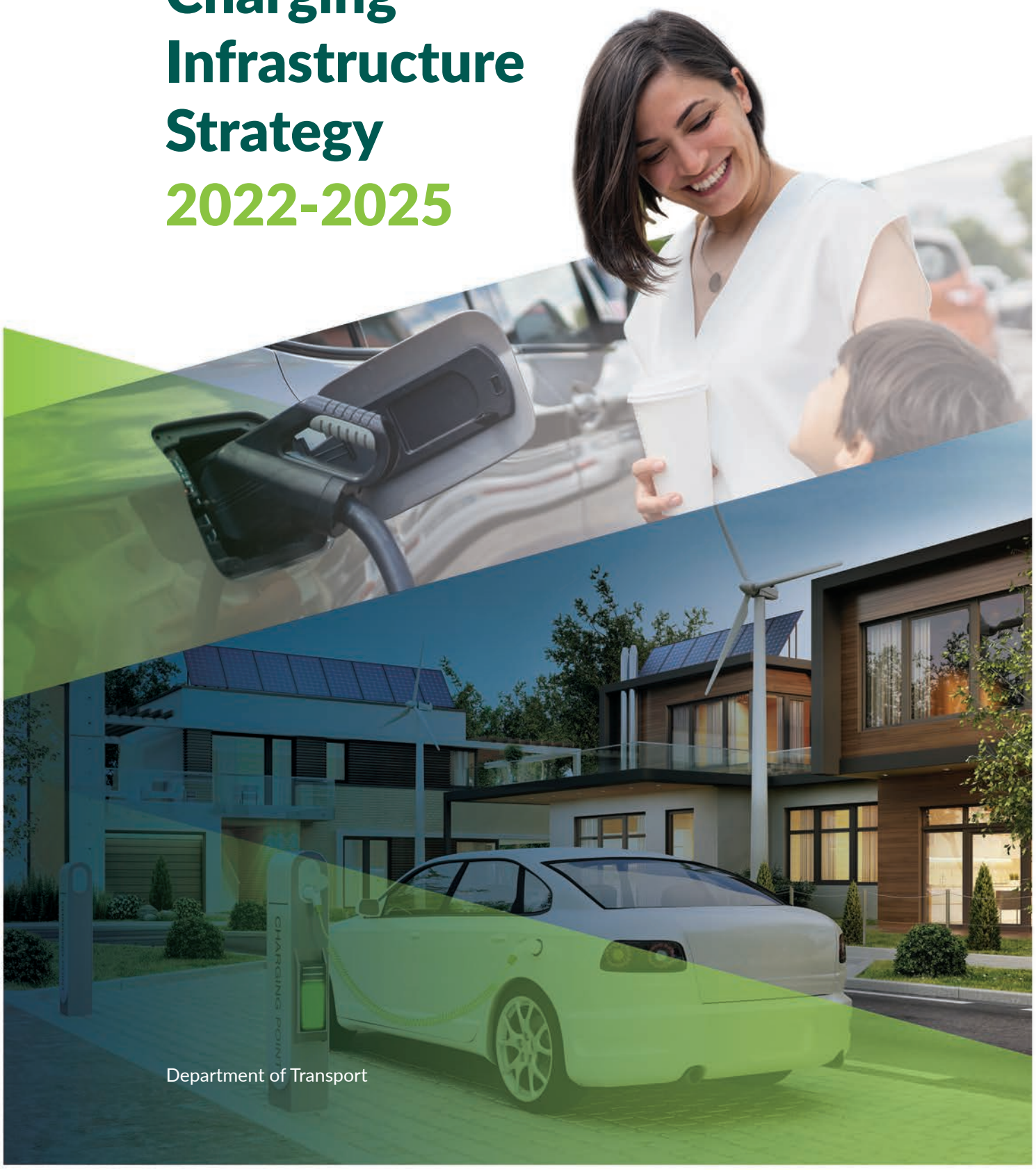
An Roinn Iompair
Department of Transport

Electric Vehicle Charging Infrastructure Strategy 2022-2025



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Acronyms

AC	Alternating current
AFIR	Alternative Fuels Infrastructure Regulation
CAF	Climate Action Fund
CCS	Combined Charging System
BESS	Battery Energy Storage System
BEV	Battery electric vehicle
CARO	Climate Action Regional Office
CCMA	County and City Management Association
CRU	Commission for Regulation of Utilities
DC	Direct current
ECA	European Court of Auditors
ERS	Electric roads systems
ESBN	Electricity Supply Board Networks
EV	Electric vehicle
eSPSV	Electric small public service vehicle
GDP	Gross domestic product
ICE	Internal combustion engine
IEA	International Energy Agency
LEV	Low emission vehicle
LGMA	Local Government Management Agency
MaREI	Research Centre for Energy, Climate and Marine
NEWKD	North East West Kerry Development
OEM	Original equipment manufacturer
OGP	Office of Government Procurement
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
UN	United Nations
V2G	Vehicle-to-grid
ZEVI	Zero Emission Vehicles Ireland

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 out 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 thatdemand.Without a doubt most of us will charge our EVs at home but 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 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 shape our policy so that we can deliver a network of publicly accessible infrastructure that is world class in terms of the interoperability, coverage and equity of transition.

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 these new developments to hasten our transition and most importantly to ensure its just nature.

Through initiatives such as the Shared Island 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, with 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 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 in line with 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 which are set out in the Government's Climate Action Plan 2021. The EV Charging Infrastructure Strategy is being published for consultation over the coming weeks to ensure that we gather the wider stakeholder views on this important element of the Climate Action Plan.

Eamon Ryan TD,
Minister for Transport

Introduction

What will this Strategy do?

This Strategy is a pathway for delivery of electric vehicle (EV) charge point infrastructure to support delivery of the Climate Action Plan ambition of almost a million EVs on Irish roads by 2030, and 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 and also takes into account the current trajectory of EV uptake and the increasing demand that will be placed on electricity distribution networks.

In the coming years, as EVs become more mainstream, the Government expects to see increasing uptake of home-charging solutions for EV owners, and also an increased demand for a seamless public charging network.

As part of the shift away from fossil fuels and 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. Other anticipated developments include electric technologies for hard-to-decarbonise transport areas, such as heavy-duty vehicles, with the continuing roll-out of battery electric buses and associated charging infrastructure and emerging technological solutions for heavy trucks.

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

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 which will grow as EV uptake increases in Ireland.

Accordingly, the main focus of the delivery element of this Strategy will be the provision of public charging infrastructure for electric cars and light duty vehicles.

In this fast-changing context, while the overall trajectory of action is clear, predicting the specifics of charge point type and interfaces that will be available by the end of this decade is less clear. 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 detail in this Strategy relating to infrastructure delivery is mainly focused on the years from now until 2025.

This Strategy identifies four main categories of charging infrastructure, all serving different user needs, depending on where and when people need to charge their EVs:

- **Home/apartment charging** (AC phase, off-peak charging to be encouraged);
- **Residential neighbourhood charging** (AC phase, replicating off-peak charging options for people without access to a home charge point);
- **Destination charging** (DC fast); and
- **Motorway/en route charging** (DC high-powered charging at highest charge power capacities).

The Strategy also sets out a plan for the delivery of each of these categories of charging infrastructure over the coming years. In 2025 the Infrastructure Strategy will be reviewed, with an updated Strategy 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.

One of the main actions to co-ordinate and oversee the delivery of this Strategy will involve the establishment of an office for low or zero emission vehicles. This office will be established

within the Department of Transport later this year, and will be called Zero Emission Vehicles Ireland (ZEVI). The years from 2022 to 2025 will also see continued development of charging to support different forms of electric mobility and multimodal travel, such as e-scooters and e-bikes, but due to the lower energy requirements for these charging solutions, these remain outside the scope of this EV Infrastructure Strategy. Charging infrastructure for micro mobility solutions such as e-bikes and e-scooters falls under the remit of the forthcoming Sustainable Mobility Policy.

At the opposite end of the vehicle scale, while there remains uncertainty about the end point technology that will be widely adopted for driving sustainably powered heavy-duty vehicles, this iteration of the Strategy does not set out a specific plan for delivering widescale infrastructure for charging e-trucks or e-buses. The development of decarbonisation options for freight and the roll out of pilot technology will progress further in the coming years. 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, and once established, the office for Zero Emission Vehicles Ireland will work with officials leading on freight sector policy with regard to the electrification of freight to determine optimal interventions to facilitate and enable the provision of charging infrastructure for this sector. The EV Infrastructure Strategy review point of 2025 will consider progress in this area and plan for the future.

How will it be delivered?

The Strategy makes several recommendations in relation to the actions, funding streams and supports that will be put in place by Government to deliver a seamless publicly accessible charging network.

The expected operational timeframe and impacts of many of the actions listed will extend beyond the end point of this Strategy and will be reviewed and amended as required as part of the delivery process to 2030.

Actions to drive delivery and to stimulate EV infrastructure availability will fall under three broad areas:

- **Public sector actions** to increase EV penetration in the public sector fleet, 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, integrate industry and private sector investment with innovation and consumer needs; and
- **Government funding supports** to stimulate targeted EV charge point roll-out, to address gaps in EV provision, and to ensure a comprehensive network for all as the EV market develops.

With ever increasing numbers of 53, EVs on Irish roads we need to stay ahead of charging that demand

Strategy structure

The Strategy consists of seven chapters:

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

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 new charge point technologies can be applied in different international and national contexts.

Chapter Five describes the organisational structures that need to be in place to coordinate, target and support implementation of this Strategy.

In Chapter Six, the delivery mechanisms, planned funding streams and instruments through which Government and state bodies will deliver a targeted infrastructure programme are set out.

In the final Chapter Seven, the actions and instruments that will be put in place by Government are drawn together with their overall timeframe for implementation and are tracked against the sustainability co-benefits that they will bring.

The main focus of the delivery element of this Strategy will be the provision of public charging infrastructure for electric cars and light duty vehicles.

CHAPTER

1

Policy and technological context

Introduction

The United Nations has identified climate change as the defining crisis of our time[1], and in 2019, Ireland became the second country in the world to declare a climate emergency[2]. Science tells us that through human actions, particularly the burning of fossil fuels, our world is heating, leading to rapid changes in weather patterns, with many negative impacts on connected natural and human environments[3]. 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 2021

In Ireland, where climate change and its impacts are a key concern of citizens[4], the Government is firmly committed to action. In 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. In the Programme for Government (2020)[5] a commitment was made to achieving a 7% average annual carbon emissions reduction to 2030. Ireland's ultimate objective of achieving carbon neutrality by 2050 through a Just Transition was also made legally binding through the Climate Action and Low Carbon Development (Amendment) Act 2021[6]. A new Climate Action Plan[7] was published in 2021 to reflect increased climate action ambitions and, on a sector-by-sector basis, to map out the actions to be taken to achieve a 51% reduction in overall greenhouse gas emissions by 2030.

As a sector closely tied to economic growth and heavily reliant on fossil fuels, transport 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 total[8]. Transitioning the Irish transport sector away from the use of fossil fuels and towards sustainable forms of travel is therefore a key objective to achieve Ireland's climate goals.

As part of an 'avoid, shift, improve' approach that prioritises sustainable mobility, the electrification of transport 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 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, with important co-benefits such as improved air quality and

1 https://www.un.org/en/un75/climate-crisis-race-we-can-win; accessed 04/03/2022.
2 https://www.rte.ie/news/environment/2019/0509/1048525-climate-emergency/, accessed 04/03/2022.
3 https://www.ipcc.ch/report/sixth-assessment-report-working-group-i/, accessed 04/03/2022.
4 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.
5 https://assets.gov.ie/130911/fe93e24e-dfe0-40ff-9934-def2b44b7b52.pdf; accessed 04/03/2022.
6 https://www.irishstatutebook.ie/eli/2021/act/32/enacted/en/print; accessed 04/03/2022.
7 gov.ie - Climate Action Plan 2021 (www.gov.ie https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/; accessed 30/03/2022.
8 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.
9 Govt of Ireland (2021) National Development Plan 2021-2030, p. 130.

reduced noise pollution, particularly in our cities and towns.

Under the National Development Plan[9], the electrification of the vehicle fleet has been identified as a strategic investment priority for transport. Funding for vehicle electrification has been included in the €1bn that has been allocated to specific carbon reduction measures. This allocation will support the Climate Action Plan ambition of having almost one million EVs on the roads by 2030.

Having an effective and reliable recharging 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 areas[10]. This Strategy is intended as a tool to deliver this infrastructure, and its remit is clearly set out in Action 277[11] 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 National Development Plan

The National Development Plan 2021 Strategic Investment Priority for Transport includes the target of nearly one million electric vehicles on the road by 2030 with additional charging infrastructure to cater for growth.

Securing an early transition to zero/low emission vehicles in the private and public fleets is key to meeting this objective, and under the NDP the Government has allocated €100m in the period to 2025 to support investment in EV charging infrastructure.

1.1.3 Public Sector Leadership

The public sector will lead by example in meeting the EV targets under the CAP by promoting the delivery of EV charging infrastructure through Green Public Procurement and through climate mandates, underpinned by national public sector energy efficiency obligations[1], and the recast Clean Vehicles Directive[2], which was transposed into Irish law in 2021[3].

EV infrastructure delivery by the public sector will also be driven by the Climate Action Mandates, which all public bodies will be required to put in place under the Climate Action Plan[4]. As part of its Climate Action Mandate, a public body will be required to purchase only zero-emission vehicles where available and operationally feasible 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.

1.1.4 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 to 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, and the clustering of demand and energy system efficiencies in border regions and along major transport corridors.

[10] And see Govt of Ireland (2021) Our rural future: rural development policy 2021-2025, p. 16.

[11] Climate Action Plan 2021 Annex of Actions, p. 156. https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/

[1] Obligations & Targets | Public Sector | SEAI; https://www.seai.ie/business-and-public-sector/public-sector/public-sector-energy-programme/obligations-and-targets/#:~:text=Every%20public%20service%20organisation%20is,and%20reduce%20your%20energy%20use. accessed 12/02/2022.

[2] Directive (EU) 2019/1161 of the European Parliament and of the Council of 20 June 2019 amending Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles (Text with EEA relevance.) https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019L1161&rid=38

[3] S.I. No. 381 of 2021 – European Communities (Clean and Energy Efficient Road Transport Vehicles) (Amendment) Regulations 2021. https://www.irishstatutebook.ie/eli/2021/si/381/made/en/print

[4] Govt of Ireland (2021) Climate Action Plan 2021, pp. 70-71, p. 74, Action 55 https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/.

1.1.5 EU 'Fit for 55'

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 55'[12] package to help member states reach their carbon emissions reduction targets. National targets for infrastructure provision will be set through the proposed Alternative Fuels Infrastructure Regulation (AFIR)[13], and through refuelling requirements mandated for the EU's main transport corridor network, the Trans-European Transport Network or 'TEN-T'[14].

Both the AFIR and the aligned 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.

1.2 Strategy scope 2022 to 2025

To address the fast-changing national and international EV charging and regulatory landscapes, this Strategy will be responsive and forward-looking. It will plan for 2030 but the implementation chapter will focus on delivery of infrastructure charging between now and 2025. It has been designed to have built-in review intervals that will allow its provisions to be re-examined to reflect new developments and innovations within the EV sector.

The first of these review intervals will occur in 2025 to establish a detailed plan for continuing EV charging infrastructure delivery from 2026-2030. This iteration of the Strategy therefore covers the period from 2022 to 2025.

1.3 Current state of play: technological context

1.3.1 Our EV trajectory

Electric vehicles, for the purposes of the Government's Climate Action Plan and this EV Infrastructure strategy, are defined as vehicles (cars and vans) with a plug-in battery powering an electric motor[15].

EVs and EV technologies are evolving extremely quickly, with the prospect of solid-state batteries being developed towards the end of the decade[16] which will transform existing vehicle weight capacities and ranges. With about 370 models of EV available on the global market in 2020, investment in the EV sector by consumers, private industry, Governments and Original Equipment Manufacturers (OEMs) is accelerating rapidly[17].

The International Energy Agency reports that across the world, the installation of publicly accessible infrastructure has increased sevenfold in the last five years. Further large-scale, rapid development and deployment of electromobility

[12] https://www.consilium.europa.eu/en/policies/green-deal/eu-plan-for-a-green-transition/

[13] The Alternative Fuels Infrastructure Regulation (AFIR) has been proposed as a revision of the in-force Alternative Fuels Infrastructure Directive (2014/94/EU). The revision, which is currently under negotiation, forms part of a package of legislative reforms (the 'Fit for 55' package) being introduced to help the EU to meet its target of reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. It is expected that the revised AFIR will require Member States to expand charging capacity in line with zero-emission car sales, and to install charging and fuelling points at regular intervals on major highways.

[14] The EU's Trans-European Transport Network (TEN-T) policy aims to build an effective, EU-wide and 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'. Required infrastructure must 'comply with, including on safety, quality for highly performing transport and alignment with environmental objectives'. For Ireland, the proposed revisions would mean sufficient charging capacity for cars, vans and trucks at 60 kilometres distance in each direction by 2025 on the core network and by 2030 for the extended core and comprehensive networks.

[15] Battery Electric Vehicles (BEVs) run solely on battery electric power. Plug in Hybrid Vehicles have a battery engine with a smaller range than BEVs and also have an internal combustion engine. So-called "mild" or "self-charging" hybrids are not categorized as EVs within Government policy.

[16] https://scitechdaily.com/breakthrough-puts-all-solid-state-batteries-one-step-closer-to-becoming-next-generation-powerhouse/, accessed 06/03/2022.

[17] https://www.iea.org/reports/global-ev-outlook-2021/trends-and-developments-in-electric-vehicle-markets;

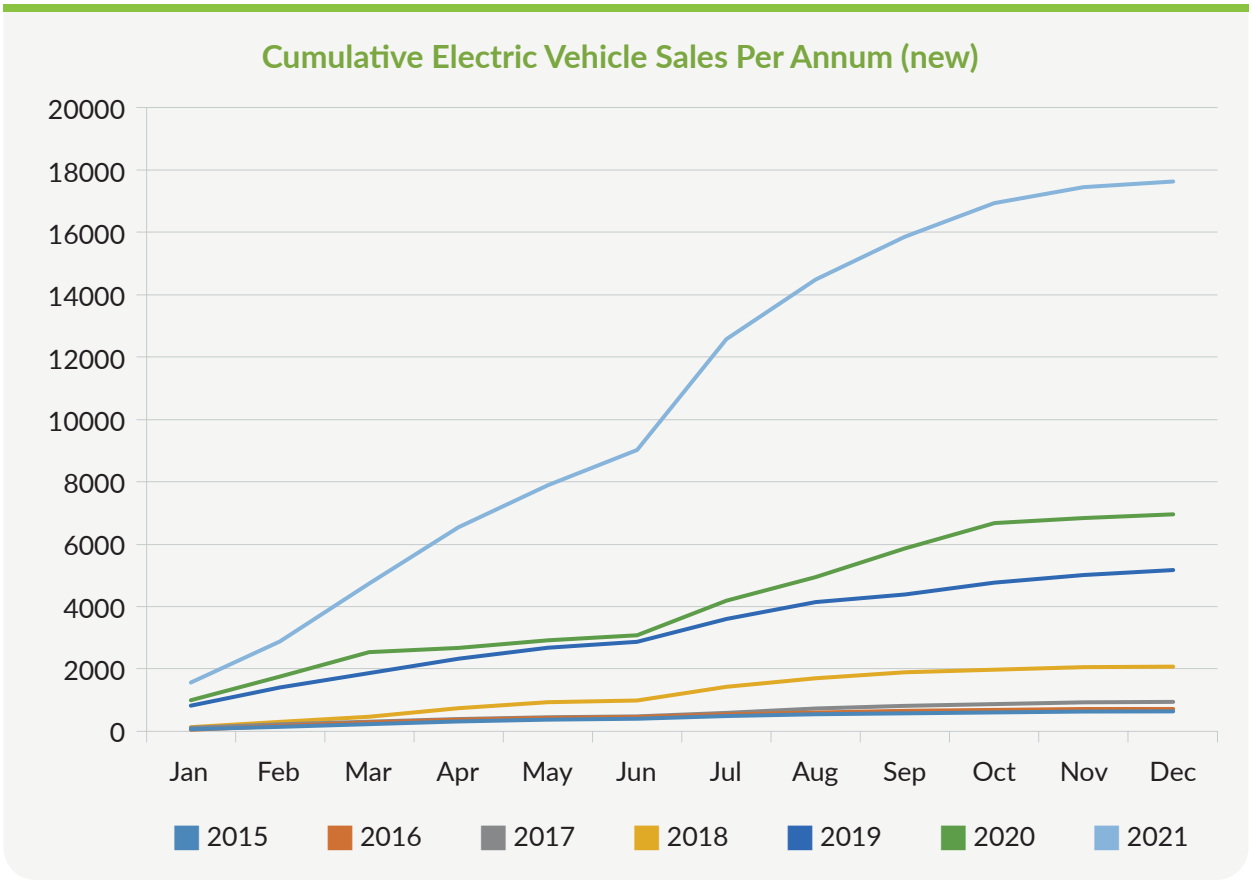
technologies is expected to occur in Europe[18] and nationally[19] over the coming decade.

In Ireland, the pace of EV uptake in Ireland has been accelerating over recent years with absolute numbers increasing as well as the relative proportion of EVs within all new car sales (Figure 1). In 2021, 16,537 EVs were registered accounting for over 15.76% of new vehicle registrations. The upward trajectory of EV sales has continued in 2022, with figures from the Central Statistics Office showing that in January and February 2022, one in five of the new cars sold in Ireland were EVs. It is anticipated that the strong growth in EV sales will continue for the rest of 2022.

1.3.2 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 charged[20]. This battery provides the power to propel the vehicle, which can be fully electric or a plug-in hybrid[21]. The term 'charge point' is often used interchangeably with 'charging point'.

Figure 1: *New Annual Registrations. Source: Central Statistics Office.*



[18] https://www.eca.europa.eu/Lists/ECADocuments/SR21_05/SR_Electrical_charging_infrastructure_EN.pdf

[19] Govt of Ireland (2021) Climate Action Plan 2021.

[20] https://www.seai.ie/technologies/electric-vehicles/what-is-an-electric-vehicle/, accessed 09/02/2022.

[21] 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.

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, meaning 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 EU[22].

With more standardised connection points and charge point sockets, EV charging is now mainly differentiated by power and vehicle battery capacity, and whether the electricity supplied to the charge point can be drawn from conventional domestic supply arrangements or whether a higher connective capacity is required.

1.3.3 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.

There are two types of AC charging: single phase or 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.

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 which is channelled directly to the battery.

The process is controlled and managed via the battery management system within the vehicle which 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 and controls the start and stop of the charging process.

Table 1. *Currently available vehicle charging technology*

Charge point speed and type	Power rating	Approximate time to charge*
Home (single-phase AC)	3-7 kW	7-16 hours
Standard (three-phase AC)	11-22 kW	2-4 hours
Fast (DC)	Up to 50kW	30 minutes
High powered (DC)	> 50 kW	30 minutes or less

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

[22] 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.

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 be a factor of the battery internal resistance, the maximum rate which the pack can sustain at the given charge level on commencement of charge, 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 and can instead plug in and charge the battery just enough to get them to their destinations[23].

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[24]. The type of available AC supply determines the type of charge point that can be installed as charge points that supply electricity significantly above 7kW (such as 11kW to 22kW) generally require a three-phase AC supply[25].

Additionally, most electric cars currently on the market either are unable to accommodate more than c. 7kW on a single-phase AC supply, or if they can take higher AC charges of up to 11kW- have been designed so that if a single-phase AC electricity supply is involved, they will not charge above 7kW. This means that in residential areas, the most effective types of charge points are the lower wattage 7kW-11kW charge points that work best over longer charging timeframes, such as overnight[26]. 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.

[23] 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 50kW fast charge point. Electric Ireland suggest that 'For a 40kW battery a typical 7kW home charging station will charge an electric car from 0-100% over the course of around 3-5 hours'.

[24] https://www.ukfrs.com/promos/17145, accessed 09/03/2022.

[25] https://www.smarthomecharge.co.uk/guides/22kw-three-phase-charging-is-it-worth-it/, accessed 09/03/2022.

[26] https://www.which.co.uk/news/2021/03/5-problems-with-electric-car-charging-and-how-to-fix-them/, accessed 09/03/2022.

EVs also have different types of connectors for different speeds of charge[27], and can only be plugged in to charge points with the same type of connector unless an adaptor is used.

Types 1 and 2 connectors: For AC charging (standard/fast), EVs typically use a Type 1 or 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.

Currently, there are approximately 2,400 publicly accessible charging points around Ireland operated by commercial charge point operators. Some car companies have installed and operate their own "supercharge points" which can currently only be accessed by owners of those companies' EVs, although there are plans to extend this access to all EV owners[28].

The purpose of this Strategy is to set a pathway for the increased and widespread delivery of publicly accessible EV charging infrastructure, to stay ahead of the significant growth in demand expected in Ireland in the coming years.

[27] Gov. UK (2021) Electric vehicle charging market study: final report, p. 20
[28] https://www.irishevowners.ie/public-charging-networks/, accessed 23/02/2022.

CHAPTER

2

Fundamental principles

This Strategy is based on a set of fundamental principles underpinning the roll-out 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.

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

Electric vehicles will have an important part to play in transforming transport in Ireland into a clean, green and sustainable transport system that will support communities and economic growth as we move towards a net zero carbon future.

The projected increase in the numbers of EVs and associated infrastructure roll-out will not occur in isolation. They will happen as an integrated part of a wider transformation that will see more people walking and cycling to their destinations, and more trips taken on public transport.

To support this mobility transformation, the ways in which our cities, towns and transport networks are designed, built and used will change 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, and progress towards achieving a better life for all as set out in the United Nations Sustainable Development Goals (SDGs)[29].

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 to ensure a fair and equitable transition to large-scale EV use.

To ensure access for all citizens, principles of universal access and universal design will be considered at all stages of EV infrastructure development, from planning and design stages to operation and use.

In Ireland, universal design is defined in the Disability Act 2005[30], 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'[31].

[29] 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://irelandsdg.geohive.ie/.

[30] Disability Act 2005.

[31] Centre for Excellence in Universal Design

Additionally, EV charging infrastructure needs to be accessible, safe and secure for all members of the population. This means that decisions around the siting and location of EV charging infrastructure should always take into account issues such as seclusion, lighting, and safety through passive surveillance to ensure that people using the infrastructure are safe and feel safe.

The importance of a Just Transition to a climate resilient society is also key, and this Strategy specifically considers ways in which to support wider access to EVs in population groups with low car ownership levels. Consideration is also given as to how to support the delivery of EV charging infrastructure in rural areas including the Gaeltacht and Islands, to support a rural transition to EVs.

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 sessions[32], a pattern comparable to that seen in other European countries such as Norway[33], the Netherlands[34] or the United Kingdom[35], where 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. 3.4kW-11kW) that can be connected to domestic electricity supplies[36]. Home charging allows electric vehicles to be parked, plugged in and left to charge overnight, with the possibility of benefiting 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, slower and off-peak time frames, home charging can reduce pressure on local electricity supply networks and can result in more evenly distributed loads across the national electricity 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. This should include provision for people who live in higher density residential blocks, such as apartments as well as people in residential developments with shared parking facilities.

Home charging solutions will also offer opportunities to help balance demand on the grid; for example[37], through dynamic power management systems that allow existing power to be shared across more charging points to charge more vehicles without having to install additional charging points. There is also the possibility of vehicle to grid (V2G) energy management systems, where plugged in EVs 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 electric trucks when these become more commonly available[38]), private charging in depots will remain the most cost-effective and common form of charging.

[32] Dept of Transport (2021) Electric Vehicle Policy Pathway Working Group Report, p 20.
[33] Govt of Ireland (2019) Low Emission Vehicle Taskforce Phase 2 Report, pp. 57-59.
[34] Netherlands Ministry of Economic Affairs (2017) Vision on the charging infrastructure for electric transport, pp. 9-10.
[35] ICCT (2020) Fulfilling electric vehicle charging infrastructure needs in Greater London and its boroughs, p. 3, p. 6.
[36] Govt of Ireland (2017) National policy framework for alternative fuels infrastructure for transport in Ireland 2017-2030, p. 40.
[37] See https://blog.wallbox.com/en-ie/benefits-of-smart-charging/, or https://www.chargepoint.com/blog/charge-more-evs-power-management, accessed 09/03/2022.
[38] EU TRAN Committee (2021) Alternative fuels infrastructure for heavy-duty vehicles study.

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

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

For those who cannot charge at home, provision of residential charging solutions that give the same benefits and mirror the home charging option should be the first objective. Residential charge points should replicate the home charging pattern of charging vehicles at night, during off-peak periods, and at a low 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. 11 kW) charge points to cater for those who do not have access to private off-street parking and cannot charge their vehicles at home[39].
- **Co-charging:** co-charging solutions, whereby EV owners can rent out the use of their personal home charge point to other EV drivers can provide a low-cost, easy to deliver charging solution for EV owners without access to a driveway.

For people on the move, sufficient provision of fast or top-up charging at strategic locations, along motorways, and at retail, amenity and other destinations will enable longer EV journeys and will alleviate lingering public concerns such as range anxiety.

- **Destination charge points:** The provision of EV charge points at destinations such as sports facilities, retail outlets, hotels, 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.

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

- **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, as set out in the revised Alternative Fuels Infrastructure Regulation[40], and as dictated by Ireland-specific market needs and freight transport patterns.

To cater for these varying charging needs and to ensure that the provision of publicly accessible charging infrastructure is as cost-effective as possible, varying business cases and models will apply[41]. These will be supported by analysis of the most effective locations, aggregation of demand, grid capacity, local planning, housing and fleet ownership conditions as well as considerations of future development policies.

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 and 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 as to how private vehicles will be refuelled. The existing model of visiting petrol forecourts will shift to one where refuelling, or in fact recharging, is primarily done at home with a small amount of top up charging required depending on individual travel needs. 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 network indicates that for the most part the private citizen considers there to be an insufficient supply of publicly accessible charge points to meet the current level of demand. However, modelling conducted in the development of this strategy, which assumes an 80% rate of home charging, indicates that in reality the current supply of publicly accessible charge points will likely be adequate for the period out to 2025. With this shift to private refueling or recharging 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 network, EV charging systems will be interoperable and as simple as possible to use

Ensuring interoperability and simple, easy to use 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, interoperability is a primary concern of the proposed Alternative Fuels Infrastructure Regulation, which recognises the need to develop complete and coherent charging networks and to ensure that charging systems are easy to use[42].

[40] Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the deployment of alternative fuels infrastructure, and repealing Directive 2014/94/EU of the European Parliament and of the Council.

[41] 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.

[42] https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A52021PC0559.

On the island of Ireland, interoperability of charging infrastructure and systems is also a significant consideration, given 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. Irish-specific studies in this area[43] have identified certain key elements that can maximise interoperability, such as the selection of standard connectors and charge points, the installation of standard sockets, 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 roll-out of EV charging infrastructure and in the adoption of existing and new charging technology and systems as these develop in the coming decade. To meet the needs of all citizens, EV charging should be as simple as possible, with a principle of access to as wide a range of people as possible with, at a minimum, solutions like contactless tap and go payments including membership options available for consumers[44].

[43] E.g. ESB Networks (2018) Preparing for electric vehicles on the Irish distribution system. Pilot study report.

[44] For example, see https://www.gov.uk/government/news/all-new-rapid-chargepoints-should-offer-card-payment-by-2020; accessed 09/03/2022.

CHAPTER

3

Network demand

3.1 Demand on the system and expansion of EV charging

In Ireland, the relatively short distances between major cities and towns, our temperate climate and our high renewable electricity potential mean that we are well positioned to transition to widespread use of electric vehicle technology.

Ireland's public charging network is currently less than half of the current average EU level of provision.

Based on analysis carried out in leading EV markets like Norway and Sweden[45], it is likely that while home and work place charging will remain dominant in Ireland in the coming decade, demand for higher speed publicly-accessible top-up charging will increase, and when sited at motorway services locations will have the added benefit of supporting and enabling longer distance travel. The coming decade will present the challenge of delivering sufficient EV charging infrastructure to meet emerging demands in a manner that is safe, resilient and sustainable.

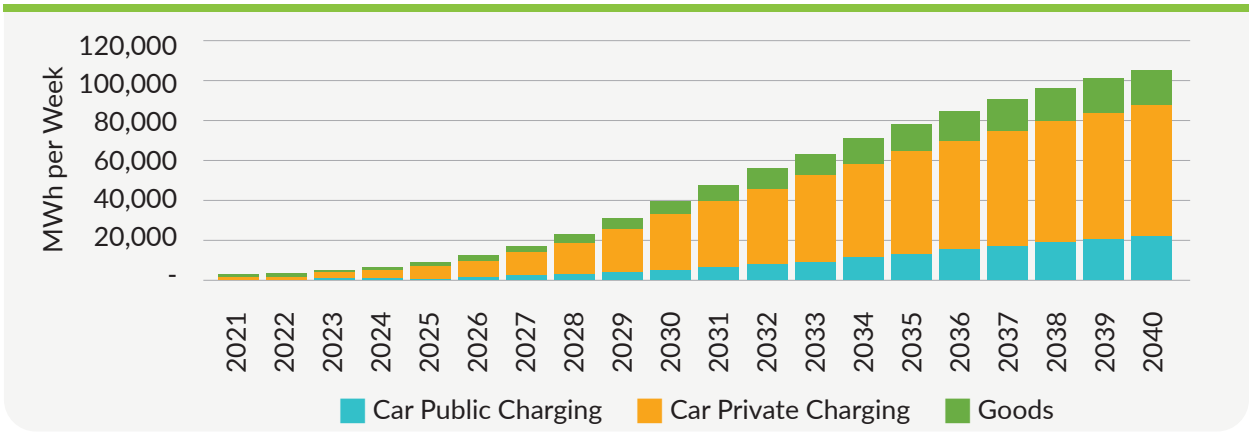
The current network of c. 2,400 publicly accessible charge points is operated by several service providers[46]. The siting of higher-powered, faster charge points can be dictated by the ability of the local electricity grid to accommodate them, as well as by the business cases for particular charge points based on consumer demand for their use[47].

A number of assumptions and projections underpin expectations of how the expansion of the current charging network may impact on electricity grid demand.

To inform this Strategy, the Department of Transport commissioned a review of the current and future supply and demand for publicly-available electric charging in Ireland which was carried out in early 2022.

The study is based on the strategy principle that the majority of EV charging will continue to be done at home, where possible. Whilst this assumption is taken to be of the order of 80% for domestic charging, the balance of charging needs that will be required in the public and semi-public sphere (for example on-street charging, multi-dwelling/shared amenity locations such as apartments, workplace, retail, as well as the aforementioned service station locations), will all represent different site specifics and considerations. The analysis indicates that total EV energy demand (for passenger cars only) will increase to 2030 as demonstrated in the figure below:

Figure 2: *Demand for Electricity for EV Charging*



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

[46] See https://www.irishevowners.ie/public-charging-networks/, accessed 09/02/2022; and https://easygo.ie/charging-network/, accessed 09/02/2022.

[47] Engel, H. et al. (2018) Charging ahead: electric vehicle infrastructure demand, McKinsey Centre for Future Mobility report.

The study reviewed the current and future demand for public charging by –

- 'local residents', particularly those without access to home or workplace charging, at a county-wide level;
- En-route journeys, which cannot be completed without a top-up charge and where this charging takes place at a location which is neither the origin nor destination of the trip; and
- Other sources of demand for public charging, including tourists and visitors, eTaxis, car clubs, light commercial vehicles, HGVS, buses and coaches.

Analysis suggests that, at a county level, the current network of public charge points will be sufficient to meet the charging needs of BEV owners without access to home-charging for the next few years, but will need significant expansion from 2025 onwards.

For en-route charging demand, single trips which were longer than the battery range of the BEV making them were identified. Despite the anticipated rapid increase in BEVs on the road, due to improvements in battery technology, the number which cannot complete long one-way journeys on a single charge will actually decline over time, so that by 2040, the study predicted that only journeys longer than 300 Km would require an en-route charge for BEVs (assuming these BEVs are able to start journeys fully charged). Given such car journeys are rare in Ireland, indicative estimates are that demand for en-route charging is likely to peak sometime between now and 2030.

In terms of specific categories of EV drivers, e-Taxis are likely to require access to conveniently located including charging hubs, dedicated for taxi use. The capacity and location specifics of these dedicated e-Taxi charging hubs would need to be identified on a city-by-city basis, taking account of the range and variability of daily mileage, the frequency of one-off long trips, the amount of vehicle down-time (if any) and the mix of 'fleet' vs individual operators etc.

3.2 Managing energy demand and grid capacity

Early research by the Sustainable Energy Authority of Ireland in 2011[48] found that night-time EV home charging would be the most beneficial for the electricity grid, with only nominal grid development then being identified as required to enable the powering of night-time EV charging. Demands on the grid and electricity network have developed significantly in the past decade and will continue to do so in the coming years. This is not just with regard to EV charging, but through other developments such as increased usage from data centres and the move to the electrification of heat through mass installation of heat pumps. Night time charging of EVs remains the optimum charging mechanism in relation to electricity demand and supply.

More recent technological developments, such as smart integrated electric charging solutions that allow for energy monitoring and demand load management are likely to become increasingly common as EV numbers trend upwards[49]. Applied systematically, these solutions can further spread demand and optimise charging across the grid; therefore, they have the potential to offer cost savings in terms of grid upgrades and electricity infrastructure investments and it is recommended that such systems be mandated for installation where possible. Financial benefits can also arise from the greater usage and higher load factors of EVs on the existing network. This is based on the network being used to distribute more electricity to end users with the cost per unit of that electricity potentially falling as a result[50].

[48] SEAI (2011) Electric vehicles roadmap 2011-2050, p. 8.
[49] https://www.lgma.ie/en/publications/general-publications/local-authority-electrification-of-fleet-and-ev-charging-guidance.pdf
[50] ESBN (2018) Preparing for electric vehicles on the Irish distribution system: pilot project report summary, p. 5.

Other initiatives also have the potential to off-set increased EV energy demands as part of the managed and smart development of the wider national electricity system. These include the possibility of Vehicle-to-Grid (V2G) energy management systems, where plugged-in EVs act as back-up batteries and feed energy back into the grid at certain times to balance demand[51], and micro-generation, where homes and businesses generate renewable energy for their own consumption[52]. Micro generation, where installed, also has the benefit that it can potentially allow EVs to be charged at home off-grid, reducing demand on the national energy network and allowing EVs to be powered by 100% carbon-neutral, renewable energy.

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

Even with off-peak overnight charging (AC 11kW) as the baseline, or default charging as an option for most EV users, there remains a need for provision of higher speed top-up charging at trip destinations or en-route - i.e. higher speed DC charging from 50 kW up to 175kW or even higher (some EU states are currently making grid resilience preparations for up to 350kW charging power).

[51] https://www.irishevs.com/guide-to-vehicletogrid-charging, accessed 09/02/2022; SEAI (2011) Electric vehicles roadmap 2011-2050, p. 5.

[52] https://www.seai.ie/news-and-media/micro-generation-support/, accessed 09/02/2022.

Destination Charging

Destination charging will provide rapid charging solutions (50-100kW typically) at trip attractor locations such as leisure centres, parks, hotels and visitor attractions where EV drivers could charge their vehicle for 1-3 hours before returning home.

There is private sector interest in this area of the EV charging infrastructure market, and in Ireland we have already seen the provision of rapid charging top-up infrastructure in car parks and in trip generating locations such as at supermarkets.

This Strategy envisages a supporting role for Government in providing initial seed funding to stimulate and encourage more widespread roll out of this 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 charging infrastructure remains critical for quick top-up en-route charging, encouraging the use of electric vehicles for both business and tourism trips. Such charging infrastructure must be fast and high powered (100kW or more) to make the electrical charging experience as similar as possible to driving an ICE vehicle and taking a quick comfort break.

The Alternative Fuels Infrastructure Regulation, currently being negotiated at EU level, will establish a minimum requirement for the quantum and power of motorway/ strategic road network EV charging points in each EU state.

ICE vehicle emissions are at their highest when driven at motorway speeds (the highest rate of battery discharge is experienced also at motorway speeds) and electric journeys on motorways can be encouraged by having ultra-rapid charging infrastructure available.

Delivering this ultra-rapid charging infrastructure network will require a high level of planning and engagement with energy providers and network operators. The energy demand for this charging infrastructure provision will be significant, with power demands of above 2MW required in some cases.

In Ireland to date, investment in this infrastructure has been led by the private sector. In other EU states, private sector investment in motorway charging facilities is widespread, and it is anticipated from stakeholder engagement that there is a similar appetite in the private sector in Ireland to invest more widely in this infrastructure. The role for Government in this space is therefore to work as a facilitator, in conjunction with the private sector, to support and enable investment in the ultra-rapid en-route charging network.

For both destination and en-route charging infrastructure there is an essential task of ensuring necessary grid capacity and resilience to support the energy demand for EV charging. The Department of Transport and Zero Emission Vehicles Ireland will therefore need to intensively engage with ESBN, EirGrid, CRU, energy suppliers, as well as charge point and forecourt operators to ensure a timely and co-ordinated approach for energy provision and grid management.

CHAPTER

4

Existing and future technologies

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

Decisions about what types of charge points to install and where they should be placed strongly influence how often and how easily they are used and who uses them. Charge point type and location are also two of the most important factors determining how much revenue is generated by EV charging, how affordable EV infrastructure is and whether users' experiences are positive or negative[53].

Both factors are therefore the focus of considerable innovation, research and development, particularly in relation to publicly accessible charge points. Charge point types are being developed to respond to accelerating research and development across the EV eco-system, with impacts on existing battery capacities and technologies, vehicles and their associated software and digital systems[54]. Different types of charge points are also being developed to respond to different charging scenarios, locations and local distribution networks. Potential technologies that may play a future role in how Irish EVs are charged include Vehicle-to-Grid (V2G) energy management systems, wireless, mobile and automated EV charging systems, battery swap technologies, multifunctional charging platforms, and high-powered charging for passenger EVs.

Across the EV sector, research and pilot projects are also focusing on electromobility solutions for road transport sectors that currently do not have commercially feasible EV technology options, such as the heavy-duty sector. Technologies being trialed for this sector include high-powered EV charge points (e.g. 350kW to 2MW capacity truck charge points[55]), building on technological breakthroughs and lessons learned in developing charging for heavy duty buses, and pilot Electric Road Systems (ERS)[56]. In the coming years, it is expected that new market offerings and solutions in all of these areas will emerge year on year, with knock-on impacts for EV infrastructure investment decisions and deployment frameworks.

Innovative solutions are also emerging in response to spatial and usability challenges, which can often be associated with fitting publicly accessible charge points into existing streetscapes used by pedestrians, cyclists and other citizens. Charge point technologies and innovative metered cabling systems have been developed that can allow existing street furniture like lampposts to also double up as charging stations. Low visibility and low spatial impact connections that can be set into kerbsides have also been developed and trialed, with the potential to allow people without off-street parking to access some of the benefits of home charging.

In cities and towns in Ireland[57] and elsewhere, EV charge points for different types of electric vehicles are being clustered to form sustainable mobility hubs. At these, citizens can access multi-modal and green transport options including e-bikes and e-scooters as well as EV charging infrastructure and links to public transport and amenities. With targeted charge point provision, all of these options can serve a range of social functions, increasing equal access to EVs in underserved areas, leveraging existing urban and public spaces and reducing problems like congestion and air pollution.

[53] UK Energy Saving Trust (2019) Positioning charge points and adapting parking policies for electric vehicles, guidance report for UK local authorities.

[54] EU Commission (2020) Batteries Europe: strategic research agenda for batteries 2020, report;

[55] Earl, T. et al. (2018) Analysis of long haul battery electric trucks in EU: marketplace and technology, economic, environmental and policy perspectives, amended paper produced for European Federation for Transport & Environment (T&E); also https://insideevs.com/news/338287/chargepoint-reveals-2-mw-charging-connector/, accessed 08/02/2022.

[56] For example, Sweden's RI.SE project https://www.ri.se/en

[57] For example, see https://www.fingal.ie/news/fingal-county-council-launch-first-mobility-hub-main-street-blanchardstown, accessed 05/03/2022; see also https://www.dublincity.ie/news/dublin-councils-investing-shared-mobility-solutions-part-workplace-re-design, accessed 09/03/2022.

As well as appropriately sited and innovative physical infrastructure, recent years have also seen a boom in new digital EV infrastructure interfaces. These support easy access to charging networks as well as facilitating streamlined payment systems and the development of climate friendly shared mobility options like e-car clubs and Mobility as a Service (MaaS)[58].

The provision of dedicated EV charging infrastructure for e-car clubs, at taxi ranks and the strategic siting of rural EV charge points also have the potential to support the transition to electric 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 where charge points should be placed and what charge points will best match the needs of consumers require a strategic and data-driven approach focused on understanding local conditions and user concerns as well as national network coverage and electricity grid requirements[59]. 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 to ensure that Irish EV charging infrastructure meets future needs.

4.2 Case studies

The following case studies look at some examples of the types of future possible EV charge point technologies that may play a role in supporting the rapid increase in EV numbers in the coming decade. They also look at how such technologies can be adapted to suit local conditions and to meet the needs of national and local authorities, businesses, communities and individual EV users.

The case studies fall into two groups. The first of these (Case studies 1 to 4) summarise some of the different charge point types that are being deployed internationally. They look at how these technologies fit into their settings and how they might be used in the future[60].

The second group of case studies (Case studies 5 and 6) look at EV infrastructure strategies and approaches that bring together new ways of thinking about mobility, public EV infrastructure, unique local conditions and the needs of citizens.

[58] For example, KPMG (2021) Mobility 2030: Implications for Ireland.
[59] AVERE (2021) Discussion paper: What role of charging infrastructure [sic] in encouraging EV uptake.
[60] 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, see Annex I.

4.2.1 Case study 1: On-street kerbside charge points in European cities

On-street charging is generally deployed in residential areas and it offers EV users without off-street charge points the closest alternative to this type of charging, as it allows drivers who park on-street near their residence to recharge overnight. With more people buying EVs and seeking to charge these at their homes, at their places of work and as they journey to and from a range of destinations, kerbside charge points will become an increasingly familiar part of our streetscapes. A range of different on-street charge point technologies are emerging to meet different user needs and to fit into a range of street scapes 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. The choice of which type of kerbside charge point technology best suits a particular location can be dictated by one or more of these considerations.

For example, in the case of lamppost charge points, such as those installed in the London boroughs of Hackney[61] and Westminster[62], they allow all charging hardware to be installed within the lamppost column without any

Table 2: *Summary of on-street charging technologies (Source: Element Energy)*

Technology	Charging Speed	Electricity supply	Ground works	Kerb-side street furniture	Electrical box above ground
Lampost charge points	Standard, up to 5.8kW	Connected to lamppost power supply	No groundworks required	No additional Street furniture	No electrical box
Lamppost with satellite bollard	Standard, up to 5.8kW		Minor groundworks	Minor street furniture	
Bollard charge points	Fast, upto 5.8kW	New power supply needed	Significant groundworks	Significant street furniture	Small electrical box
Slim bollard charge points	Fast, 7-22kW			Minor street furniture	
Pop-up charge points	Fast 7kW			Semi permanent, additional street furniture while charging	Electrical box required
Lance and socket charge point	Fast, up to 22kW				Needed – one box can supply 15 charge points
Electric Vehicle Charging Channels	Speed of home charge point 5-7kW	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 required

[61] https://news.hackney.gov.uk/over-182-new-electric-vehicle-charging-points-to-be-installed-in-hackney/, accessed 05/03/2022; https://news.hackney.gov.uk/3000-electric-vehicle-chargers-in-hackney-by-2030/, accessed 05/03/2022.

[62] https://www.westminster.gov.uk/parking/electric-vehicles

extra groundworks, such as ducting or cabling, depending on the ducting being 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 another kerbside charging solution that is 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 hardware[63]. As bollard charge points can be relatively bulky, manufacturers have focused on reducing the size and diameter of bollard charge points, 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, offering the possibility of 7-22kW AC charging from single or paired charge-point sockets and with a smart grid trial underway[64].

Photo: Ubitricity lamppost charge point in London, United Kingdom

[63] For example, Vattenfall Amsterdam, Amsterdam City.
[64] Connected Kerb Kent, Agile Streets project, accessed 11/03/2022.

Bollard charge points are another kerbside charging solution that is becoming an increasingly familiar sight in cities across Europe.

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

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 that these EVs can 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[65].

In Oslo, the possibility that larger electric vehicle hubs with V2G technology could balance local peak electricity demand was examined through a pilot project carried out by the municipality in partnership with a local real estate company[66], and a charging service provider[67]. 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 22kW charge points at the Vulkan parking garage in central Oslo. The battery reserve installed in the garage balanced power loads to avoid 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 grid[68].

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 to relieve the pressure on on-street public EV charging stations. Several car-sharing companies and an EV-to-go provision – as well as some (van-based) logistics service companies and electric taxis – also use the parking 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 times[69], which also supported the city's policy of removing a number of on-street parking spaces in the neighbourhood.

Photo: V2G charge point

A number of interesting findings emerged from the pilot including that the Battery Electric Storage System (BESS) did appear to act to reduce the grid demand within a given month. It was also found that this could have been improved by also using Smart Charging, which could provide extra savings at times of peak demand. The pilot also provided the municipality and commercial partners with insights into the value of developing a regulatory framework for V2G. 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 with data to feed into the future possible deployment of V2G charging as EV penetration increases and as more V2G-capable EV models come on-stream.

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

[66] https://www.polisnetwork.eu/news/seev4-city-newsflash-latest-round-of-updates-on-vehicle-to-grid-in-amsterdam-and-oslo/, accessed 06/03/2022.

[67] https://www.fortum.com/media/2017/11/innovative-charging-facility-electric-vehicles-oslo-norway, accessed 06/03/2022.

[68] https://www.polisnetwork.eu/news/seev4-city-newsflash-latest-round-of-updates-on-vehicle-to-grid-in-amsterdam-and-oslo/, accessed 06/03/2022.

[69] 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 at 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 for taxis and electric Small Public Service Vehicles, light duty commercial vehicles, or shared EV use schemes, including 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 following two years of preparatory work and the use of specially converted vehicles[70]. The trial identified several potential benefits of using wireless charge points[71], including 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 (where reliability was found to be more important than ease of use).

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

[70] https://www.dutchnews.nl/news/2016/11/no-strings-attached-rotterdam-trials-wireless-electric-car-charging/, accessed 05/03/2022.

[71] https://www.floading.com/en/news/rotterdam-electrical-innovation-wireless-charging-in-practice/, accessed 05/03/2022.

4.2.4 Case study 4: Integrated EV charging and sustainable mobility in Rotterdam

The trial of wireless charging in Rotterdam was part of a wider pattern of innovative municipal EV charging installation, which brought together climate action imperatives, regulatory frameworks, city assets, industry and academia. As in London[72] and other major cities, the impetus for EV support in Rotterdam was climate change[73] together with the challenges of maintaining air quality and urban environments in the face of growing transport demand. Also, like Hackney, the Rotterdam approach was structured as part of a wider commitment to sustainable mobility and increased active and public travel[74]. Underpinning the municipal approach was a commitment to a people-first approach and to continuous co-creative engagement with all stakeholders.

Following the prioritisation of public green spaces, active travel and public transport modes, the city analysed local transport patterns and piloted the use of EV and e-mobility technologies for its urban fleet. It also cooperated with public and private partners to trial electric waste collection vehicles, buses, vans and electric car-sharing programmes.

Building on the results of these pilot studies, the city developed an EV charging infrastructure strategy that incentivised home charging and the installation of charge points to serve businesses and their employees. The strategy's third target area for EV infrastructure development was multistorey carparks, and the city produced guidance to help car park owners to install charge points in their properties. To guide these interventions, the city has combined high-level and local strategic plans and roadmaps with a commitment to longer-term investments. In 2019[75], Rotterdam produced a roadmap to achieving zero-emission logistics and the city also promotes transport innovation, entrepreneurship and smart mobility as part of its 'Rotterdam Innovation City' initiative[76].

The success of Rotterdam's integrated approach to EV roll-out has led to its designation as one of the world's 20 electric vehicle capitals by the International Council on Clean Transportation[77]. This is consistent with a wider pattern of increased EV uptake in the Netherlands as a whole, where the total charge point network in 2021 comprised over 80,000 charge points. Of these, almost 50,000 were publicly accessible with a capacity of ≤22kW[78].

[72] For example, as articulated by Hackney Borough Council in https://hackney.gov.uk/our-commitment-to-electronic-vehicles; accessed 05/03/2022.
[73] Rotterdam - POLIS Network. https://www.polisnetwork.eu/member/rotterdam/
[74] Rotterdam takes the lead in electrifying transport (The Netherlands) | Eltis, https://www.eltis.org/discover/case-studies/rotterdam-takes-lead-electrifying-transport-netherlands accessed 30/03/2022.
[75] City of Rotterdam (2019) Roadmap ZECL: moving towards zero emission city logistics (ZECL) in Rotterdam in 2025.
[76] https://www.rotterdaminnovationcity.com/Themes/mobility/, accessed 09/02/2022.
[77] ICCT (2017) Electric vehicle capitals of the world: what markets are leading the transition to electric, briefing.
[78] Netherlands Enterprise Agency (2021) Electric vehicle statistics in the Netherlands, last update 23 December 2021, pp. 21-22.

4.2.5 Case study 5: Planning for Dublin's EV needs: the Dublin Local Authority EV Infrastructure Strategy

While the Netherlands is 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 roll-out. 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 trialing and scaling innovative solutions to a wide range of local challenges. It aims to bring together technology providers, academia 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 Dublin[79].

With the collaboration of the Climate Action Regional Offices, representatives of each of the local authorities and Smart Dublin set up the Dublin Regional EV Charging Working Group[80]. As in Rotterdam, collaborative stakeholder engagement and a commitment to implement broad-based charging provision for all citizens were key aims of the group[81]. Following meetings and market soundings with EV service providers and other stakeholders, the Working Group identified several possible EV charging infrastructure types and locations of interest 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 authorities[82]. 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 is expected to be published in the coming months, and while work on implementing its findings will then get underway, the development of the strategy points the way towards locally specific EV infrastructure planning and provision that harnesses and leverages international best practice; brings together planning processes, pilot schemes and the development of revenue-generating concession models; promotes collaboration across government and with stakeholders; aims for flexibility, to allow local aims to be achieved within wider collective goals; promotes interoperability and consistency across local government areas; and looks to future-proof charging infrastructure to avoid stranded assets and to allow different actors to manage the infrastructure at different points in time.

[79] https://smartdublin.ie/about/, accessed 09/02/2022.
[80] https://www.caro.ie/dublin-ev-project, accessed 09/02/2022.
[81] https://smartdublin.ie/the-dublin-region-ev-charging-working-group-supporting-dublins-transition-to-low-emission-mobility/, accessed 09/02/2022.
[82] https://councilmeetings.dublincity.ie/mgConvert2PDF.aspx?ID=33248, accessed 09/02/2022.

4.2.6 Case study 6: Rural EV infrastructure and innovation: the Dingle Project

The focus of this Strategy is on providing a national EV 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 both Rotterdam (the second largest city in the Netherlands) and Dublin, EV infrastructure provision is supported by large populations, short travel distances, easier access to the electricity transmission 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 areas[83], with Government rural development policy focused on the installation of public charging points at remote working hubs, community centres and enterprise centres in rural locations[84].

In Ireland, one of the most innovative projects to address this question is the ESB Networks Dingle Project[85], 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[86]. The overall goal of the initiative is to transition

[83] For example, see https://www.agriland.ie/farming-news/going-electric-are-evs-a-runner-for-rural-drivers/, accessed 05/03/2022.
[84] Govt of Ireland (2021) Our rural future: rural development policy 2021-2025, p. 71.
[85] https://esb.ie/tns/innovation-at-esb/innovation-projects/dingle-project#:~:text=The%20Solution,towards%20a%20low%20carbon%20future., accessed 05/03/2022.
[86] https://dinglepeninsula2030.com/wp-content/uploads/2020/07/Dingle-Peninsula-2030-Brochure_Final.pdf, accessed 05/03/2022.

the Dingle peninsula into a low-carbon society, with a more environmentally and economically sustainable future[87].

Part of the work of the initiative was to deploy and assess a range of new technologies to develop a resilient, low carbon electricity network. Over the course of a three-year project that began in 2018, 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, while demonstrating EVs and their effectiveness 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, with MaREI carrying out research on how active energy citizenship behaviours can spread across communities and what factors encourage people to adopt new technologies.

As seen in the seven case studies outlined above, innovation is fundamental to delivery of EV infrastructure at a strategic working level, as well as a technological pre-requisite. Harnessing innovation will enable efficient delivery of EV infrastructure that meets the needs and demands of a range of citizens.

[87] https://dinglepeninsula2030.com/, accessed 06/03/2022.

CHAPTER

5

Pathway to Strategy delivery

This chapter sets out the key structures that will be established to facilitate and quicken the delivery of electric vehicle charging infrastructure in the coming decade.

Delivery of charging infrastructure will be achieved by a wide range of actors and stakeholders acting together to share knowledge and best practice, to accommodate planning and regulatory structures, to drive investment and to identify optimal charge point locations and technologies.

Achieving successful infrastructure delivery will involve addressing key consumer concerns centering on affordability, convenience, and awareness of the benefits of EVs[88]. Delivery of EV charging infrastructure will also involve promoting partnerships and collaboration between public and private stakeholders, academia, energy providers and regulators to pilot locally specific infrastructure and to develop innovative technologies and solutions. It will 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 also 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 Irish Executive to promote and support EV infrastructure deployment, including through initiatives such as the Shared Island Fund and through other international collaborative and funding opportunities.

This collaborative approach will optimise the integrated nature of the electricity distribution and public charge point networks on the island.

5.1 Zero Emission Vehicles Ireland (ZEVI)

The Government will establish an office to co-ordinate and deliver the policy pathway for low emission vehicles. The office will be called ZEVI (Zero Emission Vehicles Ireland)

To coordinate the provision of EV supports and grants and the delivery of charging infrastructure, the Government will establish an office of Zero Emission Vehicles Ireland (ZEVI) within the Department of Transport.

ZEVI will draw on international best practice and will leverage expertise from across a number of bodies that currently deliver key EV policy measures and support services. It will be responsible for the strategic coordination of EV policy, regulation and taxation, management of EV grants and incentives, and the Delivery Plan for this EV Infrastructure Strategy.

ZEVI will bring together the various grant schemes that are currently administered by these organisations. These grants are a crucial part of addressing gaps in the market and ensuring early adopter EV uptake while vehicles reach cost parity with fossil fuel vehicles. As the EV market matures and price parity between EVs and ICE vehicles moves closer these supports will be gradually phased out[89], and it is expected that the delivery of charging infrastructure will be the main focus of ZEVI for the second half of the coming decade.

To fulfil this brief, ZEVI will coordinate and support the development and roll-out of publicly accessible charging infrastructure. It will collaborate with the public and private sectors and service providers to deliver destination

[88] Wappelhorst, S. et al. (2020) Analyzing policies to grow the electric vehicle market in European cities, ICCT white paper, p. ii.
[89] Dept of Transport (2021) Electric Vehicle Policy Pathway Working Group report, pp. 10-11, p. 21.

charging, residential area charging (together with local authorities) and Alternative Fuel Infrastructure Regulation (AFIR) infrastructure targets, particularly along the TEN-T network[90].

ZEVI will engage strongly with the citizens, the public sector, network operators, regulators and energy systems stakeholders as well as the private sector engaging in EV charging operations.

5.2 EV Infrastructure Energy Group

The EV Infrastructure Energy Group will bring transport and energy expertise to inform the delivery of EV infrastructure

The energy sector is a fundamental element in the successful delivery of EV charging infrastructure. ZEVI will therefore establish an EV Infrastructure Energy 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 in relation to the delivery and location of EV infrastructure, safety requirements for installation and operation of EV charging infrastructure and engage with key actors in the planning and delivery of EV infrastructure.

5.3 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, operating within the Department of Transport will collaborate closely with other Government Departments, Public Sector Bodies, Local and Regional Authorities to develop integrated policy and implementation approaches to EV infrastructure delivery[91], considering both transport and energy implications of strategy implementation.

To this end, ZEVI will convene an interdepartmental and inter-agency EV Infrastructure Delivery Group, drawing together representatives of these organisations.

The Delivery Group will provide expertise to support the delivery of a comprehensive national EV charging network. It will at an early stage 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.

5.4 EV Infrastructure Public Private Collaboration

ZEVI will establish a new multistakeholder Task Force to provide a public private partnership approach to EV infrastructure delivery

Extensive and continuous engagement with external stakeholders, industry bodies, service providers and consumers will be a key factor of the Government's approach to the delivery of 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 will convene a new public private EV Infrastructure Task Force, drawing together representatives from all areas of the EV eco-system, public sector, industry and academia. Its focus will be on identifying optimal policy

[90] See proposed Alternative Fuels Infrastructure Regulation and proposed TEN-T Regulation revision.
[91] https://www.caro.ie/; accessed 17/02/2022.

levers, investment imperatives 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 infrastructure provision such as the Netherlands or Germany, the creation of a supportive environment for innovation has been identified as one of the factors that contributes to increased EV adoption[92]. Innovation can involve synergies and linkages between stakeholders, and 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 and the integration of different types of sustainable mobility[93].

The Task Force will consider and make recommendations on how best to support and accelerate the roll-out of charging infrastructure according to user needs including safety and security.

The EV Infrastructure Taskforce will also consider how best to provide transparent and easily accessible data on EV charging infrastructure to all users and to stakeholders, taking into account digital and information technologies and platforms. As part of this work, it will also consider the best ways to ensure a wider public awareness of EV technologies and charge point networks and will support the work of ZEVI 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.

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

[92] 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.bmwi.de/Redaktion/EN/Artikel/Industry/electric-mobility-r-d-funding.html.

[93] 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.

CHAPTER

6

Delivering infrastructure

6.1 What will be delivered

This chapter describes existing and planned Government supports and funding instruments to target and address identified gaps in the EV infrastructure market, to support wider EV uptake and to ensure that charging infrastructure provision stays ahead of demand.

Underpinned by the Strategy's fundamental principles, 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, with actions in this area to prioritise the installation of smart home charge points and encourage the deployment of V2G technologies where feasible;
- **Residential charging** will provide a home-charging like solution 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; and
- **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 to EV technology of high mileage vehicle fleets, such as taxis.

It is envisioned that there will be a balance between Government supports and investment from the private sector for the delivery of charging infrastructure.

6.2 Existing Exchequer supports for charging infrastructure

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

6.2.1 EV Home Charge Point Grant Scheme[94]

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

6.2.2 Public Charge Point Scheme[95]

This scheme, which is administered by the SEAI, has been in place since September 2019, providing 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 support for the installation of infrastructure for EV owners who don't have access to a private parking space, and instead rely on parking their vehicles in public places near their homes to charge their vehicles. Funding is provided for the installation of 22kwh standard charge points.

6.2.3 eSPSV Infrastructure Scheme

The eSPSV infrastructure 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, 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

[94] https://www.seai.ie/grants/electric-vehicle-grants/electric-vehicle-home-charger-grant/
[95] https://www.seai.ie/grants/electric-vehicle-grants/public-charge-point/

as well as at Dublin and Cork airports. Further funding was made available in 2021 to support the installation of charge points at further Irish Rail locations in 2022.

6.2.4 Climate Action Fund EV infrastructure delivery[96]

In 2018, €10 million was committed from the Climate Action Fund to support ESB investment in the charging network and this has leveraged a further €10 million investment from 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; and
- 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.

6.2.5 FASTER project[97]

The FASTER project is an international joint initiative that aims to support the installation of 50kW 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 with a target date for delivery of May 2023.

6.3 Infrastructure Strategy: targeted action areas and new supports

6.3.1 Home Charging

A key principle of future support for home charging is that it will become smart home charging, building on on-going technological

[96] https://esb.ie/ecars/our-network/network-upgrades
[97] https://www.fasterevcharge.com/

developments in the fields of digital charging and demand regulation interfaces. Applied systematically, smart charging can maximise efficiencies and cost savings for EV users and across the electricity distribution and service provision networks, for example through building in default charging-time delay systems to incentivise night time charging.

Pricing to incentivise night time charging at home should also become more widespread, and ZEVI will review, through the EV Infrastructure Energy Group, actions to facilitate the implementation of such mechanisms, for example, amending the existing home charging scheme to fund only smarter charging devices that will deliver system benefits and cost savings.

ZEVI will work with the private sector to incentivise and popularise the use of "co-charging" (a person renting out the use of their home charge point to other EV owners) on a wider scale in Ireland. Co-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.

6.3.2 Shared Residence Charging Scheme

Work is currently being progressed to expand the EV home charge point grant to include shared parking in apartment blocks and similar developments. The Department is working closely with the SEAI in this area and a funding scheme for apartment buildings will launch shortly.

In rolling out this Scheme, consideration will be given to innovative EV charge point technology developments, such as smart charging and V2G technologies, that have the potential to encourage energy and cost efficiencies and electricity demand regulation.

6.3.3 Local Authority Public Charge Point Scheme to become Residential Charging Scheme

The Department of Transport has been working closely with Local Authorities to consider how the existing Public Charge Point Scheme can be enhanced to include capital costs for civil and electrics works, as well as charge point installation.

A new package of supports for Local Authorities will be launched in conjunction with this Infrastructure Strategy.

There are a range of models across Europe supporting the delivery of this type of infrastructure by Local Government, ranging from:

- Government delivery and operation of charge points, to
- Government funding the enabling capital works with installation and operation of charge points delivered through private sector, to
- 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, with varying levels of revenue incoming, depending on the profit-sharing arrangements, and the amount of work outsourced.

A critical success factor remains the key role of the Local Authority in determining the number and locations of charging points to meet the needs of their local residents.

ZEVI will therefore provide co-funding to support Local Authorities in developing local area network plans for EV infrastructure. comprising both on-street charging in areas where residents do not have access to home charging solutions, and destination charge points at Local Authority facilities.

It is envisaged that the Department will, working with Local Authorities, establish an OGP framework from which Authorities can procure expert supports to assist in the development of a local area charging network.

Local Authorities will then be able to apply for funding from a new Residential Charging Scheme which will replace the Public Points Scheme. It is

envisaged that this Scheme will provide significant co-funding of 75%. Residential charging points delivered under the new Scheme would have a charging capacity of 7-11kW per charging point and is intended that the Scheme would provide an alternative for those without access to home charging solutions.

Local charging can also support car sharing e-mobility solutions, which in turn supports wider access to EVs as part of a Just Transition where access to sustainable mobility options are limited. ZEVI will work with the car sharing sector and Local Authorities to pilot the provision of charging infrastructure to support e-car clubs.

6.3.4 Destination Charge Point Scheme

A multifaceted scheme is proposed to fund the installation of charge points by the public and private sectors at trip generating locations, or destinations. Traditionally destination charging may occur in 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.

The Department is pursuing a number of strands for this scheme including:

- Main destination charging scheme
- Visitor sites scheme
- Sports centres scheme
- Community centres scheme

The main destination charging scheme will be open for applications from the public and private sectors, from organisations such as hospitals, leisure facilities such as municipal swimming pools, cultural centres, hotels, cinemas and shopping centres.

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, and community centres.

Through the Shared Island initiative, the Department of Transport is also developing a scheme to fund a network of publicly accessible fast charge points in local sports clubs throughout the island. This would provide a reliable network of charge points in the centre of surrounding communities which could also support the uptake of EVs in rural and cross border areas.

The Government has invested greatly in local sports facilities in recent years throughout the country through the Sports Capital Grants scheme and building on this scheme to develop a Destination Charge points scheme for sports clubs will provide a ready-made network of EV charge point facilities.

It is envisaged that, in particular, the provision of destination charge points at visitor locations, sports clubs, and community centres in the Gaeltacht and Islands will support the transition to EVs in these communities.

In all Destination Charge point schemes, it is anticipated that ZEVI would provide funding for civil and electrics works, to enable the installation of EV charge points. Land owners could then consider leasing facilities to a charge point operator for installation, maintenance and operation of EV infrastructure, or operating the charge points themselves.

6.4 Public private collaboration to deliver en-route charging network

There are already many private 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 and are to be found in a range of different locations, such as petrol station forecourts, hotels and on street[98]. It is expected, as in other countries, that as EV growth continues to increase, an increasing demand will be placed on high-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 roads[99]. It is also anticipated that more private operators will enter the market for this high-speed charging provision.

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. Forthcoming requirements under the AFIR will set a framework for engagement with the private sector to establish a delivery model for Ireland's en-route EV charging network. ZEVI will work with grid managers, energy providers and private operators to facilitate the delivery of high-speed hubs and consideration will be given to how best to encourage EV infrastructure growth in the private sector.

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

[98] https://www.zap-map.com/live/

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

CHAPTER

7

Implementation

This final chapter draws together the high-level actions, funding streams and supports that will be put in place by Government to achieve delivery and implementation of EV charging in advance of demand within the timeframe of this Strategy. This Strategy is going through a public consultation process, and so these actions are maintained at a strategic level without being broken into more granular detail. Following the consultation process, a revised and final version of the Strategy will be published with a detailed Implementation Plan.

The expected operational timeframe and impacts of many of the actions listed will extend beyond the end point of this Strategy (2025) and will be reviewed and amended as required as part of the delivery process to 2030.

7.1 Timeline of actions

As referenced in **Chapter One**, this iteration of the Strategy covers the period 2022 to 2025.

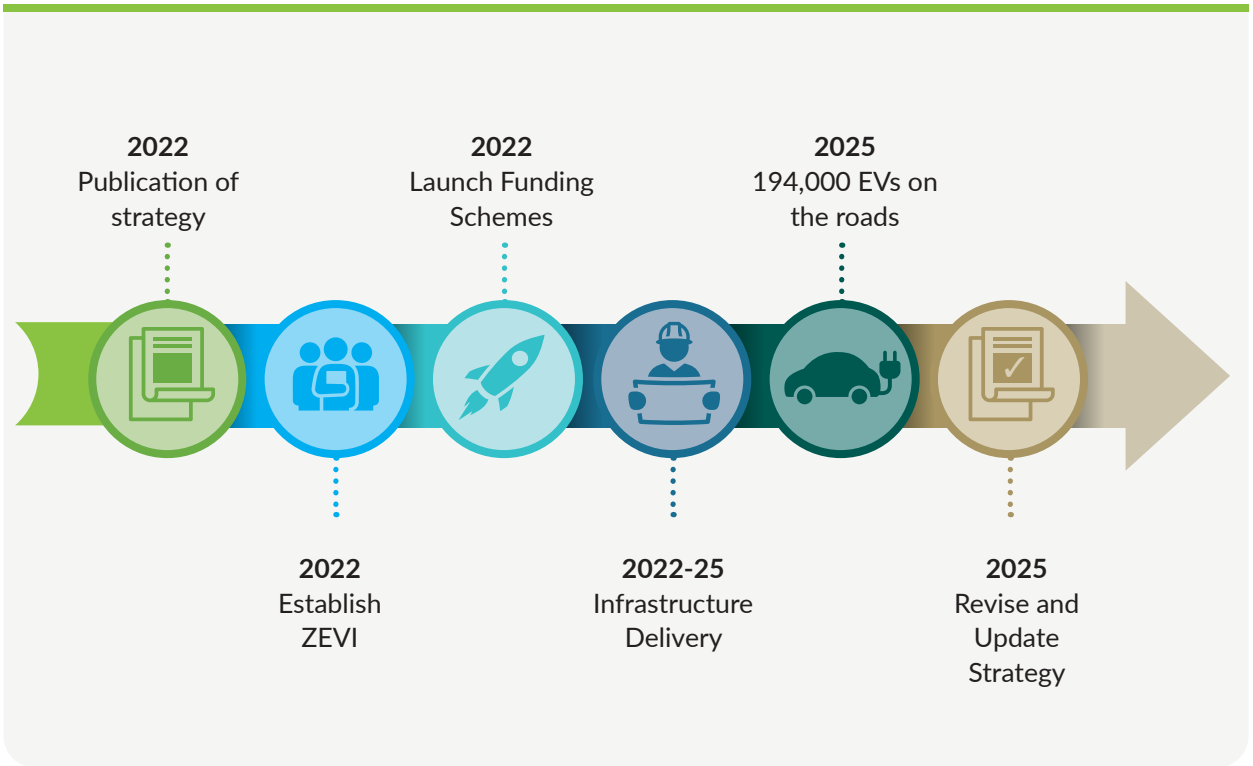


Figure 3: *Timeline of Strategy*

7.2 Table of actions

The high level actions to drive delivery and to stimulate EV infrastructure availability will fall under three broad areas.

As set out below, these areas are:

- **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, integrate industry and private sector investment with innovation and consumer needs; and
- **Government funding supports** to stimulate targeted EV charge point roll-out, to address gaps in EV provision, and to ensure a comprehensive network for all as the EV market develops.

Table 3: *Summary of high level actions*

Public sector actions	
Objective Support public sector and local government authorities to deliver EV infrastructure	
Action	**Expected results**
1. Publish Infrastructure Strategy for Consultation	○ Greater insight into co-ordination of EV policy and infrastructure strategy delivery
2. Establish ZEVI in the Department of Transport by summer 2022	○ Coordinated provision of EV supports and grants and the delivery of charging infrastructure ○ Coordinated public information and engagement campaign to address consumer charging concerns and build public knowledge of EVs
3. Update and publish Final EV Infrastructure Strategy by Q3 2022	○ Development of action plan for EV infrastructure delivery
4. Publish detailed Implementation Plan by Q4 2022	○ Delivery of action plan for EV infrastructure delivery
5. Establish Public Sector EV Infrastructure Delivery Group by Q3 2022	○ Coordinated geospatial analysis of EV targets and of charge point type provision; ○ Alignment of EV infrastructure delivery with distribution network development and sectoral coupling (energy and transport); ○ Increased EV integration with planning
6. Initiate local Authority Support package by Q3 2022	
7. Establish an EV Infrastructure Energy Group by Q3 2022	○ Collaboration between the Transport and Energy sectors in the planning and delivery of EV infrastructure.
Sustainability benefits ○ Improved access to EV infrastructure and improved ease of use and affordability of EV technologies ○ Coherent and cost-effective support for the transition to low-emitting road transport ○ Part of an overall increase in sustainable mobility and local availability of sustainable transport ○ Improved local air quality through reduced ICE vehicle use and targeted EV uptake (particularly in urban areas)	

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**
8. Establish multistakeholder EV Infrastructure Task Force by Q3 2022 **9. Having regard to AFIR requirements, develop pathway for the delivery of high-powered en-route charging infrastructure on strategic road network by Q2 2023**	○ Knowledge-sharing and collaboration ○ Leveraging expertise ○ Analysis of market variables for EV charge point development (including distribution network capacity, business cases, availability of technologies) ○ Identification of and tackling of any potential blockages to infrastructure provision ○ Synergies and support for innovation ○ Increased number of pilot trials of EV charging infrastructure and technologies ○ Roll-out of high-powered charging network
Sustainability benefits ○ Coherent and cost-effective support for the transition to low-emitting road transport ○ Increased public awareness and knowledge, integration with wider sustainable transport and movement of goods as well as people ○ Improved accessibility and equal access to EV charge points for all as part of a Just Transition to sustainable mobility ○ Increased access to green jobs and economy for Irish society as a whole ○ Ensuring flexibility in approaches to the development of infrastructure within wider sustainable mobility systems ○ Generating information for sustainable mobility policy development and to address knowledge gaps	
Action	**Expected results**
10. Engagement and Collaboration with NI executive and UK OZEV - ongoing	○ Facilitating a comprehensive and optimised EV network on both sides of the border that reflects the integrated and all-island nature of energy sector and transport infrastructure
Sustainability benefits ○ Interoperable EV infrastructure on the island of Ireland, enhancing connectivity and sustainable tourism ○ Maximises economic opportunities from sustainable mobility on both sides of the border ○ Energy efficiency and carbon savings and reinforcement of mutually beneficial energy market development (e.g. electricity grid management and renewable energy on both sides of the border)	

Government funding supports	
Objectives Increased provision of targeted EV charging infrastructure for all citizens Incentivise consumer action and stimulate EV demand	
Action	**Expected results**
11. Introduce Requirements for Smart Charging on all new Home Charge points from 2023	○ Improved grid resilience and an enhanced consumer experience
12. Identify and deliver actions for the use of "co-charging" as an EV charging solution by Q3 2022 **13. Expand the EV Home Charge point Grant Scheme to include shared parking in apartment blocks by Q2 2022**	○ A targeted increase in EV charge point provision to meet user home charging needs where on-street charging is not possible and where EV users don't have access to drive-ways
14. Support Local Authorities in the Development of local area EV charging networks by Q3 2022 **15. Develop new Residential Charging Scheme by Q3 2022**	○ An increase in the number of Local Authority publicly accessible charge points at targeted locations
16. Expand the eSPSV Infrastructure Scheme by Q3 2022 **17. Work with LAs and car club providers to develop EV charging infrastructure for e-car clubs by Q4 2022**	○ Increased numbers of dedicated eSPSV charge points at strategic locations and transport hubs to serve an increased number of electric SPSVs. ○ Incentivise the development of e-car sharing solutions to support a Just Transition
18. Implement a Destination Charge Point Scheme by Q3 2022	○ Installation of destination charge points in locations such as hotels, visitor centres and parks.

Government funding supports	
Objectives Increased provision of targeted EV charging infrastructure for all citizens Incentivise consumer action and stimulate EV demand	
Action	**Expected results**
19. Progress the 'FASTER' EV charging project - ongoing	○ Completion of planned EV charge point roll-out programme in border counties
Sustainability benefits ○ Increases availability of charging for citizens and promotes a wider spread of demand across the electricity supply network and cross-sectoral integration (transport and energy) ○ Aligns with national development plan objectives in terms of coordinated housing and transport planning ○ Allows the leveraging of public lands to support multi-modal sustainable transport and to align local demand with national network provision ○ Accelerates the transition of the high-mileage and high-emitting Small Public Service Vehicle sector to low-emitting technologies with knock-on benefits for air quality and noise pollution ○ Facilitates the roll-out of EV charging at strategic rural and urban sites to support a Just Transition to EV technologies ○ Maximises regional economic opportunities from sustainable mobility and increases EV availability for border regions and on an all-island basis	

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