State of charge

Consultation paper on developing a short-term roadmap for the public electric vehicle charging network

EECA
TE TARI TIAKI PŪNGAO
ENERGY EFFICIENCY & CONSERVATION AUTHORITY

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Foreword

EECA is pleased to be leading the conversation on developing a public EV charging roadmap for New Zealand. The Government's ambition is for a rapid increase in the uptake and use of EVs in the next decade. This will be essential if we want to meet our emissions reduction targets and will require a comprehensive charging network.

To encourage this rapid increase and decarbonise the transport sector, the private sector needs some certainty around its infrastructure investment decisions, and New Zealanders need confidence that chargers will be available when they purchase an EV. Likewise, this roadmap will help inform the Government's investment decisions of what the rollout of the public charging network should look like over the next two to five years.

EECA has been at the forefront of supporting the rollout of the public charging infrastructure in this country, co-funding the majority of the public fast chargers on the network through the Low Emission Vehicle Contestable Fund.

Until recently, the provision of public EV charging infrastructure has largely stayed ahead of EV uptake, but with the increased emphasis on addressing climate change, this uptake is expected to accelerate. Regular consumer monitoring undertaken by EECA has consistently shown that perceived availability of public chargers is a key issue that makes people less likely to consider buying an EV.

This document identifies approaches that could work for New Zealand, and the types of data we will need to inform EECA programmes, such as the Low Emissions Transport Fund (LETF), and enable an outcome which will support the uptake of EVs in New Zealand.

We welcome your feedback and specific responses to the Consultation Questions summarised in Appendix A.

Once submission have been considered, a short-term roadmap for the public electric vehicle charging network will be finalised and available in April 2022.

Andrew Caseley
Chief Executive Officer

EECA TE TARI TIAKI PŪNGAO
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Submission process

The Energy Efficiency and Conservation Authority (EECA) seeks written submissions on the issues raised in this document by 5pm on 26 November 2021. Your submission may respond to any or all of these issues. Where possible, please include evidence to support your views, for example, references to independent research, facts and figures, or relevant examples.

Please include your contact details in your submission. You can make your submission:

- By sending your submission as a Microsoft Word document to: publicevcharger.roadmapconsultation@eeca.govt.nz.
- By mailing your submission to:

  Consultation: Public EV charger roadmap
  Evidence, Insights and Innovation
  Energy Efficiency and Conservation Authority
  PO Box 388, Wellington 6140

Please direct any questions that you have in relation to the submissions process to publicevcharger.roadmapconsultation@eeca.govt.nz.

1 Purpose of this consultation

The purpose of this document is to seek feedback from the public on proposed approaches for identifying locations of public fast EV charging infrastructure and how to prioritise those locations. This will enable EECA to develop a roadmap of the future roll-out of the public EV charging network. The roadmap will be used to inform the public and industry about how the Government (and EECA specifically) is planning to approach our investment in public EV charging infrastructure in the short-term (about five years) and improve cross-sectoral collaboration to optimise the roll-out. Given the Government's role in co-investing with the private sector, the roadmap will also help to inform and give certainty to the private sector's investment decisions, and ideally bring forward investment.

As described later in the document, we propose to develop the roadmap in two phases:

1. **Phase 1:** Delivers a minimum viable product approach, supported by some existing datasets, to indicate priority charger locations for the next 12-24 months (referred to as the 'basic spatial' approach), filling current gaps in the network. The basic spatial approach will enable some minimum deliverables of service, and we will be working on the second phase in parallel.

2. **Phase 2:** Develop a more comprehensive roadmap that pulls together key datasets to model estimated EV charging demand by location or travel route. This iteration of the roadmap would be maintained as a living tool so that the guidance for upcoming investment decisions will stay up to date with the current state of the charging network and evolving demand on the network.

2 Context

New Zealand's public EV charging network has grown to the point that we now have fast direct current (DC) charging stations at least (on average) every 75 kilometres across over 96 percent of our State highway network[1]. The Government has supported this by co-funding the installation of the majority of the public fast chargers through the Low Emission Vehicle Contestable Fund (LEVCF), managed by EECA.

While New Zealand's public charging network currently has good spatial coverage, about 60% of the public charging network[2] consists of 25-50kW chargers that are capable of charging only one vehicle at a time.

So far, the growth of the public charging network has occurred organically and the provision of public EV charging infrastructure has largely stayed ahead of EV uptake. However, some pressures are starting to be identified. Regular consumer monitoring undertaken by EECA has consistently shown that one of the main issues that make people less likely to consider buying an EV is the perception that public charging stations are not easy to find[3]. A survey of over 900 EV owners undertaken by EECA in July 2021 found that the main reason that stops EV owners from using public chargers more often is having to queue or wait to charge their vehicle (41% of respondents).

[1] Refer to Waka Kotahi's vision for public EV charging Infrastructure: https://nzta.govt.nz/planning-and-investment/planning/transport-planning/planning-for-electric-vehicles/national-guidance-for-public-electric-vehicle-charging-infrastructure/enabling-a-nationwide-network-of-public-charging-infrastructure/

[2] Referring to public Direct Current (DC) chargers, not the slower Alternating Current chargers that are usually found in private charging applications. See Figure 1 for more detail.

[3] EECA's consumer monitoring from April to June 2021 found 35% of respondents identified difficulty to find public charging stations as a barrier. In comparison, 58% of respondents identified purchase price as a barrier and 50% identified uncertainty about battery life and replacement.

The Government's ambition for EV uptake and use to rapidly increase in the next decade and beyond will be essential to meeting our emissions reduction targets. This is supported by several recent publications that forecast rapid growth in EV uptake in the coming years, including the Climate Change Commission[4] and EECA's New Zealand Energy Scenarios TIMES-NZ 2.0 modelling[5].

Ministry of Transport modelling estimates that the number of battery electric vehicles (excluding plug-in hybrids) in the fleet will need to increase from the current almost 23,000 (as of August 2021) to 67,000 by 2025 to meet our emissions reduction targets.

As noted later in this document, we recognise that public charging is only one element of the EV charging environment, and we expect the majority of charging will continue to occur in the home. This work on the public charging network aligns with a wider, longer-term national electric vehicle charging infrastructure plan being developed by Te Manatū Waka – the Ministry of Transport (MoT) in conjunction with Waka Kotahi – New Zealand Transport Agency (NZTA), the Ministry of Business, Innovation and Employment (MBIE) and EECA. The wider plan will consider issues such as the Government's role in relation to public and private charging, impacts on the electricity network and ensuring a Just Transition.

3 Scope

This initial roadmap and the more comprehensive roadmap to follow consider the provision of **fast public light EV charging infrastructure in the short-term (about five years)**. The elements of this scope are described in more detail below.

3.1 Why public charging?

One of the key shifts that is enabled by electric vehicles is the ability to charge the vehicle at a range of different types of chargers, rather than just refuelling at a service station as internal combustion engine vehicles do. The different types of EV charging are described in Figure 1 below.

[4] https://www.climatecommission.govt.nz/our-work/advice-to-government-topic/inaia-tonu-nei-a-low-emissions-future-for-aotearoa/

[5] https://www.eeca.govt.nz/insights/new-zealand-energy-scenarios-times-nz/

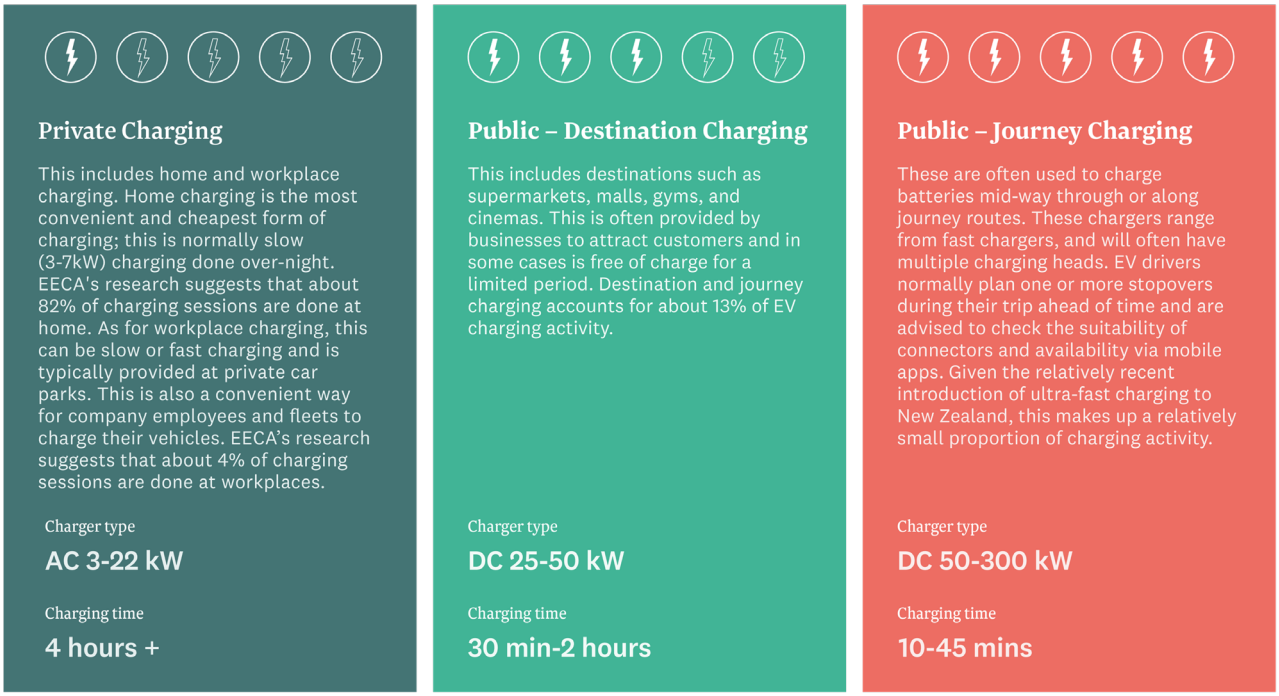

Figure 1 – Types of EV charging

This roadmap covers public journey charging. While journey charging only accounts for a small proportion of EV charging[6], it is an essential part of the charging landscape and strongly influences consumer perception of charger availability. Good availability and visibility of charging points for light EV users along main routes and at major centres is important to reducing range anxiety and encouraging EV uptake. Public destination charging, while also important, is expected to face fewer barriers than journey charging and is more likely to be commercially viable for the private sector (for example businesses using EV charging to attract customers).

Private charging has an important role and will influence demand and usage behaviour of journey charging. However, given the barriers facing journey charging, the public benefit it provides and the current lack of commercial viability, this roadmap, and the Government investment it informs, focuses on journey charging. Journey charging is also the part of the charging network that is most relevant for government to support, as it provides the 'backbone' of the network and requires higher levels of investment in infrastructure. The Government's longer-term national electric vehicle charging infrastructure plan will consider issues related to the wider EV charging landscape, including private charging and social equity.

3.2 Why fast chargers?

The roadmap only covers direct current (DC) chargers of 25kW and above. Chargers slower than 25kW (typically alternating current (AC) chargers) are generally used for private charging applications where it is possible to charge for several hours. While the majority of the public charging network currently consists of 25-50kW chargers, there may be an increasing role for high power ultra-fast chargers with multiple charging heads.

3.3 Why light EV's?

Light EVs are already available and being purchased in increasing numbers. Vehicle manufacturers and overseas governments have made it clear that EVs are the future of the light vehicle fleet and will require charging

[6] The survey of existing EV owners undertaken by EECA in July 2021 suggests that about 13% of charging is done at public chargers.

networks to support them. EV uptake forecasts from several sources are included below, and while these forecasts give a wide range of estimates, there is a common theme of rapid EV uptake across all of them. The wide range in forecast EV uptake in later years demonstrates the importance of the charging roadmap being a rolling plan, which evolves to reflect the current environment and stay ahead of charger demand.

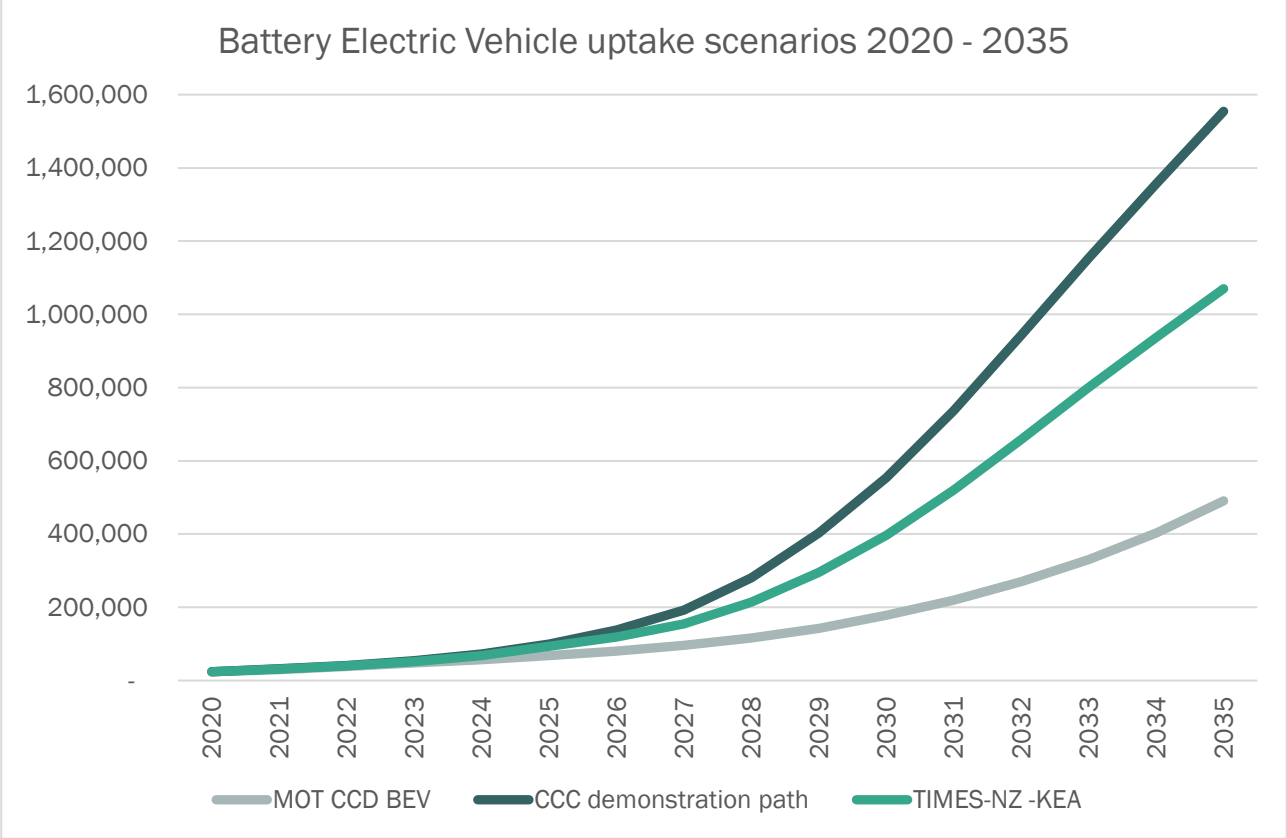

Figure 2 – Battery electric vehicle (BEV) uptake scenarios 2020-2035 (excludes plug-in hybrid electric vehicles)[7]

We recognise that heavy EVs may play an important role in decarbonising the transport sector and will require charging infrastructure to support their uptake. However, the role of the Government in supporting and planning for this infrastructure has not yet been determined.

We have not included heavy EV's within the scope of this roadmap as consideration of the future heavy EV charging network will take longer, considering the limited number of electric heavy vehicles available on the market and the role and market share of different low emission technologies (such as electric, biofuels and hydrogen). However, when considering the potential location for future EV charging sites, it will be important to include the potential to accommodate heavy vehicles in future.

[7] Source references:

- Ministry of Transport Clean Car modelling results – Estimate based on current policies, including the Clean Car Standard and Clean Car Discount. Available: https://www.transport.govt.nz/assets/Uploads/CC-modelling-results-for-public-release-July-2021.xlsx
- Climate Change Commission Demonstration Path – Estimate based on the measures and actions that would deliver the Commission's recommended emissions budgets. Available: https://ccc-production-media.s3.ap-southeast-2.amazonaws.com/public/Inaia-tonu-nei-a-low-emissions-future-for-Aotearoa/Modelling-files/Scenarios-dataset-2021-final-advice.xlsx
- New Zealand Energy Scenarios TIMES-NZ Kea scenario – Estimate based on a scenario where climate change is prioritised as the most pressing issue (Based on EECA-BEC modelling). Available: https://www.eeca.govt.nz/insights/new-zealand-energy-scenarios-times-nz/.

3.4 Why short-term?

The roadmap is designed to be a 'rolling' 5-year plan. By focussing on the near term, this roadmap intends to address the most immediate needs to support light EV uptake by New Zealand road users. Maintaining the roadmap as a living document means the guidance for upcoming investment decisions (through relevant Government funding such as the LETF) will stay up to date with the evolving charging network. The charging market will evolve in response to technology advancements, rates of market uptake and maturing behaviour. This work aligns with the wider, longer-term national EV charging infrastructure plan being developed by multiple Government agencies.

CONSULTATION QUESTION

1. Do you agree with the scope described above in sections 3.1, 3.2, 3.3, and 3.4? Can you suggest any changes?

4 Objectives

We have developed objectives that we want to achieve for the public charging network. The guidance provided through the roadmap (this document and the comprehensive roadmap to follow) and the government investment that it informs will support these objectives.

Objective 1: Support EV uptake and provide consumers with confidence in the availability of public electric vehicle charging infrastructure

As noted previously, the perception that chargers are not easy to find is one of the main barriers to EV uptake, and once people become EV owners queueing is stopping people from using the public charging network. This suggests that there is more that needs to be done to increase the availability and visibility of chargers. The power output of chargers, and therefore the time it takes to charge, is also very important for journey charging as people will be hesitant to drive an EV if charging adds excessive time to their journey.

Objective 2: Provide all users with safe and convenient access to charging infrastructure

Beyond the location of chargers, there is also a need to ensure there is equitable distribution of chargers, so they are not just concentrated in the most commercially successful locations. There is an important role for government in supporting equitable distribution. This can include supporting charger installation in rural areas or low-income communities.

There are a range of factors that impact on the ease with which all members of society can safely and conveniently access and use EV charging infrastructure. This includes the consideration of the safety of the charger location (e.g. whether there is sufficient lighting and if the charger is in a populated area), access by disabled people, affordability, charger reliability, open payment systems as well as others.

Objective 3: Ensure charging infrastructure standards such as interoperability, connectivity and energy efficiency are adequately met

There are currently no regulations mandating charger requirements, such as interoperability, connectivity and energy efficiency. However, Standards NZ and EECA have published guidelines (Publicly Available Specifications) for EV chargers for commercial use[8], with input from government and industry. It is important that the chargers that are being installed today meet consistent operational standards. If the Government is co-

[8] Available here: https://www.standards.govt.nz/shop/snz-pas-60102021/

funding public EV charging infrastructure, we want to make sure that the chargers themselves and the way the infrastructure operates is appropriate.

Objective 4: Provide the Government and industry information and guidance to better inform planning and optimal investment

Providing certainty to industry and the public on the Government's desired future state of the public charging network will provide confidence for businesses to invest in this area. Coupled with Government co-funding, this would ideally bring forward the private sector's investment plans. We want to provide sustainable and scalable EV charging infrastructure, with sites being designed to remain viable as demand grows and having the capability to respond to changing demand beyond 2025.

Developing a roadmap of what the charging network will ideally look like will also help to inform the future development of the energy infrastructure required to implement this network. This includes the scale and direction of the investment required to deliver this network (both the chargers themselves and the electricity infrastructure).

We also recognise that EVs and EV charger technology are advancing. We therefore need the ability to transition existing and future stranded assets to different types of charging (e.g. higher power) and to meet changing consumer behaviour, services (e.g. heavy freight vehicles) and vehicle technology landscapes.

Objective 5: Encourage new entrants and competition for provision of charging infrastructure and service providers

Although commercial considerations will be at the core of companies' decisions to install public charging infrastructure, there is a role for Government to make it easier for charging providers to participate by reducing barriers to their entry, thereby attracting new entrants and investment for charging infrastructure. This can be achieved through simplification and consistency of the procurement and installation process. EECA will be conducting some pilots shortly, sitting alongside charging service providers and councils as they go through the process of getting a charger approved and installed. This will provide EECA with a more detailed understanding of the barriers facing charger installation, and implementing solutions for removing these barriers. This may lead to the development of best practice guidance for streamlining the charger approval and installation process, which could be used by a range of stakeholders, including councils.

To ensure consistency and ease of user experience, there may be a need to require open and non-discriminatory infrastructure and systems (e.g. open payment systems, interoperability and connectivity to EVRoam[9]). There is also benefit in making charging-related data publicly available to the greatest extent possible, noting there will be commercial sensitivities precluding the sharing of some data. Consistent sharing of data such as charger availability and down time between use can be used to enable a better user experience.

There is also a need to be mindful of enabling exclusive arrangements for charging locations that can become a barrier to new entrants due to lack of land or access to services.

[9] EVRoam is a live database of New Zealand's electric vehicle charging infrastructure, managed by Waka Kotahi. It collects real-time information from all safe and monitored public charge points around New Zealand, and freely distributes it.

Objective 6: Enable innovation in new technology and business models

The idea of shifting the entire light vehicle fleet from fossil fuels to electricity represents a significant change for our national transportation and electricity system. As the installation of public and private charging infrastructure continues to accelerate to meet the demand of an increasing EV fleet, there is a need to enable innovative solutions to manage potential impacts from this change. Examples of this kind of innovation are grid integration and smart charging.

Innovations should be targeted at particular EV charging challenges (e.g. convenience for EV charging users, reduced wait times, ease of payment, collaboration and partnership with infrastructure and local government etc).

While system level innovation would likely be policy driven, funding innovation for public EV charging would likely support innovations to processes, systems or technology - such as new ways for reducing cost, increasing efficiency or the integration of high-powered charging stations.

CONSULTATION QUESTION

2. Do you agree with objectives 1 to 6? Please provide comment on if we have missed anything or if you consider there are higher priority objectives.

5 Approaches for a public EV charging roadmap

There are different approaches that can be used to develop a roadmap of the future provision public EV chargers. These different approaches have varying levels of resource and data input requirements, and produce outputs of varying specificity, confidence and timeframes. In the sections below we describe three approaches we propose to develop: a ‘basic spatial’ approach, a ‘data driven’ approach and a ‘digital twins’ approach. These approaches should not be considered as 'options' and are not mutually exclusive. They are an evolution of what can be done with increasing levels of data and resourcing. They also represent what can be implemented quickly (the basic spatial approach), while continuing to develop a more complex approach.

It is also important to recognise that there will also be a need to invest in charging infrastructure in some areas that may not be identified by modelling. For example, some communities or regions may require specific intervention to achieve equitable access to infrastructure.

The LETF launched on 7 October 2021 and included co-funding for public EV chargers. Noting it will take time to develop the basic spatial roadmap, the LETF will continue to use the current approach for considering charger applications in 2021. EECA then proposes to use the basic spatial roadmap approach to inform future funding in EV charging infrastructure such as the LETF for the next 12-24 months. In parallel, we propose to develop a more detailed roadmap based on a data driven approach, potentially enhanced in the longer term by a digital twin approach. This more detailed roadmap would provide a rolling roadmap of priority public charger locations, looking about five years into the future. The timing of these different steps of roadmap development are illustrated in Figure 3 below.

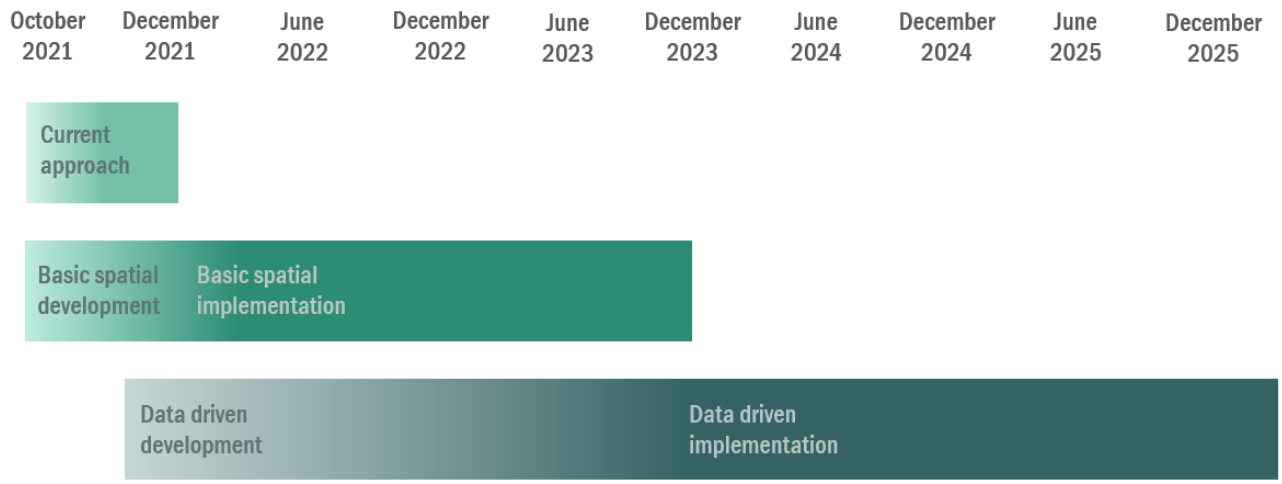

Figure 3 – Roadmap development timeline

5.1 Current Approach

The main indicator the Government currently has of the progress of the charging network is the extent to which Waka Kotahi's charging vision (a fast charger every 75km on the State highway network) has been achieved.

Figure 4 shows the current gaps in the network where there is more than 75km between chargers (i.e. where the Waka Kotahi vision for public chargers has not yet been achieved). These gaps are all in areas with low or moderate traffic flows.

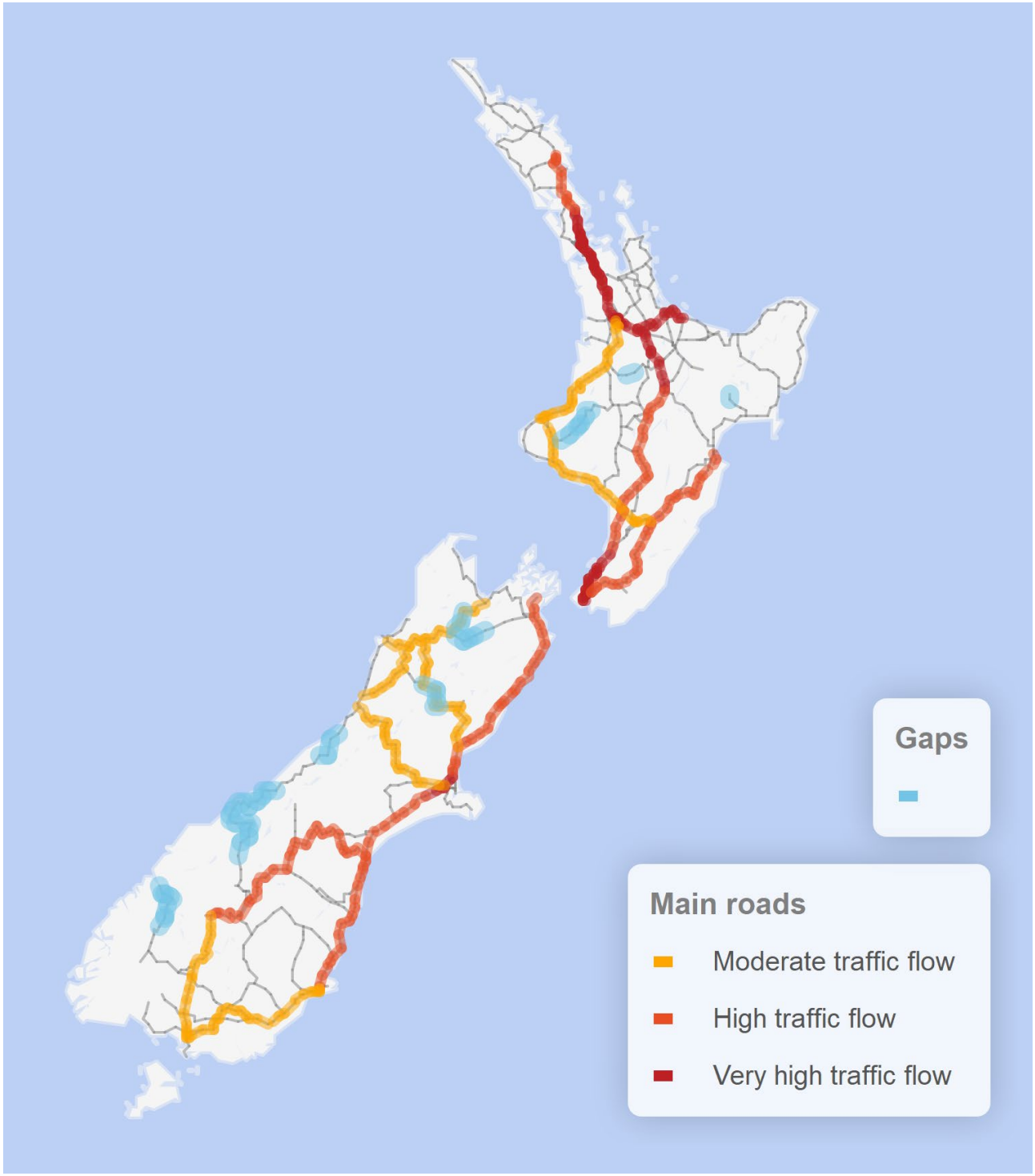

Figure 4 – Current network gaps (>75km between public fast chargers)

We propose to prioritise filling these gaps, even if this requires higher levels of government co-funding to make it commercially viable. However, we recognise that in some instances it may not be feasible to install a charger to fill these gaps. There are good reasons why chargers have not already been installed in these locations, such as high costs associated with connecting to the electricity grid. We are keen to work with industry to explore potential solutions to these challenges, such as energy storage options for remote areas.

We recognise that focussing on these last few gaps, which are in areas with relatively little traffic, is not a sufficient approach for considering the future growth of the charging network. For this reason, we propose to develop the basic spatial approach described below.

5.2 Basic Spatial Approach

Beyond the obvious gaps identified in Figure 4, there is a need to understand where additional chargers should be installed to support growing demand. The basic spatial roadmap would use a manual approach, supported by some existing datasets, to indicate priority charger locations for the next 12-24 months. A map of the main datasets for the proposed basic spatial approach is included in Figure 5 below. This map overlays main road routes with traffic volumes and the current public EV charger network.

An interactive version of this map is also available at:
www.eeca.govt.nz/insights/new-zealand-public-ev-charger-map

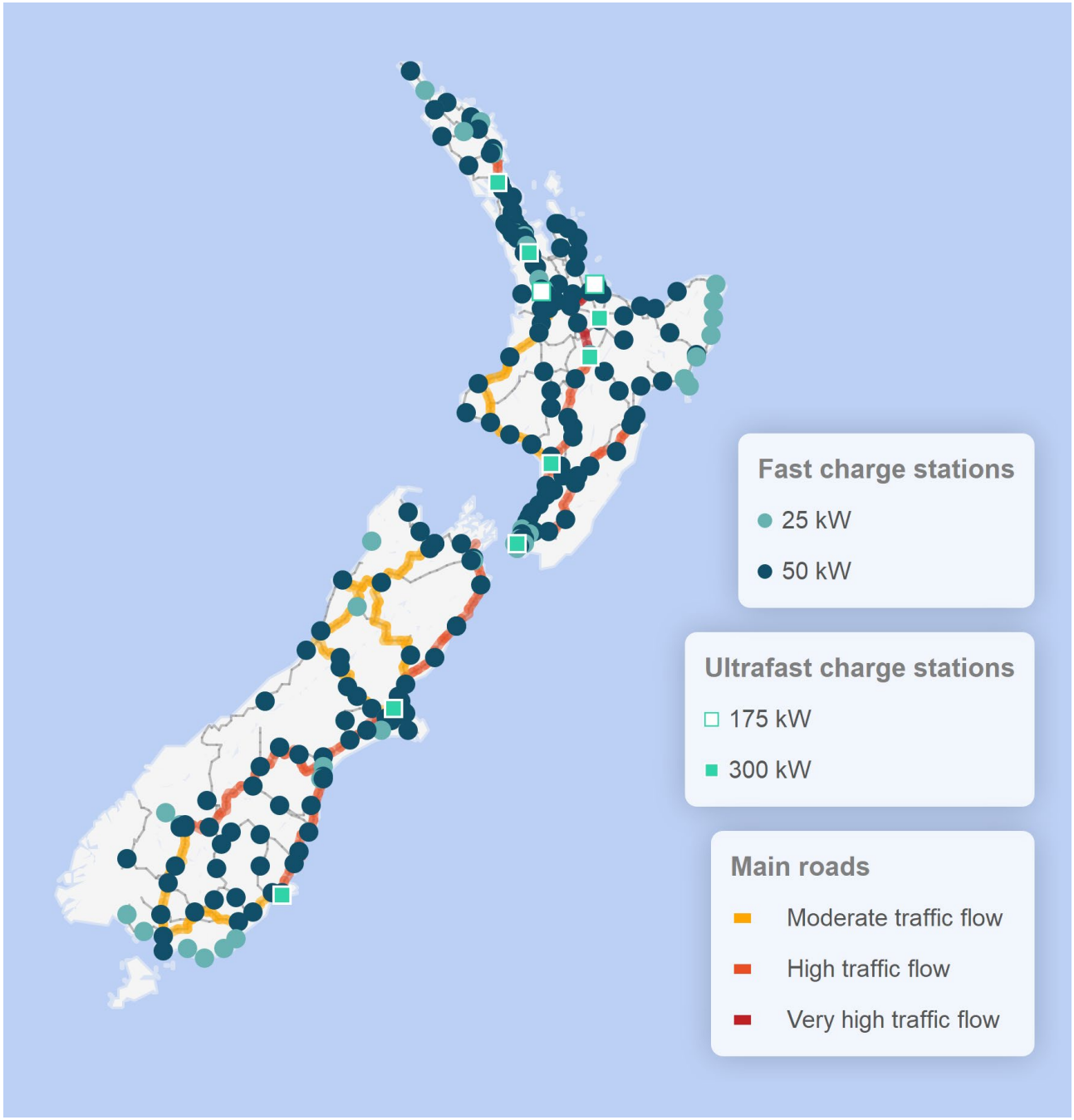

Figure 5 – Public chargers and traffic flow

To show what this looks like at a more local level, Figure 6 shows the current charger distribution in the top of the North Island, as well as the very high traffic flow routes. The map also shows the electricity distribution Grid Exit Points (GXP's) to illustrate locations along this route that may be able to accommodate high-capacity charging sites.

EECA is currently of the view that Government investment in the public charging network should be mainly focussed on high power ultra-fast charging (however, we recognise that there will continue to be a need for some investment in slower DC chargers for at least the next couple of years). This would enable the charging network to accommodate the increasing battery capacity and charging rate capability of newer EV models and the increasing number of EVs on the road (to minimise charging time and potential queueing at charging sites).

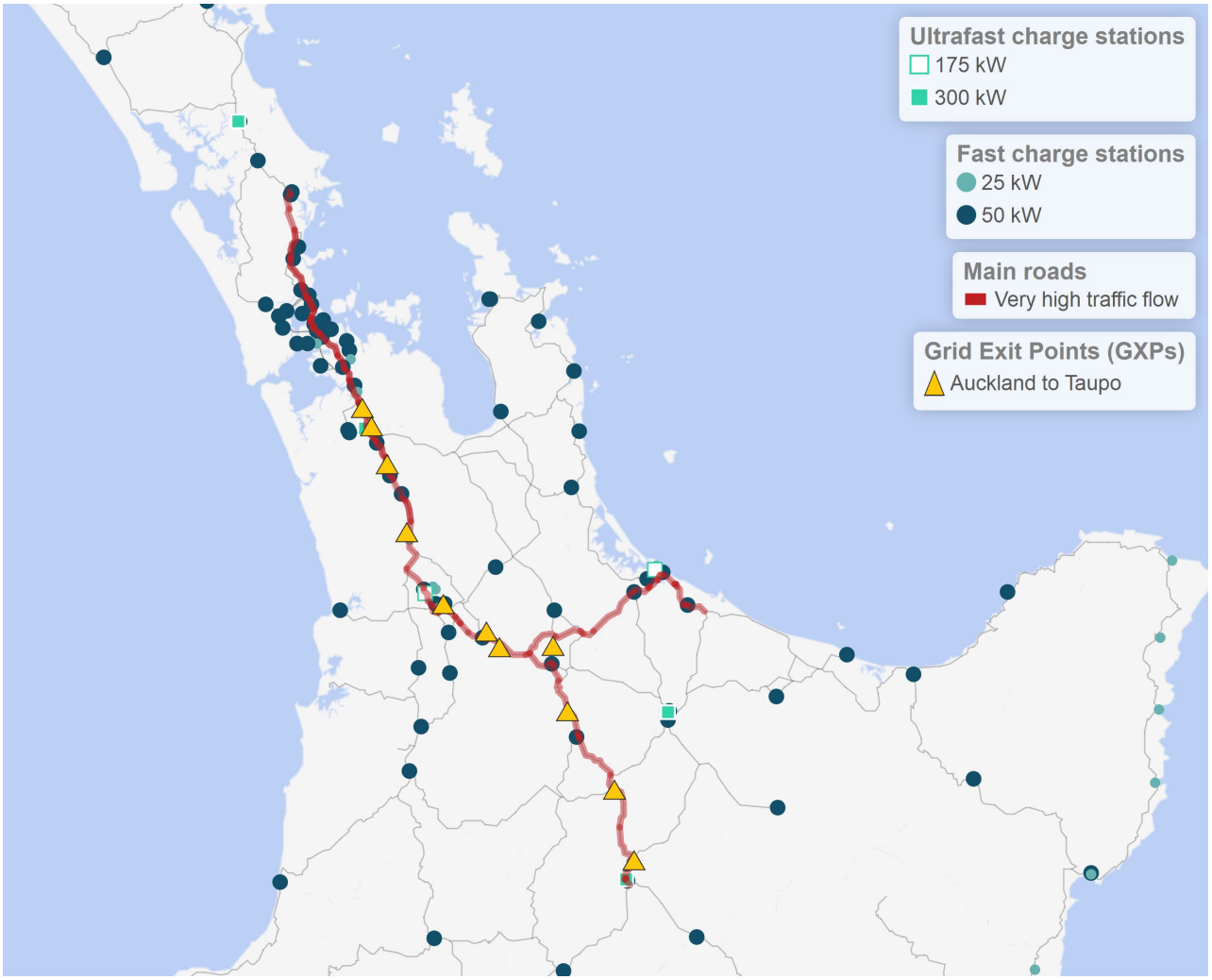

Figure 6 – Public chargers on very high traffic flow routes - Northern regions

We have identified three options for identifying potential charger locations using this currently available information. We propose that one of these options should be the basis for developing the basic spatial roadmap.

1. **Reduce distance between chargers -** One simple approach is to reduce the distance between chargers by updating the existing Waka Kotahi charger target of at least one charger every 75km (for example Norway set a target of at least two fast chargers every 50km on all main roads). This would provide coverage for the EV's in the fleet with the lowest range, while also providing a degree of flexibility if a driver needs to 'skip' a charger. This would also help to address the perception that public chargers are not easy to find. However, there are risks with planning the public charging network to accommodate the EVs with the lowest driving range, particularly the risk of stranded assets as the vehicle fleet shifts to newer EV's with longer driving range.

EECA's recent survey of EV owners suggests that drivers of older EV's with **lower range** (generally pre-2018 Nissan Leaf's) are unlikely to use their EV's on long multi-day trips, and generally use public charging for quick 10-20 minute sessions when driving around on day trips.

2. **Increase number of charging heads at existing locations -** Another approach is to maintain the existing target of 75km between chargers, but to also identify locations that require additional chargers. With the data that we currently have available, this would likely identify locations with high traffic volumes. A benefit of this approach is that increasing the number of vehicles that can charge at these locations may enable the development of complementary services, such as shops, toilets and dining).

   These chargers are likely to have higher utilisation rates and be more commercially viable. This suggests chargers identified through this approach may warrant a lower level of government co-funding. However, we consider that government support is still currently required, particularly to accelerate private sector plans to invest in charging infrastructure. We also recognise that the commercial viability of a charger location may be impacted by other issues such as type (and cost) of charger, lines costs, consents, nearby services etc.

3. **Prioritise journey charging -** An alternative is for the Government to focus mainly on creating an effective journey charging network. This could be done by prioritising chargers in locations that are within a set distance of major roads (such as State highways with high traffic flows). Locating journey chargers close to main roads will avoid the inconvenience of drivers having to detour into a town to charge, adding additional time to the journey. Utilising existing sites on the State highway network, such as service centres, could potentially play an important role and may provide sufficient space to accommodate heavy vehicle charging in future.

   Public chargers further away from main roads (such as destination chargers) would still have an important role, but would be considered a lower priority.

The approaches described above will help to give an idea of where government funding, such as the LETF, may best prioritise charging investment over the next year or two. In general however, this basic spatial approach is not sophisticated enough to ensure a robust and resilient charging network in the medium to long term, and it would be difficult to add this functionality in (such as consideration of charger queuing and wait time). This is due to the fundamentally manual nature of identifying charging locations using this approach.

CONSULTATION QUESTIONS

3. Do you think that the Government should prioritise its public charging investment in high power ultra-fast chargers?
4. Are there risks or benefits that you can see regarding the three options for the basic spatial approach (reducing distance between chargers, increasing the number of charging heads at existing locations or prioritising journey charging)? Can you suggest an alternative option?

5.3 Data driven approach

A data driven approach makes use of available privacy preserving anonymised datasets, in particular road network utilisation data, to model estimated EV charging demand by location or travel route. Using a data driven approach, it should be possible to target EV charging deployment to areas of greatest need, and more effectively target government investment (either to fill the most pressing gaps, or to fine-tune support for charging infrastructure based on the expected economics of locations).

This approach will require upfront investment in time and resources. It will also require some revision over time to check and refine outputs to align with the observed outcomes. Model parameters can be adjusted as charging and vehicle technology changes, and there is the potential for the model to find more optimal solutions than a manual deployment process. The benefits of a data-driven approach are expected to far outweigh the costs.

The model formulation for this approach has not been fully developed, however in principle the aim will be to estimate the EV charging demand for a 'grid' or other segmentation approach of the road network, including temporal elements (e.g. season, time of day, day of week) and across multiple years (based on assumptions about EV uptake, range and performance). The EV charging demand then forms the target for an EV charging network optimisation which could seek to meet a minimum standard (such maximum wait times of 10 minutes), a carrying capacity (e.g. national uptake of 67,000 EVs by 2025) or other target variable.

An illustration of the conceptual framework for thinking about EV charging infrastructure requirements is included in Figure 7 below.

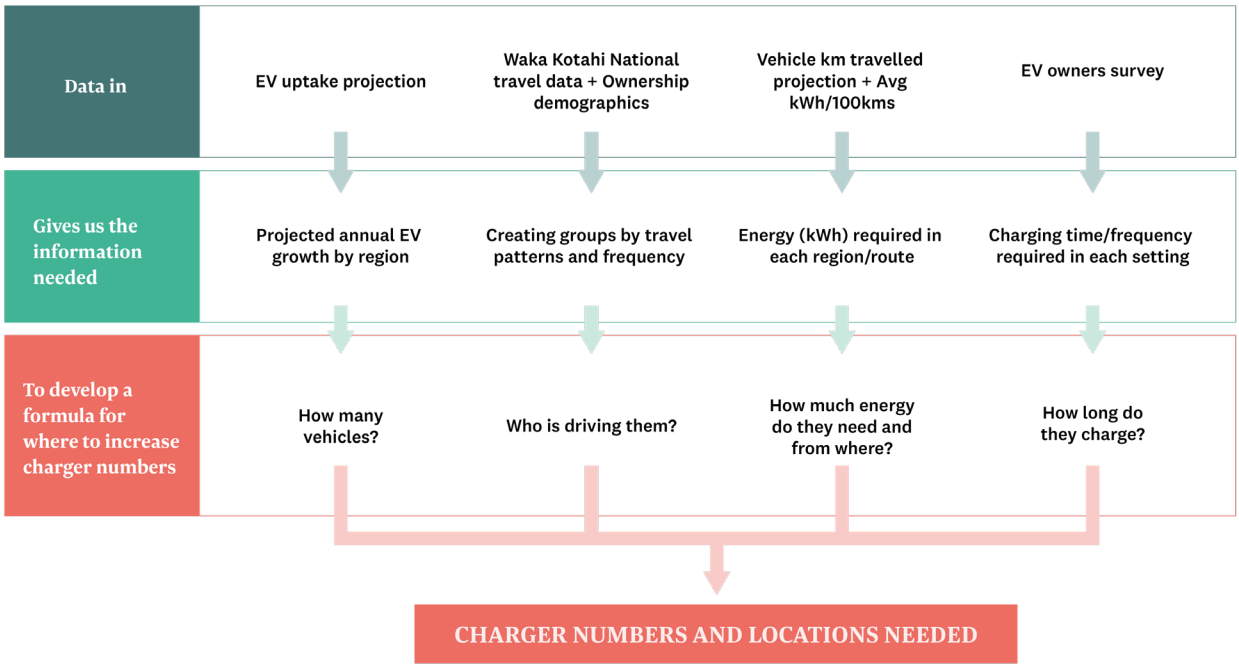

Figure 7 – Framework for EV charging requirements

The model formulation should also be able to assess the economics of chargers in different locations, based on expected utilisation. This would greatly assist commercial enterprises in selecting charger locations and would also be particularly helpful for government in assessing efficient levels of financial assistance.

Key components of model formulation include:

- Identifying available source data
- Formulating a mathematical representation of the road network (including choices about spatial resolution)
- Temporal resolution choices
- Vehicle numbers
- Vehicle travel activity, including estimated start and end points (or other travel distance proxy).
- Vehicle capability assumptions
- Driver behaviour and limitations (constraints)
- Temporal allocation of travel
- EV travel demand
- EV charging demand by spatial location
- Optimal EV network allocation algorithm (including objective function, constraints, costs etc.)
- Incremental EV network allocation algorithm (allows for existing chargers, overrides, additional constraints)
- Shortfall and infeasibility identifiers/flags.

Before commencing this approach, we would seek out prior work on this topic, such as overseas examples and academic studies and/or seek an off-the-shelf solution. There may also be New Zealand organisations that are either developing this kind of solution or could provide valuable input. Problems of this nature are routinely addressed in the operations research field, so it should not be necessary to invent a solution from scratch. It is also recommended to seek advice from experienced specialists in the field to understand if the problem is likely to be solvable and produce stable and robust solutions.

5.4 Digital twins approach

The current state-of-the-art practice for modelling complex processes is to use 'digital twins'. These are effectively large-scale simulations of places, processes or systems, where the individual components of the simulation are based on real-world data. Using a digital twin model would allow the simulation of the behaviour of individual EVs, deriving insight about aspects such as travel demand and consequently EV charging demand.

The level of detail in the simulation is both its greatest asset and its biggest hurdle. A highly detailed simulation can provide much more nuanced and granular insights; however, to gain this detail will require an enormous amount of input data, and a great deal of model development effort. A model capable of predicting individual vehicle activity would also need to manage privacy risks very carefully. Based on our current understanding of these issues, it seems likely that this approach will not be suitable in the short-medium term. However, if it is to be available longer term, which might have significant benefits, some degree of development activity should be undertaken in the interim.

CONSULTATION QUESTIONS

5. Do you agree with the proposed approach for developing a data driven or digital twins based public EV charging roadmap? Can you suggest any improvements?
6. Has your organisation undertaken any work in this area or do you have data sources that could be used as inputs?

Appendix A Consultation questions

1. Regarding the scope of this document 'the provision of fast public light EV charging infrastructure in the short-term (about five years)'

   Do you agree with the scope described above? Can you suggest any changes? (Page 8)

2. Regarding EECA's objectives for the public charging network:

   a. Objective 1: Support EV uptake and provide consumers with confidence in the availability of public electric vehicle charging infrastructure

   b. Objective 2: Provide all users with safe and convenient access to charging infrastructure

   c. Objective 3: Ensure charging infrastructure standards such as interoperability, connectivity and energy efficiency are adequately met

   d. Objective 4: Provide the government and industry information and guidance to better inform planning and optimal investment

   e. Objective 5: Encourage new entrants and competition for provision of charging infrastructure and service providers

   f. Objective 6: Enable innovation in new technology and business models

   Do you agree with objectives 1 to 6? Please provide comment on if we have missed anything or if you consider there are higher priority objectives. (Page 10)

3. **Do you think that the government should prioritise its public charging investment in high power ultra-fast chargers? (Page 16)**

4. **Are there risks or benefits that you can see regarding the three options for the basic spatial approach (reducing distance between chargers, increasing the number of charging heads at existing locations or prioritising journey charging)? Can you suggest an alternative option? (Page 16)**

5. **Do you agree with the proposed approach for developing a data driven or digital twins based public EV charging roadmap? Can you suggest any improvements? (Page 18)**

6. **Has your organisation undertaken any work in this area (modelling of EV charger locations) or do you have data sources that could be used as inputs? (Page 18)**