# Deep decarbonisation of buildings energy services through demand and supply transformations, in a 1.5°C scenario

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# Four strategies to decarbonise buildings energy demand

$$CO_2 = UE \times \frac{FE}{UE} \times \frac{CO_2}{FE}$$

**Reducing emission content of energy**

$$\frac{CO_2}{FE} = \sum_{ec} sh_{ec} \left(\frac{CO_2}{FE}\right)_{ec}$$

**1** Reduce useful energy demand

**2** Improve the conversion efficiency

**Reducing energy demand**

**3** Switch to low-carbon energy carriers

**4** Decarbonise the energy supply

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# The IAM REMIND represents the macro-economy and the energy system

## Macro-economic Module
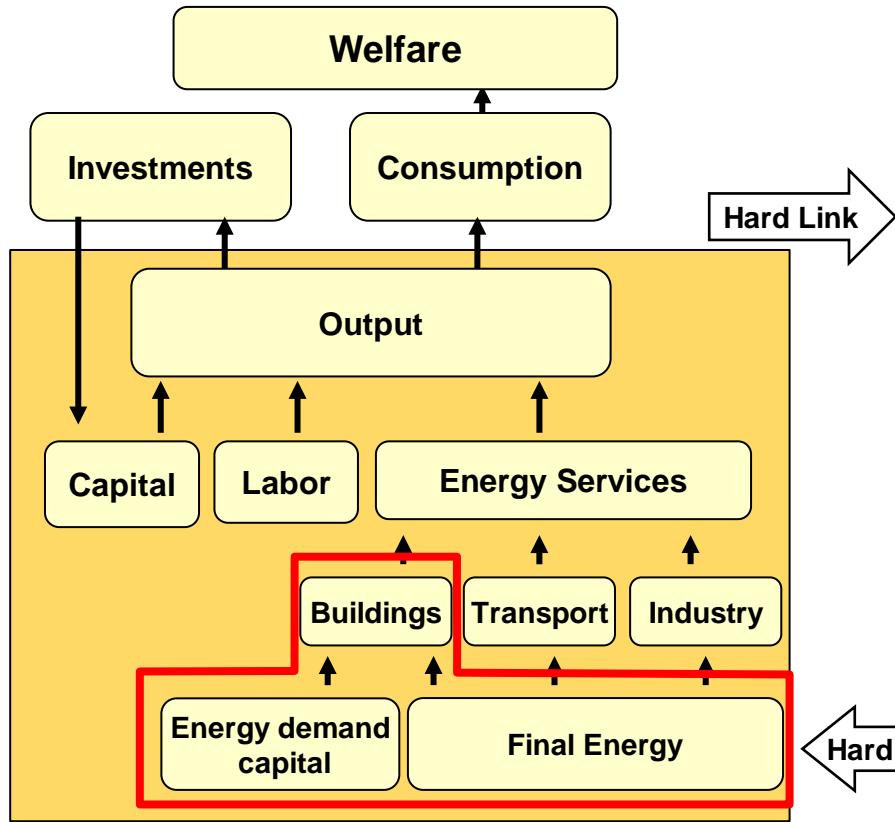
## Energy System Module
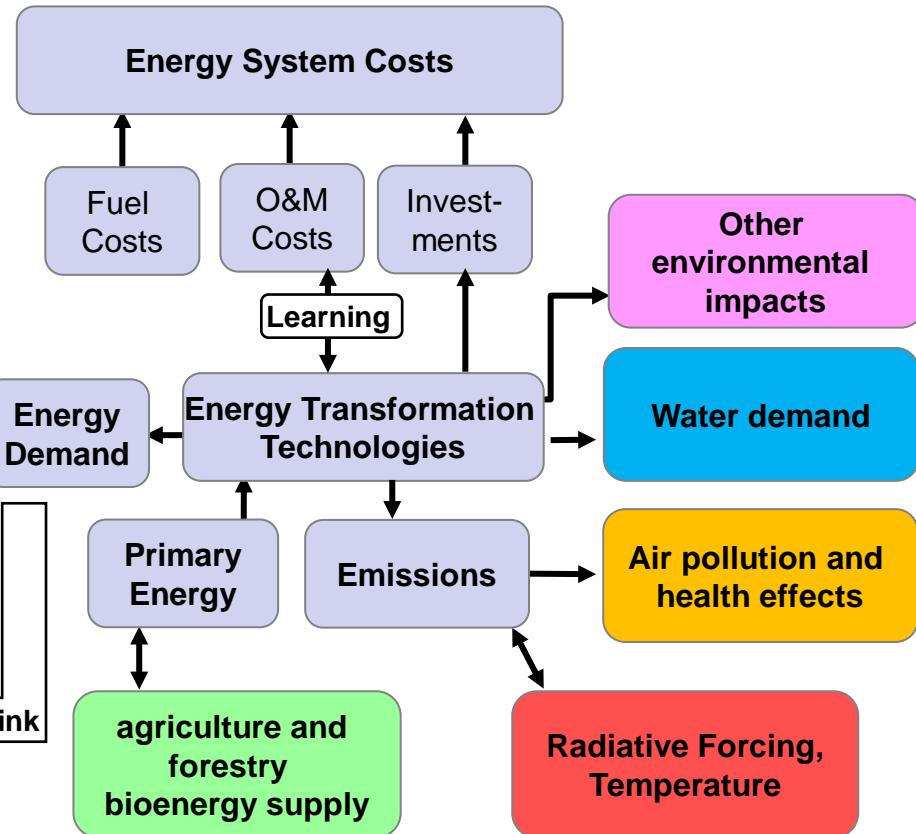


Antoine Levesque

# The decarbonisation of buildings combines two types of policies

|  |  | Efficiency Policy | |
|---|---|---|---|
|  |  | None | Alleviate market failures |
| **Climate Policy** | None | Baseline | EG – Efficiency Gap |
|  | Carbon price | 1.5°C | 1.5°C-EG |

# Energy demand reductions

# Energy demand falls by 31% if all policies are implemented
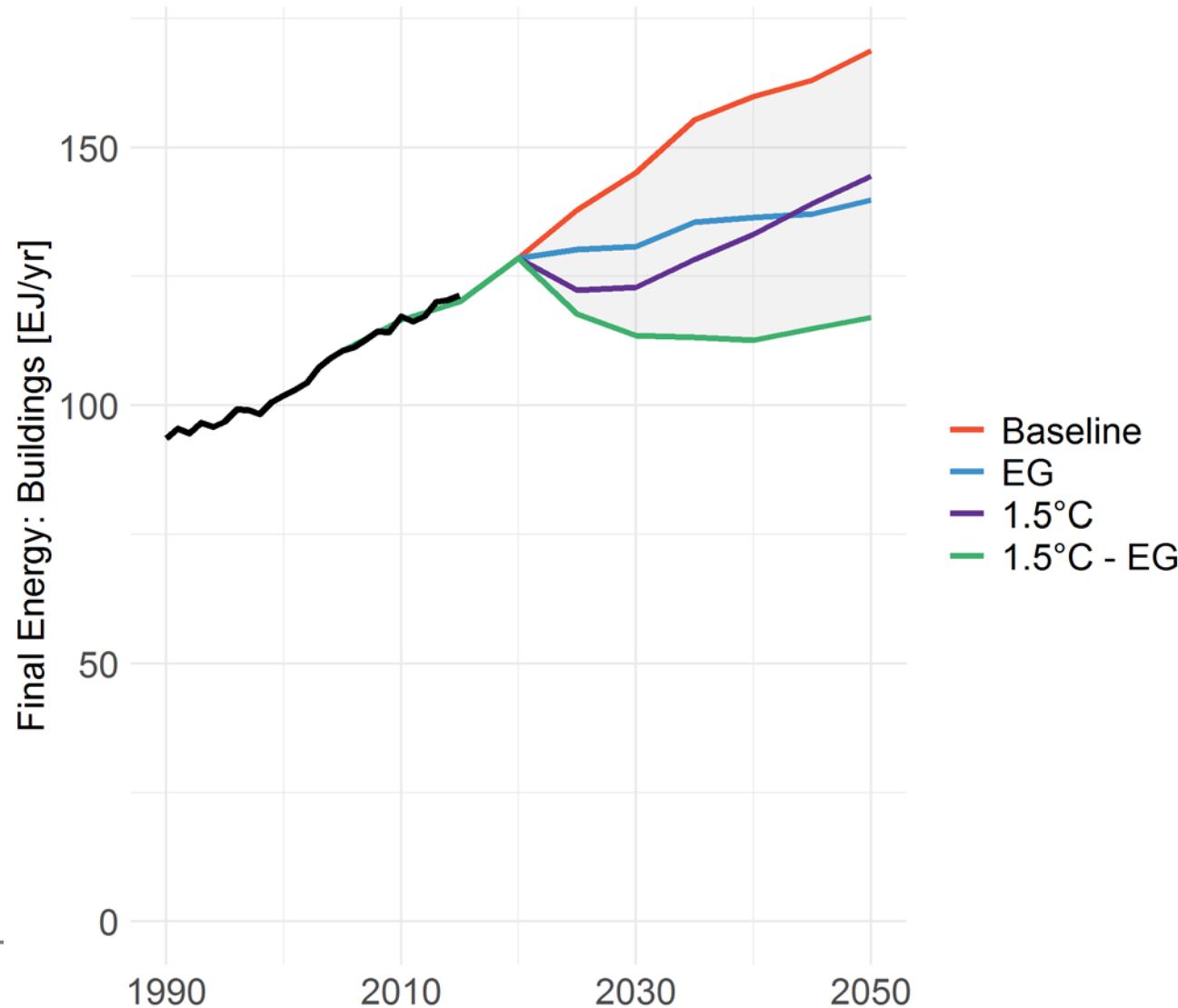
# Decarbonisation of buildings energy demand through demand and supply

# Attributing changes in emissions to the four strategies

$$CO_2 = UE \times \frac{FE}{UE} \times \left( \sum_{ec} sh_{ec} \left( \frac{CO_2}{FE} \right)_{ec} \right)$$

$$\Delta CO_2 = ue_{eff} + conv_{eff} + fs_{eff} + sd_{eff}$$

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# Reducing the carbon content is essential for decarbonising buildings



1.5°C - EG

Mt CO2/yr

- Useful Energy
- Conversion efficiency
- Electrification & fuel switch
- Supply decarbonisation

-5%
-13%
-7%
-91%
-67%

Baseline

2050
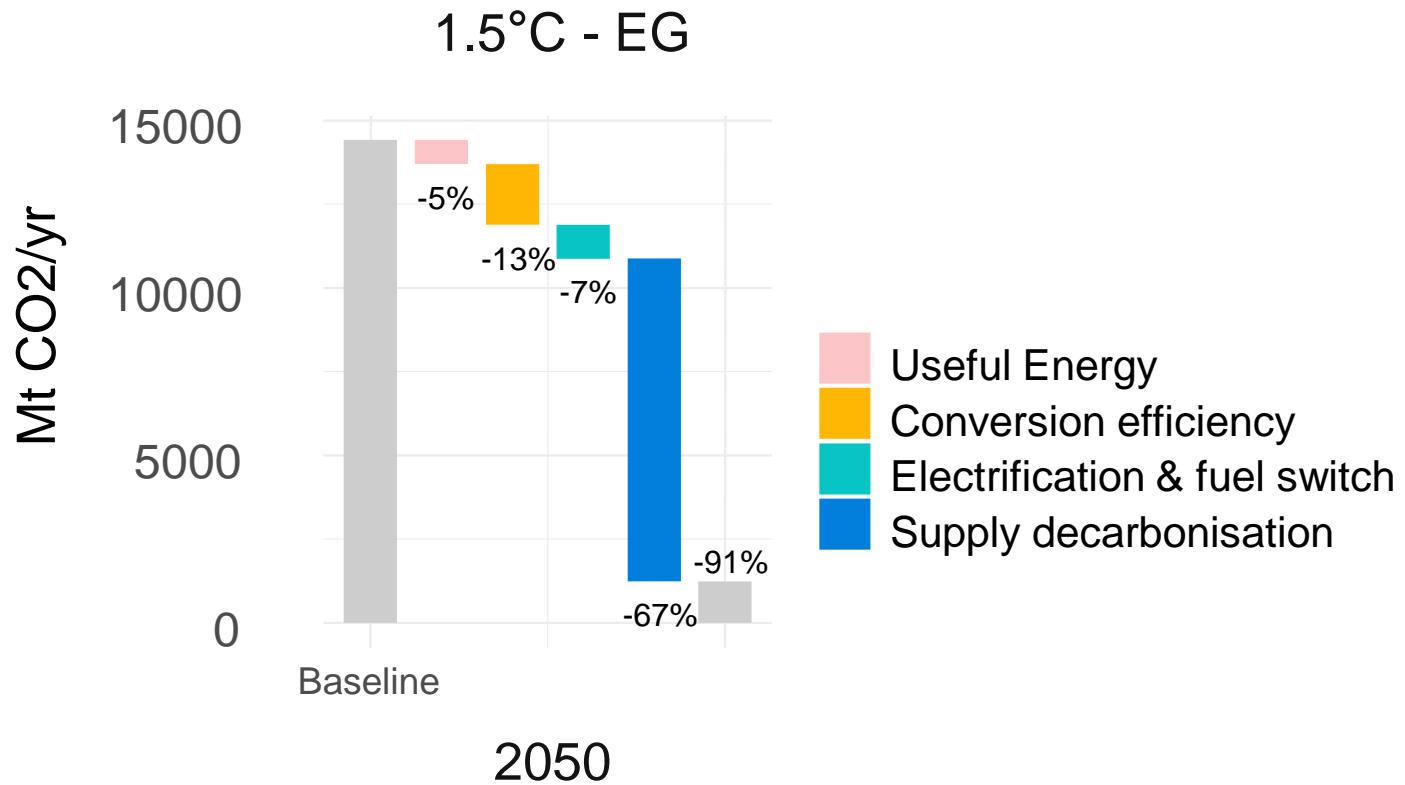
81% attributed to reductions in the carbon content of energy

# Reductions in the amount of CO2 per unit of energy is the strongest

$$CO_2 = UE \times \frac{FE}{UE} \times \frac{CO_2}{FE}$$
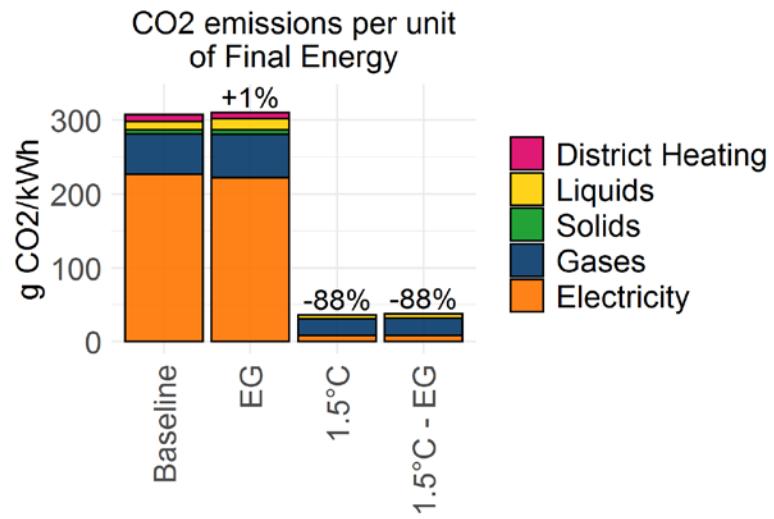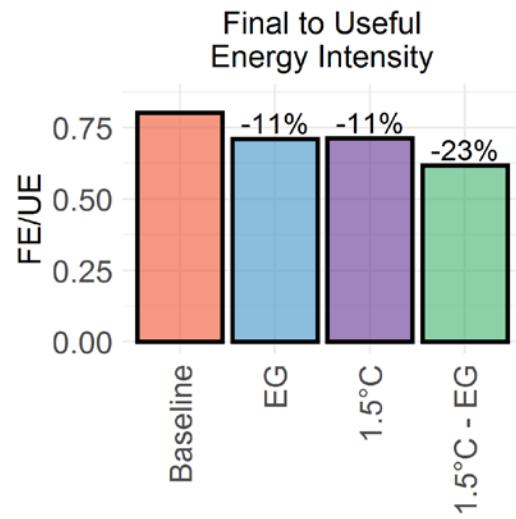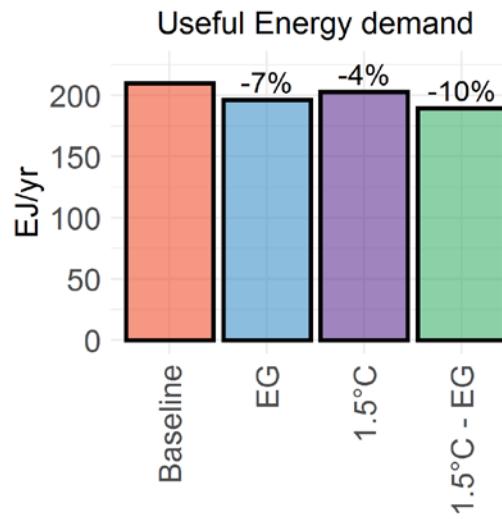
# Conclusions

The decarbonisation of the supply and fuel switching account for the bulk of buildings' decarbonisation

Fuel switching has a larger leverage than energy efficiency to decrease emissions (if supply is carbon poor)

Efficiency remains important as it is partly cost-effective and relieves pressure to decarbonise supply

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# Further work

Economic challenges for district heating:

- Expansion of the district heating share

- Decarbonisation of the sector

- Avoiding monopoly prices

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