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How can lower energy demand help Ireland achieve its climate targets?

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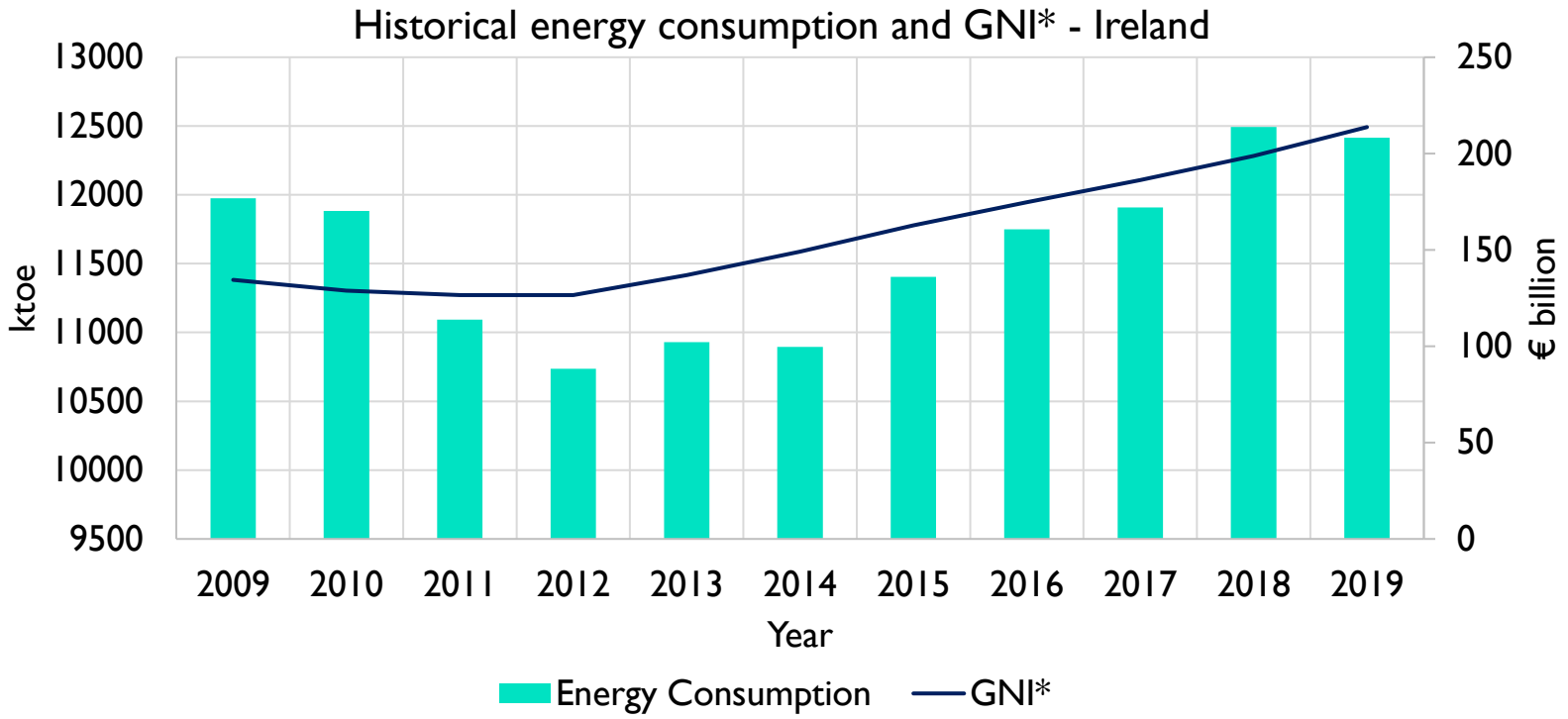
Introduction

- Energy use caused about 59% of the GHG emissions in Ireland (SEAI, 2020)
- Economic growth and energy use are strongly coupled (GNI*- Modified Gross National Income)

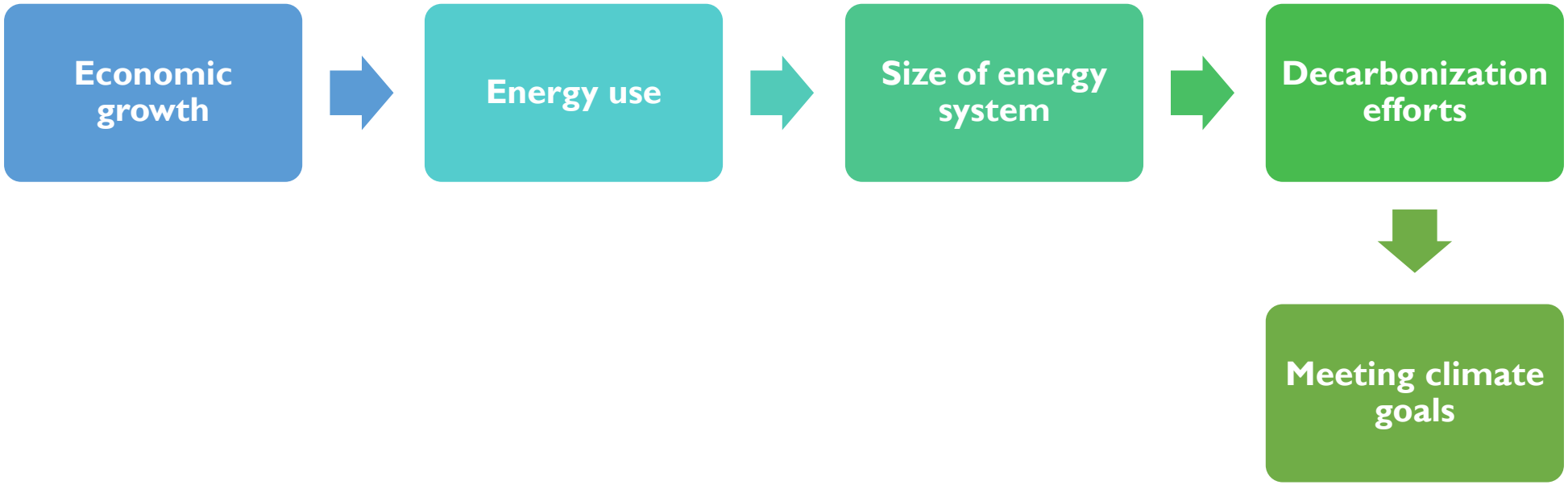


Source: Central Statistics Office, Ireland

Introduction

- If current correlation between energy use and economic growth continues, meeting climate goals will become increasingly difficult

- Hence exploring alternate energy demand growth patterns is important



Energy Systems Modelling

- Energy system models represent a simplified picture of the real energy system and the economy

- They can be useful for:
  - Compiling long-term energy and environment scenarios at national or global level
  - Assisting in the design of least-cost pathways for sustainable energy systems
  - Scientific analyses of the impact of future technologies on the energy system

- These models serve as a decision- making tool for policymakers

Introduction

- Mitigation pathways describe future emissions that keep global warming below specific temperature limits
- Current mitigation scenarios are biased towards growth and technology fixes
- IPCC's 2018 report highlights:
  - Annual Carbon dioxide emissions to reach net zero by 2050
  - Use of Carbon Dioxide Removal (CDR)
    - Risks of using CDR include:
      - adverse impacts on the ecosystem
      - feasibility in terms of cost
      - land use, availability and competition for food production
      - social acceptance and safety
- Mitigation scenarios focus on supply side
- Demand side is not well-represented in energy system models due to its complex nature

Rationale for Low Energy Demand Pathway

- Most mitigation pathways depend on novel fuels and technologies
  - Dependency can be reduced with lower energy service demands
  - Deployment of CDR and Biofuels can be limited
    - Biodiversity loss, soil degradation and adverse impacts on ecosystem can be reduced

- Efficiency improvements can have an economy-wide rebound effect
  - Buffer can be available to absorb some efficiency rebound effect if demand is reduced

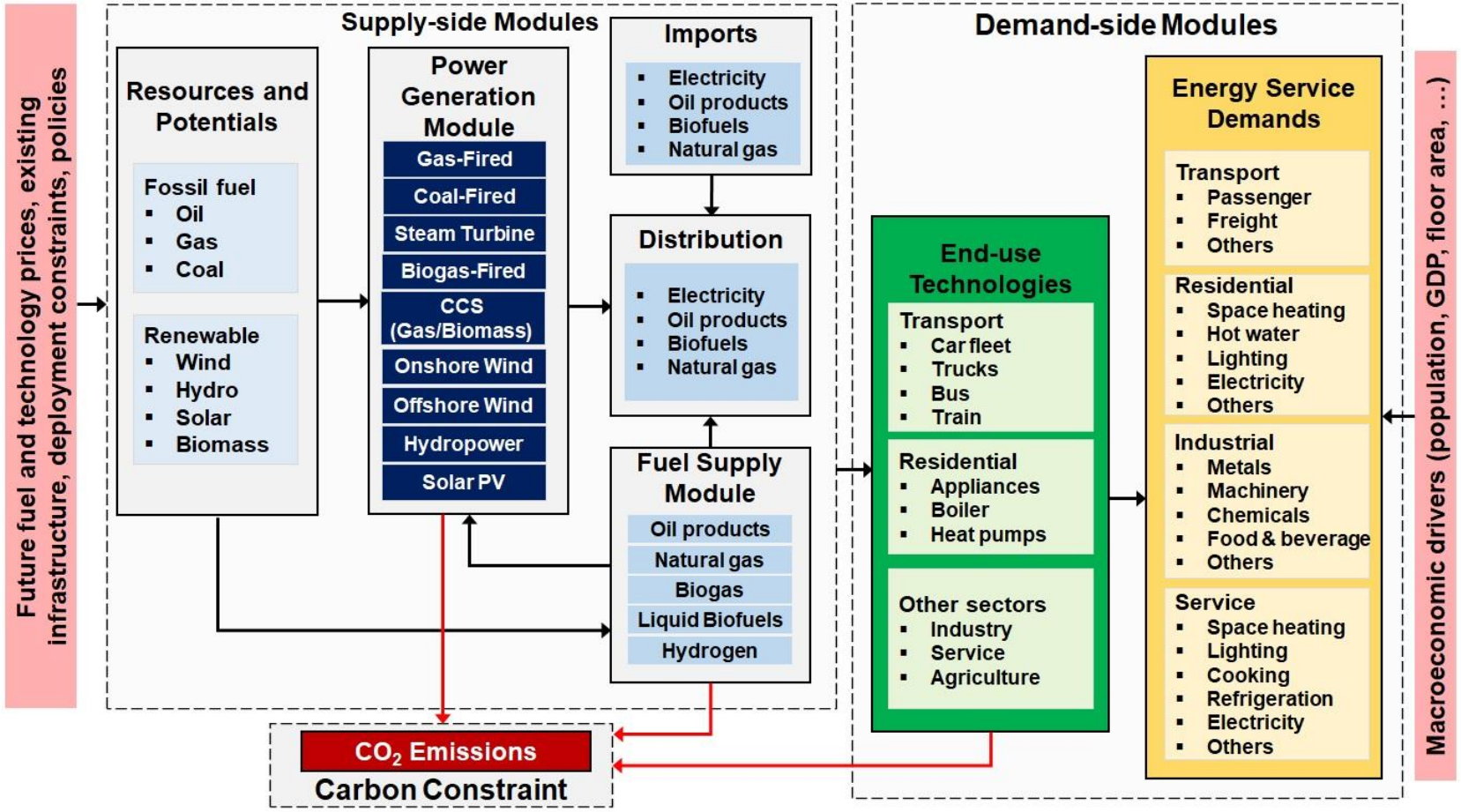
- Demand side determines the size of the entire energy system
  - Reducing energy demand services implies down sizing of entire energy system, making it easier to decarbonise supply side

Rationale for Low Energy Demand Pathway

- Ireland has significantly increased its climate mitigation ambition
  - Reduce greenhouse-gases by 51% by 2030
  - “Net-zero" target for 2050

- Ireland faces a number of challenges in meeting these objectives
  - Very high share of GHG emissions from agricultural sector
  - Transport and heating are heavily dependent on fossil fuels
  - Relatively isolated electricity grid make it very challenging to integrate high shares of renewable electricity

TIMES-Ireland Model

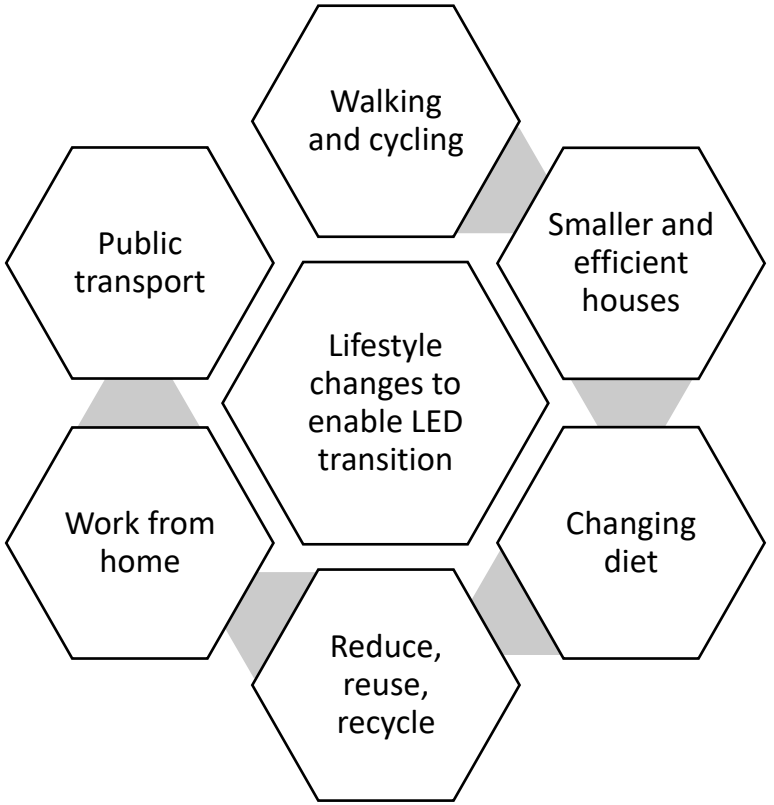


Balyk, O., Glynn, J., Aryanpur, V., Gaur, A., McGuire, J., Smith, A., ... & Daly, H. (2021). TIM: Modelling pathways to meet Ireland's long-term energy system challenges with the TIMES-Ireland Model (v1. 0). Geoscientific Model Development Discussions, 1-45.

Irish Low Energy Demand (ILED) Scenario

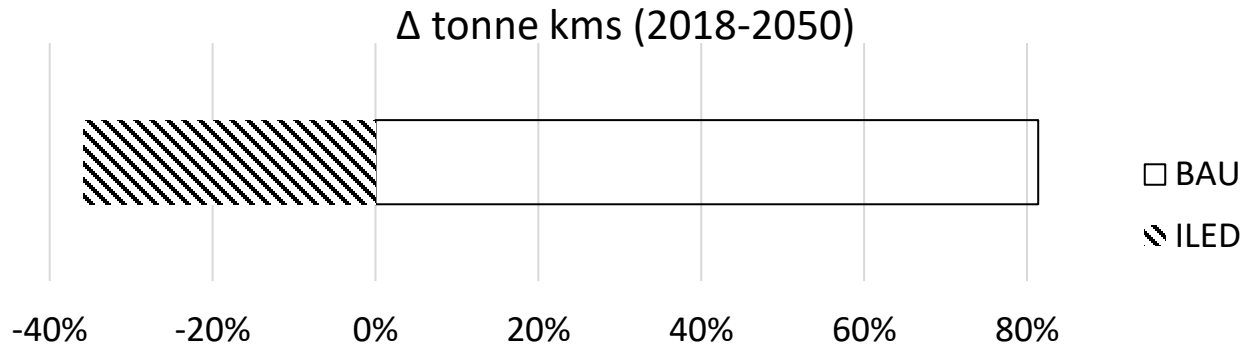
- Revolves around the idea of reducing energy consumption through
  - changes in behaviour and lifestyle
  - increasing end-use efficiency
  - denser urban development
  - economic restructuring
  - changing social infrastructure

- Proposes a reduction in energy demand without any compromise in the quality of life or end-user satisfaction

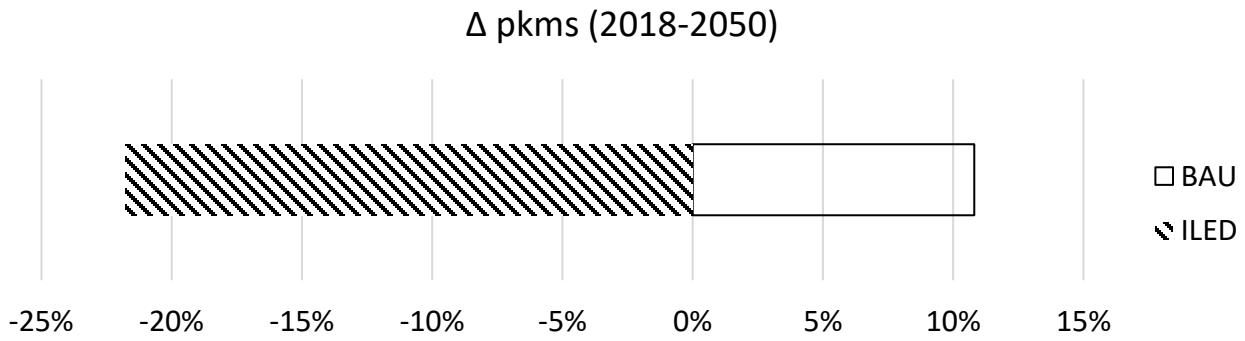


Irish Low Energy Demand (ILED) Scenario

- **Freight-** Activity level to go back to the **1995 level** by 2050
  - Better logistics
  - Efficiency improvements
  - Reviving local economy



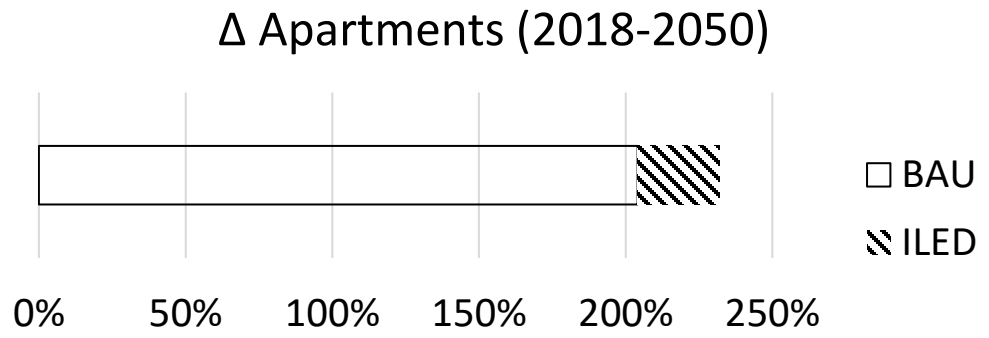
- **Passenger kilometres-** pkms/capita decrease to **12000** by 2050
  - Shorter travel distances and higher occupancy in vehicles
  - Work from home
  - Modal shift- more public transport, increase in active modes of travel (walking & cycling)

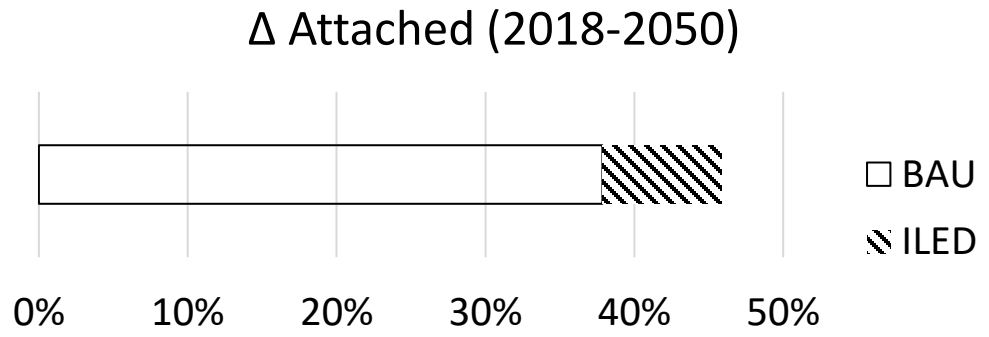


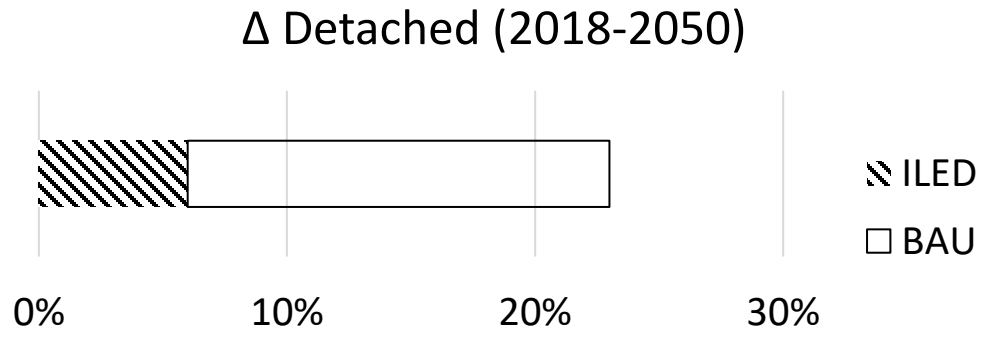
Mode	(% share) 2018	2050_ILED
Private cars	73%	52%
Motorcycles	0%	0%
Small PSVs	2%	2%
Large PSVs	14%	23%
LUAS	0%	2%
Train	3%	5%
Walking	6%	12%
Cycling	1%	4%

Irish Low Energy Demand (ILED) Scenario

- **Residential**
  - **Dwelling type**
    - More apartments and attached dwellings
    - Less detached dwellings
  - **Decrease in other energy service demands**
    - 20% decrease in space heating: 10% by lowering intl. temp by 1˚C and 10% by encouraging boiler service
    - 30% saving in water heating demand owing to shorter showers, insulating tanks etc.
    - 20% decrease in cloth and dish washing: wearing same clothes more often, using machines on full load
    - 20% reduction in electrical appliance energy use due to efficiency improvements and unplugging devices to avoid stand-by mode power consumption



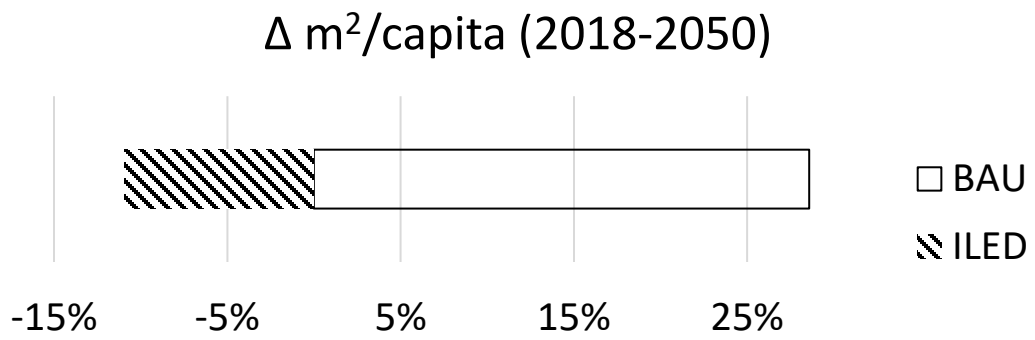




Irish Low Energy Demand (ILED) Scenario

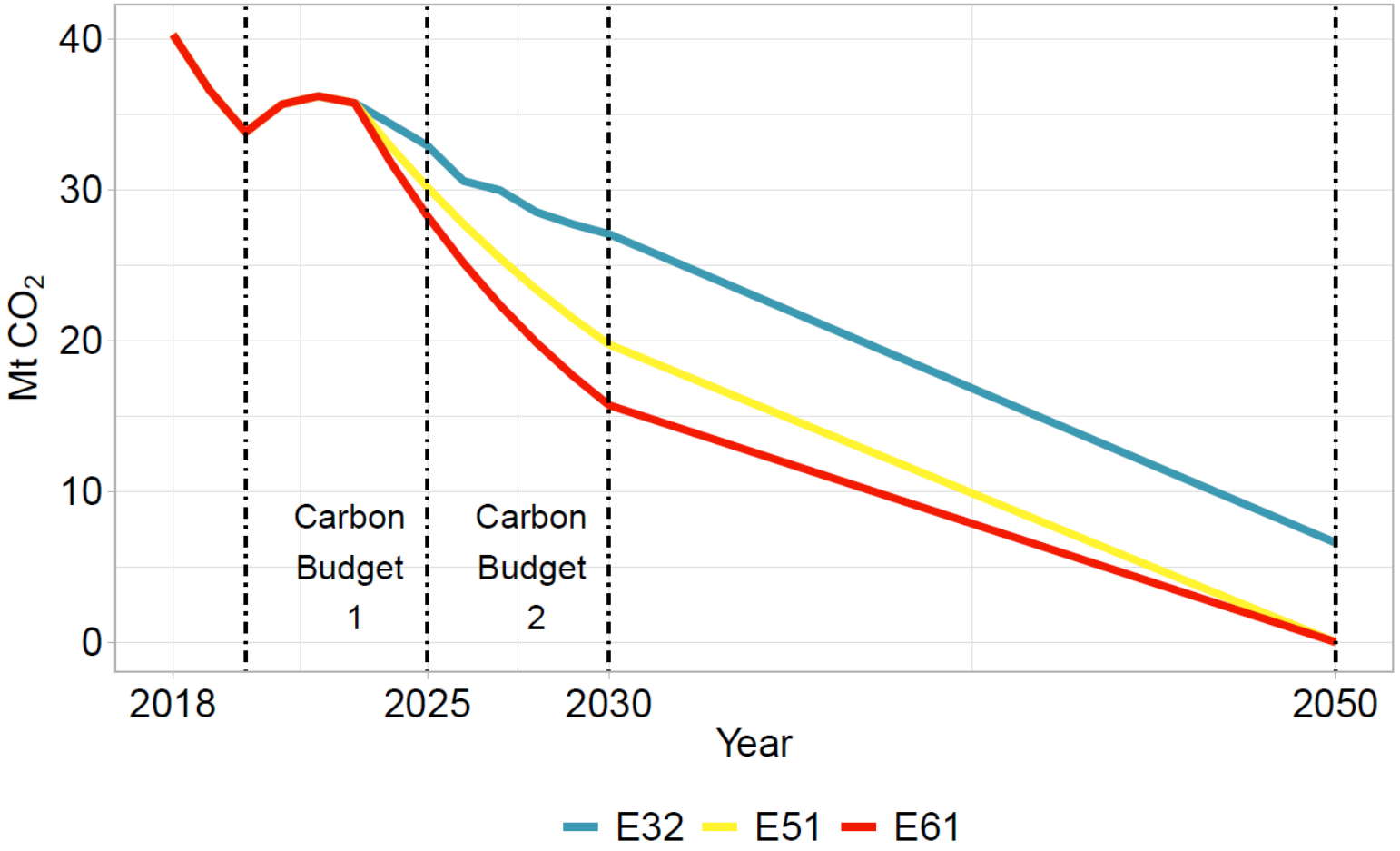
Services

- Space constraint: **Commercial** buildings-**5.3** m^2/capita; **Public** buildings-**10.7** m^2/capita
- Public lighting units are assumed to remain constant at 2040 level



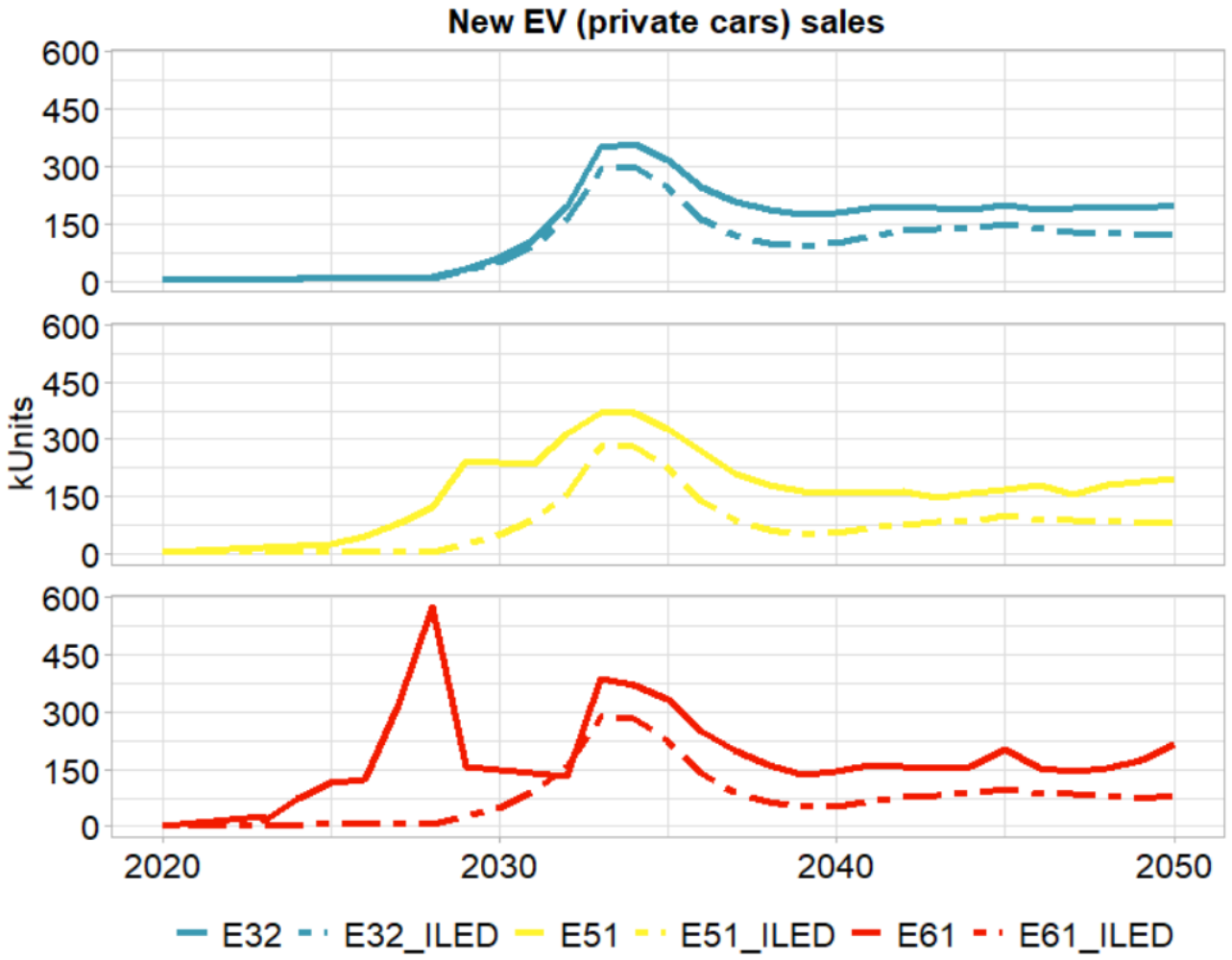
Further information on the ILED scenario: Gaur, A., Balyk, O., Glynn, J., Curtis, J., & Daly, H. (2022). Low energy demand scenario for feasible deep decarbonisation: Whole energy systems modelling for Ireland. *Renewable and Sustainable Energy Transition*, 100024.

Mitigation Pathways



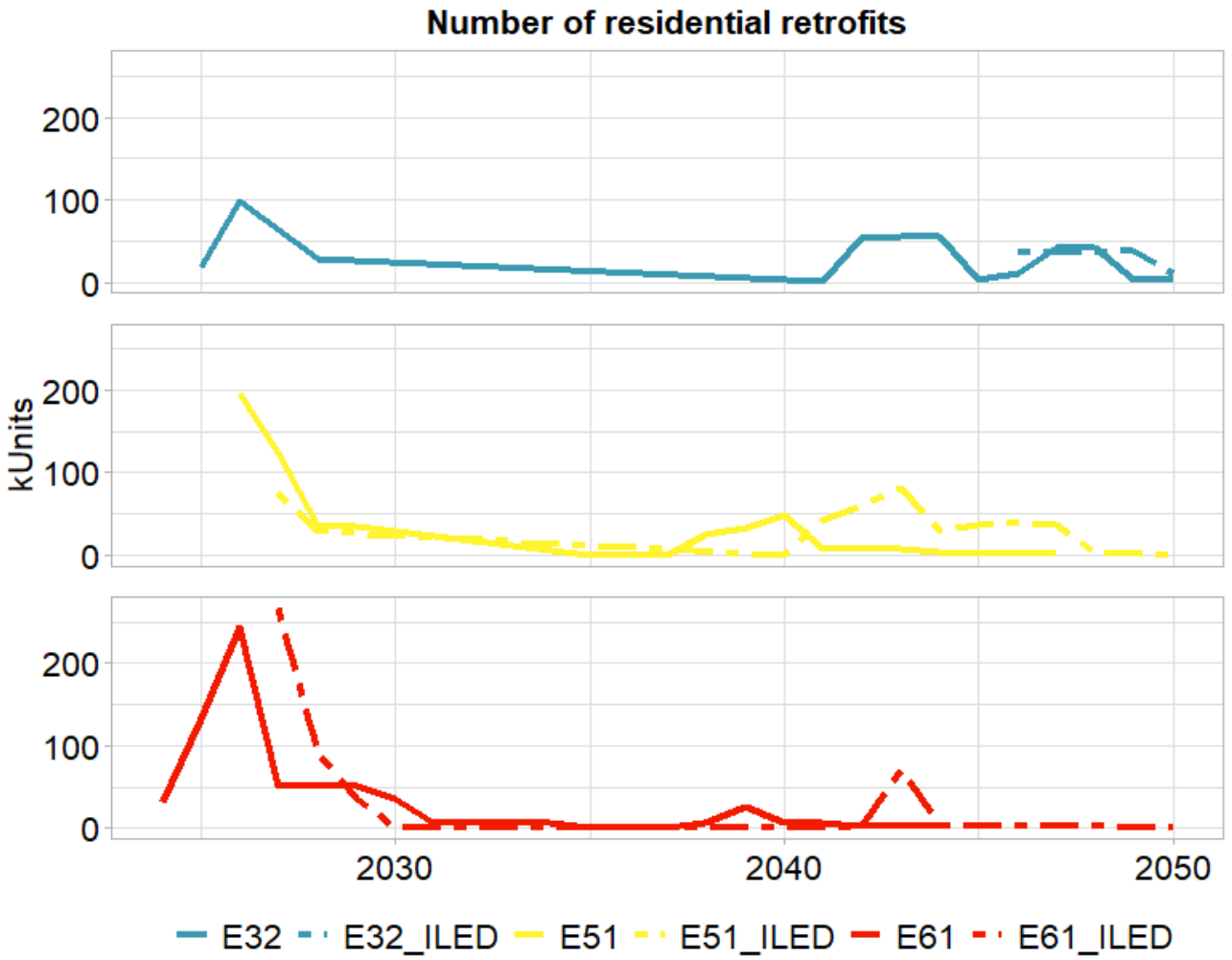
- **E32**- 32% reduction in CO2 emissions from 2018 level (Climate Action Plan 2019 consistent pathway)
- **E51**- 51% reduction in CO2 emissions from 2018 level (CAP 2021 consistent)
- **E61**-61% reduction in CO2 emissions from 2018 level (CAP 2021 consistent)

Results- Transport



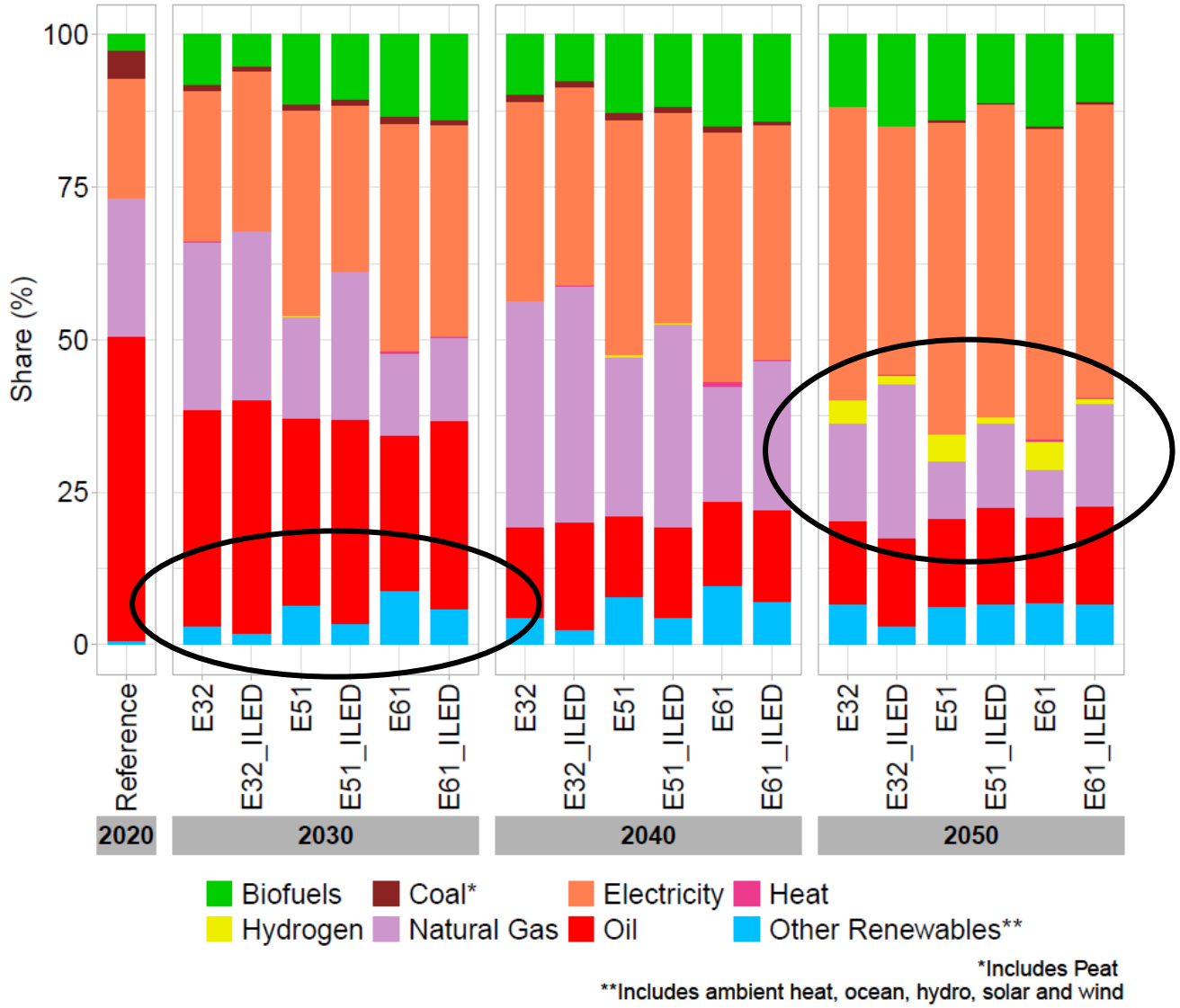
- EV sales in 2021 (October)- 8,000
- E51- Avg. EV sales per year till 2030 is 49,000
- E61- Avg. EV sales per year till 2030 is 130,000
- In ILED pathways avg. EV sales per year is 8700

Results- Residential



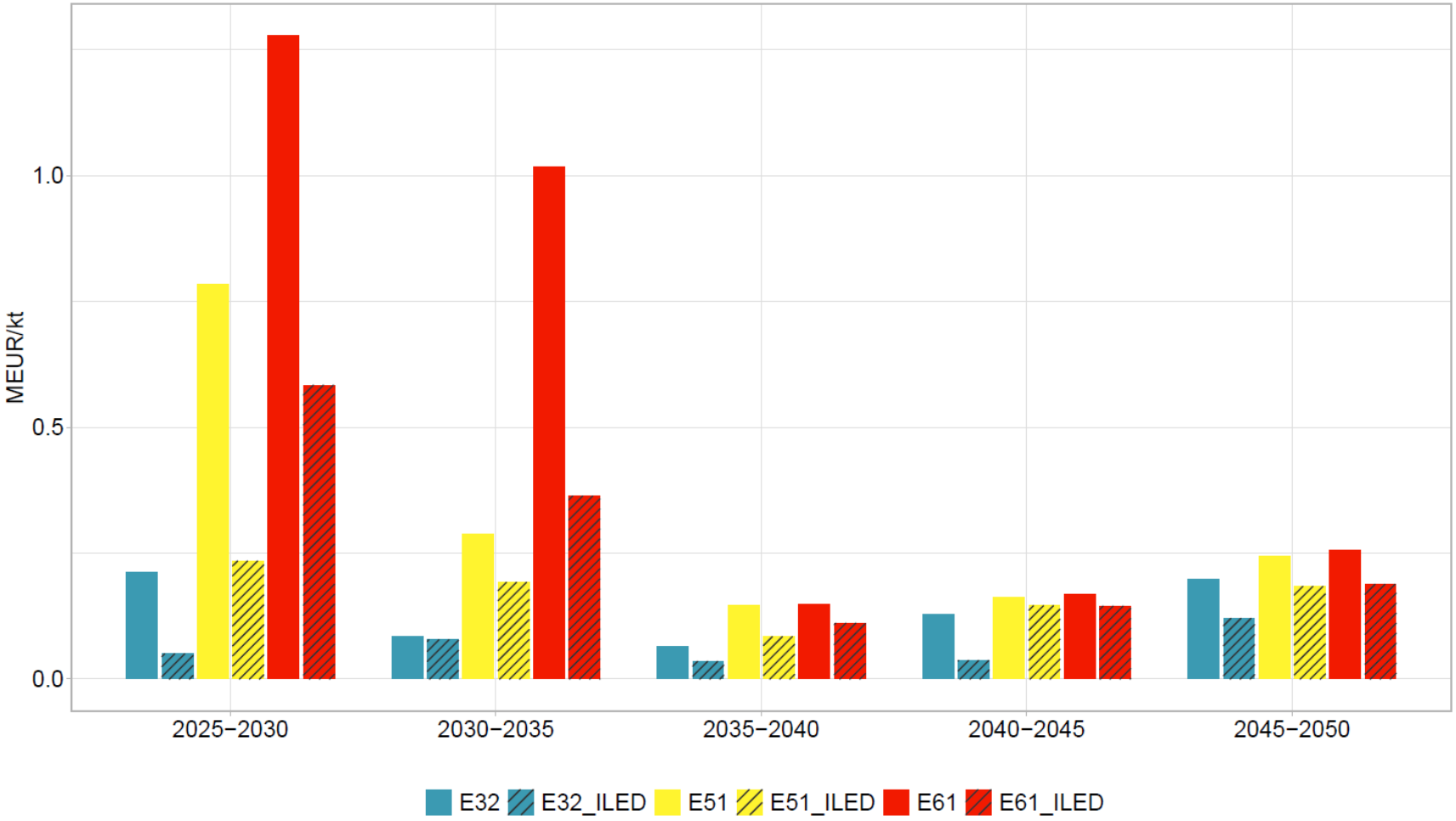
- 0.5 million dwellings to be retrofitted by 2030 (Irish Government target)
- E51- Avg. retrofits per year till 2030 is 39,000
- E61- Avg. retrofits per year till 2030 is 60,000
- E51_ILED- Avg. retrofits per year till 2030 is 10,000
- E61_ILED- Avg. retrofits per year till 2030 is 39,000

Results- Fuel Mix



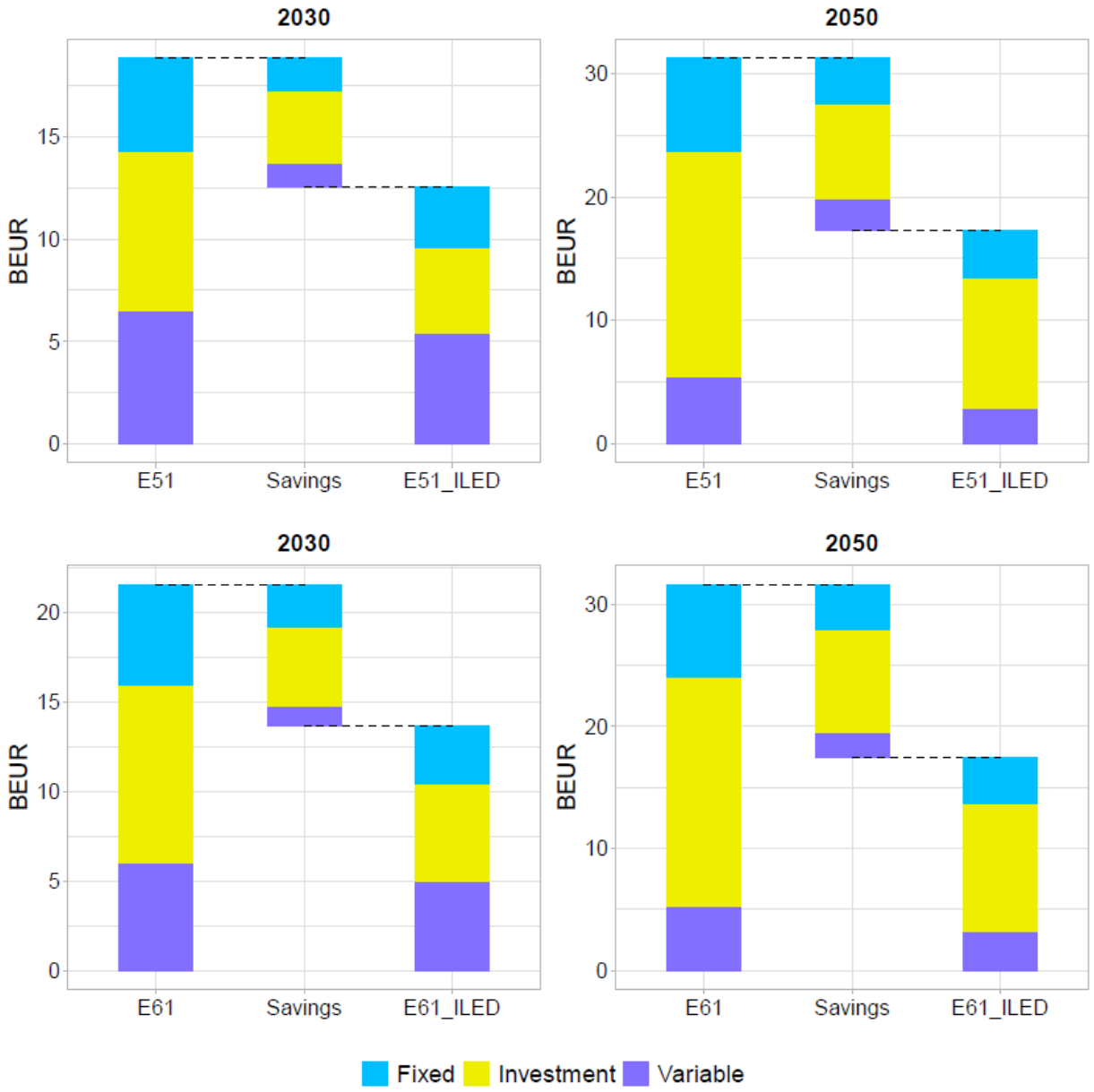
- Change in fuel supply lower in ILED pathways in 2030- fossils still present
- By 2050
  - ILED pathways foresee much lower hydrogen-novel fuel
  - Natural gas higher in ILED pathways

Results- Marginal abatement Cost



- Cost of mitigating the most expensive tonne of CO_2 in the energy system
- ILED pathways bring down the MAC considerably, particularly in the near-term

Results- Energy System Costs



- ILED pathways reduce the total system costs, bringing down the costs of transforming the energy sector
- They follow a low investment trajectory to deliver the energy needs and meet climate goals

Conclusion

- ILED pathway is valuable to meet the near-term targets, where technology alone cannot bring about the necessary reductions in CO_2 emissions
- ILED pathway reduces dependency on capital-intensive fuels and technologies, and also reduces overall system costs and the size of the energy system
- Societal benefits of ILED pathway includes less congestion, more compact and “liveable” cities and towns, health benefits, and a better standard of living from active travel and more comfortable homes

Caveats

- ILED pathways are only achievable through active policy designs
- Energy service demand reduction has not been on the government's agenda while formulating climate mitigation policies
- To bring about changes in behaviour, changes in the system are needed- smart investments, urban planning

Thank you

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