vector submission

Te hau mārohi ki anamata Transitioning to a low-emissions and climate-resilient future

Rather than making decisions or investments for electricity market silos we need to shift to making them for the system as a whole – with New Zealanders at the centre. This requires industry to 'invert' the way that energy investments are assessed – to start with the customer and to assess the total cost and value of investments across the whole electricity system. The current market, which seeks to maximise utility in each silo – rather than optimise the system as a whole – is severely limited in its ability to incentivise the uptake of the technologies that are needed to deliver decarbonisation, affordably

contents

introduction

"Our optimism for the future lies with our vision that Net Zero is not only a climate imperative, but also must drive significant modernisation, unlock greater productivity, deliver full system cost reductions and operational efficiencies for the benefit of consumers, the economy and the planet..."

– RECOSTING ENERGY, POWERING FOR THE FUTURE, LAURA SANDYS CBE AND THOMAS POWNALL

We agree with the government that **there is an opportunity to lay the foundations now for deeper emissions' reductions in the future.** This is true of our energy system – where this can be achieved by getting the conditions and settings right to unlock new consumer value and carbon busting business models through technology integration. This will be critical for a resilient; people-focused; and least cost transition.

Clean and affordable energy is an economy wide enabler of decarbonisation, driving emissions reductions across the key sectors of transport and process heat – which together make up ~30% of New Zealand's total emissions[1].

At the heart of our energy transition is a need to transform traditional supply chains through new technologies and solutions – many of which are ready today (such as smart EV charging, distributed solar and battery solutions, and the digital platforms that can optimise them which are already connecting and coordinating hundreds of distributed assets across Auckland) – and some of which are coming ever closer to market (such as green gases including hydrogen and biomass; as well as digital and data based energy platforms currently being developed).

Meeting our emission reduction goals is imperative. This includes both the emissions budgets developed by the Climate Change Commission and agreed in principle and the new Nationally Determined Contribution (NDC) target to reduce net emissions by 50 per cent below gross 2005 levels by 2030 (equating to a 41 per cent reduction on 2005 levels using the 'emissions budget' approach).

As we said to the Climate Change Commission, we encourage the Government to broaden its view of the emissions reductions that are possible by way of greater technology integration and innovation. By enabling the transformation of key sectors – including the convergence of Energy and Transport – this is not only the best way to achieve a just transition – but rather it is the only way.

This cannot be achieved by regulatory path dependency or incrementalism – nor can it be achieved by siloed thinking in Government and industry. We cannot deliver a transformed economy needed for net zero without innovation and a willingness for decision makers to make the changes.

As was highlighted within the Emissions Reductions Plan there remains a gap of 2.1 Mt CO2e between the estimated impact of policies and the emissions reductions required to meet the proposed emissions budget for 2022-2025. This is true even under the 'high policy impact' scenario. We believe that new energy technology and innovation can help bridge the gap between our draft emissions reduction plan and New Zealand's emissions reduction commitments - as was demonstrated by the Climate Change Commission's 'Further Technology Change' emissions reduction scenario which

[1] *Accelerated Electrification. April 2019. https://www.iccc.mfe.govt.nz/assets/PDF_Library/daed426432/FINAL-ICCC-Electricity-report.pdf;*

assumed the deployment of technologies which can allow faster emissions reductions to occur, drove 100% electric light vehicle use by 2030 whereas in the Further Behaviour Scenario (which assumes faster behaviour change) this does not occur until 2040 – a decade later. This tells us that accelerating the integration of technologies which make decarbonisation the default will be key in driving key sectoral shifts. The technology that we need to achieve this scenario exists today. The question is how to align regulatory and funding levers – and clear policy leadership – to accelerate its integration and drive this scenario in the best interests of New Zealand.

The Emissions Reduction Plan further states that:

"Government policy will not, by itself, meet the full extent of any given emissions budget. Therefore, we are also seeking proposals and commitments from the private sector".

- *Te hau mārohi ki anamata:* Transitioning to a low-emissions and climate-resilient future

Alongside our response to key consultation questions, we set out four key proposals **to drive accelerated emissions reductions at least cost in this submission.**

To enable these proposals, we do need action and cooperation from the Government. This is to ensure that regulation and policy choices work FOR the transformation demanded by climate change, not against it. **This requires the Government to implement settings and conditions for new technology integration and system transformation for energy and transport sectors.**

Each of our proposals are inextricably linked although we address them in 'Energy and Industry' and 'Transport' sections respectively to align with the framework presented in this discussion document.

What we propose	What we need from Government	Alignment with sector chapter
1. Accelerate the digitalisation of New Zealand's electricity infrastructure	Ensure electricity regulation enables the integration of enabling technologies and funds decarbonisation	Energy and Industry
2. Drive affordability and resilience through localised renewable generation	Integrate a whole energy system metric of cost across the electricity sector Implement Regional Energy Zones Align market and regulatory settings to further enable the integration of more solar and battery systems	
3. Enable a just and orderly transition from fossil gas	Develop a gas transition plan and new regulatory compact with industry	
4. Ensure future ready EV charging infrastructure	Implement regulations to ensure the installation of smart EV chargers	Transport

introduction (cont)

This resulting pathway can deliver 'co-benefits' at both a micro level (for example, providing consumers greater choice and control over their energy consumption) as well as a macro-economic level – driving job and market creation in high value sectors. In turn, these technologies will not just support Aotearoa's emission reductions, but enable global energy reductions which currently constitute 75% of global greenhouse gas emissions.

These benefits include:

- The emergence of new flexibility markets which optimise consumer value across our electricity system
- Diversification of renewable energy supply
- Continued Electricity affordability (including greater affordability for EVs)
- System security and community resilience
- Overcoming the dry year risk
- Accelerated affordable and renewable electrification
- Strengthening New Zealand's innovation ecosystem and high value job creation, by attracting overseas R&D investment and capability.

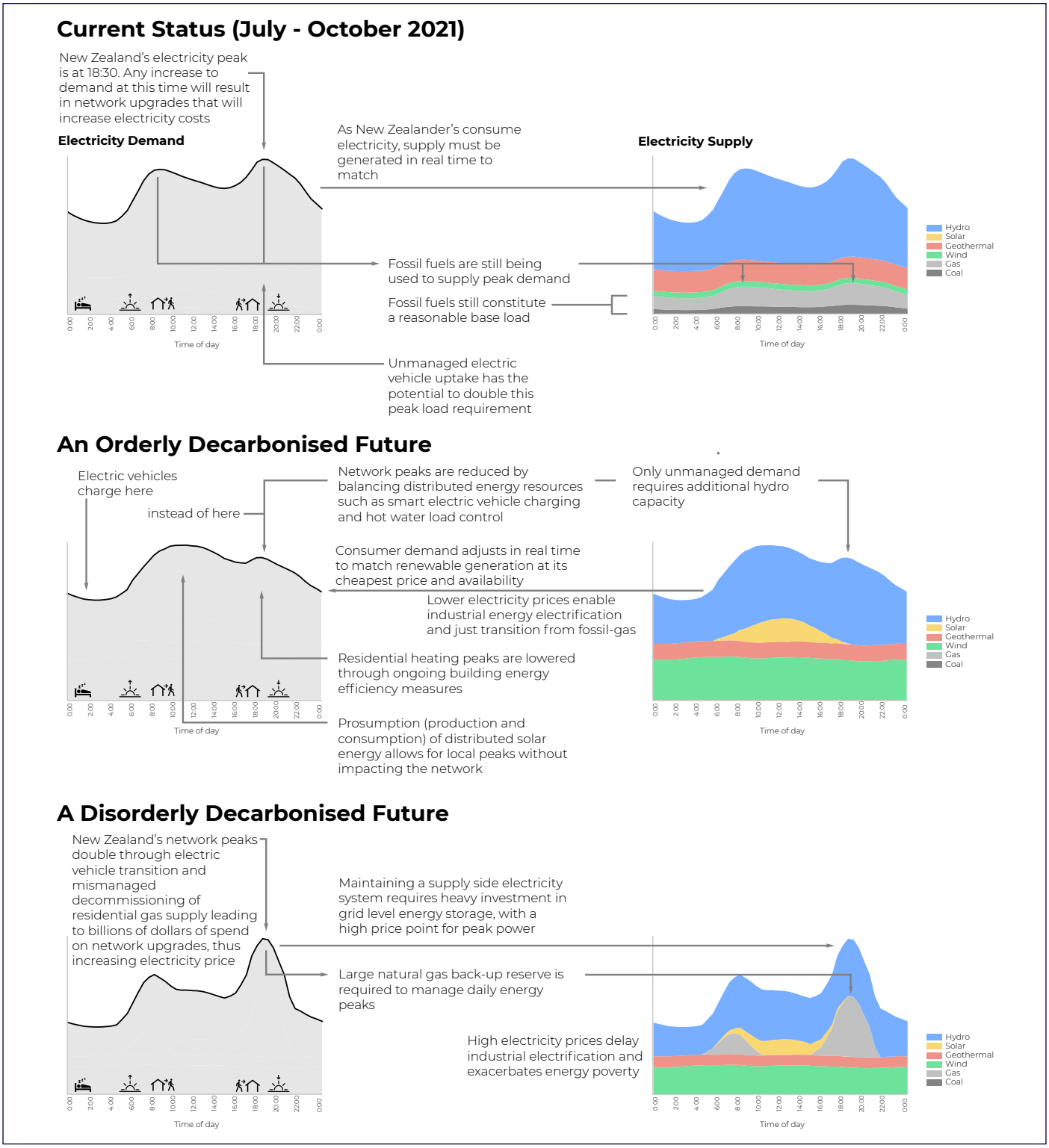


Figure 1: The right policy measures should be made now to enable an orderly decarbonised future that best serves the interests of all New Zealanders. Disorderly decarbonisation may still meet our 2050 goals, but with a high burden on our society.

Overall a critical question for decision makers in Government and industry is how to accelerate and optimise the integration of solutions to enable an orderly decarbonisation[2] that best serves New Zealanders, compared to disorderly decarbonisation that puts a high burden on society. Figure one details the impact of two scenarios on the power curves of the electricity network.

[2] *https://www.ngfs.net/ngfs-scenarios-portal/*

Aligning systems and tools

There is a need for the Government to ensure that the market settings and conditions are in place to accelerate the shifts which will enable our energy transition

The drivers of our transition – digitalisation, energy efficiency, electrification, demand side participation and renewables – are already underway. However, there are key levers that the Government can pull to accelerate them for an affordable and renewable energy transition. It is time to stand-back and ask, *"if affordable electrification and decarbonisation are the goals - does the system incentivise the behaviour that is required to reach the goal?"*. The answer currently, is no. We address a number of areas highlighted by the Emissions Reduction Plan where there is a need to align government systems and tools towards the goal of decarbonisation.

The following Government levers can provide energy businesses with certainty to enable New Zealand's emissions reductions plan:

- **Regulatory market design** which is geared towards the integration of new solutions, rather than against them

  This is fundamentally about shifting from silos to platforms – and cannot be achieved by regulatory path dependency or incrementalism

- **A gas transition strategy** to precede and guide policy choices – before these are made

Setting out a gas transition plan and regulatory compact to ensure that industry investments are well signalled in favour of the Government's decarbonisation pathway and the role of gas in it.

- Alignment of **funding** around the goal of **net zero**

This includes through the Government's own funders of the electricity industry – such as the Commerce Commission – to ensure that there are no funding gaps in our transition.

The alignment of systems and tools will be enabled by the whole systems approach

A key decision-making framework that we refer to throughout the submission is the whole systems approach. This is an overarching approach that can unite decisions across our emissions reduction pathway to orient levers, signals and resource towards the goal of decarbonisation – rather than against it. A whole-systems approach is important to achieve this because it sees interdependencies between outcomes and pathways, whole-systems value, and it reflects the importance of multiple interventions to create an eco-system which delivers decarbonisation. This whole-systems approach is a departure from traditional 1990s thinking which formed the basis of Government institutions and regulatory markets and which held that outcomes would be best achieved in silos through a linear, top-down, approach.

In a 21st century environment characterised by constant change we must challenge this ethos and instead start with from the bottom-up and target radical coordination through systems which begin with the needs and perspectives of people. Digitalisation can be a key tool in driving this – but to harness it in the best interests of people we must let go of old silos.

"Avoid the worst of all worlds. We must resist from trying to squeeze a very exciting multi-vector future into a rigid command-and-control strait jacket. The current arrangements will crush innovation and also add significant cost to the consumer."

- REDESIGNING REGULATION: POWERING FROM THE FUTURE, LAURA SANDYS CBE, DR JEFF HARDY, PROFESSOR RICHARD GREEN, DR AIDAN RHODES

Whilst particularly important for our electricity market design, we believe that the whole-systems approach has resonance for the way that we should consider our decarbonisation pathway generally. Indeed – starting with the consumer and putting the settings in place that make decarbonisation the default for consumer, Government and industry action, is fundamental to creating a system in which the goals of decarbonisation, affordability, and resilience are mutually reinforcing (rather than being understood as trade-offs to be balanced).

This concept is supported by a recommendation from COP26 referred below to drive **"policy and infrastructure** that spur **mutually reinforcing transitions."**

Actions and assets which are 'triple-duty' are lynchpins of a reinforcing system

Similar to the concept of 'double duty policies', advanced by economist Joseph Stiglitz and referenced by Prime Minister Rt Hon Jacinda Ardern at New Zealand's pre-budget speech this year, 'tiple-duty' solutions are multi-functional policies and choices which serve multiple purposes. Just as nations need policies which contribute towards more than one outcome to implement a step change in their Covid-19 economic recovery, our energy system needs actions and assets which serve multiple purposes to enable the step change required for decarbonisation.

If we get the transition right, rather than balancing trade-offs between key outcomes, we can achieve decarbonisation, economic development and resource security, and greater choice and affordability for New Zealanders as self-reinforcing outcomes.

Through our responses to the below sub-sections, we signal steps the Government can take to ensure that levers are utilised and united in support of our decarbonisation pathway.

Government accountability and coordination

Strengthen coordination across Government

We continue to support the Enabling Recommendation of the Climate Change Commission to "Coordinate efforts to address climate change across Government" and advocate for a Ministry for Energy and Decarbonisation to coordinate and resource Government workstreams needed to achieve decarbonisation.

An example of where stronger coordination is needed is around the matter of regulating for the installation of smart EV chargers. As will be described further under *Proposal 4: Ensure future ready EV charging infrastructure* we do not have a clear line of sight over which agency is responsible for driving this change – although we understand from the Electricity Authority (the Authority) that they cannot empower Connection and Operation Standards for EVs without changes to the Electricity Industry Act 2010. We remain disappointed that the Electricity Industry Amendment Bill – which was discussed at Select Committee yesterday – wasn't used for this purpose. The outcome of regulating for the

installation of smart EV chargers could be achieved through other legislation however, should an agency take ownership of the matter.

We continue to agree with the Climate Change Commission that "Coherent policy is important to ensure that government sends clear and consistent signals to households, business and communities about the transition to low emissions, and the nature and speed of change required....The current siloed nature of Aotearoa government machinery presents a challenge... **Another challenge is the lack of 'mainstreaming' of climate change considerations across government policies and procedures."**

- THE CLIMATE CHANGE COMMISSION – 2021 DRAFT ADVICE FOR CONSULTATION

This final point is clearly borne out in the example below, whereby the Commerce Commission views its ability to take into account decarbonisation to be severely limited by legislation from 1986.

Ensure that regulators take into account decarbonisation

We note that s 5NZ of the Climate Change Response (Zero Carbon) Amendment Act 2019 (Zero Carbon Act) allows regulators to take into account decarbonisation in the way that they regulate by providing that a body exercising or performing a public function, power or duty conferred by or under law may:

if they think fit ... take into account –

(a) the 2050 target; or

(b) an emissions budget; or

(c) an emissions reduction plan.

Whilst the Commerce Commission has acknowledged this provision allows them to take into account the 2050 target, they state their ability to consider this is 'limited' – due to the its interaction with provisions in the Commerce Act 1986 – which do not reference decarbonisation (unsurprisingly, being passed in 1986) – and in part due to uncertainty around the Government's response to the advice of the Climate Change Commission.

To the first of these points regarding the Commerce Act – as we have argued with relevance to the gas price pathway (where, as will be explained under *Proposal 3: Enable a just and orderly transition from fossil gas,* the 2050 target has direct relevance to regulation) we believe that the Commerce Commission has incorrectly interpreted the relationship between these provisions and underestimated the relevance of the 2050 target.

To the second point regarding uncertainty of government decision making – this perspective fails to account for the fact that, while the process and specific policies may be uncertain, the Government has already committed to achieving its 2050 targets. These are enshrined in law and can only be amended by an Act of Parliament. The Government has committed to developing climate change mitigation and adaptation policies with reference to the Climate Change Commission's recommendations.

Aligning systems and tools (cont)

This was stated in a Memorandum drafted by Chapman Tripp and submitted as part of Vector's submission on the gas price pathway[3]:

"The 2050 target is a legislative commitment to achieve net zero emissions (excluding biogenic methane) by 1 January 2050, and specified reductions in biogenic methane. Emissions budgets are set by the Minister, on advice from the Climate Change Commission, and define the quantity of emissions that will be permitted in each emissions budget period as a net amount of carbon dioxide equivalent. The Government is required to set emissions budgets with a view to meeting the 2050 target. An emissions reduction plan is a plan determined by the Minister that sets out the policies and strategies for achieving an emissions budget. The Minister is required to determine an emissions reduction plan for achieving each emissions reduction budget. Collectively, these mechanisms ensure accountability for achieving the Government's objective of net zero emissions."

Theses accountability mechanisms however do not work as intended when regulators refuse to adequately take account of the 2050 target in their decision making.

Section 5ZN is an enabling provision that empowers the regulators to make decisions that are consistent with, or contribute to the achievement of, the 2050 target, emissions budgets or emissions reduction plans, alongside the outcomes set out in existing legislation. Given the impact that regulation has on the investments of infrastructure that will enable decarbonisation it is critical that regulators take decarbonisation into account in the way that they make decisions.

Ensure regulation is aligned with policy goals

Overall it is critical that our regulatory framework – including both our electricity regulation and future resource management and planning regulation – is strongly aligned with policy goals.

Policy tools which provide strong and clear national direction can support this. Specifically, we recommend:

- **A Government Policy Statement** for the Commerce Commission to ensure that it takes into account decarbonisation (including the need to fund the infrastructure that will deliver decarbonisation, as is described further under the section *Funding and financing)*
- **Strong and clear policy guidance** to ensure that future rules developed and implemented by the Authority enable rather than inhibit the integration of carbon busting technologies *(this is described further under Proposal 1: Accelerate the digitalisation of New Zealand's electricity infrastructure)*
- **National direction for our energy system** through the future resource management and planning framework *(this is discussed further under the Planning section).*

[3] *https://comcom.govt.nz/regulated-industries/gas-pipelines/gas-pipelines-price-quality-paths/gas-pipelines-default-price-quality-path/2022-2027-gas-default-price-quality-path?target=documents&root=260725*

Aligning systems and tools (cont)

Government Policy Statements can strengthen cross-government decision making in favour of decarbonisation

It is imperative that Commerce Commission price-quality regulation funds the electricity network growth and change that is needed for decarbonisation. As we note below, the 2022 Input Methodologies review (IMs review) will be a key determinant of this future price quality pathway. We recommend a Government Policy Statement for the Commerce Commission to ensure that decarbonisation is taken into account in the way that decisions are made.

Another area where a GPS could ensure that decisions align strongly with least cost decarbonisation is for our gas transition. The need for coordination to align signals towards a just and orderly transition from fossil gas is further explained under *Proposal 3: Enable a just and orderly transition from fossil gas).*

There is a need for strong policy guidance for the Authority to ensure that future rules enable rather than inhibit carbon busting technology.

As we describe in section *Key Sector 1: Energy and Industry,* the Electricity Industry Amendment Bill (EIAB) proposes to shift key provisions concerning the relationships that networks can have with connected generation and retail out of primary legislation, and has widened the scope of the Authority to determine the relationships that networks can have with these – and other (yet undefined) technologies.

We recommend guidance to provide direction to the way that the Authority develops future regulatory rules. This is to mitigate the risks that:

- Uncertainty around the relationships that networks can have with emerging technologies deters investment in enabling platforms and solutions; and,
- that future market regulation prevents networks from integrating solutions that are needed for affordable and accelerated electrification.

Both of these risks would decelerate the integration of platforms, locking out future competitive markets and solutions. We recommend that clear and strong policy guidance is provided to the Authority to ensure that rules implemented in the future align with the policy goal of affordable and accelerated electrification and the integration of tools needed to achieve this.

We note that the EIAB also includes unprecedented 'backstop powers' for the Minister to act should the Authority not implement specified recommendations. This reflects the urgency and level of change that is required and the fact that traditional regulatory process will not by itself deliver this change. This also spotlights the fact that new policy drivers are bending our existing regulatory architecture out of shape. There is a clear need for strong policy leadership to ensure that future regulations are tailored to deliver decarbonisation. The alternative is to risk regulatory path dependency thwarting policy outcomes, increasing cost and reducing reliability.

Aligning systems and tools (cont)

Regulating for outcomes, not process can avoid regulatory path dependency.

In addition to the policy tools referred above, ensuring regulation aligns with policy also requires a change in the way regulators regulate.

"As important as 'how' we regulate, is 'what' we regulate. It is an opportunity – maybe a necessity – to redesign the market to reflect new dynamics and introduce new price, service, and innovation pressures that other sectors experience... The current prescriptive regulatory model will not be able to survive in the multi-vector, multi-product world of the future, managing both sides of the meter. It will face enormous pressure to 'catch up' with innovations through derogations, will become increasingly confused if it aims to process regulate the multiple interactions, and find itself behind the curve in identifying bad behaviour"

- REDESIGNING REGULATION: POWERING FROM THE FUTURE, LAURA SANDYS CBE, DR JEFF HARDY, PROFESSOR RICHARD GREEN, DR AIDAN RHODES

Outcomes based regulation focuses on the goal that regulations are seeking to achieve and works backwards accounting for factors (including technological environment and consumer needs and expectations) which are key to achieving these goals. This is the opposite of 'process -based regulation' - which starts with the existing regulatory architecture in assessing options. By definition, process-based regulation perpetuates a framework which was designed in the past and which almost certainly will not achieve the goals of today and tomorrow. To achieve the objectives to reduce emissions and increase renewable generation affordably, the integration of the right type of technology is critical, and we support regulatory change which accelerates the integration of this technology – rather than which works against it by seeking to entrench a regulated market model of the past.

Funding and financing

We note the recommendation of the Climate Change Commission to establish a Vote Climate Change multi-agency budget appropriation recognising the need to coordinate funding around the goal of climate change. However, consideration around the alignment of funding must extend beyond the way that Government funds itself and also consider the way the government funds key sectors and infrastructure that will actually enable decarbonisation – including our regulated electricity infrastructure. Through the price-quality framework the Commerce Commission effectively acts as a funder of New Zealand's electricity transmission and distribution infrastructure. Whilst we were encouraged by the recent findings of the Commerce Commission review into the asset management plans of networks across New Zealand – which found that all of New Zealand's 29 electricity lines companies have started to introduce policies and practices to prepare their electricity networks for the country's transition to a low-carbon economy recognising Government policy and consumer sentiment around decarbonisation – there is a need to ensure that our price quality regulation is strongly aligned towards investments needed for rapid and affordable electrification.

Aligning systems and tools (cont)

There is an urgent need to assess whether adequate funding (including an appropriate level and spread in the type of funding that is provided) is being provided through this framework. Having undertaken preliminary analysis with cross-industry partners of funding that is provided through the price quality regime (assessing this against both the needs of New Zealand and the approaches taken in overseas jurisdictions – in particular, the UK), we have found that there are some key gaps which must be urgently addressed in the next IMs review.

Certain activities that EDBs must accelerate and/or increase in order to achieve decarbonisation goals are currently not recognised by the current IM/ DPP regime. There is a general issue that the Price Path approach to forecasting uses historic expenditure to forecast future costs, which does not capture existing input costs might increase due to climate change.

Vector is collaborating with five other large NZ EDBs (PowerCo, Wellington Electricity, Unison, Orion, Aurora) to ensure that these funding gaps are addressed. In particular, the uncertainty that is linked with the rate and size of the decarbonisation challenge needs flexible regulation. We have expressed via the Electricity Networks Association (ENA) that the Commerce Commission needs to explore strategic investment in decarbonisation to ensure that EDBs are enablers of this transformation. Some of the other limitations are outlined in the table below:

Challenges for IM review	Funding gaps
Decarbonisation	The current Innovation Allowance is limited is both scope, materiality and relies on an ex-post mechanism Accelerated decarbonisation could lead to reopeners and/or CPP applications that the Commerce Commission may not be fully resourced to respond to in a flexible way. Funding needs to be carved out specifically for the purpose of achieving net zero The current settings do not incentivise or enable climate change mitigation or adaptation outcomes
Decentralisation, Digitalisation & Cyber	The current allowances are set based on historic expenditure meaning that funding in digitalisation, cyber and decentralisation will be limited to the levels EDBs have spent in the past which will not be sufficient
Affordability/ funding	There is a need to address the inflation forecasting and debt compensation issues and the Weighted Average Capital Cost (WACC) settings in order to promote, not limit, investment in the sector The current settings do not explicitly promote non-wire alternatives to defer or avoid investment, nor do they explore strategic investment or investment ahead of need

Aligning systems and tools (cont)

Planning

To achieve New Zealand's pathway to a low emissions future, our future resource management and planning framework must include strong provision for electricity system growth and change.

The resource management system is where the rubber meets the road when it comes to ensuring national policy becomes a reality in each corner of New Zealand. Therefore, the resource management system will be critical to ensuring the goals in the ERP are met.

Vector has been actively engaging with the reform of the current resource management system with a view to ensuring strong alignment with the shift towards electrification and decarbonisation. As we stated in our submission responding to the Exposure Draft of the Natural and Built Environments Bill (NBEB), "affordable electrification is about enabling the right kind of activity – not just preventing the wrong kind". We therefore support the intention to focus in the reform on enabling outcomes, such as the provision of renewable electricity infrastructure, and to integrate a stronger national planning direction in the NBEB that makes these outcomes a reality. Our resource management framework, which will in future be implemented through the National Planning Framework and the sixteen Natural and Built Environment Plans (NBEPs), must ensure that the resource management framework aligns with, rather than obstructs the goal of decarbonisation through electrification. Specifically, the resource management framework needs to provide pathways to permit the construction, use, and modification of infrastructure for the full energy system – including electricity distribution. Additionally, critical sources of renewable energy generation, particularly solar generation, need to be actively supported in national planning documents and regional plans. Pathways for enabling and consenting such activities need be strong and clear – avoiding unnecessary public notification processes and hearings of low impact activities, and avoiding administrative costs and delays. Without this policy consistency across national and regional planning documents, there is a real risk that the Emissions Reduction Plan will be just that – merely a well-intentioned plan.

We recommend national direction is provided for New Zealand's energy system.

It is not clear how existing levers which provide national direction (including existing National Policy Statements and National Environmental Standards under the RMA) will be incorporated into the NBEA's future National Planning Framework. We recommend that the development and implementation of a new national direction for our energy system as a whole, provides the strong direction and consenting pathways needed for decarbonisation, renewable energy generation and distribution, and electrification. This is because existing forms of national direction (including the National Policy Statement on Electricity Transmission) fail to account for a 'whole energy system' approach.

Indeed, the RMA framework currently includes national policy direction and rules for electricity transmission, but not the critical activity of electricity distribution. This is a significant omission given that transmission projects will not achieve anything of national or regional significance without distribution networks delivering power to consumers. The reform of the RMA is an opportunity to address this and to ensure that our future planning framework is aligned with the network growth and change that will be needed to enable decarbonisation.

Aligning systems and tools (cont)

We recommend a nationally consistent planning framework that provides a consistent set of policies and rules for the full electricity system – including both distribution and solar.

Electricity affordability is essential to the electrification and decarbonisation of New Zealand's economy transformation expected over the first three emissions budgets. The cost to build, maintain and repair the distribution network is borne by consumers in their electricity prices (with distribution making up around 25% percent of a consumers' electricity bill). Meeting the demands of accelerated electrification – the impact of which will be concentrated on our electricity distribution network – will require network growth and change. The more efficiently this can be done, the better the outcome for consumers and our decarbonisation pathway which relies on affordable electrification.

For Vector, the highest uncertainty and regulatory risk for resource management and planning is experienced at the local council level (specifically the Auckland Unitary Plan) at which local government has more influence on the establishment and interpretation of rules and standards. While the Auckland Unitary Plan brought more certainty and consistency to the infrastructure provisions, there is still inconsistency and lack of flexibility (which could be provided by thresholds, rather than hard limits) and agility (scope for plans to change – for example with changes to technology) embedded in the system that result in many activities requiring resource consent due to technicalities rather than demonstrable adverse effects. The majority of Vector's resource consents are issued with few conditions and very few require specific mitigation, indicating the low-effects nature of Vector's activities. Yet, Vector has to go through those consenting processes, leading to unnecessary delays, costs and inefficiencies – which ultimately are passed on to customers and which will undermine electrification and decarbonisation. An example of this in action is Vector's attempt to install berm batteries in 2018 for peak management. The project stalled as the batteries marginally exceeded height and (intermittently) noise limits prescribed in the Auckland Unitary Plan. These limits were designed around traditional assets and did not reflect current technologies – nor did it provide adequate scope for flexibility to accommodate new solutions. Networks need to increasingly integrate non-traditional assets. Vector trialled a bespoke solution by grouping together inverters used for solar installations to overcome these restrictions. This alternative however was cost prohibitive. The Unitary Plan created arbitrary barriers to affordable electrification which there was no way around.

There is an opportunity to reduce this unnecessary cost for distribution networks moving forward. In areas of technology change and growth – such as our emerging battery and solar market – there is a need to avoid unnecessary cost and obstruction in the future.

Much like the National Environmental Standards for Telecommunications Facilities (NESTF), and National Environmental Standards for Electricity Transmission nationally consistent rules are required for the operation of electricity distribution networks, solar. Solar has a critical role to play in increasing renewable generation; supporting resilience; and increasing competition in the wholesale market. NZ's solar industry is already faced with high upfront capital costs and recent supply chain constraints related to Covid-19. There is an urgent need for a national direction for New Zealand's nascent solar market to ensure that our future planning framework does not add additional cost and uncertainty to the industry and market.

Aligning systems and tools (cont)

Nationally consistent planning policies and rules (including permitted activities and thresholds) for solar generation can provide certainty to developers and consumer owners of solar thereby reducing costs associated with installing solar by protecting industry and consumers from unnecessary local consenting requirements. This can ensure that local planning authorities do not need to go through the duplicative process of developing regional sets of rules through the NBEPs. Rather, in the case of both the solar and distribution sets of rules proposed, these would sit above the NBEPs.

Overall, nationally consistent planning direction for electricity distribution and solar (both in the context of the National Planning Framework and intermin RMA National Direction) should be identified in the ERP to support decarbonisation and electrification.

We recommend that the ERP identify the need for joined up policy and direct that it should be is executed through a National Direction for our Energy System.

This would include (but not necessarily be limited to):

- Policies and Objectives for the whole energy system
- A set of national rules for solar (both ground based and rooftop) and emerging technologies (such as batteries) outlining permitted activities and relevant standards;
- A set of rules for electricity distribution including permitted activities related to distribution.

More granular provisions could be included as part of these rules (consistent with the nature of provisions included in the NESTF), or, they could be housed in a separate external standards whereby they could be updated to reflect changes in technology. This could ameliorate another barrier to the integration of carbon busting technologies that we have experienced through existing Unitary Plan provisions – arbitrary hard limits baked into plans and an inability to update them efficiently.

It is appropriate that solar, battery and distribution are provided for at a national level.

Many of the effects which existing planning requirements seek to manage are nationally consistent and could be managed at a national level. That is – the visual impact of rooftop solar is the same if it occurs in Northland or Southland and the noise that is generated by construction sounds the same to a consumer in Auckland or Dunedin.

Whilst we accept that this is not always the case, we support separate mechanisms to encourage solar and battery uptake by offering protection as is appropriate and in keeping with the outcomes in the NBEA. However, regional planning distinctions for solar, distribution and battery activities would require in a patchwork of arbitrary planning rules that would risk perpetuating the existing faults in our current system – including principally, unnecessary consenting cost and delays. This would increase uncertainty and cost – both of which are borne by consumers and which ultimately work against the 'rapid expansion of our electricity system which needs to start now' (the Climate Change Commission – Draft Advice).

There is a gap in our emerging future resource management and planning framework which an energy system national direction, with rules for solar and distribution would fulfil.

Aligning systems and tools (cont)

We do not believe that the purposes of the above proposals will be achieved solely through the Spatial Planning Act (SPA) nor the Renewable Energy Policy Statement as these interventions are designed to serve different, but adjacent, roles. For example, we believe that provisions concerning Electricity Distribution are likely to be too granular to be provided for in the SPA.

We support the National Policy Statement for Renewable Electricity Generation – but it has a strong focus on wind and does not go to the level of detail which we propose by way of permitted activities and Rules for solar and which are necessary to provide the emergent solar market with certainty. As above, the NPSET focuses on transmission only, and not a 'whole of energy system' approach.

Research Science and Innovation

We strongly encourage support for research science and innovation (RSI), not just to support decarbonisation, but become international leaders and we support the Government's RSI Strategy to attract international funding for R&D and frontier innovation to New Zealand. It is important that innovation is not siloed within the academic sector, and that innovation pipelines are designed to bring R&D to demonstration, commercialisation, and scale. We support the work of the Innovation Partnerships workstream to make connections enabling this pipeline and to strengthen New Zealand's innovation ecosystem.

Similarly, we support the European Union Climate-KIC model, that focuses on aligning the key partners in the innovation pipeline (academia, start-up ecosystems, financing institutions, and large-scale adopters).

Vector is well placed to use our subject matter expertise and global partnerships to develop frontier innovation (as is demonstrated by our collaboration with X, the Moonshot Factory to develop a virtualised view of the grid); to work with partners across New Zealand's innovation ecosystem to trial solutions and understand the needs of our consumer owners (demonstrated by our partnership with Christchurch based start-up, EVNEX, through our smart EV charger trial[4]); and to then bring enabling solutions to market optimising energy services nationally through Vector Technology Services (VTS) (demonstrated by our leading cyber security solution which is now being provided to a number of New Zealand networks).

By leveraging our specialised technical expertise and a range of partnerships, our strategy is to achieve both breadth and depth of impact for New Zealand's energy and innovation ecosystems. A way that our partnerships can achieve this is through the provision of platforms that can enable a range of third-party actors and applications to offer new services and solutions to new markets.

For example, the Distributed Energy Resource Management System (DERMS), which was developed by Vector and global IT firm, mPrest, can provide opportunities for a range of new innovative businesses from electricity management algorithms for load control, smart EV charging aggregators, or new appliances that are demand response compatible. As is described further under Proposal 1: Accelerate the digitalisation of New Zealand's electricity infrastructure VTS is also working with Amazon Web Services and our ability to solve global demand side energy issues can unlock new value in New Zealand's technology sector.

[4] *Smart charging put to the test in New Zealand first. https://www.vector.co.nz/news/smart-ev-charging; October 2019.*

Aligning systems and tools (cont)

Behaviour change

We note and support Key Finding 6 from 10 New Insights in Climate Science 2021 (which featured at from COP26) that "Supporting household behaviour changes is a crucial but often overlooked opportunity for climate action".[5] This supported the recommendation that:

"At regional and national levels, governments are urged to:

- translate national policies to achieve the 1.5°C target into concrete measures, ***including creating the infrastructure needed for 1.5°C-compatible lifestyles;***
- pay particular attention to solutions in areas of food, ***transport and housing*** that are of crucial relevance; and
- support changes to household consumption patterns via ***policy and infrastructure*** that spur ***mutually reinforcing transitions."***

We support this recommendation and interventions to reduce behavioural driven emissions which rely on one-off 'set and forget' decisions and actions, rather than continuous behavioural changes that may cause decarbonisation fatigue (or which may simply never happen). In this context, creating a reinforcing system in which decarbonisation is the default is about ensuring that the settings and conditions are in place to drive the right 'one off' actions that then deliver enduring system outcomes.

The value of tilting settings towards the right one-off actions (such as the installation of a smart EV charger), even with the option to opt-out (of a demand management scheme for instance) is supported by a study undertaken in Germany of 'green defaults as demand side policies'[6].

"We show that in Germany, green defaults, automatically enrolling customers in renewable energy sources, tend to stick, especially but not only among those who are concerned about the problem of climate change. This finding, based on real-world rather than experimental evidence, attests to the power of automatic enrolment in addressing environmental problems in Germany and potentially beyond, including climate change, and also adds to the growing literature on the substantial effects of shifting from opt-in to opt-out strategies"

The difference between one of actions and continuous behavioural change (and thus the

[5] *10 New Insights in Climate Science 2021. https://10insightsclimate.science/10-new-insights-in-climate-science/6-supporting-household-behavior-changes-is-a-crucial-but-often-overlooked-opportunity-for-climate-action/;*

[6] *Micha Kaiser, Manuela Bernauer, Cass R. Sunstein, Lucia A. Reisch, The power of green defaults: the impact of regional variation of opt-out tariffs on green energy demand in Germany, Ecological Economics, Volume 174, 2020; https://www.sciencedirect.com/science/article/pii/S0921800919317975;*

difference in their respective likely effectiveness) is demonstrated by the below table:

These one-off actions can be encouraged through government initiatives, such as warmer

One off action	Continuous behavioural changes
Installing a smart EV charger	Making sure that the car is only plugged in at off-peak times to avoid stressing the network and paying peak electricity prices. Whilst walking out to the garage to charge an EV from 9pm, for instance, is already tiresome for consumers, our EV charger trial found that if everyone scheduled their charging to the same 'off peak' time this would simply shift the peak at high EV penetration levels (this also would occur through use of static scheduled charging). That is, to gain comparable benefits to dynamic EV charging which coordinates charging times between EVs to spread load, without a dynamically controlled EV charger, consumers would need to arrange a complex scheduling system with their neighbours in which EVs were charged at disparate times throughout the night. To gain the further benefits of aligning charging with the availability of cheaper renewable generation, consumers would need to become attentive experts of our wholesale market and the interaction between national weather patterns and the availability of renewable energy. ***This is obviously a ridiculous strategy to drive optimised charging across the country. We set out steps the government can take to achieve a sensible alternative in Proposal 4: Ensure future ready EV charging infrastructure.***
Installing LED light bulbs	Reducing light use
Installing a heat pump, home insulation and home ventilation	Draw curtains, close windows, stop gaps, wipe moisture from windows, and not leave the heater running for too long We recognise that as demonstrated by initiatives such as the Healthy Homes Initiative (HHI) and the lived experience of countless New Zealanders, given the poor quality of New Zealand housing and overcrowding the behaviours which could be taken to keep a home warm and dry far exceed this list, and would still be ultimately incomparable to the effectiveness of one off actions such as installing insulation, heat pumps and ventilation to keeping a home healthy, efficiently.
Signing up high demand appliances to load control for cheaper electricity rates	Remembering to reallocate the use of energy using devices away from peak times (see row one above).

kiwi homes, and ensuring that settings enable the integration of digital platforms and installation of smart EV chargers that can do the heavy lifting and thinking without the customer noticing. The alternative – of failing the get these settings in place at the right time – risks locking out technology that could deliver benefits for consumers today and in the future.

Key Sector 1: Energy and Industry

The figure below details current energy flows, and emphasises the significant wasted energy in the use of fossil fuels for transport and electricity generation.

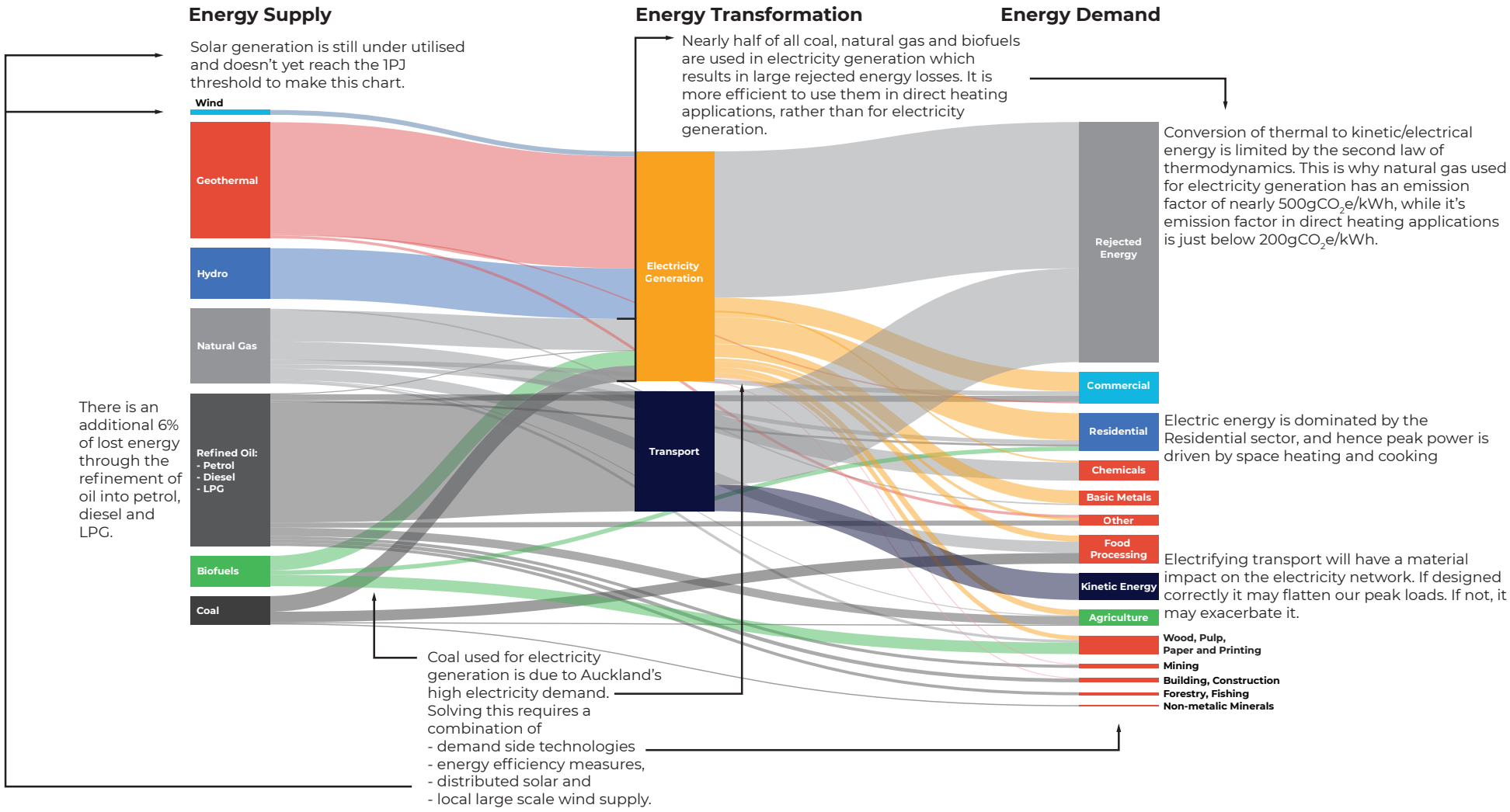


Figure 2: 2020 Energy Flows

Sector overview:

Demand side management to balance intermittent supply will lower wholesale electricity prices, reduce the reliance on back up gas generation, and lower the carbon intensity of the electricity sector.

Whilst our electricity generation is already highly renewable, our electricity market relies on fossil fuel generation assets which are turned on to meet demand peaks. As we transition our remaining fossil fuel assets to intermittent uncontrollable renewable assets (and as demand increases) we need to unlock the value of the demand side of our supply chain – by activating competitive demand side management, enabling more localised generation, and enabling greater consumer participation. This can rebalance the system, avoid unnecessary capital expenditure, and unlock low cost electricity from wind and solar. Demand side management also contributes to consumer affordability and reliability by lowering the stress on distribution networks, the national grid, and inter-island HVDC link. Lower wholesale electricity and distribution and transmission prices are critical to the transition of industrial process heat to electricity, and the development of our Hydrogen economy (with the cost competitiveness of hydrogen as a fuel alternative for transport, for instance, requiring electricity affordability).

Accelerating affordable and renewable electrification will be more complex, balancing greater demand with more intermittent renewable supply as well as a greater number of actors and assets. Managing this will require radical coordination through our electricity supply chain. For example, dynamic management of distributed energy resources (such as EV chargers, distributed solar and battery solutions, and other consumer energy using products) has the potential to align new demand to the availability of cheaper and more renewable generation and to network capacity – without a consumer noticing. Digitalisation – and integrating a whole-energy system view of cost – can help enable this, and in doing so, can recalibrate our electricity system towards decarbonisation. By coordinating across different parts of our energy system, digitalisation can support the strategic objective at the heart of New Zealand's future National Energy Strategy – to 'strengthen the coordination of supply and demand' driving system security and efficiency.

This optimised coordination will be key to avoiding system cost and to drive system security. This is demonstrated by the August 9th grid emergency, whereby a lack of generation, record demand and insufficient reserves resulted in a failure of the system to balance itself. The tools used to implement load shedding at the system operator level in response were out of date, leading to an over estimation of load required to be shed by networks. Where networks did not have sufficient capacity available through hot water load control this resulted in consumer outages. This is a prime example of why there is need to drive coordination and the integration of digital and data-based tools through our system as generation will become even more volatile and demand will increase further.

Digital platforms which enable this coordination and optimised demand management will **also enable the emergence of new consumer products and services from smart electric vehicle charging, to appliances that operate to optimise available electricity supply.**

Whilst long term intermittency, such as dry year risks that may remove hydro generation availability for weeks, require further capacity reserves (including large scale energy storage, and industrial load shedding) **short term (daily profile) peak power needs can be better solved through digitally driven demand side management.**

Greater consumer choice and control enabled by digitalisation

As has been highlighted by the Electricity Price Review there is an urgent need to 'strengthen the consumer voice' in the decision making of our electricity sector – which is particularly true for smaller consumers who struggle to make their voice heard and influence the electricity sector. The EPR Panel attributed this in part to the complexity of the industry but it also reflects a lack of consumer market power.

Digitalisation will be instrumental in enabling consumer participation in the market not least through unlocking demand-side value and thereby the market power of consumers. Enabling more distributed generation and rewarding consumers for actions and assets which optimise the whole system via smart digital platforms promises to transform consumers from price takers to price makers.

An example of digitalisation increasing consumer power is Sharesies. By leveraging a digital platform and simple innovative pricing model, Sharesies has widened access to the NZ and US stock exchange, increasing the participation of consumers and growing the market for investing in shares. Strengthening the market power of consumers is fundamentally about valuing demand as equal to supply – which digitalisation enables.

The approach of fully leveraging new technologies and innovation to their potential can also support the goal articulated in the Emissions Reduction Plan to ensure that:

"energy systems support economic development and productivity growth aligned with the transition".

The alternative – of over relying on traditional infrastructure and solutions risk reducing affordability, reliability, and competition in the market. This would stem from a market failure – however, because our market is designed by regulation this would largely be a regulatory failure. Avoiding the undesirable high prices we have observed from the 'renewables revolution' in the UK, lies in the integration of digital platforms which can give consumers choice and control.

Case study: Distributed Energy Resource Management System (DERMs)

Developed by Vector and mPrest since 2017, DERMS is a software system, able to connect distributed energy assets like solar panels and storage battery connections to our traditional infrastructure and management systems. Over the past year, more than 400 customer and network connected resources (rooftop solar, EV chargers, batteries) have been integrated with the network using the DERMS platform to provide visibility and the ability to manage the complex interactions between the network and distributed energy assets. As the number of network connected resources grows, DERMS is capable of providing an unmatched level of security and reliability to our energy management, including predictions around loading on critical infrastructure assets such as power transformers, user-defined allowable limits on loadings, and automated load reduction plans utilising available DER assets to maintain load below the defined limit. DERMS also supports improved response to unexpected events, including extreme weather. We are confident we can scale up the DER connections into DERMS as they continue to grow, and consequently we expect this system to be a key enabler for a future-ready network.

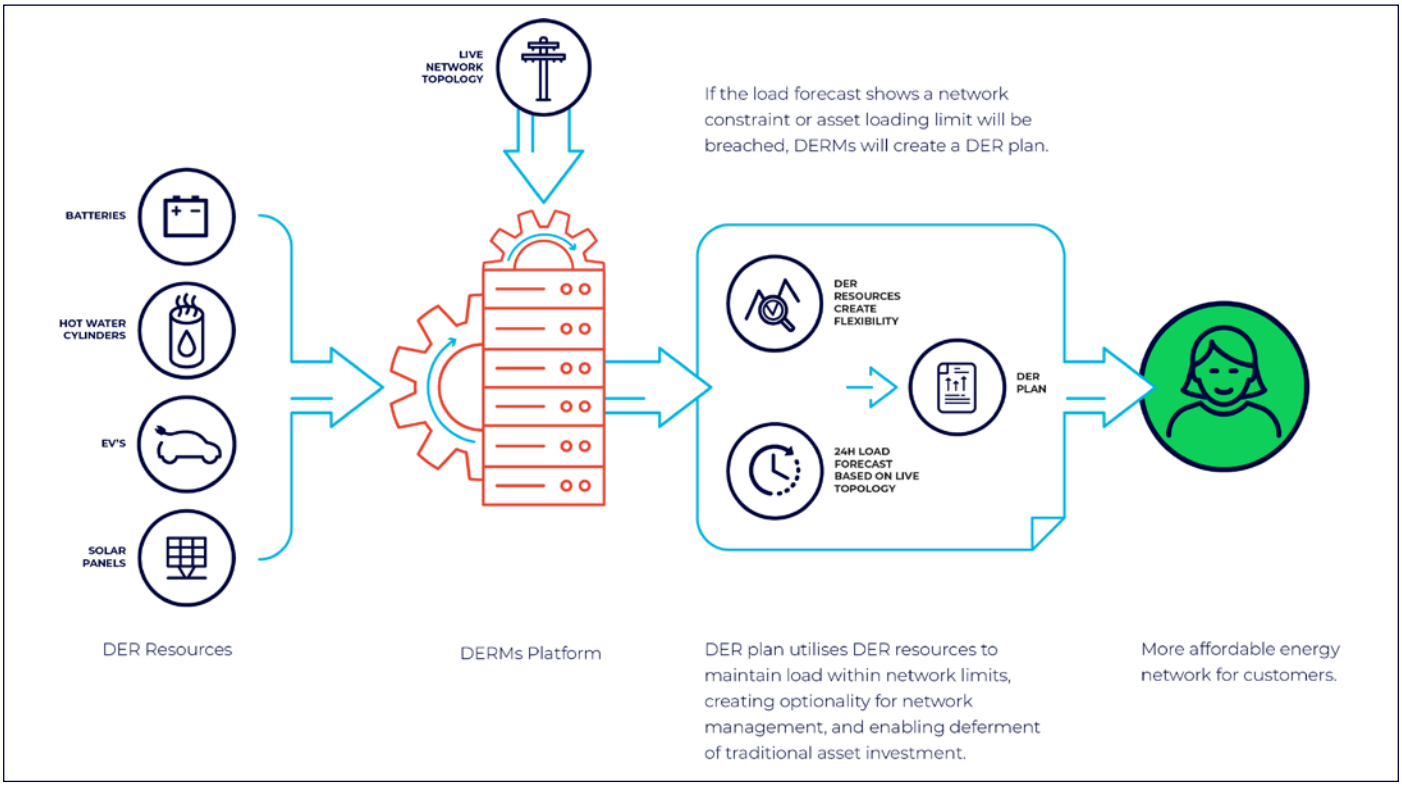


Figure three: Diagram of DERMs, Vector AMP 2021-2031

Fuel diversity for system security

Executing our energy transition requires both rapid and affordable electrification as well as the diversification of the energy sources that we rely on. This can also support a strategic objective at the heart of our National Energy Strategy – to increase system security through fuel diversity and it can be achieved by preserving optionality through policy settings for our gas transition (which is addressed in *Proposal 3: Enable a just and orderly transition from fossil gas)*, as well as enabling the integration of more distributed and localised renewable generation (as is described in *Proposal 2: Enable a least cost expansion of our renewable system).*

We support the initiatives already underway to reduce emissions from the Energy and Industry sector

We note that the Emissions Reduction Plan lists three initiatives to "Accelerate the uptake of energy-efficiency measures and technology". These include:

- EECA's GenLess campaign which mobilises business, communities, and individuals to adapt, innovate and undertake actions to reduce their emissions
- The Warmer Kiwi Homes programme offers insulation and heating grants to some home owners, allowing energy to be used more effectively to maintain warmer, dryer homes and also unlocks significant health benefits; and,
- Product regulations to create a national system for regulating energy efficiency of appliances and equipment sold in Aotearoa.

We support each of these measures – and advocate for an expansion of Warmer Kiwi Homes. Every home retrofit locks in energy saving, and health benefits for the lifetime of that property. As described under *Behaviour change* this is an example of an effective 'on-off' action that would benefit occupiers of a home today and in the future. We recommend that Warmer Kiwi Homes expands to include:

- LED lighting, which unlike heating solutions, doesn't have a rebound impact and will reduce the electricity costs for customers
- Home ventilation systems. The existing model only allows for the installation of air extraction. We ask that consideration is given to whole of home ventilation systems that will lead to drier, warmer, and healthier homes. It also reduces dehumidification costs which are common in many homes.

We also support strongly the potential for product regulations to create a national system for regulating energy efficiency of appliances and equipment sold in Aotearoa. In particular we support the proposal for Minimum Energy Performance Standards (MEPs) and labels to include requirements for demand response capability to ensure that our market supports digital enablement of consumer energy using products. As we highlighted in our submission responding to Energy efficient products and services: A regulatory reform discussion document:

"We note the finding of the review undertaken by Allen + Clarke and reported in the Cabinet Paper Updating the Energy Efficiency Regulatory System – Release of Discussion Document that there is room for improvement to ensure the Product Regulations keep pace with market and technological innovations for energy-using products. We agree. However, this is not just to avoid NZ becoming a dumping ground for poor performing products, but rather this is to take hold of the opportunity to drive a world-leading smart, connected and efficient energy system – which starts with consumers. This can drive the Government's priority outcomes: to transition to a clean, green and carbon neutral New Zealand and to ensure everyone has a warm, dry home."

- VECTOR SUBMISSION RESPONDING TO ENERGY EFFICIENT PRODUCTS AND SERVICES: A REGULATORY REFORM DISCUSSION DOCUMENT

Ensuring that market settings support efficient consumer choices can also avoid the risk of tech 'lock-out' – whereby consumers are unable to benefit from the dynamic demand management schemes in the future because their energy using devices do not have demand management capability. This would result in avoidable individual and system wide consumer cost. As will be discussed further under the Transport key sector summary this risk is particularly acute in the case of EV charging.

Whilst energy efficiency measures have a key role to play they will not be enough to manage future demand whilst meeting consumer needs by themselves. In addition to the deployment of interventions to drive energy efficiency, we must also recruit technologies that can deliver greater system optimisation and savings through smart demand management technologies.

Bold policy leadership is needed to drive decarbonisation through our energy system

The initiatives identified by the Emissions Reduction Plan (ERP) however are not nearly enough to accelerate the integration of technologies through our energy system. Instead the Government must look to the way the market is regulated and ask whether energy systems designed in the 1990s will fully leverage the value of digitalisation enabling a least cost decarbonisation of our energy system.

Whilst our technological future is uncertain, it is not the job of the regulator to try and predict, and pre-emptively regulate, this future. Rather, we encourage regulation to ensure that the settings and conditions are in place to enable new markets to flourish. This requires the acceleration of platforms that enable these new markets. This will not be achieved by the traditional regulatory approach of artificial market segmentation which was designed in the 1990s quite separately from the drivers of decarbonisation and digitalisation. The goal of artificial market segmentation was to incentivise different parts of industry to maximise value within each segment of the supply chain separately, rather than to optimise the system as whole. This reflects a 1990s view of the technological landscape as one dominated by traditional steady state assets and an assumption that in this environment, siloed optimisation was the best way to deliver whole system optimisation. However, that is no longer true with the advent of affordable and responsive demand side technologies requiring that we revisit this outdated assumption. Whilst this traditional monopoly regulation sought to replicate competitive pressures as they were understood back then, imposing artificial market segmentation in the context of cross-cutting technologies (these are technologies which 'blur the traditional boundaries' between regulated segments of the market, delivering value for more than one part of the supply chain) risks having the distortionary effect of inhibiting the competitive and disruptive potential offered by digital transformation. The cost of this risk would be significant – and would be borne by consumers.

As described by Laura Sandys CBE, Chair of the UK Digitalisation Taskforce, these 'blended assets' have a crucial role supporting the transformation of our electricity system from a commodity based to a service-based model[7]- and we encourage policy makers to consider how regulation could accelerate, rather than inhibit, their integration.

In its section *"Preparing the electricity system for future needs"* the Plan refers to the recent consultation of the Electricity Authority (the Authority) Updating the Regulatory Settings for distribution networks. As we have highlighted in our submission responding to the Electricity Industry Amendment Bill – the shape of our future market regulations will be critical in determining affordable electrification.

In this context it is not enough for policy makers to refer to the work of the Authority and assume that our electricity market regulation will re shape itself around the urgent and novel drivers of digitalisation and decarbonisation.

[7] *ReCosting Energy: Powering for the Future. Laura Sandys CBE and Thomas Pownall. https://blob-static.vector.co.nz/blob/vector/media/vector-regulatory-disclosures/annex-1-recosting-energy.pdf;*

Enable the integration of new low emissions fuels by starting with a plan

We support the Government's action to develop and use new low emissions fuels – including the Vision for Hydrogen in New Zealand and initiatives to drive this emergent market in New Zealand – as well as the consultation on the Sustainable Biofuels mandate. We urge the Government to ensure that decisions that are made across the sectors to reduce emissions (including the Buildings section) align with these efforts – rather than work against them. This would be the case, if, for example, a date by which no new gas connections was arbitrarily set without considering this in the context of a Gas Transition Plan.

We strongly support the recommendation of the Climate Change Commission to create a plan for managing the role of fossil gas across the energy system, covering associated consequences for network infrastructure and workforce during the transition, and we appreciate the work undertaken by officials to date – including through the Gas Infrastructure Working Group – to inform this plan.

We agree with the Emissions Reduction Plan that:

"Our energy supply chains are complex and interrelated. As we consider phasing out the use of gas and associated infrastructure it will be important to ensure the method and speed of transition maintains security of energy supply and prevents adverse or unexpected effects on consumers".

This is exactly why a plan is needed – before decisions are made which could send signals to the market which are misaligned with the goals which are central to a managed transition away from fossil gas.

We support the proposed National Energy Strategy

The electricity sector will fail to make a least cost transition to a low emissions future without an integrated plan of action. Our recommendations below address the objectives set out by the Commission for the Strategy to:

- Ensure access to affordable and secure low emissions electricity for all consumers; and,
- Manage the phase out of fossil fuels (including planning for the phase out of fossil gas in the energy system).

Recommendations in this Key Sector:

Consultation Question 58: What are the key priorities, challenges and opportunities that an energy strategy must address to enable a successful and equitable transition of the energy system?

1. *Accelerate the digitalisation of New Zealand's electricity infrastructure to transform our energy system from a fossil-fuelled commodity-based supply chain towards one which delivers more with less.*

Consultation Question 59: What areas require clear signalling to set a pathway for transition?

2. *Drive the efficient expansion of our renewables system by accounting for total consumer cost; implementing regional energy zones; and aligning market and regulatory settings to further enable the integration of more solar and battery systems.*

Consultation Question 61: What are your view on the outcomes, scope, measures to manage distributional impacts, timeframes and approach that should be considered to develop a plan for managing the phase out of fossil gas?

3. *Enable a just transition from fossil gas by aligning policy and investment choices around a gas transition plan.*

Achieving these outcome requires a whole systems approach to be applied to our Energy sector through the National Energy Strategy to make decisions which account for the (often interdependent) impacts across the system as a whole avoiding perverse outcomes and supporting investments in 'triple-duty' solutions which drive decarbonisation, affordability and reliability in a mutually reinforcing way – rather than positioning these outcomes as trade-offs to be balanced (which is generally posited by the traditional energy trilemma).

Strategic goals for rapid electrification:

- *Transform our supply chain to leverage the demand side through digitalisation. This part of the supply chain – that connects homes and businesses to power – is critical to reducing emissions from energy end use – which from transport and process heat makes up nearly 30% percent of our total emissions. It is also under utilised by a siloed approach to the electricity market.* ***This is supported by Proposal 1.***
- *Enable the entrance of more diverse and distributed sources of renewable generation and drive a least cost expansion of our renewable system.* ***This is supported by Proposal 2.***

Each of the proposals are underpinned by a whole systems approach – which, when applied to our electricity market provides a blue-print for a just transition.

Rather than making decisions or investments for electricity market silos we need to shift to making them for the system as a whole – with New Zealanders at the centre. This requires industry to 'invert' the way that energy investments are assessed – to start with the customer and to assess the total cost and value of investments across the whole electricity system. The current market, which seeks to maximise utility in each silo – rather than optimise the system as a whole – is severely limited in its ability to incentivise the uptake of the technologies that are needed to deliver the best consumer outcomes.

Achieving both recommendations one and two above requires us to embed a whole-systems understanding of cost and value

A feature of a whole system approach is to recognise the value of technology or decisions that avoid cost for the whole system. To enable this, the goal must be that the electricity system provides signals that account for impacts and opportunities across the supply chain and the ultimate long-term benefit to energy consumers. This would then drive investment in solutions that deliver value across the whole system for consumers and reduce reliance on traditional and capital-intensive infrastructure.

> **"A fully costed system methodology must be used by all regulated assets, regulation and policy to uncover the knock-on costs and reveal the value sitting between the current silos"**
>
> *- RECOSTING ENERGY*

We agree. The principle of a fully costed system must also be embraced by unregulated parts of our industry – with total cost to consumers embedded in the way that investments are assessed, and the way that costs are expressed.

The difference in the value of assets when their impact is understood across the whole system, as compared to when this is assessed for a single part of industry (or market segment) is striking. Our siloed, regulatory market is based on the latter – yet it is the former that shows up in a consumers' electricity bill. For example, under the traditional, levelized cost of energy metric (which only accounts for the capital and running costs of an asset) a residential smart EV charger (which is dynamically managed by a digital platform) is understood as **costing** $12NZD per MWh of energy produced. However, when accounting for the whole systems impacts (which includes displaced generation costs, system balancing and avoided network costs) it is understood as **adding value** of $174NZD per MWh of energy produced. This is revealed by the Whole-Energy System Cost metric (WESC) – which was designed by Frontier Economics for the UK Department of Business Energy and Industrial Strategy (BEIS)[8] to assess the value of different generation assets to support a more efficient expansion of renewable generation – by recognising the *whole-system* impacts of generation investments. That is – does the investment support system balancing in addition to increasing supply by offering flexibility, or, does it require another action and asset to balance its intermittency?

Applying this metric to generation in New Zealand finds that energy generated from utility scale solar adds value of $51NZD per MWh (as opposed to *costing* $74NZD per MWh of energy produced under the LCOE). This is a difference of $125 per MWh of energy produced.

This metric was then widened to demand-side assets – not just generation assets – enabling these solutions to be compared on a like for like basis with traditional generation investments for the *ReCosting Energy* project[9]. This was led by the UK Think Tank, Challenging Ideas, and developed in partnership with global cross-industry project team – including Vector, Centrica, Elexon, the UK Electricity System Operator, and Imperial College of London's Grantham Institute for Climate Change – and proposes a shift in the way we assign value through our energy system by unlocking value between the silos and enabling participation of a wider range of actors.

[8] *https://www.weforum.org/agenda/2021/07/a-new-way-to-cost-the-energy-transition/;*
[9] *ReCosting Energy: Powering for the Future. Laura Sandys CBE and Thomas Pownall. https://blob-static.vector.co.nz/blob/vector/media/vector-regulatory-disclosures/annex-1-recosting-energy.pdf;*

Key Sector 1: Energy and Industry (cont)

As spotlighted by *ReCosting Energy*[10] the WESC reveals how far from the true consumer cost and value the signals of our siloed, regulatory market can be, and must be a key tool in making visible the true value of investments across our energy system. A report showing the findings from the application of this metric to New Zealand, which Vector commissioned as part of its Climate Change Commission submission is attached as Annex 1.

Whole-Energy System Cost of different energy assets in New Zealand

Figure Two: *Net whole-system value of different energy assets per MWh*

The light blue line, which is the sum of different cost components, shows the overall system impact of an asset. It represents the change in the total cost to the electricity system when a technology is added that has a lifetime output of 1 MWh (and the rest of the system adjusts accordingly). When the blue line is below $0/MWh, adding a technology such that it produces 1 MWh over its lifetime reduces total system costs. When the blue line is above $0/MWh, it indicates that adding the technology with a lifetime output of 1 MWh increases total system costs. Technologies with lower figures will add greater benefits to the system for each MWh of energy they produce.

What we need from Government for rapid electrification: Embed the WESC

[10] *We're costing our energy system wrongly. Here's how to get it right. July 2021. https://www.weforum.org/agenda/2021/07/a-new-way-to-cost-the-energy-transition/*

Proposal 1: Accelerate the digitalisation of New Zealand's electricity infrastructure to drive emissions reductions the smart way

Key Sector 1: Energy and Industry

Proposal 1: Accelerate the digitalisation of New Zealand's electricity infrastructure to drive emissions reductions the smart way

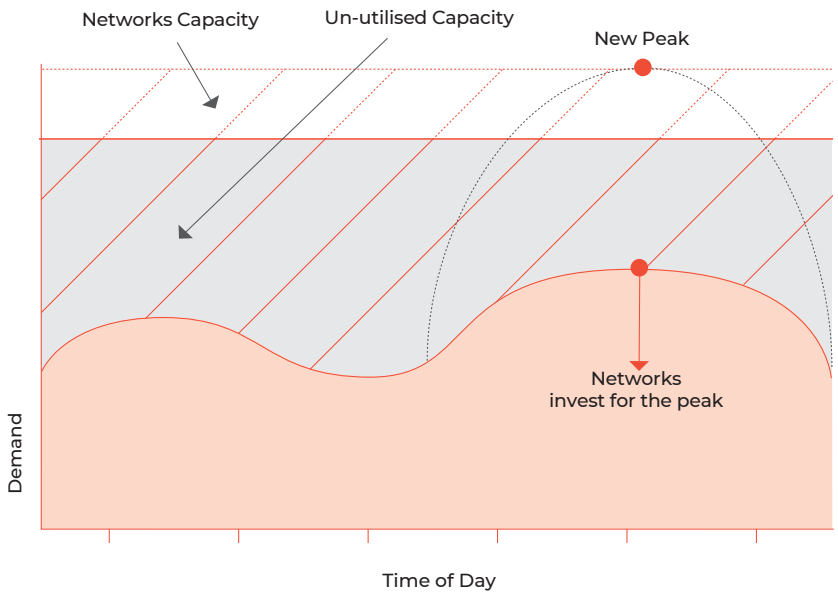
Digitalisation drives radical coordination through the market, driving stability as supply becomes more renewable and our demand increases, and unlocking new consumer value.

The Climate Change Commission's demonstration pathway includes 46% of New Zealand's light vehicle travel and 36% of the light vehicle fleet being electric by 2035. This is in addition to the imperative to decarbonise industrial process heat. These shifts will increase demand for electricity significantly and quickly.

At the same time, New Zealand will increase its reliance on more intermittent renewable sources of generation, and the integration of exporting technologies which enable bi-directional flows of power (vehicle to grid technologies, and solar and battery solutions). Managing this new demand, volatility and complexity will be critical for affordability and reliability – and in turn, for consumer confidence in a just transition.

Much of the impact of these changes will be concentrated on our networks. Like the capillaries of our system, networks are complex and granular, and are critical in ensuring that our electricity system as a whole achieves its mission in connecting New Zealanders to power. This requires localised coordination – which can be optimised through the integration of digital platforms. Just as regional UFB played a crucial role in supporting national consistency across our infrastructure performance for economic growth and resilience, the use of digital and data-based platforms can enable optimisation of our electricity system across New Zealand.

By coordinating across different parts of our energy system, digitalisation can avoid cost through the supply chain. For example, digitalisation can coordinate the times that energy using devices are drawing power from the network, flattening peaks in demand and increasing utilisation of the network. This can reduce cost – not just for consumers who use digitally enabled devices, but for all electricity consumers by avoiding capital expenditure for traditional assets through the system which would have otherwise have been needed.



Flattening peaks and increasing utilisation is important because modelling of peak demand out to 2050 shows that new demand (modelled along the Climate Change Commission's pathway) could potentially double network capacity requirements if demand is not optimised. However, smart EV charging, dynamically managed through a digital platform such as DERMs, is modelled as reducing this peak growth by as much as 60% - avoiding significant consumer cost.

In addition to new demand networks must affordably manage increased voltage from the two way flows of power. This has an important flow on effect on overall network reliability and power quality – as demonstrated by jurisdictions whereby the integration of these technologies has not been carefully managed.

Case study: learnings from overseas jurisdictions – Australia and Germany

In Germany and Australia the approach of 'more distributed but not integrated' Distributed Generation (DG) has resulted in curtailment of solar and reduced reliability.

Driven by policies for renewable generation, Germany saw major growth in distributed solar penetration but insufficiently considered how to integrate this DG with the existing power system. In addition to technical challenges, a lack of coordination in planning and deploying DG resulted in increased costs for all customers and did not enable the system to capitalise on the full value of DG[11].

Similarly, the Australian Renewable Energy Association (ARENA) considers that challenges in DER technology integration in Australia have resulted from a lack of coordination and visibility. The networks' capacity to support exports from consumer DG is rapidly being exhausted, with customers increasingly facing growing limitations to the amount of energy they can export to the grid. These are salient lessons for New Zealand and experiences we must avoid for our own energy transition. Conversely, by managing the times that a solar panel is exporting electricity to the grid, dynamic optimisation can avoid the need to defer the integration of solar battery systems into the network until an upgrade is made, or, to constrain the solar system's output on the grid to avoid exceeding voltage limits. As will be discussed further under Proposal 2 – getting these settings right to ensure that new complexity is managed is important to enable more integration of DG systems.

Digitally enabled demand management will be a key tool in electrifying transport affordably – but can also optimise demand from all energy using devices and can align a number of different levers (including pricing) for efficiency. By ensuring that digital solutions are in place, we are creating platforms to enable new innovative flexibility markets, participants, and value-streams to emerge.

As Minister Woods recently noted at an industry event on digitalisation, this is about shifting from a 'bucket of commodity' to 'an eyedropper' in terms of the way that electricity is used (including volume and optimised time of use)[12]. This is enabled by energy efficiency as well as precision around time-of-use through network integration of digital and data-based solutions – which in turn support the shift of our electricity supply chain from a commodity based, to a service based, model.

[11] *The Integrated Grid: Realizing the Full Value of Central and Distribited Energy Resources. Electric Power Research Institute. Pg 12. https://www.energy.gov/sites/prod/files/2015/03/f20/EPRI%20Integrated%20Grid021014.pdf;*

[12] *Recording of digitalisation event with Hon Dr Megan Woods. 20 October 2021. https://vimeo.com/636710619;*

Case study: The New Energy Platform

For example, the New Energy Platform (NEP) being developed by Vector Technology Services and Amazon Web Services (AWS) in Strategic Alliance, will transform metering data into insights which can deliver value across the supply chain. Initially, the NEP will leverage the breadth and depth of AWS services to rapidly collect and analyse data from more than 1.6 million IoT-connected Vector advanced meters deployed across New Zealand and Australia. The insights collected by the NEP will help Vector enable energy and utility companies to develop tailored product and pricing solutions for their customers based on their energy consumption habits.

Whilst long term intermittency, such as dry year risks that may remove hydro generation availability for weeks, requires further capacity reserves (including large scale energy storage, and industrial load shedding), **short term (daily profile) peak power needs can be better solved through digitally driven demand side management reducing the need to use peaking fossil fuel generation.**

Accelerating digitalisation requires us to integrate the platforms that can execute a step change in our electricity infrastructure. Just as the roll-out of regional Ultra-Fast Broadband (UFB) ensured enabling infrastructure was in place for economy wide digital transformation and resilience, there is an opportunity to drive a step change in enabling infrastructure for the convergence of our transport and electricity sectors, by ensuring that the solutions are in place to manage new complexity and demand.

In summary digitalisation can avoid electricity infrastructure cost; offset the need to rely on fossil peaking fuels; and increase reliability and consumer confidence in our electricity system at a time when this is needed critically. **We propose to accelerate the digitalisation of New Zealand's electricity infrastructure.**

What is Vector doing to advance this proposal?

We are working with world leading strategic alliances to develop digital and data-based platforms.

Vector is leading the way in driving these platforms in partnerships with leading global companies through VTS. Whilst the DERMs platform mentioned above is already being implemented on Auckland's network unlocking value from hundreds of DER, the opportunity and ambition of VTS is to make these solutions available to networks across New Zealand, enabling a step change in our electricity infrastructure. For example, VTS is already offering the cyber security solution which we have developed with leading global IT partners to x networks across New Zealand.

We are working collaboratively with networks across the New Zealand to build a shared understanding of the needs and opportunities for electricity consumers across New Zealand and to support greater certainty in emerging markets.

An example of this collaboration is the Northern Energy Group (NEG) which formed in 2019 around a shared interest in delivering future-ready electricity services to communities and a common belief that consumer voices need to be stronger in industry and government decision-making.

The Group consists of Counties Energy, Northpower, The Lines Company, Top Energy, Waipa Networks and Vector covering around half of New Zealand's ICPs (power

connections). As networks that are entirely or majority owned by customer trusts, the Northern Energy Group believes that customers' interests belong at the heart of our energy sector. As the sector is on the brink of significant change and opportunity the group is committed to leading a new energy future proactively, including to develop shared standards for the connection and operation of distributed assets increasing consistency and certainty in the national market for these solutions.

How can the Government support this proposal?

Develop a National Energy Strategy that values demand as equal to supply

Throughout this submission we have referred to a number of concepts that must form a key role in our future National Energy Strategy. These are:

- A whole system metric of cost (WESC) to reveal the true cost and value of assets, valuing demand as equal to supply
- A whole-systems approach to our energy system (and indeed to our emissions reduction plan overall)
- A focus on 'triple-duty' actions and assets to form the bedrock of a system where key outcomes are re-enforcing rather than being understood as trade-offs as is posited by the traditional energy trilemma

Incorporating these principles will reveal the value of digital and data-based platforms – which are 'tiple-duty' and drive whole systems value. The next crucial step is to ensure that regulation incentivises and enables the integration of these technologies.

Future proof regulation to avoid barriers to digitalisation

The Climate Change Commission recommended that the Government:

> **"Assess whether electricity distributors are equipped, resourced and incentivised to innovate and support the adoption on their networks of new technologies, platforms and business models, including the successful integration of EVs."**

As we noted in our submission, the extent to which networks are 'equipped, resourced and incentivised' to do this stems directly from regulation which funds network businesses through the Commerce Commission's price quality regulation (as we have described above), and, which determines the relationships that networks can have with these cross-cutting technologies through the Authority's market regulation.

Responding to the Climate Change Commission's recommendation requires regulation to accelerate the integration of platforms that will unlock new markets and consumer value – rather than to entrench traditional market silos.

Avoid perpetuating artificial market segmentation which will decelerate the integration of digital platforms

Accelerating digitalisation to maximise whole-systems value, and, ensuring that networks are equipped to continue delivering affordable and reliable electricity supply in the context of decarbonisation, requires our market design to enable, rather than inhibit, the integration of cross cutting technologies. These are technologies which 'blur the traditional boundaries' between regulated segments of the market, delivering value

for more than one part of the supply chain. As described by Laura Sandys CBE, Chair of the UK Digitalisation Taskforce, these 'blended assets' have a crucial role supporting the transformation of our electricity system from a commodity based to a service-based model[13].

These solutions include Vector's Utility Battery Energy Storage Systems (BESS) as well as digital platforms. As has been shown by the WESC, these solutions add significant value to consumers (for a smart EV charger which is dynamically managed through a digital platform this is around $300NZD per annum in avoided cost).

Yet market segmentation – which was implemented in the 1990s independently of the drivers of digitalisation and decarbonisation – risks inhibiting the uptake of such technologies relative to their consumer value by:

- restricting networks' ability to invest in digital technologies as they cut across traditional market boundaries (despite networks' natural and unique incentive and regulatory imperative to ensure consumer reliability and affordability);
- distorting market signals that would otherwise drive their uptake by hiding their true value to consumers through market segmentation – which by design, incentivises industry to maximise value in their own part of the supply chain.

Key provisions to operationalise the approach of artificial market segmentation are in Part 3 of the Electricity Industry Act (or, then, the Electricity Industry Reform Act - EIRA). These provisions are now at the centre of the EIAB which proposes to move provisions to an expanded jurisdiction of the Authority.

Whilst monopoly regulation seeks to replicate competitive pressures as they were understood in the 1990s maximise competition in the competitive segments of the supply chain (generation and retail) while holding the monopoly segments (distribution and transmission) to account, imposing this siloed approach in the context of cross-cutting technologies risks having the distortionary effect of inhibiting the competitive and disruptive potential offered by digital transformation. The cost of this risk would be significant – and would be borne by consumers.

It is not clear what the scope or nature of the future regulatory rules that govern the relationships between networks and emerging technologies will be – however, by transferring provisions out of primary legislation, the EIAB could create uncertainty for networks at a time when greater network investment in these solutions is required urgently.

The EIAB as it stands risks discouraging networks from making investments in cross-cutting platforms which could enable:

- More distributed and solar battery systems to connect to the network;
- New flexibility markets and services to emerge where they wouldn't have otherwise; and,
- The truly competitive and disruptive potential of digitalisation to re calibrate our market and drive consumer value.

[13] *ReCosting Energy: Powering for the Future. Laura Sandys CBE and Thomas Pownall. https://blob-static.vector.co.nz/blob/vector/media/vector-regulatory-disclosures/annex-1-recosting-energy.pdf;*

This in turn risks locking in a commodity-based supply chain which would minimise the prospect of competition to incumbents from new data based and digital market actors and services.

Ensuring that new regulation enables the acceleration of technology integration and the emergence of new flexibility markets requires certainty for network businesses that the solutions they invest in today will be able to operate tomorrow.

Provide strong policy leadership to ensure that future regulatory rules enable, rather than restrict, the integration of new technologies and to provide certainty to the market

Our concern with the EIAB as it stands is that it delegates to the Authority the power to determine matters that have historically, for good reason, been the province of primary legislation, and it does so without providing any guidance to the Authority regarding the manner in which that power should be exercised, or the matters to which the Authority should have regard. In the absence of this guidance, the risk is that regulatory path dependency carries forward the historic regulatory approach of artificial market segmentation, and, that uncertainty deters needed investments in cross-cutting solutions – including batteries and digital platforms.

As highlighted in the World Economic Forum article on the WESC:

"We are missing a big trick when it comes to how we decarbonise our energy system. We are trying to squeeze a capital-intensive set of renewable technologies into market and value arrangements, all of which are designed around a commodity-based fossil fuel past. Until we recognise that the decarbonised system has very different characteristics, a different cost base and new and varied value streams, we will end up paying for an inefficient, under-optimised, much slower and less fair transformation".

- LAURA SANDYS CBE, CHAIR OF THE UK DIGITALISATION TASKFORCE, NON EXECUTIVE DIRECTOR AT ENERGY SYSTEMS CATAPULT AND DIRECTOR OF CHALLENGING IDEAS THINK TANK

Driving this transformation cannot be executed by process based regulatory incrementalism – which will, through path dependency, only perpetuate the approach of the past. **Instead there is a need for clear and strong policy leadership to ensure that our regulatory framework is fit for the future.**

Proposal 2: Enable a least cost expansion of our renewable system

Key Sector 1: Energy and Industry

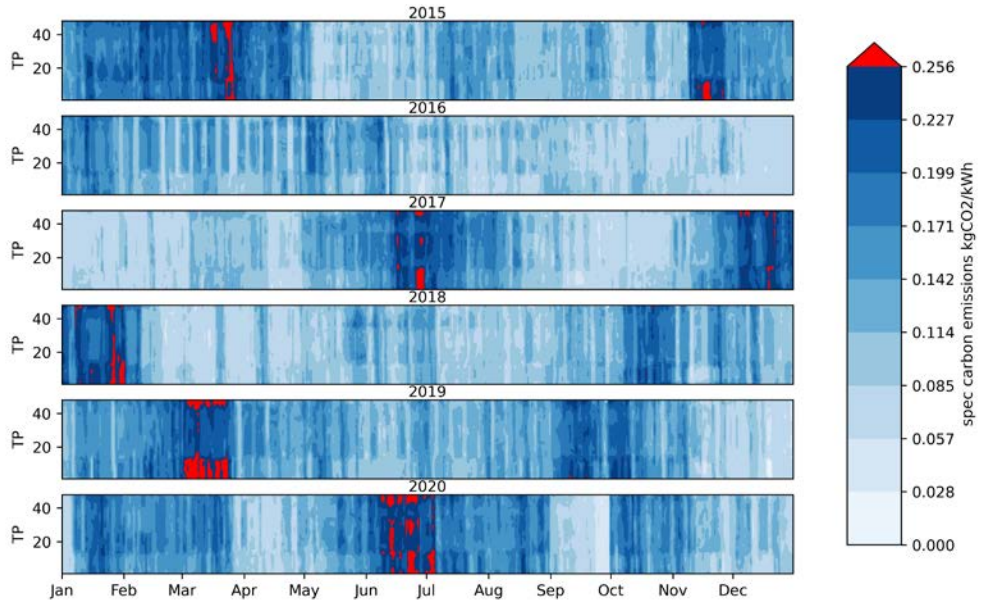
Proposal 2: Enable a least cost expansion of our renewable system

Expanding sources of renewable generation is key to meeting the target to increase renewable generation to 100% and to ensure future security of supply in a decarbonised energy system. Accelerating the integration of more diverse and localised sources of renewable generation has a material role to play to minimise our exposure to threats to system security as we accelerate electrification. As noted by the Climate Change Commission, "diverse energy sources will be needed to maintain security of supply". Driving diverse sources of generation such as solar is not a distraction from increasing whole system security and resilience as we increase reliance on renewables – but rather, it is central to achieving these goals. Relying more on solar also has the potential to reduce seasonal reliance on fossils fuels.

Burning coal while the sun is shining

Gas and coal peaking is used in the North Island almost as much during summer months as winter and which could clearly be mitigated by relying more on summer solar generation. The graph below shows the North Island carbon emissions which are generated per kWh hour consumed at each half hourly trading period during the day (the y axis) and by month (the x axis).

Emissions per kWh over half hourly trading periods by month – North Island



Hydro generation in the North Island is driven by winter rainfall (rather than snow melt). As a result, the highest risk time for the availability of hydro generation is summer to autumn when we move from low demand (and low inflows) to high winter demand. This can be mitigated by running thermal generation early – during the summer to autumn period – to meet energy demand during this time, reducing the need to use hydro-generation, keeping reservoirs full for when they are needed.

As has been noted above, expanding our renewables system efficiently and reliably requires us to look across the whole supply chain in assessing the total value or cost to consumers. The Whole-Energy System Metric of Cost (WESC) described above, finds that energy generated from utility scale solar adds value of $51NZD per MWh.

In addition to providing affordable, renewable supply, localised sources of generation have additional benefits of reducing transmission losses and increase community resilience by reducing reliance on a single, centralised point of failure.

What is Vector doing to advance this proposal?

Vector Powersmart has is delivering large scale solar projects in New Zealand and the Pacific, increasing the reliance of both New Zealand and the Pacific nations on renewable generation

Case Study: Niue

Niue has a target to have 100% renewable energy by 2025. In 2019 Vector PowerSmart completed the Niue Renewable Energy Project. This project knitted together multigenerational assets – of existing electricity infrastructure – with new solar and battery assets (including the BESS) through a digital demand response system. This created a stable and reliable system which maximises the use of renewable generation reducing emissions from generation. Niue now has 40% of its energy needs met through renewables – and often has the diesel generators shut off for hours a day. This shows that in order to get the most value from distributed solar – including system stability, distribution deferral, and maximising the use of low emissions energy sources – there needs to be coordination and integration with the wider electricity system; an understanding of network requirements and a digital DER management system, like EMS, which can coordinate a modular system.

Case Study: Laminex NZ Factory

In 2020 Vector Powersmart completed the 2,700 square meter solar panel system for the Laminex New Zealand Factory in partnership with the factory's landlord, Udy Investments. The solar system has reduced CO2 emissions by 35 tonnes between November 2020 and late February this year and is set to generate enough power for 90 average homes per year. In December and January last year the solar panels exported 26 and 29MWh to the grid respectively. Laminex New Zealand, which manufactures surfaces used for kitchens and other interior design projects, has installed the solar panels alongside a number of measures to reduce energy consumption – including the use of LED lights in its warehouses as well as light and movement senses. These energy efficiency measures alone have reduced the factory's power bills by 20 percent, demonstrating the value of integrating interventions to reduce consumption as well as remote generation, to reduce industrial emissions – while increasing Vector Powersmart Solution – New Zealand's reliance on renewable generation.

As the Emissions Reduction Plan notes, "Speeding up the rollout of renewable electricity generation will be a key factor in replacing fossil fuels in other sectors".

The Watercare 1MW solar array will offset about 25% of the water treatment plant's electricity use, and reduce carbon emissions by 145 tonnes each year.

As demonstrated by the Laminex case study – and the 1MW floating solar array delivered by Vector Powersmart for Watercare last year commercial and industrial solar can play a key role in reducing emissions from industry.

Case Study: Kainga Tuatahi project, in partnership between Vector and Ngāti Whātua Ōrākei

Kainga Tuatahi priovides behind the meter solar and battery systems for each of the 30 houses at Kupe street – a residential development for iwi first home owners delivered by Ngāti Whātua Ōrākei. These solar panels are owned by Ngāti Whātua and are repaid by home owners through body corp fees. The batteries and inverters are owned by Vector.

This project was designed to align with the objectives of Ngāti Whātua – to develop Waro Kore Papakāinga – a carbon zero community – with affordable and healthy housing. This includes bringing together innovative energy systems, waste systems, healthy waterways, kai sovereignty, and ecological enhancement. The commercial development arm of Ngāti Whātua is focussed on ways of maximising the social and environmental benefits of its developments by working with local partners, and the localisation of energy systems aligns with the motivation of Ngāti Whātua to bring iwi housing close together in Tamaki Mākaurau. As well as supporting these community goals and outcomes, the Kainga Tuatahi partnership demonstrates the benefits to our energy systems that can be gained by distributed solar and batteries – and from local network involvement in these systems.

The project enables customers to generate and store power for their own consumption and to export any surplus to the grid for a credit. In the year to date, the solar battery systems provided on average, 36 percent of customers' total consumption, and in their first four months resulted in savings of around 12.55 tonnes of carbon dioxide equivalent (CO_2e). The systems have reduced some home-owners' electricity bills – for power from the centralised grid, to which they are still connected – to as little as $13 per month. This project is also to understand the role of distributed energy systems for network optimisation. The trial seeks to assess the performance of tesla powerwall batteries in maximising solar consumption, increasing resilience (by providing back up electricity for customers in the case of an outage), and reducing peaks. Analysis has so far shown that residential batteries can contribute to a 30% peak reduction in conjunction with solar. The network business case for such projects is strong. This business case could be scaled up to capture greater benefit for communities – Vector and Ngāti Whātua are working jointly on the Kaumātua project as a wider development. Further expansion of such projects, however, requires certainty on the part of network businesses on the future scope for involvement with connected generation.

Kupe Street – Ngāti Whātua Orakei housing development and site of Kainga Tuatahi project, Vector, launched 2016

Accelerating our transition to renewables, reliably, requires increased network visibility

As has been noted by the Authority in its discussion document Updating the Regulatory Settings for distribution networks, "Distributors need greater visibility of their low-voltage networks to manage reliability and make efficient investment decisions. Third parties also need information on hosting capacity to make informed business decisions and compete on a level playing field". Indeed, increasing visibility of the network was a key theme of the EA's work. We support this – increasing network visibility can support more efficient network management and planning and enable the efficient integration of more distributed generation and micro-grids. This will enable the entrance of new generators into our market. In particular we support the proposal of the Authority to create a DER registry and note the UK Government's scheme requiring consumers to register all 'low carbon technologies' with their local networks – including solar PV, heat pumps, EV charging, points, or battery storage. By improving network visibility, this information can help networks identify changes in load, supporting more efficient operational responses, and, in conjunction with consumption data can help 'right size' future investments by enhancing networks' understanding of new technology impact.

For a DER registry to have the most value it must be implemented as a matter of urgency as this is when the impact of low carbon technologies will be most uncertain. At higher EV penetration levels for instance, information on EV installations will be less valuable.

Project Tapestry, described below, is a Moonshot being championed by X, The Moonshot Factory with Vector and a number of global partners[14] which will take visibility of the network to the next level. Perversely, as described above, the EIAB as it stands could actually deter the integration of such solutions by making networks' ability to invest in and operate these solutions uncertain. This would work against the goal of the EA to improve network visibility.

Case Study: Project Tapestry is creating a single, virtualised view of the electricity system

Tapestry is a moonshot for the electricity grid that aims to speed the transition to a resilient, carbon-free electricity system by developing new computational tools that will create a holistic and dynamic picture of the grid.

Image of virtualised network: Project Tapestry

"The electric grid is an engineering marvel — a vast and complex machine that connects us all and powers the devices that are now essential to our everyday lives. Designed more than a century ago to function like a one-way highway, with electricity flowing from fossil-fuelled power plants to cities and towns, it wasn't built for what the modern world is asking of it.

[14] *Government Welcomes Collaboration between Vector and X. Press Release. 28 September 2021. https://www.beehive.govt.nz/release/government-welcomes-collaboration-between-vector-and-x;*

Increasingly, the grid looks like a multidirectional superhighway. Billions of devices ranging from home solar panels and wind farms, to microgrids and electric vehicles are pushing and pulling energy to and from the grid all the time. Yet no one currently has the tools they need to see, manage, or plan a grid this complex. Information is siloed between dozens of different organizations and no one has a complete picture of how electricity is made, moved, and used. With industries like transportation and heating switching from fossil fuels to electricity, the demands on our grid are only increasing and becoming even more challenging to orchestrate"[15].

Leveraging data to optimise network operations

In addition to Tapestry, and the New Energy Platform described above, Vector is already supporting stronger network operations through Vector Metering – which provides smart meters across New Zealand and Australia. Network access to and application of this data can:

- Lower consumer costs by improving network asset planning processes and by informing innovative cost deferral projects
- Improve consumer reliability by building bottom up asset monitoring and forecasting tools that predict imminent failures and assist field staff
- Enable the proactive planning of the impact of DER on individual components of network leading to more efficient decisions and overall lower costs
- Support a more granular approach to forecasting which is necessary as the network is more dynamic than in the past

However, as we have said consistently for the past five years the key to data from smart meters adding value to network operations and planning is the ability for networks to access and use this data. Whilst this is now progressing, the Authority's approach to this through the DDA has been unduly lengthy and difficult.

How can the Government support this proposal?

Ensure the National Energy Strategy encourages investments which will lower the cost of electricity from a whole system perspective

While this might seem obvious, it is not presently the case. Currently, decisions and investments in our electricity system are assessed in strict market silos – i.e., by generators, the transmission network, distributors, and consumers separately. Decisions within these silos do not reflect the impact of investments on the whole electricity system. Decisions to build new generation plant for instance are made independently of the impact on transportation or balancing costs which are borne by consumers. These transmission costs increase when there is a lack of localised generation. For example, when Auckland generation closed down, Transpower needed to invest in voltage support to balance the system, increasing consumer cost. By pushing such cost onto consumers, the Transmission Pricing Methodology has removed any incentive for generators to localise generation even though this would increase system resilience and reduce prices.

An alternative approach would assess investment options in terms of their value or cost across the whole system – similar to the approach of 'integrated resource planning' which considers the impact of investments across multiple segments of the supply chain in an integrated way.

[15] *https://x.company/projects/tapestry/;*

Drive Regional Energy Zones

To support the most efficient whole-systems investments across our electricity system we support the creation of Regional Energy Zones (REZs).

This is foundationally aligned with the proposal of the Infrastructure Commission in their draft 30 year strategy to create 'renewable energy zones' (REZs), whereby a 'specific area with favourable renewable energy resources, a permissive/enabling consenting environment and transmission capacity readily available to connect low-cost, renewable electricity generation to the grid' is identified to 'reduce the cost of achieving the 2050 net zero carbon emissions target'. We support this – and recommend that a regional lens be applied to this concept, capturing other regionally specific factors which impact cost and resilience - including distance of a region from remote generation, as well as the needs of different communities.

Ensure that market and regulatory settings align with the integration of more distributed solar and battery systems

In addition to the above there are a number of opportunities to accelerate the integration of distributed renewable generation by addressing regulatory and market barriers. For example, current restrictions limit one retailer per ICP (that is per household or business). This means that even if a consumer wishes to buy power from diverse sources of generation they can only be supplied via one retailer. This limits consumer choice and makes it difficult for new generators to enter the market.

The amount of solar and battery solutions which can be integrated with the network, and the power that they can export, is effectively limited by regulated voltage limits. In New Zealand, those limits (which are prescribed under Regulation 28 of the Electricity (Safety) Regulations 2010 and implemented through Connection and Operation standards, including network congestion management policies – which are required by the Electricity Industry Participation Code) restricts voltage levels to that which is within 6% of an installation's voltage.

However, some international standards allow maximum voltage to reach +10%. Increasing our voltage limits to achieve consistency with international settings is low hanging fruit to safely enable more bi-directional technologies like solar PV and V2G to be integrated. The existing voltage limits act as a constraint on the amount of solar PV generation that can be exported onto the LV network, and so revising these limits would enable more renewable electricity generation to be connected, and more of the power generated to be exported.

There is an opportunity to encourage greater uptake of distributed renewable generation by addressing such regulatory and market barriers, and, as mentioned above, by ensuring that future resource management settings enable, rather than constrain, new localised sources of renewable generation. We understand that there is a workstream being led out of MBIE to enable the uptake of more community and distribution generation, and we encourage this work to be progressed as a priority in support of New Zealand's emissions reduction plan.

Proposal 3: Enable a just and orderly transition from fossil gas

Key Sector 1: Energy and Industry

Proposal 3: Enable a just and orderly transition from fossil gas

To reduce emissions from fossil gas we must consider it in the context of the whole Energy and Industry sector.

Domestic fossil gas use overall accounts for nearly 1% of national emissions. Decarbonising the use of gas in buildings (as is contemplated in the Building and Construction section of the Emissions Reduction Plan) must be considered in the wider context of our energy system and the role of fossil gas in this. To achieve the most efficient net reduction in emissions overall, the Emissions Reduction Plan must consider the emissions intensity of gas use in buildings against the emissions intensity of the alternative.

	Emission factor (gCO2e/kWh)[16]
Natural Gas Residential Consumption	194
Electricity (2018 national average)	109
North Island electricity, July – October 2021[17]	198
Natural Gas Electricity Supply	400 - 500
Coal Electricity Supply	850

Residential use of natural gas has an effective 100% energy conversion efficiency. As a result, it has an energy emission factor that is roughly double the national average on a good renewable year. **However during winter, such as in July 2021, the electricity emission factor of the North Island rose above that of natural gas.**

This was primarily driven by the excessive use of coal due to low hydro capacity, spotlighting our continued reliance on fossil fuel peaking for electricity. Decarbonising the energy sector as a whole – and pursuing the most efficient net reduction in emissions – requires us to start with demand driven solutions to flatten these peaks (which would be driven by *Proposal 1: Accelerate the digitalisation of New Zealand's electricity infrastructure)*, to lower reliance on high emissions local fossil fuel generation (coal and gas generation) as demand for electricity increases – and then begin the transitioning out the lower emissions use of gas, such as residential natural gas. That is, phasing is critical to achieve an orderly transition, and to avoid perverse outcomes for our emissions reduction plan.

This phased and strategic approach would also align with the outcome of affordability

There are multiple drivers of cost which could emerge from our transition from fossils gas:

- Direct consumer costs from replacing appliances and structural changes that are needed in homes to accommodate this
- Increased electricity costs as demand – and in particular peak demand – increases from electrification
- The increased cost for consumers who remain fossil gas users, as a result of costs being concentrated to a smaller number of consumers

[16] *MFE: Measuring Emission Factors, https://environment.govt.nz/publications/measuring-emissions-detailed-guide-2020/*
[17] *Electricity Authority - Generation output by plant https://www.emi.ea.govt.nz/Wholesale/Datasets/Generation/Generation_MD*

The consumer cost of transitioning from fossil gas in buildings is high and has been significantly underestimated by the Climate Change Commission.

As we said in our Climate Change Commission submission:

"the Commission has noted that the changes included in their pathway are likely to result in an increase in costs for households that use natural gas of around $150 per annum. However, the Commission has not factored in capital costs associated with structural changes that would undoubtedly need to be made to accommodate a customers' switch from gas (households which use reticulated and bottled LPG connected to buildings, as well as natural gas) to electricity. Gas hot water heaters typically are located on the outside of a home. Replacing this with an internal hot water heater would require at a minimum capital costs which are additional to the new appliance itself, potential structural changes to housing, and loss of internal liveable areas potentially impacting housing value. Analysis jointly commissioned by Vector has found that accounting for these capital costs – including appliance, labour and renovation costs, the true cost of transitioning a gas customer to electricity would be ~$2,000 (assuming that the customer uses gas for water heating and cooking) to ~$5,000 (if the customer uses gas for water heating, cooking and space heating). These costs are currently excluded from the Commission's estimated $150 per household per annum".

As reported in the NZ Gas Infrastructure Future Findings Report (included as Annex 2) released in August this year *"CCC analysis indicates estimated costs of $5.3 billion out to 2050 to make the required changes to space and water heating appliances in homes and commercial buildings"*. The report continues:

"preliminary analysis suggests that there are over 140,000 existing gas consumers that could be categorised as vulnerable that are located in low income areas. For these consumers, covering their share of the $5.3 billion in estimated appliance conversion costs will be a real struggle"

Depending on the signals that are sent to the market, consumers who are unable to meet this upfront cost are likely to be faced with higher costs from their gas connections as a result of costs being concentrated across a smaller customer base. That is, those able to meet the upfront cost to make the switch are likely to do so first – avoiding future increases in cost which will instead be borne by consumers who are unable to make the change as quickly. This is also a matter of intergenerational equity as consumers in the future will effectively meet higher costs which would have been avoided by consumers in the past. These distributional impacts depend on the timing of our transition and whether or not signals align with a phased approach.

To support the greatest reductions in emissions, affordably, we must implement a phased approach to our transition - supported by a new regulatory compact and aligned policy signals.

Our regulatory framework was designed to incentivise investment in gas infrastructure for continued reliability, whilst ensuring affordability, by providing for the recovery of gas asset costs over their 40-50 year lives. Any change to the parameters of this framework also requires a new regulatory compact and aligned policy signals to avoid perverse outcomes impacting affordability, reliability, and indeed our emissions reductions. For example, signalling to consumers to transition from fossil gas prematurely could have the perverse outcome of concentrating cost inequitably (while potentially increasing emissions as peak demand for electricity increases the use of fossil peaking) as has been described above.

Similarly, given the continued role of gas in meeting the energy needs of hard-to-abate industrial processes within the Commission's demonstration pathway, it is important that signals aren't being sent to investors which would prematurely compromise the availability of natural gas.

In sum an orderly and just transition requires us to consider the role of fossil gas in the wider context of our energy system and the complete consumer cost implications. We must then ensure that steps taken to advance our transition are phased appropriately. Along the way we must avoid arbitrary steps that would increase cost and emissions and reduce optionality (including for new green gasses) for no reason. Just as decarbonising the electricity sector targets the energy source, decarbonising the gas sector should follow suit. The entire food-waste of Auckland could supply the Waitoki natural gas network which constitutes 2% of Auckland's total gas consumption. While this is small, it is still a step that keeps the gas sector emissions competitive with electricity. Green hydrogen blending at 20% made from low demand off-peak wind power, can add a further 7% emission reduction to the gas sector.

What is Vector doing to advance this proposal?

Vector is a member of the Gas Infrastructure Future Working Group alongside the other major gas infrastructure companies Firstgas Group and Powerco, with observers from the Gas Industry Company, Ministry of Business, Innovation and Employment, the Commerce Commission, the Electricity Authority, and the Major Gas Users Group.

The group is co-chaired by Geoff Swier and Eli Grace-Webb from Farrier Swier, and was established to provide insights and analysis and to develop a coordinated and collaborative approach to a managed transition. We are surprised and disappointed that this group and its findings to date were not referenced in the Emissions Reduction Plan. We urge officials to consider this work.

The Gas Infrastructure Working Group's report shows a managed transition is critical to help navigate issues such as the high cost to consumers of changing away from gas appliances, as calculated under the Climate Change Commission's demonstration transition pathway.

This report also addresses the need to retain the option for existing gas pipelines to be repurposed for low- or zero-emissions green gasses to help in other hard to abate energy uses, such as high heat processes and heavy road transport.

How can the Government support this proposal?

We recommend that the Government align policy and investment choices around a gas transition plan to achieve this managed transition, including a new regulatory compact.

This can deliver greater whole-systems emissions reductions at least consumer cost (supporting an 'orderly transition' as was described at the beginning of this submission), and aligns with the wider energy system goals of fuel diversity for energy security, and the macro-economic co-benefits which would be gained by growth in markets for new green gasses.

This is about providing industry and consumers with the right signals to make the investments needed for a just transition. Whilst the government has separated the consultation question regarding new gas connections (which is addressed in Question 72 in *Building and Construction*) - from the discussion on the role of natural gas in our energy transition (which is in *Energy and Industry*) **the two are inextricably linked.**

As the Emissions Reduction Plan acknowledges in Building and Construction – "Reducing demand for fossil fuel in buildings may have implications for new and existing fossil gas connections. Energy supply chains are complex." However, despite this recognition there is not a clear connection between the proposal to "set a date to end the expansion of fossil gas pipeline infrastructure" at this stage, and the management of these complexities.

The Climate Change Commission made this recommendation in order to "reduce emissions from fossil gas use, and safeguard consumers". However, as we have shown, setting a date arbitrarily would in fact expose consumers to significant avoidable cost and (as shown by the table above and the interdependencies between gas and electricity) would not necessarily reduce emissions. In fact, it could have the perverse outcome of increasing emissions as coal and other fossil fuel peaking solutions are relied on to meet increased peak demand for electricity.

It is critical that a gas transition plan is developed, alongside a new regulatory compact, before any such date is set. Stipulating a date before this plan has been developed and necessary analysis undertaken is arbitrary and would send signals to consumers and investors which are unlikely to align with the needs of consumers and an orderly decarbonisation pathway.

Proposal 4:
Ensure future ready EV charging

Key Sector 2: Transport

Key Sector 2: Transport

Sector overview:

As stated by the Emissions Reduction Plan, Transport is our second-largest source of greenhouse gas emissions. It is responsible for:

- approximately 20 per cent of gross domestic emissions
- 43 per cent of total domestic CO2 emissions.

The Commission recommends the Government focuses on three areas to reduce emissions from the transport system:

1. Reducing reliance on cars and supporting people to walk, cycle and use public transport.
2. Rapidly adopting low-emission vehicles and fuels
3. Beginning work now to decarbonise heavy transport and freight.

We agree with these areas of focus and in our response we include a focus on 2 – and the conditions needed to enable the affordable and reliable convergence of our transport and electricity sectors to ensure consumer confidence. This is key to the uptake of EVs and it requires us to take an integrated whole systems approach to our future electrified transport system – which starts with the needs of consumers.

Whilst we support policies to increase the affordability of EVs themselves, the up-front cost of an EV is just the tip of the ice-berg in determining their overall affordability. Just as the cost of using an Internal Combustion Engine (ICE) includes petrol or diesel, the cost of an EV will include the cost of electricity – including electricity infrastructure costs. The convergence of our transport and electricity systems is likely to result in some shifting in household cost from ICE fuel towards electricity – however, the strategic goal should be to minimise this cost as much as possible.

We agree with the Emissions Reduction Plan that:

"we will need to use all our levers together in a concerted and coordinated way to achieve the scale and pace of change required. Our levers include:

- *The regulatory system* – including transport-specific laws, regulations, rules and standards, and changes to the resource management system so that urban planning supports lower emissions urban form"...

We support the need to align regulatory levers and below outline a proposal to regulate for the installation of smart EV chargers. However, regulatory levers which are needed to achieve the scale and pace of change required also include electricity regulations. As we have set out in *Proposal 1: Accelerate the digitalisation of electricity infrastructure and Proposal 2: Enable a least cost expansion of our renewable system* there are opportunities to support avoided cost as transport electrifies through our energy system. In particular, these opportunities include: avoiding regulatory barriers to digitalisation and ensuring the National Energy Strategy encourages investments which will lower the cost of electricity from a whole system perspective. These are critical for affordable and reliable transport electrification and in our recommendations for the Transport sector and *Proposal 4: Ensure future ready charging infrastructure* below, we outline steps that can be taken to enable affordable and reliable uptake of EVs.

Key Sector 2: Transport (cont)

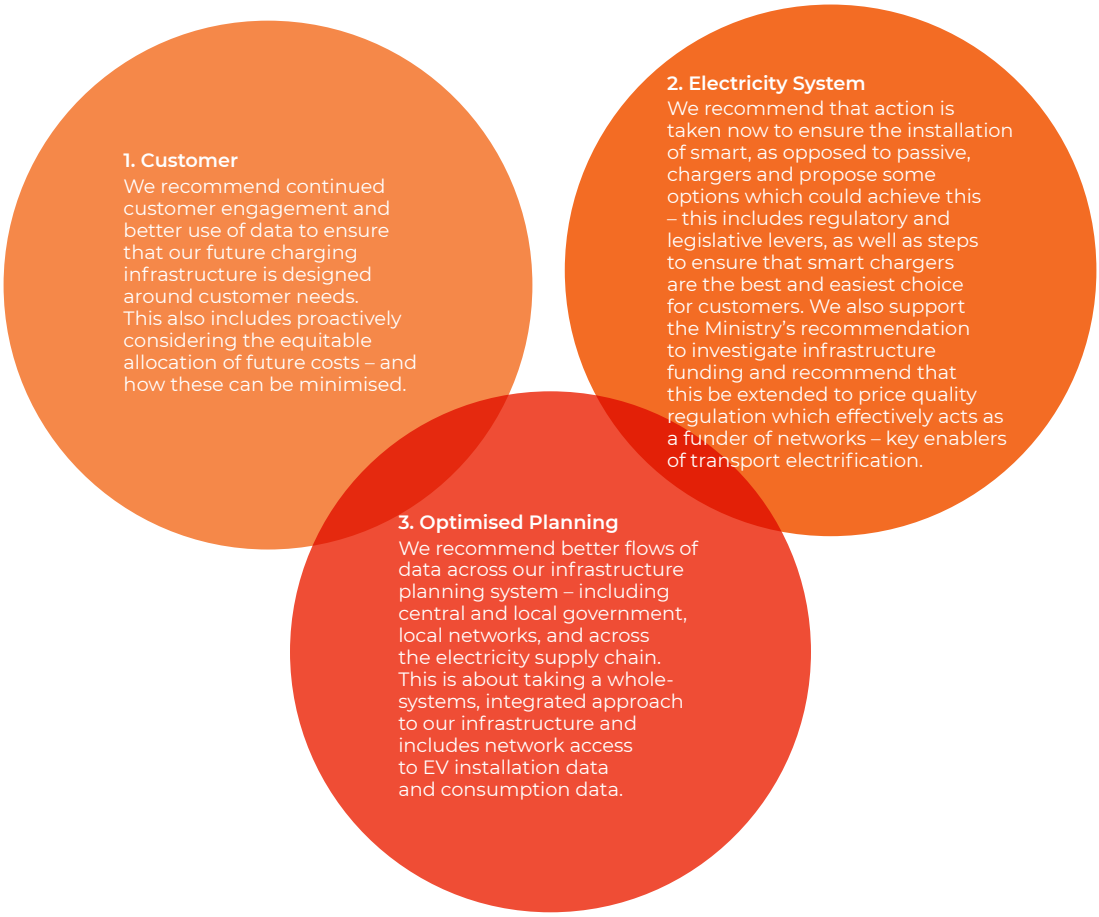
In driving the uptake of technology which can enable this, we refer back to our initial message under *Behaviour Change* in the section of our submission responding to Aligning Systems and Tools.

"We support interventions which enable consumer choices that support decarbonisation. These interventions should rely on one-off 'set and forget' decisions and actions, rather than continuous behavioural changes that may result in decarbonisation fatigue (or which may never happen). In this context, creating a reinforcing system described above in which decarbonisation is the default is about ensuring that the settings and conditions are in place to drive the right 'one off' actions that then deliver enduring system outcomes".

An example of such a one-off action is the installation of a smart EV charger (or indeed the 'installation' of any energy using device with demand management capability). As we explained above, we support the use of product standards and regulations to ensure that our market favours the integration of technologies that will then deliver individual consumer and system wide efficiencies seamlessly, supporting affordable and reliable electrification.

Key considerations for our future charging infrastructure:

The Northern Energy Group set out three key dimensions for our future charging infrastructure in its submission responding to the Ministry of Transport's Hīkina te Kohupara: Pathways to Net Zero (attached as Annex 3). These are:



We suggest that officials read this submission in it is entirety.

Recommendations for this key sector:

- We support the implementation of fringe-benefit tax (FBT) to leverage the tax system to support the uptake of EVs, and we support the Income Tax (Clean Transport FBT Exclusions) Amendment Bill to achieve this. This is referred by the Emissions Reduction Plan under "Investigate how the current tax system could support clean transport options".
- We support the Freight and Supply Chain Strategy and recommend that this include a focus on the integration of hydrogen vehicles (noting the progress made by Hīringa Energy which we commend). This aligns with the Emissions Reduction Plan's *Target transport 4: Reduce the emissions intensity of transport fuel by 15 per cent by 2035,* which refers to the role of hydrogen in decarbonising transport.
- We support the National Charging Infrastructure Plan as well as the Public EV Charging Roadmap which is being consulted on currently. Ensuring digital enablement of our future charging infrastructure must form a key part of this plan (integrating our recommendations to accelerate the digitalisation of Electricity Infrastructure as to Ensure future ready EV charging infrastructure). **We were deeply disturbed to find that the Emissions Reduction Plan did not include any mention of steps to ensure that EV charging is smart and safe.**

Strategic goals to electrify transport:

- *Ensure that all EV charging installations have smart capability to enable consumers of today and tomorrow to choose demand management schemes for dynamic load shifting to avoid capacity breaches and increase network utilisation*
- *Ensure that all EV charging installations have health and safety features*

Proposal 4: Ensure future ready EV charging infrastructure

We propose that the Government proactively ensure that the settings are in place for safe, reliable, and affordable charging infrastructure. This requires our charging infrastructure to be digitalised and for EV chargers that are installed to be standardised.

The digitalisation of charging infrastructure is important because modelling of peak demand out to 2050 shows that new demand (modelled along the Climate Change Commission's pathway) could potentially double network capacity requirements if demand is not optimised. However, smart EV charging, dynamically managed through a digital platform such as DERMs, is modelled as reducing this peak growth by as much as 60% - avoiding significant consumer cost.

The digitalisation of EVs requires two components:

1. A digital platform that can dynamically monitor and manage new demand (for dynamic rather than static load shifting)
2. EV chargers having smart capability (an IP address and capability to respond to a signal)

We have canvassed the first of these under *Proposal 1: Accelerate the digitalisation of New Zealand's electricity infrastructure*. To ensure the second of these we recommend that the installation of smart EV chargers is regulated. This was recommended by the Climate Change Commission in its final advice (Recommendation 18, 3. e) to:

"We recommend that, in the first emissions reduction plan, the Government commit to: Accelerating emissions reductions from the light vehicle fleet. This should include the Government:

3. *Accelerating the uptake of electric vehicles (EVs) by introducing a range of measures, including:*
    e. *Enhancing the roll out of EV charging infrastructure to ensure greater coverage, including at marae, multiple points of access,* ***mandatory smart charging,*** *and fast charging"*
    - *Climate Change Commission final advice Ināia tonu nei: A Low Emissions Future for Aotearoa*

As well as ensuring digital enablement, the standardisation of EV chargers is important for health and safety

EV charging will change the fuelling system that consumers are used to. Just as there are health and safety critical steps that consumers know to take, or avoid, at the petrol pump, there is a need to ensure that the settings are in place for consumer health and safety and confidence as we make the transition to EVs. In the case of EV charging this relies on the installation of the right kind of EV charger – one with a protocol to prevent current from flowing if a cable is not correctly inserted. These protocols can also detect hardware faults, disconnecting the power and preventing battery damage, electrical shorts, or fire in consumers' homes. There is a clear need for standardisation to ensure that these chargers are installed. A trial undertaken by Australian power company, Origin Energy, found that 60% of trial participants had been plugging their car batteries into standard sockets in their garages before the trial. Vector's trial revealed a similar pattern of behaviour. Participants in these voluntary trials are more likely to be early adopters and not entirely representative of the entire population – who may even less informed about the importance of the right EV charging equipment for health and safety.

We note that the difference in cost between a charger which has necessary health and safety features but no 'smart' capability – and one which has both – is marginal. That is, if the government deems it necessary to ensure that charging is safe (and it should) the additional up front cost to ensure that charging is also smart, is minimal, and, as demonstrated by the WESC is significantly offset by the whole system value that smart EV charging offers.

Standardising the installation of smart EV chargers

As we proposed under *Behaviour change* we support interventions which target one-off actions that will deliver continuous outcomes – rather than relying on continuous behavioural change and choices. As we explained expecting consumers to replicate the optimisation potential offered by smart charging through their behaviours is absurd. For affordable and safe EV uptake it is critical that settings are in place to favour the installation of chargers that are safe and smart.

Our smart EV charger trial indicates that consumers enjoy smart charging with the surveys finding that 90% of customers were satisfied with the service, with customers

actually preferring the dynamic charging service – which was found to be the most effective at flattening the peak – as compared with scheduled charging. Specifically, more than 90% of customers rated the speed of charging, ease of usage, and overall satisfaction with their current charging situation (dynamic charging in the context of Vector's smart charger trial) as positive, providing a score between 8-10 for each of these aspects of smart charging.

However, under our proposal to regulate for the installation of smart chargers, consumers could still choose to 'opt-out' of dynamically managed charging. However, if a passive charger is installed then this choice and opportunity to participate in a demand management scheme is removed (just as it is for a future occupier of the building where the passive charger is installed given the cost of retrofitting). As is stated in the Northern Energy Group submission "every passive EV charging installation effectively 'locks-out' potential for dynamic management".

We must avoid this risk of locking out technologies which can accelerate affordable electrification – just as we must avoid 'tech lock-in' through open and modular standards which avoid committing customers and systems to one technology provider. This can be achieved within standards for smart and safe EV charging. The UK's HomeCharge scheme however, which offers public funding to cover 75% of the cost of smart chargers and their installation, still includes ~500 different models across 64 different manufacturers[18]. This shows the diversity of technology providers which would be captured by 'smart' EV chargers.

By regulating for smart EV charging we can implement New Zealand's own 'green default' as referred above under *Behaviour Change*.

Case study: The UK is taking proactive steps to drive the digitalisation of EV charging infrastructure

The UK regulator the Office of Gas and Electricity Markets (Ofgem) and Department of Business Energy and Industrial Strategy (BEIS) has decided to regulate for the installation of EV chargers with 'smart' capability with legislation to be introduced by the end of the year in response to consultation undertaken in Oct 2019. This is in addition to the recent announcement to ensure that all new buildings in England will have electric car charge points from 2022.[19]

Ofgem's paper *"Enabling the transition to EVs: Ofgem's priorities for a green, fair, future"* – including four priorities across three areas – captures policy and regulatory initiatives to "ensure that the networks are prepared for increased EV adoption, facilitate unlocking flexibility through smart charging and V2X, and increase greater consumer participation through emerging new innovative products, technologies, and services in the retail market".

Its priorities sitting across the three broad areas of networks, system integration, and consumer participation and protection, include: a strategic innovation fund, encouraging customer centric modelling to better predict clusters of faster EV uptake, and incentivising and funding networks for better LV monitoring and visibility. This is in addition to the smart charging legislation to be implemented later this year[20].

[18] *Electric Vehicle Homecharge Scheme approved chargepoint model list. https://www.gov.uk/government/publications/electric-vehicle-homecharge-scheme-approved-chargepoint-model-list;*
[19] *https://www.theguardian.com/environment/2021/nov/21/all-new-buildings-in-england-to-have-electric-car-charge-points-from-2022*
[20] *Electric Vehicles: Ofgem's priorities for a green fair future. https://www.ofgem.gov.uk/publications/electric-vehicles-ofgems-priorities-green-fair-future*

We note calls internationally to ensure the uptake of smart charging, including from the programme manager at ECOS, the Environmental Coalition on Standards, Luka De Bruyckere, and a senior advisor at the Regulatory Assistance Project (RAP), an independent organisation promoting the transition to clean energy, programme manager at the Environmental Coalition on Standards, Jaap Burger.

"We need an EU strategy to install millions of smart charging points in buildings. In short, we need a 'right to plug' so that people can charge their vehicles wherever they are customarily parked. The flow of energy within buildings and onto the grid can then be optimised by smart standards.

Not only that, EV batteries can function as storage to help manage the network. Since a car can hold as much energy as a typical household consumes in a few days, connecting them to a smart network could change electricity grids as we know them. Smartly managed, electric vehicles not only emit less CO2 than combustion cars, but they could also reduce total grid emissions.

Then, European standardisation organisations must develop robust standards, aiming to allow EVs to communicate with the building and the grid. In addition, technical standards should make it easy for users to connect their devices, and have them communicate within buildings and with the grid. Standards can serve to remove complexity for users and drive down technology costs"[21].

New Zealand can do this.

What is Vector doing to advance this proposal?

Vector led New Zealand's first smart EV charger trial

Vector has undertaken a trial of 120 EV smart chargers across Auckland in which Vector has installed a 7kW smart EV charger (from EVNEX the Christchurch based start up referred above) at each participant's home. Vector has worked with participants to collect data on their EV charging preferences and to better understand how smart EV charging can satisfy their expectations to answer the question *Can we reduce the network impact of EVs without affecting customer experience or satisfaction?*

As demonstrated by the below graphic, this found that we can.

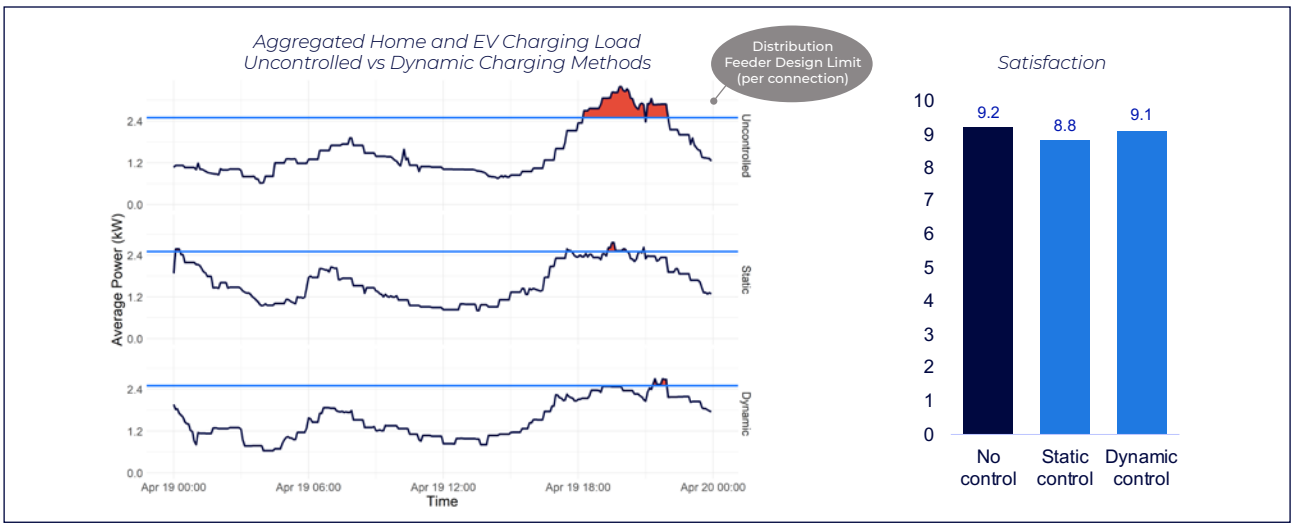


Figure One: *Impact of dynamic management on peaks and customer satisfaction*

[21] *https://www.euractiv.com/section/energy/opinion/eus-buildings-directive-should-give-ev-owners-the-right-to-a-smart-plug*

Vector is trialling a tariff for smart EV charging

Vector currently has a mandatory two part time of use (daily fixed price with different off-peak and peak volumetric prices) for mass market consumers (residential and small medium enterprises under <69kVA). Time of use offers consumers the ability to reduce their electricity bill by shifting some electricity use from peak to off-peak times as well as encouraging take-up of new technology. We are also proposing to add residential consumers with electric vehicle chargers with IP addresses capable being connected to Vector's DERMS to our controlled plans to reward these customers for shifting load from peak periods. This is at an early stage, and we are looking to understand how this aligns with consumer preferences and the impact this could have on managing load. Over the past year, more than 400 customer and network connected resources (rooftop solar, EV chargers, batteries) have been integrated with the network using the DERMS platform to provide visibility and ability to manage the complex interactions between the network and distributed energy assets.

However networks are unable to offer such pricing rewards and solutions to consumers to incentivise participation in dynamic load control for EVs, if their EV chargers are not smart in the first place.

How can the Government support this proposal?

In addition to the recommendations made in section Energy and Industry which are inextricably linked to the challenge and opportunity of transport electrification, the Government can support this proposal by:

Regulating for the installation of smart and safe EV chargers

This requires a government agency to take clear jurisdictional ownership of the matter. We note the Publicly Available Specification (PAS) Publicly available specifications (PAS) 6010:2021 and 6011: 2021 Electric vehicle (EV) chargers for commercial applications and residential use, respectively, which provide clear and simple guidance on how to safely and cost-effectively charge an EV and things to consider when installing an EV charger. PAS 6011 – developed between Standards NZ, EECA, the Commerce Commission, Electricity Authority, and industry participants – includes a communications protocol for smart charging as well as health and safety standards. However, these standards are a voluntary guide. The market is likely to favour the product with the lowest up-front cost – but which would incur the higher whole-of life cost, and lowest health and safety, to all customers. That is, having little technical knowledge customers are unlikely to enforce the PAS 6011 through their purchase decisions alone. This has been demonstrated by the above examples of consumers charging their vehicles using standard three phase sockets.

Whilst the NZ Electricity Industry Participation Code (the Code) does give effect to Distributed Generation Connection and Operation Standards, it does not currently talk to standards for EV charging installations and we understand from the Authority that establishing a connection standard for EV charging in the Code would require a change to the Electricity Industry Act 2010, which currently prevents the Code from imposing obligations on consumers. This change would create a new type of industry participant. The Electricity Industry Amendment Bill – which is being consulted on by Select Committee tomorrow, however, does not address this and if anything will work against the digitalisation of EV charging infrastructure as described above.

We urge someone in Government to take ownership of this matter and drive the steps and coordination needed to ensure the widespread installation of smart EV chargers. Once again this requires regulation to start from the outcome that is needed (smart and safe charging infrastructure) rather than process (but who's job is it?).

Regulating energy using products and standards

As we noted above, we support the proposal for Minimum Energy Performance Standards (MEPs) and labels to include requirements for demand response capability.