

## Introduction to the ESR Special Issue on Energy, Environment and Climate Change Economics

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**Abstract:** This special issue contains four papers that highlight key economic issues in Irish climate and energy policy. The first paper tackles the decision to install a home energy retrofit, identifying factors that influence the financial viability of investment. The second paper quantifies the air pollution impacts of domestic and EU-level carbon pricing. The third paper shifts the focus to climate adaptation, showing that firms in flood-prone areas face higher credit costs, indicating that climate-related physical risks are at least partially priced into the cost of credit for Irish firms. However, the authors find that some firms in flood-prone areas face greater difficulty in accessing credit. The final paper of this special issue provides a comparison of Irish emissions from production and consumption-based measurement techniques, revealing that Ireland's carbon footprint is larger under consumption-based measurement, offering insights for domestic policy design.

**T**his special issue brings together four papers to inform Irish energy and climate policy. Ireland has set ambitious climate change mitigation targets in line with The European Green Deal, which commits to achieving climate neutrality by 2050. Under national legislation, Ireland has pledged to reduce greenhouse gas emissions by 51 per cent by 2030 relative to 2018 levels and to reach climate neutrality by no later than 2050 (Government of Ireland, 2025). Despite these commitments, progress has been slow. The latest projections from the Environmental Protection Agency indicate that, even with full implementation of all policies and measures currently under discussion, Ireland is on track to only achieve a 23 per cent reduction by 2030 (Environmental Protection Agency, 2025).

The shortfall in Irish climate action underscores the need for policy interventions that maximize mitigation impact per euro spent. This is particularly true in the context of a fully employed economy facing significant capacity constraints (Barrett and Curtis, 2023). Three of the papers in this issue focus on climate mitigation policy, offering evidence-based insights to guide more efficient and effective policy design.

While mitigation remains central to climate policy, adaptation is becoming increasingly urgent as climate impacts intensify. Irish adaptation policy is guided by the National Adaptation Framework (NAF), the second statutory version of which was published in June 2024 (Government of Ireland, 2024). Efficient and effective adaptation is essential to ensure a resilient society. The economic toolkit is important for both designing and evaluating these policy measures.

Collectively, the papers of this issue inform and assess key aspects of Ireland's mitigation and adaptation policies. The first paper in this special issue, entitled "A Scenario Analysis of Financing Options for Energy Retrofits Among Irish Mortgage Holders", by Carroll, Lambert, Lyons, O'Callaghan, Franklin, McCoy and Coyne (Carroll *et al.*, 2025a), investigates the financial decision of a home energy 'retrofit', the upgrading of insulation and/or heating system in older dwellings. This paper gives important policy insight into the value of the upgrade. Much research exists in both an Irish and international context to quantify the energy savings associated with investment, but far less exists to examine this topic from the perspective of household finances. This is a primary determinant of the decision to invest. Identifying specific barriers to adoption is important for well-designed climate mitigation policy; interventions to maximise uptake can target the specific barriers limiting deployment. The work of Carroll *et al.* (2025a) provides important insight in this regard. Using a large, novel dataset of mortgaged households, Carroll *et al.* (2025a) consider the financial returns for a retrofit. They compare long-run savings and repayment burdens across a variety of loan types and financing scenarios.

Carroll *et al.* (2025a) find that retrofitting yields net lifetime financial savings for most households. However, the structure of the loan is important to mitigate against short-term financial pressures. Financial pressures are influenced by future energy prices, prevailing interest rates and the prevalence of the 'rebound effect' – an empirical observation whereby householders maintain or increase their energy consumption on foot of an insulation upgrade.

The design and structure of retrofit finance influences short-term affordability. This paper finds that longer loan maturities and mortgage top-ups are most effective in smoothing costs over time and mitigating any impediments created by high upfront costs. These findings are of particular policy relevance: energy efficiency investments are characterised by relatively large upfront payments and long-term savings, a structure that requires capital on hand to make the required investment

and reap any long-term reward. The study of Carroll *et al.* (2025a) highlights the design features that may need to be incorporated in financing arrangements to overcome potential financial impediments created by this cost structure.

The second paper in this special issue provides macro-level insights into key challenges and opportunities for climate change mitigation in Ireland. “Co-benefits of the Irish Carbon Tax and the European Emissions Trading System on Outdoor Air Pollution in Ireland” by Everett, de Bruin and Yakut (2025), examines the positive health externalities of carbon pricing – measured through reductions in air pollutant emissions. Specifically, the authors investigate whether, and to what extent, carbon pricing at the national level versus the EU level influences the magnitude and composition of Irish air pollutant emissions.

Carbon pricing is widely regarded as a cornerstone of efficient climate policy. In Ireland, two distinct carbon pricing mechanisms operate across different sectors. The EU Emissions Trading System (ETS) is a cap-and-trade scheme that applies to electricity generation and large industrial installations, while non-ETS sectors – such as transport, heating, and domestic fuel use – are subject to the national carbon tax. Everett *et al.* (2025) quantify the health co-benefits associated with each mechanism, both individually and in combination. Their findings show that transport, services, residential, and agricultural sectors – primarily covered by the domestic carbon tax – experience the largest reductions in NO<sub>x</sub> and other pollutants under higher carbon tax scenarios. Conversely, electricity, petroleum, and manufacturing sectors – mainly covered by the EU ETS – record the greatest reductions in air pollutants at higher ETS prices.

Importantly, the paper also identifies areas where co-benefits are limited. For example, pollutants such as ammonia (NH<sub>3</sub>), which are less directly linked to fossil fuel combustion, show minimal response to carbon pricing. By quantifying these positive externalities, Everett *et al.* (2025) provide valuable evidence for policymakers when assessing the broader benefits of carbon abatement relative to other policy priorities and decarbonisation options.

The third paper in this special issue, entitled “Firm Credit Conditions and Flood Risk: Evidence from Ireland”, by Carroll, Mahony, Morando, O’Sullivan and Shahabi Ahangarkolaee (Carroll *et al.*, 2025b), considers the impacts of climate change and the implications for the cost of credit for non-financial corporations in Ireland. A changing climate brings changing risks for households and firms. It is important to understand these impacts to ensure long-term resilience. Aspects of this are explored in this paper, where the authors investigate the risk created by potential flood events and the impact this may have on firm credit conditions.

Carroll *et al.* (2025b) find that loans to borrowers in flood risk areas face an interest rate premium of roughly 7 to 13 basis points and are more likely to provide a collateral. The authors combine a number of data sources, including detailed maps pertaining to the likelihood of flood events alongside geolocated loan data to compare interest rate, collateral and flood risk.

The findings of this paper provide timely and important insight for Ireland, with Carroll *et al.* (2025b) finding that increased flood risk caused by climate change is at least partially factored into the cost of credit for non-financial corporations. Although the results suggest that lenders price at least some of this important source of climate risk, they also highlight an additional difficulty in obtaining credit for borrowers located in areas susceptible to floods.

The final paper in this special issue, “Production and Consumption-based Emissions of Ireland” by Değer, de Bruin and Yakut (2025), shifts the focus to the methodology of emissions accounting. The authors compare Ireland’s emissions using two approaches: production-based accounting (PBA) and consumption-based accounting (CBA). Under PBA, emissions are attributed to the location of production, meaning Irish emissions are those generated within its territory. In contrast, CBA allocates emissions based on consumption, adding emissions embedded in imports and subtracting those contained in exports.

International climate agreements, including the UNFCCC and the Paris Agreement, require countries to report annual inventories of “anthropogenic GHG emissions by sources and removals by sinks” within their borders (UNFCCC, 2014). This production-based approach offers transparency. However, consumption is a driver of production, and CBA aligns more closely with the polluter pays principle.

Although international reporting is unlikely to adopt CBA, the comparison yields important policy-relevant insights. For example, understanding which sectors are associated with high levels of imported versus exported emissions can guide targeted interventions. Comparing PBA and CBA also sheds light on Ireland’s true contribution to global emissions. It provides insights into the extent to which emissions are generated for export or embedded in imports – information that can inform the balance between demand-side and supply-side mitigation measures.

The findings of Değer *et al.* (2025) reveal that Ireland’s emissions under CBA are 8–16 per cent higher than under PBA, depending on assumptions about electricity and cattle. This result is somewhat surprising given agriculture’s prominence in Ireland’s emissions profile and its export orientation. While CBA reduces Ireland’s agricultural emissions, as exported agricultural emissions are removed, this effect is outweighed by imported emissions in sectors such as fuels, metals, mineral products, and transport. These insights highlight the complexity of emissions attribution and the importance of considering both production and consumption perspectives in climate policy design.

Together, these papers provide a snapshot of some of the pertinent issues facing Irish climate and energy policy. Carroll *et al.* (2025a) demonstrate the importance of well-designed financial instruments for unlocking the long-term benefits of retrofit installation whilst Carroll *et al.* (2025b) consider whether climate impacts have been adequately incorporated into firm-level credit, finding emerging evidence that climate-related physical risks are already being priced into credit markets.

However, the authors also identify a residual need for strategies that strengthen financial resilience in vulnerable regions, noting that firms in these areas may face greater difficulty in securing credit.

At the macroeconomic level, Everett *et al.* (2025) quantify the air-quality co-benefits of carbon abatement – benefits that have often been overlooked in climate policy decision-making. Finally, Değer *et al.* (2025) compare Ireland’s emissions under production- and consumption-based emissions accounting approaches, revealing that a significant share of Ireland’s carbon footprint is embedded in both imports and exports. The findings of this paper offer valuable insights for the design of domestic decarbonisation policies and highlights the interconnected nature of global supply chains.

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