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Informing Ireland's carbon budgets with the TIMES-Ireland energy systems model

2021 EU Conference on Modelling for policy support

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University College Cork
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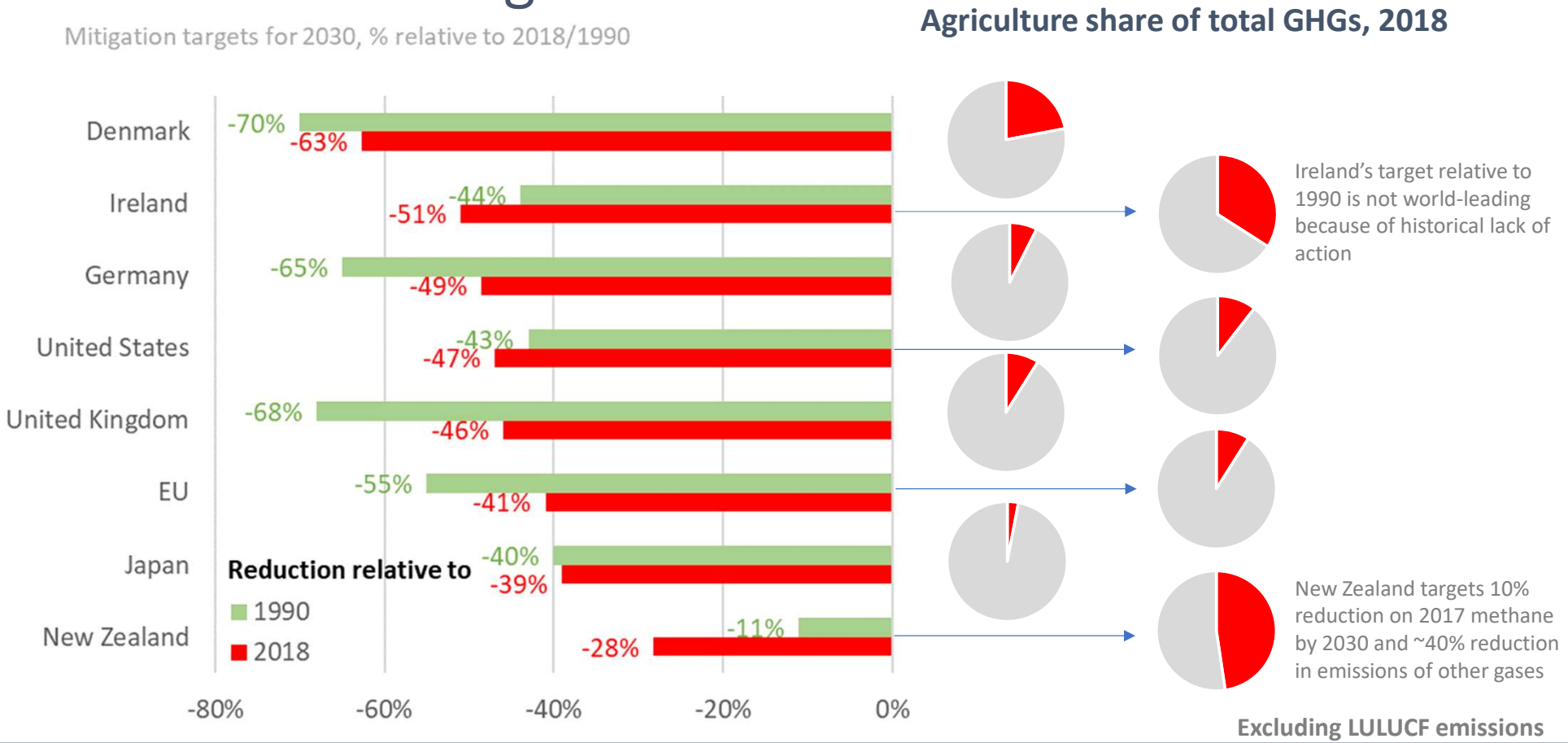
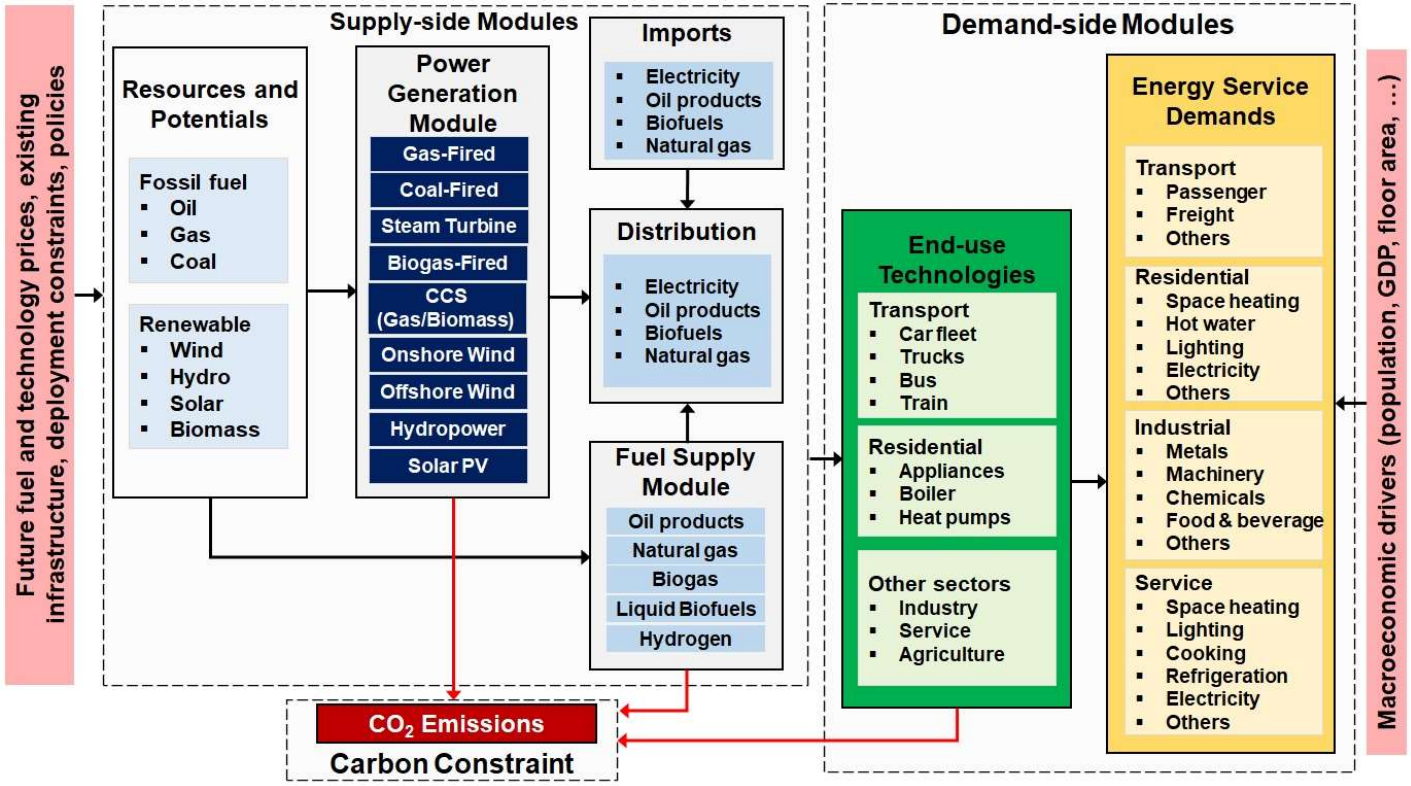
Ireland has one of the most ambitious 2030 decarbonisation targets in the world



Ireland's high share of emissions from agriculture make achieving this target even more challenging

TIMES-Ireland Model (TIM)

TIM is an Energy Systems Optimisation Model (ESOM) which calculates the "least-cost" configuration of the energy system which meets future energy demands, respecting technical, environmental, social & policy constraints defined by the user.



Given

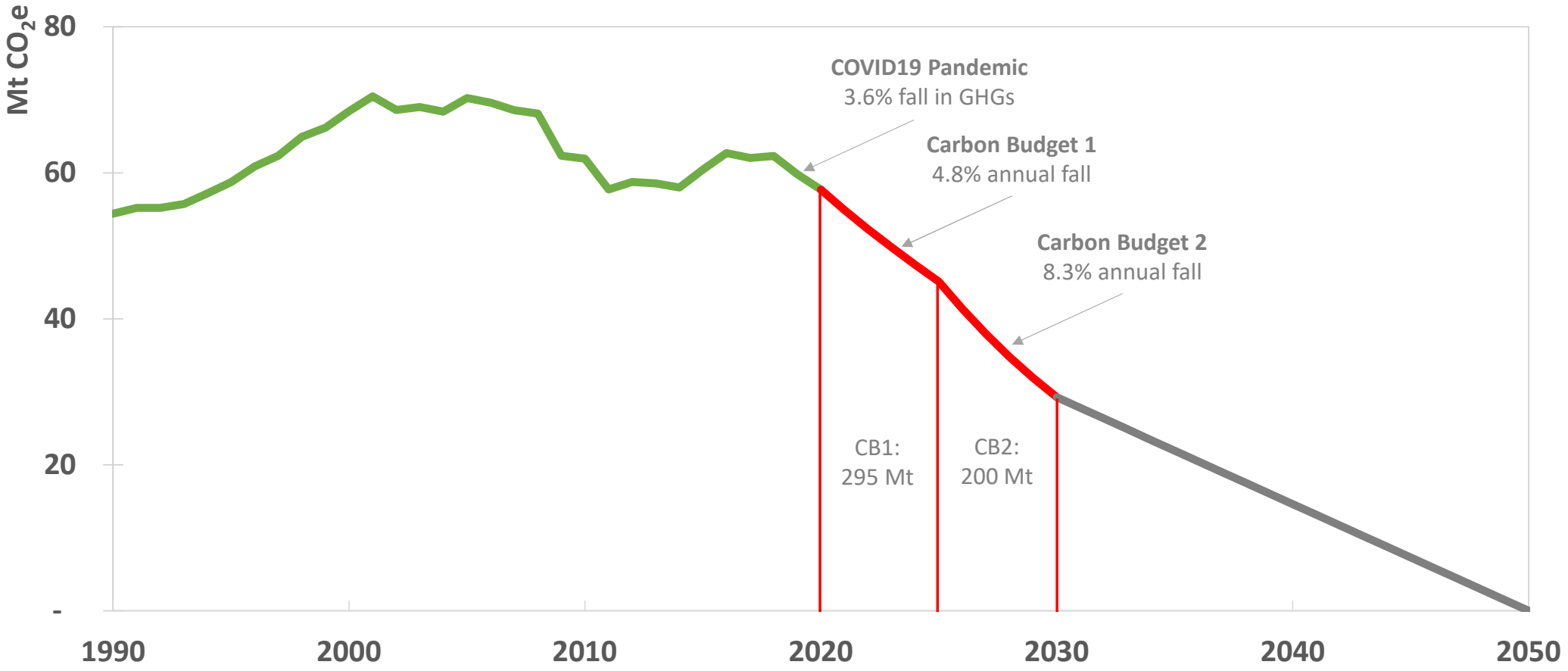
- Final energy demands
  - e.g., passenger kms, home heating
- CO_2 constraints on energy
  - e.g., carbon budget, annual target
- Technology, fuel costs & efficiency
  - Existing & future cost and performance
- Resource availability
  - e.g., on/offshore wind, bioenergy
- User-defined constraints
  - e.g., speed of technology uptake, policies

TIM calculates

- "Least-cost" energy system meeting all constraints
- Investment and operation of energy technologies
- Emissions trajectories
- Total system cost
- Imports/exports
- Marginal energy prices

Download full documentation paper: https://tim-carbon-budgets-2021.netlify.app/documentation/tim-documentation-paper.pdf

Analysis with TIM supported the Climate Change Advisory Council's consideration of the implications of carbon budgets



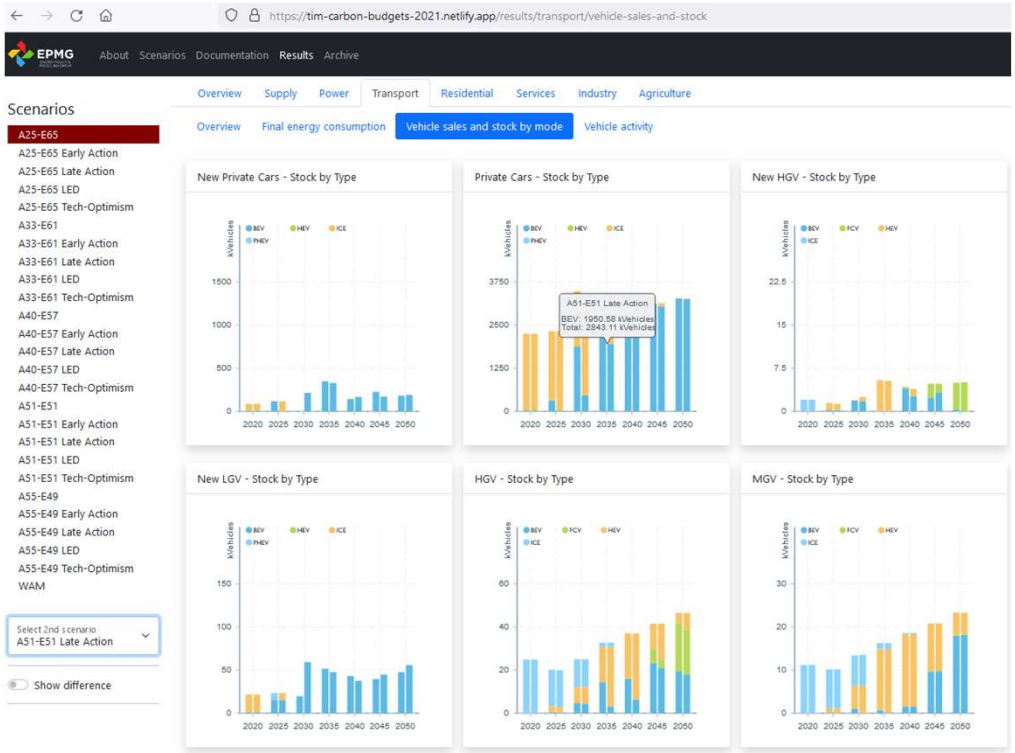
Marginal Abatement Cost (2025-30 average) in core mitigation scenarios and scenario variants

		A-51%,E-51%	A-40%,E-57%	A-33%,E-61%	A-25%,E-65%
Core	"BAU" demands, no bioenergy imports, 4-times 2018 indigenous bioenergy, no power-CCS available, no H2 import, 18 GW VAR-RE	€674	€1,100	€1,292	€1,485
Low Energy Demand (LED)	Decoupling energy service demands: mobility shifting; dematerialisation; lower heating	€128	€403	€545	€757
Tech-optimism	Up to 25GW VAR-RE by 2030, H2 import Bioenergy import x3 times 2018 by 2030, 400 MW CCS available from 2027, +20%yoy	€436	€639	€812	€1,284
LED + Tech-optimism		€76	€125	€202	€317

The Marginal Abatement Cost represents the cost of mitigating the most expensive tonne of CO_2 in each scenario for the energy sector

Web app for rapid results diagnostics, stakeholder engagement & dissemination

https://tim-carbon-budgets-2021.netlify.app/results



Key messages

❖The short time-horizon to 2030 and unprecedented decarbonisation speed requires a faster energy system transition than the natural renewal of many technologies, with wide-ranging implications

❖Unless breakthroughs in new energy technologies develop and evolve rapidly, abatement with new fuels and technologies **alone** will not be enough: Resilient pathways require a structural change in energy demands – Low Energy Demand scenario

❖Scaling up renewable electricity rapidly in all cases is essential, and managing electricity demand

Strengths of TIM & development process

- Model and results archives are **freely available:** https://github.com/MaREI-EPMG/times-ireland-model
- "Best-practice" **development approach** – Git used for version control and integration, open web app for results analysis & diagnostics
- Developers with **international expertise** and links with global TIMES community, allowing knowledge-sharing
- Using **TIMES framework** – well-proven, high quality, continuously developed/maintained, open source code
- Strength of **systems approach** – automatic "sector coupling" by design – where is the best use of resources? What are sectoral trade-offs?
- Extensive **stakeholder review** (https://tim-review1.netlify.app/)
- Training PhDs, interns etc. & wider engagement integral for national **capacity-building**
- A focus on **alternate scenarios**, sensitivities, "what if" analyses
- **Dynamic integration** with national data sources and other national models (where possible)
- **Flexible integration** – Simultaneously maintaining "stable, policy-ready" model and development of research variants, allowing innovations in ESOMs, pushing state-of-the-art – leveraging across projects

TIM development team

- **Dr. Hannah Daly**
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  - Co-PI CAPACITY project, PI/Supervisor of CCAC Carbon Budget Fellowship
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  - PhD researcher with CAPACITY project – residential sector
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  - Climate Change Advisory Council & EPA Fellowship on Carbon Budgets
- **Dr. James Glynn**
  - Former Research Fellow & lead, CHIMERA project
- **Vahid Aryanpur**
  - PhD researcher with CHIMERA project – transport sector
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  - Former postdoc, CHIMERA project, lecturer Dalian University of Technology
- **Ankita Gaur**
  - MaREI PhD researcher – energy demand drivers

With support and input from wider Energy Policy & Modelling Group at UCC & E4sma

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