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The Tango of Policymaking and Energy Systems Modelling

Author: Andrew ZP Smith

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Abstract

This report summarizes the work and key findings of the Carbon Budget Fellowship held by Andrew ZP Smith. The Fellowship ran for two years from early 2021, and was based in the Energy Policy & Modelling Group of University College Cork.

The purpose of the Fellowship was to provide a communication channel between the Climate Change Advisory Council's Carbon Budget Committee, and the TIMES Ireland Model (TIM) to provide quantitative support and insights that would allow the Committee to make recommendations for Carbon Budgets that were legal, meaningful, justified, and viable.

TIM models the Irish energy system, for transport, industry, residential and commercial energy service demand. Given a set of prices and emissions constraints, it finds the lowest-cost pathway to re-architect and restructure Ireland's entire energy system, meeting future demands using existing energy sources (electricity, coal, gas and so on), and potential future sources such as hydrogen, while reducing emissions to meet the targets set.

Extensive deliberations were held by the Committee, based on the Fellow's communication of the model outputs. Extensive modelling was done, based on the Fellow's communication of the Committee's needs. The Carbon Budgets, informed by the work of the Fellowship by and the comprehensive outputs produced by TIM, have entered into law.

The setting of the first two carbon budgets should be seen as a pilot process and a learning opportunity; recommendations for strengthening the process include migrating the composition of the Committee to be centred on technical expertise, and ensuring that government departments engage in the process in a collaborative, rather than adversarial, spirit.

The Fellowship gave the Committee direct access to TIM, and scenario development and model evolution was guided by the Committee's needs. The process overall has made it clear that Ireland has a pressing and increasing need for institutional capacity to deliver the decarbonisation transition, and that this capacity is only partially present currently.



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The Tango of Policymaking and Energy Systems Modelling

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Research Report for the Climate Change Advisory Council

*End of Project Report available for download on
<https://www.climatecouncil.ie/councilpublications/councilworkingpaperseries/>*

Prepared for the Climate Change Advisory Council
by

University College Cork

Author:

Andrew ZP Smith

Climate Change Advisory Council

An Chomhairle Chohairleach Um Athrú Aeráide

Climate Change Advisory Council Secretariat, McCumiskey House, Richview,
Clonskeagh Road, Dublin 14, D14 YR62

Email: info@climatecouncil.ie

Phone: 01 2680180 Website: www.climatecouncil.ie



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This report is based on research carried out/data from January 2021 to April 2023. More recent data may have become available since the research was completed.

Climate Change Advisory Council Research

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To enable this the EPA supports the Climate Change Advisory Council in the commission and administration of research.

Research Report for the Climate Change Advisory Council



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Executive Summary

The purpose of the Fellowship was to provide a communication channel between the Climate Change Advisory Council's Carbon Budget Committee, and the TIMES Ireland Model, to provide quantitative support and insights that would allow the Committee to make recommendations for Carbon Budgets that were legal, meaningful, justified, and viable.

Did it meet its objectives? We must conclude that it did. Extensive deliberations were held by the Committee, based on the Fellow's communication of the model outputs. Extensive modelling was done, based on the Fellow's communication of the Committee's needs. The Carbon Budgets have entered into law.

But was it *successful*? That is much harder to answer. Real success would have been for the Oireachtas to initiate an urgent and comprehensive session of legislating, to ensure that the Budgets would be met; and for public and private bodies to then implement the transition with equal urgency. This has not happened, and is not happening.

Was that success ever even possible? Perhaps not. Probably not.

Is there still an opportunity to turn the progress that is being made, into success? There is, but not without a paradigm shift in how we specify and resource the institutional capacity required to make it a success.

The Fellowships have now ended, without renewal. Some members of the TIMES Ireland Model team have left the team and have left Ireland; as a country, we have created world-class experts, and then failed to retain them. Each loss is a step backwards, just at the moment when we need to be accelerating forwards.

The meeting of the Fellowship's objectives must be seen in the wider context of the project to decarbonise Ireland. This is a project that *will* reach its Net Zero end point. But at the time of writing, the trajectory we are on means that we will get there with such high cumulative emissions between now and then, that it will be more failure than success.

We still have the opportunity to get this right. But the window to do so, is closing fast.

1 Introduction

A Carbon Budget is by its very nature quantitative.

This is no small thing.

We have taken something profoundly complex - the transition of an entire economy and society - and captured the principal objective of that transition in a single number. The uncountable dimensions of the transition have squashed down into a single scalar value. The many qualitative aspects of the transition have been omitted entirely. Almost all of the quantitative aspects, similarly, are omitted. Of all the many behaviours in the country over a five-year period, we have concerned ourselves with exactly one: the aggregate weighted total of a specific set of emissions.

To pick any number is to boil down a thousand considerations into a single conclusion. To understand that number, is to understand those considerations. To ensure the number makes sense, to ensure that in a world where that budget is delivered, there was a viable, equitable, affordable migration path that satisfied the criteria set out in law, requires us to trace through energy system and its thousands of intertwined interdependencies.

Those intertwined interdependencies are far too overwhelming for anyone to hold in their head. And so, we need to use a model of the energy system, for this purpose. The TIMES Ireland Model [TIM] is a quantitative simulation of Ireland's energy economy, which evolves energy infrastructure and energy flows year-by-year. And thus, by its nature, TIM is a complex and labyrinthine tool.

This opens up a communications gulf. On one side of the gulf, we have the members of the Carbon Budget Committee, a group of people with diverse backgrounds and skills, who need a means of getting insight into what the social, technical, economic, and political implications of different Carbon Budgets are. On the other side of the gulf, we have TIM.

The purpose of the Fellowship was to bridge this gulf, to explore different decarbonisation trajectories, and to communicate the model's inputs, operation and insights to the Carbon Budget Committee, the Climate Change Advisory Council, and beyond.

2 Objectives as set out in the proposal

The Fellowship proposal set out the following objectives:

1. translate model results into policy insights on behalf of the Climate Council;
2. explore the range of possible decarbonisation trajectories under different assumptions on technology costs and future energy demands ... including a key focus on negative emissions technologies;
3. identify the gap between existing policies and scenarios consistent with a decarbonised energy system; and
4. communicate the model's inputs, operation and insights to a broad policy and public audience to facilitate civic understanding of energy systems modelling's role in the evidence base for carbon budgets.

3 The Fellowship in practice

The Fellow has worked with the Energy Policy & Modelling Group [EPMG] at University College Cork to develop and extend TIM, and to provide policy & model insights to the Climate Change Advisory Council's Carbon Budget Committee, meeting objectives 1-3, and part of 4, above. While Negative Emissions Technologies have not developed as much as we would like, TIM now includes provisional costings for them, and they were represented in the scenarios modelled.

In addition to the work briefing the Carbon Budget Committee on the modelled scenarios and the implications for policy, further briefings were given to civil society groups, policy makers, media, and the government's Working Groups developing the Climate Action Plan, together with the development by the EPMG team including the Fellow of a public-facing website which sets out the model results, thus meeting the rest of objective 4.

Carbon Budgets 1 & 2 were set in a timely manner, with a solid foundation of information & simulations behind them, to ensure that they met their statutory criteria.

Methodologies used for each work package

WP1: Project Management

Co-ordination was done via Teams, with frequent engagement between the Fellow and the Carbon Budget Committee, and weekly meetings between the Fellow and PI.

WP2: assessing existing Irish emissions scenarios which meet 2050 net-zero objective

TIM outputs were compared with national, EU and global targets, to assess compliance. Feasibility was assessed by comparing modelled deployment rates with real-world deployment rates around the world, as well as with expert projections.

WP3: Generating alternative emissions scenario for 2050

TIM was used to generate alternative emissions scenarios, with scenario narratives and parameters developed in dialogue between the Fellow, the PI, and the Carbon Budget Committee.

WP4: Assessing the role and potential of negative emissions for Ireland in long-term decarbonisation scenarios

Literature was reviewed to assess costs, and compared against TIM parameters. A watching brief was maintained over industry news, to monitor technological progress. TIM was run with and without negative emissions available, to assess the impact on carbon budget feasibility, and to determine what the next-best alternatives were.

WP5: Identifying the gap between the long-term strategy and the current policy trajectory

TIM scenario outputs were compared against EPA With Existing Measures and With Additional Measures scenarios, by running TIM with those EPA scenarios. Policy discussions were held with the CAP Working Groups on a sector-by-sector basis, to identify gaps and policy blind spots.

WP6: Communication & Outreach

Journal papers, policy briefs, media appearances and social media by the PI, technical briefings, and a public website were used to communicate the research findings.

4 Outputs

TIM open-source model: <https://github.com/MaREI-EPMG/times-ireland-model>

Results of scenarios are posted to: <https://epmg.netlify.app/>

Smith, AZP: TIM methodology for Carbon Budgets. Report to Climate Change Advisory Council, 2023.

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Smith, AZP: Rapid literature review of the setting of national carbon budgets, framed within the Irish context, with recommendations for Ireland's first and second carbon budgets. Climate Change Advisory Council, 2021.

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5 Results of the final phase of the Fellowship

5.1 Interviews report

The report has been completed and submitted to the Council. Of the 36 recommendations made, based on interviews with members of the Council and the Carbon Budget Committee, the most significant ones were:

- 1) The future Committee should migrate towards a composition of technical experts;
- 2) faster iteration was needed between the teams developing the Climate Action Plan and the Committee to ensure that the budgets and the actions reflected each other;
- 3) that government departments should engage in the budget-setting process in a collaborative manner, rather than an adversarial one; and
- 4) Ireland must, with great urgency, increase its institutional capacity to deliver the decarbonisation transition.

The process of setting Carbon Budgets, and all the related discussions, with colleagues, with researchers at other universities, with Council members, with Councillors and senior management teams in several cities, and with policy makers and senior civil servants, has revealed a major vulnerability in Ireland's institutional capacity.

This vulnerability must be treated with the greatest seriousness. It represents a major threat to Ireland's future economy, and to Ireland's ability to deliver the decarbonisation transition in a timely and cost-effective manner. If Ireland does not deliver such a transition, it will cause significant economic harm; furthermore, Ireland's considerable soft power in the world will take damage and will shrink. Ireland's institutions currently fall short of the expert capacity required, at all levels, to deliver the transition. This includes Deputies in the Dáil, the Civil Service, authorities such as Teagasc, local Councillors, senior management teams in local authorities, media, and universities.

To illustrate how this vulnerability has arisen: the UK's Climate Change Committee has a Secretariat of around 45 people, approximately an order of magnitude larger than Ireland's. But the necessary size of such an organisation does not linearly scale with population at all: the analysis of the technical challenges of decarbonising a country of 67 million people is not hugely different to that for a country of 5 million;

and so we should reasonably expect that their Secretariats are of roughly similar size, budget and expertise.

To remedy this, two key measures must be taken, with some fair speed.

- a. briefing materials & training should be commissioned, to be disseminated to all key actors in the organisations mentioned above, that explain in direct and accessible terms what decarbonising the entire country means, and how we might do it.
- b. secure long-term funding should be put in place to build capacity for the decarbonisation transition across the entire public sector, to ensure that Ireland can call on sufficient expertise in sufficient quantities. This means recruiting and retaining an entire cohort of experts. This report recommends following a mission-oriented approach, to ensure that adequate structures are put in place, with proportionate budgets.

5.2 TIM report

The TIMES-Ireland Model is being developed at UCC to inform future possible decarbonisation pathways for the Irish energy system. We give it information on the Irish energy system as it is today, a set of constraints, including on emissions, and the best available projections for what the future technology and fuel options are.

It then finds the lowest-cost pathway to re-architect and restructure Ireland's entire energy system, for electricity, transport, industry, residential and commercial, and novel fuels like hydrogen and bioenergy, to reduce emissions to meet the target. It accounts for all the linkages in the system; rather than transform it one piece at a time, it transforms the entire system, accounting for all the sector couplings and trade-offs, even between distant parts of the system.

Rather than offering a single prescriptive plan, the model helps structure our discussions of the trade-offs and uncertainties; and helps us develop meaningful, consistent narratives of energy transformation, while considering a huge range of possible futures.

TIM has been expanded to meet the growing requirements of policymakers, and we continue to work with the international TIMES community on developing and propagating best practice for cost-optimising energy-systems models. TIM continues to receive strong support from Council and Committee members, and the TIM team is actively engaged with the Committee's ongoing work.

5.3 Gap analysis

Gap analysis of TIM has concluded. The conclusions and recommendations have been incorporated into the TIM report. Work on filling the gaps identified in heat-network modelling is ongoing; data is now being sought to fill the gaps in modelling baseline energy demand and mitigation options in the industrial sector. Work is ongoing to determine whether TIM should attempt to model consumer behaviour, or whether this should be done in a separate model, with a reconciliation process between the consumer model outputs, and TIM outputs.

5.4 Secure future funding

Future funding has been secured for the TIM team for modelling services to the Climate Council, to DECC & the DoT, and to the SEAI. Unfortunately, funding was not secured in time, and, as we have warned for the last two years, the delays in funding have led to several members of the TIM team leaving. While we take it as a great tribute to our team that our colleagues go on to take roles in prestigious organisation such as Columbia University in New York, it does mean that Ireland is bleeding away the talent that it desperately needs to provide the expert capacity to support the decarbonisation transition.

5.5 Media work

The Fellow has given interviews to Midlands 103 local radio in Ireland, and to Deutsche Welle, where there is one long-form article forthcoming on modelling and policy, and one passing mention in “IEA chief slams climate 'contradictions' from oil companies”, by Ajit Niranjana (11 April 2023), <https://www.dw.com/en/iea-fatih-birol-new-oil-gas/a-65200519>

5.6 Government briefings

Briefings have been provided to the Climate Action Plan Working Groups, to the Department of Transport, and to the Chair of the Oireachtas Committee on Environment and Climate Action