






# TII Climate Action Roadmap

---

December 2022

Role	Name	Date	Signature
TII Nominated Climate and Sustainability Champion	Rachel Cahill	20.12.22	
TII Energy Performance Officer (EPO)	Tony Redmond	20.12.22	
TII Chief Executive	Peter Walsh	20.12.22	

TII Board Approval	13 December 2022
--------------------	------------------

# CONTENTS

EXECUTIVE SUMMARY.....	6
GLOSSARY.....	9
1 INTRODUCTION.....	12
1.1 The purpose of the Climate Action Roadmap.....	12
1.2 Guide to this Roadmap.....	12
1.3 Policy Context.....	13
1.4 Measuring and reporting GHG emissions and energy efficiency.....	15
1.5 How TII can influence emissions.....	17
1.6 Preparing for climate change.....	18
2 DECARBONISATION AND ENERGY EFFICIENCY.....	19
2.1 Gap-to-target model and key terms.....	19
2.2 Approach to decarbonisation and energy efficiency modelling.....	19
2.3 Importance of the national electricity grid.....	20
2.4 Decarbonisation and energy efficiency targets.....	20
2.5 Target 1: Decarbonisation.....	21
2.6 Target 2: Energy efficiency.....	25
2.7 Decarbonisation and energy efficiency summary.....	26
3 TII'S INFLUENCE ON EMISSIONS.....	28
3.1 Context.....	28
3.2 Emissions context.....	28
3.3 Public Sector Climate Action Mandate.....	30
3.4 Levers of Influence.....	30
3.5 A Holistic Approach.....	41
3.6 Conclusion.....	44
4 CLIMATE ADAPTATION.....	45
4.1 Context.....	45
4.2 TII's Climate Adaptation Strategy.....	45
5 CONCLUSION.....	47
BIBLIOGRAPHY.....	48
APPENDIX A.....	50
TII's response to the SEAI/EPA Climate Action Mandate.....	50
APPENDIX B.....	51

---

Policy Context.....	51
APPENDIX C .....	52
Gap-to-Target Technical Note .....	52
APPENDIX D .....	53
Decarbonisation and Energy Efficiency Projects .....	53

Figure 1 TII’s emissions by scope .....	7
Figure 2 Annual road travel emissions.....	8
Figure 3 NR2040 investment priorities.....	14
Figure 4 Timeline of public sector targets .....	15
Figure 5 Activities within each GHG Protocol scope.....	17
Figure 6 TII's emissions by scope .....	17
Figure 7 Project pipeline status .....	23
Figure 8 Decarbonisation pathway to 2030.....	24
Figure 9 Energy Efficiency Path to 2030 .....	26
Figure 10 TII's scope 3 emissions in 2020 and 2021 .....	30
Figure 11 TII’s influence on emissions .....	31
Figure 12 Life cycle carbon emissions.....	34
Figure 13 Transport stakeholders in Ireland.....	37
Figure 14 Estimated vehicle emissions on National Roads .....	38
Figure 15 TII’s six-stage approach to climate adaptation .....	46
Figure 16 TII’s main assets .....	46

## TABLES

Table 1 GHG Protocol scope Definitions.....	16
Table 2 Decarbonisation and Energy Efficiency Key Terms .....	19
Table 3 Public Sector Targets.....	20
Table 4 Decarbonisation Target Calculation .....	21
Table 5 2030 Target GHG Energy Emissions Versus Baseline.....	21
Table 6 Planned TII Projects.....	22
Table 7 GHG Emissions from Energy – 2030 Projections.....	24
Table 8 Energy Efficiency Model Results .....	25
Table 9 Energy Efficiency and Decarbonisation Activities .....	26
Table 10 Definitions of scopes and Relevance to TII .....	29
Table 11 Nature and Wider Environmental Interventions .....	43
Table 12 TII’s Seven Climate Adaptation Strategic Objectives .....	45

## EXECUTIVE SUMMARY

This Climate Action Roadmap 2022 ('Roadmap') sets out Transport Infrastructure Ireland's (TII) plans to reduce emissions and meet decarbonisation and energy efficiency targets. It has been prepared in line with guidance from the Sustainable Energy Authority of Ireland (SEAI) and Chapter 9 of the Climate Action Plan 2021 (CAP21), 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 CAP21 focused on energy:

- Target 1 Decarbonisation: To reduce greenhouse gas (GHG) emissions from energy 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 59-73% (16,913-20,858 tCO<sub>2</sub>) GHG emissions reduction by 2030 and between 45-53% improvement in energy efficiency. The targets will be met due to electricity grid decarbonisation over the coming years, combined with several decarbonisation and energy efficiency projects planned by TII.

This Roadmap sets out twenty-two projects over seven areas 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 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), scope 3 (indirect emissions).

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

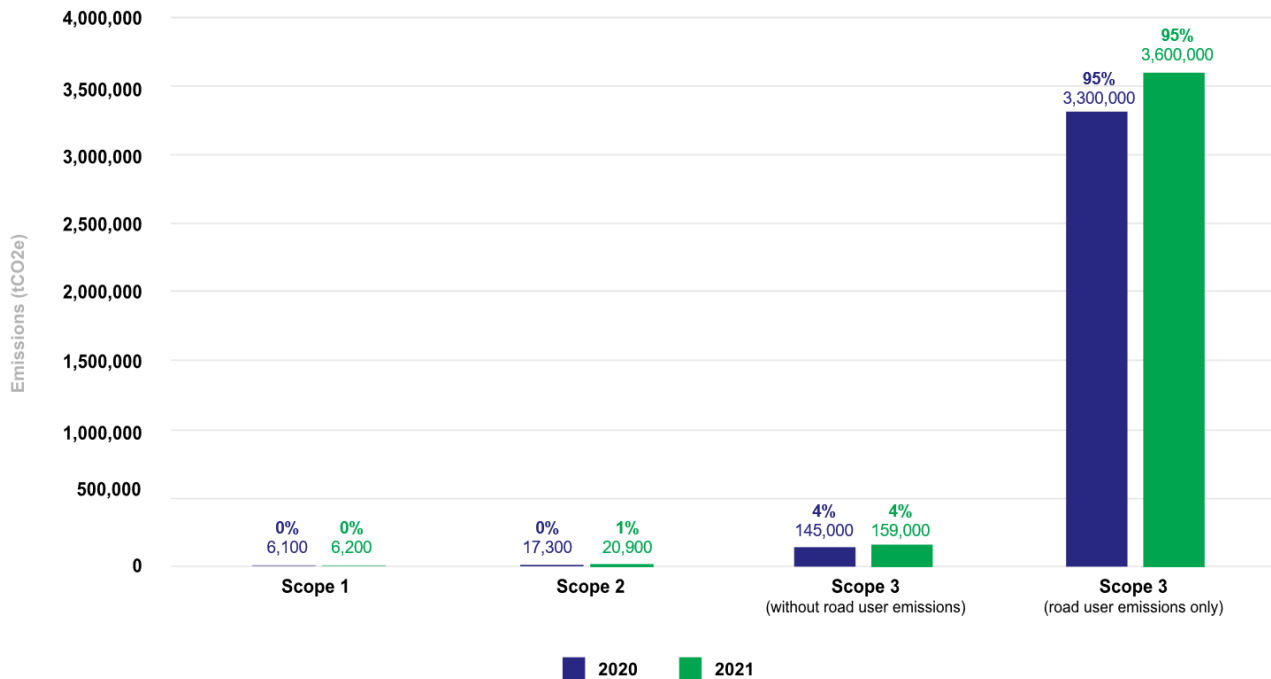
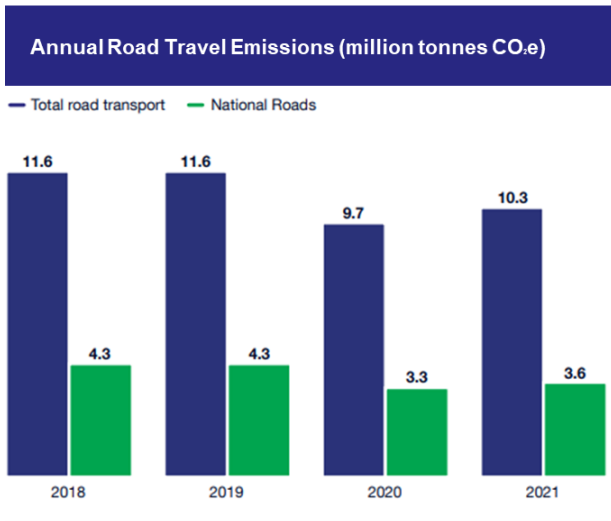


Figure 1 TII's emissions by scope

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 across the 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**.



Travel on the National Roads contributed on average **35%** of total road transport emissions in 2018-2021.

Sources: EPA, 2022 (estimate of total emissions in 2018 was 12.2 mega tonnes, road travel emissions made up of 11.6 mega tonnes of this). 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, due to be published in December 2022, which sets out TII’s approach to adapting to Ireland’s changing climate. The strategy is being developed in parallel with this Roadmap.

TII recognises that the 2030 targets are interim targets on the path to the goal of net-zero emissions by 2050. This Roadmap (2022) is a live document, which will be updated annually or as required, 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 our health and well-being and to support many of our 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 emissions or CO <sub>2</sub> emissions are emissions stemming from the burning of fossil fuels and the manufacture of cement; they include carbon dioxide produced during consumption of solid, liquid, and gas fuels as well as gas flaring.
Carbon Sequestration	Carbon sequestration is a natural or artificial process by which carbon dioxide is removed from the atmosphere and held in solid or liquid form.
Circular Economy	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.
Climate Action Plan 2021 (CAP21)	CAP21 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 a 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.
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.

Name	Definition
	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 do the same task. 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. For example, 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.
Greenways	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.
ISO140001	ISO 14001 is the international standard for Environmental Management Systems (EMS).
ISO500001	ISO 50001 is the international standard for energy management.
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 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 Luas network.

Name	Definition
Public Sector Climate Action Mandate 2021	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 2022 (‘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. It has been prepared in line with the Sustainable Energy Authority of Ireland (SEAI) guidance and Chapter 9 of the Government’s Climate Action Plan 2021 (CAP21) 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. TII’s response to the SEAI and Environmental Protection Agency (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 CAP21, which applies to public sector organisations, TII must prepare a Climate Action Roadmap (i.e., this Roadmap) to report on progress towards achieving the decarbonisation and energy efficiency targets set out in CAP21. 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.

This Roadmap (2022) is a live document, which will be updated annually or as required, to reflect TII’s progress and to respond to requirements under the Climate Action Mandate.

### 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 look 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 CAP21 provides the implementation plan to deliver on these commitments. CAP21 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.

#### *Draft National Roads 2040*

The draft National Roads 2040 (NR2040) is TII's long-term strategy for planning, operating, and maintaining the 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.

Decarbonisation is one of the greatest challenges for the NRN, and it is a central focus for NR2040; included as one of the strategy’s four investment priorities. **Figure 3** below sets out the four NR2040 investment priorities which also align with the NIFTI investment priorities: decarbonisation, protection and renewal, mobility of people and goods in urban areas, and enhanced regional and rural connectivity. NIFTI’s investment priority of decarbonisation reflects CAP21, which sets 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. **Chapter 3** of this Roadmap outlines ways in which TII is influencing a reduction in road user emissions.

NR2040 also aligns with CAP21 and the National Sustainable Mobility Policy, acting as a means of delivering policy objectives with decarbonisation as a key priority.

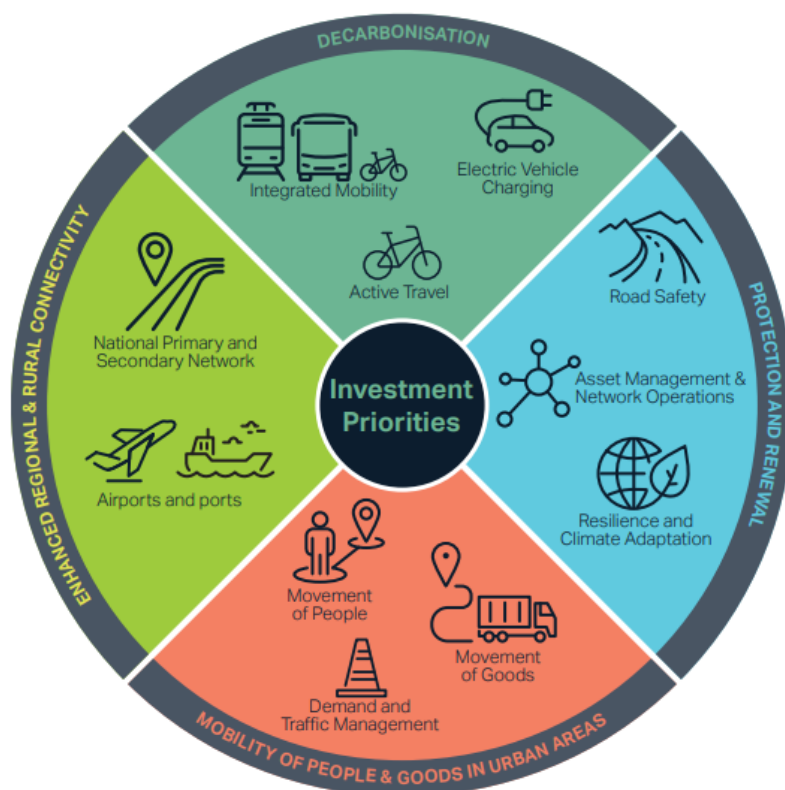


Figure 3 NR2040 investment priorities

The NR2040 investment priorities are reinforced by a series of commitments which also influence the scope of projects on National Roads developed by local authorities or other agencies. These commitments include:

1. **Future Demographic Growth Trends** – TII will continue to analyse possible growth in travel demand, reflecting Project Ireland 2040 population targets.
2. **Decarbonisation** – To reduce emissions, TII will prioritise traffic management investment in freight corridors and where congestion results in high levels of GHG emissions.
3. **Climate Adaptation and Resilience** – TII will enhance resilience of National Roads, in particular sections of the rural national secondary road network, that provide lifeline links to individuals and communities.
4. **Sustainability** – TII will work with government agencies and stakeholders to support CAP21 and government’s national climate objective to “transition to a climate resilient, biodiversity rich, environmentally sustainable and climate neutral economy by 2050.”
5. **Road Safety** – TII will deliver on its actions in the Government’s Road Safety Strategy 2021-2030 ‘Our Journey towards Vision Zero’ and collaborate with partners to deliver on supporting actions.



6. **Movement of People** – TII will support Connecting Ireland and prioritisation measures such as dedicated bus lanes where such prioritisation results in greater transport efficiency.
7. **Movement of Goods and Services** – TII will work to achieve average inter-urban speeds of 90km/h on National Road corridors between Ireland’s five cities (Dublin, Cork, Galway, Limerick, and Waterford) and five regional centres (Letterkenny, Drogheda, Dundalk, Sligo, and Athlone).
8. **Urban Congestion** – TII will promote traffic management interventions that support with optimising traffic movement on urban National Roads.

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’.

TII’s Climate Adaptation Strategy 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.

## 1.4 Measuring and reporting GHG emissions and energy efficiency

### 1.4.1 Public sector targets

In the CAP21, 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 4** below shows key dates and targets from 2009 to 2050.



Figure 4 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 extraction and production of purchased materials; transportation of purchased fuels; and use of sold products and services.

**Figure 5** 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 6** shows TII’s emissions by scope, showing that scope 1 and 2 account for 1% of emissions, while scope 3 accounts for the remaining 99%.



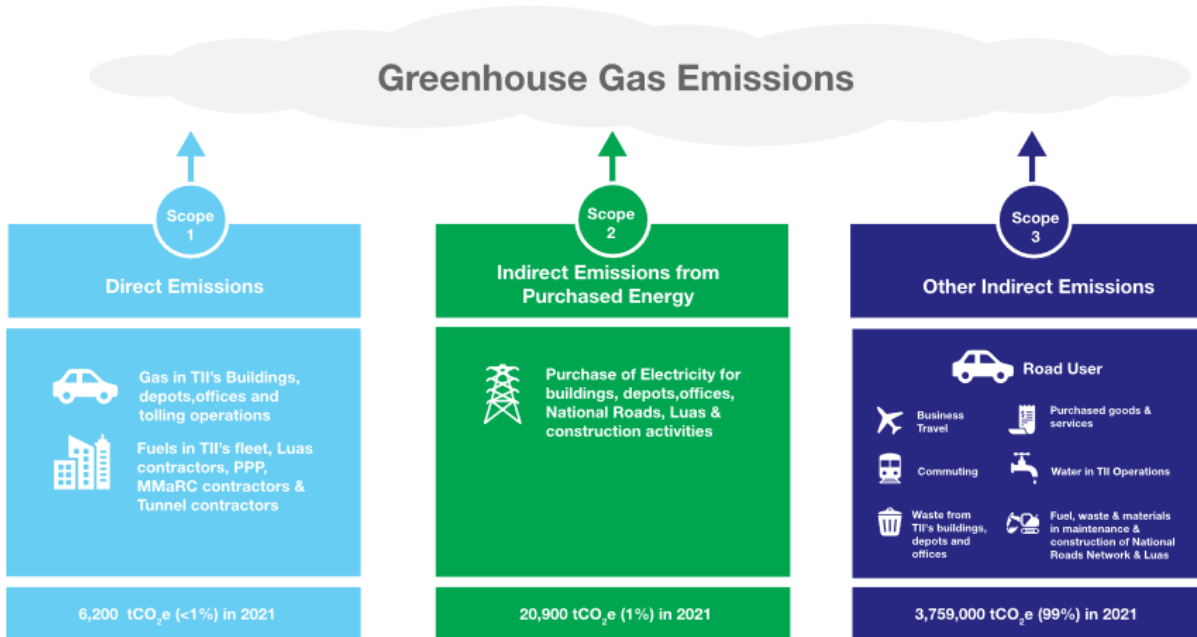


Figure 5 Activities within each GHG Protocol scope

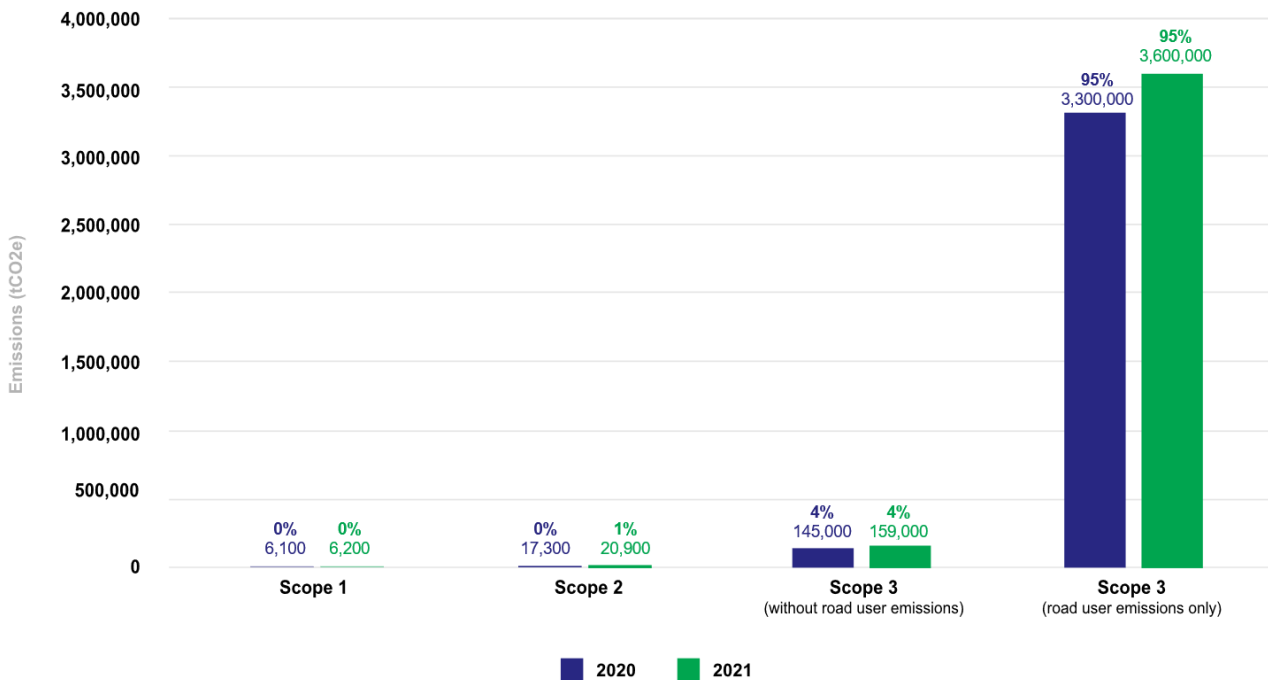


Figure 6 TII's emissions by scope

### 1.5 How TII can influence emissions

The transport sector represents a major source of Ireland’s GHG emissions, accounting for around 18% in 2021, 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
- 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 9 of the CAP21. 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 November 2022, based on the gap-to-target SEAI version 3.09 released September 2022. 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 9 of CAP21. 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 would be 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.

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 Importance of the national electricity 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. However, some years have seen a backwards shift. For example, in 2021, emissions associated with electricity production increased by 18% from 2020, due to:

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

The increase in GHG emissions seen in 2021 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.

### 2.4 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

## 2.5 Target 1: Decarbonisation

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

TII’s baseline (2016-2018 [average]) GHG emissions from energy is 28,533 tonnes of carbon dioxide (tCO<sub>2</sub>). In 2021, TII’s GHG emissions from energy was 26,978 tCO<sub>2</sub>, a reduction of 5% from the baseline. The change in tCO<sub>2</sub> from the baseline to 2021 was due to:

- **Electricity emissions:** The reduction from the baseline to 2021 can be mainly attributed to supply-side improvements from electricity grid decarbonisation. In 2021, emissions from TII’s electricity consumption were 10% less than the baseline.
- **Thermal emissions:** Between the baseline and 2021 there was an increase in thermal emissions of 6%, due to an increase in oil and gas consumption in TII’s depots and buildings.
- **Transport related emissions:** Between the baseline and 2021 there was an increase in transport-related emissions of 16%, 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
*Non-electricity target = 51% reduction in energy-related thermal and transport emissions by 2030

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	992
Transport	3,608	51%	1,768	1,840

[tCO <sub>2</sub> ] TFC	2016-2018 (average) Baseline	Reduction target %	2030 Target	Baseline minus 2030 target
Non-electricity Total*	5,416	51%	2,654	2,762
<b>Total GHG Emissions</b>				
Total GHG emissions**	28,533	72%***	7,872	20,661
*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				

### 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. There are projects in the pipeline where energy savings have not yet been quantified. These projects will be added to the decarbonisation model once the necessary data has been generated; details of these projects are outlined in **Appendix D**.

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 offset (kWh TFC/annum)	Expected implementation years
Luas infrastructure and rolling stock lighting projects	0.6m kWh	2023
Road network lighting projects in various phases	7.0m kWh	2023 - 2028
Installation of solar PV onsite at all Luas Depots	1.0m kWh	2024 - 2025
Installation of solar PV on all applicable road network management premises, in various phases.	1.3m kWh	2023 – 2028
Transition of road network light and medium contractor diesel fleets to electric vehicles, in various phases.	6.1m 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 emissions not energy)	2025 - 2029
Management premises transition from fossil fuel boilers to electric heat pumps	0.2m kWh	2029

By 2030, TII’s planned projects are modelled to result in an overall emissions reduction of 4,140 tCO<sub>2</sub>. More details on each of these projects is provided in **Appendix D**.

The project pipeline consists of projects of differing scales and readiness. **Figure 7** below outlines the status of the project pipeline in terms of project scale, readiness, and the expected size of the associated primary energy savings. The location of each bubble represents one or more projects of the same ‘project scale’ and same ‘project readiness’; the size of each bubble indicates the savings (kWh TFC) from those project(s).

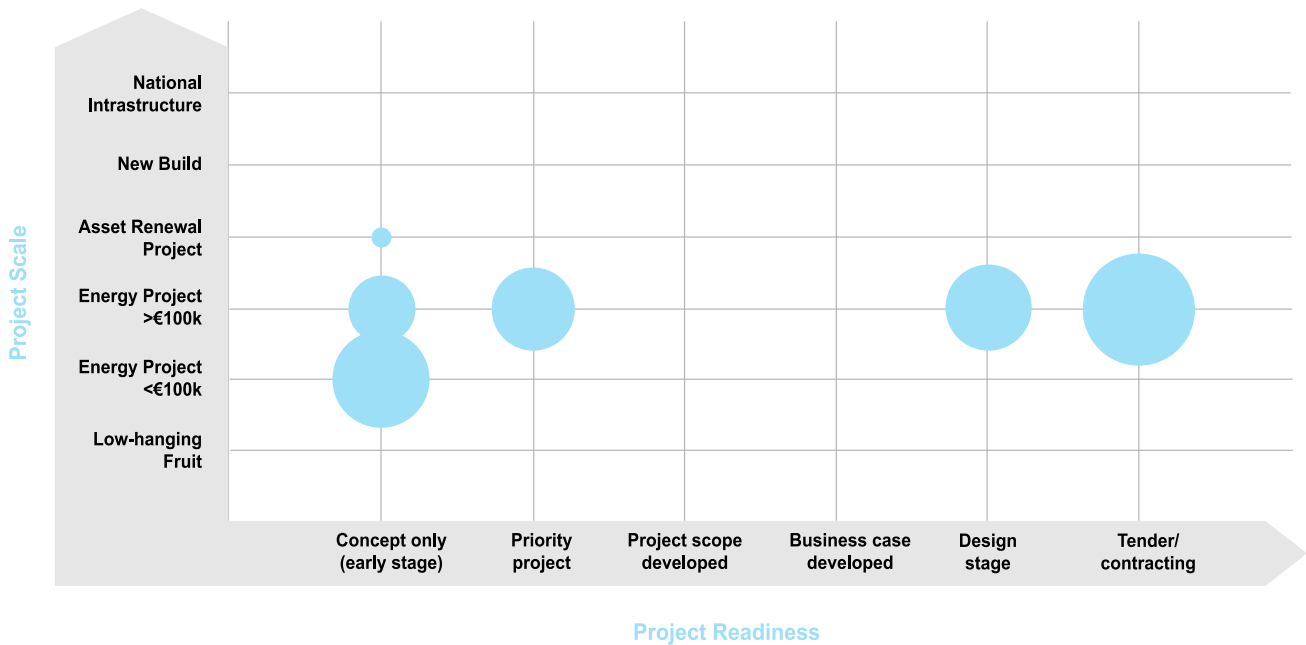


Figure 7 Project pipeline status

TII has identified four energy projects, estimated at over €100k each, that are currently at the tendering and contracting stage. This cohort of projects contributes the largest expected total primary energy savings. An additional four energy projects have been identified at the design stage. The remaining 14 projects are not as advanced in readiness and include projects at concept and prioritisation stage.

#### 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 **Figure 8**, TII’s non-electricity emissions (thermal and transport) are expected to be 9% higher in the BAU 2030 scenario than the baseline. However, TII could expect a reduction in total emissions (electricity and non-electricity) of 59% by 2030 in the BAU scenario, resulting in a gap-to-target of 13% points to the target (72%), a gap-to-target of 3,748 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 8**. In this scenario, TII’s total GHG emissions from energy are modelled to be 7,675 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 would meet 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 financial resources, a pathway to meeting the decarbonisation target, as has been described in the ‘With Project Pipeline’ scenario, may not be feasible 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	5,744	-75%	-	5,021	-78%	-
<b>Non-electricity</b>								
Thermal	1,808	886	1,919	+6%	-	1,863	+3%	-
Transport	3,608	1,768	3,958	+10%	-	790	-78%	-
<b>Non-electricity Total*</b>	<b>5,416</b>	<b>2,654</b>	<b>5,877</b>	<b>+9%</b>	<b>3,223</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>11,620</b>	<b>-59%</b>	<b>3,748</b>	<b>7,675</b>	<b>-73%</b>	<b>NIL</b>
*non-electricity total = thermal + transport								
**total GHG emissions = electricity + non-electricity								

Figure 8 shows TII’s projected emission pathways to 2030, with modelled emissions in the ‘With Project Pipeline’ scenario reaching the 2030 target.

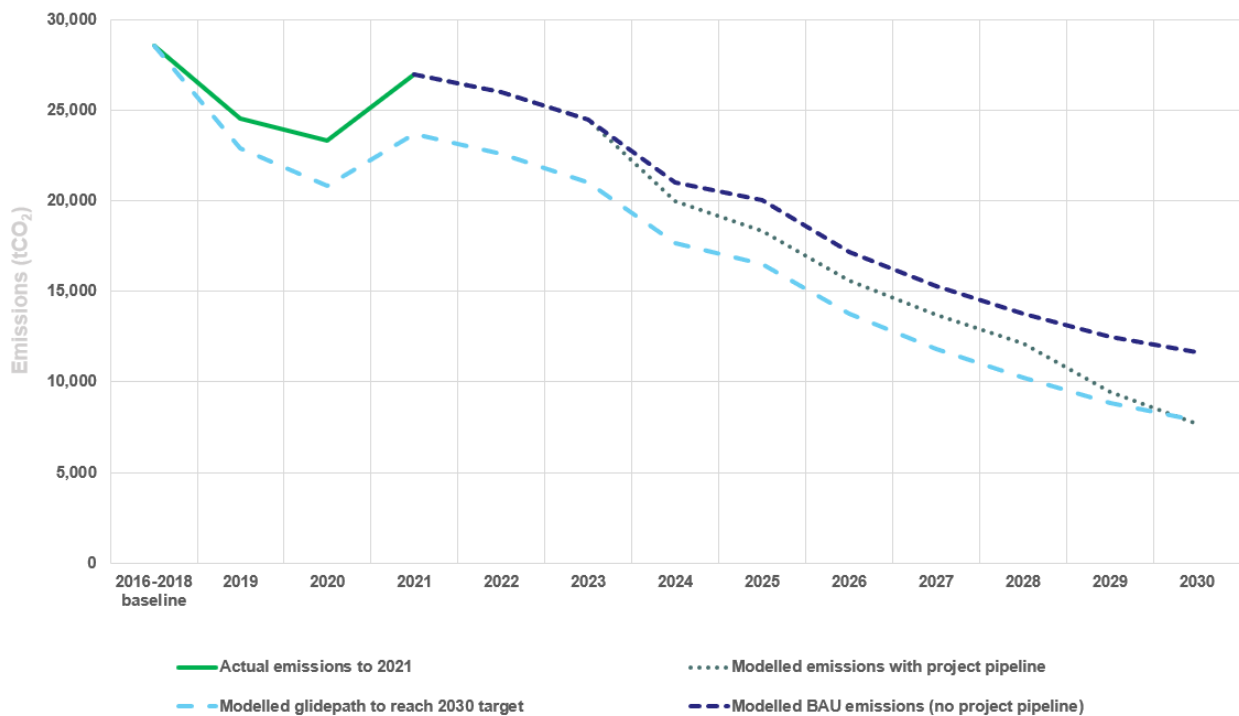


Figure 8 Decarbonisation pathway to 2030



## 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%. This would indicate that a greater than 50% improvement in energy efficiency had been achieved.

### 2.6.3 TII's planned projects that will 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 55% in 2030, indicating an energy efficiency improvement of 45% compared to the 2009 baseline, as shown below in **Table 8**. A gap-to-target of 5% 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 8%, meaning TII could reach a 53% improvement in energy efficiency. TII is expected to achieve an overall energy efficiency improvement of 45-53% depending on the delivery of the planned projects.

Table 8 Energy Efficiency Model Results

	Target	2030 BAU Projection	2030 Projection with projects
nEnPI	50%	55%	47%
Energy efficiency improvement versus 2009 baseline	50%	45%	53%
Gap-to-target in 2030	NIL	5%	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 9** below. In 2021 the nEnPI was 71.3%, equating to an energy efficiency improvement of 28.7% since 2009.

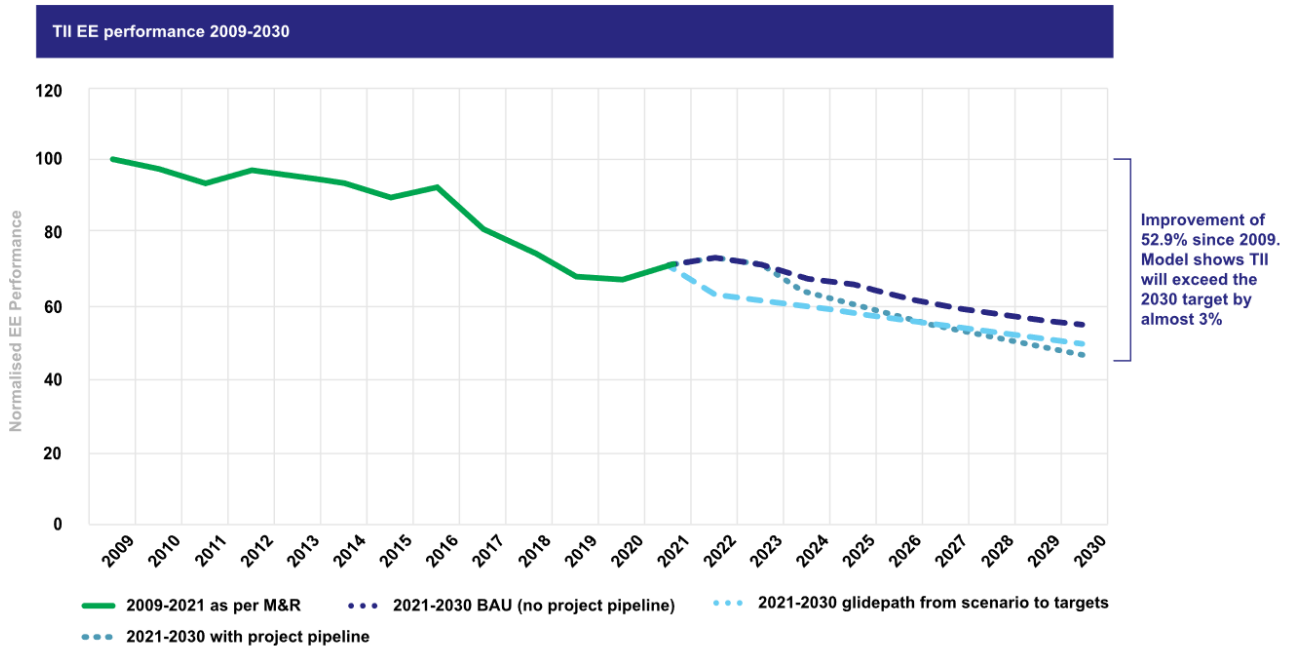


Figure 9 Energy Efficiency Path to 2030

Table 9 below outlines some of the areas of focus for improving energy efficiency across TII’s activities.

Table 9 Energy Efficiency and Decarbonisation Activities

Operation and Protection and Renewal	
<b>Decarbonisation of buildings</b>	TII is investigating decarbonisation opportunities across its assets and operations. TII has identified that three Luas depot roofs are extensive, making them ideal 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.
<b>Energy efficiency</b>	
<b>Public Sector Energy Efficiency Targets</b>	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 building. 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.
<b>Building Management System</b>	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 and blended working.

## 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 9 of the CAP21, 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 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; introduces 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.

##### 3.2.2 Overall emissions

**Table 10** 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 10 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. The Department of Transport has outlined plans to address transport sector emissions in CAP21. 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.

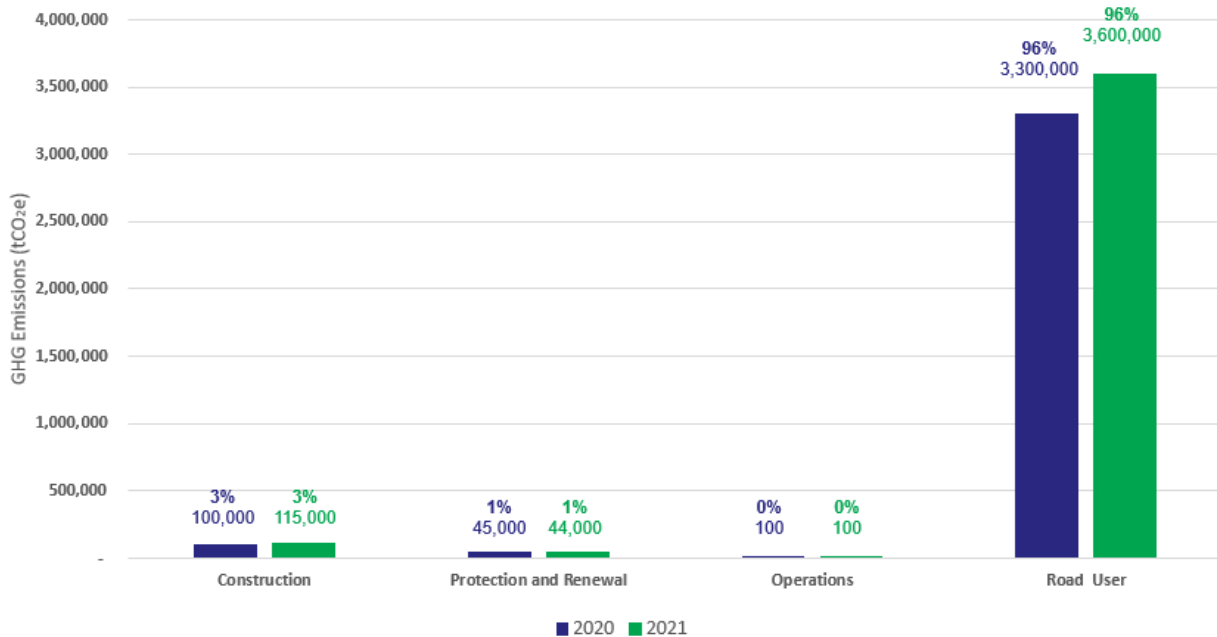


Figure 10 TII's scope 3 emissions in 2020 and 2021

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.

### 3.3 Public Sector Climate Action Mandate

The Public Sector Climate Action Mandate (the Mandate) outlined in the CAP21, 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 guidance to the public sector in October 2022, 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 Board and signed off by the CEO.

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 the transport system. Six levels 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

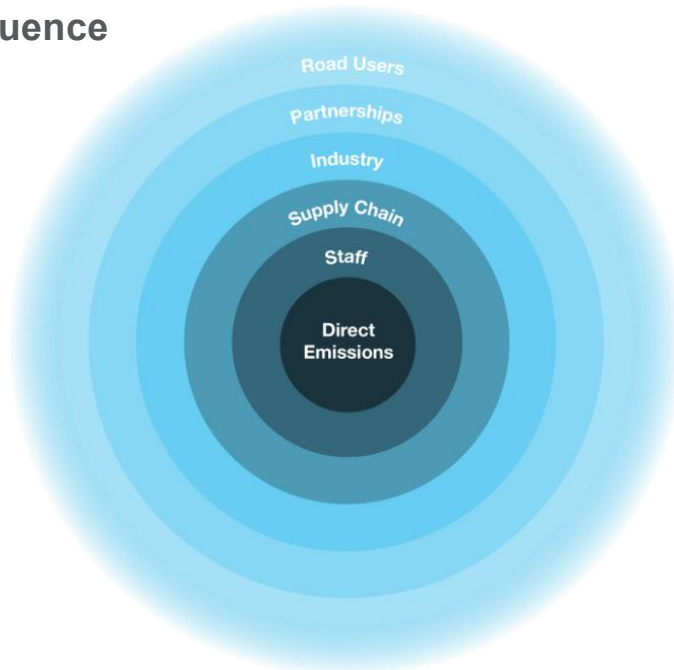


Figure 11 TII's influence on emissions

### 3.4.1 Lever 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 and light rail infrastructure and services. The rollout of "Spotlight Sessions" in 2020 allowed staff to showcase projects and initiatives, sharing information and knowledge across the organisation. Initiatives such as the Government's annual "Public Sector Innovation 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 Innovation Week in October 2022. Further training is a key focus area for TII in 2023.

Engaging internal communications are key to embedding sustainability across TII. In the 2021 Training Needs Assessment, 98% of staff stated their interest in learning about sustainability. A dedicated sustainability

section is now included in the 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 actively reduce business travel while recognising the need to balance business needs for travel and the requirement to reduce emissions.

TII’s ‘Employee Travel Survey’ (2022) shows 21% of employees commute to work by foot or bicycle, and 31% commute to work using public transport. Compared to 2020, the survey showed similar trends for active travel modes however, a 3.4% increase in staff commuting by car was recorded. As part of TII’s Blended Working Policy and associated strategies, currently under development, TII is actively seeking ways to change behaviours regarding driving to work.

As part of the travel survey, a further 58% of staff expressed an interest in switching to a more sustainable way of commuting. Forty percent of staff use active travel and 90% use public transport occasionally to come to work indicating significant opportunities for behaviour change. In 2022, under the ‘return to the office’ taskforce, TII undertook several travel-to-work initiatives to influence behaviour change in staff mobility including the promotion of E-bikes where TII leased 5 E-bikes to allow staff to engage in a “try before you buy” initiative. Twenty staff availed of the initiatives making over 100 trips. Enhanced active travel office facilities have also been designed and are currently out to tender for work to be carried out in 2023. These facilities will enhance bike parking, a drying room and shower facilities. TII expect to apply for cycle friendly employer Gold Certification in 2023.

**Case Study – Digitalisation of Paper Based Processes**

As a statutory consultee under planning legislation TII receives local authority planning applications, County Development Plans, Local Area Plans and Part 8 planning applications. In 2021 TII received over 3,000 applications. To reduce the paper-based processes and move to digitalised processes, TII now responds electronically to each application and encourages partners and consultants to submit all referrals in electronic format. This has resulted in TII reducing its use of paper, print and postage costs, alongside reducing emissions.

In early 2020, TII moved to a fully digitised process and platform for TII’s monthly Board papers, cutting down on paper and print, reducing emissions. Between meetings of the TII Board, the Audit & Risk Committee, and the Strategy Committee, the use of the platform has reduced printing approximately 100,000 pages of paper per year.

**3.4.2 Lever 3: Supply Chain: Asset management, circular economy, 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.

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.

*Asset management and circular economy*

Circular economy principles (avoid, reduce, replace, and offset) address embodied carbon emissions and resource consumption.



TII is already including these circular economy principles throughout workstreams, working closely with the supply chain to minimise emissions from materials used within assets. TII is also developing a Circular Economy Policy and Circular Economy Strategy that will focus on asset management, sustainable procurement, life cycle assessment and data and materials management. This will embed circular economy principles throughout TII's activities and standards and influence the construction industry in Ireland.

### 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 emission associated with extraction, manufacturing, transporting, installing, maintaining, and disposing of construction materials and products.

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 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's Network Management Division oversee the delivery of 200-250km of pavement renewals per year which amounts to approximately 250,000 - 300,000 tonnes of bituminous material being produced and laid on the NRN annually. This equates to approximately 42,500 – 51,000 tonnes of embodied carbon (CO<sub>2</sub>e) per annum, assuming an average of 170kg CO<sub>2</sub>e per tonne.

There are opportunities for carbon reduction in pavement renewals. Some methods have been trialled and tested more than others and are therefore at varying levels of maturity. These include:

- Irish Analytical Pavement Design Method (IAPDM)
- Recycled Asphalt Production (RAP)
- Low Energy Bound Material (LEBM)
- Warm Mix Asphalt
- Cold Mix Asphalt
- Pavement Preservation - (Rejuvenation, Retexturing, Crack Sealing Joint Repair)
- Surface Dressing
- Environmental Product Declarations (EPD) for asphalt mixtures based on a standardised life cycle assessment
- Pavement preservation techniques to extend the life of the surface courses

The case studies below set out some of the initiatives TII has progressed to reduce emissions across construction and protection and renewal.

### 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 account of field observations on in-situ foundation conditions. The analysis calculates rather than assumes material properties. Pilot application has shown an average of 10% reduction in the carriageway surface layer. 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.

### Case Study - Whole life carbon

Accounting for Whole Life Carbon (WLC) is key for TII considering the impact of construction and protection and renewal. The impacts of some of the key components of the road transport infrastructure (construction of a new road, lighting operation and protection and renewal of the built asset) were estimated employing life cycle assessment, over an assumed service life of 40 years (Figure 12 below).

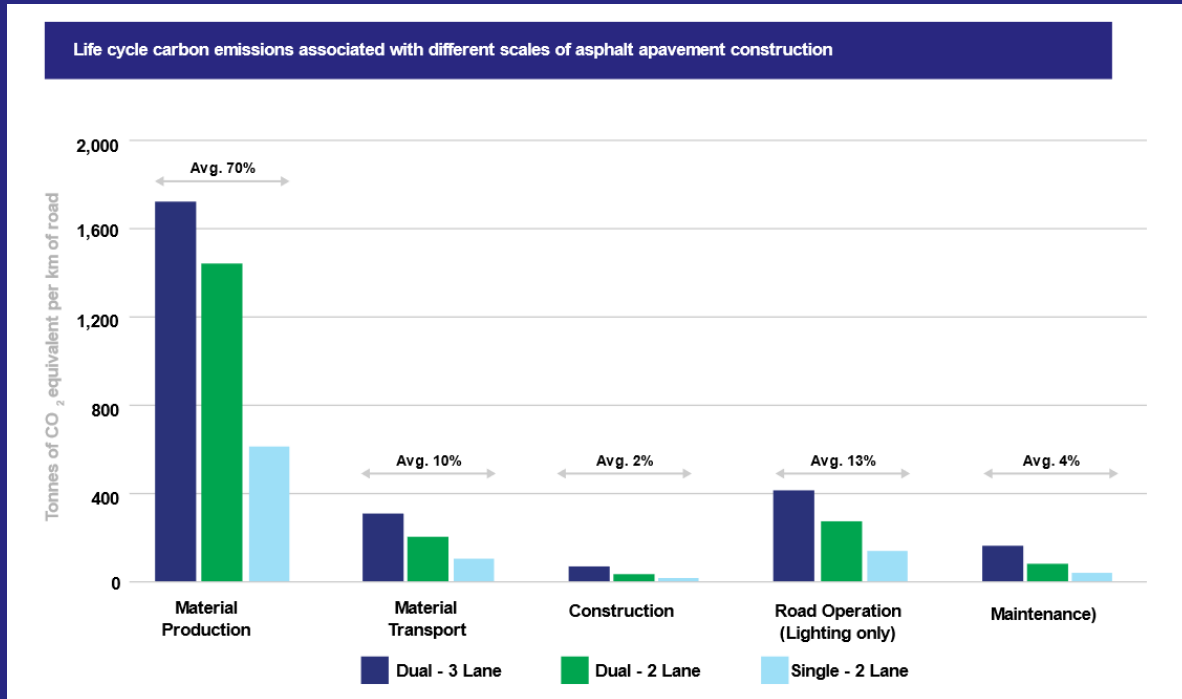


Figure 12 Life cycle carbon emissions

- The WLC of 1 km of road, modelled within the boundary constructs and the assumptions adopted in this study is determined to be 2,659 tCO<sub>2</sub>e for dual-3 lane; 2,014 tCO<sub>2</sub>e for dual-2 lane; and 880 tCO<sub>2</sub>e for single-2 lane carriageway.
- The 'Material production' phase is determined to be the dominant carbon contributor across the whole life of a road.
- The key embodied carbon contributors are the energy-intensive materials, concrete, and asphalt.
- The surface layer of the asphalt pavement (road) is the most energy intense (5 TJ over the asset's assumed service life of 40 years), followed by the embodied energy of the subgrade layer (4.2 TJ). Material-related emissions are closely followed by those attributed to material transport energy needs and thus electricity production and supply. Road-lighting operation is the next highest carbon contributing sub-system in the whole life cycle of a new road, responsible for 12-15% of the asset's whole life carbon.

### Case Study - TII Carbon Tool

The TII Carbon Tool has been developed to achieve a balance between the economic and social costs of constructing infrastructure, considering the entire lifecycle of a proposed project. The tool is used to assess the main sources of carbon emissions throughout the lifecycle of a project, from early design, to construction, use and maintenance and end-of-life. The aim is to identify where carbon savings can be made. The tool was designed to allow for new emerging carbon emission data to be included. This is used on many projects across TII. TII has advanced the development of this tool to take on board the latest amendments in the Climate Action and Low Carbon Development (Amendment) Act 2021. This has involved carrying out a bench marking exercise of the tool to ensure it is consistent across all road and light rail schemes.

### Case Study – R180 Trial

A recent TII sponsored trial on the R180 in County Monaghan investigated the use of cold mix asphalt with up to 80% RAP. An LEBM cold mix design was used for this 1.3km scheme and 3.5 tonnes of RAP was used in the base and binder courses within the pavement makeup. When the embodied carbon of the design was compared to a traditional hot mix asphalt design, embodied carbon savings of 41% were achieved. This embodied carbon saving equates to 44 tCO<sub>2</sub>e per km.

Potential Network Savings: 200km pavement renewals per annum = potential saving of 8800t CO<sub>2</sub> = 21% saving

### 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 by 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 Environmental Protection Agency (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 draw on during the development of tenders. TII has formed a Sustainability Procurement Steering Group on a pilot basis. The objective of the Steering Group is to oversee the development of a select number of TII procurements to embed and track sustainability measures introduced into the tender documents, and to assess the benefit of these measures to the tender process post-tender.

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 implementation of green procurement practices.

Environmental Product Declarations (EPDs) are an example of how TII can ensure 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 reduction of embodied and operational carbon, alongside delivering other co-benefits such as increasing biodiversity and reducing pollution.

### Case Study – Sustainability Criteria in Archaeological Procurement

The consideration of archaeology is fully integrated into the National Roads scheme planning process. Sustainability criteria have been incorporated in archaeological procurement with the intent of describing the practical measures that will be implemented in the project to ensure that the services required are delivered in a sustainable manner. This includes:

- On site facilities/premises, products and supply chain which contribute to the Tenderer’s positive sustainability performance
- Off-site practices and procedures e.g., social inclusion and transport which contribute to carbon reduction targets
- A description of where the Tenderer has demonstrated this with reference to previous projects and/or on-going operations

### 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.

#### *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.

#### *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 also produces guidelines relating to light rail, active travel, greenways, biodiversity, 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. TII's Climate Change Assessment Guidelines for National Roads and light rail will be published in December 2022.

TII standards have a large scope of influence and are used by Local Authorities on regional and local roads and are used across the construction and transport sectors. Throughout 2021, TII provided nine training courses on technical standards to road engineers. These events targeted Local Authority staff engaged on National Roads and active travel projects and other users of TII standards. TII also organises an Annual Conference on National Roads and Greenways attended by Local Authority partners.

#### *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. In 2021 and 2022, open tender competitions were organised seeking research proposals to support TII in its remit to provide safe and sustainable transport networks. Eight research projects were commissioned following the 2021 tender competition and four from the 2022 competition. TII's continued research efforts, and the sharing of this knowledge, will contribute to better understanding of approaches to reduce emissions.

### 3.4.4 Level 5: Partnerships

Collaborative partnerships will be essential in tackling the climate and biodiversity crisis and achieving wider net-zero objectives. With some solutions to the challenge still to be discovered, 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 National Transport Authority (NTA) etc. as shown in **Figure 13** below.

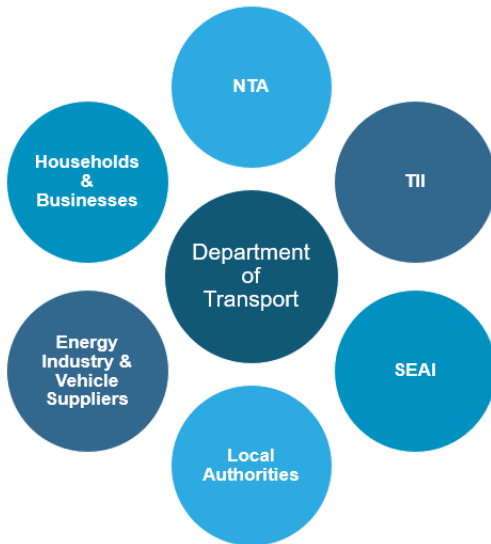


Figure 13 Transport stakeholders in Ireland

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**

Working with local authorities has resulted in the upgrade of 16,446 lighting installations across 347 projects to date. TII has 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 as part of the national public lighting energy efficiency project. TII continues to support the replacement of the remaining circa. 200,000 lights in other regions. The overall total avoided emissions from Route Lighting in 2021 is approximately 4,000 tonnes of carbon.

**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.

**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, and alongside the Luas lines and stops, presenting an opportunity to increase the quality and quantity of green space 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. These include providing shade, reducing ground

temperatures, providing water quality, attenuation, carbon sequestration, amenity, and air quality benefits. Maintenance agreements are in place with local authorities setting out agreed protocols and lines of demarcation. 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. TII is also developing a landscape management strategy to sustainably manage transport corridors and roadside landscapes

### 3.4.5 Lever 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 14** shows that travel on National Roads contributed on average 35% of total road transport emissions in 2018-2021.



Sources: 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), TII National Transport Model (NTpM), TII Road Emissions Model (REM), CSO and UCC (2021) Irish Car Stock Model v2.1

Figure 14 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 contribute to encouraging people to make lower carbon travel choices. Ireland’s CAP21 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 measures including developing the National Cycling Network Plan and the delivery of greenways. TII supports transport sector partners in the planning and delivery of the infrastructure to support the electrification of Ireland’s car fleet, reducing the numbers of internal combustion vehicles. TII is progressing several programmes, projects, and studies which will contribute to understanding emissions from travel and supporting sustainable travel choices, introduced on the following pages.



### M50 Demand Management Study

- 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 on the M50 with the installation of Variable Speed limits on the entire M50 by 2023. 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)

- 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 impact, and to ultimately roll-out a future road user charging operating model as a component in delivering the transformational change required to meet transport emission reduction targets. A draft BRUCE Implementation Plan will be completed in Q2 2023 and will be followed by a broad public and stakeholder consultation process from Q3 2023.

### Road Freight Decarbonisation Study

- In recognition of road freight's overall carbon contribution and its importance to the Irish economy, TII is currently undertaking a study to understand how efficiencies can be created for the movement of goods by freight on the NRN. Generation of logistical efficiencies by less trips and less carbon intensive trips will reduce the vehicle kilometres travelled on National Roads and reduce the external costs associated with freight travel. As part of the study TII will engage with the haulage sector and Irish rail. The potential for Freight Consolidation Centres will be explored including an assessment of their benefit.

### Bus Corridor Prioritisation

- Increasing public transport use on National Roads will contribute to reducing carbon emissions. The provision of efficient and reliable bus and coach services is dependent on less congested National Roads that prioritise bus movements over private vehicles. TII will support bus prioritisation measures where such prioritisation results in greater transport efficiencies. This includes delivering public transport corridors by providing prioritised bus lanes on national radial routes approaching the M50.

### Multi- Modal Interchange

- High quality multi-modal interchange has an important role in enabling a modal shift from private vehicles to sustainable transport modes, reducing carbon emissions. Improving 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 will develop a Park and Share strategy.

### TII Road Emission Model

- 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 CAP21 targets for the electrification of the fleet.

### Electrification of the Fleet

- Zero Emissions Vehicles Ireland (ZEV) has been established as a dedicated Office to support consumers, the public sector and businesses to make the switch to zero emission vehicles. ZEV will lead on the delivery of the Ireland’s ambitious target under CAP21 to have 945,000 electric vehicles in the Irish fleet by 2030. TII supports the Department of Transport in the coordination of the ZEV programme incorporating the delivery of the en-route charging infrastructure across the NRN.

### Severance Packages

- 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 will identify and address severance associated with busy urban National Roads through provision of safe crossing infrastructure for cyclists and pedestrians. This is an example of restorative design.

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 following projects set out examples of infrastructure and services which will reduce road user emissions.



### National and Regional Greenways Programme

- The development of the National and Regional Greenways Programme, the National Cycle Network Plan, and the major rural active travel projects is coordinated to maximise synergies and overall network development. The development of these programmes is coordinated with partner and stakeholder organisations – such as local authorities and the NTA – who are advancing local, county, and urban cycle and pedestrian networks. The collaborative approach enables TII to share understanding of climate risk and mitigation with partners and improve climate resilience across the wider cycle network.

### MetroLink

- 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, an exciting innovation for Irish public transport. MetroLink will carry up to 50 million passengers annually.

### Luas Finglas

- 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 cycling 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, applying a gender lens, creating Biodiversity Net Gain and developing a project sustainability plan.

## 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.

### 3.5.1 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.

### 3.5.2 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 road 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 toolkit, “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.
- 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. In 2021 10,362 discs were administered.
- The ‘All Aboard: Accessibility Podcast’ was developed in 2022 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.

#### Case Study – Population and Human Health Standard

The amended Environmental Impact Assessment Directive requires assessment of the likely significant effects of projects on Population and Human Health. In the development of the Population element of a TII Standards Document, the importance of embedding social value into projects is being considered including the most effective ways to engage with local stakeholders and consider their needs. The strong link with SIP Principle: Create total value for society is informing the approach to be adopted.

### 3.5.3 Nature and Wider Environmental Impacts

There is a growing recognition of the necessity to integrate climate positive design interventions with transport projects. Some of the available interventions and projects are set out in **Table 11**.

Table 11 Nature and Wider Environmental Interventions

Nature and Wider Environmental Interventions	Descriptions
Environmental Product Declarations (EPDs)	Through EPDs TII can ensure that the materials used on its networks do not have unintended detrimental impacts on the local environment.
Materials	Reducing pollution and emissions 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.
ROADSOIL	‘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 acted as research managers.
Native Woodland Pilot	‘Native Woodland Pilot project on N6’ is a TII funded research project which examines the methodologies used for offsetting carbon associated with infrastructure by native woodland planting in land available from NRN projects.
Environmental 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.

### 3.5.4 Governance

Delivering upon 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 will provide 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) under the TII Executive Office.

The Progress level of governance is comprised of appointed Sustainability Leaders with responsibility for the delivery of sustainability initiatives across their division.

### 3.5.5 Future Targets

CAP21 sets out the intention that the scope of reporting will be extended to include scope 3 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 with the greatest opportunity to influence a reduction of carbon emissions.

### 3.6 Conclusion

This chapter has set out the challenges for TII to achieve a reduction in transport emissions across Ireland. Key areas of influence have been identified whereby TII can address emissions in every part of the organisation, from staff through to the road users. 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 the areas of influence.

- Within TII, there are opportunities 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, it is possible to empower TII staff to develop new methods and approaches to deliver sustainable outcomes.
- Working with the supply chain to better consider the role of asset management, circular economy 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 will be 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, collaboration across the network will be essential to unlocking knowledge and building new tools across the ecosystem.
- TII must provide sustainable transport infrastructure and services to facilitate the decarbonisation of the transport network. Through planning and delivery of infrastructure and services TII can support people to make lower carbon travel choices.

There is no single solution to the climate crisis. TII recognises that part of the solution will be working in a way which delivers outcomes which benefit society and the natural environment. TII will apply a social value and Just Transition lens to ensure that all changes are carried out in an equitable manner, ensuring that no one gets left behind.

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

## 4 Climate Adaptation

TII’s Climate Adaptation Strategy 2022 (The Climate Adaptation Strategy) is TII’s response to Action 297, *Improve climate resilience and adapt to climate change on the light rail and National Roads Network* within the CAP21. This Chapter provides a high-level summary of TII’s Climate Adaptation Strategy, the strategy can be found in full in TII’s publications from Quarter 1 2023.

### 4.1 Context

Extreme weather events are becoming more frequent and severe due to climate change. 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, operations, and protection and renewal of roads and Luas, resulting in significant impacts to 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 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 maintain its commitment to sustainability. The Strategy outlines seven strategic objectives for climate adaptation set out in **Table 12** below which align with the six principles from TII’s overarching SIP (TII, 2021).

Table 12 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 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 step of the six-stage adaptation process, laying the foundations for stages 2-6 of the approach, as shown in **Figure 15** below. Using this process, TII is considering a wide range of climate-related hazards for six of TII’s main assets, see **Figure 16** below; NRN, light rail network, rural cycleways and national and regional greenways, land, buildings, and people.

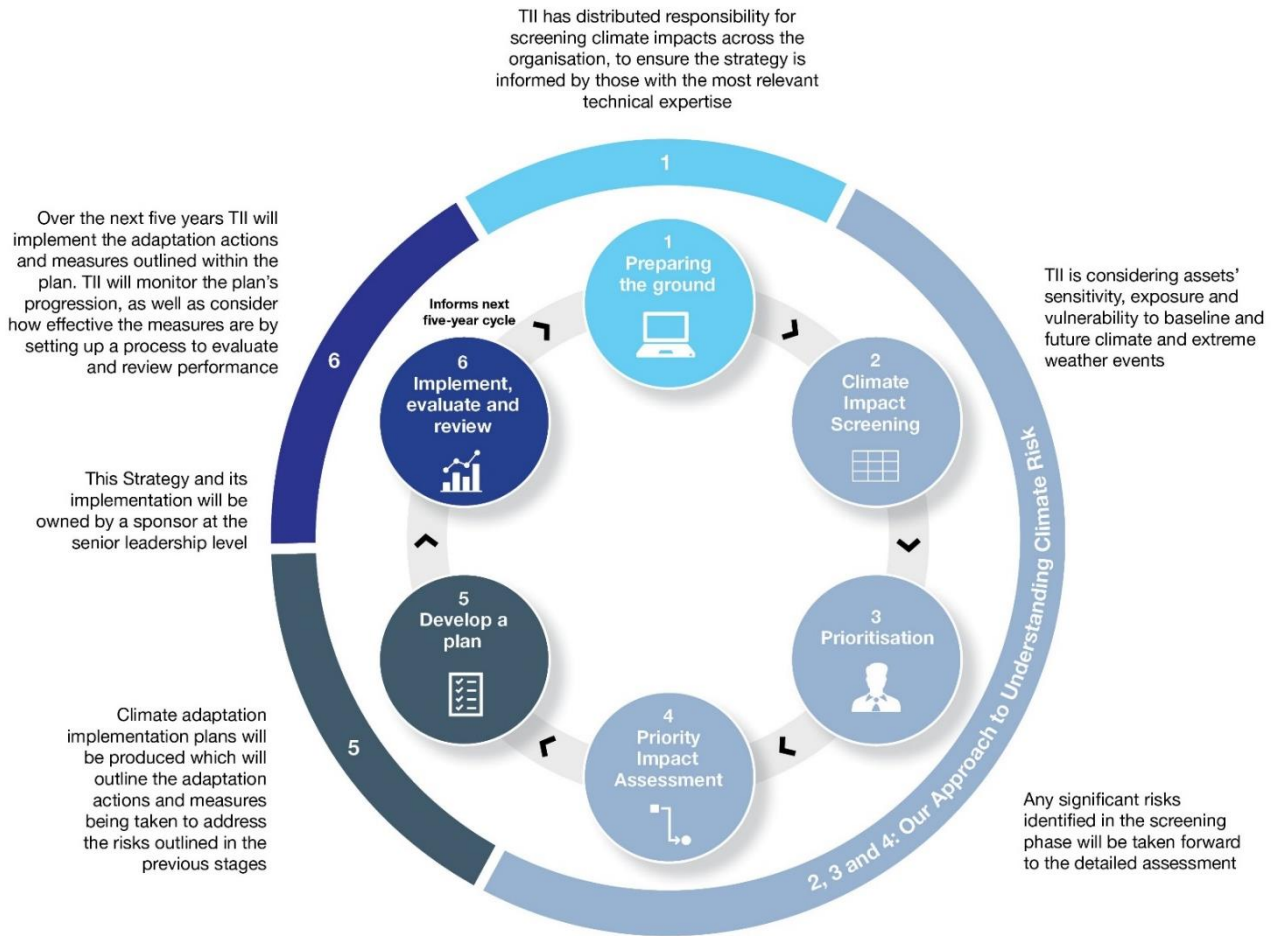


Figure 15 TII's six-stage approach to climate adaptation  
 Note: Adopted from the Sectoral Adaptation Planning process

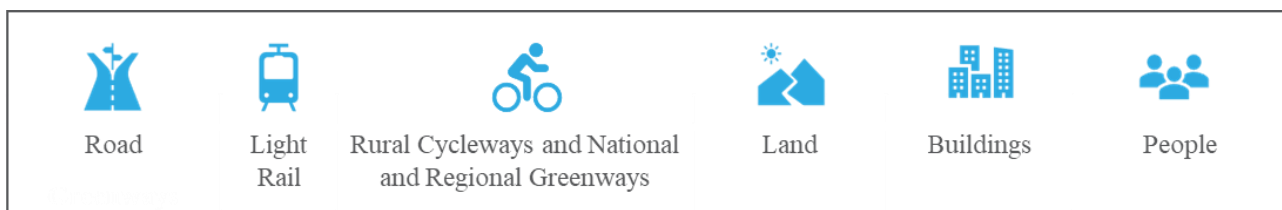


Figure 16 TII's main assets

The Climate Adaptation Strategy provides the foundations for TII's continued climate adaptation activities and includes several actions which are expected to form the basis of TII's climate adaptation activities over the next five years, in line with the Sectoral Adaptation Planning process. These actions will embed climate adaptation and climate-proofing into TII's business as usual activities across the organisation.

## 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 59-73% GHG emissions reduction by 2030 and between 45-53% improvement in energy efficiency.

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

- **Robust governance:** Overall responsibility for TII's Roadmap will sit with the Executive Office 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 the targets is contingent upon TII receiving additional funding and resources to deliver the projects needed.

This is TII's first Roadmap, and it is a live document to be updated as required.

TII recognises that to delivering on Ireland's ambitious 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 occur 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 achieve the step change required to meet the national emission reduction targets, alongside tackling the biodiversity crisis, and supporting national adaptation efforts. TII will contribute by collaborating with partners, industry, and wider transport stakeholders to deliver material change across the organisation, industry, and society.



## Bibliography

- CEDR (2020) *CEDR Strategy 2020-2021* (online) Available: <https://www.cedr.eu/strategy-and-vision>
- DCCAIE (2018) *National Adaptation Framework - Planning for a Climate Resilient Ireland* (updated in 2021) (online) Available: <https://www.nwra.ie/wp-content/uploads/2020/05/national-adaptation-framework.pdf>
- DCCAIE (2019) *Climate Action Plan 2019* (online) Available: <https://www.gov.ie/en/publication/ccb2e0-the-climate-action-plan-2019/>
- DCCAIE (2021) *Climate Action Plan 2021* (online) Available: <https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/>
- Department of Transport (2020) *Transport Trends 2019* (online) Available: <https://www.gov.ie/en/publication/8cd518-transport-trends-2019/>
- Department of Transport (2022) *Sectoral Climate Ambition Emissions from Transport Sector* (online) Available: [2022-08-24 Transport Climate Ambition - Senior Officials Group 20210324.pdf](https://www.gov.ie/en/publication/2022-08-24-Transport-Climite-Ambition-Senior-Officials-Group-20210324.pdf)
- DTTAS (2019) *Transport Climate Change Sectoral Adaptation Plan* (online) Available: <https://assets.gov.ie/39222/284b27f3507a411b982d8aff91e1bf49.pdf>
- EPA (2022) *Ireland's Greenhouse Gas Emissions Projections 2021 – 2040* (online) Available: <https://www.epa.ie/publications/monitoring--assessment/climate-change/air-emissions/EPA-Ireland's-GHG-Projections-Report-2021-2040v4.pdf>
- European Commission (2013) *DG CLIMA: Adaptation to Climate Change* (online) Available: <https://www.eea.europa.eu/policy-documents/dg-clima-adaptation-to-climate-change>
- European Commission (2021) *New EU Strategy on Adaptation to Climate Change* (online) Available: [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_21\\_663](https://ec.europa.eu/commission/presscorner/detail/en/ip_21_663)
- Government of Ireland (2015) *Climate Action and Low Carbon Development Act 2015 (No.46 of 2015)* (online) Available: <https://www.irishstatutebook.ie/eli/2015/act/46/enacted/en/html>
- Government of Ireland (2020) *Programme for Government – Our Shared Future* (online) Available: <https://www.gov.ie/en/publication/7e05d-programme-for-government-our-shared-future/>
- Government of Ireland (2021) *Climate Action and Low Carbon Development (Amendment) Act 2021 (the 2021 Climate Act) (No. 32 of 2021)* (online) Available: <https://www.irishstatutebook.ie/eli/2021/act/32/section/15/enacted/en/html>
- IPCC (2021) *AR6 Synthesis Report: Climate Change 2021 of the Sixth Assessment Report (AR6)* (online) Available: <https://www.ipcc.ch/report/ar6/wg1/>
- IPCC (2018) *Annex I: Glossary* [Matthews, J.B.R. (ed.)]. In: *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways*. Available: <https://www.ipcc.ch/sr15/chapter/glossary/>
- SEAI (2022) *M&R-2030 methodology guidance* (Public sector M&R-2030 framework) (online) Available: <https://www.seai.ie/business-and-public-sector/public-sector/monitoring-and-reporting/supports/MR-2030-Methodology-Guidance.pdf>



SEAI (2022) *Public sector energy efficiency & greenhouse gas targets - Gap-to-target model User guide* (online) Available: [Gap-to-Target-Model-User-Guide-v3.09.pdf \(seai.ie\)](#)

TII (2020) *Briefing Note: Public Transport On National Roads* (online) Available: [TII-Briefing-Note-Public-Transport-National-Roads-V.3.0-\(Draft\).pdf](#)

TII (2020) *TII Sustainability Implementation Plan – Our Future* (online) Available: [https://www.tii.ie/tii-library/sustainability/TII-Sustainability-Implementation-Plan\\_Our-Future\\_EXTERNAL.pdf](https://www.tii.ie/tii-library/sustainability/TII-Sustainability-Implementation-Plan_Our-Future_EXTERNAL.pdf)

TII (2021) *Annual Report 2021* (online) Available: <https://www.tii.ie/tii-library/reports-accounts/tii-annual-reports-and-accounts/2021%20TII%20Annual%20Report%20and%20Accounts>

TII (2021) *Asset Inventory (Roads) Summary Report* (online) Available: <https://www.tiipublications.ie/library/AM-GEN-00001-01.pdf>

TII (2021) *Statement of Strategy 2021-2025* (online) Available: <https://www.tii.ie/tii-library/statements-of-strategy/statement-of-strategy-2021-2025/tii-statement-of-strategy-2021-2025-final.pdf>

TII (2022) *List of Current Documentation* (online) Available: [https://www.tiipublications.ie/current-documents/Current-Documents-\(Sept-2022\).pdf](https://www.tiipublications.ie/current-documents/Current-Documents-(Sept-2022).pdf)

TII (2022) *National Roads 2040* (online) Available: <https://nr2040.consultation.ai/>

United Nations Framework Convention on Climate Change (1992) 'Article 1 – Definitions' (online). Available: <https://unfccc.int/resource/ccsites/zimbab/conven/text/art01.htm#:~:text=For%20the%20purposes%20of%20this%20Convention%3A&text=%22Climate%20change%22%20means%20a%20change,observed%20over%20comparable%20time%20periods.>

World Resources Institute and World Business Council for Sustainable Development (2004) *The Greenhouse Gas Protocol* (online). Available: <https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf>

# Appendix A

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

---

December 2022

## 1 RESPONSE TO THE CLIMATE ACTION MANDATE

This Appendix sets out TII’s response to the guidelines published by the SEAI and EPA on 25<sup>th</sup> October 2022. 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 25 <sup>th</sup> October 2022)	TII Response	Documentation to support adherence to the Climate Action Mandate	Status
Our people	<b>Leadership and governance for climate action</b>	Governance structure for climate and sustainability including chart showing responsibilities.	In place	Sustainability Portfolio Management Framework (2022)	Complete
		Name of nominated Climate and Sustainability Champion.	In place	Sustainability Portfolio Management Framework (2022)	Complete
		Name and role of Energy Performance Officer (EPO).	In place	Sustainability Portfolio Management Framework (2022)	Complete
		Names and roles of individuals appointed to Green Team, and terms of reference for Green Team (note that the first version of roadmap should focus on the energy targets).	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: 2021 Year End Report</li> </ul>	Complete
		How climate action links to strategic energy management (if in place) and to Energy Performance Officer responsibilities.	In place	<ul style="list-style-type: none"> <li>TII Statement of Strategy 2021 - 2025</li> <li>TII Sustainability Statement (2018)</li> <li>TII Sustainability Implementation Plan (2021)</li> <li>Energy and Carbon Enterprise Delivery Group as per the Sustainability Portfolio Management Framework (2022)</li> <li>TII Climate Action Roadmap (2022)</li> </ul>	Complete
		Sustainability strategy if available.	In place	<ul style="list-style-type: none"> <li>TII Sustainability Statement (2018)</li> <li>TII Sustainability Implementation Plan (2021)</li> <li>Sustainability Portfolio Management Framework (2022)</li> </ul>	Complete

Climate Mandate Area	Theme	Required Content (as per SEAI/EPA Guidance published 25 <sup>th</sup> October 2022)	TII Response	Documentation to support adherence to the Climate Action Mandate	Status
		As annex: energy strategy or policy/environmental strategy or policy.	In place	TII Environmental Strategy 2019	Complete
	<b>Engaging and training staff</b>	Set out plans for at least annual staff engagement workshop, focussed specifically and initially on energy related emissions, and over time on wider climate issues and reducing organisational carbon footprint.	In progress	See Chapter 3 of Climate Action Roadmap.	In progress
		Set out a plan to identify appropriate climate action training for staff that will be incorporated into ongoing staff learning and development (training needs analysis and plan for delivery).	In place	TII Sustainability Training Needs Assessment (Dec 2020) TII is developing a plan for delivery to be delivered this year based on the findings of the Sustainability Needs Assessment. The plan will be amended to meet the changing organisational needs.	Complete
		Information of any training needs analysis undertaken.	In place	TII Sustainability Training Needs Assessment and Plan (Dec 2021)	Complete
		Information on staff engagement already undertaken.	In place	<ul style="list-style-type: none"> <li>TII Quarterly Sustainability Communications / Engagement Activity Charts and monthly Sustainability Progress Group Meetings</li> <li>TII Programme re: Innovation Week</li> </ul>	Complete
<b>Our ways of working</b>	<b>Energy &amp; environmental management systems and accreditation</b>	Set target date for achievement of the energy management programme appropriate to your organisation. For larger public bodies, detail specifically when formal accreditation to ISO50001 energy management system will be achieved.	In place	TII achieved accreditation to ISO 50001: 2018 Energy Management System in 2019 and has passed subsequent surveillance audits in 2020, 2021 and 2022. Transdev (Luas Operator) achieved accreditation to ISO 50001: 2018 Energy Management System in 2021 and passed a surveillance audit in March 2022.	Complete
		State any environmental management system accreditation achieved or planned, such as ISO140001, EMAS, Green Campus etc.	In progress	TII is preparing for Stage 1 audit to achieve an Environmental Management System to ISO 14001:2015.	Q4 2023
	<b>Green public procurement</b>	Include green criteria for selection and award criteria when procuring all goods and services	In progress	See Chapter 3 of Climate Action Roadmap	In progress

Climate Mandate Area	Theme	Required Content (as per SEAI/EPA Guidance published 25 <sup>th</sup> October 2022)	TII Response	Documentation to support adherence to the Climate Action Mandate	Status
		(reference Circular 20/2019), using the published GPP guidance and criteria sets.			
		Set up a system to gather and record data on GPP implementation in your organisation, using the reporting template and guidance developed for government department reporting as a reference.	In progress	TII is currently setting up a system as stated in Climate Action Roadmap.	In progress
		Measure the environmental and climate benefits achieved through the application of green criteria in future procurements	In place	Per the CPGs, for future procurements, TII is aiming to embed sustainable considerations into all stages of the procurement lifecycle, and it is the responsibility of project and contract managers to ensure that their procurements are measurable and meet this requirement. To assist project and contract managers in this regard, TII has produced a simplified Sustainable Procurement Guide (published December 2021).	Continuous
	<b>Resource use</b>	<ul style="list-style-type: none"> <li>Timeline for review of paper-based processes to understand potential for digitisation.</li> <li>Describe plans to digitise paper- based processes.</li> </ul>	In place	See Chapter 3 of Climate Action Roadmap	Continuous
	<b>Annual Reporting</b>	Report GHG emissions and sustainability activities in the annual report	In place/ In progress	In place: sustainability activities. National Roads Indicators 2021 now include section on emissions. In Progress: GHG emissions	In progress
<b>Our Buildings and vehicles</b>	<b>Our buildings and vehicles</b>	Ensure procurement of vehicles to meet the CAP21 target for purchase of zero emission vehicles where operationally feasible, as well as the minimum targets set out by SI381/2021 Clean Vehicles Directive.	In place	TII is required to consider using green criteria in procurement processes under Circular 20/2019: Promoting the use of Environmental and Social Considerations in Public Procurement. The EPA published updated Green Public Procurement Guidance for the Public Sector in September 2021 to	Completed

Climate Mandate Area	Theme	Required Content (as per SEAI/EPA Guidance published 25 <sup>th</sup> October 2022)	TII Response	Documentation to support adherence to the Climate Action Mandate	Status
				provide green criteria that can be incorporated into public procurement. 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.	
		Ensure there is a Display Energy Certificate (DEC) in every building 'frequently visited by the public.'	Agreed	TII is progressing this certificate and will have it displayed in Q1 2023.	In progress
		Update procurement and design procedures to comply with the requirement for no fossil fuel heating after 2023.	In place	See Chapter 3 of Climate Action Roadmap. The Climate Action Mandate requires large public sector bodies (such as TII) to achieve formal environmental and/or energy management system accreditation.	Completed
		Plan for creating bicycle friendly buildings for employees and visitors, by putting bicycle parking in place by 2022.	In progress	TII bicycle parking available to employees and visitors. These facilities are currently being upgraded and will be completed by Q3 2023.	In progress
<b>Our Targets</b>	<b>Achieving the carbon emissions reduction targets (51% reduction by 2030)</b>	<ul style="list-style-type: none"> <li>• Energy related carbon emissions baseline (average of 2016-18 emissions).</li> <li>• Overall emissions and thermal (heating and transport) emissions if no new projects implemented.</li> <li>• Any growth in emissions between the baseline and target years based on planned increase/growth in services (if applicable).</li> <li>• Any planned energy related carbon reduction activities.</li> <li>• Identify any 'Gap to Target' that needs to be addressed.</li> <li>• Analysis of significant emitters.</li> </ul>	In place	See Chapter 2 of TII Climate Action Roadmap and Appendix C and D.	Complete

Climate Mandate Area	Theme	Required Content (as per SEAI/EPA Guidance published 25 <sup>th</sup> October 2022)	TII Response	Documentation to support adherence to the Climate Action Mandate	Status
		<ul style="list-style-type: none"> <li>Proposed actions to achieve energy related carbon target, detailing specific projects and timelines.</li> <li>Resources in place or to be mobilised.</li> <li>Resources, both people and financial.</li> <li>Project readiness status.</li> </ul>			
	<b>Achieving the energy efficiency target (50% improvement by 2030)</b>	<ul style="list-style-type: none"> <li>Energy efficiency baseline (note that baseline(s) for energy efficiency differs from energy related carbon emissions baseline).</li> <li>Energy efficiency in target year if no new projects implemented.</li> <li>Any growth in energy use or change in the activity metric between the baseline and target years based on planned increase/growth in services (if applicable).</li> <li>Any planned energy efficiency activities.</li> <li>Identify any 'Gap to Target' that needs to be addressed.</li> <li>Analysis of significant energy users.</li> <li>Proposed actions to achieve energy efficiency target, detailing specific projects and timelines.</li> <li>Resources in place or to be mobilised.</li> <li>Resources, both people and financial.</li> <li>Project readiness status.</li> </ul>	In place	See Chapter 2 of TII Climate Action Roadmap and Appendix C and D.	Complete
	<b>Climate Action Roadmap</b>	Put in place a Climate Action Roadmap by the end of 2022	In progress	See Climate Action Roadmap	In progress

Climate Mandate Area	Theme	Required Content (as per SEAI/EPA Guidance published 25 <sup>th</sup> October 2022)	TII Response	Documentation to support adherence to the Climate Action Mandate	Status
Optional content		<ul style="list-style-type: none"> <li>Reducing emissions of other greenhouse gases (e.g., methane, F gases).</li> <li>Reducing other indirect emissions (scope 3) e.g., from commuting, purchased goods and services etc. Identifying impact of climate change on organisational operations and undertaking climate adaptation measures.</li> <li>Activities to raise awareness of climate change mitigation and adaptation.</li> <li>Public bodies may also report on other climate action initiatives/pledges/reporting schemes they participate in.</li> </ul>	In progress	See Chapters 3 and 4 of Climate Action Roadmap	In progress



# Appendix B

## Policy Context

---

December 2022

## 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 existing Directive on Energy Efficiency (2018/2002) sets an energy efficiency target for 2030 of at least 32.5%, this EU-wide target has been set relative to the 2007 modelling projections for 2030. This target means that EU energy consumption should not exceed 1128 Mteo (million tonnes of equivalent) or 846 Mteo of final energy. EU countries will have to achieve energy savings of 0.8% each year of final energy consumption for 2021-2030. The 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. This proposal promotes 'energy efficiency first' amongst the EU's energy policy goals which sets out its importance in both policy and investment decisions.

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 CAP21 outlines the plan to deliver Ireland's climate ambition. It will be updated annually to align with legally binding economy-wide carbon budgets and sectoral ceilings. CAP21 sets ambition to increase the national electricity generation from renewables. 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 - this will include emission ceilings for the transport sector.
- Strengthens the role of the Climate Change Advisory Council in proposing carbon budgets.
- Introduces a requirement to annually revise the CAP21 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

---

December 2022

## 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 2021 (CAP21) 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 October 2022. The results presented in this chapter represent modelling outputs, dated November 2022, based on the gap-to-target tool version 3.09 released 8 September 2022. 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 2022-2030 to model TII's GHG emissions from its baseline (2016-2018 (average)) to 2030.

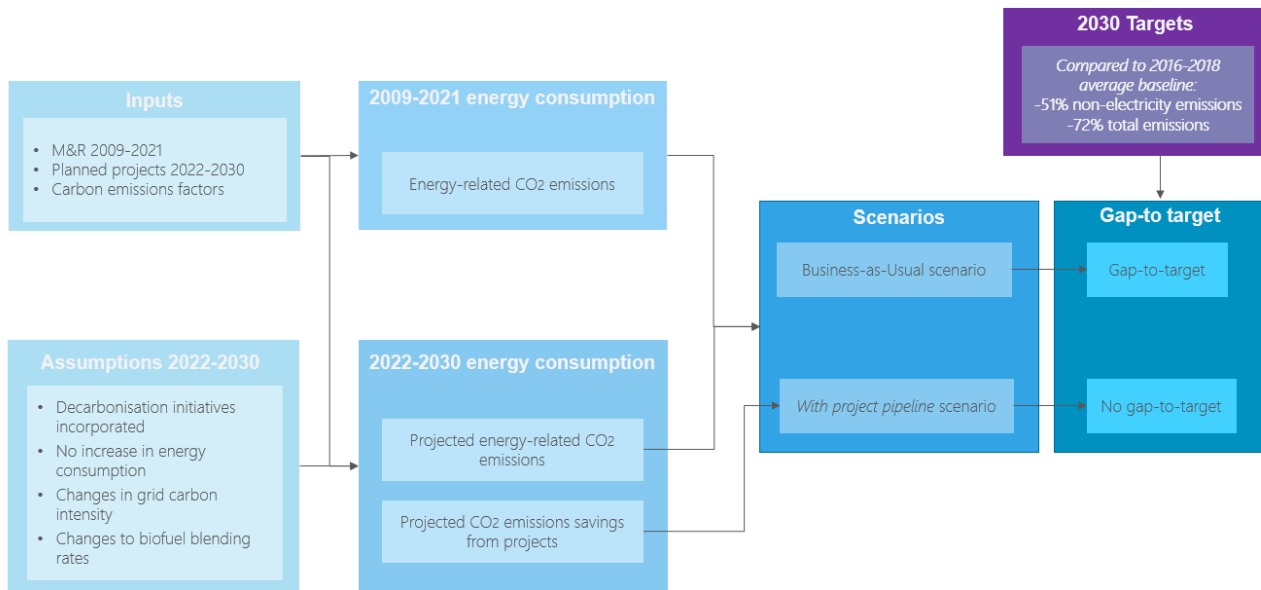


Figure 1 Representation of the decarbonisation model

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 2022 & 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. This was not deemed applicable for TII, as no future changes in operations were identified that would increase TII’s energy consumption.

## 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**.

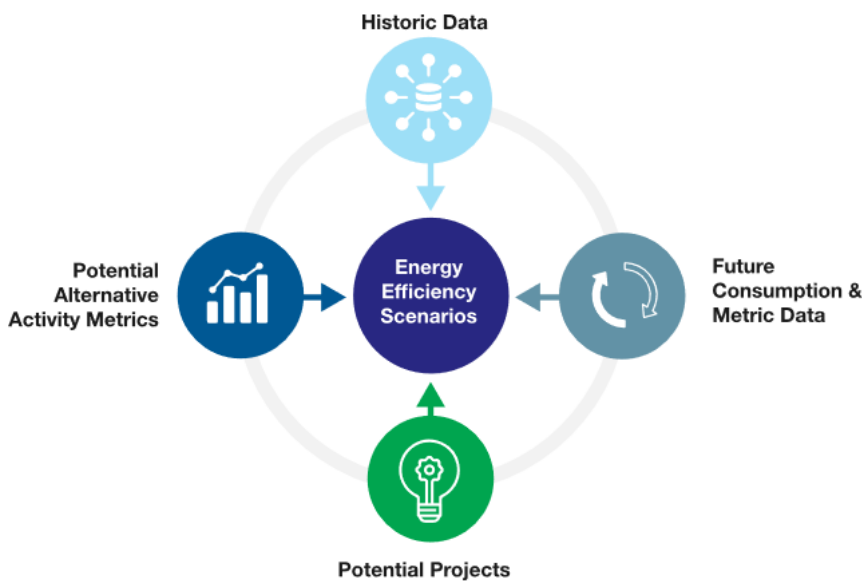


Figure 2 Building blocks for energy efficiency scenarios

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.

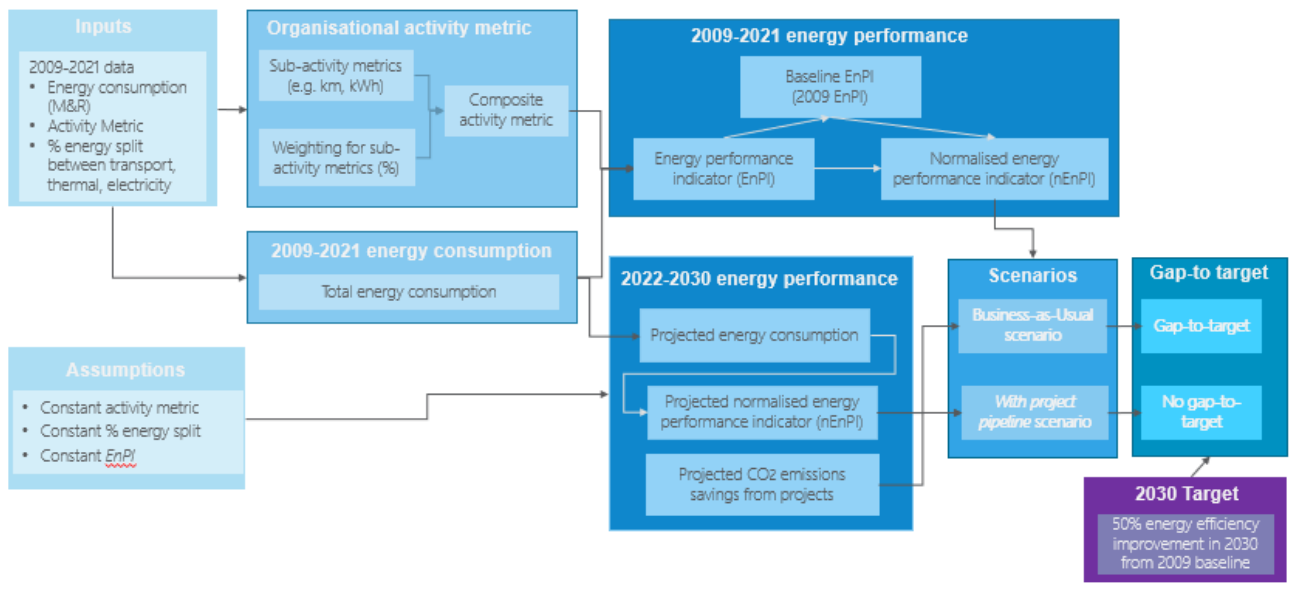


Figure 3 Representation of the energy efficiency model

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 (m<sup>2</sup>)
- 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

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.

### 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 2021 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	5,744	-75%	-	5,021	-78%	-
<b>Non-electricity</b>								
Thermal	1,808	886	1,919	+6%	-	1,863	+3%	-
Transport	3,608	1,768	3,958	+10%	-	790	-78%	-
<b>Non-electricity Total*</b>	<b>5,416</b>	<b>2,654</b>	<b>5,877</b>	<b>+9%</b>	<b>3,223</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>11,620</b>	<b>-59%</b>	<b>3,748</b>	<b>7,675</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 9% higher in the BAU 2030 scenario than the baseline. However, TII could expect a reduction in total emissions (electricity and non-electricity) of 59% by 2030 in the BAU scenario, resulting in a gap of 13% to the 72% target, this a gap of 3,748 tCO<sub>2</sub>.

In the ‘with project pipeline’ scenario, projected supply-side reductions from electricity grid decarbonisation are expected to lead to a 75% 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 projected 14% reduction by 2030 compared to the baseline. Therefore, TII is expected to exceed the 72% target, projecting a 73% reduction from the baseline.

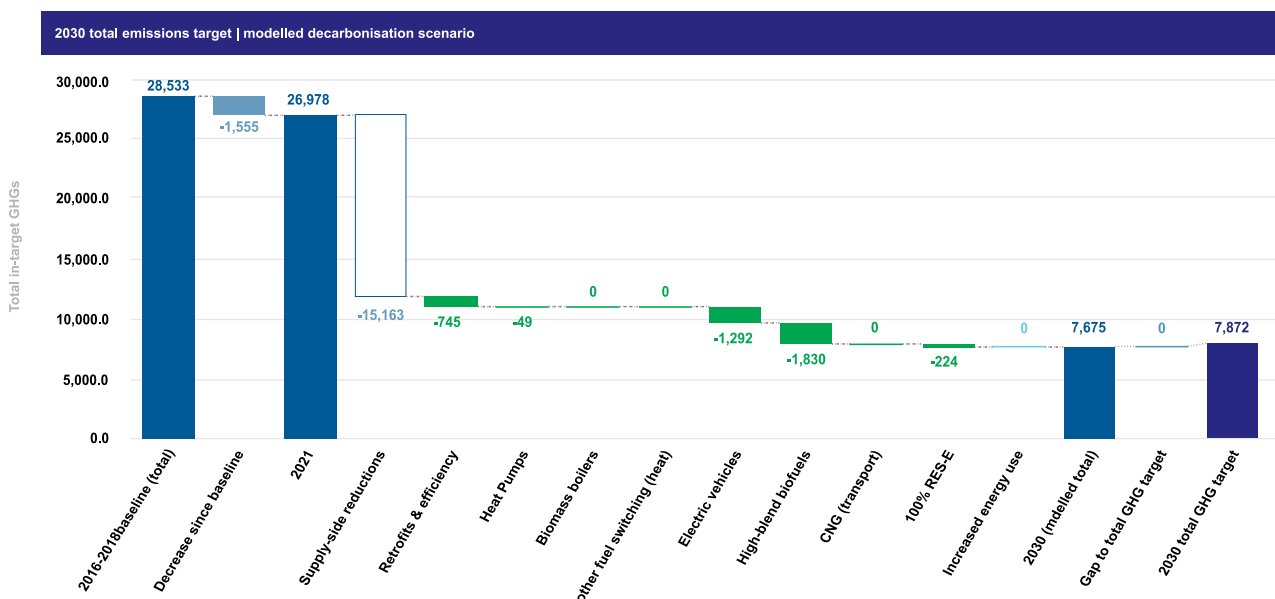


Figure 4 Impact of projects and supply-side reductions on total emissions

### 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 CAP21. 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 71% in 2021, indicating a 29% improvement in energy efficiency from the 2009 baseline. In the BAU scenario nEnPI is projected at 55%, resulting in the gap-to-target of 5% 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%	55%	47%
Energy efficiency improvement versus 2009 baseline	50%	45%	53%
Gap-to-target in 2030	NIL	5%	NIL (Target exceeded by 3%)

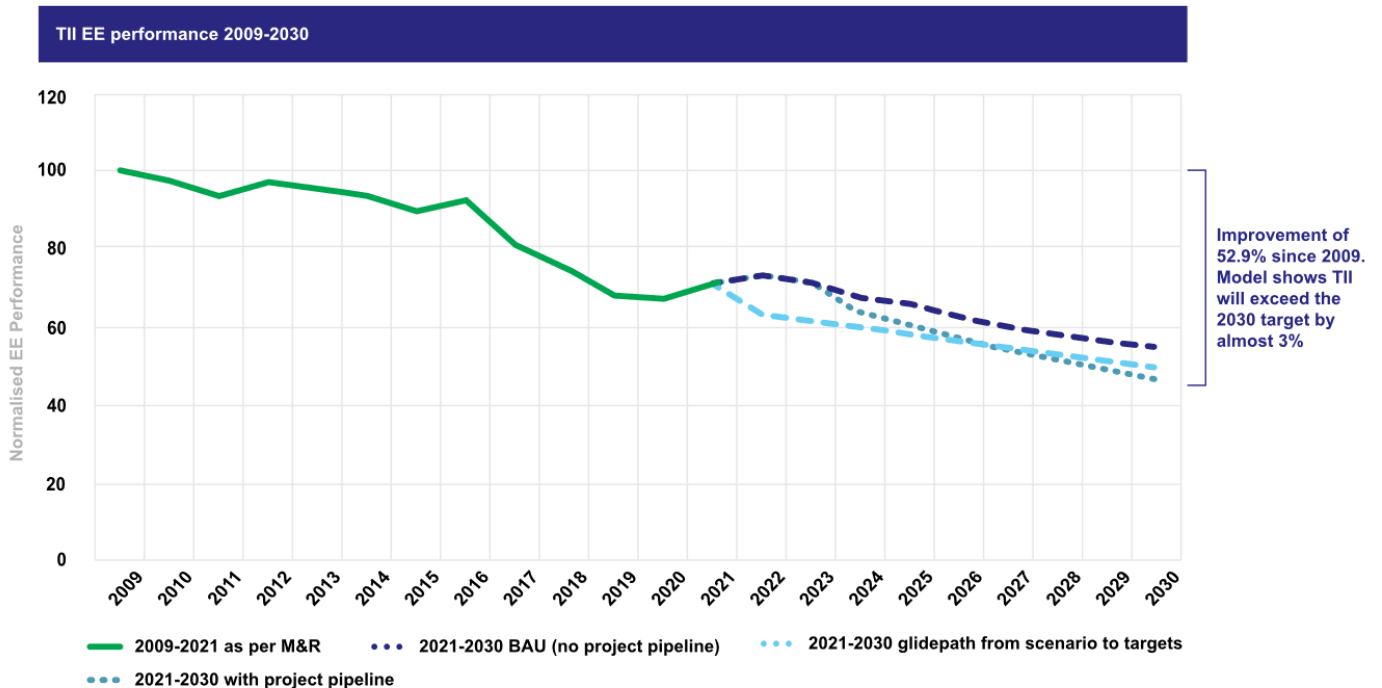


Figure 5 TII energy efficiency 2009-2030

#### 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 3,966 of single carriageway, as stated in TII’s National Road Networks Indicators (2021). 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**.

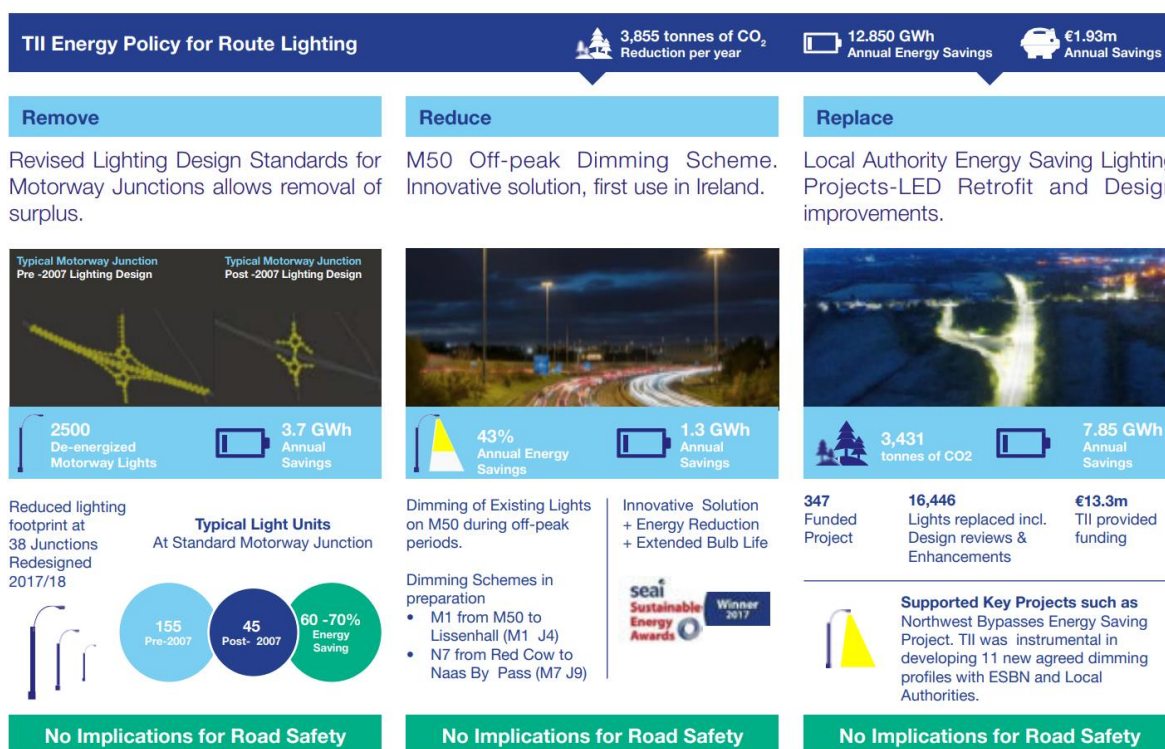


Figure 6 TII energy policy for route lighting,

Source: TII Annual Report and Financial Statements (2021)

The light rail network includes the Luas rolling stock, infrastructure and systems used during operation of the network. The emissions from the light rail network result from powering the light rail system, the operation of the three maintenance depots and offices, and running the 67 stops. 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. Thus, a variety of project are planned. For instance, among a variety of projects in TII’s project pipeline are LED lighting retrofitting projects for the light rail network.

These include plans to retrofit tram stops, depots, and car parks lighting to LED on both green and red lines. Phase 1 of the project is currently at tender stage and is expected to save 106,000 kWh per annum.



## 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 undertakes continuous improvement to keep the certification. ISO 50001 applies to TII's Parkgate Street offices and Equipment on the Motorway (e.g., Variable Message Signs [VMS] on motorways) 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 cloud.
- Sub-metering within TII's buildings and major consumers which could 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 & cooling sources.
- Removing desktop PCs from workstations.

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 ITS equipment such as VMS on N17/18 motorway (currently being trialled).
- Wind turbines connected to batteries to power ITS equipment to support the solar powered VMS.
- 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 and those projects currently under consideration have 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 both planned and proposed in **Appendix D**.

**Figure 7** below shows the project pipeline status of the projects included in the modelling. Each bubble stands for one or more projects of the same ‘project scale’ and ‘project readiness’. The location of each bubble shows the ‘type’ and ‘readiness’ of each cohort of project(s); the size of each bubble shows the savings (kWh TFC) from those project(s).

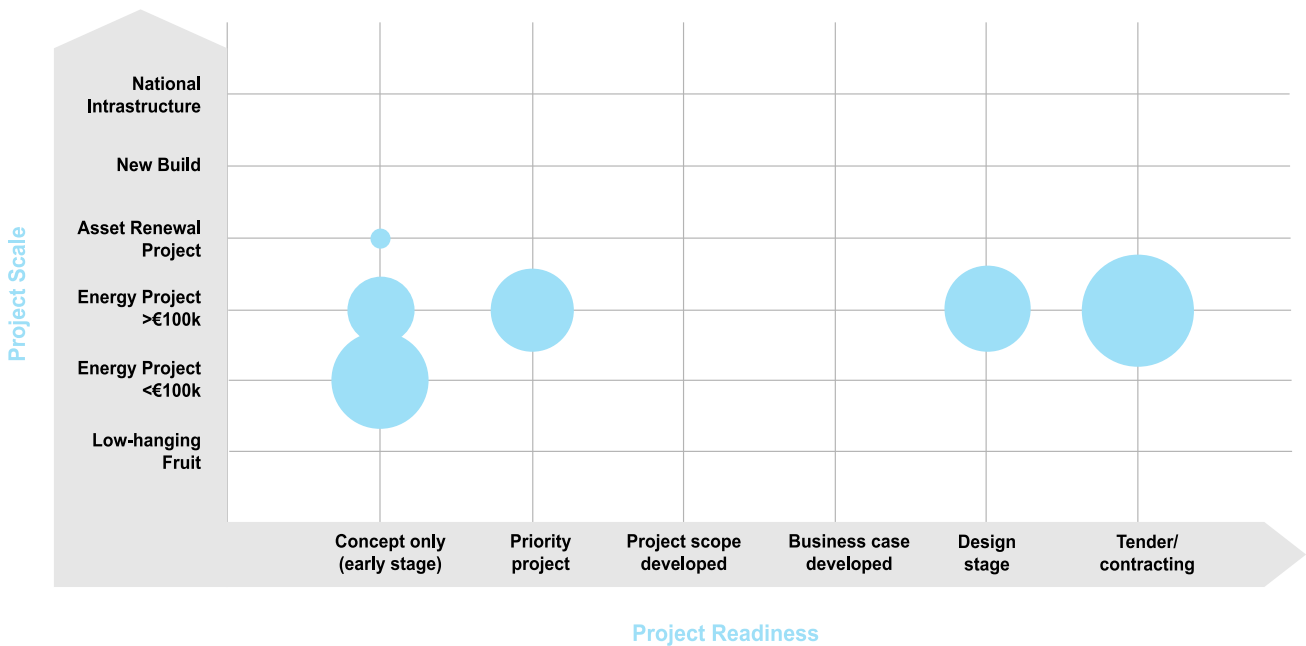


Figure 7 Project pipeline status

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

---

December 2022

## Introduction

Each project within this appendix has been categorised in terms of scale and readiness, where known a cost estimate has also been provided.

**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.

Table 3. Projects included in the Gap to Target model.

	Project details		Project categorisation	Energy savings in year after implementation		Financial summary	Notes (optional)
	Project name	Location	Project readiness	Grid electricity	Total	Estimated cost	
	[-]	[-]	[-]	[kWh TFC]	[kWh TFC]	[€]	[-]
1	Solar PV Red Cow depot	Managed Network Premises	5. Design stage	414,780	-		Rooftop mounted solar PV panel array designed to generate on-site renewable energy which will offset against the large electrical consumption at the depot. NTA in line with their guidelines has approved the production of the structural report, electrical report, CBA reports, EIA/AA Screening report and glint & glare report.
2	Solar PV Sandyford Depot	Managed Network Premises	5. Design stage	414,780	-		Rooftop mounted solar PV panel array designed to generate on-site renewable energy which will offset against the large electrical consumption at the depot. NTA in line with their guidelines has approved the production of the structural report, electrical report, CBA reports, EIA/AA Screening report and glint & glare report.
3	Solar PV Broombridge-Hamilton Depot	Managed Network Premises	5. Design stage	177,190	-		Rooftop mounted solar PV panel array designed to generate on-site renewable energy which will offset against the large electrical consumption at the depot. NTA in line with their guidelines has approved the production of the structural report, electrical report, CBA reports, EIA/AA Screening report and glint & glare report.
4	Tram Stop Lighting retrofit to LED-Phase 1	Light rail infrastructure and rolling stock	6. Tender / contracting stage	106,000	106,000		Tram Stop Lighting retrofit to LED-Phase 1: TII will retrofit the tram stop lighting, depot lighting and car park lighting on both red and green lines. TII has agreed to commence works on phase 1 which is to retrofit the red line stop lighting to LED. Further phases will see the retrofitting of the tram depot lighting and car park lighting on the red line. In a similar fashion, TII will retrofit the lighting on the green line later. The energy savings per annum for the Tram Stop Lighting retrofit to LED-Phase 1 project will be 106,000 kWh.
5	Rolling Stock Saloon lighting retrofit to LED - green line	Light rail infrastructure and rolling stock	5. Design stage	514,000	514,000		
6	NM Lighting - Phase 1 Network Lighting Projects (2023)	Managed Network Lighting	6 Tender / contracting stage	3,290,000	3,290,000	€1,400,000	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 Lighting - Phase 2 Network Lighting Projects (2024)	Managed Network Lighting	5 Design stage	1,200,000	1,200,000	€-	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).
8	NM Lighting - Phase 3 Network Lighting Projects (2026)	Managed Network Lighting	2 Priority project	1,100,000	1,100,000	€-	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).
9	NM Lighting - Phase 4 Network Lighting Projects (2027)	Managed Network Lighting	1 Concept	600,000	600,000	€-	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).
10	NM Lighting - Phase 5 Network Lighting Projects (2028)	Managed Network Lighting	1 Concept	800,000	800,000	€-	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).
11	NM Solar - Phase 1 trial deployments (2023)	Managed Network Premises	6 Tender / contracting stage	119,000	-	€266,000	Cost note refers to est. new capital investment required by TII.
12	NM Solar - Phase 2 Additional premises (2027)	Managed Network Premises	2 Priority project	480,000	-	€1,056,000	Cost note refers to est. new capital investment required by TII.
13	NM Solar - Phase 3 Additional premises (2028)	Managed Network Premises	1 Concept	680,000	-	€1,496,000	Cost note refers to est. new capital investment required by TII.
14	NM Fleet - Light fleet vehicle transition (2025) Phase 1	Managed Network Fleet	2 Priority project	374,373	561,560	€-	Swap from LIGHT vehicle diesel to Elec means less diesel consumed but an increase in electricity. For TII, an additional operational cost 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	2 Priority project	239,599	359,398	€-	Swap from MEDIUM diesel to Elec means less diesel consumed but an increase in electricity. For TII, an additional operational cost 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	1 Concept	1,123,119	1,684,679	€-	Swap from LIGHT vehicle diesel to Elec means less diesel consumed but an increase in electricity. For TII, an additional operational cost 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	1 Concept	718,796	1,078,194	€-	Swap from MEDIUM diesel to Elec means less diesel consumed but an increase in electricity. For TII, an additional operational cost 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	1 Concept	-	-	€-	Recorded here for completeness, no impact on EE. While modest capital investment may be required to provision or upgrade fueling 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	1 Concept	-	-	€-	Recorded here for completeness, no impact on EE. While modest capital investment may be required to provision or upgrade fueling 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	1 Concept	-	-	€-	Recorded here for completeness, no impact on EE. While modest capital investment may be required to provision or upgrade fueling 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	1 Concept	-	-	€-	Recorded here for completeness, no impact on EE. While modest capital investment may be required to provision or upgrade fueling 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	1 Concept	64,648	150,844	€-	Project costs will be examined closer to the year of implementation



Table 4. Projects not included in the Gap to Target model.

Project details		Project categorisation		Energy savings in year after implementation	Notes (optional)
Project name	Type	Project readiness	Total		
[-]	[-]	[-]	[kWh TFC]		
1	Onboard lighting controls and intelligent lighting control system in light rail rolling stock	Lighting	1. Concept		Modify on board lighting controls plus introduction of intelligent lighting controls system based on photo cell sensors to ensure: * internal lights off when not required. * off when required lux level is met inside the vehicle. * that the lighting is not active during sweep runs or returning to the depot at the end of service (if not carrying passengers) * that the lighting is no longer activated as soon as the tram is prepped. This project would reduce energy consumption by ensuring the lighting is only activated when the tram is occupied and in passenger service.
2	Retrofit light rail red line rolling stock with LED lighting	Lighting	2. Priority Project	400000	The introduction of a new tram fleet on the red line will introduce greater energy efficient technologies and from a lighting perspective the result would equal the efficiencies and gains if one were to update the lighting on the existing red line 401 fleet thus contributing to energy efficiency goals for 2030.
3	Light rail rolling stock heating	HVAC	2. Priority Project	0	Modify heating system controls to ensure * the heating/ventilation system only operates when trams are in service and passenger occupied. * that the heating is not active when doors are opened for a prolonged period e.g. terminus. * that the heating is not active during sweep runs or returning to the depot at the end of service (if not carrying passengers) * that the heating no longer activated as soon as the tram is prepped. * Optimal temperature setpoint . This would reduce energy consumption by ensuring the tram heating system only operates when the tram is occupied and in passenger service, the temperature relative to passenger numbers.
4	Alternative heating/ventilation control system	HVAC	1. Concept	0	This proposal relates to examining the use of an alternative/more efficient method for controlling the tram heating.
5	Light rail driver behaviour training	Energy management	1. Concept	0	TII have identified a driver behavioural training programme and supplier and have submitted a proposal to Transdev for implementation. Transdev have advised that they will endeavour to plan implementation in Qtr. 1/2 of 2023. Tractive effort on trams during acceleration is the largest single contributor to Luas energy consumption - driver training will be investigated to see what opportunities there may be to influence reduced tractive load.
6	Luas stop lighting retrofit - Green Line	Lighting	6. Tender / Contracting Stage	33000	Replace Luas Stop Lighting (Metal Halide) with LED luminaires - Green Line. Introducing energy efficient LED luminaires would generate an energy saving of approx. 65% whilst maintaining the required lux level with increased uniformity (light distribution). The replacement of the existing metal halide lamp sources with LED technology not only provides for a considerable kWh, CO <sub>2</sub> and monetary saving but also reduces the maintenance cost as the lifespan of LED lamps is greater than Metal Halide.
7	Luas depot lighting retrofit	Lighting	6. Tender / Contracting Stage	114000	Replace Luas Depots Lighting (Metal Halide) with LED luminaires. * Red Cow Depot * Sandyford Depot * Broombridge Depot. Introducing energy efficient LED luminaires would generate an energy saving of approx. 65% whilst maintaining the required lux level with increased uniformity (light distribution). The replacement of the existing metal halide lamp sources with LED technology not only provides for a considerable kWh, CO <sub>2</sub> and monetary saving but also reduces the maintenance cost as the lifespan of LED lamps is greater than Metal Halide.
8	Luas car park lighting retrofit	Lighting	6. Tender / Contracting Stage	115000	Replace Luas Car Park Lighting (Metal Halide) with LED luminaires. Introducing energy efficient LED luminaires would generate an energy saving of approx. 65% whilst maintaining the required lux level with increased uniformity (light distribution). The replacement of the existing metal halide lamp sources with LED technology not only provides for a considerable kWh, CO <sub>2</sub> and monetary saving but also reduces the maintenance cost as the lifespan of LED lamps is greater than Metal Halide.
9	Assessment/improvement of energy efficiency in TII's building assets	Energy management	1. Concept	TBC	
10	Improvement of energy efficiency in fleet	Transport	1. Concept	TBC	Improving the efficiency of TII's fleet of vehicles & seeking the support of SEAI in facilitating the development of awareness and trial of LEVs by existing contractors.
11	Dublin Tunnel LED retrofit	Lighting	1. Concept	TBC	Introducing energy efficient LED luminaires would generate a considerable energy saving

Table 4. Projects not included in the Gap to Target model.

Project details		Project categorisation		Energy savings in year after implementation	Notes (optional)
Project name	Type	Project readiness	Total		
[-]	[-]	[-]	[kWh TFC]		
12 Geothermal heat pump at Red Cow depot	HVAC	1. Concept	TBC	Red Cow depot consumes a large quantity of gas as an energy source for spatial and water heating for both office areas and tram maintenance sheds (roof mounted gas radiant panels). The geothermal heat pump will endeavour to offset the thermal energy associated to gas for office areas and potentially the tram maintenance shed area. TII in conjunction with Transdev have identified a product which has the potential to replace the gas boilers for the office areas and ceiling mounted gas radiant panels in the tram TII and Transdev are in the initial stages of review. Luas depots are in the top ten consumers of natural gas in TII sheds.	