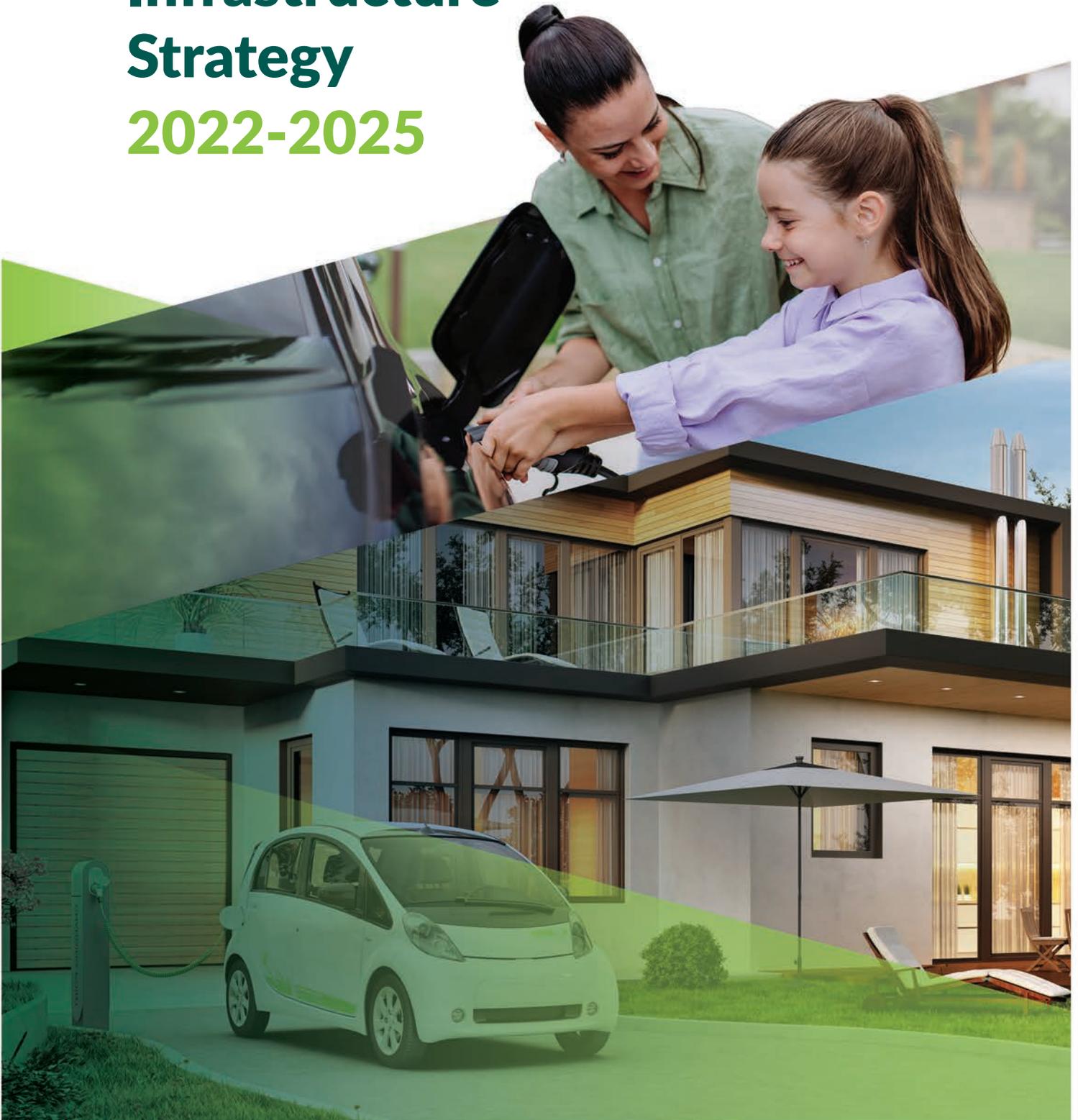




An Roinn Iompair
Department of Transport

zevi
Zero Emission
Vehicles Ireland

Electric Vehicle Charging Infrastructure Strategy 2022-2025





An Roinn Iompair
Department of Transport



Electric Vehicle Charging Infrastructure Strategy 2022-2025

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Acronyms and Definitions

AC	Alternating current
AFIR	Alternative Fuels Infrastructure Regulation
BESS	Battery energy storage system
BEV	Battery electric vehicle
CAF	Climate Action Fund
CCS	Combined charging system
CAP	Climate Action Plan
CARO	Climate Action Regional Office
CCMA	County and City Management Association
CRU	Commission for Regulation of Utilities
DAA	Dublin Airport Authority
DC	Direct current
DoT	Department of Transport
ECA	European Court of Auditors
ERS	Electric roads systems
ESBN	Electricity Supply Board Networks
eSPSV	Electric small public service vehicle
EU	European Union
EV	Electric vehicle
EVPP	Electric Vehicle Policy Pathway
GDP	Gross domestic product
HGV/HDV	Heavy goods/duty vehicle
HPC	High power charger
ICE	Internal combustion engine
IEA	International Energy Agency
LDV	Light Duty Vehicle
LEV	Low-emission vehicle
LGMA	Local Government Management Agency
MaREI	Research Centre for Energy, Climate and Marine
NEWKD	North East West Kerry Development
NSAI	National Standards Authority of Ireland
NTA	National Transport Authority
OEM	Original equipment manufacturer
OGP	Office of Government Procurement
PHEV	Plug-in hybrid electric vehicle
PMO	Project Management Office
SDG	Sustainable Development Goal
SEAI	Sustainable Energy Authority of Ireland
SFI	Science Foundation Ireland
SIMI	Society of the Irish Motor Industry
T&E	Transport and Environment
TEN-T	Trans-European Transport Network
TII	Transport Infrastructure Ireland
UK OSEV	United Kingdom Office for Zero Emission Vehicles
UN	United Nations
V2G	Vehicle-to-Grid
V2H	Vehicle-to-House
ZEVI	Zero Emission Vehicles Ireland

'Avoid, Shift, Improve' Approach¹

The 'Avoid, Shift, Improve' approach presents a framework for structuring policy measures. Inspired by the principles of sustainability, the approach seeks to achieve significant carbon emission reductions, reduced energy consumption, and less congestion, with the final objective of creating more liveable cities. The approach entails three pillars:

Avoid: This refers to the need to improve the efficiency of the transport system. Through integrated land-use planning and transport demand management, the trip length (and even the need to travel at all) may be reduced.

Shift: The 'shift' instruments seek to improve trip efficiency. A shift from the most energy-consuming urban transport mode (i.e. cars) towards more environmentally-friendly modes (such as active travel or public transport) is highly desirable.

Improve: The 'improve' component focuses on vehicle and fuel efficiency as well as on the optimisation and innovation of transport infrastructure. It aims to improve the energy efficiency of transport modes and related vehicle technology. Furthermore, it acknowledges the potential of alternative energy use.

Charge Point

A charge point is a fixed or mobile interface that allows for the transfer of electricity to an electric vehicle. It is only capable of charging one electric vehicle at a time, although it may have multiple outlets in order to accommodate different connector types.

Charge Point Categories

Category	Sub-category	Maximum Power Output	Definition
Category 1 (AC)	Slow AC charging point, single-phase	$P < 7.4 \text{ kW}$	Normal-power charging point
	Medium-speed AC charging point, triple-phase	$7.4 \text{ kW} \leq P \leq 22 \text{ kW}$	
	Fast AC charging point, triple-phase	$P > 22 \text{ kW}$	High-power charging point
Category 2 (DC)	Slow DC charging point	$P < 50 \text{ kW}$	High-power charging point
	Fast DC charging point	$50 \text{ kW} \leq P < 150 \text{ kW}$	
	Level 1 - Ultra-fast DC charging point	$150 \text{ kW} \leq P < 350 \text{ kW}$	
	Level 2 - Ultra-fast DC charging point	$P \geq 350 \text{ kW}$	

¹ https://www.transformative-mobility.org/assets/publications/ASI_TUMI_SUTP_iNUA_No-9_April-2019.pdf

Charging Pool

A charging pool consists of one or more charging stations at a specific location, including (in some instances) the dedicated parking spaces adjacent to them.

Charging Station

A charging station is a physical installation for the charging of electric vehicles. Every station has a theoretical maximum power output, expressed in kW. Every station has at least one charge point that can serve only one vehicle at a time. The number of charge points at a charging station determines the number of vehicles that can be charged at that station at any given time. Where more than one vehicle charges simultaneously at a charging station, the maximum power output is distributed to the different charge points. As a result, the power provided at each individual charge point is lower than the overall power output of that station.

Connector

EV Charging Connectors are the end-point physical interfaces that are fixed on the charging cable and get attached to the electric vehicle to facilitate charging.

Disability Act 2005

The Disability Act 2005 provides a statutory basis for accessible public services. Sections 26, 27, 28, and 29 place obligations on public bodies to make their services and information accessible to people with disabilities. Under the Disability Act 2005, local authorities must consider how the services they provide impact on people with disabilities. The impact of these services can be evaluated as follows:

- Access to quality customer services
- Access to the built environment
- Access to services delivered via information and communication technology

Just Transition²

Just Transition is a vision-led set of principles, processes, and practices that seeks to ensure that the substantial benefits of a green economy transition are shared widely, while also supporting those who stand to lose economically – be they countries, regions, industries, communities, workers or consumers.

Just Transition Fund³

The Just Transition Fund is a financial instrument within the Cohesion Policy which aims to provide support to territories facing serious socio-economic challenges arising from the transition towards climate neutrality.

² <https://climatejusticealliance.org/just-transition/>

³ <https://www.europarl.europa.eu/factsheets/en/sheet/214/just-transition-fund>

Publicly-Accessible Charging Station

Publicly-accessible charging stations are charging stations that are available to all (or a specific public grouping of) EV drivers. This includes charging stations that are privately-owned but accessible to the public. Publicly-accessible charging stations can be located on either public properties (such as public car parks) or private properties (such as supermarket car parks).

In some cases, a charging station may be located on private property, with access granted to a specific public group of users (such as clients or patients). Such a charging station would still be considered to be publicly-accessible.

However, if a charging station (located on private property) is only available to a very limited, determinate circle of persons, it cannot be classed as publicly-accessible. An example of this is a charging station in an office car park, where only employees or authorised persons have access.

Charging stations for car-sharing schemes should only be considered accessible to the public if they explicitly allow access for third-party users.

Universal Design Principles

In Ireland, Universal Design is defined in the Disability Act 2005, and is summarised by the Centre for Excellence in Universal Design as:

'The design and composition of an environment so that it can be accessed, understood and used to the greatest extent possible by all people, regardless of their age, size or disability. This includes public places in the built environment such as buildings, streets or spaces that the public have access to; products and services provided in those places; and systems that are available including information and communications technology.'

Interoperability

Interoperability, in its widest sense, is the ability of computer systems or software to exchange and make use of information. In the case of the electric vehicle charging infrastructure, achieving an interoperable ecosystem means that the available information and payment options allow any user to easily charge any model of electric vehicle at any charging station.

Minister's Foreword

The Government is deeply committed to its efforts to decarbonise private transport. I firmly believe that through our collective efforts, we can deliver on our climate objectives. The National Development Plan dedicates €1bn towards decarbonisation of transport in the period up to 2030. This funding will assist the transport sector to reduce its carbon emissions and to transform our communities into healthier places to live.

With ever-increasing numbers of EVs on Irish roads, we need to stay ahead of charging demand. Without a doubt, most of us will charge our EVs at home. However, having access to a seamless public network that complements this and provides for 'on-the-go' charging solutions is a critical component of our pathway to placing almost 1 million electric vehicles on our roads by 2030.

At this early stage in our adoption of EVs there is an opportunity for us to build upon lessons learnt elsewhere and to take on board the views of Irish EV drivers, stakeholder groups, and citizens to shape our policy. ZEV1 received 14,000 responses to the draft EV Infrastructure Strategy (which included over 3,000 EV drivers), as well as comprehensive responses and engagement from the industry stakeholders. ZEV1 have revised and refocused this strategy to shape the delivery of a network of publicly-accessible infrastructure that is world class in terms of the interoperability, coverage, and equity.

Innovation is at the heart of this process. As new technologies emerge related to the vehicles, batteries, and charging methodologies, it is essential that we continuously review our intended approach. Doing so will allow us to take advantage of new developments to hasten the transition to electrification of transport and to ensure the transition itself is just.

Through initiatives such as the Shared Island Fund and the Just Transition Fund, the Government will explore and implement the provision of targeted infrastructure to benefit communities and increase access to EVs across the island of Ireland. This will have co-benefits across other sectors such as tourism and heritage.

In doing so, we welcome the opportunity to work alongside the public sector, industry, and the private citizen in the shared delivery of a publicly-accessible infrastructure network. Given the current strong rates of EV adoption in the Irish market, it is clear that the next three years will be pivotal, with a rapid expansion of the charging network needed to match increasing demand. This will bring significant investment opportunities within the Irish market as work begins to expand the existing network and new technologies are embraced.

This strategy forms part of a wider set of actions and initiatives aimed at accelerating the adoption of electric vehicles in Ireland. These are set out in the Government's Climate Action Plan 2023.



Eamon Ryan TD,
Minister for Transport

A handwritten signature in black ink, appearing to read 'E Ryan'.

Introduction

What will this Strategy do?

This strategy is a pathway for delivery of electric vehicle (EV) charge point infrastructure. Such infrastructure will support the delivery of the Climate Action Plan ambition of almost a million EVs on Irish roads by 2030. The strategy will also help to ensure that EV charge point infrastructure provision remains ahead of demand.

This strategy reflects the urgent need for action to address climate change and the need for a strategic and just transition to sustainable ways of travelling. It considers the different charging needs of urban and rural communities. It also takes into account the current trajectory of EV uptake and the increasing demand that will be placed on electricity distribution networks as more car users switch to electric options.

In the coming years, as EVs become mainstream, we expect to see increasing uptake of home-charging solutions for EV owners, as well as an increased demand for a seamless public charging network.

As part of the shift away from fossil fuels, as well as the fundamental transformation of the transport sector, electric vehicle technology is changing rapidly, with new technologies being developed and introduced to the market at speed. Anticipated developments include electric technologies for hard-to-decarbonise transport modes, such as heavy-duty vehicles. The rollout of electric buses (and associated charging infrastructure) will continue, along with emerging technological solutions for heavy goods vehicles.

Existing, innovative, and future technologies are considered in the strategy. They have been integrated into the planned structures for infrastructure delivery and implementation.

In this fast-changing context, while the overall trajectory of action is clear, it is more difficult to predict specific details about the charge point types and interfaces that will be available by the end of this decade. For that reason, while this strategy sets out the long-term structures and frameworks that will be put in place to deliver a comprehensive national EV charging network

to meet the needs of citizens to 2030, the finer detail is mainly focused on the years up to 2025.

The Government, through the National Development Plan, has allocated €100m in the period to 2025 to support investment in EV charging infrastructure. It is anticipated that this will leverage multiples of that figure in private funding, all of which will help to deliver the strategy.

In order to coordinate and oversee the delivery of the strategy, the Zero Emission Vehicles Ireland (ZEV) office was established in July 2022. This office sits within the Department of Transport and reports regularly to the Minister.

In 2025, the Electric Vehicle Charging Infrastructure Strategy will be reviewed, with an updated version published for the years 2026-2030. This will review progress to date, and will reassess and refine the provisions, initiatives, and funding pathways set out in the following pages.

The years from 2022 to 2025 will also see continued development of policy to support the growth of micromobility and multimodal travel, including the use of e-scooters and e-bikes. Due to their lower-energy charging requirements, charging provision for these forms of transport remains outside the scope of this strategy and falls under the remit of the Sustainable Mobility Policy.

At the opposite end of the vehicle scale, the development of decarbonisation options for freight, and the rollout of pilot technology for that sector, will progress further in the coming years. Guided by European requirements, the strategy outlines a minimum provision of motorway charging infrastructure dedicated to HGVs

by 2025. Collaboration and engagement with the haulage sector and other key stakeholders (including ESBN and EirGrid) will be key to planning the decarbonisation pathway for this sector. ZEVI will work with policy colleagues in the freight sector to determine the best way of providing charging infrastructure for these types of vehicles.

What will be delivered

Currently, the majority of EV charging (c.80%) is done at home, and access to and installation of home-charging infrastructure is relatively well established in Ireland. A more significant gap exists in relation to the provision of publicly-accessible charging infrastructure. The demand for this will grow as EV uptake increases in Ireland.

The strategy focuses on the provision of publicly-accessible charging infrastructure for electric cars and light-duty vehicles. The strategy also addresses the needs of heavy-duty vehicles as required by EU regulations. It identifies four main categories

of charging infrastructure. Each serves a different user need and depends on where and when people need to charge their EVs.

- **Home/apartment charging** - AC, off-peak charging to be encouraged.
- **Residential neighbourhood charging** - AC, replicating off-peak charging options for people without access to a home charge point.
- **Destination charging** - AC or DC, depending on the type of destination.
- **Motorway/en-route charging** - DC high-powered charging at highest charge power capacities.



User Needs

Understanding the user experience has been of paramount importance in the development of this strategy. It continues to be a key part of the implementation phase. In order to put users at the centre of EV infrastructure planning, we have developed seven characters and their user journeys to show how people may interact with the future EV public charging network. The development of these personas has been supported by feedback received during the consultation process. The profiles begin to explore the users' specific requirements and how EV charging provision will need to evolve over the coming years to respond to context, scale, and opportunity. An in-depth exploration of each persona's key moments and user journey is included as an appendix. Here is a brief overview of each:

Caroline, the Car Sharer

When Caroline rents an EV from a car-sharing app at weekends, she wants to make sure the car has a full charge or that there are fast-charging facilities along the way or at her destination.



Tara, the Taxi Driver

When Tara is working as a taxi driver in West Cork, she wants to be sure she always has a full charge. She doesn't want to have to turn down potential fares because her car doesn't have enough range.



Ruairí, the Rural Commuter

When Ruairí commutes to work, he wants to feel confident that he will have enough charge to comfortably drive the long distance there and back. He also wants to be able to bring his daughter to camogie training when he gets home.



Anna, the Apartment Dweller

When Anna wants to charge her car in her apartment block, she wants to have access to an available charger (or know when they will be readily available). She doesn't want to have to worry about charger hogging or queuing endlessly for an available charger.



Mike, the HGV Driver

When Mike is driving across the country in his HGV, he needs to be able to top up his battery en route. This needs to be in a safe location so that he can rest while his HGV charges.



Rachel, the Retired Urban Dweller

When Rachel is charging her car on the go, she wants to be able to check in advance that the charger will be accessible to her. Rachel has limited mobility, so she wants to know that her chosen charger will be suitable for her needs.



The Jacksons, a Tourist Family

When the Jackson family travel in Ireland, they want to have a seamless EV experience. They want to be able to rent an EV and have charging facilities available at each of their destinations (including the remote ones). They don't want to worry about being stranded or lost on their holiday in Ireland.



Strategy structure

The Strategy consists of Six chapters along with two appendices:

The first chapter sets out the policy context for the delivery of infrastructure in Ireland and sets the scene for planned future action by Government.

Chapter Two sets out the fundamental principles underpinning the Strategy and the delivery of infrastructure, including a commitment to a people-centred approach and a Just Transition to EV technologies.

Chapter Three outlines the interaction between network demand and electricity grid and energy systems, setting out the likely electricity demand by 2030 to power Ireland's electric vehicles, and identifying how demand might be met by different categories of charging infrastructure

Chapter Four considers existing and future EV charge point technologies through several case studies, including how these technologies can be applied in different international and national contexts.

Chapter Five sets out the delivery mechanisms, planned funding streams and instruments through which Government and state bodies will deliver a targeted infrastructure programme.

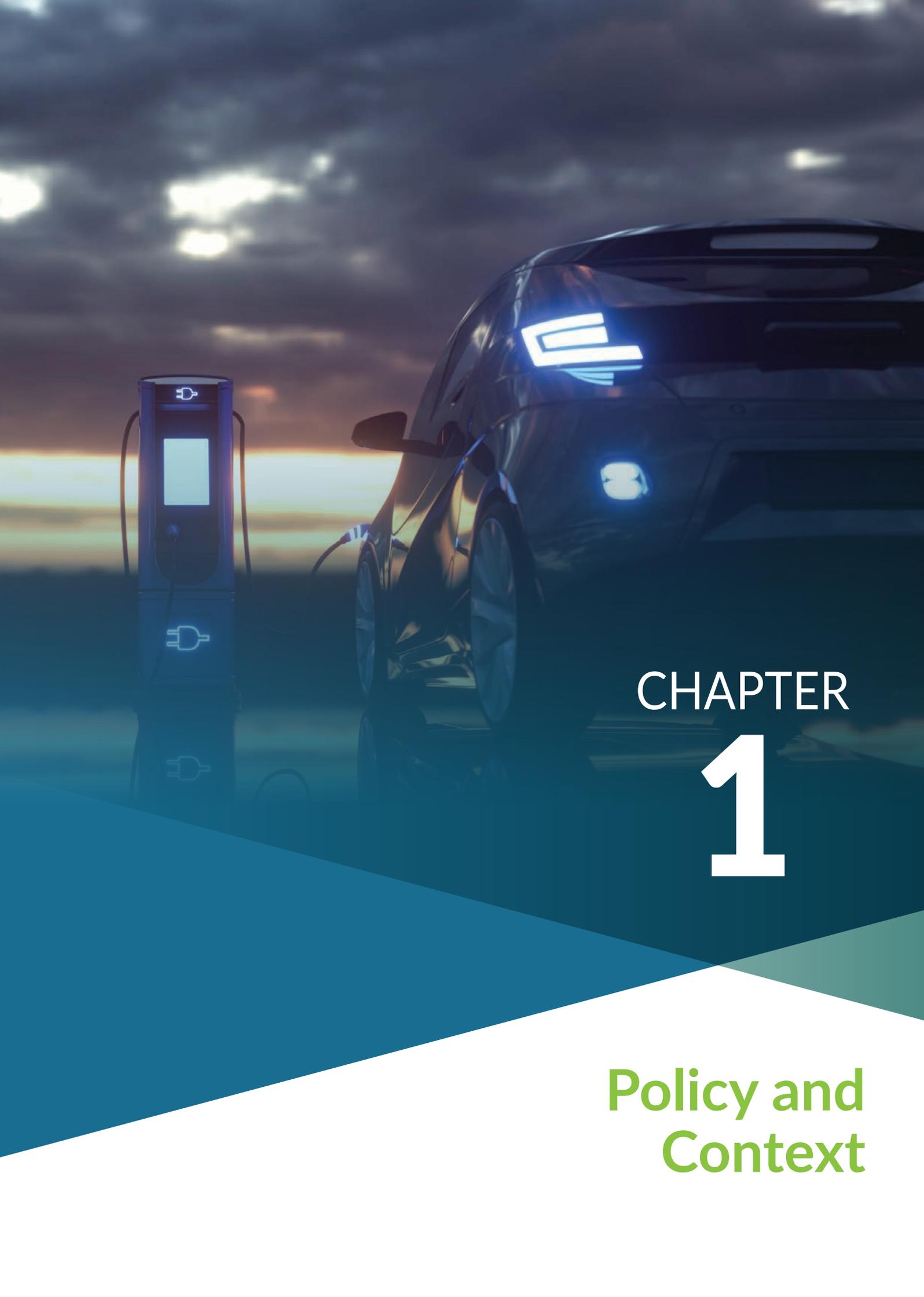
In the final Chapter Six, the organisational structures and actions that have been put in place to coordinate, target and support implementation of this Strategy are described. This chapter also gives an overview of the Implementation Plan and those actions that have been completed since the publication of the draft Strategy.

Appendix A includes an in-depth exploration of each persona's key moments and user journey.

Appendix B defines basic concepts related to electric vehicles and charging technology.



This strategy reflects the urgent need for action to address climate change and the need for a strategic and just transition to sustainable ways of travelling.



CHAPTER

1

Policy and
Context

The United Nations has identified climate change as the defining crisis of our time⁴ and in 2019, Ireland became the second country in the world to declare a climate emergency⁵. Science tells us that through human actions, particularly the burning of fossil fuels, our world is heating. This is leading to rapid changes in weather patterns, with many negative impacts on connected natural and human environments⁶. Nationally and internationally, fast and meaningful action to reduce global warming has been identified as a priority, with a focus on limiting emissions of the greenhouse gases that cause global warming.

1.1 National and international policy context

1.1.1 Climate Action Plan

In Ireland, where climate change and its impacts are a key concern of citizens⁷, the Government is firmly committed to action. This has been shown clearly over the last number of years, leading up to the Climate Action Plan 2023.

- **June 2019:** The first all-of-Government Climate Action Plan was published, setting out a pathway to reducing key greenhouse gas carbon emissions from all sectors.
- **June 2020:** The Programme for Government (2020) committed to achieving a 7% average annual carbon emissions reduction to 2030⁸.
- **July 2021:** The Climate Action and Low Carbon Development (Amendment) Act 2021⁹ came into effect. Ireland's ultimate objective of achieving carbon neutrality by 2020 (through a just transition) was made legally-binding through this act.
- **November 2021:** A new Climate Action Plan was published in 2021¹⁰ to reflect increased climate action ambitions. It also mapped out (on a sector-by-sector basis) the actions to be taken to achieve a 51% reduction in overall greenhouse gas emissions by 2030.
- **April 2022:** The carbon budget programme (proposed by the Climate Change Advisory

Council of the Houses of the Oireachtas) was formally adopted. These carbon budgets placed legally-binding limits on the level of emissions that may be released during a specific time period. This was the first time such limits had been introduced.

- **July 2022:** The Government established sectoral emission ceilings for relevant sectors of the economy. Under these ceilings, the transport sector is obligated to achieve a 50% reduction in emissions by 2030.
- **December 2022:** Publication of the Climate Action Plan 2023. This will be the first statutory Climate Action Plan to take the legally-binding carbon budget programme and sectoral emissions ceilings into account, and each sector must set out a clear action plan and pathway to meeting its emissions abatement targets.

Transport is closely tied to economic growth as well as being heavily reliant on fossil fuels. As a result, it has a key role to play in the fight against climate change. In Ireland, transport is responsible for about a fifth of our total national carbon emissions, with passenger cars accounting for nearly half of the transport total¹¹. Because of this, transitioning the Irish transport sector away from the use of fossil fuels and towards sustainable forms of travel is a key objective in the achievement of Ireland's climate goals.

⁴ <https://www.un.org/en/un75/climate-crisis-race-we-can-win>, accessed 04/03/2022.

⁵ <https://www.rte.ie/news/environment/2019/0509/1048525-climate-emergency/>, accessed 04/03/2022.

⁶ <https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/>, accessed 04/03/2022.

⁷ For example, see Leiserowitz, A. et al. (2021) Climate Change in the Irish Mind, New Haven, CT: Yale Program on Climate Change Communication; see also <https://www.epa.ie/news-releases/news-releases-2022/epa-survey-shows-climate-change-remains-the-most-pressing-environmental-issue-facing-ireland.php>; accessed 04/03/2022.

⁸ <https://assets.gov.ie/130911/fe93e24e-dfe0-40ff-9934-def2b44b7b52.pdf>; accessed 04/03/2022.

⁹ <https://www.irishstatutebook.ie/eli/2021/act/32/enacted/en/print>; accessed 21/11/2022.

¹⁰ Climate Action Plan 2021

¹¹ In 2019, transport was responsible for 20.4% of national greenhouse gas emissions, with a drop of 15.7% in 2020 due to the impacts of Covid restrictions on travel. With the lifting of restrictions, transport emissions have once again started to climb towards pre-pandemic levels, with increases across the whole road network in the first quarter of 2022.

The 'Avoid, Shift, Improve' approach prioritises sustainable mobility. As part of the 'Improve' element, electrification has been identified as having a key role in decarbonising transport. Together with increasing walking and cycling (active travel), expanding the use of public transport, and reducing the number of fossil-fuelled trips, replacing internal combustion engines with renewable electric technologies will contribute to a significant reduction in greenhouse gases. As well as lowering carbon emissions, electrification of the vehicle fleet offers a pathway to zero tailpipe air-pollutant emissions. Benefits include improved air quality and reduced noise pollution, particularly in our cities and towns.

Under the National Development Plan¹², the electrification of the vehicle fleet has been identified as a strategic investment priority for transport, with an aim to have approximately 30% of the vehicle fleet electrified by 2030.

Having an effective and reliable charging network is an essential part of enabling drivers to make the switch to electric vehicles. It is also an essential part of ensuring just and equal access to EVs across Ireland, including in rural areas¹³. This strategy is intended as a tool to deliver this infrastructure, and its remit is clearly set out in Action 271¹⁴ of the Climate Action Plan, which is to:

'Develop a national infrastructure strategy to address on-street, location and fast-charging infrastructure needs to stay ahead of demand, having particular regard to non-urban needs'

1.1.2 EU 'Fit for 55'

'Fit for 55'¹⁵ refers to the EU's target of reducing net greenhouse gas emissions by at least 55%

by 2030. The Fit for 55 package was submitted to the European Council in July 2021. It is being discussed across several policy areas, such as environment, energy, transport, and economic and financial affairs.

Within the Fit for 55 package, the EU Commission proposed to revise rules on CO₂ emissions for cars and vans. The proposal introduces increased EU-wide reduction targets for 2030 and sets a new target of 100% for 2035. In practice, this means that from 2035 it will no longer be possible to place cars or vans with an internal combustion engine on the market in the EU. The Council adopted its general approach on the proposal in June 2022, and an agreement with the European Parliament was reached in October 2022. The agreement will now have to be formally adopted by the two institutions.

In Ireland, our national EV infrastructure systems will also be shaped by updated EU legal structures and new guidelines that will be drawn up as part of the Fit for 55¹⁶ package to help member states reach their carbon emissions reduction targets.

1.1.3 Alternative Fuels Infrastructure Regulation

At an EU level, the upcoming Alternative Fuels Infrastructure Regulation (AFIR) will lay down common technical specifications and requirements for EV infrastructure. These will relate to transparent user information, data provision and sharing, and payment requirements. Once in force, they will ensure a seamless and easy charging experience.

National targets for infrastructure provision will be set through the proposed AFIR¹⁷, and through refuelling requirements mandated for the EU's

¹² Govt of Ireland (2021) National Development Plan 2021-2030, p. 130.

¹³ gov.ie - Our Rural Future: Rural Development Policy 2021-2025 (www.gov.ie) Page 16

¹⁴ Climate Action Plan 2021

¹⁵ <https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/>

¹⁶ <https://www.consilium.europa.eu/en/policies/green-deal/eu-plan-for-a-green-transition/>

¹⁷ The Alternative Fuels Infrastructure Regulation (AFIR) has been proposed as a revision of the in-force Alternative Fuels Infrastructure Directive (2014/94/EU). The European Council proposal: <https://www.consilium.europa.eu/en/press/press-releases/2022/06/02/fit-for-55-package-council-adopts-its-position-on-three-texts-relating-to-the-transport-sector/> & European Parliament proposal: https://www.europarl.europa.eu/doceo/document/TA-9-2022-0368_EN.html

main transport corridor network, the Trans-European Transport Network (TEN-T)¹⁸.

Both the AFIR and the aligned associated targets for total publicly-accessible charging power output and TEN-T targets are currently being negotiated. When agreement is reached, these frameworks will specify national EV charge point targets for Ireland, including the numbers and types of charge points required and the types of places in which these charge points are to be located. This strategy is intended to provide the framework through which these obligations, once settled, can be delivered.

1.1.4 Renewable Energy Directive

The Renewable Energy Directive is the legal framework for the development of renewable energy across all sectors of the EU economy.

Since its introduction in 2009, the ambition and measures in the directive have been reviewed several times in order to deliver the urgent emission cuts required. The latest proposed revision is now being considered by the European Council and the European Parliament, and it is expected to be adopted by first quarter 2023¹⁹.

The revised proposal of the Renewable Energy Directive (REDIII) includes a focus on the potential of EV charging to contribute to cleaner, more efficient energy systems. It is closely linked to the revision of the Alternative Fuels Infrastructure Regulation (AFIR). Both will play an important role in creating the right framework of EV charging for a range of purposes and in a variety of locations.

1.1.5 National Development Plan

In the National Development Plan 2021, funding for vehicle electrification has been included in the €1bn that has been allocated to specific carbon-reduction measures. It allows for €100m

in the period to 2025 to support investment in EV charging infrastructure.

This allocation will support the Climate Action Plan ambition of having almost one million EVs on the roads by 2030.

Securing an early transition to zero/low-emission vehicles in the private and public fleets is key to meeting this objective.

1.1.6 National Sustainable Mobility Policy

The National Sustainable Mobility Policy²⁰ (published in April 2022) sets out a strategic framework to 2030 for active travel and public transport. The framework supports Ireland's overall requirement to achieve a 51% reduction in carbon emissions by the end of this decade.

While this policy does not directly cover the provision of public charging infrastructure, it is key that the EV Charging Infrastructure Strategy aligns with its principles and targets. These include shifting away from the private car to greater use of active travel and public transport as part of the overall 'Avoid, Shift, Improve' principle.

The scale of behavioural change required to achieve these targets is transformational and unprecedented. Therefore, it will be key to understand how the implementation of the National Sustainable Mobility Policy will impact on accelerating trends, urban development, user behaviours, and, consequently, on public charging infrastructure needs.

Some plans are already under consideration, such as the provision of e-Mobility hubs. These consist of charging infrastructure for shared electric-mobility solutions such as electric bicycles and e-car clubs. When coupled with the right demand-management measures and land-use planning, these will help embed our electrification strategy into our wider sustainable mobility policy.

¹⁸ The EU's Trans-European Transport Network (TEN-T) policy aims to build an effective, multimodal transport network across the EU. The development of the TEN-T is based on identifying the transport infrastructure in Member States that has 'high added value at the European level and that should be part of the TEN-T network'.

¹⁹ https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en

²⁰ Ireland's new Sustainable Mobility Policy is a Priority in our Climate and Energy Use Plans For the Future - MerrionStreet

1.1.7 Public Sector Leadership

The public sector will lead by example in meeting EV targets under the CAP by promoting the delivery of EV charging infrastructure through Green Public Procurement, through climate mandates (underpinned by national public sector energy-efficiency obligations)²¹, and through the recast Clean Vehicles Directive, which was transposed into Irish law in 2021²². A Public Procurement Framework for charging infrastructure for public sector fleets will also be developed.

As part of its Climate Action Mandate, a public body will be required to procure only zero-emission vehicles from the end of 2022. This will enable Ireland to go beyond the requirements of the Clean Vehicles Directive and act as an international leader in this area. Public sector procurement contracts for delivery and haulage should specify zero emissions vehicles where possible.

At local level, local authorities will also need to prepare individual Climate Action Plans (to be in place by March 2024) as part of the

Climate Action and Low Carbon Development (Amendment) Act 2021²³. These will include both mitigation and adaptation measures and will be updated every five years. Local Authority Development Plans must be aligned with their Climate Action Plans.

1.1.8 Shared Island

As part of the Shared Island initiative, and supported through the Shared Island Fund, the Government will work through all-island partnerships to explore and implement the provision of targeted EV charging infrastructure. This will benefit communities and increase access to EVs across the island of Ireland, with co-benefits across other sectors such as tourism and heritage.

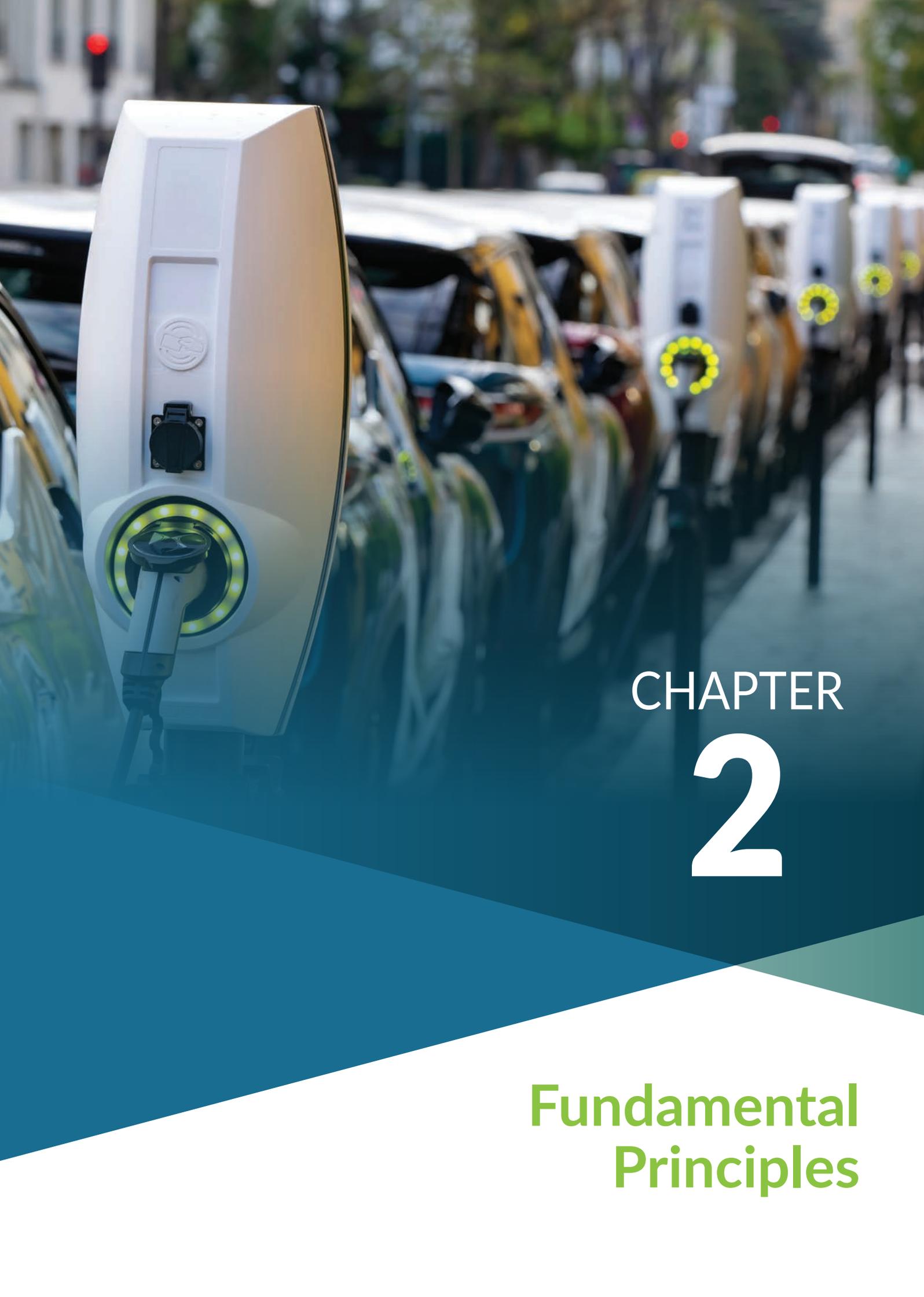
The Government will also work to promote the parallel development of aligned standards and the use of interoperable technologies and digital systems on the island. This will help to capture and exploit benefits arising from expected renewable energy alignment on both sides of the border. In border regions and along major transport corridors, it will also deliver efficiencies in meeting the requirement for EV charge points.

²¹ <https://www.seai.ie/business-and-public-sector/public-sector/public-sector-energy-programme/obligations-and-targets/>

²² <https://www.irishstatutebook.ie/eli/2021/si/381/made/en/pdf>

²³ Climate Action and Low Carbon Development (Amendment) Act 2021 ([irishstatutebook.ie](https://www.irishstatutebook.ie)) amendment 16





CHAPTER
2

**Fundamental
Principles**

This strategy is based on a set of fundamental principles that underpin the rollout of EV charging infrastructure over the coming decade. These principles exist against the backdrop of climate change, the urgent need to decarbonise the Irish transport system, and the opportunity to maximise the benefits of the electric mobility transition for all citizens. They aim to make EV charging possible for everyone, regardless of income, age, health, or location.

2.1 Principle 1: EV infrastructure will form part of a wider sustainable transport network

As part of the 'Avoid, Shift, Improve' approach²⁴, it is key that for those journeys where the only option is to travel by private car, their carbon footprint can be improved by using an electric vehicle. Electric vehicles will have an important part to play in transforming the Irish transport system into one that is clean, green, and sustainable. This improved system will support communities and economic growth as we move towards a net zero carbon future.

The projected increase in the number of EVs (alongside the rollout of associated infrastructure) will not occur in isolation. It will happen as part of a wider transformation that will see more people walking and cycling to their destinations. This transformation should also involve more use of public transport and new shared car initiatives (such as car clubs) in preference to car ownership.

To support this mobility transformation, the ways in which our cities, towns, and transport networks are designed, built, and used will change. This will happen as part of a wider prioritisation of sustainability and climate-friendly policies. With sustainability will come co-benefits such as improved air quality, lower noise pollution, and healthier environments. These will support progress towards achieving a better life for all as set out in the United Nations Sustainable Development Goals (SDGs)²⁵.

It will be important that both the planning of and investment in electric vehicle charging

infrastructure is undertaken in a way that considers the wider sustainable-transport system. The Government's new Sustainable Mobility Policy will set out a roadmap for the transition to sustainable transport systems and technologies in the coming decade.

The provision of electric vehicle charging infrastructure will align with this roadmap, recognising that sustainable mobility will not be a one-size-fits-all model. Instead, it will develop and evolve to reflect local needs and circumstances. These will include whether vehicle users live in rural or urban settings, whether they live in houses or apartments, what access they have to public transport options, and whether they can use active travel to move around.

2.2. Principle 2: EV charging infrastructure will work for everyone, regardless of age, health, income, or other needs

A fully-inclusive EV charging infrastructure network will work for everyone, regardless of age, health, income, or other needs. This will ensure a fair and equitable transition to large-scale EV use.

To ensure access for all citizens, a set of Accessibility Standards, specifically focused on EV charging infrastructure, will be developed. These standards will ensure that principles of universal access and universal design are considered at all stages of EV infrastructure development, from planning and design stages to operation and use.

Additionally, EV charging infrastructure needs to be accessible, safe, and secure for all members

²⁴ https://www.transformative-mobility.org/assets/publications/ASI_TUMI_SUTP_iNUA_No-9_April-2019.pdf

²⁵ Particularly UN SDG 3 'Good health and well-being', SDG 7 'Affordable and clean energy', SDG 9 'Industry, Innovation and infrastructure', SDG 11 'Sustainable cities and communities' and SDG 13 'Climate action'; for more information on the SDGs see <https://sdgs.un.org/goals> and <https://irelandsg.geohive.ie/>.

of the population. This means that decisions around the siting and location of EV charging infrastructure should always take into account the potential impact on users and the wider public. Issues such as seclusion, lighting, and safety, together with the potential creation of new hazards to other road users such as pedestrians or cyclists, should be carefully considered at all the stages of the decision-making process.

The strategic siting of rural EV charge points will support the transition to electric car use in areas of low population density. Moreover, the strategic planning of EV schemes will be extended, both nationally and on an all-island basis, in order to calibrate the provision of charging infrastructure from a just transition perspective. This will not only include rural areas or locations where making the business case for investment is more challenging, but also other underserved areas lacking public transport provision or other travel alternatives.

The provision of dedicated EV charging infrastructure for e-car clubs and at taxi ranks has the potential to support the move away from car ownership. This is an example of embracing the 'Avoid, Shift, Improve' approach.

The need for a reliable EV infrastructure to support the tourism industry will also be given special consideration, particularly in those areas (often rural) where seasonality may pose challenges to developing a year-round, commercially-viable charging infrastructure. This includes, for instance, tourist offerings such as the Wild Atlantic Way, the Gaeltacht, and the Islands.

2.3 Principle 3: For the majority of EV users, home charging will remain the main solution

Home charging is the most cost-effective and convenient way of charging electric vehicles in Ireland. It currently accounts for c. 80% of EV charging sessions²⁶, a pattern comparable

to that seen in other European countries such as Norway²⁷, the Netherlands²⁸, or the United Kingdom²⁹. In these countries, most early-adopter charging is done at home.

Approximately three quarters of Irish car owners have access to private off-street parking with the option of installing lower-power charge points (c. 3.4 kW-7 kW) that can be connected to domestic electricity supplies³⁰. Home charging allows electric vehicles to be parked, plugged in, and left to charge overnight, with the possibility of benefitting from lower night-rate electricity prices.

As well as being cost-effective for vehicle users, home charging can also offer wider systemic benefits. By spreading the charging loads across longer and off-peak time frames, home charging can reduce pressure on local electricity networks and can result in more evenly-distributed loads across the national electricity grid. If combined with at-home renewable-energy generation, such as solar panels, it can reduce or remove the need for electricity from the grid.

As EV uptake accelerates in Ireland, home charging should remain the most common and easiest form of charging for the majority of vehicle users. Special provisions should be made for people who live in higher-density residential blocks (such as apartments) as well as people in residential developments with shared parking facilities. The Energy Performance of Buildings Regulations 2021 already have particular standards in place for new buildings (containing one or more dwellings) and buildings undergoing major renovation. Such buildings must include infrastructure which allows for the future installation of charging points for EVs.

Home-charging solutions will also offer opportunities to help balance demand on the grid. For example³¹, dynamic power-management systems will allow existing power to be shared across more charging points. This will enable more

²⁶ Dept of Transport (2021) Electric Vehicle Policy Pathway Working Group Report, p 20.

²⁷ Govt of Ireland (2019) Low Emission Vehicle Taskforce Phase 2 Report, pp. 57-59.

²⁸ Netherlands Ministry of Economic Affairs (2017) Vision on the charging infrastructure for electric transport, pp. 9-10.

²⁹ ICCT (2020) Fulfilling electric vehicle charging infrastructure needs in Greater London and its boroughs, p. 3, p. 6.

³⁰ Govt of Ireland (2017) National policy framework for alternative fuels infrastructure for transport in Ireland 2017-2030, p. 40

³¹ <https://blog.wallbox.com/en-ie/benefits-of-smart-charging/>

vehicles to charge simultaneously at a slower pace, without having to install additional charging points. There is also the possibility of Vehicle-to-Grid (V2G) energy-management systems. These allow plugged-in EVs to act as back-up battery storage and feed energy back into the grid at certain times to balance demand.

Similarly, for commercial vehicles such as electric vans and light trucks (as well as heavier, battery-fuelled electric trucks when these become more commonly available³²), private charging in depots will remain the most cost-effective and common form of charging.

2.4 Principle 4: Options will be provided for those who cannot charge at home

For some, charging at home will not be an option. It is vital that they are provided with residential charging solutions that mirror and give the same

benefits as the home-charging option. Residential charge points should replicate the home-charging pattern of charging vehicles at night, during off-peak periods, and at a lower cost. There is an onus on national and local government to facilitate the provision of these charging solutions for citizens who do not have access to a home charge point.

- **Residential on-street charge points:** It is expected that as growing numbers of people switch to EVs, there will be an increased need for publicly-accessible and on-street (c. 7 kW) charge points to cater for those who do not have access to private off-street parking and cannot charge their vehicles at home³³.
- **Shared Charging:** Shared-charging solutions, whereby EV owners can rent out the use of their personal home charge point, can provide a low-cost, easy-to-deliver charging solution for EV owners without access to a driveway.
- **Destination charge points:** The provision of EV charge points at destinations such as sports

³² EU TRAN Committee (2021) Alternative fuels infrastructure for heavy-duty vehicles study

³³ European Court of Auditors (2021) Special report on infrastructure for charging electric vehicles.



Residential charge points should replicate the home-charging pattern of charging vehicles at night, during off-peak periods, and at a low cost.

facilities, retail outlets, hotels, co-working hubs, tourist sites, and privately-operated carparks will also cater for the charging needs of people wishing to top up their EVs during the day and while on the go. Such locations would be particularly suited for fast charge points and (depending on duration of stay) high-powered charge points. The latest Energy Performance of Buildings Regulations 2021 will also require the provision of charging points and ducting infrastructure in new buildings and existing buildings undergoing major renovations (other than a dwelling). This is subject to the building meeting specific thresholds.

- **En-route charge points:** Increased provision of publicly-accessible high-powered (c. > 100 kW) charge points will also be needed to cater for drivers making longer journeys, such as between cities or along the National Roads Network.
- **Fast Taxi-Charging Hubs:** To support the greening of the taxi fleet, a number of dedicated fast taxi-charging hubs will be required to enable drivers to quickly charge and go.
- **Publicly-accessible heavy-duty-vehicle charge points:** A minimum number of publicly-accessible high-powered charge points will also be required to meet the future charging needs of heavy-duty electric vehicles such as large goods trucks. This number will be set out in the revised Alternative Fuels Infrastructure Regulation and will be dictated by Ireland-specific market needs and freight transport patterns.

To cater for this range of needs, and to ensure that the solutions are as cost-effective as possible, varying business cases and models will apply³⁴. These will be supported by analysis of locations, demand, grid capacity, local planning, housing, and fleet ownership conditions. Future development policies will also be considered.

Provision of publicly-accessible charging infrastructure will also respond to technological developments and innovation. This will future-proof public supports as well as private

investment and assets. It will allow employment and economic opportunities to be identified and maximised.

As EV uptake increases and becomes more mainstream in Ireland, it is anticipated that there will be a collective shift in public understanding about how private vehicles are refuelled. The existing model of visiting petrol forecourts will shift to one where refuelling (or, in fact, charging) is primarily done at home. Depending on individual travel needs, only a small amount of top-up charging may be required. In effect, EV drivers can depart their place of residence with the equivalent of a 'full tank' daily, without ever needing to visit a public charge point.

At present, research into perceptions about the existing charging network indicates that, for the most part, private citizens consider there to be an insufficient supply of publicly-accessible charge points to meet the current level of demand. One of the key objectives of this strategy is to address the possible range and charger anxiety of early EV adopters and to provide confidence to potential users regarding their charging options. This is particularly important for those who cannot charge at home. With this shift to private refuelling/charging behaviour as EVs become more mainstream, there will be an equivalent shift in public perceptions regarding the frequency of recharging and dependence on public charging points.

2.5 Principle 5: Across the EV charging network, EV charging systems will be interoperable and as simple as possible to use

Ensuring interoperability and simple charging interfaces will be a crucial part of developing a fast, reliable, and easy-to-use charging network, facilitating market growth.

At an EU level, the upcoming Alternative Fuels Infrastructure Regulation will lay down common technical specifications and requirements

³⁴ Publications Office of the EU (2020) State of the art on alternative fuels transport systems in the European Union, p. 262; Ryan et al. (2018) The state of play in electric vehicle charging services: global trends with insight for Ireland, UCD Energy Institute Report.

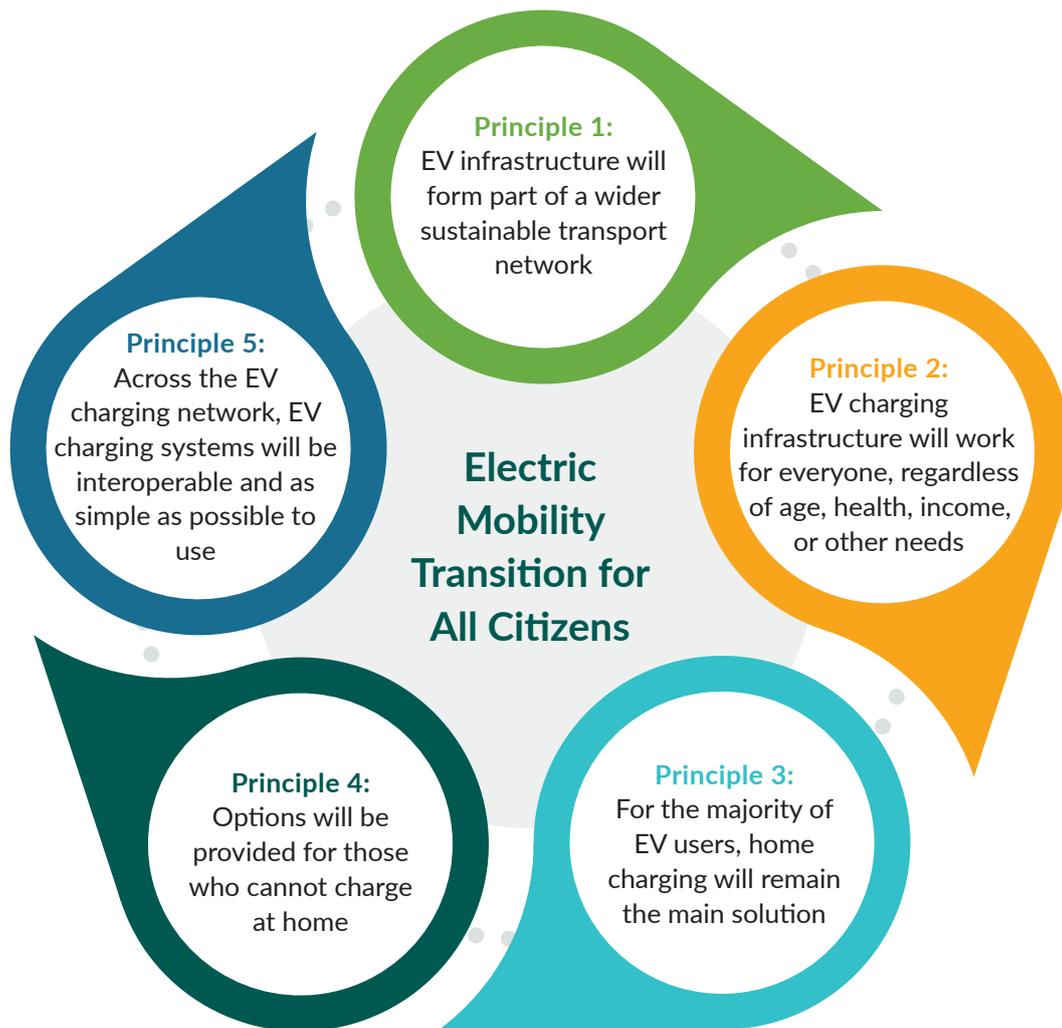
regarding transparent user information, data provision and sharing, and payment requirements. Once in force, these will ensure a seamless and easy charging experience.

On the island of Ireland, interoperability of charging infrastructure and systems is also a significant consideration. This is due to the integrated all-island nature of the energy sectors both north and south of the border, and the significant cross-border movement of people and freight.

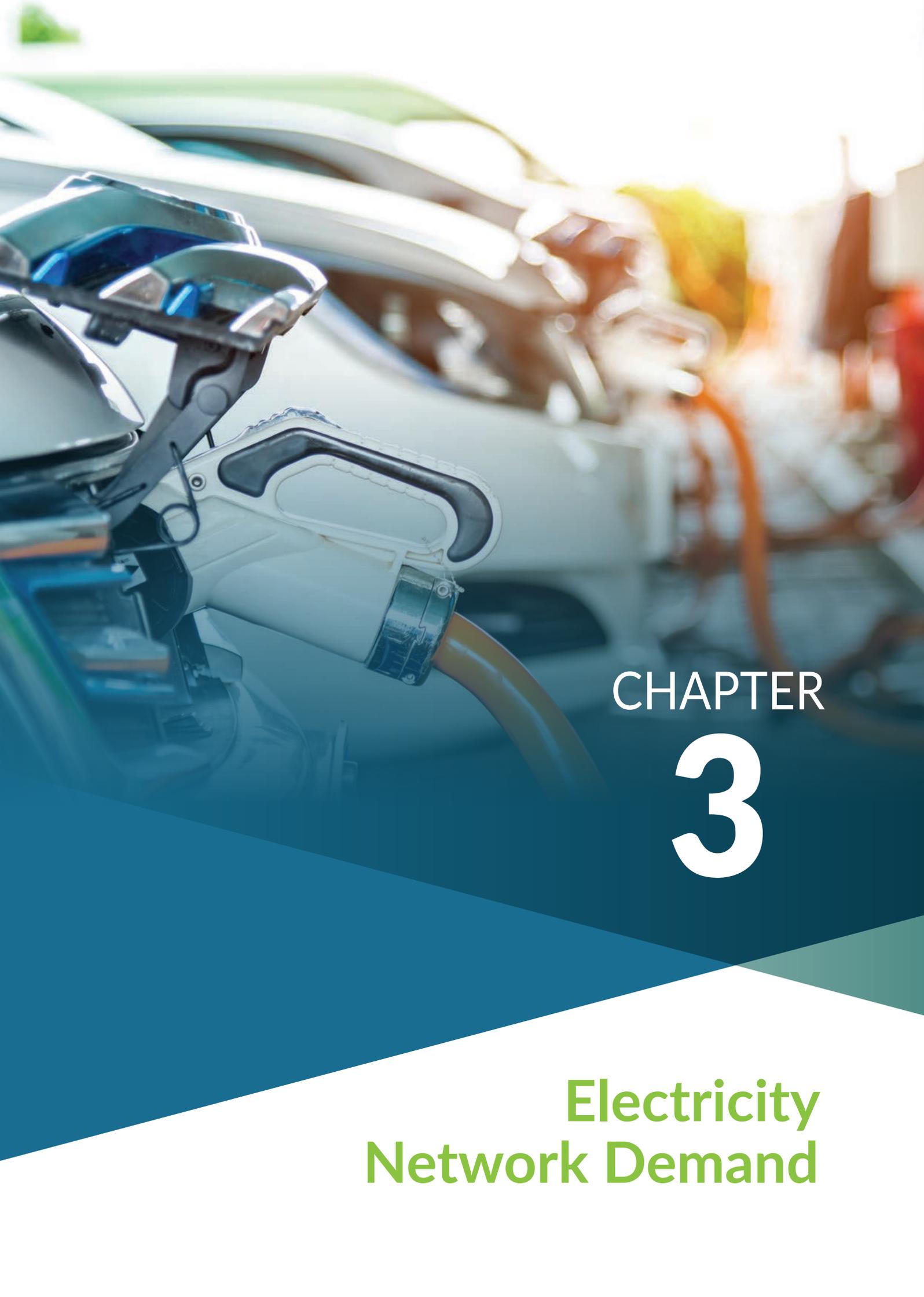
In practice, interoperability involves developing and applying common standards for physical connection points, and ensuring that digital interfaces and operating systems recognise and

can communicate with each other. Ireland-specific studies in this area³⁵ have identified certain key elements that can maximise interoperability. These include the selection of standard connectors (which have now also been adopted at EU level) and charge points, and the development of interoperable hardware and software solutions. The simpler and easier to use these systems are, the more people will be able to use them.

Interoperability will therefore be a key requirement in the development and rollout of EV charging infrastructure. To meet the needs of all citizens, EV charging should be as simple as possible, with a principle of easy access.



³⁵ E.g. ESB Networks (2018) Preparing for electric vehicles on the Irish distribution system. Pilot study report. CRU18220-ESB-Networks-EV-Pilot-Project-Summary-Report-2.pdf



CHAPTER

3

**Electricity
Network Demand**

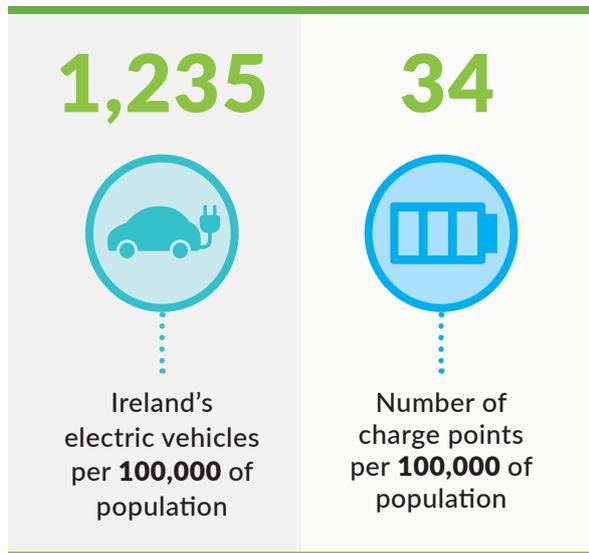
3.1 Demand on the system and expansion of EV charging

The widespread use of electric vehicles will place more pressure than ever on Ireland’s electricity network. Nonetheless, this is a challenge that must be faced in order to meet our country’s climate goals. In-depth planning will be needed as well as detailed consultation with energy providers and network operators. However, a range of smart technological advancements will also play a part in making sure the grid can cope with the surge in charging demand.

Current Charging Network

With a charging network of approximately 1,700 publicly-available charge points³⁶, Ireland is currently behind the EU average in infrastructure provision. Across the EU, there is an average of 73 charging points per 100,000 inhabitants. However, this is very unevenly distributed and only 8 countries surpass this ratio: Austria, Belgium, Denmark, Finland, Germany, Luxembourg, the Netherlands, and Sweden³⁷.

Figure 1: Public charge points and electric vehicles licensed in Ireland per 100,000 of population³⁸



Part of the reason for Ireland having fewer charge points in comparison to the European average is likely to be the greater access to home charging solutions in Ireland than across Europe,

where up to 42% of citizens do not have the facility to access a home charger³⁹.

Based on the rapidly-growing number of EVs in Ireland, we are also behind EU averages when looking at the number of EVs per charge point installed. However, there are other valid ways to compare. The gap is narrower, for example, when comparing the number of EVs per DC rapid charge point (>50 kW). The European average is 147, while in Ireland we have 207 EVs per DC rapid charge point (>50 kW).

Ireland has a range of unique geographical and socioeconomic characteristics. These characteristics frame both the challenges and opportunities of improving our charging network. They include:

- Relatively short distances between major Irish cities and towns, and a relatively short geographical distance on the island;
- A temperate climate;
- A high amount of and potential for renewable electricity;
- A high percentage of homes with driveways.

Overall, these factors make Ireland an ideal location for successful widespread use of electric vehicle technology.

While it is important to benchmark ourselves against other markets, it is also key to fully understand Ireland’s specific circumstances. They must be considered when forecasting and planning for future public charging needs.

³⁶ European Alternative Fuels Observatory/Ireland/Infrastructure (September 22)

³⁷ ChargeUp Europe, State of the Industry Insights into the Electric Vehicle Charging Infrastructure Ecosystem

³⁸ European Alternative Fuels Observatory. Battery Electric Vehicles or BEVs licensed, last update 30 Sept 2022.

³⁹ McKinsey Article: Europe’s EV opportunity—and the charging infrastructure needed to meet it

The Scale of the Charging Network Required by 2025

The coming decade will present the significant challenge of delivering sufficient EV charging infrastructure to meet emerging demands. This must be done in a manner that is safe, resilient, equitable, and sustainable.

As well as Government action to increase the investment in the EV Charging network (with €100m pledged over the three years to 2025), the EU Alternative Fuels Infrastructure Regulation (AFIR) will increase the ambition of EV charging provision in Ireland. The AFIR is currently being negotiated at EU level and expected to come into force in 2023.

The EU, through the AFIR, will require a minimum deployment of public charging infrastructure to be established for each state in the EU. Member States are expected to be mandated by law⁴⁰ to ensure that, at least:

1. Publicly-accessible charging stations are deployed, commensurate to the number of

BEVs/PHEVs (1 kW of charging per BEV and 0.66 kW per PHEV). This is to incentivise the uptake of light-duty electric vehicles.

2. A minimum coverage of publicly-accessible charging points (dedicated to light-duty vehicles) is in place on the national motorway network by the end of 2025. For example, charging pools with over 300 kW charging capacity, including an ultra-rapid (over 150 kW) charger, will be required at least on the Ten-T Core Network, every 60 km in each direction.
3. A minimum coverage of publicly-accessible charging points (dedicated to heavy goods vehicles) is in place by the end of 2025. For example, charging pools with a total capacity of 1400 kW every 120 km on 15% of the TEN-T Network, with at least one charger sized 350 kW (minimum of 8 such charging pools).
4. Each urban node (Irish examples being Dublin, Cork, and Shannon) has a 600 kW charging pool for HGVs, with at least one charger of 150 kW in each pool. These pools must be in place by the end of 2025.

⁴⁰ The Alternative Fuels Infrastructure Regulation (AFIR). The regulation is currently under negotiation. The European Council proposal: <https://www.consilium.europa.eu/en/press/press-releases/2022/06/02/fit-for-55-package-council-adopts-its-position-on-three-texts-relating-to-the-transport-sector/> & European Parliament proposal: https://www.europarl.europa.eu/doceo/document/TA-9-2022-0368_EN.html The criteria above are the minimum standards called for in each of the three positions; by the Council, the Commission or Parliament. If the triologue negotiations finalise on a higher requirement, ZEV1 will adjust the figures upwards.



Using these guidelines will result in a range of estimates for the amount of publicly-accessible charge points needed by 2025.

By 2025 Ireland is expected to have 195,000 light-duty electric vehicles. The ambition of this strategy is focused on delivering the infrastructure to meet and be ahead of Ireland’s charging needs. The first AFIR criteria above would require Ireland to have approximately 169,000 kW of charging power across the country. This strategy aims to deliver at least the AFIR requirement. The distribution of the different types of charge-point offerings will be designed based on user needs. As outlined in Table 1, the number of charge points could increase from approximately 1700 in September 2022 to somewhere between 2540 and 4850 by 2025.

The key target will be to deliver the overall power required with an optimal mix of charger types to address the three categories of need: residential/ neighbourhood charging, destination charging, and en-route charging.

As seen from Table 1, while each scenario shows

a different number of residential/neighbourhood charge points and destination/en-route charge points, each combination delivers the same total charging power. This is because of the difference in charging power offered by each category of chargers. Larger, ultra-fast chargers (with 350 kW power), that could be based in en-route charging stations, provide almost 50 times the charging power of a neighbourhood 7 kW charger. Between now and 2025, scenarios 2, 3, or 4 are the most likely.

The number of publicly-accessible chargers required under AFIR depends on several factors such as:

- EV uptake in the years to 2025;
- The level of BEV uptake versus PHEV uptake;
- The mix of slow/fast/rapid/ultra-fast chargers. This will be driven by the charging behaviour of users and the availability of new technologies that enable faster charging.

Although home and workplace charging will remain dominant in Ireland, it is likely that demand for higher-speed, publicly-accessible

Table 1: Charge Point Rollout Scenarios

	Residential/ Neighbourhood 0-22 kW	Destination/ En-Route 23 kW-350 kW	Total Number of Publicly- Accessible Chargers Nationwide	Total Charging Power Nationwide (kW)
Existing	1,349	374	1,723	67,237
Scenario 1	1,460	1,080	2,540	169,000
Scenario 2	1,650	1,300	2,950	169,000
Scenario 3	1,990	1,320	3,310	169,000
Scenario 4	2,660	1,180	3,840	169,000
Scenario 5	4,070	780	4,850	169,000

top-up charging will increase⁴¹. When sited at motorway service locations, these will have the added benefit of supporting and enabling longer-distance emission-free travel. The siting of higher-powered, faster charge points will be dictated by two key factors: the consumer demand for particular charge points as well as the local electricity grid’s ability to accommodate them in a timely fashion.

Impacts on the Grid

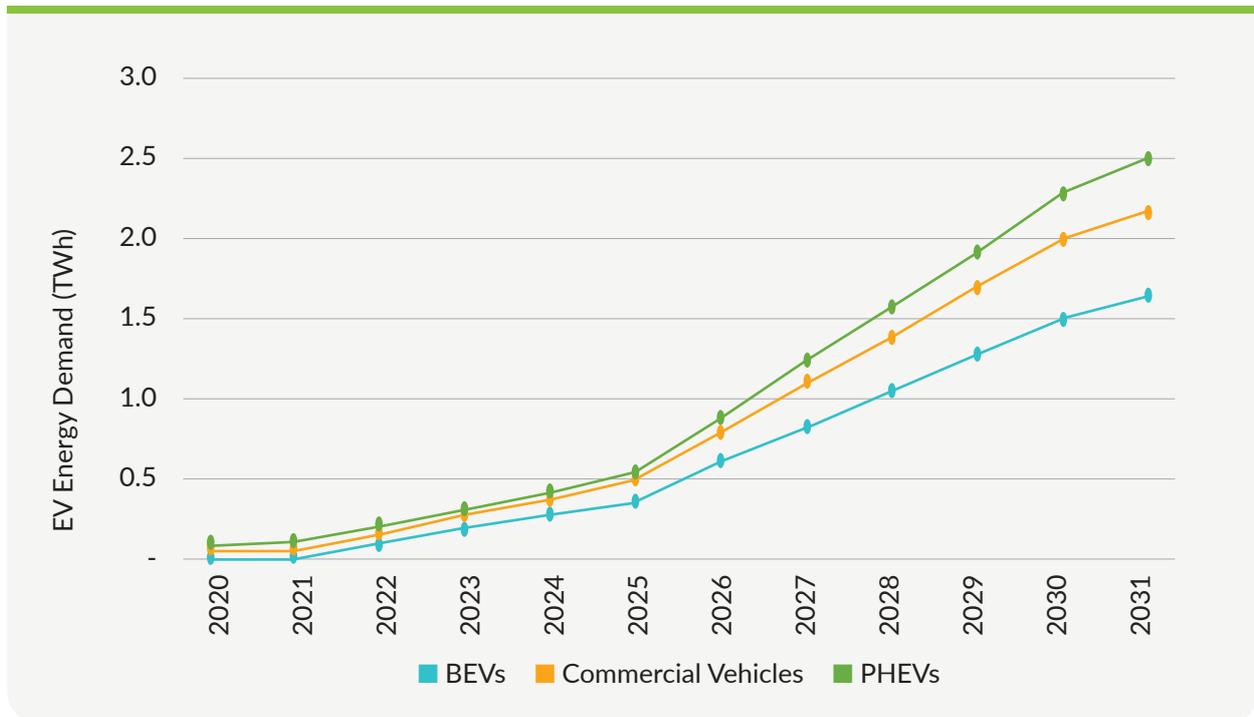
As electric vehicle uptake increases, EV charging is expected to have a significant impact on the local (low and medium voltage) electricity grid.

ESB Networks studies, as part of their National Network Local Connections Programme (NNLC)⁴², have shown that EV charging could result in different localised peaks at different times in different places. This would require significant investment in new and reinforced electrical networks to accommodate this additional electrical load.

The NNLC studies also showed that if EV charging can be done in smarter ways, the existing local network could accommodate much of this new load, and investment could be minimised or deferred. One of the cornerstone aspects of this programme is the rollout of grid demand-response services. These will help to engage households (as one customer cohort) to adjust demand based on signals sent by the grid operator and to get rewarded for providing this service.

EirGrid’s latest All-Island Generation Capacity Statement 2022-2031 provides an EV energy-demand forecast up to 2031⁴³. It accounts for the number of vehicles, vehicle efficiency, and average distance per vehicle (Figure 2). It assumes that 100% of the CAP21 targets will be met with 845,000 passenger vehicles and 95,000 commercial vehicles by 2030. From the graph, we can see that electricity demand due to EV charging is expected to grow considerably in the next decade, particularly between 2025 and 2031.

Figure 2: EV Energy Demand - Median Scenario



⁴¹ OECD/IEA; Nordic EV Outlook 2018: Insights from leaders in electric mobility | READ online (oecd-ilibrary.org)

⁴² National Network, Local Connections Programme (esbnetworks.ie)

⁴³ EirGrid and SONI – Ireland Capacity Outlook 2022-2031

3.2 Managing energy demand and grid capacity

As EV numbers increase on Irish roads, how and when people charge will become critical for the effective management of the wider electricity system. Technological developments, such as smart, integrated electric-charging solutions, will help manage the impact and maximise the renewable energy used to supply this new load.

The path towards electric mobility may not only change the overall demand volume but also the shape of the hourly load curve of the power system. This will entail significant challenges for electricity generation and transmission as well as for distribution infrastructure⁴⁴. However, there is potential for reducing the impact on peak load by coordinating the charging sessions to make the demand more flexible. ESB Networks is advancing options in this space. With the rollout of smart meters and smart home chargers, people will have access to at-home technology with the ability to receive pricing signals. These signals will guide EV owners to charge at times that are more favourable. Furthermore, this load - if charging takes place at times when renewable generation is high - would increase the level of renewable generation that can be accommodated on the electricity network. This would minimise or defer the required investments in infrastructure upgrades.

Other initiatives also have the potential to offset increased EV energy demands. These include the possibility of Vehicle-to-Grid (V2G) energy-

management systems, where plugged-in EVs can act as back-up batteries and feed energy back into the grid at certain times to help balance demand⁴⁵. Another possibility is microgeneration, where homes and businesses generate renewable energy for their own consumption⁴⁶. Microgeneration, where installed, can potentially allow EVs to be charged at home (or at a local level), off-grid. This would reduce demand on the national electricity network and facilitate EVs to be powered by 100% carbon-neutral, renewable energy.

Potentially, EV owners can financially benefit from smart and flexible charging options in two ways:

- (1) At home, they can save money by charging during off-peak hours. Night-time charging is approximately half the price of day-time charging.
- (2) Where the EV charging point (at home or in public) can respond to ESB Networks or EirGrid signals, there are financial incentives emerging to reward the user for this service.

⁴⁴ European Commission - Effect of electromobility on the power system and the integration of RES

⁴⁵ Guide To... Vehicle-to-Grid Charging – IrishEVs

⁴⁶ Micro-generation Support Scheme | Press Release | SEAI



3.3 Grid development and resilience for delivery of higher-speed charging infrastructure

Destination, en-route, and other fast-charging infrastructure is important for the continued uptake of electric vehicles. Therefore, it is essential for the electricity grid to have the capacity and resilience to support such demand. The grid must be supported by a smart and equally-resilient charging network. Zero Emission Vehicles Ireland will intensively engage with ESB, EirGrid, CRU, and energy suppliers, as well as charge point and forecourt operators, to ensure a timely and coordinated approach to energy provision and grid management.

Even with off-peak overnight charging (AC 7 kW) as the baseline default charging option for most EV users, there remains a need for provision of higher-speed top-up charging at trip destinations or en route. In practice, this would involve higher-speed DC charging at power levels ranging from 50 kW up to 350 kW.

Destination Charging

Destination charging will provide charging solutions (typically 7 kW-100 kW) at tourism and leisure locations such as leisure centres, parks, hotels, and visitor attractions. These would allow EV drivers to charge their vehicles for 1-10 hours before returning home, depending on the nature of their visit and duration of stay.

The private sector has already shown interest in this area of the market. In Ireland, we have seen the provision of top-up charging infrastructure in locations such as car parks, supermarkets, and hotels.

This strategy envisages a supporting role for Government in providing initial seed funding to stimulate and encourage more widespread rollout of this kind of charging infrastructure. Government will also have a key role in coordinating the various stakeholders involved in delivering this infrastructure.

En-Route Charging

Ultra-rapid, high-speed, on-the-go charging will encourage the transition to electric vehicles. Such charging infrastructure must be fast and high-powered (100 kW or more) to make the charging experience as similar as possible to taking a quick comfort break while driving an ICE vehicle.

Currently, in Ireland, there are approximately 375 publicly-accessible charge points at power levels in the range of 50 kW-350 kW capacity. To deliver

on AFIR requirements, this number will need to increase to between 780-1,320 rapid-charging points.

Delivering this ultra-rapid charging network will require a high level of planning as well as engagement with energy providers and electricity network operators. The energy demand for this will be significant, with power demands of above 2 MW required in some cases. This is equivalent to a connection for a large factory or 800-home housing estate. This will necessitate much planning, as well as deep reinforcement of the electricity network in some instances. It can take 90 working days to complete planning studies and develop a quotation for such a large installation. It is critical that ESB Networks are informed at the earliest stage of planning and that every EV charger is installed in compliance with all regulated connection policies and contractual agreements.

In Ireland to date, Government, European, and ESB funding have supported private investment to deliver the initial phase of infrastructure that is in place today. In other EU states, there is widespread private-sector investment in motorway charging facilities. Stakeholder engagement shows that Ireland's private sector seems to have a similar desire to invest more widely in this infrastructure.

Government's role is to work as a facilitator, supporting and enabling investment in the ultra-rapid, en-route charging infrastructure. An example of this will be the development of a National EV Charging Network plan. The plan will define the EV charger rollout requirements and consider these in the context of the electricity grid's readiness to meet the projected EV public charge-point demand between 2023 and 2025.



CHAPTER

4

Existing & Future
Technologies

Mass-market adoption of electric vehicles is still at an early stage. The sector is constantly seeking new innovations to improve the experience of EV owners and to enable the transition from ICEs to EVs. In this chapter, we look at innovative initiatives and pilot schemes that are taking place in Ireland and across Europe. By learning from these, diverse user needs can be accommodated. In addition, every user's experience of EVs and charging infrastructure will be on a continuous path to improvement.

4.1 Innovating for the future: EV charging for local conditions and diverse user needs

Widespread innovation is ongoing across the full spectrum of the EV ecosystem. This can be seen in areas such as vehicle development, charging technology development, and infrastructure planning. All these changes have a view to improving the EV owner and driver experience, and enabling the transition from fossil fuel to EVs.

In the **light vehicle sector**, charge point types are being developed to respond to accelerating research and development in vehicles. An example of this is the improvement in battery capacities and technologies, enabling faster charging. Different types of charge points are also being explored to consider even easier charging experiences such as wireless and battery swap technologies, and multifunctional charging platforms. Chargers and EV battery systems are also being developed to provide new controls and services such as mobile and automated EV charging systems. These will enable charging points to automatically respond to price signals or to availability of renewable energy. New technologies will allow vehicles to provide services to the home or electricity grid through Vehicle-to-Grid (V2G) or Vehicle-to-House (V2H) systems.

In the **heavy goods and buses sectors**, technologies being trialled include high-powered EV charge points (e.g. 350 kW to 2 MW capacity charging points for trucks⁴⁷). These build on technological breakthroughs and lessons learned during the development of charging infrastructure

for heavy-duty buses, as well as pilot electric road system (ERS)⁴⁸.

In the near future, it is expected that new market offerings and solutions in all of these areas will emerge year on year. This will have knock-on impacts for EV infrastructure investment decisions and deployment frameworks.

Business model innovation is also being trialled, with a view to reducing the need for car ownership and moving towards more sustainable towns and cities. The provision of dedicated EV charging infrastructure for e-car clubs and at taxi ranks, as well as in strategic rural locations, is key. It will support the transition to electric and sustainable mobility in communities with low car ownership or population densities, and where demand for publicly-accessible charge points may be limited. In all instances, decisions about charge point locations and types require a strategic and data-driven approach. This should focus on understanding local conditions and user concerns as well as national network coverage and electricity grid requirements⁴⁹. In practice, this will mean the monitoring and analysis of local and national data, continuous stakeholder engagement, flexible approaches to technologies and infrastructure, and a user-centred approach. These approaches will ensure that Irish EV charging infrastructure meets future needs.

4.2 Case studies

In the following seven case studies, we explore charging technologies that may potentially help us in Ireland in the coming decade. We also include future-thinking initiatives that have already been rolled out in Ireland.

⁴⁷ Earl, T. et al. (2018) Analysis of long haul battery electric trucks in EU also Industry Develops 3.75 MW Charging System For EV Trucks

⁴⁸ For example, RI.SE: Research and Innovation Platform for Electric Roads

⁴⁹ AVERE-discussion-paper-full.pdf



- **Case Study 1⁵⁰: On-Street Kerbside Charging in European Cities**
 - This looks at how residential and neighbourhood charging is being deployed in Europe. It looks at how these technologies fit into their settings and how they might be used in the future.
- **Case Study 2: Vehicle-to-Grid Charging**
 - This looks at an example in Oslo where managed car parking at large electric vehicle hubs with V2G technology can lead to extra savings at times of peak demand.
- **Case Study 3: Wireless Charging**
 - Plugless wireless charging offers many advantages in terms of ease of use and satisfactory charging experience. This case study looks at a trial in Rotterdam.
- **Case Study 4: Planning for Dublin’s EV Needs: The Dublin Local Authority EV Infrastructure Strategy**
 - The development of this strategy points the way towards locally-specific EV infrastructure planning and provision. This provision harnesses and leverages international best practice to serve the Local Authority area and the needs of its citizens.
- **Case Study 5: Rural EV Infrastructure and Innovation: The Dingle Project**
 - In rural areas, longer driving distances, combined with less access to public transport, lead to higher use of fossil fuels.

As a result, it’s critical that rural populations are enabled to transition to EVs. The Dingle Project shows how communities engage with this transition. It also presents some factors that encourage people to adopt new technologies.

- **Case Study 6: Fingal County Council Launch First ‘e-Mobility Hub’**
 - This hub comprises five parking bays with specific, colour-coordinated purposes including age-friendly, disabled, electric-vehicle charging, bike rack (bike share and public), and car sharing.
- **Case Study 7: Ultra-Fast Charging Pools in Ireland**
 - The first eight-bay, high-power EV charging hub (located at Junction 14, Mayfield on the M7, Monasterevin, Co Kildare) went live in 2021.
 - The first high-power 350 kW charging points rolled out on Ireland’s highest traffic motorways.

As will be seen in the seven case studies, innovation is fundamental to the delivery of EV infrastructure at a strategic working level, as well as being a technological prerequisite. It may take time to bring some of these new technologies to the market, due to their costs. However, harnessing innovation and pushing certain boundaries will enable efficient delivery of EV infrastructure to all citizens. These moves should always ensure safety, and enhance customer experience at an affordable cost.

⁵⁰ Case Studies 1 and 3 are based on the case studies outlined in Element Energy (2022) Ireland’s National EV Strategy Input: On-street and innovation report.



4.2.1 Case Study 1: On-Street Kerbside Charge Points in European Cities

On-street charging is generally deployed in residential areas. It offers EV users without off-street charge points the closest alternative to home charging. It allows drivers who park on the street near their residence to charge overnight. With more people buying EVs and seeking to charge them at home, at work, and on the go, kerbside charge points will become an increasingly familiar part of our streetscapes. A range of different on-street charge point technologies is emerging to meet different user needs and to fit into a range of streetscapes and spaces. Of these, lamppost and bollard charge points are the most commonly available, with other innovative kerbside charge point solutions emerging.

As can be seen from Table 2 below, the main considerations for kerbside charge point installation are how much space they take up, how they relate to and can be integrated with existing street furniture, and whether they require extensive groundworks and technology to allow them to connect to the electricity supply network. These considerations can help to guide the choice of the most appropriate kerbside charging technology for a particular location. Accessibility impacts are also a key consideration for kerbside charging technologies. Such charge points should not impact negatively on the mobility and access of the wider public.

Table 2: Summary of On-Street Charging Technologies (Source: Element Energy)

Technology	Charging Speed	Electricity Supply	Groundworks	Kerbside Street Furniture	Electrical Box above Ground
Lamppost charge points	Up to 5.8 kW	Connected to lamppost power supply	No groundworks	No additional Street furniture	No electrical box
Lamppost with satellite bollard	Up to 5.8 kW		Minor groundworks	Minor street furniture	
Bollard charge points	Up to 5.8 kW	New power supply needed	Significant groundworks	Significant street furniture	Small electrical box
Slim bollard charge points	7-22 kW			Minor street furniture	
Pop-up charge points	7 kW			Semi-permanent, additional street furniture while charging	Electrical box
Lance and socket charge points	Up to 22 kW				
Electric vehicle charging channels	Speed of home charge point 5-7 kW	Connected to home power supply	Minor groundworks	No street furniture	No additional electrical box
Wireless charging	Range of speeds (early stages)	New power supply needed	Significant groundworks		Electrical box

For example, lamppost charge points (such as those installed in the London boroughs of Hackney⁵¹ and Westminster⁵²) allow all charging hardware to be installed within the lamppost column without any extra groundworks such as ducting or cabling (so long as the ducting is of sufficient quality). This means that rather than having to install an extra piece of street furniture on already-crowded urban streets, charge points can be inserted into existing features that are already present in large numbers and connected to the electricity distribution network.

Bollard charge points are also becoming an increasingly familiar sight in cities across Europe. They offer higher charging speeds than lamppost charge points but require more space for installation.

Many different operators have developed their own proprietary versions of these types of charge points, each with a different design and size of their above-ground hardware⁵³. As bollard charge points can be relatively bulky, manufacturers have focused on reducing their size and diameter, with most of the hardware deployed underground. For example, Connected Kerb offers one of the smallest bollard designs and is in the early deployment phase in Kent in the United Kingdom. This design offers the possibility of 7-22 kW AC charging from single or paired charge-point sockets, with a smart-grid trial underway⁵⁴.

However, bollard charge points do pose accessibility challenges. Where they are installed, the project must be appropriately designed to mitigate these impacts.



Photo: Connected Kerb bollard charge points in Kent, United Kingdom

⁵¹ <https://news.hackney.gov.uk/over-182-new-electric-vehicle-charging-points-to-be-installed-in-hackney/>

⁵² <https://www.westminster.gov.uk/parking/electric-vehicles>

⁵³ For example, Vattenfall Amsterdam, Amsterdam City.

⁵⁴ Connected Kerb Kent, Agile Streets project,



4.2.2 Case Study 2: Vehicle-to-Grid Charging System in Oslo Car Park

As the number of EVs connected to the electricity distribution network increases, the potential for EVs to act as back-up electricity storage, allowing demand to be spread across the grid, also increases. Innovative technology such as bidirectional cabling is being piloted to test the future feasibility of Vehicle-to-Grid (V2G) charging.

In Oslo, the possibility that larger electric vehicle hubs with V2G technology could balance local⁵⁵ peak electricity demand was examined through a pilot project. This was carried out by the municipality in partnership with a local real estate company⁵⁶ and a charging service provider⁵⁷. Support for the pilot, which started in 2017, was provided by the European Regional Development Fund (Interreg North Sea Region). The project involved building an electric-car charging facility of over 100 flexible 22 kW charge points at the Vulkan parking garage in central Oslo. A battery reserve was installed in the garage to balance power loads. This avoided straining the power grid during times of high usage. The trial examined the feasibility of setting up large EV charging facilities in garages without having to make expensive and time-consuming upgrades to their power grid⁵⁸.

By 2019, the numbers of charging sessions from the 100 flexible 22 kW charging stations had tripled since the project launch in February 2017, with use and turnover increasing by the day. EV charging is free at night-time for residential parking, with Oslo City Council paying Aspelin Ramm to provide this service. This relieves the pressure on on-street public EV charging stations. Several car-sharing companies, an EV-to-go provision, some van-based logistics service companies, and electric taxis also use the parking



Photo: V2G charge point

garage during the day. Parking charges relating to the use of the facility are paid separately from EV charging, with further differences in charging for residents at off-peak times⁵⁹. This also supports the city's policy of removing a number of on-street parking spaces in the neighbourhood.

A number of interesting findings emerged from the pilot. For example, the battery electric storage system (BESS) did appear to reduce the grid demand within a given month. In addition, the pilot discovered that this reduction could have been improved by also using smart charging. This addition could provide extra savings at times of peak demand. The trial allowed the development of commercial charging products and technology, and provided access to residential-type charging opportunities for local EV owners. It also provided the Oslo municipal authority and commercial partners with data and insights to feed into the future possible deployment of V2G charging.

⁵⁵ For example, Roks et al. (2019) Vehicle-to-everything (V2X) in the Netherlands, Utrecht University report for the Netherlands Enterprise Agency.

⁵⁶ <https://www.polisnetwork.eu/news/seev4-city-newsflash-latest-round-of-updates-on-vehicle-to-grid-in-amsterdam-and-oslo/>

⁵⁷ <https://www.fortum.com/media/2017/11/innovative-charging-facility-electric-vehicles-oslo-norway>.

⁵⁸ https://www.seev4-city.eu/wp-content/uploads/2020/09/SEEV4-City-Operational-Pilot_Final-Report.pdf.

⁵⁹ Dai et al (2020) European Regional Development Fund Interreg North Sea Region SEEV4-City: Final report – Oslo operational pilot.



4.2.3 Case Study 3: Wireless Charging in Rotterdam

Wireless charging is still in the very early stages of development, with a number of small-scale trials currently underway. Wireless charging has no above-ground hardware at/near the parking space and requires an induction pad to be installed on the vehicle and in the pavement. This technology is useful for fleet vehicles making many short stops or where there is not appropriate space for above-ground hardware. Its applications could include use by taxis, small electric public-service vehicles, light-duty commercial vehicles, or shared EV-use schemes (such as car clubs).

In 2016, for example, the city of Rotterdam carried out pilot trials of wireless charging, with three city companies participating in the trial. The scheme required two years of preparatory work and the use of specially-converted vehicles⁶⁰. During the trial, several potential benefits of wireless charge points were identified⁶¹. These included increased ease of use for drivers, as there was no need to connect or pack up cables at the start and end of charging (with possible increased benefits for drivers with limited mobility and for taxis). It

was also found that the charging infrastructure had a very low impact on street views and had the potential to integrate with future technologies such as autonomous EVs. The trial allowed the municipality to simultaneously gather useful data (for future technological and software development) and insights into user experiences. These experiences showed that reliability (which was an issue during the trial) was considered to be more important than ease of use.



Photo: Char.gy wireless charging, Marlow, Buckinghamshire, United Kingdom

⁶⁰ Dutch News - no-strings-attached-rotterdam-trials-wireless-electric-car-charging.

⁶¹ Rotterdam-electrical-innovation-wireless-charging-in-practice



4.2.4 Case Study 4: Planning for Dublin's EV Needs: The Dublin Local Authority EV Infrastructure Strategy

While countries like the Netherlands and Norway are at the global forefront of EV adoption and infrastructure provision, initiatives closer to home have started to take similarly integrated and innovative approaches to EV infrastructure rollout. One such approach has been taken by the Smart Dublin initiative, which was launched by the four Dublin local authorities in 2016. Its goal is to future-proof the Dublin region by trialling and scaling innovative solutions to address a wide range of local challenges. It aims to bring together technology providers, academics, and citizens to transform public services and enhance quality of life. The initiative was founded on the principle that, through collaboration and innovation, issues such as the climate crisis and digital divide can be tackled to build a better and more resilient Dublin⁶².

The Climate Action Regional Offices collaborated with representatives of each of the local authorities and Smart Dublin to set up the Dublin Regional EV Charging Working Group⁶³. As in Rotterdam, key aims of the group included collaborative stakeholder engagement and a commitment to implementing broad-based charging provision for all citizens⁶⁴. Following meetings and market soundings with EV service providers and other stakeholders, the working group identified several possible EV charging infrastructure types and locations that local authorities could target for development. These included on-street-parking charge points, public car parks, local authority facilities and depots, locations owned by community or charitable organisations, and multi-storey car-parking facilities.

The analysis and engagement carried out by the working group led to the commissioning of an EV charging infrastructure strategy for the

four local authorities⁶⁵. The strategy examines existing EV provision within the Dublin region. Projected future demand is estimated based on climate action targets, population growth, and a range of current and future electric vehicle types. Projections also include high levels of private investment, an assumed mix of existing and new technologies, and lessons drawn from best-practice EV infrastructure programmes in other countries and cities.

The strategy has now been published and work on implementing its findings is underway. The strategy provides a helpful example of locality-specific EV infrastructure planning and provision that aims to:

- Harness and leverage international best practice;
- Bring together planning processes, pilot schemes, and the development of revenue-generating concession models;
- Promote collaboration across government and with stakeholders;
- Be flexible, allowing local aims to be achieved within wider collective goals;
- Promote interoperability and consistency across local government areas;
- Future-proof charging infrastructure.

⁶² <https://smartdublin.ie/about/>

⁶³ <https://www.caro.ie/dublin-ev-project>

⁶⁴ <https://smartdublin.ie/the-dublin-region-ev-charging-working-group-supporting-dublins-transition-to-low-emission-mobility/>

⁶⁵ <https://councilmeetings.dublincity.ie/mgConvert2PDF.aspx?ID=33248>



4.2.5 Case Study 5: Rural EV Infrastructure and Innovation: The Dingle Project

This strategy document focuses on providing a national EV charging network that caters for all of Ireland's citizens and that allows everyone, no matter where they live, to grasp the opportunities and benefits that electric-vehicle technologies can offer. In Dublin, EV infrastructure provision is supported by large populations, short travel distances, easier access to the electricity grid, and the presence of businesses and universities. Although the range of electric vehicles is increasing, the provision and availability of charging infrastructure is seen as a key concern for EV drivers in rural areas⁶⁶. In rural areas, Government development policy is focused on the installation of public charging points at remote working hubs, community centres, and enterprise centres⁶⁷.

In Ireland, one of the most innovative projects to address the urban/rural divide is the ESB Networks Dingle Project⁶⁸, which arose out of the pioneering work of the Corca Dhuibhne/Dingle Peninsula 2030 initiative. The initiative is a multi-partner project partnership that was established in 2018 by four organisations: Dingle Creativity and Innovation Hub, ESB Networks, North East West Kerry Development (NEWKD), and MaREI (the SFI Centre for Energy, Climate and Marine)⁶⁹. The overall goal of the initiative is to transition the Dingle Peninsula into a low-carbon society with a more environmentally and economically-sustainable future⁷⁰.

Part of the initiative's work was to deploy and assess a range of new technologies to develop a resilient, low-carbon electricity network. Over the course of three years, ESB Networks worked with local people to trial renewable and clean-energy-enabling technologies at their properties. These included EVs and 15 smart EV charge points, five of which were replaced with bidirectional (V2G) charge points. The trial allowed the impact of V2G to be assessed as a possible tool to balance

part of a rural electricity transmission grid. It also demonstrated the effectiveness of EVs over longer distances and across more challenging rural landscapes. The EV trial also fed into wider questions of how communities engage with the low-carbon energy transition. MaREI researched how energy citizenship behaviours can spread across communities and the factors that encourage people to adopt new technologies.

Some of the key findings were:

- Retrofitting (as well as the deployment of heat pumps, solar PV panels, and electric vehicles) can lead to significant emissions reductions (up to 50%) for homes, businesses, and transport.
- Electric vehicles can be used for daily driving in rural communities without disruption to normal patterns.
- Range, cost to charge, and performance are perceived more positively following the users' experiences.
- For long-distance driving, EVs are deemed to be less practical than internal combustion engine alternatives.

The project recommended that the successful national rollout of EVs requires an increase in public charging facilities.



⁶⁶ <https://www.agriland.ie/farming-news/going-electric-are-evs-a-runner-for-rural-drivers/>

⁶⁷ Govt of Ireland (2021) Our rural future: rural development policy 2021-2025, p. 71

⁶⁸ ESB Networks' Dingle Project

⁶⁹ https://dinglepeninsula2030.com/wp-content/uploads/2020/07/Dingle-Peninsula-2030-Brochure_Final.pdf

⁷⁰ <https://dinglepeninsula2030.com/>



4.2.6 Case Study 6: Fingal County Council 'e-Mobility Hubs'

In 2020, Fingal County Council became the first local authority to put in place an e-mobility hub⁷¹. The hub comprises five parking bays with specific, colour-coordinated functions. These include age-friendly, disabled drivers, electric vehicle charging, bike rack (bike share and public), and car sharing.

The aim of the hub is to encourage varied and sustainable types of transport in areas that are close to existing public transport links and have a high concentration of employment, housing, shopping, amenities, and recreation.

Building on this initiative (and in line with the Dublin Local Authority Electric Vehicle Charging Strategy), in 2022, Dublin City Council collaborated with EasyGo charge point operators to install a neighbourhood EV charging pool. This new, publicly-accessible charging pool is located at a leisure centre close to Finglas Civic Centre. This is a key location that will appeal to

EV drivers right across Dublin and further afield. The charging pool consists of a 75 kW Rapid DC charger and a 22 kW Fast AC charger. The site will also host electric vehicles for car-share clubs, as well as an electric bicycle station. There is also the option to tap and pay by card on the state-of-the-art Tritium 75 kW rapid charger. This site can be scaled up to facilitate more EV charging and parking as demand increases. It is hoped that it will be a model for other civic sites and locations⁷².



Photo: <https://easygo.ie/news/dublin-city-council-evolve-sustainable-transport-in-finglas/>

⁷¹ Fingal County Council launch first 'Mobility Hub' on Main Street, Blanchardstown

⁷² Dublin City Council EV-olve Sustainable Transport in Finglas





4.2.7 Case Study 7: En-Route High-Power Charging & Charging Pools in Ireland

Motorway/en-route charging (ultra-rapid charging) is one of the four key categories of charging infrastructure that has been called for in this strategy. As battery range continues to increase, so does the capacity of vehicles to charge faster. In order to enable long distance journeys without the need for excessive delays, ultra-fast chargers are required on our motorway network. While few electric cars can currently avail of the full charging capacity provided by a 150 kW or 350 kW charger, car technology is moving in this direction. This means that a 15-minute stop could deliver 200-400 km additional range.

ESB Ecars & Climate Action Fund: High-Power Charge Pools

Infrastructure supported by the Government's Climate Action Fund is being rolled out by ESB ecars. In July 2021, the first eight-bay high-power charging hub⁷³ (including a mix of 150 kW and 50 kW charge points) was installed at Junction 14 on the M7 Motorway. ESB ecars plans to roll out over 50 charging hubs throughout Ireland. These will charge 3-8 vehicles simultaneously.



Photo: <https://fleet.ie/investment-improvements-to-irelands-ev-charging-network/>

Ionity & Circle K 350 chargers

From 2019-2021, charge-point operator, Ionity, joined forces with the forecourt and convenience retailer, Circle K, to install ultra-fast charge points at six strategically-located Circle K sites across the country.

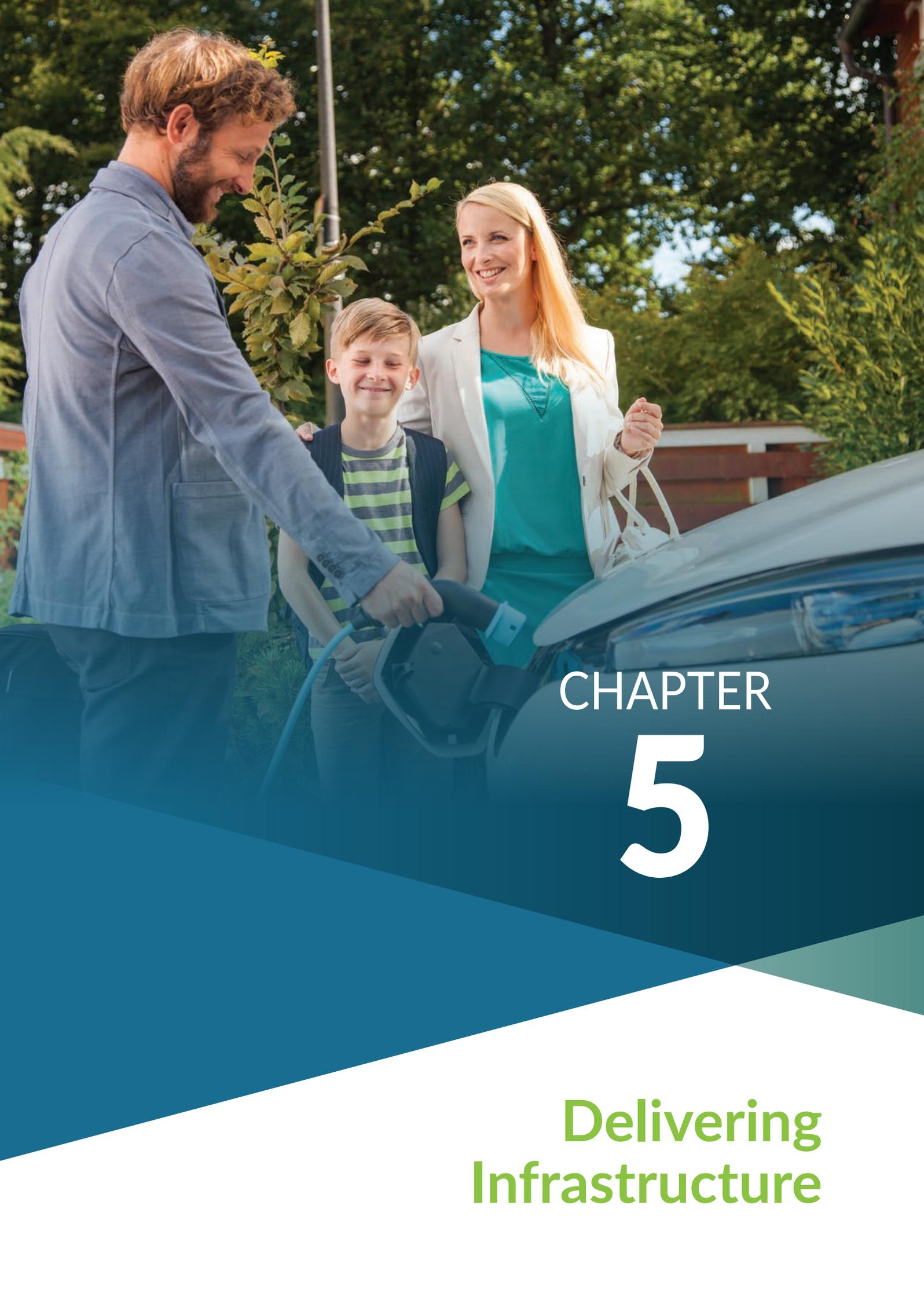
The sites include Gorey on the M11, Athlone on the M6, Kill North and Kill South on the N7, Cashel on the M8, and City North on the M1. Each charging point is equipped with an average of four 350 kW chargers which use the leading European- standard Combined Charging System (CCS). These installations were partly funded by European funds through the Connecting Europe Facility⁷⁴.



Photo: <https://www.circlek.ie/sustainability/research2021>

⁷³ Charging forward in the EV market (esb.ie)

⁷⁴ https://europ-e.eu/assets/20190425_europ-e_press_release.pdf



CHAPTER

5

**Delivering
Infrastructure**

This chapter sets out the landscape of public EV charging infrastructure in the medium term. It explores the standards that will apply, as well as the existing and planned Government supports and funding instruments. These supports will target and address identified gaps in the EV infrastructure market. The chapter also sets out the objective for delivery of charge point infrastructure by 2025. This will support increasing EV uptake and ensure that charging infrastructure provision stays ahead of demand.

5.1 Infrastructure Designed for Users

Everyone experiences charging differently. Designing services which people will use and enjoy requires an understanding of users' different charging needs, their perceptions, and their feelings during the entire charging journey. The development of personas as part of this final strategy helped stakeholders to understand and empathise with a diverse range of customer needs, and to embed a customer mindset into the decision-making process. This user-centred approach is and will continue to be key for the development of standards and for the provision of Government supports and funding instruments as part of this strategy.

5.2 What will be delivered

The ambition of this strategy is to deliver an EV charging network that will meet and be ahead of EV users' needs. Underpinned by the strategy's fundamental principles, and the understanding of consumer needs, delivery of EV charging infrastructure will be guided by the following understandings:

- **Home charging** should be the main form of charging for most electric vehicle owners. Actions will be taken to prioritise the installation of smart home chargers and to encourage the deployment of V2G technologies where feasible.
- **Residential neighbourhood charging** will provide a similar solution to home charging for EV owners without access to a driveway.
- **Destination charging** will bridge the gap between home and local charging and meet the

need for top-up charging where required.

- **En-route charging**, involving higher-speed, higher-power charge points at strategic locations, will become increasingly important to cater for charging on the go. This will facilitate the quicker transition of high-mileage vehicle fleets to EV technology. It will also address range anxiety.

Ultimately, there is no one charging solution for EV users: each type of charge-point will be used at some point by EV drivers, depending on their needs and circumstances on a given trip. What is important is to deliver sufficient charge points of different types so that each user can charge in a convenient, energy-efficient, and cost-effective manner.

5.3 Risks and Dependencies

Delivery of the EV Charging Infrastructure Strategy (particularly the AFIR infrastructure targets) will be highly challenging and require transformation of existing systems and processes. It is recognised that there are associated risks that will need to be managed and mitigated by ZEV1 and key stakeholders to enable the delivery of the strategy. Table 3 below shows a high-level risk and dependency view. These will be managed as part of the Implementation Plan where an in-depth risk and dependency analysis will be completed as part of the National EV Charging Network Plan.

Table 3: Risks and Dependencies for Delivering EV Infrastructure

Risk	Dependency	Stakeholders
Lack of available grid capacity to meet demand within the timelines	Investment in grid capacity	ZEVI
	Establish a working group to manage this particular risk	ESB Networks
	Deliver a National EV Charging Network Plan for AFIR	Transport Infrastructure Ireland
Lack of site availability for implementation of charge points across schemes	National Planning Framework	Commission for Regulation of Utilities
Lack of available staff & resources for delivery	Resourced stakeholder recruitment plans	Local Authorities
Lack of adequate public & private funding in the years up to 2025	ZEVI funding plan within Department of Transport planning process	Charge Point Operators
	Available private funding for investment	SEAI



5.4. EV Infrastructure Standards

Ensuring that EV charging infrastructure works for everyone is a key aim of this strategy, and one that will uphold the principles outlined in Chapter 2. EV infrastructure standards will be

mandated through European regulations, the Alternative Fuel Infrastructure Regulation (AFIR), and Irish legislation and regulations. The following standards will apply for publicly-accessible charging points:

Table 4: Required Standards

User Needs	Required Standards
Ease of Payment	<ul style="list-style-type: none"> All new public charge points installed after the Alternative Fuels Infrastructure Regulation comes into force (expected to be in 2023), will be required to accept card payments by means of a contactless facility. This will enable ad-hoc transactions. From 1 January 2027 onwards, charge point operators shall ensure that all publicly-accessible charging points operated by them (and that have a power output equal to or more than 50 kW) can accept card payments. Charge point operators will clearly display their prices, as well as comparison costs for other fuels. As a result, this information is known to end users before they initiate a charging session. Pricing will be non-discriminatory.
Accessibility Standards & Safety	<ul style="list-style-type: none"> ZEVI will consult on accessibility standards for all users in Q1 2023. Accessibility guidelines for EV charge points in Ireland will be published following this consultation. From then on, public charge points will need to adhere to these standards.
Data Sharing to Facilitate Innovation	<ul style="list-style-type: none"> Charge points will be enabled to send and receive data dynamically, enabling the flow of information between market actors that are dependent on this data to fully develop the charging experience. Such parties include charge point operators, mobility service providers, e-roaming platforms, ESB Networks and, ultimately, end consumers. In 2023, ZEVI (in consultation with stakeholders) will publish a Data Strategy of how information will flow and be used.
Interoperability	<ul style="list-style-type: none"> While the market may dictate additional connectors, charging points for light-duty vehicles will be equipped (at least) with Type 2 connectors for AC connections and Combo 2 connectors for DC connections. Future innovations, such as wireless charging, will also be required to comply with minimum technical specifications.
Smart Charging , V2G, and Innovations	<ul style="list-style-type: none"> From one year after AFIR comes into force, all new public charge points (installed from that point onwards) will be required to be enabled for smart charging. This will enable future Vehicle-to-Grid operations and other system services and efficiencies such as electricity-demand regulation.
Sustainability Tracking	<ul style="list-style-type: none"> In tracking the progress made under this strategy (and in alignment with other relevant strategies such as the Sustainable Mobility Strategy), we will be tracking sustainability benefits.
Reliability and Reporting	<ul style="list-style-type: none"> Reliable infrastructure is critical to mass-market rollout. ZEVI will consider options for ensuring reliability of service for EV users, with reference to actions in other jurisdictions. It will implement such options if appropriate or required.

5.5 National Publicly-Accessible Infrastructure Targets

In addition to addressing each of the four main categories of infrastructure above, ZEV1 will ensure that a national fleet-based target will be achieved. An overall fleet-based target will ensure that publicly-accessible charge point infrastructure will meet the demands of EV uptake across the country in both urban and rural areas. An EU target is currently being considered and will form part of AFIR. This target is expected to include, at a minimum, the installation of:

- 1 kW of charging infrastructure for each BEV and
- 0.66 kW of charging infrastructure for each PHEV

With an estimated number of 195,000 plug-in EVs on the road by 2025, this target could be achieved through a number of different charge-point scenarios. The table below outlines five example possibilities. The optimum mix of charge points will depend on driver needs, and the ability to deliver the charge points in a timely manner. The most likely outcome is scenario 2, 3, or 4 below. The amount of charge points and kW power required to meet this target will be finalised in 2023.

Each one of these new charge points will have to overcome challenges of site availability, planning, electrical connections, resources, and funding.

Table 5: Charge Point Rollout Scenarios

	Residential/ Neighbourhood 0-22 kW	Destination/ En-Route 23 kW-350 kW	Total Number of Publicly- Accessible Chargers Nationwide	Total Charging Power Nationwide (kW)
Existing	1,349	374	1,723	67,237
Scenario 1	1,460	1,080	2,540	169,000
Scenario 2	1,650	1,300	2,950	169,000
Scenario 3	1,990	1,320	3,310	169,000
Scenario 4	2,660	1,180	3,840	169,000
Scenario 5	4,070	780	4,850	169,000

5.6 Existing Exchequer supports for charging infrastructure

Currently, Exchequer funding is available for the following types of EV charging infrastructure:

5.6.1 Home charging

Electric Vehicle Home Charger Grant⁷⁵

Established in 2018 and administered by the SEAI, this grant provides up to €600 towards the installation cost of a domestic charge point.

Since July 2022, the grant is now open to all homeowners, whether they own an electric vehicle or not. The resulting charge point can also be used for visitor use or at rented accommodation.

Since September 2022, the Electric Vehicle Home Charger Grant only supports smart chargers. Applied systematically, smart charging can maximise efficiencies and cost savings for EV users and across the electricity distribution network. It can also maximise the use of renewable electricity on the electricity grid through service provision to networks. For example, this can be done by designating night-time hours as the default charging time, or using Vehicle-to-Grid technologies.



How might we support users and landlords to install home chargers to make home charging the preferred and most convenient alternative?



How might we enable users to avail of lower-cost electricity for charging?

How might we encourage users to install clean energy at home?

Electric Vehicle Apartment Charging Grant⁷⁶

Since July 2022, the Electric Vehicle Home Charger Grant has been expanded to include shared parking in apartment blocks and similar developments.

The Apartment Charging Grant is administered by the SEAI and assists residents and owners of apartments and other multi-unit developments who want to install a home charger for their EV. The grant is designed for bulk installation of chargers at a single location, and provides up to 80% supports for cabling, infrastructure, labour, and construction costs. Owners, management companies, housing bodies, local authorities, and commercial and private landlords can apply.

Under building regulations, a building (containing one or more dwellings) undergoing major renovations, which has more than 10 car-parking spaces, shall install ducting infrastructure for each space. This enables the subsequent installation of charging points for electric vehicles.



How might we support residents and apartment owners to install home chargers, particularly for those who share parking?

How might we discourage users, particularly those with shared at-home parking, from hogging chargers?

5.6.2 Residential/Neighbourhood Charging

Electric Vehicle Public Charge Point Grant⁷⁷

This scheme, which is administered by the SEAI, has been in place since September 2019. It provides local authorities with a grant of up to €5,000 per charge point to support the development of on-street public charge points.

The main focus of the scheme is to provide

⁷⁵ <https://www.seai.ie/grants/electric-vehicle-grants/electric-vehicle-home-charger-grant/>

⁷⁶ Apartment Charging Grant | EV Grants | SEAI

⁷⁷ <https://www.seai.ie/grants/electric-vehicle-grants/public-charge-point/>

support for the installation of infrastructure for EV owners who don't have access to a private parking space. Funding is provided for the installation of 22 kWh standard charge points.

As part of a review of this scheme, ZEVl have reviewed supports for local authorities in other countries. There are a range of models across Europe supporting the delivery of EV infrastructure by local government, including:

- Government delivery and operation of charge points;
- Government funding of the enabling capital works, with installation and operation of charge points delivered through the private sector;
- The full outsourcing of capital works, charge point installation, and operations.

The different business models require different levels of capital investment and ongoing supports from local authorities. Varying levels of revenue are received, depending on the profit-sharing arrangements and the amount of work outsourced.

Much success is based on the actions of the local authority in determining the number and locations of charging points to meet the needs of their local residents.

Based on the review carried out by ZEVl, the current EV Public Charge Point Grant will be retired and a new suite of supports for local authorities will be introduced as outlined in 5.7.2 below.



How might we ensure that those who don't have a private charger can rely on public on-street chargers?

How might we provide safe, convenient, and accessible chargers and information to those who need it?



How might we support those who are unfamiliar with EV chargers to confidently find and use them?



eSPSV Infrastructure Grant Scheme

The eSPSV Infrastructure Grant Scheme was designed to encourage more taxi drivers to convert to electric vehicles. The project involves installing taxi-dedicated electric vehicle charge points at major transport hubs nationwide. These hubs are places where multiple transport modes, including road, rail, light-rail, and air travel networks intersect.

Since the launch of the Scheme in 2020, charge points have been installed in Dublin (Heuston), Cork (Kent) and Limerick (Colbert) train stations as well as at Dublin and Cork airports. Further funding was made available in 2021 to support the installation of charge points at more Irish Rail locations. In 2022, this was extended to Shannon airport.



How might we ensure that taxi drivers have dedicated access to chargers at busy periods?

5.6.3 Top-up charging (Destination and En-route)

Climate Action Fund: EV Infrastructure Delivery⁷⁸

In 2018, €10 million was committed from the Climate Action Fund to support ESB investment in the charging network. This has leveraged a further €10 million investment from the ESB. This intervention will result in:

- 90 additional high-power charge points, each capable of charging two vehicles;
- 52 additional fast charge points, which may replace existing standard charge points;
- 264 replacement standard charge points, with more modern technology and with each consisting of two charge points.

This project is ongoing and will contribute to the provision of EV infrastructure within the timeframe of this strategy, with an expected completion date of 2023.

⁷⁸ <https://esb.ie/ecars/our-network/network-upgrades>

⁷⁹ <https://www.fasterevcharge.com/>

The FASTER Project⁷⁹

The FASTER Project is an international joint initiative that aims to support the installation of 50 kW capacity in 73 EV charging stations on the island of Ireland and in Scotland. The project, which is a partnership between regional and local authorities and academic institutions in all three jurisdictions, has been awarded over €6.4 million from the European Union's INTERREG VA Programme.

The Ireland-specific part of the project aims to fund up to 40 fast charge points in various locations on both sides of the border. The target date for delivery is May 2023.

5.7 New Infrastructure Supports to deliver for User needs:

5.7.1 Home Charging/Shared Charging

ZEVI will work with the private sector to incentivise and popularise the use of 'shared charging' (a person renting out the use of their home charge point to other EV owners) on a wider scale in Ireland. Shared charging can bring significant benefits, particularly in urban areas, where it can provide a charging solution for EV owners without a home-charging option themselves.



How might we encourage and support owners of home chargers to rent their personal chargers when not in use?

5.7.2 Residential Charging

The ZEVl office has been working closely with local authorities to consider how best to support them as they roll out EV charging infrastructure in their jurisdictions. A key action for local authorities will be to work with ZEVl to enable and support the delivery of residential-area charging networks for residents without access to home or apartment charging solutions.

To support local authorities, ZEVl will launch a comprehensive new suite of co-funding supports. This will include supports for:

- Planning and designing an EV charging network at local and regional levels, along with an implementation plan for delivery. These will comprise both on-street charging in areas where residents do not have access to home charging solutions, and destination charge points at local authority facilities.
- Development of business cases for funding.
- Support for procurement of services.
- Funding of at least 75% for EV charge points that have been identified.

A new Residential Neighbourhood Charging Scheme will be launched by ZEVl to provide EV charging for residents without access to off-street parking. This type of charging will be designed to mimic home charging, and will incentivise off-peak charging in a location convenient to the resident's home. It is envisaged that this scheme will provide significant co-funding of at least 75%.

Residential charging points delivered under the new scheme would have a charging capacity of 7-11 kW per charging point.

Local charging can also support car-sharing e-mobility solutions, which in turn support wider access to EVs where access to sustainable mobility options is limited. ZEVl will work with the car-sharing sector and local authorities to pilot the provision of charging infrastructure to support e-car clubs.



How might we encourage people to consider e-car sharing as a viable alternative to owning a private car?

How might we ensure that mobility hubs are easily-accessible by public transport or active mobility?

5.7.3 Destination Charging

A multifaceted scheme is proposed to fund the installation of charge points by the public and private sectors at trip-generating locations or destinations. These will support EV users in making top-up charges while out and about. Traditionally, destination charging has occurred at visitor and tourist attractions, retail outlets, car parks, public amenities, hotels, leisure facilities, etc.

Installing fast EV infrastructure at these locations will provide a reliable network of publicly-accessible charge points that can also be accessed by the surrounding community, tourists, and others who visit these areas.

In addition, some destination locations (such as hotels and guesthouses), where visitors stay and park for longer durations, would be supported in delivering slower charge points. To receive such support, these charge points would need to be publicly-accessible.

ZEVl is pursuing a number of strands for this scheme including:

- Main Destination Charging Scheme including a Visitor Sites Scheme
- Sports Centres Scheme
- Community Centres Scheme (Just Transition Fund Scheme)
- Car Clubs

- **The Main Destination Charging Scheme** will be open for applications from the public and private sectors, organisations such as hospitals, leisure facilities such as municipal swimming pools, cultural centres, hotels, cinemas, and shopping centres.
- Through the **Visitor Sites Scheme**, ZEVI will also launch new grant schemes to support the rollout of publicly-accessible electric vehicle charging infrastructure at both state-owned and commercial visitor locations nationwide. Community centres will also be included in these schemes.
- Through the **Shared Island initiative**, ZEVI is developing a scheme to fund a network of publicly-accessible fast charge points in local sports clubs across the island. The **Sports Centres Scheme** will build on the successful Government initiative of the Sports Capital Grants, which greatly improved sports facilities and communities in recent years.
- ZEVI will pursue funding through the Just Transition Fund to fund a **Community Centre Scheme**. It is envisaged that, in particular, the provision of destination charge points at visitor locations, sports clubs, and community centres in rural areas, the Gaeltacht, and the Islands will support the transition to EVs in these communities.
- **EV Car clubs** offer a significant opportunity for avoiding car ownership, enabling more use of public transport while still having access to sustainable motoring when other sustainable mobility options are not available. Destination charging can support car-sharing e-mobility solutions. ZEVI will work with the car-sharing sector and local authorities to pilot the provision of charging infrastructure to support e-car clubs.

In all destination charge point schemes, it is anticipated that ZEVI would provide funding for civil and electric works, to enable the installation of EV charge points. Landowners could then consider leasing facilities to a charge point operator for installation, maintenance, and

operation of EV infrastructure. Alternatively, they could operate the charge points themselves.



How might we best support hotels and local communities to install chargers in areas where there is an influx of tourists only during busy seasons?



How might we provide additional alternatives to those who don't get to use destination charging facilities?

How might we encourage local sports clubs and other key attractions to install EV chargers?



How might we ensure that people with special requirements in terms of accessibility have enough options and information about where to charge their EVs?



How might we enable people who only need a car a few times a year to avoid car ownership but still have the use of a sustainable car when needed?

5.8 En-route charging network

There are already many private charge point operators that serve Irish consumers, providing both fast and high-powered charge points. Most of these charge points are stand-alone or set in groups of two to four. They are found in a range of different locations, such as petrol station forecourts, hotels, and streets⁸⁰. It is expected (as in other countries) that as EV growth continues, an increasing demand will be placed on high-

⁸⁰ <https://www.zap-map.com/live/>

speed charging infrastructure across the strategic road network.

Patterns of charge point use in countries with high EV uptake also suggest that demand for higher-speed top-up charging is likely to increase with greater numbers of EVs on the roads⁸¹. It is also anticipated that more private operators will enter the market for this high-speed charging provision.

En-route charging will be at the highest power, typically ultra-fast chargers with a minimum of 150 kW and up to 350 kW. This will enable users to stop and top up their vehicle charge within 10 minutes before continuing their journey.

ZEVI will place a renewed strategic focus on delivering high-powered public charge points in heavily-trafficked areas and along key parts of the national road network to reduce queuing time, reduce range and charger anxiety, and improve the EV driver experience.

Strong feedback to our draft consultation shows that a major increase in high-power charging infrastructure will be required to stay ahead of EV demand. This is also indicated by the Alternative Fuels Infrastructure Regulation. In addition to mandating an overall level of EV charging power as outlined in 5.5 above, the forthcoming requirements under the AFIR will set a framework for engagement with the private sector. This framework will establish a delivery model for Ireland's en-route chargers. Distance-based targets for the TEN-T Network should ensure full coverage of electric charging



points along the main road networks as follows:

1. By the end of 2025, there will be at least one charging pool with at least 300 kW of charging capacity (including at least one rapid-charge point of 150 kW), every 60 km on the TEN-T Core Network. This network is coloured yellow on the map and includes the following motorways and national routes: N7, N69, N8, M1, N28, N40, and M50.

⁸¹ OECD/IEA (2018), Nordic EV outlook 2018: insights from leaders in electric mobility, p. 44 of 105.

- 2. By 2030, this level of cover will be deployed throughout the full TEN-T Comprehensive Network and the capacity on the Core Network will be doubled to 600 kW.

Following the publication of this Electric Vehicle Charging Infrastructure Strategy, ZEVl, in conjunction with TII, ESNB, and private operators, will develop a National EV Charging Network Plan (En-Route Charging). This will consider the charging infrastructure needs for en-route charging along with the dedicated infrastructure requirements for heavy goods vehicles. Pending the final agreement of the AFIR regulation, this implementation strategy should be delivered in Q2 2023.

The delivery of this en-route EV charging network will reassure existing and future EV users who may have concerns about EV charging availability, particularly when planning longer journeys.



How might we design wayfinding solutions so that people can easily find EV chargers en route?

How might we create a safe and pleasant en-route charging location for users?

How might we provide a seamless charging experience, especially for those not familiar with the service?



How might we ensure that the number and power of en-route chargers is adequate to minimise queuing?



How might we provide accessible chargers and information for those who need them?

5.9 Heavy-duty vehicle charging hubs

The transition of heavy-duty vehicles from fossil fuel to electricity has been slower than in the light-vehicle industry. However, truck manufacturers have either already started or are about to start series production of their new zero-emission trucks⁸². The transition to electric buses is also significant across Europe, particularly in the city-bus sector, where 21% of all new registrations were electric in 2021⁸³.

The charging needs of buses is likely to be met at bus stations and bus depots, with opportunity charging taking place on public infrastructure.

The Climate Action Plan has called for 700 HDVs and 300 electric buses by 2025, growing to 3,500 low-emission trucks and 1,500 electric buses by 2030. It is expected that the speed of adaptation to electricity will take off significantly in the latter half of this decade.

In addition to catering for Irish vehicles, charging infrastructure must also cater for the international haulage business which will be dependent on public charging infrastructure in Ireland.

The Alternative Fuels Infrastructure Regulation is expected to call for a skeleton infrastructure to be installed by 2025, with this to be rapidly increased by 2030 and 2035.

It is estimated that by end of 2025, at least 8 charging pools, dedicated to infrastructure for HDVs (including buses), will be installed across the TEN-T Network (motorway network). Each motorway charging pool will consist of an aggregate charging capacity of 1400 kW with at least one 350 kW charger.

In addition to this, by 2025, a dedicated HDV charging pool of at least 600 kW will be present at each of Dublin, Cork, and Shannon airports.

In order to enable the delivery of this infrastructure, ZEVl will work with private

⁸² Getting zero-emission trucks on the road - ACEA - European Automobile Manufacturers' Association

⁸³ Cities are buying more electric buses, but an EU deadline is needed (transportenvironment.org)

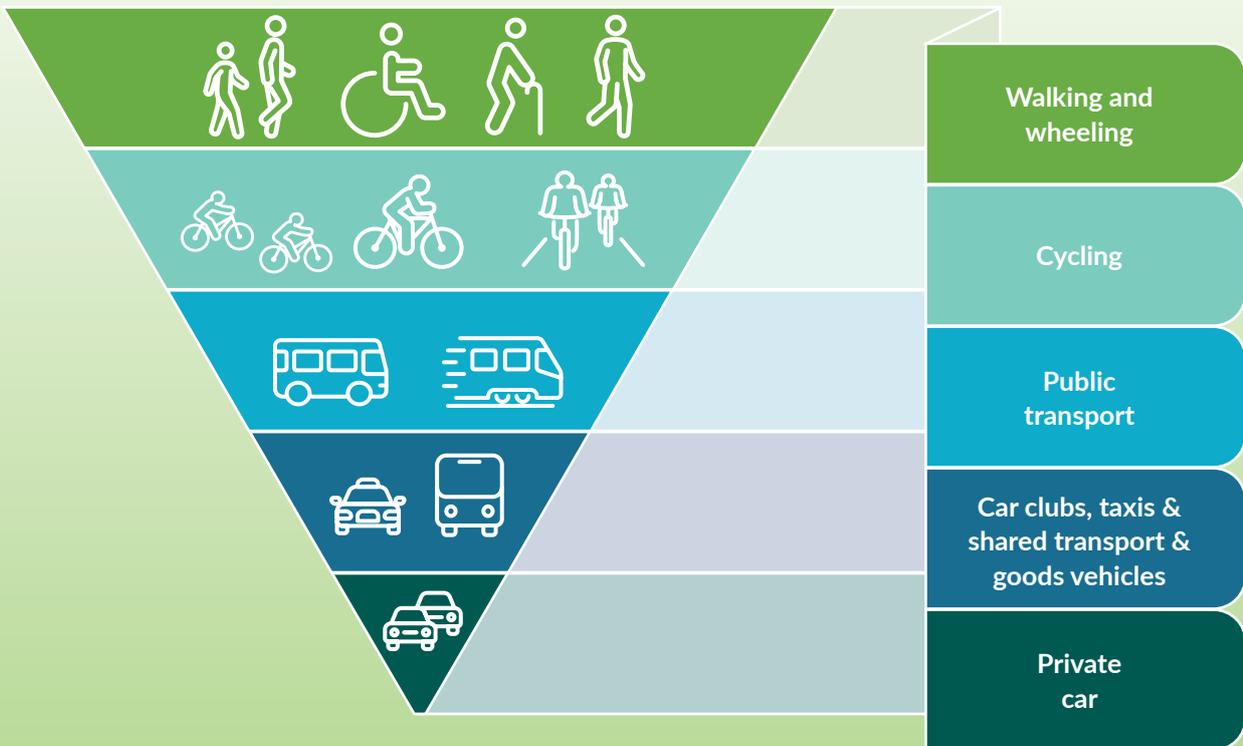
sector providers, as well as TII, ESNB, and local authorities to develop a National EV Charging Network Plan (En-Route Charging) for HGVs. The key risks and dependencies outlined in Table 3 are particularly pertinent in relation to this category of charge point infrastructure. The National EV Charging Network Plan (En-Route Charging) for HGVs will consider what mitigation measures can be put in place as well as considering how the supply of enabling services can be delivered. As well as this, ZEVU will engage with haulage industry stakeholders, DAA, and Cork and Shannon airports to deliver this goal.



How might we ensure that charging requirements don't unnecessarily delay HGV drivers who are working to tight deadlines?

How might we design forecourts in a way that gives HGV drivers access to dedicated HGV chargers and spaces to rest?

Sustainable Transport Hierarchy





CHAPTER

6

Implementation

This final chapter contains information on the ZEVI structures, the high-level actions, funding streams, and supports that have been implemented since the publication of the draft strategy in March 2022. It also presents an overview of the Implementation Plan. The draft version of this strategy underwent a public consultation process. Details from that process have been incorporated into this final strategy.

6.1 Governmental and Collaborative Structures

This section sets out the key structures that have been established to facilitate and quicken the delivery of electric vehicle charging infrastructure in the coming decade. Collaboration has been identified as an important part of the process and these structures aim to maximise the positive effects of sharing expertise.

The delivery of this EV Charging Infrastructure Strategy will be achieved by a wide range of actors and stakeholders acting together to:

- Share knowledge and best practice;
- Accommodate planning and regulatory structures;
- Drive investment;
- Identify optimal charge point locations and technologies.

Achieving successful infrastructure delivery will involve addressing key consumer concerns about affordability, convenience, and ease of use. Partnerships and collaboration will be encouraged between public and private stakeholders, academics, energy network operators, energy providers, and regulators as they work together to pilot infrastructure and to develop innovative technologies and solutions. Successful delivery will also be based on the identification and sharing of relevant data, and on targeted research and information sharing to address knowledge gaps.

Cross-border engagement across all levels of Government will be required to support the development of public charging networks on an all-island basis. Based on a principle of

maximising cooperation, the Government will work with the Northern Ireland Executive to promote and support EV charging infrastructure deployment. This will happen through initiatives such as the Shared Island Fund, as well as through other international collaborative and funding opportunities. This collaborative approach will help integrate and standardise public charge point networks on the island, to ensure ease of use and application for cross-border travel.

In July 2022, the Government established a new office within the Department of Transport: Zero Emission Vehicles Ireland (ZEVI). ZEVI will coordinate the provision of EV supports and grants, as well as the delivery of charging infrastructure. It will also coordinate and steer the collaborative efforts to deliver EV infrastructure and ensure a satisfactory experience for all EV users.

This chapter gives more detail on ZEVI and on the composition and purpose of the collaborative delivery groups that will be formed to support it.

6.2 Zero Emission Vehicles Ireland (ZEVI)



The Government has established the Zero Emission Vehicles Ireland office. ZEVI will co-ordinate and deliver the policy pathway for low-emission vehicles.

ZEVI will draw on international best practice and will leverage expertise from across a number of organisations that deliver EV policy measures and support services. It will be responsible for the strategic coordination of EV policy and strategy, management of EV grants and incentives, and

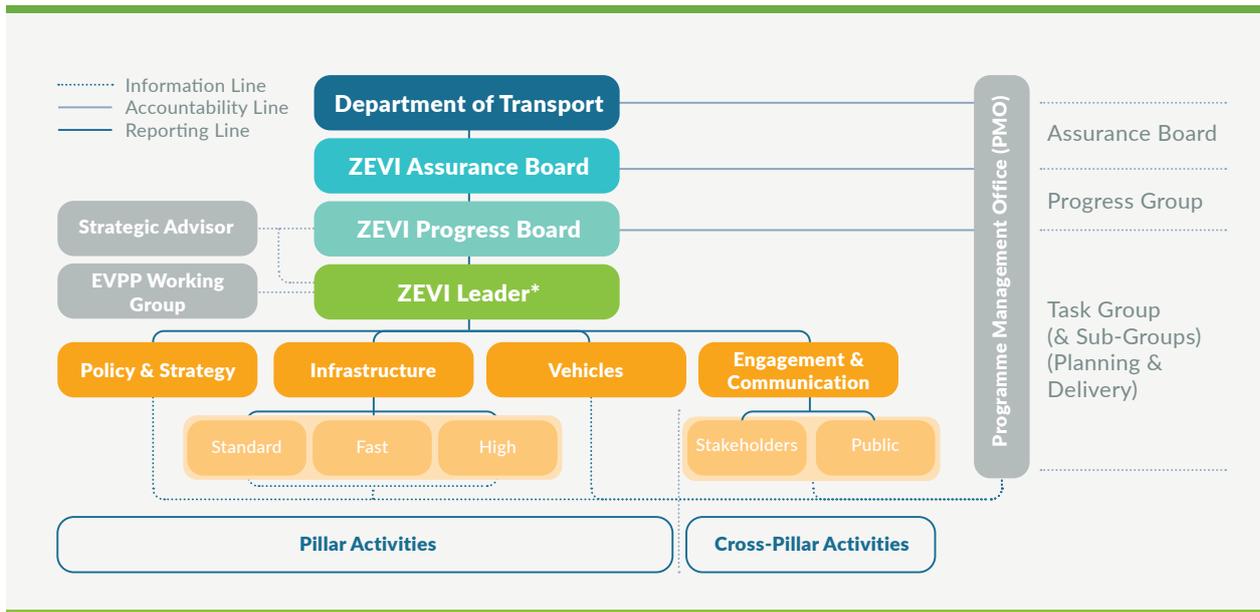


Figure 3: ZEV I Organisation, Structure, and Governance

the Implementation Plan for this EV Charging Infrastructure Strategy.

ZEV I will bring together the various vehicle grant schemes that are currently in place. These grants are a crucial part of addressing gaps in the market and ensuring early-adopter EV uptake. This is especially important until the lifetime costs of electric vehicles are priced similarly to fossil-fuel vehicles. As this price parity moves closer, such supports will be gradually phased out⁸⁴, and it is expected that Government funds will focus on the delivery of charging infrastructure.

ZEV I will coordinate and support the development and rollout of publicly-accessible charging infrastructure. It will collaborate with the public and private sectors, as well as service providers, to deliver destination charging, residential neighborhood charging, and Alternative Fuel Infrastructure Regulation (AFIR) infrastructure targets (particularly along the TEN-T Network)⁸⁵.

The ZEV I office sits within the Department of Transport. The organisation and governance of the office is outlined in Figure 3, above.

ZEV I has four pillars of focus: Policy & Strategy, Infrastructure, Vehicles, and Communications and Engagement.

The ZEV I Assurance Board and Progress Board bring together the key enablers for the delivery of this strategy (ZEV I, SEAI, NTA, TII, and ESB Networks) with other key stakeholders such as the CCMA and the CRU.

In addition to the Assurance and Progress Boards, there is a wide range of stakeholders who will contribute to the objectives of the strategy and without whom, the strategy could not be delivered successfully. To facilitate this wider collaboration, ZEV I established three infrastructure stakeholder groups and one vehicles stakeholder group to share knowledge and best practice, and to identify barriers and potential solutions.

- Group 1: Public Sector Energy Delivery Group
- Group 2: Public Sector EV Infrastructure Delivery Group
- Group 3: Public-Private Infrastructure Stakeholder Group

⁸⁴ Dept of Transport (2021) Electric Vehicle Policy Pathway Working Group report, pp. 10-11, p. 21.

⁸⁵ See proposed Alternative Fuels Infrastructure Regulation and proposed TEN-T Regulation revision.

- Group 4: Public-Private Vehicles Stakeholder Group

In addition to engaging with stakeholders through these formal groups, ZEVI will engage strongly with citizens. This will be done through the website, social media channels, and a comprehensive communications program.

6.2.1 Public Sector Energy Delivery Group



The Public Sector Energy Delivery Group will bring transport and energy expertise to inform the delivery of EV infrastructure.

The energy sector plays a fundamental part in the successful delivery of EV charging infrastructure. ZEVI has established a Public Sector Energy Delivery Group comprising representatives from relevant Government Departments, agencies, and the energy sector. This group will consider the wider impacts of the electrification of transport in Ireland. In so doing, it will review and consider energy impacts of increasing EV uptake, monitor grid constraints, and consider safety requirements. The group will engage with key actors in the planning and delivery of EV infrastructure.

6.2.2 Public Sector EV Infrastructure Delivery Group



The Public Sector EV Infrastructure Delivery Group will bring together public bodies active in the delivery of EV infrastructure.

ZEVI will collaborate closely with other Government departments, public sector bodies, and local and regional authorities to develop integrated policy and implementation approaches to EV infrastructure delivery⁸⁶.

To this end, ZEVI has convened an interdepartmental and inter-agency Public Sector Infrastructure Delivery Group, drawing together

representatives from a range of organisations.

The delivery group will provide expertise to support the delivery of a comprehensive national EV charging network. At an early stage, it will identify issues and challenges emerging in the implementation of this strategy and provide solutions and guidance where appropriate. The group will work to integrate EV infrastructure provision into the planning framework, while considering local energy provision. The group will also consider whether new regulations are required to facilitate the provision and installation of EV infrastructure.

6.2.3 Public-Private Infrastructure Stakeholder Group



ZEVI established a new multi-stakeholder Public-Private Infrastructure Stakeholder Group to provide a partnership approach to EV infrastructure delivery.

Extensive and continuous engagement with external stakeholders, industry bodies, service providers, and consumers will be central to the Government's approach to delivering infrastructure. Best-practice examples in other jurisdictions are clear about the benefits of such engagement as a way of sharing information, addressing blockages, encouraging investment, ensuring stakeholder buy-in, and meeting the needs of citizens.

ZEVI has convened a new Public-Private Infrastructure Stakeholder Group, drawing together representatives from the EV ecosystem, public sector, industry, and academia. Its focus will be on identifying optimal policy levers, funding sources, and innovations to support EV infrastructure delivery. It will be transparent, responsive to market shifts and technological developments, and will facilitate best practice and knowledge sharing.

In countries with high levels of EV uptake and EV charging infrastructure provision, such as

⁸⁶ <https://www.caro.ie/>

the Netherlands or Germany, the creation of a supportive environment for innovation has been identified as one of the factors that contribute to increased EV adoption⁸⁷. Innovation can involve synergies and linkages between stakeholders, as well as between energy, transport, and digital technology systems. Business-model innovation has also been identified as a potential contributor to increased infrastructure provision, allowing the development of new types of commercial relationships between stakeholders, local authorities, and service providers. It also allows the integration of different types of sustainable mobility⁸⁸.

The stakeholder group will consider and make recommendations on how best to support and accelerate the rollout of charging infrastructure according to user needs (including safety and security).

The group will also consider how best to implement the data-sharing provisions of the

Alternative Fuel Infrastructure Regulation. The AFIR will require operators of charge points to provide static and dynamic data to a National Data Point which in turn will share it with the industry.

This group will also consider how best to ensure a wider public awareness of EV technologies and charge-point networks. The group will support the work of ZEVl in this area.

Collaboration between businesses, research institutions, and public bodies has also emerged as a source of innovation and of new technological and digital solutions to EV charging challenges and opportunities. Data and evidence gaps will be addressed by leveraging national research and enterprise-funding opportunities, and by working with the university sector to carry out EV-charging research and pilot projects.



⁸⁷ For example the Dutch 'Formula E-Team' or 'Living Lab Smart Charging' initiatives, Netherlands Enterprise Agency (2019) Mission Zero: powered by Holland, pp. 13-14; see also German targeted EV R&D funding, <https://www.bmw.de/Redaktion/EN/Artikel/Industry/electric-mobility-r-d-funding.html>.

⁸⁸ S. Hall et al. (n.d.) The innovation interface: business model innovation for electric vehicle futures, report funded by Future Cities Catapult, EPSRC and University of Leeds, UK.

6.2.4 Public-Private Vehicles Stakeholder Group



ZEVI established a Public-Private Vehicles Stakeholder Group with expertise to support and inform electric vehicle rollout.

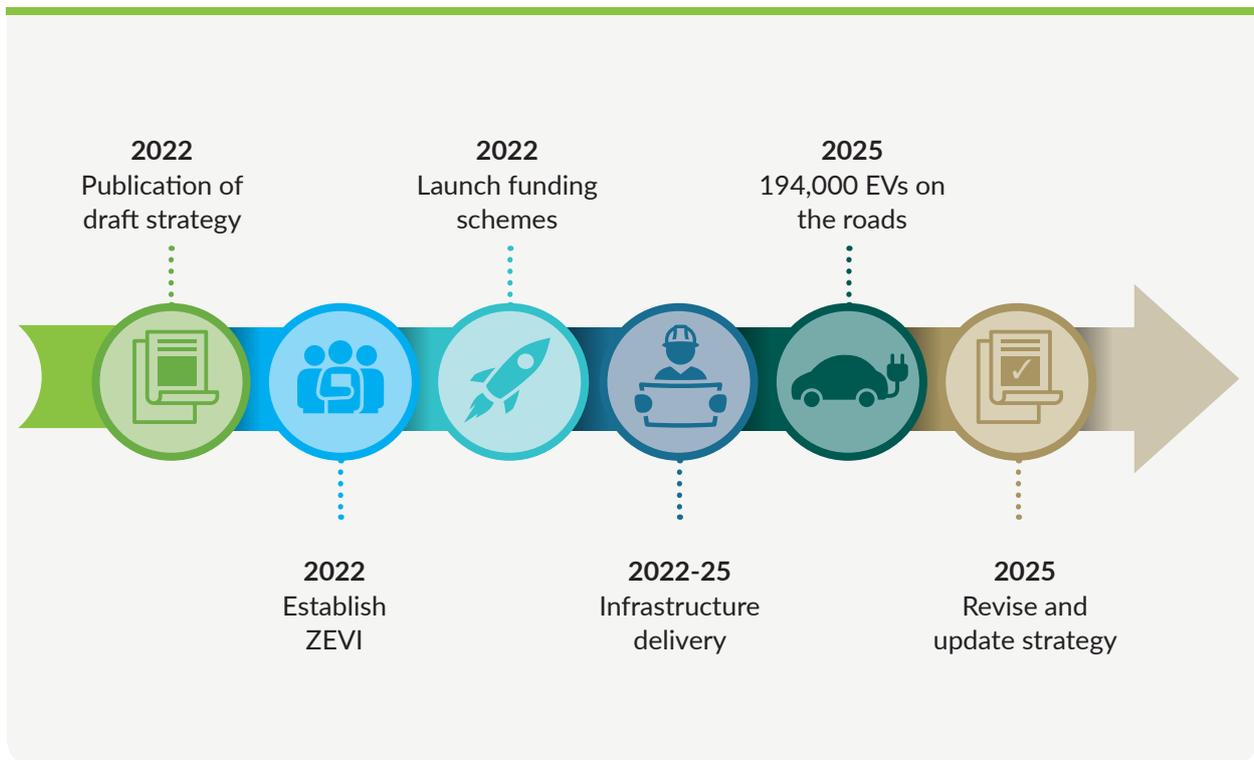
The Public-Private Vehicles Stakeholder Group will bring together representatives from the car industry and car user groups. These will include the taxi industry, car-rental groups, car-sharing groups, tourism groups, HGV representatives and EV and motoring associations. While this group will be focused on the vehicular issues associated with encouraging the transition to EVs, it is an important user group to contribute to the EV infrastructure strategy.

Public infrastructure will be designed to meet driver needs. EV drivers' charging needs are considerably influenced by the design and capability of their vehicles, and the purpose of their journeys. For example:

- Vehicle battery size
- Vehicle on-board charging capacity dictating how quickly the battery can be charged
- EV taxi drivers drivers will have different charging needs to car rental organisations or car clubs.

This framework for strategy delivery will allow for prompt stakeholder engagement across multiple sectors. Most importantly, it will help to meet the increasing pace of demand for EV charging infrastructure over the coming years.

Figure 4: Timeline of Strategy



6.3 What’s Been Achieved Since Publication of the Draft Strategy

Chapter 7 of the Draft EV Charging Infrastructure Strategy identified high-level actions to drive delivery and to stimulate EV infrastructure availability. These fall under three broad areas:

- **Public sector actions** to coordinate the delivery of infrastructure across all levels of Government and to facilitate the development of a comprehensive mixed-type EV charge point network serving the needs of all citizens;
- **Integrated EV delivery and stakeholder engagement** to leverage existing expertise,

share knowledge, and to integrate industry and private sector investment with innovation and consumer needs;

- **Government funding supports** to stimulate targeted EV charge point rollout, to address gaps in EV provision, and to ensure a comprehensive network for all as the EV market develops.

Several of the initial actions identified have been completed. These are outlined in the tables below. Any actions that have not been completed will be carried through to the implementation plan that will be published along with this strategy.

Table 6: Summary of high-level actions

Public Sector Actions	
Objective	
Support the public sector and local government authorities to deliver EV infrastructure	
Action	Expected Results
1. Publish draft Electric Vehicle Charging Infrastructure Strategy and complete public consultation process	<ul style="list-style-type: none"> • The draft version of the strategy was published in May 2022 and the public consultation process generated 14,000 responses, including stakeholder responses. These informed the final strategy, due to be published in January 2023. • The draft strategy and public consultation process provided greater insight into coordination of EV policy and infrastructure.
2. Establish ZEV1 in the Department of Transport by summer 2022	<ul style="list-style-type: none"> • The ZEV1 office was officially established in July 2022. • The office coordinates provision of EV supports and grants, as well as the delivery of charging infrastructure to support consumers, the public sector, and businesses. All this helps Ireland to continue to make the switch to zero-emission vehicles. • The office undertook a coordinated public information and engagement campaign to address consumer charging concerns and build public knowledge of EVs.
3. Update and publish final Electric Vehicle Charging Infrastructure Strategy before end of 2022	<ul style="list-style-type: none"> • This document, the final Electric Vehicle Charging Infrastructure Strategy (reflecting feedback from the public consultation process) will be published in January 2023.
4. Publish detailed Implementation Plan before end of 2022	<ul style="list-style-type: none"> • An action plan for EV infrastructure delivery was developed. This will be published in January 2023.

Integrated EV Delivery and Stakeholder Engagement

Objectives

Coordinate and support EV infrastructure delivery across the EV ecosystem and on a strategic and comprehensive national basis

Support private-sector investment and technological innovations to meet consumer needs

Action	Expected Results
<p>5. Establish Public Sector EV Infrastructure Delivery Group (with terms of reference)</p> <p>6. Establish Public Sector Energy Group (with terms of reference)</p> <p>7. Establish Public-Private Infrastructure Stakeholder Group (with terms of reference)</p> <p>8. Establish Public-Private Vehicles Stakeholder Group</p> <p>(Groups established with first workshops convened in October 2022)</p>	<ul style="list-style-type: none"> • Alignment of EV infrastructure delivery with distribution network development and sectoral coupling (energy and transport) • Increased EV integration with planning
<p>9. Engagement and collaboration with Northern Ireland Executive and UK OZEV - ongoing</p>	<ul style="list-style-type: none"> • Facilitation of a comprehensive and optimised EV network on both sides of the border. This network will reflect the integrated and all-island nature of the energy sector and transport infrastructure.

Government Funding Supports	
<p>Objectives</p> <p>Increased provision of targeted EV charging infrastructure for all citizens</p> <p>Incentivise consumer action and stimulate EV demand</p>	
Action	Expected Results
<p>10. Introduce requirements for smart charging on all new home charge points from 2023 (Completed September 2022)</p>	<ul style="list-style-type: none"> Improved grid resilience and an enhanced consumer experience Enabling car owners to opt for cheaper electricity through charging at night time (if they opt in for a night meter or a smart meter)
<p>11. Expand the EV Home Charger Grant scheme to include shared parking in apartment blocks by Q2 2022 (Completed September 2022)</p>	<ul style="list-style-type: none"> A targeted increase in EV charge point provision to meet home-charging needs where on-street charging is not possible and where EV users don't have access to driveways
<p>12. Support local authorities in the development of local EV charging networks (Carried forward)</p>	<ul style="list-style-type: none"> An increase in the number of local authority publicly-accessible charge points at targeted locations
<p>13. Develop new Residential Charging Scheme (Carried forward)</p>	
<p>14. Progress the 'FASTER' EV charging project (Ongoing)</p>	<ul style="list-style-type: none"> Completion of planned EV charge point rollout programme in border counties
<p>15. Implement a Destination Charge Point Scheme by Q3 2022 (Carried forward)</p>	<ul style="list-style-type: none"> Installation of destination charge points in locations such as hotels, visitor centres, and parks.



A targeted increase in EV charge point provision to meet home-charging needs where on-street charging is not possible and where EV users don't have access to driveways

6.4 Overview of Implementation Plan

The Electric Vehicle Charging Infrastructure Strategy is accompanied by an Implementation Plan that sets out key actions and deliverables from 2023 to 2025. It includes a comprehensive range of new and expanded measures to support the delivery of electric vehicle charge point infrastructure.

ZEVI has a governance programme involving Assurance and Progress Boards, along with the stakeholder delivery groups referenced above. The ZEVI office leadership reports to the Minister for Transport on a regular basis. The Minister will oversee progress on the implementation of the Electric Vehicles Charging Infrastructure Strategy.

The Implementation Plan includes actions and deliverables across the following categories:

- **National EV Charging Network Plan:** The focus of this framework is on producing a national EV-charging-infrastructure demand plan and a related demand-supply assessment based on the electricity grid's readiness to meet projected demand between 2023 and 2025. The framework will provide for the necessary standards, processes, metrics, and governance needed to create a structured process for planning, tracking, and communicating Ireland's progress under the AFIR regulations.
- **Schemes:** This section contains the planned deliverables for enabling the charging infrastructure schemes to be installed and go live.
- **Policy & Strategy:** This section of the plan includes deliverables and related milestones for delivering the necessary policies in support of the expansion of the EV charging infrastructure. These policies cover topics such as interoperability, accessibility, measures to improve ease of use for the customer, and governance of the implementation of the AFIR regulations in Ireland.
- **Communications and Reporting:** This section details the reports and communications that ZEVI will be making to the public, to the Government, and to the European Union in relation to the progress being made on expanding the charging infrastructure nationally.

The Implementation Plan will be delivered in collaboration with other stakeholders such as Transport Infrastructure Ireland, the National Transport Authority, the Sustainable Energy Authority of Ireland, ESB Networks, regional assemblies, local authorities, and charge point operators.

As explained in Chapter 1, the strategy and Implementation Plan are part of a comprehensive set of national policies and plans to enhance Ireland's response to climate change. The milestones in the Implementation Plan align with the respective action plans for these other national plans such the Climate Action Plan.

The outcomes of the Implementation Plan will be supported by complementary actions from other relevant national policies and strategies, and will support delivery of the Climate Action Plan goals.

The Implementation Plan will be reviewed on an annual basis up to 2025 to measure how we are delivering our goals. This will allow us to adopt any lessons learned along the way.



APPENDIX

A

Personas &
Journeys



Caroline Connolly

The Car Sharer

Background

Age	Location	Family Status	Income
28	Dublin	Single	Low

Travel Habits

How Often Does She Travel?

She commutes to work 2-3 times a week and makes shorter local trips on days she works from home.

Journey Purpose

Travelling to work, to meet friends in town, to the shops.

When Does She Travel?

Peak commuting times in the morning and the evening. Lunchtime trips when she works from home.



I learned to drive when I lived at home and used my parents' car. But now I try and cycle and take public transport if I can. It's cheaper and faster!

Key Moments - Caroline, the Car Sharer

Motivation



Caroline is money savvy. She doesn't want the burden or expense of owning her own car. She prefers to cycle or take public transport where possible, but there are some journeys for which a car is essential. Car sharing is the perfect alternative.

Usage



Caroline typically relies on cycling or public transport. She uses the car a few times a year - mostly for going out to retail parks, for a weekend away, or for specific circumstances such as moving apartments.

Support



Caroline needs to be able to get to and from the e-mobility hub easily via public transport. She is not familiar with the charging network, so needs easy-to-find information about where and how to charge.

Activity



As she doesn't have an at-home charger, she usually charges when out and about. Having destination charging at retail parks is ideal because she can do her shopping while her car charges.

Concerns



She is worried that she won't be able to find chargers or use them properly. She also needs to return the car with a full charge, and she will get fined if she doesn't.

Customer Journey - The Car Sharer

	Planning		The Journey			The Way Home
Moments	<p>Caroline has just moved and needs to move her belongings across the city, from Drumcondra to Kilmainham.</p> <p>She signs up to a car-sharing app so that she can move her belongings and make a trip to the retail park to pick up some new home decor.</p>	<p>Caroline plans to pick up a car in the local e-mobility hub on Saturday morning. This is usually a busy time, so she books in advance to avoid disappointment.</p>	<p>Caroline takes a bus down to the local e-mobility hub and is able to collect her fully-charged car easily.</p> <p>She packs up the car and makes a few trips back and forth from the old apartment to the new apartment.</p>	<p>On Saturday afternoon, Caroline makes a trip to the retail park. She needs to make sure that the car has enough charge in it to avoid a fine when she returns to the hub.</p>	<p>Caroline isn't familiar with EV charging services. She checks online and reserves a fast charger in the retail park. She charges the car while she does her shopping.</p>	<p>Caroline brings the car back to the e-mobility hub and takes the bus home.</p>
Highs and Lows	<p>Excited to move apartment</p> 	<p>Relieved to have booked a car</p> 	<p>Tired</p> 	<p>Anxious about not finding a charger</p> 	<p>Relieved that she could find the information she needed</p> 	
Considerations	<p>How might we encourage people to consider e-car sharing as a viable alternative to owning a car?</p>	<p>How might we meet the demand for car sharing at weekends?</p>	<p>How might we ensure that e-mobility hubs are easily-accessible by public transport or active mobility?</p>	<p>How might we support users to find charging facilities so that they don't risk facing a fine upon returning the car?</p>	<p>How might we provide accessible information about EV charging to infrequent users?</p>	



Tara Traynor

The Taxi Driver

Background

Age	Location	Family Status	Income
55	Skibbereen, Cork	Married, 3 kids	Medium

Travel Habits

How Often Does She Travel?

Daily for work.

Journey Purpose

Providing taxi journeys.

When Does She Travel?

Tries to work during the day, but at busy periods she picks up a few night shifts.



I don't want to let anyone down because I don't have enough charge in my car to do the trip.

Key Moments - Tara, the Taxi Driver

Motivation

Tara has an at-home charger installed so that she always has a reliable place to charge. Having a full charge at the start of the night is essential.

Usage

On a busy night out, Tara might need to quickly top up her charge and wants to be able to do so between bookings.

Support

She needs access to a dedicated fast charger that will give her the boost she needs to make it to the end of the night.

Activity

Tara drives for work, and needs to take a break to rest, if possible, between bookings. She needs to have safe facilities to grab some food or take some calls.

Concerns

She is worried about being stranded in a remote area with unhappy passengers. On any given night, she never knows what delays might come up or how long she'll be out for.

Customer Experience – The Taxi Driver

	Planning	The First Journey - Going Out		The Second Journey - Coming Home	
Moments	<p>It's Saturday afternoon and Tara has been busy on the phone taking bookings for the evening. People rely on her taxi service to go out at night and to get home.</p> <p>There are quite a few long trips ahead: on a typical night she could be driving almost 200 km between the bigger towns and villages. Tara has a home charger installed in her driveway.</p>	<p>It's 7 pm, and she starts her evening off in Skibbereen. Firstly, she heads to Schull where she has a few pre-bookings.</p> <p>After Schull, she heads to Baltimore, Castletownshend, and Glandore. It's a big night out in Skibbereen so she has multiple big trips to do between Skibbereen and the surrounding areas.</p>	<p>It's already 11 pm, the time when there is a momentary lull before it's home time for all the people she brought out. She's been driving for almost 4 hours and needs to top up her charge. There's a small mobility hub outside of Skibbereen. There is a dedicated taxi charger, so she can take a break for 20 minutes and top up her charge.</p>	<p>She feels confident now that she will have enough charge in her car to complete all her bookings. She heads back into Skibbereen and brings home everyone who was out that night.</p>	<p>Once she has finished up in Skibbereen, she gets a last-minute passenger looking to go to Bantry. She brings them there as the last trip of the evening. After all the pre-bookings, as well as the last-minute ones, she manages to get home to Skibbereen at 2 am.</p>
Highs and Lows	<p>Prepared for the night ahead</p> 	<p>Looking forward to the evening ahead</p> 	<p>Anxious about how much charge is left in the car</p> 	<p>Restless that it's only halfway through the night</p> 	<p>Relieved she's been able to complete all her trips</p> 
Considerations	<p>How might we assist taxi drivers to install home chargers if there are no other alternatives in the local area?</p>	<p>How might we encourage people to pre-book taxis and share taxis with neighbours in rural areas?</p>	<p>How might we ensure that taxi drivers have dedicated access to chargers at busy periods?</p>	<p>How might we support taxi drivers to be able take all the bookings they need to without worrying about their charge?</p>	



Ruairí Reynolds

The Rural Commuter

Background

Age	Location	Family Status	Income
33	Virginia, Cavan	Single Dad, 1 daughter	High

Travel Habits

How Often Does He Travel?

Daily, usually at peak travel times.

Journey Purpose

Work, shops, childcare.

When Does He Travel?

Usually at peak travel times in the morning and the evening.



My commute is quite long but I want to be there for my daughter after work and not have to worry about charging the car.

Key Moments – Ruairí, the Rural Commuter

Motivation



Ruairí typically commutes by bus to Dublin for work. Occasionally, he needs to get home early to be able to bring his daughter to camogie training. On those days, he drives to make sure he will get home on time.

Usage



He usually drives to work twice a week and either works from home or takes the bus on days where he doesn't need to be home early.

Support



Ruairí has a second-hand EV and is worried about the range. His commute is quite long, so he is worried he won't have enough charge if there are diversions along the route or he has to do extra trips after work.

Activity



Destination charging is really important to Ruairí. He spends enough time on the road and doesn't want to spend extra time away from home while waiting for his car to charge.

Concerns



He is worried about not being around in the evenings for his daughter and running out of charge on his commute.

Customer Journey - The Rural Commuter

	Leaving in the Morning		Arriving to Work		On the Way Home	
Moments	<p>Today, Ruairí is driving to work in Dublin. He has decided to take the car so that he can make it back in time to bring his daughter to camogie training this evening.</p> <p>He charged his car overnight, so is happy to get into a fully-charged car to make his trip to Dublin (which will be around 200 km in total).</p>	<p>There is a lot of traffic on the road this morning, so he ends up taking a diversion which ends up being quite long. He usually has about 250 km range in his car.</p>	<p>To make sure that he has enough charge to make the commute home, Ruairí usually books a charger in work. Today, however, he ends up leaving it too late and misses his spot.</p>	<p>Ruairí is in meetings all day and doesn't have time to figure out a plan to top up the charge on his car.</p>	<p>Ruairí jumps in the car to drive home and remembers he needed to top up his charge. He will have enough to get home but is worried about getting back from the training pitch.</p> <p>He remembers that the local GAA club has installed a charger on the grounds. He picks up his daughter and is able to park and help out at the training session while the car charges.</p>	
Highs and Lows	<p>Relieved to have a home charger installed</p> 	<p>Stressed about the extra distance he has to drive</p> 	<p>Anxious because there isn't an available charger, and he doesn't have time to find an alternative</p> 	<p>Frazzled at work</p> 	<p>Anxious about making it home and getting to training</p> 	<p>Elated that there's a charger at the local pitch</p> 
Considerations	<p>How might we support those with range anxiety to have access to chargers either at home or close to home?</p>	<p>How might we ensure that diversions due to traffic don't disrupt travel plans for those with limited range?</p>	<p>How might we provide additional alternatives to those who don't get to use destination charging facilities?</p>	<p>How might we share information about alternative charging options in local areas?</p>	<p>How might we give guidance and support to those who may need to disrupt their travel plans in order to charge en route?</p>	<p>How might we encourage local sports clubs in rural areas to install EV chargers?</p>



Anna Abbott

The Apartment Dweller
(Shared Parking)

Background

Age	Location	Family Status	Income
27	Galway City	Single, no kids	Medium

Travel Habits

How Often Does She Travel?

Daily, walking to work usually.

Journey Purpose

Work, shops, visiting friends, weekend activities.

When Does She Travel?

Usually peak travel times in the morning and the evening. Weekends out to the countryside.



I don't use my car every day, but when I do need to, I want to have a good charge on it so I can do what I need to do.

Key Moments – Anna, the Apartment Dweller

Motivation



Growing up in a rural area, Anna has always wanted to be independent in her travel. She recently purchased her first EV so that she can visit her family home in the countryside or go for spontaneous trips with friends.

Usage



Anna lives in a residential development with shared parking facilities. Anna usually only uses her car at the weekend or for trips after work to the supermarket.

Support



The apartment management company for Anna's apartment block installed EV chargers for the residents. Anna needs to have reliable access to the chargers. In addition, she needs to have a reliable booking system that she can access.

Activity



As most of Anna's trips are at the weekend or are spontaneous, Anna likes to avail of at-home charging so that she isn't wasting her limited travel time at a forecourt, waiting for the car to charge.

Concerns



Anna is worried about having to queue excessively, as there are limited chargers in her apartment complex. There are some residents who hog the chargers, which seem to always be in use.

Customer Journey - The Apartment Dweller

	Saturday Morning				Saturday Afternoon	Saturday Evening
Moments	Anna needs to go to lunch with family in Ballinrobe. It's about a 100 km roundtrip. Anna's parents don't have an at-home charger, so she needs to make sure she has a full charge before she leaves.	The chargers in the apartment block have been booked up over the last few evenings so Anna hasn't had the chance to fully charge her car this week.	She has a half charge in the car, so she decides to leave early so that she can charge in the forecourt on her way. It's a fast charger, so it's a bit more expensive than what she's used to paying.	She is waiting for about 30 minutes to charge. There are restaurants and shops at the forecourt, so she manages to get some breakfast and pick up a dessert for the family lunch.	She arrives at her parents' house and spends a lovely evening with the family. Before she leaves, she remembers to book a charging slot in the apartment block. There will be a free charger for her when she gets home.	She heads back home that evening and the charging spot she booked is free to use at last. She'll now have a full charge and be ready for the next spontaneous trip.
Highs and Lows	Excited to spend time with the family	Annoyed that she never gets to use the charger in the apartment block	Frustrated that she always has to look for another charger	Patient while she gets some food	Organised and prepared to get a charger when she gets home	Relieved to see the charger she booked is free
						
Considerations	How might we assist people to charge their EVs before taking a long journey?	How might we discourage users from hogging chargers and overcharging?	How might we support those who have to pay extra to use en-route charging in an emergency?	How might we provide facilities at en-route forecourts so that the wait is comfortable and pleasant?	How might we remind users to book chargers based on their charging habits?	



Mike Murphy

The HGV Driver

Background

Age	Location	Family Status	Income
52	Waterford	Married, 3 grown-up children	Medium

Travel Habits

How Often Does He Travel?

Every day during the working week.

Journey Purpose

To deliver goods across the country.

When Does He Travel?

Peak travel times.



I usually have to stop and rest while on the road anyway, so it would be great to have good facilities at forecourts where I can charge up too.

Key Moments – Mike, the HGV Driver

Motivation



Mike drives a HGV for work. At night, it's parked up in a depot, so he doesn't have to worry about charging it overnight.

Usage



He drives most days to make deliveries. He uses the motorway network across the country. His HGV charges overnight at a depot, but on longer days he uses en-route charging to top up his charge.

Support



Mike needs suitable charging facilities to be located beside rest facilities. As a HGV driver, he is under time pressure and he wants to make sure he can rest and charge at the same time. This stops his journey from becoming unnecessarily long.

Activity



At charging stations, Mike would like to be able to take a break, rest, and eat while he tops up the charge on his lorry.

Concerns



Mike is concerned about his journey becoming longer if he has to take time to charge and then take time to rest. He wants to be able to do both simultaneously.

Customer Journey - The HGV Driver

	Leaving in the morning		Arriving to Work		On the Way Home	
Moments	Mike collects his lorry from the HGV depot outside Waterford. It has been charging overnight there so he is able to get in and set off for the day.	After heading to the port to collect his load, he finds out he is driving to Galway this morning. He is under a tight deadline, and only has 4 hours to get there.	It's lunchtime, and he'd like to stop and rest for a while. He would also like to try to top up the charge on his lorry while he takes a break for lunch so that he doesn't have to worry about it later.	He stops in a forecourt just off the motorway. There are dedicated chargers for HGVs, so he parks and charges for an hour while he gets lunch. This is his usual spot for charging and eating lunch.	He gets back on the motorway and manages to make his delivery in Galway on time. Leaving early and avoiding rush hour makes all the difference.	He leaves the lorry in the depot in Galway to charge overnight. He is staying overnight in the city, so he'll come back and collect it in the morning to make another trip home tomorrow.
Highs and Lows	Ready for the day ahead	Anxious to get on the road early	Getting tired before lunch	Rested and on the home stretch	Confident he'll finish his journey on time	Happy to finish driving for the day
						
Considerations		How might we ensure that charging requirements don't unnecessarily delay HGV drivers who are working to tight deadlines?	How might we design forecourts in a way that gives HGV drivers access to dedicated HGV chargers and spaces to rest?	How might we reward HGV drivers who frequently stop at the same forecourts for rest and charging?		



Rachel Reynolds

The Retired Urban Dweller

Background

Age	Location	Family Status	Income
67	Clonmel	Widowed, 2 grown-up sons	Low

Travel Habits

How Often Does She Travel?

Once or twice a week.

Journey Purpose

Going to the shops and doctor's appointments.

When Does She Travel?

Early afternoons.



It's so frustrating when I can't tell if the charge point will be accessible when I get there - it makes me anxious about my journey.

Rachel, the Retired Urban Dweller

Motivation



Rachel has an EV that she uses for small trips around town. She mainly goes to the shops, to visit family, and to medical appointments. She doesn't have a driveway, so she relies on neighbourhood or destination charging.

Usage



Rachel needs to use chargers which meet her accessibility requirements. For example, there needs to be space around the car so that she can move comfortably with her wheelchair.

Support



Being shown how to use an EV charging app and the chargers is important to helping Rachel retain her independence while travelling. She also needs adequate signage to find the appropriate spots.

Activity



If the neighbourhood charger isn't available, Rachel usually charges at her destination - whether it's at the doctor's office or the supermarket.

Concerns



She is worried about not knowing how much charge is left in her car. As well as this, she gets anxious about not knowing what to expect when she gets to a charger: will there be an accessible spot and will there be enough signage to help her find it?

Customer Journey - The Retired Urban Dweller

	Planning				Charging	The Way Home	
Moments	Rachel has to go to a doctor's appointment in town. It's a 15-minute drive to the other side of town.	Rachel doesn't drive very often, so she tries not to hog the on-street charger. However, she is sometimes left not knowing how much charge is in her car before she gets in.	She's running late and realises she might only have enough charge to get to the doctor's. She needs to top up her charge either on the way or at the doctor's office.	There is an easy-to-use app where she has already loaded her charging preferences - she needs an accessible spot and a fast charger beside the doctor's office. There is a picture of the EV charger available, so she knows what to expect when she arrives. She reserves the spot.	She's nervous that she won't be able to find the spot. She has never parked there before so is on the lookout for signs.	She arrives to the doctor's practice and there is a sign to direct her to the EV chargers. The charger is what she expected to see. She plugs in her car to the fast charger.	Rachel heads in to see the doctor and when she comes out her car has plenty of charge to take her home.
Highs and Lows	Confident that she knows where she's going 	Anxious about how much charge is left in her car. 	Nervous about her range 	Reassured that there's an app to book a spot 	Worried she won't be able to find the spot 	Relieved to be able to find the charger and make her appointment on time 	Happy that she was able to access the right charger 
Considerations	How might we help infrequent drivers to know how much charge they need based on their travel habits?	How might we support drivers who are not able to access their first choice of charger?	How might we provide accessible chargers and information to those who need it? How might we support those who are unfamiliar with EV chargers to confidently use and book spaces?	How might we provide appropriate signage for EV chargers?			



The Jacksons

The Tourist Family

Background

Age	Location	Family Status	Income
42	Portland, Oregon	Married, 2 kids	High

Travel Habits

How Often Do They Travel?

They are driving every day during their trip.

Journey Purpose

Travelling to scenic sites, to local towns, and to their accommodation.

When Do They Travel?

Throughout the day, but mostly in the morning.



We have always wanted to camp along the west coast of Ireland as a family. With two kids in tow, a car is essential.

Key Moments - The Jacksons, Tourist Family

Motivation



John and his wife Janet are very conscious of the environment and the impact they have. However, having two small kids can sometimes make it difficult to choose the most sustainable option. Convenience now has to come first.

Usage



Driving around the Wild Atlantic Way for 10 days. They are going to see different scenic routes and spots along the way.

Support



The Jackson Family need a convenient way to find out where different chargers are and to pay for charging.

Activity



When charging, they want to be able to occupy the kids so that they don't get bored and restless. They prefer to either charge at night at the hotel or while on to go at a tourist attraction or restaurant.

Concerns



They aren't too familiar with the system here, so they are worried about not being able to find a charger if their first choice isn't available.

Customer Journey - The Tourist Family

	Planning			The Journey	Charging		
Moments	In advance of their trip, John looks online to figure out the best route, as well as the best places to charge along the Wild Atlantic Way.	When booking the hotels along the route, John makes sure to check that there is overnight charging available.	For longer legs of their journey, John maps out the distance they plan on driving, and where they might need to stop to charge. He looks up the services and facilities available at the charging points.	John and his family are driving the longest part of their trip today, from Clare to Kerry. There wasn't an available charging space in the hotel, so they decide to make a stop on the way to charge.	They have enough charge to get to the next town. They look online to see what types of chargers are available and book a slot to avoid disappointment.	They easily find the charger in the local village. There were plenty of signs and it was located close to all the services they needed.	John parks his car for 2 hours while it charges, and the family enjoy lunch and some playtime in the local playground.
Highs and Lows	<p>Pleased that he has planned the family trip in advance</p> 			<p>Disappointed that the charger he wanted to use wasn't available</p> 	<p>Anxious about how he will occupy the children</p> 	<p>Relieved that there was an alternative</p> 	
Considerations	How might we help tourists who are coming to Ireland to prepare for their journey so that it is as seamless as possible?	How might we best support hotels and local communities to install chargers in areas where there is an influx of tourists only during busy seasons?	How might we provide information to customers to ensure that they choose the right charger location for their needs?	How might we best support customers when there isn't charging available at their destination?	How might we assist customers to adapt their travel plans based on their EV charging needs?	How might we design wayfinding solutions so that people can easily find EV chargers?	How might we best utilise the amenities in local villages and towns to support destination charging?



APPENDIX **B**

EV Basics

What is an EV Charge Point?

At its simplest, an electric vehicle charging point is a piece of interface equipment that connects a single electric vehicle to an electricity supply, allowing the vehicle's battery to be charged⁸⁹. This battery provides the power to propel the vehicle, which can be fully electric or a plug-in hybrid⁹⁰. The term 'charge point' is often used interchangeably with 'charging point'.

Charging points can be stand-alone interfaces (as is the case with most home charge points) or can be arranged in various combinations or clusters at particular locations. These combined charging points form hubs where more than one electric vehicle can charge at a time.

Most publicly-accessible EV charging points consist of a single parking bay and an adjacent electricity connection point. Where more than one charging point is provided, multiple connection points can be grouped together in single charging stations. This reduces the cabling and hardware required to connect the charge point to the electricity supply and is an efficient way of allowing more than one vehicle to charge at a time. A common arrangement is to have two twinned sockets set in a single charging station, serving two side-by-side or back-to-back parking bays.

When EV technologies were at an early stage, different manufacturers developed different types of connection points and sockets. This meant that vehicle owners had limited options when it came to where and how they could charge their EVs. As the EV market has developed, standard, interoperable connection points have become more common, particularly in the EU⁹¹.

With more standardised connection points and charge point sockets, EV charging is now mainly differentiated by power and vehicle battery capacity. Another key factor is whether

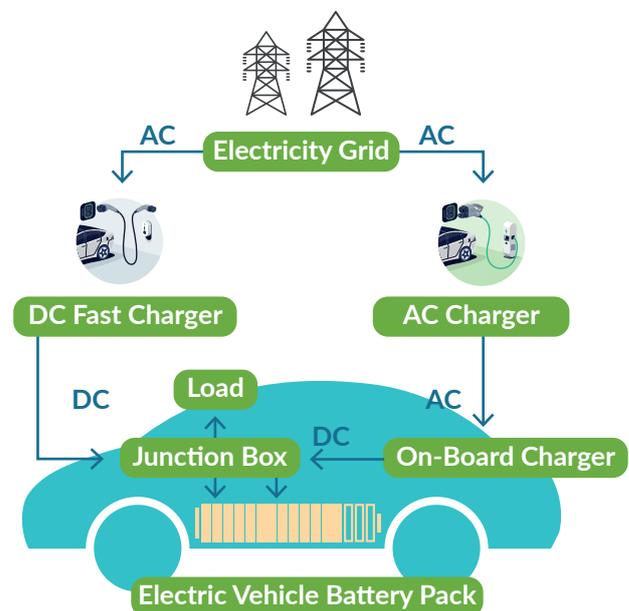
the electricity supplied to the charge point can be drawn from conventional domestic supply arrangements, or whether a higher connective capacity is required.

How Does EV Charging Work?

To charge an EV, the vehicle is parked and attached to the charging point connection or socket by a charge point cable.

EV charge points generally fall into two categories: standard charging and fast charging, otherwise known as AC and DC charging.

Figure B1: AC vs DC charging



⁸⁹ <https://www.seai.ie/technologies/electric-vehicles/what-is-an-electric-vehicle/>, accessed 09/02/2022.

⁹⁰ The EU's Alternative Fuels Infrastructure Directive (2014/94/EU; currently in force and undergoing revision) expands this definition to also include an interface that is capable of 'exchanging a battery of one electric vehicle at a time', i.e. battery-swap technology. This battery-swap charging point is not currently included in this strategy. This may change in future iterations of the strategy as battery swap technology becomes more widely available and more commercially feasible. Electric vehicles are also defined as set out in the Alternative Fuels Infrastructure Directive.

⁹¹ Annex II of the Alternative Fuels Infrastructure Directive requires that normal-power and high-power AC recharging points be supplied with socket outlets or vehicle connectors of Type 2 as described in standard EN 62196-2:2017. Direct current high-power charging points are to be equipped with connectors of the combined charging system 'Combo 2' as described in standard EN 62196-3:2014; see also ECA (2021) Infrastructure for charging electric vehicles, special report, p. 24.

Alternating Current (AC)

AC charging is associated with slower speeds of EV charging. There are two types of AC charging: single phase and three phase. When charging, AC electricity is supplied by the charge point to the vehicle. The onboard charger on the vehicle detects the maximum power available from the charge point. The vehicle converts this AC power into DC power and manages the charging of each cell in the vehicle’s battery pack.

Direct Current (DC)

DC charging is largely associated with faster speeds of charging. DC charging can quickly charge the battery pack of the vehicle. In this case, the DC charge point converts AC electricity into DC electricity which it supplies to the vehicle. This is channelled directly to the battery.

The process is controlled and managed via the vehicle’s battery management system. This communicates with the DC charger via the connecting cable and tells the charger how much power to supply at any given point during the process. It also controls the start and stop of the charging process.

Table B1. Currently-Available Vehicle-Charging Technology

Charge Point Speed and Type	Power Rating	Time to charge for a 300kM journey
Home (single-phase AC)	3-7 kW	7-16 hours
Standard (three-phase AC)	11-22 kW	2-4 hours
Fast (DC)	Up to 50 kW	70 minutes
High-powered (DC)	> 50 kW	70 minutes or less

**Also depends on the vehicle’s charging capability, the state of charge at commencement of charge, and other factors such as the battery pack and ambient temperatures, and driving behaviors.*

The power level (in kW) of a charge point indicates the maximum amount of energy which could be supplied to a battery pack over the course of one hour. The actual amount of energy transferred to the battery will depend on factors such as the battery’s internal resistance, the maximum rate that the pack can sustain at the



given charge level on commencement of charge, the battery cooling system, etc. Also, with top-up charging (particularly when using higher-powered fast charge points), EV users often do not need to fully charge their EVs. Instead, they can plug in and charge the battery just enough to get them to their destinations⁹².

AC electricity can be used by all speeds of charge points, while DC electricity can only be used by fast or high-powered charge points. In most residential areas, single-phase AC electrical power supplies are most common, as this type of supply system is suited to relatively low electrical loads (such as lighting and heating), with a few large electric motors. For larger industrial or commercial buildings, a higher-power three-phase AC system is often used. The type of available AC supply determines the type of charge point that can be installed, as charge points that supply electricity significantly above 7 kW (such as 11 kW to 22 kW) generally require a three-phase AC supply⁹³.

Additionally, most electric cars currently on the market are either unable to accommodate more than c. 7 kW on a single-phase AC supply, or (if they can take higher AC charges of up to 11 kW) have been designed so that if a single-phase AC electricity supply is involved, they will not charge above 7 kW. This means that in residential areas,

the most effective types of charge points are the lower wattage 7 kW-11 kW charge points that work best over longer charging timeframes, such as overnight. AC charge points also tend to be more compact in size, meaning that they fit better in domestic contexts where space for charging infrastructure may be limited.

Types of Connectors

EVs also have different types of connectors for different speeds of charge⁹⁴, and can only be plugged in to charge points with the same type of connector unless an adaptor is used.

Type 2 connectors: For AC charging (standard/fast), European EVs typically use a Type 2 connector. Type 2 connector technologies are more common in newer EVs, and the use of this charge point type has been supported as a way to achieve standardised, interoperable charging across the EU.

Combined Charging Standard (CCS) or CHAdeMO connector types: Some charging stations contain more than one connector type (e.g. both CCS and CHAdeMO), allowing the charging of a range of different EV models. In practice, this means that most EVs will be able to use most publicly-accessible charge points.

Figure B2: Typical European connectors



TYPE 2 / AC 43

Type 2 is the connector found at all standard chargers. The AC43 connector is used to charge EVs such as the Renault Zoe.



CCS COMBO

This connector is used to charge most other vehicles, including BMW, Volkswagen, Hyundai, etc.



DC CHAdeMO

This connector is used to charge Nissan Leaf and Mitsubishi vehicles.

⁹² For example, instead of using a fast charge point to fully charge the battery in c. 50 minutes, it might be enough to charge up to 80% in maybe 30-40 minutes. The speed and level of charge varies from EV model to EV model, but an average new EV would generally take c. an hour to charge on a 50 kW fast charge point. Electric Ireland suggest that 'For a 40 kW battery, a typical 7 kW home charging station will charge an electric car from 0-100% over the course of around 3-5 hours'.

⁹³ <https://www.ukfrs.com/promos/17145>, accessed 09/03/2022. <https://www.smarthomecharge.co.uk/guides/22kw-three-phase-charging-is-it-worth-it/>, accessed 09/03/2022. <https://www.which.co.uk/news/2021/03/5-problems-with-electric-car-charging-and-how-to-fix-them/>, accessed 09/03/2022.

⁹⁴ Gov. UK (2021) Electric vehicle charging market study: final report, p. 20

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