# A colossal missed opportunity

Ireland's climate action and the potential costs of missing targets

This report is a collaborative effort between the Irish Fiscal Advisory Council and the Climate Change Advisory Council.

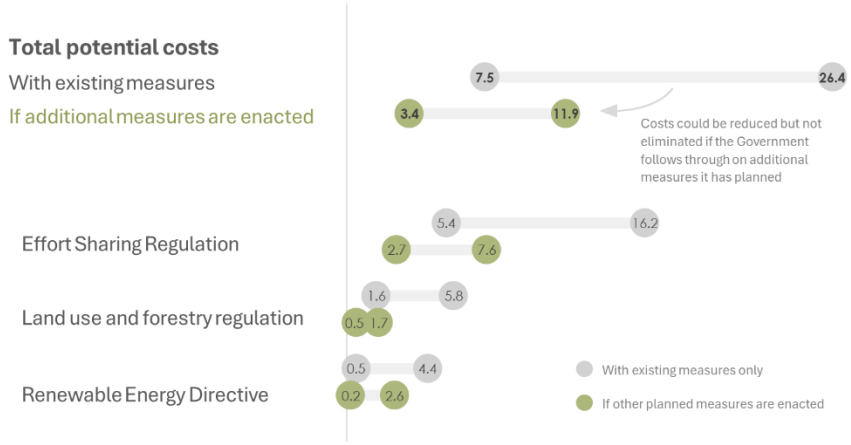
The collaboration arose as both institutions saw an urgent need for realistic estimates of the costs faced if Ireland fails to meet its climate commitments.

Irish Fiscal Advisory Council

CLIMATE CHANGE ADVISORY COUNCIL

## Following through on plans could reduce potential costs substantially

€ billion




The state may have to pay out €8 to €26 billion to its EU partners if it does not step up on climate action it has agreed to.

However, if the Government follows through on plans it has still not enacted, it could reduce this risk and potential costs to between €3 and €12 billion.

The Government would need to be even more ambitious to reduce the costs further.

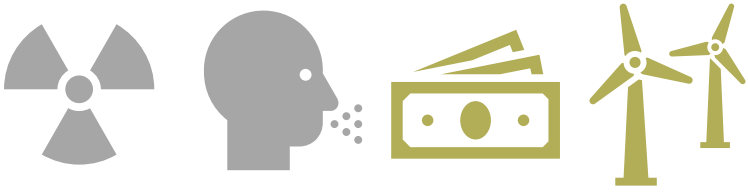
## For context, less than half the upper range of costs could

Upgrade Ireland's national energy grid **€7 billion**

Reduce the cost of 700,000 new Electric Vehicles to under €15,000 and ramp up charging networks **€4 billion**

Support forestry and the rewetting of peatlands **€1 billion**

## Swifter action would do more than just avoid hefty payments



It would transform Ireland into a healthier, more sustainable, and energy-secure society, reducing reliance on imported fossil fuels, while also boosting economic activity and employment in related sectors.

# Summary

This report looks at the potential costs Ireland faces if it fails to meet its agreed EU climate commitments. These require domestic reductions in greenhouse gas emissions, an increasing share of renewable energy, and improved energy efficiency. There are of course other costs and benefits to Ireland reducing its emissions and enhancing green energy. However, it is vital to understand costs from missing targets to better understand the trade-offs involved.

We estimate that Ireland could potentially have to pay out €8 to €26 billion to its EU partners if it does not step up climate action swiftly. If the Government implements the additional measures in its own Climate Action Plan by 2030, it could reduce the range to €3 to €12 billion.

There are three key pieces of legislation. The most important is the Effort Sharing Regulation. Ireland and other EU countries agreed to adopt this in 2018. It covers emissions from domestic transport, buildings, small industry, waste, and agriculture. If Ireland emits more than allowed, the state will have to purchase the gap from overperforming countries — those that reduce their emissions more than required. It will likely be able to offset some costs by using some limited flexibilities permitted by the legislation. Two other pieces of legislation could pose smaller yet still significant costs. They cover land use and forestry, and the share of energy coming from renewable sources.

The combined costs are substantial. To put them in context, less than half the upper end of those potential costs would cover drastic measures to reduce emissions. As an illustration, €12 billion — just one-tenth of the capital spending planned out to 2030 — could achieve all of the following. It could reduce the costs of buying 700,000 new electric cars to less than €15,000 per vehicle, covering one-in-three households. It would allow the Government ramp up charging infrastructure. It would cover the estimated additional costs of upgrading Ireland's energy grid. And it would support forestry and the rewetting of peatlands.

By not taking actions like these, Ireland faces a colossal missed opportunity to both reduce emissions in line with its commitments and deliver significant improvements in Irish society.

Swifter action would do more than just avoid hefty payments and meet Ireland's agreed commitments. It would transform Ireland to a healthier, more sustainable, and more energy secure society.

Our estimates of potential costs reflect plausible upper and lower bounds based on international evidence. The wide range illustrates the high degree of uncertainty involved. This relates to the path for Ireland's emissions, the costs of demonstrating compliance with the legislation, and broader uncertainty around costs if the EU as a whole misses its targets.

One thing is certain. Without action to reduce emissions now, Ireland will face avoidable costs.

# Summary Table

## Ireland's progress towards the main EU targets

| | What does it cover? | What is our target? | Where do we currently stand? | Where will we be in 2030? | Potential costs of missing targets |
|---|---|---|---|---|---|
| **Effort Sharing Regulation (ESR)** | It sets binding national targets for reducing greenhouse gas emissions. It covers domestic transport (excluding aviation transport), buildings, small industry, waste and agriculture emissions out to 2030. | Ireland has annual limits to reduce emissions in these sectors with a target to reduce emissions by 42% by 2030, compared to 2005 levels. | Not on track. Emissions in 2023 were 43 Mt $CO_2$ equivalent, 5% above the required trajectory. | Ireland is projected to exceed its emissions limits, with emissions 57% above target under WEM and 28% under WAM. | Range from €5 to €16 billion under the WEM scenario, and from €3 billion to €10 billion under the WAM scenario. |
| **Land-Use, Land-Use Change and Forestry (LULUCF) Regulation** | Sets binding national limits on net emissions from the land sector, including forests, wetlands, and agricultural land. | Ireland's binding target is to achieve a reduction of 0.6 Mt $CO_2$ equivalent LULUCF emissions by 2030, relative to average levels in 2016-2018. Equivalent to a reduction of 6% relative to 2022 levels. | Not on track. In 2022, Ireland's net LULUCF emissions were 4 Mt $CO_2$ equivalent, 7% above the 2030 target. | Ireland is projected to miss its LULUCF targets, with emissions more than double the target under WEM scenario and 32% above target under WAM scenario. | Range from €1.6 to €5.8 billion under the WEM scenario, and from €0.5 to €1.7 billion under the WAM scenario. |
| **Renewable Energy Directive (RED)** | Establishes renewable energy targets for gross final energy consumption, including sub-targets for heating & cooling, and transport. | Ireland is required to maintain a baseline renewable energy share of 16% of gross final energy consumption and achieve a 43% renewable energy share by 2030. | Not on track. In 2023, Ireland's renewable energy share was 15%, below our benchmark level of 16%, and 28 percentage points below the 2030 target. | Ireland is projected to fall short of its renewable energy target by 12 percentage points in the WEM scenario and fall marginally below the target in the WAM scenario. | Range from €0.5 billion to €4.4 billion under the WEM scenario, and €0.2 to €2.6 billion under the WAM scenario. |
| **Energy Efficiency Directive (EED)** | Sets national targets for reductions in energy use of all kinds, along with binding sub targets for improving energy efficiency. Currently non-binding. | Ireland's target is to reduce Final Energy Consumption to 10.5 Mtoe by 2030, a reduction of 13% relative to 2022 levels. | Not on track. Final Energy Consumption in 2023 was 12.0 Mtoe, 15% above the 2030 target. | Ireland is projected to miss its energy efficiency targets, exceeding the target by 21% under the WEM scenario and 19% under the WAM scenario. | No compliance regime at present. |

Notes: WEM stands for "with existing measures". This is a scenario that includes all currently implemented policies. WAM stands for "with additional measures. This scenario includes planned, but no yet implemented policies. See main text for further details. All cost estimates are nominal.

# Introduction

Ireland has committed to a range of legally binding climate and energy targets. These aim to reduce emissions, increase renewable energy, and improve energy efficiency by 2030. These targets are all part of the EU's efforts to achieve carbon neutrality by 2050. Failing to meet these commitments could result in substantial costs. Ireland may be required to purchase compliance from other EU Member States, and it could potentially incur financial sanctions.

This report focuses specifically on the costs of Ireland not meeting its EU targets. The focus is on national emissions and renewable energy targets. It does not assess Ireland's national carbon budgets or additional policies, which may set more stringent targets. That is not to say that there are no other costs or benefits associated with policies in this space – there are. However, these EU regulatory costs are an essential part of the overall picture that can help shape more effective policy. This report seeks to address a number of knowledge gaps in this area. It builds on and updates work by Walker et al. (2023).

## There are four key pieces of legislation

The EU's green architecture has several important pieces. For three pieces of legislation, we can estimate the potential costs to Ireland from not meeting targets.

## 1 The Effort Sharing Regulation

The most significant risk for Ireland in terms of not meeting targets is the cost that may arise from the Effort Sharing Regulation. This covers Ireland's agreed commitments to reduce emissions up to 2030 from domestic transport, buildings, small industry, waste, and agriculture.

Ireland is already near the bottom of the league when it comes to emissions reductions covered by this regulation. Failing to meet these commitments means Ireland will probably have to purchase allocations from other Member States that overperform against their annual emission allocations. This would be the case even after Ireland uses other flexibilities.

Purchasing emission allocations could be expensive and difficult. Few Member States are likely to overperform and

have allocations to sell. Furthermore, the shortfalls expected for three large Member States, Germany, Italy, and France could be substantial. Indeed, Germany's expected shortfall is so great as to mean that it might require more than half of the emissions allocations likely to be available. The shortage of emissions allocations available for purchase could result in a bidding war. This would leave Ireland with limited or no access to the necessary allocations to, in effect, purchase its compliance with the regulation.

This poses challenges for Ireland. If Ireland somehow manages to obtain emissions allocations, we estimate that it might need to spend between €5 billion and €16 billion to purchase these. This would fall to €3 to €8 billion if additional policy measures planned but not yet enacted were followed through on by the Government.

This cost range is wide for two reasons. First, it is difficult to put a price on emissions allocations. Ultimately, their cost will depend on what Member States charge for them. It might also involve non-financial concessions between Member States. The range of estimates reflects a variety of pricing approaches that we consider reasonable. Second, there is a possibility for Ireland to act more decisively—but in line with our legislation—on some of the measures it has been slow to implement thus far. This could push costs down.

With emissions allocations potentially in short supply, what would happen were Ireland unable to buy any? This question is difficult to answer. It could potentially result in substantial penalties or legal repercussions. The legislation is currently not clear on this. Financial penalties for Member States not hitting their emissions targets are basically unknown. That is, they are not explicitly defined in cash terms. The European Commission could opt to take costly action, including infringement proceedings, against Member States. But there are no previous examples of countries missing targets to work off.

While financial penalties are unclear, what is known is how non-financial penalties will work. Countries like Ireland which are set to exceed their emissions face tighter requirements from 2027. Ireland faces annual evaluations and will be required to submit a corrective action plan if it is not making sufficient progress against its annual target. But

it is the compliance checks in 2027 and 2032 that will be key to how Ireland's emissions are assessed.[1]

## 2 The land use, land use change, and forestry regulation

The second regulation we focus on is the Land-Use, Land-Use Change and Forestry Regulation. Under this regulation, Ireland has agreed to use nature-based solutions and practices that improve how it manages land and forestry to reduce and offset emissions.

At present, Ireland also looks set to fall short of its agreed commitments under this regulation.

To comply with the regulation, Ireland will need to purchase further emissions allowances (known as Land Removal Units). We estimate that Ireland might need to spend between €0.5 billion and €5.8 billion to comply with the Land-Use, Land-Use Change and Forestry Regulation.

## 3 The Renewable Energy Directive

The third piece of legislation we consider is the Renewable Energy Directive. Under this Directive, Ireland has committed to achieving a 43% share of renewable energy in gross final energy consumption by 2030, alongside additional sub-targets for specific sectors such as heating and cooling transport.

At present, with existing measures, Ireland risks falling short of these targets. While additional measures could help bridge the gap, the scale and complexity of infrastructure development mean that purchasing statistical transfers from other Member States may be necessary to comply with the directive. The cost of acquiring these transfers could range between €0.2 and €4.4 billion euros.

## 4 The Energy Efficiency Directive

A final piece of legislation we consider is the Energy Efficiency Directive. This sets energy efficiency targets for final and primary energy consumption. No costs are estimated for this directive, given there is currently no compliance mechanism associated with it. However, failing

[1] The first compliance check is in 2027 covering the period 2021 to 2025. Ireland looks set to meet its requirements in these years if flexibilities are used. The cost of using these flexibilities up to 2025 is estimated at €0.7 billion. The second compliance check is in 2032 covering 2026 to 2030.

to meet energy efficiency targets could increase the costs of achieving emissions reduction targets elsewhere.

## What can Ireland do?

Ireland has two options to offset risks.

First, meeting targets. Ireland could just knuckle down and start to hit the targets. Putting in place more ambitious measures and accelerating planned measures to reduce emissions in Ireland would help avoid the need to purchase substantial emissions allowances from other countries. It would require significant investments and policy changes. But it would mean improving citizens lives here rather than transferring large sums to our European neighbours.

Second, buying compliance. Ireland could buy annual emissions allowances from other Member States in the years to come to help it comply. This might make sense to do earlier rather than later, given that prices are likely to rise as we get nearer to the end of the assessment period, particularly if demand for allowances rises sharply. Buying emissions allowances earlier might mean Ireland could avail of lower prices and it could provide a buffer for future overshoots. However, other countries may not be willing to sell allowances if they are unsure about hitting their own requirements. Ireland would also likely have to compete with large Member States elsewhere that are struggling to meet their targets, like Italy and Germany.

## Will this be enforced?

Many Member States look set to miss their targets. As such, questions around the degree of enforcement will inevitably arise.

There are three important points to consider in this context:

First, this is the law as it stands. We are simply estimating the costs Ireland potentially faces based on existing pieces of legislation.

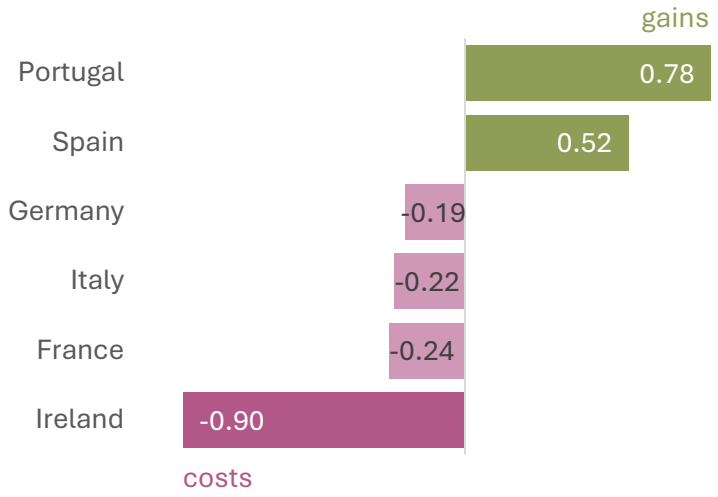
Second, some countries stand to benefit. For example, countries such as Spain and Portugal are estimated to exceed their targets. This means they could sell surplus allowances to others and generate revenue equivalent to

0.5% and 0.8% of GDP, respectively, or 1.9% and 2.9% of GDP in a high-price scenario (Figure Nº 1).[2]

Third, the size of costs to countries other than Ireland are small relative to the size of their economies. For instance, Germany, France, and Italy face large emissions gaps. This could result in significant costs. However, as a share of their economies, these costs are relatively low at close to just 0.2% of GDP. For Ireland, the financial burden of the Effort Sharing Regulation is much higher — potentially up to five times greater when assessed as a percentage of GNI*. This also holds for higher price assumptions. It suggests that the risks around costs are less pressing in other Member States than they are in Ireland.

Nº 1 **Ireland risks being an outlier**

% GDP estimated costs of missing Effort Sharing Regulation (Ireland in % GNI*)




Source: Own workings based on national "with additional measures" projections, using ETS futures prices, assuming no use of flexibilities.

A further point to note in this context is that missing targets is already costing Ireland. In the past four years, Ireland has lost out on €500 million of potential revenue from carbon credits it was entitled to sell. This reflects the fact that it is behind on its targets, and so it is holding onto ETS allowances in an effort to try to make up the gap to its target rather than auctioning these. In addition, other Member States are already purchasing statistical transfers for falling behind their renewable energy targets.

[2] These cost estimates refer to the cumulative emissions gap under the With Additional Measures scenario in the Effort Sharing Regulation, without accounting for potential flexibilities. They also depend on pricing assumptions. More details can be found in the section on the Effort Sharing Regulation and Appendix A.

## Action now makes the most sense

Stepping up efforts on climate action now and meeting targets makes the most sense. It would avoid the risk of Ireland getting into a cycle of deepening emissions reductions requirements, including targets for 2040 and 2050, EU legal challenges, and a need for sudden policy shifts.

Recent events have highlighted how climate action can benefit people. Ireland's reliance on imported fossil fuels left it exposed to geopolitical disruptions and price rises during the cost-of-living crisis. More recently, Storm Éowyn showed the need for more secure and stable energy infrastructure.

Acting now can help reduce these vulnerabilities and avoid large transfers to neighbouring countries. Ultimately, these are funds that could instead be used to improve people's well-being.

## This report works through each piece of legislation

The rest of this report works through each of the regulations and directives that are relevant. We discuss the approaches that we have taken in terms of identifying projected gaps to our commitments and how best to price any costs from missing targets. In each case, we set out a range of costs to reflect the uncertainties involved.

## We then put the costs in perspective

The final part of this report, Chapter 5, looks at putting some of the potential costs in context. This is important. The costs are potentially very large. By not taking actions sooner to avoid these costs and reduce emissions, Ireland faces a colossal missed opportunity.

We highlight a few illustrative measures. These cover actions related to the energy grid, the uptake of electric vehicles, and on forestry and peatlands. The illustrative measures sum up to a total at the middle of the potential cost range. They equate to just one-tenth of capital spending allocated out to 2030. Yet these would go a long distance to meeting Ireland's agreed targets.

There is further support for the idea that the costs of achieving Ireland's transition, and meeting national and EU

targets, may not be as large as one might expect. Earlier work by the Irish Fiscal Advisory Council puts the potential annual spending required at 0.6 to 1.1% of modified gross national income or GNI* (Casey & Carroll, 2023). More recently, McInerney and FitzGerald (2024) put the additional annual investment costs at 0.3% of GNI*. That suggests costs equivalent to between 6% and 23% of capital spending in 2025.

Swifter action would do more than just avoid hefty payments and meet Ireland's agreed commitments. It would transform Ireland's society, making it healthier, more sustainable, and more energy secure.

# 1 The Effort Sharing Regulation

## Overview

The Effort Sharing Regulation is one of the central pieces of the EU's climate policy architecture. It sets binding national climate targets for Member States' emissions.

The Effort Sharing Regulation covers domestic transport (excluding aviation transport), buildings, small industry, waste and agriculture emissions up to 2030.[3] Together, these sectors are responsible for more than 60% of EU emissions.[4]

The Effort Sharing Regulation accounts for 71% of Ireland's total emissions. Agriculture makes up half of these and is the largest single contributor.[5]

The Regulation was initially agreed by Member States and adopted in 2018.[6] In 2023, the requirements were strengthened, and the Regulation now requires Ireland to have reduced its emissions in 2030 by 42%, relative to 2005 levels.[7]

### How it works

The Effort Sharing Regulation works by setting emission limits for the years 2021 to 2030. Member States are provided with binding annual emission allocations. Each of these corresponds to a limit on the tonnes of $CO_2$ equivalent that can be emitted for each year in the

[3] It excludes sectors covered under the EU Emissions Trading Scheme (EU ETS), which includes emissions from power plants, cement plants and domestic (intra-EU) aviation operations.

[4] The European Commission provides a useful overview.

[5] See the Environmental Protection Agency's (2024) report "Ireland: Provisional Greenhouse Gas Emissions". These data are as of 2022 and include LULUCF.

[6] See Regulation (EU) 2018/842 from May 2018. Note that Ireland was originally required to reduce its emissions in 2030 by 30% relative to its 2005 levels as part of the Effort Sharing Regulation.

[7] See amending Regulation (EU) 2023/857 from April 2023. The overarching goal is for Member States to collectively reduce emissions covered by this regulation by 40% by 2030.

areas covered. The number of allowances is different for every year, generally declining.[8]

Member States are required to stay within these annual emission allocations, otherwise they face costs for not meeting targets.

Failing to meet these commitments entails having to purchase allocations from Member States that surpass their emission reduction targets.

**Annual Emissions Allocations**

Annual Emissions Allocations are limits on emissions assigned to Member States for each year under the Effort Sharing Regulation. They are calculated to give a path towards the 2030 emission reduction targets.

In years where national emissions are lower than a Member State's allocation, these surpluses can be "banked" for use in later years. This is subject to some limitations. Correspondingly, in years where actual emissions exceed allocations, a limited number of allocations can be borrowed from the following year.

Annual Emissions Allocations can also be bought and sold between Member States. Revenues from the sale of Annual Emissions Allocations should be used for climate action.

## Flexibilities

Member States can avail of some "flexibilities" under the Effort Sharing Regulation in terms of its efforts to achieve compliance for this period. This gives some scope for Member States to reduce the number of accountable emissions which are considered when assessing compliance by using certain flexibilities. [9]

First, Ireland can use a flexibility related to the Emissions Trading System.[10] This would involve the state not auctioning off a portion of Ireland's Emissions Trading System allowances. Using this flexibility results in lower revenue for the State—Ireland will no longer receive money from auctioning this portion of allowances.

[8] Annual Emissions Allocations have been implemented for 2021–2025. However, allocations for 2026–2030 can be estimated based on the methodology in the 2023 amendment to the Effort Sharing Regulation.

[9] The Effort Sharing Regulation provides for a limited safety reserve available to Member States meeting certain criteria in addition to these flexibilities but as it will not apply to Ireland and is subject to fulfilment of the overall EU 2030 target it is not expected to impact on this analysis.

[10] The Emissions Trading System is a market for capping and trading carbon credits. It covers emissions in the power, aviation, and energy intensive sectors.

Ireland can use 1.9 Mt $CO_2$ equivalent (approximately 4.2% of Ireland's relevant emissions in 2022) per year of these flexibilities to offset the excess emissions under the Effort Sharing Regulation. Ireland has confirmed that it is using the Emissions Trading System flexibility.

Second, Ireland could benefit from flexibilities if it exceeds its commitments in another Regulation — the Land Use, Land Use Change and Forestry Regulation. [11] Overperformance in this Regulation would entail countries being allowed some flexibility to offset any failure to reduce emissions in the Effort Sharing Regulation.[12] However, to access this flexibility, Ireland would have to meet its own LULUCF targets. There are also limits to how much each Member State can use this flexibility (For a detailed discussion of LULUCF, see Section 2).

### Requirements may tighten

If Ireland exceeds its emissions allowances, it faces a compounding penalty. This means that, any excess emissions would scale up the next year's requirements, as well as being multiplied by 1.08. This would necessitate steeper future emission cuts, making the transition to a low-carbon economy more challenging and expensive, as the most cost-effective solutions are exhausted first (see Appendix for more detail).

### Timing

Member States' compliance will be assessed once detailed reviews of emissions data are completed. These are scheduled to take place in 2027 for the years 2021–2025 and 2032 for the years 2026–2030.

## Compliance at EU level

To assess how the Effort Sharing Regulation is being complied with, we can look at emissions projections.

[11] https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM:2024:498:FIN

[12] LULUCF operates as a separate market. Member States that over-emit will need to buy their way into compliance. By contrast, under emitting Member States can use their surpluses to help comply with their Effort Sharing Regulation requirements or they can sell these to another Member State.

### Emissions Projections

Emissions pathways are routinely estimated using two key scenarios:

**With Existing Measures (WEM)**

This scenario reflects emissions based on policies, regulations, and incentives that have already been implemented or adopted, i.e., no further actions are taken beyond those currently in place.

**With Additional Measures (WAM)**

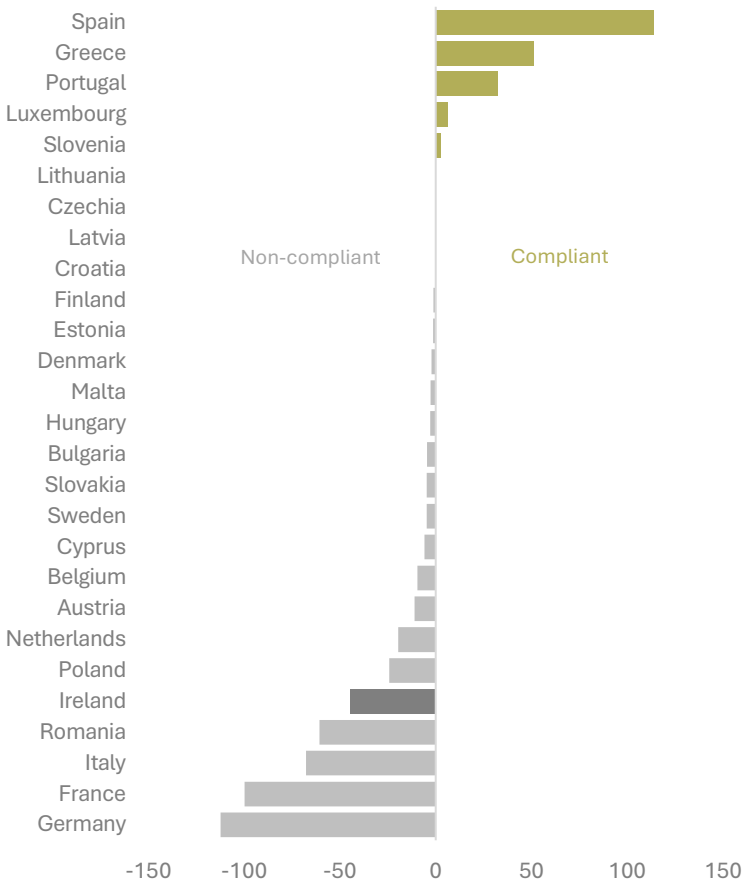
This scenario includes the impact of both existing measures and additional planned policies, regulations, and incentives that are likely to be adopted and implemented in the future. In the case of Ireland, these include many, but not all of the policies and measures outlined in Ireland's Climate Action Plan 2024 (2023).

For information on the measures and assumptions included in each scenario, see Environmental Protection Agency (2024b).

As things stand, the EU looks unlikely to achieve its emissions reduction targets (Figure Nº 2). Current projections, even with additional measures, show it overshooting annual emissions allocations by a cumulative 279 Mt $CO_2$ equivalent, or 8.3% of the EU's total emissions in 2022. Eighteen countries look set to underachieve their targets, by a cumulative total of 480 Mt $CO_2$ equivalent. However, some countries look set to overachieve on their targets, reducing emissions by a cumulative total of 205 Mt $CO_2$ equivalent more than required.

## Nº 2 Most countries are off track

Cumulative gap under the Effort Sharing Regulation, Mt $CO_2$ equivalent



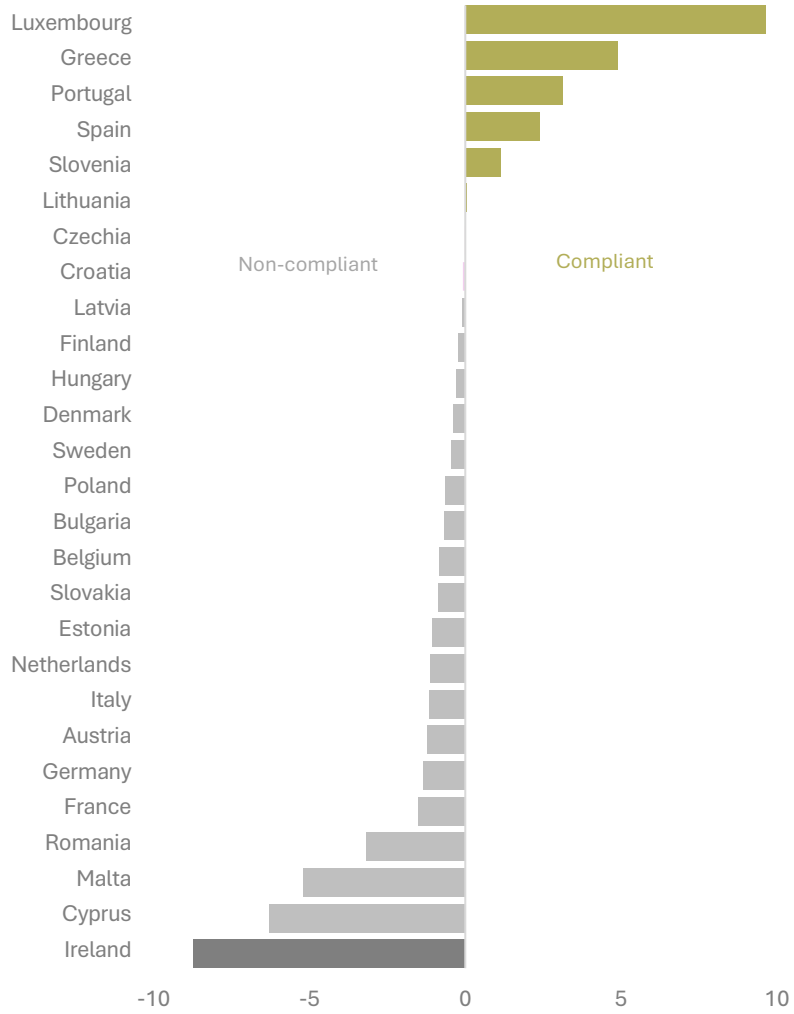

Source: Climate Action Progress Report (European Commission, 2024).
Note: This figure covers the Annual Emissions Allowances for 2021 to 2030. It is based on the With Additional Measures scenarios. It excludes potential ETS and LULUCF flexibilities.

Figure Nº 2 shows the cumulative total of Annual Emission's Allowances that may or may not be available under the Effort Sharing Regulation.

While Germany and France have large cumulative gaps in absolute terms, relative to the size of their populations, Ireland's gap is substantially larger (Figure Nº 3). Ireland has the highest per capita emissions gap at 8.7 tonnes of $CO_2$ emissions per capita, whereas Germany's emissions gap stands at 1.4 tonnes of $CO_2$ emissions per capita. The higher per capita shortfall suggests that countries like Ireland may face higher costs relative to the size of their economy and greater challenges in meeting their targets.

## Nº 3 Ireland's shortfall is larger, given its size

Per person emissions gap, tonnes of $CO_2$ equivalent emissions




Source: Climate Action Progress Report (European Commission, 2024) and Eurostat.
Notes: The Figure shows the cumulative gap to the Annual Emissions Allowances for 2021 to 2030 under the Effort Sharing Regulation in terms of tonnes of $CO_2$ equivalent per person. It uses the "With Additional Measures" scenarios for each country. The potential use of ETS and LULUCF flexibilities are excluded. Per capita values are calculated using total population in 2021.

# Ireland's compliance

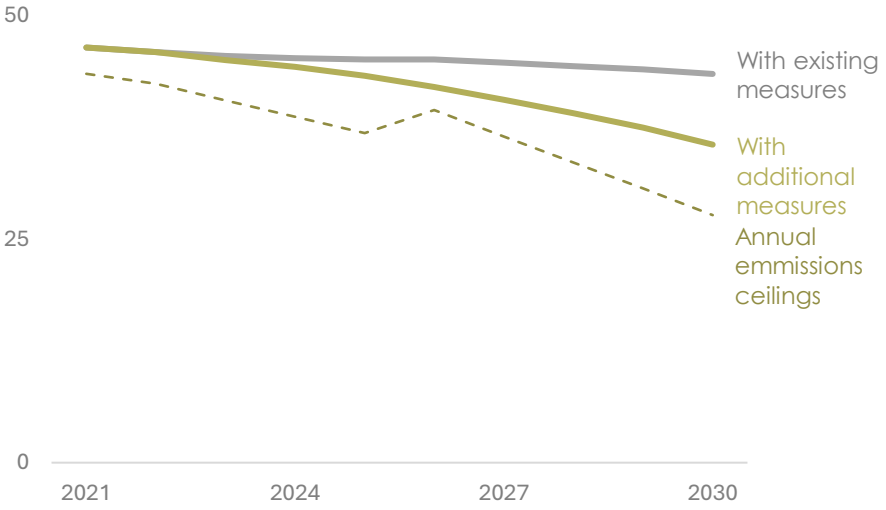
To assess compliance, the first thing to do is to measure the likely path for Ireland's emissions in the areas covered by the Effort Sharing Regulation.

Final emissions data for sectors covered by the Effort Sharing Regulation are available for 2021 and 2022, while there is provisional data available for 2023. We can also compare projected emissions against annual allocations for the period 2024 to 2030.

Figure Nº 4 shows the EPA's projections for Ireland's emissions under both the With Existing Measures and With Additional Measures scenarios. In every year, and under both scenarios, Ireland is projected to exceed its annual emissions allowances. This is estimated to lead to cumulative excess emissions of 47 Mt $CO_2$ equivalent by 2030 under the With Additional Measures scenario, equivalent to one whole year of relevant emissions in Ireland.[13] The excess rises to a large cumulative gap of 77 Mt $CO_2$ in the With Existing Measures scenario (Figure Nº 5).

Nº 4 **Ireland is likely to have excessive emissions**

Annual emissions, Mt $CO_2$ equivalent

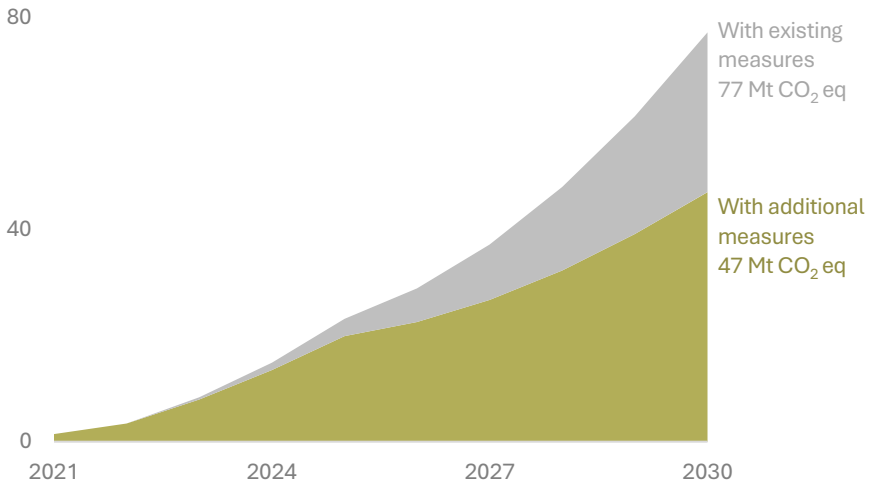



Source: EPA and Ireland's Final updated National Energy and Climate Plan 2024.
Notes: Figures show non-ETS emissions. Projection figures are used for 2021 to 2030. Figures do not reflect 2021 and 2022 inventories or either ETS or LULUCF flexibilities.

[13] Ireland's Effort Sharing Regulation emissions were 45.9 Mt $CO_2$ equivalent in 2022.

## Nº 5 A large cumulative gap is likely

Cumulative emissions gap, 2021–2030 Mt $CO_2$ equivalent

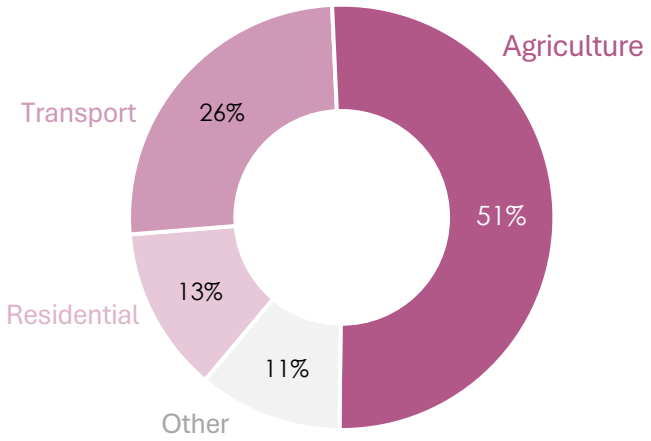



Source: EPA and Ireland's Final updated National Energy and Climate Plan 2024.
Notes: Final inventory emissions are used for 2021 and 2022. Projection figures are used for 2023-2030. Figures do not reflect ETS or LULUCF flexibilities.

Agriculture makes up a half of Ireland's Effort Sharing Regulation emissions (Figure Nº 6). The projections suggest that agriculture will continue to contribute the majority of emissions under the Regulation. This is true for both scenarios — with existing measures and with additional measures. This means that agriculture has a major opportunity to help Ireland meet its targets. Transport accounts for approximately one quarter of emissions, while residential buildings accounts for one eighth of emissions.

## Nº 6 Agriculture is a critical source of emissions

% of Effort Sharing Regulation emissions in 2022




Source: Environmental Protection Agency.

# Pricing

Once we have an estimate of the gap between Ireland's projected emissions and its allocations, the next challenge is to assign prices, or costs to this gap.

The prices that will apply under the regulation are highly uncertain. Ultimately, the price of missing targets will depend on the extent to which other EU Member States achieve targets. If Ireland fails to meet its targets with its agreed commitments, it will have to purchase Emissions Allocations from Member States who have exceeded their requirements. The price of these will be determined bilaterally between Member States.[14]

As things stand, there will be more countries missing targets than achieving targets across the EU. This means there will probably be a shortage of Emissions Allocations to go around. In addition, the needs of two large economies, France and Germany, would be large enough to consume all of the allowances projected to be available from over-performing countries.

In such situations, market prices can end up being very difficult to predict. They could be highly non-linear: increasing rapidly over and above what may be seen in a normally functioning market as Allocations are bought up.

With emissions allocations likely to be insufficient to meet demand from underperformers, some Member States could face infringement proceedings for not complying with the Effort Sharing Regulation. It is possible the cost of these infringement proceedings could at least be equal to the price of the very last Annual Emissions Allocation purchased.[15]

To account for this uncertainty, we can use several approaches. These provide a range for what the potential prices and costs might be. The prices considered are in nominal terms, reflecting the total cost at the time of payment. The prices can be broadly grouped into two categories: 1) market-based prices, and 2) non-market-based prices.

[14] In 2020, Ireland was one of four Member States which exceeded their Annual Emissions Allocations. Ireland bought Emissions Allocations from Slovakia along with use of international credits from the Clean Development Mechanism to meet its obligations.

[15] It is unclear what would happen the proceeds of any infringement proceedings were they to take place. Ultimately, the revenue may be recycled back to Member States through the EU budget. However, the destination of the proceeds is likely to favour those who complied with the climate targets, as doing otherwise would undermine compliance incentives.

**Market-based prices**

This approach assigns a market value to greenhouse gas emissions. Three sets of market-based prices are used.

1) **EU Emissions Trading System (ETS) futures prices**
The Emissions Trading System is a well-established and transparent cap and trade market for carbon credits. The price is established through a market mechanism whereby companies will either purchase allowances (if reducing emissions is more expensive) or abate their emissions. These ETS allowances are freely tradable. A futures market for ETS allowances has also formed — a market for trading future ETS allowances. These futures prices represent the market's best guess at what the likely cost of abating emissions will be. Therefore, the ETS futures prices offer one possible scenario for the price of future carbon credits.

2) **Analysts' predictions of ETS prices**
These prices are also based on the ETS system. The ETS futures market for contracts several years into the future is relatively illiquid. For example, the trading volume of ETS futures for December 2028 is only a fraction of that for December 2025. Due to this limited liquidity, these contracts may not serve as the most reliable indicators of future prices. As an alternative, another option to use is what experts—in this case market analysts—believe the future price of ETS credits will be. EU carbon price forecasts based on a survey of analysts are collated on a regular basis by Carbon Pulse.[16]

3) **Analysts' predictions of ETS 2 prices**
Similar to the original Emissions Trading System, the ETS 2 is a new emissions trading system designed to cover emissions from fuel combustion in buildings, road transport and small industries.[17] This market will cover some of the emissions included under the Effort Sharing Regulation and for that reason the prices of these allowances may be a good indication of the price of the Effort Sharing Regulation allocations. The ETS 2 will become operational in 2027. As a result, a market price for these emissions

[16] For this analysis, the Median ETS price forecast numbers from 2025-2030 were used from assessments compiled by Carbon Pulse in October 2024; https://carbon-pulse.com/331777/.

[17] The ETS 2 extends to sectors already covered by Ireland's carbon tax. As a result, Ireland has a derogation from the ETS 2 requirements until 2030.

has not yet been established. However, several analysts have predicted what the future price of these emission allowances will be.[18]

**Non-market-based prices**

There are a number of non-market-based prices which can be used as a potential reference point for Annual Emissions Allocation pricing. Estimates for the cost of carbon vary depending on methodology, underlying assumptions and the geographic scope of the analysis. Given that compliance involves purchasing emissions allocations from other Member States, we focus on a common price estimate at the EU level:

1) **EU Marginal Abatement Cost**
   The marginal abatement cost for the EU represents the cost of reducing the last unit of emissions required to meet a specific target. It provides an estimate of the cost of removing emissions across all Member States.

   Conceptually, the marginal abatement cost focuses on the cost of actions—what it takes to mitigate emissions—rather than the harms caused by those emissions. These estimates are based on models that assume the EU finds the cheapest way to meet its goals. There are two ways this price estimate could prove wrong. First, in reality, political and practical limitations mean the actual cost would likely be higher. Second, the price of purchasing compliance is likely to be an average cost of removing a certain amount of emissions over time, rather than the marginal cost of reducing the very last emission. These sources of potential error move in opposite directions.

The pricing assumptions are discussed in further detail in the appendix alongside detailed workings.

# Potential costs of missing targets

The potential costs of missing targets depend on both the gap to target, and the price associated with it. In other

[18] For further details on the analysts used see the appendix.

words, the cost of missing targets reflects the emissions gap and the price of these emissions.

The costs reflect many uncertainties. The largest of these reflects the price assumed for carbon emissions. Yet, there are also uncertainties associated with future policy measures, which could significantly reduce the costs. And it is uncertain how much various flexibilities might apply.

In scenarios assuming ETS flexibilities apply, we include revenue foregone. This represents the lost revenue from Ireland not auctioning off its available permits.[19]

Another flexibility that Ireland might avail of relates to the Regulation covering land use. The Land Use, Land Use Change, and Forestry (LULUCF) Regulation governs the EU's greenhouse gas emissions and removals from the land-use sector. Depending on Ireland's compliance with this, and the EUs as a whole, Ireland may be able to offset more of its costs with additional flexibilities. However, at present, this is unlikely with both Ireland and the EU as a whole off track with respect to LULUCF targets.

## Nº 7 Potential costs in the Effort Sharing Regulation

€ billion cost under each scenario

| | With additional measures | | | With existing measures only | | |
|---|---|---|---|---|---|---|
| | With ETS + LULUCF flexibility | With ETS flexibility | No flexibility | With ETS + LULUCF flexibility | With ETS flexibility | No flexibility |
| ETS futures | 2.7 | 3.6 | 3.7 | 5.4 | 6.1 | 6.2 |
| Analysts' predictions for ETS | 3.6 | 4.6 | 5.3 | 7.9 | 8.6 | 9.3 |
| Analysts' predictions for ETS 2 | 4.1 | 4.9 | 5.6 | 9.0 | 9.5 | 10.3 |
| EU Marginal Abatement Cost | 6.2 | 7.6 | 9.8 | 15.6 | 16.2 | 18.4 |

Sources: Environmental Protection Agency (2024), Carbon Pulse, Macrobond, Transport and Environment (2024), Veyt, Homaio, Clearblue.
Notes: The table shows the range of estimated costs for Ireland not meeting Effort Sharing Regulation targets. Estimates are based on projected 2027 and 2032 prices, reflecting the expected timing of compliance assessments for the 2021–2025 and 2026–2030 periods. The ETS futures are the latest available at the time of writing. The scenario where ETS offsets are used to offset costs incorporate the cost of the ETS revenue forgone.

In scenarios where Ireland achieves greater emissions reductions, the potential costs are lower. Given the uncertainties, there is a wide range of potential costs, from €2.7 billion up to €16.2 billion (Table Nº 7). This ignores the "no-flexibility" scenarios, which are presented for

[19] This is equal to the sum of the revenue forgone in each of the years from 2021–2030. In each year this is calculated as 1.9Mt $CO_2$ equivalent times the ETS price for each year (either historical price or futures price).

completeness only. They are a hypothetical scenario in the event that no offsets were used. Ireland has indicated that will use the ETS flexibility. As a result, these scenarios do not represent costs that Ireland will ultimately face.

At the moment, the most likely cost is assessed to be at least €6.1 billion. That is the cost under the WEM scenario including the use of ETS flexibility. However, this will evolve over time. With the implementation of additional climate action this cost could be lowered.

# 2 The Land Use, Land Use Change, and Forestry Regulation

The Land Use, Land Use Change, and Forestry (LULUCF) Regulation governs the EU's greenhouse gas emissions and removals from the land-use sector. This includes land-use categories such as forested land, cropland, grasslands and wetlands. The Regulation sets binding targets for how much $CO_2$ equivalent the sector is to remove.

Since 1990, land in Ireland has acted as a source of emissions and there is considerable research underway to understand how Ireland's land can turn from a source to a sink of emissions. Measures such as increased afforestation in Ireland and rewetting of drained organic peat soils are examples of measures to deliver reduced emissions in this area.

Estimating the potential cost of these emissions is currently highly uncertain as the National Inventory undergoes improvements to incorporate Irish sourced spatial and emissions data, which can result in fluctuations.

## How it works

The LULUCF Regulation establishes binding requirements for Member States in the land-use sector.

The regulations are split into two compliance periods: 2021–2025 and 2026–2030. Each period has distinct accounting rules.

In the first period, Member States are required to balance emissions and removals in the land-use sector, adhering to the "no-debit rule". The rule requires that emissions must not exceed removals accounted for relative to a benchmark period.

In the second period, Ireland is required to reduce its emissions by 0.626 Mt $CO_2$ equivalent by 2030—approximately 15% reduction relative to 2022 levels according to current inventory figures.[20] Member States are required to demonstrate progress towards the target over the period 2026–2030. Therefore, annual emission reduction targets have been set, which assume a liner pathway to the target. Any cumulative emissions above the linear pathway will result in additional costs for Ireland.

At the EU level, the target is to achieve net removals of 310 Mt $CO_2$ equivalent by 2030.[21]

Similar to the Effort Sharing Regulation, failing to meet these commitments entails having to purchase allocations from Member States that overperform against their annual emission allocations.

## Timing

Member States are required to report their net emissions in five-year cycles.

The LULUCF's first compliance period, 2021–2025, closely follows the Kyoto protocol accounting rules. Member States must submit compliance reports for the first period by 15 March 2027, demonstrating that their emissions do not exceed removals, relative to the reference period.

For the LULUCF's second compliance period, 2026–2030, final compliance reports must be submitted by 15 March 2032. These are intended to confirm that the EU-wide target in net removals has been achieved. During this period, accounting practices will shift to align with simplified reporting obligations.

## How it interacts with the Effort Sharing Regulation

The LULUCF Regulation has an important interaction with the Effort Sharing Regulation. Credit transfers are available in both directions. That is to say, Ireland could, depending on its success or failure in achieving requirements, use

[20] The technical requirement is for Ireland to reduce its emissions by 0.626 Mt $CO_2$ equivalent by 2030, relative to the average emissions over 2016-2018. The final target of 3.7 Mt $CO_2$ equivalent emission by 2030 may change with revisions to the historical data.

[21] See EU directive 2018/841.

compliance in one regulation to help with compliance in the other.

(1) **LULUCF to Effort Sharing Regulation** – One possibility would be for Ireland to transfer any overachievement in the LULUCF sector towards the Effort Sharing Regulation so as to satisfy the Effort Sharing Regulation target. This is 'the LULUCF flexibility' mentioned in the Effort Sharing Regulation section. However, this flexibility is capped. Projections under the with existing measures scenario indicate that a flexibility of 9.5 Mt $CO_2$ equivalent may be available for the first compliance period (2021–2025). But for now, it seems unlikely that this flexibility will be available in the second period (2026–2030).[22]

    Any overachievement of the LULUCF target could also create opportunity for the transfer/sale of LULUCF credits to other Member States that may need them.

(2) **Effort Sharing Regulation to LULUCF** – Another possibility reflects the fact that Member States can deduct annual emission allocations under Effort Sharing Regulation from LULUCF targets. However, current projections suggest that Ireland is likely to underachieve in terms of its emissions reductions for other sectors covered under the Effort Sharing Regulation. This makes it unlikely that this avenue could be used for Ireland.

    Instead, it would require transfer/purchase from other Member States to comply because of our shortfall in reaching our own LULUCF target. However, opportunities for purchase in this case are expected to be limited for Ireland (and thus expensive) due to the likelihood of other/larger Member States falling short on their LULUCF targets.[23]

For the purposes of the estimating the cost of missing targets, we assume no Effort Sharing Regulation to LULUCF transfers occur. This assumption seems reasonable, given that Ireland looks unlikely to meet its Effort Sharing Regulation requirements under both the WEM and WAM

[22] https://www.epa.ie/our-services/monitoring--assessment/climate-change/ghg/indicators--targets/

[23] In addition, if Europe achieves its overall LULUCF target and therefore has surplus credits, priority for compensating LULUCF target shortfall will be given to countries who have fallen short of their target due to natural disturbances such as forest fires and windthrow. The Regulation also includes provision for the effects of a high proportion of organic soils compared to the EU average, but uncertainty remains on the cost implications under this provision.

scenarios. It should therefore have no credits to transfer towards LULUCF compliance.

## Requirements may tighten

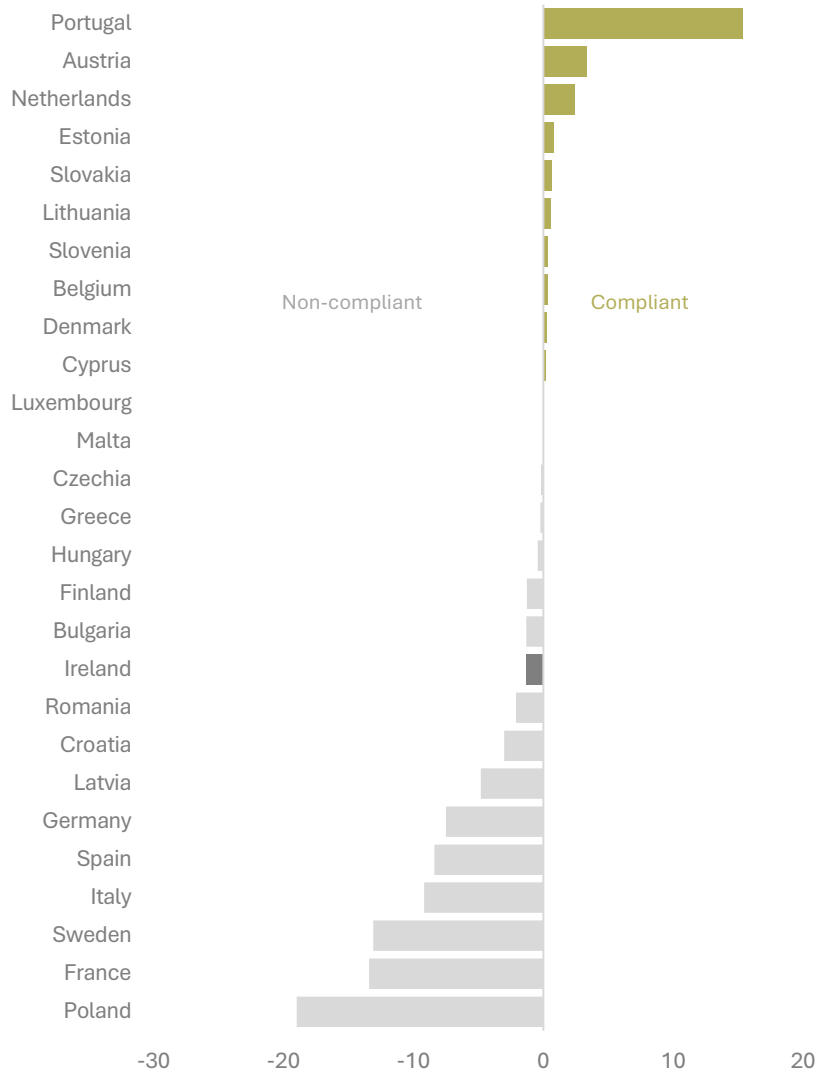
As with the Effort Sharing Regulation, if Ireland exceeds its emissions allowances, it faces a compounding penalty. This means that, any excess emissions would scale up the next year's requirements, as well as being multiplied by 1.08. This could necessitate steeper future emission cuts, making the transition to a low-carbon economy more challenging and expensive.

## Compliance at an EU level

The EU as a whole is currently projected to miss its LULUCF (Land Use, Land-Use Change, and Forestry) emissions reduction targets for 2030. Projections show a cumulative gap of approximately 61 Mt $CO_2$ equivalent (Figure Nº 8). Countries like Poland, France, Sweden, Italy, Spain, and Germany account for most of the shortfall. This is offset in part by the performance of Portugal, Austria, and the Netherlands.

Nº 8 **Most EU countries will miss their LULUCF targets**

Cumulative gap with Annual Emissions Allowances, Mt $CO_2$ equivalent, based on "with existing measures" projections




Source: European Commission (2024).

## Compliance in Ireland

Based on current projections, Ireland will adhere to the no-debit rule over 2021–2025. This means Ireland may have the LULUCF flexibility available under the Effort Sharing Regulation for this period.[24]

Under the With Existing Measures scenario projections Ireland would have net credits of 9.5 Mt $CO_2$ equivalent, which could be used to offset emissions under the Effort Sharing Regulation.

[24] Depending on compliance at the EU level with the LULUCF Regulation.

Under the With Additional Measures scenario, Ireland would have net credits of 13.7 Mt $CO_2$ equivalent. This could mean Ireland could use the maximum amount of the LULUCF flexibility and use 13.4 Mt $CO_2$ equivalent to offset the emissions under the Effort Sharing regulation for 2021-2025.

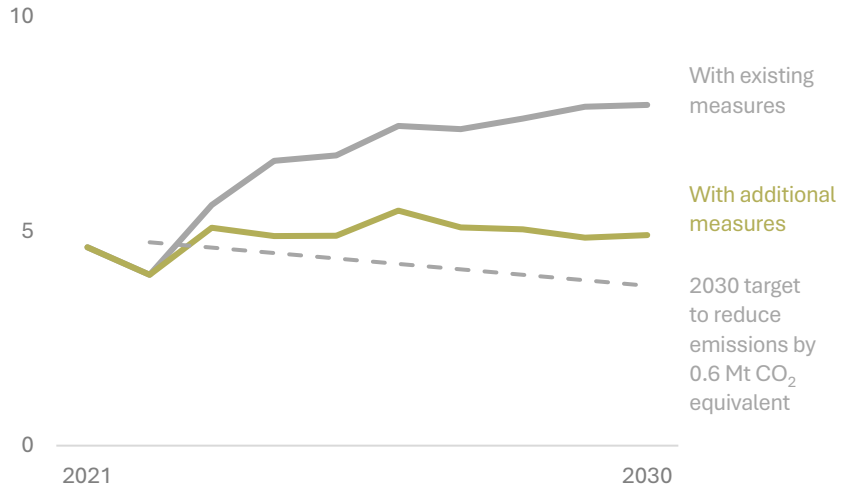
For the second period, 2026–2030, Ireland's binding target is to reduce net LULUCF emissions by 0.6 Mt $CO_2$ equivalent by 2030 (Figure Nº 9). This reduction is measured relative to the average emissions for 2016–2018. To achieve this, net LULUCF emissions from 2026 to 2029 must follow a linear trajectory towards the 2030 target. A carbon budget for 2026–2029 is set based on this trajectory, starting from 2022.

Ireland is projected to have a substantial increase in forest and peatland emissions until 2030. The age profile of Ireland's forests has reduced the removals potential from the total forest area until 2037. From then, a decline in forest emissions is anticipated as the age profile normalises.

Both scenarios project emissions in 2030 to be higher than the emissions targets. With existing measures, Ireland would be projected to have emissions more than double those allowed by 2030. If additional measures are enacted, the projections show that emissions brought closer to the required level, albeit that they would still not be low enough to meet our target.

Nº 9 **Ireland's LULUCF emissions**

Emissions, Mt $CO_2$ equivalent

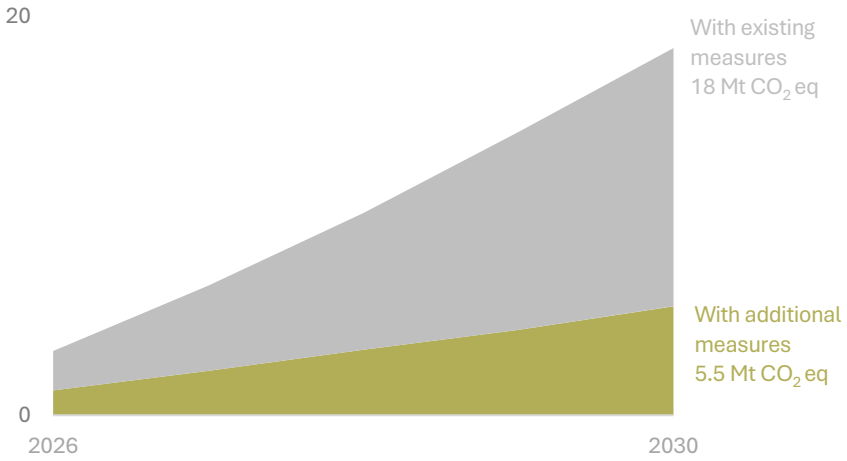



Source: Ireland's Final updated National Energy and Climate Plan 2024.
Note: The linear pathway is constructed using the average of 2021–2023 emissions as the starting point.

Cumulatively, Ireland could build up a large degree of excess emissions without additional policy measures. This cumulative gap (Figure Nº 10) is what we use to determine the costs applied for the second period.

Nº 10 **Ireland's cumulative LULUCF emissions gap**

Mt $CO_2$ equivalent; covers the second compliance period, 2026–2030




Source: Ireland's Final updated National Energy and Climate Plan 2024.

# Pricing

Once again, there is a large degree of uncertainty around the price at which emissions allowances could be purchased under the LULUCF Regulation. There is currently no market for trading LULUCF credits.

However, given the targets for LULUCF revolve around reducing the number of emissions from the sector, and link between the Effort Sharing Regulation and the LULUCF Regulation, the price assumptions used here are the same as in the Effort Sharing Regulation section.

That is not to say that the final price of purchased emissions allowances in the LULUCF Regulation will be the same as that under the Effort Sharing Regulation. The sectors covered by each Regulation are fundamentally different. They likely face different marginal abatement costs, and, as a result, different costs from purchasing emissions allowances. However, in the absence of better information, the price scenarios assumed for the Effort Sharing Regulation provide a range of plausible prices that could be used.

That being said, the abatement costs are likely to be lower for LULUCF emissions than for Effort Sharing Regulation

emissions. As a result, the realised price is likely to be towards the lower end of the four price scenarios below:

1) Emissions Trading System futures.
2) Analysts' predictions for ETS prices.
3) Analyst's predictions for ETS 2 prices.
4) EU Marginal Abatement Cost.

# Potential costs of missing targets

Given the differing accounting treatments, the emissions gaps are calculated separately for the two periods.

Once again, the potential cost of missing targets is a function of the emissions gap in each period and the price of these emissions.

Table Nº 11 shows the potential costs of purchasing compliance under the LULUCF regulation for the period 2021-2030. As Ireland is projected to meet the "no-debit" rule in 2021-2025, all of these costs stem from the 2026-2030 period.

The costs range from relatively small amounts of €0.5 billion under the WAM scenario to substantial amounts of €5.8 billion under the WEM scenario.

At the moment, the most likely scale of cost is assessed to be at least €1.6 billion; however, this will evolve over time.

Nº 11 **Ireland's potential costs under LULUCF**

€ billion cost under each scenario

| | With additional measures | With existing measures |
|---|---|---|
| ETS futures | 0.5 | 1.6 |
| Analysts' predictions for ETS | 0.8 | 2.6 |
| Analysts' predictions for ETS 2 | 0.9 | 3.0 |
| EU Marginal Abatement Cost | 1.7 | 5.8 |

Notes: Estimates are based on projected 2032 prices, reflecting the expected timing of compliance assessments for the 2026–2030 periods.

# 3 The Renewable Energy Directive

The Renewable Energy Directive sets ambitious targets for increasing renewable energy sources across the EU. It sets a binding EU target of a 42.5% share of gross final consumption of energy coming from renewables in the EU—but with an aim of 45%—by 2030.[25]

## How it works

The Renewable Energy Directive sets a baseline renewable energy share of gross final consumption of energy that countries cannot fall below over the period 2021–2030. It also sets targets for the share of energy that is renewable by 2030.

In addition, there are interim targets for the years 2022, 2025, and 2027. Member States are provided with indicative paths for their renewable energy share out to 2030. These paths are intended to be consistent with the EU as a whole meeting its interim target. If the EU as a whole does not meet its interim targets, the interim targets become active for Member States. In such cases, Member States may face costs from purchasing compliance related to these years.

Under the directive, Ireland has to maintain a baseline renewable energy share of 16% for the period 2021–2030. And it has to increase its renewable energy share to 43% by 2030. Ireland has interim renewable energy share targets of 21% for 2022, 28% for 2025, and 34% for 2027.

There are other targets for the share of the renewable energy share of heating and cooling (RES-H), and the renewable energy share of transport (RES-T).[26] However, it is the overall target for renewable energy share of gross final

[25] See EU directive 2023/2413.

[26] Ireland's RES-H target is to increase the renewable energy share in heating to 10.3% by 2025. Technically, Ireland is required to increase the renewable energy share in heating by 0.8 percentage points annually from 2021–2025 and by 1.1 percentage points annually from 2026–2030. The figures above are calculated based on Ireland's RES-H of 6.3% in 2020. Ireland's RES-T target is to increase the renewable energy share in transport to at least 29% by 2030. Alternatively, Ireland can achieve compliance by reducing its greenhouse gas intensity in transport by 14.5% by 2030.

consumption of energy which will be the basis for any additional costs.

## Timing

In terms of the 2030 target, any costs associated with purchasing compliance could fall due between 2030 and 2032, although the exact timing is uncertain. The publication of Ireland's formal renewable energy share result for 2030 would be published by Eurostat in 2032.

If Ireland was to miss the baseline targets for a renewable energy share of 16%, costs would likely arise at least two years after the year in question. Again, this would follow the timing of the publication of the final renewable energy share results for the EU.

However, where the need to purchase compliance becomes clear ahead of time, Member States can conclude multi-annual statistical transfers agreements. This could change the timing of compliance costs.

## Achieving compliance

The Renewable Energy Directive allows for Member States to achieve compliance in a number of ways.

First, Member States can achieve their renewable energy targets.

Second, for those Member States that do not achieve their targets, they can buy statistical transfers from other Member States that overachieve their targets.

Member States can enter into joint projects with other Member States to co-fund investment in renewable energy projects or coordinate joint support schemes, which can count toward the renewable energy share of a Member State. [27, 28] EU countries can also enter into joint projects with third countries. This can count towards national targets if the project involves electricity generation or physical flows of energy into the EU. In addition, Member States can also contribute to the Union renewable energy financing mechanism. There are other options for addressing any gap to target in addition to those presented here.

[27] Information on cross border renewable energy projects is available here; https://ec.europa.eu/energy/renewable-energy/transparency_platform/map-viewer/main.html

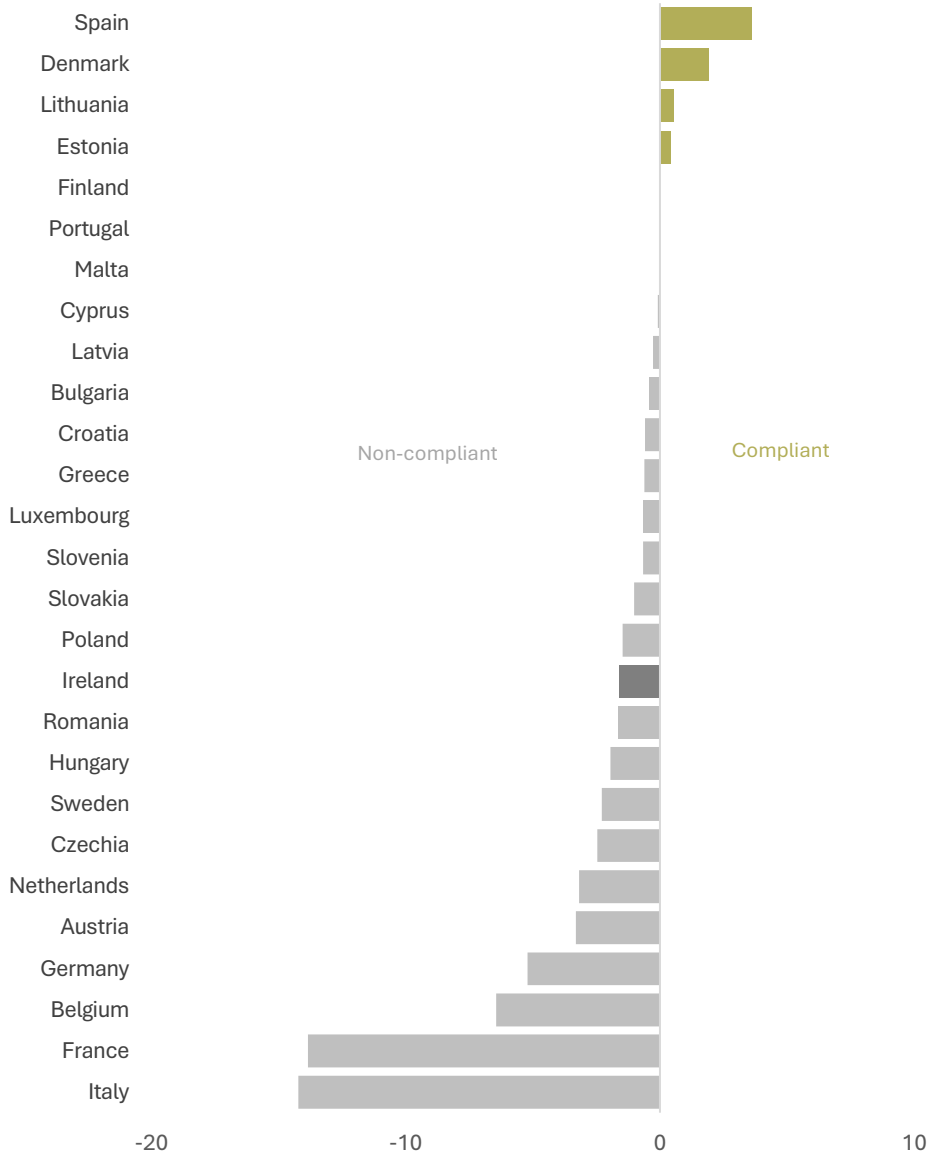
[28] The Commission has published an assessment of implementation of joint support schemes with limited examples to date; https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52023DC0778&qid=1702652010954

# Compliance at the EU level

At the EU level, most countries look set to miss their renewable energy targets unless they go beyond existing measures (Figure Nº 12). At the EU level, 36% of energy will come from renewable energy sources by 2030 as compared to a target of 42.5%. The overall shortfall would be 56 Mtoe of renewable energy.  Six countries will exceed their renewable energy target. However, 21 countries will fall short of their renewable energy targets.

Nº 12 **Many countries could miss renewable energy goals**

Mtoe of Final Energy Consumption, shortfall vs renewable energy share targets, With Existing Measures scenarios




Source: National Energy and Climate Plans.
Notes: Where available, the figures are taken from the Draft Updated National Energy and Climate Plans published in 2024. If these were not available, figures are taken from the Final National Energy and Climate Plans published in 2023.

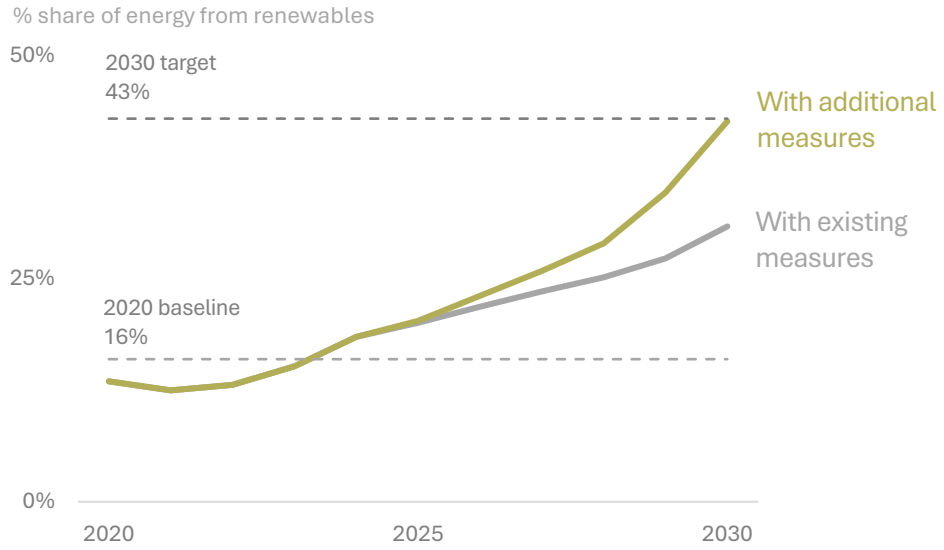
# Compliance in Ireland

To assess Ireland's compliance with the Renewable Energy Directive, the first thing to do is to measure the likely path for Ireland's renewable energy consumption.

In 2023, Ireland's share of energy from renewables was estimated to be 15%. Ireland has fallen below its baseline renewable energy share of 16% of gross final consumption of energy in each of the years 2021–2023.

Figure Nº 13 shows the latest projections of Ireland's renewable energy share. With existing measures, Ireland will miss its 2030 renewable energy share target by 12 percentage points, or 1.6 Mtoe.

Nº 13 **Ireland risks missing its own renewable energy targets**




Source: Ireland's Final updated National Energy and Climate Plan 2024.

Under the with additional measures scenario, Ireland will fall marginally short of its target of 43% of energy from renewable sources.[29]

However, this scenario is heavily dependent on a large ramp up in renewable energy production in 2029 and 2030. Half the progress towards the target is to come from additional renewable energy sources in these two years. A significant proportion of this progress is expected to come from a ramp up in offshore wind generation and biomethane development which may not be achieved in time.

[29] Technically, Ireland will fall short of the target for renewable energy share by 0.3 percentage points, or 37 ktoe.

Large infrastructure in Ireland such as this may be subject to planning delays. In addition, there are risks that Ireland may not switch to electric vehicles (EVs) as quickly as envisioned. The with existing measures scenario assumes the share of EVs rises to 29% (693,000) of total car stock by 2030. While the with additional measures scenario assumes the EV share rises to 35% (845,000) by 2030. Unless investment in renewables is enabled, including through grid upgrades, these measures of themselves will not sufficiently reduce emissions.

The Sustainable Energy Authority of Ireland (2024) has modelled risk scenarios around the delay in developing Ireland's offshore wind capacity and other key technologies. Under the WEM projections, this would see Ireland fall short of its renewable energy share target by 6 percentage points. Were there widespread delays—not just offshore wind capacity— Ireland would fall short of its targets by 13 percentage points.

# Pricing

As with the Effort Sharing Regulation, the cost of purchasing compliance depends on Ireland's own performance as well as how other EU Member States fare. As noted above, if Ireland itself does not meet its targets, there are several ways to achieve compliance.

As many of those options to achieve compliance are difficult to price, here we focus only on the price of purchasing statistical transfers from Member States who overachieve on their renewable energy share targets.

As it stands, the EU as a whole looks unlikely to meet its renewable energy share targets (Figure Nº 12). This means that there will be a shortage of statistical transfers, given the expected level of demand out there for them.

Similar to the Effort Sharing Regulation, with a potential shortfall in the supply of statistical transfers at the EU level, some countries may face infringement proceedings for not being able to comply with the Renewable Energy Directive. The potential costs of infringement proceedings are not clear but there is a risk that costs could be very high.

The European Commission has provided guidance to Member States on the prices of statistical transfers. The Commission suggests that Member States selling statistical

transfers should charge a price equivalent to the average cost of generation of renewables in their country.

This guidance is non-binding, and Statistical transfers will be negotiated bilaterally between Member States. As a result, the price of statistical transfers is still highly uncertain. It depends on the extent to which other EU Member States achieve their requirements.

To reflect the uncertainty, we use four pricing assumptions. This illustrates the potential range in costs related to purchasing compliance with the Renewable Energy Directive.

1. Historical 2020 cost adjusted for inflation. Ireland failed to meet its overall renewable energy share target for 2020. As a result, Ireland had to purchase statistical transfers from Estonia and Denmark in order to be compliant with the previous Renewable Energy Directive. Ireland purchased 3.5 TWh of renewable energy credits, at a cost of €50 million. Under the first scenario, we assume the cost of purchasing compliance per GWh, in real terms, is the same as in 2020. This is likely a lower bound as the future cost of statistical transfers will be much higher.
2. Dutch Gas futures for 2030. While gas is non-renewable and cannot be used to meet the renewable energy targets, gas futures can provide a guide to the likely future energy costs, based on the current market design. However, it is ultimately (renewable) energy that needs to be purchased.
3. German power futures for 2030. Similarly to above, this can provide a guide to the likely future costs.
4. Cost of renewables in countries likely to exceed targets. Ultimately, Ireland will be buying renewable energy from countries who have surplus renewable energy relative to their own targets. Ireland may have to pay a cost equivalent to the cost of generating the renewable energy in these surplus countries. Based on existing measures, countries like Spain and Denmark will have surplus renewable energy to sell.[30]

[30] Here we take the weighted average price from the two most recent renewable energy auctions in Spain. We take this price as under the WEM scenarios, Spain has most excess renewable energy to sell. The weighted average prices was €57.1 per MWh in 2022. This price was indexed to inflation to arrive at a 2030 price.

The prices used are in nominal terms. More detail on the prices used is provided in the appendix, along with the workings for the costs of purchasing compliance.

# Potential costs of missing targets

As in previous sections, the cost of missing targets is a function of the gap to the renewable energy share target and the price of renewable energy.

Here we assume, that Ireland does not pursue joint projects with other EU countries or other compliance options in order to achieve compliance. Instead, we assume that Ireland buys statistical transfers from other Member States who overachieve their renewable energy targets as was the case for achieving compliance with the 2020 target.

Again, the estimation of the likely costs of purchasing compliance involves many uncertainties.

There are three potential sources of costs from missing targets, which would be additional to each other:

1) Ireland falls below its baseline renewable energy share target of 16%. Ireland fell below its baseline share in 2021, 2022 and 2023. Ireland could face compliance costs for falling below its baseline share in 2021 and 2022.[31]
2) Ireland fails to meet its 2030 renewable energy share target of 43%. Both WEM and WAM scenarios see Ireland falling below the 43% target in 2030.
3) The EU fails to meet interim targets, in which case Ireland's interim targets become active, and Ireland misses its interim targets. Under both WEM and WAM scenarios, Ireland is set to miss its interim targets for 2025 and 2027 so could face potential costs for missing these targets.[32]

While there is uncertainty as to the exact timing of the payments, as a simplifying assumption, the prices used for

[31] A country has one year to return above its baseline share. If it does so, it is deemed compliant in the previous year. Ireland is projected to be above its baseline share in 2024. As a result, Ireland would be deemed compliant in 2023 even though it fell below the baseline in 2023.

[32] The EU met its interim target for 2022 so Ireland will not incur costs for missing its interim 2022 target.

the calculations here are those for two years following the target year (i.e. 2032 prices are used for 2030 targets).

The cost arising from these sources is outlined in Table Nº 14 under each projection scenario. The costs of purchasing compliance are highly uncertain but could range from €0.2 to €2.6 billion under the With Additional Measures scenario, to €0.5 billion to €4.4 billion under the With Existing Measures scenario.

## Nº 14 Range of potential costs under Renewable Energy Directive

€ billion, 2021–2030 period

| | With additional measures | | | With existing measures | | |
|---|---|---|---|---|---|---|
| | Missed Baseline for 2021-2022 | Missed 2030 target + missed baseline for 2021-2022 | Missed 2030 target + missed baseline for 2021-2022+ EU misses interim targets | Missed Baseline for 2021-2022 | Missed 2030 target + missed baseline for 2021-2022 | Missed 2030 target + missed baseline for 2021-2022+ EU misses interim targets |
| Same cost as 2020 | 0.2 | 0.2 | 0.6 | 0.2 | 0.5 | 1.0 |
| Gas (Dutch) futures | 0.4 | 0.4 | 1.1 | 0.4 | 1.0 | 1.8 |
| Renewable energy strike price in Spain | 0.6 | 0.6 | 2.1 | 0.6 | 1.9 | 3.7 |
| German power futures | 0.8 | 0.9 | 2.6 | 0.8 | 2.3 | 4.4 |

Notes: 2027 and 2032 prices are used based on the assumption that these are the years in which final calculations of emissions are made.

# 4 The Energy Efficiency Directive

The Energy Efficiency directive sets targets for reducing overall energy consumption in the EU. It sets a binding target at an EU level, with Member States given an indicative (non-binding) path for reducing Final Energy Consumption (FEC). Final Energy Consumption refers to the total energy consumed by end users—excluding energy used by the energy sector itself (such as for electricity generation and distribution) and energy lost in transformation and distribution processes. It includes energy consumed by households, industry, services, agriculture, and transport. Under the Energy Efficiency Directive, it includes international aviation but excludes ambient heat.

The directive was agreed by Member States in July 2023.[33] The EU is required to reduce energy consumption by 11.7% relative to projections in the 2020 EU reference scenario. Essentially this means that the EU cannot consume more than 763 Mtoe of final energy in 2030.

Ireland has been set an indicative target of 10.5 Mtoe of final energy consumption (a reduction of 13% relative to 2022 levels), by 2030, in order to be compliant with the Energy Efficiency Directive.[34]

## How it works

The key requirement under the Energy Efficiency Directive is the target of reducing Ireland's final energy consumption to 10.5 Mtoe by 2030.

However, as well as the (non-binding) target to reduce Final Energy Consumption, the directive sets out separate, binding sub-targets requiring Member States to achieve cumulative, progressively increasing end-use energy savings. From 1 January 2021 to 31 December 2023, annual savings must amount to 0.8% of final energy consumption. After this initial period, the target increases in successive

[33] See EU Energy Efficiency Directive (EU/2023/1791).

[34] The Government accepted these non-binding targets in February 2024.

two-year intervals: 1.3% from 1 January 2024, 1.5% from 1 January 2026, and 1.9% from 1 January 2028.[35]

Ireland's NECP notes that it intends to deliver the energy savings required through a combination of the energy efficiency obligation scheme (EEOS) to achieve energy savings targets on certain energy companies ("obligated parties") and a range of alternative measures. [36]

Under the Energy Efficiency Directive, public sector bodies are also required to reduce their total final energy consumption by at least 1.9% annually, compared to 2021 levels. Additionally, at least 3% of the total floor area of public buildings must be renovated, to zero energy building or nearly zero energy building status, each year to improve energy performance.[37]

### Timing

The Energy Efficiency Directive sets indicative energy efficiency target for Member States to achieve by 2030 and binding sub-targets for Member States to achieve each year up to 2030.

To ensure progress, they are required to submit updates on their national contributions and trajectories. The progress towards meeting these binding sub-targets will be assessed in 2027 and 2029.

# Compliance at an EU level

Based on existing measures, 22 out of 27 Member States are expected to fall short of their Final Energy Consumption

[35] These percentages are calculated based on the average annual final energy consumption during the three years preceding 1 January 2019.

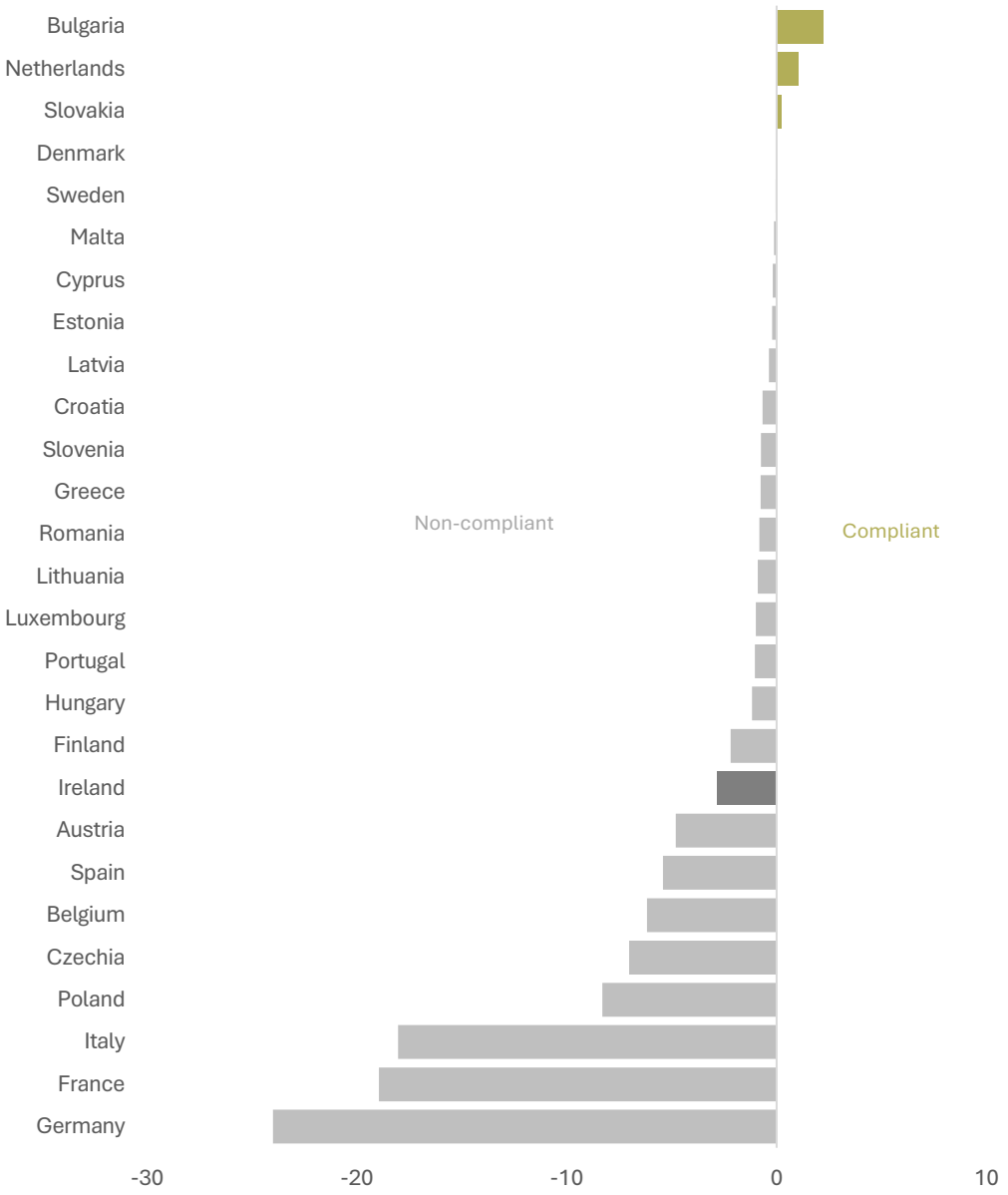
[36] The EEOS, which was introduced through SI 522/2022 (European Union EEOS) Regulations 2022 for Ireland, set a target for the obligation period between 2021-2030 for obligated parties (energy companies including the largest energy suppliers and distributors in Ireland which sell more than 400 GWh of energy per year to final customers) to deliver cumulative end-use energy savings of 36,424 GWh (although this is likely to increase). Obligated parties are set specific annual targets based on their market share, which can be met by supporting homeowners, businesses and communities to carry out energy efficiency upgrades. More information on the scheme can be found here; https://www.seai.ie/about/regulatory-functions/energy-efficiency-obligation-scheme

[37] There are flexibilities which allow Member States to estimate and achieve yearly energy savings in public buildings that are at least equivalent to the savings that would have been achieved under the default renovation requirement. Ireland signalled to the Commission in December 2023 that it may apply this alternative approach rather than the 3% renovation rate but is currently collecting data on the floor area of public bodies concerned.

(FEC) targets for 2030 (Figure Nº **15**). This would lead to a total excess of 105.7 Mtoe of energy consumption, or 14% more Final Energy Consumption. The remaining countries are expected to achieve their targets, collectively achieving an additional reduction of 3.4 Mtoe beyond their obligations. Taken together, the EU is expected to face a shortfall of 102.3 Mtoe in achieving its binding final energy consumption target of 763 Mtoe by 2030.

Nº 15 **Most countries set to miss their energy efficiency targets**

Mtoe of Final Energy Consumption vs targets, With Existing Measures scenarios




Source: National Energy and Climate Plans.
Notes: Where available, the figures are taken from the Draft Updated National Energy and Climate Plans published in 2024. If these were not available, figures are taken from the Final National Energy and Climate Plans published in 2023.

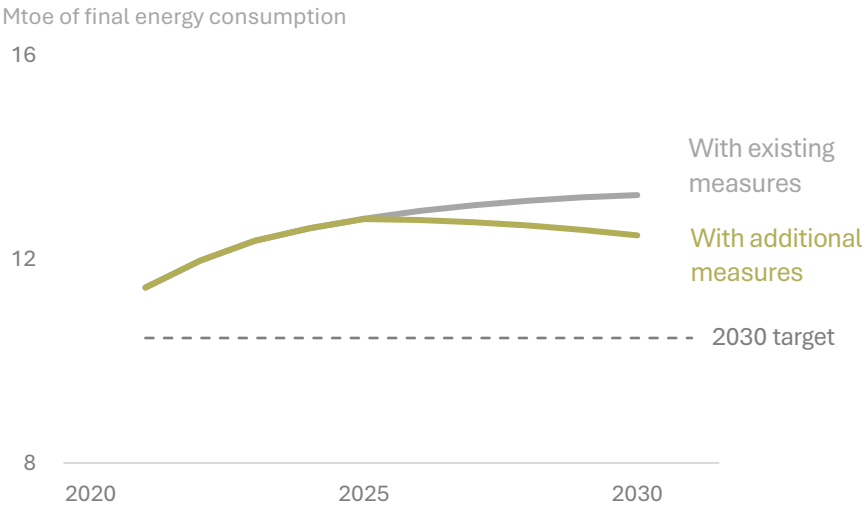
# Compliance in Ireland

To assess compliance, the first thing to do is to measure the likely path of Ireland's energy efficiency.

Figure Nº 16 illustrates the latest projections under the Energy Efficiency Directive for Ireland. Based on existing measures, Ireland is projected to exceed its Final Energy Consumption target by 27% (2.8 Mtoe), falling short of its commitment to achieve 10.5 Mtoe by 2030. Even under the scenario with additional measures, the gap is expected to narrow to 2 Mtoe, leaving Ireland still below its required target.

These challenges are further compounded by Ireland's rapid economic and population growth, including growth in datacentres. In the years ahead, this will most likely lead to upward increases in energy demand.

Nº 16 **Ireland risks not meeting its energy efficiency targets**




Source: Ireland's Final updated National Energy and Climate Plan 2024.
Note: It includes energy consumed by households, industry, services, agriculture, and transport (including international aviation), but excludes ambient heat.

# Potential costs of missing targets

At present, there is no compliance mechanism. The Energy Efficiency Directive does not provide mechanisms for Member States to purchase allowances or credits to offset shortfalls in meeting their energy efficiency targets.

As things currently stand there will not be costs associated with missing these targets. For this reason, no compliance costs are estimated for missing these targets.

However, this may change in the future. As a result, it may become a source of additional costs. In addition, higher energy demand resulting from missed energy efficiency targets would increase the costs of meeting obligations under the Renewable Energy Directive and the Effort Sharing Regulation. The overshoot in energy demand relative to targets is already incorporated in emissions projection scenarios. Were energy efficiency targets met, the costs of purchasing compliance would greatly reduce.

Improving energy efficiency remains one of the most cost-effective ways to reduce emissions and alleviate overall costs from missing targets.

# 5 Putting this in context

The amounts outlined here are potentially substantial. At the upper range of estimates, Ireland faces €27 billion in costs from missing its agreed climate targets.

These costs would represent a massive transfer of wealth to Ireland's neighbours. Having transferred these amounts, Ireland would still be obliged to meet its commitments. In fact, these could be stepped up so that the overall adjustment would be greater.

Allowing these costs to fall on the Irish State instead of meeting its agreed commitments to reduce emissions would be a colossal missed opportunity. It would miss out on a chance for Ireland to reduce pollution, improve health outcomes, and create a more resilient energy system and natural environment.

## What could be done with this money?

The scale of costs begs the question, what could be done in terms of actually achieving Ireland's agreed commitments with such amounts?

To understand how large the amounts in question are, we set out illustrative actions. The measures we consider here represent under half the upper end of the range of estimated costs from missing agreed targets. Yet, they would go a long way to ensuring Ireland achieves its transition and avoids potential costs of purchasing compliance. The actions would also help reduce pollution, health risks, and running costs, while improving Ireland's energy security and resilience to the impacts of climate change.

As an illustration, €12 billion — just one-tenth of the capital spending planned out to 2030 — could achieve all of the following. It could reduce the costs of buying 700,000 new electric cars to less than €15,000, covering one-in-three households. It would allow the Government ramp up charging infrastructure. It would cover the estimated additional costs of upgrading Ireland's energy grid. And it would support forestry and the re-wetting of peatlands.

### Upgrading Ireland's energy grid
**€7 billion**

One of the major medium-term costs facing Ireland in terms of its transition is the need to expand the electricity grid and make it much more resilient. This would cater for much bigger flows of energy and would move the energy from where it is generated to where users are located. This grid investment, in addition to a baseline level of investment, is estimated at around €7 billion by 2030 (McInerney & FitzGerald, 2024; Government of Ireland, 2024b; McNamara, 2024).[38] It would be consistent with the Climate Action Plan's targets to roll out 22 Gigawatts of renewable energy by 2030.[39]

It is worth noting that investment in Ireland's energy grid would benefit compliance elsewhere. That is, the investment would enable greater flexibility and more renewable energy capacity. In turn, this would help Ireland comply with the Renewable Energy Directive. It would also help ensure that changes in transport and buildings related to the Effort Sharing Regulation would be mirrored by an energy system that delivers more green energy. In other words, it would help ensure that homes with heat pumps and people with electric cars are not largely powering those with electricity generated by burning fossil fuels. As the Climate Action Plan 2024 notes, "the decarbonisation of other sectors, including transport, heating, and industry, relies to a significant degree on electrification" (Government of Ireland, 2024b, p. 154).

Lastly, a focus on the energy grid would have other benefits beyond just compliance. It would also help with other goals such as delivering more housing, greater energy resilience, and more supply, which has also been a concern for foreign direct investment.

### Reducing the price of 700,000 electric cars to below €15,000 and ramping up charging infrastructure
**€4 billion**

The Climate Action Plan targets 845,000 private electric vehicles on the road by 2030. Currently, there are only around 80,000. The state could reduce the cost of electric vehicles for 700,000 drivers to less than €15,000, pushing it

[38] This reflects the costs of Transmission System Operator (TSO), Distribution System Operator (DSO) plus backup capacity upgrades set out in the Climate Action Plan 2024, with McNamara estimating that 50% are in addition to business-as-usual investment requirements.

[39] This includes targets of deploying 9 gigawatts of onshore wind, 8 gigawatts of solar power, and at least 5 gigawatts from offshore wind projects.

towards its 2030 goal, with an outlay of €3 billion and contributing to an estimated abatement in 2030 of 4 Mt $CO_2$ equivalent.[40] This example is purely illustrative. A more sensible policy would involve more carefully targeted supports. We assume that a ramp up in charging infrastructure would cost approximately €1 billion.[41]

### Forestry and peatlands supports
**€1 billion or less**

Rewetting 80,000 Hectares of peatlands could deliver massive reductions in emissions at a low cost. This much land is equivalent to the size of all of Bord na Móna's peatlands. An estimated outlay of €0.3 billion could save a cumulative total of 6.5 Mt $CO_2$ equivalent of emissions by 2030 (Teagasc, 2023).

Measures in forestry could also help with low costs. Afforestation of 8,000 Hectares and the prevention of deforestation of 500 Hectares per year could cost just €0.2 billion. Yet these measures could mitigate a cumulative total of 0.8 Mt $CO_2$ equivalent and 1.1 Mt $CO_2$ equivalent respectively, by 2030. Land conservation measures could also be implemented. Recent examples include the acquisition of Ireland's marine national park at the Conor Pass for less than €6 million.

These initiatives could be included as part of a broader policy approach that encourages the farming sector to diversify to activities that not only reduce greenhouse gas emissions but that also encourage their capture and storage.

## Total cost of measures above: €12 billion

[40] This assumes the SEAI grant is increased from €3,500 at present to €7,500 and it reflects the purchase price of a Hyundai Inster in Ireland, with the €3,500 SEAI grant added back so that it assumes a starting price of €22,495.

[41] ESB Networks estimates that approximately 1 Mega Volt Amperes of public EV charging infrastructure is required under the Alternative Fuel Infrastructure Regulation in addition to targets under the Climate Action Plan. This contributes to an estimated overall network reinforcement requirement of €2.2 to €2.5 billion as part of its proposed investment programme under price review 6 (ESB Networks, 2024). The ESB (2018) previously estimated that it would cost €0.35 billion of network investment to support a 20% electric vehicle uptake in Ireland. With the 845,000 target for private vehicles being closer to 40% of all vehicles, we assume approximately €1 billion of investment in the electricity network over the period to 2030 should adequately make enough electricity network capacity available to allow these vehicles to be connected to the network.

These measures are purely illustrative. However, they give a good sense of what could be achieved in the context of the potential costs Ireland faces for missing its targets.

As well as helping prevent the costs of purchasing compliance, most of these policy measures could be enacted in a one-off and time limited way. This would limit their impact on fiscal sustainability.

Such measures would have to be introduced along with broader policies. To succeed, they would have to be matched by efforts to enable private sector development of renewable energy more swiftly than has been the case to date.

## It's not all about money!

There are many areas where policy changes could have a huge impact with very little cost. For instance, the Government could do more to remove misconceptions about electric vehicles and insulated homes. It could also offset measures to electrify transport by increasing taxes on petrol or diesel vehicles. Another relatively low-cost change that could have large impacts would be to streamline planning and regulations, while upskilling the public sectors' expertise in delivering on Ireland's climate transition.[42]

The Government could also look to change incentives in agriculture — Ireland's largest emitter. Measures around breeding (cumulative mitigation of 1.6 Mt $CO_2$ equivalent by 2030), the lifespan of animals (cumulative mitigation of up to 3.7 Mt $CO_2$ equivalent by 2030), and fertiliser type (cumulative mitigation of up to 2.6 Mt $CO_2$ equivalent by 2030) could substantially lower emissions in a cost effective way (Teagasc, 2023).[43]

Part of the adjustment in agriculture could involve diversifying what farms do. For example, encouraging more diverse farming activities, such as afforestation, would not only reduce emissions but would act as a carbon sink. Part of the challenge, in that case, is encouraging this diversification. Similarly, other measures in the land-use

[42] An example of this is outlined in Longoria et al. (2024) where they highlight how planning and regulatory delays for energy infrastructure significantly increases energy prices and emissions.

[43] This includes greater use of the dairy Economic Breeding Index and reducing the finishing time for beef animals. Teagasc's Marginal Abatement Cost Curves show the cost effectiveness of various measures to reduce agriculture and LULUCF emissions: https://www.teagasc.ie/media/website/publications/2023/Teagasc-MACC-2023-Executive-Summary-web1.pdf.

sector such as improved grassland management—like rotational grazing or using organic fertilizers to improve soil carbon sequestration (cumulative mitigation of 2.7 Mt $CO_2$ equivalent by 2030)—delaying harvesting trees could substantially reduce emissions (7.9 Mt $CO_2$ equivalent by 2030).[44]

## Timing matters

An important consideration is how to take action with the economy already operating at full capacity. In this sense, timing is important.

While there are shortages of workers, the Government could tackle areas that rely less on workers and more on imports. This would add less fuel to price pressures and avoid exacerbating worker shortages. As an example, providing supports for the import of a large number of electric vehicles would help Ireland meet its climate objectives without adding to pressures on worker shortages or domestic prices. By contrast, retrofitting would potentially entail more pressure in areas where demand is already high, and worker shortages are proving challenging.

This is not to say that infrastructure and retrofitting goals are not essential. Ireland will need sustained investment in long-term infrastructure improvements and structural change to meet its ongoing requirements and to realise long-term benefits to the economy and society.

[44] Delaying clearfelling until the timber volume Mean Maximum Annual Increment (MMAI) is achieved (Teagasc, 2023).

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# Jargon explainer

| | |
|---|---|
| **AEAs** | Annual Emissions Allocations<br><br>These are yearly emissions limits assigned to Member States under the Effort Sharing Regulation to ensure compliance with the overall 2030 emission reduction targets. We refer to them in the text frequently as Emissions Allocations. |
| **Carbon Credits** | Tradable certificates representing one tonne of carbon dioxide equivalent ($CO_2$ equivalent) reduced or removed. |
| **EED** | Energy Efficiency Directive<br><br>Sets targets for reducing the EU's final and primary energy consumption by improving energy efficiency across sectors. |
| **EEOS** | Energy Efficiency Obligation Scheme<br><br>Energy savings targets for large energy suppliers and distributors by supporting energy efficiency upgrades. |
| **ESR** | Effort Sharing Regulation<br><br>Sets binding national climate targets for EU Member States for the period 2021–2030 to reduce emissions in sectors not included in the ETS, such as transport (excluding aviation and maritime), buildings, small industries, agriculture, and waste management. |
| **ETS** | Emissions Trading System<br><br>Cap-and-trade system that allows the trading of greenhouse gas emission allowances in electricity and heat generation, energy-intensive industries, domestic aviation, and from 2024, maritime transport. |
| **FEC** | Final Energy Consumption<br><br>Total energy delivered to end users, excluding energy used by the energy sector itself, energy lost during transmission and distribution, and energy used for international shipping. |
| **Flexibilities** | Compliance mechanisms that allow Member States to offset shortfalls under one regulation by using surpluses from |

| | |
|---|---|
| | another regulation, and banking or borrowing units across time periods. |
| **Futures/ forwards** | Financial contracts that set a fixed price for the purchase or sale of an asset on a future date, to hedge against price volatility or to signal market expectations. |
| **Mtoe/ktoe** | Mega/kilotonnes of oil equivalent<br><br>Units of energy measurement, equivalent to 1,000,000 or 1,000 tonnes of oil. |
| **LULUCF** | Land Use, Land Use Change, and Forestry<br><br>Sector covering emissions and removals resulting from land use, land-use change, and forestry activities such as organic and mineral grasslands and wetlands, deforestation, afforestation, reforestation, and forest management. |
| **MAC** | Marginal Abatement Cost.<br><br>Cost of reducing an additional tonne of $CO_2$ or equivalent emissions. |
| **Mt $CO_2$ eq** | Million tonnes of carbon dioxide equivalent (also referred to as megatonnes of carbon dioxide equivalent).<br><br>Unit of measurement for greenhouse gas emissions that converts all emissions into the equivalent amount of carbon dioxide. |
| **MWh** | Megawatt-hours<br><br>Units of energy measurement, equivalent to 1,000 kilowatt-hours. |
| **PEC** | Primary Energy Consumption<br><br>Total energy, excluding energy used for international shipping (maritime bunkers) and energy used as raw material rather than fuel (non-energy consumption). |
| **RED** | Renewable Energy Directive<br><br>Sets binding targets for increasing the share of renewable energy in the EU's energy consumption to 42.5% by 2030. |
| **RES** | Renewable energy share |
| **RES-H** | Renewable energy used for heating and cooling |
| **RES-T** | Renewable energy used in transport |
| **Statistical transfers** | Compliance mechanism that involves the bilateral transfer of surplus renewable |

| | |
|---|---|
| | energy achievements from one Member State to another that is not meeting its targets. |
| **TWh** | Terawatt-hours<br><br>Units of energy measurement, equivalent to 1 billion kilowatt-hours. |
| **WAM** | With Additional Measures<br><br>Emissions projection scenario that includes the impact of both existing measures and planned policies that are likely to be implemented. |
| **WEM** | With Existing Measures<br><br>Emissions projection scenario based on policies and measures that have already been implemented or formally adopted. |

# Appendix A
# More detail on the regulations, directives and calculations

This section provides more details on the regulations and directives, and provides the workings for the costs of purchasing compliance.

## The Effort Sharing Regulation

### Tightening requirements

One aspect of the Effort Sharing Regulation only briefly touched on in the main report and not covered in the calculations is the possibility of a tightening of requirements.

Basically, Ireland faces a tightening of its requirements if it exceeds its emissions allowances. This could arise if Ireland's emissions were to exceed its annual ceiling and if it fails to make up the gap through the use of available flexibilities. This excess would potentially get added to the next year’s requirements and multiplied by a factor of 1.08. This creates a compounding effect. It means that steeper emission cuts could bind in later years making the transition to a low carbon economy even more challenging. And any breaches in earlier years would still need to be addressed. In other words, even if Ireland brought its emissions back in line in later years, the previous excesses would mean that tighter overall requirements would still bind.

Although this tightening of requirements is not a direct financial penalty, it would probably still mean increased costs. For instance, Ireland would have to do more in a shorter time period to meet its upwardly adjusted target.

Costs of reducing emissions usually get more expensive as the low-hanging fruit is already taken up.[45] This would make it more stringent and probably more expensive to achieve the adjusted target.

We have not factored this potential tightening into our calculations.

## Pricing

As discussed in the main text, the pricing assumptions can be broadly grouped into two categories: 1) Market-based prices and 2) non-market-based prices.

**Market-based prices**

This approach assigns a market value to greenhouse gas emissions and can take a number of values based on the chosen market referenced. Two sets of market-based prices are used.

**EU Emissions Trading System (ETS) futures prices.** A key market price for emissions is from the EU Emissions Trading System (ETS), a well-established and transparent carbon market. This is a scheme that applies to certain sectors, such as electricity and heat generation, energy-intensive industry sectors, aviation within Europe and maritime transport. The ETS establishes a market-driven mechanism for emissions reduction by operating as a "cap-and-trade" system and allowing sectors to trade allowances. The price is established through a market mechanism whereby companies will either purchase allowances (if reducing emissions is more expensive) or abate their emissions (if buying allowances is costlier), ensuring that sectors with the lowest abatement costs undertake reductions first. As caps tighten to meet the targets, the cost of achieving deeper reductions increases, and the ETS price rises accordingly. This alignment ensures the ETS price serves as a reliable benchmark for the cost of carbon in the traded sectors, directly linking market prices to the cost of emissions abatement.[46]

[45] This is reflected in the way marginal abatement cost curves slope up to the right. This highlights how countries will typically start with the most cost-effective options on the left but will be forced to move rightwards and adopt more costly solutions over time.

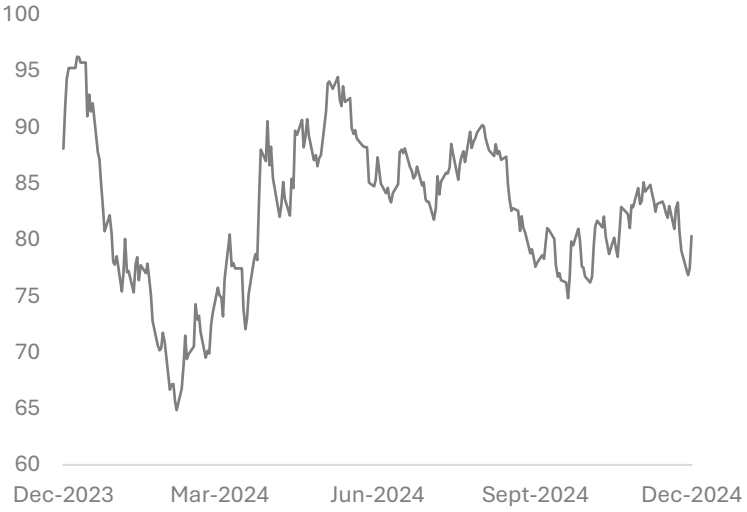
[46] UK Department for Business, Energy & Industrial Strategy. Traded Carbon Values Used for Modelling Purposes: 2023.

These ETS allowances are freely tradable and a futures market—a market for trading future ETS allowances—has formed.[47] These ETS futures can provide an indication of what the market thinks the future price of these emission allowances will be.

Therefore, the ETS futures prices offer one possible scenario for the price of future carbon credits. Figure Nº 17 shows the price for 2030 ETS allowances.

Nº 17 **EU Emissions Trading Scheme prices**

December 2030 futures prices in € per metric tonne




Source: Intercontinental Exchange.

However, the ETS market captures different sectors than those covered under the Effort Sharing Regulation. As a result, the abatement costs in the ETS sector may not be the same as the abatement cost in the non-ETS sector. This may result in differing prices for emissions under the ETS and the Effort Sharing Regulation.

In addition, the ETS is a market in which supply and demand are equal and where the supply of units is controlled through the Market Stability Reserve (MSR) to minimise price volatility. As mentioned above, this may not be the case under the Effort Sharing Regulation — there is no liquid market for Annual Emissions Allocations. This could result in the price for Annual Emissions Allocations under the Effort Sharing Regulation being greater than the ETS market prices.

[47] Futures contracts are financial instruments that involve the trade of a specific quantity of EU allowances used in the EU ETS for use for a future, pre-defined date.

At the time of writing, ETS futures for 2025 are priced at €68.6 per tonne of $CO_2$ and €81.2 per tonne of $CO_2$ for 2030.

**Analysts' predictions of ETS prices.** These prices are also based on the ETS system. However, The ETS futures market for contracts several years into the future is relatively illiquid. For example, the trading volume of ETS futures for 2028 is only a fraction of that for December 2025. Due to this limited liquidity, these contracts may not serve as the most reliable indicators of future prices. As an alternative, another option to use is what experts—in this case market analysts—believe the future price of ETS credits will be. EU carbon price forecasts based on a survey of analysts are collated on a regular basis by Carbon Pulse. [48]

As of Q4 2024 predicted an average value of ETS futures for 2025 to be €75.5 per tonne of $CO_2$ and €133.6 per tonne of $CO_2$ for 2030.

4) **Analysts' predictions of ETS 2 prices.** Similar to the original Emissions Trading System, the ETS 2 is a new emissions trading system created to cover emissions from fuel combustion in buildings, road transport and small industries. This market will cover some of the emissions included under the Effort Sharing Regulation and for that reason the prices of these allowances may be a good indication of the price of the Effort Sharing Regulation allocations. However, the ETS2 is not yet established and will only become operational in 2027. As a result, a market price for these emissions has not yet been established. However, several analysts have predicted what the future price of these emission allowances will be.

   The prices used are the average of three analyst predictions for 2027 and 2030. In a baseline scenario, Veyt predicts a 2027 price of €50 per $tCO_2$ and a 2030 price of €150 per $tCO_2$.[49] In a baseline scenario, Homaio predicts a 2027 price of €68 per $tCO_2$ and a 2030 price of €222 per $tCO_2$.[50] In a

[48] https://carbon-pulse.com/331777/.

[49] See here: https://veyt.com/press-releases/starting-in-2027-europes-second-big-emission-trading-scheme-will-increase-fossil-fuel-prices/.

[50] See here: https://www.homaio.com/post/what-is-the-eu-ets-2-price-forecast-for-2030.

baseline scenario, Clearblue predicts a 2027 price of €55 per $tCO_2$ and a 2030 price of €105 per $tCO_2$.[51]

As a result, the average price is €58 per $tCO_2$ in 2027 and €159 per $tCO_2$ in 2030.

**Non-market-based prices**

As mentioned in the main text, there is one non-market-based price used here.

**EU Marginal abatement cost (MAC).** The marginal abatement cost represents the cost of reducing the last unit of emissions required to meet a specific target. Conceptually, it focuses on the cost of actions—what it takes to mitigate emissions—rather than the harms caused by those emissions.

The marginal abatement cost reflects the expense of using the most cost-efficient technologies or policies to achieve reductions and rises with more ambitious targets. For instance, research by Statistics Norway (2019) illustrates this relationship through a marginal abatement cost curve for reducing Effort Sharing Regulation emissions in the EU, where costs increase as deeper emissions reductions are pursued. Based on this analysis and adjusting for the revised Effort Sharing Regulation target which came into force in 2023 along with adjustment for inflation, Transport & Environment (2024) calculated a marginal abatement cost for Effort Sharing Regulation sectors of circa €260 per tonne of $CO_2$ in 2024 prices. This is the equivalent to €300 per tonne of $CO_2$ in 2030 prices. We similarly calculate the marginal abatement cost for 2025 to be €63.6 per tonne of $CO_2$ in 2025 prices.

In each pricing scenario, 2025 prices and 2030 prices are used for the period 2021-2025 and 2026-2030 respectively. This is because it is the 2025 (or 2030) abatement costs faced by countries in surplus, relative to their targets, which are likely to be the costs of additional Allocations that Ireland will have to purchase.

However, given the compliance costs will be paid in 2027 or 2032, the above prices (for 2025 and 2030) are then indexed to EU wide inflation to arrive at a nominal figure for 2027 and 2032. In the European Commission's Autumn 2024

[51] See here: https://www.clearbluemarkets.com/news/montel-news-covers-clearblues-special-report-on-eu-ets-2#:~:text=Key%20takeaways%3A,around%20EUR%20105%20by%202030.

Economic forecasts, EU inflation is forecast to be 2.4% in 2025 and 2% in 2026. From there, we use a simplifying assumption that inflation is 2% for 2027-2032.

## Flexibilities

There are two flexibilities available to Ireland that make it easier to meet Ireland's Effort Sharing Regulation commitments.

First, Ireland can use the Land Use, Land Use Change and Forestry (LULUCF) flexibilities. These flexibilities can be used to help offset any failure to reduce emissions in the Effort Sharing Regulation. However, availing of these means that Ireland would have to meet its own LULUCF targets, and the EU as a whole would have to meet its LULUCF target. There are also limits to how much each Member State can use this flexibility.

For the 2021-2025 reporting period Ireland has access to a maximum of 13.4 Mt $CO_2$ equivalent. This means that a maximum of 2.68 Mt $CO_2$ equivalent annually is available for 2021-2025. Ireland may have access to less flexibility if it doesn't meet its LULUCF targets.

For the 2026-2030 period, there is very significant uncertainty with respect to need to access flexibilities/markets for compliance under the LULUCF regulation and current projections indicate no access to flexibility under the Effort Sharing Regulation in the second 5-year period. As a result, in the calculations, it is assumed that this flexibility is not available for 2026-2030.

The second flexibility Ireland can use is the Emission's Trading System (ETS) flexibility. This would involve the state not auctioning off some of Ireland's Emission's Trading System allowances. As a result, Ireland no longer receives money it otherwise would from auctioning the allowances it has. Ireland could use 1.9 Mt$CO_2$ equivalent per year of these flexibilities to offset the excess emissions under the Effort Sharing Regulation. Up to the full amount of the available flexibility can be used in any one year, if needed.

However, as using this flexibility isn't costless—the State receives lower revenue than it otherwise would—the revenue forgone has been added to the costs of purchasing compliance in the scenarios that use ETS flexibilities.

The calculations for the revenue forgone are shown in Table Nº 18 **ETS auction revenue forgone**Nº 18. To arrive

at the revenue forgone, the annual average strike price for existing ETS auctions was used for 2021-2023. Similarly for 2024, average strike price for the first half of the year is used. For 2025-2030, ETS futures prices are used. In total, €1.4 billion would be forgone over the period 2021-2030.

## Nº 18 ETS auction revenue forgone

| | ETS flexibility (Mt $C0_2$ eq) | ETS price assumed (€ per tonne of $CO_2$) | Revenue forgone (€ million) |
|---|---|---|---|
| **2021** | 1.9 | 53 | 101 |
| **2022** | 1.9 | 80 | 152 |
| **2023** | 1.9 | 83 | 159 |
| **2024** | 1.9 | 63 | 120 |
| **2025** | 1.9 | 69 | 131 |
| **2026** | 1.9 | 71 | 135 |
| **2027** | 1.9 | 73 | 139 |
| **2028** | 1.9 | 76 | 145 |
| **2029** | 1.9 | 78 | 150 |
| **2030** | 1.9 | 81 | 155 |

| | |
|---|---|
| **Cumulative 2021-2025 (€ billion)** | 0.7 |
| **Cumulative 2026-2030 (€ billion)** | 0.7 |
| **Cumulative 2021-2030 (€ billion)** | 1.4 |

Source: Environmental Protection Agency and Macrobond.

## Workings for costs of missing targets

The detailed data and workings used to arrive at the costs from missing targets under the Effort Sharing Regulation are illustrated below. The two periods 2021-2025 and 2026-2030 are treated separately under the assumption that costs from missing targets for 2021-2025 fall due in 2027 and the costs from missing targets for 2026-2030 fall due in 2032.

## Nº 19 Effort Sharing Regulation emissions, allocations and flexibilities

Emissions Mt $CO_2$ equivalent

| | Inventory | Projected level of emissions (WEM) | Projected level of emissions (WAM) | Annual emissions allowances | Gap (WEM) | Gap (WAM) | Possible ETS offset | Possible LULUCF offset (WEM) | Possible LULUCF offset (WAM) |
|---|---|---|---|---|---|---|---|---|---|
| **2021** | 44.9 | 46.4 | 46.4 | 43.5 | 1.4 | 1.4 | 1.9 | 1.9 | 2.7 |
| **2022** | 44.3 | 45.9 | 45.9 | 42.4 | 2.0 | 2.0 | 1.9 | 1.9 | 2.7 |
| **2023** | | 45.5 | 45.0 | 40.5 | 4.9 | 4.5 | 1.9 | 1.9 | 2.7 |
| **2024** | | 45.2 | 44.3 | 38.7 | 6.6 | 5.6 | 1.9 | 1.9 | 2.7 |
| **2025** | | 45.1 | 43.3 | 36.8 | 8.2 | 6.4 | 1.9 | 1.9 | 2.7 |
| **2026** | | 45.1 | 42.0 | 39.4 | 5.7 | 2.7 | 1.9 | | |
| **2027** | | 44.7 | 40.6 | 36.4 | 8.3 | 4.1 | 1.9 | | |
| **2028** | | 44.3 | 39.1 | 33.5 | 10.8 | 5.6 | 1.9 | | |
| **2029** | | 44.0 | 37.5 | 30.6 | 13.4 | 6.9 | 1.9 | | |
| **2030** | | 43.5 | 35.6 | 27.7 | 15.8 | 7.9 | 1.9 | | |
| **2021-2025** | | 228.1 | 224.9 | 201.9 | 23.1 | 19.9 | 9.6 | 9.5 | 13.4 |
| **2026-2030** | | 221.6 | 194.7 | 167.5 | 54.1 | 27.1 | 9.6 | 0.0 | 0.0 |
| **2021-2030 total** | | 449.7 | 419.5 | 369.4 | 77.2 | 47.1 | 19.1 | 9.5 | 13.4 |

Source: Environmental Protection Agency.
Note: The 2023 inventory is provisional at the time of publication and as a result is not used for calculating costs of missing targets. Instead the 2023 projection figures are used.

## Nº 20 Pricing assumptions for Effort Sharing Regulation

Prices, € per tonne of $CO_2$ equivalent

| | ETS prices/ futures | Average of analysts' predictions for ETS | Average of analysts' predictions for ETS 2 | EU Marginal abatement cost | |
|---|---|---|---|---|---|
| **2025** | €68.6 | €75.5 | | €62.4 | Actual price |
| **2026** | €70.0 | €77.0 | | €63.6 | 2025 indexed price |
| **2027** | €71.4 | €78.5 | €57.7 | €64.9 | 2025 indexed price/Actual price |
| **2030** | €81.2 | €133.6 | €159.1 | €300.4 | Actual price |
| **2031** | €82.8 | €136.3 | €162.2 | €306.4 | 2030 indexed price |
| **2032** | €84.5 | €139.0 | €165.5 | €312.5 | 2030 indexed price |

Source: Macrobond, Carbon Pulse, T&E, Veyt, Homaio, and Clearblue.

## Nº 21 Potential costs of purchasing compliance with the Effort Sharing Regulation, 2021-2025

€ billions

| | With additional measures | | | With existing measures only | | |
|---|---|---|---|---|---|---|
| | With ETS + LULUCF offsets | With ETS offset | No offsets | With ETS + LULUCF offsets | With ETS offset | No offsets |
| ETS futures | 0.4 | 1.4 | 1.4 | 1.0 | 1.6 | 1.7 |
| Analysts' predictions for ETS | 0.4 | 1.5 | 1.6 | 1.0 | 1.7 | 1.8 |
| Analysts' predictions for ETS 2 | 0.5 | 1.3 | 1.1 | 0.9 | 1.4 | 1.3 |
| EU Marginal Abatement Cost | 0.0 | 1.3 | 1.3 | 0.9 | 1.5 | 1.5 |

## Nº 22 Potential costs of purchasing compliance with the Effort Sharing Regulation, 2026-2030

€ billions

| | With additional measures | | | With existing measures only | | |
|---|---|---|---|---|---|---|
| | With ETS + LULUCF offsets | With ETS offset | No offsets | With ETS + LULUCF offsets | With ETS offset | No offsets |
| ETS futures | 2.2 | 2.2 | 2.3 | 4.5 | 4.5 | 4.6 |
| Analysts' predictions for ETS | 3.2 | 3.2 | 3.8 | 6.9 | 6.9 | 7.5 |
| Analysts' predictions for ETS 2 | 3.6 | 3.6 | 4.5 | 8.1 | 8.1 | 8.9 |
| EU Marginal Abatement Cost | 6.2 | 6.2 | 8.5 | 14.6 | 14.6 | 16.9 |

## Nº 23 Potential costs of purchasing compliance with the Effort Sharing Regulation, 2021-2030

€ billions

| | With additional measures | | | With existing measures only | | |
|---|---|---|---|---|---|---|
| | With ETS + LULUCF offsets | With ETS offset | No offsets | With ETS + LULUCF offsets | With ETS offset | No offsets |
| ETS futures | 2.7 | 3.6 | 3.7 | 5.4 | 6.1 | 6.2 |
| Analysts' predictions for ETS | 3.6 | 4.6 | 5.3 | 7.9 | 8.6 | 9.3 |
| Analysts' predictions for ETS 2 | 4.1 | 4.9 | 5.6 | 9.0 | 9.5 | 10.3 |
| EU Marginal Abatement Cost | 6.2 | 7.6 | 9.8 | 15.6 | 16.2 | 18.4 |

# Land Use, Land Use Change, and Forestry Regulation

## Pricing assumptions

The pricing assumptions used for the calculations of costs from purchasing compliance with the LULUCF Regulation are the same as those in the Effort Sharing Regulation.

## Projections for emissions/removals

The two periods, 2021-2025 and 2026-2030 are treated differently as they have different accounting rules.

For the first period, 2021-2025, Ireland has to adhere to a "no-debit" rule. Essentially, Ireland can have no net emissions (emissions minus removals) relative to a benchmark period.

Under the with existing measures scenarios, Ireland would have 7.8 Mt $CO_2$ equivalent of debits (emissions) and 17.3 Mt $CO_2$ equivalent of credits (removals), leaving net credits of 9.5 Mt $CO_2$ equivalent that can be used as a flexibility under the Effort Sharing Regulation for 2021-2025.

Under the with additional measures scenarios, Ireland would have 5 Mt $CO_2$ equivalent of debits and 18.7 Mt $CO_2$ equivalent of credits, leaving net credits of 13.7 Mt $CO_2$ equivalent. However the flexibility under the Effort Sharing Regulation is capped at 13.4 Mt $CO_2$ equivalent for 2021-2025.

For the second period, 2026-2030, Ireland must reduce its total LULUCF emissions linearly to 3.7 Mt $CO_2$ equivalent by 2030. In the calculations, the starting point for this linear path was assumed to be 2022 and the starting emissions was assumed to be the average of 2021-2023 emissions, equivalent to 4.7 Mt $CO_2$ equivalent by 2030. As a result, the target emissions reduce by 0.13 Mt $CO_2$ equivalent each year. The cumulative gap to target is estimated relative to this indicative linear path.

If Ireland exceeds its LULUCF emission targets post 2026, it faces a compounding penalty. This means that, any excess emissions would scale up the next year's requirements, as well as being multiplied by 1.08. This could necessitate steeper future emission cuts, making the transition to a low-carbon economy more challenging and expensive. This has not been factored into the calculations below.

### Nº 24 LULUCF emissions and projections

Mt $C0_2$ equivalent

| | Projected level of emissions (WEM) | Projected level of emissions (WAM) | Target 2026-2030 | Gap (WEM) 2026-2030 | Gap (WAM) 2026-2030 |
|---|---|---|---|---|---|
| **2021** | 4.6 | 4.6 | | | |
| **2022** | 4.0 | 4.0 | 4.7 | | |
| **2023** | 5.6 | 5.1 | 4.6 | | |
| **2024** | 6.6 | 4.9 | 4.5 | | |
| **2025** | 6.8 | 4.9 | 4.4 | | |
| **2026** | 7.5 | 5.5 | 4.2 | 3.2 | 1.2 |
| **2027** | 7.4 | 5.1 | 4.1 | 3.3 | 1.0 |
| **2028** | 7.6 | 5.0 | 4.0 | 3.6 | 1.1 |
| **2029** | 7.9 | 4.8 | 3.9 | 4.1 | 1.0 |
| **2030** | 7.9 | 4.9 | 3.7 | 4.2 | 1.2 |
| | | | | | |
| **2021-2025** | 27.6 | 23.5 | | | |
| **2026-2030** | 38.3 | 25.4 | 19.9 | 18.4 | 5.5 |

Source: Environmental Protection Agency.

## Workings for costs from purchasing compliance

The detailed data and workings used to arrive at the costs from purchasing compliance with the LULUCF regulation are shown below.

## Nº 25 LULUCF price assumptions

Prices, € per tonne of $CO_2$ equivalent

| | ETS prices/ futures | Average of analysts' predictions for ETS | Average of analysts' predictions for ETS 2 | MAC | |
|---|---|---|---|---|---|
| **2030** | €81 | €133 | €159 | €300 | Actual price |
| **2031** | €83 | €136 | €162 | €306 | 2030 indexed price |
| **2032** | €84 | €139 | €165 | €312 | 2030 indexed price |

Source: Macrobond, Carbon Pulse, T&E, Veyt, Homaio, and Clearblue.

## Nº 26 LULUCF costs of purchasing compliance 2021-2030

€ billion

| | With additional measures | With existing measures |
|---|---|---|
| ETS futures | 0.5 | 1.6 |
| Analysts' predictions for ETS | 0.8 | 2.6 |
| Analysts' predictions for ETS 2 | 0.9 | 3.0 |
| EU Marginal Abatement Cost | 1.7 | 5.8 |

# Renewable Energy Directive

## Pricing

The four pricing scenarios for the calculations of the costs of purchasing compliance with the Renewable Energy Directive are as shown below.

1. Historical 2020 cost adjusted for inflation. Ireland failed to meet its renewable energy share targets for 2020. As a result, Ireland had to purchase statistical transfers from Estonia and Denmark in order to be compliant with the previous Renewable Energy Directive. Ireland purchased 3.5 TWh of renewable energy, at a cost of €50 million. Under the first scenario, we assume the cost of purchasing compliance per GWh, in real terms, is the same as in 2020. That is, the 2020 cost is indexed to (euro area) inflation.
2. Dutch TTF Gas futures for 2030. While gas is non-renewable and cannot be used to meet the renewable energy targets, gas futures can provide a guide to the likely future energy costs. However, it is ultimately (renewable) energy that needs to be purchased. At the time of writing, these range from €45 per TWh in 2025 to €30 per TWh in 2027.
3. German power futures for 2030. Similarly to above. At the time of writing, these range from €94 per TWh in 2025 to €74.5 per TWh in 2028
4. Cost of renewables in countries likely to exceed targets. Ultimately, Ireland will be buying renewable energy from countries who have surplus renewable energy relative to their own targets. Ireland may have to pay a cost equivalent to the cost of generating the renewable energy in these surplus countries. Here we have taken a weighted average strike price from the two most recent auctions in Spain. We take this price as, based on current projections, Spain has most excess renewable energy to sell. The weighted average price was €57.1 per MWh in 2022. This price was then indexed to inflation.[52]

[52] The two most recent auctions took place in October and November 2022. In October, 146 MW biomass was auctioned at an average price of €93.09 per MWh, and 31 MW of solar PV was

Futures prices are used where available until 2030. If the futures prices do not exist for the relevant years prior to 2030, the last available price was then indexed to inflation.

There is significant uncertainty on when compliance costs will arise. While costs of purchasing compliance may arise in 2032, as it is renewable energy in 2030 that would need to be purchased, the 2030 prices are used, however these are indexed to inflation for 2031 and 2032.[53]

The same inflation assumptions used for the Effort Sharing Regulation and LULUCF calculations are used here.

## Workings for costs of purchasing compliance

As mentioned in the main text. There are three potential source of costs from missing targets:

1) Ireland falls below its baseline renewable energy share target of 16%. Ireland fell below its baseline share in 2021, 2022 and 2023. Ireland could face costs from purchasing compliance for falling below its baseline share in 2021 and 2022 but as things stand, not for 2023. This is because countries have one year to return above their baseline share. Ireland is expected to return above its baseline share in 2024.

2) Ireland fails to meet its 2030 renewable energy share target of 43%. Both WEM and WAM scenarios see Ireland falling below the 43% target in 2030.

3) The EU fails to meet interim targets, in which case Ireland's interim targets become active, and Ireland misses its interim targets. Under both WEM and WAM scenarios, Ireland is set to miss its interim targets for 2025 and 2027 so could face potential costs for missing these targets. The scenarios which this applies to assumes that the EU misses its interim targets in both 2025 and 2027.

The detailed data and workings used to arrive at the costs of purchasing compliance with the Renewable Energy Directive are shown below.

auctioned at an average price of €53.88 MWh. In November 2022, 45.5 MW of onshore wind was auctioned at an average price of €42.78 per MWh: https://www.miteco.gob.es/es/energia/renovables/regimen-economico.html.

[53] This is instead of using futures prices for 2031 or 2032.

## Nº 27 Renewable energy share calculations

% share (unless otherwise stated)

| | Projected share of renewables (WEM) | Projected share of renewables (WAM) | Baseline 2020 share | Minimum Trajectory | Projected Final Energy Consumption (WEM) (Mtoe) | Projected Final Energy Consumption (WAM) (Mtoe) | Gap to baseline 2020 share | Gap (WEM) (TWh) | Gap (WAM) (TWh) |
|---|---|---|---|---|---|---|---|---|---|
| **2021** | 13% | 13% | 16% | | 11.4 | 11.4 | 4.7 | | |
| **2022** | 13% | 13% | 16% | 21% | 12.0 | 12.0 | 4.0 | 10.9 | 10.9 |
| **2023** | 15% | 15% | 16% | | 12.4 | 12.4 | 1.1 | | |
| **2024** | 19% | 19% | 16% | | 12.6 | 12.6 | | | |
| **2025** | 20% | 20% | 16% | 28% | 12.8 | 12.8 | | 11.2 | 10.9 |
| **2026** | 22% | 23% | 16% | | 12.9 | 12.8 | | | |
| **2027** | 24% | 26% | 16% | 34% | 13.1 | 12.7 | | 15.2 | 11.4 |
| **2028** | 25% | 29% | 16% | | 13.1 | 12.7 | | | |
| **2029** | 27% | 35% | 16% | | 13.2 | 12.6 | | | |
| **2030** | 31% | 43% | 16% | 43% | 13.3 | 12.5 | | 18.7 | 0.4 |

Source: Environmental Protection Agency.

## Nº 28 Renewable energy price assumptions

Prices, € million per TWh

| | Same cost as 2020 | Gas (Dutch) futures | Renewable energy strike price in Spain | German power futures |
|---|---|---|---|---|
| **2025** | €18 | €45 | €64 | €94 |
| **2026** | €18 | €37 | €65 | €95 |
| **2027** | €19 | €30 | €66 | €84 |
| **2028** | €19 | €31 | €68 | €75 |
| **2029** | €19 | €31 | €69 | €76 |
| **2030** | €20 | €32 | €71 | €78 |
| **2031** | €20 | €33 | €72 | €79 |
| **2032** | €21 | €33 | €73 | €81 |

Source: EEX, ICE, and PV-magazine.

## Nº 29 Renewable energy costs of purchasing compliance

€ billions

| | With additional measures | | | With existing measures | | |
|---|---|---|---|---|---|---|
| | Missed Baseline for 2021-2022 | Missed 2030 target + missed baseline for 2021-2022 | Missed 2030 target + missed baseline for 2021-2022+ EU misses interim targets | Missed Baseline for 2021-2022 | Missed 2030 target + missed baseline for 2021-2022 | Missed 2030 target + missed baseline for 2021-2022+ EU misses interim targets |
| Same cost as 2020 | 0.2 | 0.2 | 0.6 | 0.2 | 0.5 | 1.0 |
| Gas (Dutch) futures | 0.4 | 0.4 | 1.1 | 0.4 | 1.0 | 1.8 |
| Renewable energy strike price in Spain | 0.6 | 0.6 | 2.1 | 0.6 | 1.9 | 3.7 |
| German power futures | 0.8 | 0.9 | 2.6 | 0.8 | 2.3 | 4.4 |