EPMG
ENERGY POLICY & MODELLING GROUP

EPMG Research Showcasing Event

17th December 2024

Engineers Ireland, Clyde Road, Dublin

MaREI
Energy · Climate · Marine

Environmental Research Institute

UCC
University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

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Welcome

Session 1: Carbon Budgets and Policy Pathways

Session 2: Emissions, Energy Security, Infrastructure

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Funders

CAPACITY
CLIMATE ACTION PATHWAYS & ABSORPTIVE CAPACITY

An Roinn Comhshaoil, Aeráide agus Cumarsáide
Department of the Environment, Climate and Communications

IRENA
International Renewable Energy Agency

SELFS
Sustainable integrated pathways for carbon-negative energy, land and food systems

epa Research

seai
SUSTAINABLE ENERGY AUTHORITY OF IRELAND

Gas Networks Ireland

ESB Energy for generations

ESB NETWORKS

EirGrid

Taighde Éireann Research Ireland

Energy Exemplar

CRU
An Coimisiún um Rialáil Fóntais
Commission for Regulation of Utilities

CLIMATE CHANGE ADVISORY COUNCIL

iea 50

etsap
ENERGY TECHNOLOGY SYSTEMS ANALYSIS PROGRAM

ISEA
Irish Solar Energy Association

irbea
irish bioenergy association

NSF
U.S. National Science Foundation

Friends of the Earth

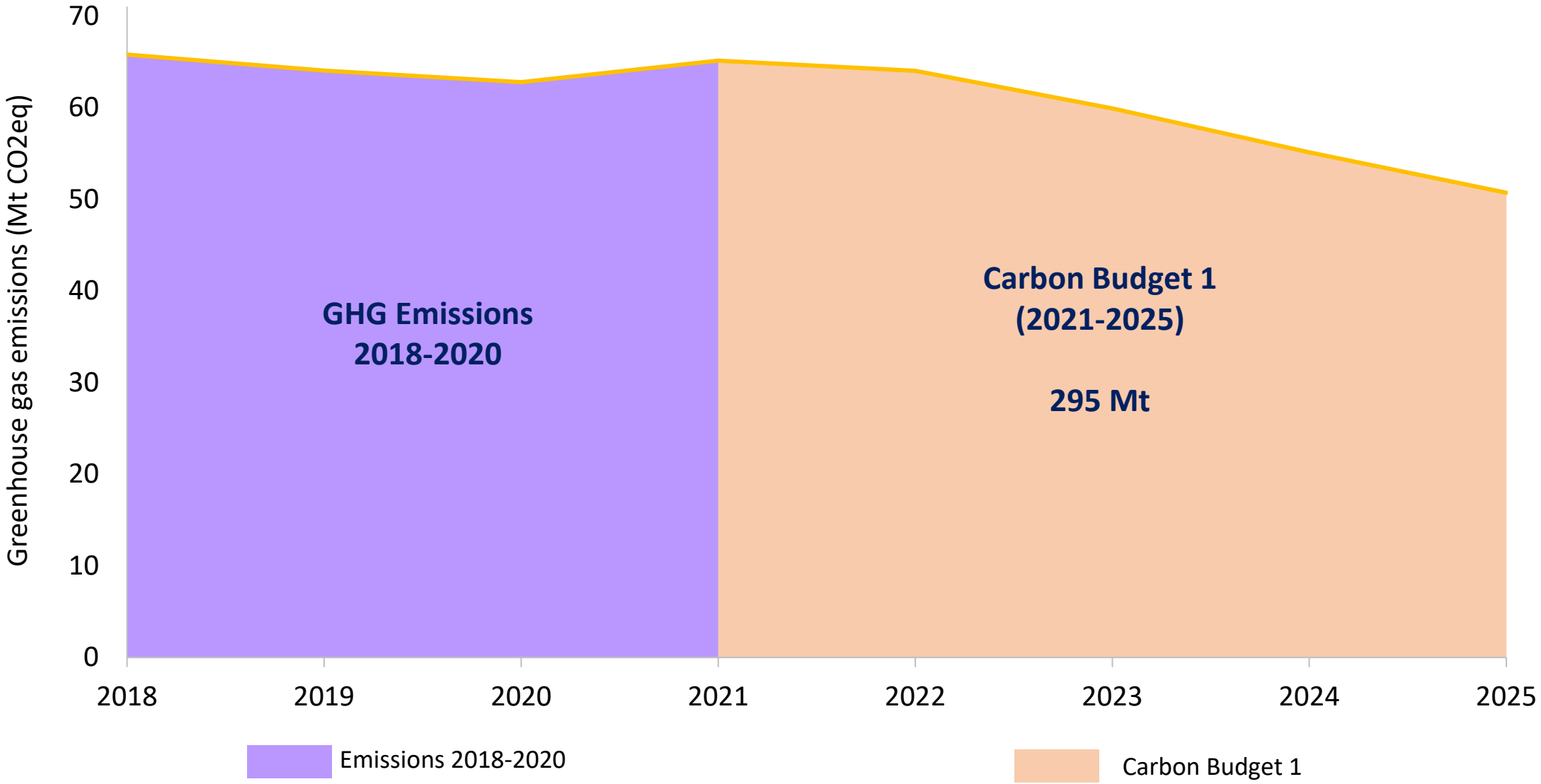
ICCA
IRELAND'S CLIMATE CHANGE ASSESSMENT

国家自然科学基金委员会
National Natural Science Foundation of China

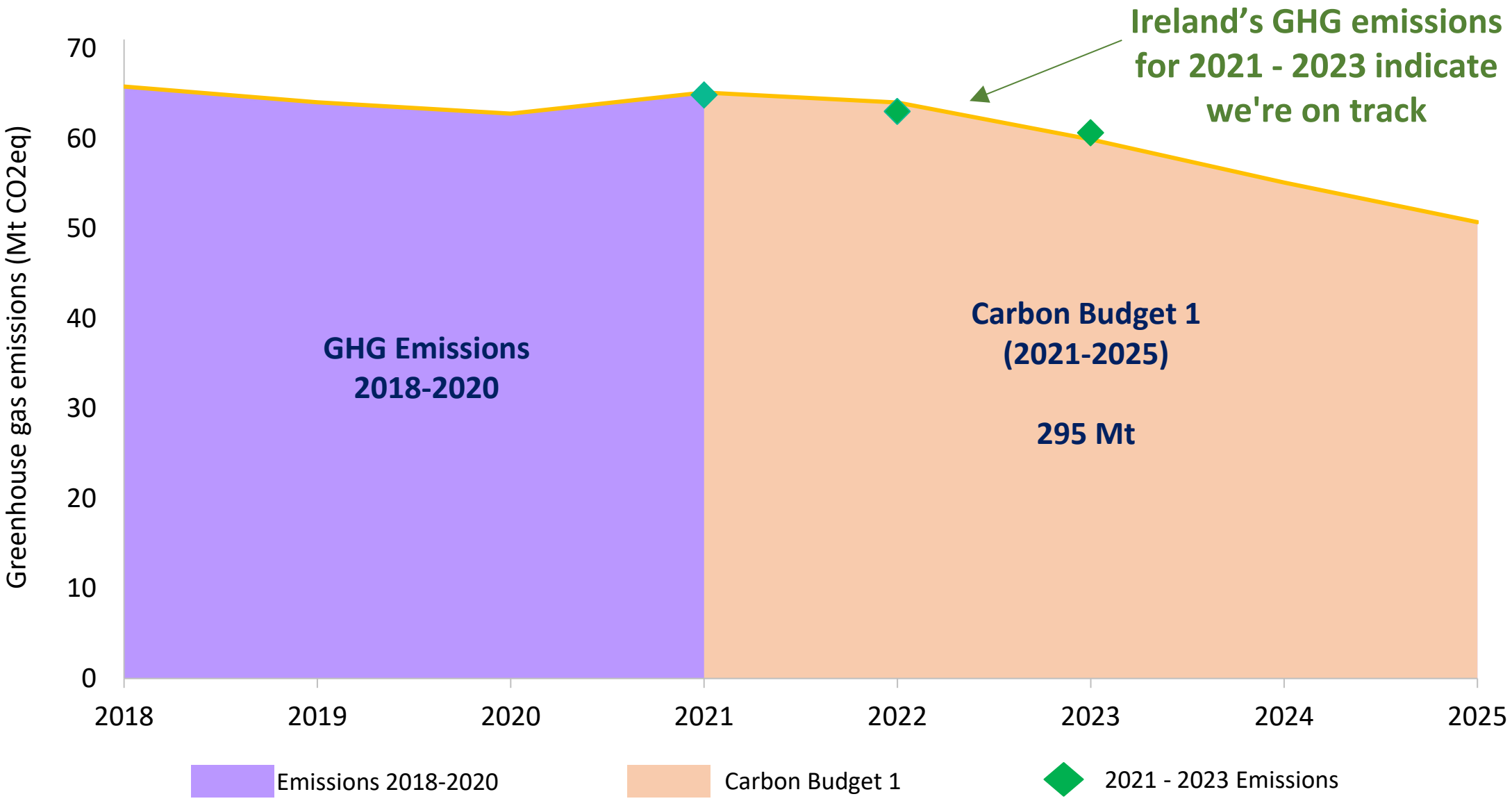
Carbon budget 1: we are on track but are we on target?

Prof. Brian Ó Gallachóir

Indicative Pathway to Meet Ireland's 1st Statutory Carbon Budget



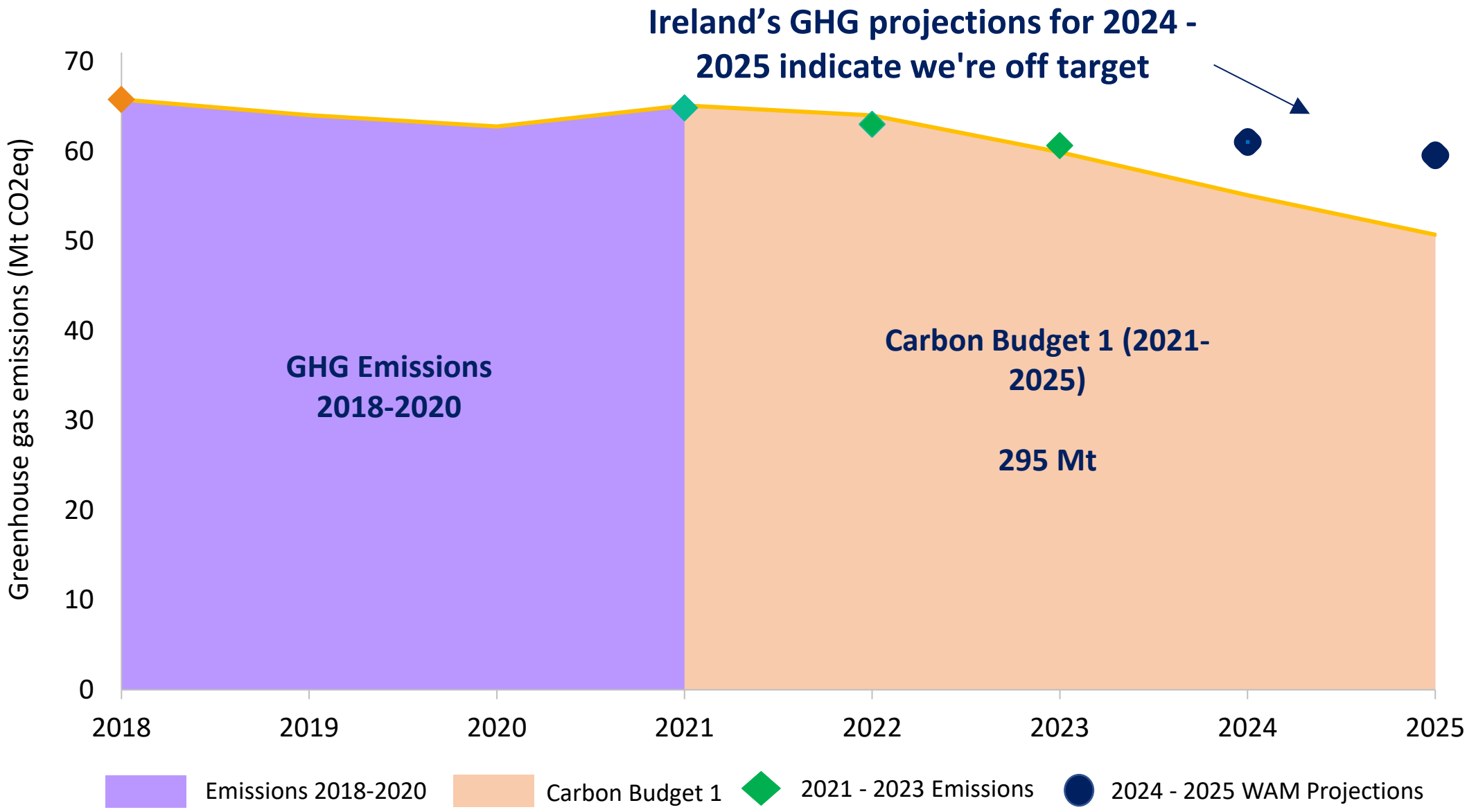
Indicative Pathway to Meet Ireland's 1st Statutory Carbon Budget



Progress to date towards sectoral emissions ceilings

Sectors		Sectoral Emissions Ceiling 2021-2025 Millions of tonnes	Emissions Expended			Share of Emissions Ceiling Expended
			2021	2022	2023	2021-2023
Electricity		**40**	9.9	9.7	7.6	68%
Transport		**54**	11.1	11.8	11.8	64%
Buildings (Residential)		**29**	6.9	5.8	5.3	62%
Buildings (Commercial and Public)		**7**	1.4	1.4	1.4	61%
Industry		**30**	7.1	6.6	6.3	67%
Agriculture		**106**	21.9	21.8	20.8	61%
Other		**9**	1.9	1.9	1.8	63%
LULUCF			4.6	4.0	5.6	
Total including LULUCF		**295**	**64.8**	**63.0**	**60.6**	**64%**

Indicative Pathway to Meet Ireland's 1st Statutory Carbon Budget



Prospects for meeting CB1 and sectoral emissions ceilings

Sectors		Sectoral Emissions Ceiling Millions of tonnes CO_{2eq}	2023 Emissions	Remaining Emissions Allowable		Reduction required relative to 2023
		2021-2025	2023	*2024*	*2025*	2024-2025
Electricity		40	7.6	*6.8*	*6.1*	-10% p.a.
Transport		54	11.8	*10.4*	*9.1*	-12% p.a.
Buildings (Residential)		29	5.3	*5.4*	*5.5*	+1% p.a.
Buildings (Commercial & Public)		7	1.4	*1.4*	*1.3*	-3% p.a.
Industry		30	6.3	*5.4*	*4.7*	-14% p.a.
Agriculture		106	20.8	*20.8*	*20.8*	0% p.a.
Other		9	1.8	*1.7*	*1.6*	-5.5% p.a.
LULUCF			5.6			
Total including LULUCF		**295**	**60.6**	***55.6***	***51.0***	**-8.25% p.a**

Prospects for meeting CB1 and sectoral emissions ceilings

Sectors		Sectoral Emissions Ceiling Millions of tonnes CO_{2eq}	2023 Emissions	2024 H1 Emissions Estimates	Remaining Emissions Allowable		Reduction required relative to 2023
		2021-2025	2023	H1 2024	*2024*	*2025*	2024-2025
Electricity		40	7.6	3.2	*6.8*	*6.1*	-10% p.a.
Transport		54	11.8	5.8	*10.4*	*9.1*	-12% p.a.
Buildings (Residential)		29	5.3	3.9	*5.4*	*5.5*	+1% p.a.
Buildings (Commercial & Public)		7	1.4	0.7	*1.4*	*1.3*	-3% p.a.
Industry		30	6.3	2.8	*5.4*	*4.7*	-14% p.a.
Agriculture		106	20.8	9.8	*20.8*	*20.8*	0% p.a.
Other		9	1.8	1.0	*1.7*	*1.6*	-5.5% p.a.
LULUCF			5.6	?			
Total including LULUCF		**295**	**60.6**	**27.1**	*55.6*	***51.0***	**-8.25% p.a**

Prospects for meeting CB1 and sectoral emissions ceilings

1. We're currently on track to meet CB1 when we compare the last three years of data with a trajectory to meet CB1. Continuing on this trajectory requires an 8.25% average annual reduction in GHG emissions in 2024 and 2025. EPA GHG emissions projections indicate we are off target by **15 Mt**
2. The CB1 trajectory indicates we should expend at most 64% of CB1 by 2023 (189 Mt). We've expended (188.4 Mt) just lower than this amount in total over the past three years (i.e. in 60% of the CB1 time-frame);
3. Residential emissions in 2023 (5.3Mt) were lower than the annual emissions required in 2024 and 2025 (5.5 Mt p.a.) to meet residential sectoral emissions ceiling, but grew in H1 2024 to 3.9 Mt
4. Agricultural emissions have expended the lowest share of their emissions ceiling compared with all other sectors (60.9%). If Ag emissions are maintained at 2023 levels in 2024 and 2025, Ag will meet its SEC
5. Non-residential buildings also well on track to meet SEC. A 3% p.a. reduction over 2024-2025 is required to keep within SEC.
6. Electricity is poorest performing sector to date, expending 68% of its emissions ceiling. It requires a 10% reduction per annum to remain within SEC, but did achieve a 22% reduction in 2023 and is on track for 2024.
7. The transport sector is recognized for its system inertia. It is doing well to date (i.e. expended 64% of its SEC - aligned with overall CB1 trajectory in graph). However, going forward it needs a 12% reduction per annum over next 2 years. This compares with EPA projections that suggest a 2% reduction p.a. under the WAM scenario.
8. Industry also very challenging. Expended 67% of its SEC and needs a 14% p.a. reduction in 2024-2025 to remain within SEC.

Policy Pathways to Carbon Budget 2 SECs

Dr. Fionn Rogan

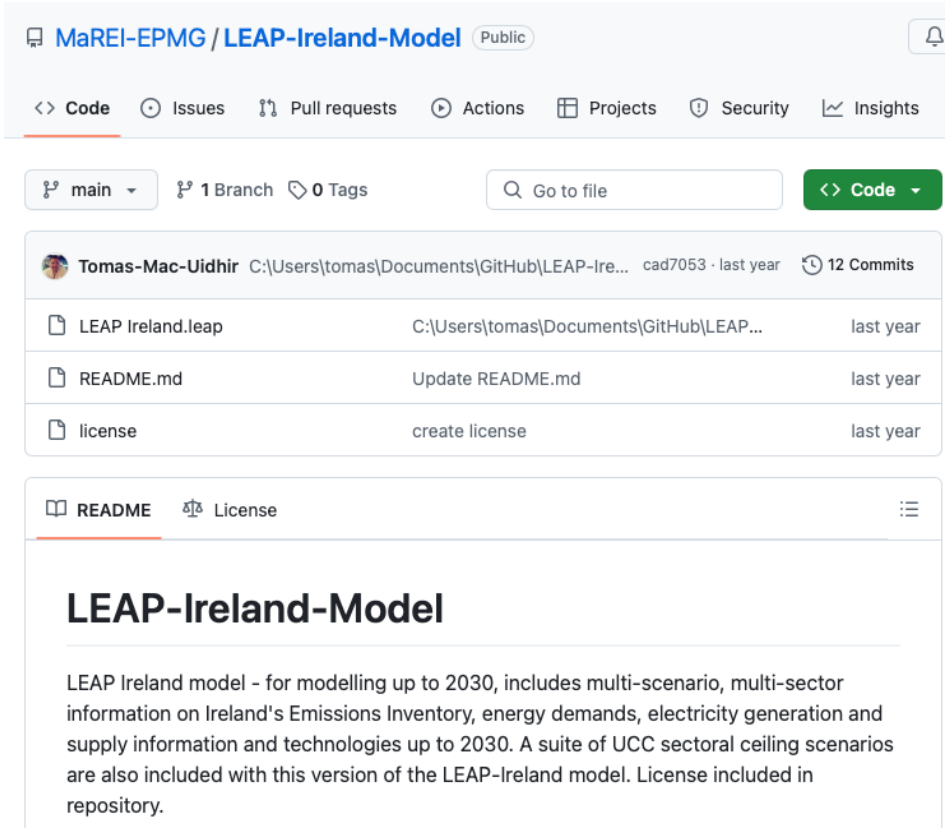
Sector Emission Ceilings

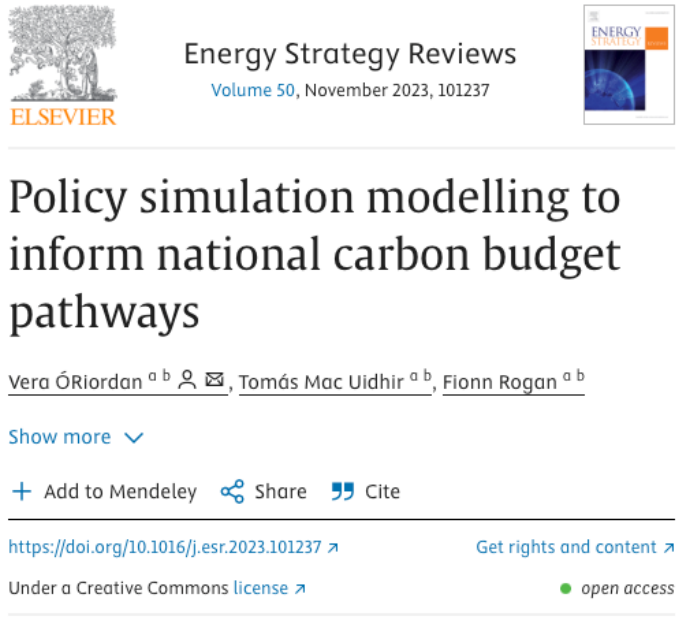
	CB1 (2021-2025)	CB2 (2026-2030)
Electricity	40	20
Transport	54	37
Industry	30	24
Services	7	5
Residential	29	23
Agriculture	106	96
Other	9	8
LULUCF	XXX	XXX
Total	295	200

Current pathways overshoot CB2

	CB1 (overshoot WAM)	CB2 (overshoot WAM)	Unallocated (proportionally distributed)	Total
Electricity				
Transport				
Industry				
Services				
Residential				
Agriculture				
Other				
LULUCF				
Total				

LEAP Ireland Model





Pathways for the Transport Sector: Avoid, Shift & Improve

	Examples (from Climate Action Plan)		
Avoid	Reduce all vehicle KMs by 20% by 2030		
Shift	Additional 125,000 active travel journeys by 2025		
Improve	845K Electric vehicles; Biofuel blending (E10/B20)		

1. *Policy measures to shift transport demand to reduce CO_2 emissions have largest unrealized potential*

Transport – Avoid Policy Measures

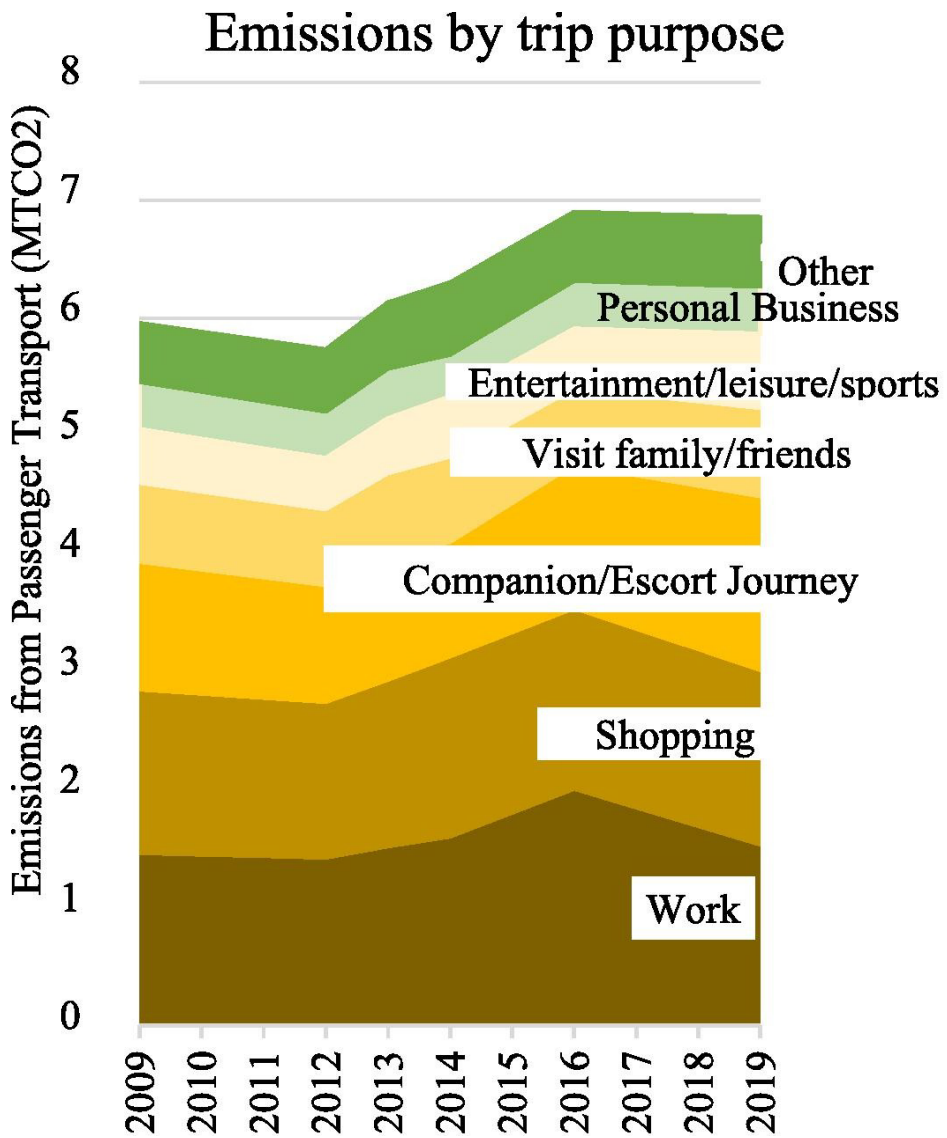
	Policy Measure modelled in LEAP Ireland		
1	20% Reduction of total vehicle kilometres by 2030		
2	20% Reduction of total car kilometres by 2030		
3	20% Reduction of total car commuting km by 2030		
4	Remote working hubs		
5	Working from Home 2 days per week		

2. ***Many 'Avoid' policy measures are based on important but slow changes such as planning & infrastructure***
3. ***There is a need for quick demand reduction, e.g. working from home in 2020***

Transport – Shift Policy Measures

	Policy Measure modelled in LEAP Ireland		
1	125,000 Sustainable Journeys per day		
2	Additional 1000km of walking and cycling infrastructure		
3	Bus Connects - 5 cities (Cork, Limerick, Waterford, Galway, Dublin)		
4	Rural Transport System - Connecting Ireland's rural mobility plan		
5	Additional electric bikes		
6	School Transport Scheme		
7	Additional 300 buses added to the Public Service Fleet		
8	Luas extension - Cork, Limerick, Galway		
9	Park and Ride provisions		
10	DART+ West Program		
11	Bike Share Schemes		
12	Metrolink		

4. ***Shift' policy measures most numerous but have smallest mitigation impact. Combination with improve is vital***
5. ***Important to consider trip purpose, such as escort journeys, which are more car intensive than commuting trips***



Source: (O'Riordan V., Rogan F., Ó Gallachóir B., Mac Uidhir T., Daly H., (2022) *How and why we travel – Mobility demand and emissions from passenger transport,* Transportation Research Part D: Transport and Environment, Volume 104, 2022, 103195, ISSN 1361-9209, https://doi.org/10.1016/j.trd.2022.103195

Transport – Improve Policy Measures

	Policy Measure modelled in LEAP Ireland		
1	Electric Vehicle Uptake (1/3 car fleet)		
2	Biofuel mixing (E10/B20)		
3	95,000 EV commercial vehicles by 2030		
4	Electrification of passenger rail services		
5	Electrification of 1,500 passenger buses		
6	Speed management		

6. ***Biofuel blending can achieve quick savings, but impact diminishes as car fleet electrifies. Risks from supply chain security and impact of Energy Efficiency Directive (EED) need more research***
7. ***Accelerated shift to public transport AND early electrification of public transport is one of the most impactful combinations of policy measures***
8. ***Policy targets, policy pathways and policy mechanism not all present and aligned for all policy measures***

Transport

	SEC (2026-2030)	LEAP Ireland
CO_2 (Mt)	37	35

- LEAP Ireland scenario achieves all policy measures with targets in Climate Action Plan
- Additional policy measures:
  - Working From Home (2/days week)
  - Speed Management (freight & cars)
  - Early & full electrification of passenger rail (by 2030)
- Updated scenario achieves transport SEC for 2026-2030

Residential

	SEC (2026-2030)	LEAP Ireland
CO_2 (Mt)	23	22.2

- Current policy target: retrofit 500,000 dwellings to a B2 standard by 2030
- LEAP Ireland scenario:
  - Prioritise retrofitting for dwellings with low BERs first i.e. G, F, E, D, C
  - Prioritise retrofitting for dwellings with most CO_2 intense fuels first, i.e. Peat, Coal, Heating Oil, Natural Gas, Solid Multi-fuel, Wood.
- Updated scenario achieves residential SEC for 2026-2030

Questions & comments welcome. Research is ongoing to improve accuracy & realism of modelling.

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Carbon budgets after 2030?

EPMG Research Showcase – Engineers Ireland

Prof. Hannah Daly

December 17th 2024

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Environmental
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University College Cork, Ireland
Coláiste na hOllscoile Corcaigh

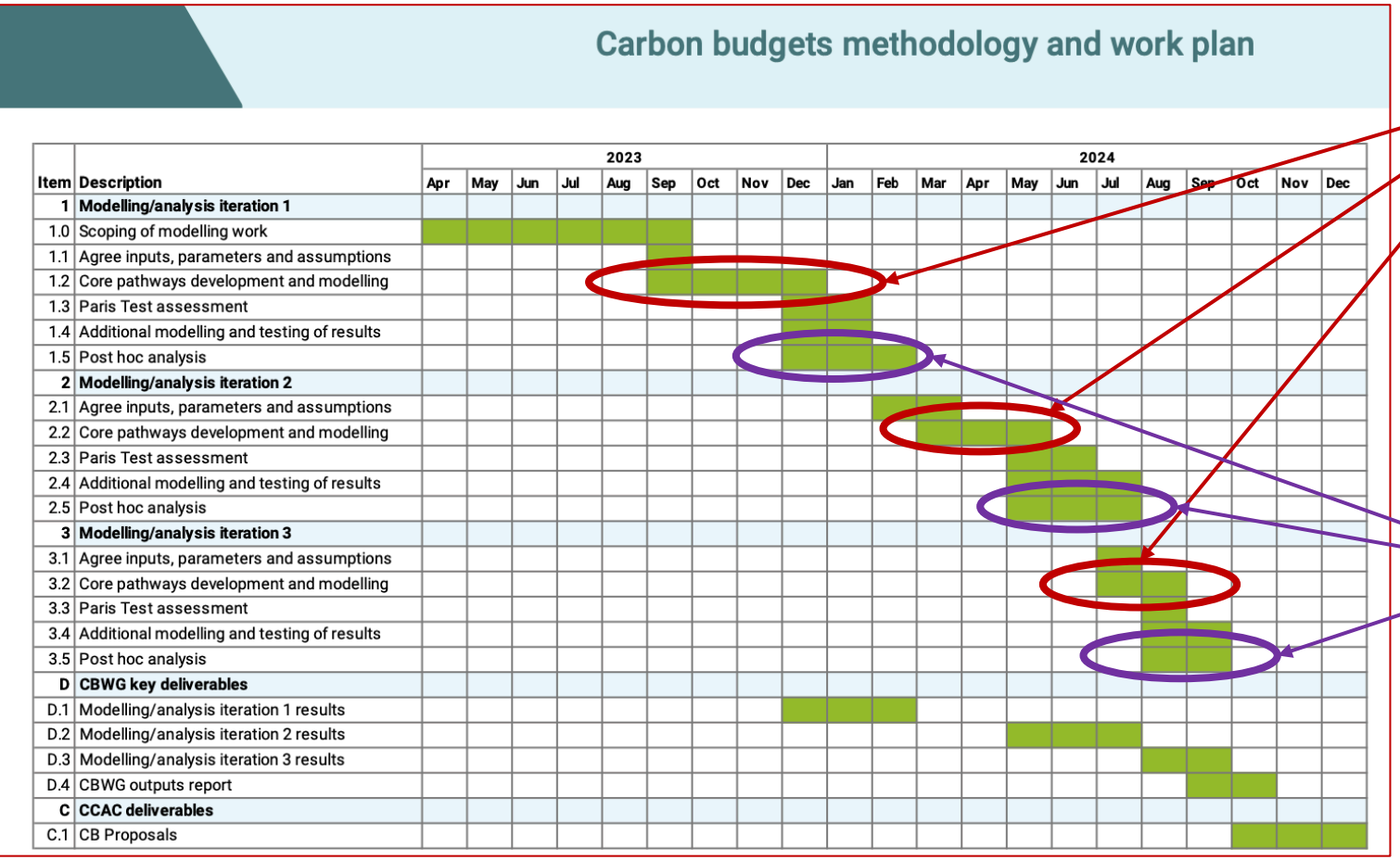
CARBON BUDGETS

Ireland needs to stop using harmful fossil fuels in the next 15 years - climate watchdog

A new proposed carbon budget for the years 2036-2040 would require emissions to be much lower than today's.

1.00am, 12 Dec 2024 ↗9.3k 119 Comments Share

Modelling & engagement process

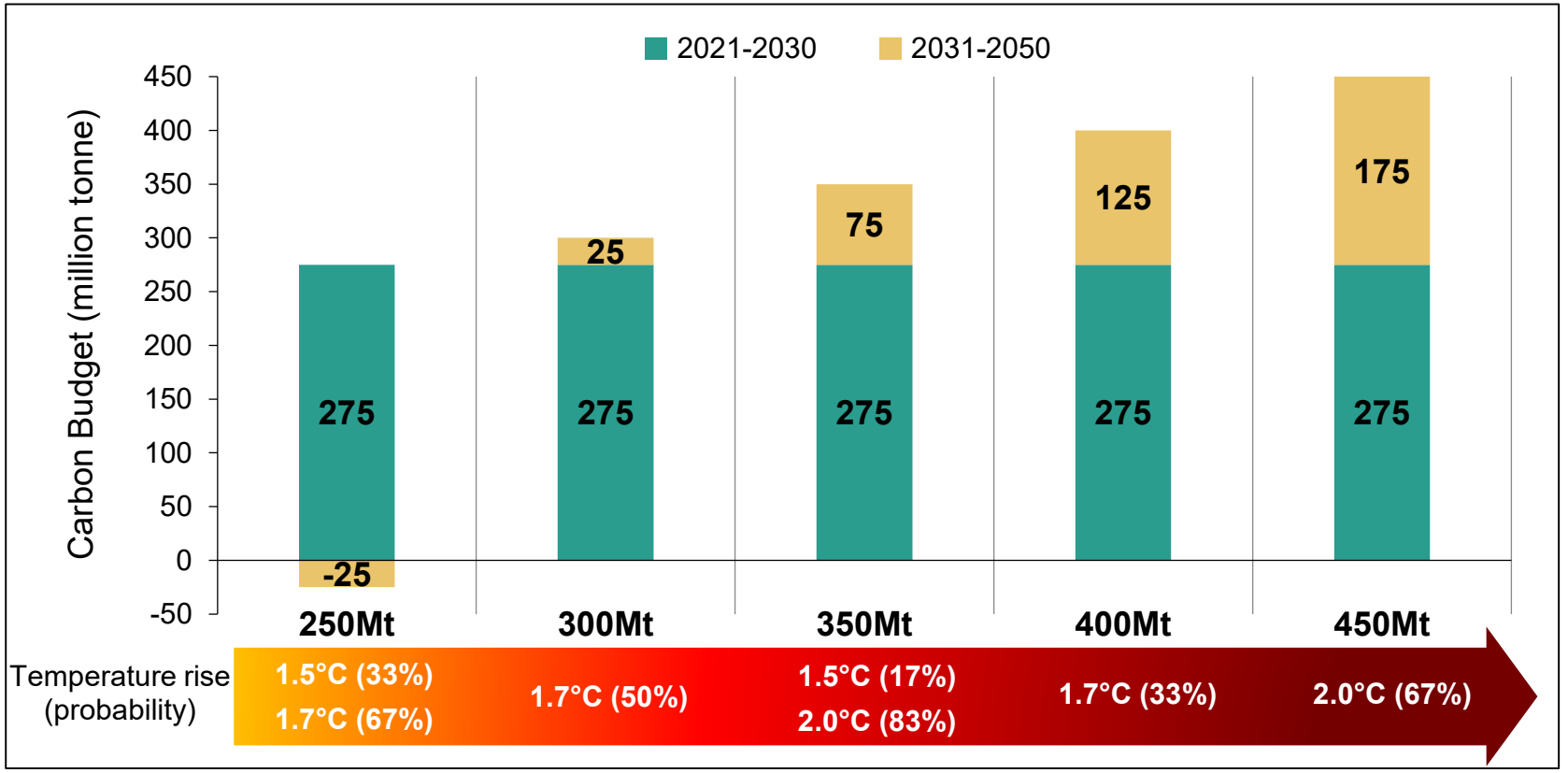


Item	Description	2023 Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2024 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	**Modelling/analysis iteration 1**																					
1.0	Scoping of modelling work																					
1.1	Agree inputs, parameters and assumptions																					
1.2	Core pathways development and modelling																					
1.3	Paris Test assessment																					
1.4	Additional modelling and testing of results																					
1.5	Post hoc analysis																					
2	**Modelling/analysis iteration 2**																					
2.1	Agree inputs, parameters and assumptions																					
2.2	Core pathways development and modelling																					
2.3	Paris Test assessment																					
2.4	Additional modelling and testing of results																					
2.5	Post hoc analysis																					
3	**Modelling/analysis iteration 3**																					
3.1	Agree inputs, parameters and assumptions																					
3.2	Core pathways development and modelling																					
3.3	Paris Test assessment																					
3.4	Additional modelling and testing of results																					
3.5	Post hoc analysis																					
D	**CBWG key deliverables**																					
D.1	Modelling/analysis iteration 1 results																					
D.2	Modelling/analysis iteration 2 results																					
D.3	Modelling/analysis iteration 3 results																					
D.4	CBWG outputs report																					
C	**CCAC deliverables**																					
C.1	CB Proposals																					

3 iterations of modelling scenarios, following consultation & engagement

Additional analysis on implications of carbon budgets for biodiversity, macroeconomic impacts & climate impacts

Core Carbon Budget Scenarios



Remaining/overshoot downscaled Global Carbon Budget >2031

Existing Sectoral Emissions Ceiling for energy, CB1+2

"Fair" allocation of remaining global carbon budget to Irish energy system is highly sensitive to

- Equity principles
- Methane & non-energy mitigation
- Climate sensitivity etc.

This interpretation downscales 2021 GRCB on a per-capita basis

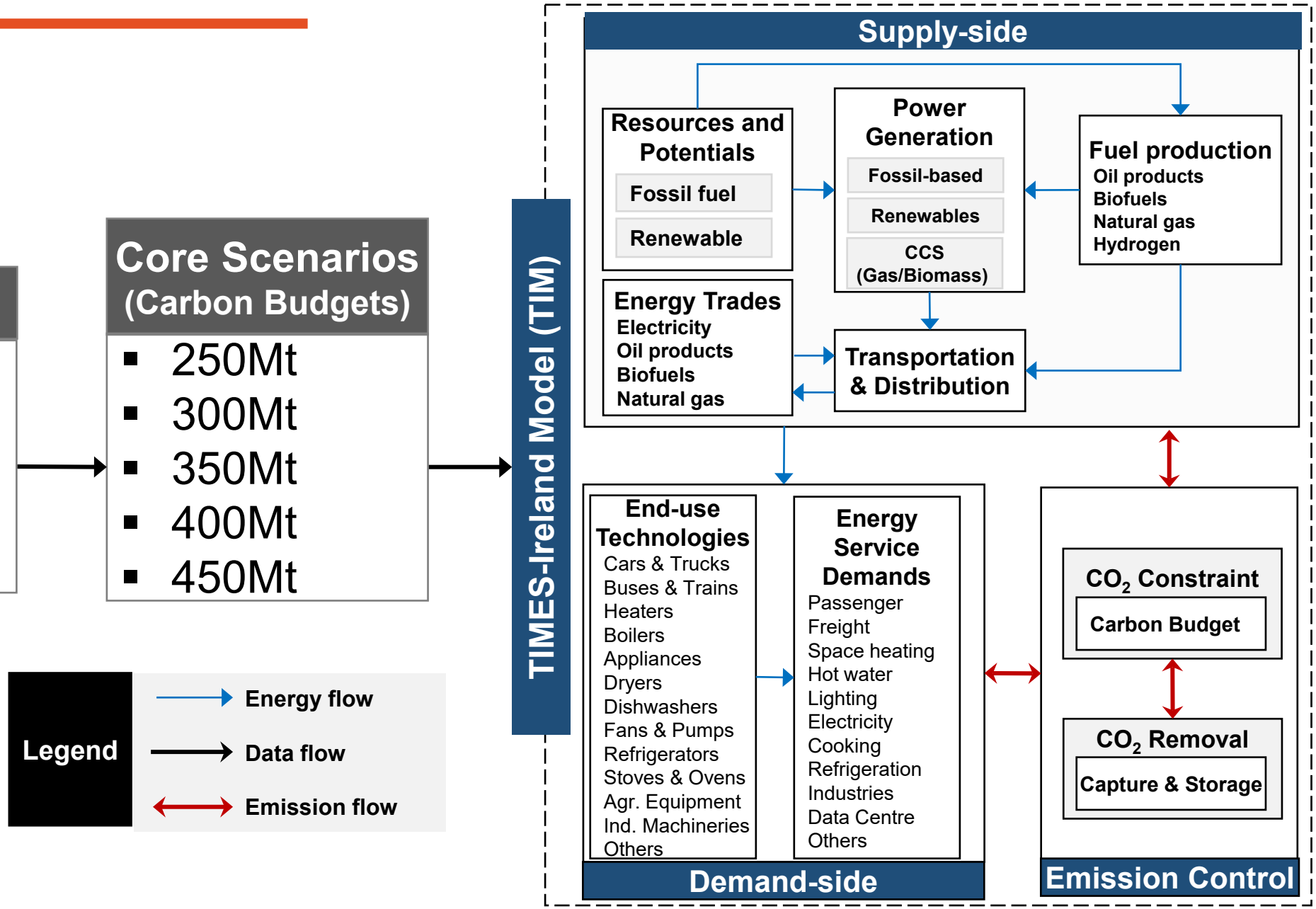
Carbon budget & scenarios

Further analysis

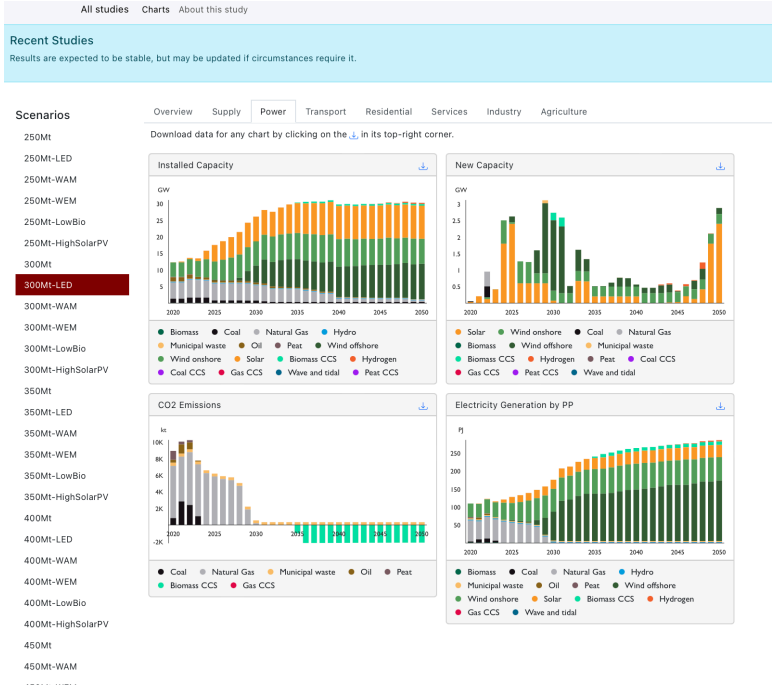
- Low Energy Demand
- WEM & WAM
- Limited Bio-Supply
- High Solar PV

Core Scenarios (Carbon Budgets)

- 250Mt
- 300Mt
- 350Mt
- 400Mt
- 450Mt



Explore the scenario results



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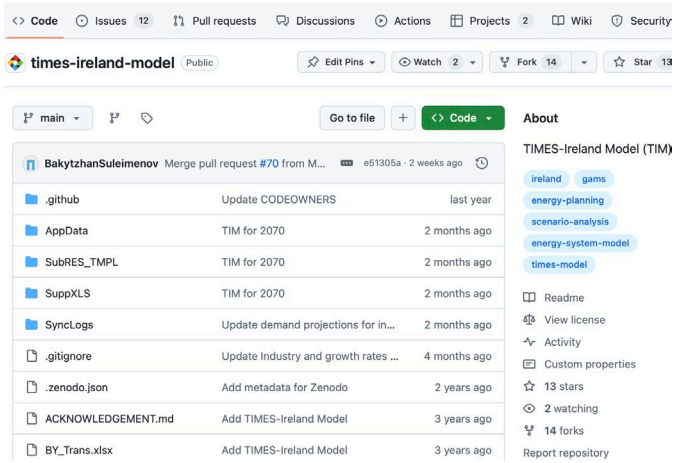
https://epmg.netlify.app/TIM-Carbon-Budget-August_2024/results/

zenodo

https://zenodo.org/records/14337533

Download the model



MaREI-EPMG

https://github.com/MaREI-EPMG/times-ireland-model

Read the findings

PATHWAYS FOR IRELAND'S ENERGY SYSTEM TO 2050

Modelling analysis to support the Climate Change Advisory Council on the Second Carbon Budget Programme

Prof. Hannah Daly, Dr Vahid Aryanpur, Bakytzhan Suleimenov & Dr. Paul Deane

Energy Policy and Modelling Group, University College Cork

September 2024

CLIMATE CHANGE ADVISORY COUNCIL

https://www.climatecouncil.ie/carbonbudgets/carbonbudgetsworkinggroup2023-2024/

https://doi.org/10.1038/s44168-024-00181

Implications of accelerated and delayed climate action for Ireland's energy transition under carbon budgets

Check for updat

Vahid Aryanpur[1,2], Olexandr Balyk[3], James Glynn[4], Ankita Gaur[1,2,5], Jason McGuire[1,2,6] & Hannah Daly[1,2]

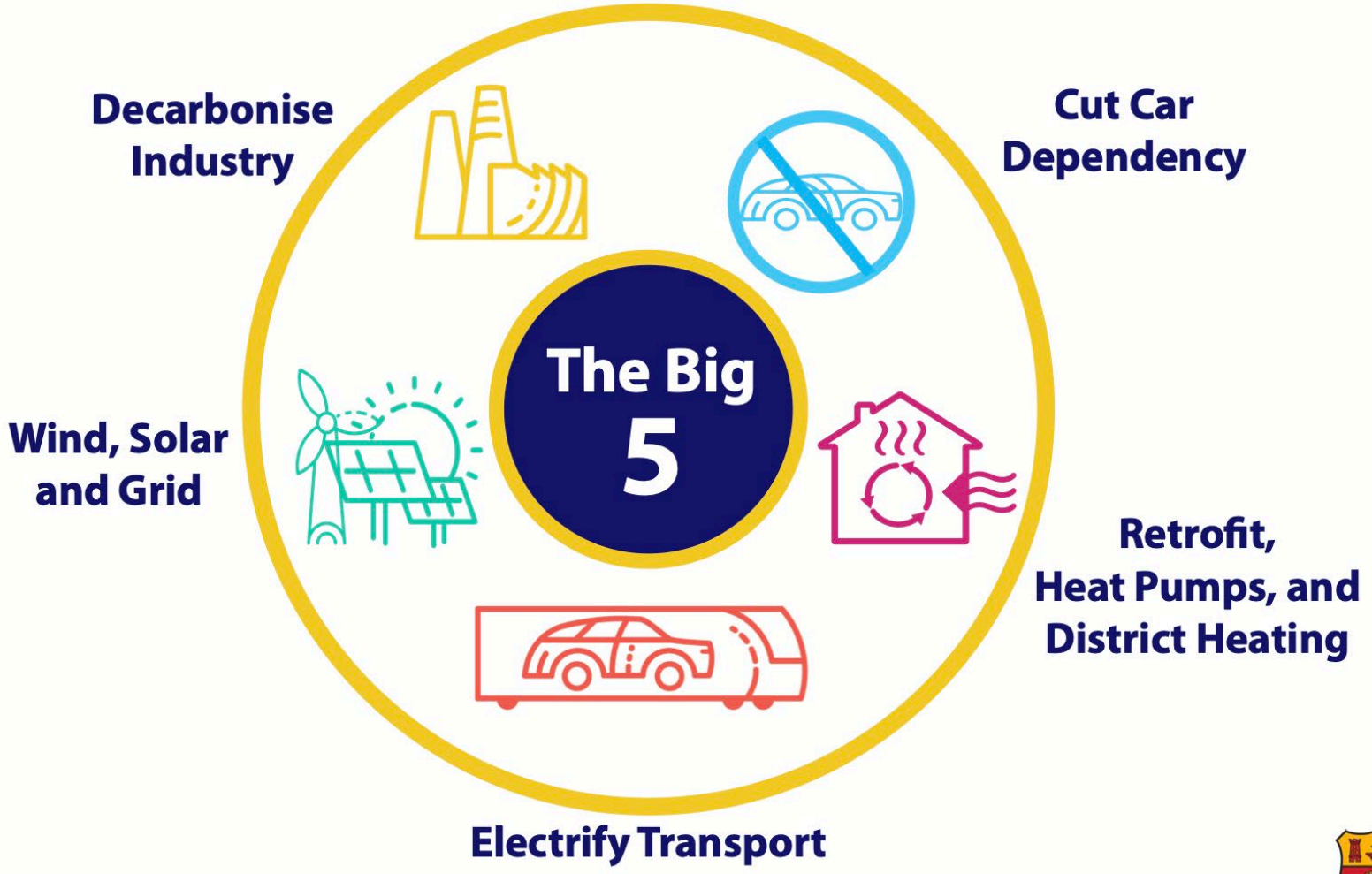
npj | climate action

https://www.nature.com/articles/s44168-024-00181-7

Can we reconcile feasibility & fairness?

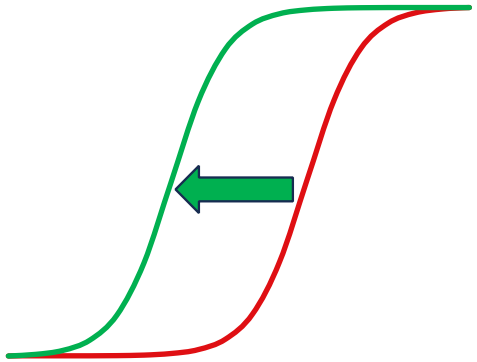
- **The energy transition in a nutshell:**
  - Nearly complete **phase-out of all fossil fuels** required in 2040s in all scenarios.
  - Depending on temperature outcome & early overshoot, some **negative emissions technology** (NETs) required. This brings **significant risks & trade-offs**
  - Moderating final **energy demands** through structural change – is necessary to meet most carbon budget scenarios, especially to deal with overshoot
  - Over-reliance on **bioenergy** creates risks for land use & sustainability. Energy transition mainly requires rapid solar, wind & electrification, and demand reductions.
- **Existing commitments and policies to 2030 already overshoot many CB scenarios by 2030**
  - Committed SECs already overshoot 250Mt CB by 2030
  - WAM & WEM pathways both exceed 300Mt CB by 2030 & require infeasible cuts and/or reliance on CDR post-2030
  - Moreover, SECs are already too high – 16Mt "unallocated savings" yet to be allocated
- **Delayed mitigation** is locking-in carbon and stranded assets, leading to overshoot of early CBs:
  - increases reliance on risky carbon dioxide removal technologies,
  - misses out on opportunities of mitigation
  - leads to higher long-term mitigation costs.
- Ambitious carbon budget scenarios are **less costly** than current WEM and WAM pathways

Five Actions for 90% Energy Emissions Savings to 2030

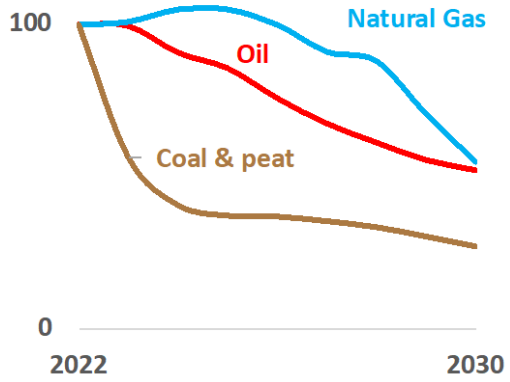


Realising the benefits

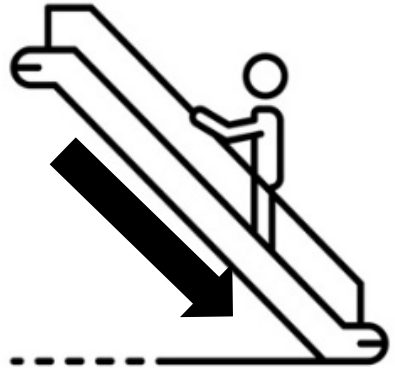
Accelerate clean energy



Cut fossil fuels



Manage energy demand



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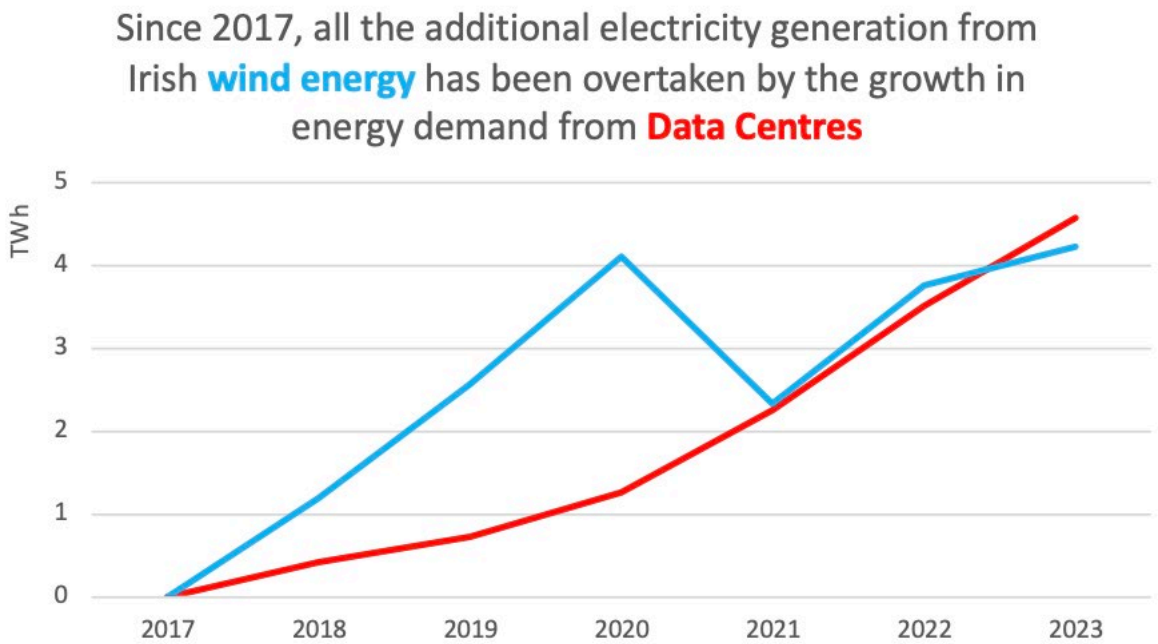
Data centres in the context of Ireland's carbon budgets

Prof. Hannah Daly

December 2024

MaREI Energy · Climate · Marine

Environmental Research Institute



Data Sources:
- Additional data centre demand: CSO Table MEC02
- Growth in wind energy: SEAI Energy Balances, 2023

https://www.friendsoftheearth.ie/assets/files/pdf/data_centrres_and_the_carbon_budgets_-_prof_hannah_daly_dec_2024.pdf

Panel Discussion
Session 1: Carbon Budgets and Policy Pathways

Chair: Oisín Coghlan (Friends of the Earth)

Panel Members

- Prof John Fitzgerald
- Prof. Brian Ó Gallachóir
- Dr. Fionn Rogan
- Prof Hannah Daly

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Short Break (15 mins)

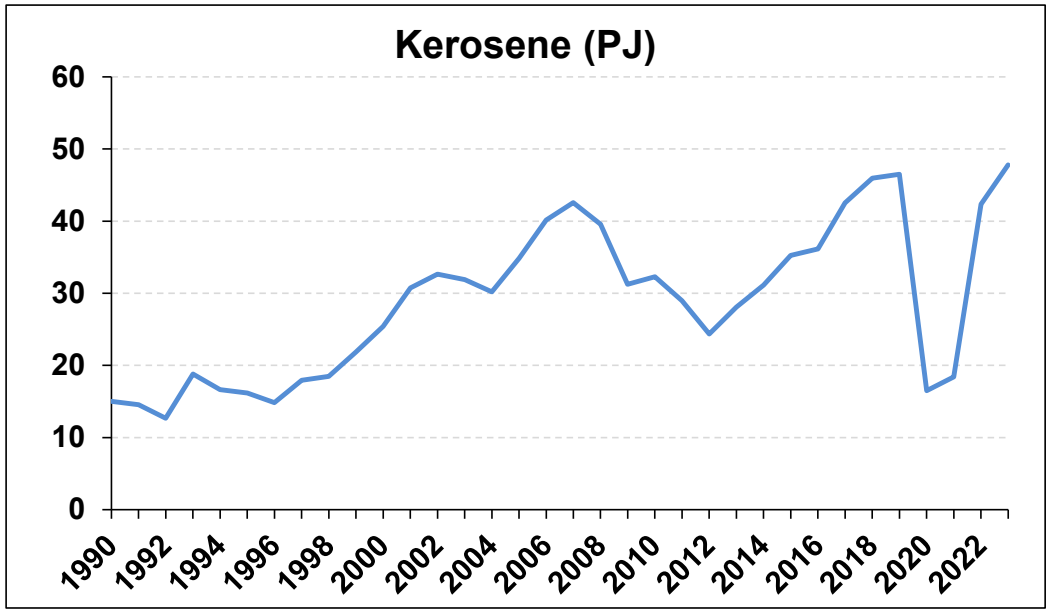
Are emissions from aviation a blind spot in Ireland's climate goals?

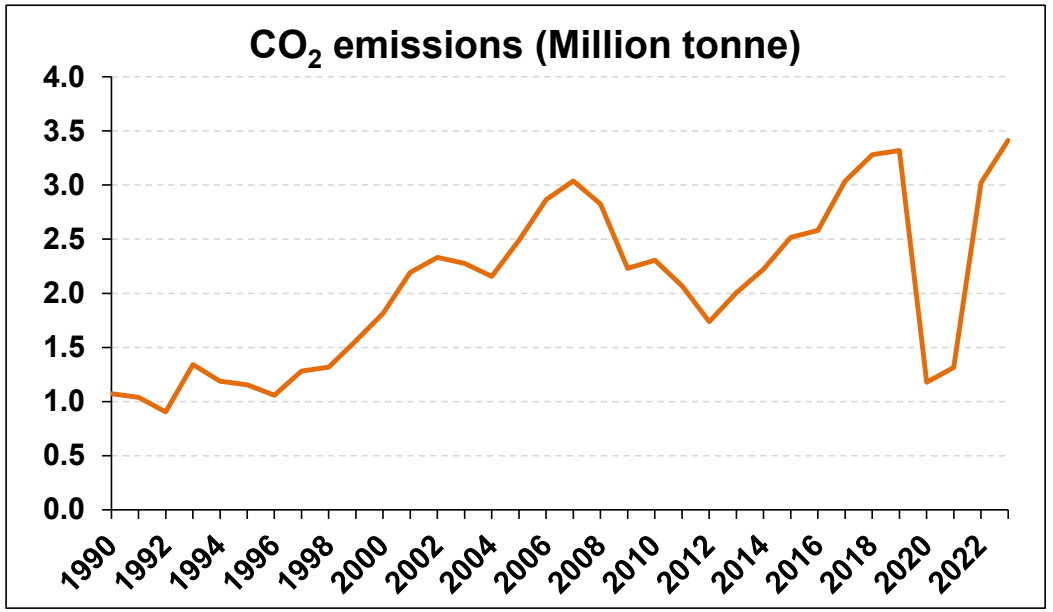
Dr Vahid Aryanpur

Internation Aviation in Ireland

❑ Fuel and emissions per year

- 15-48 PJ of jet kerosene, ~20% of total oil imports.
- 1-3 Mt of CO_2 (~10% of total energy-related CO_2 emissions)
- Significant reductions: Financial crisis, COVID-19 pandemic restrictions

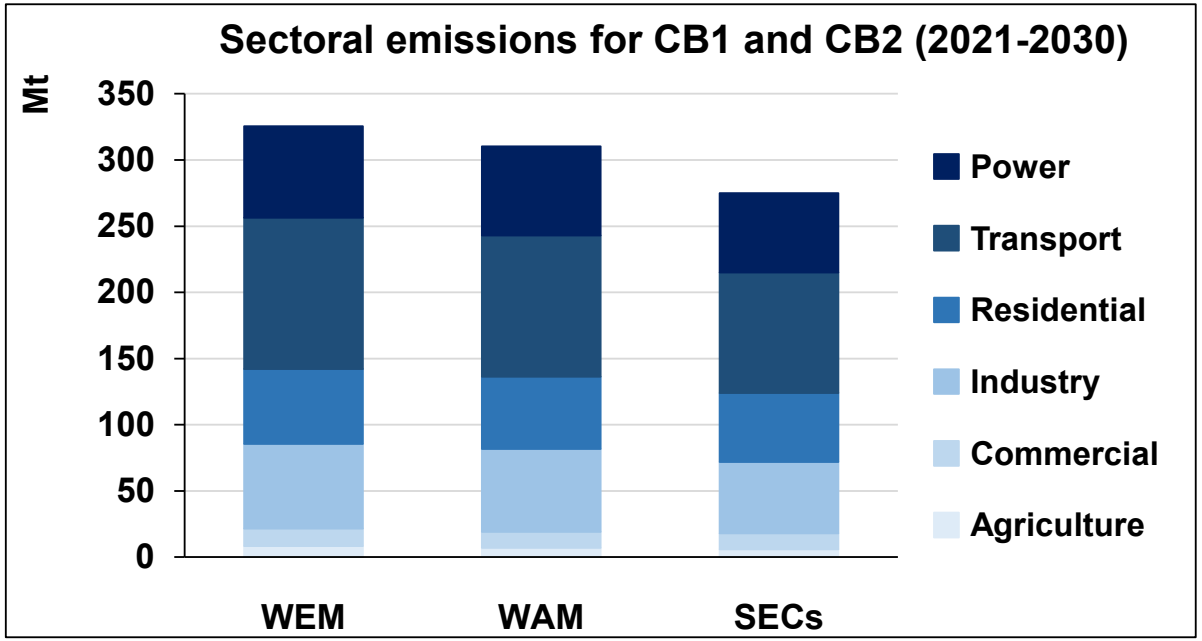




Source: SEAI's national energy balances

Carbon Budgets & Aviation

- Global warming is driven by cumulative GHG emissions
- In Ireland, legally binding carbon budgets:
  - Sectoral Emission Ceilings (SECs)
  - With Existing Measures
  - With Additional Measures
- The aviation sector has been excluded
- Climate Action Plan 2024 aligns with ReFuelEU regulations



This study explores:

How and to what extent aviation emissions could deplete the Ireland's carbon budget?

Air Travel Categories

CSO Data (2013-2023)

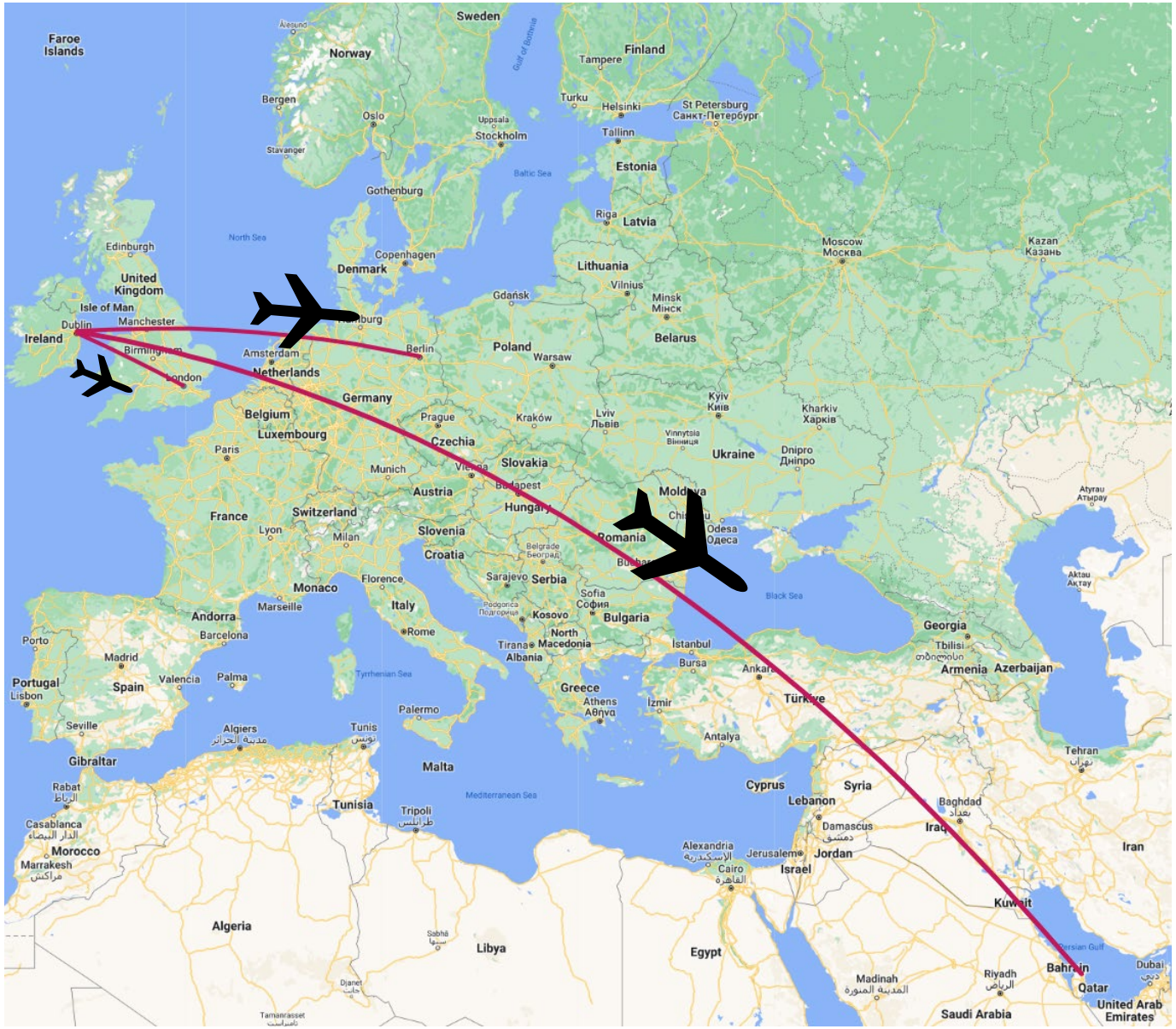
- Number of flights
- Number of passengers
- Departure flights (Destinations)

Average distance

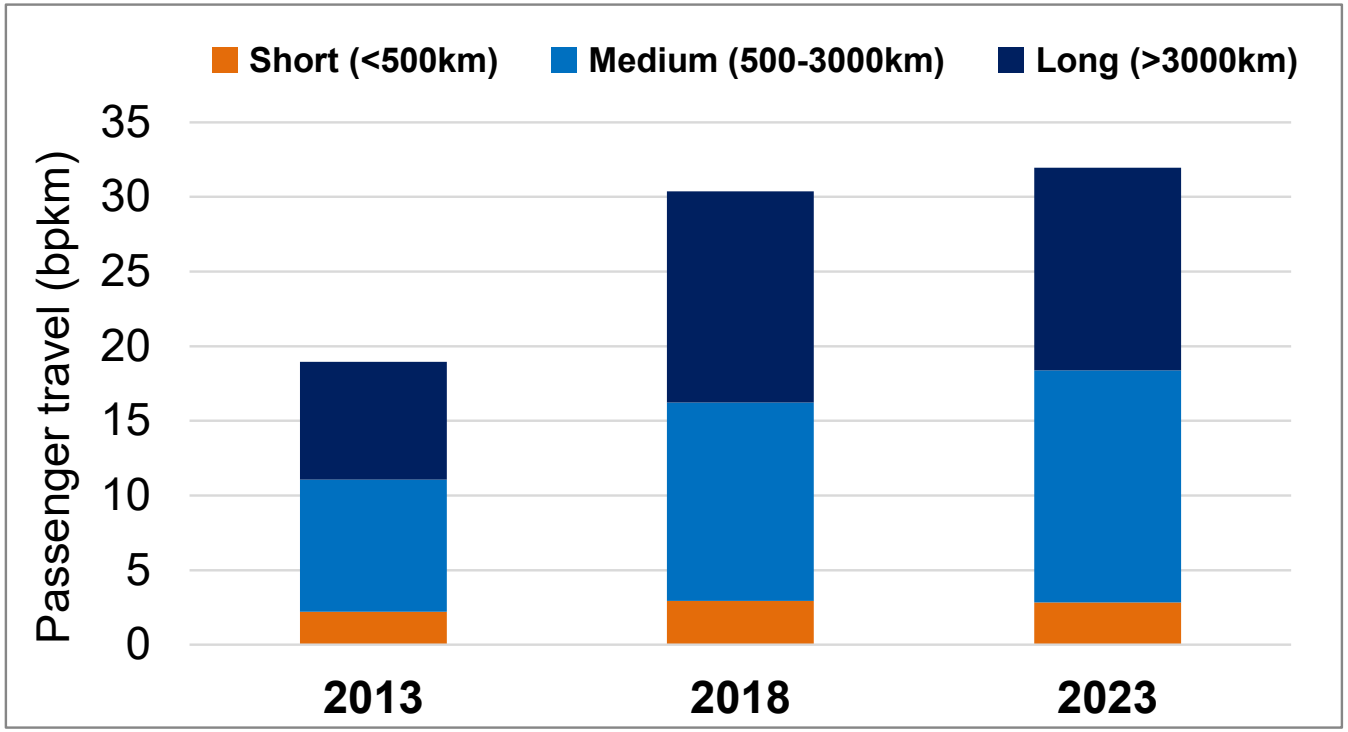
1. Short or Regional (<500km)
2. Medium or Intracontinental (500-3000km)
3. Long or Intercontinental (>3000km)

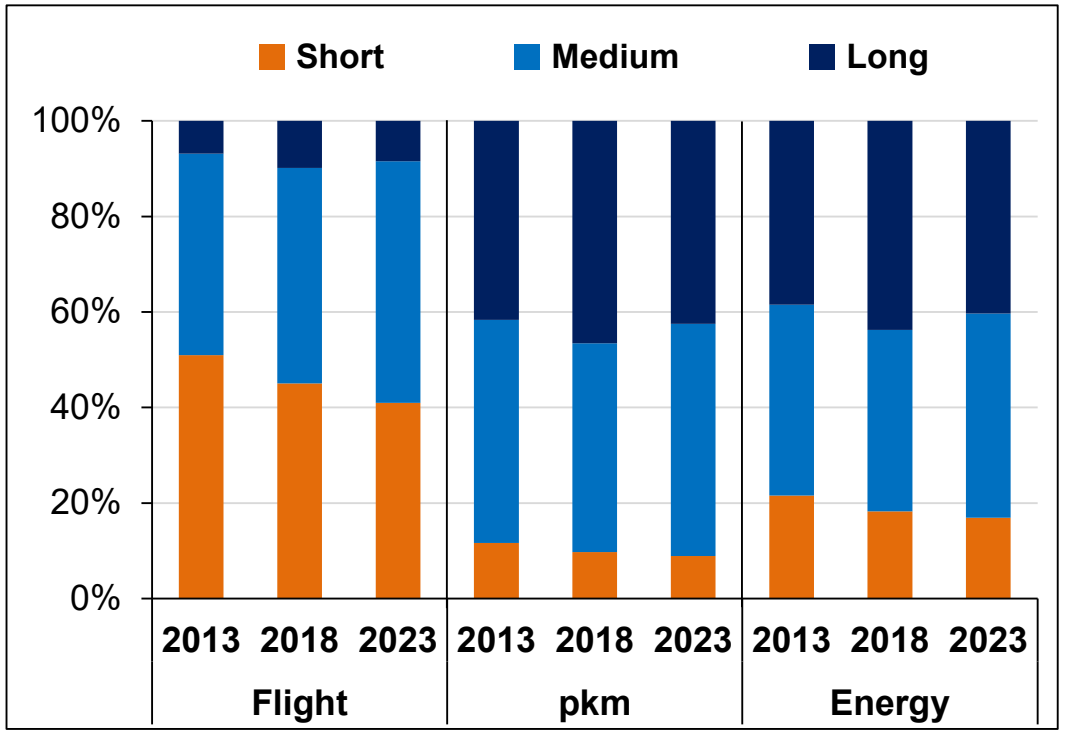
Weighted average travel distance

1. Short: 450km
2. Medium: 1450km
3. Long: 5250km



Flight Trends: Demand, Distance & Energy



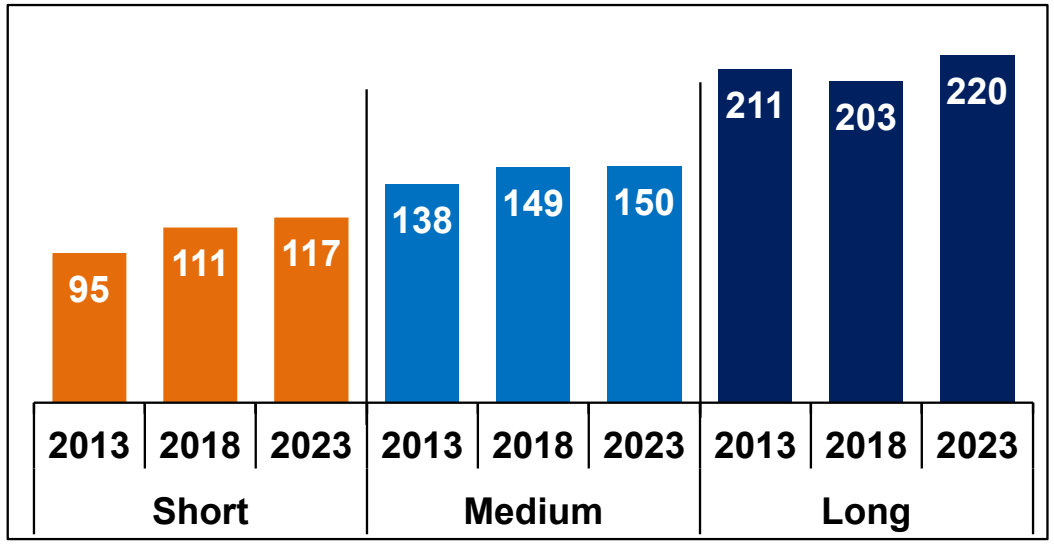


- Demand: 68% ↑, from 19 to 32 bpkm.
- Short, medium, and long-range flights increased by 29%, 75%, and 72%, respectively.

- Short flights has declined (from 51% to 41% of total number of flights)
- On average, short flights made up 45% of flights but accounted for only 10% of pkm and 20% of aviation energy use.

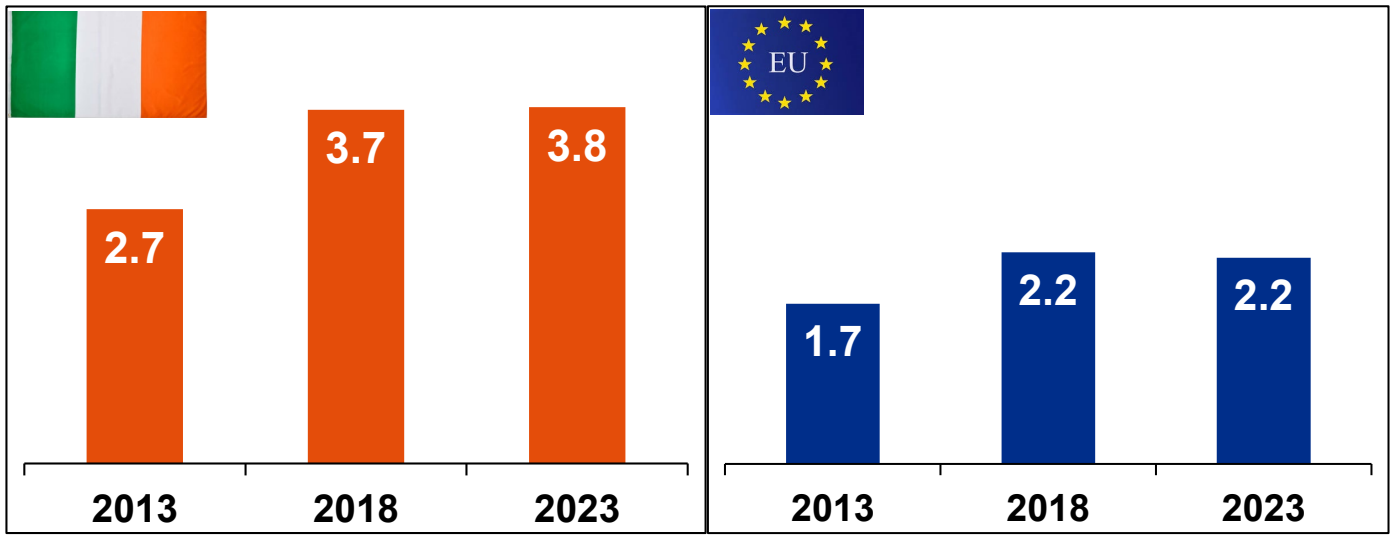
Average Passengers & Trips

Passenger per flight in Ireland



- The number of passengers per flight has increased across all travel ranges by 4-24% (more occupied seats)

Average trips per capita in Ireland & the EU



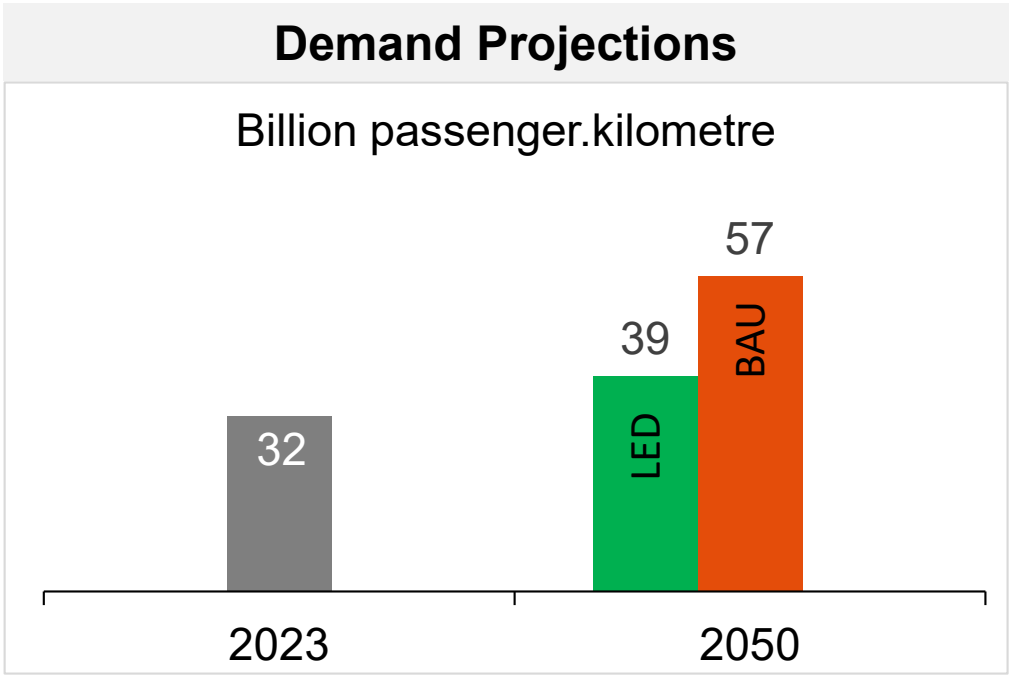
- Air travel trips per capita is higher than the EU (~double)
- Gap over the EU grew from 1.0 to 1.6 trips per capita

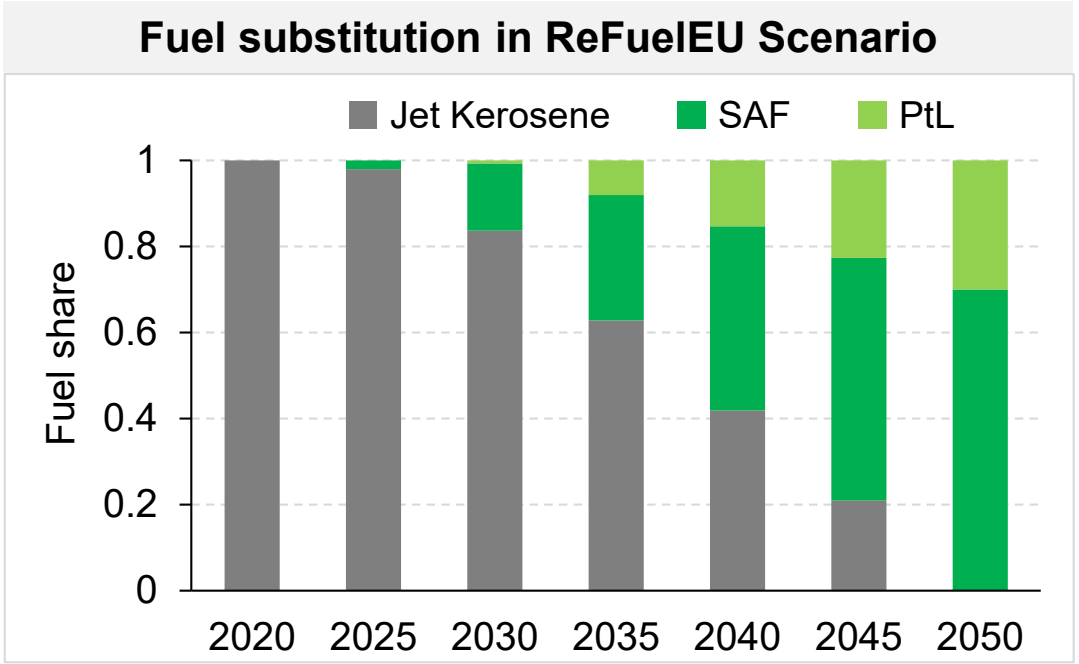
- **Overall Trend: Irish Air Passengers Travel Further & Farther Than 10 Years Ago**

Future Scenarios

- **Demand-side projections**
  - BAU: Proportional to population & economic growth
  - LED: Proportional to population, inelastic to GNI*

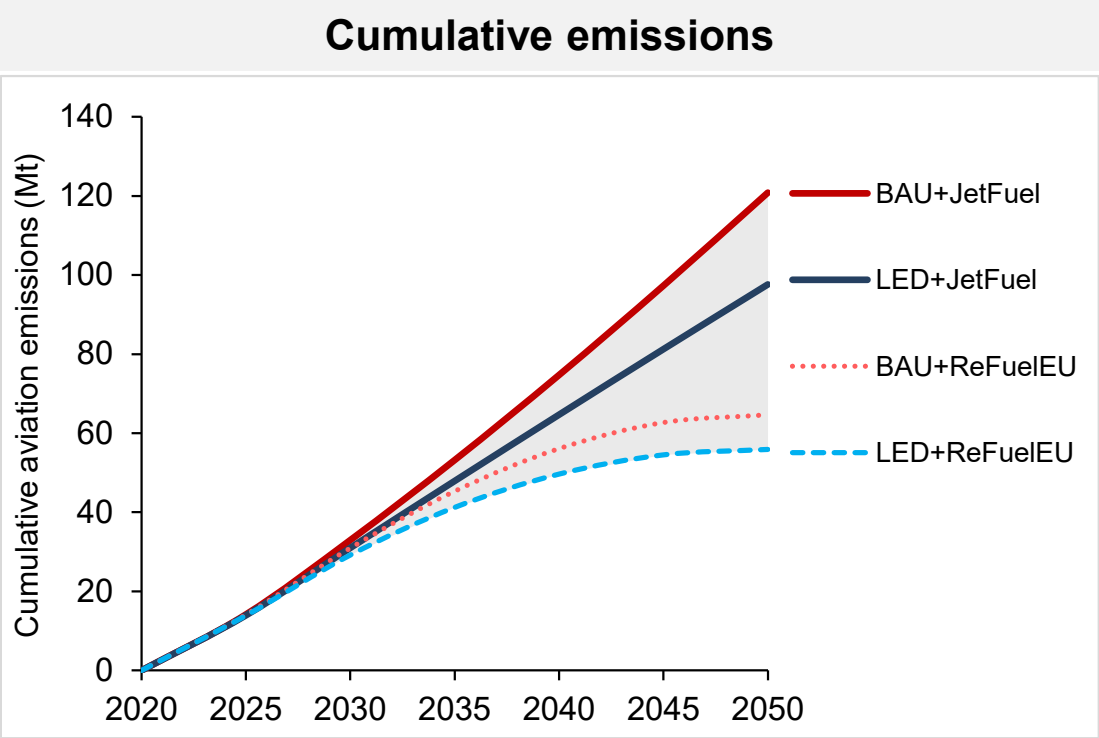
- **Supply-side projections**
  - JetFuel: Fossil-based fuels (100% kerosene)
  - ReFuelEU: SAF (2% in 2025, 70% in 2050) & PtL (0.7% in 2030 to 30% in 2050)

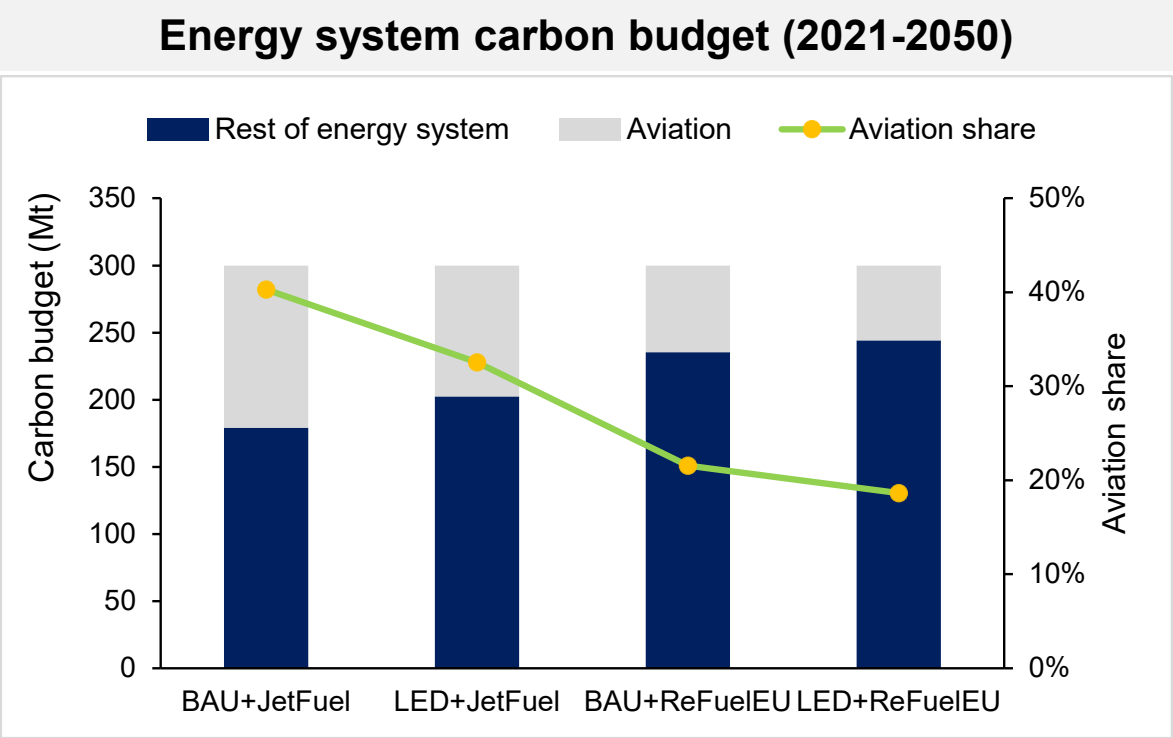




Demand- and supply-side pathways creates 4 scenarios

Results: Cumulative emissions





- **Fossil fuel reliance scenarios**
  - Emits 98-121 Mt, consuming 33-40% of the 300Mt carbon budget, equivalent to the total budget for road transport.
- **ReFuelEU Scenarios**
  - Significantly cut aviation emissions. Even these cleaner options consume 19-22% of the total carbon budget.

Key Takeaways

Ireland's international aviation accounts for

- 9% of total final energy consumption
- 11% of total energy-related CO_2 emissions
- 20% of oil imports

Future pathway (2050)

- Aviation emissions could consume 19% to 40% of Ireland's total carbon budget
- A low-demand scenario can cut aviation fuel use by one-third compared to BAU

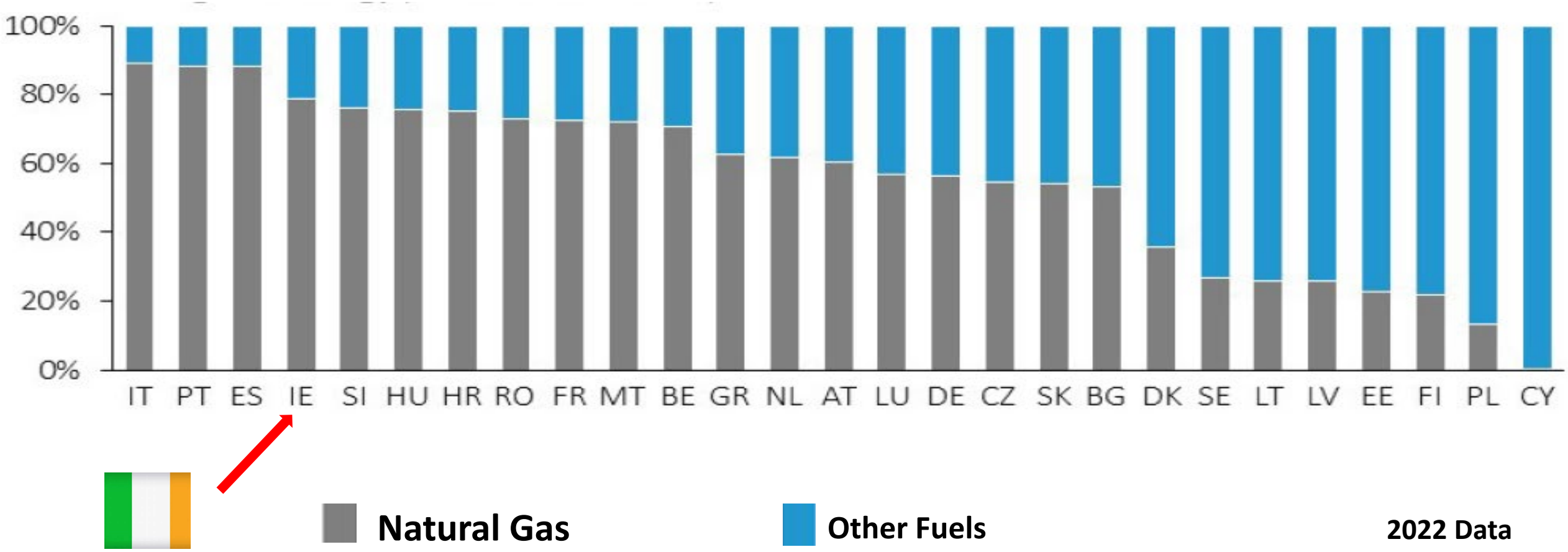
Risks and concerns

- Aviation emissions threaten to disproportionately deplete Ireland's carbon budget
- Decarbonisation pathways based on zero emission fuels face significant feasibility issues
- Aviation remains a blind spot in Ireland's climate goals

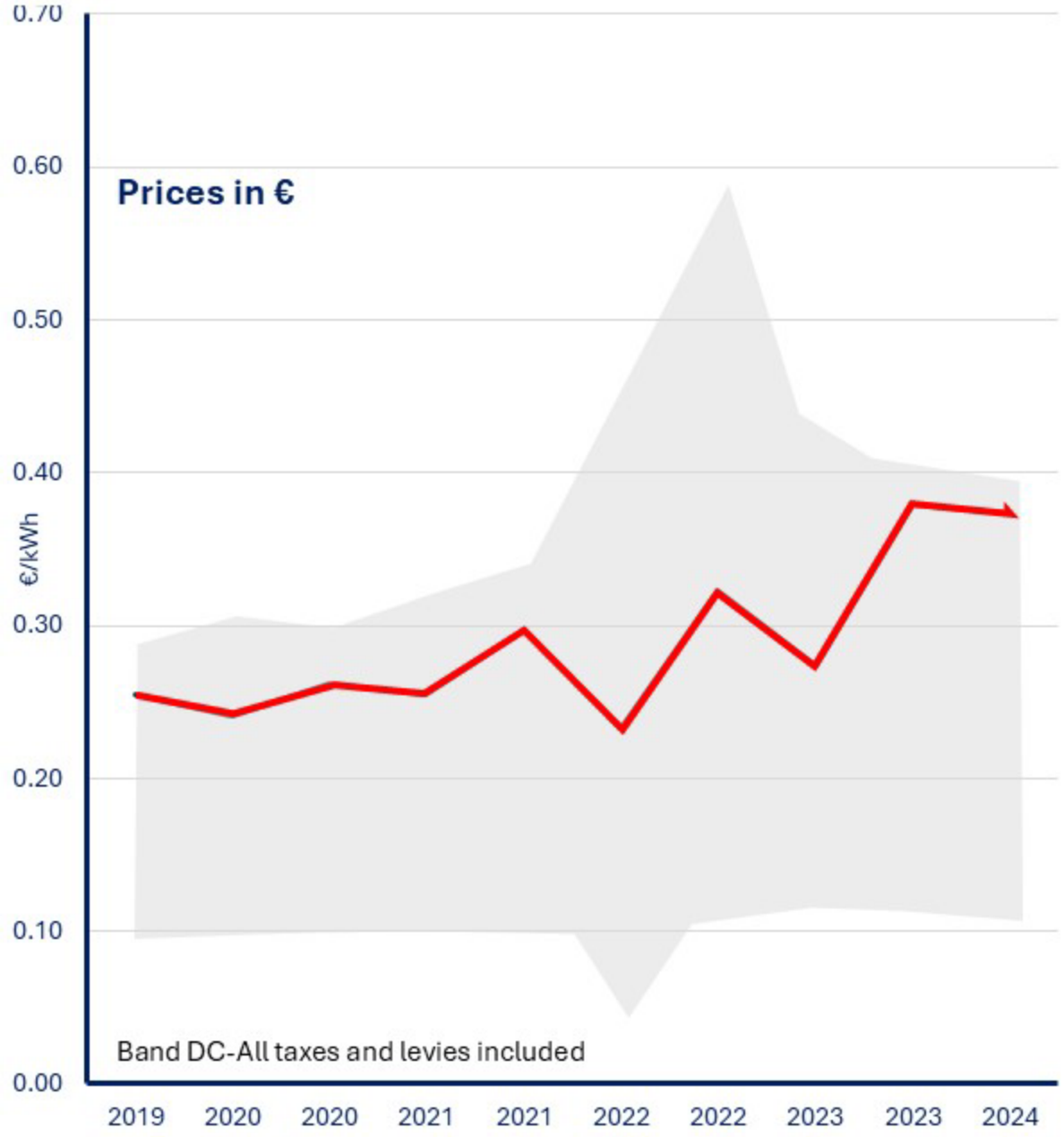
Energy Security

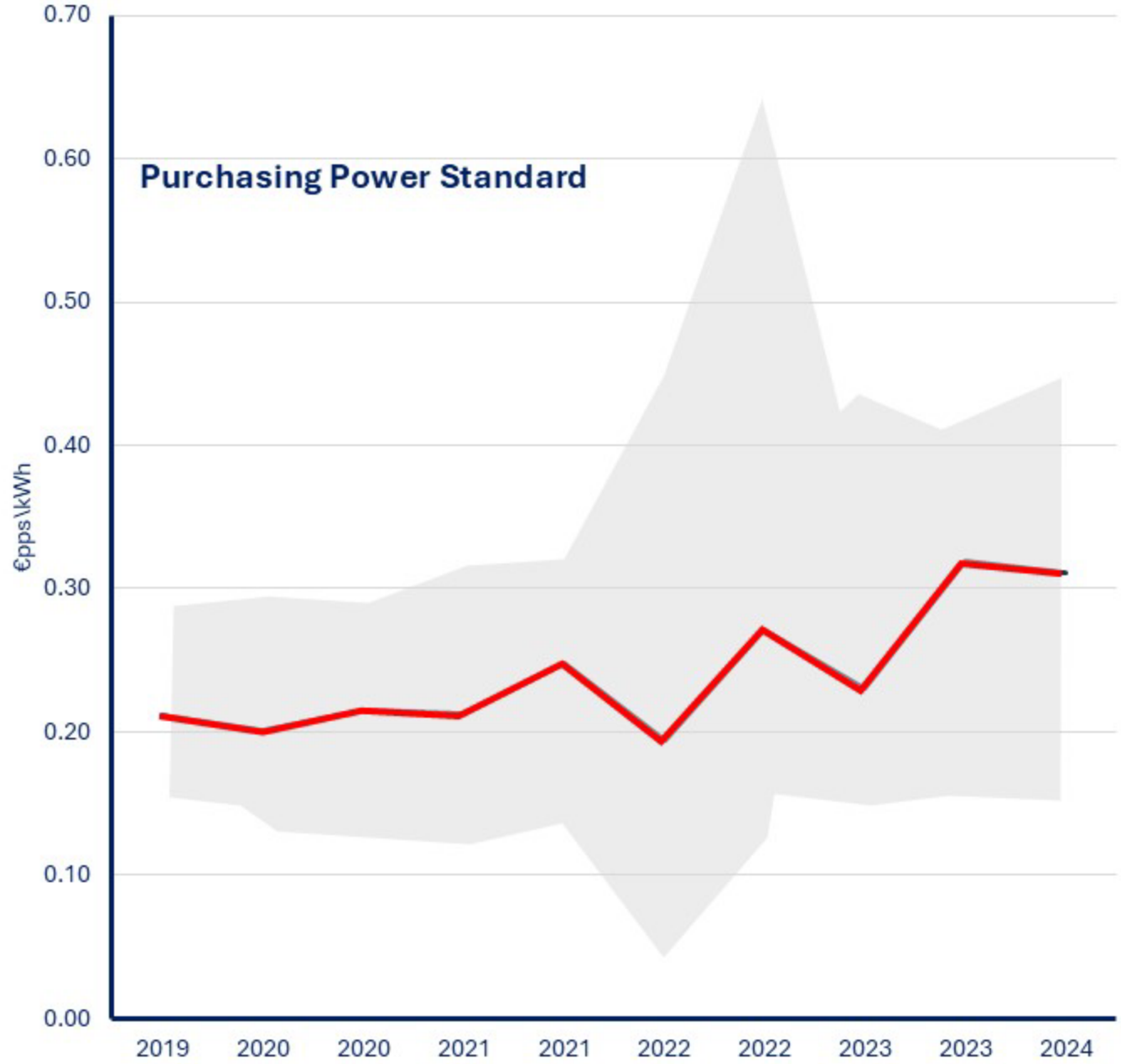
Dr. Paul Deane

Price Setting Technology as share of hours



EU Residential Electricity Prices from 2019 to 2024 in € and in Purchasing Power Standard.
Range of prices in grey. Ireland prices in red solid line





Energy Security…its about prices and physical supply

The **dominance of natural gas in Ireland's power** system means electricity prices will remain elevated for next 3-5 years

Renewables will help lower wholesale prices, but these reductions will likely be eroded by **network costs increases**

The narrative that electricity will be 'cheap' is not helpful, but it can be **affordable, less volatility and less polluting**

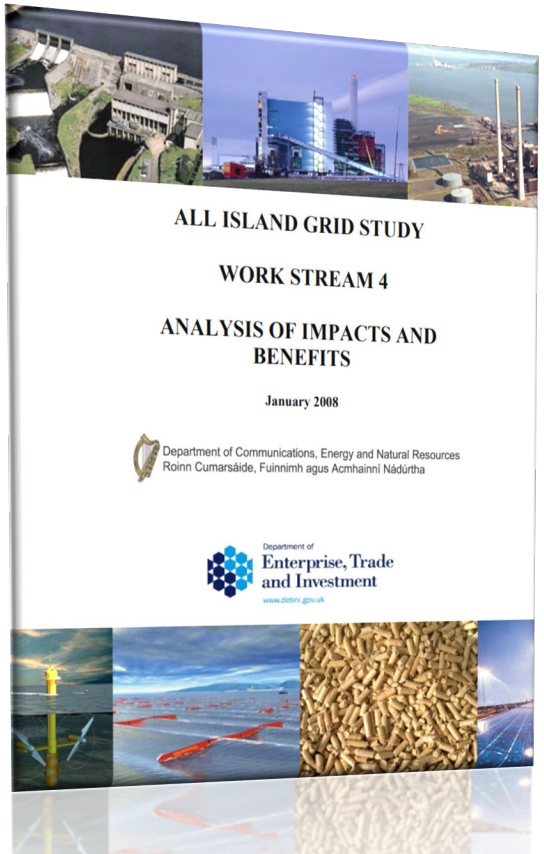
Electricity Market Reform is required to **incentive and deliver** a fossil free power system by 2035

Interconnectors will play a crucial role in mitigating flexibility needs across various timeframes, **except at the time of prolonged shortages in generation that affect multiple countries.**

As we trade commodity market volatility for meteorological volatility, **we need to repurpose Ireland Strategic Oil Reserves to Clean Energy Reserves**

A new Government will have to contend with old problems

Action 17: To create a Strategic Gas Emergency Reserve to protect Ireland in the event of a gas supply disruption as Ireland makes a secure transition to majority renewable energy



Ireland needs a detailed plan for energy system decarbonization that aligns with Climate targets

Longer term| Moving from Market to Meteorological Risks

Renewable generation shortage events might occur 2 to 4 times annually, lasting on average up to 6-10 days and resulting in a generation gaps

Interconnectors will play a crucial role in mitigating flexibility needs across various timeframes, except at the time of prolonged shortages in generation that affect multiple countries.

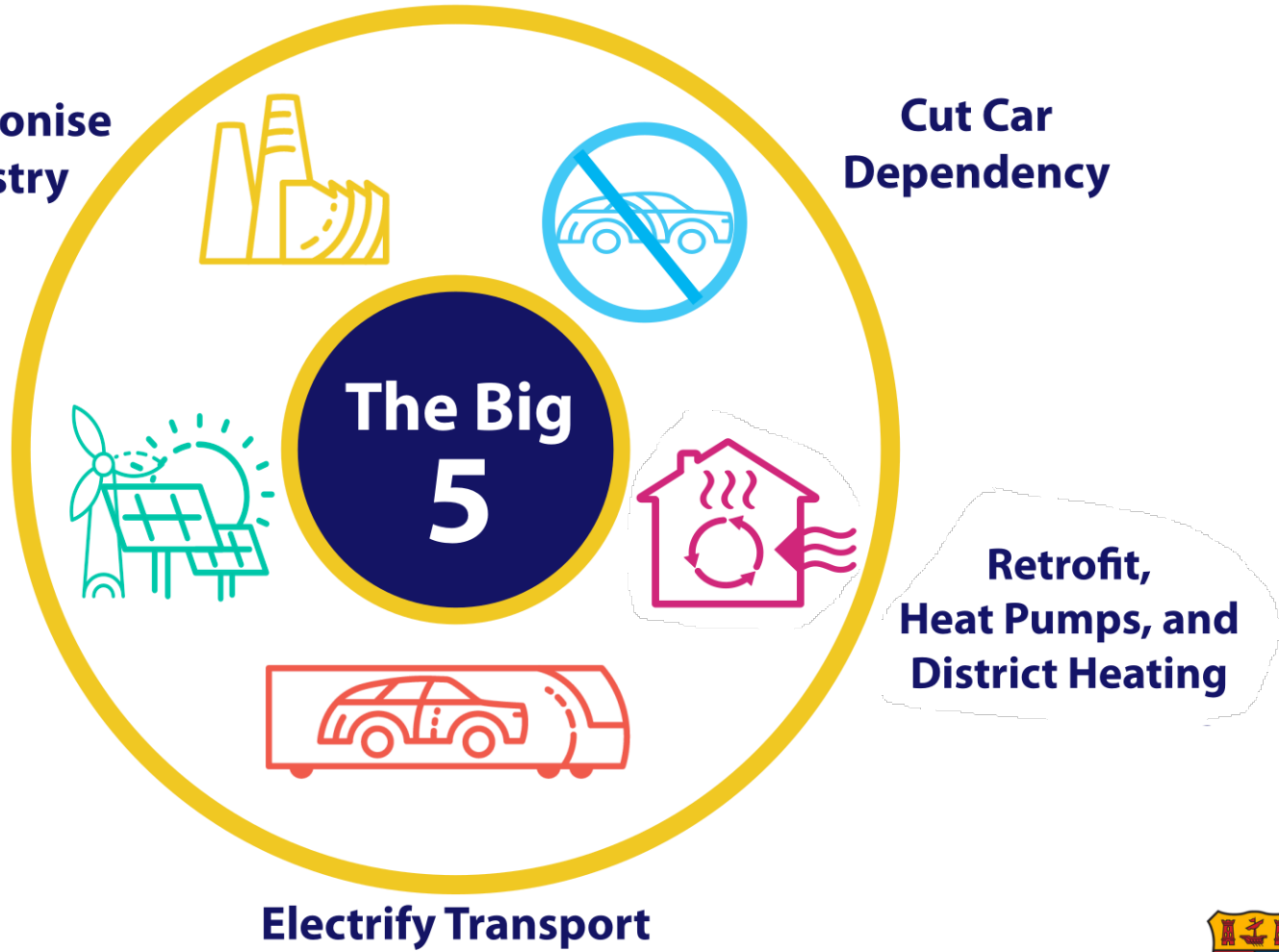
Under Ireland's membership of the EU and the International Energy Agency, Ireland is obliged to hold strategic oil stocks to protect against a possible supply interruption. Today, we hold about €1.5 billion worth of oil in strategic reserves in locations across Ireland, which is about 80 days' worth of use.

Residential decarbonisation

– The interaction between Retrofitting, Heat Pumps, and District Heating

Dr. Tomás Mac Uidhir

Five Actions for 90% Energy Emissions Savings to 2030



Retrofit,
Heat Pumps, and
District Heating

~ 26 TWh heat demand

	Retrofitting (# homes)	Heat Pumps (# HPs)	District Heating (energy)
2030 Target	500,000	400,000	2.5 TWh
Progress	~53,000	~14,000	~0 TWh

MaREI
Energy · Climate · Marine

Heating Energy Analysis Tool (HEAT)

- A new simulation tool to examine the interaction between residential retrofitting, heat pumps, and district heating to 2040

- National, Regional, Local level

- What is the district heating potential in my area?
- What level of emissions reduction can district heating deliver?
- What homes (and how many) are required to deliver the target?
- What challenges will this interaction present – can we mitigate?
- What will it cost, and who will pay?

Heating Energy Analysis Tool (HEAT)

- A new simulation tool to examine the interaction between residential retrofitting, heat pumps, and district heating

- **National** (**3** scenarios - SEAI District Heating Candidate Areas)

    1) 2.7 TWh
    2) 5.1 TWh
    3) 8.1 TWh

Different levels of ambition across residential, commercial, public sectors

Scenario 1:

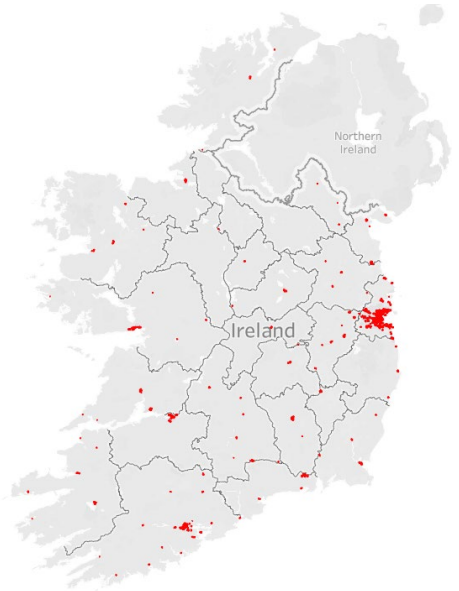
- Identifies a total of **2.7 TWh** of district heating potential across ~ **1500 small area (SA)** locations
- Delivers **0.87 TWh** of district heating to Residential sector (about **35% of target**)

HEAT RESULTS

- ~ **85,000** homes connected to DH by 2030 **(78 - 153 Million €)**
- ~ **500,000** retrofits & **400,000** heat pumps by **2030 (32 Billion €)**
- **> 1 M** retrofits & **830,000** heat pumps by **2040 (47 Billion €)**
- Reduce annual emissions to **1.4 MtCO2 by 2040** (from cohort)

Scenario 2:

- Identifies a total of **5.1 TWh** of district heating potential across ~ **3400 small area (SA)** locations
- Delivers **2.6 TWh** of district heating to Residential sector (**exceeds 2030 target**)

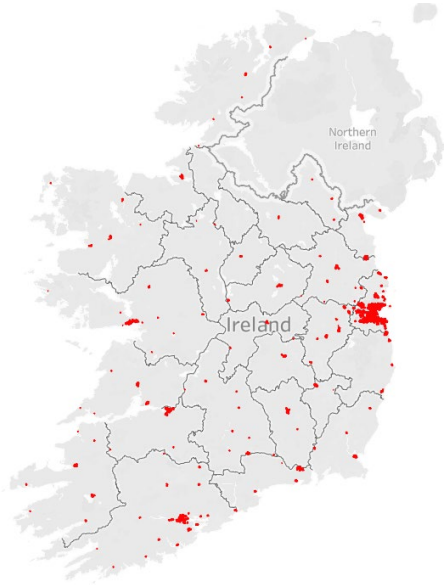


HEAT RESULTS

- ~ **254,000** homes connected to DH by 2030 **(234 - 456 Million €)**
- ~ **500,000** retrofits & **400,000** heat pumps by **2030 (32 Billion €)**
- **> 1 M** retrofits & **830,000** heat pumps by **2040 (47 Billion €)**
- Reduce annual emissions to **1.2 MtCO2 by 2040** (from cohort)

Scenario 3:

- Identifies a total of **8.1 TWh** of district heating potential across ~ **5900 small area (SA)** locations
- Delivers **4 TWh** of district heating to Residential sector (by 2040 – does not achieve)



HEAT RESULTS

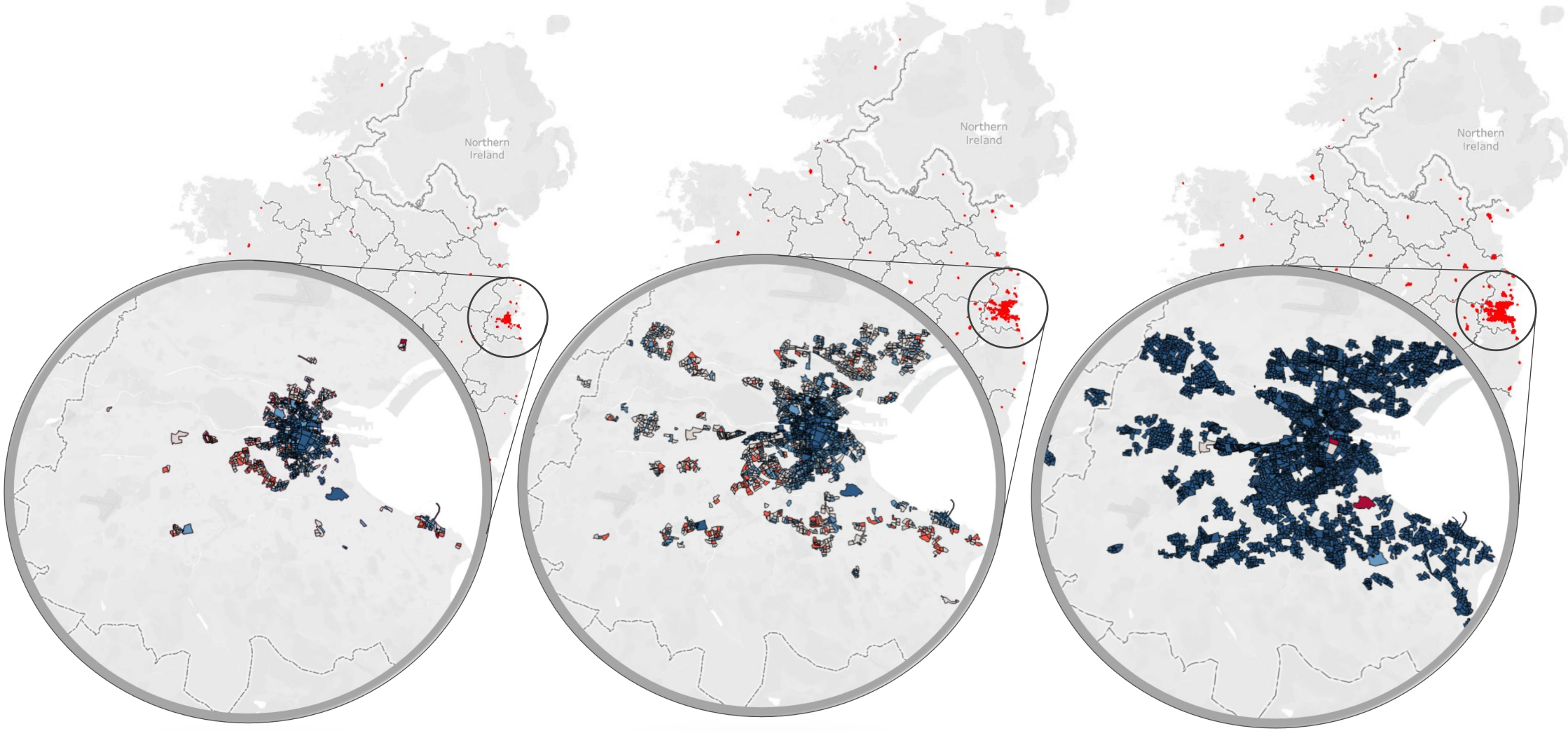
- ~ **390,000** homes connected to DH by 2030 **(358 - 700 Million €)**
- ~ **500,000** retrofits & **400,000** heat pumps by **2030 (32 Billion €)**
- **> 1 M** retrofits & **830,000** heat pumps by **2040 (47 Billion €)**
- Reduce annual emissions to **1 MtCO2 by 2040** (from cohort)

Growing ambition

0.86 TWh

2.6 TWh

4 TWh



Conclusion & Next Steps

- Immediate action required to deliver 2.5 TWh DH by 2030
- Above 4 TWh of residential DH difficult to deliver (in HEAT)
- No. Dwellings required approximates SEAI figures
- Further stakeholder engagement and calibration required
- Update regional data
- Calculate estimated savings (post-retrofit)
- Further user-choice for targets e.g. retrofitting

HEAT Tool

HEAT(Heating Energy Analysis Tool)

Scenario Name: EPMG_Showcase_event

Retrofit Choices

Retrofit Priority	BER
1	G
2	F
3	E
4	D
5	C
6	B3

Update BER Order

Fuel Switch Priority	Fuel
1	Coal
2	Heating Oil
3	Natural Gas
4	Peat
5	Solid Multi-Fuel
6	Wood
7	Electricity

Reorder Fuels

Year	Annual Retrofits
2024	43431
2025	56557
2026	61892
2027	67056
2028	71854
2029	76077
2030	79512
2031	55000
2032	55000
2033	55000
2034	55000
2035	55000
2036	55000
2037	55000
2038	55000
2039	55000
2040	55000

Use Sample values

Advanced Retrofit Options

District Heating Choices

District Heating Priority	BER
1	C
2	D
3	E
4	F
5	G
6	B3

Update BER Order

Fuel Switch Priority	Fuel
1	Natural Gas
2	Heating Oil
3	Coal
4	Solid Multi-Fuel
5	Peat
6	Wood
7	Electricity

Reorder Fuels

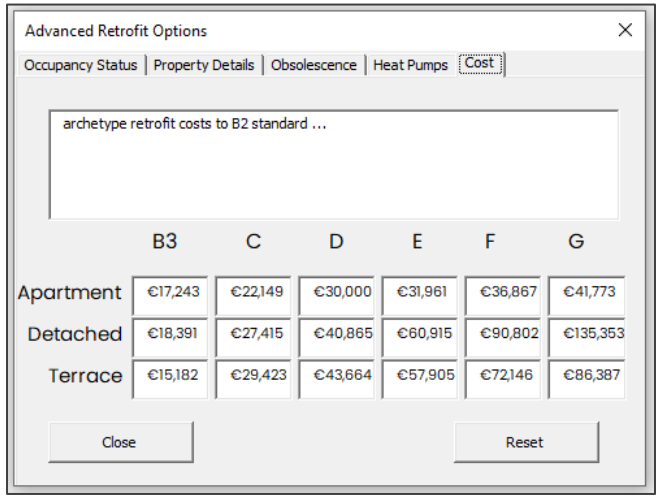
Year	DH Demand (TWh)
2024	0.00
2025	0.00
2026	0.20
2027	0.28
2028	0.28
2029	0.28
2030	1.25
2031	0.40
2032	0.80
2033	0.28
2034	0.28
2035	0.28
2036	0.00
2037	0.00
2038	0.00
2039	0.00
2040	0.00

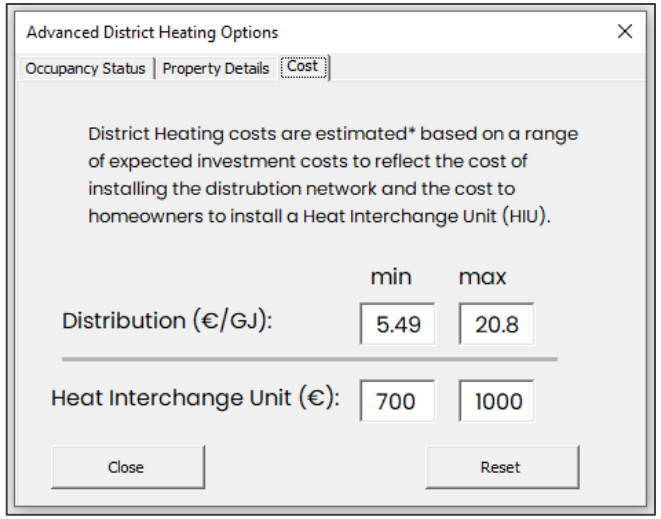
Use Sample values

Advanced District Heating Options

Reset All

Generate





Thank you

tomas.macuidhir@ucc.ie

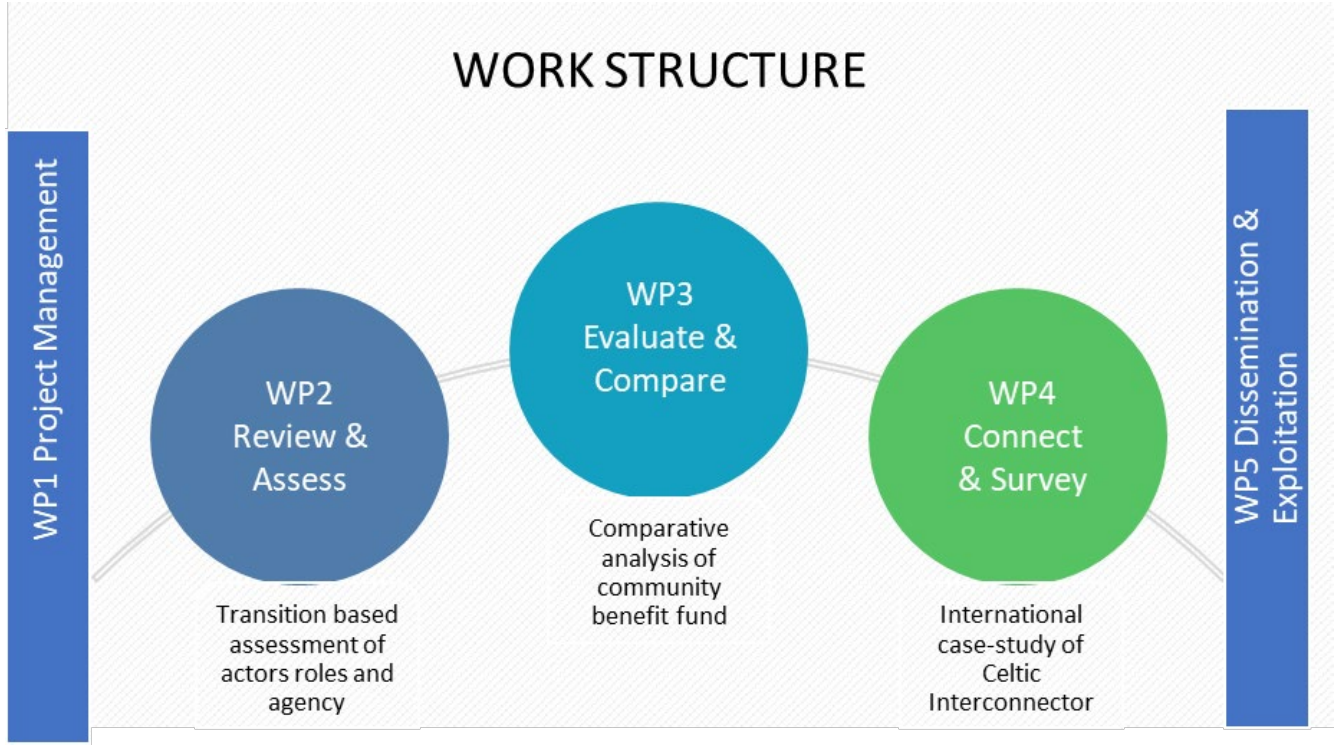
Engagement on energy infrastructure

Dr. Alexandra Revez

STEPS
STEPS FOR PUBLIC ENGAGEMENT WITH ENERGY TRANSITIONS IN AN ERA OF CLIMATE CRISIS

Steps for Public Engagement with Energy Transitions

in an era of Climate Crisis



Start November 2020

End April 2025

Team: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Aoife Deane


Evan Boyle


Alexandra Revez

Website:

https://www.marei.ie/project/public-engagement-with-energy-transitions-in-an-era-of-climate-crisi

This project is supported by EirGrid and Science Foundation Ireland

EirGrid GROUP

sfi Science Foundation Ireland

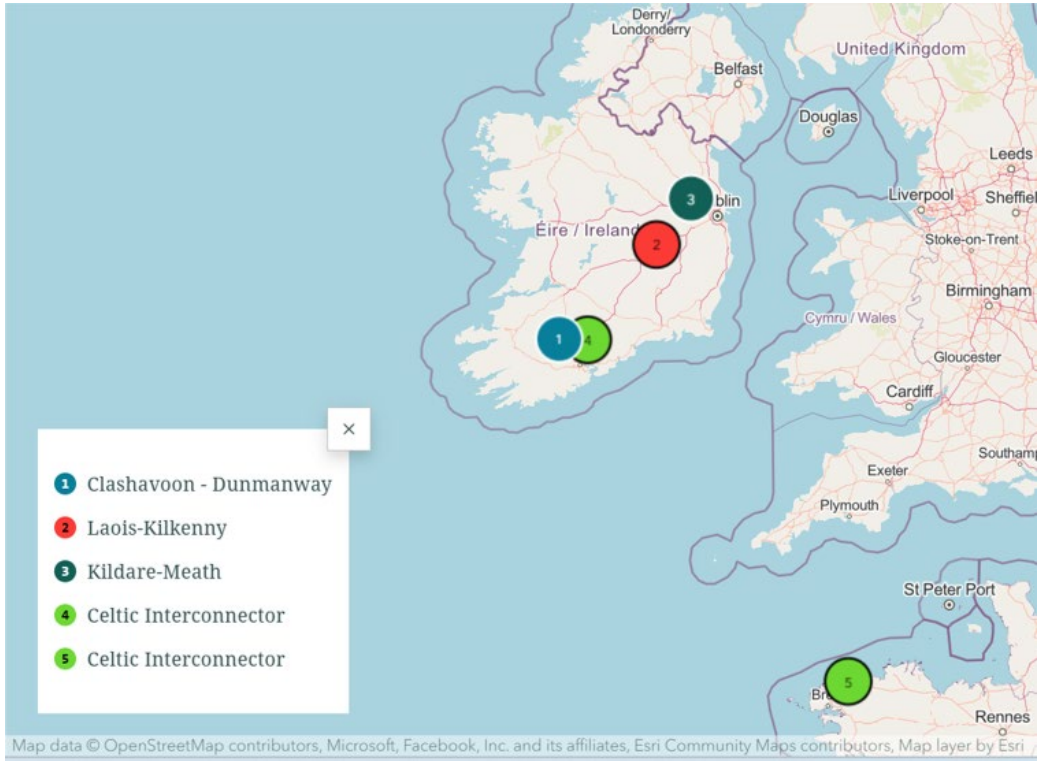

Engagement
EIRGRID
MaREI
Energy · Climate · Marine
Climate Action

RESEARCH OVERVIEW: activities and projects

Research Activities

3 Literature Reviews
Document Analysis
EirGrid Interviews (x3)
1 Net-Map Workshop (x3)
Post Net-Map Interviews (x3)
2 Practitioner Workshops (x7)
5 Energy Citizen Roadshows
3 Kildare-Meath Community Forum
2 Focus Groups
1 Delphi Panel
1 Webinar
3 Fund-Route-Map Analysis
2 SSH/Interdisciplinary Workshops

Projects



As the backbone of our energy system, **electricity grids are critical for the clean energy transition**. Europe has **the most interconnected and resilient electricity grid in the world** bringing electricity to consumers every minute, hour and day of the year. However, for the EU to bring renewable electricity to its consumers and empower them to produce it, **electricity grids need to develop further and faster**. **In the next seven years, we should double our cross-border transmission infrastructure**.

An accelerated energy transition requires a shift towards a **decentralised, digitalised, integrated and flexible system**, with the expansion and upgrade of both the transmission and distribution grids. Investing in grids today will help to reduce greenhouse gas emissions and energy costs for consumers. **cross-border energy infrastructure projects can decrease**

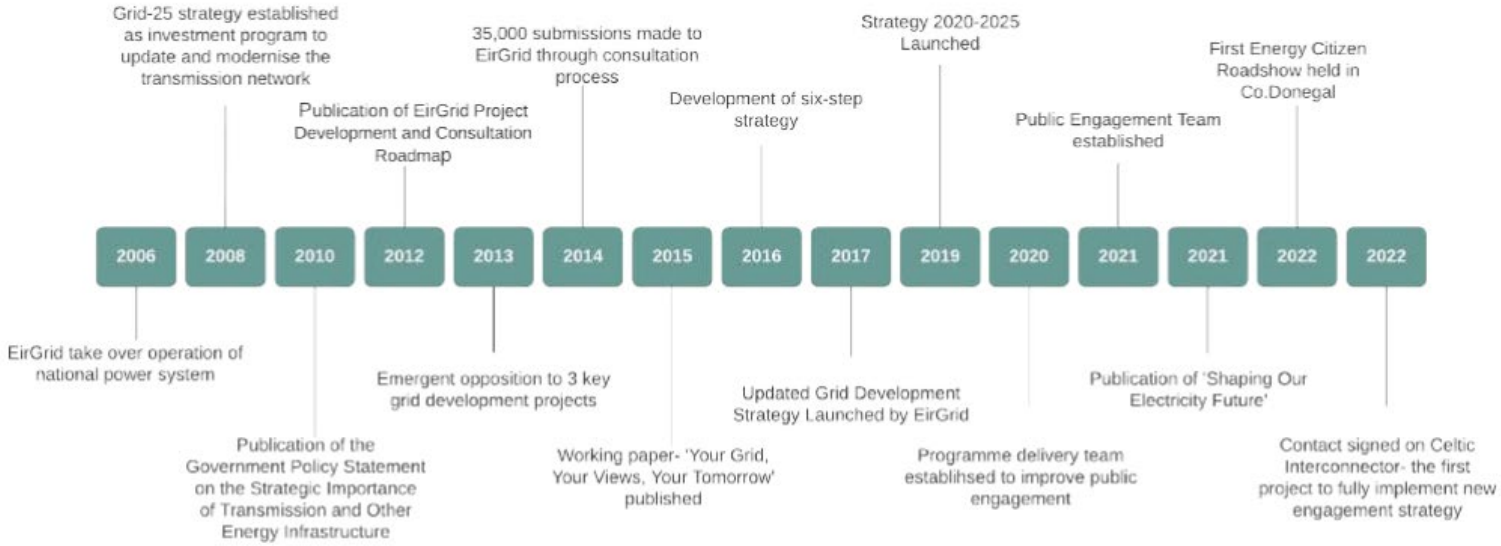
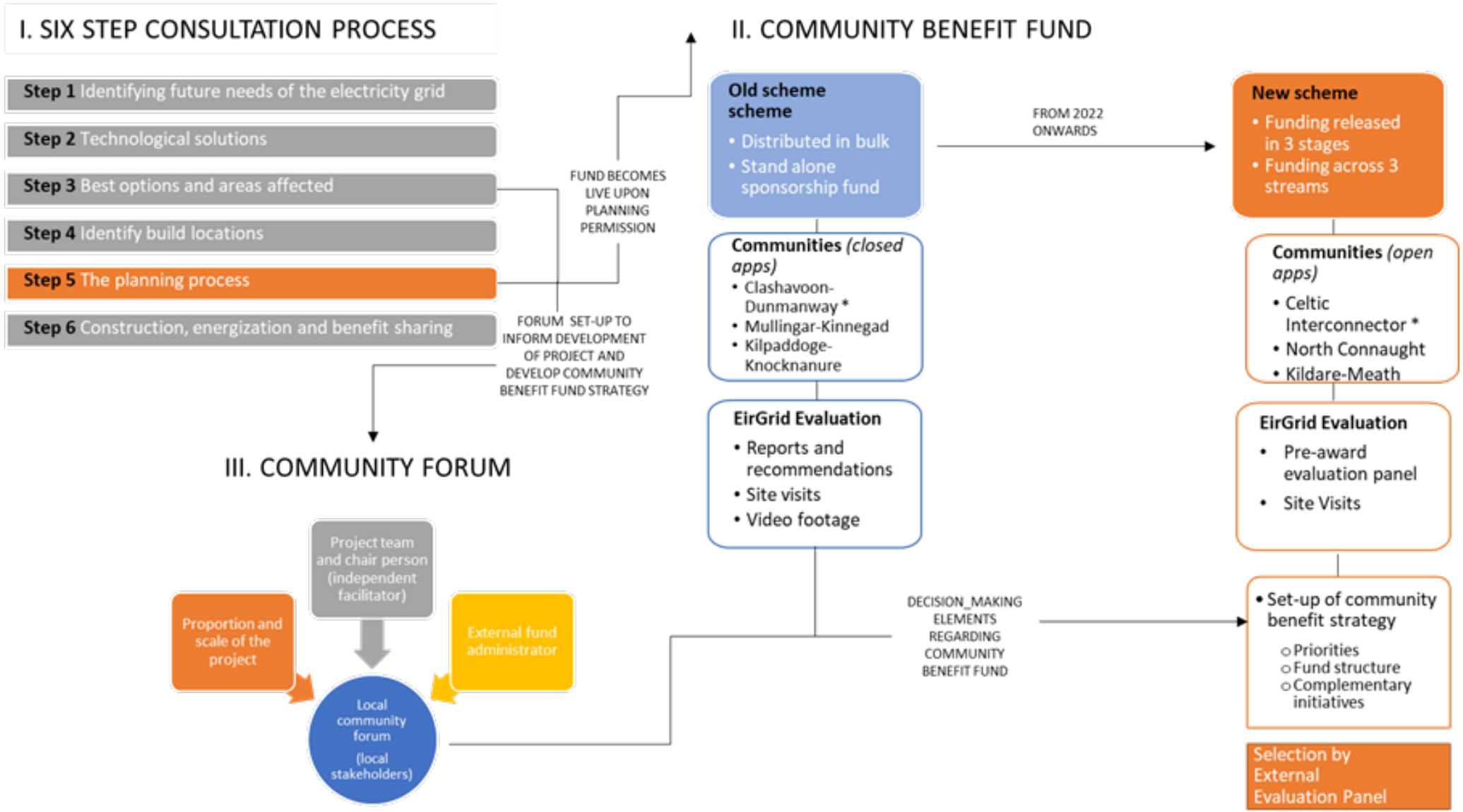


Fig1. Timeline of Eirgrid's evolving public engagement

Evolving Engagement Strategy

Over €580 billion of investment is required for electricity grid development and upgrades in this decade alone to meet European renewable targets, with considerable infrastructural changes proposed at local levels across the continent. The EU Action Plan for Grids (2023), suggested that guidance is needed to **better engage with stakeholders** and communities in the context of stimulating **faster permitting** for grid deployment.

THREE INNOVATIONS +1



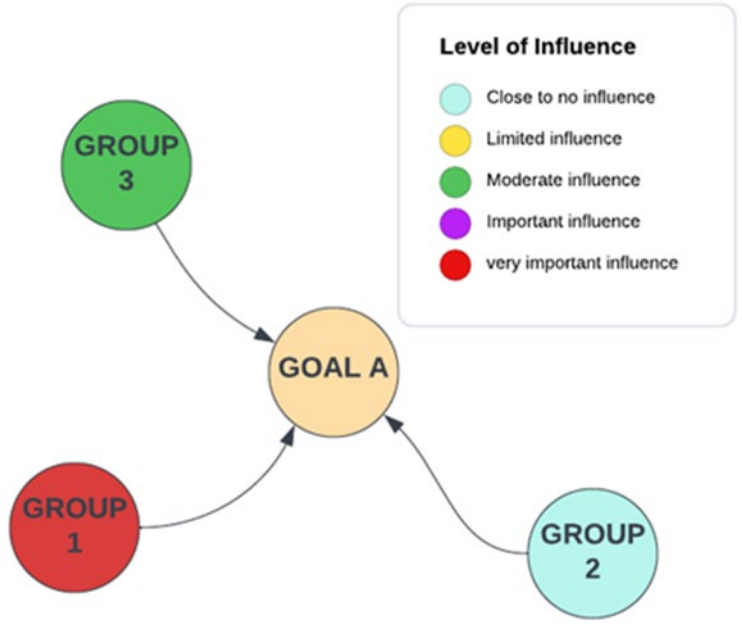
Community Forums

How and to what extent do participatory practices open spaces of influence for community actors to partake in decision-making?

The local implementation of a community forum presents itself as a sounding board for communities to express their preferences regarding the choice of technology and decisions around siting but also it opens new mechanisms to engage forum members in pursuing other community development goals.

A need for greater emphasis on full life-cycle delivery to enhance the community forum's role as a mechanism through which procedural participation can be expanded and capacity built to enable community development projects

Step 1	Identifying future needs of the electricity grid
Step 2	Technologies to meet future needs
Step 3	What is the best option and what area may be affected
Step 4	Where exactly should we build?
Step 5	The planning process
Step 6	Construction, energisation and benefit sharing

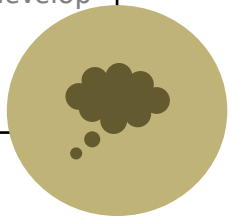


REFLECTIONS ON THE VALUE OF THE COMMUNITY FORUM

- Early engagement (starting from step three with six step process) allowing for the transfer of rich technical and geographical information to stakeholders.
- Flexibility within membership of the forum coordinated by the members themselves.
- Independent facilitation as pivotal to delivery of open, representative and transparent dialogue and information sharing.
- The tangible success from working with the forum and engaging extensively with communities and public can be seen indirectly through the very small number of submissions received during the planning process.

REFLECTIONS FROM PRACTITIONERS

- Greater emphasis on the full life-cycle delivery of the grid project to enhance the Community Forum's role, which is already delivering strongly in terms of information sharing and community benefit fund allocation.
- Each forum should be consulted on their possible need for additional learning and knowledge sharing in the later stages of grid development.
- Continued support for community projects by exploring opportunities for match-funding or additional funding streams from other sources beyond EirGrid to develop local community projects.



To Expedite or Engage?

- *"The number of projects to be delivered means things are moving fast. This fast pace of project development within the organisation can sometimes be in tension with the time requirements needed to follow the necessary engagement protocols"*

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Research article

Levers and obstacles for implementing public engagement practices in electricity grid development

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ARTICLE INFO

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Infrastructure development
Citizen participation

ABSTRACT

The scale of change required through the development of new energy infrastructure throughout Europe is vast. The societal dimensions of the energy transition are increasingly recognised as centrally important and approaches to infrastructure development which seek to incorporate such considerations are warranted. EirGrid - Ireland's national electricity transmission operator - through their own historical context, have undergone a journey to develop new strategies for

Critical Summary of Community Benefit Literature

BACKGROUND

A few different financial models of compensation and benefit provision are outlined within the literature, including one-off lump sum payments, a stream of payments, part ownership, direct investment in the community, tax reductions, and reduced energy prices. Community payments or benefits can also be a mechanism for engagement.

Benefit community payments have been suggested as an instrumental tool to address distributional asymmetries related to the impacts of infrastructural developments.

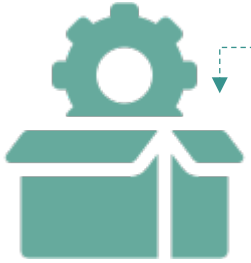
COMMUNITY BENEFIT SCHEMES IN EUROPE

Case studies outlined in France, Italy, UK and Germany

DELIVERY, ADMINISTRATION & MONITORING

Different stakeholders accept the case for community benefit, but the mechanisms for doing it remain complex.

PROCEDURAL & DISTRIBUTIONAL JUSTICE



How benefit is spread across society, and who is involved in the process are two different measures of justice

SSH and Interdisciplinary Perspectives on the Celtic Interconnector

Despite the critical importance of delivering a more flexible and resilient energy transmission grid infrastructure across Europe, **research addressing energy union strategies has focused mainly on understanding Interconnectors' technical and economic implications.** This space has many unexplored opportunities and challenges, including **low public awareness of interconnector projects**. **Inviting Interdisciplinarity and Social Science and Humanities (SSH) insights** is critical to learning about interconnectors from broader contexts and capturing local community insights.

Panel Discussion
Session 2: Emissions, Energy Security and Infrastructure

Chair: Jeanne Moore (NESC)

Panel Members

- Dr Vahid Aryanpur
- Dr. Paul Deane
- Dr. Tomas Mac Uidhir
- D. Alexandra Reves

Join at

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Closing Remarks

Fionnuala Callanan

Thank you to everyone who participated in the event, and to Engineers Ireland for hosting us

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