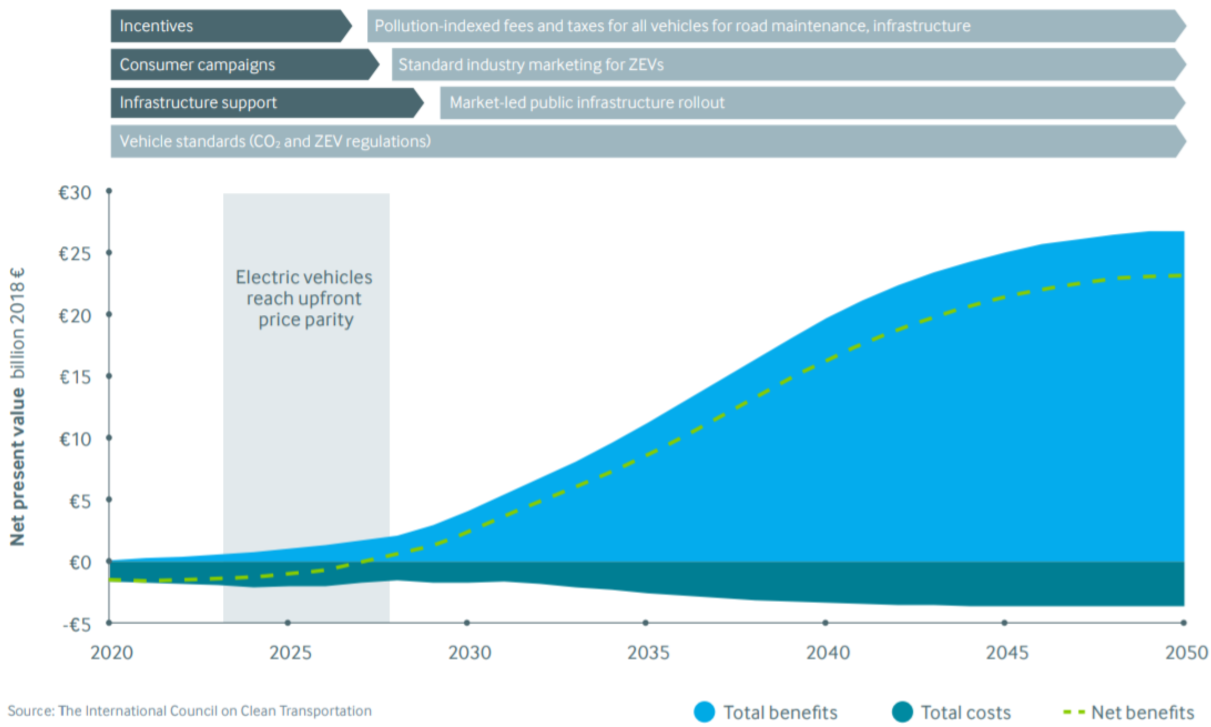
- Align with 2030 and 2050 targets, while also setting New Zealand up for net zero emissions later and to contribute to the global effort;
- Prioritise actions that reduce gross emissions within our borders;
- Increase resilience to climate impacts and the value of creating options in our infrastructure and investment choices; and to
- Leverage co-benefits (such as health, well-being and the environment).

Question 2: Emissions budget levels

We are supportive of the need for New Zealand's budgets to meet our 2030 Paris Agreement target and are therefore supportive of the structure of the proposed budgets. Our analysis aligns with the Commission's conclusion that focusing on transport and process heat will provide effective and achievable emission reduction outcomes. The economic analysis across these sectors is consistent with analysis in other countries that examine Government investment to deliver economic and climate outcomes.

While some organisations may be concerned about the role of Government and the need for policy support, it is reasonable to set and deliver clearly signalled long-term transition programmes. In many instances, this support can be short-term and transitional in nature. For example, analysis of German transport policy has illustrated that in the 2020s the balance of investment in the electrification of transport can shift from public investment to private sector and market led initiatives.

Figure 2: Costs, benefits and policy over the transition to Zero Emissions Vehicles in Germany



Question 3: Break down of emissions budget

We support the need to break down emissions budgets by the categories of gross long-lived gases, biogenic methane and carbon removals from forestry.

We would appreciate more information on the approach that is proposed for F-gases.

Transpower, as an ETS participant who operates electrical switchgear using SF_6 gas, is required to monitor, collect information and report on its SF_6 usage in electrical switchgear annually. SF_6 is predominantly used in outdoor circuit breakers and high voltage gas insulated substations which allows for high capacity sites on small footprints.

It is our understanding that there are no specific legislated gas emission targets for SF_6 itself. However, the New Zealand Government has agreed to international climate change targets and has set a number of overall national greenhouse gas emissions targets (and intervening emissions budgets). As a greenhouse gas, SF_6 emissions are included in the scope of those targets. Up until this time we believe there have been no specific emissions targets in relation to SF_6 within New Zealand.

The Paris Agreement aims to limit the global average temperature increase to 1.5° Celsius above pre-industrial levels. Under the Climate Change Response Act 2002, New Zealand's target is to achieve zero net accounting emissions of all greenhouse gases (including SF_6) other than biogenic methane by the calendar year beginning on 1 January 2050 and for each subsequent calendar year.

Transpower has processes in place for the use, maintenance and reporting on SF_6 emissions and inventory. We are also in the process of developing a SF_6 strategy for the management to Net Zero emissions status. There are currently no viable alternatives for SF_6 in our high voltage outdoor equipment and where alternatives exist for other equipment, increased costs and size are limiting. Technologies to replace these assets are not readily available with proven equipment not expected to reach the New Zealand market until 2030.

We ask that the Commission is clear in its budgeting for F-gases as to which classes of gases are expected to contribute to emissions reductions and their respective target proportions to ensure that hard to abate applications, such as SF_6 in high voltage equipment, are not unintentionally penalised by ambitious targets and are enabled to decarbonise in a just transition.

Question 4: Limit on offshore mitigation for emissions budgets

We support the recommendation that domestic action should be prioritised for meeting emissions budgets. Our analysis has identified that there are significant opportunities to reduce emissions domestically in the transport, process heat and electricity generation sectors.

Question 5: Cross-party support for emissions budget

We support the need for cross-party support for the emissions budget. Industries need a stable regulatory environment to make long-term investments and transformational shifts and cross-party support can help to enable this.

Question 6: Coordinate efforts to address climate change across Government

We support the need for coordinated efforts to address climate change across Government. The levers available to mitigate climate change sit across a number of agencies e.g. Electric vehicles under Ministry of Transport, Energy under MBIE, RMA and water allocation and climate change under Ministry for the Environment. There are interdependencies between each that means no agency or department can work in isolation.

Leadership to coordinate across agencies, supported by policy, strategy and assigned accountability will provide both policy makers and industry with clarity and consistency. Over the next decade we expect there to be an increasing convergence of energy vectors and the integration of transport with urban infrastructure.

While we do not have a specific view on the use of VOTE or other funding mechanisms, the $70 million Government Investment in Decarbonising Industry (GIDI) Fund is precisely the type of intervention required to enable rapid decarbonisation at scale. The contestable aspect of the fund ensures support is first targeted to the areas that can make the lowest cost, most material and immediate emissions reductions. It is likely to be effective in overcoming capital cost barriers. If successful, the GIDI Fund could be scaled-up to provide more support in accessing the significant sums of capital that will be required to enable businesses to transition away from fossil fuels.

The Government's $200 million State Sector Decarbonisation Fund is also providing important and timely support for conversion of public sector coal boilers. In time this fund could be expanded to also target diesel and LPG boilers.

Question 7: Genuine, active and enduring partnership with iwi/Māori

We support the intent that the Commission has outlined to develop an enduring partnership with iwi/Maori.

Question 8: Central and local government working in partnership

We support the need for central and local government to work together to develop and deliver the transitions required. This will require more national direction to councils to take climate change requirements into account. It could also be particularly relevant in spatial planning where inconsistency between local government agencies can make planning and consenting complicated where infrastructure or asset networks cross many boundaries.

Question 9: Establish processes for incorporating the views of all New Zealanders

We support the need for wide consultation with New Zealanders but balanced with the need for timely decision making as action on climate change is urgently required if we are to meet our Paris Agreement commitments.

Question 10: Locking in net zero – long lived gases

We support the approach to focus on decarbonising sources of long-lived gas emissions where possible. Collectively, our use of fossil fuels in transport and process heat make up 31% of New Zealand's total emissions. Reducing emissions from these long-lived gas emitting sectors will be easier and lower cost than reducing emissions from other sectors, like agriculture.

We agree with the Commission that New Zealand should be setting a path that would achieve near-complete decarbonisation in a number of areas including low and medium temperature heat used in industry, electricity generation, energy use in buildings and land transport. We agree with the Commission that for each of these sectors there are already available technologies that can be widely used to reduce or completely avoid gross emissions.

The reduction of emissions in some of these sectors could also be an economic opportunity. For example, a recent Concept Consulting study found that each year of delay in electrifying transport will increase New Zealand's cumulative emissions and transport costs by around 1% and $1 billion respectively to 2050.

This analysis is corroborated by findings in our recent Electrification Roadmap report. The report found that electrification and increased renewable generation can reduce New Zealand's annual emissions by at least 4.7 Mt CO_2-e while generating annual net benefits to the economy of around $500 million from 2030 building to at least 9.6 Mt CO_2-e and $1.4 billion a year by 2035.

Question 11: Locking in net zero – native forests as long-lived source of carbon removals

No comment.

Question 12: Our path to meeting the budgets

We support Paris Agreement consistent emissions budgets and are committed to ensuring that New Zealanders and New Zealand businesses are able to decarbonise through electrification and renewable generation.

In our view, the set of policy proposals from the Commission sets the right priorities for New Zealand for the next five to ten years. In some sectors of the economy and society, change is more possible, and gains are more achievable in the immediate term. There are in fact some significant early gains to be made.

These are:

- transport, and in particular light transport;
- process heat, and in particular lower temperature activities; and
- increasing the proportion of renewable electricity, and in particular the shift to 95% renewables.

These priorities identified by the Commission are well aligned with the previous analytical and modelling work by the Productivity Commission, Transpower, and the Interim Climate Change Commission as well as with the findings of our Electrification Roadmap.

Our Electrification Roadmap, the latest in our suite of Te Mauri Hiko analyses, explores two of these key targets for decarbonisation – transport and process heat. As well as being achievable, these two targets are the most cost-effective abatement choices available to New Zealand. The Roadmap looks at the challenges and opportunities in each space and explores what options are available to policy makers to encourage and enable that change.

There is also a near-term opportunity to increase the percentage of renewable electricity in New Zealand to at least 95% by replacing baseload thermal power plants with renewable generation.

Our analysis is aligned with the Commission's, that the transport and process heat sectors should be an early priority.

Question 13: An equitable, inclusive and well-planned climate transition

We support the need for an equitable and inclusive climate transition.

As we discuss in our response to Question 5, we strongly support the need for a well-planned transition. Clear direction and a stable policy environment are vital for businesses to be confident in making long lived decisions about their assets and associated investments.

We support the Commission's recommendation to develop policies for creating a workforce with the skills needed for accelerating the low emissions transition, however we believe this needs to be a time-critical action. The Government needs to be thinking about the workforce requirements now because of the lag time in the education system and other sources of employment such as immigration.

In Whakamana i Te Mauri Hiko, we found that for the electricity sector alone, New Zealand would need thousands more highly skilled people by 2035 to the meet the demand ramp for new generation, transmission and distribution investments required for electrification[1]. This labour requirement is on top of ensuring the industry can secure resources to manage material levels of retirement over the next 15 years as the workforce ages. Turnover rates for the industry are relatively low, meaning current workforce development processes have been designed to replace small numbers – a practice that will not be sufficient to meet the demand ramp driven by electrification and increased renewability.

But ramping up workforce demand is not the only challenge. Supplying workforce demand has become more difficult due to the decline of vocational training, the relative weakness of the electricity industry's employment brand relative to other industries, stricter immigration laws and growing international competition for New Zealand trained workers.

[1] Section 9 of Whakamana i Te Mauri Hiko – "Access to skilled workforce" pp 79 - 80

On top of additional workforce capacity demand, new capabilities will be required to deliver new types of infrastructure, such as digital and technology innovation, automation, robotics, artificial intelligence and data science.

It is unlikely that the electricity sector is alone in the workforce challenges it faces to enable decarbonisation, therefore, we support the Commission's recommendation to focus on:

- Assessing how the education system sets all New Zealanders up for the low emissions jobs of the future, with skillsets that enable workers to adapt and lifelong learning;
- Upskilling and redeploying workers transitioning from high emissions sectors; and
- Developing skills and training into low emissions industries by Māori, for Māori.

Question 14: Transport

Since 1990 transport emissions have almost doubled, and in 2018, transport emissions accounted for 37% of the New Zealand's emissions included in the Net Zero Carbon target. We support the Commission's policy recommendations to target material transport emissions reductions and, as we lay out in our recently released Electrification Roadmap, while the challenge is significant, it is achievable. Decarbonising transport will be critical to ensuring New Zealand can meet its emissions reductions targets. In our view, the key observations in this area are:

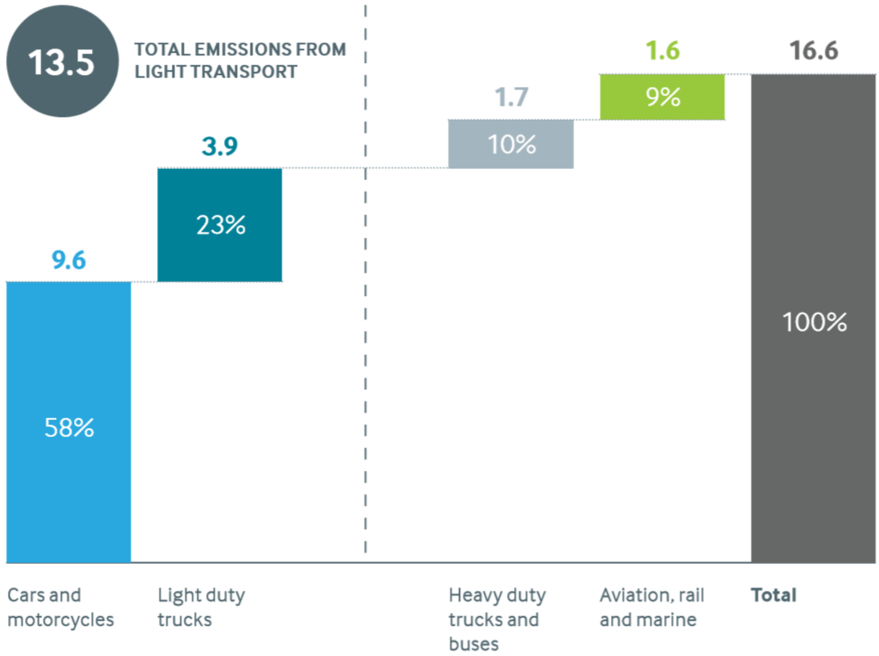
- the Commission is right to prioritise the electrification of light vehicles in the immediate term. There are large gains to be made and the technology is available;
- this is a project to bring forward a social change – the mass adoption of electric vehicles – that is already set to happen in New Zealand, but will happen too late without policy intervention;
- bringing this social change forward can be done. The policy and technology tools are available, and other countries have already begun to stimulate mass adoption; and
- once the adoption of electric vehicles has critical mass, with the supporting systems and feedback loops that come with mass adoption, the policy measures can be wound back.

We expand on each of these points below.

The Commission is right to prioritise the electrification of light vehicles in the immediate term

We strongly support the Commission's recommendation to prioritise accelerating the electrification of the light vehicle fleet. Light vehicles, including cars, vans and light duty trucks, make up close to 80% of our transport emissions. Electric alternatives for these types of vehicles are becoming more widespread and economic to run, making light vehicles the largest emissions reductions opportunity for New Zealand, especially leading up to 2025 and 2030.

Figure 3: Breakdown of New Zealand transport emissions, 2018



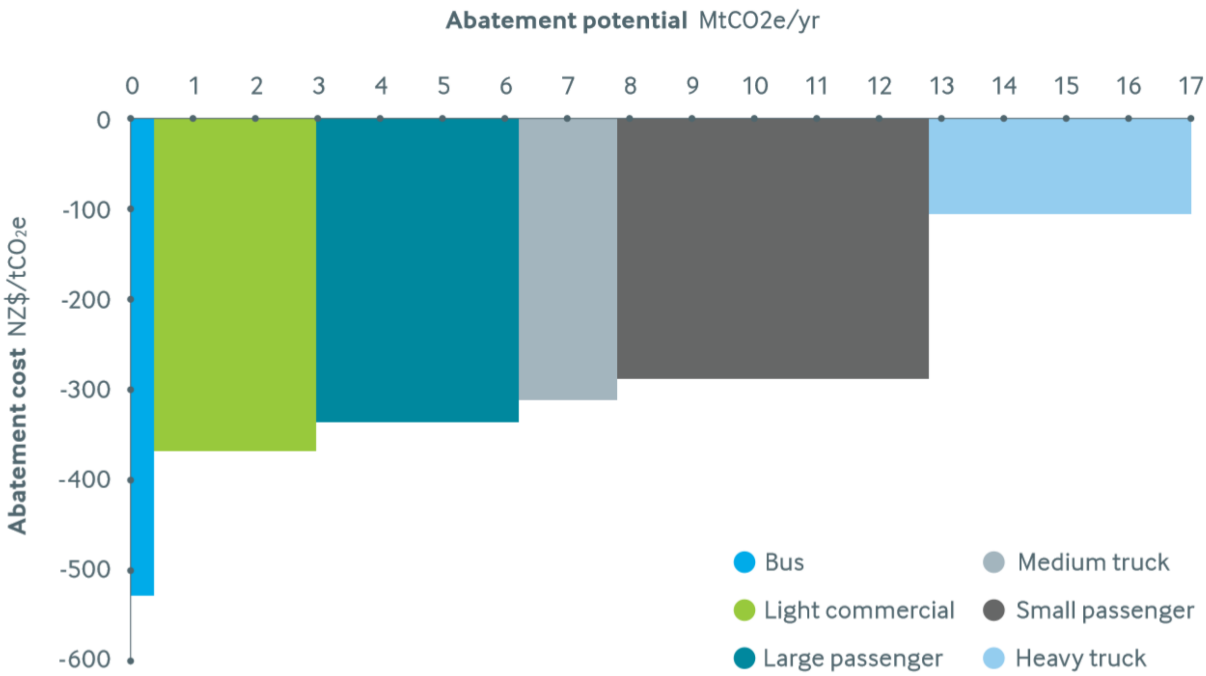
Source: Ministry for the Environment

Our remaining transport emissions from heavy duty trucks, buses, rail, aviation and marine will also need to be decarbonised in time, likely through alternative fuels such as biofuels and/or hydrogen. But because the technology is still emerging, focus within these areas should be on ensuring the settings are in place for rapid uptake once the technology is more readily available.

As a bonus, electrifying our fleet can bring economic benefits to New Zealand. Based on the Ministry for the Environment's marginal abatement cost curves and our Whakamana i Te Mauri Hiko analysis, we estimate that by accelerating the uptake of light EVs and continuing to progress the decarbonisation of heavy transport, we can reduce annual emissions by 2.1 Mt CO_2-e and generate net benefits to the economy of $0.6 billion in 2030. By 2035, annual emissions reductions increase to 6.1 Mt CO_2-e and net benefits to $1.6 billion.

The Ministry for the Environment's marginal abatement cost curves forecast that by 2030 most road electric transport options will have negative marginal abatement costs – i.e. they will reduce costs for consumers and the economy while reducing emissions.

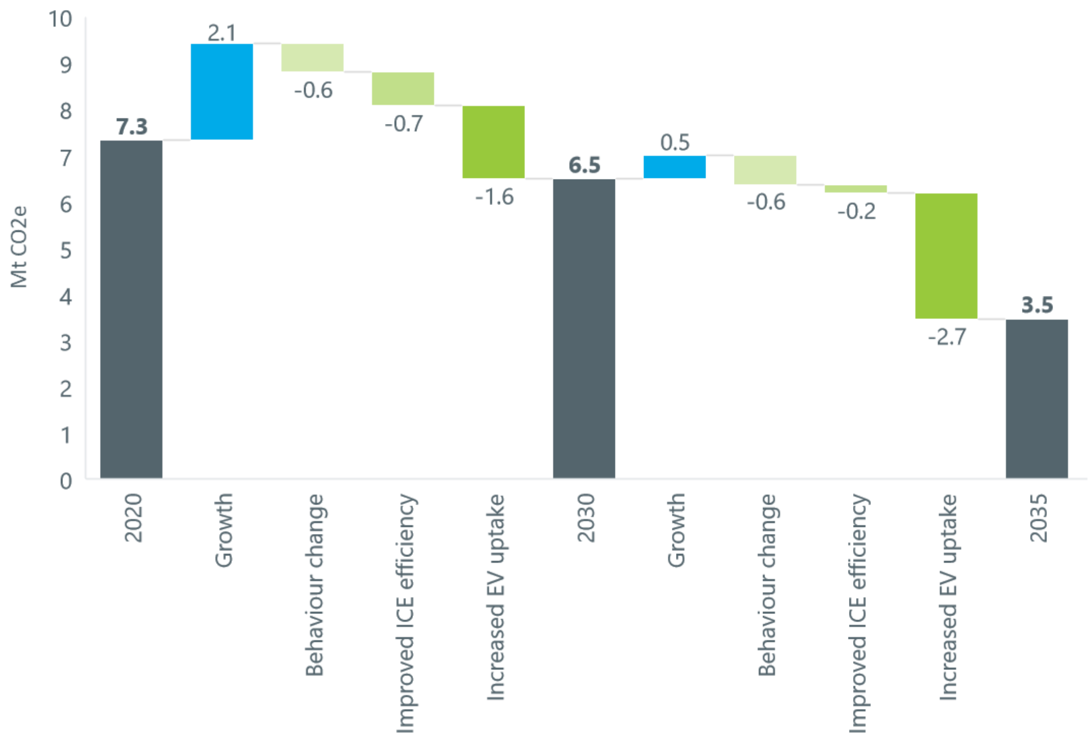
Figure 4: EV transition marginal abatement cost curve 2030



Source: Ministry for the Environment

We acknowledge that reducing the need to travel and shifting to alternative modes of transport will also play a role in a decarbonised transport sector. However even with material behaviour change, decarbonising our fleet will make the most progress to reducing our emissions. Our analysis of the Commission's Our Path scenario, as shown in Figure 5, outlines that EVs can provide the most emissions reductions in light vehicles, equivalent to 4.3 Mt CO_2-e by 2035, against a starting baseline of 7.3 Mt CO_2-e. In contrast, behaviour change like switching to public transport or travelling less, can achieve a much smaller 1.2 Mt CO_2-e reduction by 2035.

Figure 5: Composition of light passenger transport emissions reductions based on the Commission's 'Our Path' scenario



This is a project to bring forward a social change

Left to current market and policy settings, purchase price economics will likely favour EVs towards the end of this decade and mass EV adoption will follow. But this will be too late to meet our 2030 Paris Agreement commitments.

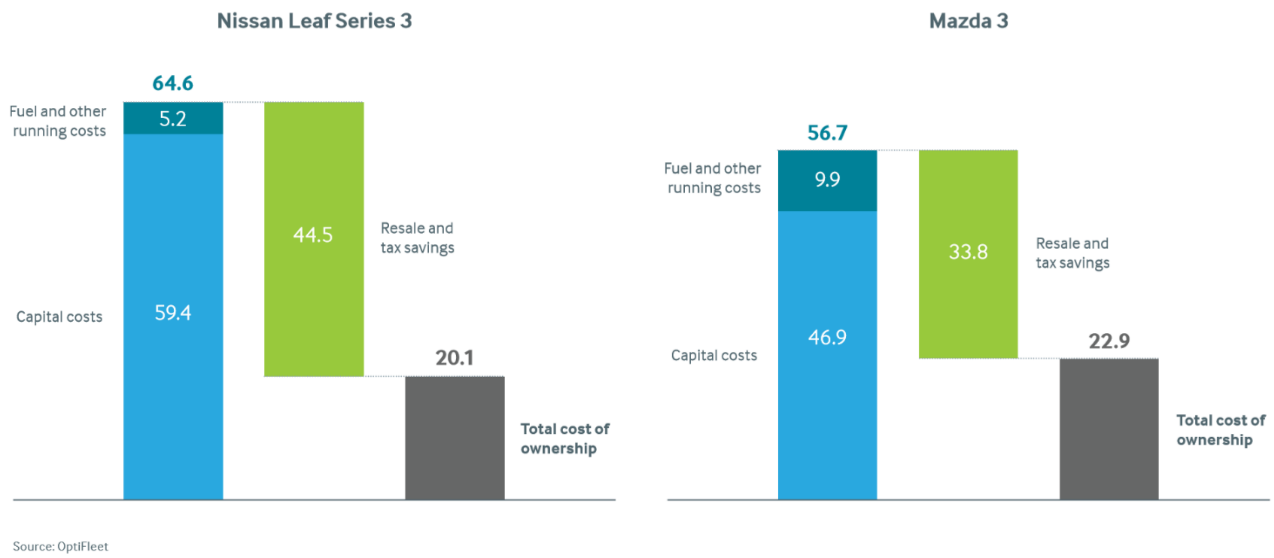
Light passenger EVs are now readily available, with nearly 50 battery EV and plug in hybrid EV models already on our roads, with more expected as car manufacturers globally announce shifts to EV production (e.g. GM will be producing EVs only by 2035, Volvo by 2030, and Ford by 2030 in Europe).

In the Electrification Roadmap, we found that under a business-as-usual scenario, EV uptake is likely to begin to accelerate around 2023 as TCO parity is reached for most EVs, driving state sector and large business fleets to begin to electrify. Uptake will then further accelerate markedly around 2028 when sticker price parity is reached for most EVs, driving the small businesses and households who prefer new cars to electrify.

However, as most private car sales in New Zealand are second-hand, under a business-as-usual scenario, EV uptake will only become significant when the average second-hand car sticker price is affordable to the average household, which could take up to ten years. Cars bought new by fleets today will only become affordable for the average household between 2025 and 2030.

The key for light electric vehicles is that on a total cost of ownership (TCO) basis, the economics are such that EVs will become cheaper to own within the next five years, driven by cheaper running costs which offset the high EV sticker price – the cost to charge an EV is equivalent to an average of $0.40 per litre, compared to an average of $2.00 per litre of petrol. For fleet owners that have the ability to buy in bulk and have access to low cost capital, EVs can already have lower TCOs than similar petrol vehicles.

Figure 6: Example of total cost of ownership comparison ($ 000s)



Note: Corporate buyer, three-year ownership term, no fringe benefit taxes

But even when TCO parity is reached, consumers will not immediately move to buying EVs due to their high up-front capital costs, which today can range anywhere between 30-50% higher than their petrol/diesel equivalents. For some, the rationale will be not having access to the capital required to cover the sticker price. For others, 'hyperbolic discounting' will be an issue, which is the tendency for people to put disproportionate weighting on nearer term costs/benefits even if the lifetime benefits significantly outweigh the costs.

Until purchase price parity is reached, the higher up-front capital cost of EVs will be the greatest barrier for adoption, even when the total cost to own an EV will be significantly lower for most of the 2020s. This is the single most important policy question for accelerating EV adoption in the transport sector in the 2020s: where EVs offer total savings for consumers, businesses, the economy and our climate, but the up-front purchasing cost is a barrier, how can policy overcome this? Other barriers to EV adoption include 'range anxiety' which is quickly being overcome by improvements in battery technology and increasing availability of public chargers.

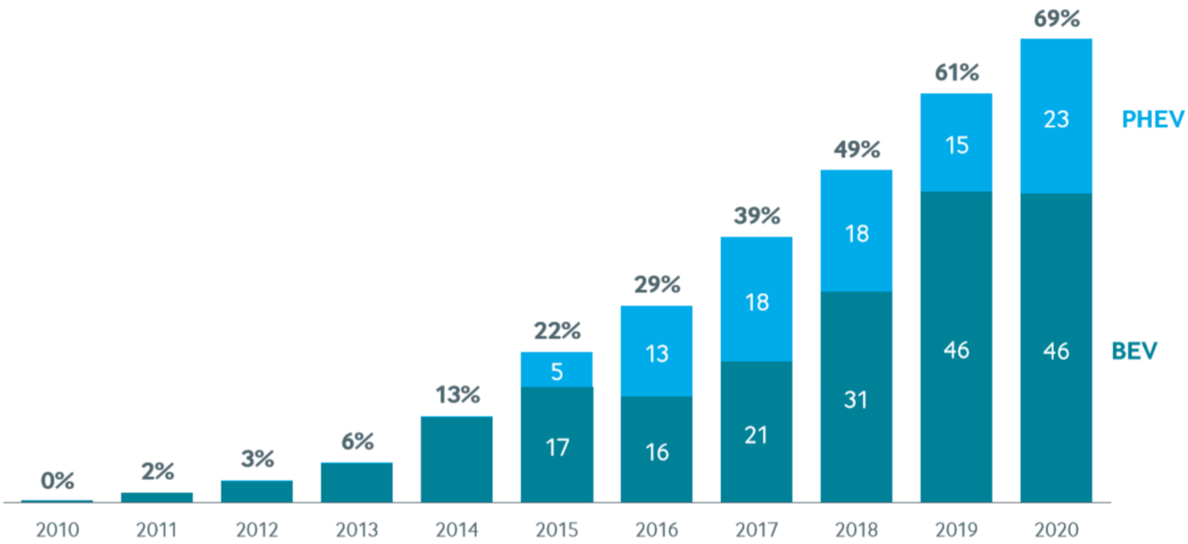
These barriers are likely to be overcome in time through technological developments and natural economics, however not at a pace we need if New Zealand is to meet its carbon targets.

Bringing this social change forward can be done

The good thing is that jurisdictions overseas have proven that a rapid uptake of EVs is possible with the support of a framework of policy, regulation and incentives.

Norway leads the world in the scale and speed of EV uptake. In 2020, EVs made up almost 70% of new car sales, up from less than one per cent in 2010. This rapid growth has been enabled by a suite of interventions.

Figure 7: Percentage of new Norwegian cars that are EVs



Source: Inside EVs, World Economic Forum, European Alternative Fuels Observatory

For a country fuelled mostly by hydroelectricity (much like New Zealand) it has made environmental sense for Norway's transport fleet to rapidly electrify, and the Government has had incentives in place since the 1990s. Back then, the Norwegian Government introduced a temporary, and later permanent, exemption from Norway's vehicle purchase tax, making the price of EVs fall below that of petrol- and diesel-powered vehicles. Since then, EVs have been given the right to park for free in some municipal car parks, drive in bus lanes, take ferries without a ticket and drive toll-free. Norwegian EV users are not required to pay VAT on their cars, or road tax, and company EVs are taxed at a lower rate than petrol or diesel-powered vehicles.

It is worth noting that if New Zealand were to adopt similar EV policies to Norway, we could improve on these policies by having a stronger focus on distributional equity impacts. Because Norway has an exemption for EVs for its vehicle purchase tax this provides increasing cost relief as the car becomes more expensive. This is economically regressive and disproportionately impacts less well-off consumers. The feebate proposed by the Productivity Commission is a good example of a policy that would achieve the same outcomes as Norway's policy but with a much fairer outcome in terms of distributional impacts. As the rebate for EVs would be flat, it would ensure that the lower the cost of the car, the greater the percentage of upfront cost relief for the EV.

Other countries are also ramping up their efforts with the formation of the Zero Emissions Vehicles Transition Council by the UK COP26 in November 2020, which aims to strengthen cooperation between governments and large automotive markets. The council is made up of Ministers and representatives from California, Canada, Denmark, European Commission, France, India, Italy, Japan, Mexico, Netherlands, Norway, Spain, South Korea and Sweden, the United Kingdom.

Similarly, in February 2021, the World Economic Forum launched the Zero Emissions Urban Fleets network, a forum for public and private actors to sync and synergize related global initiatives. The group's focus for 2021 is to place European city actors on a path to achieve 50% and 100% electrification by 2025 and 2030 respectively.

What is encouraging is that investment in EV enabling interventions, which comes at an initial cost to the economy, does not need to be sustained out to 2035. Norway has already begun winding back their support as natural economics has taken over, and we can expect other countries who are well on their way to electrifying their fleet to do the same.

Left to its own devices, rapidly improving economics will eventually deliver the switch from fossil fuels to clean energy in transport. Under current conditions, mass adoption of EVs in New Zealand is likely to occur around the end of this decade. That will be too late, however, for New Zealand to realise the economic benefits of decarbonisation and meet our Paris commitments.

Each year of delay in electrifying transport will increase New Zealand's cumulative emissions and transport costs by 1% and $1 billion respectively to 2050.

What is needed now is a kick start to accelerate electrification of transport. With clear, transitional policy and market settings in place in 2021 that specifically target the high upfront capital cost of EVs and getting supply of EVs into New Zealand, we can bring forward mass adoption of EVs by five years to around 2025 and begin wholesale transformation of our transport sector around the end of the decade.

This is an opportunity we cannot afford to miss. But we need to act now. In our Electrification Roadmap, we set out seven areas that need to be addressed together to enable the transport electrification we need to meet our emissions reductions targets. The first two areas are of particular importance:

- Improve immediate access and availability of EVs;
- Reduce up-front capital cost barriers and improve access to capital;
- Reduce operating cost barriers;
- Create behavioural incentives;
- Enable access to EV charging;
- Ensure uptake is supported by electricity infrastructure; and
- Support alternative fuels for heavy vehicle decarbonisation.

These recommendations align with those made by Commission and we will speak to these in more detail in the following sections. Specific policy measures are summarised in the table below:

Figure 8: Options for transport decarbonisation

Focus area	Options to accelerate transport electrification
Improve immediate access and availability of EVs	• Implement the Government's proposed Clean Car Standard with long-term signals and regular reviews for progressively tightening standards • Automotive industry and Government work together with vehicle manufacturers and suppliers to increase EV supply into New Zealand Government and local government fleets as soon as possible • Strengthen economic incentives for commercial fleets to electrify • Set an import ban deadline on petrol and diesel-powered light vehicles to enable vehicle manufacturers, importers and dealers time to transition
Reduce up-front capital cost barriers, improve access to capital	Implement solutions to overcome upfront capital cost barriers, for example: • The Ministry of Transport's Clean Car Discount (feebate scheme) • Low cost finance to spread out upfront capital cost of EVs. For example, through scaling up New Zealand Green Investment Finance funding • Business model innovation for alternative ownership models that address upfront capital costs. For example, fleet-as-a-service for corporates, car subscription services, car share pools, and transport-as-a-service for consumers • Developing corporate purchasing pools or car buyer clubs to drive purchasing scale to access discounts and to cut out intermediaries • Banks and traditional lenders to incentivise EV uptake through sustainability-linked lending, particularly to assist commercial fleets to electrify • EECA grants for heavy vehicle (hydrogen, biofuel and electric) proof of deployment
Reduce operating cost barriers	Implement solutions to reduce operating costs, for example: • Extension of Road User Charge exemption • Fringe Benefit Tax exemption or reduction for corporate purchasers of EVs • Electricity market regulation to promote increased offering of peak/off-peak electricity pricing and targeted EV electricity offerings
Create behavioural incentives	Implement behavioural incentives: • Use of transit lanes • Free or discounted parking • Preferential car parks in public and private carpark buildings • Free or discounted access to ferries
Enable access to electric vehicle charging	Improve the availability and speed of public charging infrastructure: • Implement and incentivise widespread fast charging network expansion with government co-investment where required • Support rollout of on-street charging infrastructure for locations without off-street parking
Ensure uptake is supported by electricity infrastructure	Ensure the electricity sector can enable electrified transport: • Implement standards for EV chargers to ensure that they are 'smart' and can provide services back to the electricity grid • Increase uptake by electricity networks of demand response in order to use EV batteries to effectively defer network investment • Drive collaboration between network owners and charging infrastructure owners • Upgrades to distribution and transmission networks to increase capacity when required • RMA reform to ensure that new renewable power plants and their transmission lines can built in step with increasing electricity demand
Support alternative fuels for heavy vehicle decarbonisation	Ensure the heavy vehicle sector can decarbonise through: • Ensuring the development of fast charging heavy EV infrastructure • Clarify settings around Road User Charges for heavy vehicles • Support the development of green hydrogen supply chains, including refuelling infrastructure

The policy measures can be wound back

As we've seen overseas, these supporting interventions need only to be in place while we kick start transport electrification. We anticipate the need for strong support from now until 2025. From 2025 to 2030, support can be rolled back as uptake increases, and from 2030, our fleet will continue to electrify with no support.

A major expansion of the electricity system is required

As discussed in Section 1 of this submission, we agree with the Commission that the electrification of energy use, as needs to happen in the transport sector, will require a major expansion of the electricity system.

The transport sector is an area where this expansion in the electricity system can be more nuanced than building a lot more infrastructure at increasing cost. The uptake of EVs will drive demand for significant increases in the volume of electricity to be delivered around New Zealand. However, it also has the potential to help flatten the peak demand on the network, by empowering consumers to shift demand to off peak periods and access significant off-peak electricity price savings.

Unlocking this potential requires coordinating the availability of EVs, smart charging infrastructure, peak/off peak pricing tariffs and innovative electricity retail offerings. The work required to do that should not be underestimated, but it is doable.

Transpower is committed to playing it part in this major expansion of the system. We highlight in Section 1 some of the key challenges to delivering this major expansion in a way that helps New Zealand reach its climate change targets in 2030 and 2050, such as making significant changes to the way we think about least regrets investment decision-making, consenting of major projects, and land access.

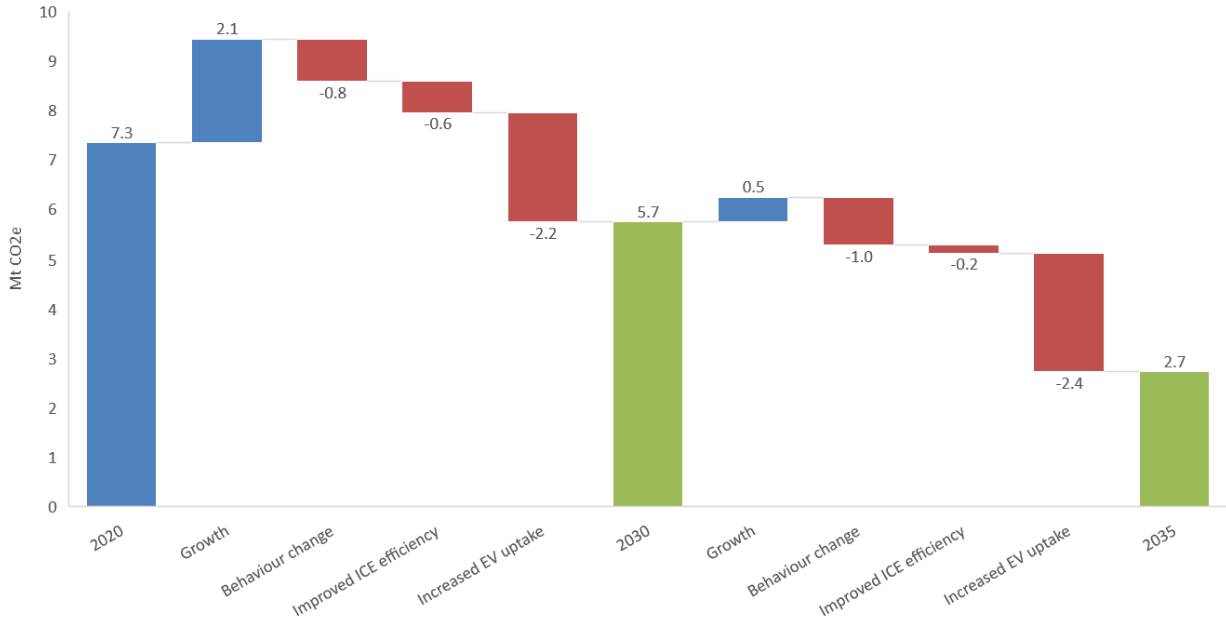
Necessary action 2 - Integrated national transport network

We support the need to develop an integrated national transport network to reduce travel by private vehicles and increase walking, cycling, low emissions public and shared transport.

Most of our response to Question 14 will focus more on the electrification of transport for two reasons:

1. Even under the most ambitious mode shift scenarios, electric vehicles will still play a large role in decarbonising transport. Figure 9 shows our analysis of Commission's tailwinds scenario, which is one of the more aggressive behaviour change scenarios. The chart shows that the potential for annual emissions reductions from behaviour change is 1.8 Mt CO_2-e by 2035, which is still outsized by the 4.6 Mt CO_2-e from electric vehicles.
2. As Grid Owner and Operator, our interests are primarily in ensuring reliable and affordable electricity to the country, including its electric vehicle fleet.

Figure 9: Light passenger vehicle emissions – the Commission's Tailwinds scenario



In Whakamana i Te Mauri Hiko and the Electrification Roadmap we took into account the impact of mode shift when forecasting annual Vehicle Kilometres Travelled (VKTs) out to 2050. If New Zealand were to continue on a business-as-usual approach to travel and considering pre-COVID-19 population growth forecasts, we could expect an average light vehicle VKT growth of 1.3% per year. We expect that this rate would decrease to 1% annually because of mode shift, although this decrease could be larger with increased public transport investment. 1% is the rate we used in our Whakamana i Te Mauri Hiko base case modelling.

Mode shift is an important lever for emissions reductions and can be accelerated through the adoption of electric buses and further electrification of rail, as it will make public transport more appealing. Mode shift can also ease the pressure on our national transport infrastructure as we transition to a low carbon transport system.

However, because we expect VKTs to grow modestly or at best remain flat in parallel with some mode shift, it is important that we focus on electrifying our light vehicle fleet alongside improving active and public transport.

EVs also have the benefit of providing a way for us to start decarbonising *now*, even if on a small scale, as it can be done cost effectively and requires a smaller degree of behaviour change. Policy and infrastructure that enables and encourages mode shift requires a lead time to design and implement/build which can take years.

Time-critical necessary action 2 - Accelerate light electric vehicle uptake

We strongly support the Commission's recommendation to prioritise the electrification of light vehicles, because by doing so, we have the opportunity to reduce up to 80% of New Zealand's transport emissions.

As mentioned above, the light vehicle market will electrify on its own when left to its own devices, but not at a rate needed to meet our 2030 emissions reductions targets. Faster electrification, through bringing the mass adoption point for EVs forward by five years, is possible through a suite of interventions that increase the entry of EVs into New Zealand, enables a deep and diverse second-hand EV market and enables every New Zealander to access clean transport and contribute to meeting the country's zero carbon targets.

The interventions described in the following sections are each a part of the system of change we need to see in New Zealand. Each intervention alone will not be enough to drive significant electrification.

Within light vehicles, we recommend prioritising passenger cars because the technology is more readily available, then shift our focus to vans and light commercial trucks as the technology matures. We expect that the mechanisms used to address electrification of light passenger vehicles, vans and light commercial trucks to be the same in format but tailored according to each vehicle type.

Time-critical necessary action 2.a. - Time limit on light vehicles with internal combustion engines

We support the need to place a time limit on light vehicles with internal combustion engines (ICE) entering, being manufactured, or assembled in New Zealand, as part of the suite of interventions needed to transition to electric vehicles. Setting a ban date would send clear long-term signals to both the supply and demand side of the market, enabling a smooth transition to EVs.

On the supply side, setting a ban date would signal to global car suppliers (both new and second hand) that New Zealand's demand for imported ICE vehicles will decline significantly while the demand for EVs is growing. In response, suppliers are then likely to begin shifting their business models and processes to ensure sufficient EV supply into the country by the ICE ban date, otherwise they risk losing a part of their business.

On the demand side, a ban date signals to consumers that policy and infrastructure are transitioning to support EVs and are reducing support for ICE vehicles. This gives consumers the confidence to buy EVs ahead of the ban date, and also makes buying new ICE vehicles closer to the ban date more unattractive.

A ban date will also deliver clear signals to developers of long-term infrastructure, like EV charger providers and network companies to invest in infrastructure that will enable EV uptake.

Many countries or territories have already announced ban dates. Countries of note include Norway and South Korea by 2025, United Kingdom and Germany by 2030, Canada and China by 2040.

We support the need to set a date for the near future, such as before 2035. As around 60% of New Zealand's car imports are second-hand, it is important that New Zealand sets a date that is soon enough to prevent countries from exporting their old ICE vehicles to New Zealand.

Concept Consulting and Retyna's *Shifting Gear* report provides a comprehensive analysis of the impacts of an ICE ban in New Zealand. Their study concludes that New Zealand could ban new entry of light ICE vehicles as early as 2032.

Time-critical necessary action 2.b. - Measures to ensure there are enough EVs and reduced upfront cost

We support the need for a package of measures to ensure there are enough EVs entering New Zealand and to reduce the upfront cost barrier. The upfront cost barrier is likely to be the greatest barrier to EV adoption in the 2020s even when the total cost to own an EV will be significantly lower for most of the decade. In the Electrification Roadmap, we identified 'access' as one of the key barriers to EV uptake: **New Zealand's access to global EV supply** and **New Zealanders' access to EVs.** Below, we detail how different measures can address these barriers.

Ensuring New Zealand can access global EV supply

New Zealand is a small player in the global vehicle market. We currently have around 3.5 million passenger cars on our road, less than 1% of the 1.4 billion cars worldwide. For this reason, there is real potential for constrained supply of EVs into New Zealand, both new and second-hand, as other countries also move to electrify their transport systems. New Zealand must ensure that it is well positioned now to import enough EVs to meet what needs to be rapidly growing demand.

Globally, New Zealand needs to be a destination of choice for electric vehicle suppliers by providing the right incentives and market signals to only attract increasingly clean vehicles into the country. There are three key interventions that could help New Zealand achieve this:

- Implement an emissions standard such as Ministry of Transport's proposed Clean Car Standard, which would require vehicle importers to bring in progressively more fuel efficient and electric vehicles. Without a form of regulation or policy intervention, by 2025 New Zealand's cars will produce twice the emissions levels of EU vehicles and the incentives on vehicle importers will remain inconsistent with our climate goals. The Clean Car Standard could outline a long-term pathway with targets becoming more stringent over time. Similar to an ICE ban, this would send clear, long-term market signals for the phase out of emissions intensive vehicles
- Implement an ICE ban, as discussed earlier in the response. This mechanism would work alongside the emissions standard to send long-term market signals for the phase out of emissions intensive vehicles
- Explore the potential to 'pool' or bulk purchase EVs, especially for government and commercial fleets, to enable purchasing savings. A bulk purchase would strengthen New Zealand's negotiating position and signal that there is a strong demand for electric vehicles.

Such interventions are not a world first and what's reassuring is that vehicle manufacturers are already shifting their businesses to meet the higher EV demand:

- Tesla intends to ramp up output from 499,550 in 2020 to 20 million annually by 2030
- General Motors plans to exclusively offer electric vehicles by 2035
- Ford intends to sell only electric vehicles in the European market by 2030
- Volvo will only make electric vehicles by 2030
- BYD, a Chinese EV manufacturer looking to enter the Australian and New Zealand markets, is targeting sales of 400,000 BEV/PHEVs in 2021

Ensuring New Zealanders can access EVs

Supply focused interventions will not be enough. New Zealanders also need to be encouraged to transition to EVs (where public or active modes are unattractive) to build local demand. Currently, even as the total cost of ownership of EVs are falling and are on track to save New Zealanders' money, the largest barrier to adoption is the high up-front cost of electric vehicles. Consumers either do not have access to the capital or exhibit 'hyperbolic discounting' which is the tendency to disproportionately weight decisions towards near term costs/benefits even if the lifetime benefits significantly outweigh the costs.

Therefore, to build local demand for EVs and help New Zealanders overcome the capital cost barrier, we support the Commission's recommendation to implement a feebate or subsidy scheme, as well as recommend additional capital cost mechanisms:

- Implement a feebate or subsidy scheme to bring down the upfront cost of an EV. US studies have shown that for every US$1,000 provided as an EV rebate there is a correlated 7.7% increase in EV sales. Point of sale schemes like the Ministry of Transport's proposed feebate scheme, where buyers of more fuel efficient and electric vehicles receive a rebate, funded by fees on higher emitting vehicles, were shown to have the most effective impact on lifting sales. The feebate also has the additional benefit of disincentivising the purchase of ICE vehicles;
- Explore potential new or extension of co-funding and grants such as EECA's Low Emissions Vehicles Contestable Fund, and low-cost loans such as via New Zealand Green Investment Finance that enable buyers to more easily spread out the payment of up-front capital costs;
- Also, as New Zealand's banks increasingly commit to sustainable finance and shifting away from fossil fuel exposure there are opportunities to develop new lending options for EV purchasers, thus improving access to capital and the upfront economics.

EV uptake rates would benefit from these interventions being in place immediately to encourage uptake while EVs still cost more than ICE equivalents. Once sticker price parity is met, then interventions can start to be wound back. We expect sticker price parity for most light vehicles to occur between 2025 and 2030. Consistent support through to the time of sticker price parity appears to be critical for fleet transformation. For example, the Chinese government cut EV incentives in July 2019, because it believed the costs of EVs had decreased sufficiently. However, this caused sales of hybrid and EVs to decline by 34% in September 2019 and 46% in October 2019.

An important consideration for creating access to EVs is the fact that most private passenger vehicle purchases in New Zealand are second hand. Therefore, much of the focus of the interventions described is to enable those who usually purchase newly imported vehicles (e.g. commercial fleet operators) to buy electric so that they feed into the second-hand market. This is how the second-hand ICE market already operates, so it is a matter of ensuring the new vehicles cycling through are EVs.

The government should target the electrification of government and commercial fleets to build demand for EVs in New Zealand. These fleet owners also tend to have lower up-front cost barriers due to the access to lower cost capital, the ability to access mechanisms that spread out upfront capital costs like competitive leasing arrangements and the ability to procure in bulk. Business and government fleets can also help raise public awareness and trust in EV technology by giving their drivers the experience of driving EVs. Brand association also boosts public perception of reliability.

Experience in Denmark has shown that if corporates are excluded from an initial incentive regime, fleet transition stagnates. Fringe Benefit Tax (FBT) reductions or exemptions could be particularly valuable in incentivising the uptake of electric vehicles by commercial fleets. As commercial fleets typically turn over their fleets every three to four years, this would be effective at seeding the second-hand EV market, improving EV access to consumers. While the FBT is technically an operating cost, a reduction in FBT can have similar economic effects to a reduction in the upfront capital costs for corporates who access vehicle leasing.

It will also be important to focus on how to stimulate the availability of affordable second-hand EVs for different uses (e.g. SUVs, wagons, utes, vans) and at different price points (e.g. three-year, five year, ten-year-old EVs) to ensure that different customers' needs and preferences can be met.

Time-critical necessary action 2.c. - Improve the efficiency of the light vehicle fleet and introduce emissions

As stated above, we support the need to improve the efficiency of the light vehicle fleet and achieving this through the introduction of an emissions target for light vehicles new to New Zealand.

We have not completed our own analysis on what the emissions target for light vehicles new to Aotearoa should be.

Time-critical necessary action 2.d. - Charging infrastructure plan

Accessible charging infrastructure will be a critical enabler for rapid uptake of EVs. We are supportive of the recommendation to develop a charging infrastructure plan for the rapid uptake of EVs.

Two of the top three concerns for EV adoption, charging and range anxiety are addressed by an effective network of public and private charging options, with direct correlation shown internationally between EV adoption uptake increases and the number of chargers available per

100,000 people. We must invest in a sustained way in the charging infrastructure to be ready to enable what needs to be a wave of new EVs in New Zealand.

The plan should consider the differing roles of government, the private sector and individual EV owners. The government may not necessarily need to be responsible for the whole delivery of a nationwide charging infrastructure network, but rather could play an enabling role, or leverage partnerships with the private sector.

For a successful nationwide charging network, it is important that the different charging demand profiles and behaviours are understood, as these will have implications on the location of chargers, the different capacities required and the impact on the electricity system.

For example, everyday EV drivers are likely to plug in their vehicles when they get home in the evening and let them slow charge overnight, which may not require any new technology to the user but may have implications for the local distribution network. Other EV drivers may not have access to charging at home and will therefore require charging infrastructure close to home. Every now and then, an EV driver may go on a long trip such as from Auckland to Wellington and will require fast charging during a driving break.

Buses and heavy trucks have different charging behaviours. These vehicles usually have high utilisation and require fast charging at high capacities, which will have significant infrastructure needs and may require local electricity network upgrades. Smaller commercial vehicles may have lower utilisation and are able to charge at the workplace. Small numbers of vehicles at the workplace may not require a site upgrade for electrical capacity, but larger fleet operators may need to upgrade their electrical capacity.

Charging infrastructure for different charging needs is already emerging in New Zealand. For example, ChargeNet's charging network, hyper chargers, Tranzit's 450 kW, Wellington City Council's charging for those with no off-street parking. These are the types of infrastructure that will need to be ramped up to meet growing EV uptake.

Because a lot of EV charging happens at home or on site at a workplace, there also needs to be a component of the charging infrastructure plan that focuses on better enabling EV owners (both residential and commercial) to install and manage their own charging, especially as many have limited experience of interfacing with the electricity system.

Our interviews with commercial fleet owners revealed that there are still a number of information gaps across the installation process that result in sub-optimal solutions, unexpected additional costs and prolonged timelines. For example, during its heavy EV freighter trial, ALSCO discovered that a second charger needed to be installed to speed up truck charging. As this required a second charging station at each of the four locations, the sites unexpectedly needed to be upgraded to accommodate charging infrastructure. New Zealand Post underwent a similar exercise and shared their experience in the form of an EV charging installation guide.

Key to a fast and smooth installation of charging will be the building and sharing of planning knowledge and technical capability. Industry and government coordination across charger installers, suppliers, network operators, local government and landowners will be required.

The development of a national charging network will need to be in close co-ordination with the electricity sector. A critical element of the charging network will be the electricity network's capability to support vehicle charging. Smart charging of EVs provides an opportunity for energy consumption to be shifted away from peaks and, in doing so, offers an opportunity to decarbonise our economy most affordably. If not managed carefully, non-smart EV charging has the potential to materially increase demand peaks in distribution networks and the grid, resulting in avoidable expense in the network infrastructure, the cost of which then falls on the end user.

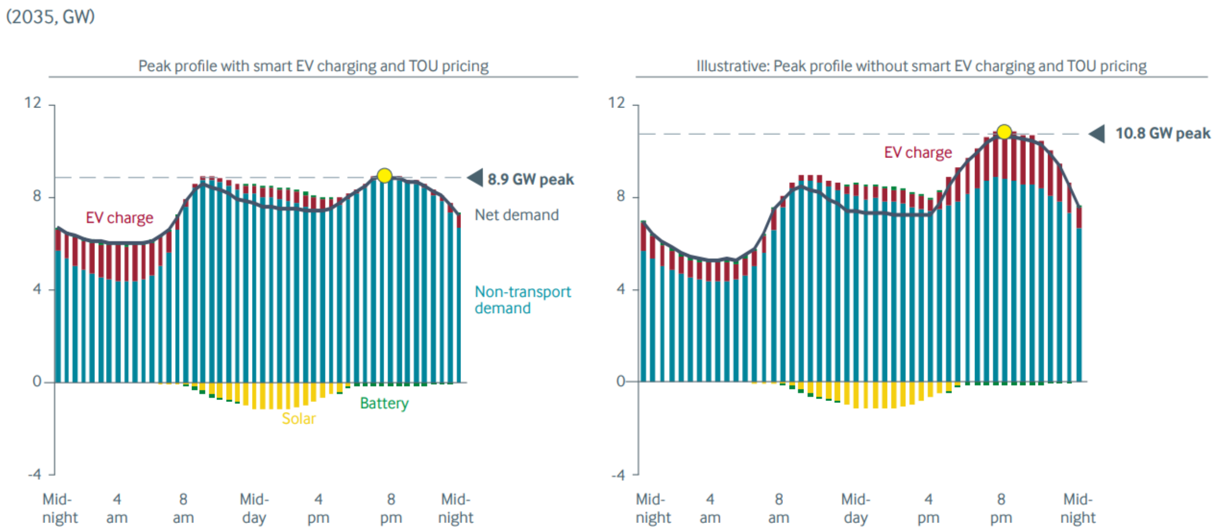
Both transmission and distribution networks are built to meet peak demand capacity. In New Zealand, peak demand occurs in the mornings before people head to school and work, and in the evenings when they return home. If price insensitive EV users plug in their vehicles as soon as they get home in the evening, then the electricity demand from those vehicles add to peak demand as illustrated by the second chart in Figure 10. As more EVs charging in the evening are added to the system, distribution and transmission networks will need to be upgraded, the costs of which are shared by all consumers through their electricity bill. This dynamic effectively penalises non-EV owners by charging them for network upgrades caused by EV charging during peak periods.

This raises the importance of smart charging, a demand-side management tool, in its role of preventing avoidable investment in the network and costs to end users. Smart chargers enable consumers to physically plug in their car when they get home in the evening but control actual charging such that it occurs through the night outside of peak periods. Smart charging requires data sharing so that the charger knows in real time whether or not to charge based on network congestion and information can also be fed back to the network operators to enable strategic network planning. Smart chargers' 'peak smoothing' effect, which is shown in the first chart in Figure 10, has the potential to save consumers approximately $1.5 billion for every gigawatt of avoided peak electricity demand growth.

Part of this avoided cost is through improved network utilisation. Because networks' costs are primarily driven by the capacity (MW) of their infrastructure but recover costs on an energy consumed ($/MWh) basis, if peak demand is maintained but energy consumption grows, network charges to consumers can be reduced on a per unit basis.

Similarly, generation is built so that it can meet both peak and total energy demand. By ensuring that electric vehicles charge in off peak periods, we can increase the amount of low emissions energy delivered while not commensurately increasing peaks. This negates the need for otherwise avoidable peaking generation or grid expansion.

Figure 10: Peak profile loads with and without smart EV charging[2]



In 2019, UK EV charging project 'Electric Nation', which at the time was claimed to be the "largest smart charging project in the world", concluded that with there is sufficient flexibility in charging requirements such that with the right incentives and tools (such as time of use pricing and smart charging) the impact of charging on peak demand can be managed. The next phase of the project is focussing on 'vehicle to grid' (V2G) capabilities, which has the potential to be more beneficial than smart charging due to the ability to put significant levels back into the network at peaks times, reducing the need for additional generation.

It is only when smart charging is rolled out across the majority of New Zealand households that we can benefit EV demand side management and avoided network infrastructure investment. Because smart charging requires new technology and data sharing, widespread smart charging needs to be enabled by enforcing inverter and charging standards, improvements to planning, code requirements and innovative energy management platforms.

There is a significant interface here between government energy policy and regulation and the operation of generator-retailers, electricity distributors and the transmission grid. Ensuring the right regulatory settings are in place across the industry to actively support EV uptake without compromising pricing or energy security must be an ongoing and primary focus for regulators and policy makers.

For example, New Zealand could scale up flexibility markets for distributed energy resources to provide demand response and distributed generation services to electricity networks and the energy market. This would ensure EV uptake can be integrated effectively within the electricity

[2] Section 5 of Whakamana i Te Mauri Hiko – "Demand side management of peaks" pp 61 - 70

system at a network level, including the ability for EV batteries to contribute to supplies on the network during peak demand periods.

Other examples are in electricity prices. Off-peak electricity pricing enables cheaper electricity prices when charging EVs off peak but needs to be enabled by cost reflective pricing in electricity networks. Other innovative solutions, such as separate metering for EVs could allow for electricity retailers to develop targeted pricing packages for EVs, which can further drive down the cost of charging.

Consistent with this focus on policy and regulatory settings, New Zealand must ensure that we build sufficient new renewable electricity generation capacity at the right time to support the electrification of the economy.

Necessary action 3 – Accelerate light electric vehicle uptake

Necessary action 3.a. – Fiscal incentive to reduce upfront cost of EVs

See response to Time critical necessary action 2.b.

Necessary action 3.b. - Interventions such as leasing, hire and sharing schemes

We support the need to explore alternative 'ownership' models. We state in our Electrification Roadmap that innovative commercial and private 'ownership' models can help overcome the upfront cost barrier, with the added benefit in some instances of decreasing the number of cars on the road.

Examples of alternative models include fleet financing, fleet-as-a-service, vehicle subscriptions, leasing and car share schemes, and group purchasing pools. Companies in New Zealand are already innovating in this space. Mercury recently completed and will expand on its successful EV subscription trial, EVDrive, which allows customers to pay a monthly subscription for an EV bundled with insurance, maintenance and registration. Turners and SIXT also have EVs available in their respective subscription services. EV car share is also becoming increasingly available, with services being provided by CityHop, Mevo, Zilch and Loop.

Rideshares are also providing the opportunity for passengers to choose low emissions alternatives and incentivise low emissions vehicle adoption. For example, Uber recently launched Uber Green, as part of its plan to become a zero-carbon platform by 2040, which gives customers the option to request an EV or hybrid electric vehicle. Drivers receive an extra $0.50 from a $1 rider surcharge for every Uber Green trip completed.

Encouraging behaviour change will play a large role in ensuring the success of alternative ownership models. The models need to be convenient, attractive, price competitive compared to owning your own vehicle.

Necessary action 3.c. - Bulk procure and ensure the supply of EVs into Aotearoa

See response to Time critical necessary action 2.b.

Necessary action 3.d. - Incentivise EV uptake via tax system

We support the need to incentivise EV uptake via mechanisms such as the tax system, particularly the Fringe Benefit Tax on businesses.

For businesses, reaching TCO parity is heavily dependent on the fringe benefit tax (FBT) regime. The FBT is currently a disincentive for commercial fleet conversions to EVs as the value of the FBT is proportionate to the capital cost of the vehicle. As the up-front capital cost of EVs is currently substantially more than for a petrol equivalent, the FBT perversely penalises an organisation for buying a cleaner vehicle. For many organisations, this FBT voids the economic case for EVs.

Similar issues exist overseas and have been addressed – for example, the United Kingdom introduced company tax incentives for EVs in 2020 that have improved the economic case for conversion to electric fleets. As the up-front capital cost of EVs continues to fall the UK intends to wind back the level of tax incentive.

Certainty around policy settings for FBT is now important in supporting the electrification of the light vehicle fleet as businesses account for a material proportion of New Zealand's annual new car registrations. Increased uptake of new EVs by businesses now will feed into the second-hand car market in time to provide greater variety and opportunities for household consumers to purchase used EVs.

Necessary action 3.e. - EV battery refurbishment, collection and recycling systems

We support the need to develop EV battery refurbishments, collection and recycling systems to support sustainable electrification of the light (and later heavy) vehicle fleet.

Markets for second-hand batteries are already emerging within and beyond transport sector.

In the transport sector, companies such as Blue Cars in New Zealand are exploring how to cost effectively refurbish batteries for continued EV use. Vehicle manufacturers worldwide are also building battery recyclability into the design of their EVs (for example, GM, BMW, Rivian, Proterra).

Other international start-ups are starting to emerge, such as Redwood whose cofounder was previously CTO at Tesla, that see value in recovering materials from lithium ion batteries. Straubel claims that Redwood can recover between 95 and 98 percent of a battery's nickel, cobalt, copper, aluminium, and graphite, and more than 80 percent of its lithium. By the time a battery has made it through Redwood's recycling facility, it has been broken down into its basic ingredients—lithium carbonate, cobalt sulphate, and nickel sulphate—that are ready to be reintegrated into the battery manufacturing process.

EV batteries are typically replaced after they lose approximately 20% of capacity, leaving behind 80% that can be used for applications that require less frequent battery cycling (charging and discharging), such as stationary storage. Grid scale batteries, a form of stationary storage, have the potential to contribute to peak management and network deferral on the electricity grid and could offer a productive second home to EV batteries once they are no longer suitable for use in vehicles.

Last year, electricity distributor Counties Power and Australian battery technology company Relectrify worked together to deploy New Zealand's largest battery system repurposing EV batteries to-date. The battery has already proved that it can provide peak shaving in Counties Power's utility testing lab. The system will be installed on the network where it can provide redundancy, flexibility and resiliency for customers in a remote rural area, highlighting the value that batteries can unlock to provide reliable and affordable power in isolated communities and power grids more broadly.

Vector also conducted a trial with Relectrify where Nissan Leaf battery packs were repurposed to supply 15 kWh of usable energy at power levels up to 10 kW – or enough electricity to power a standard New Zealand solar home for 1-2 nights. Vector have also launched the Battery Industry Group supported by EECA, the Motor Industry Association, and over 80 other businesses with the aim of designing a 'circular' product stewardship scheme for large batteries. Vector's *New Energy Futures Paper: Batteries & the Circular Economy* provides some analysis on the battery opportunity for New Zealand.

EV batteries currently need replacing every 5-8 years however with technology advancements, the 'first life' of batteries are expected to last longer. Because of this longer 'first life', we can expect high volumes of batteries ready for their 'second life' from the late 2030s. This lag time gives New Zealand enough time to ensure the emerging markets and technology that are required to enable battery reuse and recycling are scaled up and ready for the first wave.

Necessary action 3.f. - Other pricing mechanisms

We are generally supportive of interventions that could lower the operating costs for EV owners, and in turn make the total cost of ownership more attractive (e.g. the existing road user charge exemption), or act as a behavioural incentive (e.g. free public parking). As discussed earlier, because of the nature of consumer decision making, up front capital costs will still be the largest barrier, therefore mechanisms to target capital cost barriers should be prioritised over operating cost barriers.

Norway is a good example of how such mechanisms have resulted in an increased uptake of electric vehicles. Since the 1990s, the Norwegian Government first introduced an exemption from Norway's vehicle purchase tax, making the price of EVs fall below that of petrol- and diesel-powered vehicles. They later introduced the right for EV owners to park for free in some municipal carparks, drive in bus lanes, take ferries without a ticket and drive toll-free. Norwegians are not required to pay VAT on their cars, or road tax, and company EVs are taxed at a lower rate than ICE equivalents. The suite of interventions has enabled an increase in share that EVs make of new vehicle purchases – from 2% in 2011 to 70% in 2020.

What is also evident in the Norway example, is that pricing mechanisms do not necessarily need to be permanent but can be rolled back over time once the costs of EVs come down. Norway has been incrementally phasing out interventions such as reduced company tax, free public parking and road toll exemptions without reversing any of the EV growth.

Other jurisdictions have had success in increasing EV uptake through pricing mechanisms including China's subsidies which has grown EV sales to account for roughly 50% of global sales, California's federal tax credit, rebates and other incentives which have boosted EV sales from 1 million new EV registrations in 2009 to over 2 million in 2019, and Germany's subsidies of as much as 9,000 euros per electric vehicle which boosted sales for Carfellows, a German auto-trading website, about tenfold.

Necessary action 3.g. - Mitigate impacts for low-income households and people with disabilities, regional and remote access, and with limited access to electricity

We support the need to mitigate impacts for low-income households, and people with disabilities, regional and remote access, and with limited access to electricity.

In the Electrification Roadmap, we drew particular attention to the fact that while many New Zealand households will be able to afford an EV over the next ten years, lower income households are at risk of being left behind. This will have the perverse effect of increasing social and economic inequity because those who are last to electrify are also last to benefit from the savings gained from EVs. Achieving a just transition to a lower emissions future in which everyone in New Zealand can benefit will be a critically important measure of our decarbonisation success.

We must make sure that lower income households and other communities that may not have easy access to vehicles are supported to electrify as well. There is international precedent here that is worth our attention: work is being done around the world to co-design electrification and transport solutions with communities to provide transport security while addressing climate change. EV ride-sharing programmes, electrified school transport options and multifamily domestic charging solutions are being developed in order for EVs to support a just transition to a low carbon future.

Part of the solution will be ensuring the second-hand market has sufficient volumes of low-cost electric vehicles. Second hand electric vehicles are expected to become affordable to the average household after ten years of ownership. Because of this lag time it is important that New Zealand begins seeding a diverse and liquid second hand EV market immediately by accelerating the uptake of new EVs now. Fleet owners such as the government and businesses are best placed to begin this transition due to their tendency to purchase vehicles based on the total cost of ownership rather than upfront costs. As TCO parity between EVs and ICE vehicles is already being met in some instances, and is imminent in others, the transition can begin now.

With energy bills making up a material proportion of living costs, it is lower income households that are positioned to benefit the most from lower energy costs associated with electrification of transport. By 2035, we estimate that a two-car household with two EVs will halve their annual total energy bill. As discussed earlier in our response, lower cost electricity can be enabled by widespread electrification of transport paired with smart charging. Smart chargers have a 'peak smoothing' effect and has the potential to save consumers approximately $1.5 billion for every gigawatt of avoided peak electricity demand growth.

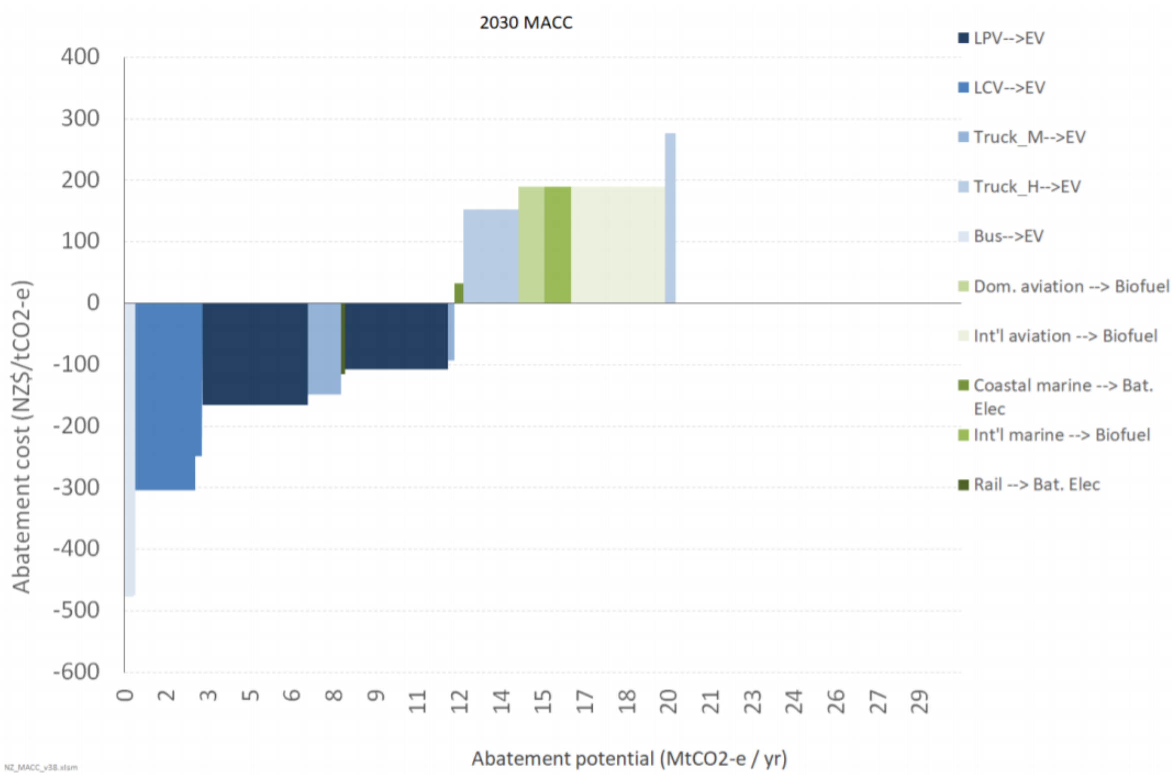
Part of this avoided cost is through improved network utilisation. Because networks' costs are primarily driven by the capacity (MW) of their infrastructure but recover costs on an energy consumed ($/MWh) basis, if peak demand is maintained but energy consumption grows, network charges to consumers can be reduced on a per unit basis.

Necessary action 4 – Increase the use for low carbon fuels for trains, ships, heavy trucks and planes

We broadly support the need to increase the use of low carbon fuels for trains, ships, heavy trucks and planes.

As stated earlier, because 'heavier' transport (i.e. non-light transport) is still developing in technology, more costly to abate and accounts for only 20% of New Zealand's transport emissions, light vehicles should remain the top priority for electrification in the immediate future leading up to 2025.

Figure 11: Transport Marginal Abatement Cost Curve for 2030 - public benefit basis, Ministry for the Environment



That being said, 'heavier' transport decarbonisation efforts in the near-term should focus on ensuring the policy settings are configured such that the sector is able to transition in an efficient and timely manner once the technology is more readily available.

Necessary action 4.a. - Polices for low carbon liquid fuels

We support the principle to set a target and introduce policies for low carbon liquid fuels. We have no further analysis to substantiate the volume required.

Necessary action 4.b. - Low carbon fuel standards or mandates

We support the need to introduce low carbon fuel standards or mandates to increase demand for low carbon fuels. Through our research on the Electrification Roadmap we found that biofuels and/or hydrogen will have a role to play in the harder to electrify transport areas. It isn't clear what path(s) New Zealand will take so options should be kept open.

Necessary action 4.c. - Establish low emissions fuel plants

We support the principle that low emissions fuel plants will need to be cost competitive with traditional fossil fuels.

Necessary action 4.d. - Decarbonising the rail system

We support the emphasis on decarbonising the rail system. Kiwirail is already making progress by electrifying the rail system in Auckland.

KiwiRail is currently extending by 19 kilometres the electric commuter service from Papakura to Pukekohe. The total project, which includes a new substation and power supply from Drury, two new stations, corridor safety improvements, a freight bypass at Pukekohe and stabling for the electric trains, comes to $371 million.

The company is also spending $35 million provided by the government on a four-year programme to upgrade 15 electric trains the company has used on freight services between Palmerston North and Hamilton since 1988.

Where electricity is the fuel of choice, enough lead time and planning with the electricity sector is required to ensure electricity supply is not a constraint.

Question 15: Heat, industry and power sectors

This section of the Commission's draft advice is wide ranging and touches on a number of important topics. As the Commission's discussion shows, taken together, the heat, industry and power sectors present a significant opportunity for decarbonisation.

Importantly, in this section the Commission recommends both systemic changes that will have a long-term influence on decarbonisation in New Zealand, and specific shorter-term priorities where cost effective gains can be made.

- The Commission is right to identify that systemic changes in energy will be required for us to meet our long-term targets
- The Commission is right to prioritise the decarbonisation of lower temperature space, water, and process heat in the immediate term
    - Electricity and biomass can largely decarbonise the process heat sector
    - Low temperature applications offer the best opportunities to reduce heat emissions in the immediate term
    - Medium temperature coal conversions offer the next best decarbonisation opportunities in process heat
- Electrification of transport and process heat can be achieved while improving the electricity sector's performance against the Energy Trilemma
    - Affordability of electricity supply can be maintained or improved while we increase our uptake of electricity
    - Security of electricity supply can be maintained or improved while we increase our uptake of electricity
    - Demand side innovation could significantly reduce costs and improve reliability if deployed appropriately
- A major expansion of the electricity system is required and can be done while improving the electricity sector's performance against the Energy Trilemma

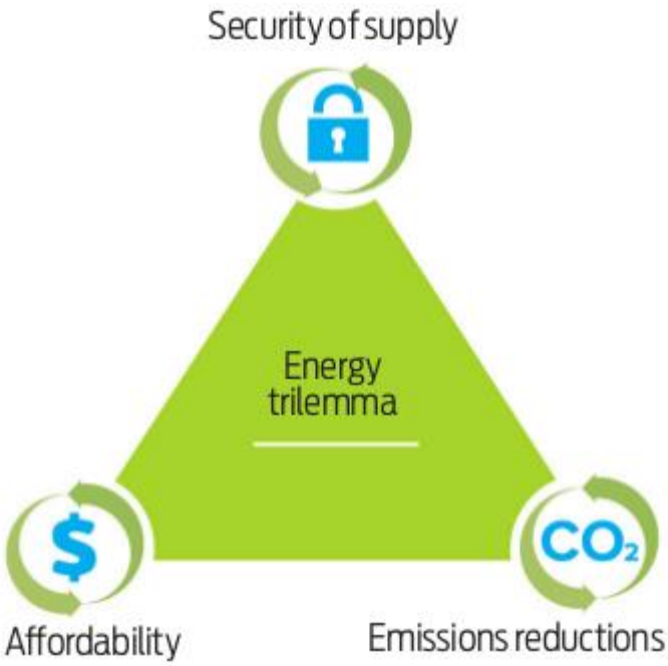
The Commission is right to identify that systemic changes will be required for us to meet our long-term targets

We endorse the systemic changes the Commission recommends, including:

- development of a cohesive national energy strategy;
- setting renewable energy targets for the energy sector as a whole;
- a policy setting of maximising use of electricity; and
- scaling up provision of low emission energy sources, like biomass.

As identified by the Commission, a national energy strategy can be a platform for articulating how New Zealand's electricity system can enable decarbonisation while continuing to deliver reliable, affordable, low emissions electricity. This essential relationship between affordability, reliability, and sustainability is summarised by the "energy trilemma" described in the figure below:

Figure 12: Energy trilemma



We have noted above our view that shifting to 95% renewable electricity is one of the short term decarbonisation gains available to New Zealand, and that the major expansion of the electricity system required to meet our 2035 and 2050 climate change targets does not have to imply affordability challenges. The process of developing the national energy strategy can also allow stakeholders to work through reliability and security concerns as the transition to 2035 and 2050 targets is mapped out.

The Commission is right to prioritise the decarbonisation of low temperature space, water, and process heat in the immediate term

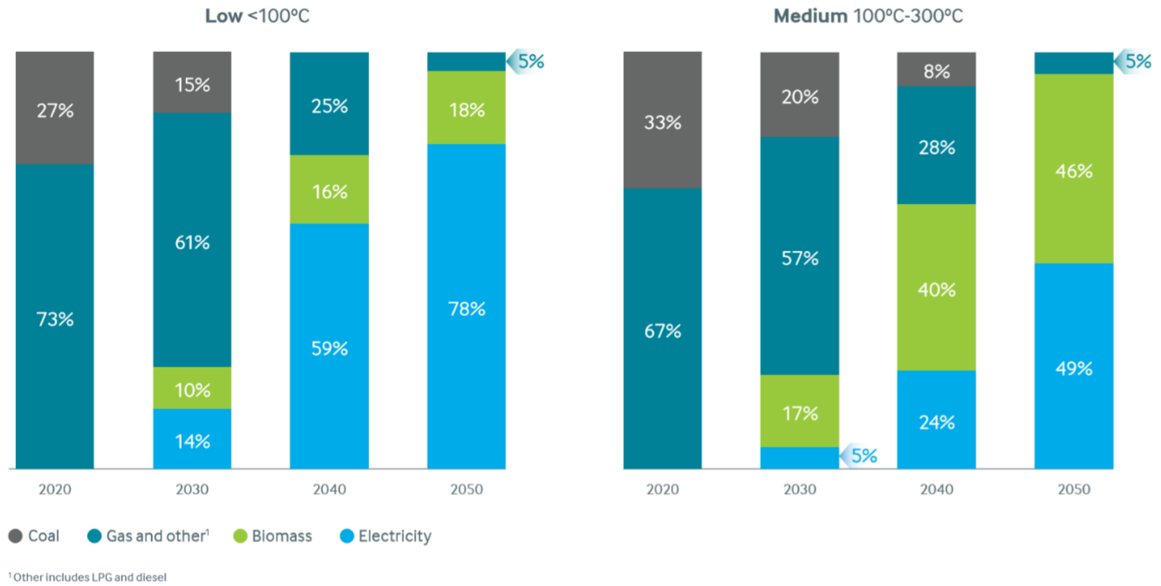
Electricity and biomass can largely decarbonise the process heat sector

Our Electrification Roadmap has shown that there is a large opportunity to support those who use fossil fuels to provide space, water and industrial heat to make the transition to low emissions fuels such as biomass and electricity. Process, space, and water heating make up 10% of New Zealand's gross emissions and 17% of the emissions covered under our Net Zero target.

There is strong alignment between our independent research and the way the Commission framed the issues in the sector and identified its priorities. Our analysis illustrates that electricity and biomass will both have critical roles to play in decarbonising heat.

The graph below demonstrates that the compelling economics of heat pumps at low temperatures mean electricity is likely to play a large role in decarbonising low temperature heat applications. However, as temperatures increase, and the efficiency of electric heat pumps decreases we see electricity and biomass playing a complementary role in decarbonising medium temperature applications.

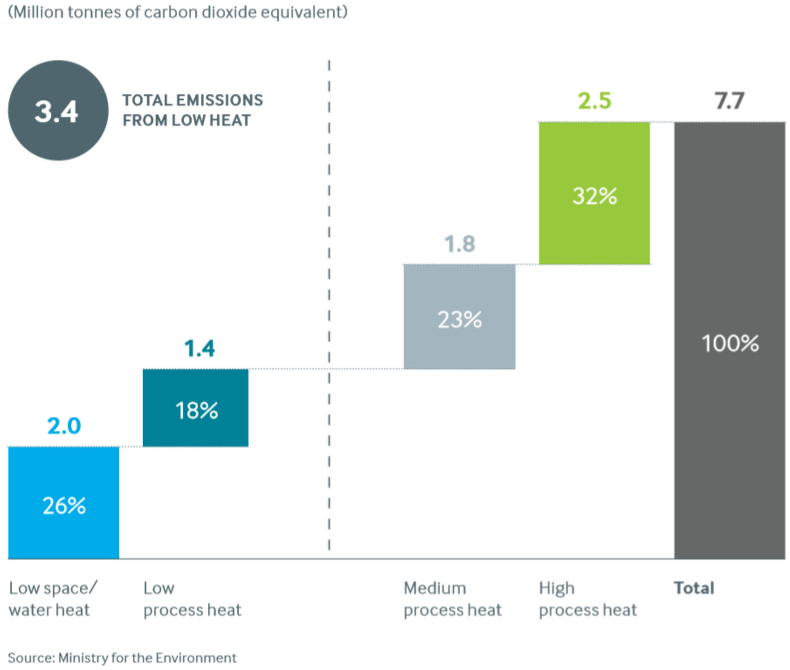
Figure 13: Supply of low and medium heat abatement opportunities



Low temperature applications offer the best opportunities to reduce heat emissions in the immediate term

The most immediate opportunity lies at temperatures below 100°C, where electric heat pumps can offer highly cost-efficient heating. Where traditional heat plants use chemical or electrical energy to generate heat directly, and therefore have a maximum efficiency of 100%, heat pumps do not generate their own heat. Rather, heat pumps gather existing heat energy either from ambient sources or the exhaust of a process and force it into the start of a process. Because of this characteristic, for every unit of electricity that is put into a heat pump, the process might receive three to five units of heat. This ratio is called a Coefficient of Performance (COP) and can make heat pumps highly cost competitive when compared to traditional heat sources. 44% of addressable heat emissions in New Zealand, including space and water heating, are from low heat temperature. A further 23% of addressable heat emissions are from medium temperature processes:

Figure 14: Composition of heat emissions, 2018



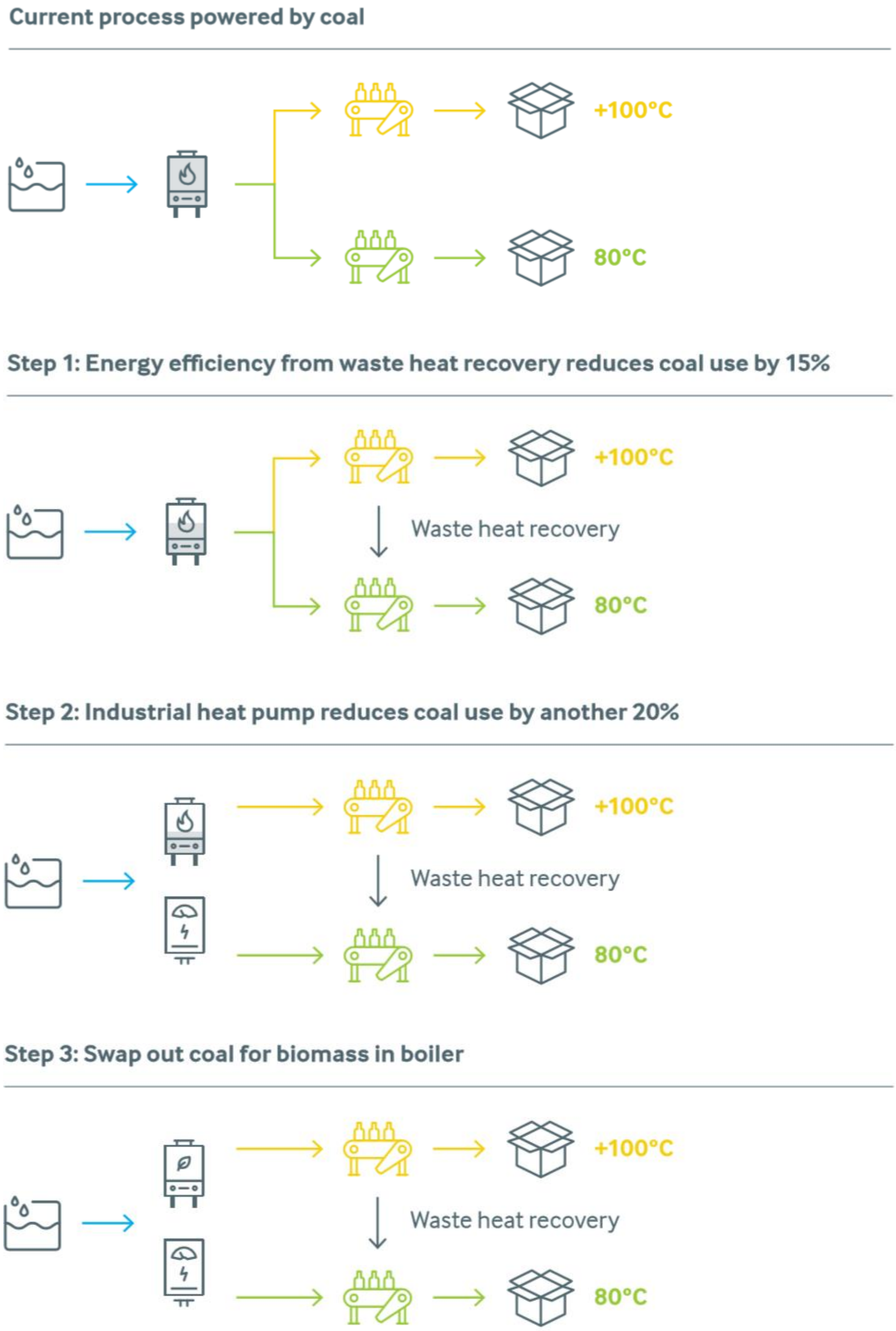
Medium temperature coal conversions offer the next best decarbonisation opportunities in process heat

The next significant tranche of decarbonisation sits in medium temperature process heat applications which are currently unable to benefit from the efficiencies of electric heat pumps. It is worth noting that heat pumps capable of generating steam do exist globally and that technology is improving in this space. This may make them a viable alternative to fossil fuels in applications such as milk drying in time.

For medium temperature sites which burn coal for their heat needs, biomass and electricity can complement each other to enable an existing boiler to switch to a low carbon fuel. This allows the owner to continue making use of their sunk capital.

Biomass is much less energy dense than coal, so filling a coal boiler up with biomass will not produce as much heat energy as the equivalent amount of coal. To convert this boiler to biomass to provide the medium temperature heat needs for the site, a site owner can make energy efficiency improvements or install alternative fuel sources such as electric heat pumps to provide heat to lower temperature processes. This de-loads the boiler allowing coal to be progressively substituted for biomass until eventually coal is no longer required at all:

Figure 15: Biomass and electricity as complementary fuels for mixed temperature sites

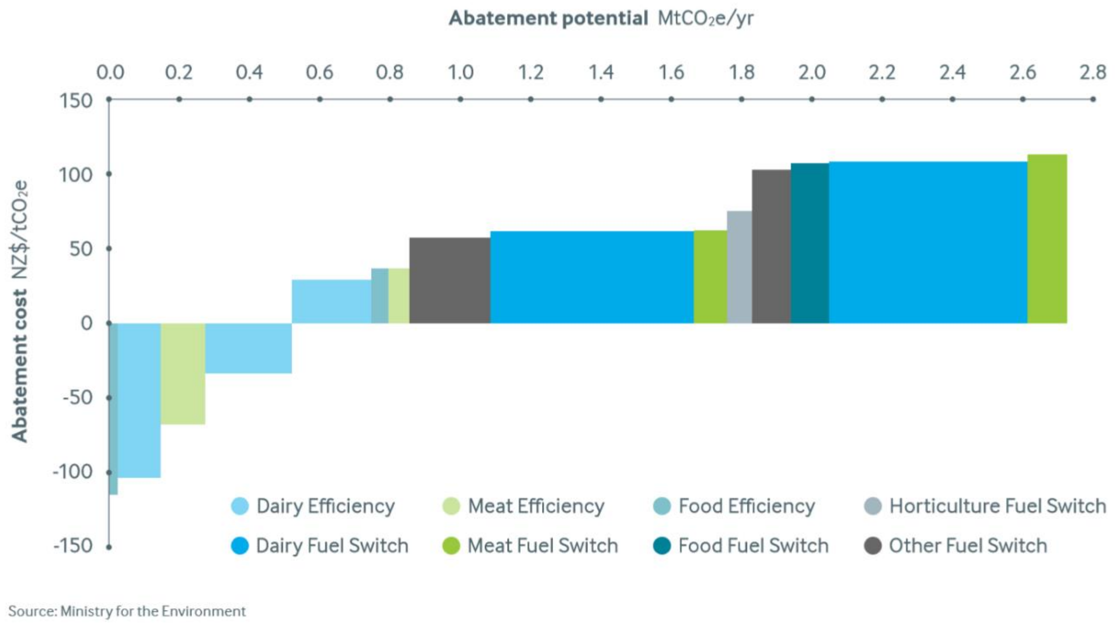


Source: Transpower analysis and interviews with industry experts

The heat emissions reductions identified by the Commission are achievable, both practically and economically

The Commission recommends 1.4 Mt CO_2-e of annual process heat reductions by 2030 and 2 Mt CO_2-e by 2035. Our analysis suggests that this is achievable. Low temperature heat offers some of the lowest cost abatement available in the economy. The Ministry for the Environment identifies that 1.2 Mt CO_2-e of low and medium temperature heat could be abated at less than $60/t$CO_2$-e and a further 1 Mt CO_2-e could be abated at around $100/t$CO_2$-e using a 2030 marginal abatement cost curve. There are also immediate opportunities to remove a significant volume of these emissions through cost saving or cost neutral measures as shown in MfE's Marginal Abatement Cost Curves below.

Figure 16: Process heat marginal abatement cost curve, 2030



Source: Ministry for the Environment

There are a number of important actions that can enable heat emissions reductions

Our Electrification Roadmap identifies the following priorities in the next five years to transition process heat to low emissions fuels, with a specific focus on the first two priorities:

- Alleviate capital cost barriers for those ready to benefit from decarbonising
- Establish and scale markets to drive clean energy costs down
- Rapidly transition public sector coal, diesel and LPG boilers to clean energy
- Accelerate clean heat audits and site decarbonisation strategies; improve fossil fuel boiler information
- Build process design and process heat decarbonisation capabilities
- Improve network planning, coordination and connection processes

These priorities are more fulsomely explained in the table below:

Figure 17: Options for process heat decarbonisation

Focus area	Options to accelerate process heat decarbonisation
Alleviate capital cost barriers for those ready to benefit from decarbonising	Implement solutions to reduce capital cost barriers, for example: • Expanded and scaled-up contestable funding, possibly via an extension of the Government Investment to Decarbonise Industry (GIDI) fund • Grants for proof of deployment projects • Low-cost finance options to spread out up-front capital cost - for example, through scaling up New Zealand Green Investment Finance funding • Business model innovation, including heat-as-a-service business models to spread out or remove the barrier of up-front capital costs
Establish and scale markets to drive clean energy costs down	Implement solutions to improve economic advantage of clean energy: • Development of a deep Power Purchase Agreement (PPA) market in order to help drive down electricity prices and provide longer-term price certainty to purchasers • A national biomass supply chain strategy to provide confidence in future biomass prices and security of supply • A robust carbon price that appropriately prices the economic impacts of fossil fuel emissions. Recent reforms of the NZ Emissions Trading Scheme go a long way towards achieving this
Rapidly transition public sector coal, diesel and LPG boilers to clean energy	• Continue to implement the $200 million Clean Powered Public Service Fund and scale further if needed • Expand scope of the fund to include diesel and LPG switching
Accelerate clean heat audits and site decarbonisation strategies and improve fossil fuel boiler information	Improve information available to purchasers of energy, sellers of clean energy and enabling infrastructure providers, for example: • Accelerate clean heat audits and site decarbonisation strategies to ensure all fossil fuel boilers have a transition plan • Improve publicly available fossil fuel boiler information (location, age, capacity) • Increase availability of user guides and case studies for process heat decarbonisation
Build process design and process heat decarbonisation capabilities	Build process design and process heat decarbonisation capabilities, for example: • Demonstrate the application of electric heat pumps to enable biomass conversion of existing coal boilers • Commission world-leading partnerships to pilot very high temperature heat pump trials for milk powder drying • Ensure a skilled, trained workforce to guide switching processes
Improve network planning, coordination and connection processes	• Improve connection processes so Transpower and EDBs can rapidly and cost effectively connect new customers and sources of generation • Improve information about prospective conversions to support proactive network planning • Remove first mover disadvantages for new grid / electricity network connections and alleviate RMA barriers • Identify and map areas of the electricity network with the potential for lower electricity prices and areas of surplus capacity • Identify and map areas of potential use of direct geothermal heat in New Zealand, as well as locations with strong, reliable supplies of biomass

Overcoming upfront capital cost barriers

There are many process heat users who could already benefit from switching to a low emissions fuel source, however for many organisations the capital required to make the change is difficult to raise, and we observed through our interviews that businesses have a bias towards spending capital on 'core business' activities rather than on process changes. In many instances this upfront capital cost barrier is the single largest barrier for heat users to switch to clean fuels.

The Ministry for the Environment estimates that we could save up to 0.5 Mt CO_2-e using energy efficiency or heat pumps at a net cost saving to process heat users.

Some New Zealand businesses have already taken advantage of these opportunities. For example, Alliance Group and Ashburton Meat works have both installed electric heat pumps to partially decarbonise their processing facilities and are saving 30-40% on their energy bills at these sites as a result.

The recently announced Government Investment in Decarbonising Industry (GIDI) fund is an example of a well targeted, contestable fund that can help businesses overcome the upfront capital cost barrier. In time, if the GIDI fund proves to be successful, it could be scaled and expanded to deliver greater emissions reductions.

Establish and scale markets to drive clean energy costs down

Being able to have confidence in the long-term supply of low emissions fuels is essential to give businesses the certainty that they need to invest in long lived assets. The biomass industry will play an important role in allowing many businesses to transition to low emissions fuels. Supporting and fostering this industry and providing confidence in the ongoing long-term supply of biomass is an essential component in encouraging businesses to invest in biomass fuelled plants.

The electricity sector in contrast is well established but has a significant task ahead to meet the projected demand from transport and heat electrification. The sector needs to evolve to continue to deliver affordable, secure, and reliable supply of electricity as the economy becomes more reliant on it.

Prices in the electricity market can be variable, adding some risk to any decision to adopt electricity as a low emissions fuel. It is common in other countries to manage this volatility using Power Purchase Agreements (PPAs). We discuss PPAs in greater detail below while discussing electricity affordability.

Accelerate clean heat audits and improve information sharing

While there are strong opportunities to decarbonise industrial processes, often the expertise to identify these opportunities is not held in the organisations who own the plant. It is important that organisations have access to process decarbonisation consultants to help them identify and pursue these opportunities.

This point is especially important for sites with harder to abate processes. These opportunities tend to require significant changes to the operation of a site, including not only heat plant, but in some cases, changes to the process itself. In these cases, a long-term strategy which charts progressive steps towards eventual decarbonisation is vital. The process of creating such a long-term strategy is complicated and requires specialist expertise that is often not available in the businesses who need them.

EECA's Energy Transition Accelerator provides an avenue for businesses to access the kind of expertise that is required, meaning that they have a concrete roadmap for how they will eventually decarbonise their site. This work also offers invaluable information for low emissions fuel sectors to plan their supply chain to meet growing demand.

As an example of site audits and information sharing, Transpower is currently working with South Island electricity distribution businesses, EECA and expert consultants to identify coal boilers and their forecast retirement dates. Through this programme we have already identified 1.5 GW of fossil fuelled boilers in the South Island. This information is vitally important for those of us in the electricity and biomass sectors in planning our networks and supply chains to enable these conversions.

The electrification of transport and process heat can be achieved while improving the electricity sector's performance against the Energy Trilemma

In May 2020, the World Economic Forum released its 2020 Energy Transition Index. It assesses countries for their current energy performance, as well as how prepared they are to transition their energy sector to deliver energy security, fair prices and a sustainable energy supply.

New Zealand comes in at a respectable number six for current system performance, reflecting our historic renewable electricity base, but we come in well down the table at number 24 for our readiness to transition our energy sector.

The sustainability of New Zealand's electricity is already high and will improve as a result of natural market forces as demand for electricity increases and renewable generation technologies like wind and solar continue to decline in cost. However, there are opportunities to further improve affordability and reliability through careful implementation of policy, innovation, and continued prudent management of the grid.

Affordability of electricity supply can be maintained or improved while we increase our uptake of electricity

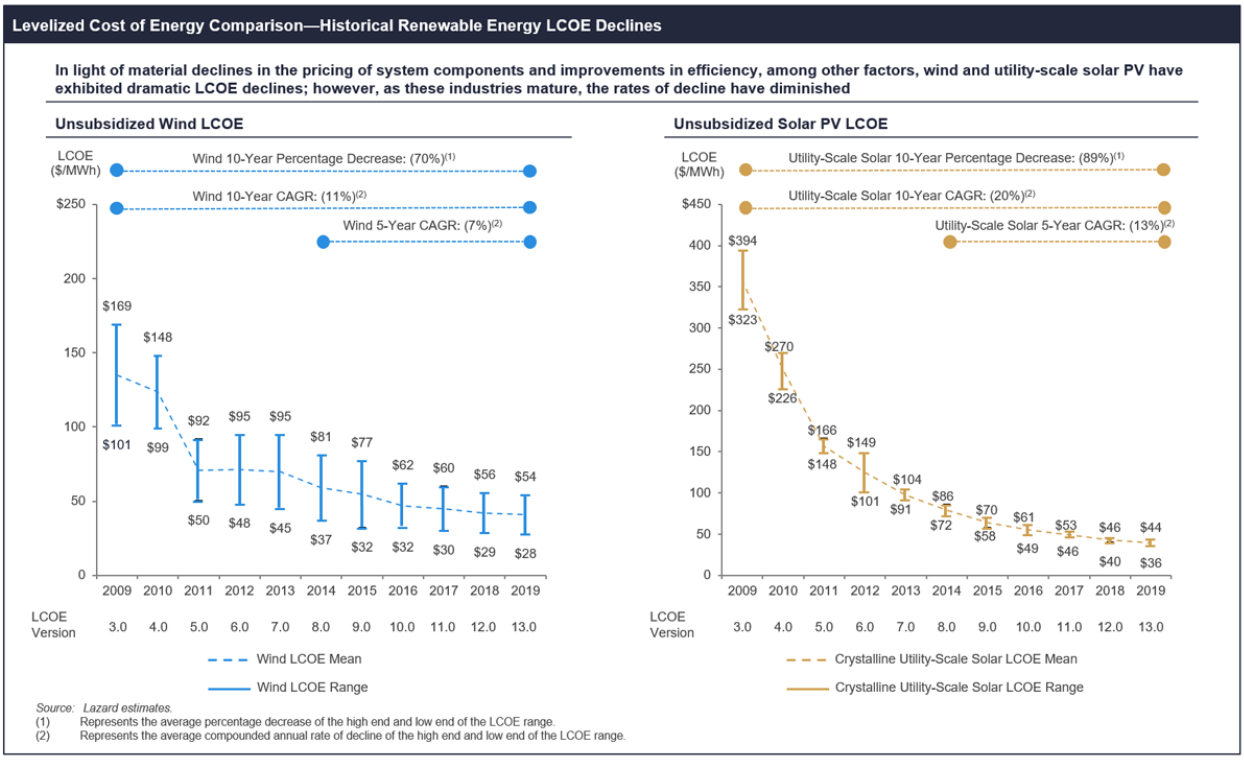
Generation

A large expansion of the electricity system does not imply a commensurate major expansion in electricity costs, nor a one for one increase in transmission build. The cost of new renewable generation is declining rapidly. New Zealand needs to build a lot more of it, but it is getting cheaper to do so. New renewable generation is already more cost effective than today's base load thermal generation, and technology will continue to improve. By way of example, in Australia the wholesale electricity price has more than halved in the last three years as 20 GW of new renewables have been built.

In a sector where the fundamentals of our business have been relatively stable for the last 100 years, the deployment of solar, wind, and battery technology is rapidly changing how power systems are designed, built, and operated. This disruption has been driven by the plummeting costs of these technologies and the adoption of new contracting models to support them.

This is well demonstrated in Lazard's historical comparison of the USD price of different forms of electricity generation:

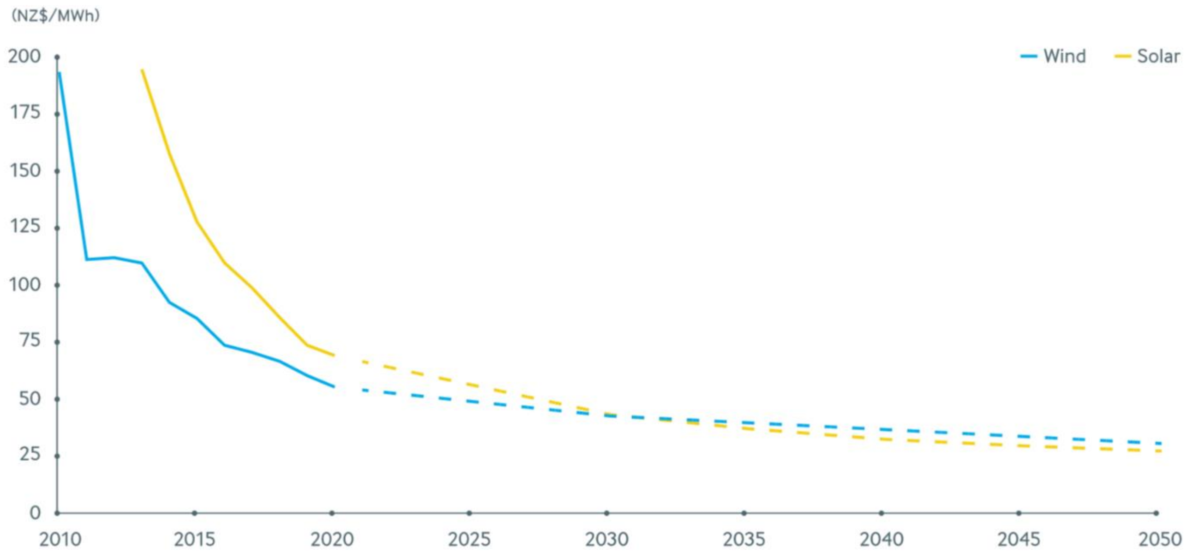
Figure 18: Lazard's historical levelised cost of energy comparison



The cost of building new wind and solar generation has dropped by 70% and 90% respectively in the last decade and continues to decline. In parts of the world, it is now cheaper to build new renewable generation than it is to continue *operating an existing* fossil fuel powered plant where the capital has already been sunk.

We forecast that these trends will continue. The following graph illustrates our forecasts for the current and future levelised cost of energy for wind and solar generation. We predict that new wind can be built today for approximately $60/MWh and new solar can be built for $70/MWh. We forecast that within this decade both of these prices will fall below $50/MWh.

Figure 19: Levelised cost of energy of new build renewable electricity generation[3]



Applies New Zealand cost scale factor to historical US cost trend (Lazard) and indexes forecast reduction (NREL) to today's cost in New Zealand.
Source: Lazard, Levelised cost of energy and levelised cost of storage – 2020; National Renewable Energy Laboratory (NREL), Annual technology baseline 2019

New Zealand has a wealth of renewable resources, such as wind, geothermal and solar. Our access to low cost renewable electricity could be a significant opportunity to drive economic growth. New 21st century industries like data centres and hydrogen could be established by leveraging low cost renewable electricity. It can provide New Zealand with a distinct competitive advantage over other countries, making us an attractive place to do business.

Transmission

In the same way that changes in commuter behaviour would challenge transport network design, rapid deployment of new generation has challenged transmission network operators internationally.

The good news for New Zealand is that our grid is well suited to absorbing very high levels of intermittent renewables. Much of our hydroelectricity is flexible and can be used to "firm" intermittent generation. Our electricity is already 80 to 85% renewable, which will only increase if NZ Aluminium Smelter (NZAS) exits the market and more renewable generation is built. However, only 40% of our overall primary energy comes from renewable sources, reflecting our dependence on oil for transport and our use of coal and gas for industrial and building heat – drying milk, and heating schools and hospitals, for example.

Converting these transport and heating activities will significantly increase the demand for electricity, but this increase in electricity delivered across the transmission grid and distribution

[3] Combines historical data from Lazard with LCOE forecasts from NREL

networks does not have to imply a similar scaling up of expensive network build. Distributed energy resources and demand response have the potential to significantly reduce the amount of infrastructure required to deliver the future electricity system. Peak use of the network drives network build, not the total energy volume delivered across it. Energy volume is often how consumers' bills are charged. As a general rule of thumb, if energy volume grows at a faster rate than peak demand, network charges for consumers will decline. The more that electrification of new sectors of the economy like transport and process heat can be done in a way that means the new energy volume doesn't drive up the peak to the same degree, the more can be done with the existing network. Examples of these would include electric vehicles being charged overnight or electrified dairy factories operating outside of peak winter months based on milking seasons. We forecast that peak demand could grow at half the rate of energy volume growth to 2050 which could lead to reduced network charges for all consumers in time.

Providing certainty to new generators and to electricity consumers

Converting existing industry, building new industry, and building new renewable generation often relies on having a predictable price for energy.

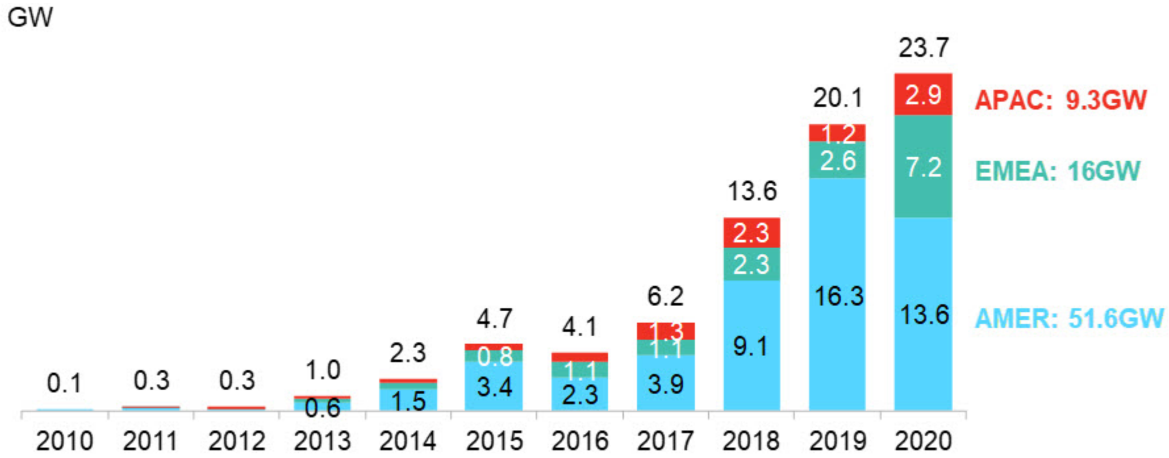
Electricity purchased through the wholesale market can be volatile. Prices swing daily, seasonally, and over multi-year periods in response to supply and demand. Large energy users can hedge, at best, three years in advance via the ASX futures market.

This lack of future price certainty can make investing in capital intensive projects such as new renewable generation, process heat conversion, or development of new industry risky.

Internationally, this volatility is commonly managed through very long term (5-20 year) contracts between a generator and a customer called Power Purchase Agreements (PPAs). The length of the contract gives both parties the ability to avoid the impacts of wholesale market volatility and gives them confidence to invest – often at rates below the wholesale price. PPAs are often used to "underwrite" the financing and development of new renewable energy generation (for developers) and large commitments to electrification (for energy users). Stable, long-term deals tend to lower the cost of capital for projects, in turn reducing the cost of energy.

PPA volumes are increasing globally. The corporate sector is also becoming an increasing source of demand for new PPAs:

Figure 20: Global corporate PPA volumes, 2010-2020



Source: BloombergNEF. Note: Data is through 2020, reported in MW DC capacity. Onsite PPAs not included. Australia sleeved PPAs are not included. Pre-market reform Mexico PPAs are not included. APAC number is an estimate. These figures are subject to change and may be updated as more information is made available.

In New Zealand however, we have tended to struggle with scale. Where Amazon in California can release one PPA tender and back the development of hundreds of megawatts of new generation, in New Zealand there are few organisations who consume sufficient quantities of electricity to do this on their own.

For reasons such as these, the Major Electricity Users Group has recently released the first sizeable tender of this type in the New Zealand market.

The ability to underwrite new investments in electrification and process heat conversion through long-term, low cost renewable electricity is a significant opportunity for New Zealand. If stable counterparties such as the New Zealand Government were to begin tendering their electricity procurement via PPAs then they would potentially stand to secure a discount to their current electricity costs while also forming the foundation of a national PPA market and increasing the proportion of renewable generation in electricity supply.

Security of electricity supply can be maintained or improved while we increase our uptake of electricity

New Zealand's electricity market is designed to ensure that generators receive the right signals to conserve water when energy is scarce, and to offer low prices when there is an abundance.

Transpower does not see an immediate need for change to ensure security of supply and we are not advocating market redesign. However, if the need for further market evolution to ensure security of supply arises in the future, it would be beneficial for the industry and government to have explored possible solutions to potential shortfalls in peak or dry year cover well before they are needed.

Having this discussion now ensures that the industry can be well prepared and will allow us to move quickly if the need were to arise. The NZ Battery project is a timely and important avenue for investigating both the size of the dry year problem and the solutions that are available to remedy it cost effectively.

Managing electricity security is a key part of the System Operator function which Transpower performs on behalf of the sector. The issues we discuss in this section are a subset of the areas that the System Operator monitors, namely daily peak demand and dry year risks.

Short term peak demand security requires enough generation capacity to be available to meet daily peaks and a well-designed and operated grid that can ride through faults such as weather-related events.

The dry year challenge is an energy issue – where there is a shortage of energy (namely water) which can be converted into electricity to meet energy demand. Long term security requires enough energy production throughout the year to ensure we maintain enough hydro storage during winters with lower than normal rainfall. This is currently achieved by first dispatching renewable wind and geothermal, and then using backup fossil fuel plants as lake levels decrease.

There are a number of options to address dry year risk, including both technology-based 'silver bullet' solutions, and market-based solutions. Market-based mechanisms, if correctly implemented, could potentially deliver a combination of least cost technological solutions to dry year that do not rely on an individual silver bullet solution.

In Whakamana i Te Mauri Hiko, we predict that meeting peak demand will become more challenging as peak demand increases by ~30% to 40% out to 2050. The challenge of meeting dry year risk increases with energy demand, which in Whakamana i Te Mauri Hiko we predict will increase by ~55% to 70% by 2050. Both of these would be exacerbated by the exit of thermal plant. Transpower is actively planning for the eventual retirement (date unknown) of the Taranaki Combined Cycle gas-fired power station and the potential unavailability of coal/gas-fired Rankine units at Huntly.

These plants contribute to system stability and Transpower needs to ensure it is ready to respond when decisions are made around the future of these assets. (Our WUNIVM project addresses the voltage stability implications of Huntly Rankine units becoming unavailable.)

Introducing policy that discourages these thermal power plants from running might require the introduction of other incentives to ensure that sufficient energy and capacity are still available to meet peak and dry year needs.

While this is important, it should also be noted that these incumbent plants are not the only generators that are able to fill this role and a solution should be agnostic to who provides peak capacity and dry year security. To demonstrate this, the table below summarises the relative strengths of potential physical solutions. Note that since this table was developed another solution, hydrogen electrolyser demand response, has been discussed which could provide both dry year and peak demand cover.

Figure 21: Potential technology options for managing peak and dry year risk[4]

Technology	Ability to contribute to peak demand	Ability to contribute to dry year	Comments
Gas (Combined cycle)	◐	●	Lower flexibility challenges economics, emits carbon
Gas (Open cycle/Peaker)	●	●	High flexibility, emits carbon
Hydrogen peaker	●	●	Currently very expensive
Biomass	●	●	More expensive than gas, needs net zero fuel source
Short duration pumped hydro energy storage	●	◐	Dry year contribution limited by size, sites need to be identified
Long duration pumped hydro energy storage	●	●	Consenting may be difficult
Renewable overbuild	○	●	Could be expensive
Batteries	●	○	May need multiple value streams to be economic
Renewable overbuild and batteries	●	●	Could be expensive
Additional HVDC capacity	●	○	Allows SI hydro to contribute more to NI peaks
Demand response	●	○	Allows peaks to be managed, potentially at least cost
Large scale load interruption	○	●	Prolonged shutdown of major loads, likely to be expensive

If it appears that these solutions are not likely to be developed within the incentive framework provided by the ‘energy only’ market, a number of market and regulatory changes could incentivise investment. The following table summarises a number of potential options to remedy the situation.

[4] Section 7 of Whakamana i Te Mauri Hiko – “Ensuring investment signals deliver security of supply” pp 69-70

Figure 22: Potential market options for managing peak and dry year risk[5]

Market option	Primarily targets peaks	Primarily targets dry year	Comments
Increase Customer Compensation Scheme payments		✓	Mechanism that exists today which could be scaled up – requires retailers to pay a weekly charge if their customers need to reduce energy use
Firm energy market		✓	Procures additional 'firm energy' to cover dry years – it is the dry year equivalent of a capacity market
Increase lake level requirements leading into winter		✓	Would allow for more energy cover entering winter – may still require additional firm energy in a dry summer to reach higher lake levels
Strategic reserve mechanism		✓	Designed to protect thermal baseload capacity for energy shortages. Likely to be better designed as a market-based mechanism to provide other options
Retailer reliability obligation (RRO)	✓	✓	Requires retailers to contract sufficient 'on demand' resources. Only triggered when material reliability gaps are identified in advance. Could be designed to target peaks, dry year, or both
Capacity market	✓		Procures the availability of peaking plant and/or demand response
Ensuring market settings allow batteries to realise true economic value	✓		Requires batteries to access multiple value streams (e.g. network deferral, energy, ancillary markets) simultaneously.
Balancing market	✓		A balancing market that operates between one and five minutes could provide stronger price signal for flexible generation

While Transpower does not profess to have the answers to the dry year problem, we are confident that there are many possible technological and market-based options which are outlined in this section that will ensure security of supply can be managed into the future as we transition to a more electrified and more renewable energy system.

Demand side innovation could significantly reduce costs and improve reliability if deployed appropriately

Consumers finding options to reduce their own energy costs through electric vehicles, solar panels, smart appliances and home batteries is a good thing, however the transition to these new technologies presents a double-edged sword.

A well-managed deployment could significantly reduce costs for consumers.

[5] Section 7 of Whakamana i Te Mauri Hiko – "Managing dry year risk" pp 75 - 77

These technologies will drive cost efficiencies if they are deployed in a way that they consume electricity during off peak times or offer services into the wholesale market. However, a poorly managed deployment could be costly.

If these distributed energy resources behave in a way that adds to peak congestion or compromise network stability, then it could result in increased network build and more expensive fossil fuel generation being dispatched to meet peaks.

The development of standards for solar and battery inverters is currently being considered. We expect uptake for solar and batteries to increase markedly from the mid-2020s. It is a priority that standards are in place before significant deployment.

Deploying electric vehicles to households with chargers that charge as soon as they are plugged in is likely to result in significant peak system issues as people return home at the end of their day, which coincides with peaks in winter.

Deploying electric vehicles with 'smart' chargers will avoid these peak capacity issues and will give owners better access to off peak electricity prices, saving customers significant sums of money and alleviating congestion on the Grid and on local distribution systems. In Whakamana i Te Mauri Hiko we estimate New Zealand could avoid approximately $3 billion in peaking generation, and transmission and distribution upgrades through smart demand-side management[6]. We also discuss the impact of smart charging on the electricity network in response to Question 14: Transport.

To incentivise uptake of these technologies, it is essential that owners get access to the value that their assets provide the system.

Distributed Energy Resource Markets could offer owners 'value stacking' by allowing electricity retailers, generators, distribution companies, or Transpower to pay them to provide services. This creates a win-win where asset owners receive income and electricity market participants gain access to services to support their business needs.

There are a number of levers available that could make a large difference in the near-term:

- Time of use pricing: Ensuring that distribution companies and retailers increasingly offer peak/off peak rates for end consumers as this will enable consumers to access value for services delivered to the electricity system.
- Standards: Ensuring that technology standards for equipment like solar inverters and EV chargers play nicely with the grid. First, this limits the opportunity for consumers to install low performance equipment which could externalise costs to other participants. Second, smart devices will allow consumers to participate in electricity markets and respond to price-based signals in near real time.

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[6] Section 5 of Whakamana i Te Mauri Hiko – "Demand side management of peaks" pp 61 - 70

- Platforms for event-based pricing: Ensuring that electricity markets have the right platforms to enable price-based signals to be sent to end consumers and for end consumers to communicate response back to the market.
- Retail sector innovation: Sub-ICP metering will allow for a consumer to have more than one electricity retailer at their premises. By way of example, a retailer with a bespoke EV tariff offering for off-peak EV charging could supply a consumer's EV while the rest of the house is supplied by another retailer. This will create competition for smart retail services for end consumers and could enable the development of a flourishing aggregation market for distributed energy resources.

Transpower as System Operator recently commissioned Sapere Research Group to investigate the opportunity that Distributed Energy Resources such as solar and batteries present to New Zealand. This investigation found that "there could be significant uptake … within 5 years" and also suggested that "higher specification equipment would be needed than might otherwise be installed to unlock the full value potential."

A major expansion of the electricity system is required and can be done while improving the electricity sector's performance against the Energy Trilemma

Delivering all of the energy that will be required to decarbonise the transport and process heat sectors will require a significant increase in generation, as well as an expansion in transmission and distribution networks.

We are already seeing an unprecedented increase in the interest for new generation, with announcements from many existing market players indicating that they intend to significantly increase their activity in the near future.

We're also seeing increasing demand for new electrically powered industrial sites. Transpower is in the process of transforming our customer connection process to simplify and accelerate the connection experience. While Transpower is working to ensure it can enable this electrified future, we reiterate what we said in our MBIE AREEE submission – the challenge for the electricity industry is significant.

In short, under any scenario the Commission is right to observe that a major expansion in the electricity system is required, starting now. However, it is important to be clear about what this major expansion of the electricity system implies and does not imply.

It does not imply a commensurate major expansion in electricity costs, nor a one for one increase in transmission build. The cost of new renewable generation is declining rapidly. New Zealand needs to build a lot more of it, but it is getting cheaper to do so. New renewable generation is already more cost effective than today's base load thermal generation, and technology will continue to improve.

In addition, the major increase in electricity delivered across the transmission grid and distribution networks does not have to imply a similar scaling up of expensive network build. Peak use of the network drives network build, not the total energy volume delivered across it. Energy volume is often how consumers' bills are charged. As a general rule of thumb, if energy volume grows at a faster rate than peak demand, network charges for consumers will decline.

The more that electrification of new sectors of the economy like transport and process heat can be done in a way that means the new energy volume doesn't drive up the peak to the same degree, the more can be done with the existing network. Examples of these would include electric vehicles being charged overnight or electrified dairy factories operating outside of peak winter months based on milking seasons.

More generally, there will be greater variation in where and when energy is available to the grid, and greater flexibility from users in how they take energy from the grid, that will mean the grid is much better utilised outside the peak. We forecast that peak demand could grow at half the rate of energy volume growth to 2050 which could lead to reduced network charges for all consumers in time.

In short, we are talking about a major expansion in the volume of delivered electricity and that will require more network investment, but how much depends on the path New Zealand takes to decarbonise. Our estimates above of increased large grid upgrade projects before 2035 assume the sector co-ordination and policy work is done to enable distributed energy resources and demand response to smooth the growth in peak demand as the volume of electricity delivered to the economy grows. If this does not happen then the investment may need to be greater.

While delivering the infrastructure required to support this future poses a significant challenge to the sector, our work in Whakamana i Te Mauri Hiko confirmed that it is achievable. We are already seeing a significant increase in the amount of new generation being planned, Transpower has embarked on our Net Zero Grid Pathways project to determine the bets future buildout of the Grid in collaboration with industry, and consumers are already transitioning to electricity as a low emissions fuel source. As the pace of these changes increase, we will need to plan under considerable uncertainty, improve our pace of delivery, and ensure that we have the right people with the right skills to complete the volumes of work required. Whakamana i Te Mauri Hiko provides us a foundation upon which we can work to ensure all of the parts that we have control over are well placed to handle the transition.

Transpower is committed to doing our part in ensuring that the grid supports this transition, however there are areas in which modifications to regulations, consenting, and land access could better enable the sector to deliver against this challenge. We discuss these areas in more detail in *Section 1: Overview – Investment Decision Making*, and *Section 1: Overview – Consenting and Land Access*.

The overall objective to these changes in how we make investment decisions, project consenting, and land access, is speed. We need to commit to investment decisions, and build the infrastructure, faster than we have to date.

When we make these changes, and increase the speed of decision-making, there will be positive feedback loops. Faster decisions will mean New Zealand captures the benefits of each project more quickly. It will also mean the system becomes more agile – we create the potential for smaller projects done quickly, rather than unwieldy timeframes creating a bias toward larger projects.

Energy

Time-critical necessary action 3 - Target 60% renewable energy no later than 2035

We support the use of renewable energy targets as they provide clear measures of progress while ensuring that New Zealand's energy system has flexibility to adapt as New Zealand moves towards low emissions fuels.

Time-critical necessary action 3.a. - National energy strategy

We support movement towards a national energy strategy which ensures that we are able to transition towards low emissions fuels while maintaining an affordable, secure and reliable supply of energy to New Zealanders.

We have a wealth of renewable electricity resources which can be developed to deliver a modern, low-carbon economy. The price of developing renewables like solar and wind continues to fall, technology in batteries and EVs continues to evolve and our renewable electricity base is ideally suited to the electrification of transport and industry. Electricity is already highly renewable and as New Zealand moves from fossil fuel to low emissions electricity, we will make further progress against our renewable energy target as fuels are substituted and even more renewable generators are delivered.

Additionally, we have the opportunity to also move from 80-85% renewable to at least 95% renewable through displacing thermal baseload with renewable generation. This is likely to occur through natural market forces as highly competitive wind and solar developments outcompete the existing thermal baseload plants. A unified energy strategy is essential in a future where fuel substitution and consumer behaviour change will impact on multiple parts of the energy sector in an interconnected way.

Necessary action 5 - Maximise the use of electricity as a low emissions fuel

We agree with the Commission's recommendation that we should maximise the use of electricity as a low emissions fuel. New Zealand's electricity is already highly renewable and will only become more so as new solar and wind generation outcompete thermal baseload generation.

To support this transition, the sector needs to continue to provide reliable, affordable, and low emissions electricity. The magnitude of change will be significant, and we are committed to doing our bit to enable this future.

In Whakamana i Te Mauri Hiko, we explored how the electricity sector would need to adapt to accommodate a 55-70% increase in demand for electricity. To meet this demand, we will need to build as much new generation in the next 15 years as we have in the last 30 to 40 years. The sector needs to be able to plan under considerable uncertainty for investments with long lead times, we need coordination and processes that allow us to adapt as New Zealand navigates its energy transition, and we need the right people with the right skills to make it all happen. Through this work, the sector needs to ensure that New Zealanders continue to receive a reliable, affordable, and low emissions electricity supply to support their transition away from fossil fuels.

While we are committed to doing our part, the challenge is much broader than just Transpower. In Whakamana i Te Mauri Hiko, we identify 10 key areas for change to enable the electricity sector to respond to rapidly increasing demands. Delivering against these 10 key areas will enable New Zealand to maximise the use of electricity as a low emissions fuel:

Figure 23: Ten areas of change[7]

[7] Part 2 of Whakamana i Te Mauri Hiko – pp 43 - 81

Connections process:

- This is critically important and is a process that Transpower is already improving through applying lean, end to end process optimisation

System planning:

- An integrated national energy strategy that focuses across vectors (electricity, gas, hydrogen, biomass, biofuels etc) and across sectors of the economy (e.g. industry, transport etc)
- Long-term electricity transmission plan that identifies the least regrets investments that enables the least cost transition to increased electrification and renewable generation (Transpower's responsibility). The intent of Transpower's Net Zero Grid Pathways project is to develop this plan

Getting the incentives right:

- Predictable, long-term, rising carbon price signals
- Policies that are complementary to the carbon price to accelerate decarbonisation (e.g. EV feebate, GIDI funding etc)
- Proof of deployment projects for new technology

Removing the barriers:

- RMA and access to property
- Enabling access to PPAs for industry to reduce costs (e.g. template framework agreement for PPAs for industry, all of Government PPA to reduce government energy costs, and potential matching platform for buyers and sellers)
- Electricity Industry Participation Code evolution to provide a level playing field for new technologies like batteries

Demand-side management of peaks:

- New markets for distributed energy resources to access
- Pricing reform (e.g. via peak/off peak pricing in distribution networks) to provide incentives for customers to provide services when they are most needed (both increasing customer profitability and alleviating stress on the grid)
- New platforms and aggregators to link individual consumers with these markets
- New technology standards to ensure that consumers' devices can respond to price signals in near real time and can play well with the Grid

Ensuring generation can meet peaks:

- Generation and the grid are built to meet peaks. These peaks are often short in duration and infrequent, meaning that large amounts of capital are often underutilised to ensure that electricity is available when we need it most
- While meeting peaks is less likely to be an issue in the New Zealand market than dry year, it is still important and should be monitored

- Deployed correctly, demand side technology and markets which incentivise them have the potential to maximise our consumption of electrical energy while minimising the amount that our peaks grow by. This would lead to less peaking generation, higher network utilisation and less grid expansion

Managing dry year risk:

- The work that the NZ Battery project is doing should help to size the dry year problem, clarify the options available to us and identify the trade-offs we need to make to address this challenge
- Managing dry year risk could become more difficult in future if some thermal power plants close

Protecting system stability:

- This area is vitally important, and it falls squarely as Transpower's responsibility. In our role as System Operator we are always looking at changes in system conditions to ensure that we can continue to operate the New Zealand power system securely and meet our Principal Performance Obligations under our agreement with the Electricity Authority as System Operator

Workforce development:

- Delivering a net zero carbon economy will develop tens of thousands of jobs[8]
- But it will require highly skilled capabilities (often in new areas) and more capacity if we are to be successful

Collaboration:

- To deliver all of these conditions for success it will require increased collaboration across government, policy makers, regulators, the electricity industry, businesses and consumers

Necessary action 5.a. - Coal electricity generation retirement

New Zealand's electricity market is designed to ensure that generators receive the right signals to conserve water when it is scarce, and to offer low prices when there is an abundance. The ability to manage this dry year risk is currently provided largely by fossil fuel generators, who at present run infrequently and, in the future, are likely to run even less frequently.

Before committing to any mandate for the closure of coal electricity generation assets, both the System Operator and Grid Owner see it as critical that Policy makers have viable and reliable

[8] As demonstrated in a recent study led by Cameron Hepburn at the University of Oxford, and including Nobel prize winner Joseph Stiglitz, and well-known climate economist Nicholas Stern

approaches to maintaining security of supply. It is essential that a solution to the dry year problem is found.

Because of the pivotal role that large thermal units often play in the grid, decommissioning of a plant (or units within a plant) needs to be carefully signalled and coordinated. As an example, the unexpected closure of the 1,600 MW Hazelwood Power Station in Victoria, Australia was extremely disruptive to the Victorian power sector and raised challenges for maintaining grid stability that could have been better mitigated had the closure been signalled further in advance.

Necessary action 5.b. - Solutions to the dry year problem

We support ongoing investigation into solutions to New Zealand's dry year problem, including understanding the size of the problem, identification of solutions, and identification of the costs and benefits of these various solutions. We have provided a more fulsome discussion on the options that we have identified to manage the dry year challenge in our answer to Question 15 under the heading "Security of electricity supply can be maintained or improved while increasing our uptake of electricity".

Necessary action 5.c. - Measures, such as a disclosure regime, to reduce wholesale electricity market uncertainty

We are unclear as to which potential disclosures the Commission is referring and therefore cannot comment.

Necessary action 5.d. – Electricity distribution businesses

Electricity distribution businesses are an essential enabler of New Zealand's decarbonisation. They continue to evolve their businesses to adapt to New Zealand's changing energy environment.

They will play a vital role in enabling New Zealanders and businesses to transition to renewable electricity and it is essential that they offer an affordable, responsive network connection service to all who wish to make the transition.

New Zealand's distributors, via the Electricity Networks Association, articulate what the sector needs to achieve in their Network Transformation Roadmap.

As New Zealand's power system decarbonises, we expect that more distributed generation will be built, and more smart devices will connect to distribution networks. As these resources hit scale, they are likely to begin impacting on transmission assets as well as the distribution networks that host them. To ensure that the grid remains operable throughout this transition, the amount of coordination and information exchange that will be required between distribution and transmission operators is likely to increase.

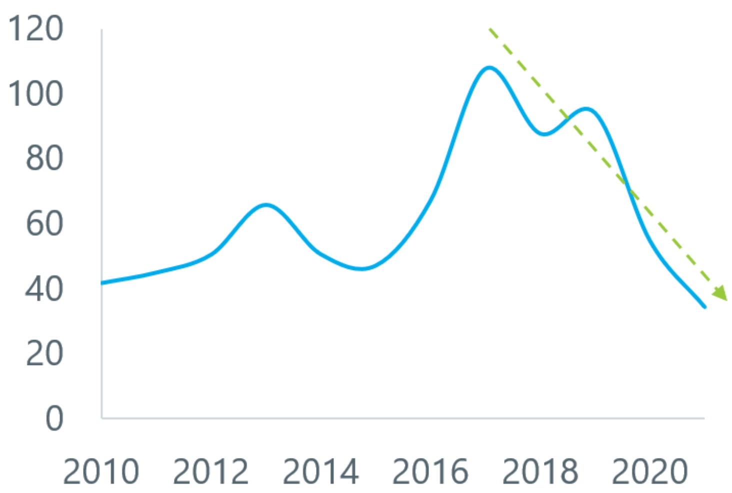
In our MBIE AREEE submission we identify that we need to:

- Improve connection processes so Transpower and EDBs can rapidly and cost effectively connect new customers and sources of generation;
- Improve information about prospective conversions to support proactive network planning;
- Remove first mover disadvantages for new grid/electricity network connections and alleviate RMA barriers;
- Identify and map areas of the electricity network with the potential for lower electricity prices and areas of surplus electricity capacity; and
- Identify and map areas of potential use of direct geothermal heat in New Zealand, as well as locations with strong, reliable supplies of biomass.

Necessary action 5.e. – Independent generation and distributed generation

Increased independent generation in overseas markets has led to strong uptake in renewable generation, alongside material reductions in electricity prices in some instances. For example, the graph below shows that following the large-scale investment in 20 GW of new renewables through the middle of the decade, the price of wholesale electricity in Australia has more than halved from previous highs.

Figure 24: Falling wholesale price of electricity in Australia (2020 real, AU$/MWh)



One of the most popular methods of ensuring access to capital for independent generators in such markets is through the use of Power Purchase Agreements (PPAs). These agreements allow an independent generator to have a high degree of certainty over future returns which means that their development projects are attractive to holders of private capital. These arrangements also offer an entity who is seeking to electrify the ability to secure long-term, reliable, low cost pricing. In this way, PPAs are a win-win for both renewable generation and for electrification.

We have covered the impacts of PPAs in our above discussion on electricity affordability, and believe that there are four pragmatic near-term options that Government or a commercial entity could take to accelerate the formation of a PPA market in New Zealand:

- All of Government electricity PPA requiring that procurement is backed by new build renewable generation. This would potentially offer Government lower electricity costs while also driving renewable generation build
- Provide information on how PPAs work to interested parties (e.g. PPA design, how do you firm your contract etc.)
- Create a standard form template (similar to an ISDA agreement) for PPAs which corporates could use
- Establish a matching platform which could aggregate smaller portions of demand to make a collective PPA

Necessary Action 5.e. – Monitor and review to ensure electricity remains affordable and accessible

Affordable electricity is essential to a decarbonisation strategy that maximises the use of electricity as a low emissions fuel.

The Grid is designed to enable consumers to benefit from highly efficient generators that are distant from their consumption. Enabling new large-scale generation will continue to drive price efficiencies for consumers as new generators connect to the grid and increase competition.

In a perfectly efficient market with no informational asymmetry and no barriers to entry, you would expect the average price of electricity to closely track the Long Run Marginal Cost (LRMC) of new generation plus the cost of firming.

If an observer were interested in monitoring the efficiency of the electricity market, then comparing the average wholesale electricity price to the Long Run Marginal Cost of new generation would give an indication of how quickly producer surpluses are being squeezed out of the market through new entrant competition. This would provide an indication as to whether the market is effectively driving new investment in least cost generation.

We have discussed in our answer to Question 15 how demand response, distributed energy resources, and smart chargers could potentially reduce the overall system costs to drive affordable electricity prices. For further information, see pages 46-59 of our MBIE AREEE submission, and more recently, our submissions to the Electricity Authority’s Innovation and Participation Advisory Group (IPAG).

IPAG, the Electricity Networks Association and Transpower have all published roadmaps and papers on the opportunities that Distributed Energy Resources, smart chargers, and demand response offer and how to bring them into reality in New Zealand.

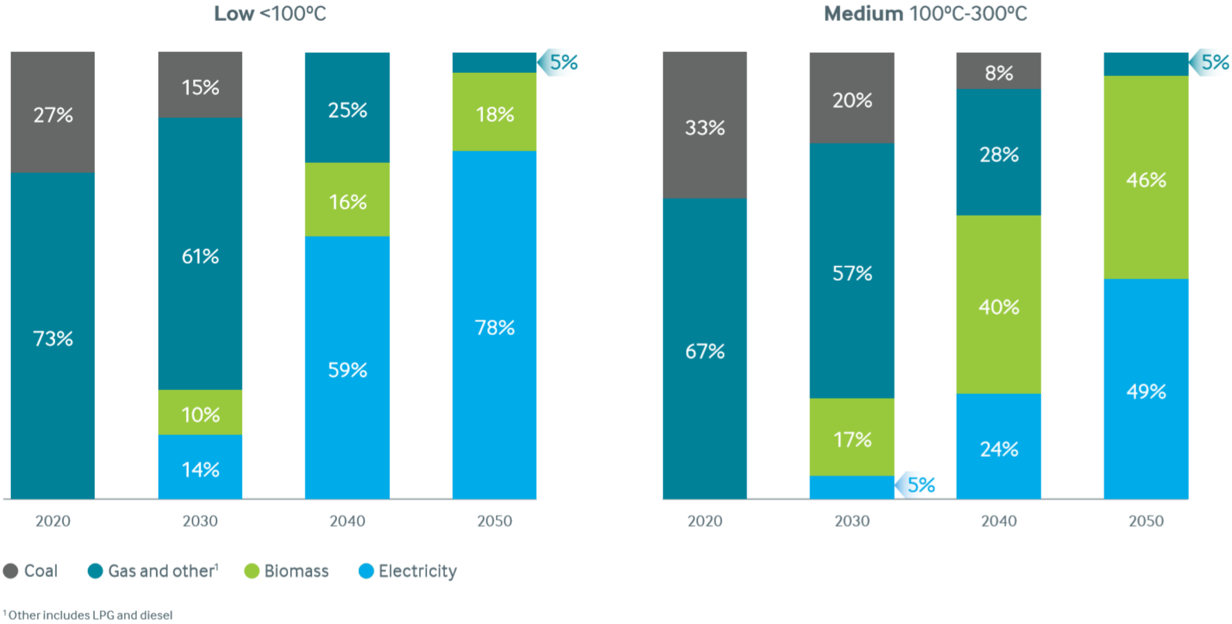
Necessary action 6 - Scale up provision of low emissions energy sources

Necessary action 6.a. - Bioeconomy

The biomass industry will play an important role in allowing many businesses to transition to low emissions fuels. Supporting and fostering this industry and providing confidence in the ongoing long-term supply of biomass is an essential component in encouraging businesses to invest in biomass fuelled plant. Bioenergy should be an essential component of any forward-looking energy strategy for New Zealand.

In our Electrification Roadmap, we identify that biomass will be a key enabler of decarbonisation in medium temperature processes. At medium temperatures, where heat pumps are less efficient and biomass may not be a dense enough fuel, the two fuels are complementary, achieving in tandem what neither can do well alone. The graph below demonstrates that between biomass and electricity, a significant proportion of New Zealand's heat emissions can be abated over time.

Figure 25: Supply of low and medium heat abatement opportunities



Establishing a long-term supply chain in which businesses can have confidence is essential as it allows them to make long lived investment decisions to move away from their dependence on fossil fuels.

As we were conducting interviews to inform our Electrification Roadmap, we heard from a number of interviewees that they would consider converting to biomass today if they could have confidence that they would be able to secure a long-term supply of fuel. Without this confidence, they were more reticent to commit to the upfront costs associated with decarbonising through biomass substitution if it made them vulnerable to biomass shortages in future. This is not a reason to discount the use of biomass in process heat. Biomass needs to be a key enabler of decarbonisation of process heat. There is an opportunity to develop a long-term biomass supply chain strategy which maximises the use of biomass for decarbonisation, given the important role that it will play.

We believe that any biomass shortages which do eventuate are likely be localised and short lived, however we need to ensure that businesses can have the confidence to invest in long lived assets that would allow them to decarbonise.

Necessary action 6.b. - Hydrogen

Hydrogen as a storage, decarbonisation and transport fuel is an emerging industry. The long-term opportunities should be explored for later carbon budgets in a national energy strategy.

It is likely to be most effective in hard to abate and costly segments. Examples could include long-haul transport, replacement of coal in steel making, and production of ammonia for fertiliser. As a result, we do not believe that hydrogen is an immediate, near-term priority for delivering significant emissions reductions in the 2020s. However, it is likely that hydrogen will play a role in the 2020s and will play an increasing part in decarbonising hard to abate areas of the economy from 2030.

New Zealand has the opportunity to focus on low hanging fruit in the coming two budgets and take part in selective proof of deployment projects. With the pace and scale of investment internationally and the selective applications in New Zealand there will be an opportunity to adopt technologies into the economy over the next three budgets.

Process heat

Necessary action 7 - Reduce emissions from process heat

Our Electrification Roadmap has shown that there is a need to support those who use fossil fuels to provide space, water and industrial heat to make the transition to low emissions fuels such as biomass and electricity. Process, space, and water heating make up 10% of New Zealand's gross emissions and 17% of the emissions covered under our Net Zero target. 44% of addressable heat emissions sit in low temperature applications and a further 23% result from medium temperature processes.

The Commission is right to target emissions from low temperature processes which offer very low-cost abatement opportunities. After these opportunities, medium temperature heat applications are next most attractive, while many high temperature applications will require innovation and development to have feasible alternatives.

Electricity and biomass have a complementary role to play in enabling this decarbonisation. In the low temperature space, electric heat pumps offer highly cost effective and low emissions heat source. In the medium temperature space, where heat pumps are not as efficient, biomass can be used to substitute coal in existing boilers.

Necessary action 7.a. – No new coal boilers

Banning new coal boilers would limit the path dependence that is endemic in New Zealand's process heat fuel sector today. A new coal boiler installed today may have a life of between 30 and 60 years depending on how it is maintained and refurbished. As we identify in our Electrification Roadmap the economics of installing a low emissions boiler are much easier at the time of first purchase. Once a high emissions boiler is installed, the economics of converting are much more difficult as the initial capital has been sunk. This risks a process heat user deciding to install a marginally cheaper boiler now, at the cost of 30-60 years of emissions. It also risks the potential early stranding of that asset in the medium term if the burning of coal becomes untenable, either from a regulatory or social licence perspective.

Even current coal boiler assets can have their economic life extended. To effect change within the 2030 and 2050 timeframes proactive early replacement of current boiler and heat systems is needed to avoid a long tail of carbon intensive process heat.

The figure below demonstrates that when you need to replace a boiler in either case, the decision is finely balanced between a low carbon and a high carbon fuel.

Figure 26: Most economically rational end of life replacement investment

Source: Transpower analysis

However, if the high carbon boiler is already in place however, the operating cost savings are unlikely to be high enough to justify investment.

Figure 27: Most economically rational before-end-of-life fuel choice – demonstrating the impact of sunk boiler costs on investment decisions

Source: Transpower analysis

Even when significant operating cost savings are available, it is often difficult for firms to overcome the capital cost barriers that boiler replacement pose. This is well demonstrated by conversions by both Alliance Group and Ashburton Meat Works who have managed to reduce their energy costs by 30-40% after installing electric heat pumps to displace the diesel and coal that they had previously been burning. Even with such a strong cost saving opportunity, the low cost of using their existing boilers meant that they couldn't make the business case work until they received EECA grants to support the investment.

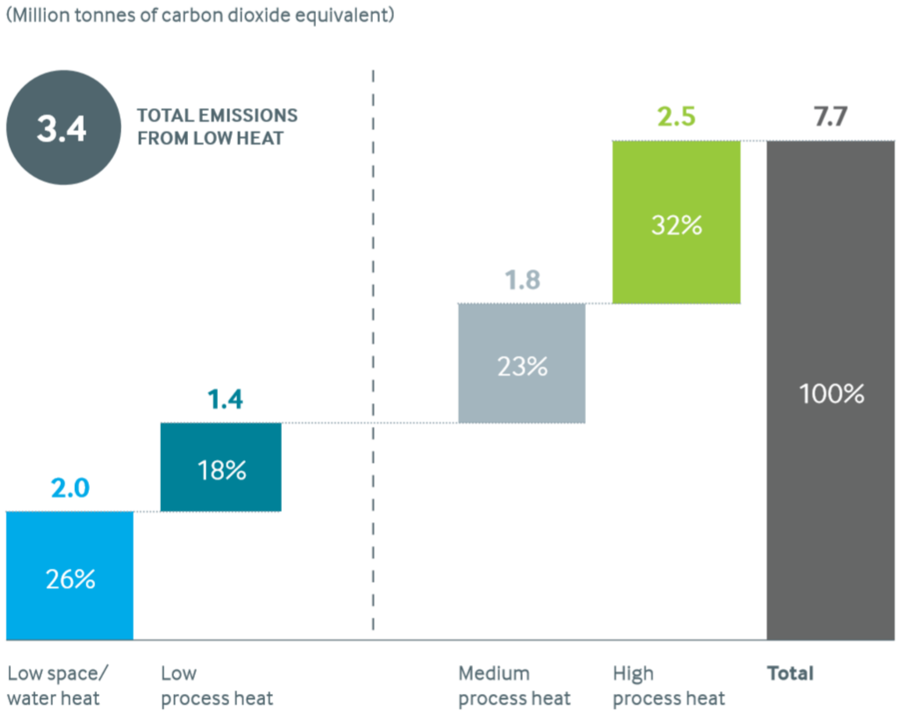
From our interviews, the upfront capital cost barrier is the largest barrier to converting heat use to cleaner fuel sources. Initiatives like the GIDI fund are well targeted at overcoming this barrier, and as it is contestable, will also drive the lowest cost abatement opportunities to be realised.

Necessary action 7.b. – Measures to reduce emissions from boilers

Our analysis, presented in our Electrification Roadmap indicates that achieving a 1.4 Mt CO_2-e annual emissions reduction by 2030 and a 2 Mt CO_2-e annual emissions reduction by 2035 is achievable at a low marginal abatement cost.

The most compelling abatement opportunities lie in the low temperature space, where there is potential for up to 3.4 Mt CO_2-e of emissions reductions at very low cost. Following this opportunity, there is an additional 1.8 Mt CO_2-e of emissions reductions available at medium temperatures.

Figure 28: Composition of heat emissions, 2018



Source: Ministry for the Environment

By targeting coal conversions at low temperatures first, achieving the emissions reductions in the timeframes suggested is entirely achievable.

Necessary action 7.c. - Identifying and reporting on emissions reduction opportunities

Process heat decarbonisation is a complicated systems design challenge. It is essential that process heat users assess their sites for the energy efficiency, process optimisation, and fuel switching opportunities that they have available to them.

By ensuring that all process heat users are aware of their opportunities, we can ensure that the lowest cost abatement is pursued.

Our Electrification Roadmap recommends that accelerating clean heat audits and developing site decarbonisation strategies be a top priority.

This information can then also be used by clean energy providers to proactively plan network and supply chain expansion, ensuring that they are well prepared as heat users decarbonise.

EECA's Energy Transition Accelerator provides an avenue for businesses to access the kind of expertise that is required, meaning that they have a concrete roadmap for how they will eventually decarbonise their site. This work also offers invaluable information for low emissions fuel sectors to plan their supply chain to meet growing demand.

As an example of site audits and information sharing, Transpower is currently working with South Island electricity distribution businesses, EECA and expert consultants to identify coal boilers and their forecast retirement dates. Through this programme we have already identified 1.5 GW of fossil fuelled boilers in the South Island. This information is vitally important for those of us in the electricity and biomass sectors in planning our networks and supply chains to enable these conversions.

Necessary action 7.d. – Access to capital

For many organisations, access to capital is the single largest barrier to taking up low emission alternative fuels. For these organisations, while they may have opportunities to unlock ongoing OPEX reductions while reducing emissions, the capital requirement is either too high to finance or presents a payback period which is unattractive when comparing to other opportunities that the business may be faced with.

The capital contributions offered through the competitively tendered Government Investment in Decarbonising Industry (GIDI) fund appear to be highly effective in incentivising businesses to pursue energy efficiency and decarbonisation opportunities.

Supporting businesses with capital contributions has a significant impact on the payback of these investments in decarbonisation and we heard from a number of interviewees while preparing our Electrification Roadmap that the GIDI funding was very well targeted to overcoming these barriers.

For example, St John of God hospice is now saving 60% on their energy bill after installing hot water heat pumps over their alternative LPG option. As a charity that provides essential services to high needs individuals, capital can often be difficult to come by. A grant from EECA allowed them to install the more expensive but lower emissions heat pump solution while also more than halving their heating bills.

Necessary action 8 - Support innovation to reduce emissions from industrial processes

Necessary action 8.a. – Long-term strategy for hard-to-abate industries

As well as adopting long term strategies for hard-to-abate industries, our work in developing the Electrification Roadmap taught us the necessity of adopting long term strategies for hard-to-abate processes, even within easier to abate industries.

These opportunities tend to require significant changes to the operation of a site, including not only heat plant but in some cases changes to the process itself. In these cases, a long-term strategy which charts progressive steps towards eventual decarbonisation is vital. The process of creating such a long-term strategy is complicated and requires specialist expertise that is often not available in the businesses who need it.

Necessary action 8.b. – Bespoke solutions

We support the Commission's recommendation that the Government investigate whether bespoke solutions requiring research and development specific to Aotearoa will be required.

Many high emissions processes, often at very high temperatures don't currently have viable low carbon alternatives.

Novel processes, such as using hydrogen in steel manufacturing, might offer opportunities to remove significant emissions in these industries.

Alongside New Zealand specific research and development, even just installing imported technology will require new skills and capabilities. In our Electrification Roadmap we recommend that New Zealand build process design and process heat decarbonisation capability to ensure we are able to adopt these new technologies.

Many emerging technologies exist, such as very high temperature heat pumps, which may help decarbonise processes such as milk drying. The nascent nature of the technology means that they are unlikely to be adopted by private companies anytime soon, but demonstration projects may help build capability, and prove the technology for use across New Zealand if they had support.

Buildings

Necessary action 9 - Increase energy efficiency in buildings

Necessary action 9.a. - Improve energy efficiency standards for all buildings

We strongly support a focus on energy efficiency. Energy efficiency investments offer some of the lowest cost abatement opportunities available to New Zealanders and we should maximise the uptake of these opportunities to lower the overall cost of our transition.

Necessary action 9.b. - Improve the operational energy performance of commercial and public buildings.

We support measures which improve the operational energy performance of commercial and public buildings

We also note that many commercial or public spaces including schools, universities and hospitals use coal, gas, LPG, or diesel for space and water heating. In these applications, replacing their existing equipment with high efficiency heat pumps could materially reduce their emissions while also saving on energy bills.

For example, while Christchurch International Airport has proactively installed ground sourced heat pumps for their water and space heating requirements, the business case for doing so can be marginal in comparison to higher emissions alternatives.

Necessary action 9.c. - No new natural gas connections

As discussed in our response to Necessary Action 8.a., fuel choices are highly path dependent and heating systems are very long lived.

Any new gas connection which is built today is likely to still be operating in 2050, when we are aiming to reach Net Zero Carbon, as the economics of switching once a heating system is established are difficult.

Urban form

Necessary action 10 - Reduce emissions from urban form

We support the Commission's recommendation that the Government promote the evolution of urban form to enable low emissions transport and ensure a coordinated approach to decision making.

We would also encourage the Commission to consider the constraints that the existing Resource Management framework apply to low emissions electricity infrastructure. We provided a detailed description of these concerns in our MBIE AREEE submission (see pages 22-49).

Question 16: Agriculture

No comment

Question 17: Forestry

No comment

Question 18: Waste

We would ask that the Commission is clear in its budgeting for F-gases as to which classes of gases are expected to contribute to emissions reductions and their respective target proportions.

Transpower, because we operate electrical switchgear using SF_6 gas, is required to monitor, collect information and report on its SF6 usage in electrical switchgear annually. SF_6 is predominantly used in outdoor circuit breakers and high voltage gas insulated substations (allowing high capacity sites on small footprints) and there is no proven technology equivalent available at high voltages.

There are currently no viable alternatives for SF_6 in our high voltage outdoor equipment and where alternatives exist for other equipment, increased costs and size are limiting. Technologies to replace these assets are not readily available with proven equipment expected to reach the New Zealand market after 2030.

Transpower has processes in place for the use, maintenance and reporting on SF6 emissions and inventory. We are also in the process of developing a SF6 strategy for the management to Net Zero emissions status.

The Commission's evidence section on F-gases and the advice focus on HFCs and the Kigali Amendment to the Kyoto Protocol, while the targets are set for F-gases. The Kigali Amendment focuses on HCFs and does not include all F-gases related to the Kyoto Protocol. It is not clear that the tool the Commission are suggesting will lead to the desired outcome as it is unclear whether the Commission is targeting reductions in HFCs or in all F-gasses.

It is our understanding that there are no specific legislated gas emission targets for SF_6 itself. However, the New Zealand Government has agreed to international climate change targets and has set a number of overall national greenhouse gas emissions targets (and intervening emissions budgets). As a greenhouse gas, SF_6 emissions are included in the scope of those targets. Up until this time we believe there have been no specific emissions targets in relation to SF_6 within New Zealand.

The Paris Agreement aims to limit the global average temperature increase to 1.5° Celsius above pre-industrial levels. Under the Climate Change Response Act 2002, New Zealand's target is to achieve zero net accounting emissions of all greenhouse gases (including SF_6) other than biogenic methane by the calendar year beginning on 1 January 2050 and for each subsequent calendar year.

Question 19: Multisector strategy

Necessary action 16 - Support behaviour change

Nudging consumers to change their preferences should be an essential component of New Zealand's decarbonisation strategy. Increasing uptake of public transport makes the job of converting the private fleet easier. Even beyond this kind of behaviour change, consumer purchasing decisions have to change for us to be effective. In transport particularly, the vast majority of our emissions come from the vehicles that New Zealanders drive every day. We will need to ensure that New Zealanders are supported and encouraged, both financially and through behavioural nudges to accelerate the transition away from high emissions vehicles where they are able to.

Question 20: Rules for measuring progress

No comment

Question 21: Nationally Determined Contribution (NDC)

No comment

Question 22: Form of the NDC

No comment

Question 23: Reporting on and meeting the NDC

No comment

Question 24: Biogenic methane

No comment

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