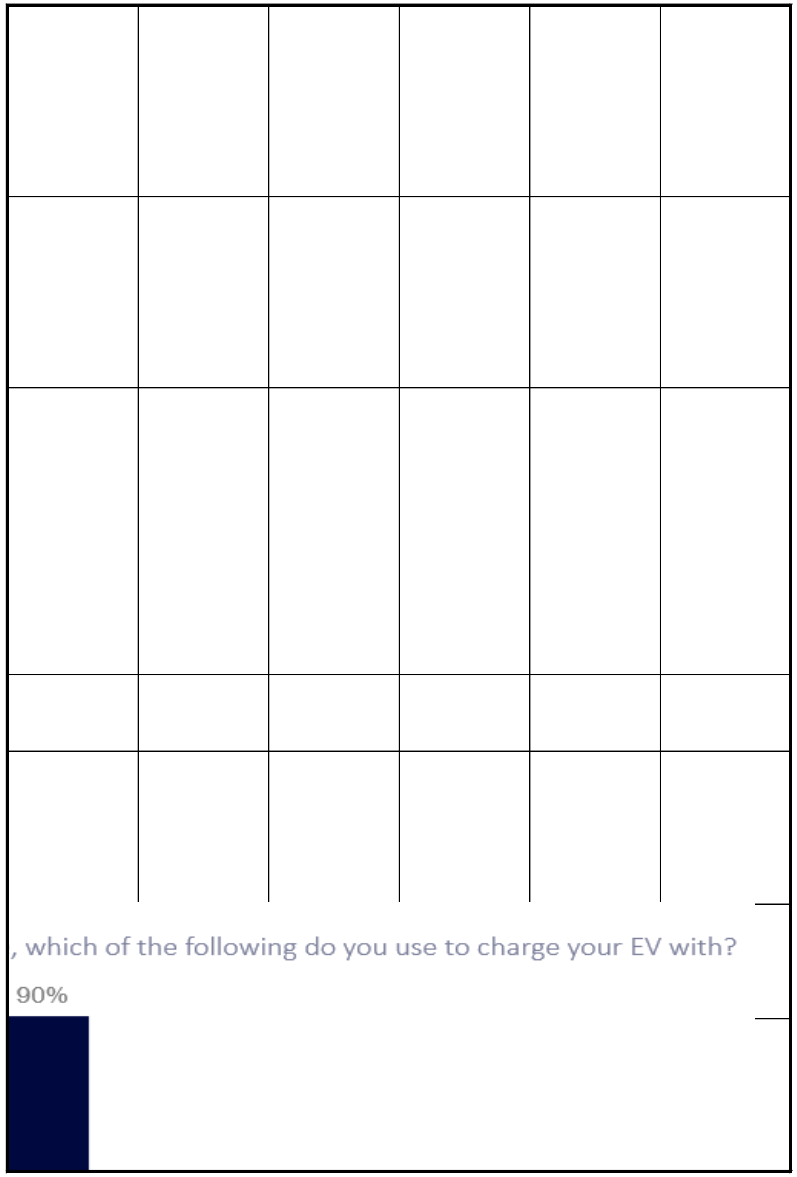
ESIG Webinar: EV Smart Charging Trial	
Question	**Answer**
Do Vector expect to use a more market-based appraoch in the future so charging can be optimised against other value streams and how might this impact results? (edited)	We definitely see a role for market-based signals to ensure that the highest value case for flexibility is encouraged. That being said, this is something that requires some focus as (at least in the New Zealand context) the market and industry set up and rules don't naturally allow for this 'whole-of-system' value to be exposed or obtained. There is a great discussion on this in the UK work "Re-costing energy' http://www.challenging-ideas.com/wp-content/uploads/2021/01/ReCosting-Energy-Powering-for-the-Future.pdf
Customer satisfaction won't be impacted if they're charging outside of the managed control period anyway. Should you test managing charging from 9pm-12pm?	Based on the learnings from the 'observe' and 'test' periods within the trial, smart charging was active from 5pm to midnight so it did affect customers that charged after 9pm.
How consistently did customers belong to a single charging behavior group? And more broadly, how confident is Vector on the persistence of this behavior?	The behaviour was fairly consistent and persistent across the whole trial, apart from the Covid-19 lockdown periods which saw significant reduction in driving. In the future, we are sure that behaviour will continue to evolve as EV adoptions move from early-adopter to mass market stage. Data and visibility is critical to keep monitoring and ensure we can pro-actively plan the network to meet our customer's needs.
The uncontrolled energy consumption is much less in the dynamic case, but the max network capacity used is pretty much the same. Isn't that the determinant?	You must be referring to the final evaluation of the algorithms, which shows the accumulated breaches over a 9-week period. We know that the dynamic breach, that you are referring to, is due to the use of EV on-board timers and the dynamic algorithm could only react to, but not anticipate those spikes. Fine-tuning the algorithm would get rid of this problem.
Were there cases of EVs supplying the evening household consumption using the vehicle-to-home capability that some EVs feature?	No. We think this technology will play some role in the future but our experience to date hasn't gone beyond some very targeted exploratory testing.
Do you think central control of charging will be essential at very high penetrations ? Or will de-centralised control be able to manage network impacts ?	We do not think that there is a binary answer to this question and that the future will be a combination of both. To this extent our Distributed energy resources management system (DERMS) has been designed with a system-of-systems architecture so that both directly ineracts with DERs and in-directly via 3rd party/aggregator

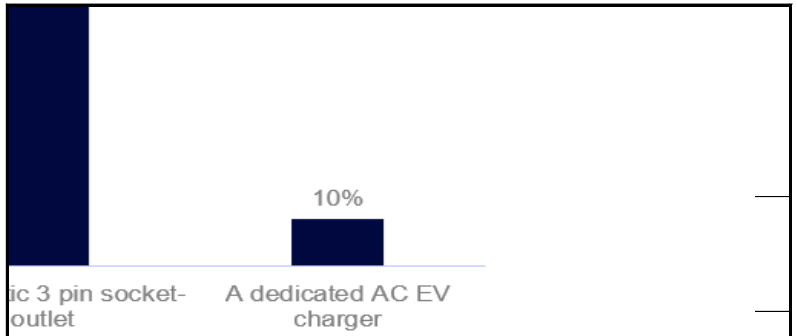
Did you also try to inject the energy of the batteries back to the grid in form of ancillary services to balance the grid	Not for this trial. In NZ there are really only a few ancillary services that allow, or are structured to allow demand-side participation - although this is currently being worked on by industry and government. FYI we use our hot water controllable load for the under frequency reserve market and there has been talk within the industry of how aggregators could participate in this and voltage support.
Also do we need to look at Distribution Transformer loadings as existing cycling I believe allows them to 'relax' Off Peak?!!	Yes you are right. A very long evening would mean that the current transformer ratings would need to be reduced. As discussed, gaining LV visibility is key for us at this stage and we have only just reached agreement within the industry to obtain regular flows of houshold half hour data. We have a project in-flight to allow us to build an accurate picture of distribution transformer load profiles.
The HWLC info is interesting, especially in the context of this webinar. What technology dominates? Are you rolling out grid-integrated heat pump technology?	The existing technology is legacy ripple technology, however we have tested a modern Smart Hot Water system and are currently working through the investment plan to update this for future needs. As an aside, we are very interested in leveraging the capabilities of the advanced meters that are on our network especially since they are receiving communications upgrades and will allow greater flexibility and bandwidth in comms. On your second question: No, we are not currently pursuing grid-integrated heat pump technology.
What is the typical peak per customer load? And, what is the LV system able to deliver per customer? Thx	A typical ADMD for a residential customer is 2.5kW. The LV network is still built to fit and forget. We are now harnessing smart meter data to gain LV visibility.
Hi, re extropolation. What is the basis of believing that future customers (say in 20 years) will behave like these customers?	As mentioned in the presentation because we are still at the early adopter stage these types of programmes need to continually be refreshed. What we do know is that consumer values and behaviours will continue to change over time (as will technology) so we need continully be looking forward.
Do you know how many EV customers use a 7kW charger as opposed to a 3 pin plug in Vector or NZ?	As part of our trial we learnt that 90% of EV owners use the domestic 3 pin socket outlet to charge their EV with. We don't have data for the whole Vector network nor New Zealand.
Would car manufacturers be open to include a default start charge time setting that is randomized for individual car between a set time period at night?	We see that the car OEMs are going to be an important part of the equation especially as transportation and energy industries become more intertwined. This will also extend to large fleet owners / managers, especially if we move to more of a subcription model for car ownership.

Do you plan to look at shifting charging to the day to take advantage of solar?How would you approach shifting load when customers use shared public chargers?	At this stage solar uptake in NZ is low so it is not a priortiy. However our trialists that have their own solar systems have raised this as something they desire to increase self-consumption (spread between electricity price and solar buyback is high in NZ). We don't currently have a strategy regarding load shifting of public chargers, however this is something we are considering for future EV research
Is there a paper available that summarizes the pre-research and trial results?	We will aim to publish a report of the trial, but currently do not have a data. The best way to ensure you get our info is to monitor website or follow Vector on LinkedIn. We will also ask ESIG to share it with its members.
Time or Simple tariff price switching always gives spikes. Needs Auto bartering with the Customer systems?	Optimisation as to highest value use is definately going to be something that will need to be considered by the industry. We are aware of some programmes in Australia and New Zealand that have started to do this - essentially an aggregator provides the consumer with a fixed energy price but installs solar and battery. The aggregator then manages the optimisation of energy and balances the in/out flow of energy to minimise cost. New Zealand is currently looking at introducing multi-trader relationships (i.e. the ability for a consumer to contract with more than one retailer and minimise price by jumping between them). This may mean that more consumers look to do this themselves as well.
So I think we need a hierachical management mechanism from Customer through Distributor/Supplier. DER Management to control Local and Central impact?	We do not think that there is a binary answer to this question and that the future will be a combination of both. To this extent our Distributed energy resources management system (DERMS)has been designed with a system-of-systems architecture so that both directly interacts with DERs and in-directly via 3rd party/aggregator
Do you anticipate any further investments in public transportation? Can you re-explain how you forecasted future EV ownership?	On public transportation, we are collaborating with the local Auckland transport authority to electrify bus depots in a cost-efficient way by providing a flexible connection agreement via DERMS. At the same time, we are also working them them to integrate electric ferry charging into the network. On your second quesiton, future EV ownership is still very much an unknown at this stage as there are so many things that could impact it - e.g. government intervention, consumer attitudes to climate change, availability and cost of EVs, cost of ICE vehicles etc. While the total numbers of EVs are hard to predict (we have our own forecasts and test these against the other available forecasts for NZ) we have experimented with using a behavioural model to understand where EV's would come on the network. This is based on behavioural research and info we have regarding the psychographics of current owners. Whilst helpful it is definetly not a silver bullet.
The load profile has a big step @ 9pm (21:00). How would that effect the system esp. generation?	Vector does not participate in generation, which is managed by other market structures. Our load diversity curve shows that EVs could contribute about 1kW at system level. Our biggest concern is at the ends of LV networks, which will be more strongly affected

could you explain more on the exponential distribution of the number of chargers/power relation?	When there is only one charger, it will always add the maximum value of that charger to household peak demand. With increasing numbers of chargers, it becomes statistically less and less likely that they will all charge at the same time, hence the average contribution of each charger reduces. This paper is a good overview of the concept https://core.ac.uk/download/pdf/77009569.pdf
could you talk what were the impacts on the networks where EVs connected to charge in different optimization approaches, with the meter devices you were using?	We are not quite sure we understood the question, we are happy to take a separate note on this.
Re off-peak rate used for EV charging, was this a general off-peak rate or a specific EV tariff?	In reality all the prices we have seen are just off peak pricing. There are a couple of tariffs that retailers have which say they are EV, but this is just marketing. The whole house load is charged at that rate and the timing matches the standard peak, off peak times.
Have you any analysis of the unmanaged charge behaviours of consumers without 7kW chargers (e.g. from your smart meter data or pre selection survey)?	Yes, we have some information from the pre-trial survey (e.g. prefered charging location (home, public, office), frequency). We will start looking at this separtely with smart meter data.
Have you looked at using EVs to load shift between different times of the day and will you also (later) do a V2G trial?	We have not specifically looked to move load to other times of the day at this stage. We have been experimenting with V2G technology and see that this could be an interesting tool in the future.
Do you know what % of your participants have solar PV onsite?	Among the 200 EV participants, there are about 10 solar PV trialists. Most of them live on an isolated island.

Q: When at home


, which of the following do you use to charge your EV with?
90%


10%
ic 3 pin socket-outlet
A dedicated AC EV charger