Carbon budgets in Ireland: The most likely transition path & policy implications

Climate Change Revisited
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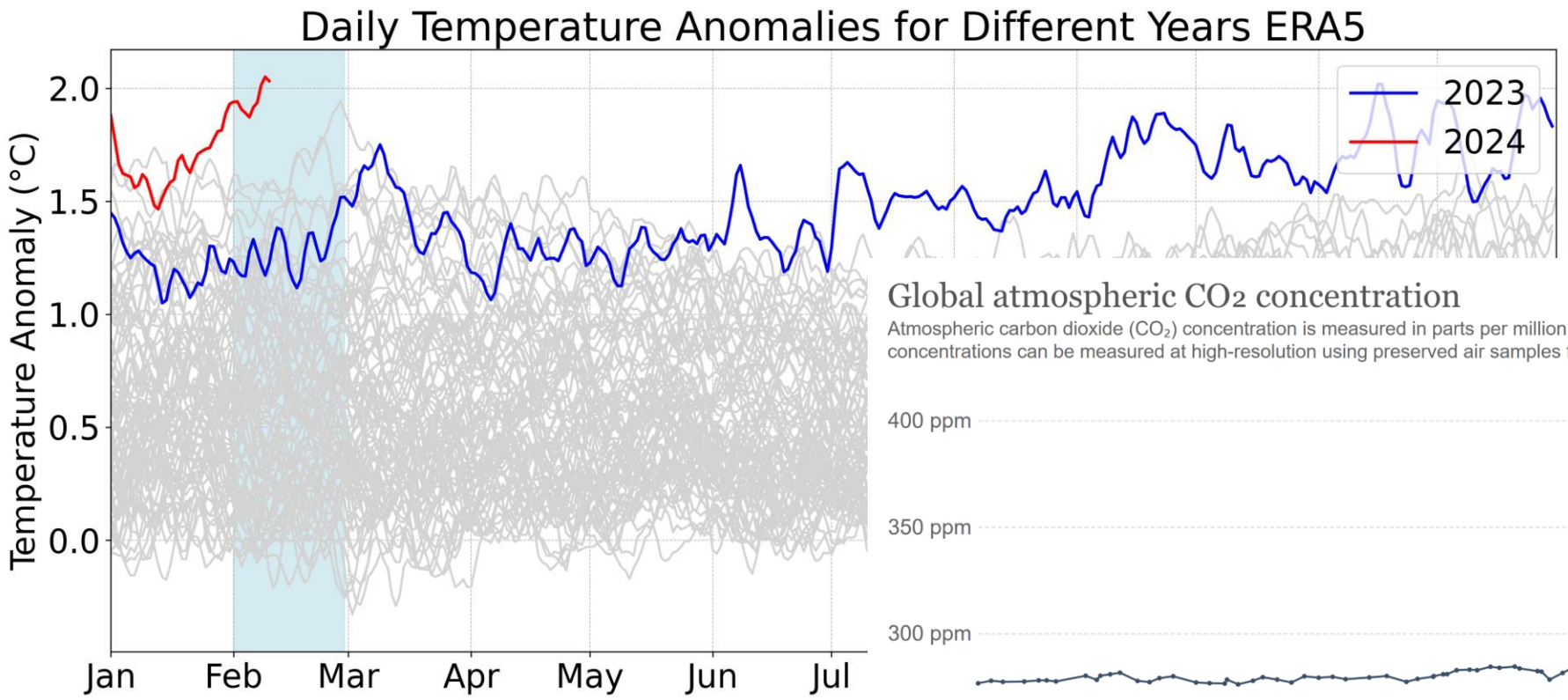
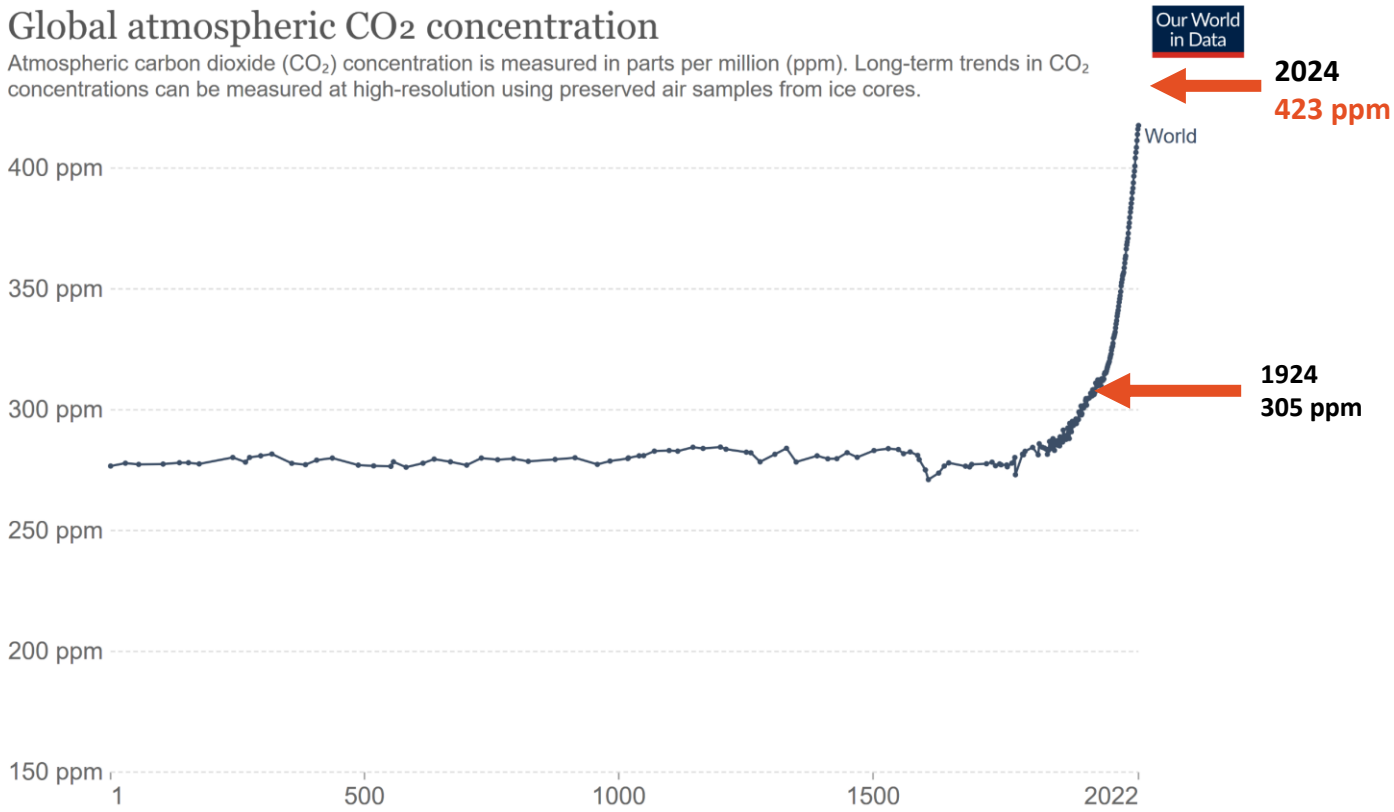
MaREI Energy · Climate · Marine | Environmental Research Institute | UCC University College Cork, Ireland Coláiste na hOllscoile Corcaigh | Science Foundation Ireland sfi For what's next

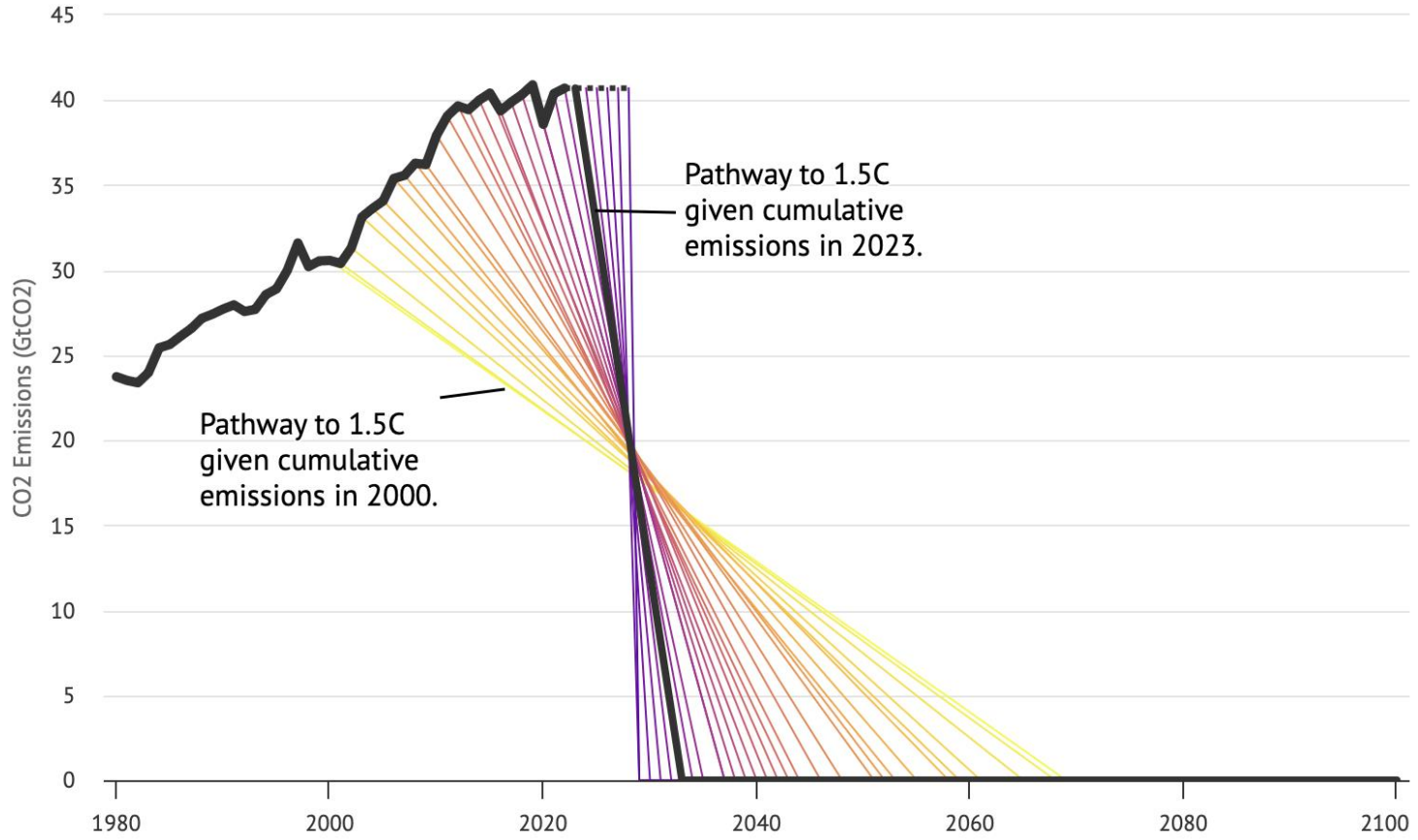
The status quo is hugely costly

February is breaking heat records, after a record 2023





The remaining carbon budget for 1.5°C is tiny



Source: UNEP Gap report.

CarbonBrief
CLEAR ON CLIMATE

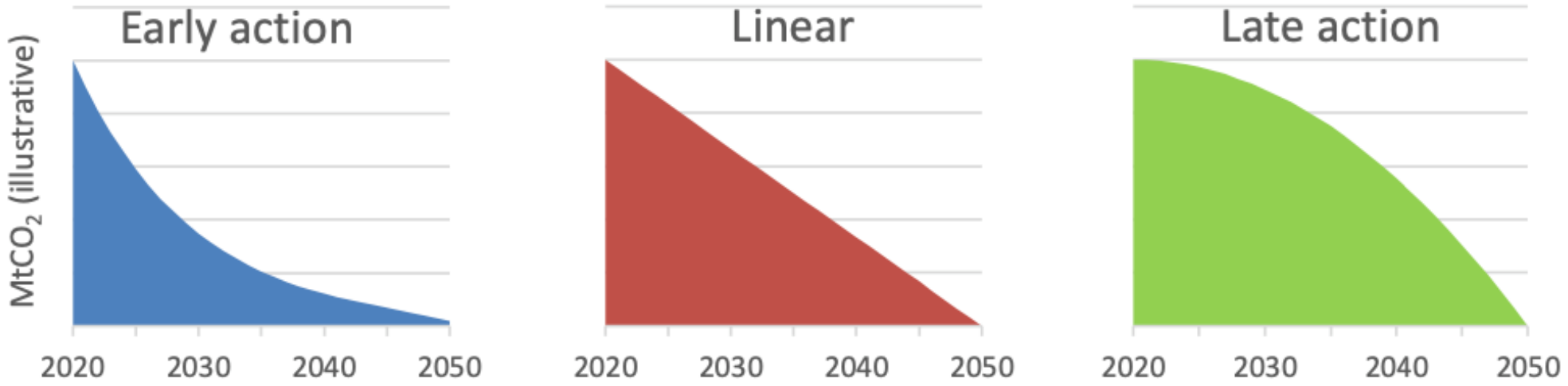
Emission reduction trajectories associated with a 50% chance of limiting warming below 1.5C, without a reliance on net-negative emissions, by starting year. Solid black line shows historical emissions, while dashed black line shows emissions constant at 2023 levels. Source: Historical CO2 emissions from the Global Carbon Project. 1.5C carbon budgets based on Lamboll et al 2023. Chart by Carbon Brief, adapted from a figure originally designed by Robbie Andrews.

The cost of fossil fuel dependence

- ~€5 bn annual fossil fuel imports in 2018 (SEAI estimate)
- €1 bn cost of energy credits & financial support in 2022
- Energy insecurity & inflation
- Compliance cost for EU decarbonization target: up to €8.1 bn (cumulative)
- Health & hardship:
  - >1000 annual premature deaths from energy-related air pollution
  - Cold, damp homes linked to respiratory & cardiovascular disease

Why carbon budgets matter

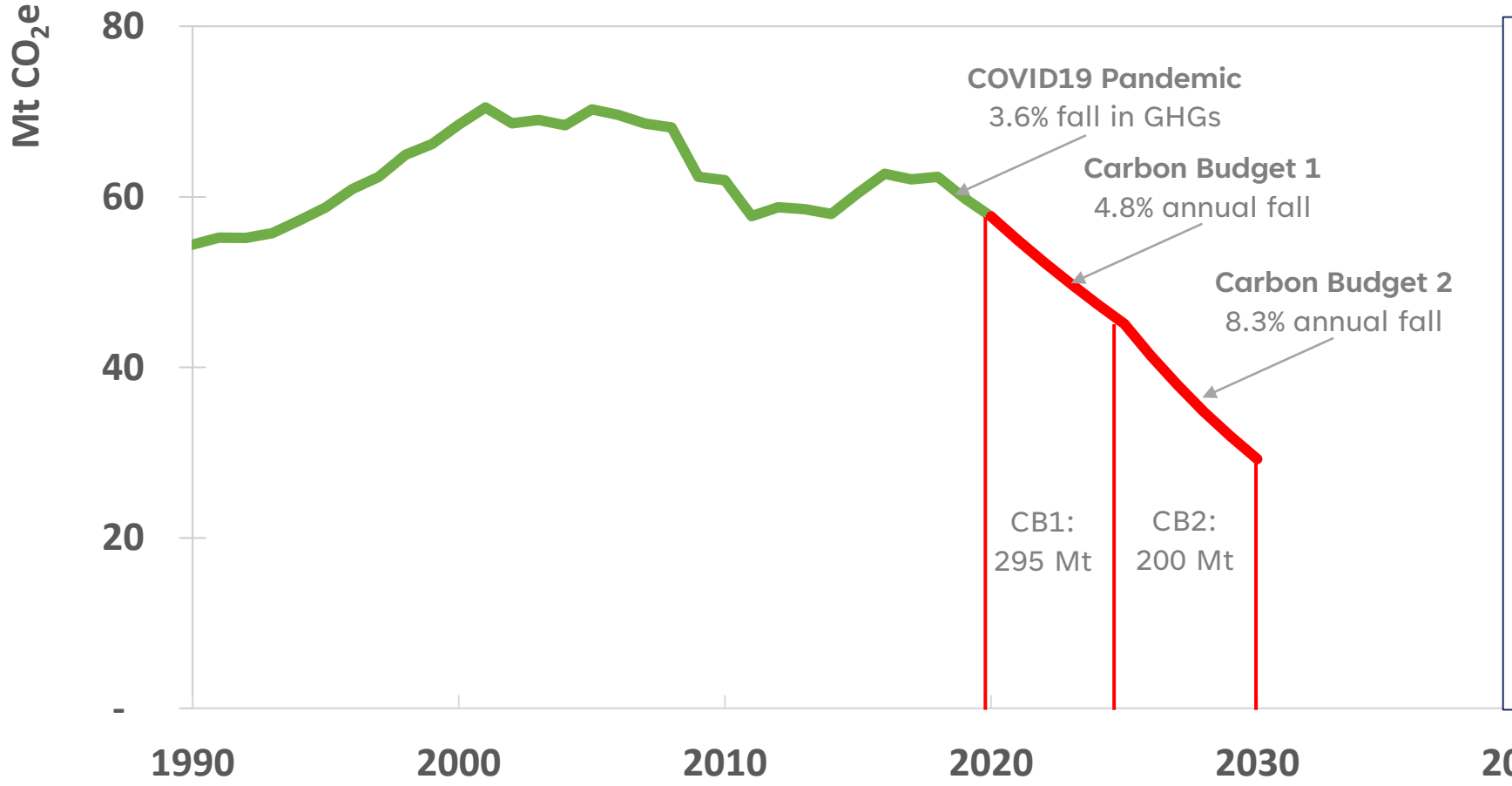
"Net zero by 2050" is not the overriding goal



"Late action" pathway leads to **double** the cumulative CO_2 emissions, and therefore warming impact of "early action"

Ireland's climate commitment

Legally-binding carbon budget framework consistent with Paris Agreement



What target post-2030?

European Commission:

Cut GHG emissions by 90% relative to 1990 by 2040

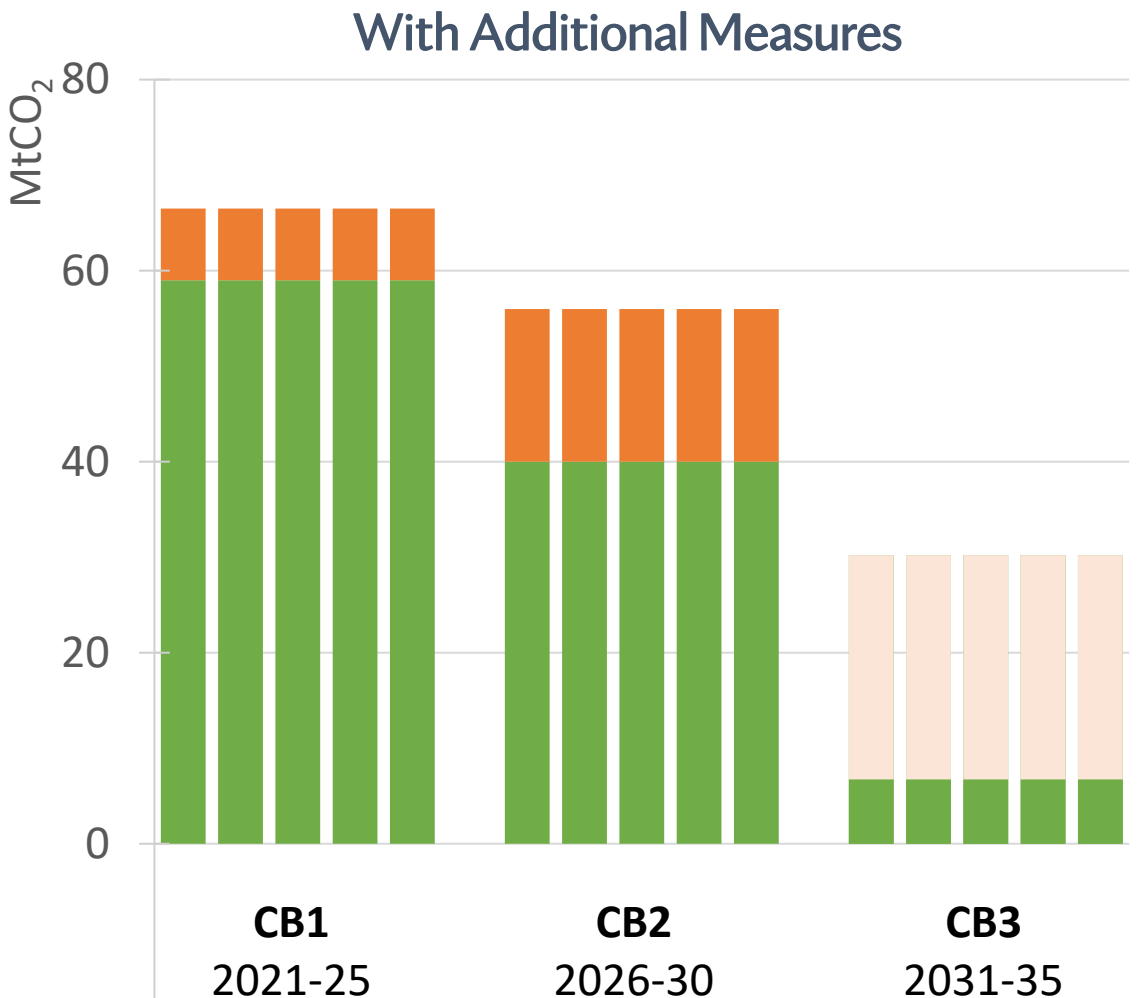
International Energy Agency:

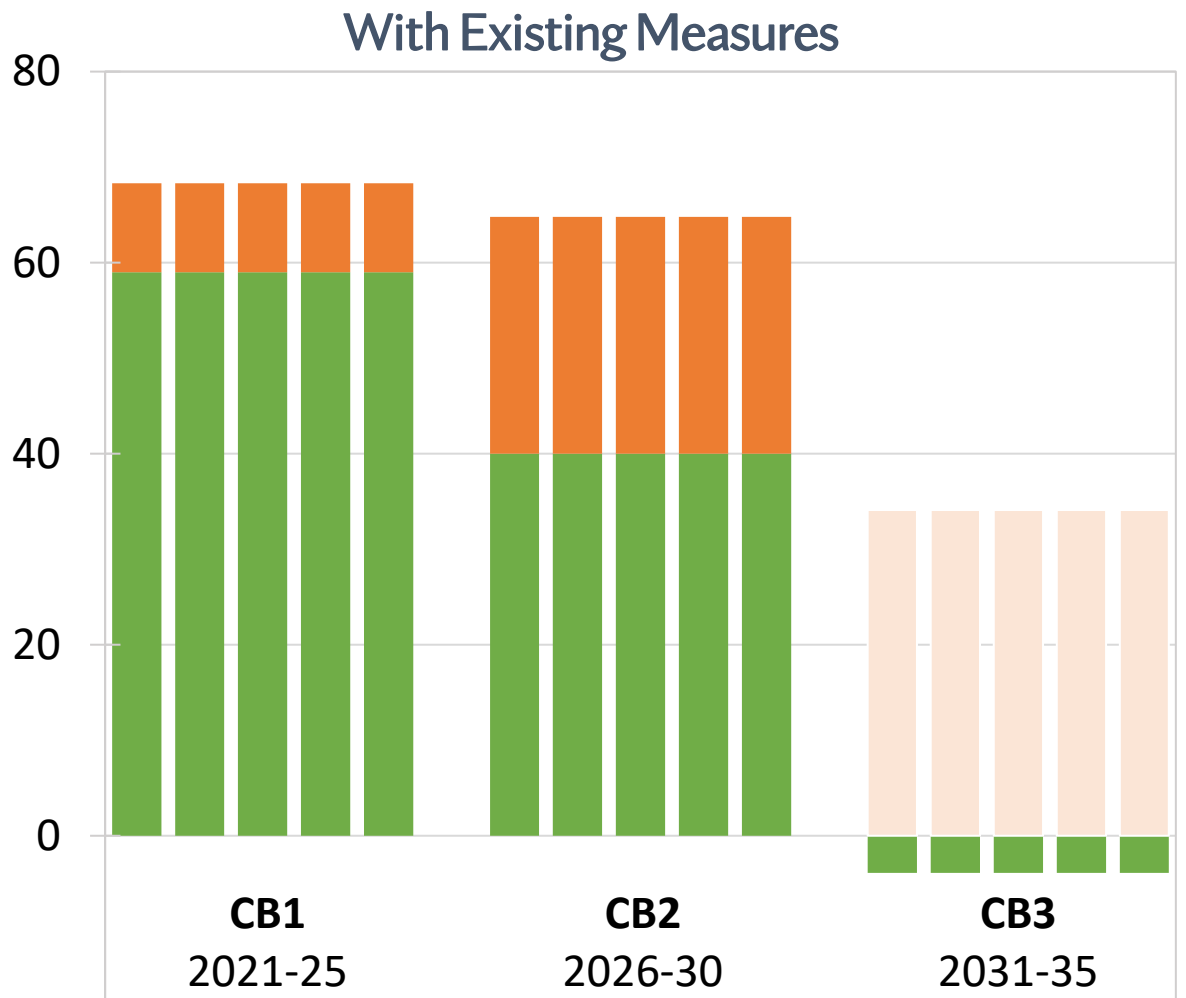
Cut energy-related GHG emissions in Advanced Economies by 85% by 2035 relative to 2022

Impact of overshoot of first carbon budgets?

Carrying forward carbon budget overshoot

The emissions overshoot projected by the EPA will leave little-to-no carbon budget left in in the 2030s



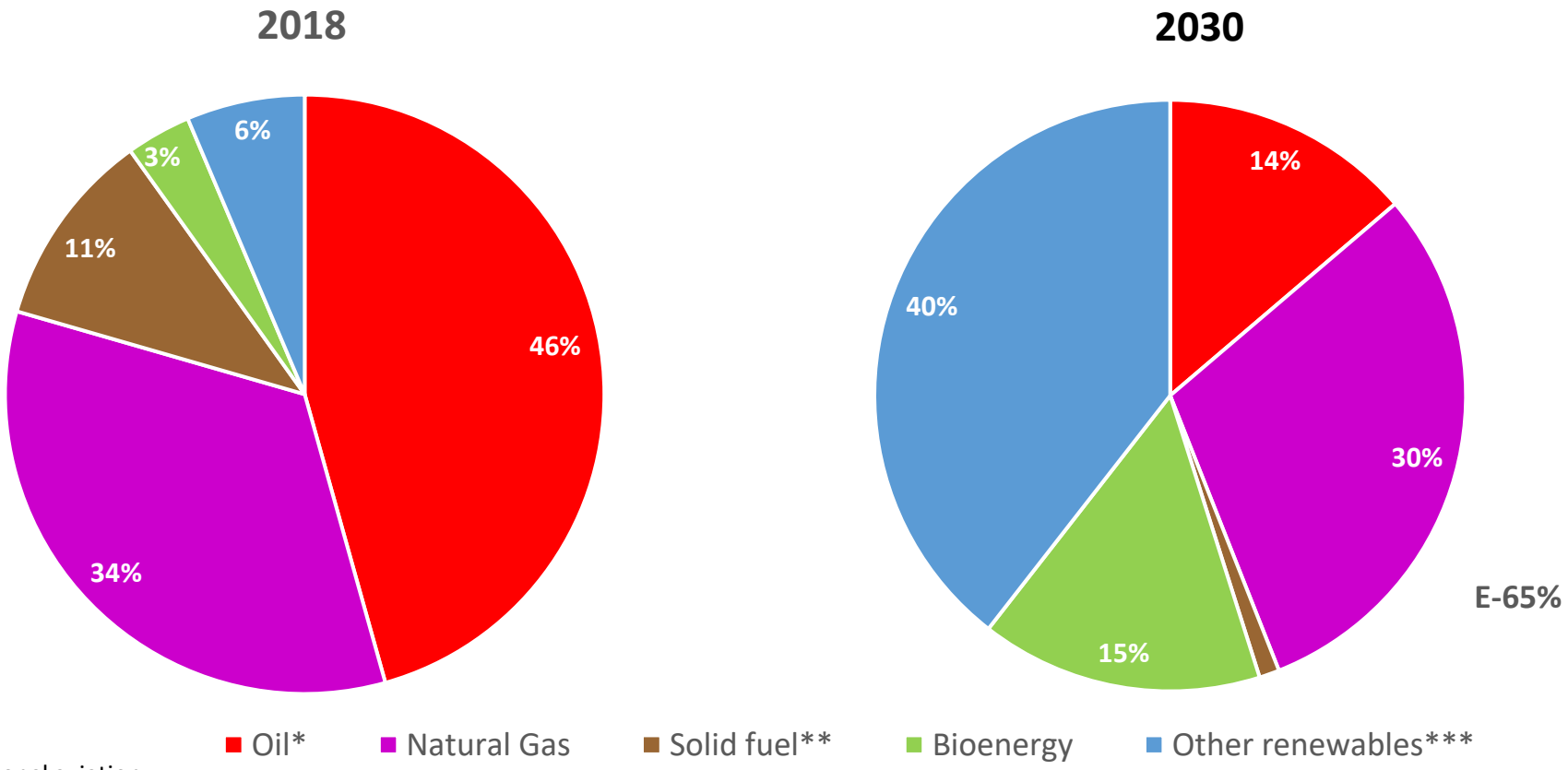


The urgency of the energy transition

- **Ireland is on track to breach legally-binding carbon budgets and international obligations**
  - An urgent course correction is necessary to get on track
- **Time, not technology, is the main barrier**
  - A measure to cut 1 tonne of GHG emissions is 7-times more effective if introduced in 2024, rather than in 2030
  - There is no need, and no time left, to wait for new technology innovations
- **No miracles necessary**
  - The vast majority of emissions savings required this decade come from renewables, electric vehicles & heat pumps.
  - These are mature, scalable and cost-effective technologies that bring wider benefits.
- **Cutting energy demand growth is necessary alongside low carbon technologies**
  - The speed at which we need to decarbonize energy means that deploying clean technologies alone is insufficient, because we are hitting real deployment limits
  - Energy-intensive growth (such as data centers, car bloat, increasing travel distances) is offsetting emissions savings from renewables.
- **Fossil fuel demand is the problem**
  - Decarbonisation planning is typically framed around clean energy targets (e.g., 80% of electricity from renewables, 1 million EVs by 2030).
  - However, carbon budgets constrain total **cumulative fossil fuel use**.
  - Climate policy should include a focus on constraining fossil fuel use – starting with the most carbon-intensive fuels.

Energy systems modelling to inform the energy transition

To meet carbon budgets, fossil fuels fall from 90% of primary energy demand in 2018 to 45-50% in 2030, and overall energy demand falls, despite growing economy & population

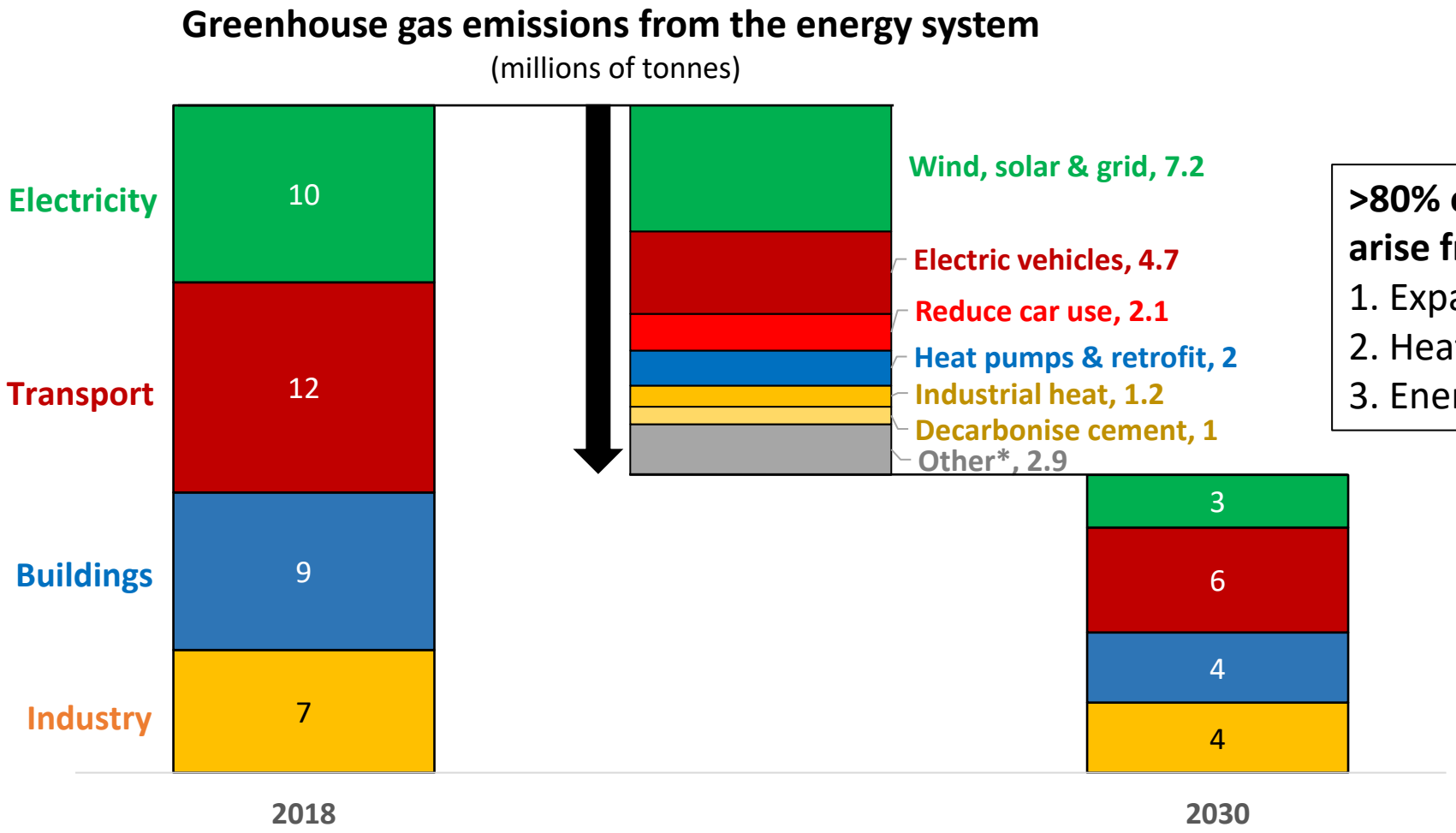


* Oil excludes kerosene for international aviation
** Coal, peat and MSW
*** Primary wind, solar, ambient heat, hydro & ocean

No miracles necessary

The vast majority of fossil fuels can be cut with solutions that already exist, are scalable, and bring wider benefits

Climate Action Plan measures to reduce GHG emissions in the energy system

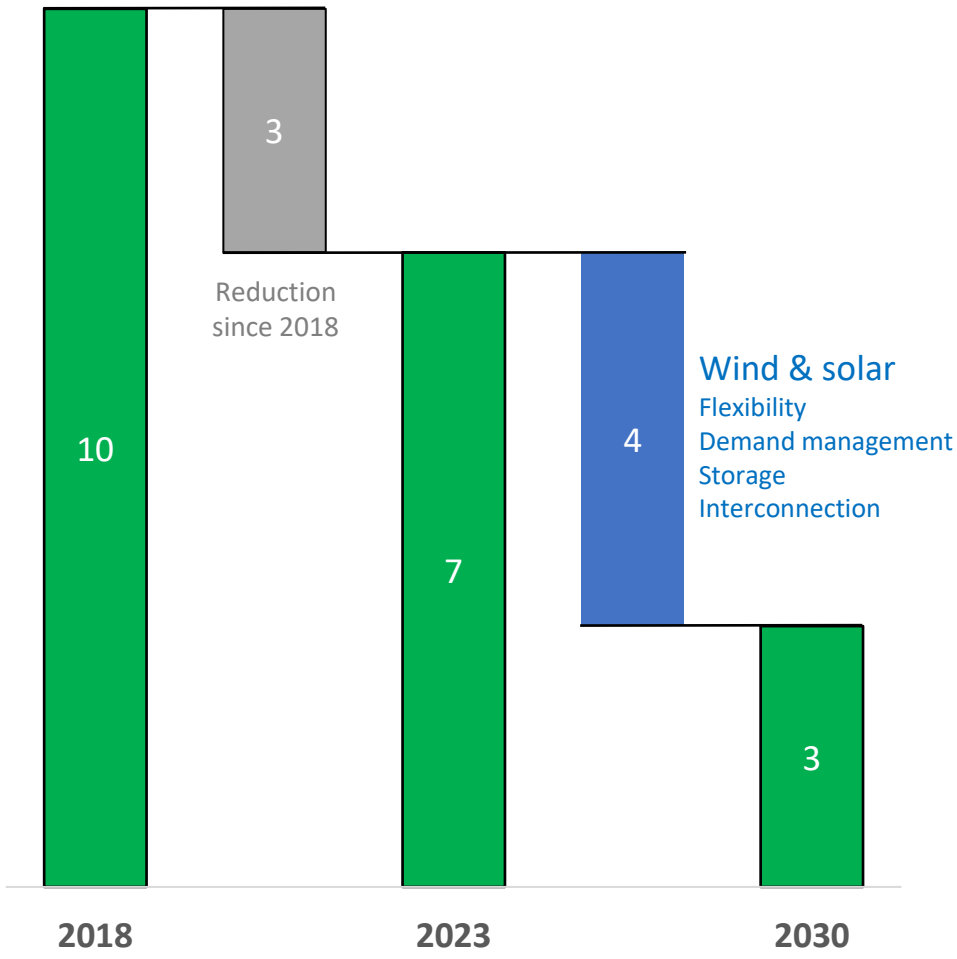


>80% of emissions reductions by 2030 arise from:

1. Expansion of wind & solar PV
2. Heat & transport electrification
3. Energy demand reduction

*Other: District heat, biogas, hydrogen, demand reduction & efficiency

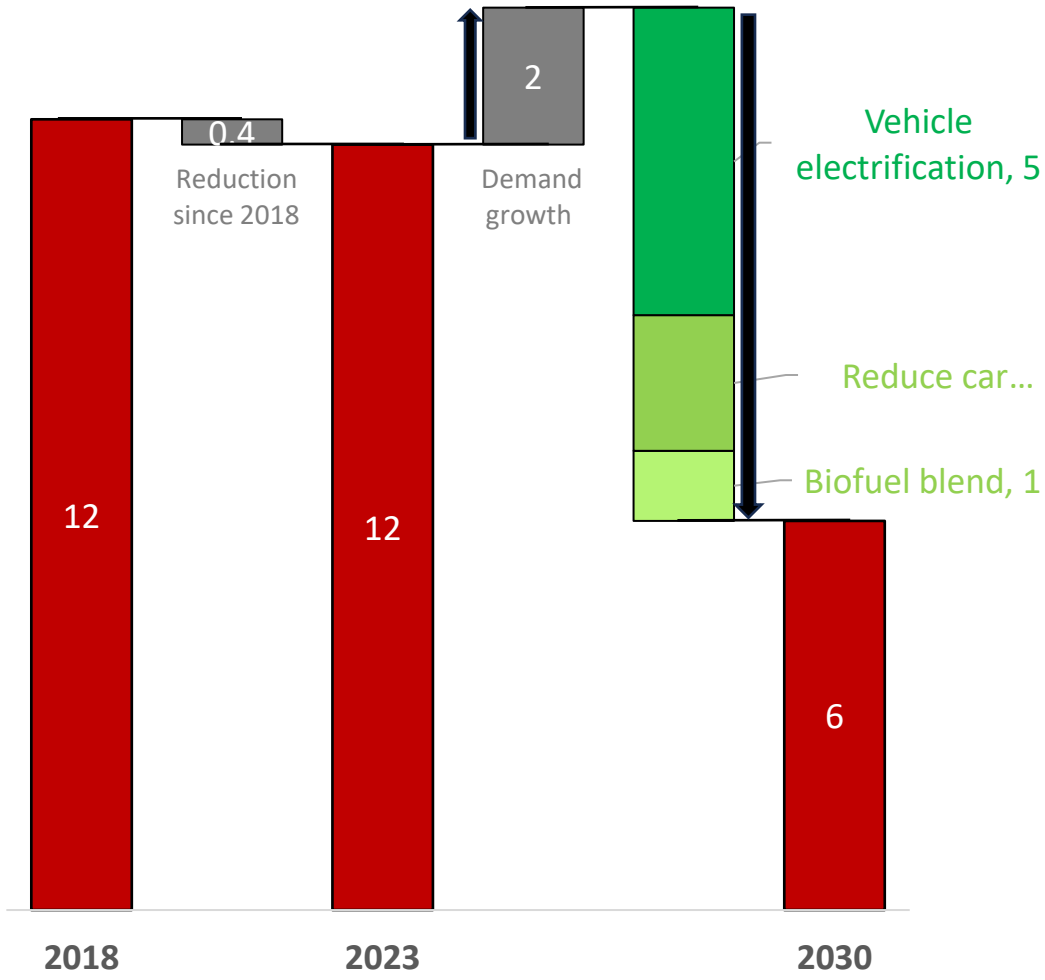
Greenhouse gas emissions from electricity generation
(million tonnes)



Decarbonising electricity is paramount

- **Onshore wind, offshore wind & solar PV (both large-scale solar farms & rooftop) must become the backbone of the energy transition**
  - Rapid and widescale building of renewables must be complemented by investment in the power grid, interconnection and energy storage, like batteries
- **Emissions fell in 2023, to the lowest level since at least 1990,** because of a fall in coal generation and significant increase in imports from the UK
  - Construction of onshore wind energy has slowed significantly since 2020, and needs to increase significantly
- **Demand growth, mainly from data centers, is outpacing supply**
- **Renewables reduce the use of gas-fired power** plants but do not replace the need to have them on stand-by, until seasonal electricity storage

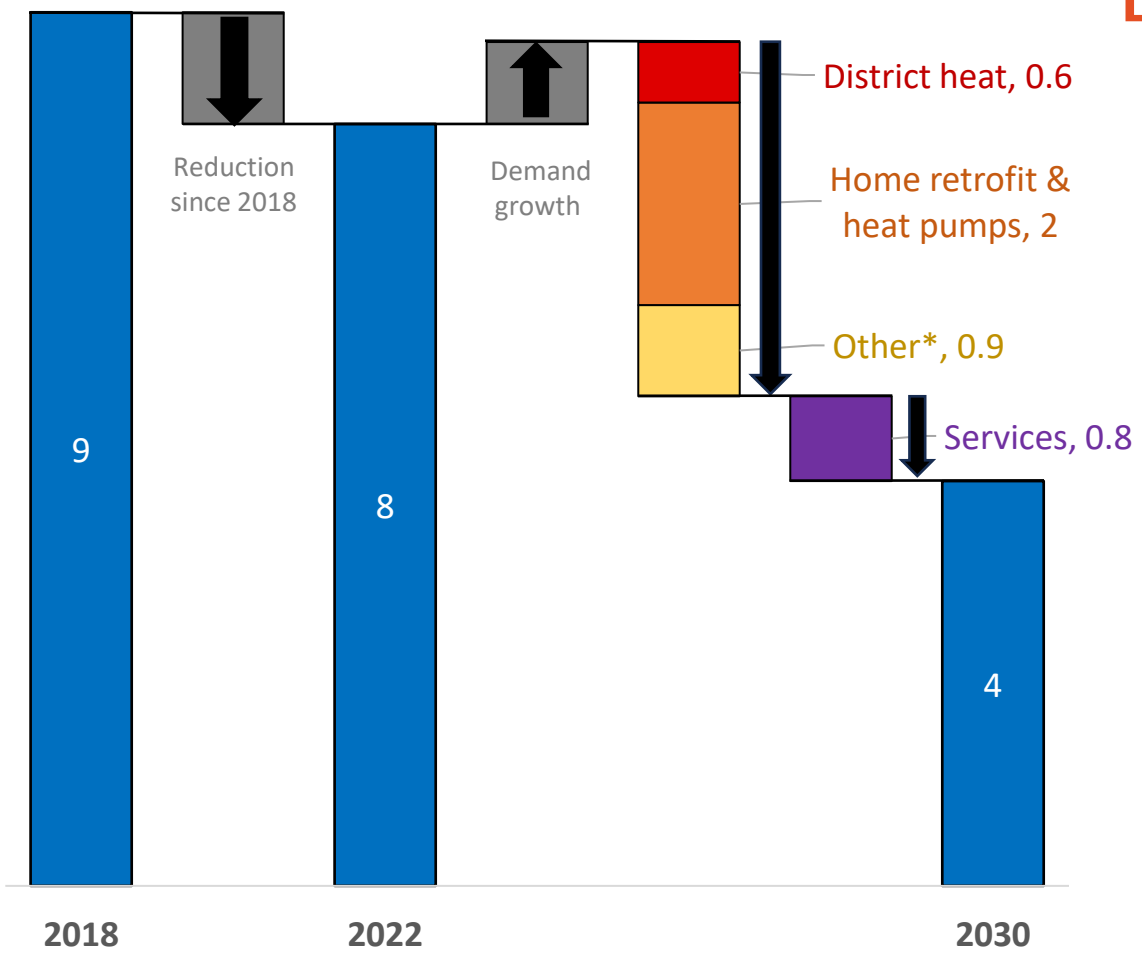
Greenhouse gas emissions from the transport sector
(million tonnes)



Electrify transport & cut car dependency

- **Electrifying private cars, vans & trucks cuts passenger transport emissions by 5 million tonnes by 2030.** To achieve this, new fossil fuel car sales should be halted as quickly as possible
- **Reducing car use cuts emissions by 2 million tonnes by:**
  - Increasing public transport
  - Walking and cycling
  - Cutting overall travel demand

Greenhouse gas emissions from the buildings sector
(million tonnes)

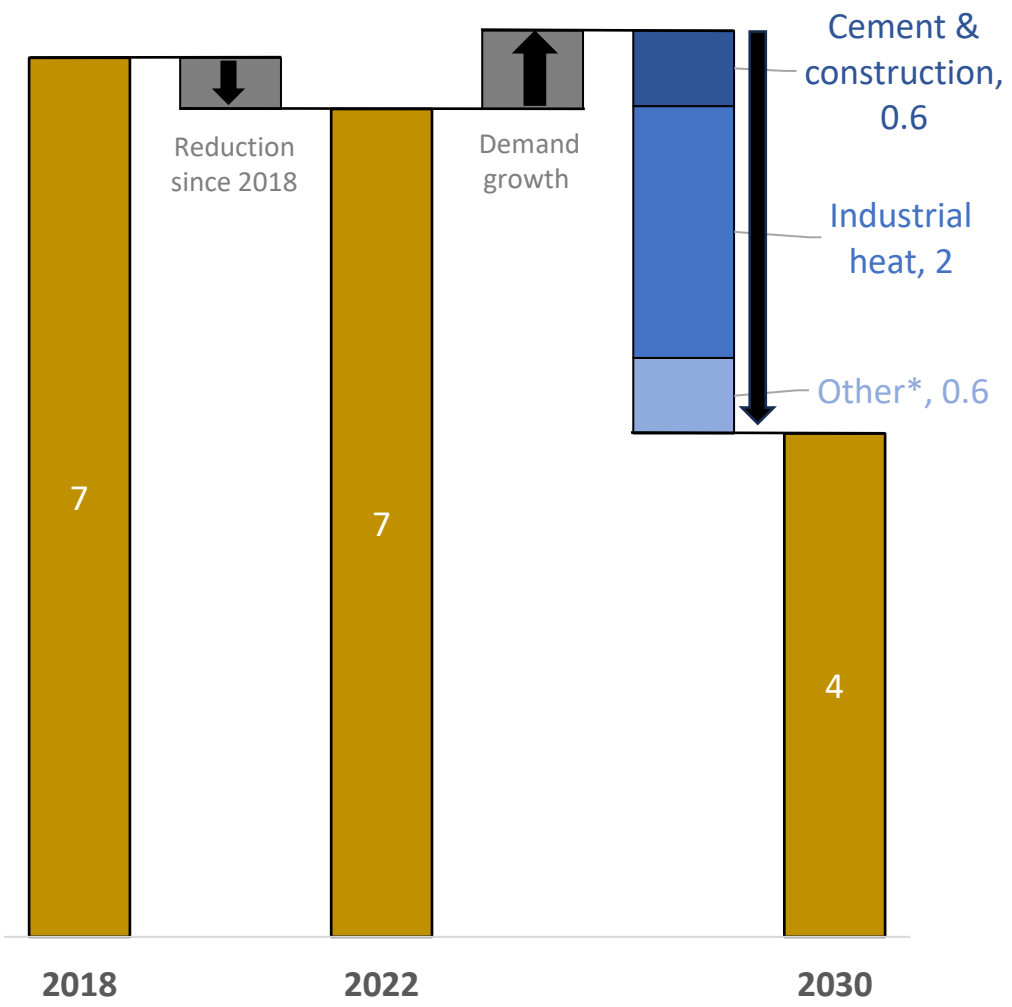


*Other: New building standards, biogas, energy efficiency

Decarbonise buildings

- **Retrofitting** – reducing heat loss in homes and installing **heat pumps** instead of boilers – is the main lever to decarbonize buildings
- **District heating** – local, centralised heat networks - can also play an important role

Greenhouse gas emissions from the industry sector
(million tonnes)



*Other: Biogas, energy efficiency

Decarbonise industry

- **Replacing fossil fuels used for industrial heat with electricity** and other zero-carbon fuels saves 2 million tonnes of GHGs by 2030

- **Cement manufacture accounts for >3 million tonnes of GHG emissions**, 57% of industrial emissions.
  - Replacing some cement in construction and changing the process of manufacturing cement can reduce its carbon intensity

- **Metals, food & beverages together account for ~2 million tonnes of GHG emissions,** mainly from using natural gas for heat.

The challenge ahead

- **Time, not technology**, is the main barrier to meeting carbon budgets
- Overall **cost** is manageable: **Deployment constraints are the main barrier**
  - High upfront cost of renewables, electrification & efficiency is largely paid back from lower fossil fuel use
  - The additional net cost of energy transition is <1% of GNI* in the period to 2050
- However, **finance** is a challenge
  - Transition from high op-ex to high cap-ex energy system
  - Most additional expenditure is required this decade; monetary and non-monetary benefits accrue later
- Therefore the **role of the State is paramount**
  - Resourcing & mandating State institutions
  - Aligning economic strategy
  - Financing; creating markets
  - Analogies – public health?

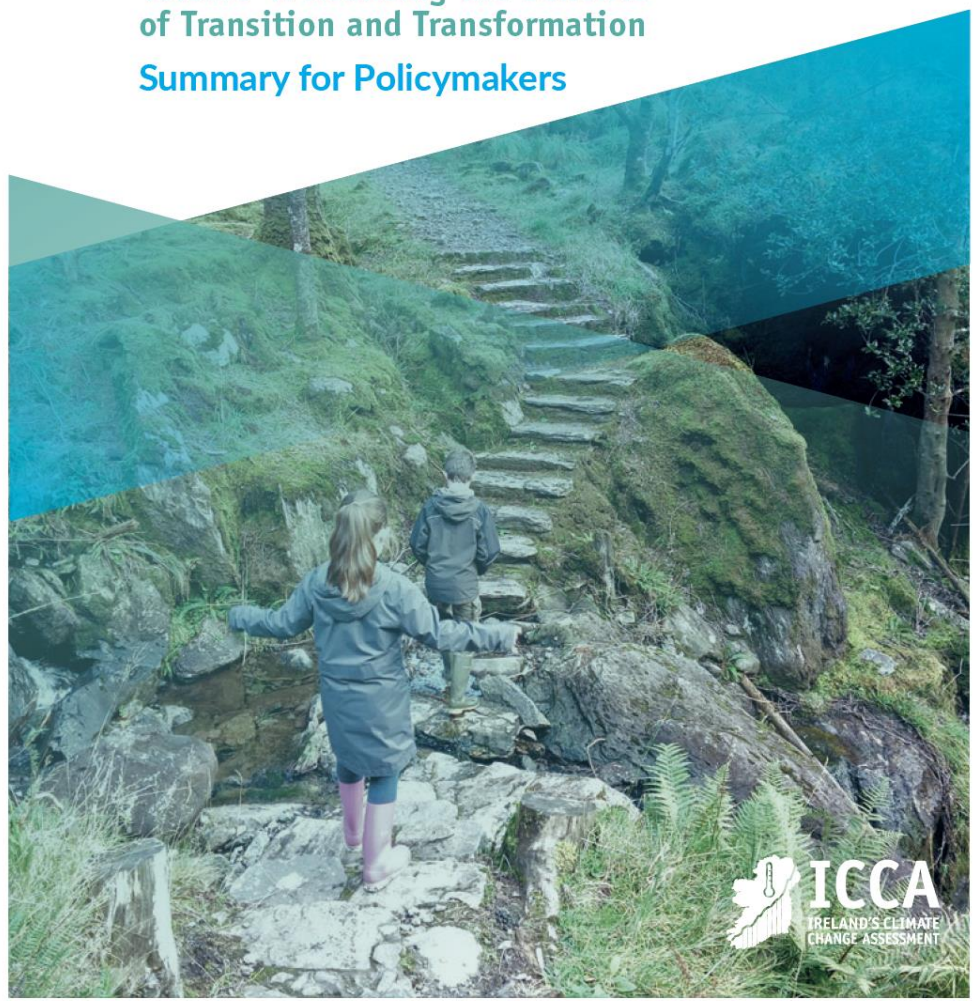
Building infrastructure & networks

Public engagement, buy-in & leadership

Setting long-term vision

Transformative change

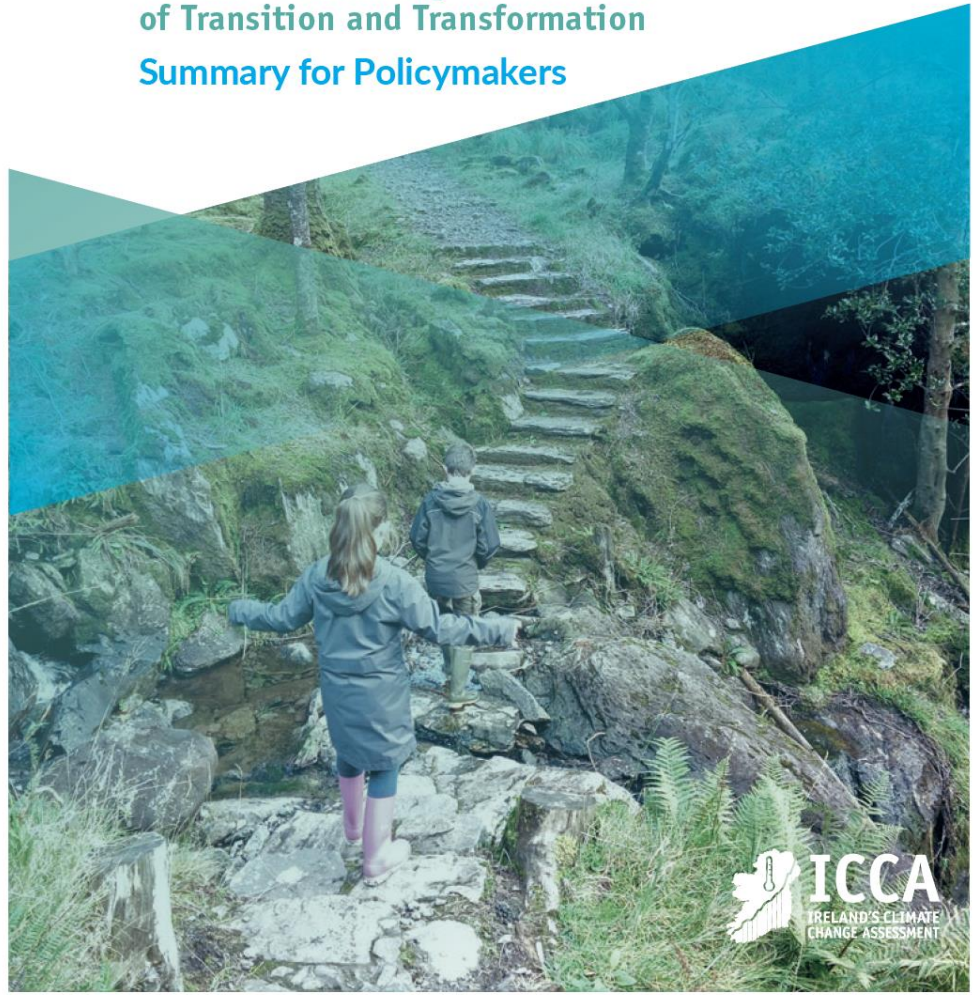
Transformative change is a fundamental, system wide reorganisation across technological, economic and social factors, including paradigms and goals, and valuing the climate, the environment, equity and wellbeing within decision making.



A transformational approach

Realising the benefits of climate action

- Taking a transformational approach offers co-benfits:
  - Human wellbeing & health
  - Equity
  - Nature
  - Prosperous livelihoods
- Reduces reliance on uncertain, unproven technologies
- Lowers the cost and (necessary) speed of technological transition

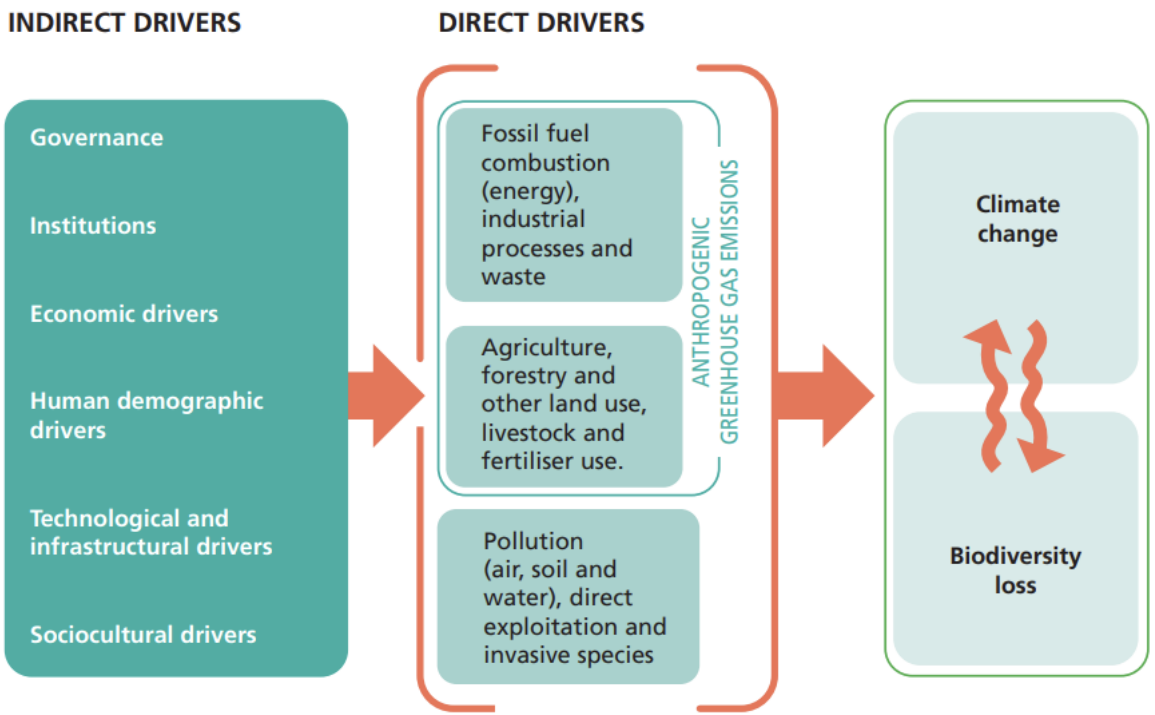


Focus on co-benefits of energy transition

- **Ending dependence on fossil fuels increases resiliency**
  - Price certainty; Affordable energy with lower price volatility: counter-inflationary: Lower vulnerability to geopolitical events and weather extremes
- **Health benefits of a clean & efficient energy system**
  - Air pollution from fossil fuels causes >1k premature deaths annually
  - Particular benefits from retrofitting homes relying on solid fuels for heat
  - Reducing polluting cars from towns and cities
- **Improving wellbeing**
  - Lower traffic
  - Increase home temperatures
- **Energy policies can address social inequalities**
  - Energy deprivation; fuel poverty; transport poverty
- **Overall cost is manageable**
  - But majority of upfront cost must be invested in the new energy system before 2030: benefits of lower fossil fuel bills (& intangible benefits) accrue after 2030

Technology switches alone will be insufficient

A change in approach is required to achieve transformation



- Address indirect drivers, which act as barriers to transformation
- Tackle climate & biodiversity loss together
- Mobilise all actors
- Re-evaluate economic paradigm
- Prioritise just transition
- An integrated, long-term vision

Just Transition

- **Winners & losers** from the energy transition
  - Emissions intensive activities & sectors will face pressure to contract or change
  - "Just Transition": ensuring fairness, especially for workers and communities who face pressures due to the energy transition.
  - This entails
    - Community engagement: involving local communities in decisionmaking
    - Ensuring benefits of renewables accrue to communities
    - Create new employment opportunities & re-training workers who may face job losses: e.g., re-training workers in peat industry to rehabilitate bogs for carbon sequestration & ecosystems
- The **wealthiest** generate far more emissions than the average person.
  - Globally, the wealthiest 10% emit as much as the poorest 50%
  - Policies can target emissions-intensive activities, e.g., frequent flyer tax, without reducing quality of life among the richest in society

Why the inertia? We have solutions that bring wider benefits

Change is hard, even if it is for the better

- Status quo bias
- Infrastructure, institutions, habits are slow to change
- Bystander effect
- Unlike war, food shortage, pandemics, there is no historical precedent
- Always be something more urgent.. Especially as climate change progresses
- Many interests vested in the status quo, that block change
- Solutions are not fair (or seen to be?) – remember Golfgate?
- Not appreciating cumulative & irreversible nature of climate change
- Scientific reticence : “fiddling while Rome is burning” (Hansen, 2023)

A note on agriculture

Why are we stuck?
What can we do about it?

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