An Overview of Carbon Pricing
PBO Publication 35 of 2019

Key Points:

• Ireland will not meet its 2020 targets for both emission reductions and renewable energy. This will likely cost between €66 million and €103 million in total. Ireland also faces significant challenges in meeting EU 2030 reduction targets and national 2050 long-term environmental goals.

• Setting an adequate price for carbon emissions through a Carbon Tax, a Regulatory system, and/or the use of a Shadow Price of Carbon can play a significant role in incentivising households and firms to reduce carbon emissions and in mobilising environmentally friendly technologies.

• In Ireland, a carbon tax was introduced in 2009. Tax receipts grew every year from 2010 to 2018, reflecting strong economic growth, and amounted to €431 million in 2018. Auto Diesel accounts for 42% of the carbon tax receipts.

• The current rate is €20 per tonne of CO2 emissions. The Climate Change Advisory Council has pointed to a need for an increase in Carbon Tax to reduce CO2 emissions. Key Action 9 of the Government’s new Climate Action Plan commits to the implementation of a carbon tax rate of at least €80 per tonne by 2030.

• An important aspect of increasing carbon pricing is the role of complementary supports to assist with the increased burden on households on a low income, who generally spend a higher proportion of their income on energy.

• Research from the ESRI shows that low income households can be compensated for increases in the carbon tax. Different compensation schemes include lump-sum rebates and revenue recycling through the existing tax and welfare system.

• Overall, taxation should be seen as one tool in a wider portfolio of policy levers for achieving climate goals.

Introduction

Pricing carbon has come to the fore of public policy debates about climate change mitigation, in light of the well evidenced role played by man-made CO2 emissions in driving climate change. According to the United Nations’ body Intergovernmental Panel on Climate Change (IPCC) global average temperatures have increased by nearly 1°C since the pre-industrial era. It is very likely that emissions produced by human economic activity were the main reason for this. Future projections also foresee a worsening of these trends without sustained reductions in the levels of Greenhouse Gas (GHG) emissions.

Setting an adequate price on carbon emissions represents a policy response to this issue, as it can play a significant role in:

• Altering the behaviour of individuals and firms and incentivising environmentally friendly decision-making;

• Mobilising technological advancements required to generate carbon neutral growth;

• Driving the reduction in carbon emissions and the increase in renewable energy required to support the achievement of EU 2020 and 2030 targets, as well as national 2050 long-term environmental goals.

Appropriate carbon pricing is necessary to support the achievement of the European Union's long-term aim to reduce its greenhouse gas emissions by 80–95% below 1990 levels by 2050. Each EU Member is required to deliver a significant reduction in emissions. Ireland also


3 Greenhouse gases include Carbon Dioxide (CO2), Methane (CH4), Nitrous Oxide (N20), Sulfur Hexafluoride (SF6), Hydrofluorocarbons (HFCs), Perfluorocarbons (PFCs) and Nitrogen Trifluoride (NF3).
signed up to various EU Directives and EU Decisions. In particular, the reduction in emissions in the EU from energy intensive sectors is managed by the EU Emissions Trading Scheme (ETS) and is the responsibility of individual companies. Conversely, governments of Member States are responsible for cutting greenhouse gas emissions in the non-ETS sectors, including agriculture, transport, residential, commercial, waste and non-energy intensive industry.

The EU has committed to reducing greenhouse gas emissions in the non-ETS sectors by 30% from 2005 levels by 2030. This was translated into the greenhouse emissions targets for each Member State under the Effort Sharing Regulation. There are also climate and energy targets for 2020 under the Effort Share Decision. However, Ireland will not meet these targets for both emission reductions and renewable energy. Ireland also faces significant challenges in meeting EU 2030 reduction targets in the non-ETS sector and national 2050 reduction targets (at least 80% reduction in CO₂ emissions) in the electricity generation, built environment and transport sectors (EPA, 2019). This will entail costs for the Exchequer as it will need to purchase emission allowances to comply. The Department of Communications, Climate Action and Environment estimate that this will cost between €66 million and €103 million. Costs associated with missing later (2030) targets could be substantially higher.

The National Mitigation Plan points out the role of carbon pricing in reducing demand for fossil fuels and incentivising energy efficiency improvements by households and firms. The central role that carbon pricing will play in the transition to a low-carbon economy was re-stated in the Government’s Climate Action Plan, which commits to an increase in the carbon tax and the review of the shadow price of carbon in project appraisal for all public capital investments.

Sometimes taxing or regulating carbon can lead to “carbon leakages”. This is the case when the higher costs of climate and energy policies incentivise firms to relocate to other countries that do not have similar policies. This gives the countries with weaker climate policies a trading advantage. The sectors and products that are at most risk of carbon leakage include: cement, aluminium, iron and steel, paper, refineries and chemicals. In the EU, the Emission Trading Scheme (ETS) creates a level playing field for ETS sectors.

Overall, there are three main approaches to set prices on carbon and influence decision-making. These are:

- The implementation of a Carbon Tax;
- The introduction of a Trading or Regulatory system; and
- The use of a Shadow Price of Carbon in cost-benefit analysis of capital projects.

This note will focus primarily on an analysis/discussion of the key issues around the carbon tax, but there will also be a concise discussion of the other two approaches.

### The Irish Carbon Tax

The carbon tax makes individuals and firms consider societal costs from the generation of CO₂ emissions by setting a price for each unit of pollution. The tax is calculated based on the amount of CO₂ emissions released in the combustion of carbon-based fossil fuels, i.e. coal, oil, natural gas, etc. The easiest way from an administrative viewpoint is to tax the supplier of fossil fuels (IMF, 2019; OECD, 2018). The supplier of fossil fuels can then pass the tax onto customers through higher prices.

In Ireland, the carbon tax was introduced in 2009 on petrol, diesel, oils and gas, and was extended to solid fuels (coal and peat) in 2013 and 2014. The rate per tonne of CO₂ emissions was €15 from 2010 to 2011 and was increased to €20 per tonne of CO₂ emissions in 2012. It applies exclusively on emissions in non-ETS sectors. As shown in Figure 1, Carbon Tax receipts from 2010 to 2018 grew every year, reflecting strong economic growth, and amounted to €431 million in 2018. Auto Diesel accounts for 42% of carbon tax receipts, which is also reflective of the current composition of the vehicle fleet in Ireland with 60% of vehicles operating on diesel. It is interesting to note that unlike carbon tax receipts from

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6 Department of Communications, Climate Action and Environment (2017), *National Mitigation Plan*.
7 Department of Communications, Climate Action and Environment (2019), *Climate Action Plan*.

Auto Diesel, which increased by 86.5% from 2010 to 2018, receipts from petrol decreased by 26% over the period. This change is likely due to consumers switching from petrol to diesel vehicles.

The Climate Change Advisory Council highlighted that the carbon tax will need to be increased in order to reduce CO\textsubscript{2} emissions and to combat climate change. As outlined by John FitzGerald in his Opening Statement to the Oireachtas Committee on Budgetary Oversight\textsuperscript{9}, the Climate Advisory Council recommends to Government an increase in the carbon tax to at least €35 per tonne in Budget 2020. The Advisory Council also recommended that to achieve further decarbonisation, the carbon tax would need to rise to at least €80 per tonne by 2030. The latter has become a Government commitment in the 2019 Climate Action Plan.

Recent Studies on the Irish Carbon Tax

Options and economic and environment implications of increasing the tax per tonne of CO\textsubscript{2} emissions were examined by the Economic and Social Research Institute (ESRI). Their research paper\textsuperscript{10} looked at the economic and environmental consequences of increasing the carbon tax by four different amounts: €5, €10, €15 and €20. The results are caveated as the paper applies a static methodology and investigates short-term effects (it does not account for general equilibriums and interactions between markets in the economy\textsuperscript{11}).

A €5 increase per tonne of carbon would reduce annual non-ETS CO\textsubscript{2} emissions by 1.2%. This would cost households between €0.45 and €2.30 depending on their income. A €20 increase in the carbon tax would reduce annual carbon emissions by 4.8% (which is still

\textsuperscript{9} John FitzGerald (2019), Opening Statement to Oireachtas Committee on Budgetary Oversight

\textsuperscript{10} Kelly C De Bruin and Akyut Mert Yakut (2018), The Economic and Environmental Impact of increasing Irish Carbon Tax, ESRI.

\textsuperscript{11} Wider economic effects are analysed in De Bruin and Yakut (2019) using an intertemporal computable general equilibrium model. They find that while impacts at sectoral level are significant, with the energy and transport sectors being impacted the most due highest price increases for LPG, diesel and gasoline, overall wider GDP impacts are negligible and increases in overall prices for households are moderate.
insufficient to meet emissions targets) and would cost households €1.87 to €9.63 across the income deciles.

Expressed as a percentage of disposable income, a €5 increase per tonne of carbon would range from 0.16% for the poorest household group to 0.07% to the richest household group. A €20 increase per tonne of carbon would range from 0.67% additional cost for the poorest household group to 0.28% to the richest household group. While the carbon tax is regressive, as the additional cost is a higher proportion of disposable income for lower income deciles compared with upper deciles, the ESRI paper suggests that potential negative impacts on households in fuel poverty could be addressed by measures such as an increase in the winter fuel allowances.

Increases in the carbon tax are estimated to impact the price of diesel (+1.7% (+7.1%) for a €5 (€20) increase) and petrol (+1.3% (+5.5%) for a €5 (€20) increase) the most. The estimated impacts of a carbon tax increase on production costs across sectors are limited (+1.4% increase in production costs for a doubling of the carbon tax). At a sectoral level, the natural gas supply sector and the transportation sectors will be worst off. Finally, an increase in the carbon tax will have limited negative effects on international competitiveness, as the commodities subject to the highest price increases account for a small share of Irish exports.

Measures to address fuel poverty include tax incentives and subsidies for energy conservation (home insulation schemes) and less carbon intensive energy sources (solar panels installation grants). Another option is to give the carbon tax revenue back to households. This is known as a “fee and dividend” model.

Recent research by the ESRI analyses alternative approaches to mitigate the regressive effects of a carbon tax. Reaños and Lynch (2019) examine how returning carbon tax revenue to households can reverse the regressive effect of a carbon tax. A “fee and dividend” model that returns carbon tax revenue equally to every household leads to a small change in income inequality. A targeted approach that directs more of the revenue to poorer households reduces income inequality to a greater extent. The targeted approach is more progressive and the administrative costs are likely to be lower compared to a flat cash transfer, given that the revenues could be recycled through the existing tax and welfare system.

A paper by Bercholz and Roantree (2019) (also from the ESRI) studies the impact of an increase in carbon tax on household’s incomes and outlines different solutions to compensate for the increased tax burden on lower-income households. Based on the assumption that firms’ prices are fixed, and that firms and households don’t change their behaviour, they explore the effects of four alternative compensation packages: (i) a lump sum rebate; (ii) an increase to all income tax credits; (iii) an increase in social welfare payments (including state pension); (iv) and an increase to both tax credits and welfare payments (including child benefit, tax credits and state pension).

Before any compensation scheme is modelled, the study finds that in light of a €10 rise in the Irish Carbon tax, large households and rural dwellers would experience the largest losses. Low-income households would see larger losses as percentage of both income and expenditure (i.e. a regressive impact).

On the other hand, model results find that overall most households can be compensated for a carbon tax rise, however there are clear trade-offs. The lump-sum rebate is progressive (leaving low-income households better off on average) and easy to communicate, but the administration is generally costly and complex. The increase in tax credits appears to be efficient in economic terms, but it would have regressive effects. The increase in social welfare payments would be highly progressive, but it could reduce incentives to join the labour market. The increase to both tax credits & welfare payments is progressive, but it is unclear if would provide the double dividend (reduction in carbon emissions and increase in economic activity).

Revenue raised from the carbon tax can also be directed to reducing, in a sustainable manner, other taxes that empirical studies find to have distortionary effects on economic growth (i.e. income taxes). Furthermore, the revenue can be reused to fund public investment and support the enhancement of the productive capacity of the economy. The efficiency gains can outweigh the impact of higher costs from carbon tax. However, the effects of taxation are complex and hard to identify, depending on the characteristics of the non-polluting and polluting sectors. It could be the case that the option of policy or regulatory changes might be more cost effective than carbon tax increases (IMF, 2019). The effectiveness of a carbon tax in reducing carbon emissions also depends on the existence of feasible “green” alternatives that households can switch to in response to price increases.


In terms of revenue yields, Table 1 provides estimates for four alternative increases amounts in the Irish Carbon Tax (based on the Revenue Ready Reckoner).

**Table 1: Carbon Tax yields for 2019**

<table>
<thead>
<tr>
<th>Increase by €5 a Tonne</th>
<th>€ Million - Full Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase by €10 a Tonne</td>
<td>213</td>
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<tr>
<td>Increase by €15 a Tonne</td>
<td>320</td>
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<tr>
<td>Increase by €20 a Tonne</td>
<td>426</td>
</tr>
</tbody>
</table>

Source: Revenue Ready Reckoner (June 2019). The increase amounts and the resulting full year estimates are inclusive of VAT.

**The Shadow Price of Carbon**

The use of a Shadow Price of Carbon in cost-benefit analysis (CBA) of capital projects represents a third way to price carbon by monetising the negative impact of environmental emissions. As a general rule a high price of carbon would make public investment in environmentally sustainable projects more viable. Values for the shadow price of carbon are outlined in DPER’s public spending code, which is a document outlining the set of rules and procedures that all Irish public bodies are obliged to apply to the use of public funds to ensure that the best possible value-for-money is achieved. According to the code, the shadow price of carbon should be based on the estimated futures price of CO₂ equivalent derived from the EU Emission Trading Scheme (ETS). However, as mentioned before, the ETS has failed to price carbon optimally.

The Climate Action Plan noted that the public spending code will be reformed in relation to how the shadow price of carbon is calculated. The strategy is to increase the shadow price to €32 per tonne by 2020, €100 per tonne by 2030 and €265 by 2050. This compares to previous recommended projected values of €10 per tonne by 2020, €35 per tonne by 2030 and €100 by 2050.

**Conclusion**

This Note explored alternative ways for pricing carbon generally, with a particular focus on the Irish Carbon Tax. These approaches aim to incentivise households and firms to reduce their usage of carbon-based fuels. The note outlines some of the recent studies on the income distributional effect of carbon taxation and how to compensate for the increased burden on households. The main compensation schemes to reduce the economic incidence on poorer households include a lump-sum rebate or the use of the tax and social welfare system. It must be noted that the use of taxation should be seen as one tool in a wider portfolio of policy levers for achieving climate goals, encompassing public expenditure, finance, spatial planning and investment in research and development. Recently initiatives have also considered strengthening the budgetary framework for climate policy, including Ireland’s participation in the Paris Collaborative on Green Budgeting launched by the OECD.\(^5\)

\(^{14}\) Climate Change Advisory Council (2018), *Annual Review 2018*.  
\(^{15}\) For information on the evolution of green budgeting in an Irish context see Anna Cremins and Laura Kevany (2019), *An Introduction to the Implementation of Green Budgeting in Ireland*, IGEEES; and Parliamentary Budget Office (2018), *Briefing Paper 12.*
## Publications

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication 31 of 2019</td>
<td>Tracing Brexit Related Exchequer Expenditure - Budget 2019</td>
<td>17 June 2019</td>
</tr>
<tr>
<td>Publication 24 of 2019</td>
<td>An Overview and Analysis of Contingent Liabilities in Ireland</td>
<td>01 May 2019</td>
</tr>
<tr>
<td>Publication 20 of 2019</td>
<td>Quarterly Economic and Fiscal Commentary – Q1 2019</td>
<td>09 April 2019</td>
</tr>
<tr>
<td>Publication 17 of 2019</td>
<td>Scrutiny processes for existing tax expenditures in selected European Parliaments</td>
<td>02 April 2019</td>
</tr>
</tbody>
</table>

### Expenditure Analysis series

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication 30 of 2019</td>
<td>The National Development Plan – An overview, and an analysis of major (discrete) infrastructure projects</td>
<td>11 June 2019</td>
</tr>
<tr>
<td>Publication 29 of 2019</td>
<td>Gross Voted Expenditure: January to May 2019 - Illustration and analysis of budgetary management by Vote Group</td>
<td>07 June 2019</td>
</tr>
<tr>
<td>Publication 26 of 2019</td>
<td>General Government Expenditure: How its composition constrains decisions about government spending</td>
<td>22 May 2019</td>
</tr>
<tr>
<td>Publication 25 of 2019</td>
<td>Gross Voted Expenditure: January to April 2019 - Illustration and analysis of budgetary management by Vote Group</td>
<td>03 May 2019</td>
</tr>
<tr>
<td>Publication 18 of 2019</td>
<td>Irish Water's Strategic Funding Plan 2019-2024 – Context and Implications</td>
<td>02 April 2019</td>
</tr>
</tbody>
</table>

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| Publication 16 of 2019 | An introduction to tax revenue buoyancy | 25 March 2019 |

## Infographic series

<table>
<thead>
<tr>
<th>Publication 34 of 2019</th>
<th>Analysis of Gross Voted Current Health (Vote 38) expenditure @ end May 2019</th>
<th>25 June 2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication 27 of 2019</td>
<td>Dáil Select Committees and the Ministerial Vote Groups which they scrutinise – 2019</td>
<td>24 May 2019</td>
</tr>
<tr>
<td>Publication 23 of 2019</td>
<td>Vote 38 Health – Total Gross Voted Allocation: Budget 2017 to Budget 2019</td>
<td>01 May 2019</td>
</tr>
<tr>
<td>Publication 22 of 2019</td>
<td>Public Services 2019 - Programmes by expenditure</td>
<td>18 April 2019</td>
</tr>
<tr>
<td>Publication 19 of 2019</td>
<td>Total Gross Voted Allocation and Expenditure Cycle 2018</td>
<td>04 April 2019</td>
</tr>
<tr>
<td>Publication 14 of 2019</td>
<td>Exchequer Revenue – Significant Months</td>
<td>13 March 2019</td>
</tr>
</tbody>
</table>

## European Semester series

<table>
<thead>
<tr>
<th>Publication 21 of 2019</th>
<th>Preliminary Analysis of the Stability Programme Update 2019</th>
<th>17 April 2019</th>
</tr>
</thead>
</table>

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