

Strengthening environmental considerations in public investment in Ireland

Assessment and recommendations



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Abstract

Infrastructure is an important consideration in both climate change mitigation and adaptation. It plays a pivotal role in achieving climate neutrality and resilience but is also susceptible to certain risks. As infrastructure has a long lifespan, it is particularly vulnerable to the impacts of climate change over time. Poor planning and management of infrastructure assets can also increase dependency on fossil fuels and lock in climate risks. It is thus important that infrastructure is implemented in a way that helps address environmental and climate challenges.

Developing effective strategies to meet environmental and climate objectives is one of the main priorities of the Irish Government. Project Ireland 2040 offers a unique opportunity to ensure that infrastructure investments support climate mitigation and adaptation efforts. Building on this impetus, the OECD has provided technical support to the Irish Government to strengthen climate and environmental considerations in its public infrastructure decision making process.

This policy paper sets out a detailed overview of infrastructure planning, project appraisal and budgeting practice in Ireland, and identifies challenges and opportunities for environmental and climate considerations.

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Executive summary

Infrastructure is an essential consideration when it comes to both climate change mitigation and adaptation. It plays a pivotal role in achieving climate neutrality and resilience but is also susceptible to certain risks. As infrastructure has a long lifespan, it is particularly vulnerable to the impacts of climate change over time. Poor planning and management of infrastructure assets can also increase dependency on fossil fuels and lock in climate risks. It is thus important that infrastructure is implemented in a way that helps address environmental and climate challenges.

Developing effective strategies and policies to meet environmental and climate objectives is one of the main priorities of the Irish Government. The Next Generation EU Plan and the Project Ireland 2040, which will provide over EUR 165 billion to infrastructure investments by 2030, offer a unique opportunity to ensure that infrastructure investments support climate mitigation and adaptation efforts. Most notably, public capital spending and a robust infrastructure governance are crucial to ensure Ireland meets national, EU and international environmental commitments.

Within this context, the OECD has provided technical support to the Irish Government to strengthen climate and environmental considerations in public infrastructure decision making (i.e. strategic planning, project appraisal, and public budgeting). The action was funded by the European Union via the Technical Support Instrument, and implemented by the OECD, in co-operation with the Directorate-General for Structural Reform Support of the European Commission. The main outputs of this project, which takes a cross-sectoral perspective, are two papers that propose a series of recommendations and new methodological approaches for integrating considerations relevant for carbon mitigation and climate adaptation in the appraisal process set out in the Irish Public Spending Code (PSC)¹.

This first paper sets out a detailed overview of infrastructure planning, project appraisal and budgeting practice in Ireland, and identifies challenges and opportunities for environmental and climate considerations. A more detailed description of the content of each chapter is provided in the paragraphs below.

Integrating environmental considerations in long-term strategic planning

Ireland has made important efforts to ensure better alignment between its long-term strategic plan and international climate change commitments. The National Planning Framework (NPF) sets out the long-term strategy for Ireland to accommodate growth and development within environmental limits, strengthening the country's responsiveness to climate change. It supports the integration of climate and environmental considerations into statutory plans and guidelines, including climate change mitigation and

¹ In March 2023, the Minister for Public Expenditure, NDP Delivery and Reform announced a package of reforms aimed at enhancing project delivery for the National Development Plan. Under these reforms, the Public Spending Code, which sets the appraisal guidelines for Exchequer funded capital projects will be removed and replaced by a set of Infrastructure Guidelines, to be published in 2023.

adaptation, protection of biodiversity and ecosystems, energy efficiency, circular economy, waste management, air and water quality, noise pollution, and land consumption.

As a support to the sustainability goals pursued under the NPF, the revised version of the Irish investment strategy and budget (i.e. the National Development Plan or NDP 2021-2030) further promotes investments to strengthen the environmental sustainability and the adaptive capacity of new and existing infrastructure assets. Moreover, as an integral part of the NDP Review carried out in 2021, for the first time ever, the country undertook an assessment of the impact that each of the Exchequer-funded measures contained in the NDP was likely to have on climate and environmental outcomes.

Despite progress made, the report identifies three main challenges and opportunities to improve the consideration of environmental and climate aspects in Ireland's long-term planning:

- The self-qualitative assessment carried out by the different government departments to evaluate the likely impacts of proposed measures in the NDP was just a one-off exercise, and results have not informed the selection and prioritisation of investment projects.
- In Ireland, each government department is responsible for ensuring that project proposals align with environment and climate goals. Nonetheless, there is a risk that a lack of coherence and consistency across sectoral policies will emerge.
- More efforts are needed to mainstream climate change adaptation in key national and sectoral policy instruments, as well as to develop effective adaptation options and implement them.

Integrating environmental considerations in project appraisal and in the planning and permit process

The existing framework for project appraisal in Ireland provides some opportunities to integrate environmental and climate considerations. The Public Spending Code (PSC) sets out the value-for-money requirements for the evaluation, planning and management of public investment projects in Ireland. In 2019, the country introduced a series of reforms to the PSC to strengthen strategic alignment with the government's core objectives, including climate and environmental goals.

To date, the different stages of the project lifecycle envisaged by the Code offer different opportunities to integrate environmental and climate considerations. For example, the long- and short-list of options provided, respectively, at the Strategic Assessment and Preliminary Business Case stage can be assessed based on frameworks that consider environmental factors. These include multi-criteria models, balanced scorecards or SWOT analyses. Likewise, the Benefits Realisation Plan for the Final Business Case can also be used to value environmental and climate aspects.

Environmental and climate considerations are also part of the economic appraisal of short-listed options (in the Preliminary Business Case stage). Indeed, the PSC requires economic appraisals to estimate and monetise the emissions impacts of projects. Recently, DPENDR has also tripled the price of carbon that is applied under the new PSC. In cases where emissions are not considered relevant, significant, or practicable for inclusion, public bodies are asked to explain how this conclusion was reached as part of the economic appraisal process.

Besides cost-benefit analysis, the PSC also considers the use of multi-criteria analysis to integrate green considerations during economic appraisal. It combines monetary and non-monetary criteria and ensures a degree of structure, analysis and openness that supports more comprehensive assessment of the environmental impacts of projects (i.e. water and air pollution, impacts on biodiversity and landscape, etc.) and climate (i.e. greenhouse gas emissions).

Additional opportunities to integrate environmental and climate considerations are offered by the framework governing the permit process for infrastructure projects. All capital projects arising from the NPF

are subject to the requirements of the Irish planning and permitting process, which include environmental assessments. The results of such environmental assessments are expected to be integrated into project design, for example, through mitigation measures to prevent, reduce or offset negative impacts. Furthermore, they provide the planning authority with an overview of the project's impacts on the environment and inform the decision to grant planning permission.

Despite these efforts, challenges and opportunities to further integrate environmental and climate considerations in the Irish project appraisal process include the following:

- A lack of detailed, central-level guidance to assess environmental factors and integrate climate change adaptation in project appraisal.
- A need for better methodologies to capture the emissions impact of projects across their lifecycle, as well as induced or indirect emissions.
- Difficulties in defining the counterfactual scenario under cost-benefit analysis.
- The fact that the environmental impact assessment (EIA) and the strategic environmental assessment (SEA) are part of the planning process, but separate from the PSC process.
- A lack of detailed guidance to integrate climate change adaptation in EIA.
- The tendency of the Irish public administration to outsource economic and financial appraisal to private consulting firms rather than conducting them in-house.
- A lack of a clear prioritisation mechanism for infrastructure projects based on their interactions with the environment and climate.

Green budgeting incentives

Ireland has been implementing a series of reforms to its budgetary framework for several years, including a larger focus on policy objectives and outcomes (i.e. well-being budgeting, green budgeting, equality budgeting, carbon budgets).

In 2022, Ireland's methodology on green budgeting integrated four main initiatives in the annual Expenditure Report, the Revised Estimates Volume, and the Public Service Performance Report: 1) tagging of climate-related government expenditure; 2) progressive increases in carbon tax; 3) strengthening the link between climate-related expenditure and climate action and outcomes; 4) carbon budgets.

In December 2022, Ireland published the Climate Action Plan 2023. It is the second annual update to Ireland's Climate Action 2019. It implements the carbon budgets and sectoral emissions ceilings and sets out a roadmap to reduce emissions by 2030 and reach net zero in 2050.

If green budgeting is one of a range of inputs into a more complex process that also requires consideration of the outputs/outcomes associated with tagged expenditure, it should also be used to directly inform decisions about sectoral resource allocations and performance tracking.

To address some of these challenges, the report identifies the following potential areas for improvement:

- Better integrate green budget tagging and carbon budgets into budget cycle decision making to strengthen the information and prioritisation of budget allocations.
- Use green budget tagging and carbon budgets as complementary tools to help prioritise and select investments.

1 Introduction

1.1. The urgency of the climate crisis and the role of infrastructure in climate change mitigation and adaptation

Global temperatures are already estimated to have risen by 1.1°C above pre-industrial levels. Despite the commitments made under the Paris Agreement, further temperature increases are inevitable (UNFCCC, 2015^[1]). At the Conference of the Parties (COP 26) in Glasgow, several countries including Ireland committed to net-zero emissions by 2050. An updated analysis from the International Energy Agency (IEA) of new targets shows that mitigation measures proposed would be enough to hold the rise in global temperatures to 1.8 °C by the end of the century (IEA, 2021^[2]). Although exceeding the 1.5 °C target, this is encouraging. However, these efforts should be shared across countries, with pledges being fulfilled in full and on time.

The changing weather patterns emerging from these temperature increases will have a very strong impact all over the world. In Ireland, the number of warm days is expected to increase and heat waves are expected to occur more frequently. Moreover, there will be an increase in the frequency of heavy precipitation events in winter and autumn, while the average levels of annual, spring and summer rainfall will be lower. Sea level is also projected to rise at a rate of 3.6 mm per year or higher. As a result, some impacts are already unavoidable, such as coastal erosion, increased likelihood of river and coastal flooding and more serious damages to property and infrastructure, water stress for crops, pressure on water supply and adverse impacts on water quality, negative impacts on human health and wellbeing, among others (Environmental Protection Agency (EPA), n.d.^[3]). For this reason, parallel to net-zero commitments, a focus is needed on climate change adaptation. This involves reducing and managing the risk of losses and damages caused by changing climate conditions and extreme weather events such as sea level rise, droughts, heavy rains, and forest fires. According to the EEA, between 1980 and 2020, weather and climate-related extremes accounted for around 80% of total economic losses caused by natural hazards in the EEA Member States, amounting to a total loss of EUR 487 billion. For Ireland, the agency notes that the losses caused by weather and climate-related extremes over the same period amounts to EUR 2 968 million (EEA, 2022^[4]).

Infrastructure is an essential consideration when it comes to both climate change mitigation and adaptation. It plays a key role in paving the way towards climate neutrality and resilience, but it is also liable to certain risks. As infrastructure has long use lifespan, it is particularly vulnerable to the impacts of climate change over time. Poor planning and management of infrastructure assets can increase dependency on fossil fuels and lock-in climate risks. It is thus important that infrastructure is implemented in a way that contributes positively to addressing the climate challenge.

Most of the existing energy and transport infrastructure was designed and built for a world of cheap and abundant fossil fuels, contributing to economic growth in many regions but also to GHG emissions. As of today, infrastructure's share of carbon emissions, which already accounts for a large part of total emissions, is growing over time. In Europe, the energy sector is estimated to represent 26% the EU's greenhouse gas in 2020, with transport emissions at 22% (EEA, 2021^[5]). Due to expected increased demand, CO₂

emissions from transport will increase by 16% in 2050 even if today's commitments to decarbonise transport are fully implemented (ITF, 2021^[6]).

In addition to the value depreciation caused by gradual wear and aging, changing climate conditions have led to an increase in the frequency of climate-related shocks (such as floods, extreme temperatures, geological hazards, security threats and other risks) that are testing the limits of infrastructure resilience. For example, sea level rise will affect building areas, while higher temperatures imply higher heat tolerance for infrastructure such as railway tracks (European Commission, 2021^[7]). Adequate planning and investments are required to ensure that both new and existing infrastructure can withstand external shocks throughout their planned lifespan.

For these reasons, choices made on infrastructure investment will be critical for achieving net-zero carbon emissions in the coming decades. Operation, maintenance, and the decommissioning of any infrastructure project should be carried out in a climate-neutral way. This implies circular economy considerations such as the recycling or repurposing of materials. Adaptation measures building on climate risk assessments are also necessary to ensure climate-resilient infrastructure projects.

High quality public investment is essential to enable the green transition. Furthermore, a concerted effort between government and private sector finance will be necessary to unlock sustainable climate-neutral interventions and investments at scale. However, considering the high level of uncertainty and the risks involved, governments need to show leadership in leveraging public finance to de-risk further net-zero financing, including in infrastructure. Long-term low emissions strategies and complementary medium-term action plans that set out the climate targets of a given jurisdiction can play an important role in steering investment decisions (Aguilar Jaber et al., 2020^[8]). Likewise, governments are called upon to take the front-end risk in low-carbon investments and accept any front-end losses as a means to attract more private sector financing (Di Leva and Vaughan, 2022^[9]).

1.2. The momentum for climate proofing infrastructures

Considering the urgency of climate change and the potential of infrastructure governance² to mitigate and adapt to the climate crisis, Ireland can no longer wait to streamline environmental and climate considerations in the public investment decision-making process. The Next Generation EU Plan and the Project Ireland 2040, which will be providing over EUR 165 billion for infrastructure investments by 2030 (Department of Public Expenditure, NDP Delivery and Reform, 2019^[10]), are a unique opportunity to ensure that investments in infrastructure supports mitigation and adaptation efforts to climate change.

Recovery plans are a once-in-a-generation opportunity for governments to take climate action. Governments are planning infrastructure investment as part of recovery packages to jumpstart their economies. In November 2021, the US congress passed the USD 1.2 trillion Infrastructure Investment and Jobs Act, with over EUR 550 billion in new spending above the current baseline for existing infrastructure programs. Similarly, the United Kingdom committed to deliver GBP 100 billion in total investment in 2021-22 to support the recovery.

In the EU, the Recovery and Resilience Facility (RRF) is the largest component of Next Generation EU (NGEU) which includes over EUR 700 billion in grants and loans targeted to climate targets. Importantly, the national recovery and resilience plans are required to allocate at least 37% of total expenditure to investments and reforms that support climate objectives. The plans are expected to do no significant harm

² The term "infrastructure governance" refers to the policies, frameworks, norms, processes and tools, used by public bodies to plan, make decisions, implement and monitor the entire life cycle of public infrastructure (OECD, 2020^[18]).

to environmental objectives (as defined in article 17 of the EU Taxonomy Regulation³). This will be achieved by selecting or designing interventions in line with the Do No Significant Harm (DNSH)⁴ principle, and by substantiating DNSH compliance as part of the DNSH assessment. DNSH compliance is a necessary condition for the Commission's approval of the recovery and resilience plans of Member States.

Recovery plans include investments to improve the energy efficiency of buildings to support more sustainable transport infrastructure and mobility solutions in cities, including rapid mass transport; renewal of the bus fleet and of local public transport trains; digitization; urban cycle routes; rail station projects; electric charging stations. The US legislation includes the largest investment in the resilience of physical and natural systems in American history with over USD 50 billion to protect against droughts, heat, floods, and wildfires, in addition to a major investment in weather proofing.

Despite the crucial role of public investment to take climate action, just a limited amount of investments across OECD countries and partners is directed to green objectives, and even less is specifically targeted to climate adaptation⁵. The OECD data shows that while public spending on green recovery measures in 44 major economies has doubled since April 2021, it still only accounts for 21% of total spending on COVID-19 economic recovery measures with poor coverage of adaptation measures (OECD, 2021^[11]).

1.3. Ireland's environmental commitments and infrastructure plan

Under the Recovery and Resilience Facility, Ireland will receive approximately EUR 990 million - entirely in grants -, which will be used to support investments between now and mid-2026. In June 2021, the country has committed to spend 42% of these funds (i.e. approximately, EUR 415 million) to support the green transition with investments in energy efficiency for residential and public buildings, renewable energy sources (particularly onshore and offshore wind), sustainable transport, sustainable water management, and protection of biodiversity and ecosystems through the restoration and rehabilitation of wetlands. This will help Ireland to meet the EU's 2030 climate targets and the 2050 climate neutrality objective (Department of Housing, Planning and Local Government, 2018^[12]; European Commission, 2022^[13]; European Commission, 2021^[14]). According to the most recent country-report published in June 2022 by the EC, the current share of the Irish plan's estimated expenditure contributing to the green transition amounts to approximately 50,33% (European Commission, 2022^[13]).

Developing effective strategies and policies to support environmental objectives and decarbonisation efforts is one of the main priorities for the Irish Government. Aside from establishing a schedule of annual increases in its carbon tax to EUR 100 per tonne by 2030, Ireland has adopted the Climate Action and Low Carbon Development (Amendment) Act (2021^[15]). The latter establishes a legislative requirement to

³ The six environmental objectives included in article 17 of the EU Taxonomy Regulation comprise (1) climate change mitigation, (2) climate change adaptation, (3) sustainable use and protection of water and marine resources, (4) the circular economy, (5) pollution prevention and control, and (6) protection and restoration of biodiversity and ecosystems (European Parliament and Council, 2020^[87]).

⁴ The Do No Significant Principles is enshrined by the EU Regulation for the Recovery and Resilience Facility (RRF). It requires that no measure (i.e. no reform and no investment) included in a Member State's Recovery and Resilience Plan (RRP) should lead to significant harm to any of the six environmental objectives within the meaning of Article 17 of the Taxonomy Regulation (European Parliament and Council, 2021^[88]). See the endnote above to know more about the "six environmental objectives".

⁵ This is one of the conclusions drawn by the OECD in its analysis of the environmental measures included in the COVID-19 recovery packages of 44 major economies, including the EU, and their likely impact on the environment (positive, negative, or mixed). More information can be found in the OECD Green Recovery Database. In addition to the 37 OECD members, the OECD Green Recovery Database also include Costa Rica (Accession) and Brazil, China, India, Indonesia, and South Africa (key partners).

achieve a climate resilient, biodiversity rich and carbon neutral economy in Ireland by no later than 2050 (Department of Public Expenditure, NDP Delivery and Reform, 2021^[16]), with an intermediate objective of reducing total greenhouse gas (GHG) emissions by 51% by 2030 compared to 2018 levels⁶.

This all comes at a time when investment in public infrastructure is increasing. Ireland's National Development Plan (NDP) 2021-2030 and Ireland's National Planning Framework (NPF) are the two branches of a substantial investment program named Project Ireland 2040 (Department of Public Expenditure, NDP Delivery and Reform, 2018^[17]), which will encompass over EUR 165 billion going to infrastructural investments by 2030. To ensure value for money and strategic alignment with the Government's climate commitments, the appraisal of such investment needs to reflect environmental, economic, and social considerations in a comprehensive and coherent manner.

With significant investments expected from Project Ireland 2040, public capital spending and infrastructure governance will play a key role in ensuring Ireland meets national, EU and international environmental commitments. Flood relief schemes, public buildings, education and health facilities, water infrastructure, roads, ports, and sustainable transport programs are examples of areas where there should be a robust assessment of climate change and environmental consequences with respect to public decision-making.

Given these premises, Ireland is now committed to improving planning and appraisal of public investments in infrastructure. This includes streamlining carbon proofing, measuring, and quantifying the emissions impact of infrastructure - whether direct, indirect, or induced⁷ - and accounting for climate risk and uncertainty. These represent a major step towards creating a more robust assessment system of environmental costs and benefits of infrastructure projects, one that takes into account their entire lifecycle.

In the above outlined context, the OECD has provided support to the Irish Government to strengthen climate and environmental considerations in public infrastructure decision making. The action was funded by the European Union via the Technical Support Instrument, and implemented by the OECD, in co-operation with the Directorate-General for Structural Reform Support of the European Commission. Most notably, the initiative aims at supporting the Irish efforts to ensure that public investment appraisals are aligned with Ireland's climate and environmental objectives as well as strengthened government understanding of the environmental impact of its investment decisions.

This policy paper provides a detailed explanation of infrastructure planning, appraisal, and budgeting in Ireland, and provides an analysis of the main challenges and opportunities to integrate environmental and climate considerations in each one of these areas (chapters 1 to 3). This paper also provides an overview of other countries' examples to integrate green considerations in infrastructure planning, budgeting, and appraisal, identifying the main elements that can be useful and provide inputs for the policy reform agenda in Ireland (Chapter 4).

⁶ The commitment is fully aligned with the EU's target to reduce GHG emissions from the continent by at least 55 per cent by 2030 - Fit for 55 package - under the European Green Deal (2019^[89]).

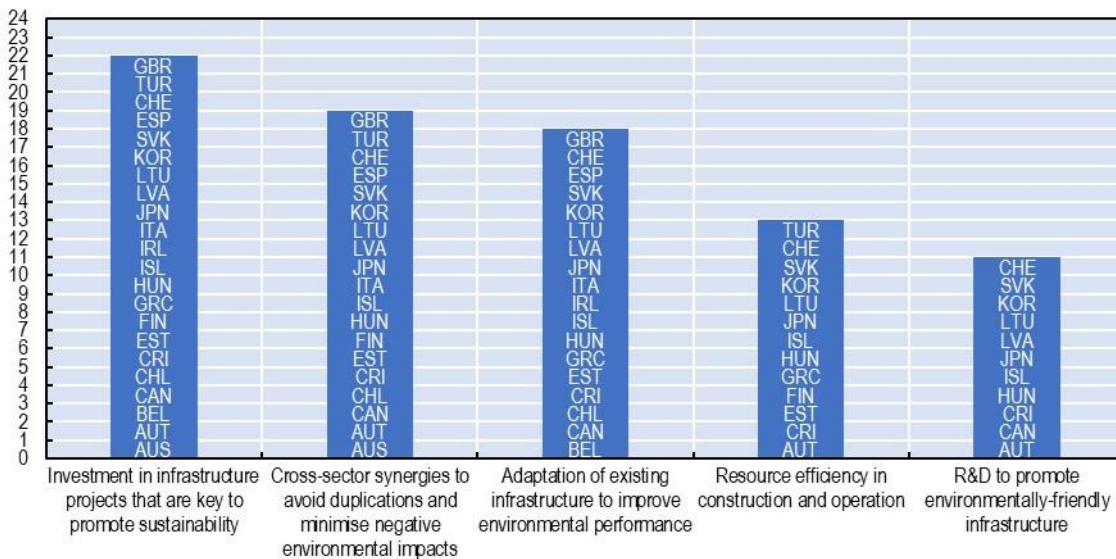
⁷ Direct emissions are emissions that occur from sources that are controlled and or owned by an organisation (e.g. emissions associated with fuel combustion in boilers, furnaces, and vehicles). Indirect emissions are associated with the purchase of electricity, steam, heat, or cooling. Lastly, induced emissions refer to emissions generated upstream and downstream relative to the other two categories defined (Greenhouse Gas Protocol, n.d.^[90]).

2 Long-term strategic planning for infrastructure in Ireland: Challenges and opportunities for environmental and climate considerations

Developing a long-term strategic vision for infrastructure helps governments identify and address infrastructure service needs in a timely and coherent manner. As highlighted by the 2020 OECD Recommendation on the Governance of Infrastructure, a long-term strategic vision should be aligned with long-term policy objectives, including commitments on environmental protection, climate change mitigation, human rights, social inclusion, gender equality, regional development, among others (OECD, 2020_[18]). Furthermore, strategic planning is key to ensure that structural investments are made to enable the climate transition (e.g. transition to sustainable energy sources and sustainable transportation modes). Long-term infrastructure strategies also have an important role in protecting biodiversity, conserving natural resources, and reducing the impact of climate change for the population at large, including the most fragile communities.

Most OECD countries have become aware of the importance of ensuring policy coherence between long-term infrastructure plans and broader sustainable development objectives. This is congruent to the commitments made under the Sustainable Development Goals of Agenda 2030. According to a recent survey from the OECD, most member countries (73%) have aligned their long-term infrastructure plan with environmental and climate action policies. In the vast majority of these countries, the recurrent policy objective is to invest in projects that are key enablers for the implementation of broader government sustainability initiatives (67%), closely followed by the adaptation of existing infrastructure to improve environmental performance (57%), and identification of cross-sector synergies to diminish negative environmental impacts (57%). Fewer OECD countries have adopted targets on resource efficiency in the construction and operation of infrastructure (40%) and on research and development to promote environmentally friendly infrastructure (33%) (see Figure 2.1). Similar trends are observed when looking only to OECD countries that are EU member states, where 76% of countries have aligned their long-term infrastructure plan with environmental and climate objectives.

Figure 2.1. Goals and targets in long-term plans among countries that reported alignment of their long-term infrastructure plan with environmental or climate action plans, 2020



Source: (OECD, 2020_[19])

Ireland has made important efforts to ensure better alignment between the long-term strategic plan and international climate change commitments. Notably, its long-term plan promotes investments in infrastructure projects that are key to promote sustainability and the resilience of existing infrastructure to improve environmental performance. This chapter will provide an overview of the long-term strategic planning process for infrastructure in Ireland, in particular the formulation, revision and implementation of Project Ireland 2040, the National Planning Framework, and the National Development Plan. Furthermore, it will look at the different methodologies and tools that have been implemented to promote alignment with climate and environmental objectives.

2.1. Setting a long-term vision for the country's development: Project Ireland 2040

Project Ireland 2040 (PI2040) is the Government's long-term overarching strategy for the country's development, ensuring sustainability and resilience. It aims to strengthen Ireland's infrastructure backbone, move beyond Dublin's traditional socio-economic dominance and enable all regions to develop their full potentials. The main scope is to make the country ready to accommodate the anticipated 1 000 000 extra people who will be housed, work and go to school in Ireland over the next 25 years (McGreevy, 2018_[20]; Department of Public Expenditure, NDP Delivery and Reform, 2018_[17]). Alongside investments in physical infrastructure (i.e. road and rail networks, water infrastructure, housing, ports and airports, digital connectivity, etc.), PI2040 supports rural communities, as well as businesses, industries, and local enterprises to create new employment opportunities. It also includes investments in childcare and healthcare for the elderly, education and innovation, cultural heritage, agriculture, forestry and fishery, tourism, low-emission vehicles, and sustainable urban mobility (Department of Public Expenditure, NDP Delivery and Reform, 2018_[17]).

Project Ireland 2040 allocates nearly EUR 165 billion over the course of 10 years (until 2030) to infrastructure investments. This combines EUR 136 billion directly from the Exchequer, as well as nearly

EUR 25 billion by state-owned non-Exchequer funding. As a result, public capital investment will move from the relatively low levels it has been in recent years, due to the economic crisis, to being amongst the highest in the EU (as a percentage of national income). Public resources will help Ireland to tackle the deficits in its infrastructure network, while also meeting the emerging needs of a fast-growing population (Department of Public Expenditure, NDP Delivery and Reform, 2018^[17]).

The National Planning Framework (NPF) and the National Development Plan (NDP) 2021-2030 combine to form Project Ireland 2040. The NPF sets out the vision and strategy for the development of Ireland to 2040, while the NDP provides the enabling investment to implement that strategy.

2.1.1. The National Planning Framework (NPF)

The NPF was launched in 2018 following extensive research, consultation, and environmental assessment processes. It sets the high-level strategic vision and spatial strategy for Ireland over the next 20 years. The main purpose is to develop all parts of Ireland, whether rural or urban, to successfully accommodate growth and change. It proposes a new region-focused strategy to manage growth and ensure a more balanced distribution of people and economic resources across the national territory (Department of Housing, Planning and Local Government, 2018^[12]). The NPF is given full legislative support within the planning system, including regular review and update, to reflect changing circumstances and make adjustments where necessary. A review of the NPF is planned in 2024, and this will be an opportunity to assess any structural developments that have occurred since its adoption (Department of Public Expenditure, NDP Delivery and Reform, 2021^[16]). The planning legislation underpinning the Framework also envisages the creation of a new independent Office of the Planning Regulator (OPR), which will be responsible for monitoring the implementation of the NPF (Department of Housing, Planning and Local Government, 2018^[12]).

The various policies proposed in the NPF are structured around National Policy Objectives and builds on 10 National Strategic Outcomes (NSOs):

1. Compact Growth: ensure the sustainable growth of more compact urban and rural settlements, supported by jobs, housing, public services and amenities;
2. Enhance Regional Accessibility: enhance connectivity and accessibility between key urban centres and across regions, investing in roads and rail networks;
3. Strengthened Rural Economies and Communities: ensure equal balance of growth in Ireland's three regions (the Northern and Western, Southern, and Eastern and Midland), investing in rural regeneration, tourism, agriculture, fisheries and forestry, as well as in broadband and digital connectivity;
4. Sustainable Mobility: improve public transport system, also introducing electric and hybrid traction systems for public transport fleets, promote soft mobility and new technologies such as electric vehicles, and electrify the country's mobility system;
5. A Strong Economy supported by Enterprise, Innovation and Skills: promote jobs and employment opportunities, especially supporting the local enterprises, invest in education and training, research, and innovation, attract new investments and talents, and strengthen the rural economy;
6. High-Quality International Connectivity: invest to improve maintenance and expand the capacity of the country's ports and airports;
7. Enhanced Amenity and Heritage: protect and value the country's cultural and natural heritage and amenity, investing in cultural and creative facilities;
8. Transition to a Low Carbon and Climate Resilient Society: promote the transition to a low-carbon, climate-resilient and environmentally sustainable economy. Invest in renewable energy sources, such as wind, wave and solar;

9. Sustainable Management of Water, Waste and other Environmental Resources: invest in water infrastructure to conserve and enhance the quality of this resource. Limit waste production and promote circular economy principles;
10. Access to Quality Childcare, Education and Health Services: guarantee access to primary education and invest in the school systems to ensure it can adequately respond to curriculum change and technological developments. Guarantee access to childcare and healthcare. Re-organize health-services, giving relevance to primary and community care when needs can be met locally.

The NPF's success depends on its policy reflections and programme delivery at the national, regional, and local level. The fact that the NPF comes with a 10-year National Development Plan, which sets out a budgetary and financial roadmap, provides a solid foundation to deliver transformational change over the coming years. However, investment alone is insufficient. The implementation of the Framework will also require more effective planning and co-ordination processes to ensure that the NPF shapes the policies and deliverable actions of government departments and agencies, state bodies, local government and infrastructure providers, working in conjunction with communities, civic society, the private sector and neighbouring administrations (Department of Housing, Planning and Local Government, 2018^[12]).

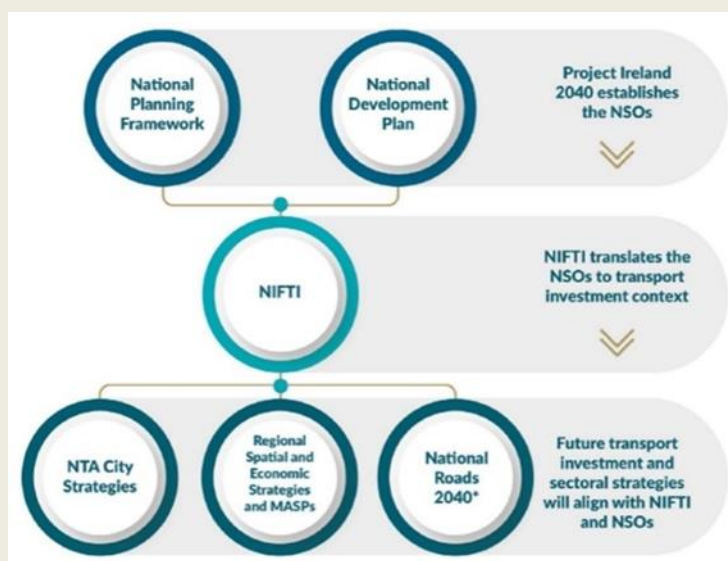
The NPF is linked with sectoral strategies that support the implementation of the planning framework in each sector. For example, the Department of Transport has developed the National Investment Framework for Transport in Ireland (NIFTI) to support the consideration and prioritisation of investments in the land transport network. Likewise, in 2021, the Department of Rural and Community Development launched the new rural policy to 2025, which is underpinned by the NSO of achieving strengthened rural economies and communities. Another interesting example is the 2019-2024 Irish Water Strategic Funding Plan, which links funding decisions with policy objectives, including supporting the NPF and regional economic and spatial Strategies (see Box 2.1).

Box 2.1. Infrastructure planning by sector: examples of sectoral strategies that support the implementation of the planning framework in Ireland

The National Investment Framework for Transport in Ireland (NIFTI)

The NIFTI is the Department of Transport's a high-level strategic framework to support the consideration and prioritisation of investments in the land transport network. It supports the delivery of the 10 NSOs, the Climate Action Plan and the national decarbonisation commitments. The NIFTI also informs the future regional, metropolitan, and local strategies for transport (see Figure 2.2).

Figure 2.2. NIFTI role in investment decision-making



Source: (Department of Transport, Decembre 2021^[21])

The four investment priorities outlined in the NIFTI aim to address the main challenges efficiently and effectively to the implementation of the NSOs. For a project to receive approval, it must align with at least one of these four priorities:

1. Mobility of people and goods in urban areas;
2. Protection and renewal;
3. Enhanced regional and rural connectivity;
4. Decarbonisation

The NIFTI also defines two different hierarchies to further guide investments in the transport sector: a modal hierarchy and intervention hierarchy. These hierarchies are to support Sponsoring Agencies in their consideration and assessment of potential solutions to an identified need or problem. Under the Modal hierarchy, active travel and public transport solutions should be considered before private transport. Under the Intervention hierarchy, maintenance and optimisation of existing assets should be considered before substantial improvements or new infrastructure. This is to ensure that the most sustainable and cost-effective solution to a given transport need is identified.

The Rural Policy to 2025

In 2021, the Department of Rural and Community Development published the new rural policy to 2025. The policy aims at increasing regional employment, repopulating rural towns and villages, and improving digital connectivity, transport, and services in rural areas. The Regional Spatial and Economic Strategies of the three Regional Assemblies (i.e. Northern and Western Region, Southern Region, and Eastern and Midlands Region) reflect and underpin the NPF objectives at regional level. Moreover, Local Authority County and City Development Plans and Local Economic and Community Plans will align with their respective Regional Spatial and Economic Strategies to ensure a shared vision from national and regional level to local level.

The 2019-2024 Irish Water Strategic Funding Plan

Irish Water is a state-owned water utility company in Ireland and provides water and wastewater services to water users in the country. The 2019-2024 Irish Water Strategic Funding Plan outlines how the funding decisions meet the policy objectives, including supporting the NPF and Regional Economic and Spatial Strategies. Specific objectives are set out in relation to the water and wastewater requirements of cities. Irish Water is also supporting on-going work in developing subsidiary level strategies to assist in implementing the NPF including the Regional Spatial and Economic Strategies (RSES) as well as City / County Development Plans and Local Area Plans. Moreover, the Irish Water's approach to aligning the 3rd Regulatory Control Capital Investment Plan (2020 – 2024) with the National Planning Framework is to ensure alignment with growth projections

Source: (Department of Transport, Decembre 2021^[21]); (Department of Rural and Community Development, 2021^[22]); (National Investment Office, 2021^[23])

2.1.2. The National Development Plan (NDP) 2021-2030

The NDP defines the budget and financial plan underpinning the implementation of the 10 NSOs contained in the NPF over the next 10-years, but it is expected to be renewed with more frequency (i.e. before the 10 years pass). The new NDP for the years 2021-2030 is an early update to the NDP launched in 2018. It was drafted following a review conducted over two phases which commenced in October 2020 and included extensive engagement, public consultation, and analysis led by the National Investment Office within the Department of Public Expenditure, NDP Delivery and Reform (DPENDR). The first phase comprised of an assessment of the progress on the implementation of the PI2040 over the past three years. In the second phase, a strategic dialogue took place between DPENDR and other departments with the primary aim of agreeing on the new 5-year rolling Departmental capital allocations and overall 10-year capital ceilings out to 2030 (Department of Public Expenditure, NDP Delivery and Reform, 2021^[16]).

Overall, the NDP 2021-2030 envisages a total public investment of EUR 165 billion. Exchequer funding as approved by the Government and voted by the Oireachtas will account for EUR 136 billion or approximately 80 per cent of the total funding. Non-Exchequer funding by State-backed enterprises and bodies will amount to almost EUR 29 billion or 20% of the total funding (Department of Public Expenditure, NDP Delivery and Reform, 2021^[16]). Table 2.1 shows the gross voted capital allocations for the period 2021-2025 for certain sectors, as agreed in the Government decision of 27 July 2021 (i.e. S180/20/10/2207D).

In order to ensure the effective delivery of the NPF and strengthen the monitoring of the NDP implementation, Ireland has set up the **Investment Tracker**. The tracker lists a range of projects and programmes committed to by Departments over the period of the NDP (mainly, projects/programmes with costs greater than EUR 20 million), providing information on cost figures and explanation of cost variation, name and location, agency/department responsible for the delivery, brief description of the current status of the project/programmes, stage of the project lifecycle, estimated commencement and completion dates, and contribution to the NSOs. The Tracker was first published in September 2017. A further innovation in 2019 was the development of MyProjectIreland, a new citizen-focussed interactive map which allows the user to navigate public investment projects across the country and to find out what is happening in their local area in an accessible way (Department of Public Expenditure, NDP Delivery and Reform, 2021^[24]; Jenkinson, 2018^[25]).

Table 2.1. Departmental Gross Voted Capital Allocations (in EUR millions)

	2021	2022	2023	2024	2025
Environment, Climate and Communications	579	700	850	950	1 100
Housing, Local Government and Heritage	2 766	3 400	3 526	3 866	4 016
Office of Public Works	206	270	270	288	310
Public Expenditure and Reform (less OPW)	15	33	30	20	20
Rural & Community Development	169	192	196	200	205
Transport	2 511	2 547	2 614	2 664	2 665

Source: (Department of Public Expenditure, NDP Delivery and Reform, 2021^[24])

A full mid-term review of the NDP will be undertaken in 2025, to allow the Government to (i) take stock of progress in terms of delivery of the planned projects and programmes, (ii) and review and reaffirm investment priorities of the Government. The review will be carried out in order to prepare and publish a new updated 10-year plan for public capital investment in 2026, covering the period 2026 to 2035.

In carrying out its coordinating role for the NDP, DPENDR does not consider the merit of individual projects. The projects included in the NDP are chosen directly by the different departments. Moreover, all project proposals are subject to planning law, and each government's department is responsible to ensure compliance with all regulatory requirements, including those related to environmental impact assessments. Proposals must also undergo all the steps of the appraisal process and the value-for-money tests envisaged in the Public Spending Code (Department of Public Expenditure, NDP Delivery and Reform, 2021^[16]).

2.2. Integrating environmental and climate considerations in long-term strategic infrastructure planning in Ireland

The planning process provides an established means through which to implement and integrate climate change objectives, including adaptation, at local level. Moreover, the Irish planning legislation already requires different levels of the planning process to address climate change.

The existing National Planning Framework ensures climate implications of spatial choices are considered and addressed from the top of the planning hierarchy. Under the NSO “*transition to a low carbon and climate resilient society*”, the Irish government commits not only to reduce the country's carbon footprint but also to improve Ireland's resilience to the negative impacts of climate change and avoid inappropriate forms of development in vulnerable areas (see Box 2.2 to know more about climate change adaptation in Ireland). The Irish governments and its departments are called upon to integrate climate change considerations into statutory plans and guidelines, as well as to take them into account as a matter of course in planning-related decision-making processes.

Box 2.2. The National Adaptation Framework

Ireland's climate adaptation policy is given legal effect by the Climate Action and Low Carbon Development Act 2015. Section 5 of the Act requires that the Minister for Communications, Climate and Environment to develop a National Adaptation Framework (NAF). After Government's approval, Ireland's first NAF was published in January 2018. The Framework outlines a whole of government and society approach to climate adaptation in Ireland. It also aims at improving the enabling environment for adaptation through ongoing engagement with civil society, the private sectors, and the research community, as well as by providing a clear definition of climate resilience and guiding principles to plan for climate change adaptation.

Sections 6 and 7 of the 2015 Act also set out legal requirements for the preparation of sectoral adaptation plans in priority sectors identified in the NAF. Priority sectors include: agriculture, forestry and seafood, biodiversity, built and archaeological heritage, transport infrastructure, electricity and gas, communication, flood risk management, water quality and service infrastructure, and health. The sectoral adaptation plans were approved by the Irish government in October 2019.

The NAF and its sectoral plans form part of an iterative process and will be revised at a minimum every five years to reflect developments in scientific knowledge and to facilitate the modification and escalation of adaptation actions as necessary

Sectoral Adaptation Plans.

Sectors are expected to develop their adaptation plan following the 6-step approach of the "Sectoral Guidelines for Planning for Climate Change Adaptation":

1. Preparing the ground;
2. Climate impact screening;
3. Prioritisation;
4. Priority impact assessment;
5. Develop your plan;
6. Implement evaluate and review.

In brief, Sectoral Adaptation Plans should provide, as a minimum, evidence of a clear understanding and description of the risks presented by climate change to the sector, their vulnerability to such risks and actions to address the risks and ensure the sector's climate resilience. Sectors should also carry out a prioritisation exercise based on what they consider the most urgent and pressing risks for areas under their remit.

Local and Regional Adaptation

Given their close relationship with the community, their proximity to events and their familiarity with local conditions, local governments sector have a pivotal role in planning and implementing responses to climate risks. For this reason, NAF recognises the importance of considering local authorities and their as part of the development of sectoral adaptation plans to ensure coordination and efficiency with actions delegated to the local level when appropriate.

According to NAF, each local authority should make and adopt local adaptation strategies based on the regional governance approach to adaptation planning which will be established under the Framework. Moreover, the development of strategies must be undertaken in accordance with the Local Authority Adaptation Strategy Development Guidelines, the NAF and the requirements of the Climate Action and Low Carbon Development Act 2015.

Source: (Department of Communications, Climate Action and Environment, 2018^[26])

2.2.1. Environmental assessment carried during the preparation of the NPF

As mentioned in the previous section, the National Planning Framework sets out the long-term strategy for Ireland to accommodate growth and development within environmental limits, strengthening its responsiveness to the climate crisis. It supports the integration of climate and environmental considerations into statutory plans and guidelines, including climate change mitigation and adaptation, protection of biodiversity and ecosystems, energy efficiency, circular economy, waste management, air and water quality, noise pollution, and land-consumption (Department of Housing, Planning and Local Government, 2018^[12]).

As part of the preparation of the NPF, a number of environmental assessments have been carried out, including a **Strategic Environmental Assessment**, an **Appropriate Assessment**, and a **Strategic Flood Risk Appraisal** (SFRA) (see Box 2.3). These have evaluated the impact of NPOs and NSOs on the wider natural environment. Results have fed into the drafting process of the NPF, ensuring environmental impacts of the new Framework were considered and addressed at the high strategic level. Within this process, avoidance of preventable negative impacts has been the preferred mitigation strategy.

Box 2.3. Environmental assessments at the plan/programme level in Ireland

Environmental assessments in the planning process, both in relation to preparing plans and deciding on planning applications and appeals, have become more common in recent years in Ireland. This comes as a response to both pressing environmental challenges and requirements under EU and national law. The most common assessment processes at the plan/programme level are the following:

Strategic Environmental Assessment (SEA)

SEA is a systematic evaluation of the likely significant environmental effects of implementing a plan or programme (such as development plans, local area plans, etc.), before a decision is made to adopt it. It can be carried out either by the in-house SEA team within the planning authority or regional assembly, or by external specialists, or a combination of both.

The main output of the SEA is the Environmental Report, which contains an evaluation and assessment of all the environmental dimensions considered to be relevant for the plan/programme. The Environmental Report forms part of the draft plan/programme's documentation, with the integration between the iterative procedures of preparing the Environmental Report and of the draft plan. This ensures that any environmental issues that arise out of the SEA process is adequately integrated and addressed in the drafting of the plan right from the outset, including mitigation measures to offset adverse environmental impacts.

Appropriate Assessment (AA)

The AA is a comprehensive ecological assessment of the likely impacts a proposal – on its own or in combination with other plans/projects – can have on the Natura 2000 network⁸. A plan/projects can only be approved when it is demonstrated that it will not negatively affect the integrity of a Natura 2000 site. In case of overriding public interest, a plan with adverse impacts on a Natura 2000 site can still be realised but shall be complemented with adequate compensation measures.

For plans, AA is normally carried out by the planning authority, either by an in-house team or by external experts, or a mix of the two. There is no prescribed method for undertaking AA, or form or content for

⁸ The EU Birds Directive in 1979 and the Habitats Directive in 1992 established the Natura 2000 network of sites of the highest biodiversity importance for rare and threatened habitats and species across the EU.

reporting. The main outcome of the process is the Natura Impacts Statement (NIS), which contains data and information on the plan/project and site along with an analysis of the likely effects.

Similar to SEA, AA contributes to the integration of environmental considerations into the adoption of a plan and promotes sustainable development.

The Strategic Flood Risk Appraisal (SFRA)

The objective of SFRA is to ensure planning policy takes account of flood risk when catering for future growth and can address planning and infrastructural needs required to facilitate projected growth.

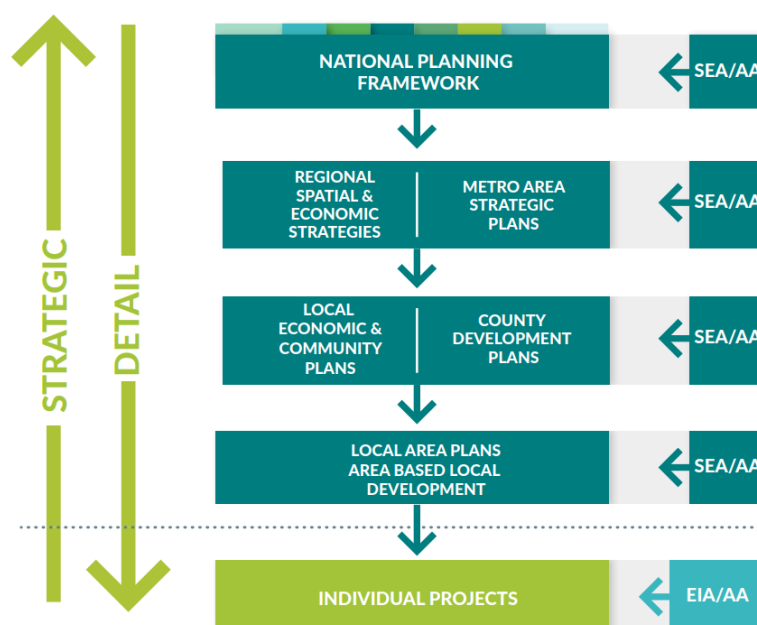
In Ireland, the 2009 Planning System and Flood Risk Management Guidelines are core to the development of the SFRA. They introduce comprehensive mechanisms for the integration of land use and infrastructure planning with flood risk management best practice, such as the “sequential approach”. According to the latter, the principle of avoiding areas of high flood risk must be the first consideration at all levels of the planning process. If this is not practical, the consideration of an alternative, less vulnerable land use should be proposed. Where avoidance or substitution is not possible, then a robust justification must be made, accompanied by sustainable mitigation measures, to ensure that the proposed development will not increase flood risk both for the present-day scenario or in the future, taking into account the full effects of climate change.

Source: (Department of Housing, Planning and Local Government, 2018^[12]; Department of Housing, Local Government and Heritage, 2022^[27]; Department of Housing, Local Government and Heritage, 2009^[28]; Department of Housing, Local Government and Heritage, 2021^[29])

Nonetheless, the NPF is a high-level strategic framework document, and its actual implementation depends on the tiering of regional and local level plans. At lower levels of the hierarchy, it is necessary to provide opportunities for more focused assessments to inform decision-making at a level of granularity which cannot be undertaken at the national scale. All plans, projects and activities arising from the NPF need to be subject to the relevant environmental assessment requirements, including SEA, EIA, and AA as appropriate (see Figure 2.3) (Department of Housing, Planning and Local Government, 2018^[12]).

As part of its wider implementation, the Department of Housing, Planning and Local Government is committed to developing updated statutory planning guidelines to assist authorities in making sustainable decisions which fully integrate the relevant environmental requirements and support the delivery of National Policy Objectives (Department of Housing, Planning and Local Government, 2018^[12]).

Figure 2.3. SEA and AA within the Planning Hierarchy of the NPF



Source: (Department of Housing, Planning and Local Government, 2018_[12])

2.2.2. Environmental qualitative assessment carried under the NDP 2021 Review

The NDP is not meant to define a specific blueprint for the achievement of Ireland’s climate targets. Rather, each department, in receipt of the capital investment allocations for the climate and environmental strategic priorities they have identified, are directly responsible for developing a detailed suite of policies and measures to maximise the impact of this planned investment.

As an integral part of the NDP Review carried in 2021, for the first time ever, an assessment was undertaken on the impact that each of the Exchequer-funded measures contained in the NDP is likely to have on climate and environmental outcomes. When developing measures for inclusion in the NDP, Departments were asked to undertake a qualitative self-assessment of the impact each measure is likely to have on seven specified climate and environmental outcomes. Such outcomes align with the six environmental objectives included in the EU Taxonomy Regulation (Regulation 2020/852).

- Climate mitigation: the likely impact of the measure on greenhouse gas emissions;
- Climate adaptation: the contribution the measure will make to Ireland’s climate resilience;
- Water quality: any difference the measure may make to pollution levels in waterways;
- Air quality: any difference the measure may make to air pollution levels;
- Waste & circular economy: what change in waste levels might be expected of the measure;
- Nature & biodiversity: what impact the measure may have on biological diversity
- Just transition: will the measure contribute to employment that is compatible with Ireland’s long-term climate and environmental objectives?

Each measure was then assigned a score against each outcome (except for “Just Transition”), ranging from +3 to -3, based on the projected impact the measure would have on the specific outcome (the same weight has been applied across all outcomes). Based on the sum of these scores, the measure was then assigned a category depending on whether the cumulative score the measure received was positive, zero

or negative. Aside of this self-qualitative assessment for environmental impacts, proposals will still have to go through the appraisal process envisaged in the Public Spending Code (PSC).

Category A indicates that the measure in question is likely to have, on balance, a favourable impact on climate and environmental outcomes. Category B indicates that the measure will likely have no significant impact on climate and environmental outcomes, or that any favourable impacts may be offset or balanced by some unfavourable impacts. Finally, Category C indicates that the measure may have a net unfavourable impact on climate and environmental outcomes. However, this review is by no means definitive. A net favourable categorisation does not mean that a measure will have no unfavourable impacts on climate and environmental outcomes. Similarly, measures that are categorised as potentially having an unfavourable net impact may still deliver very significant benefits to wider societal objectives. These assessments are not intended to signal that favourably categorised measures should be prioritised or that unfavourably categorised measures should not proceed.

Overall, an unfavourable assessment is a signal that there should be an increased focus on ensuring that negative climate and environmental impacts of this investment are minimised as much as possible. Where feasible, departments should go beyond the minimum requirements imposed by legislation and put in place complimentary measures that offset or negate any potentially unfavourable impacts that have been identified. Additionally, many of the measures included in the NDP Review are under development and all measures will need to be subject to the full rigour of the Public Spending Code at a later stage. This includes a detailed quantitative assessment of the specific impact on GHG emissions a measure will have.

This is the first time the government has attempted to undertake a systematic climate and environmental assessment of all capital expenditure plans. The national approach will be continually refined based on international best practice, which is emerging through Irish participation in initiatives like the OECD Senior Infrastructure and PPPs Officials Network, the OECD Paris Collaborative on Green Budgeting and the Coalition of Finance Ministers for Climate Action.

2.3. Challenges and opportunities to integrate environmental and climate considerations in long-term strategic planning in Ireland

2.3.1. The self-qualitative assessment of the interventions to be included in the NDP 2021-2030 was a one-off kind of exercise

The qualitative self-assessment to be carried out by each Government Department to evaluate the likely impact of the proposed measure was a one-off exercise. The results have not informed the prioritisations of projects and the exercise was conducted as an ex-post analysis of the already selected portfolio. While the methodology used is innovative and well-aligned with the EU Taxonomy, the self-qualitative assessment could be better leveraged to inform the decision-making process and translate into concrete results during the plan formulation.

2.3.2. Improve planning and actions for climate change adaptation

Despite the progress achieved in assessing the country's risks and vulnerabilities to climate change, further research is needed on the vulnerability of key sectors and the identification of critical thresholds. This will help inform national, sectoral, and local adaptation policies and plans. Moreover, according to the review conducted by the European Commission - as part of EU Adaptation Scoreboard, Ireland needs to further improve in terms of stakeholder engagement for the development of adaptation policy. In particular, the government would benefit from identifying adaptation options consistent with the results of sectoral risk assessments, mainstreaming adaptation across all major national policy instruments, as well as developing

monitoring and reporting systems on adaptation to climate change, including adaptation-related expenditures (Climate ADAPT, 2022^[30]).

Ireland also needs to start focusing more on adaptation actions (and thus also on the post-adaptation planning phase), implementing the priorities identified in existing sectoral adaptation plans and local adaptation strategies. To date, there are no specific programmes or projects focused on implementing adaptation measures (Climate ADAPT, 2022^[30]).

2.3.3. Integrate considerations of climate change adaptation in SEA

In 2015, Ireland's Environmental Protection Agency (EPA) issued a guidance note on "Integrating Climate Change into Strategic Environmental Assessment in Ireland". An updated guidance specific to climate change adaptation should now be provided. This is important in terms of mainstreaming climate change adaptation in strategic plans and programmes.

2.3.4. The risk of a lack of consistency in planning across sectors

Each government department is responsible for ensuring that project proposals align with national and supra-national policy objectives for the environment and climate. This guarantees some flexibility as Departments are free to decide how to achieve climate and environment targets in the way that is the most appropriate to the characteristics, features and resources of each sector. While this flexibility is limited by compliance of the DNSH for RRF investments, there is a risk that a lack of coherence and consistency across sectoral policies will emerge.

2.3.5. Improve across-sectors consistency in planning for climate change adaptation

Building on the Climate Change Advisory Council's 2020 Review, DECC would benefit from bringing more coherence to how the different adaptation plans and strategies are prioritised and funded. Most notably, there is a need to develop a common and detailed guidance to prioritise climate change impacts and risks, which can be applied across sectors. More coherence on how costs of extreme weather are assessed should be provided.

3 Public investments appraisal in Ireland: Challenges and opportunities for environmental and climate considerations

Infrastructure is a long-lived capital-intensive investment. Decisions made today about the nature, location, and design of infrastructure will have long-lasting effects that influence the extent to which anticipated benefits are delivered over time and align with broader policy objectives (OECD, 2021^[31]). Governments have a primary role in defining which investment options are best able to contribute to the achievement of identified policy goals. Political dynamics can undermine sound decision making on infrastructure when processes for project appraisal and prioritisation are not sufficiently robust and formalised (OECD, 2017^[32]). If the incentives are skewed towards displaying immediate tangible results to a certain constituency, certain infrastructure needs might end up being neglected, resulting in inefficient investments that fail to adequately respond to the needs of the population. Political myopia can hamper sustainable infrastructure investments, especially those whose benefits are often intangible and manifest themselves just in the long-term.

In the context of a wider focus on sustainable development, infrastructure investment is increasingly required to address multiple economic, social, and environmental objectives. This creates challenges for decision-makers, who are expected to weigh and balance different (and sometimes competing) goals when selecting and prioritising projects (OECD, 2021^[31]). While there is a natural inclination to promote ‘shovel-ready’ solutions, this should be balanced with the need for environmentally sustainable and climate-resilient infrastructure.

As highlighted in the 2020 OECD Recommendation on the Governance of Infrastructure, governments benefit from decision-making processes that are based on a sound understanding of the expected returns of infrastructure projects and pay due consideration to economic efficiency as well as social, environmental, and climate costs and benefits throughout the whole of the asset’s life cycle. Short lists of projects should be developed using assessment methods that analyse both monetary and non-monetary costs and benefits. They should also consider the projects’ contribution to environmental and resilience policy goals.

Traditional tools and mechanisms to appraise and prioritise infrastructure projects are often ill-equipped to factor in environmental and climate aspects. This is due to the inherent difficulty to estimate the environmental costs and benefits of an infrastructure asset and translate them into monetary values. Moreover, cause-effect relationships are not straightforward and there is lot of uncertainty about the consequences and effects of changing climate conditions and extreme weather events. Technological innovation can support decision-makers and projects’ proponents by monitoring and providing up-to-date information on the performance of infrastructure assets and services. For example, tools such as Building

Information Modelling (BIM) offer opportunities to take a whole-of-life perspective in the design, procurement and operation and their accelerated deployment may bring much-needed transparency and performance data to decision making.

In this chapter, the OECD will provide an overview of the appraisal process for public investments in Ireland, highlighting the way climate and wider environmental considerations are currently taken into account. The analysis will be informed by a combination of desk research, insights collected through questionnaires and a fact-finding mission carried out in April 2022.

3.1. The appraisal process for public investment in Ireland

3.1.1. The Public Spending Code: a cross-sectoral perspective and guide

The Public Spending Code (PSC) sets out the value for money requirements for the evaluation, planning and management of public investment projects in Ireland. These requirements apply to all public bodies and all bodies in receipt of Exchequer capital funding. The Code is designed to be sufficiently detailed to aid better decision-making and improved value for money, but sufficiently broad to apply to the spectrum of investment areas that make up the public capital programme (Department of Public Expenditure, NDP Delivery and Reform, 2019^[33]).

In March 2023, the Minister for Public Expenditure, NDP Delivery and Reform announced a package of reforms aimed at enhancing project delivery for the National Development Plan. Under these reforms, the Public Spending Code, which sets the appraisal guidelines for Exchequer funded capital projects will be removed and replaced by a set of Infrastructure Guidelines, to be published in 2023. The number of approval stages prior to implementation has also been reduced from 5 to 3.

The PSC defines a series of steps and activities which are necessary to run a project's appraisal, identifying 5 main stages. These form the project lifecycle (see Figure 3.1, Figure 3.2). Subject to approval, each project must work its way through the project lifecycle. Still, the guidelines allow for some flexibility as it recognises that the level of detail shall be commensurate to the scale of the project under consideration.

Figure 3.1. PSC Project Lifecycle



Note: This figure shows the different stages of the project lifecycle accompanied by the actions and steps to be carried out in each of them
Source: (Department of Public Expenditure, NDP Delivery and Reform, 2019^[33])

The PSC also sets out the requirements for the organisations involved in public investment projects, making a distinction between two main administrative roles: the Sponsoring Agency and the Approving Authority (Department of Public Expenditure, NDP Delivery and Reform, 2019^[33]).

The Sponsoring Agency may be a government department, local authority, state agency, higher education institute, cultural institution, or other state body. It has primary responsibility for evaluating, planning, and managing public investment projects within the PSC parameters. It must obtain the necessary approvals from the Approving Authority at each point in the process and ensure that the project proceeds along the lines approved by the latter. The Approving Authority (i.e. Department of Transport, Department of Health,

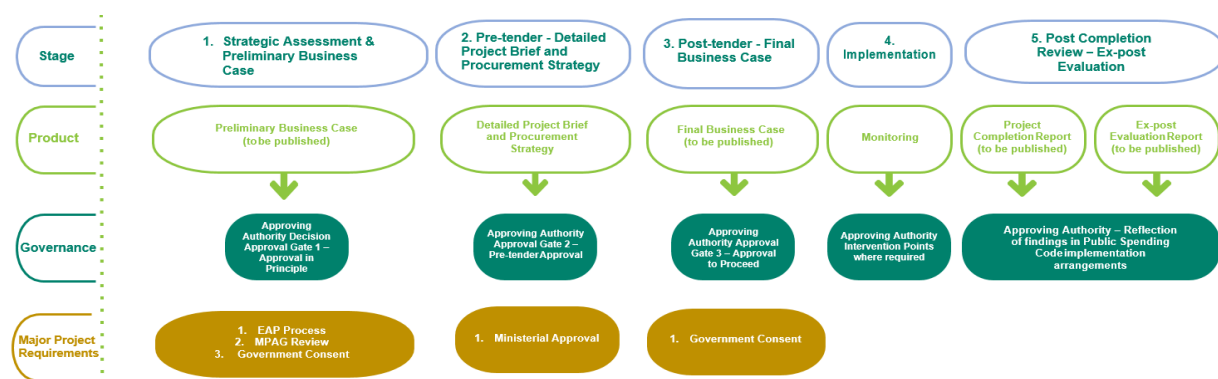
etc.) has the ultimate responsibility for the project. It is the responsibility of the relevant Accounting Officer to ensure compliance with the relevant requirements of the Public Spending Code.

For capital-investment projects and programmes with an estimated cost in excess of EUR 200 million, there is a further level of scrutiny. For these projects, the Approving Authorities are required to seek Government consent through a Memorandum of Decision at two key stages of the project lifecycle:

- Preliminary Business Case / Approval in Principle - Approval Gate 1.
- Final Business Case - Approval Gate 3.

In addition to the specific requirements regarding the Approving Authority, in November 2021, an External Assurance Process was introduced for major capital projects in excess of EUR 200 mln. This involves additional independent expert reviews at the Strategic Assessment and Preliminary Business Case stage of the project lifecycle. This allows for robust scrutiny of the costs underpinning major public investment proposals, and for the consideration of issues such as risk, delivery and governance in the business case for the proposal. A Major Projects Advisory Group (MPAG)⁹ has also been established to support DPENDR in assimilating the outputs from the external reviews, informed by those who have successfully delivered major public infrastructure in Ireland.

Figure 3.2. Public Spending Code: Project Lifecycle and Decisions Gates



Note: The figure shows the role of the Sponsoring and Approving Agency along the project lifecycle as envisaged in the PSC
 Source: this image was copied and pasted from a power point presentation DPENDR shared with the OECD during the fact-finding Mission in Dublin, 12 April 2022.

⁹ In December 2021, Minister McGrath announced the appointment of external experts to the MPAG. This is a group of four highly qualified experts with extensive experience at senior levels in planning, managing, and delivering major public investment projects (to see MPAG’s members, visit gov.ie - [Minister McGrath introduces new Assurance Process for major capital projects and establishes Advisory Group \(www.gov.ie\)](http://www.gov.ie))

The PSC provides a high-level guidance on the evaluation, planning and management of public investment projects, with each sector required to then specify the processes and methodologies to be used. It is the responsibility of each Government Department to ensure that departments and agencies draw up their own sector-specific guidance, ensuring that they are consistent with the principles set out in the Public Spending Code. For example, in the transport sector, the Common Appraisal Framework for Transport Projects and Programmes (CAF) sets out a general guidance for the appraisal of transport investments, which aligns with the Public Spending Code. These guidelines are translated into specific agency guidance, such as the ones developed by the Transport Infrastructure Ireland (TII) and the National Transport Authority (NTA) (see Box 3.1).

Within the project appraisal process, sponsoring agencies often rely on the services offered by private consulting firms from Approval Gate 1 (i.e. the Strategic Assessment and Preliminary Business Case stage) to Approval Gate 3 (i.e. the Final Business Case). Moreover, even if to a more limited extent, private consultants can assist approving agencies in the assessment and evaluation of public investment projects.

Consulting firms offer support mainly in project management, project governance, risk assessment and risk management and in the economic and financial appraisal of projects. They can also on-board engineering partners to conduct EIA. The three main fields for which they are often called to give assistance to public authorities are transport, education, health, and, recently, housing.

Box 3.1. Project appraisal in the transport sector

In the transport sector, the Common Appraisal Framework for Transport Projects and Programmes (CAF) sets out a guidance for the appraisal of transport investments. Currently, the CAF is undergoing a review to bring it in line with the requirements of the PSC.

The CAF was designed to assist and guide Sponsoring Agencies to develop robust and comparable transport business cases for proposed public investment. In turn, the CAF informs agency (Transport Infrastructure Ireland (TII) and National Transport Authority (NTA)) and sectoral guidance (see Figure 3.3).

The document is divided into 7 different sectors:

1. Project Development Process;
2. Preliminary Appraisal;
3. Detailed Appraisal Process;
4. Detailed Guidance on appraisal types;
5. Guidance on both central Government and transport specific parameters for use in economic appraisal;
6. Details on the processes to be carried out when evaluating, implementing and monitoring a programme or project;
7. Templates to report quantitative and qualitative results of the appraisal.

The 2021 version CAF improves the alignment with the 2019 Public Spending Code, introducing revised approval thresholds and updates roles and responsibilities for the review of transport investment proposals.

Figure 3.3. Transport project appraisal process



Source: Presentation the Irish Department of Transport shared with the OECD in the fact-finding mission in Dublin, 12 April 2022

Source: (Department of Transport, 2021^[34])

3.2. The integration of environmental considerations in the appraisal of public investments in Ireland

The existing framework and tools for project appraisal in Ireland already provide opportunities to integrate environmental and climate considerations (see Box 3.2 to learn more about environmental and climate considerations in project appraisal in the transport sector). Recently, the country has undertaken additional steps to strengthen environmental considerations in the decision-making process for public investments.

3.2.1. The 2019 reforms to the Public Spending Code

In 2019, the country introduced a series of reforms to the PSC to strengthen strategic alignment with Government's core objectives, including climate and environmental goals. Across the different stages of the PSC project lifecycle, there are different opportunities to integrate environmental and climate considerations. For example, the long- and short-list of options developed in the Strategic Assessment Report and Preliminary Business Case Stage could be assessed based on frameworks that consider the environmental dimension (along with affordability, scope, and deliverability). These can be multi-criteria models, balanced scorecards, or a SWOT analysis¹⁰. The Benefits Realisation Plan for the Final Business Case can also be an instrument to value environmental and climate aspects. The Plan sets out the measurable benefits arising from an investment proposal, including environmental benefits, such as emissions reduction. It also defines the arrangements to monitor the achievement of benefits and a detailed activity-based programme to ensure impacts are fully realized (Department of Public Expenditure, NDP Delivery and Reform, 2019^[33]). DPENDR has also tripled the price of carbon that is applied under the new

¹⁰ The balanced scorecard approach is a tool to assist in gathering metrics and understanding performance across a number of dimensions. Areas of focus may include economic, financial, social and environmental.

PSC. This re-appraisal of the cost of carbon was based on the estimated costs associated with achieving a 30 per cent reduction in greenhouse gas emissions by 2030.

Despite these efforts, the guidelines contained in the PSC are still general and the methodology for valuing carbon pricing needs to be further refined. This includes more detailed instructions on how to capture indirect or induced emissions. As of today, DPENDR has a full programme of works to improve the Code and make it more aligned with Ireland's green objectives. One of the main priorities is to increase the cost associated with the release of additional greenhouse gases into the atmosphere. This requires primary research to estimate the marginal abatement cost to be paid to reach Ireland's goal of 51% reduction in emissions by 2030. This is highly specialised work that has been progressing in the revision of the Climate Action Plan¹¹ with the collaboration of UCC MaREI¹², building upon the modelling work undertaken in support of the Climate Action Plan 2019 and the National Mitigation Plan.

Moreover, Ireland needs to develop a new model to assess the emissions impact of infrastructure investments to ensure that the full range of potential consequences are captured and properly valued, as well as to better integrate climate change adaptation. Currently, PSC focuses primarily on climate change mitigation, however, project appraisal should also consider the vulnerability of public investments to changing climate conditions and extreme weather events. This would be an initial first step to identify and develop adaptive measures that can strengthen the resilience of infrastructure.

Box 3.2. Transport sector: environmental and climate considerations in the appraisal process

Within the transport sector, there are two main stages where environmental and climate considerations are integrated into the appraisal process.

The Strategic Assessment Report (Approval Gate 0):

The SAR verifies the strategic alignment with national and sectoral policies, which may include environmental and climate objectives. As an outcome, it provides a long list of options for intervention (i.e. all potential options) to be further discussed according to the two modal hierarchies (a modal and an intervention hierarchy) set out in the NIFTI, which promote sustainable transport modes. Under the modal hierarchy, active travel and public transport solutions are preferred to private transport. Under the intervention hierarchy, maintenance and optimisation of existing assets are considered before substantial improvements or new infrastructure. This ensures that the most sustainable and cost-effective solution to a given transport need is identified.

Preliminary Business Case (Approval Gate 1):

The PBC verifies and ensures the strategic relevance of a project with respect to the national and sectoral policy - including the investment priorities set out in the NIFTI -, which may include environmental and climate objectives. A shortlist of options is defined by a MCA that appraises options against different criteria, including on environment and climate. Economic appraisal is then performed for the selected options, and it is updated at Approval Gate 3 (with the Final Business Case). According to the CAF, *"an economic appraisal assesses the project from the point of view of its impact on the economy as a whole. It is important to note that such an appraisal should not be confined to purely commercial or monetisable impacts of the project, but rather should look at its broader economic, social and environmental impacts"*. CBA and CEA indeed integrate environmental and climate considerations (i.e. the shadow price of carbon). Nonetheless, considering that many environmental costs and benefits are difficult to monetize, the CAF suggests to also have a qualitative analysis for factors like air quality,

¹¹ The Climate Action Plan 2023 (CAP23) is the second annual update to Ireland's Climate Action 2019.

¹² MaREI is the SFI Research Centre for Energy, Climate and Marine research and innovation co-ordinated by the Environmental Research Institute (ERI) at University College Cork (UCC). The Centre comprises over 220 researchers focusing on defined global challenges such as the Energy Transition, Climate Action and the Blue Economy.

noise and vibration, landscape and visual quality, biodiversity, cultural heritage, land use, and water resources. A realistic and accurate assessment of these qualitative factors is presented in the Project Appraisal Balance Sheet.

In addition to that, Environmental Impact Assessment (at the project level) and Strategic Environmental Assessment (at the plan/programme level) are also performed as part of the planning process. The results are used to inform the economic appraisal.

Source: (Department of Transport, 2021^[34])

3.2.2. The Economic Appraisal: options for environmental and climate considerations in Ireland

As outlined in the PSC, the short-list of options developed in the Preliminary Business case is subject to a detailed appraisal process, which includes financial and economic appraisal and a sensitivity analysis (Department of Public Expenditure, NDP Delivery and Reform, 2019^[33]). The Sponsoring Agency is the body responsible for conducting these analyses and for submitting them to the Approving Authority.

The economic appraisal assesses the desirability of a project from the societal perspective; it considers the wider economic and social costs and benefits associated with a given project, including non-market impacts. There exist different methodologies to conduct economic appraisal, including the cost-benefit analysis (CBA), the cost-effectiveness analysis (CEA), and the multi-criteria analysis (MCA). The most appropriate to implement depends on the type, scale, and complexity of the project under scrutiny¹³ (see Figure 3.4). Moreover, the choice and application of the appraisal methodology must respect the sectoral guidance and the PSC. Combinations of different methodologies are often a good solution to robustly appraise a project. For example, MCA can be used in conjunction with the CBA, giving full consideration to the quantitative and qualitative elements of the project (Department of Public Expenditure, NDP Delivery and Reform, 2019^[33]).

As a general rule, CBA is required for all projects with an estimated cost in excess of EUR 100 million (Department of Public Expenditure, NDP Delivery and Reform, 2019^[33]). In some cases, however, CBA may not be a useful aid to decision-making, and it is more appropriate to opt for CEA or MCA.

Figure 3.4. Economic appraisal methodologies and investment sectors

Sectors for which CBA <u>may</u> be more suitable:	Sectors for which CEA and/or MCA <u>may</u> be more suitable:
<ul style="list-style-type: none"> • Energy • Transport • Enterprise & Innovation • Health (new capacity) • Environmental infrastructure (including flood defence) • Agri-food • Communications • Tourism • Higher Education 	<ul style="list-style-type: none"> • Housing • Health (replacement and refurbishment) • Urban and regional development • Public Buildings • Culture • Schools

Note: The PSC highlights sectors for which different approaches can be considered. In all cases however, the specific approach should be agreed with the Approving Authority

Source: (Department of Public Expenditure, NDP Delivery and Reform, 2019^[33])

¹³ Sponsoring Agencies and Approving Authorities should engage on the choice of appropriate appraisal methodology as part of the discussion on the appraisal plan during the Strategic Assessment Stage.

Under the existing framework, there are different ways through which environmental and climate aspects can be part of projects' economic appraisal. For example, the consideration of long-term horizons allows for the incorporation of a greater range of challenges, including those associated with changing climate conditions (Department of Public Expenditure, NDP Delivery and Reform, 2019^[33]). Moreover, the PSC requires economic appraisal to estimate the emissions impact of a project or proposal from a "basket of seven" greenhouse gas emissions¹⁴, including methane, carbon dioxide and sulphur hexafluoride. Most notably, CBA runs a quantitative assessment of the net impact on GHG emissions, which are priced according to a schedule of values that are based on the estimated marginal cost society will incur to reach specific climate targets (i.e. the likely cost to Ireland of removing these emissions from the atmosphere)¹⁵. This helps the Government to have an overview of the expected climate impacts of an investment proposal before agreeing to financing the project. CBA shall also monetise the value of other specified non-GHG emissions (i.e. noise, SO₂, PM and noise), where these may be relevant to air quality. For the monetisation of other specified non-GHG emissions (i.e. PM_{2.5}¹⁶, NO_x, NMVOCs, SO_x), values based on EU reference tables are provided centrally in the PSC guidance¹⁷. In cases where emissions are not considered to be relevant, significant, or practicable for inclusion in the economic appraisal, public bodies should note how this conclusion was reached (Department of Public Expenditure, NDP Delivery and Reform, 2019^[35]).

MCA can also be a good appraisal methodology to consider green aspects, as it brings a degree of structure, analysis and openness that lies beyond the practical reach of CBA, and better assess the environmental (i.e. water and air pollution, impacts on biodiversity and landscape, etc.) and climate (i.e. GHG emissions) impacts of a project. It combines criteria which can be valued in monetary terms - even just indirectly (i.e. through hedonic pricing techniques and stated preferences) - and criteria for which monetary valuations do not exist (Department for Communities and Local Government, 2009^[36]).

3.3. The assessment of environmental impacts during the planning and permit process

All capital projects requiring consent arising from the National Planning Framework are subject to the Irish planning and permit process (see Figure 3.5), including the relevant environmental assessment requirements. For projects that may give rise to significant effects on the environment, applications for development consent shall be accompanied by the EIA with the Environmental Impact Assessment Report (EIAR) and the AA with the Natura Impact Statement (NIS).

The results of such environmental assessments are expected to be integrated into project design, for example, with the inclusion of mitigation measures to prevent, reduce or off-set negative impacts. Furthermore, they should ensure that the planning authority or An Bord Pleanála fully understands the

¹⁴ The "basket of seven" GHG emission includes Carbon Dioxide (CO₂), Methane (CH₄), Nitrous Oxide (N₂O), Sulphur Hexafluoride (SF₆), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Nitrogen Trifluoride (NF₃). Where these emissions are considered relevant, significant and practicable for inclusion in the appraisal, they are converted into CO₂e (carbon dioxide equivalent) using GWP (Global Warming Potential) conversion rates. They are then monetised according to the shadow price of carbon, differentiating between emissions in the non-traded (non-ETS) and traded (ETS) sectors. Where emissions are not considered to be relevant, significant or practicable for inclusion, public bodies should note how this conclusion was arrived at in the economic appraisal.

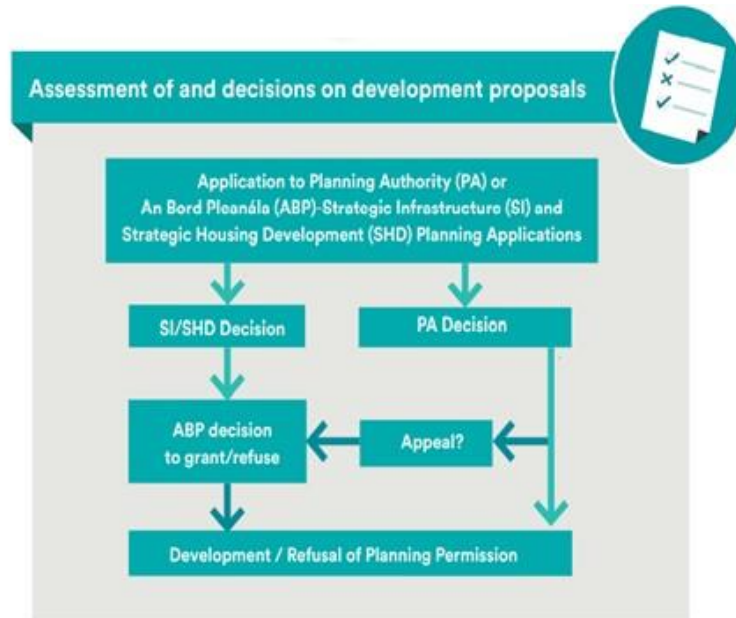
¹⁵ For details on the shadow price of carbon 2020-2050 (per tonne of CO₂e) for the ETS and Non-ETS sector - priced in €2014/tCO₂ - used in Ireland see the Public Spending Code 2019.

¹⁶ The PM_{2.5} values are disaggregated by rural, suburban and urban exposure, to reflect the increased damage costs in more densely populated areas where human exposure is higher.

¹⁷ For details on the valuations for the estimated damage costs of non-greenhouse gas pollutants see Public Spending Code 2019.

impacts of a certain proposal on the environment and factor this into the decision to grant a planning permission.

Figure 3.5. Planning Permission in Ireland



Note: This image is to illustrate the main steps and institutions involved in the process to obtain planning permission in Ireland

Source: (Department of Housing, Planning and Local Government, 2018^[12])

3.3.1. Environmental Impact Assessment (EIA)¹⁸

The EIA is a process of assessment of the effects of a project or development proposal on the environment, and it is undertaken by a planning authority or An Bord Pleanála¹⁹ during the consideration of applications for planning permission. The EIA is comprised of the five following steps (Department of Housing, Local Government and Heritage, 2021^[29]):

1. An Environmental Impact Assessment Report (EIAR) is prepared by the developer and submitted with the planning application. Details must be published in the newspaper notice and site notice accompanying the planning application;
2. The planning authority must carry out consultations, including public consultation;
3. The planning authority must carry out an examination of the EIAR, any supplementary information provided by the developer and any relevant information received through consultations;

¹⁸ The EU Directive on EIA is the Directive 2011/92/EU. Directive 2014/52/EU amends the 2011 codified Directive but does not replace it. The European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018) and Regulations on of 1st September 2018 transpose the EU Directive on EIA into Irish planning law. In Ireland, EIA provisions in relation to planning development consents are contained in the Planning and Development Act 2000, as amended and in the Planning and Development Regulations 2001, as amended.

¹⁹ A Bord Pleanála is Ireland's national independent planning body that decides appeals on planning decisions made by local authorities as well as direct applications.

4. The planning authority must provide a reasoned conclusion on the significant effects of the project on the environment, taking into account the results of the examination and, where appropriate, its own supplementary examination;
5. The reasoned conclusion must then be integrated into the decision of the planning authority

The EIA does not, in itself, dictate the outcome of the development consent decision of the competent authority, but is an important consideration in the decision-making process. The EIA is one input into development consent decision-making; a negative assessment does not necessarily dictate that a proposed project must be refused consent. In this regard, EIA is significantly different from the Appropriate Assessment process carried out under the Habitats and Birds Directives whereby a negative assessment will dictate refusal of development consent, except in exceptional circumstances. Similarly, a positive assessment does not necessarily dictate that development consent will be granted as there may be other issues relating to proper planning and sustainable development which will give rise to refusal (Department of Housing, Local Government and Heritage, 2018^[37]).

The EIAR must be prepared by, or on behalf of the developer, by qualified and competent experts, and it informs the EIA process. It provides a description of the project, of its likely significant (direct and indirect) effects on the environment²⁰, along with a description of the main alternatives analysed as well as measures to avoid, prevent, reduce or offset adverse environmental consequences. The main purpose is to inform the decision-making with regarding to granting planning permission (by the planning authority or An Bord Pleanála) by providing an assessment of the likely environmental impacts of the proposal (Department of Housing, Local Government and Heritage, 2021^[29]).

The EIA is mandatory for all the types of development listed in Part 1 or Part 2 of Schedule 5 to the Planning and Development Regulations 2001, as amended. These are developments likely to have significant effects on the environment. Examples include certain power stations, airports, railways, ports, waste disposal activities and certain overhead power lines, pig and poultry farms and larger housing (>500 dwellings) and retail (> 10 000 square metres area) developments. EIA is also mandatory for certain categories of changes or extensions to an existing development, for example, an extension to a pig farm over a certain size (Department of Housing, Local Government and Heritage, 2021^[29]; Department of Housing, Local Government and Heritage, 2018^[37]).

Some of the classes of development listed in Schedule 5 have thresholds beyond which there is a mandatory requirement for EIA. If the proposed development falls below the given threshold, it is referred to as sub-threshold development. In these cases, the planning authority must consider if the proposed development is likely to have any significant effects on the environment that should be assessed through the EIA process. This is known as 'EIA screening'.

For relatively simple cases, screening can be done through a 'preliminary examination' of the proposal. If there is any doubt as to whether an EIA is required, a more detailed process - 'screening' - must be carried out and concluded in a 'screening determination' by the competent authority (i.e. the planning authority in this instance). The decision as to whether a preliminary examination or screening determination is required is made by the planning authority. The latter will consider the following: (a) the characteristics of the proposed development (including scale, demolition, use of natural resources, waste production, pollution and risk of major accidents); (b) the location proposed (including environmental sensitivity and absorption capacity); and (c) the type and characteristics of potential impacts (including the size of the area affected, the scale of the impact, how likely the impact is to occur and the duration of any impact). If the planning

²⁰ The environmental factors considered are: (i) population and human health, (ii) biodiversity, with particular emphasis on species and habitats protected under EU Directives, (iii) land, soil, water, air and climate, (iv) material assets, cultural heritage and the landscape, and (v) the interaction between the factors mentioned.

authority decides there is no real likelihood of significant effects on the environment, the EIA (or EIAR) is not required (Department of Housing, Local Government and Heritage, 2021^[29]).

3.3.2. Appropriate Assessment (AA)

Single projects may be subject to Appropriate Assessment, with the AA process being carried out by the planning authority or An Bord Pleanála prior to deciding whether to grant planning permission. As a general rule, a project can only be approved where it can be demonstrated that it will not negatively affect the integrity of a Natura 2000 site (Department of Housing, Local Government and Heritage, 2021^[29]; Department of Housing, Local Government and Heritage, 2009^[28]).

The AA process for projects is similar to that of plans and programmes. Once screening determines a project is likely to have significant impacts on a Natura 2000 site (without considering possible mitigation measures), the AA is carried out to assess its implications, alone and/or in combination with other projects. The first step consists in the preparation of the NIS. If adverse effects on the integrity of the Natura 2000 site cannot be excluded, alternative solutions can be considered. If the alternative solutions still do not clearly indicate that there will be no adverse consequences, the proposed intervention can must be considered under IROPI, with the possibility to apply the derogation procedure envisaged in Article 6(4) of the EU Habitats Directive. (Department of Housing, Local Government and Heritage, 2021^[29]; Department of Housing, Local Government and Heritage, 2009^[28]).

3.4. Challenges and opportunities to integrate environmental and climate considerations in the current appraisal framework in Ireland

With significant infrastructure investments expected from Project Ireland 2040, public capital spending will play a key role in ensuring Ireland meets national, EU and international environmental commitments. However, substantial reforms are needed to strengthen project appraisal and ensure future investments contribute to green objectives. Carbon proofing and accounting for climate risks and uncertainty in infrastructure investment will be a major step towards achieving this objective.

3.4.1. Central-level guidelines on how to consider environmental considerations in project appraisal are still general, often leading to great levels of heterogeneity across sectors

Despite the precision of the information requirements and of the appraisals necessary at the different phases of the project lifecycle, the consideration on the interactions between the project and the environment vary considerably across sectors (i.e. the consideration of the interactions between the project and the environment varies considerably from one sector to another). This is especially the case when it comes to planning documents and prioritization schemes. In attempting to better address the environmental concerns related to infrastructure investment projects, it is important to ensure consistency across sectors, taking into account that they often deal with projects of different scales²¹ (i.e. flood management risk vs. transport). In other words, there is the need to define more detailed guidelines at the central level to assess environmental factors into project evaluation.

Moreover, existing methodologies are limited in the way they account for greenhouse gas emissions. There is a need to develop more robust methodology to capture the impact of project lifecycle emissions, as well

²¹ There are over 50 projects in the NDP with estimated costs of over EUR 100 mln. A sectoral breakdown can be viewed in the investments programme and project tracker: www.gov.ie/en/publication/6db7c4-investment-projects-and-programmes-tracker/

as indirect or induced emissions. This will ensure that the full range of potential impacts are captured and adequately assessed.

3.4.2. EIA and SEA are part of a planning process, which is separate from the project appraisal process

The EIA findings are not usually used to inform the economic appraisal of projects. EIA is usually conducted after a preferred option for implementation has been identified, therefore its results will only inform subsequent Approval Gates, such as the preparation of the Final Business Case. Nonetheless, there are differences across sectors. For example, the Department of Transport incorporates the EIA's results in the Project Appraisal Balance Sheet (PABS) – during the economic appraisal process – also to inform the identification and/or design of mitigation measures to reduce or offset adverse environmental impacts.

3.4.3. The project appraisal/evaluation process in Ireland primarily focuses on climate change mitigation

The project appraisal process in Ireland pays due attention to climate change mitigation, for example estimating the GHG emissions of infrastructure projects and using the shadow price of carbon in CBA. However, in order to adequately assess a project's impacts on the environment, project appraisal should consider a wider range of environmental aspects. This could include water and air pollution, impacts on biodiversity, climate adaptation, etc.

3.4.4. Considerations of climate change adaptation should be better integrated in project appraisal as well as in the permit process for public investments

Currently, Ireland's approach focuses mainly on climate change mitigation. Neither the National Adaptation Framework (NAF) nor the PSC and its supplementary guidance materials set out any requirements or indication to integrate climate change adaptation in the appraisal of public investment projects. However, considering climate change adaptation - including the vulnerability of public investments to changing climate conditions and extreme weather events – is key to identify adaptive solutions capable of strengthening the resilience of infrastructures, as well as to support the country's transition to a low-carbon, climate resilient and environmentally sustainable economy by the end of 2050. For this reason, DECC, in collaboration with DPENDR should develop detailed guidance on how to integrate climate change adaptation into the assessment of public investment, which can be applied across sectors.

Considerations of climate change adaptation should also be integrated in key instruments in the permit process of public investment projects, such as the Environmental Impact Assessment (EIA). Back in 2015, Ireland's Environmental Protection Agency (EPA) issued a guidance note on "*Integrating Climate Change into Strategic Environmental Assessment in Ireland*". Today, updated guidance specific on integrating adaptation considerations in EIA should be provided.

3.4.5. Challenges in defining a counterfactual under the CBA

In a CBA, one of the main difficulties, from the methodological point of view, is the definition of the counterfactual case (i.e. what would the actual scenario be if the proposed project were not to be implemented). Several stakeholders highlighted that this is a key challenge to assess climate impact during project evaluation.

3.4.6. Reliance on private contractors to carry the environmental assessments and write project appraisal documents

The lack of sufficient level of resources (including, time and money) within the Irish public administration system has led to wide scale outsourcing of the economic and financial appraisal of infrastructure projects to private consulting firms, rather than conducting them in-house. Consulting firms also provide support in project management, project governance, risk assessment, and risk management.

It is not always practical nor feasible for Government Departments and Agencies to prepare Business Cases and conduct economic appraisal for any given project. Moreover, they often act as Approving Authority with the responsibility to review such documents and analyses.

Taking this into account, it is important to start building the necessary capacity and capability nationally - in the public service as well as within industry -, to upskill and invest, to adopt new technologies, and to develop the relevant supports and management systems.

3.4.7. The absence of a clear prioritisation mechanism

Currently, in Ireland, there is a gap in the evaluation and prioritization of infrastructure projects based on their interactions with the environment and climate.

4 Budgeting practices in Ireland: Challenges and opportunities for environmental and climate considerations

In this chapter, the OECD will provide an overview of the budgeting practices in Ireland, focusing on those that integrate environmental and climate considerations and identifying challenges and areas for improvement. The analysis will be informed by the results of the research conducted by the OECD, the insights collected through a questionnaire and a fact-finding mission that took place in April 2022.

4.1. The budgeting framework in Ireland

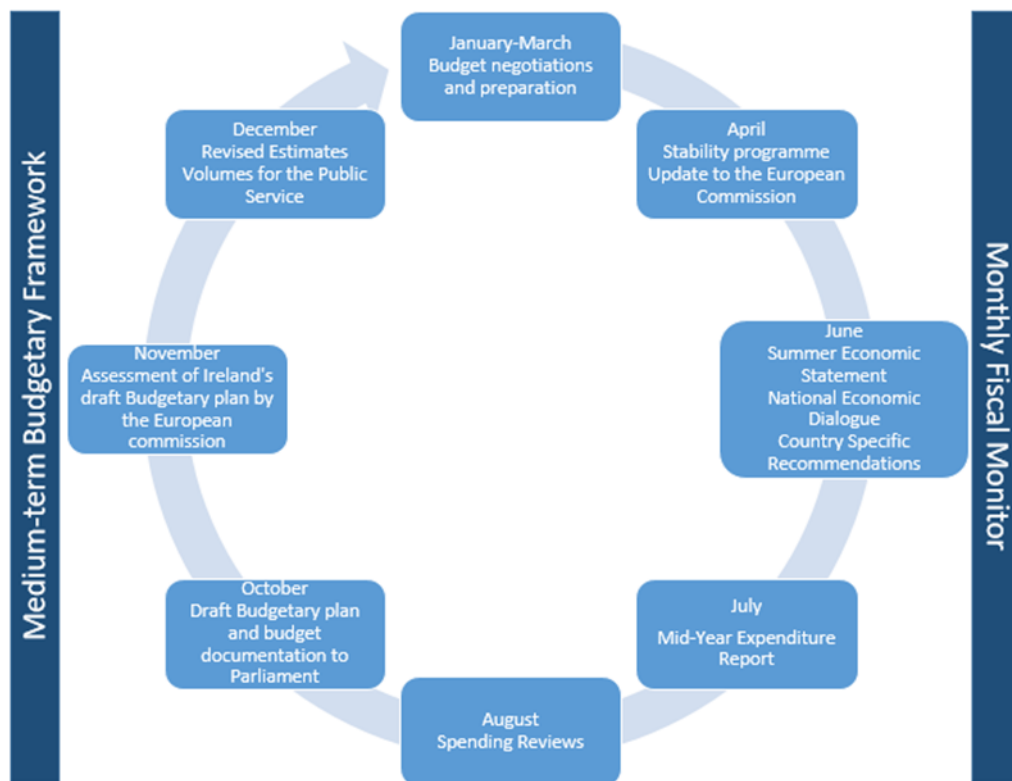
4.1.1. *The Irish budget cycle*

The basis for the Irish budget cycle is annual but includes multi-annual and sub-annual components. Like other European countries, Ireland submits its stability programme to the European Commission in April as part of the European Semester. The programme includes economic and fiscal forecasts, updated in June in the Summer Economic Statement.

In July, the Department of Public Expenditure, NDP Delivery and Reform publishes the Mid-Year Expenditure Report (Government of Ireland, 2021^[38]) which sets out the pre-budget ceilings. Spending reviews are circulated in August (Department of Public Expenditure, NDP Delivery and Reform, 2021^[39]).

The budget documents are published in October followed by the Revised Estimates for Public Services (Government of Ireland, 2022^[40]) in December, which provides detail on the individual programme allocations of the current year. The Votes for each ministry and agency are approved by the Irish Parliament (see Figure 4.1).

Figure 4.1. Irish Budget Cycle



Ireland has put in place strategic components for the scrutiny of public expenditure within its budget cycle.

- The Medium-Term Budgetary Framework is supported by regulation and serves as a basis for the annual budget planning;
- Spending reviews are a valuable input to classify saving decisions and to inform expenditure prioritisation (Department of Public Expenditure, NDP Delivery and Reform, 2021^[39]);
- The fiscal monitor is published monthly and provides an update on central government finances. (Department of Public Expenditure, NDP Delivery and Reform, 2022^[41]).

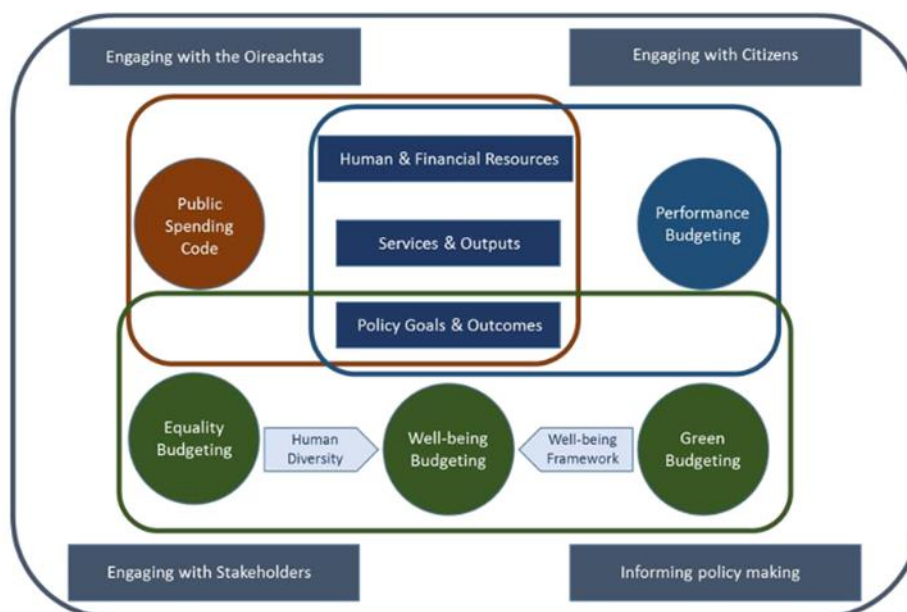
Additionally, the country has adopted a Public Spending Code and has developed cost accounting tools to systematise value for money.

4.1.2. The ongoing reforms of the budgetary framework

Ireland has been implementing a series of reforms of the budgetary framework for several years (see Figure 4.2). The reforms objectives are to:

- Indicate how public money is used (Performance Budgeting).
- Develop indicators to inform policy-making (Public Spending Code).
- Amplify focus on policy objectives and outcomes (Well-being budgeting, Green budgeting, Equality budgeting).
- Increase the competency of the civil service (establishment of the Irish Government Economic & Evaluation Service).

Figure 4.2. Reforms of the budgetary framework in Ireland



Source: (Department of Public Expenditure, NDP Delivery and Reform, 2021^[42])

There has also been improvement in setting up a methodical collection and presentation of performance material to guide resource allocation decisions. The budgetary choices are no longer simply competing demands for supplementary expenditures but are also influenced by the use and the impact of these credits.

4.2. The integration of environmental and climate considerations in budgeting practices in Ireland through the green budgeting initiatives

In 2022, Ireland's methodology on green budgeting integrated three main initiatives in the annual Expenditure Report (Department of Public Expenditure, NDP Delivery and Reform, 2021^[42]) and the Public Service Performance Report (Department of Public Expenditure, NDP Delivery and Reform, 2022^[43]):

- Green budget tagging (tracking climate-related government expenditure).
- Progressive increases in carbon tax²² (Department of Public Expenditure, NDP Delivery and Reform, 2020^[44]).
- Incorporation of a green angle to the performance framework (beyond carbon tax funds).
- Definition of carbon budgets with sectoral carbon ceilings (Government of Ireland, 2022^[45]).

Climate was also integrated in the Economic and Fiscal outlook 2022 (Department of Finance, 2021^[46]) and the Review of Green Budgeting from a Tax perspective (Department of Finance, 2022^[47]).

²² "As per the commitment in the Programme for Government, all of the revenue that will be raised by this increase in carbon tax will be used to: Ensure that the increases in the carbon tax are progressive by spending EUR 3 billion on targeted social welfare and other initiatives to prevent fuel poverty and ensure a just transition, provide EUR 5 billion to part fund a socially progressive national retrofitting programme, and allocate EUR 1.5 bln of additional funding to encourage and incentivise farmers to farm in a greener and more sustainable way" (Department of Public Expenditure, NDP Delivery and Reform, 2021^[91])

4.2.1. Green budget tagging implementation

Ireland started to implement green budget tagging in 2019 (Department of Public Expenditure, NDP Delivery and Reform, 2018^[48]), like other European countries (see Box 4.1). Initially, the expenditure identified was very similar to that eligible for the Irish Sovereign Green Bond, launched in 2018²³.

Box 4.1. Examples of green budget tagging in OECD countries

France

Since 2020, France publishes a green budget that incorporates tagging of positive, neutral and negative expenditure against six environmental objectives. Additionally, the green budget includes impact assessments and green performance data.

The evaluation criteria must integrate the carbon objectives contained in the French low carbon and climate strategy.

Italy

Italy publishes an annual list of subsidies with positive, negative, and uncertain environmental effects.

Moreover, the country has implemented budget tagging which identifies expenditure on environmental protection and on the use and management of natural resources. The information is intended to give an overview of the environmental expenditure forecasts for a three-year period 2022-2024. This framework may change during the course of the year depending on budgetary management operations.

Source: (Ministry of Economy, Finance and Recovery of France, 2021^[49]; Ministry of Ecological and inclusive transition of France, 2018^[50]; Ministry of Sustainable Infrastructure and Mobility (MIMS), 2021^[51]; Ministry of Economy and Finance (MEF), 2021^[52]; Ministry of Economy and Finance (MEF), 2021^[53])

In 2023, the tagging included the expenditure of six departments (Office of Public Works, Department of Environment, Climate & Communications, Department of Agriculture, Food and Marine Department of Transport, Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media, Department of Housing, Local Government & Heritage) for a total of EUR 3 587 million (including Capital Carryover) (+ 12,7 % compared to 2022) (See Table 4.1). Green budget tagging is piloted to inform the public and policy makers about measures which are helping or hindering progress towards our climate targets. It is updated every year. As part of REV 2023 (Government of Ireland, 2023^[54]), the Department of Public Expenditure, NDP Delivery and Reform will develop and apply definitions to identify and track government spending that may be having a negative impact on climate and environmental outcomes.

²³ Eligible green project categories for the proceeds of the green bond issue include: Sustainable water and waste management, clean transportation, environmentally sustainable management of living natural resources and land use, renewable energy, energy efficiency and climate change adaptation projects.

Table 4.1. Green Budget Tagging 2023

Departments	Programmes/Schemes	2022 (million)	2023 (million)	% Change
Office of Public Works	1	85 516	76 520	-12%
Department of Environment, Climate & Communications	15	345 008	660 777	48%
Department of Agriculture, Food and Marine	8	570 496	585 907	3%
Department of Transport	5	1 873 452	1 912 700	2%
Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media	1	0	4 500	100%
Department of Housing, Local Government & Heritage	5	213 294	239 299	11%
Total	35	3 087 766	3 479 703	11%
Additional Climate Related Spending via Capital Carryover (Greenways, Carbon Reduction, Public Provision Payments, Public Transport Investment, Peatlands Restoration and Management)	5	n.c.	107 166	
Total	40	3 087 766	3 586 869	

Source: (Department of Finance, 2023^[55])

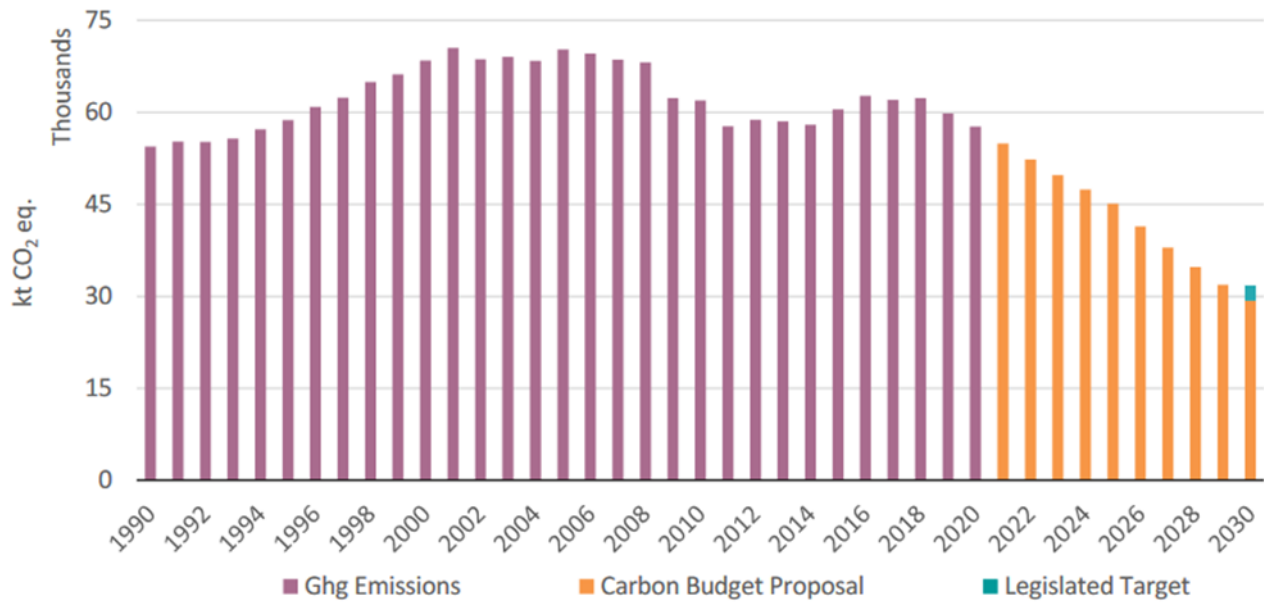
The Irish approach considers “*Any expenditure which promotes, in whole or in part and whether directly or indirectly, Ireland’s transition to a low carbon, climate-resilient and environmentally sustainable economy*” (Department of Public Expenditure, NDP Delivery and Reform, 2018^[48]). The expenditures included are those for which the environmental objective is clearly established or those which have a significant environmental impact and aim to modify the behaviour of agents rather than the direct emissions linked to public action.

All the information concerning tagging were not gathered in one document or green budget statement. The tagging objectives were described in the budget 2023 from a tax perspective (Department of Finance, 2023^[55]), in the performance report (Department of Public Expenditure, NDP Delivery and Reform, 2022^[43]) and the amounts in the Appendix 8 – Climate Related Expenditure for 40 programmes within six Departments of the revised estimates (Government of Ireland, 2023^[54]). The methodological document for the classification of expenditure, which contains all the information and the classification of expenditure, has not been published since 2018 (Department of Public Expenditure, NDP Delivery and Reform, 2018^[48]). This document was easily understandable and accessible to describe the classification applied by DPENDR.

4.2.2. Carbon budgets developments

The carbon budget is the finite amount of carbon that can be emitted into the atmosphere before global warming exceeds a critical temperature threshold, beyond which the climate situation would become irreversible and difficult to control. The international scientific community estimates this budget to be one billion tons of carbon.

Currently, almost 150 countries around the world have committed to achieving zero emissions by 2050. In July 2021, Ireland passed new legislation to achieve net zero emissions by 2050, and to reduce its emissions by 51% by the end of the decade (see Figure 4.3) (Government of Ireland, 2021^[56]).

Figure 4.3. Greenhouse Gas Emissions (GHG) (2020-2030) and National Target (2030)

Source: (Irish parliamentary Budget Office, 2022^[57])

The Irish legislation provides a strong framework for climate policy, which includes drawing up economy-wide and sector-specific 5-year carbon budgets on a rolling 15-year basis. Ireland launched a public consultation on carbon budgets in 2021 (Government of Ireland, 2021^[58]) before introducing them in 2022. The carbon budget programme, comprising of three 5-year budgets came into effect on 6 April 2022 (Government of Ireland, 2022^[45]). The Advisory Council on Climate Change has developed a transition programme.

In the context of COVID-19, greenhouse gas (GHG) emissions in Ireland decreased by 3.6% in 2020. However, 2021 saw emissions rise again by 4.7% as some sectors began to emerge from Covid-related restrictions. The key sources of GHG emissions include Agriculture (33.3%), Transport (15.7%) and Energy (14.4%). The first budget, from 2021 to 2025, foresees a reduction in greenhouse gas emissions of 4.8% per year and 8.3% over the period 2026-2030, once the investments start to take effect. It predicts a further reduction by 3.5% from 2031 to 2035 (see Figure 4.4).

Figure 4.4. Ireland's Carbon Budgets

Budget Period	2021 - 2025	2026 - 2030	2031 - 2035 (provisional)
MtCO ₂ eq.	295	200	151
Average annual reduction	4.8%	8.3%	3.5%

Source: (Government of Ireland, 2022^[59])

The section 6B of the Climate Action and Low Carbon Development (Amendment) Act provides that the carbon budgets must be published not more than 30 days after being approved by both Houses of the *Oireachtas*. New legislation also sets out an obligation to revise the climate action plan on an annual basis and makes government departments responsible for delivering their carbon budgets and achieving their

mitigation targets. Box 4.2 includes examples of other OECD member countries that have also introduced carbon budgets in recent years.

Box 4.2. Examples of carbon budgets in OECD countries

France

The first three carbon budgets were adopted by decree in 2015 at the same time as the national low-carbon strategy. Covering the periods 2015-2018, 2019-2023 and 2024-2028, they set the national greenhouse gas emission ceilings that are not to be exceeded. These budgets also define short-term methods for emissions reduction

New Zealand

In 2021, the government announced its plans to establish an emissions budget that would be monitored by the country's Climate Change Commission.

United Kingdom

In 2020, the government released its sixth carbon budget based on recommendations by an independent Climate Change Committee. The five-year carbon budget covers the period from 2033 to 2037. It includes policy recommendations intended to inform government policy and budgets priorities and to achieve the budget ceilings.

Source: (OECD, Forthcoming^[60])

Ireland's first carbon budget programme came into effect in April 2022. On 28 July 2022, the government announced sectoral emission ceilings which define how each sector of the economy will contribute to achieving the carbon budget (see Figure 4.5) (Department of the Taoiseach, 2022^[61]). The Land Use, Land Use Change and Forestry sectoral ceiling will be finalised no later than end 2023 and in parallel with the completion of the Land-use Review.

Figure 4.5. Sectoral Emissions Ceilings

Sector	2018 Baseline (MtCO ₂ eq.) ¹	Sectoral Emission Ceilings for each 5-year carbon budget period (MtCO ₂ eq.)		Emissions in final year of 2021-2025 carbon budget period (MtCO ₂ eq)	Reduction in Emissions in final year of 2021-2025 carbon budget period compared to 2018 Baseline	Emissions in final year of 2026-2030 carbon budget period (MtCO ₂ eq)	Reduction in Emissions final year of 2026-2030 carbon budget period compared to 2018 Baseline
	2018	2021-2025 [*]	2026-2030 [*]	2025 [*]	2025	2030	2030
Electricity	10	40	20	6	-40%	3	-75%
Transport	12	54	37	10	-20%	6	-50%
Built Environment - Residential	7	29	23	5	-20%	4	-40%
Built Environment - Commercial	2	7	5	1	-20%	1	-45%
Industry	7	30	24	6	-20%	4	-35%
Agriculture	23	106	96	20	-10%	17.25	-25%
LULUCF ²	5	XXX	XXX	XXX	XXX	XXX	XXX
Other (F-Gases, Waste & Petroleum refining)	2	9	8	2	-25%	1	-50%
TOTAL³	68	XXX	XXX	XXX	XXX	XXX	XXX
Legally binding Carbon Budgets and 2030 Emission Reduction Targets ⁴	-	295	200	-	-	34	51%
Annual unallocated Emission Savings in 2030	-	-	5.25 ⁵	-	-	-	-
Unallocated Savings 2026-2030 ⁶	-	-	26	-	-	-	-

Note:

¹Million tonnes of carbon dioxide equivalent

² Finalising the sectoral emissions ceiling for the LULUCF sector has been deferred for up to 18 months from July 2022 to allow for the completion of the Land-use Review

³ Following finalisation of the sectoral emissions ceilings for the LULUCF sector, 5-year economy-wide total figures will be available

⁴ As provided by section 6A(5) of the Climate Action and Low Carbon Development (Amendment) Act 2021

⁵ Unallocated savings on an economy-wide basis in 2030 (final year of second carbon budget period), before factoring in net LULUC F sector emissions

⁶ Unallocated savings on an economy-wide basis in the second 5-year carbon budget period from 2026-2030, before factoring in net LULUCF sector emissions

Source: (Government of Ireland, 2022^[59])

In December 2022, Ireland published the Climate Action Plan 2023 (CAP23). It is the second annual update to Ireland's Climate Action 2019. It implements the carbon budgets and sectoral emissions ceilings and sets out a roadmap to reduce emissions by 2030 and reach net zero in 2050. (Government of Ireland, 2022^[59]).

4.3. The impact on public finance

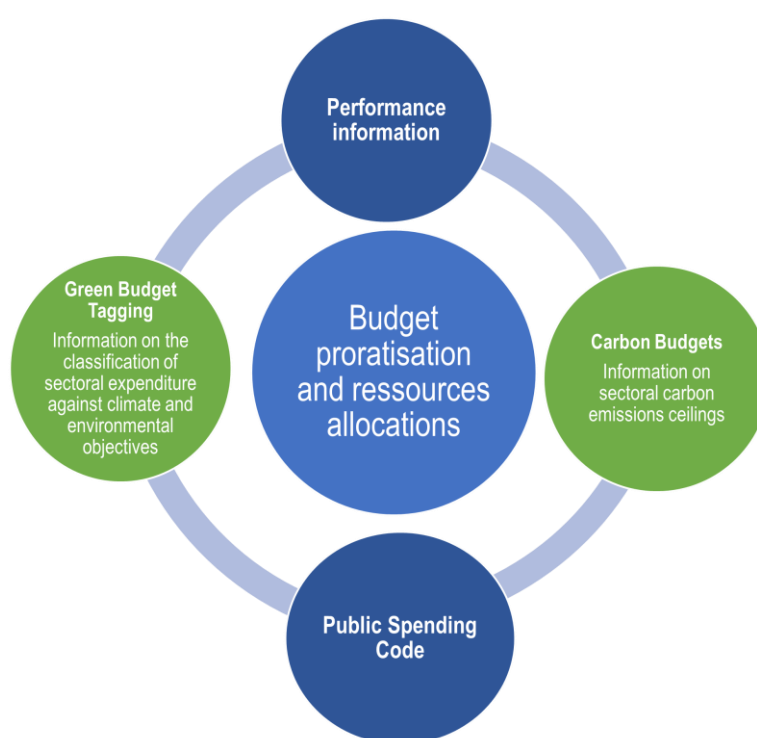
The low-carbon transition will involve a profound transformation of the Irish economy. Its implementation requires public action to be consistent with Ireland's climate commitments at all territorial levels, implying the integration of climate issues in each sector, each policy measure and at each stage of project construction.

Green budget tagging is a technical element that serves as information for the preparation and discussion of the budget. Tagging of expenditure on an annual basis is designed to enhance transparency and accountability in respect of public expenditure on climate action and the environment. This provides a greater degree of insight at an intra- and inter-departmental level and an important input into policy formulation that can affect how Departments decide to allocate their budgets. If tagging is one of a range of inputs into a more complex process that also requires consideration of the outputs/outcomes associated

with tagged expenditure it should also be used to directly inform decisions about resource sectoral allocations and performance tracking.

Carbon budgets set emission ceilings by sector. These targets should be used as indicators within the tagging process and used more proactively in the budget discussion with ministries to select and prioritise budget allocations (including capital spending). The alignment of green tagging and carbon budgets is a good practice to avoid developing several different methodologies in silos. For example, the ceilings established by carbon budgets should be used as a ranking criterion in the green budget tagging method. On the other hand, the information gathered through the budget tagging exercise should be used when defining the carbon budgets ceilings (see Figure 4.6).

Figure 4.6. Examine the relationship between expenditure and emissions reductions in each sector



Additionally, the elements identified in the Climate & Environmental Assessment of the National Development Plan (Department of Public Expenditure, NDP Delivery and Reform, 2021^[62]) to classify capital investment spending proposals (see Chapter 1) are not aligned with the classification criteria used for the green budget tagging and the carbon budgets. (e.g. different objectives and definitions).

4.4. Challenges and opportunities to integrate environmental and climate considerations in the budget framework in Ireland

4.4.1. Better integrate green budget tagging and carbon budgets into the budget cycle decision making to strengthen information and prioritisation of budget allocations

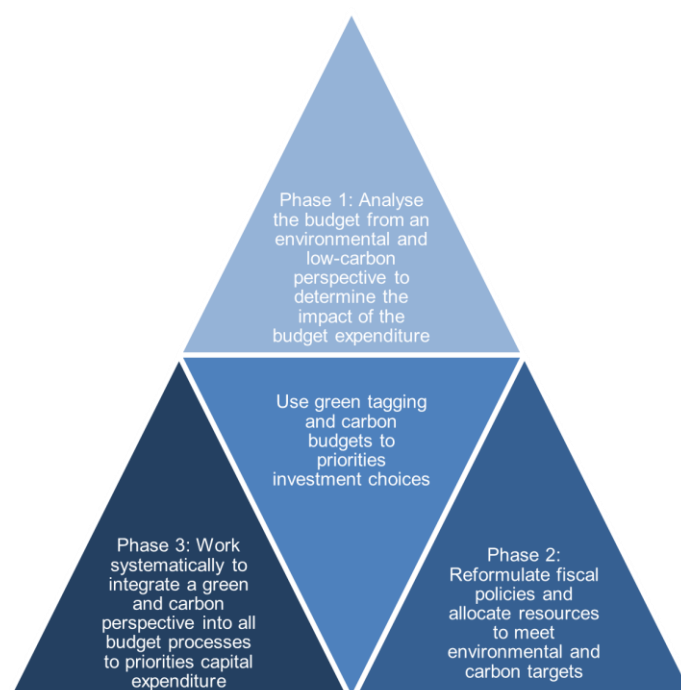
Green budgeting is being developed in Ireland as an input into the wider policy evaluation process within line Departments. However, it should be more integrated fully into the decision-making and prioritisation of

expenditure processes. The green budget tagging exercise and the carbon budgets ceilings should enable line ministries and the Department of Public Expenditure, NDP Delivery and Reform to propose, modify, prioritise, and allocate resource.

The link between expenditure and outputs/outcomes within the green budgeting framework should be strengthened, and the information generated by green budgeting be a valuable input into the processes provided for the in the public spending code that focus on prioritisation of current and capital expenditure.

This will influence the prioritisation of policy choices and investment projects (see Figure 4.7).

Figure 4.7. Integration of green tagging and carbon budgets in the budget cycle



The integration of green tagging and carbon budgets information should be done during the budget cycle:

- **Budget planning:** Helps to identify and integrate environmental and carbon emissions objectives in the medium-term budget planning and strategy.
- **Budget preparation:** Helps to identify, negotiate, and allocate annual resources according to the budget planning objectives.
- **Budget approval:** Helps to integrate and justify the policy choices in the budget documentation.
- **Budget execution:** Helps to monitor programmes and the potentially harmful budget demands and deviations.
- **Budget oversight:** Helps to review and evaluate policy and budget execution against environmental and carbon emissions ceilings This helps to respect the government's national and international targets.

4.4.2. Use green budget tagging and carbon budgets as complementary tools to help prioritise and select investments

The estimation of expenditure (via tagging) and the imposition of carbon budget constraints (emissions ceilings) are necessary elements to help prioritise and select investments. The assessment of the environmental and carbon impacts of public investment projects should be further strengthened:

- By extending the number of departments and programmes tagged in the REV estimates;
- By extending socio-economic assessments beyond the usual sectors of application (transport or public buildings);
- By adopting a broad view of the climate impact of projects (impacts throughout the life of the projects and indirect impacts);
- By ensuring that projects are compatible with the public policy guidelines necessary for the low-carbon transition;
- By encouraging investment in low-carbon transition projects.

The better integration of green budgeting in the budget process will increase transparency and accountability on the delivery of climate action and impact on climate outcomes, as well as climate expenditure, with both these things being important inputs into the prioritisation process and procedures outlined in the Public Spending Code and in the ex-post analysis of existing programmes carried out within individual Departments and as part of the Spending Review process.

The prioritisation of criteria for the selection of investments through the public spending code should:

- Include and prioritise government expenditure classified as environmentally friendly, according to the information provided by the green budget tagging exercise;
- Be aligned with the carbon ceilings set in the carbon budgets.

5 International/OECD best practices to integrate environmental and climate considerations in budgeting and public investment appraisal

In the context of a wider focus on well-being and sustainable development in OECD countries, infrastructure investment is increasingly required to address multiple economic, social, and environmental objectives. This creates challenges for decision-makers, who are required to weigh and balance different (and sometimes competing) goals in selecting and prioritising projects. This chapter will provide an overview of the different methods and tools OECD countries are using to integrate environmental and climate considerations into infrastructure planning, project appraisal and prioritisation process. In particular, it will touch upon:

- Methodological approaches used to quantify the emissions impact of infrastructure projects, as well as other tools to monetise climate and environmental impacts and benefits in a standardised way;
- Evaluation tools developed to include environmental and climate impacts during the project prioritisation process.

5.1. Canada

In 2019, Canada adopted a new Act on Impact Assessment (i.e. **the Impact Assessment Act 2019 or IAA**) which set out a new process to assess the positive and adverse effects of a project and its contribution to sustainability. The Act increased regulatory certainty and clarity and helped streamline the impact assessment process. This was achieved by enhancing the level of cooperation with other jurisdictions and Indigenous groups, reducing the red tape for projects' proponents and avoiding duplicating efforts in reviewing project proposals. The logic underlying the 2019 IAA is "**one project, one assessment**", creating one single assessment process that meets the requirements of all the jurisdictions involved. Moreover, it includes the possibility to launch regional and strategic assessments in order to gain a better understanding of environmental issues outside the scope of the individual project. These also allow for the consideration of the cumulative effects of development in a certain territory.

5.1.1. Background

In 1992, the country adopted the Canadian Environmental Assessment Act, which was later reformed in 2003, 2012 and 2019. The 2019 Act repealed the Canadian Environmental Assessment Act of 2012 and created the Impact Assessment Agency. This is a federal body accountable to the Canadian Minister of Environment and Climate Change, and it leads all impact assessments of major projects on federal lands and outside of Canada, ensuring consistency, coherence and efficiency of the assessment process. Results are then used to inform decision-making and promote the country's sustainable development.

The Impact Assessment analyses the positive and negative impacts of a project and provides proposals of mitigation measures to reduce, avoid or offset the negative effects and enhance the positive aspects of a project. The impact studies cover different dimensions, including the environment, economy, health, and society. They also promote public participation of citizens, particularly of Indigenous communities (Government of Canada, 2022^[63]). As a result, the Canadian federal process for environmental impact assessment incorporates environmental features into a comprehensive and complete study - which covers other key dimensions of a project's impacts - depending on the expected harshness of possible opposing environmental effects.

The type of projects subject to the 2019 IAA include the following:

1. Designated projects that are described in the Physical Activities Regulations (Project List – see Box 5.1).
2. Those designated by the Minister not described in regulations, based on factors set in the legislation.
3. Non-designated projects on federal lands and outside Canada that are assessed by federal authorities before decisions are made.

Box 5.1. A proposed impact assessment system

The objective of the Project List is to capture major projects, like mines, pipelines and hydro dams, with the greatest potential for adverse effects in areas of federal jurisdiction related to the environment, while also providing certainty and clarity as to which projects are subject to the Impact Assessment Act. In particular, it includes large projects that are likely to have an impact on fish and fish habitats, and aquatic Species at Risk; Migratory birds; Changes to the environment on federal lands, including First Nation reserve lands; Changes to the environment in a province other than the one where the project is taking place or outside of Canada (e.g. as it may be the case when GHG emissions are involved); and Environmental effects arising from federally, regulated project types such as nuclear, rail, ports, airports, interprovincial pipelines and offshore energy activities.

Federal lifecycle regulators are unique in that they are mandated under federal legislation to regulate the full life cycle for specified project type, from impact assessment of the initial design and construction to the operation and eventual decommissioning or closure of projects. Each assessment regime plays a distinct role in Canada's regulatory framework.

Source: (Government of Canada, 2019^[64])

5.1.2. Impact Assessment Process Overview – see Figure 5.1

Initially (in planning phase 1), the Impact Assessment Agency, taking into account the comments and opinions of provincial and territorial jurisdictions, Indigenous groups, the general public, federal authorities

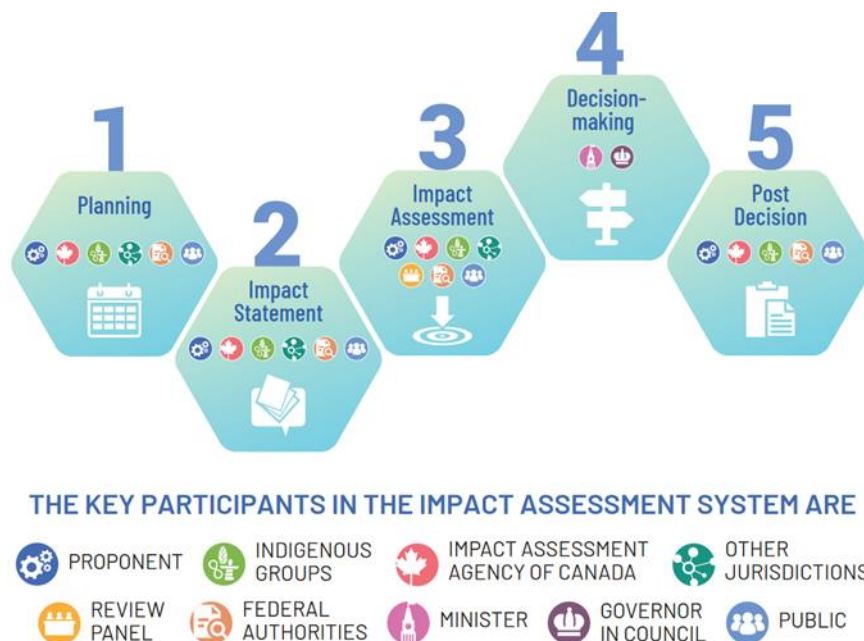
and experts, decides whether or not an impact assessment is required for a given project proposal, and plans the assessment process (Government of Canada, 2022^[65]).

Subsequently, the proponent submits the Impact Statement containing all the information and studies outlined in the Tailored Impact Statement Guidelines (provided by the Agency itself with all other actors involved in the process). The Agency reviews the Statement analysing the potential environmental, health, social and economic impacts of the proposed interventions, including its benefits. It then develops an Impact Assessment Report, drafts the potential conditions for the project’s implementation, and shares both documents with the Minister of Environment and Climate Change (Government of Canada, 2022^[65]). In all these phases, the key actors involved in the project or affected by it can actively take part in the drafting process of key documents (i.e. experts from federal departments, Indigenous groups, the public and other jurisdictions, including provincial, territorial and Indigenous).

Once the impact assessment process is complete, the Minister issues a decision statement to the proponent. This document states the Government’s decision about whether the project is in the public interest and if it is allowed to proceed. If the project is approved, it also includes conditions the proponent must adhere to when carrying out the project. One key condition is the requirement to develop and carry out a follow-up program in consultation with Indigenous groups and relevant authorities. The Agency tracks and reports on these follow-up programs to determine whether the impacts of the project were accurately predicted. This work helps the Agency understand if the conditions were effective in preventing negative effects. Decision statements can also provide a time limit within which the proponent must develop the project (Government of Canada, 2022^[63]).

The decision statement is a legally binding document. The Agency monitors the proponent’s compliance with the decision statement through inspections. If the proponent does not comply with the decision statement, it is a violation of federal law and the proponent may be fined (Government of Canada, 2022^[66]).

Figure 5.1. Impact Assessment Process Overview



Source: (Government of Canada, 2022^[65])

5.1.3. Regional and strategic assessment

The Impact Assessment Act allows for the conduct of regional and strategic assessments. Either the Minister of Environment and Climate Change establishes a committee for this type of assessments, or the Minister may authorize the Impact Assessment Agency of Canada (the Agency) to conduct the assessment (Government of Canada, April 2022^[67]).

Regional assessments assess the effects of existing or future physical activities carried out in a region. They also evaluate the cumulative effects of development in a certain territory. Strategic assessments examine the Government's existing or proposed policies, plans, or programs relevant to the impact assessment. The first strategic assessment undertaken by the Government of Canada will be on climate change. It will lay out how climate change considerations will be integrated in the impact assessment process and in determining whether a project is in the public interest. This will include determining how Canada's climate change commitments under the Paris Agreement and the Pan Canadian Framework on Clean Growth and Climate Change will be considered in project reviews (Government of Canada, 2018^[68]).

Both assessments are considered when evaluating the impacts of a given project. In particular, strategic assessments help to better align projects with existing environmental frameworks that protect different aspects of the environment, such as the fight against climate change or the protection of biodiversity. They can also support the early planning of the impact assessment process, including the identification of issues and information requirements (Government of Canada, 2018^[68]).

5.1.4. The Climate Lens - General Guidance

In 2022, Canada developed a so-called "climate lens" instrument. The purpose of the climate lens is to deliver direction to project proponents or applicants who need to undertake a Climate Lens valuation. The purpose of the climate lens guidance is to:

- Explain the purpose of the Climate Lens and which projects are subject to the requirement;
- Provide information on when and how to submit completed assessments to Infrastructure Canada;
- Describe the requirements for conducting the greenhouse gas (GHG) mitigation assessment component of the Climate Lens;
- Describe the requirements for conducting the climate change resilience assessment component of the Climate Lens.

The Climate Lens has two components: the *GHG mitigation assessment*, which measures the expected GHG emissions effect of an infrastructure plan, and the *climate change resilience assessment*, to anticipate disturbances (Government of Canada, 2022^[69]).

Table 5.1. Main guidance documents in Canada for environmental assessments

Sector	Guidance	Institution	Date	Source
General	Impact Assessment Process Overview	Government of Canada	2019/2022	https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/impact-assessment-process-overview.html
	Climate Lens		2022	https://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/climate_lens_general_guidance_version_122.pdf

5.2. France

France has developed a system for the supervision and monitoring of investment projects for public investments. As part of this, a classification method of these investments was included in the green budget annexed to the finance law, which could be of interest to Ireland, particularly as it relates to the Strategy and Planning phase of the infrastructure project life cycle. This procedure is interesting for Ireland as it integrates environmental objectives into the selection of public investment projects, with specific guidance for transport infrastructure. In addition, the French green budgeting process incorporates assessment criteria for investments that are aligned with the environmental objectives of the public sector.

5.2.1. Context and legal framework

Since the law of 10 July 1976 on the protection of nature, which, for the first time, established the need for an impact study, the methods for environmental assessment have been profoundly modified by the law of 12 July 2010. This latter introduced an examination of projects in order to better transpose European regulation. Ordinance of 3 August 2016 completes the changes initiated and transposes Directive 2014/52/EU.

The Decree of 29 June 2021 amends several provisions of the Environmental Code relating to public debate, environmental assessment and public enquiry.

5.2.2. Procedure

Public or private projects relating to the implementation of investments, works or structures that may affect the natural environment must include an impact study to assess their consequences on the environment. Depending on several criteria, a project will be subject to an impact study, an impact notice (lighter administrative procedure) or be exempt from any procedure in certain circumstances.

5.2.3. Impact Assessment for green investment integrated in the green budget initiative

In 2020, France published its first report on the environmental impact of the central government budget using positive, negative, mixed and neutral classifications according to six environmental objectives including adaptation and mitigation to climate change. For example, most of the mixed expenditure is capital expenditure with a favourable medium-term impact in terms of climate objectives, even though the work generates short-term environmental damage. This is the case for major public transport infrastructure projects.

According to whether they cause a negative or positive effect on any of these 6 dimensions and to the kind of impact they have (i.e. short-, medium-, long-term), government expenditures are tagged as (French Government, September 2020^[70]):

- **Favourable expenditures:** this category covers three types of expenditure:
 - Environmentally targeted expenditures or expenditures contributing directly to the production of an environmental good or service (green activity);
 - Expenditures with no explicit environmental target, but with an indirect positive impact;
 - Favourable but controversial expenditures with favourable short-term effects but a potential technology lock-in risk in the long term.
- **Neutral expenditures:** expenditures with no significant impact on the environment; no information or insufficiently substantiated information to determine a favourable or unfavourable effect on the environment.

- **Unfavourable expenditures:** expenditures causing direct harm to the environment or creating incentives for environmentally harmful behaviour.
- **Mixed expenditures:** expenditures with favourable and unfavourable impacts on the different environmental objectives/criteria used for evaluation.

Most of mixed expenditure is capital expenditure with a favourable medium-term impact in terms of climate objectives, even though the work may generate short-term environmental damages. This is the case for major public transport infrastructure projects (French Government, September 2020^[70]). Regarding the expenditures on transport infrastructure, the French approach takes into account the diversity of modes of transport and the different energy sources on which they rely (the use of a decarbonised energy source or a mode of transport with lower emissions than road transport leads to a favourable rating on the Climate mitigation and Climate adaptation). It also considers the life cycle of the infrastructure, and therefore all the induced effects, including emissions, during the construction phase (see Box 5.2).

Moreover, the budgetary appropriations favourable to the environment cover spending for:

- The development of green infrastructure and mobility (EUR 1.4 billion on the Recovery Plan mission);
- The taxes allocated to the French Transport Infrastructure Financing Agencies (*Agence de financement des infrastructures de transport de France*), earmarked for the most environmentally friendly projects (rail and public transport in particular) for EUR 0.8 billion.

With regard to expenditure on transport infrastructure, the French scenario takes into account the diversity of modes of transport and the different energy sources on which they rely (the use of a decarbonised energy source or a mode of transport with lower emissions than road transport leads to a favourable rating on the Climate mitigation and Climate adaptation) as well as the life cycle of the infrastructure, and therefore all the induced effects, including emissions, during the construction phase (See Box 5.2).

Box 5.2. The example of the investments of the mission Ecology, Development and Sustainable Mobility

The “Ecology and Sustainable Development and Mobility” mission covers most of the expenditures relating to the environment and climate. The proposed appropriations for this mission (including the relevant earmarked account and the specific budget) stand at EUR 27.6 bln in 2021. Most of the expenditures under this mission are favourable for the ecological transition. They stand at EUR 18.2 bln in the 2021 Budget Bill. They consist primarily of expenditures on renewable energy sources (EUR 6.9 bln), earmarked taxes for water agencies (EUR 2.2 bln), expenditures to promote the ecological transition, especially the energy efficiency bonus (EUR 1.5 bln), and the Ministry’s payroll and operating expenditures related to ecological policies (EUR 1.0 bln). The car-scrapping bonus in particular has been tagged as favourable for the Climate and Pollution Objectives, as is the case for the automobile bonus, which is part of the same action. This tagging is warranted by the favourable environmental impact of replacing older vehicles with greener new ones.

The decision was made not to tag these expenditures as favourable for the Climate Mitigation Objective and unfavourable for the Waste Objective, given the possibility that the bonus will lift automobile sales and increase vehicle production. This mission also concerns expenditures with mixed impacts on the environment, accounting for the ambivalent effects of certain expenditures with regard to the different environmental objectives. Most of the mixed expenditures are those for new transport infrastructures, especially for rail transport (EUR 3.8 bln in the 2021 Budget Bill). In the medium term, these expenditures reduce the carbon footprint of mobility and transport, but their construction results in waste in the short term and takes up land that has a negative impact on biodiversity. These expenditures in

the 2021 Budget Bill include EUR 2.5 bln for rail, EUR 0.8 bln in earmarked taxes for the Société du Grand Paris and EUR 0.5 bln for the share of expenditures on rail and waterway projects in the budget of the French Agency for Transport Infrastructures Funding (AFITF).

Tax expenditures due to the reduced rate of the domestic tax on the consumption of energy products applied to biofuels (EUR 240 mln in 2021) were tagged as unfavourable for the Biodiversity Objective and favourable for the Climate Objective. Some EUR 4.9 bln of the expenditures under this mission in the 2021 Budget Bill have an exclusively unfavourable environmental impact. This concerns tax expenditures totalling EUR 2.6 bln in the 2021 Budget Bill to boost the competitiveness of certain business sectors. The main environmentally unfavourable tax expenditures relate to reduced rates of the domestic tax on the consumption of energy products for goods vehicles (EUR 1.3 bln) and to tax breaks for energy-intensive production facilities (EUR 0.7 bln). Some budget appropriations are also tagged as unfavourable for the environment. These include solidarity expenditures for areas that are not connected to the national electricity grid (EUR 1.5 bln), since they finance electricity generation with higher carbon emissions than average. Investment expenditures funded out of the specific budget for “Air Traffic Control and Operations” are tagged as unfavourable for the Climate Mitigation and Climate Adaptation Objectives, as well as the Pollution Objective, since they promote the expansion of air transport, as do expenditures on air transport funded under Policy Programme 203 (EUR 41 mln in payment appropriations). Expenditures on operations funded out of the specific budget are deemed to cover operation of existing capacities, therefore are consequently tagged as neutral.

Source: (Ministry of Economy, Finance and Recovery of France, 2021^[49])

Going forward, the objective for green budgeting is to take stock of results of the 2020 exercise, consider how to refine the methodology and possibly broaden the scope of the analysis and its reliability. For example, the rating of expenditures that were initially assessed as having a neutral environmental impact, such as spending on government properties, could be reassessed (Lelong and Wendling, 02 November, 2020^[71]).

As green budgeting will be a yearly exercise, it will be possible to compare budgets from one year to another. Accordingly, with time and practice, the method will get standardized, and it will strengthen its potential to guide the country’s efforts towards environment protection.

5.2.4. A new methodological approach to quantify emissions impact of projects

In 2022, the French Ministry for the Ecological Transition launched a new guide to assess the impacts of projects on GHG emissions. The aim was to ensure an effective consideration of emissions impacts in the environmental assessments of projects, as well as to make public investments better aligned with the GHG emissions reduction trajectory defined by the National Low Carbon Strategy (NLCS). The new methodological approach is rigorous and transparent, and it quantifies the emissions generated and/or avoided by a project over the widest possible perimeter and for each stage of the project’s lifecycle (i.e. design, construction, operation and dismantling) (Ministère de la transition écologique of France, 2022^[72])

The impact of a project on GHG emissions is assessed on the basis of its contribution to increasing or decreasing GHG emissions or to the removal of GHG emissions. Therefore, within the framework of an impact study, there is a focus on evaluating the difference in GHG emissions between a situation without the project (i.e. baseline situation) and a situation with the project. In order to do so, the new methodological guide launched by the French Ministry for the Ecological Transition proposes 7 steps (Ministère de la transition écologique of France, 2022^[72]):

The definition of the study area (i.e. perimeter)

The scope for the analysis is mainly defined according to three different criteria:

- **Type of GHG emissions:** the greenhouse gases to be considered in the analysis are those identified in the framework of the international climate agreements, i.e. the Paris Agreement. These include Carbon dioxide, methane, nitrous oxide, Hydrofluorocarbons, Perfluorocarbons, Sulphur hexafluoride, nitrogen trifluoride. GHG emissions are then to be converted into CO₂ equivalents using the Global Warming Potentials (GWP) proposed by the International Panel on Climate Change (IPCC) and established within the framework of the UN Climate Change Convention (UNFCCC).
- **Temporal scope:** for the analysis of impacts on climate, the calculation of GHG emissions of a project must cover its entire lifecycle, including the construction phase (feasibility studies, design, implementation, up until the commissioning of the project), the operating phase (i.e. operations, maintenance, servicing, renewal of use of the project), and the end-of-life phase (where appropriate, this includes activities carried out at the end of the operational phase, such as deconstruction, transport and waste treatment of project materials and equipment, as well as rehabilitation of occupied land)²⁴. Moreover, emissions estimates are to be presented both through a chronicle of annual emissions expressed in tons of CO₂ equivalent for each of the project's phase and through the estimated quantity of cumulative emissions over the entire lifecycle of the project.
- **Spatial scope of emission sources:** the analysis shall include all emissions generated and/or avoided as a result of the project, directly and indirectly, on and off site.

Description of the initial state of the environment

This step consists in the identification of the emissions for the scenario “without the project”. The assessment is done on the basis of (i) the most relevant available emission balances, (ii) the project's area of influence (e.g. national, regional, local, cross-border or even international), and (iii) the objectives and guidelines contained in planning documents. Additionally, a critical review of the data used is also conducted, including an analysis and description of limitations and uncertainties.

Definition of scenarios with and without project

This step includes the description of the evolution of the initial state of the environment, if the project is implemented, as well as an overview of the likely evolution of the environment in the absence of project's implementation. The scenario “without the project” is defined as the most likely GHG emissions trajectory of the study area in the absence of the project, while the “with the project” scenario corresponds to the most likely GHG emissions evolution trajectory of the study area plus the quantified estimate of the project's GHG emissions.

A sensitivity analysis shall also be carried out to determine whether a change in the assumptions underpinning both scenarios might have a significant effect on the final results.

Determination of significant emission categories for each scenario

For each emissions scenario, and on the basis of a pre-quantification of each emissions type, the project developer must define and justify the choices of significant emissions categories taken into account in the calculation of GHG emissions for the study area.

²⁴ However, when a new project is installed on the perimeter of an old project, the end-of-life phase of the old project (demolition for example) must be included in the work phase of the new project (construction phase)

In France, there exist both general and sectoral guides recommending specific procedures to determine significant GHG emissions.

Quantification of emissions and estimation of uncertainties for each scenario

This step consists of quantifying emissions, for each scenario, taking into account existing sectoral guides and databases or expert estimates available for cases that are similar or equivalent to that of the project under analysis.

The 2022 guidance proposes a specific method to calculate emissions generated and/or avoided in both scenario, these include:

- Collecting and gathering data and models that are appropriate for the different activities (or operations) related to the construction, operation and end-of-life phases of the project;
- Estimating the quantity of GHG emissions produced for each operation/activity – this includes the quantification of GHG emissions generated by emission sources (+) and GHG emissions absorbed in carbon sinks (-);
- Summarising the values obtained.

For a given operation, emissions are the product of an activity data, expressed in a unit of work characterizing the activity of the emission type (i.e. quantities of materials used, transportation of raw materials, fuel consumption of vehicles, etc.), and an emission factor which reflects the unit emissions per unit of work.

$$\text{GHG emissions (in tCO}_2\text{e)} = \text{activity data (in tons or m}^3\text{)} \times \text{corresponding emission factor (tCO}_2\text{e/quantity)}$$

Calculation of project impact (the differential between with and without the project scenarios)

The GHG impact of a project is calculated as the difference between the cumulative GHG emissions of the scenario “with the project” and the cumulative GHG emissions of the scenario “without the project”. Moreover, the GHG emissions impact of the project is quantified per year for each project phase, as well as for its entire lifecycle.

Definition of ARC and monitoring measures

The impact study must also provide a description of Avoid-Reduce-Compensate (ARC) measures and quantify their expected effects. These measures will help to

- Avoid significant adverse effects of the project on the environment and human health;
- Reduce unavoidable effects;
- Compensate for any significant adverse environmental and health effects of the project that could neither be avoided nor sufficiently reduced

The ARC sequence aims to design projects with the least environmental impact. It applies to all components of the project, from the construction phase to the decommissioning phase, including the operating phase. As general rule, if the quantification of GHG emissions from the project results in significant impacts, the application of the ARC sequence is mandatory.

The 2022 guidance also recommends defining monitoring measures concerning the implementation of ARC measures and their effectiveness. The project developer is required to therefore indicate the relevant criteria for monitoring both these two aspects. In case of insufficient results or drift with respect to the planned actions, he shall develop and propose corrective or complementary measures.

Table 5.2. Main guidance documents in France for environmental assessment

Sector	Guidance	Institution	Date	Source
General	Guide de l'évaluation socioéconomique des investissements publics	Secrétariat général pour l'investissement	Dec - 2017	www.strategie.gouv.fr/publications/guide-de-levaluation-socioeconomique-investissements-publics
Transport	Fiches outils du référentiel d'évaluation des projets de transport	Ministère de l'Équipement, des Transports et du Logement	Jul - 2020	www.ecologie.gouv.fr/evaluation-des-projets-transport
	Recommandations pour l'évaluation socioéconomique des projets de TCSP	Ministère de l'Équipement, des Transports et du Logement		www.scribd.com/document/243815417/CERTU-Recommandations-pour-l-evaluation-socio-economique-des-projets-TCSP-pdf

5.3. Italy

In 2021, within the process defining the Recovery and Resilience Plan and considering the new principles and conditions attached to the Next Generation EU Plan, the Italian Ministry for Sustainable Infrastructure and Mobility (MIMS) has developed **a new evaluation and planning framework to promote sustainable infrastructure**. This included the revision of the guidelines for the ex-ante assessment of public works, new operational guidelines specific to the different sectors under the Ministry's competence (i.e. railway, road transport, etc.), as well as a new scoring mechanism to define an order of priority for public investments in infrastructure.

In brief, MIMS revised existing planning instruments and introduced new tools to give more relevance to sustainability, including environmental sustainability, when planning and financing infrastructure projects.

5.3.1. Ex-ante evaluation: the feasibility project

The new guidelines for the ex-ante evaluation of public investments ask the project's proponents to draft a feasibility project. The latter includes an assessment of the project along its key dimensions - economic and financial, social, environmental, institutional and governance –, a sectorial analysis. It also compares different design alternatives. The results of this preliminary analysis will be used in the process of informing the screening phase (i.e. whether a given project will be financed or not) and the scoring mechanism (SIMS), which helps define an order of priority for project financing on an annual basis (Ministero delle Infrastrutture e della Mobilità Sostenibili, 2022^[73]).

With regards to the environmental dimension of the project, both positive and negative impacts are assessed:

1. The project's significant contribution to the six environmental objectives defined by the European Commission in the EU Taxonomy (i.e. climate change adaptation and mitigation, circular economy, water resources, pollution, biodiversity and ecosystems);
2. Project's compliance with the Do No Significant Harm (DNSH) Principle for all the six environmental objectives.

Moreover, the feasibility project includes a carbon footprint estimate for the construction phase of the project - through a certification scheme²⁵ - and an assessment of the emission balance of the project along its entire lifecycle, including the operation phase. Emission impacts are then compared across different scenarios, including the "do-nothing" (i.e. the project is not implemented) (Ministero delle Infrastrutture e della Mobilità Sostenibili, 2022^[73]).

²⁵ The estimates must be validated by a third party certifier according to internationally recognized protocols and standards.

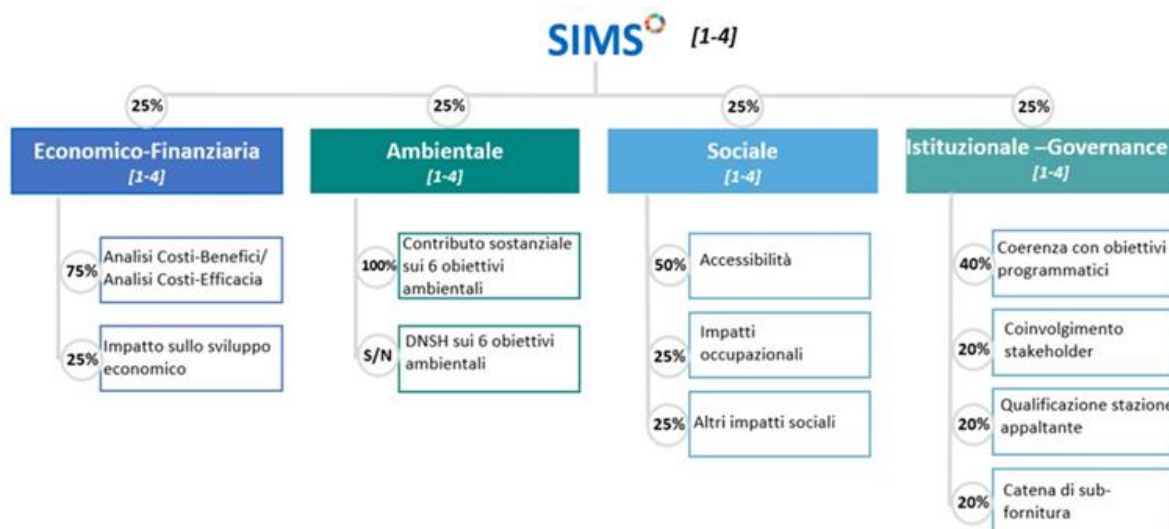
5.3.2. The new scoring mechanism: SIMS²⁶

The new scoring system proposed by MIMS, also known as SIMS, is based on multi-criteria and contributes to the definition of an order of priority for project financing. It assesses projects across four different dimensions, which include sub-domains with their specific components of analysis, indicators and qualitative information. The four dimensions are outlined below.

- **Economic-financial dimension**, which considers the results of the cost-benefit analysis (CBA) and cost-efficacy analysis (CEA), as well as the analysis of the project's impacts on the territory's economic development;
- **Environmental dimension**, which considers both the substantial contributions to one or more environmental objectives as defined by the EU Taxonomy and compliance with the DNSH Principle (See Box 5.3).
- **Social dimension**, which considers the project's impacts on accessibility, territorial inequalities, employment and potential benefits to the people involved;
- **Institutional and governance dimension**, which is broken down into the level of coherence with national and European strategic orientations, stakeholder engagement, qualification level of the contracting authority, and control mechanisms on the supply chain or other indicators for the quality of governance.

The evaluation of each sub-domain is performed on a discrete scale of 4 levels [1 min; 4 max], that is continuous and linearly increasing. The final rating is a weighted average of the scores received on each of the four dimension, which is in turn determined by the score received in each sub-domain (see Figure 5.2) (Ministero delle Infrastrutture e della Mobilita' Sostenibili, 2022^[73]).

Figure 5.2. SIMS



Source : (Ministero delle Infrastrutture e della Mobilita' Sostenibili, 2022^[73])

The weight structure is intended to be flexible enough to reflect the evolutions of the Ministry's objectives and priorities. In order to ensure some standardisation of the qualitative and quantitative criteria used for scoring, MIMS has developed guiding grids. This helps promote homogeneity of the final results, and it is

²⁶ As previously mentioned, the scoring mechanism is informed by the analyses and content of the feasibility project.

key to reduce subjectivity and ensure comparability of projects across different sectors (Ministero delle Infrastrutture e della Mobilita' Sostenibili, 2022^[73]).

The scoring system can also support monitoring activities in the construction phase of the project to keep track of expected impacts and/or check on compliance with commitments made at the proposal stage (for example, the use and recycling of materials, control over the sub-supply chain, employment impacts, stakeholder involvement). Results can then be shared with the project's proponent, the contracting authority and other entities in charge of implementation (Ministero delle Infrastrutture e della Mobilita' Sostenibili, 2022^[73]).

Box 5.3. Evaluation of the environmental dimension (according to operation guidelines for railway transport)

For ex-ante valuation of project along the environmental dimension, the main references are the InvestEU regulation and the EU Regulation 2020/852. As per the original plan, the assessment process considers both the positive and negative impact of a given project on the environment. On one side, it evaluates the “substantial contribution” to one or more of the six environmental objectives²⁷ identified by the EU Taxonomy. On the other side, it verifies compliance with the DNSH Principle.

To evaluate the “significant” contribution to the six environmental objectives, the following steps are taken:

1. The technical screening criteria adopted by the EC in the Delegated Regulation 2021/2139 of 4 June 2021 are used to determine the “substantial” contribution of the intervention to climate change adaptation and mitigation (to be supplemented with any technical screening criteria for environmental objectives relevant to the sector as soon as the relevant Delegated Regulation by the Commission is available);
2. Calculation of the percentage of this contribution on a scale from 0% to 1%.

To assess compliance with the DNSH, the procedure suggested by the EC is as follows:

1. A preliminary assessment to determine whether an intervention might cause significant damage to one of the environmental objectives;
2. If so, a more detailed assessment of the intervention is undertaken in order to confirm the negative impact, and thus to exclude the intervention from eligibility for funding.

Source: (Struttura Tecnica di Mission per l'indirizzo startegico, lo sviluppo delle infrastutture e l'alta sorveglianza, 2021^[74])

5.4. New Zealand

In order to strengthen the role of cost benefit analysis (CBA) in public sector decision-making, the New Zealand Treasury developed the **CBax Tool**, which is an excel-spreadsheet model with a database of values to help agencies monetise costs and benefits. The Tool improves the robustness and reliability of the cost-benefit analysis and offers an important support to agencies for the monetisation of environmental impacts. Due to the inherent complexity, uncertainty and dynamic nature of environmental and climate aspects, their translation into monetary terms is a common challenge for those responsible for project appraisal.

²⁷ Climate change mitigation, climate change adaptation, sustainable use and protection of water and marine resources, transition towards the circular economy, prevention and reduction of pollution, ecosystem and biodiversity protection and restoration (article 9 of the EU Regulation 2020/852).

5.4.1. The CBAX Tool (by the Treasury)

The New Zealand Treasury released the first version of the CBAX Tool in October 2015. A new version was presented in September 2021. The Tool was designed specifically with social sector agencies²⁸ in mind, but it can also help calculate present values for many initiatives. It contains publicly available data from New Zealand that can be used to value many types of impacts (i.e. benefits (or savings) and costs). Examples include the costs of an emergency department visit, the cost of the Jobseeker Support benefit and increased income for individuals. The CBAX Tool also allows individual users to add their own values for impacts into the model (New Zealand's Treasury, September 2021^[75]).

Various agencies helped develop the values contained in the Tool using different valuation methodologies, including non-market valuation such as surveys (i.e. the General Social Survey). Values have then been adjusted to reflect a common time period.

The Treasury welcomes suggestions on CBAX, also on the basis of the practical experience in using it. It invites suggestions on data and information for inclusion in the CBAX impacts database. This may be information that is available and can be shared, or it may be a request for values that would be of benefit to the wider public. Moreover, the Treasury will review and update the Tool on an annual basis, including reviewing the impacts database to consider other costs and benefits (New Zealand's Treasury, 2021^[76]; New Zealand's Treasury, September 2021^[75]).

Besides being an instrument to help agencies in the monetisation of costs and benefits, including environmental and climate impacts, the CBAX tool has also the advantage of making the CBA more robust, transparent and consistent across the different sectors, as it provides common values and assumptions. Moreover, it encourages a longer-term perspective. This is key in ensuring an adequate assessment of environmental costs and benefits which are more likely to accrue over the long term (New Zealand's Treasury, 2021^[76]; New Zealand's Treasury, September 2021^[75]).

5.4.2. Climate change and environmental impacts in the CBAX Tool

Climate change impacts (by the Treasury)

The CBAX Tool includes recommended values for emission valuation, also known as “shadow emission values”. These are based on the estimates of the future costs of emission reduction (abatement) required for the country to reach its domestic emission targets. This is reflected in the Climate Change Commission’s final advice²⁹ (i.e. net zero emissions by 2050) (New Zealand's Treasury, 2021^[76]). Values will be annually updated as knowledge of abatement costs for New Zealand improves (see Figure 5.3).

²⁸ “Social sector” refers to all development and welfare activities and includes inter alia, health, education, water supply, transport, agriculture and allied activities, infrastructure, irrigation, management of natural resources such as water, forest, land, energy, welfare schemes and services, etc. provided by government and non-government entities.

²⁹ For more information, see <https://www.legislation.govt.nz/act/public/2002/0040/latest/DLM158584.html>

Figure 5.3. Recommended Shadow Emission Values, NZD\$ (2021) per tonne of CO₂-equivalent

Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Low	59	65	72	78	85	91	98	104	108	112	116	120	124
Central	87	97	107	116	126	136	146	155	161	167	174	180	186
High	171	182	193	203	214	219	224	230	235	241	247	253	259

Year (cont.)	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Low	129	133	137	141	145	149	153	157	161	165	169	173	178	182	186
Central	192	198	204	210	216	222	228	235	241	247	253	259	265	271	277
High	265	271	278	284	291	298	305	313	320	328	336	344	352	361	369

Year (cont.)	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060
Low	188	189	191	193	195	197	199	201	203	205
Central	286	294	303	312	321	331	341	351	362	373
High	387	407	427	448	471	494	519	545	572	601

Year (cont.)	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070
Low	207	209	211	214	216	218	220	222	224	227
Central	384	395	407	419	432	445	458	472	486	501
High	631	662	695	730	767	805	845	887	932	978

Note: the table shows the recommended target-consistent shadow emission value range to monetise the impact of emissions or avoided emission in CBA. A 'low' and 'high' path have been provided to reflect the uncertainty around future abatement costs (e.g. through new or different technologies or inherent future technology cost uncertainty). Importantly, going further into the future, the uncertainty around abatement costs increases. For those policies and investments with emissions impacts expected to occur beyond 2050, the CBAX Tool User Guidance recommends applying a 3% per annum increase from the recommended value for 2050. For the 'high' case, it recommends a 5% increase and for the 'low' case a 1% increase

Source: (New Zealand's Treasury, 2021^[76])

For each year, a range of values are provided to reflect the uncertainty of future abatement costs in New Zealand, including (i) the impacts of future technologies on abatement cost; (ii) the nature of international trading arrangements and prices; (iii) uncertainties over future government policy choices, such as the relative mix of ETS, complementary policies, or international emission trading. The low, central, and high price path enables agencies to undertake a **sensitivity analysis** for new policies and investments, analyse the difference in results and provide range around the central value (see Box 5.4). The sensitivity analysis allows to consider the impact of changing key assumptions (i.e. shadow price of emissions) on the viability of the investment, and agencies can directly use the *Sensitivity Analysis* tab in the excel-spreadsheet to capture the different results (New Zealand's Treasury, 2021^[76]).

Box 5.4. Apply the shadow emissions values in the CBAX tool

Agencies can choose to incorporate these values in the CBAX tool in two ways:

1. Segmenting into three time periods (i.e. (i) present to 2030, (ii) 2031 to 2050, (iii) beyond 2050) and using the relevant values in the CBAX database. In this case, agencies can directly use the standard CBAX functionality in the excel-spreadsheet (see Figure 5.4)

Figure 5.4. Shadow emissions values, segmented by time period

Time period	Sensitivity	\$/tonne (2021\$)	CBAX database row
Present – 2030	Low	97	220
	Central	145	221
	High	192	222
2031 – 2050	Low	173	223
	Central	258	224
	High	343	225
2050 – onwards	Low	211	226
	Central	466	227
	High	911	228

2. Full yearly time series by overriding the CBAX calculations with separate calculations. In this case, the risk of making mistakes (i.e. wrong calculations) increases

Source: (New Zealand's Treasury, 2021^[76])

Wider environmental values (by the Ministry for the Environment)

To broaden the scope of the analysis and better assess the long-term outcomes for sustainability, the CBAX Tool includes environment-related impact values. These were developed with the support of the Ministry of the Environment; the Ministry will further expand and refine them over time. The Tool does not yet cover key environmental domains, such as biodiversity and habitat loss, the value of recycling materials and marine resources. As of currently, environmental values cover (see Box 5.5) (New Zealand's Treasury, 2021^[76]):

- Waste – landfill costs;
- Wetland ecosystem services – cost of replacement;
- Urban development – benefits of agglomeration (productivity) and costs from congestion and water pollution;
- Freshwater quality – benefits from cleaner water.

All are primarily tied to the benefit of preserving and improving natural capital, though the cost of further wetland loss is expressed as replacing natural capital with physical capital (i.e. grey infrastructure).

Box 5.5. Environmental impacts values in the CBAX Tool

Waste

The cost for waste flow to four landfill types incorporates the Government's decision to increase and expand the national waste disposal levy. The CBAX impact values are the estimated total charges at the landfill gate, including the levy.

Wetland

The cost of further wetland loss reflects the estimated annual cost per hectare of replacing valuable ecosystem services for flood protection with new physical infrastructure for that purpose.

The other environmental impacts

The other environmental impacts use non-market valuation, such as preference surveys. These monetised values should be regarded as indicative estimates, not exact numbers. They allow evaluation of different policy settings by comparing these non-market benefits and costs against those more readily identifiable in financial terms.

In some cases, the values were also selected from multiple possible options. For example, the freshwater values are the estimated marginal benefit for a 1% improvement in 'good outcomes' for the three selected indicators.

Two studies from Lincoln University's Agribusiness and Economics Research Unit (AERU) explain in detail the careful steps required to arrive at these monetised values. Overall, the approaches adopted are widely applied internationally, and their results are consistent with the established body of literature in New Zealand

Source: (New Zealand's Treasury, 2021^[76])

5.5. The Netherlands

The Netherlands has a long-standing tradition of using Cost-Benefit Analysis (CBA). This tool has been supporting decision-making for public investments for almost a century now. Within the CBA, however, the projects' impact on nature has long been disregarded. Nonetheless, biodiversity and ecosystem services are now increasingly being considered in the analysis of the social costs and benefits of public projects.

5.5.1. Background

Up until the 1970s, Dutch CBAs mainly pertained to major investments in flood risk management but impacts on nature were usually not included. Reporting environmental effects of public investments, including those on nature, started in 1978 when NEI and RIN presented an Environmental impact analysis (EIA) and a CBA comparing the extension of the port of Den Helder with alternative solutions in the ports of IJmuiden and Rotterdam. Most effects on nature were given in physical terms, which were presented next to monetary costs and benefits. Some effects on nature were monetized, in particular the foregone revenues of fishing, the loss of shell lime production and the loss of water cleaning capacity. The impact of a new port on five basic functions of nature (production function, intermediary and supporting function, informative function, regulatory function and conservation) (Bos and Ruijs, 2019^[77]).

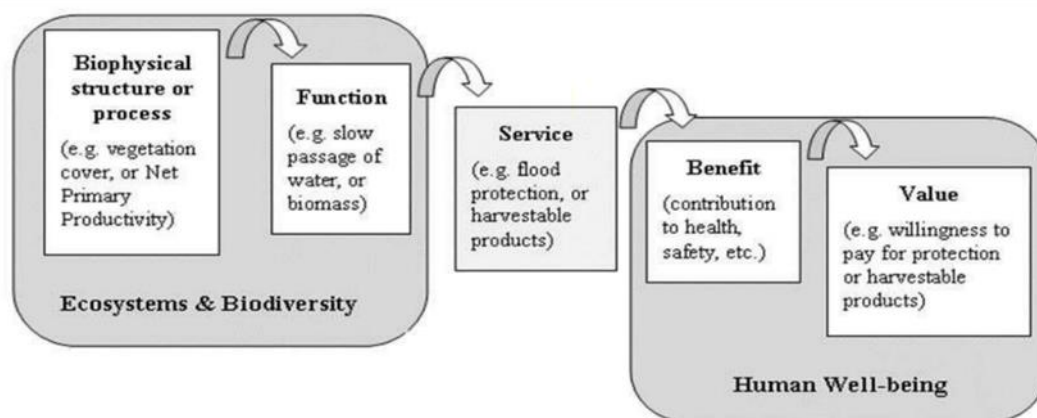
The first national guidelines on CBA were launched in 2000, but did not explicitly discuss projects' effects on nature. These kinds of evaluations were separately addressed in a supplementary guidance that focused exclusively on transport infrastructure projects. Moreover, due to the shortage of data and a lack of primary valuation studies, any attempts to consider impacts on nature resulted in arbitrary assumptions or token entries. The values thus obtained already suggested that the nature effects were relevant but no reliable monetary value could be estimated. In other cases, impacts on nature were double counted or other errors were made in quantifying and valuing the welfare effects in terms of costs and benefits (Bos and Ruijs, 2019^[77]).

In 2013, an updated CBA guidance was published by the Netherlands Bureau for Economic Policy Analysis (CPB) and the Netherlands Environmental Assessment Agency (PBL). This included a brief discussion of accounting for the impact on nature. The topic was then addressed more in-depth in the **supplementary guidelines on CBA and nature**, published in October 2018 (Bos and Ruijs, 2019^[77]).

5.5.2. The 2018 Handbook on CBA and nature

The 2018 Handbook provides a guide **to analyse and quantify the welfare changes resulting from changes in biodiversity and/or ecosystem services** (see Box 5.6) (Klooster et al., 2018^[78]).

Figure 5.5. From physical nature effects (leading to changes in biophysical structures and/or processes) to monetised welfare effects



Source: (Klooster et al., 2018^[78])

More specifically, the Handbook proposes a 6-step scheme (see Table 5.3) to translate projects' physical impacts on nature into monetised welfare effects with the CBA. It also discusses the different tools available for the assessment and evaluation of such effects (i.e. the materiality matrix, existing guidelines for quantifying changes in ecosystem services, the nature points methodology, different valuation methods to express the welfare effects – in monetary terms - of changes in ecosystem services), and it suggests the most appropriate ones to use according to the different case at stake.

Table 5.3. Actions to move from physical nature effects to welfare effects

ACTIONS	ZERO ALTERNATIVES	POLICY ALTERNATIVES
Determining physical effects on nature and welfare effects through changes in ecosystem services and biodiversity		
A	Define the current state of nature in the area of influence (i.e. the area where physical effects occur) in terms of land use and quality thereof.	Identify the intended physical impacts on nature for the different alternatives, in terms of change of land use and change of quality within a land use category
B	Identify the relevant ecosystem services per land-use category (by means of a materiality matrix). Note: It is important to distinguish between intermediate and final services	Identify the relevant ecosystem services for each new or changed land-use category (by means of a materiality matrix). Note: it is important to distinguish between intermediate and final services.
C	For the relevant ecosystem services identified (and, where appropriate, the intermediate ones), determine the qualitative or, preferably, quantitative ecosystem services provided. Where this is (partly) not feasible, biodiversity can additionally be quantified separately	For each alternative, determine the qualitative or, preferably, quantitative ecosystem services provided for the relevant final ecosystem services (and, where necessary, the intermediary ones). Where this is not (or only partly) possible, biodiversity can also be quantified separately
Comparing and monetizing welfare effects		
D	Identifying the differences in the provision of final ecosystem services and/or biodiversity between the baseline situation and the alternatives	
E	Valuing the change in final ecosystem services by determining the willingness to pay for the final ecosystem service	
F	Check step to ensure that all relevant ecosystem services are included in the analysis and that there is no double-counting	

Source: (Klooster et al., 2018^[78])

Action C is about quantifying the changes in ecosystem services and biodiversity. For changes in ecosystem services, the method to use strongly depends on the ecosystem service at stake. For this reason, the 2018 Handbook only presents available sources to consult for more in-depth guidance. For changes in biodiversity, the Handbook suggests using the biodiversity points methodology.

Biodiversity points is an innovative practice that helps enrich the scope of CBA by offering a robust methodology to measure the volume and quality of ecosystem services and biodiversity. It also opens the way to the integration of the information and data collected in impact studies - such as strategic environmental assessments and environmental impact assessments - into the project appraisal process, for example in cost-benefit or cost-effectiveness analyses.

Box 5.6. Biodiversity, ecosystems services and welfare effects

Biodiversity can be defined as the variation, size and quality of species, populations and ecosystems. Projects or policies that lead to a change in the size or quality of nature affect biodiversity, which in turn has a direct and/or indirect impact on the provision of ecosystem services. For example, a loss of biodiversity can lead to a loss of regulating services such as pollination, natural pest control and erosion protection, thus affecting the resilience of the ecosystem. This indirectly leads to a loss of the production services provided. In addition, many people value maintaining species diversity and passing it on to future generations. Thus, biodiversity also contributes directly to the cultural ecosystem services that nature provides. After twenty years of research, however, the exact relationship between biodiversity and ecosystem services is yet not entirely clear. Biodiversity plays a fundamental role in the functioning of ecosystems, but, as of today, the exact relationship between biodiversity and ecosystem services can only be quantified to a limited extent. Moreover, this relationship is often non-linear.

In general, regulating ecosystem services benefit from increased biodiversity. This is certainly true over the long term as higher biodiversity supports ecosystem resilience. However, production services (i.e. agriculture, forestry) can also produce high yields with relatively low biodiversity. In the case of cultural ecosystem services, the relationship varies by ecosystem service. In general, cultural services

benefit from more biodiversity, although this does not always apply to recreational services. In addition, there may be synergies between ecosystem services, as well as trade-offs. Such trade-offs are particularly evident between production services (such as agricultural production) and regulatory services.

Because of the difficulty in estimating the exact contribution of the change in biodiversity to the change in wealth, a fall-back option is provided to visualize the effects on biodiversity through the natural points method.

Source: (Klooster et al., 2018^[78])

5.5.3. Biodiversity points

The biodiversity point method was developed in the Netherlands in 2009 and it measures the amount and quality of ecosystem services and biodiversity and their changes (i.e. projects' impacts) in a standardized way. Its use is recommended by existing Dutch guidelines on CBA (Bos and Ruijs, 2019^[77]; Sijtsma et al., 2009^[79]; Klooster et al., 2018^[78]).

The biodiversity points are calculated by multiplying three components:

- The area of natural or semi-natural ecosystems affected (in hectares or square km);
- The ecological quality of each area;
- A weight factor per type of ecosystem, reflecting the contribution of the ecosystem to species richness at national, European or global level, which depends on the species present in the ecosystem and their threat level.

The ecological quality is measured by an intactness or robustness score, in a range from 0 to 1. This measure is determined for each of the relevant ecotopes based on the number of characteristic species present in the area relative to their presence in an intact ecosystem. Environmental impact assessments (EIAs) generally provide the necessary information on ecological quality, before and after the policy intervention. This information per ecotype of the number of characteristic species in the area can then be translated into ecological quality scores, before and after the policy intervention. Multiplying the ecological quality scores for the different ecotopes by the acreage of their area gives the **Ecological Quality Area score (EQA) per ecotope** (Bos and Ruijs, 2019^[77]).

The EQAs of the ecotopes are multiplied with standardised weight factors reflecting the threat level to the ecotope, which is related to the relative number of red list species in the ecotope³⁰. Determining the weighting factors is not straightforward and different methods and data sources are possible. However, such weights are standardized for each country and based on systematic ecologic data collection which is objective and transparent.

Biodiversity points or T-EQA is defined as:

$$\text{Biodiversity points} = \sum_{i=1}^n \text{Area}_i \times \text{Quality}_i \times \text{Weight factor}_i$$

With $i \in \{1, \dots, n\}$ the different types of ecotopes or nature types.

³⁰ Extremely threatened ecotopes have the highest weight, while commonly occurring ecotopes with common and not threatened species have the lowest weight. As a result, an intervention in a highly threatened ecotope results in a higher score than a similar intervention in a non-threatened ecotope. For example, salt marshes have a weighting factor of 2.4, nutrient-poor peatlands and moist heather lands have a weighting factor of 1.2 and agricultural grasslands have a weighting factor of 0.4.

The biodiversity point method gives a standardized quantitative summary value for the impact of biodiversity, providing decision-makers with a single objective measure to compare alternative interventions. Moreover, for assessing the overall effects of a project, biodiversity points is also considered more informative than qualitative or ordinal expert opinions, as these are generally not standardized and comparable for different CBAs, and cannot provide an indicator of change in biodiversity per euro invested (see Box 5.7 to learn on the use of biodiversity points in CBA and CEA).

Besides the advantages it brings, the consideration of biodiversity points in CBA and/or CEA remains modest. One reason is that they do not give a very intuitive measure of biodiversity. A more regular application of the method would help in this regard. The use of biodiversity points in CBA and CEA can also be advanced by offering overviews of the costs per points for various types of nature at various locations, providing concrete examples of cheap vs. more expensive interventions for improving or protecting nature and discussing what factors drive differences in cost-effectiveness. Moreover, the value of biodiversity points may be further investigated and made more robust by surveying the willingness to pay for such points. The quality and weighting factors per ecosystem type can then be replaced by monetary unit value that reflect people's preferences. In this way, the contribution of each ecosystem and the ecosystem services it provides to welfare is reflected. Such information on the costs and willingness to pay for biodiversity might be used to incorporate reasonable estimates in monetary terms for changes in biodiversity in future CBAs (Bos and Ruijs, 2019^[77]).

Box 5.7. Two examples of CBA and CEA with biodiversity points

CBA for increasing biodiversity by raising groundwater levels

For three areas in the peatlands in the Netherlands, two alternatives for raising the groundwater levels were compared through a CBA. According to the results, both alternatives improved biodiversity, and the second alternative provided the highest levels of aquatic biodiversity. In the analyses, all effects, including effects on biodiversity, were monetized on the basis of a survey that measured the willingness-to-pay. However, the scientific basis for the willingness-to-pay values has been considered as weak. The study did not properly present the biodiversity change to the respondents, and it was not clear about the population impacted by the change proposed. For this reason, in 2009, Sijtsma, Hinsberg, Kruitwagen and Dietz re-calculated the results, using the biodiversity points methods in the CBA. Figure 5.6 presents the results. The biodiversity effects are given both in monetized values as well as in biodiversity points. Monetized values hardly differ between the two alternatives, whereas the biodiversity points clearly show that the alternatives have different biodiversity impacts. Moreover, the area having the largest monetized value does not result in the highest gain in biodiversity points.

The revised results provide more relevant information to policy makers to distinguish between the effects on nature of both alternatives, as well as to evaluate for which alternatives and in which area they would obtain the highest extra biodiversity per euro invested. The information in biodiversity points can also be supplemented with a more qualitative description of the impacts on nature of the various alternatives.

Figure 5.6. Results from a full CBA and a CBA presenting biodiversity points separately

Area	Alternative	Value of biodiversity (mln euro)	Biodiversity points
Krimpenerwaard	Alt.1	0.5	1352
	Alt.2	0.5	1751
Groot Wilnis Vinkeveen	Alt.1	1.2	808
	Alt.2	1.2	1730
Wormer and Jisperveld	Alt.1	0.5	976
	Alt.2	0.5	1691

Note: direct costs minus avoided costs

Source: (Bos and Ruijs, 2019^[77])

CEA for the reconstruction of the Afsluitdijk

In order to meet legal safety standards of flooding once every 1/10.000 years, the Afsluitdijk enclosure dam needed fundamental reconstruction. The dam also needed to continue providing two other functions: (i) management of water levels in the IJsselmeer and (ii) good connections for transport by car and by ship. Moreover, the renovation of the dam could be combined with new functions with respect to nature, such as green dikes and special sluices for fish.

The cost-effectiveness analysis that was conducted showed the effects on nature in two different ways: the extent to which legal environmental protection standards were met and the score in biodiversity points. In contrast to the perspective of minimal legal standards for the environment, the score in biodiversity points does not only look at negative effects on the environment, but also considers how much extra biodiversity can be created. In order to calculate the biodiversity points for the plans to renovate the Afsluitdijk, the impact area and the different habitats had to be distinguished and the quality and relative weight of each habitat had to be assessed.

- The impact area considered was 3 km on both sides of the 33 km long Afsluitdijk.
- The ecological quality varied from 0 for paved surface to 3.4 for areas with a sweet-salt water gradient. The average ecological quality was 37.5 %.
- The average weighting factor was 1.6.
- Before any intervention, a total of 11 770 biodiversity points could be counted for an area of 19 000 ha.

As reported in the Figure 5.7 below, only some alternative interventions and options have substantial impact on nature, i.e. the natural enclosure dam, the 500 ha extra marshes and the fish sluice. They either result in larger areas of rare habitat types (with high weighting scores) or result in substantial quality improvements. The Figure also shows that the option Green Afsluitdijk has a clear positive effect on biodiversity: an increase of 1 600 biodiversity points. An interesting result was that nearly the same amount of biodiversity points (1 500) could be obtained by constructing a fish sluice in the Afsluitdijk, but at only a fraction of the costs: not EUR 550 mln euro, but EUR 10 mln. Hence, fish sluices were much more cost-effective for improving biodiversity.

Figure 5.7. Renovating the enclosure dam: cost-effectiveness of various options for extra biodiversity

Type of habitat	Relative weight	Quality of current situation (percentage)
I. IJsselmeer and Afsluitdijk		
Landzone		
roadside grass	0.4	13
Makkumer Noorwaard	1.8	55
paved road surface	0.0	
Shoreline and marshes		
Makkumer Noorwaard	1.6	54
Brackish	2.4	
brackish and sweet-salt gradient	3.4	
Open water		
shallow and sweet	1.3	35
shallow and brackish	2.0	
shallow, brackish and sweet-salt gradient	3.0	
deep and sweet	0.7	34
II. Waddensea (north side of Afsluitdijk)		
Saltmarsh including pioneer and climax stages and sweet-salt gradient	3.4	
Saltmarsh including pioneer and climax stages	2.4	

Source: (Bos and Ruijs, 2019^[77])

This CEA was well received by policy makers. The results were almost completely adopted in the final decision of the Dutch Cabinet. The option Green Afsluitdijk was rejected, and it was decided to construct a fish sluice. Subsequent political decision-making led to a much more advanced and fish-friendly, but also much more expensive fish sluice (EUR 35 mln).

Source: (Bos and Ruijs, 2019^[77]; Sijtsma et al., 2009^[79]; Witteveen & Bos and Arcadis, 2006^[80]; Wessels et al., September 2011^[81])

5.6. The United Kingdom

The **UK Green Book** is a good practice example of a national guidance on how to appraise policies, programmes and projects. It gives indications on the design and use of monitoring and evaluation before, during and after implementation. The Book is not designed to be a mechanical or deterministic decision-making device, rather it provides thinking models and methods to support public decision makers in the analysis and evaluation of the social – or public – welfare costs, benefits, and trade-offs of alternative implementation options for the delivery of policy objectives (HM Treasury, 2022^[82]).

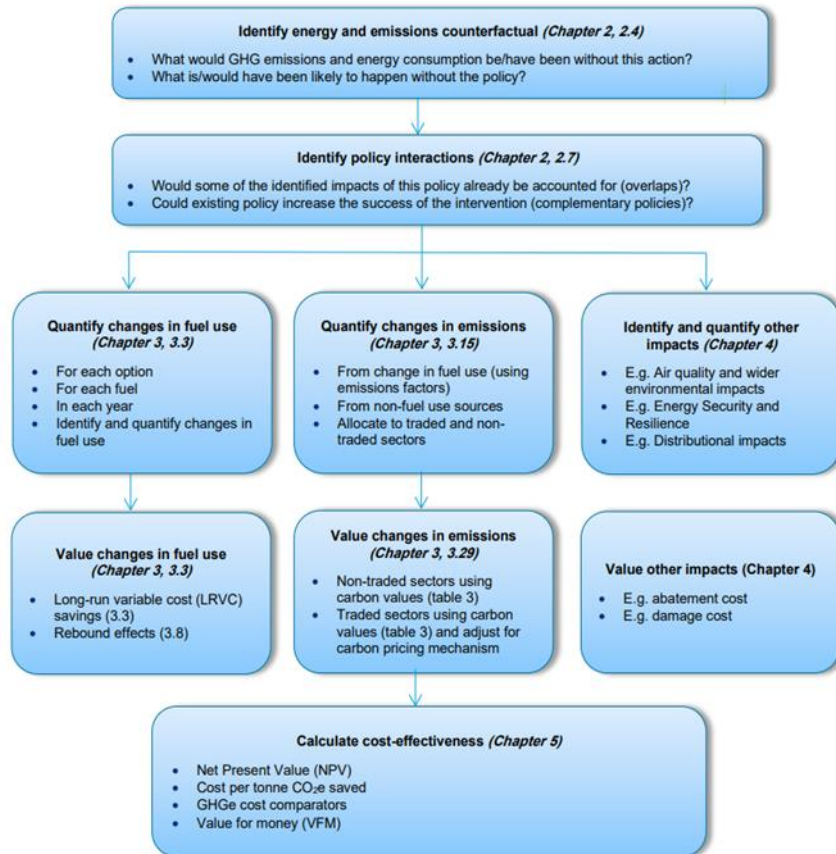
The UK Green Book is often accompanied by supplementary subject guidance dealing with specific topics, which are generally issued by the competent Ministry or public agency. For example, even though some general indications on how to include environmental and climate considerations (i.e. natural capital, air quality, noise, waste recreation, amenity, landscape, water quality and resources, flood risk and coastal erosion, climate change vulnerability, biodiversity, land values, GHG emissions) in appraisal are already provided in the Book, more specific guidelines have been published on energy use and GHG emissions, impacts on air quality, and climate change risks and adaptation.

5.6.1. Green Book supplementary guidance: valuation of energy use and GHG emissions for appraisal

This supplementary guidance provides government analysts with a set of rules for quantifying and valuing energy use and GHG emissions (see Figure 5.8). In particular, it gives practical information about implementation of the carbon valuation methodology for UK policy and project appraisal. It also outlines

the reporting requirements for compliance with carbon budgets and guidance on how to calculate the cost-effectiveness of climate change policies (Department for Business, Energy & Industrial Strategy, 2023^[83]). Moreover, this supplementary guidance covers additional impacts, including impacts on air quality (see Box 5.8).

Figure 5.8. Analytical process to appraise impacts on energy use and GHG emissions



Note: the figure shows the analytical process and calculations required when valuing energy and GHG impacts, and the relevant sections within this guidance which provides more details

Source: (Department for Business, Energy & Industrial Strategy, 2023^[83])

The guidance is also accompanied by an **Excel-based calculation toolkit** to convert increases and/or decreases in energy consumption into changes in GHG emissions and values such changes, data tables with the latest published assumptions for carbon values, energy prices, long-run variable energy supply costs, emission factors and air quality damage costs for the 2010-2100 period. A background information document explaining the methodologies presented in the main text is also included (Department for Business, Energy & Industrial Strategy, 2023^[83]).

Box 5.8. Air quality impact

In addition to energy use and GHG emissions, this supplementary guidance considers other additional impacts, including impacts on air quality. Generally speaking, a policy option designed to reduce CO₂ will also reduce other air pollutants (and vice versa for air quality policies), but in some cases there might be trade-offs. To account for these synergies and trade-offs, and ensure they contribute

appropriately to the decision-making process, policymakers should build the air quality impacts of their policy into their appraisal process, where possible, using monetary values.

The Interdepartmental Group on Costs and Benefits (IGCB), a Defra-led panel of experts, has developed a number of monetisation methodologies to aid such policymakers, but the approach to be taken mainly depends on the characteristics of the project under analysis.

The Impact Pathway approach

For any policy where estimated air quality impacts are above £50m NPV, the guidance suggests undertaking the “impact pathway” approach, a bespoke air quality impact valuation.

The impact pathway approach follows the source of the emission to its dispersion in the atmosphere, and the resultant exposure to estimate a range of end points (such as health impacts) that are valued. Impacts therefore vary based on a range of considerations (such as dispersion and toxicity) that arise from differences in geographical location and population exposed.

At present, this approach has been used to estimate the impact of four different air pollutants: nitrous oxide (NO_x), sulphur dioxide (SO₂), ammonia (NH₃) and particulate matter (PM₁₀).

The Damage Cost approach

For any policy where there are air quality impacts valued below £50m NPV, the guidance recommends to value impacts using the “damage costs” approach, and an online calculator is made available to monetise the costs.

“Damage costs” are based on the impact pathway approach but have been calculated using a range of representative emissions in order to estimate an average marginal effect for each additional tonne of gas introduced into the atmosphere. These primarily value health impacts, though non-health impacts are also included. Damage costs are not linked to limit values being exceeded. It must be noted that these monetary values do not include all the likely impacts of air pollution, such as non-health impacts on acidification and soil eutrophication, and do not include the impacts on ecosystems, visibility or ozone depletion.

Where the change in emissions arising from the policy is known, analysts are recommended to use the Damage Costs Calculator, which applies monetary values to emissions. Where the change in emissions arising from the policy is not known, analysts should use the Activities Costs Calculator, which links a wide range of actions and technologies with the associated level of emissions, and applies monetary values to these.

The Abatement Cost approach

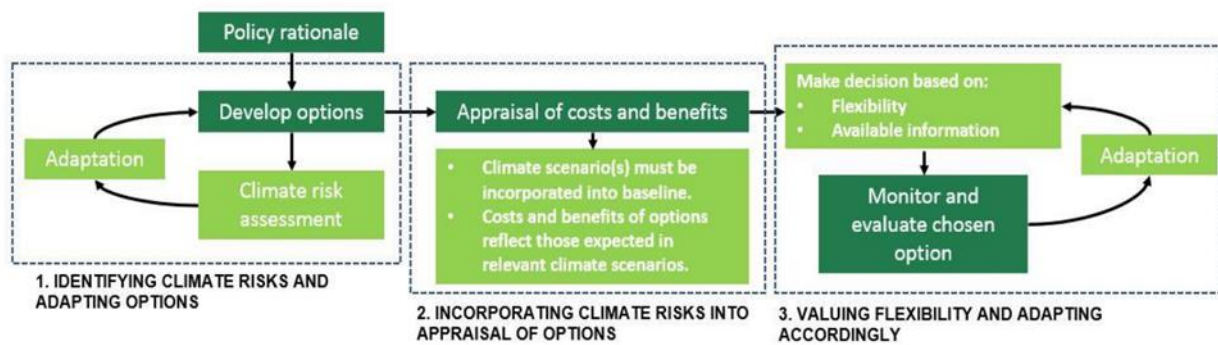
Air quality, as with most environmental assets, is subject to a number of major threshold and equity factors, which are protected through the establishment of minimum standards on ambient concentrations, emissions and exposure. These standards are delivered through national and international obligations covering these areas. Where a proposal is expected to affect compliance with these obligations (whether causing, removing or altering the extent of an exceedance), then the abatement cost of restoring compliance should be factored into the appraisal. This should be undertaken through an estimation of the cost of offsetting measures (the “abatement cost” approach). Only the amount of air quality that breaches the relevant obligation should be valued using this approach, instead, changes below the obligation should be valued using the impact pathway or the damage costs approach.

Note: a supplementary guidance specific to air quality impacts was published in 2013 by the Department for Environment, Food & Rural Affairs in collaboration with HM Treasury. This publication was withdrawn on 14 January 2019, and it is now being updated
Source: (Department for Business, Energy & Industrial Strategy, 2023^[83])

5.6.2. Green Book supplementary guidance: climate change and environmental evaluation

The supplementary guidance supports analysts and policymakers in identifying if and how their proposals (i.e. projects, programmes or policies) might be affected by climate risks and challenges. It informs them how to design appropriate adaptation measures. More specifically, it defines a step-by-step process to integrate considerations of climate change and climate resilience into the overall appraisal process proposed in the UK Green Book (see Figure 5.9) (Department for Environment, Food & Rural Affairs, 2020^[84]).

Figure 5.9. Building on the Green Book approach to account for climate change



Note: the figure shows how considerations of climate change effects can be integrated in the overall appraisal process of the UK Green Book
Source: (Department for Environment, Food & Rural Affairs, 2020^[84])

Considerations of the effects of climate change are to be integrated at three key stages:

Developing options

In climate resilient appraisal, the development of policy options is based not only on a rationale for intervention, but also on an assessment of the potential climate risk (i.e. Climate Risk Assessment or CRA – see Box 5.9). Once climate risks and opportunities have been identified, options can be revised to improve resilience to future climate changes and include adaptation measures at the design stage. The new or refined options may involve simple no or low-regret adaptation measures, or those which are more fundamental and address trade-offs identified in a climate risk assessment.

Box 5.9. Conducting risk assessment

Climate Risk Assessment identifies the likelihood and magnitude of a climate triggered event, including economic damage, social disruption, human illness or injury, and fatalities. Hazard, exposure, vulnerability, and adaptive capacity are all elements to be considered when identifying climate change impacts on policies, programmes and projects. Other important factors to assess are timing, tipping points (i.e. critical threshold for changes in climate from one stable state to another), international effects, and irreversibility.

The CRA should follow a structured approach. In early planning stages, the focus should be on identifying potential climate risk and how risks could affect activities, projects, design, implementation and/ or functions. Once these are identified, a more detailed risk analysis is needed to explore how climate risks are transmitted to impact the policy, programme or project.

The most recent Climate Change Risk Assessment (CCRA), published in 2017, identified 57 key climate risks to the UK, which reflect six domains of climate change risks for the UK and assesses their urgency. These six areas can be used in the first instance to give an indication of the potential climate change risks that are relevant to any options considered for a policy, programme or project and where possible the full list of risks should be consulted.

Figure 5.10. The top six areas of climate change risks for the UK



Note: these six domains represent a non-exhaustive list of climate change risks, and other relevant risks should be considered on a case-by-case basis in the project appraisal process

Source: (Department for Environment, Food & Rural Affairs, 2020^[84])

Source: (Department for Environment, Food & Rural Affairs, 2020^[84]; Department of Environment, Food & Rural Affairs, 2017^[85])

Appraisal of options

Climate change effects and impacts are to be included in the costs and benefits of the shortlisted options for the project, policy or programme being considered. This should include the counterfactual baseline. Given uncertainty, it may be necessary, based on climate risk, to consider multiple climate scenarios, where climate change effects and impacts differ. Comparing options with adaptation measures to those without adaptation helps to recommend options which provide the best overall value given climate risks (see Box 5.10 to learn about further appraisal methods under climate uncertainty).

Decision-making, monitoring and evaluation: valuing flexibility and adapting accordingly

When making a decision on which option to pursue, value should be given to options that address uncertainty. Policy options which can adapt over time may become more valuable. It may be possible to value such flexibility using quantitative measures as part of the benefits appraisal. At least, the benefits of flexibility should be considered when choosing between final options. Moreover, as monitoring and evaluation makes the effectiveness of options clearer over time, the more flexible options can be adapted according to changing information.

Box 5.10. Further Appraisal methods under climate uncertainty

Appraisal can be particularly challenging when there are elements of uncertainty. Several techniques can be used to handle uncertainty, but the most appropriate tool to apply in climate resilient appraisal will depend on the policy, programme or project being appraised.

The ECONADAPT Toolbox³¹ provides a good starting point to decide on the appropriate methods to address climate uncertainty. The ECONADAPT research project aims to support adaptation planning by building a knowledge base on the economics of adaptation to climate change and converting this into practical information for decision makers. This toolbox includes a list of some of the commonly used appraisal methods ranging from Cost-Benefit Analysis to Real Options analysis. These appraisal methods, examples of the types of appraisal options and common applications as well as whether they are able to address climate uncertainty are shown in Table 5.4 below.

Table 5.4. Potential appraisal techniques for climate resilient appraisal

Method	Well suited for	Common applications	Dealing with uncertainty
Cost-Benefit Analysis	Low and no regret options in the near future. Where clear market values can be used.	Agriculture, Forestry, Energy, Water and coastal management, Transport	Does not explicitly deal with uncertainty. Can be combined with sensitivity testing and probabilistic modelling.
Cost-effectiveness Analysis	Short-term options. Where benefits should be examined in non-monetary terms. Where pre-defined objectives must be achieved.	Health, Civil protection, Biodiversity protection	Does not explicitly deal with uncertainty. Can be combined with sensitivity testing and probabilistic modelling.
Real Options Analysis	The appraisal of large capital investment over the medium term. Where information on climate risk probabilities is available. When future changes in operation are possible.	Construction, Regional planning, Energy, Forestry, Agriculture	Deals explicitly with uncertainty by analysing the performance of options for different potential futures.
Robust Decision Making	The appraisal of investments over long timescales. Where large uncertainties exist. Where a mix of quantitative and qualitative information needs to be considered.	Water and coastal management, Agriculture, Energy, Health, Construction, Civil protection	Deals explicitly with uncertainty by using a maximum-minimum approach to assess options under a wide range of possible climate scenarios (quantitatively or qualitatively). Analyses the performance of options for different potential futures.
Iterative Risk Management	Policy appraisal over medium-long-term. When there are clear risk thresholds.	Water management, Coastal management, Agriculture, Health, Forestry	Deals explicitly with uncertainty. Promotes iterative analysis, monitoring, evaluation and learning.
Portfolio Analysis	When a number of complementary adaptation actions are possible. When good economic and climate information exist.	Water and coastal management, Forestry, Health, Fisheries, Agriculture, Biodiversity protection	Deals explicitly with uncertainty. Examines the complementarity of adaptation options for dealing with future climates.

Multi-Criteria Decision Analysis	Scoping options. Where a mix of quantitative and qualitative data needs to be considered.	Water and coastal management, Agriculture, Biodiversity protection	Can integrate uncertainty as an assessment criterion. Relies on subjective expert judgement or stakeholder opinion where empirical data are not available.
<p>Note: this is not an exhaustive list of methods but provides a comprehensive overview of potential techniques that can be applied and it is good starting point to decide on how best to appraise a policy, programme or project Source: (Department for Environment, Food & Rural Affairs, 2020^[84])</p> <p>Source: (Department for Environment, Food & Rural Affairs, 2020^[84]; Ecologic Institute, 2016^[86])</p>			

³¹ See the 2016 report “ECONADAPT Web-Toolbox”, Tröltzsch, Jenny; Josselin Rouillard; and Manuel Lago.

References

- Aguilar Jaber, A. et al. (2020), "Long-term low emissions development strategies: Cross-country experience", *OECD Environment Working Papers*, No. 160, OECD Publishing, Paris, <https://doi.org/10.1787/1c1d8005-en>. [8]
- Bos, F. and A. Ruijs (2019), "Biodiversity in the Dutch practice of cost-benefit analysis", *CPB Background Document*, <https://www.cpb.nl/sites/default/files/omnidownload/CPB-Background-Document-feb2019-Biodiversity-in-the-Dutch-practice-of-cost-benefit-analysis.pdf>. [77]
- Climate ADAPT (2022), *Ireland - Climate ADAPT: sharing adaptation knowledge for a climate-resilient Europe*, <https://climate-adapt.eea.europa.eu/en/countries-regions/countries/ireland> (accessed on January 2023). [30]
- Department for Business, Energy & Industrial Strategy (2023), *Valuation of energy use and greenhouse gas - Supplementary guidance to the HM Treasury Green Book*, Government of the United Kingdom, <https://www.gov.uk/government/publications/green-book-supplementary-guidance-environment>. [83]
- Department for Communities and Local Government (2009), *Multi-criteria analysis: a manual for making government policy*, Government of the United Kingdom, <https://www.gov.uk/government/publications/multi-criteria-analysis-manual-for-making-government-policy>. [36]
- Department for Environment, Food & Rural Affairs (2020), *Accounting for the effects of climate change - Supplementary Green Book Guidance*, Government of the United Kingdom, <https://www.gov.uk/government/publications/green-book-supplementary-guidance-environment>. [84]
- Department of Communications, Climate Action and Environment (2018), *National Adaptation Framework - Planning for a Climate Resilient Ireland*, Government of Ireland, <https://www.gov.ie/en/publication/fbe331-national-adaptation-framework/#:~:text=The%20NAF%20outlines%20a%20whole,sector%2C%20and%20the%20research%20community>. [26]
- Department of Environment, Climate and Communication, Ireland (2021), "Climate Action and Low Carbon Development (Amendment) Bill 2021", <https://www.gov.ie/en/publication/984d2-climate-action-and-low-carbon-development-amendment-bill-2020/>. [15]

- Department of Environment, Food & Rural Affairs (2017), *UK Climate Change Risk Assessment 2017 Evidence Report*, Government of the United Kingdom, <http://www.theccc.org.uk/UK-climate-change-risk-assessment-2017/>. [85]
- Department of Finance (2023), *Budget 2023 - Beyond GDP - Quality of Life assessment*, Government of Ireland, <https://www.gov.ie/en/publication/04fef-budget-publications/>. [55]
- Department of Finance (2022), *Budget 2022 - A review of green Budgeting from a Tax Perspective*, http://file:///C:/Users/lolong_m/Downloads/201243_56e364cf-9bfc-4993-b405-e34784b0c4bc.pdf. [47]
- Department of Finance (2021), *Economic and Fiscal Outlook 2022*, <http://assets.gov.ie/201250/f0886750-a25f-4bf4-9d1d-2918347495f0.pdf>. [46]
- Department of Housing, Local Government and Heritage (2022), *Strategic Environmental Assessment - Guidelines for regional assemblies and planning authorities*, Government of Ireland, <https://www.gov.ie/en/publication/7e1aa-strategic-environmental-assessment-guidelines-for-regional-assemblies-and-planning-authorities/>. [27]
- Department of Housing, Local Government and Heritage (2021), *Environmental Assessment and Planning in Ireland*, Office of the Planning Regulator, <https://www.opr.ie/planning-leaflets/>. [29]
- Department of Housing, Local Government and Heritage (2018), *Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment*, Government of Ireland, <https://www.gov.ie/en/publication/53aee9-guidelines-for-planning-authorities-and-an-bord-pleanala-on-carrying/>. [37]
- Department of Housing, Local Government and Heritage (2009), *Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities*, Government of Ireland, https://irishriverproject.com/wp-content/uploads/2021/12/npws_2009_aa_guidance.pdf. [28]
- Department of Housing, Planning and Local Government (2018), *Project Ireland 2040 - National Planning Framework*, Government of Ireland, <https://npf.ie/project-ireland-2040-national-planning-framework/>. [12]
- Department of Public Expenditure, NDP Delivery and Reform (2022), *Fiscal Monitors*, <http://www.gov.ie/en/collection/d5cef7-monthly-revenues-and-expenditures-of-all-subsectors-of-general-gover/>. [41]
- Department of Public Expenditure, NDP Delivery and Reform (2022), *Public Service Performance Report 2021*, <http://assets.gov.ie/224970/372e0f82-8a79-40ca-a95f-618cd7d11012.pdf>. [43]
- Department of Public Expenditure, NDP Delivery and Reform (2021), *Budget 2022 - Expenditure report*, <http://assets.gov.ie/201256/3efe3b32-a9d5-41bd-a2ed-41387528b8cc.pdf>. [42]
- Department of Public Expenditure, NDP Delivery and Reform (2021), *Budget 2022 - The Use of Carbon Tax Funds 2022*. [91]
- Department of Public Expenditure, NDP Delivery and Reform (2021), *Climate and Environmental Assessment of NDP Review Spending Proposals*, <https://www.gov.ie/en/publication/77fe2-national-development-plan-phase-1-report-2021/> (accessed on July 2022). [62]

- Department of Public Expenditure, NDP Delivery and Reform (2021), *National Development Plan 2021-2030*, Government of Ireland, <https://www.gov.ie/en/press-release/7ac57-government-launches-the-renewed-national-development-plan-2021-2030/>. [24]
- Department of Public Expenditure, NDP Delivery and Reform (2021), *Project Ireland 2040 - National Development Plan 2021-2030*, Government of Ireland, <https://www.gov.ie/en/publication/774e2-national-development-plan-2021-2030/> (accessed on July 2022). [16]
- Department of Public Expenditure, NDP Delivery and Reform (2021), *Spending reviews*, <http://www.gov.ie/en/collection/87ee1-spending-review-2021/?referrer=http://www.gov.ie/en/collection/8930f-spending-review-2021/>. [39]
- Department of Public Expenditure, NDP Delivery and Reform (2020), “The use of carbon Tax funds 2020”, *Staff Paper. Climate Change Unit at Department of Public Expenditure and Reform*, <https://igees.gov.ie/the-use-of-carbon-tax-funds-in-2020/>. [44]
- Department of Public Expenditure, NDP Delivery and Reform (2019), *Project Ireland 2040*, Government of Ireland, <https://www.gov.ie/en/collection/580a9d-project-2040-documents/>. [10]
- Department of Public Expenditure, NDP Delivery and Reform (2019), *Public Spending Code - Central Technical References and Economic Appraisal Parameters*, Government of Ireland, <https://www.gov.ie/en/publication/public-spending-code/>. [35]
- Department of Public Expenditure, NDP Delivery and Reform (2019), *Public Spending Code: A Guide to Evaluating, Planning and Managing Public Investment*, Government of Ireland, <https://www.gov.ie/en/publication/public-spending-code/>. [33]
- Department of Public Expenditure, NDP Delivery and Reform (2018), “An introduction to the implementation of Green Budgeting in Ireland”, *Staff Paper 2018. Climate Change Unit at Department of Public Expenditure and Reform*, <https://igees.gov.ie/an-introduction-to-the-implementation-of-green-budgeting-in-ireland/>. [48]
- Department of Public Expenditure, NDP Delivery and Reform (2018), *Project Ireland 2040*, Government of Ireland, <https://assets.gov.ie/7335/7692660a70b143cd92b1c65ee892b05c.pdf> (accessed on July 2022). [17]
- Department of Rural and Community Development (2021), *Our Rural Future - Rural Development Policy 2021-2025*, Government of Ireland, <https://www.gov.ie/en/publication/4c236-our-rural-future-vision-and-policy-context/#:~:text=The%20vision%20of%20this%20policy,of%20urban%20and%20rural%20areas.> [22]
- Department of the Taoiseach (2022), , *Government announces sectoral emissions ceilings, setting Ireland on a pathway to turn the tide on climate change*, <https://www.gov.ie/en/press-release/dab6d-government-announces-sectoral-emissions-ceilings-setting-ireland-on-a-pathway-to-turn-the-tide-on-climate-change/#:~:text=2021%2D2025%3A%20295%20Mt%20CO2,for%20the%20second%20budget%20period> (accessed on August 2022). [61]
- Department of Transport (2021), *Common Appraisal Framework V4*, Government of Ireland, <https://www.gov.ie/en/organisation-information/800ea3-common-appraisal-framework/>. [34]

- Department of Transport (Decembre 2021), “NIFTI”, in *National Investment Framework for Transport in Ireland*, Government of Ireland, <https://www.gov.ie/en/publication/cfae6-national-investment-framework-for-transport-in-ireland-nifti/>. [21]
- Di Leva, C. and S. Vaughan (2022), *Accelerating Net-zero Pledges with Public-led Climate Financing [IISD guest article]*, International Institute for Sustainable Development (IISD), <https://sdg.iisd.org/commentary/guest-articles/accelerating-net-zero-pledges-with-public-led-climate-financing/>. [9]
- Ecologic Institute (2016), *Economics of Climate Change Adaptation in Europe (ECONADAPT)*, <https://www.ecologic.eu/10743> (accessed on August 2022). [86]
- EEA (2022), *Economic losses from climate-related extremes in Europe*, <https://www.eea.europa.eu/ims/economic-losses-from-climate-related>. [4]
- EEA (2021), *Trends and projections in Europe 2021 - N.13/2021*, Publication Office of the European Union, <https://doi.org/10.2800/80374>. [5]
- Environmental Protection Agency (EPA) (n.d.), *What impact will climate change have on Ireland?*, <https://www.epa.ie/environment-and-you/climate-change/what-impact-will-climate-change-have-for-ireland/> (accessed on 24 May 2023). [3]
- European Commission (2022), *2022 Country Report - Ireland [Commission Staff Working Document] - SWD (2022) 615 final/2*, https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/european-semester-your-country/ireland/european-semester-documents-ireland_en (accessed on August 2022). [13]
- European Commission (2021), “EU Vademecum 2021-2027”, in *Economic Appraisal Vademecum 2021-2027 - General Principles and Sector Applications*, European Union, <https://doi.org/10.2776/182302>. [7]
- European Commission (2021), *Ireland’s recovery and resilience plan*, Official website of the European Union, <https://doi.org/10.2775/178492> (accessed on November 2022). [14]
- European Commission (2019), *COM (2019) 640 - The European Green Deal*, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN>. [89]
- European Parliament and Council (2021), *EU Regulation 2021/241 establishing the Recovery and Resilience Facility*, Official Journal of the European Union, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021R0241>. [88]
- European Parliament and Council (2020), *EU Regulation 2020/852 on the establishment of a framework to facilitate sustainable investment*, Official Journal of the European Union, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020R0852>. [87]
- French Government (September 2020), *Report on the Environmental Impact of the Central Government Budget*, French Government, http://www.budget.gouv.fr/files/uploads/extract/2021/PLF_2021/report_environmental_impact_french_central_government_budget_2021.pdf. [70]
- Government of Canada (2022), *Impact Assessment Agency of Canada*, Government of Canada, <https://www.canada.ca/en/impact-assessment-agency.html> (accessed on August 2022). [63]

- Government of Canada (2022), *Impact Assessment Agency of Canada*, [65]
<https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/impact-assessment-process-overview.html> (accessed on August 2022).
- Government of Canada (2022), *Impact Assessment Process Overview*, [66]
<http://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/impact-assessment-process-overview.html> (accessed on April 2022).
- Government of Canada (2022), *The Climate Lens: General Guidance*, [69]
http://www2.gov.bc.ca/assets/gov/environment/climate-change/action/cleanbc/climate_lens_general_guidance_version_122.pdf.
- Government of Canada (2019), *Discussion Paper on a the proposed Project List - a proposed impact assessment system*, Government of Canada, [64]
<https://www.canada.ca/en/services/environment/conservation/assessments/environmental-reviews/environmental-assessment-processes/discussion-paper-proposed-project-list.html>.
- Government of Canada (2018), *The proposed impact assessment system: a technical guide*, [68]
 Government of Canada,
<https://www.canada.ca/en/services/environment/conservation/assessments/environmental-reviews/environmental-assessment-processes/a-technical-guide.html>.
- Government of Canada (April 2022), "Impact Assessment Agency of Canada", *Policy and Guidance - Regional and Strategic Assessments*, [67]
<https://www.canada.ca/en/impact-assessment-agency/services/policy-guidance/regional-strategic-assessments.html> (accessed on August 2022).
- Government of Ireland (2023), *Revised Estimates for Public Services*, [54]
<http://www.gov.ie/pdf/?file=https://assets.gov.ie/244538/26edc78f-49db-454f-817f-b27a40d030bc.pdf#page=null>.
- Government of Ireland (2022), *Carbon Budegts 2022*, [45]
<http://assets.gov.ie/222805/697ec730-a09f-4216-a54a-6a5cd0b358df.pdf>.
- Government of Ireland (2022), *Revised Estimates for Public Services 2022*, [40]
<http://assets.gov.ie/207416/1ebb916d-9839-458f-a4df-9fa77be9b7de.pdf>.
- Government of Ireland (2021), *Climate Action Plan 2021 - Securing Our Future*, [56]
<http://assets.gov.ie/224574/be2fecb2-2fb7-450e-9f5f-24204c9c9fbf.pdf>.
- Government of Ireland (2021), *Mid-Year Expenditure report*, [38]
<http://assets.gov.ie/179751/ae549b3-8176-425a-833c-d375c0d7999c.pdf>.
- Government of Ireland (2021), "Public Consultation on Crabon Budget - Consultation Paper", [58]
Concultations on Carbon Budgets, <https://www.gov.ie/en/consultation/42eaf-public-consultation-on-carbon-budgets/> (accessed on July 2022).
- Government of ireland (2022), *Climate Action Plan 2023*, [59]
<http://www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/>.
- Greenhouse Gas Protocol (n.d.), *Guidance*, [90]
<https://ghgprotocol.org/guidance-0> (accessed on November 2022).

- HM Treasury (2022), *The Green Book - Central Government Guidance on Appraisal and Evaluation*, Government of the United Kingdom, [82]
<https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government/the-green-book-2020#a1-non-market-valuation-and-unmonetisable-values>.
- IEA (2021), *Net Zero by 2050 Scenario*, International Energy Agency (IEA). Retrieved from: [2]
<https://www.iea.org/reports/net-zero-by-2050>.
- Irish parliamentary Budget Office (2022), *Climate Related Spending 2022*, [57]
http://data.oireachtas.ie/ie/oireachtas/parliamentaryBudgetOffice/2022/2022-03-09_climate-related-spending-2022_en.pdf.
- ITF (2021), *ITF Transport Outlook 2021*, OECD Publishing, Paris, [6]
<https://doi.org/10.1787/16826a30-en>.
- Jenkinson, F. (2018), *Project Ireland 2040, Investment Projects and Programmes Tracker - Overview and Analysis*, Department of Public Expenditure and Reform, [25]
<https://www.gov.ie/en/policy-information/96bb35-investment-projects-and-programmes-tracker/>.
- Klooster, J. et al. (2018), *Werkwijzer Natuur - Maatschappelijke Kosten-Baten Analyses*, Arcadis Netherlands B.V., [78]
https://ce.nl/wp-content/uploads/2021/03/CE_Delft_7J94_Werkwijzer_Natuur_DEF.pdf.
- Lelong, M. and C. Wendling (02 November, 2020), *France's "Green Budget" for 2021*, [71]
 International Monetary Fund (IMF), <https://blog-pfm.imf.org/pfmblog/2020/11/frances-green-budget-for-2021-.html>.
- McGreevy, R. (2018), *Project Ireland 2040: the infrastructure plan's main points*, The Irish Times, [20]
<https://www.irishtimes.com/news/ireland/irish-news/project-ireland-2040-the-infrastructure-plan-s-main-points-1.3394625> (accessed on April 2022).
- Ministère de la transition écologique of France (2022), *Prise en compte des émissions de gaz à effet de serre dans les études d'impact*, Ministère de la transition écologique of France, [72]
http://www.ecologie.gouv.fr/sites/default/files/Prise%20en%20compte%20des%20C3%A9missions%20de%20gaz%20C3%A0%20effet%20de%20serre%20dans%20les%20C3%A9tudes%20d%20E2%80%99impact_0.pdf.
- Ministero delle Infrastrutture e della Mobilita' Sostenibili (2022), *Quadro programmatico, scelte e valutazione. Verso la definizione di un framework integrato per la realizzazione di infrastrutture resilienti e sostenibili*, Ministero delle Infrastrutture e Mobilita' Sostenibili, [73]
<https://www.mit.gov.it/comunicazione/news/opere-pubbliche-nuovi-metodi-per-la-programmazione-e-la-valutazione-dei-progetti>.
- Ministry of Ecological and inclusive transition of France (2018), *The ecological and inclusive transition towards carbon neutrality*, [50]
<http://www.ecologie.gouv.fr/sites/default/files/Projet%20SNBC%20EN.pdf>.
- Ministry of Economy and Finance (MEF) (2021), *Ecobilancio dello Stato 2022-2024*, [52]
http://www.rgs.mef.gov.it/Documenti/VERSIONE-I/Attivit--i/Bilancio_di_previsione/Ecobilancio/2022/Ecobilancio-dello-Stato-2022.pdf#%5B%7B%22num%22%3A6%2C%22gen%22%3A0%7D%2C%7B%22name%22%3A%22XYZ%22%7D%2C68%2C567%2C0%5D.

- Ministry of Economy and Finance (MEF) (2021), *Ecorendiconto dello Stato 2020*, [53]
<http://www.rgs.mef.gov.it/Documenti/VERSIONE-I/Attivit--i/Rendiconto/Ecorendiconto/2020/Ecorendiconto-dello-Stato-2020.pdf>.
- Ministry of Economy, Finance and Recovery of France (2021), *Rapport sur l'impact environnemental du budget de l'Etat*, [49]
http://www.economie.gouv.fr/files/files/2021/Rapport_impact_environmental_budget_Etat_2022.pdf?v=1633948985.
- Ministry of Sustainable Infrastructure and Mobility (MIMS) (2021), *Catalogo dei sussidi ambientalmente dannosi e favorevoli*, [51]
<http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwiHpMOrzZv5AhVqgM4BHYaUDtMQFnoECAMQAQ&url=https%3A%2F%2Fwww.mite.gov.it%2Fpagina%2Fcatalogo-sussidi-rassegna-stampa-2022&usq=AOvVaw2f8PIYNsVYY9ISZ0EDBGT8>.
- National Investment Office (2021), *Assessing the alignment of the National Planning Framework and the National Development Plan*, Department of Public Expenditure and Reform (DPER), [23]
<https://www.google.com/url?sa=i&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=0CAMQw7AJahcKEwignea3i6n9AhUAAAAAHQAAAAAQAg&url=https%3A%2F%2Fassets.gov.ie%2F132628%2Fb16e6f24-7aca-494c-ac99-3073188b2733.pdf&psig=AOvVaw3SPIZEAUUV8n5tDA6FOhIHj&ust=1677153>.
- New Zealand's Treasury (2021), *CBAX Tool User Guidance - a guide for departments and agencies using Treasury's CBAX tool for cost benefit analysis*, New Zealand Government, [76]
<https://treasury.govt.nz/publications/guide/cbax-tool-user-guidance>.
- New Zealand's Treasury (September 2021), *The Treasury's CBAX Tool*, [75]
<https://www.treasury.govt.nz/information-and-services/state-sector-leadership/investment-management/plan-investment-choices/cost-benefit-analysis-including-public-sector-discount-rates/treasurys-cbax-tool> (accessed on August 2022).
- OECD (2021), *OECD Implementation Handbook for Quality Infrastructure Investment: supporting a sustainable recovery from the Covid-19 Crisis*, OECD Publishing, [31]
<https://www.oecd.org/finance/OECD-Implementation-Handbook-for-Quality-Infrastructure-Investment.htm>.
- OECD (2021), "The OECD Green Recovery Database: Examining the environmental implications of COVID-19 recovery policies", *OECD Policy Responses to Coronavirus (COVID-19)*, OECD Publishing, Paris, <https://doi.org/10.1787/47ae0f0d-en>. [11]
- OECD (2020), *Recommendation on the Governance of Infrastructure - OECD/LEGAL/460*, [18]
<https://legalinstruments.oecd.org/en/instruments/OECD-LEGAL-0460>.
- OECD (2020), *Survey on the Governance of Infrastructure*, [19]
https://qdd.oecd.org/subject.aspx?Subject=GOV_INFRA.
- OECD (2017), *Gaps and Governance Standards of Public Infrastructure in Chile: Infrastructure Governance Review*, OECD Publishing, Paris, <https://doi.org/10.1787/9789264278875-en>. [32]
- OECD (Forthcoming), *Green Budgeting: The way forward*, OECD Publishing. [60]

- Sijtsma, F. et al. (2009), *Natuureffecten in de MKBA's van projecten voor*, PBL Netherlands Environmental Assessment Agency, <https://www.pbl.nl/publicaties/natuureffecten-in-de-mkba-s-van-projecten-voor-integrale-gebiedsontwikkeling>. [79]
- Struttura Tecnica di Mission per l'indirizzo strategico, lo sviluppo delle infrastutture e l'alta sorveglianza (2021), *Linee Guida Operative per la Valutazione degli Investimenti in Opere Pubbliche - Settore Ferroviario*, Ministero delle Infrastrutture e della Mobilita' Sostenibili, <https://www.mit.gov.it/comunicazione/news/opere-ferroviarie-le-linee-guida-per-valutare-gli-investimenti-secondo-il>. [74]
- UNFCCC (2015), *The Paris Agreement*, <https://unfccc.int/documents/184656>. [1]
- Wessels, S. et al. (September 2011), *Natuurpunten voor de Afsluitdijk, Toets, Kennisplatform over Milieueffectrapportage*. [81]
- Witteveen & Bos and Arcadis (2006), *CBA daling grondwater veengebieden..* [80]