
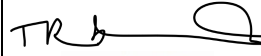



# TII Climate Action Roadmap

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September 2023

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TII Board Approval	26 September 2023
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## EXECUTIVE SUMMARY

This Climate Action Roadmap 2023 ('Roadmap') sets out Transport Infrastructure Ireland's (TII) plans to reduce emissions and meet decarbonisation and energy efficiency targets. This Roadmap (2023) documents progress and builds upon last year's Roadmap (2022). It has been prepared in line with guidance from the Sustainable Energy Authority of Ireland (SEAI), the Environmental Protection Agency (EPA) and Chapter 10 of the Climate Action Plan 2023 (CAP23), which stipulates that the public sector will lead by example in delivering on Ireland's decarbonisation commitments.

This Roadmap demonstrates how TII will achieve emissions reductions to 2030. As a public sector organisation TII has two targets under CAP23 focused on energy:

- Target 1 Decarbonisation: To reduce greenhouse gas (GHG) emissions associated with energy from TII's operations by 72% to 7,872 tonnes of Carbon Dioxide (tCO<sub>2</sub>) by 2030, compared to a 2016-2018 (average) baseline of 28,533 tCO<sub>2</sub>; and
- Target 2 Energy Efficiency: To improve energy efficiency by 50% by 2030 compared to a 2009 baseline.

These targets focus on the emissions and energy performance within TII's control; from electricity purchased by the organisation, and emissions produced from combustion on site such as gas and oil in offices and depots (for heating and hot water), as well as fuels like diesel, used in TII's fleet and the sub-contractors' fleets for the light rail network and National Roads Network (NRN).

Use of the SEAI's gap-to-target model to estimate future emissions shows that TII expects to achieve between 61-73% (17,203-21,097 tCO<sub>2</sub>) GHG emissions reduction by 2030 and between 46-53% improvement in energy efficiency. The targets will be met as a result of electricity grid decarbonisation over the coming years, combined with several decarbonisation and energy efficiency projects planned by TII.

This Roadmap sets out twenty-seven projects to be delivered between 2023 and 2030. The successful achievement of the targets is dependent on the accuracy of the model predictions, and all the projects being implemented as planned. This will require additional funding and resources, as well as availability of the expected technology and solutions.

GHG emissions within TII's direct control account for around 1% of the GHG emissions associated with delivery, operation and use of the transport infrastructure and services provided by TII. The remaining 99% of emissions are not controlled but can be influenced by TII.

The GHG Protocol is an internationally recognised standard to measure and manage emissions. Within this framework, emissions are categorised into three scope definitions: scope 1 (direct emissions from sources that are owned or controlled by an organisation), scope 2 (indirect emissions from electricity), and scope 3 (indirect emissions).

**Figure 1** shows TII's emissions broken down by the three scopes.

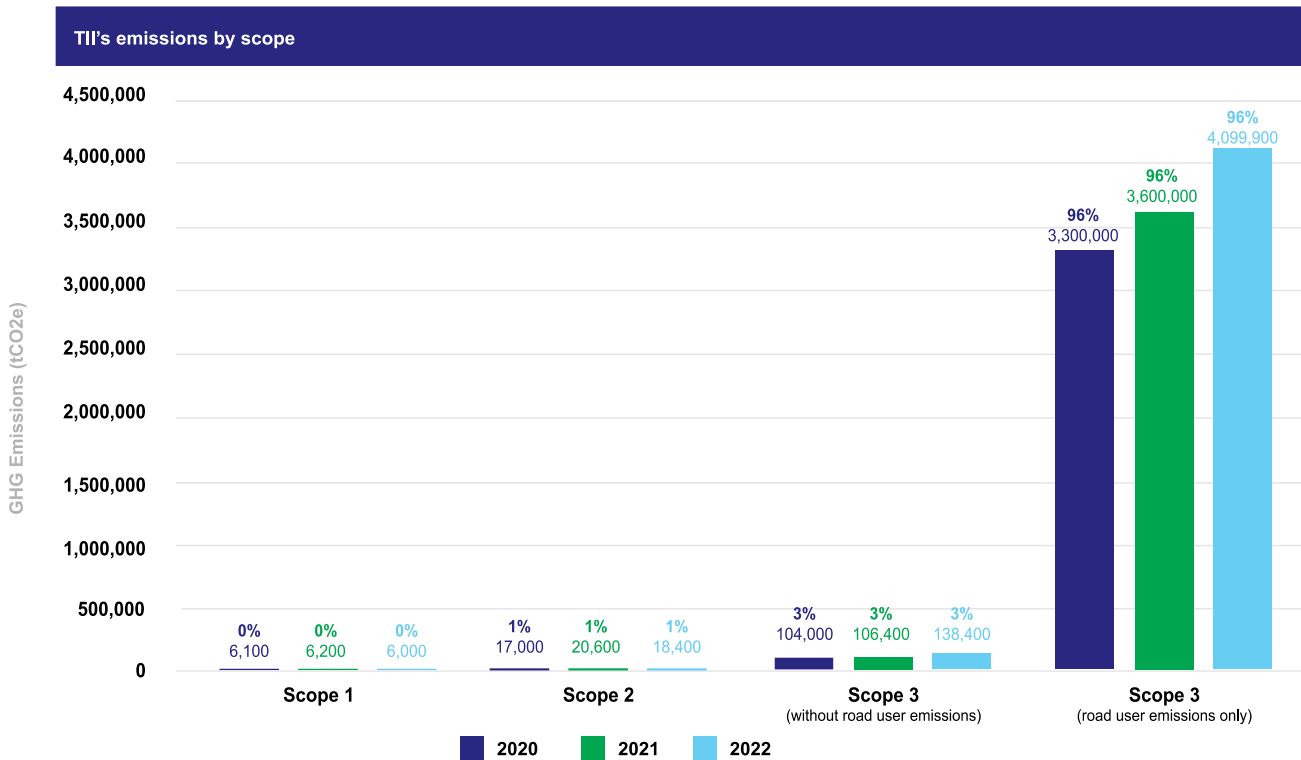


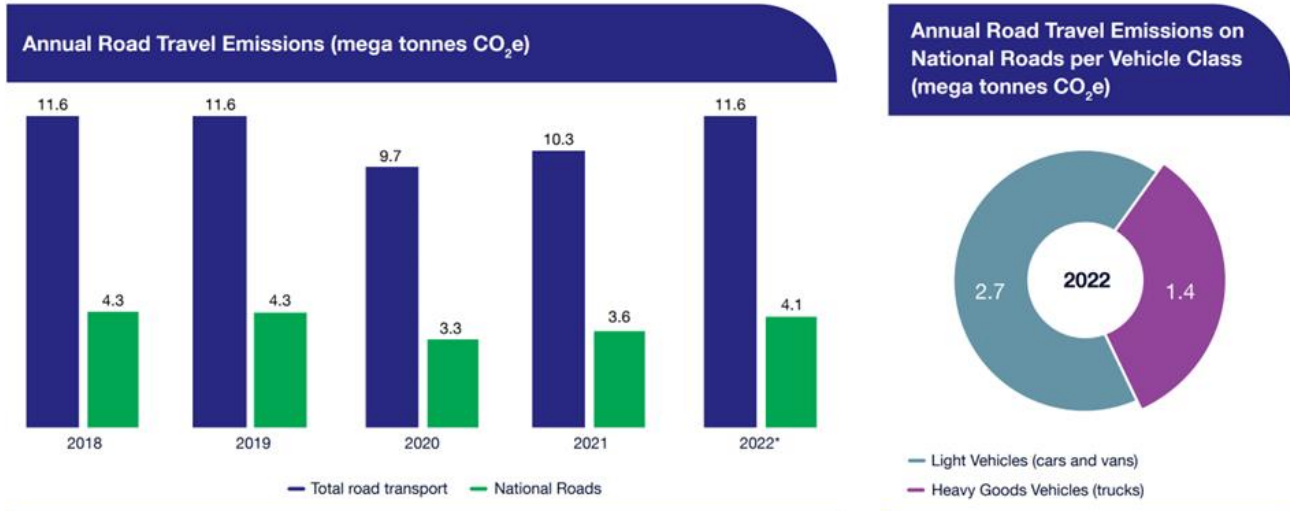
Figure 1 TII's emissions by scope<sup>1</sup>

TII is working with partners, stakeholders, and suppliers to reduce the overall emissions associated with construction, operation, and protection and renewal of transport infrastructure, and use of TII's transport networks. To reduce these emissions, this Roadmap sets out TII's six levers of influence:

1. Direct emissions
2. Staff
3. Supply Chain
4. Industry
5. Partnerships and
6. Road Users.

Each lever is addressed qualitatively in this Roadmap, with reference to TII's broad suite of climate-related projects and programmes that will contribute to the reduction of emissions within TII's influence. For example, TII produce standards, guidelines, and technical documents that are used across the construction and transport sector. Nationally the transport sector requires a reduction of 50% from 12 million tCO<sub>2</sub>e in 2018 to 6 million tCO<sub>2</sub>e in 2030. Travel on National Roads accounts for approximately 35% of road transport emissions as shown in **Figure 2**.

<sup>1</sup> Emission figures for 2022 are provisional, moreover, scope 3 emissions include additional categories not available in previous years. Better quality data for the years 2020-2021 resulted in an update to emissions previously reported.



Travel on National Roads contributed an average of **35%** of total road transport emissions in 2018-2022.

Heavy Goods Vehicles (HGVs) contributed **34%** of National Roads emissions in 2022.

Sources: 1. EPA, 2022 (estimate of total transport emissions in 2018 was 12.2 mega tonnes, road travel emissions made up 11.6 mega tonnes of this; \*2022 Total road transport emissions is EPA projection and not inventory as per previous years)  
 2. TII National Transport Model (NTpM), TII Road Emissions Model (REM), CSO and UCC (2021) Irish Car Stock Model v2.1.

**Figure 2 Annual Road Travel Emissions**

This Roadmap also references TII’s Climate Adaptation Strategy, which was published in December 2022, setting out TII’s approach to adapting to Ireland’s changing climate. The strategy is currently being implemented.

TII recognises that the 2030 targets are interim targets on the path to the goal of net-zero emissions by 2050. This Roadmap (2023) is a live document, which will be updated annually, to reflect TII’s progress and to respond to requirements under the Climate Action Mandate.



**GLOSSARY**

Name	Definition
Biodiversity	Biodiversity includes all life on Earth. As defined by the United Nations Convention on Biological Diversity (CBD), “biological diversity” means the variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes genetic diversity within species, between species and of ecosystems. Humans rely on biodiversity for health and well-being, and support of economic activities.
Biodiversity Crisis	The biodiversity crisis is the rapid loss of species and the rapid degradation of ecosystems.
Biofuels	Biofuels are liquid or gaseous transport fuels, such as biodiesel and bioethanol, made from biomass which are renewable alternatives to fossil fuels in the transport sector.
Business As Usual (BAU)	The energy consumption before additional energy-saving projects (project pipeline) as considered within the SEAI gap-to-target model.
Carbon Budget	A carbon budget represents the total amount of emissions, measured in tonnes of CO <sub>2</sub> equivalent, which may be emitted by a country or a region during a specific period.
Carbon Emissions	Carbon dioxide (CO <sub>2</sub> ) emissions are emissions resulting from the burning of fossil fuels. CO <sub>2</sub> is a compound of carbon and oxygen formed when carbon is burned and is one of the main greenhouse gases.
Carbon Sequestration	Carbon sequestration is a natural or artificial process by which carbon dioxide is removed from the atmosphere and stored in solid or liquid form.
Circular Economy	<p>The circular economy aims to keep materials, components, and products in-use in the economy for as long as possible. In circularity, the key objective is to design consumption and production systems to create and retain value. Circular economy has been defined in legislation, under the Circular Economy and Miscellaneous Provisions Act 2022 No. 26 of 2022 as follows:</p> <p>“Circular Economy” means an economic model and the policies and practices which give effect to that model in which—</p> <ul style="list-style-type: none"> <li>(a) production and distribution processes in respect of goods, products and materials are designed so as to minimise the consumption of raw materials associated with the production and use of those goods, products and materials,</li> <li>(b) the delivery of services is designed so as to reduce the consumption of raw materials,</li> <li>(c) goods, products and materials are kept in use for as long as possible thereby further reducing the consumption of raw materials and impacts harmful to the environment,</li> <li>(d) the maximum economic value is extracted from goods, products, and materials by the persons using them, and</li> <li>(e) goods, products and materials are recovered and regenerated at the end of their useful life.</li> </ul>
Climate Action Plan 2023 (CAP23)	CAP23 provides a detailed plan for taking action to achieve a 51% reduction in overall greenhouse gas emissions by 2030 and setting Ireland on a path to reach net-zero emissions by no later than 2050, as committed to in the Programme for Government and set out in the Climate Act 2021.
Climate Change	The United Nations Framework on Climate Change (UNFCCC, 1992) defines climate change as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.
Climate Crisis	Problems that are being caused or likely to be caused by changes in the world's weather, in particular the world getting warmer as result of human activity increasing the level of carbon dioxide in the atmosphere
Climate Hazards	Any identified climate-related event or long-term change to which TII’s assets can be vulnerable.

Name	Definition
Climate Mitigation	The Intergovernmental Panel on Climate Change (IPCC, 2018) defines mitigation of climate change as: ‘a human intervention to reduce emissions or enhance the sinks of greenhouse gases’. Mitigation measures include technologies, processes or practices that contribute to mitigation.
Climate Risk	How climate hazards translate to a detrimental impact on TII’s vulnerable assets.
Co-benefits	The term “Co-benefits” refers to simultaneously meeting several interests or objectives resulting from a political intervention, private sector investment or a mix thereof. Co-beneficial approaches to climate change mitigation are those that also promote positive outcomes in other areas, such as air quality and health, economic prosperity, and resource efficiency or more general in terms of Sustainable Development (SD) Benefit.
Connecting Ireland	The Connecting Ireland Rural Mobility Plan (2021) is a major national public transport initiative developed by the National Transport Authority (NTA), with the aim of increasing connectivity, particularly for people living outside major cities and towns.
Conversion Factor	The number or formula needed to convert a measurement in one set of units to the same measurement in another set of units.
Decarbonisation	Decarbonisation is the removal or reduction of carbon dioxide inputs from human activity into the atmosphere which is important for limiting global warming. The main levers for decarbonisation are the development of renewable energies, switching fuels and the improvement of energy efficiency.
Direct Emissions	Greenhouse gas emissions from use of fossil fuels, including in buildings, vehicles, and equipment.
Energy Efficiency	Energy efficiency is a reduction in the energy used to achieve the same result. Retrofitting options can be used to reduce energy usage. These may include switching to LED lighting and energy efficient appliances or upgrading insulation. Energy efficiency has a variety of benefits including reducing GHG emissions, reducing demand for energy imports, and lowering energy costs.
Green infrastructure	Green infrastructure is a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services such as water purification, air quality, space for recreation and climate mitigation and adaptation. Examples include biodiversity-rich natural areas such as woodland, ponds or wildflower meadows.
Green Public Procurement (or Sustainable Procurement)	Green Public Procurement (GPP) (or Sustainable Procurement) is a process where public authorities seek to source goods, services or works with a reduced environmental impact.
Greenhouse Gas Emissions (GHG)	Gases that trap heat in the atmosphere are called greenhouse gases. Greenhouse gas emissions come from many different sources. The two most important from the point of view of human contribution to climate change are carbon dioxide (CO <sub>2</sub> ) and methane (CH <sub>4</sub> ). Carbon dioxide mainly comes from the burning of fossil fuels for energy. Other sources of greenhouse gas emissions include industrial processes such as cement manufacturing, fertiliser spreading in agriculture and refrigeration gases.
Greenway	A cycleway that caters for people walking, wheeling, and cycling in a mainly recreational environment.
Hydrotreated Vegetable Oil (HVO)	HVO is a low carbon fuel that is obtained by processing lipids such as vegetable oil, tallow, or used cooking oil, all made from paraffinic hydrocarbon.
Indirect Emissions	Indirect emissions arise because of an organisation’s activity but occur at sources that are typically not owned or controlled by the organisation. Emissions from electricity use in buildings, vehicles, equipment, lighting etc. are indirect emissions.
ISO 14001	ISO 14001 is the international standard for Environmental Management Systems (EMS).
ISO 50001	ISO 50001 is the international standard for energy management.

Name	Definition
Just Transition	A Just Transition seeks to ensure that the substantial benefits of a green economy transition are shared widely, while also supporting those who stand to lose economically – be they countries, regions, industries, communities, workers, or consumers.
National Cycling Network Strategy	The National Cycling Network Strategy is a planned core cycle network of 3,500km which will criss-cross the country connecting more than two hundred villages, towns, and cities. The network will include cycling links to transport hubs, education centres, employment centres, leisure and tourist destinations, and support “last mile” bicycle deliveries.
National Investment Framework for Transport in Ireland (NIFTI)	NIFTI is the Department of Transport’s high-level strategic framework to support the consideration and prioritisation of future investment in land transport. It represents the Department’s contribution to Project Ireland 2040, the Government’s long-term, overarching strategy to make Ireland a better country for all and to build a more sustainable future.
Net-Zero	Net-zero emissions refers to achieving a balance between greenhouse gas emissions generated and greenhouse gas removals.
Operations	TII operations are all non-material-based activities required to uphold or provide services on the National Roads and Luas networks.
Protection and Renewal Activities	Protection and renewal refer to maintaining the physical infrastructure of the transport network in a safe and adequate condition. It encompasses the maintenance of existing transport infrastructure and assets, such as roads, rail, vehicles, and supporting technologies, but excludes upgrades to the network which deliver improved performance. This includes maintenance of the national roads and Luas networks.
Public Sector Climate Action Mandate 2023	The Public Sector Climate Action Mandate will support public sector bodies leading by example on climate action. It aims to inspire the necessary climate action in wider society to reduce Ireland’s greenhouse gas (GHG) emissions by 51% by 2030. The Mandate requires public sector bodies to show leadership in climate action by taking, and reporting on, the actions set out in the Mandate.
Road User	The term “road user” refers to a motorist, passenger, public transport provider or user, freight vehicle driver, motorcyclist, cyclist, or pedestrian.
Sectoral Emissions Ceilings	Sectoral Emissions Ceilings refer to the total amount of permitted greenhouse gas emissions that each sector of the economy can produce during a specific period.
Supply-Side Emissions Reductions	Supply-side emissions reductions are attributed to the decarbonisation of Ireland’s electricity grid and additional biofuel blending in road transport fuels.
Sustainable Drainage Systems (SuDS)	SuDS are drainage systems that mimic nature and typically manage rainfall close to where it falls. They are environmentally beneficial, causing minimal or no long-term detrimental damage. SuDS consider water quantity (flooding), water quality (pollution) biodiversity (wildlife and plants) and amenity value.
Sustainable Energy Authority of Ireland (SEAI)	The SEAI is Ireland’s national sustainable energy authority and works with householders, businesses, communities, and government to create a cleaner energy future.
Total Final Consumption (TFC) and Total Primary Energy Requirement (TPER)	Energy consumption can be expressed as total final consumption (TFC) or total primary energy requirement (TPER). Primary energy also accounts for the energy that is consumed and/or lost in transformation, transmission, and distribution processes. It is calculated by applying conversion factors, which vary by fuel type, to final consumption values. Conversion factors for thermal and transport fuels typically remain unchanged from year to year. The current factors are available on the SEAI website. The gap-to-target decarbonisation model considers carbon emissions in terms of TFC, while the energy efficiency model considers carbon emissions in terms of TPER.
Zero Emissions Vehicles (ZEV)	Zero emissions vehicles (ZEVs) are vehicles that do not use petroleum fuels and therefore do not emit greenhouse gas emissions from the tailpipe. Battery electric vehicles and hydrogen fuel cell electric vehicles are examples of these technologies.

## 1 INTRODUCTION

*Our Shared Future*, the 2020 Irish Programme for Government, commits to lowering Ireland's greenhouse gas (GHG) emissions by increasing energy efficiency and reducing fossil fuel dependence across the public sector. This Climate Action Roadmap 2023 ('this Roadmap') sets out Transport Infrastructure Ireland's (TII's) plan to reduce GHG emissions and actions to contribute to the delivery of climate targets. This Roadmap (2023) documents progress and builds upon last year's Roadmap (2022) published in December 2022. It has been prepared in line with the Sustainable Energy Authority of Ireland (SEAI) and Environmental Protection Agency (EPA) guidance and Chapter 10 of the Government's Climate Action Plan 2023 (CAP23) which stipulates that the public sector will lead by example in delivering on Ireland's decarbonisation commitments. Meeting the targets depends upon TII receiving additional funding and resources to deliver the interventions needed and overcoming risks and challenges that may be outside of TII's control. TII's response to the SEAI and EPA Guidance on the requirements for a Climate Action Roadmap has been set out in **Appendix A**. This Roadmap also includes reference to TII's broad suite of climate-related projects and programmes that will contribute to the reduction of emissions within TII's control and/or influence across the transport sector, and references TII's Climate Adaptation Strategy, TII's approach to adapting to Ireland's changing climate. This is TII's Roadmap to 2030 but TII recognises that this is an interim target towards achieving the 2050 net-zero targets.

### 1.1 The purpose of the Climate Action Roadmap

Under the Climate Action Mandate in CAP23, which applies to public sector organisations, TII must update the Climate Action Roadmap (i.e. this Roadmap) annually, to report on progress towards achieving the decarbonisation and energy efficiency targets. Overall, the public sector must achieve a 51% reduction in GHG emissions and a 50% improvement in energy efficiency by 2030. Each public sector organisation has been set an individual target by the SEAI for overall GHG emissions reduction from energy. TII's target is to reduce GHG emissions from energy by 72% by 2030 compared to a 2016-2018 baseline (average).

This Roadmap (2023) is a live document, which will be updated annually.

### 1.2 Guide to this Roadmap

This Roadmap has been prepared with five main chapters:

**Chapter 1 – Introduction:** Presents the information needed to navigate this Roadmap; including an overview of the policy context, introduction to energy efficiency and measuring GHG emissions from energy, and the importance of addressing overall emissions and climate adaptation.

**Chapter 2 – Decarbonisation and energy efficiency:** Sets out the 2030 decarbonisation and energy efficiency targets that apply to TII, summarises TII's forecast GHG emissions from energy, and the organisation's expected energy efficiency, by 2030. This chapter also includes details of the planned projects that will contribute to TII's decarbonisation and energy efficiency targets.

**Chapter 3 – TII's influence on emissions:** Outlines the breadth of sustainability initiatives and measures TII is delivering to contribute to a decarbonised transport sector, setting these out across six levers of influence.

**Chapter 4 – Climate adaptation:** Summarises TII's climate adaptation strategic objectives and approach to adaptation as set out within TII's Climate Adaptation Strategy, published in December 2022.

**Chapter 5 – Conclusion:** Summarises TII's approach to climate action and looks ahead.

### 1.3 Policy Context

This introduction to the Roadmap's policy context is accompanied by a detailed policy review in **Appendix B**.

#### 1.3.1 European Policy

The European Green Deal outlines Europe's response to the climate crisis. The Green Deal commits to achieving climate-neutrality in the European Union (EU) by 2050 and sets the EU GHG emissions reduction target to at least 55% for 2030 to limit global warming to 1.5 degrees Celsius, in line with the Paris Agreement. The EU is working to revise its climate, energy, and transport related legislation under the 'Fit for 55' package. This will increase EU targets to align with the 2030 and 2050 ambitions.

#### 1.3.2 Irish Policy

Our Shared Future, the Irish Programme for Government, commits to a 51% reduction in Ireland's overall GHG emissions from 2021 to 2030, and to achieving net-zero emissions by 2050. Ireland's Climate Action and Low Carbon Development (Amendment) Act 2021 enacts the national climate objectives into law. The Act commits Ireland to move to a climate resilient and climate neutral economy by 2050 in alignment with the European Green Deal. Ireland's CAP23 provides the implementation plan to deliver on these commitments. CAP23 recognises that there is significant potential to lower Ireland's GHG emissions by increasing energy efficiency and reducing fossil fuel dependence across the public sector.

#### 1.3.3 TII Policy

TII's Statement of Strategy 2021-2025 commits the organisation to providing sustainable transport infrastructure and services, delivering a better quality of life, supporting economic growth, and respecting the environment. The Statement of Strategy includes eight goals, and several supporting strategic objectives that address the need to reduce carbon, including:

- Existing Infrastructure:
  - Introduce measures to support the reduction of carbon and other emissions in TII operations.
- New Infrastructure:
  - Deliver infrastructure that supports low-carbon transport systems and emission reductions.
  - Promote further use of low-carbon products in construction projects.
- Services:
  - Support and develop carbon-reduction measures in the transport sector.

TII's Sustainability Implementation Plan (SIP), launched in March 2021 sets the direction for TII's sustainability agenda. It presents six key sustainability principles to guide action across all areas of sustainability, including Principle 5 'Transition to Net Zero'. The SIP is being updated in 2023 to reflect current progress.

TII's Climate Adaptation Strategy published in December 2022 outlines TII's approach for adapting to climate change. The seven strategic objectives of the Climate Adaptation Strategy align with the SIP's key sustainability principles.

National Roads 2040 (NR2040) published in April 2023 is TII’s long-term strategy for planning, operating, and maintaining the National Roads Network (NRN). It supports the delivery of Project Ireland 2040 (National Planning Framework) objectives and aligns with the Department of Transport’s National Investment Framework for Transport in Ireland (NIFTI). NR2040 will be delivered by TII in collaboration with other government agencies and transport stakeholders. NR2040 outlines commitments to address challenges such as population growth, decarbonisation, biodiversity, climate adaptation, safety, and congestion.

NR2040 also aligns with CAP23 and the National Sustainable Mobility Policy, acting as a means of delivering policy objectives with decarbonisation as a key priority.

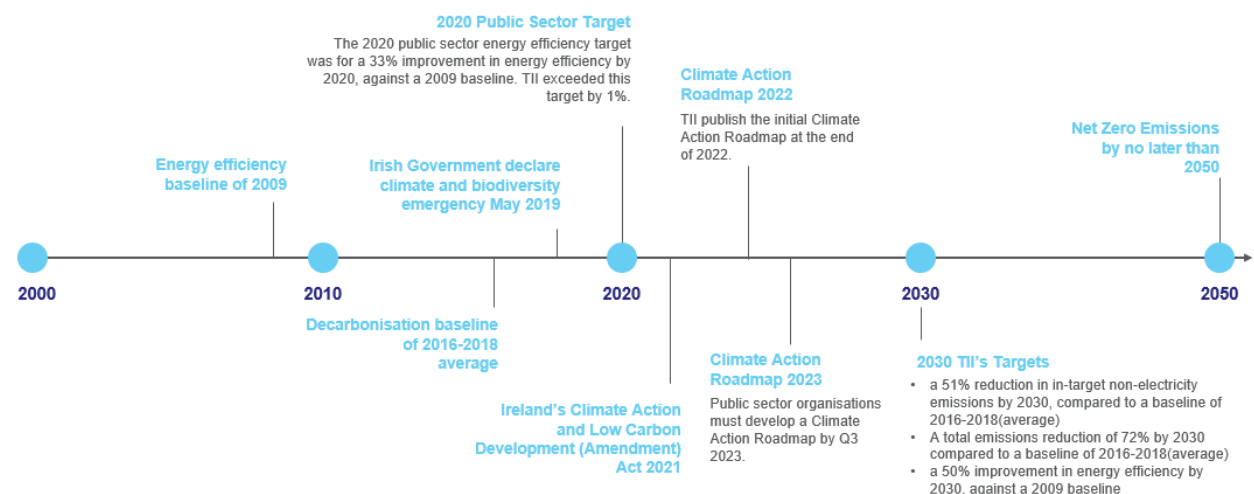
## 1.4 Measuring and reporting GHG emissions and energy efficiency

### 1.4.1 Public sector targets

In the CAP23, the public sector has a clear mandate to lead on climate action. The Government has set ambitious targets for public sector organisations:

1. A 51% reduction in the total tonnage of direct energy-related GHG emissions (i.e., thermal and transport), plus projected supply-side reductions in indirect energy-related emissions (i.e., electricity), compared to a 2016-2018 (average) baseline.
2. A 50% improvement in energy efficiency by 2030, compared to a 2009 baseline.
3. Net-zero emissions no later than 2050.

Each public sector organisation will contribute to achieving the overall sectoral targets outlined above. **Figure 3** below shows key dates and targets from 2009 to 2050.



**Figure 3** Timeline of public sector targets

### 1.4.2 Energy performance reporting

Public sector organisations in Ireland are required to report energy performance annually using the SEAI Public Sector ‘Monitoring and Reporting’ (M&R) system. The M&R system enables monitoring of progress, identification of improvement opportunities, and validation of emissions savings.

TII data reported through the M&R system annually includes:

- Energy consumption
- Activities undertaken; and
- Energy saving projects.

The M&R data is used in this Roadmap to model progress to meeting TII’s targets.

### 1.4.3 GHG emissions categorisation

The GHG Protocol is an internationally recognised standard to measure and manage emissions. Within this framework emissions are categorised into three scope definitions as defined in **Table 1**.

*Table 1 GHG Protocol scope Definitions*

<b>Scope 1 emissions</b>	Direct GHG emissions. These occur from sources that are owned or controlled by the organisation, for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc. emissions from chemical production in owned or controlled process equipment.
<b>Scope 2 emissions</b>	Indirect GHG emissions. These are emissions generated from the purchase of electricity consumed by the organisation. These emissions are “indirect,” meaning the release of GHGs is physically occurring off-site on behalf of the organisation in question.
<b>Scope 3 emissions</b>	Indirect GHG emissions. These emissions are a consequence of the activities of the organisation but occur from sources not owned or controlled by the organisation. Some examples of scope 3 activities are the extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services.

**Figure 4** below illustrates the types of activities which generate GHG emissions for TII under each scope. Scope 1 emissions (direct emissions) occur when fossil fuels (e.g., diesel, coal, oil, or gas) are directly used by TII, such as diesel for TII’s fleet and gas used on site to heat TII’s buildings. Scope 2 emissions (indirect emissions) are generated off site, such as the electricity supplied by the grid to TII and used to power the Luas and light the NRN, created from a mixture of fuel (e.g. wind, coal, and gas). Scope 1 and scope 2 emissions are part of the mandatory reporting within the M&R system. **Figure 5** shows TII’s emissions by scope, showing that scope 1 and 2 account for approximately 1% of emissions, while scope 3 accounts for the remaining 99%.

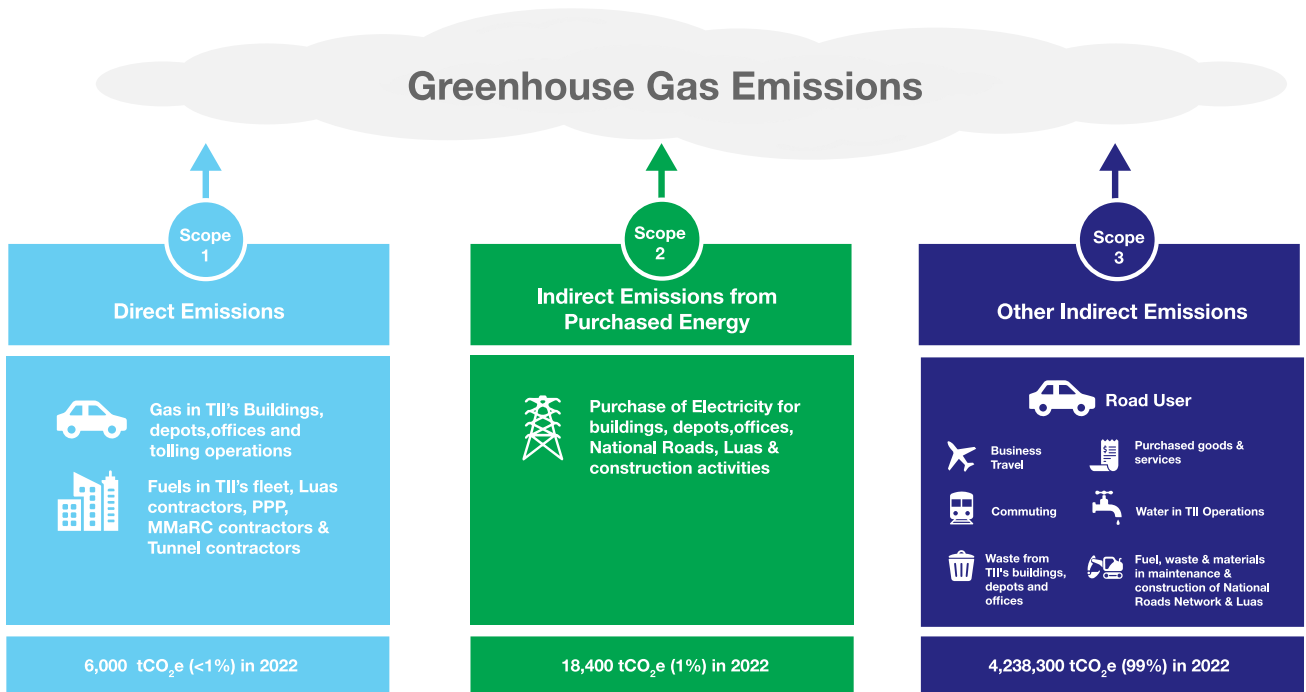


Figure 4 Activities within each GHG Protocol scope<sup>2</sup>

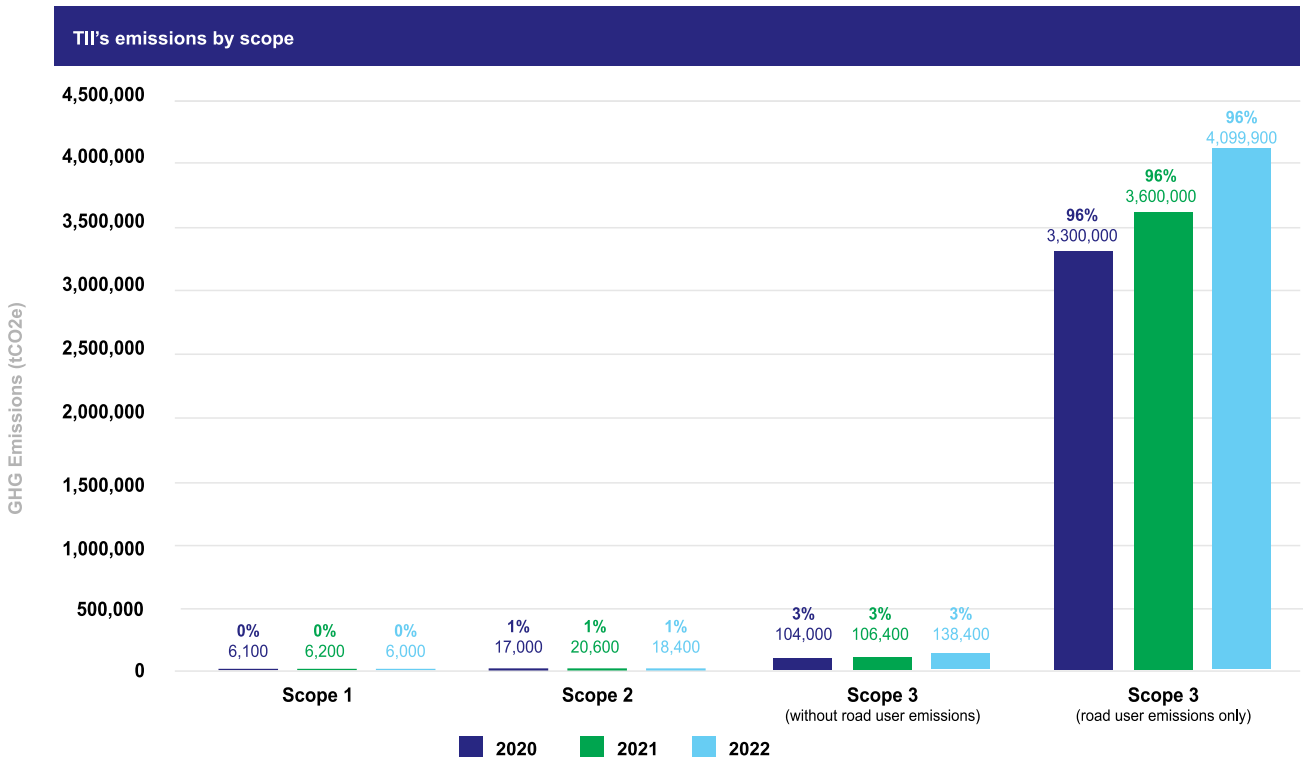


Figure 5 TII's emissions by scope<sup>3</sup>

<sup>2</sup> Emission figures for 2022 are provisional

<sup>3</sup> Emission figures for 2022 are provisional, moreover, scope 3 emissions include additional categories not available in previous years. Better quality data for the years 2020-2021 resulted in an update to emissions previously reported.



## 1.5 How TII can influence emissions

The transport sector represents a major source of Ireland's GHG emissions, accounting for around 19% in 2022, approximately 11 million tCO<sub>2</sub>e. Beyond addressing the GHG emissions from energy and making energy efficiency improvements, TII is working with partners, stakeholders, and suppliers to reduce the overall emissions associated with the operation, protection and renewal, construction of transport infrastructure, and use of TII's transport networks. This includes:

- TII's development of policies, strategies, industry standards and guidelines
- Working with the supply chain to use more sustainable products and processes for projects; and
- Encouraging sustainable travel choices through the development of demand management measures and the provision of public transport and active travel infrastructure and services.

TII has identified six levers of influence to address all emissions across TII:

- Direct emissions
- Staff
- Supply Chain
- Industry
- Partnerships and
- Road Users.

TII's approach to each lever is described in [Chapter 3](#).

## 1.6 Preparing for climate change

Risks associated with climate change include increasingly severe and frequent extreme weather events, extreme temperatures, and flooding. In addition to efforts to reduce GHG emissions, TII continues to adapt to the climate change impacts affecting its infrastructure and services.

TII has adopted the European Commission's asset-based methodology for climate-proofing and is developing detailed risk assessments to establish a better understanding of future climate risks. TII's six-stage approach to climate adaptation is set out in the TII Climate Adaptation Strategy and summarised in [Chapter 4](#) of this Roadmap.

## 2 DECARBONISATION AND ENERGY EFFICIENCY

This chapter sets out the decarbonisation and energy efficiency 2030 targets that apply to TII and summarises TII’s forecast GHG emissions from energy consumption, and the organisation’s expected energy efficiency by 2030. It includes a summary of the planned projects that will contribute to TII’s decarbonisation and energy efficiency. A technical note with supporting information is provided in **Appendix C**.

### 2.1 Gap-to-target model and key terms

The SEAI’s gap-to-target model was used to forecast TII’s GHG emissions and energy efficiency. The gap-to-target model consists of a decarbonisation component (‘decarbonisation model’) and an energy efficiency component (‘energy efficiency model’). The detail and methodology behind each component are outlined in the technical note (see **Appendix C**), with the modelling approach following the SEAI methodology and aligning with Chapter 10 of the CAP23. The energy modelled includes electricity, gas, and liquid fuels (i.e., petrol and diesel) used in the operation of the National Roads and light rail networks. Conversion factors are as per the SEAI gap-to-target model.

The results presented in this chapter represent modelling outputs, dated July 2023, based on the gap-to-target SEAI version 3.12 released May 2023. As further decarbonisation and energy efficiency projects are developed and progressed, the modelling will be updated to reflect their impact, and results will be reported in future Roadmaps. Modelling is used to project future scenarios based on currently available information and is therefore subject to change. The limitations of the modelling exercise are detailed in the technical note (see **Appendix C**).

Key terms referred to throughout this chapter are set out in **Table 2** and are defined in the glossary. The supporting policy context for this chapter can be found in **Appendix B**.

*Table 2 Decarbonisation and Energy Efficiency Key Terms*

Key Terms Found in the glossary
Conversion factors
Decarbonisation
Direct emissions
Energy efficiency
Supply-side reductions
Total Final Consumption (TFC) and Total Primary Energy Requirement (TPER)

### 2.2 Approach to decarbonisation and energy efficiency modelling

The modelling aims to develop a pathway for TII to achieve the targets set out in Chapter 10 of CAP23. Two scenarios were modelled: a ‘Business as Usual’ case in which TII does not implement GHG emissions reduction and energy efficiency projects; and a ‘With Project Pipeline’ case in which TII implements a portfolio of projects between 2023 and 2030.

The modelling of the ‘With Project Pipeline’ case represents a technical feasibility study in which budget considerations are not the focus. It is proposed that the project pipeline is implemented over the period 2023-2030. However, all solutions proposed are based on what is currently technically feasible, or options that can reasonably be expected to become available to TII between now and 2030. A pathway to achieving the decarbonisation and energy efficiency targets has been identified, however there are costs, challenges, and risks associated with implementing the project pipeline. For example, the availability of Hydrotreated Vegetable Oil (HVO) at the level required for TII is uncertain at this time.

The potential for challenges such as funding, resources, planning and technicalities can lead to timelines extending beyond initial intention which could lead to adjusted implementation dates (but remaining within the pathway to 2030). There may also be a need for additional trial projects or extended trial periods before widespread roll out of a certain project is achievable.

To account for this uncertainty, TII has considered both the ‘Business as Usual’ and ‘With Project Pipeline’ scenarios, and modelling results are presented as ranges of emissions reduction and energy efficiency outcomes.

### 2.3 Decarbonisation and energy efficiency targets

The public sector targets for decarbonisation, energy efficiency and associated baselines are set out in **Table 3** below. TII’s individual target for decarbonisation is also noted.

**Table 3** Public Sector Targets

	Target	Sectors	Target	Baseline year	Target Year
Target 1	Decarbonisation target	Thermal Transport Electricity	51% reduction (direct emissions: thermal and transport)  <i>TII 72% reduction (total emissions)</i>	2016-2018 (average)	2030
Target 2	Energy efficiency target	Thermal Transport Electricity	50% improvement	2009	2030

### 2.4 TII’s achievements in 2022

As stated in TII’s ‘Annual Report and Financial Statements 2022’, in 2022 across all operations TII delivered 71 sustainability related actions and progressed 187 actions, including 41 recurring actions (TII, 2023). The below projects are a sample of energy related projects which TII delivered in 2022:

- TII progressed the implementation of energy reduction measures across the NRN, following the early development and adoption of the “Energy Reduction in Public Lighting on National Roads” document published in June 2016.
- TII undertook further replacement of existing lights with LEDs on the non-motorway sections of the NRN, equating to an average energy saving of over 171,000 kWh annually.

- A scheme initiated in 2017 aimed at dimming road lighting on the M50 motorway during night-time periods, achieved approximately 1.35 million kWh reduction in energy consumed and almost 400 tonnes of carbon emissions avoided each year.
- TII has continued to increase the use of electric vehicles across contractor fleets, with all new cars being electric vehicles (EV). Where EV solutions are not yet available, TII increased the use of Hydrogenated Vegetable Oil (HVO) as a renewable fuel replacement.
- TII Luas Operations in collaboration with TII's Luas Network operator initiated an alternative lighting trial for tram vehicles, fitting a trial tram with LED lamps as a replacement for fluorescent lamps. Trials continue into 2023 to secure the correct product for mass transit vehicles which meet specific tram related standards. Successful trials can eventually lead to a roll-out to the Luas tram fleet.
- TII Luas Operations in collaboration with TII's Luas Network operator initiated a heating and ventilation unit trial to improve the energy efficiency of the tram passenger saloon heating and ventilation modules, a system that regulates the quantity of air delivered depending on the number of passengers onboard, thus conserving energy. Trials continue into 2023. Successful trials can eventually lead to a roll-out to the Luas tram fleet.
- TII completed structural and electrical surveys on TII's Luas tram depot roofs to establish the suitability of installing large rooftop solar PV arrays on the depot roofs. This stage also included reports required for planning and financial assessment. The rooftop solar PV arrays will offset a minimum of 10% of the depot electricity consumption.
- TII Luas Operations in collaboration with TII's Luas Network operator, initiated Luas infrastructure surveys to establish an alternative lighting technology to illuminate its tram stops, depots and car parks. Stop lighting modelling was completed allowing the next phase to commence in 2023/2024.

Further information is available in TII's '2022 Annual Report'.

## 2.5 Target 1: Decarbonisation

### 2.5.1 TII's baseline and current GHG emissions from energy

TII's baseline (2016-2018 [annual average]) GHG emissions from energy is 28,533 tonnes of carbon dioxide (tCO<sub>2</sub>). In 2022, TII's GHG emissions from energy were 24,284 tCO<sub>2</sub>, a reduction of 15% from the baseline. The change in tCO<sub>2</sub> from the baseline to 2022 was due to:

- **Electricity emissions:** The reduction from the baseline to 2022 can be mainly attributed to supply-side improvements from electricity grid decarbonisation. In 2022, emissions from TII's electricity consumption were 20% less than the baseline.
- **Thermal emissions:** Between the baseline and 2022 there was an increase in thermal emissions of 5%, due to an increase in oil and gas consumption in TII's depots and buildings.
- **Transport related emissions:** Between the baseline and 2022 there was an increase in transport-related emissions of 10%, due to increased transport fuel consumption.

### 2.5.2 TII’s decarbonisation target for 2030

TII’s decarbonisation target is set by SEAI. SEAI calculates the 2030 decarbonisation target using the data reported to the M&R system and SEAI emissions projections for electricity.

TII must reduce total GHG emissions from energy by 72% overall (total emissions) and by 51% for non-electricity emissions (transport and thermal) by 2030 compared to the 2016-2018 (average) baseline.

The total emissions target is calculated using the 51% required reduction in non-electricity emissions and SEAI’s projection for supply-side emissions reduction for the electricity grid (77%), compared to the baseline. These steps have been set out below in **Table 4**. This results in a total emissions reduction target of 72% by 2030 for TII, compared to the 2016-2018 (average) baseline. As SEAI update projections for the electricity grid, the total emissions target is subject to change in line with expected electricity grid decarbonisation.

**Table 4** Decarbonisation Target Calculation

Decarbonisation target calculation
+ non-electricity target for 2030*
+ electricity emissions at the baseline
- minus the projected supply-side emissions reductions from electricity grid decarbonisation by 2030
= 2030 total emissions target
<i>*Non-electricity target = 51% reduction in energy-related thermal and transport emissions by 2030</i>

TII’s target reduction of 72% in total emissions requires an overall reduction in GHG emissions from energy of 20,661 tCO<sub>2</sub> compared to the baseline, as shown below in **Table 5**.

**Table 5** 2030 Target GHG Energy Emissions Versus Baseline

[tCO <sub>2</sub> ] TFC	2016-2018 (average) Baseline	Reduction target %	2030 Target	Baseline minus 2030 target
<b>Electricity</b>				
Electricity	23,117	77% (based on anticipated grid decarbonisation)	5,218****	17,899
<b>Non-electricity</b>				
Thermal	1,808	51%	886****	922
Transport	3,608	51%	1,768****	1840
<b>Non-electricity Total*</b>	<b>5,416</b>	<b>51%</b>	<b>2,654</b>	<b>2,762</b>
<b>Total GHG Emissions</b>				
Total GHG emissions**	28,533	72%***	7,872	20,661
<p>*Non-electricity total = thermal + transport  **Total GHG emissions = electricity + non-electricity  ***This target will fluctuate in line with changes to the emissions forecasts published by the SEAI  ****CAP23 only specifies targets for non-electricity emissions and for total emissions. Thus, 2030 targets for electricity, thermal and transport are calculated based on projected emissions in 2030, as there is no specific target set for those emissions.</p>				

### 2.5.3 TII’s planned projects expected to reduce GHG emissions from energy

TII has planned several projects that will contribute to a reduction in the GHG emissions associated with energy use. **Table 6** below sets out the projects where energy savings are quantified, along with their energy offset shown in kilowatt-hours per annum (kWh TFC/annum), and the expected years of implementation. The projects take place across a wide portfolio of locations, contracts, and fleets, and therefore delivery will be on a phased basis.

As energy efficiency is a key lever for decarbonisation, the decarbonisation model also includes emissions reductions from energy efficiency projects, such as LED lighting retrofits.

**Table 6** Planned TII Projects

Planned projects	Energy consumption avoided** (kWh TFC/annum)	Expected implementation years
Road network lighting projects in various phases	7.0m kWh	2023 - 2028
Installation of solar PV on all applicable road network management premises, in various phases.	1.3m kWh	2023 – 2028
Luas stop lighting projects and rolling stock lighting trials	0.11m kWh	2024 – 2025
Installation of rooftop solar PV arrays onsite at all Luas Depots	1.0m kWh	2025 – 2027
Transition of road network light and medium contractor diesel fleets to electric vehicles, in various phases.	3.7m kWh	2025 – 2028
Transition of road network heavy vehicle contractor fleets to alternative fuel (for example HVO), in various phases*	N/A kWh (The transition will reduce carbon emissions instead of fuel consumption)	2025 – 2029
Management premises transition from fossil fuel boilers to electric heat pumps	0.15m kWh	2029

\*These projects are added only in the decarbonisation model, as they will have no impact on energy efficiency.

\*\* The total energy savings estimated take into consideration the increases in energy consumption as a result of implementing said projects.

By 2030, TII’s planned projects are modelled to result in an overall emissions reduction of 3,669 tCO<sub>2</sub>. Each of these projects are at different stages of the project life cycle. TII has identified six energy projects that are currently at the tendering and contracting stage. This cohort of projects significantly contributes to the total primary energy savings. An additional six energy projects have been identified as at the design stage.

The remaining 15 projects are not as advanced in readiness and include projects at concept and prioritisation stage. Such projects include later phases of road network lighting, solar PV, and fleet fuel transition. Details on each of these projects are provided in **Appendix D**.

### 2.5.4 Projected 2030 GHG emissions from energy – Business as Usual

The Business as Usual (BAU) scenario projects TII’s GHG emissions from energy to 2030, if no new emissions reduction projects are implemented. In the BAU case, emissions savings are incurred due to supply-side reductions from the decarbonisation of the electricity grid and increased biofuel blending rates.

In the BAU scenario, a gap-to-target would remain in 2030. As outlined below in **Table 7** and **Table 6**, TII’s non-electricity emissions (thermal and transport) are expected to be 5% higher in the BAU 2030 scenario than the baseline. However, TII could expect a reduction in total emissions (electricity and non-electricity) of 61% by 2030 in the BAU scenario, resulting in a gap-to-target of 11% points to the target (72%), a gap-to-target of 3,310 tCO<sub>2</sub>.

### 2.5.5 Projected 2030 GHG emissions from energy – With Project Pipeline

The ‘With Project Pipeline’ scenario models the emissions savings that would result if TII’s planned project pipeline was implemented as outlined above in **Table 6** and below in **Figure 6**.

In this scenario, TII’s total GHG emissions from energy are modelled to be 7,661 tCO<sub>2</sub> in 2030, considering both the supply-side decarbonisation and the planned projects, which will contribute to a reduction in GHG emissions. This is a decrease of 73% from the baseline, as shown below in **Table 7**. In the ‘With Project Pipeline’ scenario, TII meets its target.

The scenario analysis demonstrates the need for TII to implement a pipeline of projects to reach the 2030 target. However, there are costs, challenges, and risks associated with implementing the project pipeline. Without the allocation of additional funding and resources, this pathway to meeting the decarbonisation target as described in the ‘With Project Pipeline’ scenario may not be achievable for TII.

**Table 7** GHG Emissions from Energy – 2030 Projections

[tCO <sub>2</sub> ] TFC	2016-2018 (average) Baseline	2030 Target emissions	‘Business as Usual’ Scenario			‘With Project Pipeline’ Scenario		
			2030 emissions	% Change from baseline to 2030	Gap-to-target in 2030	2030 emissions	% Change from baseline to 2030	Gap-to-target in 2030
<b>Electricity</b>								
Electricity	23,117	5,218	5,504	-76%	-	5,007	-78%	-
<b>Non-electricity</b>								
Thermal	1,808	886	1,896	+5%	-	1,841	+2%	-
Transport	3,608	1,768	3,781	+5%	-	813	-77%	-
<b>Non-electricity Total*</b>	<b>5,416</b>	<b>2,654</b>	<b>5,677</b>	<b>+5%</b>	<b>3,024</b>	<b>2,654</b>	<b>-51%</b>	<b>NIL</b>
<b>Total GHG Emissions</b>								
<b>Total GHG emissions**</b>	<b>28,533</b>	<b>7,872</b>	<b>11,182</b>	<b>-61%</b>	<b>3,310</b>	<b>7,661</b>	<b>-73%</b>	<b>NIL</b>
*Non-electricity total = thermal + transport								
**Total GHG emissions = electricity + non-electricity								

**Table 6** shows TII’s projected emission pathways to 2030, with modelled emissions in the ‘With Project Pipeline’ scenario reaching the 2030 target.

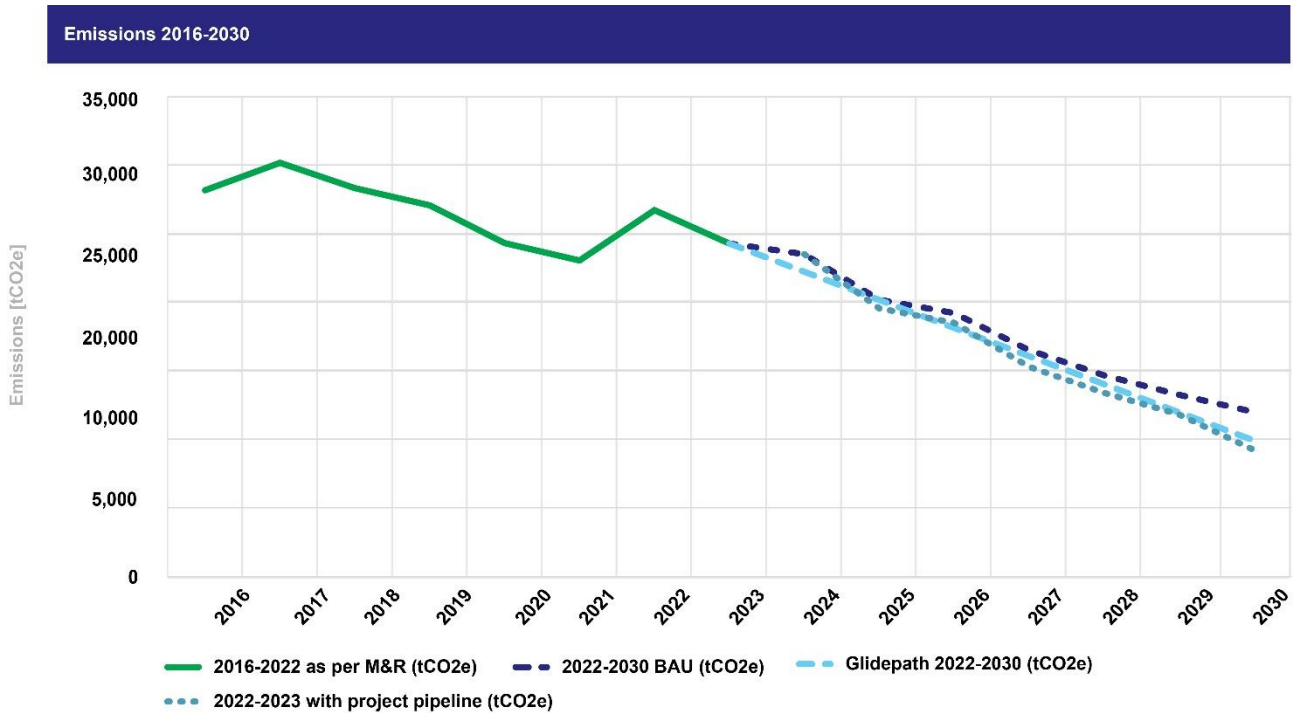


Figure 6 Decarbonisation pathway to 2030

### 2.5.6 Impact of decarbonisation initiatives

Table 8 shows the relative impact of each decarbonisation initiative towards the total emission reduction expected from 2023 to 2030. This excludes supply-side decarbonisation, as if it were to be added, supply-side decarbonisation would account for the biggest total contribution. As shown in the table below, the biggest contribution towards total emission reduction is expected from the implementation of low-carbon fuel initiatives for TII’s fleet (such as biofuels and electric vehicles), which account for approximately 75% of the total. A sizeable contribution is expected from lighting retrofits, which contributes 18% of the total.

Table 8 Impact of decarbonisation initiatives towards total emission reductions in 2030 (excluding supply-side decarbonisation)

Decarbonisation Initiative	Total in-target emissions
Retrofits & efficiency	18%
Heat pumps	1%
Electric vehicles	33%
High-blend biofuels	42%
100% RES-E	6%
<b>Total modelled changes</b>	<b>100%</b>

The electrification of vehicles will result in a decrease in scope 1 emissions, but an increase in scope 2 emissions from increased electricity use. It is expected that as the grid decarbonises, overall emissions will decrease.



In 2024, it is expected that the Luas timetable will increase in frequency to accommodate additional services and more passengers. The increased service will result in an expected 0.7% increase in emissions compared to total emissions in 2022. This increased activity is included in the gap-to-target tool (in accordance with the SEAI guidance) under “other increases in energy consumption, e.g. new facilities, more activity, expansion”. The magnitude of increased activity is based on available information and assumptions at the time of the Roadmap’s development. Subsequent Roadmaps and modelling should have this increase factored directly into the BAU during the gap-to-target tool’s set-up by SEAI. The increased service is expected to have a positive impact for service users as the increase in service will enable more people to use public transport rather than driving; which will have an impact on reducing road user emissions.

### 2.5.7 Implementation timeline

Figure 7 below outlines the expected implementation timeline for the projects considered in the Gap-to-target model. The year represented in the timeline refers to the expected date of completion of the project.

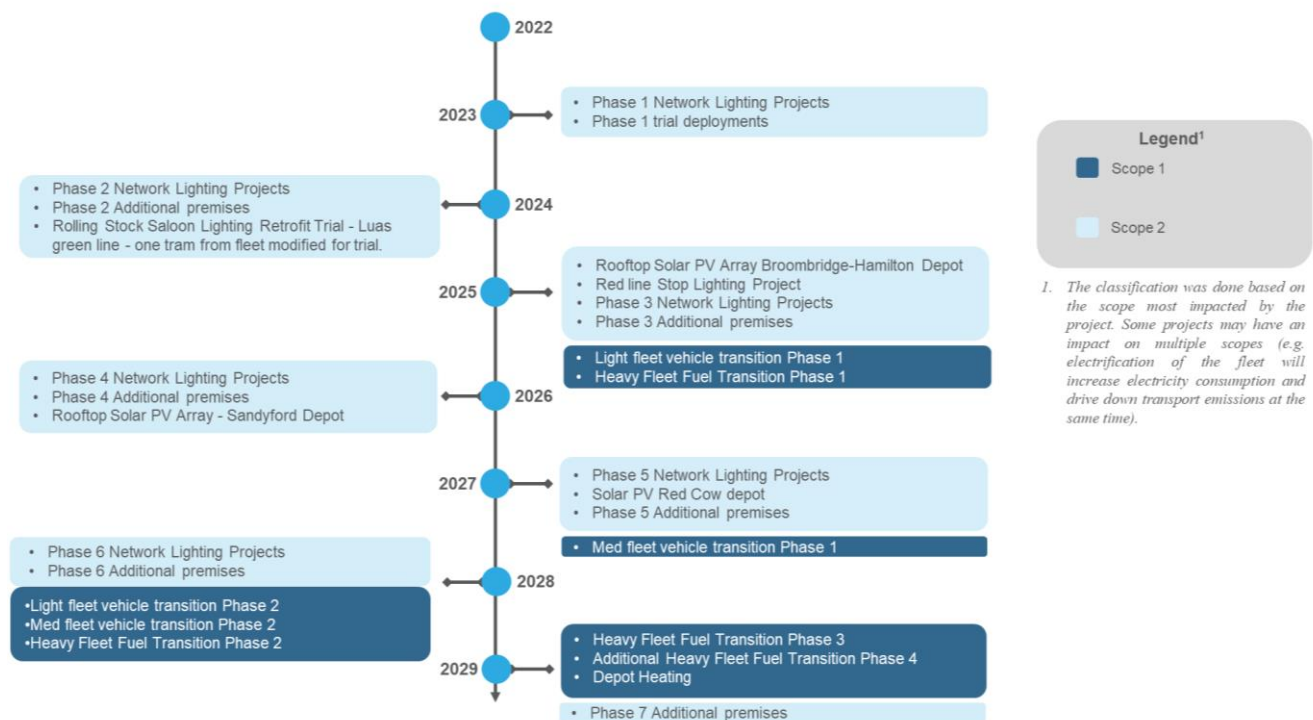


Figure 7 Project implementation timeline

## 2.6 Target 2: Energy efficiency

### 2.6.1 Measuring TII’s energy efficiency

Delivering energy efficiency projects have a variety of benefits including reducing GHG emissions, reducing demand for energy imports, and lowering energy costs.

TII measures its energy efficiency annually using an Energy Performance Index (EnPI). EnPI is calculated using annual energy consumption and a measure of TII’s annual activity, known as an activity metric.

The EnPI for each year is normalised to allow comparison against the energy performance in the baseline year (2009) against subsequent years, this is called the normalised Energy Performance Index (nEnPI).

### 2.6.2 TII’s energy efficiency target for 2030

To achieve the public sector 2030 target of an energy efficiency improvement of 50%, TII’s nEnPI must be less than 50%.

### 2.6.3 TII’s planned projects to improve energy efficiency

As set out in Section 2.5.3, decarbonisation projects also support TII’s improvements in energy efficiency. The projects outlined above in **Table 6** feed into the energy efficiency model to provide an assessment of TII’s anticipated performance against the energy efficiency target.

### 2.6.4 Energy efficiency improvement and gap-to-target

Based on the SEAI methodology, the BAU forecast of TII’s nEnPI is estimated to reach 54% in 2030, indicating an energy efficiency improvement of 46% compared to the 2009 baseline, as shown below in **Table 9**. A gap-to-target of 4% remains in the BAU scenario. Energy reductions related to the decarbonisation projects (described in Section 2.5.3) will improve TII’s energy efficiency by a further 7%, meaning TII could reach a 53% improvement in energy efficiency. TII is expected to achieve an overall energy efficiency improvement of 46-53% depending on the delivery of the planned projects.

**Table 9** Energy Efficiency Model Results

	Target	2030 BAU Projection	2030 Projection with projects
nEnPI	50%	54%	47%
Energy efficiency improvement versus 2009 baseline	50%	46%	53%
Gap-to-target in 2030	NIL	4%	NIL (Target exceeded by 3%)

The modelling shows a continuing trend of improvement, with substantial improvement in energy efficiency since the baseline year of 2009, as shown in **Figure 8** below. In 2022 the nEnPI was 69%, equating to an energy efficiency improvement of 31% since 2009.

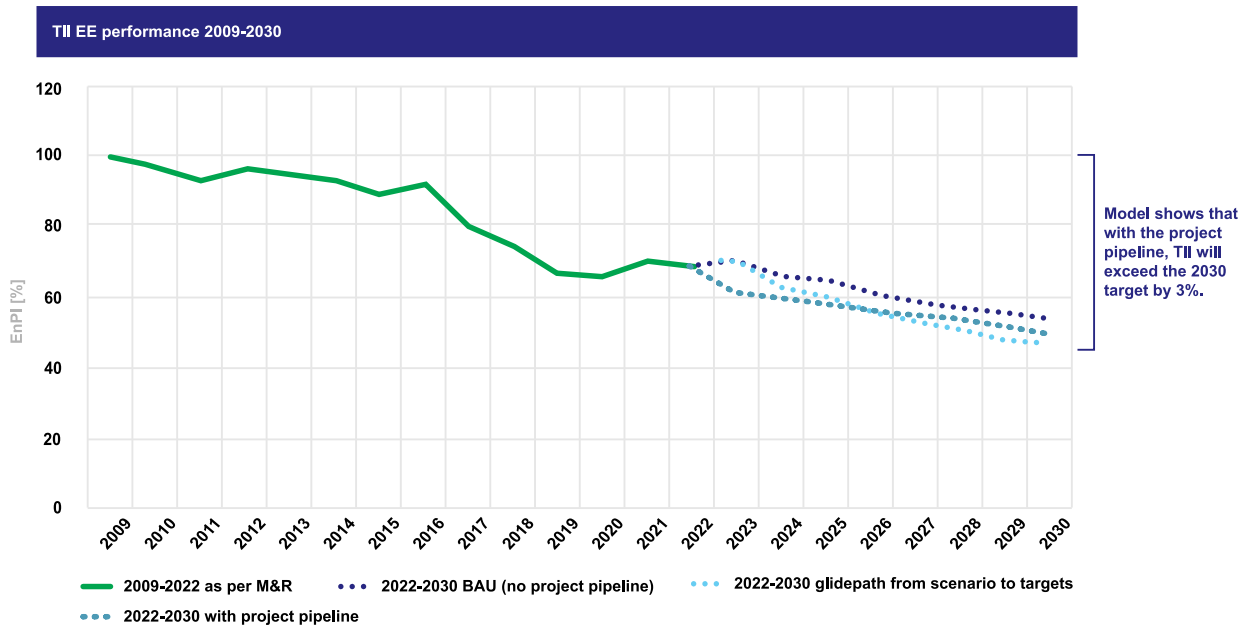


Figure 8 Energy Efficiency Path to 2030

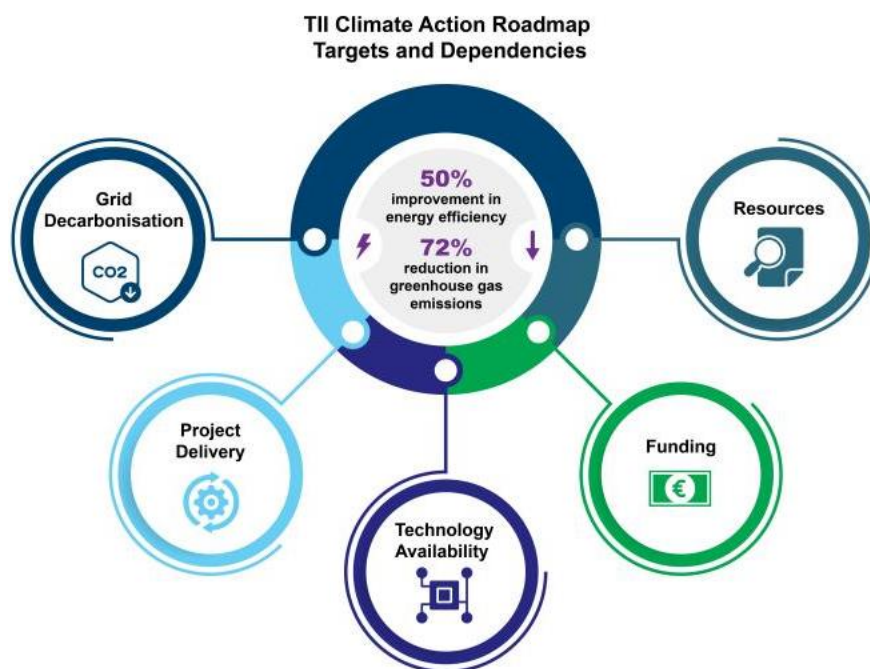
Table 10 below outlines some of the areas of focus for improving energy efficiency across TII’s activities.

Table 10 Energy Efficiency and Decarbonisation Activities

Operation and Protection and Renewal	
Decarbonisation of assets	TII is investigating decarbonisation opportunities across its assets and operations. TII has identified the three Luas depots as being suitable locations for the generation of renewable electricity. TII has commenced phase one of a renewable energy project which involves the installation of rooftop solar photovoltaic (PV) arrays. This will contribute to national climate adaptation and mitigation efforts through on-site generation of electricity reducing TII’s reliance on the national grid. TII is reviewing wider opportunities for rooftop or ground mounted PV at its motorway protection and renewal depots distributed across the NRN and where feasible will develop on-site generation projects.
Energy efficiency	
Public Sector Energy Efficiency Targets	TII is working to meet the public sector energy efficiency targets for 2030. For example, TII’s headquarters now operate with greater efficiency, due to the replacement of core heating and cooling equipment on all Parkgate Street buildings. Similar core equipment upgrades have also been completed at the Luas Sandyford depot buildings following the extension of the depot. Additionally, all lighting is equipped with LED energy efficient technology. Changing work practices such as those addressed in TII’s blended working policy are challenges that will be addressed in future versions of the Roadmap.
Building Management System	Spatial and water heating is controlled from a central BMS (Building Management System), and an intelligent lighting system operates based on people’s presence and activity within the offices. This enables improved energy efficiency and is particularly important given the newly established hybrid working.

## 2.6.5 Risks

This section outlines the risks to meeting the decarbonisation and energy efficiency targets within the Roadmap. **Figure 9** illustrates some of the key risks in achieving the targets. Limitations to the model are set out in **Appendix C**.



**Figure 9** Climate Action Roadmap, Targets and Dependencies

### 2.6.5.1 Performance of the national grid

GHG emissions savings are highly sensitive to changes in the national electricity grid carbon emissions factors. These carbon emissions factors change from year to year as the efficiency of the electricity grid changes. Ireland's electricity grid has significantly decarbonised in recent years, and it is expected that this trend will continue, as fossil fuels are phased out of power generation. Recent years have seen a backwards shift: for example, in 2021, emissions associated with electricity production increased by 18% from 2020. This is due to:

- Increased electricity demand
- Less wind power availability; and
- The use of older plants including a coal fired plant.

However, 2022 saw total emissions fall to 2019 levels, decreasing by 9% compared to 2021. The increased GHG emissions in 2021 and 2022 compared to previous years is not expected to become a trend for Ireland's electricity production. However, it illustrates the sensitivity of the grid to these compounded factors and impacts on energy efficiency modelling.

The SEAI publishes projections for supply-side emissions reductions, based on the decarbonisation of the electricity grid and the anticipated increased proportions of biofuels blended in liquid transport fuels. In the most recent projections, the emissions intensity of the national grid is expected to reduce by 77% by 2030, from the 2016-2018 (average) baseline. The forecasts incorporate many variables and assumptions. TII's modelling relies upon these SEAI-provided inputs.

It is important to specify that changes in grid performance will be reflected in a corresponding adjustment in the SEAI gap-to-target model. Specifically, changes to the projected decarbonisation of the grid by 2030 will be reflected in a corresponding change within the gap-to-target model. The risk associated with the performance of the national grid falls outside TII's control.

#### **2.6.5.2 Funding and Resourcing**

The projects that have been included in the model vary in terms of project readiness from concept to tender/contracting stage. The projects which are at concept stage have not yet been developed to any significant extent beyond simple scoping and early-stage engagement. Other projects are at a more advanced stage with well-defined designs and technical specifications. Projects that are currently at concept stage cannot be considered equivalent to those that are at a tendering stage. For TII to deliver the emissions savings projects, significant additional funding and resources will be needed. A programme of targeted investment will be required to deliver the planned projects and support the associated monitoring and maintenance into the future.

#### **2.6.5.3 Availability of Hydrogenated Vegetable Oil (HVO) and Electric Vehicles**

As set out in Section 2.5.6 above, a significant portion of the target will be achieved via the transition to high-blend biofuels, such as HVO. HVOs result from the process of hydrotreatment of virgin or waste vegetable oils. They are one of the potential solutions for reducing carbon emissions in heavy-duty vehicle transportation in the near to medium future. Nonetheless, their production and market uptake face significant obstacles throughout their supply chain. Given the sizeable contribution that is expected to result from HVOs (42% of the total excluding supply side reductions), they are instrumental for TII to reach the targets.

HVO production (particularly from refined vegetable oils like rapeseed and palm oil) consumes a significant amount of energy. Even though raw materials from certain waste or by-products (such as tall oil, tallow, or used cooking oil), have shown better environmental performance and lower costs, the availability of these is limited, and larger volumes would require the use of additional raw materials. The availability of low-priced waste vegetable oil is crucial for the economic viability of HVO production. Their production and use are also associated with complex environmental issues and trade-offs, namely; concerns about land use change, environmental impacts, supply chain ethics, raw material availability, and economic viability (Sunde et al, 2011; Lorenzi et al 2019; Martinez-Villarreal et al, 2023). This will be a risk for TII if HVO is a consistently viable option for organisations to reduce their carbon emissions in the coming years.

Within the model, the transition to EVs accounts for a third of the overall target. While this transition should be relatively straightforward for the light vehicle classes such as passenger cars, the transition will be more complex for heavier duty vehicles such as winter maintenance trucks.

## **2.7 Decarbonisation and energy efficiency summary**

TII's Roadmap modelling, using the SEAI methodology and various SEAI inputs, identifies a path to achieving the targets set out for TII in Chapter 10 of the CAP23, based on a combination of supply-side emissions reductions and a portfolio of projects. The modelling is based on what is assumed to be technically feasible in the period to 2030.

Delivery of the project portfolio has started but will take years to complete. Project costs will be assessed as each project progresses from concept to delivery in line with standard project appraisal guidelines. Some projects will induce an increased operation cost rather than a capital cost. In some cases, ongoing savings arising from a project may defray capital cost.

TII is committed to achieving its targets, however, it must be recognised that success is dependent on some factors that are outside TII's control, including:

- The grid decarbonisation progressing as forecast.
- Additional funding and resources for the delivery of planned decarbonisation and energy efficiency projects.
- Developments in the medium classes of electric vehicles (EVs) to provide sufficient range for the long-distance Motorway Maintenance and Renewal Contract (MMaRC) operations; and
- The widespread availability of HVO (or the maturation of some other technology or fuel) for the Heavy-Duty Vehicle (HDV) classes.

TII acknowledges that additional or alternative solutions may emerge in coming years and that the medium- and longer-term elements of some of the projects are subject to review and reconsideration in the light of any developments that might enable TII to meet its targets.

### 3 TII'S INFLUENCE ON EMISSIONS

#### 3.1 Context

TII is working with partners, stakeholders, and suppliers to reduce the overall emissions associated with construction, operation, and protection and renewal of transport infrastructure, and use of TII's transport networks.

This chapter discusses TII's influence on emissions; outlines TII's key levers of influence (TII staff, TII's supply chain, the wider industry, partnerships, and road users), and sets out some of the projects under each lever. TII's influence is underpinned by a holistic approach, considering social value, biodiversity, and wider environmental impacts as part of the transition to a net-zero future and sustainable mobility outcomes.

#### 3.2 Emissions context

##### 3.2.1 Ireland's climate commitments

Ireland's goal is to become climate resilient, biodiversity rich, and environmentally sustainable, with a climate neutral economy no later than 2050. In April 2022, Ireland's first carbon budget was published by the Irish Government to provide a framework for reducing GHG emissions and set milestones on the path to achieving the 2050 goals. The Sectoral Emissions Ceilings released in July 2022, determine how each sector of the economy will contribute to achieving the carbon budget. The transport sector requires a reduction of 50% from 12 million tCO<sub>2</sub>e in 2018 to 6 million tCO<sub>2</sub>e in 2030. To address the climate crisis, the transport sector must reduce emissions associated with travel and decarbonise infrastructure and services.

**Table 11** below shows the expected levels of emissions change to 2030 for the transport sector, as shown in Chapter 15 of CAP 23. The range of measures modelled to achieve this emissions change includes known public transport schemes as set out in the National Development Plan (NDP). The emissions for the transport sector decarbonisation pathway were modelled by the National Transport Authority (NTA).

*Table 11 Expected Levels of Emissions Change to 2030*

Modelled Growth / Reduction in Emissions	Car	HGV	LGV	PT	Other	Total (Mt CO <sub>2</sub> e)
Demographic Growth	0.62	0.73	0.01	-0.01	0.48	<b>1.84</b>
Sustainable Transport and Behavioural Change	-1.06	-0.27	-0.08	-	-0.68	<b>-2.09</b>
Electrification and Vehicle Technology	-2.99	-0.29	-0.22	-0.38	-0.86	<b>-4.74</b>
Biofuels	-0.36	-0.36	-0.11	-0.02	-0.24	<b>-1.08</b>
<b>Total</b>	<b>-3.79</b>	<b>-0.19</b>	<b>-0.40</b>	<b>-0.41</b>	<b>-1.30</b>	<b>-6.08</b>

##### 3.2.2 Overall emissions

**Table 12** below defines each of the GHG Protocol scopes of emissions and explains the relevance of each to TII. Chapter 2 of this Roadmap primarily addresses scope 1 and 2 emissions, over which TII has control. This Chapter addresses TII's influence over scope 3 emissions.

**Table 12** Definitions of scopes and Relevance to TII

	Definition	Relevance to TII
Scope 1	Direct GHG emissions. These occur from sources that are owned or controlled by the organisation, for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc. emissions from chemical production in owned or controlled process equipment.	This area covers gas and oil on-site combustion in offices and depots, for heating and hot water. It also includes fuels e.g., petrol and diesel, which are used primarily in contractor protection and renewal fleets operating on the light rail and road networks.
Scope 2	Indirect GHG emissions. These are emissions generated from the purchase of electricity consumed by the organisation. These emissions are “indirect,” meaning the release of GHGs is physically occurring off-site on behalf of the organisation in question.	This includes electricity for TII’s offices and depots, Luas network and the NRN. For example, traction, lighting, signage, cooling and ventilation.
Scope 3	Indirect GHG emissions. These emissions are a consequence of the activities of the organisation but occur from sources not owned or controlled by the organisation. Some examples of scope 3 activities are extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services.	<p>This includes all emissions associated with construction and protection and renewal of TII infrastructure and services, for example embodied emissions from constructing a new road and the associated emissions from material supply chains. This also includes the emissions from water, business travel, waste and purchasing.</p> <p><i>Road users</i> The largest source of emissions comes from the vehicles driving on the network. This includes direct and indirect (in the case of electric vehicles) emissions from road users, passenger vehicles, public transport, commercial vehicles. TII has an important role to contribute to influencing the reduction of these emissions.</p>
<p>Note: TII’s role is to provide sustainable transport infrastructure to facilitate the movement of people and goods across Ireland.</p>		

In 2018 scope 1 and 2 emissions accounted for less than 1% of TII’s total GHG emissions, with scope 3 accounting for the remaining 99%. Whilst addressing scope 1 and 2 emissions is a fundamental part of climate mitigation, TII recognises the need to address wider scope 3 emissions given the nature of the organisation and its wide sphere of influence on the transport ecosystem. **Figure 10** shows the breakdown of TII’s scope 3 emissions across TII’s operations, construction and protection and renewal of the National Roads and Luas networks and road user emissions from the NRN.



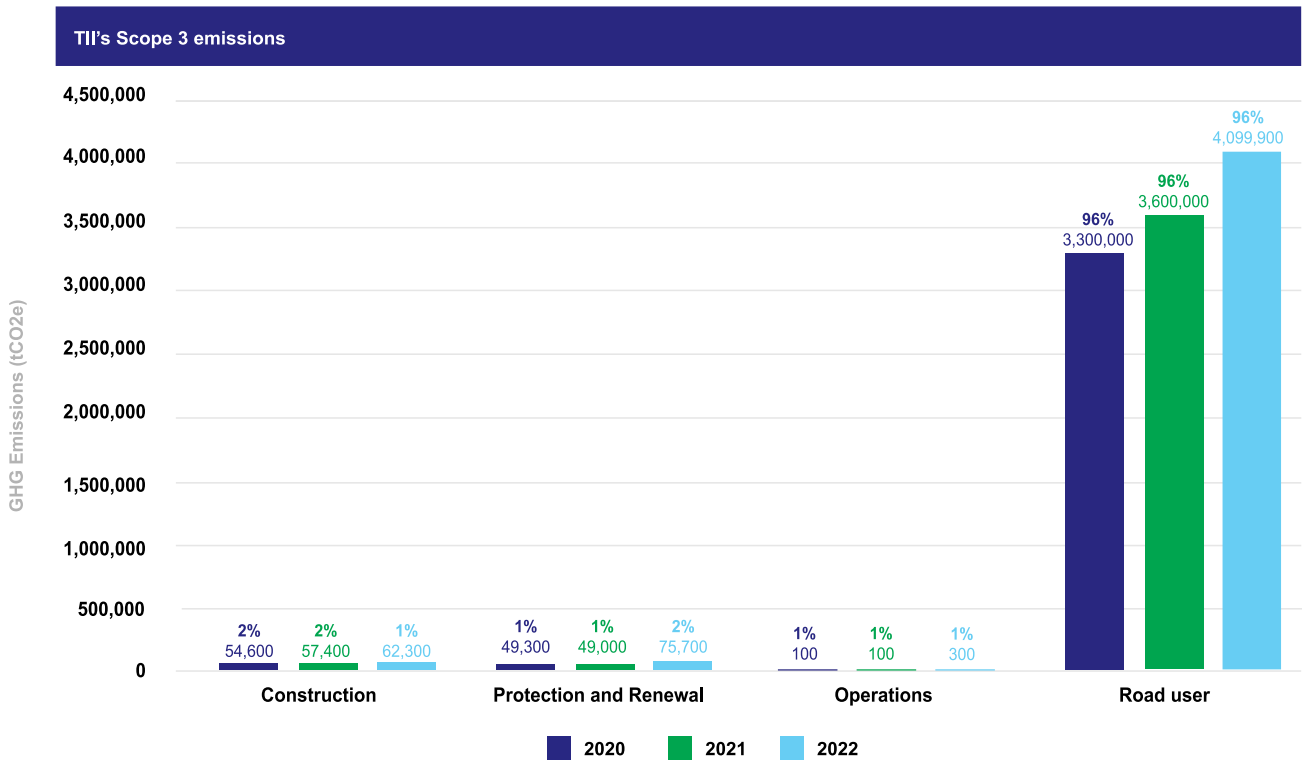


Figure 10 TII's scope 3 emissions from 2020 to 2022<sup>4</sup>

In addition to the energy-related projects detailed in Chapter 2, TII is implementing programmes and projects to advance a broad range of climate and sustainability objectives, including influencing scope 3 emissions. While not directly responsible for the reduction in road user emissions, TII actively supports government policy targeted at reducing road user emissions in Ireland, remaining agile to evolving targets, technologies, and transport needs.

### 3.3 Public Sector Climate Action Mandate

The CAP23 Public Sector Climate Action Mandate (the Mandate) focuses predominantly on reducing scope 1 and 2 emissions and must be adopted by public sector bodies, including TII, as a means of leading by example in terms of the organisational changes required to decarbonise. The Mandate sets out requirements for action and reporting across the following areas:

- GHG emissions targets
- People
- Ways of working
- Buildings and vehicles

The SEAI issued updated guidance to the public sector in June 2023, setting out the minimum evidence requirements to demonstrate adherence to the Mandate. The guidance states that each organisation's Roadmap must be approved by the most senior management level within the organisation.

<sup>4</sup> Emission figures for 2022 are provisional, moreover, scope 3 emissions include additional categories not available in previous years. Better quality data for the years 2020-2021 resulted in an update to emissions previously reported.

TII is already actively implementing the actions set out in the Mandate (as a minimum). The status of these measures is detailed in **Appendix A**.

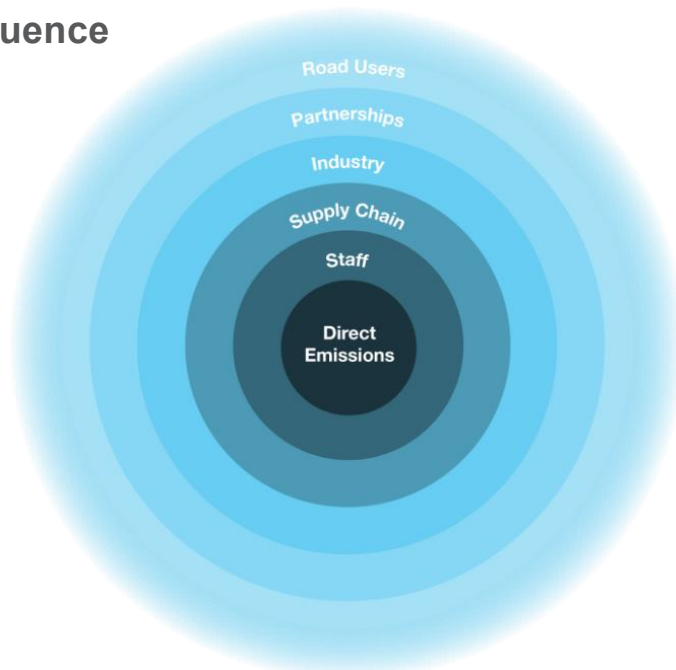
### 3.4 Levers of Influence

TII provides sustainable transport infrastructure and services to facilitate the movement of people and goods across the country, supporting economic growth, respecting the environment, and delivering a better quality of life for citizens.

To fulfil its function while lowering emissions, TII has adopted an integrated approach to implementing climate action and sustainability across the organisation.

While not all emissions are under the control of TII, TII is indirectly responsible for scope 3 emissions and can influence emissions across the supply chain and transport ecosystem. Six levers of influence have been identified, shown in **Figure 11** below. The first lever, direct emissions, is addressed within Chapter 2 of this Roadmap. This chapter will address each of the remaining levers.

## TII Influence



**Figure 11** TII's influence on emissions

#### 3.4.1 Level 2: Staff: A skilled and influential workforce

Delivering on emissions reductions and collaborating with partners towards a sustainable transport system requires strong leadership and embedding a culture of sustainability across the organisation.

TII staff play an important role in delivering, managing, and influencing projects and organisational activities that will contribute to emissions reductions. Enabling collaboration among staff, facilitating knowledge sharing, and providing opportunities for staff to develop innovative solutions supports TII's climate action agenda.

TII staff are encouraged to enhance their knowledge and expertise by participating in transnational and national research projects relating to road, light rail and cycling infrastructure and services. Initiatives such as the Government’s annual “Public Service Transformation Week”, and regular TII webinars relating to sustainability and climate action, empower TII staff to discuss new methods and approaches for delivering projects more sustainably. All-staff webinars on energy-related matters, in addition to other sustainability and climate action initiatives featured as part of TII’s programme for Transformation Week in October 2022. Further training has been a key focus area for TII in 2023, continuing to 2024.

In Q4 2022 TII carried out an Employee Engagement Survey which included questions relating to the topic of sustainability. The findings, summarised below, suggest that sustainability is being effectively communicated and promoted to TII employees:

- 81% of respondents understand how sustainability is relevant to their role at TII.
- 79% stated that TII effectively communicates the importance of sustainability to employees.
- 71% stated that sustainability is effectively promoted at an organisational level by Senior Management.
- 70% stated that sustainability is effectively promoted within their department by managers and the rest of the team.
- 74% stated that TII uses the right channels to engage on sustainability.

Engaging internal communications are key to embedding sustainability across TII. In Q1 2023 TII launched a Sustainability Education, Engagement & Awareness Programme (EEAP). The programme features a wide range of sustainability-focused information sessions which are scheduled throughout the year. Key events and milestones are incorporated into the EEAP schedule. Additional training material is being created to support the EEAP. A dedicated sustainability section is included in the bi-weekly CEO update to all staff and on TII’s intranet page. TII staff are also engaging with local authorities and other partners to share knowledge and skills.

As an employer, TII influences business travel and commuting to work emissions. As part of the M&R data, TII tracks business travel through collecting data on flights, public transport and car use. In 2023 TII will update its Business Travel Policy to recognise the need to balance the business needs for travel and the requirement to reduce emissions. TII is establishing a working group to propose principles that will underpin changes to the policy.

Promoting sustainable modes of travel and behaviour change is a priority for TII. However, to successfully implement such initiatives, TII is aware of the effort that is required to provide the adequate facilities and infrastructure necessary for employees to engage in active travel. More specifically, TII provides employees with a dry room, arranges bike maintenance sessions for staff and is currently upgrading its facilities to further provide for the needs of bike users.

TII has introduced a variety of initiatives to promote active travel and behaviour change. For instance, TII engages in a variety of campaigns aimed at promoting walking and cycling including:

- Regular travel to work surveys and communication of same to staff to raise awareness on sustainable mobility.
- Bike-to-work scheme offering to help staff purchase a bike for commuting.
- 4-week *Marchathon* step challenge (12 teams and 50 staff).

- ‘Ready Set Cycle’ programme over 10 weeks encouraging cycling among staff, which comprises a call for 10 cycling champions, promotion of cycle to work scheme, a free bicycle repair clinic and a cycling distance competition.
- 4-week *Walktober* step challenge (10 teams and 40 staff).
- Planned participation in the ‘Smarter Travel Mark’ programme recently launched by the National Transport Authority (NTA) to support employers to develop voluntary Travel Plans focused on encouraging staff to sustainably and actively commute, considering flexible working arrangements.
- Active partner in the NTA ‘Smarter Travel Workplaces’ programme, promoting behaviour change among staff.
- Leasing of two E-bikes for Summer 2023 to allow staff engage in a “try before you buy” initiative.

Building on these efforts, TII updated its Blended Working Policy, incorporating insights from TII’s Smarter Travel Survey (2022) and best practice.

### 3.4.2 Lever 3: Supply Chain: Materials and Circular Economy, Asset Management and Ways Of Working, and Sustainable Procurement

Significant quantities of energy and materials are used in the protection and renewal, construction, and operation, of transport infrastructure and services. The extraction, processing and transportation of project materials requires energy and releases carbon, resulting in embodied carbon. Embodied carbon is the carbon dioxide (CO<sub>2</sub>) or GHG emissions associated with the manufacture and use of a product or service. For construction products, this means the CO<sub>2</sub> or GHG emissions associated with extraction, manufacturing, transporting, installing, maintaining, and disposing of construction materials and products.

TII will reduce resource consumption to address scope 3 emissions by re-thinking how existing infrastructure is used, and re-engineering systems to optimise material use, protection and renewal, repair, and refurbishment to increase the lifetime of TII’s assets.

#### *Materials and Circular Economy*

For TII, the implementation of a circular economy involves moving from a “waste” to a “value” approach to assets, components, and materials where they are kept at their highest value at all times and in use within the transport infrastructure system.

To achieve this, TII is developing a Circular Economy Policy and Strategy, which is due to be published in Q4 2023. It will focus on the areas of:

- Life Cycle Assessment,
- Materials Management and Data,
- Asset Management,
- Collaboration,
- Re-Engineering of Systems, and
- Procurement.

In particular, the following objectives are set out within the policy and strategy:

- Reduce resource consumption,

- Keep assets, components and materials at their highest value,
- Maintain safety and technical function of services, assets and components,
- Promote restorative and regenerative design, and
- Drive down emissions.

This aligns with the Whole of Government Circular Economy Strategy 2022-23 and the National Investment Framework for Transport in Ireland (NIFTI) and will embed circular economy principles throughout TII’s activities and standards thus influencing the wider construction and materials industry in Ireland.

Work to date has included working closely with the supply chain to minimise emissions from materials used within assets and undertaking research into materials optimisation and sustainable materials management. With the development of the policy and strategy, TII is now taking a systematic approach to capturing and retaining value at every lifecycle stage. The following case studies demonstrate some of TII’s initiatives to embed circularity and reduce carbon in whole scheme design.

**Case Study – Luas Finglas Circular Economy Pilot**

Luas Finglas is the planned extension of the Luas Green Line, running from Broombridge to Charlestown through Tolka Valley and Finglas village. The Preferred Route for Luas Finglas is approximately 4km long with four stops. Approximately 70% of the proposed route will be grass track. Five key circular opportunities for the project were identified and developed through the pilot:

1. Track Design for Disassembly
2. Hierarchy of excavated materials
3. Active travel, inclusive design and network integration
4. BIM and material data integration
5. Nature-based solutions and regeneration of public space

The proposed grass track design saves approximately 40% in the embodied carbon associated with construction and maintenance materials – primarily concrete and steel. As a result of implementing a circular economy approach for excavated materials and connecting this into ground investigation analysis, approximately 21,000m<sup>3</sup> (around 38,000 tonnes) of expected excess made ground material is being matched with suitable reuse opportunities on the project and in the local area. Material data categories are being integrated in the project environment, including material types, sources, applications, whether they are recycled or reused, and recycling and reuse potential. Waste data categories are also being integrated. Soft landscaping features are included to act as Sustainable Drainage Systems (SuDS), filter strips, buffers and placemaking with added biodiversity value. The planting scheme reflects the soil available and needs of the area, ensuring a low future management regime. A biodiversity net gain approach as well as lighting and asset sharing and potential community uses to activate the area are being explored with project stakeholders including Dublin City Council, Fingal County Council and local environment groups to build community ownership, increase resource efficiency and regenerate local ecosystems.

### Case Study – Mass Haul Tool

Appropriate consideration of earthworks is necessary at the early stage of design and planning, at Phase 2 (Option Selection) and Phase 3 (Design and Environmental Evaluation), to achieve objectives such as circular economy, waste minimisation, optimal material re-use, emissions reduction and a well-informed and sustainable design.

Mass Haul involves the assessment of the allocation and haulage of material across a scheme. However, an effective Mass Haul assessment should consider factors such as topography, proposed road alignment, earthworks volume, ground conditions, material sources and destinations and haulage constraints, with a level of detail appropriate for the Project Phase and project-specific objectives. The level of detail must also be balanced with what is reasonable with respect to the Project Phase and the level of information which can be practicably obtained.

To assist with this process, two Excel-based tools have been developed which undertake material analysis, produce summary Mass Haul diagrams, conduct further haulage analysis, and highlight opportunities for more sustainable design through earthworks and haulage optimisation. The tools were released in 2022 and are available to all interested parties for use.

### Case Study – Dunkettle Interchange Upgrade Scheme Materials Management

Several good practice measures have been implemented on the Dunkettle Interchange Upgrade Scheme to minimise the impact of the construction of the project on the surrounding environment.

For example, TII and the contractor have pursued a very successful strategy in sustainably sourcing general fill material. Under Article 27 Environment Protection Agency (EPA) licences from nearby developments supply over 450,000 tonnes of general embankment fill material to the site. This has led to a substantial reduction in the carbon footprint of the scheme associated with material transportation. On average, the fill material has been sourced from sites within an 8km radius of the site, while the closest licenced quarry source for such material is approximately 15km from site. There is also an added benefit of waste prevention whereby if the material did not get utilised as part of this scheme, in most instances it would have been disposed of at a licenced tip.

Similarly, approximately 3000 tonnes of topsoil has also been sourced under an Article 27 licence with similar benefits incurred in relation to reducing the carbon footprint of the scheme. The timber which is used on site is sourced from Forest Stewardship Council (FSC) aligned sources which ensures that high standards are met in terms of environmentally responsible and socially beneficial forestry practices, while also bringing co-benefits for carbon reduction.

## Asset Management and Ways of Working

Strategic asset management contributes to a circular economy by extending the life of National Roads, greenways, and light rail infrastructure to ensure the safety, resilience, availability, and efficiency of TII's transport networks. This approach in turn will minimise the total lifecycle cost to TII while preserving the asset value and maintaining services for road users. The TII Asset Management Strategy contributes to enabling circular economy principles whilst managing TII's complex transport network. TII oversees the delivery of ca. 200km (approx. €110 million) of pavement asset repairs and renewals each year. Investment in the TII pavement renewal programme ensures that the national road surface and structure is maintained to a high level. By having a robust maintenance programme, the need to reconstruct the NRN is reduced which in turn avoids additional carbon emissions. During the life of the pavement asset, varying levels of carbon emissions are generated depending on the road condition. Through optimal investment in the TII pavement renewal programme pavement condition is improved, and pavement maintenance is reduced.

In 2023 TII commenced a project to embed environmental and carbon Key Performance Indicators (KPIs) within the pavement asset renewal programme.

The project will ensure that lifecycle carbon and environmental benefits and impacts will be integrated within the pavement asset renewal programme. This project will also support evidence-based scaling up of decarbonisation initiatives on the network.

There are opportunities for carbon reduction in pavement renewals with methods being at varying levels of maturity. The case studies below set out some of the initiatives TII has progressed to reduce emissions across construction and protection and renewal, contributing to the CAP23 requirements to reduce industry emissions.

#### Case Study – Surface Course Layer Preservation

The surface course layer of road pavements ages and deteriorates with use. To restore the functionality of the surface course, the layer would typically be milled out and replaced every 10 to 20 years. Such maintenance intervention generates significant environmental impacts in terms of waste, use of primary resources, product manufacturing, emissions linked to transport and on-site plant use etc. In most cases, this maintenance approach can be substituted with a more sustainable one. Instead of leaving the surface course to deteriorate until a full layer replacement is required, a preservation or a rejuvenating product can be applied to the surface and upper part of the surface course. Such products are applied at defined intervals during the lifetime of the surface course to extend its functional life and therefore delay the need for full layer replacement. Preservation products slow down the ageing and deterioration processes while rejuvenating products partially reverse the effects from ageing and deterioration. Following the successful trial of a preservation product on the M1 in 2019 TII intends to include a specification for preservation and rejuvenating products in the next revision of TII Publication CC-SPW-00900 Specification for Roadworks – Series 900 Road Pavements - Bituminous Materials.

#### Case Study – Bio-based Asphalt Pavement Binder and Rejuvenator

The ‘Bio-based Asphalt Pavement Binder and Rejuvenator’ project is aimed at identifying a new sustainable bio-based (organic) source of asphalt pavement binder. Bio-binders are the product of processed bio-oil and serve as a substitute material for bitumen. The focus of the project will be on microorganisms from water purification (microalgae) or biomass from a by-product of a manufacturing process (e.g. waste cooking oil and lignin). The bio-binder project will identify a new sustainable asphalt bitumen (from a biomass) via three key objectives:

- To identify the most suitable biomass for production of the bio-based asphalt pavement binder.
- To identify the most suitable and environmentally friendly method of biomass processing – to produce the first bio-based asphalt binder.
- To evaluate the bio-based asphalt binder – via a programme of intensive testing:
  - a) As a full asphalt binder in a typical Irish asphalt pavement mix (SMA and HotMix Asphalt),
  - b) within aged bitumen only,
  - c) within an asphalt recycled mix, and
  - d) as healing agent in the asphalt self-healing system.

The state of the art of bio-binders in Ireland is considered to be a Technology Readiness Level (TRL) 2 according to TII Publication GE-GEN-01006 Guidelines for the Implementation of Innovation. Once this research is finalised TII expects it to be TRL 4. It is TII’s intention to trial the use of bio-binders on the pavement asset repair and renewal scheme on the network.

### Case Study – Asphalt Concrete

TII Publication CC-SPW-00900 Specification for Roadworks – Series 900 Road Pavements - Bituminous Materials is currently being reviewed in the context of allowable levels of Reclaimed Asphalt Pavement (RAP). Based on the successful completion of Pilot and Trial work on the N80 in collaboration with industry, South Dublin County Council and Kildare National Roads Office, a specification for incorporating high levels of RAP is currently under development (up to 70%). It is expected CC-SPW-00900 will be updated in 2023.

Other materials and methods that contribute to carbon reduction on schemes include the following:

- Low Energy Bound Material (LEBM) (in situ/ex situ recycling, CC-SPW-00900 already contains a specification for this material. The process has been used on portions of the N59. Phase two of this project commenced in June 2023 with another planned for Longford in 2024).
- Unbound and Hydraulically Bound Materials (TII Publication CC-SPW-00800 Specification for Roadworks – Series 800 Road Pavements – Unbound and Hydraulically Bound Mixtures allows the incorporation of recycled aggregates without impacting on durability).
- Pavement Preservation (rejuvenation, retexturing, crack sealing joint repair).

The following case studies demonstrate some of TII’s initiatives to embed circularity and reduce carbon in whole scheme design.

### Case Study – Irish Analytical Pavement Design Method (IAPDM)

The IAPDM developed by TII is a performance-based method of pavement design. The tool takes a circular and lean approach to pavement design. It models performance based on material characterisation and deterioration modelling. It takes into account field observations on in-situ foundation conditions. The analysis calculates rather than assumes material properties. IAPDM provides the opportunity to reduce bituminous material requirements and to incorporate reused and recycled materials into designs, reducing the embodied carbon associated with road projects. IAPDM has been used in the design of the pavement of the N5 Westport to Turlough Major Improvement scheme and is currently incorporated into the Contract for the N5 Scamogue to Ballaghaderreen Major Improvement. IAPDM has also been used in the design of a number of pavement asset repair and renewal schemes. Feedback from these schemes has been used to develop a training workshop delivered in May 2023 to delegates from Local Authorities, National Road Design Offices, Consultants, Contractors and material Producers. Further workshops will be rolled out to meet demand. On completion of the workshops the IAPDM tool will be used on all projects delivered with TII funding.

### Case Study – TII Carbon Tool

The TII Carbon Assessment Tool has been developed to assess carbon emissions throughout the entire lifecycle of a proposed project from early design to construction, maintenance, and end-of-life in accordance with PAS2080, Carbon Management in Buildings and Infrastructure. It assists TII and its contractors to comply with the GHG reporting requirements as outlined in the Environmental Impact Assessment (EIA) Directive (2014/52/EU). The tool has been recently upgraded to a web-based application where carbon savings can be identified throughout the project planning phase and to allow for new emerging carbon emission data to be included. The tool is accompanied by the User Guidance Document (GE-ENV-01106) Construction Embodied and Lifetime Maintenance Emissions. Currently, the tool is being used for a detailed benchmarking exercise to evaluate the embodied carbon associated with the construction of a typical road project and the functionality of the tool will be further advanced with the inclusion of cycleways.



**Case Study – Project Management Guidelines and Climate Assessment Guidance**

TII Publication PE-PMG-02041 Project Management Guidelines provides guidance to Project Managers regarding the processes and deliverables related to the planning, design, development and construction/implementation of National Road, Greenway and Public Transport Capital Projects which are funded through TII and/or TII is the Sanctioning Authority unless otherwise instructed by TII. Collectively, these documents will assist in ensuring consistency of approach in the delivery of these projects, including embedding sustainability across the project lifecycle. The Project Management Guidelines, which were updated in May 2023, include the requirement for compliance with TII Publications PE-ENV-01104 Climate Assessment Guidance and PE-ENV-01105 Climate Assessment of Proposed National Roads – Standard to assess GHG emissions associated with proposed road developments and consider the impact to the climate during all phases of TII projects.

These documents describe the minimum requirement to establish a comprehensive and consistent description and understanding of climate factors relevant to National Roads, Light Rail and Rural Cycleways.

**Sustainable Procurement**

A key part of reducing emissions through the supply chain is through sustainable procurement. Ireland has committed to implementing Green Public Procurement (GPP) / Sustainable Procurement in all tenders using public funds from 2023. TII procurement is valued at more than €500m annually and through its supply chain TII can influence GHG emissions reductions. TII has produced a Sustainable Procurement Guide (2021) for all spend across TII. This is an internal document which is based on the EPA Sustainable Procurement Guide for the public sector. TII is developing a library of sustainability selection and award criteria questions across all sectors, which contract managers can use during the development of tenders.

The TII Sustainable Procurement Steering Group (SPSG) which was formed at the end of 2022, has embedded sustainability measures in a number of TII procurements so far in 2023. Some members of the group will form part of the Evaluation Team to evaluate the Sustainability Award Criteria which includes environmental and social aspects. Going forward the SPSG will look at procurements in the earlier stage of the procurement cycle to ensure a greater impact. Alongside this, the process for selected procurements will be improved, as well as improving the monitoring, reporting and communication of results. In this way, TII is ensuring that sustainability requirements are embedded in all TII procurements.

Life Cycle Costing (LCC) is an important aspect of procurement. For example, the choice of materials in drainage systems impacts on the frequency of protection and renewal, and cleaning. Choosing a material requiring less protection and renewal may then have a lower operational carbon footprint and reduced costs. TII has created internal checklists to apply LCC for procurement of selected products to progress the implementation of green procurement practices.

**Case Study – Award Criteria: Pilot CO<sub>2</sub> Ladder**

The CO<sub>2</sub> Performance Ladder is a certification scheme developed in the Netherlands to encourage companies to reduce their carbon emissions and improve their sustainability performance. The scheme is based on a ladder system, with five levels of certification that companies can achieve by demonstrating their commitment to reducing their carbon footprint and implementing sustainable practices.

To achieve certification under the CO<sub>2</sub> Performance Ladder scheme, companies must undertake several steps to reduce their carbon emissions.

TII has selected a pilot project, the M7 Kildare Bypass Pavement Scheme, which has a budget of €8 million. The CO<sub>2</sub> Performance Ladder is to be used as an award criterion for the scheme, which went out to tender in May 2023. If this pilot is successful TII may include this criterion in suitable projects in the future.

Environmental Product Declarations (EPDs) will aid TII in ensuring that the materials used on the network do not have unintended negative impacts on the local environment. Taking an approach to projects which considers the circular economy and introduction of LCC and EPDs, will assist in the reduction of embodied and operational carbon, alongside delivering other co-benefits such as increasing biodiversity and reducing pollution.

**Case Study – Environmental Product Declarations**

TII is currently finalising complementary Product Category Rules (cPCRs) to facilitate the production of EPDs for Asphalt Concrete materials and expects to publish this Standard in 2023. Following publication of the cPCRs for EPDs, TII Publication CC-SPW-00900 Specification for Roadworks – Series 900 Road Pavements - Bituminous Materials will be revised to make bituminous materials product specific EPDs a mandatory requirement for works on National Roads. It is expected that the industry will require up to a 6-to-12-month lead in time to deliver the EPDs.

This will be followed by the development of cPCRs to facilitate the production of EPDs for other mixed materials in TII Publication CC-SPW-00800 Specification for Roadworks – Series 800 Road Pavements – Unbound and Hydraulically Bound Mixtures .

In parallel with the development of cPCRs for CC-SPW-00800 materials TII is developing a project level Life Cycle Assessment (LCA) tool incorporating product EPDs to be used in conjunction with the IAPDM and utilised for project level LCA for Pavement Asset Repair and Renewal Schemes and to calculate the carbon impact of pavement maintenance works.

**3.4.3 Level 4: Industry: Research, Design and Standards**

TII influences the industry through research, design, and standards. TII maintains and regularly updates a range of standards, guidelines, and technical documents in relation to the planning, design, construction, protection and renewal, and operation of National Roads.

*Investing in research*

TII actively participates in research and collaboration to support innovation and best practice. For example, TII organises an annual research programme covering technical areas associated with greenways, road, and light rail infrastructure. Annual open tender competitions are organised seeking research proposals to support TII in its remit to provide safe and sustainable transport networks. TII’s continued research efforts, and the sharing of this knowledge, will contribute to better understanding of approaches to reduce emissions. There is a growing recognition of the necessity to integrate climate positive design interventions with transport projects. TII is undertaking research to enable this, with examples outlined in **Table 13**.

**Table 13** TII Research

Research Projects	Descriptions
<b>ROADSOIL</b>	‘ROADSOIL’ is an international research project funded by CEDR which examines the sustainable use and management of soils in road projects focusing on impacts, soil functions and reuse. CEDR research received funding and coordination support from TII, who acts as research manager.
<b>Peatlands Rehabilitation</b>	TII is researching methodologies for the sustainable management of earthworks as a means of rehabilitating degraded peatlands and enhancing the biodiversity of peatland habitats. The research will result in a detailed technical guidance document on how the placing of earthworks material can be optimised in a hierarchy of biodiversity gains, carbon storage and carbon sequestration benefits. The document will detail all the necessary desk top studies, site investigation techniques, sampling requirements as well as legislative requirements, material management, and project management aspects of the rehabilitation process.

### *Transport Research Arena (TRA)*

TRA is the foremost European research and technology conference on transport and mobility and covers all transport modes and all aspects of mobility. TRA24 will be held in Dublin, April 2024, with the overall theme of “Transport Transitions: Advancing Sustainable and Inclusive Mobility”. The event is hosted by the Department of Transport and co-organised by the European Commission. TII, University College Dublin and Enterprise Ireland are organisers of the conference.

### *Participation in the Conference of the European Directors of Roads*

The Conference of the European Directors of Roads (CEDR) promotes excellence in the management of European National Roads. The activities of CEDR include benchmarking and sharing of knowledge and best practices, collaborations and sharing of resources as well as professional networking and competence building. TII’s collaboration with CEDR includes participation in several working groups (including decarbonisation of National Roads); sharing experience and research with other European roads authorities and enabling TII to feed into national policy on sustainability in transport. TII is also participating in a number of research programmes commissioned under the CEDR Transnational Research Programme: this participation includes the provision of funding as well as staff members to represent TII on the Programme Executive Board which provides technical management and oversight to the research.

### *Standards, guidelines, and technical documents*

TII maintains and regularly updates a range of standards, guidelines, and technical documents in relation to the planning, design, construction, protection and renewal, and operation of National Roads. TII standards and technical documents (available at <https://www.tiipublications.ie/>) have a large scope of influence and are used across the construction and transport sectors. TII standards are mandatory for National Roads but are used by Local Authorities on Regional and Local Roads.

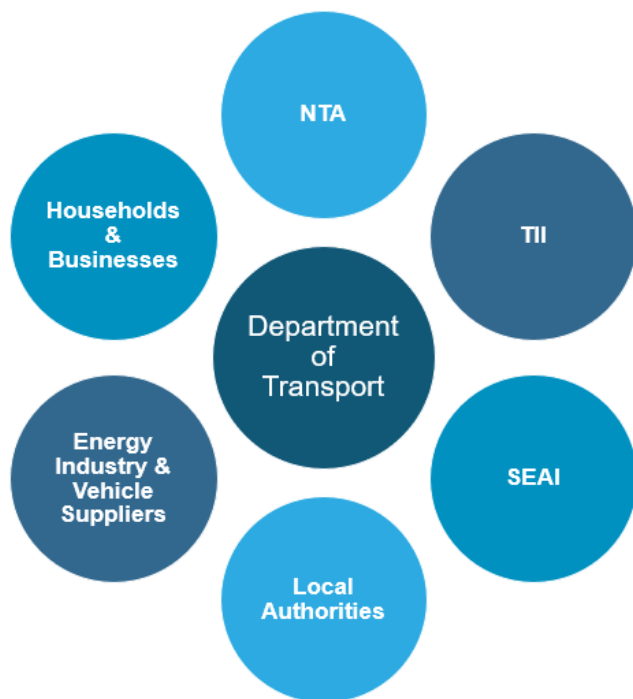
TII also produces guidelines relating to light rail, active travel, greenways, biodiversity, landscaping, project management for public transport, and gender considerations for project design. These guidelines have contributed to delivering infrastructure that increases biodiversity and supports low-carbon travel. In recent years, emphasis has been placed on ensuring that the sustainability principles from the TII Sustainability Implementation Plan are embedded in TII documents. Examples of this include revisions to TII’s Project Management and Project Appraisal guidelines, a new analytic approach to pavement and foundation design, and new standards relating to carbon, climate and air quality assessment of proposed National Roads, all published in 2022. TII Publication GE-GEN-01101 Guide to the Implementation of Sustainability for TII Projects was published in July 2023.

Throughout 2022, TII provided seven training courses for road engineers, covering topics such as road safety inspection and auditing, design of vehicle restraint systems, geometric road design and design of road pavements. TII also held two online “TII Roadshow” events to present recent developments in standards. These events are publicised to all subscribers to the TII Publications website and are open to all. TII organises an annual conference on National Roads and Greenways attended by the Department of Transport and Local Authority partners. In September 2022, the conference was held in Sligo and was attended by over 300 Local Authority officials engaged on national road and greenway projects. The conference is to be held in Cork in September 2023.

### 3.4.4 Level 5: Partnerships

Collaborative partnerships will be essential in addressing the climate and biodiversity crisis and achieving wider net-zero objectives, including actions set out in CAP23. Cooperation and cross sectoral innovative thinking are required for a holistic approach to reducing emissions.

TII has overall responsibility for the delivery, management, and operation of the NRN, light rail network, the proposed Metrolink and greenways. Across the transport sector, TII works under the direction of the Department of Transport and with other partners including local government, academia, industry, European authorities, and other government agencies, such as the NTA etc. as shown in **Figure 12** below.



**Figure 12** Transport stakeholders in Ireland

For example, TII works with local authorities in varying ways, such as through the provision of annual funding allocations to deliver on the functions of TII in relation to National Roads and greenways. These partnerships are critical to enabling safe and resilient networks and services. In 2021 TII delivered the first park and share facility on the NRN in partnership with Louth County Council. In addition to supporting shared travel, the facility provides safe parking and access to bus services, which also supports reducing the environmental impact of commuting in individual cars. The provision of this type of facility, which is safe, reliable, and secure, encourages car sharing and can lead to an overall reduction in direct emissions from cars.

### Case Study – Road Lighting Upgrades

TII undertook the replacement of existing high wattage route lighting luminaires with LEDs on the non-motorway sections of the NRN. In 2022, 260 old style high-pressure sodium lanterns were replaced across the country by local authorities with an estimated energy saving of over 171,000 kWhr annually. This has an equivalent estimated carbon saving of approximately 57 tonnes of carbon (based on EPA emissions factors). This cooperation with local authorities has resulted in the upgrade of 16,706 low energy LED route lighting installations by TII to date across 351 funded projects. These projects are in addition to the more substantial Climate Action Plan actions on public lighting within Ireland. In 2022, TII continued to work with the Road Management Office (RMO) and local authorities to develop, procure and award a contract to support the replacement of 78,000 lights with LEDs in the Southwest region and the replacement of 73,500 lights with LEDs in the Eastern region as part of the National Public Lighting Energy Efficiency Project (PLEEP).

TII continues to support the replacement of the remaining circa. 45,000 lights in region West of PLEEP. The works contract will be awarded in 2023.

### *Sharing knowledge and tools, and building skills*

TII provides guidance and training programmes to partners to enable upskilling and project delivery. TII also shares tools, such as the TII Carbon Tool (discussed in Section 3.4.2). This tool is shared widely with industry partners to quantify embodied and operational carbon on transport and infrastructure schemes across the country. TII provides support to local authorities which are delivering TII funded schemes. This ensures that local authorities can increase biodiversity and create connected wildlife corridors throughout the country whilst providing co-benefits that include sequestering carbon and providing adaptation benefits.

### Case Study – Collaborating for better biodiversity outcomes

Addressing the biodiversity crisis requires a collaborative approach as biodiversity crosses human-made boundaries. TII owns 3,500 HA of land and landscapes adjacent to motorways, National Roads, greenways, and alongside the Luas lines and stops, presenting an opportunity to increase the quality and quantity of green spaces in Ireland. TII co-authored the Pollinator-friendly Management of Transport Corridors with the National Biodiversity Data Centre, as part of the All-Ireland Pollinator Action Plan.

Increasing the quality and quantity of green infrastructure across the network will provide many benefits to service road users, wildlife, and the assets. Maintenance agreements are in place with local authorities setting out agreed protocols and lines of demarcation.

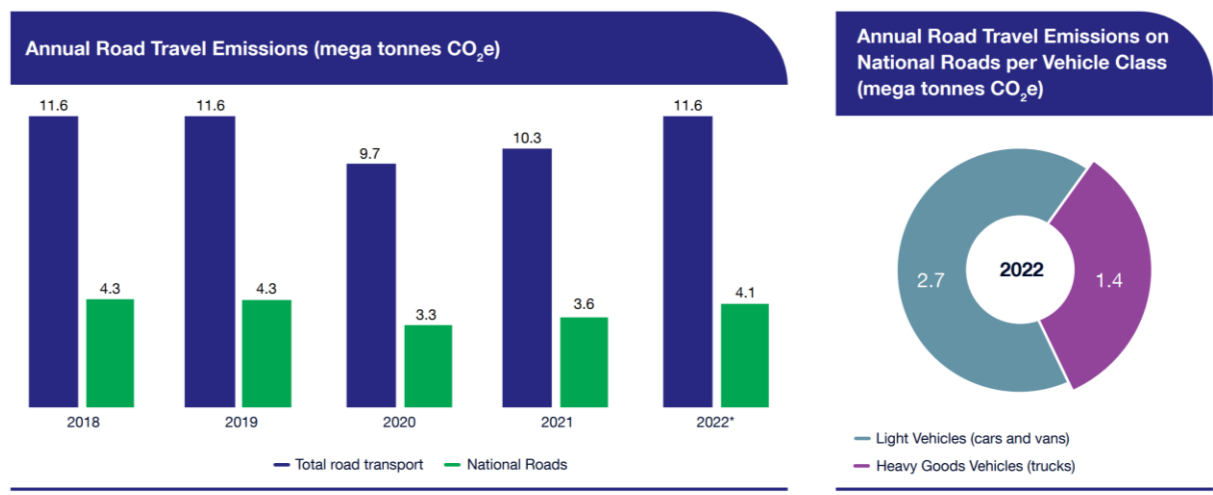
TII has developed biodiversity and landscape strategies to facilitate and sustainably manage transport corridors and roadside landscapes. When launched, along with the TII soft landscape standard, these strategies will facilitate increasing the impact of biodiversity and landscape treatments on climate resilience and adaptation by:

- Reducing the urban heat island effect, facilitating urban cooling and providing shade
- Slowing the flow and improving the quality of water through sustainable drainage systems
- Sequestering carbon
- Improving the quality of air and soil, and
- Conserving, enhancing, restoring, and transforming habitats and the biodiversity that they support.

### 3.4.5 Level 6: Road Users: Sustainable mobility and behaviour change

The transport sector accounts for approximately 20% of Ireland’s total emissions. These emissions are generated from the movement of people and goods on the transport network, driven by emissions from internal combustion vehicles, both private vehicles and freight vehicles as well as the non-electrified public transport fleet. As population and economic growth are linked to travel demand, the transport sector’s emissions will continue to grow without interventions.

Decreasing the transport sector’s GHG emissions involves reducing the use of internal combustion vehicles, and enabling public transport, walking, and cycling as the preferred travel options. There are many factors that contribute to individual travel decisions including the availability of high-quality network infrastructure and services, cost, accessibility, safety, convenience, reliability, and distance of travel. **Figure 13** shows that travel on National Roads contributed on average 35% of total road transport emissions in 2018-2022. Traffic increased by almost 17% across the NRN in 2022 compared to 2021. Heavy Goods Vehicles (HGVs) accounted for 34% of NRN emissions in 2022.



Travel on National Roads contributed an average of **35%** of total road transport emissions in 2018-2022.

Heavy Goods Vehicles (HGVs) contributed **34%** of National Roads emissions in 2022.

Sources: 1. EPA, 2022 (estimate of total transport emissions in 2018 was 12.2 mega tonnes, road travel emissions made up 11.6 mega tonnes of this; \*2022 Total road transport emissions is EPA projection and not inventory as per previous years)  
 2. TII National Transport Model (NTpM), TII Road Emissions Model (REM), CSO and UCC (2021) Irish Car Stock Model v2.1.

**Figure 13** Estimated vehicle emissions on National Roads

Through the provision of sustainable transport infrastructure and services, including public transport and walking and cycling networks, TII can support people to make lower carbon travel choices. Ireland’s CAP23 contains several transport-focused targets and measures to shift to low energy transport modes such as walking, cycling, and public transport, alongside accelerating the electrification of road transport and increasing the use of biofuels. TII is the lead agency for several of these actions including the roll-out of 1,000km of walking / cycling infrastructure and developing the National Cycling Network Plan. TII in collaboration with the Department of Transport and NTA has prepared this network plan to develop a safe, connected, and inviting cycle network between urban areas and key destinations to achieve accessible, sustainable, and high-quality routes that contribute to reducing the carbon impact of transport and promote a healthy and inclusive society. TII aims to remain responsive and adaptable to changing technologies, policies, and road user demands.

The 2023 Climate Action Plan identified TII as the agency responsible for delivering the Alternative Fuel Infrastructure Regulations for ‘en-route’ charging, on the TEN-T network with specific actions for TII to undertake “*planning and enabling works for AFIR high-power charging requirements on TEN-T network*”. In addition, the Roads Traffic and Roads Act 2023 creates a new function for TII in regard to the “*provision of a safe and efficient network of recharging infrastructure*”. This new legislation is aligned to the Government’s Climate Action Plan 2023 and ensures that TII as an experienced public agency with infrastructure delivery experience now has a clear mandate to play a leading role in ensuring the roll out of en-route charging infrastructure across the national road network in line with Government policy and EU AFIR regulations.

TII is progressing several programmes, projects, and studies which will contribute to understanding and reducing emissions from travel and supporting sustainable travel choices, introduced in **Table 14** below.

**Table 14** Transport Emissions Reduction Projects

Projects	Linked Policy <sup>5</sup>	Descriptions
M50 Demand Management Study	The Greater Dublin Area (GDA) Transport Strategy 2022-2042  National Development Plan 2021-2030	In 2014 TII published its M50 Demand Management study which outlined a series of measures to improve the safety and reliability of the M50 and reducing congestion. TII's Dynamic Traffic Management project is currently being implemented with the installation of Variable Speed limits on the M50. Reducing congestion and creating more stable flow conditions on the M50 will reduce GHG emissions.  The NTA's draft Greater Dublin Area Transport Strategy has identified the need for a Demand Management Scheme for the Greater Dublin Area. TII will work with the NTA to develop this scheme. Demand management measures on M50 and National Roads approaching the M50 will be considered as part of the options explored.
Better Road User Charging Evaluation (BRUCE)	Climate Action Plan 2023, Action TR/23/21  National Road Haulage Strategy 2022 – 2031, Action 18 and 21  National Sustainable Mobility Policy   Action Plan 2022 – 2025, Action 47	BRUCE is a strategic decision-making project grounded in the expiry of PPP schemes commencing in 2033, to determine the future direction of operation and protection and renewal of the NRN through road user charging in Ireland. The project aims, firstly, to understand how the NRN can through road user charging continue to make tangible contributions to the delivery of key public policy agendas including: decarbonisation of transport, demand management, encouraging mode shift to more sustainable modes, and encouraging equitable access to opportunities. This understanding will be used to inform the design of potential road use charging operating models and to consult with all stakeholders on potential approaches and timelines. Following consultation, the project aims to test options and measure their potential impact. The Project BRUCE Roadmap will be published in Q4 2023.
Road Freight Decarbonisation	Climate Action Plan 2023, Action TR/23/9  National Road Haulage Strategy 2022	TII has explored the potential of urban freight consolidation centres to reduce kilometres of travel by heavy goods vehicles in urban areas. TII presented a study report to the Department of Transport to fulfil its obligations under Action 6 of the Department of Transport haulage strategy. TII will further explore the potential positive impact of freight consolidation centres on National Roads.  TII administer the Alternatively Fuelled Heavy Goods Vehicles (AFHDV) purchase grant scheme on behalf of the Department of Transport to promote the decarbonisation of freight.

<sup>5</sup> Linked policies are reflective of those most pertinent to the projects at the time of writing.

Projects	Linked Policy <sup>5</sup>	Descriptions
	-2031, Action 6	In 2023, TII will continue to administer the AFHDV scheme with an increased budget of €5 million to further prompt the transition to alternatively fuelled vehicles transporting goods across the network.
Bus Corridor Prioritisation	National Sustainable Mobility Policy   Action Plan 2022 – 2025, Action 38	Congestion levels on the NRN impact on the efficient use of the network and increase emissions, including carbon. TII has published a standard to allow for the consideration of Bus Priority Measures on Type 2 Dual Carriageways and Motorways. Use of this standard, where appropriate, will enable an increased mode share of public transport thus increasing the number of people transported along the network per m2 of road space. To enable this increase in mode share the bus journey must be seen as more attractive than its corresponding car journey. The pilot schemes proposed and supported by TII, allow for the reallocation of existing road space, with some additional widening to provide bus priority measures along heavily congested Dublin urban radials approaching the M50. These will aid in increasing the reliability and efficiency of bus services and decrease bus journey times.
Integrated Mobility	National Sustainable Mobility Policy   Action Plan 2022-2025, Action 25	High quality integrated mobility has an important role in enabling a modal shift from private vehicles to sustainable transport modes, reducing carbon emissions. Improving the convenience and attractiveness of public transport will support the mobility of people in urban areas and enhance regional and rural connectivity. TII will contribute to integrated mobility by investing in measures such as Park and Ride / Share adjacent to the NRN. In 2023, TII is developing a Park and Share strategy.
Low Emissions Vehicle Tolling Incentive (LEVTI)	Electric Vehicles Charging Infrastructure Strategy 2022 – 2025	The LEVTI Scheme is managed by TII through the Tag Service Providers on behalf of the Department of Transport. The LEVTI scheme started in June 2018 offering discounted toll charges to the drivers of electric vehicles as part of a government initiative to incentivise the switch to electric vehicles. It offers higher discounts for off peak travel which decreases congestion and emissions during rush hour. The scheme subscription has quadrupled since 2019.
TII Road Emissions Model	The Climate Action and Low Carbon Development (Amendment) Act 2021	TII has developed a Road Emissions Model and air quality tool (REM) to model emissions associated with the NRN. TII has carried out a baseline study to 2018. TII will forecast future emissions, using the National Transport Model and future vehicle fleet composition forecasts and scenarios including CAP23 targets for the electrification of the fleet. TII is working with the Department of Transport and other partner agencies to agree future fleet scenarios.
Electrification of the Fleet	Climate Action Plan 2023, Action TR/23/60  National Road Haulage Strategy 2022 – 2031, Action 20	Zero Emission Vehicles Ireland (ZEVI) has been established as a dedicated Office to support consumers, the public sector and businesses to make the switch to zero emission vehicles. ZEVI will lead on the delivery of Ireland’s ambitious target under the CAP to have almost 1 million electric vehicles on our roads. The uptake of electric vehicles will also require a step change with 30% of the private car fleet to be electrified by 2030, and all new car registrations to be electric for subsequent years. TII supports the Department of Transport in the coordination of the ZEVI programme incorporating the delivery of the en-route charging infrastructure across the NRN. A targeted ZEVI Media Campaign will be launched in Q4 of 2023.  TII is collaborating with ZEVI on developing a National En-Route Charging Plan which is due to be published for consultation in Q3 2023 and finalised by the end of 2023. This plan, which complements CAP 2023 and is underpinned by TII’s new mandate, will guide TII’s activities over the short to medium term as TII seeks to mobilise to ensure the provision of en-route charging across the national road network over the next 15 to 20 years. TII will be seeking funding and resources from Government to develop a coordinated programme of



Projects	Linked Policy <sup>5</sup>	Descriptions
		<p>interventions to support the accelerated provision of high-powered charging infrastructure on the national road network, including, for instance:</p> <ul style="list-style-type: none"> <li>• Enabling delivery by facilitating and progressing grid upgrade enabling works to streamline the process for operators to access the required grid power/ connections for high powered charging facilities; and</li> <li>• Direct public funding to facilitate delivery and deployment of charging infrastructure in areas where there is a demonstrable market gap (i.e., insufficient en-route high power charging infrastructure to meet AFIR and/ or forecast market demand).</li> </ul>
<p><b>Local Transport Plans</b></p>	<p>National Sustainable Mobility Policy</p>	<p>The purpose of a Local Transport Plan (LTP) is to set the framework for the transport infrastructure, services and supporting measures which will create opportunities for sustainable and active travel and integrating place-making within a settlement achieving compact growth, sustainable mobility and delivering on National Roads policy.</p> <p>The process for the preparation of LTP's is based on TII/NTA Area Based Transport Assessment (ABTA) Guidance. TII and NTA are actively involved in the preparation of these LTP's with the assistance and support of engineering colleagues. A key output from the LTP is the identification of the requirements for each mode of transport within a settlement which will inform local land use planning policy and provide the focus of future transport investment. TII has engaged with the NTA and Local Authorities on 30 LTPs. Of these, 21 are pre-draft and 9 have been on public display. These LTPs are funded through various methods by TII, the NTA and in a number of cases by the Local Authority. At this stage, measures or schemes identified by the process are being prioritised for inclusion in NTA and Local Authority programs and potentially TII projects and schemes but, importantly, are also influencing local planning policy.</p>
<p><b>Severance Packages</b></p>	<p>Climate Action Plan 2023, Action TR/23/29</p> <p>National Road Safety Strategy 2021 – 2030, Action 2</p> <p>National Sustainable Mobility Policy   Action Plan 2022 – 2025, Action 4</p>	<p>The NRN should cater for the needs of all road users, including cyclists and pedestrians. Where National Roads present a hostile or dangerous environment for cyclists and pedestrians, TII will work to provide segregated facilities adjacent to National Roads. TII is identifying and addressing severance associated with busy urban National Roads through provision of safe crossing infrastructure for cyclists and pedestrians. This is an example of restorative design.</p>

As set out in the carbon budgets programme, the sectoral emissions for transport must decrease by approximately 50% by 2030. The energy case for investment in networks and services must be considered as projects may lead to a net increase in energy consumption and associated carbon emissions. In instances where an increase in TII's emissions can be demonstrated to lead to an overall net economy-wide emissions reduction (e.g., expanding the light rail network removes private vehicle journeys), an investment can be

considered climate beneficial. The methodology to be applied is expected to be published by SEAI in 2024. The projects in **Table 15** below set out examples of infrastructure and services which will reduce road user emissions.

**Table 15 Sustainable Transport Projects**

Projects	Linked Policy <sup>6</sup>	Descriptions
National and Regional Greenways Programme	Climate Action Plan 2023, Action TR/23/30  National Development Plan 2021-2030  Project Ireland 2040	The development of the national and regional greenways programme and active travel projects interacting with the NRN are coordinated to maximise the coherence and connectedness of local, regional, and national active travel infrastructure. The development of these programmes is coordinated with delivery partners, such as the Department of Transport and NTA, so as to develop high-quality active travel networks that will contribute to reducing the carbon impact of transport and promoting a healthy and inclusive society. TII has published a Project Manager’s Manual for Greenway Projects and the Greenway Standard to guide the development of national and regional greenway projects under the remit of TII.
MetroLink	Climate Action Plan 2023, Action TR/23/36  National Development Plan 2021-2030  Project Ireland 2040	MetroLink will be a high-frequency rail line running from Swords to Charlemont, linking Dublin Airport, Irish Rail, DART, Dublin Bus, and Luas services, creating fully integrated public transport in the Greater Dublin Area. As well as linking major transport hubs, MetroLink will connect key destinations including Ballymun, the Mater Hospital, the Rotunda Hospital, Dublin City University and Trinity College Dublin. Much of the 19-kilometre route will run underground. MetroLink is expected to carry up to 50 million passengers annually.  The MetroLink vision aims to create an efficient, low-carbon, and climate-resilient metro system that connects passengers and meets future demand. The vision focuses on priority areas like climate change mitigation, biodiversity, heritage, skills, learning, community engagement, safety, health, wellbeing, connectivity, productivity, growth, and collaboration. MetroLink will implement sustainability commitments and minimum standards in contractor and operator procurement, ensuring shared responsibility for sustainability. MetroLink’s Project Sustainability Plan assesses infrastructure sustainability frameworks and rating systems and is to be integrated into the MetroLink Environmental Operation plan and management system. MetroLink will oversee the plan, and a Target Delivery Tracker to track sustainability performance throughout the project lifecycle.
Luas Finglas	National Development Plan 2021-2030  Project Ireland 2040	Luas Finglas will provide a key public transport connection between Dublin’s north-western suburbs and the city centre and will be key to the overall reduction in reliance on the private car in areas served by the scheme. Luas Finglas is projected to result in an approximate reduction of 10,000 car trips daily. Active mobility options, such as cycle lanes and pedestrian paths, will encourage people to walk and cycle to the stops, and along the route.  As part of the development of the plans, Luas Finglas has specific sustainability requirements and is trialling initiatives such as applying a Circular Economy approach, undertaking public life assessments, applying a gender lens, undertaking a Biodiversity Net Gain assessment and developing a project sustainability plan.

<sup>6</sup> Linked policies are reflective of those most pertinent to the projects at the time of writing.

### 3.5 A Holistic Approach

As TII works to reduce scope 3 emissions across its supply chain, address embodied emissions, and facilitate sustainable mobility, it is essential to do this with a focus on a 'Just Transition', enhancing social value, a consideration of wider environmental impacts, and with the appropriate governance and strategic oversight in place.

### 3.6 A Just Transition

'Just Transition' is a term used to refer to the transition towards a climate-neutral economy in a fair and equitable way. Transport is an enabler to education, employment, health care and leisure activities. Reducing transport poverty is key to building an inclusive and equal society.

TII will continue working with partners across the transport sector to align with the relevant Just Transition principles. This includes using data to understand the economic and social impacts of projects and programmes across Irish society, such as road user charging. It also means continued engagement with communities and stakeholders through inclusive participatory processes whenever the introduction of carbon reduction projects and programmes has the potential to increase transport costs.

### 3.7 Social Value

Connecting communities, facilitating social inclusion, prioritising safety, and increasing general wellbeing are core components of designing and operating sustainable transport networks that consider the needs of all users and their communities. Different types of people have different travel needs and mobility challenges.

People with disabilities who wish to live and travel independently often experience barriers preventing them from accessing economic, social, and civic participation opportunities. To support the transition to a sustainable future, an enhanced understanding of the role of accessibility in the design and management of transport systems is required at a local, national, and international level. Public transport must prioritise accessibility and equity for all, and walking and cycling networks must be designed for people of all ages, physical abilities, and all genders.

TII is actively working to understand and cater for the different transport system requirements across Ireland's population:

- The "Travelling in a Woman's Shoes" study researched how women use the transport network in Ireland and explored reasons for modal choice and barriers to travel.
- TII has developed a Gender Lens Checklist tool 'Applying a Gender Lens to TII Public Transport Projects' to embed the integration of social sustainability and gender equality into its project development to ensure better outcomes for communities along its light rail schemes. The tool is being piloted on the Luas Finglas scheme.
- Access for all is central to any scheme design and operation carried out by TII directly or by third parties, on its behalf. TII uses best international practice in Universal Design and encourages innovative and imaginative solutions to achieve these goals. The Luas User Group (LUG) was established prior to the delivery of the first Red and Green Luas Lines. As a forum, it has proved effective in achieving consensus with marginalised groups, in hearing their needs and in considering these, where feasible, at the earliest stages of design. The LUG advises TII in relation to the accessibility of its transport services and facilities with a view to improving public transport services for everybody in accordance with "Transport Access for All", the Government's Sectoral Plan under the Disability Act 2005 and the National Disability Strategy Implementation Plan.

The LUG is also proactive in identifying and recommending practical measures towards removing barriers that prevent accessibility to the relevant transport service as well as ensuring no future barriers are created. TII works in partnership and in on-going consultation with the group.

- TII has continued to support and administer the Disability Tolling Exemption scheme through active engagement and collaboration with the Disabled Drivers Association of Ireland (DDAI) and the Irish Wheelchair association.
- The ‘All Aboard: TII’s Accessibility Podcast’ was published in May 2023 to provide a platform for designers, advocates, and researchers to share what accessible public transport means to them, and how accessibility has been incorporated in their work. Their insights are enriched by the lived experiences of people with disabilities, their family members and carers.

### 3.8 Nature and Wider Environmental Impacts

TII recognises the importance of incorporating wider environmental interventions with transport projects. Some of the available interventions and TII projects include the following:

- Materials - Reducing pollution through using materials such as warm lay and cold lay asphalt and managing deposition from exhaust fumes to reduce the risk of these pollutants entering the ground water.
- Native Woodland Planting - TII is working to develop solutions such as Native Woodland Planting and other biodiversity initiatives that contribute to sustainability objectives while ensuring sustainable use of surplus lands.
- Air Quality (Nitrogen Dioxide) and Noise Monitoring - TII currently monitors environmental noise and nitrogen dioxide (using diffusion tubes) at several sensitive receptors adjacent to the M50. In 2019, TII established a public website whereby real-time noise monitoring data, and indicative nitrogen dioxide concentrations, updated periodically throughout the year following laboratory analysis, are available to the public and other stakeholders. In 2023, the system is being upgraded to enable continuous real-time monitoring.

### 3.9 Governance

Delivering the changes needed to reduce scope 3 emissions, including road user emissions requires a robust and collaborative governance process internally, within the wider transport system and across government. TII recognises that delivering its carbon reduction and sustainability initiatives and projects requires a significant level of organisational and cultural change. It also requires strong stakeholder management and engagement (both internal and external), management controls and robust governance arrangements. To achieve this, TII is adopting a strategic cross divisional portfolio management approach, which provides the governance platform and resources to facilitate the transformation of TII to a more sustainable public body.

The Organisational Governance Model for TII’s Sustainability Portfolio can be defined through three vertical levels of governance: 1) Assurance, 2) Progress, and 3) Delivery, which are supported by a centralised Portfolio Management Office (PMO) within the TII Executive Office.

The Assurance level provides oversight and assurance to ensure the successful implementation of the Sustainability Portfolio, offering a corporate view including broader company-wide concerns and external industry perspective.

The Progress level of governance is comprised of appointed Sustainability Leaders with responsibility for reporting on the progress of delivery of sustainability related projects and initiatives across their respective divisions.

The Delivery level is comprised of the existing corporate Departmental structure within TII and is responsible for the successful management of sustainability activities in line with typical work processes within a division. Where extensive cross departmental collaboration is required, Enterprise Delivery Groups may be formed. Where there is a need for specific governance, targeted Steering or Working Groups may be formed, as required, in line with normal TII project and initiative delivery practices.

### **3.10 Risks to Delivery**

Throughout this chapter, it is evident that a considerable body of work related to sustainability is being progressed across TII, demonstrating a pro-active and agile response to government targets. However, there are challenges to meeting the ambitious targets set out in CAP23 including challenges and uncertainties associated with reducing scope 3 carbon emissions that are outside of TII's control. This includes stakeholder constraints, technological development, planning, and funding and resourcing of projects and initiatives. TII recognises the need for extensive engagement and collaboration across all spheres of influence to enable the continued reduction of scope 3 emissions in future.

### **3.11 Measuring Emissions**

TII is developing a carbon inventory to capture all carbon emissions associated with its activities, including scope 3. This will build understanding of the scope 3 areas and enable identification of opportunities to influence a reduction in carbon emissions with the greatest impact.

### **3.12 Conclusion**

This chapter has set out the challenges for TII to achieve a reduction in transport emissions across Ireland and some of the means by which TII is addressing these challenges. Key areas of influence and ways for TII to address emissions have been identified. A holistic approach embedding the themes of Just Transition, social value, nature and environmental impacts and governance, has been set out to underpin the work being carried out across all areas of influence.

- TII continues to embed a culture of sustainability across the organisation and encourage staff to enhance their knowledge and expertise. Through training initiatives and engagement in national and transnational research projects, TII staff are empowered to develop new methods and approaches to delivering sustainable outcomes.
- Working with the supply chain to better consider the role of circular economy, asset management and sustainable procurement will be necessary to enable TII reduce resource consumption and address scope 3 emissions. Adopting these approaches can also deliver other co-benefits such as increasing biodiversity and reducing pollution.
- Innovative thinking is essential to developing the solutions required to reduce emissions. TII can influence the wider industry through research, design, and standards.
- Partnering with wider transport stakeholders, such as government, local authorities, transport providers etc, across the network will be essential to unlocking knowledge and delivering solutions across the transport ecosystem.

- TII must provide sustainable transport infrastructure and services to facilitate the decarbonisation of the transport network. Through planning and delivery of alternative fuel recharging and refuelling infrastructure and services on the national road network TII can displace significant quantities of fossil fuels in the current system with electricity and hydrogen and support businesses and citizens in transitioning to zero emission vehicles and people in making lower carbon travel choices.

There is no single solution to the climate crisis. TII recognises that part of the solution is working in a way which delivers equitable outcomes that benefit society and the natural environment. TII will continue to apply a social value and Just Transition lens to its projects and operations.

Robust governance continues to be essential to ensuring effective delivery and a holistic approach enabling progress while avoiding unintended consequences. The continued focus on sustainability across the organisation will ensure progress in the key areas highlighted in this chapter, enabling transformational change across TII and its levers of influence.

## 4 CLIMATE ADAPTATION

This Chapter provides a high-level summary of TII’s Climate Adaptation Strategy 2022 (The Climate Adaptation Strategy), which was published in December 2022, and can be found in full in TII’s publications. The Strategy is TII’s response to Action 297 of the Climate Action Plan (2021) to, *“Improve climate resilience and adapt to climate change on the light rail and National Roads Network.”*

### 4.1 Context

Extreme weather events are becoming more frequent and severe due to climate change. The most recent headline findings from the Intergovernmental Panel on Climate Change states substantial projected differences in potential climate change impacts between 1.5°C and 2°C as follows, *“These differences include increases in mean temperature in most land and ocean regions (high confidence), hot extremes in most inhabited regions (high confidence), heavy precipitation in several regions (medium confidence), and the probability of drought and precipitation deficits in some regions (medium confidence)”* (IPCC, 2023).

Climate adaptation is defined by the European Commission as; *“Anticipating the adverse effects of climate change and taking appropriate action to prevent or minimise the damage they can cause or taking advantage of opportunities that may arise”* (European Commission, 2013).

TII’s transport networks and infrastructure are vulnerable to extreme climate conditions which can cause damage to assets and disruptions to services such as tolling and operations, which can have an impact on a variety of areas such as safety, finances and reputation. TII will continue taking a proactive approach to manage the impacts of climate change and TII’s Climate Adaptation Strategy sets out TII’s approach for adapting to climate change.

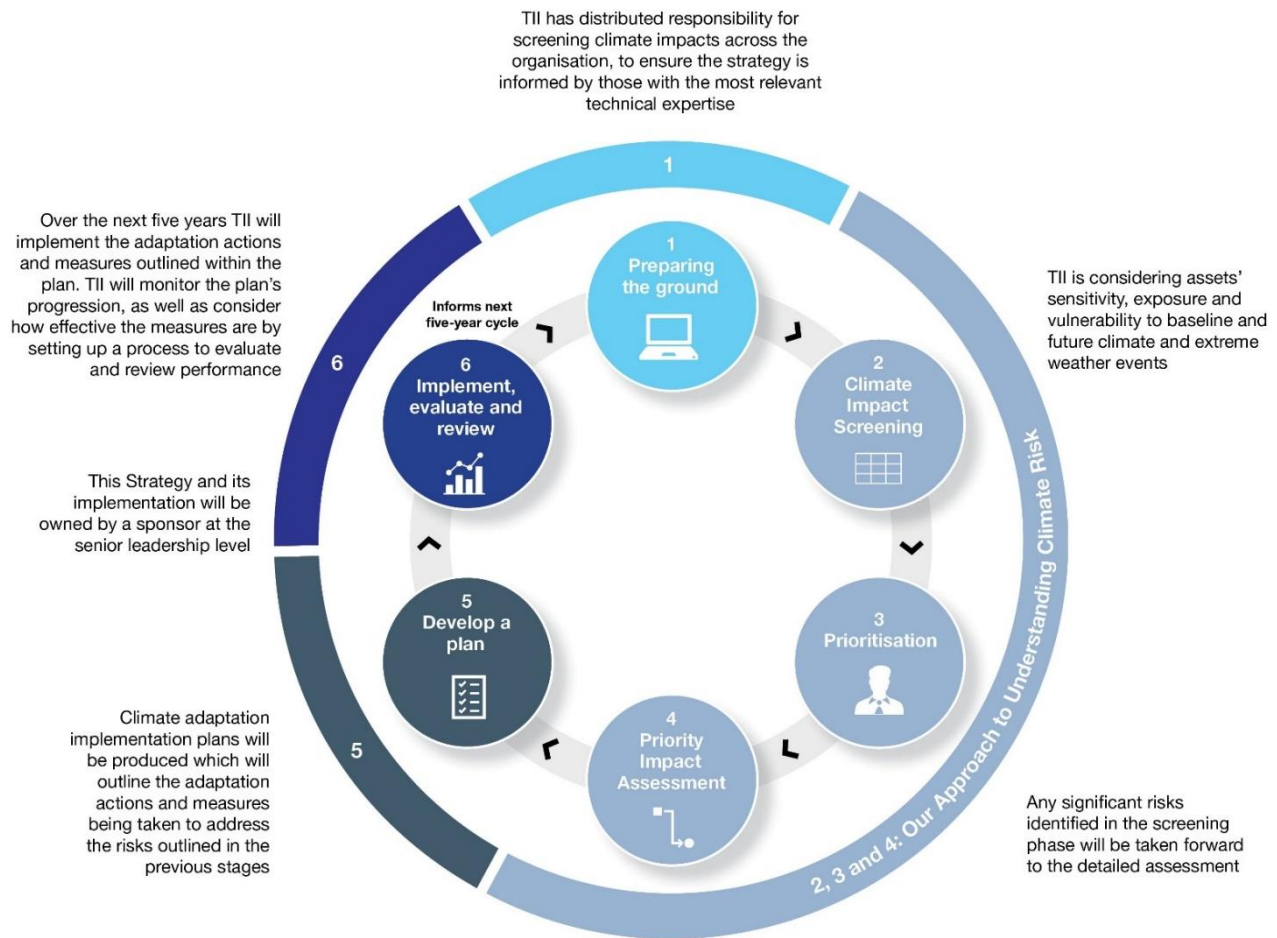
### 4.2 TII’s Climate Adaptation Strategy

The Climate Adaptation Strategy builds on TII’s previous Climate Adaptation Strategy, published in 2017. It aims to increase the resilience of TII’s infrastructure and people against the impacts of climate change. The Strategy outlines TII’s climate adaptation aim to be an organisation that is adaptive to the impacts of climate change and maintains its commitment to sustainability. The Strategy outlines seven strategic objectives for climate adaptation set out in **Table 16** below which align with the six principles from TII’s overarching SIP.

**Table 16** TII’s Seven Climate Adaptation Strategic Objectives

TII’s Seven Climate Adaptation Strategic Objectives	
1	<i>Observe fewer network disruptions during climate-related events</i>
2	<i>Rapidly recover from any climate-related events</i>
3	<i>Have a robust, flexible, and equitable organisation that responds effectively during climate events</i>
4	<i>Enhance the climate resilience of lifeline roads in order to maintain community accessibility</i>
5	<i>Engage with the wider adaptation efforts across Ireland through partnerships and wider research</i>
6	<i>Embed climate adaptation within TII’s operations, policies, and procedures, to ensure a safe and resilient network</i>
7	<i>Adopt a low-carbon approach into TII’s designs, standards and processes when considering climate adaptation, while also considering wider social and environmental benefits</i>

TII has developed the Climate Adaptation Strategy in line with international and national best practice approaches to climate adaptation planning. TII is following the six-stage approach to climate adaptation in line with national sectoral adaptation planning guidelines. The Strategy forms the main output of the first stage of the six-stage adaptation process, laying the foundations for stages 2-6 of the approach, as shown in **Figure 14** below. Using this process, TII is considering a wide range of climate-related hazards for six of TII’s main assets, see **Figure 15** below; NRN, light rail network, rural cycleways and national and regional greenways, land, buildings, and people.



**Figure 14** TII’s six-stage approach to climate adaptation

Note: Adopted from the Sectoral Adaptation Planning process



**Figure 15** TII’s main assets



### 4.3 Next Steps

The Climate Adaptation Strategy provides the foundations for TII's climate adaptation activities and includes several actions which will be implemented over the next five years, in line with the Sectoral Adaptation Planning process.

Climate impact screening and prioritisation assessments have been completed in Q2 2023 for each of TII's six main asset groups identified in **Figure 15**. This corresponds with stage 2 and 3 of TII's six-stage approach to climate adaptation. The climate impact screening assessments identified the vulnerability of each of TII's assets based on the sensitivity and exposure rating of each asset to climate hazards such as flooding and extreme heat. The outputs of the screening assessments include the identification of which climate asset-hazard pairings require further investigation through the means of a detailed climate risk assessment covering the likelihood and consequence of a climate hazard impacting the asset. These prioritisation tables and key findings for each asset group are captured in a summary document, along with the approach taken for the climate impact screening assessments.

The methodology for the more detailed climate change risk assessments is expected to be completed in Q3 2023 and will be used to inform climate change risk assessments on the prioritised asset-hazard pairings (stage 4 of TII's six-stage approach). The detailed climate change risk assessments will use spatial information, climate data, and consider asset specific characteristics where possible. The aim of the detailed climate risk assessment is to provide a sufficient level of detail on the climate risks such that tangible climate adaptation measures and actions can be developed, forming climate action plans for each of the asset groups. This is Stage 5 of TII's six-stage climate adaptation approach (**Figure 14**).

## 5 CONCLUSION

This Roadmap sets out TII's plans to reduce GHG emissions and meet decarbonisation and energy efficiency targets. Through planned projects, and the continued decarbonisation of Ireland's electricity grid, TII expects to achieve between 61-73% GHG emissions reduction and between 46-53% improvement in energy efficiency by 2030.

Effective delivery of the GHG emissions reductions outlined in this Roadmap will rely on:

- **Robust governance:** the Executive Office has overall responsibility for TII's Roadmap and reporting to TII's Board.
- **Engaged staff:** TII will continue to empower staff to identify innovative approaches to emissions reductions, provide support and training, and communicate progress to all staff.
- **Monitoring and evaluation:** High quality data, monitoring, and reporting will support improved measuring and monitoring of progress with responsibility to achieve the targets being distributed across the organisation.
- **Funding and resources:** Meeting emissions reduction targets is contingent upon TII receiving additional capital and operational funding and resources to deliver the necessary projects whilst overcoming challenges and uncertainties within and out of TII's control. Note that while TII regularly assesses capability gaps and makes submissions to DoT in line with civil and public service processes (annually) where it is considered that additional resources are / will be necessary to make progress in a given area, TII cannot hire any additional resources without sanction from DoT.

This Roadmap is a live document which will be updated annually.

TII recognises that delivering on Ireland's ambitious climate action targets requires transformative change across the transport system. With public sector targets only accounting for a small proportion (less than 1%) of TII's overall emissions, TII's biggest impact will come through its influence on scope 3 emissions. This will be realised through:

- Working with the supply chain to encourage lower carbon materials and construction processes; and
- Working with partners and stakeholders to achieve a greater modal shift towards public transport, walking and cycling, transition to the use of zero emissions vehicles, and management of overall travel demand.

TII recognises the scale of the challenge to meet the national emission reduction targets, addressing the biodiversity crisis, and supporting national climate adaptation efforts. TII will contribute by collaborating with partners, industry, and wider transport stakeholders to deliver material change across the organisation, industry, and society.

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Appendix A

**TII's response to the SEAI/EPA Climate Action Mandate**

# Appendix A

## TII's response to the SEAI/EPA Climate Action Mandate

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September 2023

## 1 RESPONSE TO THE CLIMATE ACTION MANDATE

This Appendix sets out TII’s response to the guidelines published by the SEAI and EPA in July 2023. The guidelines outline minimum level of requirements and documentation across all public sector organisations.

Climate Mandate Area	Theme	Required Content (as per SEAI/EPA Guidance published July 2023)	TII Response	Documentation to support adherence to the Climate Action Mandate	Status
Our targets	<b>Achieving the carbon emissions reduction target</b>	Reduce GHG emissions by 51% in 2030.	In progress	See Chapter 2 of this Climate Action Roadmap.	In progress
	<b>Achieving the energy efficiency target</b>	Increase the improvement in energy efficiency in the public sector from the 33% target in 2020 to 50% by 2030.	In progress	See Chapter 2 of this Climate Action Roadmap.	In progress
	<b>Updating the Climate Action Roadmap</b>	Update Climate Action Roadmaps annually in line with updated Public Sector Climate Action Mandate.	In progress	See Chapter 3 of this Climate Action Roadmap.	In progress
Our people	<b>Leadership and governance for climate action</b>	Establish and resource Green Teams, reporting to senior management, to become integrated drivers of sustainability in every public sector body.	In place	<ul style="list-style-type: none"> <li>○ ‘Green Team’ known as the Energy and Carbon Enterprise Delivery Group as per the Sustainability Portfolio Management Framework (2022)</li> <li>○ TII’s Energy &amp; Carbon Terms of Reference</li> <li>○ TII Energy &amp; Carbon Group: 2022 Year End Report</li> </ul>	Complete
		Nominate a member of the Management Board as the Climate and Sustainability Champion with responsibility for implementing and reporting on the Mandate.	In place	Sustainability Portfolio Management Framework (2022)	Complete
	<b>Engaging and training staff</b>	Incorporate appropriate climate action and sustainability training (technical and behavioural, including green procurement training) into learning and development strategies for staff.	In place	TII Sustainability Training Needs Assessment (Dec 2020). In March 2023, TII launched its Sustainability Education, Engagement & Awareness programme to TII Staff, made up of a calendar of relevant themes to TII, with input from Divisions and Directorates across the organisation. Each month, internal webinars and events are delivered by staff or external experts. The webinar and events are supplemented by online modules developed each month, on a dedicated learning portal,	Complete



Climate Mandate Area	Theme	Required Content (as per SEAI/EPA Guidance published July 2023)	TII Response	Documentation to support adherence to the Climate Action Mandate	Status
				<p>Articulate. The portal allows staff to learn at their own pace, which was a recommendation that came out of the Sustainability Needs Assessment, of how TII staff like to learn.</p> <p>In 2023, the Sustainability Education, Engagement &amp; Awareness programme covered topics including Climate Policy Landscape, Biodiversity, Climate Communications, and Sustainable Mobility. Upcoming topics for 2023 include Innovation &amp; Transformation (in line with Public Service Transformation Week 2023), Sustainability Partnerships and Sustainable Leadership.</p>	
		Organise staff workshops (at least annually) to engage on climate issues, including a focus on decreasing the organisation’s carbon footprint.	In progress	See Chapter 3 of Climate Action Roadmap.	In progress
		Ensure all senior management (P.O. level or equivalent and above) complete a climate action leadership training course in 2023, similar to the Local Authority training course as delivered by the CAROs.	In progress	The HR Department is currently identifying a climate action leadership course to deliver to all staff at PO level and above in Q4 2023.	In progress
<b>Our way of working</b>	<b>Reporting progress against the Climate Action Mandate requirements</b>	<p>Report on the following in the Annual Report:</p> <ul style="list-style-type: none"> <li>○ GHG emissions</li> <li>○ Implementation of the mandate</li> <li>○ Sustainability activities report</li> <li>○ Compliance with Circular 1/2020: Procedures for offsetting the emissions associated with official air travel.</li> </ul> <p>Using SEAI’s Public Sector Monitoring and Reporting System, public bodies are to report annually on implementation of the individual mandate requirements using a ‘comply or explain’ approach.</p>	In place/ In progress	<p>The TII Annual Report includes details on GHG emissions and sustainability activities across TII.</p> <p>TII is undertaking annual reporting against individual mandate requirements including using the M&amp;R system.</p> <p>TII is compliant with Circular 1/2020 and is working in conjunction with Finance to produce the necessary return for the period 2022.</p>	In progress

Climate Mandate Area	Theme	Required Content (as per SEAI/EPA Guidance published July 2023)	TII Response	Documentation to support adherence to the Climate Action Mandate	Status
	<b>Resource use</b>	Review any paper-based processes and evaluate the possibilities for digitisation so it becomes the default approach. Eliminate paper-based processes as far as is practicable. Where paper must be procured, ensure that recycled paper is the default.	In progress	TII is commencing a review of paper-based processes across the organisation in 2023.	In progress
	<b>Energy &amp; environmental management systems and accreditation</b>	Achieve formal environmental certification for large public sector bodies, such as ISO 50001 (Energy Management Standard) or ISO 14001 (Environmental Management System), with a view to going beyond ISO 14001 to adopting EMAS (Eco Management and Audit Scheme). Specifically: <ul style="list-style-type: none"> <li>○ All public sector bodies with an energy spend greater than €2m per annum to achieve ISO 50001 certification by end-2024;</li> <li>○ All remaining public bodies to implement energy management programmes as per SEAI’s energy management guidance (S.I. 426 of 2014) and report to SEAI annually on M&amp;R.</li> </ul>	In place and in progress	<p>TII achieved accreditation to ISO 50001: 2018 Energy Management System in 2019 and has passed subsequent surveillance audits in 2020, 2021 and 2022. TII will be due for recertification in 2023 whereby the certification is an ongoing process. In Q4 2021, TII procured a consultant to undertake a Gap Analysis against the existing draft EMS documents.</p> <p>TII is currently working towards developing an EMS to gain accreditation to ISO 14001:2015. This will include the tracking of environmental criteria including water usage and waste production.</p> <p>TII completes an energy audit every four years. TII’s S.I. 426 audit was carried out in 2021.</p> <p>TII reports annually to the SEAI on M&amp;R.</p>	In place and in progress
	<b>Green public procurement</b>	Implement Green Public Procurement (GPP), in line with the EPA Green Public Procurement Guidance and using GPP Criteria Search where appropriate. All public bodies shall:	In progress	See Chapter 3 of Climate Action Roadmap for further details on Green Public Procurement. TII is aiming to embed sustainable considerations into all stages of the procurement lifecycle. To assist project and contract managers in this regard, TII has produced a simplified Sustainable Procurement Guide (published December 2021).	In progress

Climate Mandate Area	Theme	Required Content (as per SEAI/EPA Guidance published July 2023)	TII Response	Documentation to support adherence to the Climate Action Mandate	Status
		<ul style="list-style-type: none"> <li>○ Cease using disposable cups, plates and cutlery from any public sector canteen or closed facility, excluding clinical (i.e., non-canteen healthcare) environments;</li> </ul>	In progress	TII has ceased using disposable cups, plates and cutlery and is working towards EMS accreditation to ISO 14001:2015.	In progress
	<b>Low carbon construction methods</b>	<ul style="list-style-type: none"> <li>○ Specify low carbon construction methods and low carbon cement material as far as practicable for directly procured or supported construction projects from 2023.</li> </ul>	In progress	See Chapter 3 of Climate Action Roadmap.	In progress
<b>Our Buildings and vehicles</b>	<b>Our buildings and vehicles</b>	Promote the use of bicycles (including push bikes, electric bikes, and cargo bikes) and shared mobility options as an alternative to car use among employees and visitors by creating and maintaining facilities (both inside and outside of buildings) that support such options, including secure and accessible bicycle parking, shared mobility parking, and charging stations, as appropriate, with a view to achieving the Smarter Travel Mark, which is currently being developed as part of the Sustainable Mobility Pathfinder Programme.	In progress	TII is working on promoting the use of bicycles and shared mobility options for both employees and visitors. In 2023, progress was made on a variety of initiatives and projects. TII intends to participate in the Smarter Travel Mark scheme in 2023.	In progress
		Phase out the use of parking in buildings that have access to a range of public transport services and active/shared mobility options for the majority of staff/visitors while providing that sufficient accessible parking is maintained for those with physical mobility issues.	In progress	TII has commenced phasing out parking and recently removed 5 car spaces to increase bicycle parking facilities.	In progress
		Display an up-to-date Display Energy Certificate in every public building that is open to the public to clearly show energy use.	In place	As of Q1 2023, TII provides up-to-date Display Energy Certificate on every public building.	In place

Climate Mandate Area	Theme	Required Content (as per SEAI/EPA Guidance published July 2023)	TII Response	Documentation to support adherence to the Climate Action Mandate	Status
		<p>The public sector will not install heating systems that use fossil fuels after 2023, in (1) new buildings, and (2) “major renovation” retrofit projects (as defined in the Energy Performance of Buildings Directive (EPBD)) unless at least one of the following exceptions applies:</p> <ul style="list-style-type: none"> <li>○ The fossil-fuel use is only using electricity from the grid;</li> <li>○ There is no technically viable non-fossil alternative (generally only related to applications for a purpose other than space heating);</li> <li>○ The installation of a renewable space heating system would increase final CO2 emissions;</li> <li>○ The fossil-fuel use is provided for backup, peaking, or operational purposes (and makes up less than 10% of annual heating energy);</li> <li>○ Where the direct replacement of existing fossil fuel heating is required for an emergency maintenance purpose.</li> </ul>	In progress	<p>TII will not install heating systems that use fossil fuels after 2023.</p> <p>See Chapter 2 of Climate Action Roadmap for decarbonisation plans.</p>	In progress
		<p>In relation to existing buildings:</p> <ul style="list-style-type: none"> <li>○ Large public sector bodies and sectoral groups with a large estate should commence a deep retrofit of at least one building in 2023 in pursuit of the 2030 51% target;</li> <li>○ All public sector bodies should develop a building stock plan, in line with the EPBD, by end-2023 for retrofitting their building stock to meet CAP targets;</li> </ul>	Awaiting guidance	<p>The TII building stock comprises three depots on the Luas system and a small number of private dwellings. All remaining buildings are leased. TII also uses some local authority buildings. The TII requirements for a building stock plan are to be confirmed with SEAI.</p>	Pending

Climate Mandate Area	Theme	Required Content (as per SEAI/EPA Guidance published July 2023)	TII Response	Documentation to support adherence to the Climate Action Mandate	Status
		<ul style="list-style-type: none"> <li>As part of the building stock plan, public sector bodies should undertake data gathering and consider the long-term (to 2050) retrofit key performance indicators to upgrade all their building stock to Nearly Zero Energy Buildings (NZEB) or Zero Emission Buildings (ZEB) as outlined in the EPBD proposal and Energy Efficiency Directive;</li> <li>In 2023, SEAI will work with sectoral groups with a large estate to develop a renovation target.</li> </ul>			
		<p>Procure (purchase or lease) only zero-emission vehicles from the end of 2022, enabling Ireland to go beyond the requirements of the EU Directive, amending Directive 2009/33/EC on the promotion of clean and energy-efficient road transport vehicles (EU Directive 2019/1161, the Clean Vehicle Directive) and act as an international leader in this area.</p> <p>An exception applies where the vehicle is exempt under European Communities (Clean and Energy-Efficient Road Transport Vehicles) (Amendment) Regulations (S.I. 381 of 2021).1 Public sector procurement contracts for delivery and haulage should specify zero emissions vehicles where possible.</p>	In progress	<p>It is TII policy to only procure zero emission vehicles where operationally feasible. This is supported by the installation of charging points at its head office.</p> <p>TII is aiming to embed sustainable considerations into all stages of the procurement lifecycle in alignment with the Green Public Procurement guidance.</p>	In progress

Appendix B

**Policy Context**

# Appendix B

## Policy Context

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September 2023

## 1 EUROPEAN POLICY

The European Green Deal outlines Europe's response to the climate crisis. The Green Deal commits to delivering net-zero GHG emissions in the EU by 2050 and sets the EU GHG emissions reduction target to at least 55% for 2030 to limit global warming to 1.5 degrees Celsius, in line with the Paris Agreement. The 'Fit for 55' legislative package will turn the EU's ambition into reality. The EU is working to revise its climate, energy, and transport related legislation under the 'Fit for 55' package, this will align the current laws with the 2030 and 2050 ambitions. Ireland is a supporter of the EU's enhanced climate ambition.

To promote a higher energy performance of its buildings, the EU has established a legislative framework including the Energy Performance of Buildings Directive 2010/31/EU and the Energy Efficiency Directive 2012/27/EU. In combination these Directives aim to establish a highly energy efficient and decarbonised building stock by 2050, create a good environment for investment decisions, and enable consumers to make informed decisions to save energy and money. Both directives were amended in 2018 and 2019, as part of the Clean Energy for all Europeans package. Public bodies in the EU must ensure that new public buildings, and buildings undergoing major renovation, comply with net zero-energy provisions as per this legislation or by allowing for roofs to be used for renewable energy installations.

The Energy Efficiency Directive targets energy savings in the public sector including obligating annual renovation of public buildings, and accounting for energy efficiency in procurement processes. These measures ensure that the public sector will lead by example in upgrading the energy performance of their buildings. The Directive requires large public organisations to complete energy audits every four years.

The European Commission (the Commission) has revised the Energy Efficiency Directive to align with meeting the EU 2030 target of reducing GHG emissions by at least 55% (compared to 1990 levels). In 2021 the Commission proposed a new directive on energy efficiency which will further prioritise energy efficiency needs within the European Union (EU) and make the ambition binding, which was adopted in July 2023. This proposal promotes 'energy efficiency first' amongst the EU's energy policy goals which sets out its importance in both policy and investment decisions. It would require EU Member States to collectively ensure an additional reduction of energy consumption of 11.7% by 2030 compared to 2020.

The Commission's Renewable Energy Directive 2018/2001 is the legal framework for the development of renewable energy across all economic sectors. It is proposed that the Directive, last revised in 2018, will undergo a second revision to align with the ambition of the European Green Deal and the recent REPower EU Plan. Under the existing directive, the EU is bound to a target of at least 32% renewable energies for 2030, with a potential upwards revision by 2023. The Renewable Energy Directive promotes incentivisation for the use and expansion of public transport and energy efficient technologies and use of renewables within the electricity, heating, and transport sectors to reduce energy consumption.



## 2 NATIONAL POLICY

Our Shared Future, the Programme for Government, commits to a 51% reduction in Ireland's overall GHG emissions from 2021 to 2030, and to achieving net-zero emissions by 2050.

Ireland's CAP23 outlines the plan to deliver Ireland's climate ambition, in alignment with legally binding economy-wide carbon budgets and sectoral ceilings. CAP23 sets out a pathway for increased decarbonisation ambition across all sectors. There is significant potential for lowering Ireland's GHG emissions by increasing energy efficiency and reducing fossil fuel dependence across the public sector.

The national target for public sector energy efficiency is set for 50% energy efficiency by 2030, all public buildings to achieve a B BER rating, and a new emissions reduction target of 50%. To assist in delivering this goal, the Public Sector Energy Efficiency Strategy was produced in 2017. Public bodies report on energy performance to the Sustainable Energy Authority of Ireland (SEAI) annually.

Under the EU Energy Efficiency Directive, Ireland is required to submit a National Energy Efficiency Action Plan (NEEAP) every three years. Ireland's 4th NEEAP was published in early 2017.

The National Climate and Energy Plan (2021) builds on previous national strategies and sets out Ireland's decarbonisation objectives including measures relating to renewable energy, energy efficiency, energy security, internal energy market, research, innovation, and competitiveness, together with planned policies and measures.

The Climate Action and Low Carbon Development (Amendment) Act 2021 enacts these objectives in law. This acts as a legally binding framework with goals and commitments, to ensure that targets and obligations are met at an EU and national level.

The Act commits Ireland, in law, to move to a climate resilient and climate neutral economy by 2050 in alignment with the European Green Deal, and includes the following elements:

- Establishes 2050 emissions target.
- Introduces a system of successive 5-year, economy-wide carbon budgets. The first two carbon budgets covering the periods 2021-2025 and 2026-2030 were announced by the Climate Change Advisory Council in 2021 (with a provisional budget from 2031). Once adopted by the Oireachtas, the carbon budgets will be used to prepare sectoral emissions ceilings for relevant sectors of the economy.
- Strengthens the role of the Climate Change Advisory Council in proposing carbon budgets.
- Introduces a requirement to annually revise the national Climate Action Plan and prepare a National Long Term Climate Action Strategy at least every decade.
- Introduces a requirement for all Local Authorities to prepare individual Climate Action Plans which will include both mitigation and adaptation measures.

In 2022 Ireland's first carbon budget programme was approved. The programme consists of three 5-year budgets (2021-2025; 2026-2030; 2031-2035). Each budget sets out a total allowed quantity of emissions and the average annual reduction for each period. For the 2021-2025, the overall emissions allowed are 295 Mt CO<sub>2</sub>e, representing an average reduction in emissions of 4.8% per annum. For 2026-2030, the budget is 200 Mt CO<sub>2</sub>e, an average reduction of 8.2% per annum. In 2031-2035, the budget is 151 Mt CO<sub>2</sub>e, representing an average reduction in emissions of 3.5% per annum for the third provisional budget. In addition, the Irish government reached an agreement regarding Sectoral Emissions Ceilings, which set limits on the maximum GHG emissions per sector.

Sectoral Emissions Ceilings have been set for the electricity, transport, buildings, industry, and agriculture sectors. In particular, the percentage in reduction set for 2030 compared to 2018 is as follows:

- Electricity: 75%,
- Transport: 50%,
- Buildings (Commercial and Public): 45%,
- Buildings (Residential): 40%,
- Industry: 35%,
- Agriculture: 25%,
- Other: 50%

The carbon budgets are intended for Ireland to progress towards the 2030 target of a 51% reduction from a 2018 baseline.

Appendix C

**Gap-to-Target Technical Note**

# Appendix C

## Gap-to-Target Technical Note

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September 2023

## 1 INTRODUCTION

The Sustainable Energy Authority of Ireland (SEAI) and the EPA (Environmental Protection Agency) have developed a modelling tool for public bodies to use to project progress towards the 2030 Climate Action Plan 2023 (CAP23) targets. This is known as the “gap-to-target Tool”. The tool consists of a decarbonisation component (“decarbonisation model”) and an energy efficiency component (“energy efficiency model”) which form the two distinct parts of this tool. The details of both components are outlined in this technical note.

## 2 MODEL BACKGROUND

This Appendix (**Appendix C**) has been prepared in line with the SEAI/EPA guidance on Climate Action Roadmaps published in May 2023. It documents how TII has utilised the gap-to-target model in line with the SEAI’s *Gap-to-target model User guide* and the *Public Sector M&R-2030 Framework M&R-2030 Methodology Guidance*. The results presented in this chapter represent modelling outputs, dated July 2023, based on the gap-to-target tool version 3.12 released May 2023. The Climate Action Roadmap (‘Roadmap’) contains a glossary of key terms to assist with reading this Appendix.

Public sector organisations in Ireland must report energy performance annually using the SEAI Public Sector ‘Monitoring and Reporting’ (M&R) system. The M&R system enables monitoring of progress, identification of improvement opportunities, and validation of emissions savings.

Data reported through the M&R system annually includes:

- Energy consumption.
- Activities undertaken; and
- Energy saving projects.

The gap-to-target tool was used to forecast TII’s GHG emissions and energy efficiency progress to 2030. The gap-to-target tool consists of a decarbonisation component (‘decarbonisation model’) and an energy efficiency component (‘energy efficiency model’). These are described below. The gap-to-target tool uses data collected through the M&R system as a basis for modelling.

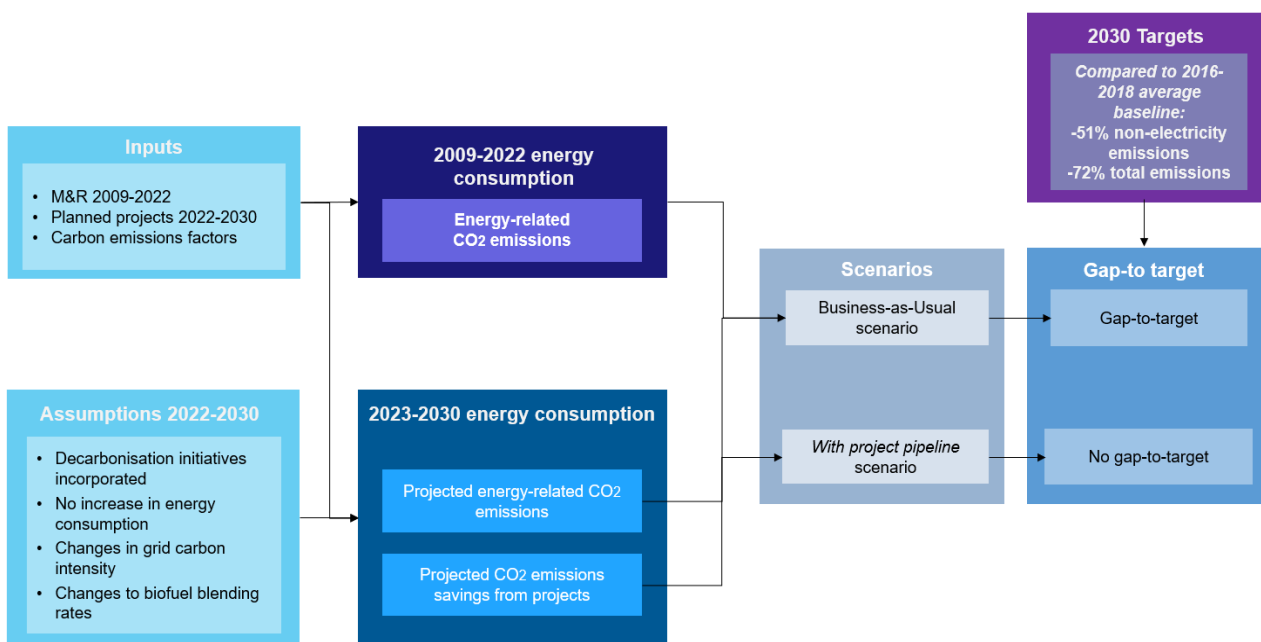
### 2.1 Decarbonisation model

The decarbonisation model aggregates emissions as in-target non-electricity, in-target electricity and total. They are defined in **Table 1** below, in line with the SEAI M&R System Guidance:

**Table 1** Definition of types of emissions under M&R guidance

<b>In-target non-electricity emissions</b>	In-target non-electricity emissions arise from the combustion of fuels ('energy types'): <ul style="list-style-type: none"> <li>At Public Sector Organisation (PSO) facilities, to generate heat, steam, electricity, or power in stationary equipment such as boilers, furnaces etc.</li> <li>In vehicles &amp; mobile plant, including cars, trucks, trains, planes, ships, non-road mobile machinery.</li> <li>For the generation of purchased heat, cooling &amp; or steam, including district heating.</li> </ul>
<b>In-target electricity emissions</b>	In-target electricity emissions arise from: <ul style="list-style-type: none"> <li>Consumption of electricity purchased from the electricity network ('grid electricity').</li> <li>Consumption of electricity purchased via corporate purchase power agreement (CPPA).</li> <li>Consumption of electricity that is produced by a non-fuel-based generator inside the meter boundary of a PSO electricity end-user, e.g., solar PV, hydro, wind turbines.</li> </ul>
<b>Total emissions</b>	These are the sum of in-target electricity and in-target non-electricity (thermal and transport) emissions

A visual representation of the decarbonisation model can be found in **Figure 1**. The model uses historic M&R system data relating to energy consumption, carbon emissions factors set by the SEAI and TII's portfolio of planned projects from 2023-2030 to model TII's GHG emissions from its baseline (2016-2018 (average)) to 2030.



**Figure 1** Representation of the decarbonisation model

Future emissions pathways are calculated up to 2030, relying on SEAI carbon emissions factors and M&R system data. The options to 'model future GHG emissions incorporating decarbonisation initiatives between 2023 & 2030 (aka 'with project pipeline scenario')' and 'include anticipated changes to biofuel blending rates (road diesel and petrol) in calculation of future emissions' are selected by default.

Supply-side decarbonisation, for both electricity and liquid road transport fuels are accounted for within the model. Specifically, electricity decarbonisation relates to the anticipated phasing out of fossil fuels and increased renewable energy in power generation (grid decarbonisation). While supply-side decarbonisation for fuels relates to the increased rates of blending of biofuels in road diesel and petrol. The model includes SEAI forecasts of carbon emissions factors and applies future grid conversion factors.

The impact of additional decarbonisation initiatives is accounted for either as standalone or within a portfolio of projects. The model includes calculations for a variety of initiatives, including:

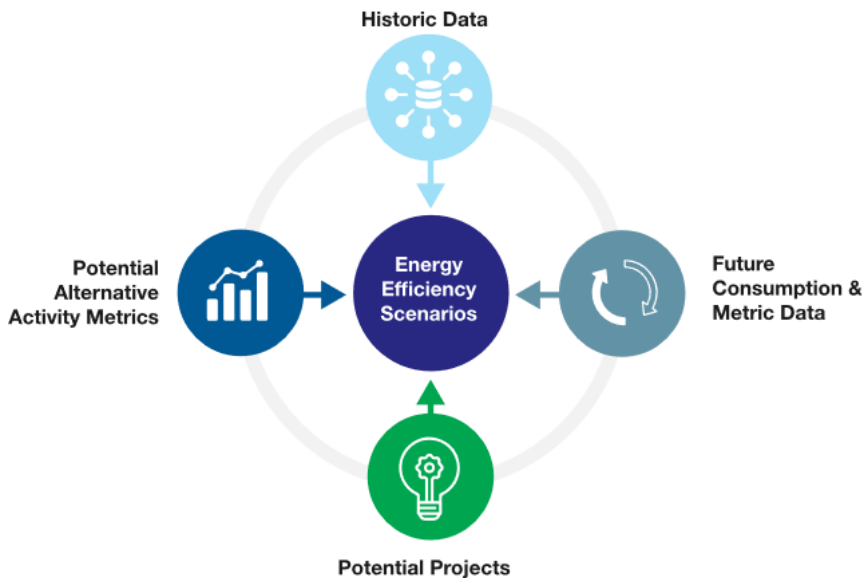
- i) Energy efficiency gains from building retrofits & other decreases in energy consumption
- ii) Fossil-fuel boilers replacement with heat pumps
- iii) Fossil-fuel boilers replacement with biomass boilers
- iv) Other thermal (heat) fuel switching, e.g. changing from oil heating to gas heating
- v) Fossil-fuel transport replacement with electric vehicles
- vi) Fossil-fuel transport replacement with high-blend biofuels
- vii) Fossil-fuel transport replacement with compressed natural gas (CNG)
- viii) 100% renewable electricity (onsite generation) reducing the required grid electricity imports

For fuel switching initiatives, the model accounts for both the reduction in the fossil fuel consumption (e.g. natural gas for boilers) and the increase in electricity consumption (e.g. required for heat pumps), and applies the relevant carbon emissions factors.

The model also has the flexibility to add further increases in energy consumption, e.g., arising from expansions, new facilities, or growth in activities. In 2024, it is expected that the Luas timetable will increase in frequency. This will have a positive impact for service users by increasing the accessibility of public transport, enabling the shift from personal vehicles to public transport than personal vehicles which will reduce on-road user emissions. This increased Luas activity is estimated to result in an energy consumption increase of 1.8mkWh, which is included in the model.

## 2.2 Energy efficiency model

The energy efficiency model considers TII's energy efficiency, using a baseline of 2009 and a target date of 2030. The energy efficiency scenario depends on a variety of inputs, as set out in **Figure 2**.

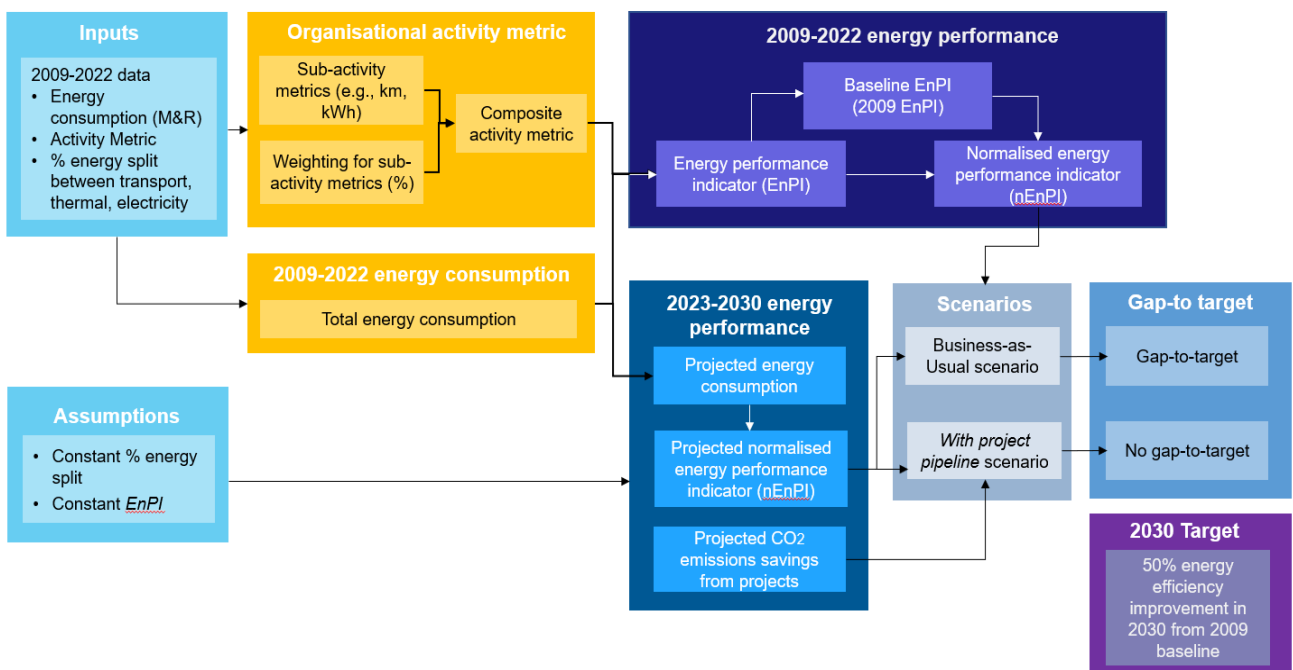


**Figure 2** Building blocks for energy efficiency scenarios

Source: SEAI, Public sector energy efficiency & greenhouse gas targets - Gap-to-target model User guide (2022)

Within each scenario there are several variables that can be changed. These are: activity metrics; split of final energy consumption (percentage of electricity, heat, transport within final consumption); primary energy conversion factors; whether the Business as Usual (BAU) energy efficiency will change; and energy efficiency projects.

**Figure 3** below indicates how activity metrics, Total Final Consumption (TFC), Total Primary Energy Requirement (TPER), and Energy Performance Indicator (EnPI) relate to each other and are calculated.





**Figure 3** Representation of the energy efficiency model

The model is based on choosing an activity metric, which is a measure of the activity that TII undertakes. As TII is a complex organisation, a composite activity metric is used to track performance as this allows distinct aspects of TII’s organisation, which consume several types and quantities of energy, to be appropriately incorporated. The composite organisation-level activity metric is based on more than one sub-activity metric. The scale of each sub-activity metric’s contribution to the overall activity metric is specified by TII and is based on each sub-activity metric’s share of the overall energy consumption.

The sub-activities included in composite activity metric are:

- No. of lighting points in tunnels and Motorway Service Areas
- No. of lighting columns on PPP and MMarC schemes (no. of columns)
- Product of distance travelled by Luas vehicles and the un-laden weight of Luas trams (tonne.kilometres)
- Area of the administration buildings and Luas depots (m2)
- Transport distance travelled (km)

TII measures its energy efficiency annually using an Energy Performance Index (EnPI). EnPI is calculated using annual energy consumption and a measure of TII’s composite activity metric. It is calculated by dividing the Total Primary Energy Requirement (TPER) for each year by the corresponding activity metric for each year.

The EnPI for each year is normalised to allow comparison against the energy performance in the baseline year (2009), this is called the normalised Energy Performance Index (nEnPI). EnPI is normalised by dividing it by the baseline EnPI (EnPI in 2009). Lower nEnPI values show higher energy efficiency improvements, with an nEnPI below 50% meaning that the energy efficiency target of a 50% improvement has been achieved.

### 2.3 Updates to Luas sub-activity metric

As per the 2022 iteration of TII’s Climate Action Roadmap, the model uses an updated sub-activity metric for the Luas within the composite organisational-level activity metric. Previously, the activity for the Luas was tracked using the kilometres travelled by Luas vehicles for each year, when the tram type per line was more homogenous. The updated sub-activity metric is the product of the distance travelled by Luas vehicles and the unladen weight of the Luas vehicles.

The benefit to using this updated sub-activity metric is that it accounts for the difference in weights between different models of tram in the fleet. This results in a more exact reflection of the Luas’ energy performance. This is especially important for the period from 2019 to 2021, when the Luas Green Line trams were extended in length which increased their weight but did not affect the kilometres travelled by the vehicles. Due to the extension of trams on the Green Line, the old sub-activity metric of kilometres travelled by the Luas was no longer considered to be the most proper measure of activity as the fleet is no longer as homogenous. The composite organisation-level activity metric used in the energy efficiency model has been updated in the M&R system to reflect the changes to the Luas sub-activity metric.

To account for the changes in Luas timetable as described in section 2.1, the Luas tonne-km activity metric was increased accordingly by an estimated 8% of the 2022 metric, from 2024 onwards.

### 3 MODEL FINDINGS

The results of the gap-to-target model have been outlined in Chapter 2 of the report. Below further details and graphical representations of the findings of the decarbonisation and energy efficiency models have been set out.

#### 3.1 Decarbonisation model

TII’s decarbonisation target is set by SEAI. SEAI calculates the 2030 decarbonisation target using the data reported to the M&R system and SEAI emissions projections for electricity. TII must reduce total GHG emissions from energy by 72% overall (total emissions) and by 51% for non-electricity emissions (transport and thermal) by 2030 compared to the 2016-2018 (average) baseline.

The total emissions target is calculated using the 51% required reduction in non-electricity emissions and SEAI’s projection for supply-side emissions reduction for the electricity grid (77%), compared to the baseline. This results in a total emissions reduction target of 72% by 2030 for TII, compared to the 2016-2018 (average) baseline. As SEAI updates its projections for the electricity grid, the total emissions target is subject to change in line with expected electricity grid decarbonisation.

In the model, two scenarios were set out for TII: Business-as-Usual (BAU) and ‘With Project Pipeline’. The BAU scenario looks at emissions projections to 2030 whereby emissions reductions depend solely on supply-side decarbonisation. Supply-side emissions reductions from 2023 to 2030 are expected from an increased proportion of biofuels in liquid transport fuels and the decarbonisation of the electricity grid over time.

The ‘With Project Pipeline’ scenario explores a situation in which both supply-side decarbonisation and the emissions reductions from the project pipeline are achieved. **Table 2** outlines the GHG emissions projected under the BAU and ‘With Project Pipeline’ scenarios.

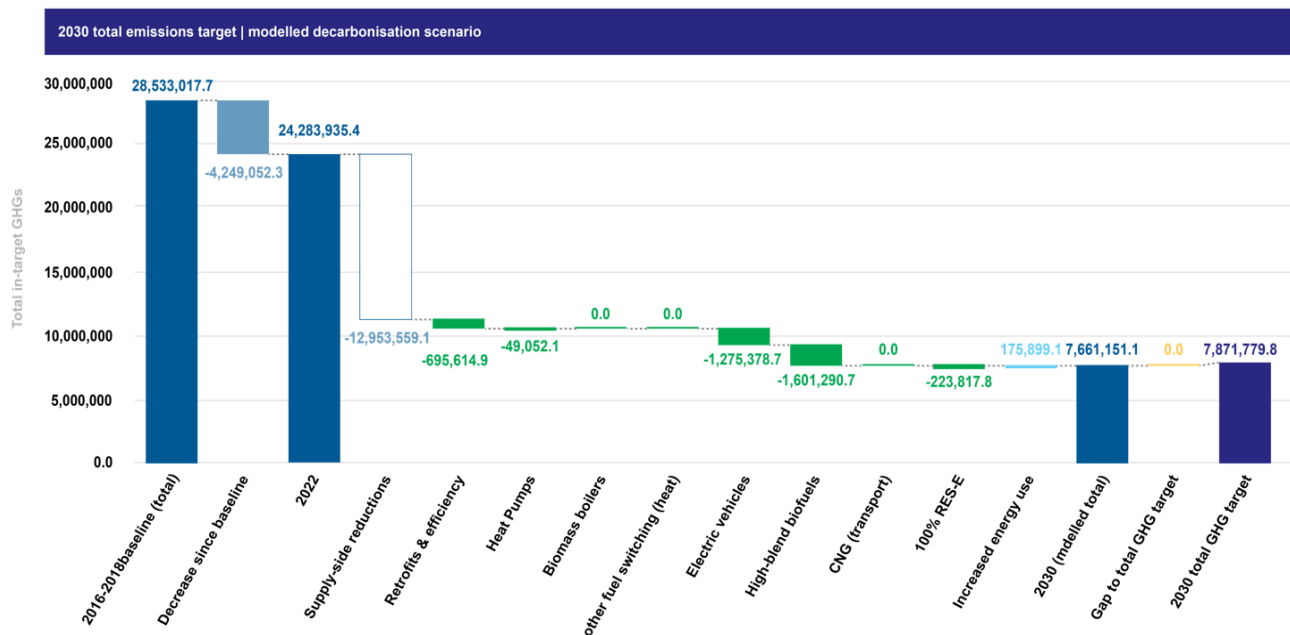
**Table 2** GHG emissions from energy - 2030 projections

[tCO <sub>2</sub> ] TFC	2016-2018 (average) Baseline	2030 Target emissions	‘Business as Usual’ Scenario			‘With Project Pipeline’ Scenario		
			2030 emissions	% Change from baseline to 2030	Gap-to-target in 2030	2030 emissions	% Change from baseline to 2030	Gap-to-target in 2030
<b>Electricity</b>								
Electricity	23,117	5,218	5,504	-76%	-	5,007	-78%	-
<b>Non-electricity</b>								
Thermal	1,808	886	1,896	+5%	-	1,841	+2%	-
Transport	3,608	1,768	3,781	+5%	-	813	-77%	-
<b>Non-electricity Total*</b>	<b>5,416</b>	<b>2,654</b>	<b>5,677</b>	<b>+5%</b>	<b>3,024</b>	<b>2,654</b>	<b>-51%</b>	<b>NIL</b>
<b>Total GHG Emissions</b>								
<b>Total GHG emissions**</b>	<b>28,533</b>	<b>7,872</b>	<b>11,182</b>	<b>-61%</b>	<b>3,310</b>	<b>7,661</b>	<b>-73%</b>	<b>NIL</b>
*Non-electricity total = thermal + transport								
**Total GHG emissions = electricity + non-electricity								

In the BAU scenario, a gap-to-target would remain in 2030. TII’s non-electricity emissions (thermal and transport) are expected to be 5% higher in the BAU 2030 scenario than the baseline. However, TII could expect a reduction in total emissions (electricity and non-electricity) of 61% by 2030 in the BAU scenario, resulting in a gap of 11% to the 72% target, this is a gap of 3,310 tCO<sub>2</sub>.

In the ‘With Project Pipeline’ scenario, projected supply-side reductions from electricity grid decarbonisation, alongside the delivery of decarbonisation initiatives, are expected to lead to a 78% reduction in electricity emissions between the baseline and 2030. A higher rate of biofuel blending in liquid transport fuels will further increase supply-side reductions. TII plans to deploy a portfolio of projects between 2023 and 2030 to further accelerate decarbonisation. The planned projects are detailed in **Appendix D**.

**Figure 4** sets out the impact of the variety of projects on reaching the decarbonisation target. This includes projects grouped under the following categories: retrofits and efficiency initiatives, electric vehicles, and 100% renewable energy sources in electricity (RES-E), which, in addition to previous reductions from the baseline to 2021, will result in a further 12% reduction (in addition to the ‘Business as Usual’ scenario) by 2030 compared to the baseline. Therefore, TII is expected to exceed the 72% target, projecting a 73% reduction from the baseline.



**Figure 4** Impact of projects and supply-side reductions on total emissions

### 3.2 Energy efficiency model

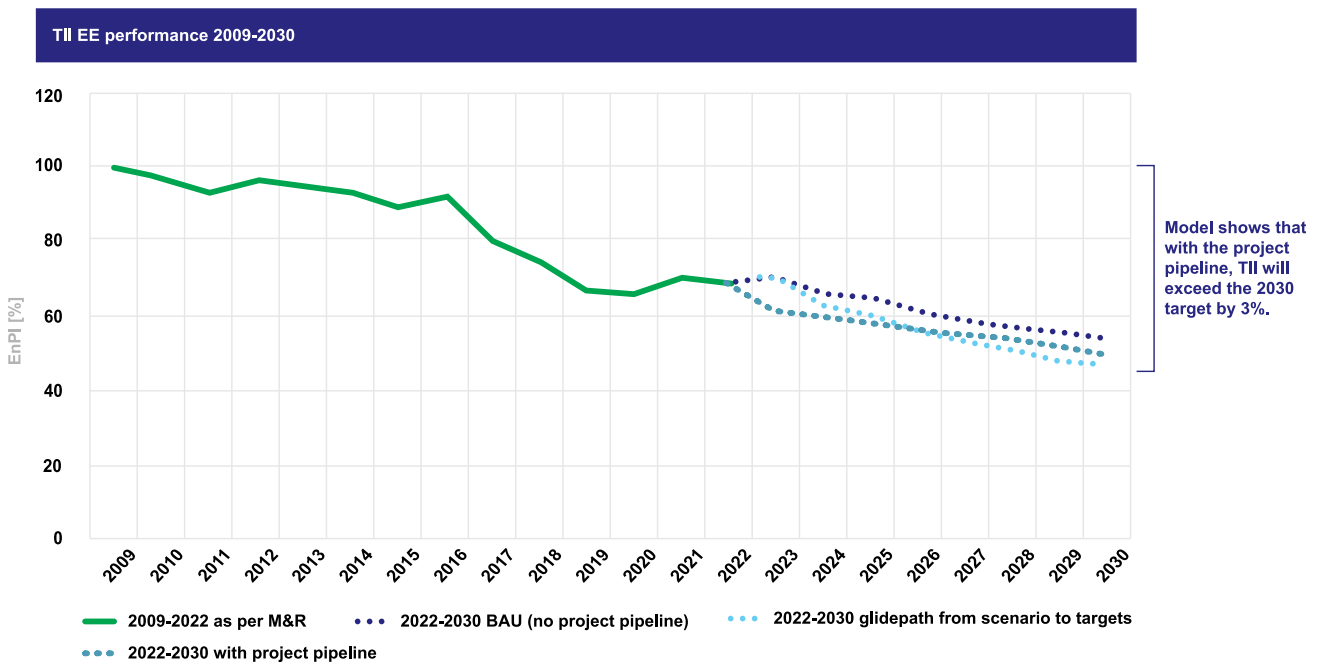
The public sector is obliged to improve its energy efficiency by 50% by 2030, as set out in the Public Sector Climate Action Mandate 2022 and the CAP23. This follows from Ireland’s first National Energy Efficiency Action Plan (NEEAP) of 2009, which obliged the public sector to improve its energy efficiency by 33% by 2020. TII’s energy efficiency target is a 50% improvement from its 2009 baseline by 2030. Progress towards this target is tracked using the data reported to the M&R system.

Results from the energy efficiency model are shown in **Table 3** below. **Figure 5** shows nEnPI reaching 69% in 2022, indicating a 31% improvement in energy efficiency from the 2009 baseline. In the BAU scenario nEnPI is projected at 54%, resulting in the gap-to-target of 4% against the 50% target.

Projects that will contribute to decarbonisation will also contribute to an improvement in energy efficiency and have therefore been included within the project pipeline. When the project pipeline is considered, the gap-to-target is closed and the 50% target is exceeded by 3%. This shows that if the planned projects are implemented as in the ‘With Project Pipeline’ scenario, TII is expected to achieve the energy efficiency target.

**Table 3** Results from the energy efficiency model

	Target	2030 BAU Projection	2030 Projection with projects
nEnPI	50%	54%	47%
Energy efficiency improvement versus 2009 baseline	50%	46%	53%
Gap-to-target in 2030	NIL	4%	NIL (Target exceeded by 3%)

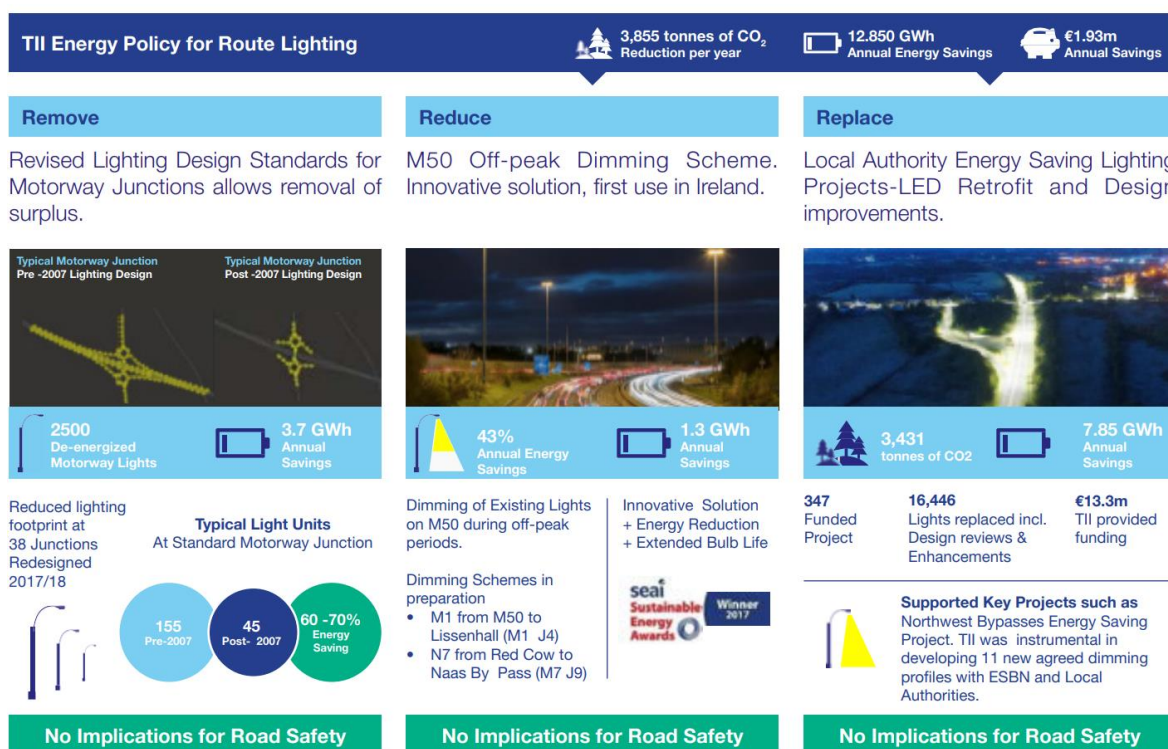


**Figure 5** TII energy efficiency 2009-2030

#### 4 ANALYSIS OF MAJOR EMITTERS

TII’s energy-related carbon emissions include all the electricity, thermal and transport fuel emissions associated with TII’s buildings, depots and offices, the National Roads network (fuel and electricity consumption for operations such as PPP, MMarC, and tunnels, excluding road users) and light rail network. Most emissions are associated with the operation of the National Roads network and the operation of the light rail network.

The National Roads network is made up of 995 km of motorway, 332 km of dual carriageway and 3,974 of single carriageway, as stated in TII’s National Road Networks Indicators (2022). The emissions from the National Roads network arise from: route lighting, tunnels, motorway service areas, motorway operations and maintenance, bridge maintenance, travel information services for road users and tolling. Route lighting on roads and tunnels consumes the largest amount of energy. Therefore, TII has focused on finding measures to reduce energy consumption from traffic route lighting. This includes removing surplus lighting, dimming/voltage regulation where appropriate, and replacing of existing fittings with LED lighting. The removal of surplus lighting at motorway junctions have provided typical energy savings at each junction of ~70%. TII’s Energy Policy for Route Lighting of Remove, Reduce and Replace has contributed to 12.85 GWh in energy savings per year, which amounts to an annual emissions reduction 3,855 tCO<sub>2</sub>. This is illustrated in **Figure 6**.



**Figure 6** TII energy policy for route lighting (Source: TII Annual Report and Financial Statements (2021))

The Luas network is Dublin's Light Rail Transit system. The Luas network consists of two tram lines, the Luas Red Line (21km) and the Luas Green Line (22km) which interchange in Dublin city centre. The Luas network has 69 tram stops, seven park and ride facilities at stop locations, 24 traction substations, three tram depots and a fleet of 81 tram vehicles ranging from 41 metres to 54.6 metres in length, capable of carrying 312 and 380 passengers respectively.

The Luas forms transport hubs with Irish Rail stations at Heuston, Connolly, Spencer Dock and Broombridge and shortly with Bus Connects at the Red Cow interchange thus providing a seamless transport experience for passengers.

The Red Line extends from Tallaght, in the southwest of Dublin, through the city centre, to The Point in Dublin's Docklands. The Line has two spurs one to service Connolly Station, and one to service Saggart.

The Green Line extends from Bride's Glen in the southeast of Dublin to Broombridge in the north-west city suburbs. The line consists of a combination of single and twin tracks and is 43km in length overall.

38 million passenger journeys were made on Luas in 2022 with an average 120,000+ passenger journeys made each day. Modern tramways are one of the most environmentally friendly and energy-efficient forms of public transport, with zero emissions at the point of use. The existing Luas network and its continued expansion has the potential to reduce commuter's carbon footprint and prevent chronic road congestion, helping to meet the carbon emissions goals set out in CAP23.

As the operation of the Luas network relies on electricity, the implementation of energy efficiency projects on the network is key to decreasing energy use and associated emissions. TII will deliver a number of projects aimed at increasing the efficiency of the Luas infrastructure such as stop LED lighting retrofitting projects which will replace all metal halide lamps with LED lamps for the light rail network. Further projects phases will target the Luas depots and park & ride car park lighting.

Alongside this, TII will also focus on decarbonising the electricity feeding all Luas depots. Luas depots are measured as among the top four highest energy consuming sites within the TII organisation. This shall be carried out via on-site renewable energy generation via the introduction of commercial scale rooftop solar PV arrays on the roof areas of the tram depots. The arrays will vary in size between 350KWp and 500KWp thus contributing significantly to decarbonising the electricity consumed on site and thus significantly reducing the CO<sub>2</sub> emissions. These projects are included within the gap-to-target model.

## 5 OPPORTUNITIES ARISING FROM A DETAILED DESIGN

TII is accredited to ISO 50001: 2018 Energy Management Systems and in the context of ISO surveillance, TII delivers continuous improvement in order to retain the certification. ISO 50001 applies to TII's Parkgate Street offices, its staff transport fleet and Equipment on the Motorway (e.g., Variable Message Signs [VMS]) as these systems are under the control of TII. TII has to date identified the following opportunities which have been completed or are in progress:

- Replacement of core building services equipment at all Parkgate Street buildings to energy efficient latest technology which included gas boilers, Air Handling Units (AHUs), Fan Coil Units (FCUs), chillers, pumps, and calorifiers.
- Upgraded lighting to LED technology including presence detection to allow for an automated lighting system.
- The ongoing migration of IT system applications to the cloud.
- Sub-metering within TII's buildings and major consumers which lead to better control of electrical consumption and thus lead to emission reduction opportunities.

The following opportunities were found following the 2022 recertification audit for ISO 50001:

- Reducing boiler return temperature to ensure condensing effect.
- Fitting a weather compensator to the Building Management System to adjust on times according to the external temperature.
- Monitoring system for Intelligent Transportation Systems (ITS) energy consumption.
- Investigating heat pumps as replacements to the current heating and cooling sources at Parkgate Street HQ.
- Removing desktop PCs from workstations. All staff will use laptops and following the introduction of hot desking (new hybrid working system) will dock at booked workstations. This will ensure no laptop will remain powered on after close of business thus reducing consumption of electricity.
- Introduction of hybrid working thus ensuring the most efficient use of the three buildings whilst also facilitating an increase of up to 100 new personal in 2023 / 2025 for large capital projects.

These opportunities will contribute to TII achieving a higher building energy rating.

The Energy Efficiency Directive (EED) mandates large organisations such as TII to complete energy audits every four years. This is reflected in Irish legislation in S.I. 426 of 2014 and is known as the Energy Auditing Scheme. TII's 2021 S.I. 426 audit found the following opportunities:

- Solar PV panels to power motorway based ITS (Intelligent Transport System) equipment such as VMS (Variable Message Sign) on N17/18 motorway (currently being trialled).
- Wind turbines connected to batteries to power motorway based ITS equipment to support the solar powered VMS.
- Motorway based weather stations powered from solar/ wind combination.

The findings of the recertification audit for ISO 50001 and S.I. 426 energy efficiency audit inform project planning decisions. The planned project pipeline has been outlined in Appendix D.

## 6 INVESTMENT AND RESOURCES

Overall TII has a mature project delivery ability. TII has a proven record of delivering large (>€1m), complex, capital investments of a similar scale and complexity to those projects planned in Appendix D. For TII to deliver the emissions savings projects, significant additional funding and resources will be needed. A program of targeted investment will be required to deliver the planned projects and support the associated monitoring and maintenance into the future. Achieving the targets will be dependent on TII receiving additional resources and funding.

## 7 LIMITATIONS

The projects that have been included in the model vary in terms of project readiness from concept to tender/contracting stage. The projects which are at concept stage have not yet been developed to any significant extent beyond simple scoping and early-stage engagement. Other projects are at a more advanced stage with well-defined designs and technical specifications. Projects that are currently at concept stage cannot be considered equivalent to those that are at a tendering stage.

The use of modelling has inherent limitations as models provide a simplified picture of the real-world situation. The gap-to-target model focuses on key features relating to decarbonisation and energy efficiency of TII up to 2030. However, a model cannot include all the details of a real-world situation and therefore not all attributes of decarbonisation and energy efficiency can be represented. The results of the model are therefore considered approximations and not real or exact observation.



Appendix D

**Decarbonisation and Energy Efficiency Projects**

## Introduction

Each project within this appendix has been categorised in terms of scale and readiness, where known a cost estimate has also been provided. The categories have been provided by the SEAI.

**Table 1 Project scale categories**

Category	Description
1 Zero- or minimal-investment	'Low-hanging fruit', consisting of energy management, staff awareness and minor investments in controls (e.g. automatically powering off PCs).
2 Standalone energy project (<€100k)	Investments in single systems (e.g. lighting, heating, etc.) that have a defined payback based on energy cost savings.
3 Standalone energy project (>€100k)	Investments in single or multiple systems (e.g. lighting, heating, etc.), potentially including building fabric measures. These projects are not necessarily limited to the built environment, i.e. a project could involve fleet replacement.
4 Asset renewal project	Generally where a full building retrofit is required, or a building is recommended for replacement.
5 New build project	New buildings being constructed. These will be to the latest building standards, which are tending towards NZEB by the end of this decade. Energy Efficient Design principles are promoted by SEAI. These ensure that the energy footprint of a building can be minimised for the energy service required.
6 National infrastructure project	Large elements of national infrastructure are being upgraded or replaced, e.g. rolling stock (rail), buses, water and waste systems, and hospitals.

**Table 2 Project readiness categories**

Category	Description
1 Concept	Project has been identified by an audit, end-of-life of existing system, or is desirable to the client. Project has not been developed to any significant extent beyond simple scoping and early market engagement.
2 Priority project	Project has been identified through structured energy management processes and audits and has been prioritised among other register of opportunity projects. Project has not been developed to any significant extent.
3 Project scope developed	Project scope has been advanced and developed and basic project parameters are understood. This could be through feasibility study, opportunity assessment or through deeper engagement with the market (e.g. receiving quotations, etc.).
4 Business case developed	Project has been developed to include surveys, schedules, baseline energy data (from metering or engineering calculations). Consideration has been given to contracting approach and a robust analysis of cost and energy savings has been undertaken to inform a business case for the project. Financing options are being considered and/or budget is being sought.
5 Design stage	Detailed design work has been undertaken, either by a consultant engineer or as part of a procurement exercise. Project is very well defined - design drawings, technical specification, schedules and the contracting approach have all been defined. Finance is in place.
6 Tender / contracting stage	Project is ready for tendering, or tendering is underway. Project is very advanced and contractor could be mobilised within 3 months.

Projects included in the Gap to Target model.

Project ID	Project details				Project categorisation		Energy savings in year after implementation				Financial summary			Notes (optional)	
	Project name	Location	Type	Sub-type	Project scale	Project readiness	EE or RE or CHP?	Grid electricity	Thermal	Transport	Total	Estimated cost	Project will seek to avail of external funding or support		Project will seek to incorporate pay for performance
	[ - ]	[ - ]	[ - ]	[ - ]	[ - ]	[ - ]	[ - ]	[kWh TFC]	[kWh TFC]	[kWh TFC]	[kWh TFC]	[€]	[ - ]	[ - ]	[ - ]
1	NM Lighting - Phase 1 Network Lighting Projects (2023)	Managed Network Lighting	Lighting	Lighting & lighting controls (public lighting)	3 Standalone energy project (>€100k)	6 Tender / contracting stage	EE	4107000	0	0	4107000	1400000	None	No	Cost note refers to new capital investment required by TII - assumption is no new capital will be required by TII (operator may offset capital costs against savings).
2	NM Lighting - Phase 2 Network Lighting Projects (2024)	Managed Network Lighting	Lighting	Lighting & lighting controls (external)	3 Standalone energy project (>€100k)	5 Design stage	EE	383000	0	0	383000	250000	None	No	Cost note refers to new capital investment required by TII - assumption is no new capital will be required by TII (operator may offset capital costs against savings).
3	NM Lighting - Phase 3 Network Lighting Projects (2025)	Managed Network Lighting	Lighting	Lighting & lighting controls (external)	3 Standalone energy project (>€100k)	2 Priority project	EE	736981.2053	0	0	736981	3000000	None	No	Cost note refers to new capital investment required by TII - assumption is no new capital will be required by TII (operator may offset capital costs against savings).
4	NM Lighting - Phase 4 Network Lighting Projects (2026)	Managed Network Lighting	Lighting	Lighting & lighting controls (public lighting)	3 Standalone energy project (>€100k)	2 Priority project	EE	612175.4	0	0	612175	1000000	None	No	Cost note refers to new capital investment required by TII - assumption is no new capital will be required by TII (operator may offset capital costs against savings).
5	NM Lighting - Phase 5 Network Lighting Projects (2027)	Managed Network Lighting	Lighting	Lighting & lighting controls (public lighting)	3 Standalone energy project (>€100k)	1 Concept	EE	600000	0	0	600000	0	None	No	Cost note refers to new capital investment required by TII - assumption is no new capital will be required by TII (operator may offset capital costs against savings).
6	NM Lighting - Phase 6 Network Lighting Projects (2028)	Managed Network Lighting	Lighting	Lighting & lighting controls (public lighting)	3 Standalone energy project (>€100k)	1 Concept	EE	550843	0	0	550843	0	None	No	Cost note refers to new capital investment required by TII - assumption is no new capital will be required by TII (operator may offset capital costs against savings).
7	NM Solar - Phase 1 trial deployments (2023)	Managed Network Premises	Energy supply	Onsite renewable electricity generation - solar PV	3 Standalone energy project (>€100k)	6 Tender / contracting stage	RE	119000	0	0	0	266000	None	No	Cost note refers to est. new capital investment required by TII.
8	NM Solar - Phase 2 Additional premises (2024)	Managed Network Premises	Energy supply	Onsite renewable electricity generation - solar PV	3 Standalone energy project (>€100k)	6 Design stage	RE	160000	0	0	0	464000	None	No	Cost note refers to est. new capital investment required by TII.
9	NM Solar - Phase 3 Additional premises (2025)	Managed Network Premises	Energy supply	Onsite renewable electricity generation - solar PV	3 Standalone energy project (>€100k)	2 Priority project	RE	200000	0	0	0	580000	None	No	Cost note refers to est. new capital investment required by TII.
10	NM Solar - Phase 4 Additional premises (2026)	Managed Network Premises	Energy supply	Onsite renewable electricity generation - solar PV	3 Standalone energy project (>€100k)	1 Concept	RE	200000	0	0	0	580000	None	No	Cost note refers to est. new capital investment required by TII.
11	NM Solar - Phase 5 Additional premises (2027)	Managed Network Premises	Energy supply	Onsite renewable electricity generation - solar PV	3 Standalone energy project (>€100k)	1 Concept	RE	200000	0	0	0	580000	None	No	Cost note refers to est. new capital investment required by TII.
12	NM Solar - Phase 6 Additional premises (2028)	Managed Network Premises	Energy supply	Onsite renewable electricity generation - solar PV	3 Standalone energy project (>€100k)	1 Concept	RE	200000	0	0	0	580000	None	No	Cost note refers to est. new capital investment required by TII.
13	NM Solar - Phase 7 Additional premises (2029)	Managed Network Premises	Energy supply	Onsite renewable electricity generation - solar PV	3 Standalone energy project (>€100k)	1 Concept	RE	200000	0	0	0	580000	None	No	Cost note refers to est. new capital investment required by TII.
14	NM Fleet - Light fleet vehicle transition (2025) Phase 1	Managed Network Fleet	Transport	Electric vehicle	3 Standalone energy project (>€100k)	2 Priority project	EE	-374373	0	935932.5153	561560	0	None	No	Swap from LIGHT vehicle diesel to Elec means less diesel consumed but an increase in electricity. For TII, an additional operational costs will arise relating to extra over on EV replacements vs standard light diesels, while differential energy costs will also be considered.
15	NM Fleet - Med fleet vehicle transition Phase 1 (2027)	Managed Network Fleet	Transport	Electric vehicle	3 Standalone energy project (>€100k)	2 Priority project	EE	-239599	0	598996.8098	359398	0	None	No	Swap from MEDIUM diesel to Elec means less diesel consumed but an increase in electricity. For TII, an additional operational costs is likely to arise relating to extra over on EV replacements vs standard medium diesels, while differential energy costs will also be considered. Medium vehicle projections are subject to the availability of vehicles of appropriate range when loaded / towing etc.
16	NM Fleet - Light fleet vehicle transition Phase 2 (2028)	Managed Network Fleet	Transport	Electric vehicle	3 Standalone energy project (>€100k)	1 Concept	EE	-1123119	0	2807797.546	1684679	0	None	No	Swap from LIGHT vehicle diesel to Elec means less diesel consumed but an increase in electricity. For TII, an additional operational costs will arise relating to extra over on EV replacements vs standard light diesels, while differential energy costs will also be considered.
17	NM Fleet - Med fleet vehicle transition Phase 2 (2028)	Managed Network Fleet	Transport	Electric vehicle	3 Standalone energy project (>€100k)	1 Concept	EE	-718796	0	1796990.429	1078194	0	None	No	Swap from MEDIUM diesel to Elec means less diesel consumed but an increase in electricity. For TII, an additional operational costs is likely to arise relating to extra over on EV replacements vs standard medium diesels, while differential energy costs will also be considered. Medium vehicle projections are subject to the availability of vehicles of appropriate range when loaded / towing etc.
18	NM Fleet - Heavy Fleet Fuel Transition Phase 1 (2025)	Managed Network Fleet	Transport	Combination/other	1 Zero- or minimal-investment	2 Priority project	RE	0	0	1065562.538	0	0	None	No	Recorded here for completeness, no impact on EE. While modest capital investment may be required to provision or upgrade fuelling equipment, there will be an increase in operational costs, based on likely prevailing market rates. Full roll out is dependent on a successful trial (planned for this winter (2022-2023). If available TII will work to increase the transition from diesel year on year - availability and costs may ultimately limit ambition.
19	NM Fleet - Heavy Fleet Fuel Transition Phase 2 (2028)	Managed Network Fleet	Transport	Combination/other	1 Zero- or minimal-investment	1 Concept	RE	0	0	2163414.85	0	0	None	No	Recorded here for completeness, no impact on EE. While modest capital investment may be required to provision or upgrade fuelling equipment, there will be an increase in operational costs, based on likely prevailing market rates. Full roll out is dependent on a successful trial (planned for this winter (2022-2023). If available TII will work to increase the transition from diesel year on year - availability and costs may ultimately limit ambition.
20	NM Fleet - Heavy Fleet Fuel Transition Phase 3 (2029)	Managed Network Fleet	Transport	Combination/other	1 Zero- or minimal-investment	1 Concept	RE	0	0	2863433	0	0	None	No	Recorded here for completeness, no impact on EE. While modest capital investment may be required to provision or upgrade fuelling equipment, there will be an increase in operational costs, based on likely prevailing market rates. Full roll out is dependent on a successful trial (planned for this winter (2022-2023). If available TII will work to increase the transition from diesel year on year - availability and costs may ultimately limit ambition.
21	Additional Heavy Fleet Fuel transition Phase 4 (2029)	Various fleet elements	Transport	Combination/other	1 Zero- or minimal-investment	1 Concept	RE	0	0	393345	0	0	None	No	Recorded here for completeness, no impact on EE. While modest capital investment may be required to provision or upgrade fuelling equipment, there will be an increase in operational costs, based on likely prevailing market rates. Full roll out is dependent on a successful trial (planned for this winter (2022-2023). If available TII will work to increase the transition from diesel year on year - availability and costs may ultimately limit ambition.
22	Depot Heating (2029)	Managed Network premises	HVAC	Boiler upgrade	4 Asset renewal project	1 Concept	EE	-64648	215492	0	150844	0	None	No	Project costs will be examined closer to the year of implementation
23	CPM Solar - Rooftop Solar PV - Red Cow Luas depot	Managed Network premises	Energy supply	Onsite renewable electricity generation - solar PV	3 Standalone energy project (>€100k)	5 Design stage	RE	414780	0	0	414780	700000	Yes	No	Due to issues with the integrity of the roof at Red Cow depot coupled with a proposal to upgrade the Red Cow depot which includes extending the tram shed and accommodation block, the rooftop solar PV array for Red Cow will be delayed and absorbed into the main depot upgrade project.
24	CPM Solar - Rooftop Solar PV - Sandyford Luas Depot	Managed Network premises	Energy supply	Onsite renewable electricity generation - solar PV	3 Standalone energy project (>€100k)	5 Design stage	RE	414780	0	0	414780	500000	Yes	No	TII IPG group approved the project and its funding source. Project Services achieved NTA approval. TII ORCA held initial meeting with J.B. Barry Transportation (technical consultants) in March 23, instructing J.B. Barry's to proceed with the production of the tender documents in July 23. TII architecture dept will manage the planning process having commenced in April 23
25	CPM Solar - Rooftop Solar PV - Broombridge-Hamilton Luas Depot	Managed Network premises	Energy supply	Onsite renewable electricity generation - solar PV	3 Standalone energy project (>€100k)	5 Design stage	RE	177190	0	0	177190	400000	Yes	No	TII IPG group approved the project and its funding source. Project Services achieved NTA approval. TII ORCA held initial meeting with J.B. Barry Transportation (technical consultants) in March 23, instructing J.B. Barry's to proceed with the production of the tender documents in July 23. TII architecture dept will manage the planning process having commenced in April 23
26	CPM Lighting - Luas Red line Stop Lighting Project	Managed Network premises	Lighting	Lighting & lighting controls (external)	3 Standalone energy project (>€100k)	6 Tender / contracting stage	EE	106000	0	0	106000	0	Yes	No	The red line stop lighting project involves the replacement of the existing stop lighting metal halide (MH) lamps and fittings with LED type fittings and lamps on each of the red line stops from Tallaght stop to Connolly stop. The scope of the works will include verification and testing of the electrical installation on completion which includes the lighting circuitry, protective devices, earthing & bonding and lighting controls.
27	CPM Fleet - Rolling Stock Saloon Lighting Retrofit Trial - Luas green line - one tram from fleet modified for trial.	Managed Network premises	Lighting	Lighting & lighting controls (internal)	3 Standalone energy project (>€100k)	5 Design stage	EE	8000	0	0	8000	0	None	No	Saloon LED Lighting Trial is being implemented by Transdev (Luas operator). The trial will involve the replacement of the existing saloon fluorescent tubes with LED lamps on a single tram from the Luas fleet. This trial will determine if the replacement LED lamps conform to certain quality, brightness (lux levels) and durability standards. In addition to energy savings, the introduction of LED technology offers other benefits such as: -Waste Reduction: The overall quantity of fluorescent tubes consumed will be significantly reduced -Maintenance: There will be a reduction in the cost of parts and labour. -Reliability: The service life of LED tubes is in excess of 10 years.