Accelerating Renewable Electricity MBIE Consultation

Thank you for the opportunity to comment on the MBIE Accelerating Renewable Energy strategy. With experience working across and with digital, hardware and commercial innovators, electricity distribution businesses, energy communities and retail, SAIL believes this is critical to affordably and equitably delivering the urgently needed energy transition at home and enabling a dynamic electricity sector to drive digital and other exports.

Our comments are limited to the opportunities for Demand Energy Resource (DER) engagement (Section 8) and Community Energy (Section 9) to unleash a massive wave of private solar and other DER investment that would accelerate action on climate change and offer price sensitive consumers access to cheaper power.

8.7 Do you consider the development of the demand response (DR) market to be a priority for the energy sector?

An effective mechanism to make demand response available to multiple buyers and reward those providing demand flexibility is a priority. This is as there is considerable overseas evidence that demand response (DR) has material value across a stack of applications that enhance the use of renewables and/ or reduce costs of network infrastructure, and whilst the NZ market has differences, those drivers are also important here (see 8.8). Work to properly enable DR is urgent so that we can appropriately inform and shape the imminent mega wave of investment in DERs, accelerate that investment by showing the value available to flexible resources and avoid unnecessary investment in other infrastructure. However, creating a centralised DR market may not be the best way to optimise DRs, rather real world action and experimentation is needed to better understand the dynamics of DRs and different actors in the DR value chain before we jump to designing a solution.

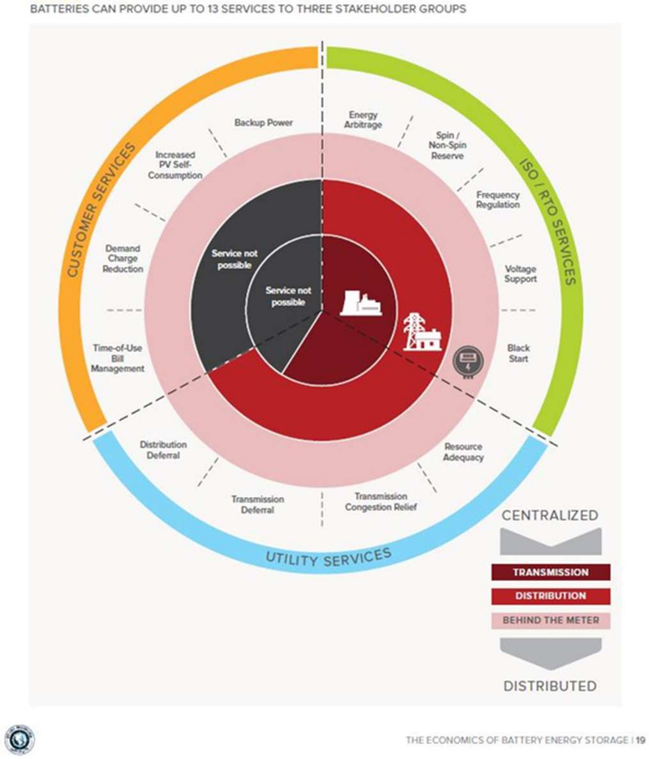
Work is urgent as:

a. we are embarking on a mega-wave of investment in DERs and need 1. decisions to be made and 2. habits/ behaviours to be formed, that will enable investments in the assets and behaviours to deliver flexibility (and so the climate opportunities DR offers). For example:
    - Someone investing in an electric hot water, cooling or heating solution today will see the most energy efficient option is a heat pump. However, in a world where DR has considerable value (see 8.8), then electrical efficiency may be less valuable than the ability to change when energy is used to use more clean renewables and avoid peaks (reducing CO_2e; accessing cheaper, clean power). Storage, radiant or connected heat pump heating that can heat well insulated homes making them healthier when it is sunny or windy could shift more demand from peaks/ fossil fueled periods than the most electrically efficient dumb option – but we need to ensure value flows to energy users to influence these investments;
    - Today the industry is striving to establish a new habit of night charging for electric vehicles (as currently that both suits networks by avoiding peak times and retailers by generally charging at lower wholesale prices). As intermittent renewables become more dominant in our system, there will increasingly be times when there is so much wind and solar that prices will be very low and 100% clean generators are backed off[1]. The habit (and charging infrastructure) we need then for EV owners is

[1] Even in the ICCC Business As Usual scenario wind curtailment is forecast. To chase the aspirational 2035 100% renewables goal we can expect far more free, clean electricity to be curtailed.

one that supports flexible charging i.e. vehicles available to charge during the day when we have an excess of clean energy. Consumer habits are notoriously hard to change once established, so we need to establish the mechanisms now to convey value for flexible demand.

b. A significant contributor to the DR value stack is electricity networks[2]. Flexible demand can defer the need for network growth investment by reducing peaks, reduce the extent or duration of outages when combined with network automation schemes (reducing SAIDI penalties or increasing rewards) and enabling more renewables to be integrated efficiently. Now is the time for New Zealand to establish a holistic view of the value of DERs and enable accessible DR as 1. Electricity Distribution Businesses (EDBs) collectively have a multi-billion $ re-investment programme over the coming years some of which could be deferred if DR can be made available, and 2. EDBs have set their own goal of experimenting with non wires alternatives over the next two years[3]. As it is the case that investment in some DERs (or the enabling of flexibility on them) makes most sense when you can access multiple value streams[4], then it is urgent that DER investors begin to understand the full opportunity – and not just the value to EDBs – so they make these desirable investments and offer assets at an appropriate marginal price.



If we do not act quickly to establish the mechanisms to connect flexibility demand (and payments) to flexibility suppliers then we can expect considerable investments in DERs that are not flexible – missing opportunities to use more renewables – and risk considerable reinvestment in 40+ year assets to meet needs that might otherwise have been more efficiently met by DR.

A centralised DR market or "command and control" distributed system operator may not be the most appropriate or efficient mechanism to optimise DR:

This reflects the many different potential sources and applications of DR across different activities, temporal and spatial scales, magnitude, frequency of use/ availability, level of certainty, and different interactions with flexibility sellers' operations, lives and preferences. Whilst a market is

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[2] https://www.ena.org.nz/dmsdocument/483

[3] ENA Network Transformation Roadmap (Figure 9, p22) states EDBs will introduce contestable programmes for network support over the next 2 years and operationalise over 2-5 years.

[4] For example see The Economics Of Battery Energy Storage, Rocky Mountain Institute

effective at uncovering price and providing transparency, in this new and highly emergent field a centralised market is likely to restrict innovation, experimentation and ultimately the available resources. There are already multiple players innovating in this area including aggregators (ENEL), network operators (Transpower, Vector), retailers (Contact Energy), and technology platform providers (emhTrade), and integrated solution providers (Sonnen) so the challenge may not be creating a market that competes with them, but understanding what barriers they face to grow.

The urgent steps need to be understanding:

a. the barriers 1. to buyers accessing resources and 2. for those that have potential to invest in and provide flexibility doing so;
b. through real world experiments, iterations and deployments, the complex nature of the characteristics/ decision variables of different actors, needs and resources and therefore the nature of the market(s), system(s), product(s) or service(s) they need to interact with; and
c. the potential need, resource and value not just in the context of today but aspirational future scenarios.

8.8. Do you think that DR could help to manage existing or potential electricity sector issues?

Yes, DR can help manage existing and potential electricity sector issues. DR is particularly exciting as it offers the opportunity to simultaneously resolve the energy trilemma. Intelligently used it can deliver cleaner, cheaper and more resilient energy.

DR can access a material stack of value from its different applications (see Table 2[5]). DR will often use assets substantially invested in for other reasons (i.e. an EV for transport, HVAC for comfort or residential battery for solar self-use) so it provides an energy resource at a relatively low marginal cost and modelling has shown it economic in multiple markets[6][7]. DR may additionally use resources not otherwise impacting on valued by the asset owner such as reactive power to reduce peaks[8] and/ or improve power quality.

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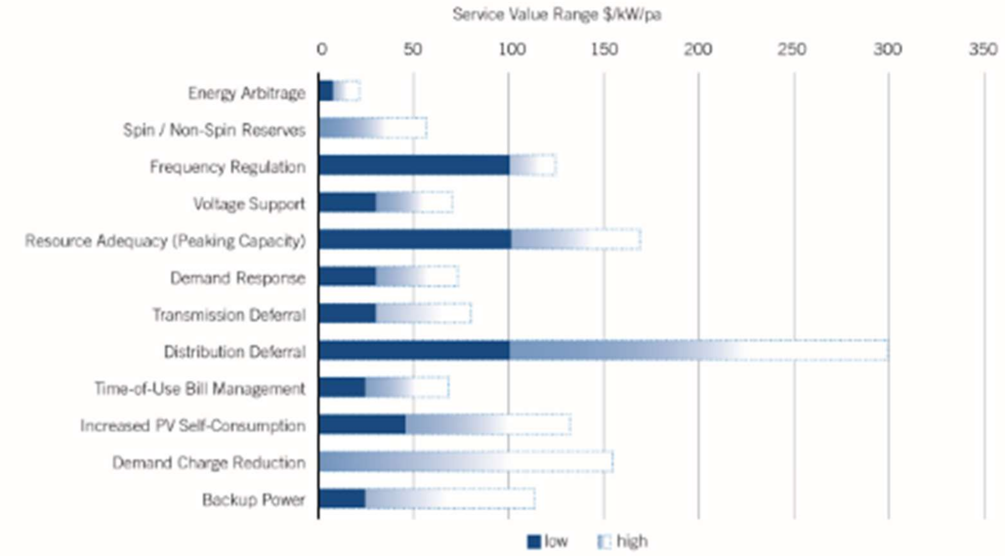
[5] Battery Storage In New Zealand, Transpower, 2017

[6] https://www.rmi.org/wp-content/uploads/2017/05/RMI_Document_Repository_Public-Reprts_RMI-TheEconomicsofDemandFlexibilityFullReport.pdf

[7] https://www.nic.org.uk/wp-content/uploads/Smart-Power.pdf

[8] UK Power Networks Leighton Buzzard trial reported a 19% reduced real energy use from batteries to reduce peaks when managing reactive power

Table 2
A SUMMARY OF POTENTIAL BATTERY VALUE FOR EACH SERVICE



Existing NZ aggregators (i.e. ENEL) show us DR can be available at the industrial and commercial level whilst new platforms (i.e. emhTrade) evidence consumers can be engaged, that engagement sustained and they will take action[9] (action which automation of EV management, smart heating, inverter management, connected homes and batteries with multiply several fold).

DR can help tackle the following current sector issues:

1. Reduce electricity network CAPEX for growth and security;
2. Reduce electricity network outages (and so VoLL);
3. Improve network power quality;
4. Reduce energy market volatility – tackling spikes and helping to underpin demand at times of high renewables such that better prices will underwrite more renewable investment.

DR can help tackle the following projected sector issues as we push toward the 100% target:

1. Increase the use of intermittent wind or solar power that will otherwise be curtailed reducing the overall cost of power, increasing the use of clean power and giving more options to hard pressed consumers to access power when it is cheaper;
2. Allow more behind the meter renewables to be installed with existing network capacity allowing a faster take up of behind the meter renewables taking advantage of consumer funds that may otherwise have gone on non-value adding consumption goods, and reducing network upgrade costs;
3. Tackle the perception that new investment is solar and wind will disadvantage the energy poor.

[9] EEA Conference, 2018 Enhancing Networks With The Sharing Economy, emhTrade.

DR can reduce electricity network growth CAPEX

Electricity Distribution Businesses (EDBs) are projecting a significant wave of investment to replace ageing assets, cater for current growth and meet the needs of the electrification of transport and heat – collectively their CAPEX programmes in coming years are dollar billions[10]. DR can reduce this by reducing the demand that drive this investment[11] - as hot water cylinder ripple control has long done for EDBs. Wellington Electricity estimates that with no DER management they would need to invest $430m across 100s of projects by 2035 to support electric vehicles, and can more than halve this investment with management[12]. Economically deferring this CAPEX will directly reduce the costs to customers.

DR can reduce electricity network outages

Transpower has already pioneered DR for this purpose. Powerco's Whangamata Energy Storage System (ESS) shows how non wire assets can reduce outages – but through owning a dedicated and exclusively used new network asset rather than 3rd party DR.

EDBs have invested extensively in loop automation schemes and increasing intelligent outage management systems. Together these enable EDBs to more quickly restore parts of their networks through back feeding areas that would otherwise have been impacted by an outage. Today EDBs are limited by the available capacity on the back-feeding assets which limits the number of customers restored. With DR, networks can reduce demand or access more energy on both the back-feed and targeted restored parts of the network. This will allow them to restore more customers, more quickly. The value of this can be significant (represented by VOLL), but the EDB can also benefit directly from incentives (or penalties) on outage performance.

DR can improve electricity network quality

Modern solar and battery inverters typically support four quadrant power control that can use reactive power to improve network power quality.

DR can reduce energy market volatility

DR will be one of the tools available to manage energy market volatility. Innovative retailers[13] customers evidences that consumers will change their energy use to access windows of significantly cheaper power or avoid times of very high power even with today's limited options of switching things on or off. Enabling DR to access the full range of value benefits it offers, will increase business and residential investments in automated assets that will participate in DR and so increase the amount of demand that will shift to moderate energy market prices. With nearly 1 in 4 solar

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[10] Powerco's CPP alone is circa $1.3bn and was submitted before material EV uptake is experienced. Powerco alone spent $149m in FY19 on renewals and growth a 30% increase on the year before (Powerco, Delivering On Our Promise, Numbers Report)

[11] https://www.ena.org.nz/dmsdocument/483

[12] https://www.ea.govt.nz/development/work-programme/evolving-tech-business/open-networks/event/open-networks-standards-workshop/?utm_source=Electricity+Authority+Subscribers&utm_campaign=b5034792cf-Market+Brief+-+3+December+2019&utm_medium=email&utm_term=0_9103cdb36a-b5034792cf-711994153

[13] For instance Flick, Electric Kiwi, Blueskin Energy Network and emhTrade's P2Power

installations now including batteries[14] and a growing pool of EVs, NZ will be adding MWs of DR capacity monthly.

Increase the use of intermittent wind or solar power that will otherwise be curtailed

Across the world high penetration of wind and solar are causing clean renewable energy to be curtailed at times[15]. In 2015 the UK paid wind generators GBP80m not to generate. New Zealand on introducing new solar inverter standards, set voltage limits to automatically curtail consumer owned solar if generation exceeds local demand and even the ICCC BAU scenario forsees wind curtailment. Quite simply the price path or wind and solar, alongside the reality that consumer (incl business) investment decisions for behind the meter generation look at consumer and not wholesale prices, means that a mega-wave of generation in these assets will take place and mean at times we have oversupply of 100% clean energy with a near zero marginal cost to generation. Whilst curtailment will at times reflect network constraints where only localised Dr can help and be moderated by shifting hydro to peak and, in time hydrogen generation, NZ will experience wasteful curtailment of cheap 100% green power only to use more expensive power or carbon later[16].

A deep pool of DR resources can access this curtailed or spilled power taking advantage of effectively free energy to reduce the overall cost of power, increase the use of clean power and give more options to hard pressed consumers to access power when it is cheaper

Allow more behind the meter renewables and electric vehicles to be installed with existing network capacity

The Green Grid project (EPECentre, University of Canterbury) shows that above certain levels of PV penetration additional network investment will be needed to convey generation to where there is demand (and so avoid curtailment of renewable generation on local networks). As noted above, encouraging an effective, deep pool of DR can avoid this investment. One network company showed how managing hot water cylinders across just 3 homes could instantaneously use 88% of the solar generated from one home[17].

Wellington Electricity estimates that with no DER management they would need to invest $430m across 100s of projects by 2035 to support electric vehicles, and can more than halve this investment with management[18].

Correct the perception that new investment in DERs (especially solar and wind) will disadvantage the energy poor

The above examples show that without DR, NZ faces the prospect of curtailing (throwing away) 100% clean, no marginal cost electricity, as well as investing more than is needed in network

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[14] Brendan Winitana, SEANZ annual conference, Wellington, 2019

[15] https://www.nic.org.uk/wp-content/uploads/Smart-Power.pdf

[16] NZ already curtails or spills energy. Localized over-voltage has caused consumer solar to be curtailed. Hydro is periodically spilled ie summer 2019/20 – albeit in the latter case a longer term energy "shifting" solution such as hydrogen or pumped hydro will make better use of the resource.

[17] Powerco, EEA Conference, 2015

[18] https://www.ea.govt.nz/development/work-programme/evolving-tech-business/open-networks/event/open-networks-standards-workshop/?utm_source=Electricity+Authority+Subscribers&utm_campaign=b5034792cf-Market+Brief+-+3+December+2019&utm_medium=email&utm_term=0_9103cdb36a-b5034792cf-711994153

infrastructure. In particular it is frequently held out that investment in rooftop solar with favour the wealthy (who will avoid costs) and disadvantage the poor who are left to pay for the system.

An alternative perspective with a dynamic system that rewards and efficiently uses DR could allow us to:

- Fund a massive investment in solar (rooftop) PV and energy storage (electric vehicles, smart connected controls for HVAC etc) from households and businesses that would otherwise have spent some of these dollars on non-productive consumer goods (or other features of property developments that attract tenants and consumers but are not productive capital goods). In effect NZ gets to fund productive new green generation without diverting any capital investment from productive activity;
- The inevitable "surplus" solar from this investment will flow in to the system and the prosumers will tend to accept relatively low electricity prices for this surplus (as they do not need to earn an investment rate of return);
- Consumer energy storage (electric vehicles, smart connected controls for HVAC etc) DR will be used to minimize curtailment of behind the meter PV, as well as utility PV and wind generation and/ or the need to invest more in networks. Consumers with a high price sensitivity (that will often include poorer consumers[19]) can be offered the opportunity to use this cheap power when available and rewarded. The reverse of this perspective is of course that we have added flexibility in how we charge our growing clean (EV) transport fleet to best use intermittent power. DERs will also be used to defer network growth and resilience investments.
- The growing volumes of energy conveyed across electricity networks from distributed generation to EVs etc, will help drive down the per kWh cost of delivering electricity, whilst the dynamic use of "free" electricity that would otherwise have been curtailed provides times of lower cost energy.

8.9 What are they key features of demand response markets? For instance, which features would enable load reduction or asset use optimisation across the energy system, or the uptake of distributed energy resources? 8.10 What types of demand response services should be enabled as a priority? Which services make sense for New Zealand?

A centralised DR market or "command and control" distributed system operator may not be the most appropriate or efficient mechanism to optimise DR.

This reflects the many different potential sources and applications of DR across different activities, temporal and spatial scales, magnitude, frequency of use/ availability, level of certainty, and different interactions with flexibility sellers' operations, lives and preferences.

A simple example of the variables at play. As a residential consumer I may be willing to have:

- *reactive power in my inverter managed anytime for a low payment, my hot water in a DR programme daily (subject to service levels I will not notice) for a modest payment,*
- *my heating dropped by 2 degrees periodically (which depending on the start time,*

[19] Today "energy poor" consumers when budget constrained have a basic choice to use power or not use power (and go cold). This contrasts for instance with their choice for food, where they will choose at times to buy cheaper food rather than simply forgo food. With a more dynamic energy system supported by effective DR (and appropriate material investments), electricity consumers will begin to get a choice to access cheaper power at certain times (but in a retail model without the full risk of dynamic pricing).

any pre-heating, outside temperature differential or current thermal envelope will deliver DR for a different period of time) for a more material payment; and/ or
- *my EV not charged or heating off occasionally for a high payment (and subject to certain notice and restoration service levels).*

To add complexity:

- *I may only want some of these interventions where they have a climate or social benefit whilst the financial rewards may need to be paid to me or a nominated 3rd party (i.e. charity) whereas my neighbor may just be triggered by savings/ rewards;*
- *different people will commit to any of these service levels for very different specified time durations (for instance I may lock in to a discounted EV lease that includes the "DR" package for the duration of a 3 year lease) but some DR buyers are looking for confidence that they can contract DR to defer an investment 5 or 10 years;*
- *I may not be able to commit my DR to an exclusive location, though it will typically be there (as I may move or my EV may be away from home or not charging then); and*
- *Of course different DR owners will want different levels of engagement or passive participation (i.e. most residential consumers do not want to be bothered with routine notices and advices or worry too much about who it is that needs the DR resource – just my preferences met).*

From a DR buyer perspective trying to defer a long term investment decision, or a gentailer deciding between DR and a financial hedge, many consumers will appear an unreliable source of DR. However, as with hot water ripple control, the diversity of different people's behaviours mean that a portfolio of many consumers' assets will prove reliable and predictable.

Whilst a market is effective at uncovering price and providing transparency, in this new and highly emergent field a centralised market risks restricting the innovation and experimentation needed to co-optimise the many "consumer side" variables with the value in the supply chain. Without this innovation we risk ultimately reducing the available flexible resources.

There are already multiple players innovating in this area including aggregators (ENEL), network operators (Transpower, Vector), retailers (Contact Energy), and technology platform/ service providers (emhTrade, Cortexo, Embryium), and integrated (single product) solution providers (Sonnen) so the challenge is understanding what barriers they face to grow – and then designing interventions (potentially including a market) that reduces these barriers.

Deciding the features of a market (or even if a formal market is appropriate) and what other interventions are needed, should be based on real world experience with innovation and experimentation engaging real business and residential DER asset owners and industry participants who can benefit from flexibility. The National New Energy Development Centre may provide a focal point for adding this layer of innovation and insight on to DER investments, engaging the industry to offer value for flexibility and identifying the real-world barriers to participation.

9.1 Should New Zealand be encouraging greater development of community energy projects?

Yes, New Zealand needs to urgently drive an affordable clean energy transformation adding further renewables to generation and ensuring that the electrification of transport and heat is powered by renewables. Change today is too slow. Community energy is a key lever to unleash a mega-wave of private investment (i.e. from outside the traditional utility sector) in Distributed Energy Resources to deliver that transition in tomorrow's dynamically engaged, clean, affordable and secure energy system.

- We need to do this urgently as the IPCC recommended drastic action over only 12 years in 2018 to stabilise global warming at 1.5 degree C above pre-industrial temperatures[20]. The human cost of inaction is immeasurable, whilst estimated global financial losses from climate change to 2100 could be between $4.2 and $43trn on a global stock of manageable assets of $143trn[21]. But as we head through 2020, we (the incumbent electricity industry, policy-setters and regulators) are far from delivering transformative action.
- Community energy investment is economically efficient as it will often be funded by private spending that generally will not otherwise have been invested in a productive asset or, by enabling community sharing, allow more efficient use of the renewables and reduce other avoidable behind the meter investment (see 9.3).
- Community energy has scale-able potential.
    - Survey after survey shows considerable latent demand by consumers and businesses to invest directly in their own generation and related energy solutions, whilst new entrants, like SolarCity, offer low upfront cost options clearing "commercial" barriers. These investments be far more economic when energy and resources are shared on a community basis and benefit from diversity of generation and flexible demand capacity (as with the wider electricity system).
    - Sector after sector are being revolutionised by the consumer drivers of the social and sharing economies. With the right policy and regulatory settings, and the re-alignment of our electricity system from one currently optimised to the delivery of centralised generation to (relatively "dumb") consumers to one optimised for the future DERs, we can unleash social and sharing economy innovation and energy in electricity too.
- Incidentally, community energy can also drive security of supply by 1. delivering distributed generation, storage and demand flexibility that intelligently integrated to networks provides local resilience (i.e. for storms, earthquakes etc) and 2. by supporting resources that encourage EVs to reduce reliance on fuel imports.

The key question is not should government encourage community energy but, recognising a massive wave of behind the meter DER investment is likely (as consumers look at retail prices), what sort of market, network pricing/ access and commercial structures allows our community to most efficiently locate and use that consumer led investment? In this context, better enabling community energy innovation is a must so that we can discover and build this future energy system.

9.2 What types of community energy projects are most relevant in the New Zealand context?

"Community energy" provides a blank canvass for local, business, social, Maori or other groupings (with or without the incumbent supply chain) to define our future dynamically engaged DER based energy system. As such the nature of projects will be diverse, entail significant innovation and experimentation and can be expected to evolve as we learn.

[20] Special Report of the Intergovernmental Panel on Climate Change (IPCC) on Global Warming 1.5°C, 2018.
[21] The G20 Financial Security Board led Taskforce for Climate-related Financial Disclosures (TCFD) and the World Economic Forum How To Set Up Effective Climate Governance On Corporate Boards (Guiding principles and questions), 2019.

Policy and interventions should not therefore focus on which *types* of community energy projects are most relevant in New Zealand, rather what are the most valuable characteristics or attributes of projects and appropriate measures of success or outcomes (i.e. delivering in the long-term, cleaner, more affordable, community relevant electricity choices).

It is tempting to "paternalistically" look at the NZ big energy picture[22] to dictate that the best types of community energy projects are those that directly tackle our most immediate opportunities or urgent problems. However, the best innovation will come from enabling the many (community energy) actors that want to tackle the many different "problems" they see in our current system and emergent future system to do so[23].

Transformative change will be accelerated if we create the right environment for these many innovators to experiment and drive change, rather than narrow innovation to some chosen "winner" types of projects.

That said, New Zealand has some unique advantages and cultural needs (such as a highly digitised electricity system due to high smart meter penetration and te ao Māori (Māori world) perspectives) that can be reflected by a focus on the characteristics and attributes of community projects.

9.3 What are the key benefits and downsides/risks of a focus on community energy?

The key benefits of a focus on community energy (considering the urgency of the transition that is needed and need to unleash funds, innovation and action) are:

- Community energy investment is economically efficient as it will often be funded by private spending that generally will not otherwise have been invested in a productive asset or, by enabling community sharing, allow more efficient use of the renewables and shared community use will reduce other avoidable behind the meter investment.
    - When a private home invests in solar and battery they typically will displace spend on a long lasting consumable i.e. BMW, boat, kitchen; we displace consumption with a productive clean energy asset whilst still delivering at least the same level of consumer utility (happiness).
    - Often a non-energy commercial business investing in solar/ battery/ DERs will displace some other low productivity investment such as customer parking landscaping or attractive features in a shopping centre that were designed to attract customers/ staff or promote CSR outcomes, but now will be invested in a productive asset.
    - Solar and wind is intermittent generation. As we increase solar and wind investment it is important to change when and where power is used to reflect this. Without enabling community "sharing" of differing capacities to generate or change when electricity is consumed (or simply leveraging the diversity of demand), those investing in behind the meter energy assets need to focus on maximising their self use of that energy (due to the relative financial losses experienced when exporting).

[22] i.e. 1. current high renewables so desire to focus on the big hits to transport and process heat; 2. desirability of renewables that directly meet the winter peak and assist with the periodic dry winter.

[23] See under 8.8 section above "Correct the perception that new investment in DERs (especially solar and wind) will disadvantage the energy poor" for an alternative scenario perspective on the emerging future problems innovators may focus on to drive better outcomes.

This leads to the need for each customer to make further investments to store energy or change when it is used. This is inefficient and avoidable if energy is shared across a community. A pilot by one network company, for instance, showed 88% of solar from one house could be instantaneously consumer by two other homes substantially by managing hot water cylinders[24].
    - The report observes that smaller scale community energy solutions are less cost effective than utility scale, and that is true on a generation per dollar spent. However as noted above, when private capital is redirected from consumption (and consumers still get the same utility/ well-being), we are not comparing apples with apples. Mass public transport systems are arguably a more cost effective environmental solution to mass transport, but we do not discourage private car ownership as being economically less efficient.
- Community energy offers the opportunity to engage millions of actors, individual investments and DERs in driving an energy transition. It is commonly maintained that it is difficult to engage consumers in energy and even more challenging to change their energy behaviours (that are constrained by habits, social norms, knowledge and the material environment)[25].
    - Stimulating a community energy focus encourages numerous levers to engage people in the energy transition (including social and sharing economy, local peer ambassadors and knowledge sharing, peer to peer energy "markets or solutions", better access to demand side assets that can be managed)[26].
    - Engaging people in solar, for instance, drives far more energy change than simply the solar generation - one retailer reported that their consumers with solar panels consumer 16% less electricity at winter peaks than their other customers[27].
    - There is a high probability that significant innovation will come from enabling actors that are not part of the incumbent mainstream electricity sector.
        - There is rational inertia that drives incremental regulatory change and business investment, based in deep sector expertise and networks that drive incumbents to exploit technology, social and digital mega shifts to do better what we do today.
        - Proven decision models (used by incumbents) drive discrete, high confidence, incremental changes within the world we are used to operate.
        - Our peers reinforce our silo thinking (or lack of "cognitive diversity").
        - Industrial transition and innovation theories show how existing regimes of incumbent value chains and regulators can slow or miss change until it is too late to adapt[28].
        - Incumbents too often discount or ignore the uncertain opportunities in adjacent domains or possible from substantive change in market and business models.

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[24] Which potentially can be done using existing infrastructure.
[25] Energy Cultures, CSAFE, University of Otago.
[26] For insights on levers see International Energy Association, Task 24 working papers.
[27] Technology provider emhTrade (platform provider for peer to peer P2Power and Blueskin Energy Network) at the EEA conference, 2017.
[28] For instance, Regime Destabilisation As The Flipside of Energy Transitions: Lessons from the history of the British coal industry (1913-1997) B Turnheim, F Geels, Energy Policy, 2012 or The Innovators Dilemna, Clayton Christensen.

    - A Community Energy focus will enable new actors and innovators bring insights and cognitive diversity to the energy transition.
- Incidentally community energy can also drive security of supply by:
    - Delivering distributed generation, storage and demand flexibility that intelligently integrated to networks provides local resilience (i.e. for storms, earthquakes etc, see response 8.8).
    - By supporting resources that encourage EVs which will reduce reliance on fuel imports.

The report notes that community engagement can slow schemes and the transition. This is a real risk, but it should be considered in the context that "community energy" can have a very broad definition that can include businesses and developers driving solutions – and doing so on commercial timelines. In addition, current slow progress by communities reflects the absence of precedents and normalised solutions (as discussed in Barriers below).

The report notes the commonly cited downside or risk of community energy schemes that they may allow some to avoid network costs and leave others to pick up the bill. This risk should be considered but not overstated as:

- Community energy schemes may well use the local network if appropriate pricing is in place. In this event it may increase volumes using the network (reducing per kWh costs on average), compared to the alternative of forcing network customers adding solar and other DERs to focus on maximising their self-consumption (and so reduce network use even more) to avoid losses on export.
- By focusing on community and shared solutions and use of renewables, we can allow the energy poor to access cheap, green electricity (if they can adapt when they use power to times of high wind and/ or solar), something the current industry has not offered at scale.
- As noted elsewhere a higher penetration of DERs connected to communities and networks in a truly dynamic system, can cut other system costs (so offsetting the impact of reduced volumes).

9.4 Have we accurately identified the barriers to community energy proposals? Are there other barriers to community energy not stated here?

The barriers identified are accurate. However some key considerations are only briefly detailed in this section of the report and have been expanded on below. These are 1. the nature of the critical role played by network pricing and network's desire to engage with community energy resources; 2. the role of networks as incumbent owners of the assets connecting communities and 3. the sector coupling between community energy, building developments, property and the Internet of Things that means pioneers here are typically tackling many barriers/ problems well beyond the immediate energy remit.

1. **The role of electricity network pricing as a barrier**

The report correctly identifies the significance of network pricing in constraining investment and profitability in Community Energy (and perversely driving a focus on behind the meter self-consumption over efficient community action).

What drives the price difference between exported electricity and retail electricity

This price difference is not retailer profiteering. Retail electricity prices include energy market (including hedge), electricity network, metering, regulatory and retail service costs/ margins and taxes. Energy market cost generally is the only cost *incurred by* the retailer directly reduced by buying solar exported electricity so this sets the price the retailer will pay. (There is evidence that solar conscious consumers and communities can reduce other costs – but that is a separate subject).

Regardless of where an unit of electricity was generated, or whether the retailer has needed it conveyed the length of the country or metres down a street, the retailer incurs the same electricity network costs.

A local bus ticket or an inter-city airfare

Consumers – especially those seeking to realise the benefits of an energy community - expect that their locally generated electricity should be conveyed for a lot less cost than electricity that has to come from 100s of miles away. They expect to pay just a local bus ticket, not an inter-city airfare as:

1. they are only using a fraction of the network assets (physically none of the Medium Voltage that can be half of a local network companies assets and none of the transmission assets);

2. in much of New Zealand they are using these assets at a “quiet” time (i.e. not the winter peak they are sized for) so are not driving new asset investment. In the urban areas where summer AC loads may drive the peak, solar generation could even reduce network investment.

In defence of every kWh delivered incurring the same cost regardless of assets used or distance travelled, networks explain that:

1. the low voltage network (and even your house network) does not exist in isolation from the rest of the electricity grid. Voltage and frequency need to be managed. Contributions need to be made for outage management, inspections and maintenance that are not related to the major cost driver of investing for peak time capacity;

2. consumers installing solar will use less kWh than in the past, so networks need to recover this revenue somewhere and the simple charging model is one way of doing this (though perversely by driving self-use of PV it may further reduce network volumes);

3. new pricing is coming, as the report notes. Witness the transition to Time-Of-Use that with lower middle of the day conveyancing costs may make consumers more neutral between import and export at that time of day (but may further drives effort to self-consume and export to networks less at the more expensive peak when the local generation may be of most use). However it has taken years to even deliver modest change (TOU pricing) in a stable environment.

Changing network pricing is difficult. Networks are regulated businesses that need to operate within constraints. There are many winners and losers. Consumers may need new services to get the best outcomes. Networks cannot be assured of how retailers will package the pricing or innovate services. But sooner rather than later we need to move closer to a local bus ticket if we want to stop holding back consumers from investing in and sharing much needed renewable electricity.

The incumbent electricity value chain has also not yet adapted its services or offers for energy storage. Batteries at scale will deliver many benefits to multiple parties in the existing supply chain (improved power quality, peak reductions, and the ability to restore more of the network post outages). With widespread local generation and storage it may even be possible to use these distributed resources to mitigate the impact of outages and defer renewal investments. Energy community investment in storage (and PV) will be depressed until people understand and share in these value streams. Even solar PV only smart inverters can offer power quality enhancing capabilities to networks.[29] We note the progress made and intent *indicated* by the ENA's Network Transformation Roadmap project and exciting (isolated) projects, but also that the smart network and interaction with DERs dialogue has been on-going since about 2010 (with a smart network ENA working group responding to Section 54Q of the Commerce Act).

2. ***The role of electricity networks as the incumbents (potentially) connecting energy communities***

The result of the network pricing and, to date, limited engagement with and payment for services that DERs owned by communities is a critical constraint for energy communities. As the networks are the monopoly connection point, investors in DERs have no option but to focus on self-consumption and minimising network charges.

So energy communities today need to be created *behind the meter* with physically co-located communities i.e. embedded or secondary networks, to get the best financial return[30]. This is as otherwise retail pricing takes a significant proportion of the underlying savings inherent in local generation.

Few communities would know how, or may even be able to, acquire from the local network company the low voltage network connecting them so it is difficult for existing communities to create a behind the meter network. The hot spots of interest today therefore are new developments (or existing properties with multiple tenants behind a single meter). Here the gains from on-site solar generated power and investment or action to shift demand can be shared by the community/ investor. The benefits are not eroded by the local electricity distribution company's low voltage, medium voltage or "pass through" Transpower costs.

Creating a behind the meter energy community enhances the direct financial return from the solar PV/ DER investment and facilitates further benefits – such as making the development more desirable to sustainability focused tenants/ buyers.

These energy communities are now gaining momentum but the physical need for green field sites massively limits who can act and when.

3. ***The barriers of sector coupling as community energy pioneers change in building development, property and internet of things technology***

To drive a successful energy community, pioneers need to navigate their way through a set of complex challenges extending far beyond "energy assets" and regulation.

- new developers need to pioneer new legal, marketing, building management and other constructs to realise and share the benefits of the community;

[29] It is worth noting that these issues are complex and take time to work through. However the industry efficiently and quickly adapted standards several years ago to use the capabilities of smart inverters to switch off customer generation in the event of over-voltage (i.e. to benefit their business model), but has not progressed changes that deliver new benefits to the consumer (or mitigate the risk of their systems being switched off) with the same expediency.
[30] Communities do exist across local networks and our experience with them shows a significant part of the value of their proposition is lost in the network charge, constraining growth and profitability.

- sponsors need to find and educate participants and future tenants, as well as secure sufficient certainty of the purchase of power given the long term investment[31];
- the pioneers need to drive and socialise the availability and/ or standardisation of:

  - software solutions helping optimise the use of solar and associated services (i.e. billing, management of assets such as space/ water heating and cooling levels and times or EV charge schedules);
  - legals and commercial contracts;
  - property design (including materials and fittings ie AC, space and water heating, appliances, storage) to enable solar energy to be best used and electricity peaks to be avoided (i.e. energy efficiency includes managing when and where energy is used). The need to invest to change when and where power is used, also slows take up in existing buildings that need retro-fitting to this new paradigm;
  - techniques that enable and reward the behaviour change underpinning use of more local renewables.

Frequently pioneers of energy communities are also driving other ambitious change such as introducing shared community buildings, gardens or electric vehicle infrastructure that add to the complexity and duration of projects, and may also introduce additional planning or stakeholder engagement requirements.

There are also exciting energy communities exceptions that “cross the meter”. These are where people heavily value other benefits of local generation and community action – such as sustainable power, progressing resilience, or spending locally – and our experience working with them is they simply accept a chunk of value is “lost” to the incumbent electricity industry and it is the price of showing leadership.

New Zealand also arguably has some specific challenges. For instance, many property sub-divisions are developed by relatively small developers (compared to the large estate developers of the UK), and with many different house designs (compared to the more standardised options of Bavaria). Relatively poor insulation, piecemeal heating solutions and old electrical appliances limit the ability to adopt some solutions important to managing when power is used. But it also has some great advantages including the near universal presence of half hour meters (so long as the data is accessible to innovators) and an Electricity Authority exploring change (including data accessibility and the potential to enable a separate retailer to buy generation from the one supplying electricity to a home).

9.5 Which barriers do you consider most significant?

These are 1. the nature of the critical role played by network pricing and network’s desire to engage with community energy resources; 2. the role of networks as incumbent owners of the assets connecting communities and 3. the sector coupling between community energy, building developments, property and the Internet of Things that means pioneers here are typically tackling many barriers/ problems well beyond the immediate energy remit.

The reasons are further set out in 9.4 above.

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[31] This is not simple locking up a long term contract. In some markets for instance credit insurance is also used to underpin a PPA.

9.6 Are the barriers noted above in relation to electricity market arrangements adequately covered by the scope of existing work across the Electricity Authority and electricity distributors?

No. We acknowledge the initiatives taken by the Electricity Authority and the personal commitment and vision of members of its team. However progress is not commensurate with the urgent speed and scale of transition the globe needs.

- For instance as noted in section 9.4 pricing reform and smart network engagement work with DERs has been ongoing for many years with little consumer-centric solution focus that is key to enabling community energy or DERs.
- Specifically with regard to the push for cost reflective pricing, price reform is very important and we recognise it must be grounded in what drives network costs. However many functionally competitive industries have pricing strategies, that whilst considering cost, also consider the value proposition they enable for their consumers and package pricing along with information and other services/ products that empower their consumers to achieve consumer-centric outcomes. The benefits of combining price incentives, information and technology in a packaged, enabling consumer solution has been widely and long recognised in electricity sector studies[32]. Vertical disintegration of the industry may make this hard, but it is not impossible – and it is the norm for other industries to optimise different parties in the supply chain behind the scenes from an integrated consumer proposition.
- We acknowledge also that the EA has limited influence on some actors and that regulatory incentives and power is split with the Commerce Commission who set the overall incentives on and rewards for electricity networks to act. Relatively small R&D allowances (in an industry where the regulatory revenue model means super-returns are unlikely to be realised from innovation), no strong incentives to encourage action on 54Q of the Commerce Act and regulatory settings focused on ensuring long term on-going investment are all likely to influence the response rate, direction and magnitude of the regulated sector and so efficiency of the "electricity market".

9.7 What do you see as the pros and cons of a clear government position on community energy, and government support for pilot community energy projects?

A clear policy on community energy will bring focus on enabling non traditional energy sector players innovate and be integrated with the current electricity system. The signal to the Commerce Commission, EA, EECA, policy and regulatory actors in adjacent sectors (i.e. building, planning, transport) and the electricity sector itself will be an enabler for identifying and tackling barriers or attracting appropriate support. It will give momentum, confidence and some increased certainty to innovators capable of releasing and shaping the mega wave of private investment in DERs to be ones of community and social benefit (rather than an optimised behind the meter solution).

Support for specific projects (structured well) will help establish the legal, financial, credit and market management frameworks needed to accelerate other projects. They will overcome knowledge barriers as to the benefits, technologies and process. By bringing together multiple participants (each bringing their own part of the solution), it can help each accelerate their own

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[32] See the Studies of Studies: The potential of smart meter enabled programmes to increase energy and systems efficiency: a mass pilots comparison" from the Euopean VaasaETT Think Tank, published 2011 or "Understanding Electric Utility Customers – Summary Report", subtitled "What We Know and What We Need To Know", from the Electronic Power Research Institute (EPRI), published October 2012. Numerous vendors have developed products to assist networks and retailers to deliver packaged solutions (i.e. Opower, Tendril, Cortexo, emhTrade).

programmes, product developments and capability maturity. This will help us more quickly and cost effectively deliver the community energy ecosystem and position our innovators with export opportunities.

The key risks lie in:

1. How to pick the right projects to achieve the above goals and fit those projects in to strategically driving a coherent system transition (rather than tactically just funding a set of good ideas). This needs to be done without distorting the market and in a way that cascades the insights, tools and processes to the followers.
2. Managing the inevitable failures along the way to doing something novel so that we learn, iterate and develop (or close initiatives if this sensibly is the right answer.
3. How to deliver this without distracting critical resource from NZs other big win opportunities.

9.8 Any there any other options you can suggest that would support further development of community energy initiatives?

Within the options we suggest that the following is additionally considered.

Option 9.1 Policy

Policy consideration and direction should extend beyond the formal energy sector to consider the impact of sector coupling. In particular community energy development is closely linked to

1. urban planning and building regulations (i.e. community housing and tiny homes will often address energy and other community solutions) whilst building standards or rental home upgrades may dictate energy use options, and

2. electric vehicles (i.e. how and where you can dynamically charge – or not charge – to optimise renewables and community energy).

Within the energy sector, the combined impact of policy, ComCom regulation and EA regulation deserves further focus to accelerate the pace at which barriers are tackled. The Policy focus may be sufficient for this.

Option 9.2 Market Access And Regulatory Barriers

As noted above, whilst acknowledging the breadth and progress of recent EA and ENA initiatives, the pace of change (of at least publicly discussed projects) does not reflect the urgency of the IPCC advice and public discourse.

A revised focus on the combined impact of policy, ComCom direction/ regulation and EA direction/ regulation deserves further focus to accelerate the pace at which barriers are tackled and that in scoping, for instance, price reform, it is done in a manner akin to what we see in contestable markets (i.e. pricing, information and solutions are packaged to enable both late majority/ laggard customers with traditional needs and early adopter/ majority customers with emergent needs).

One issue not discussed in the paper, but debated overseas, is that if communities really want to drive a community energy solution on an existing network, but that the monopoly network asset owner does not offer pricing or a commercial structure that realistically enables this, then the community has the right to buy (or lease) the relevant network assets. As noted in 9.4 under current network pricing, there is an argument that community energy solutions are only possible at a greenfield site (or one that is already behind the meter) which creates a massive brake to the take up. The right to buy/ lease would create a backstop that creates a contestable situation in which networks will make their future decisions. This would be complex area but an understanding of overseas debate and precedents would be of value (recognising also that many of our networks are Trust owned so in principal managed by the community already).

Another powerful back stop would be exceptional (time bound?) rights for the Minister to intervene directly.

Option 9.3 Pilots

With respect to pilots the agenda should consider

- How this fits with the investment in the National New Energy Development Centre and its goals/ early capability building.
- The opportunity to use government owned assets and facilities to further government and community energy goals/ accelerate pilots. These may include natural sites for physical communities such as Housing NZ properties, military bases or hospital and education sites that are multi-tenanted as well as specific distributed energy resources such as the EV car fleet or space/ water heating/ cooling in buildings.

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