Modelling the EU LTS - Insights for urban development and citizens

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What? How? Why?

What has been modelled for the "A Clean Planet for All" exercise?

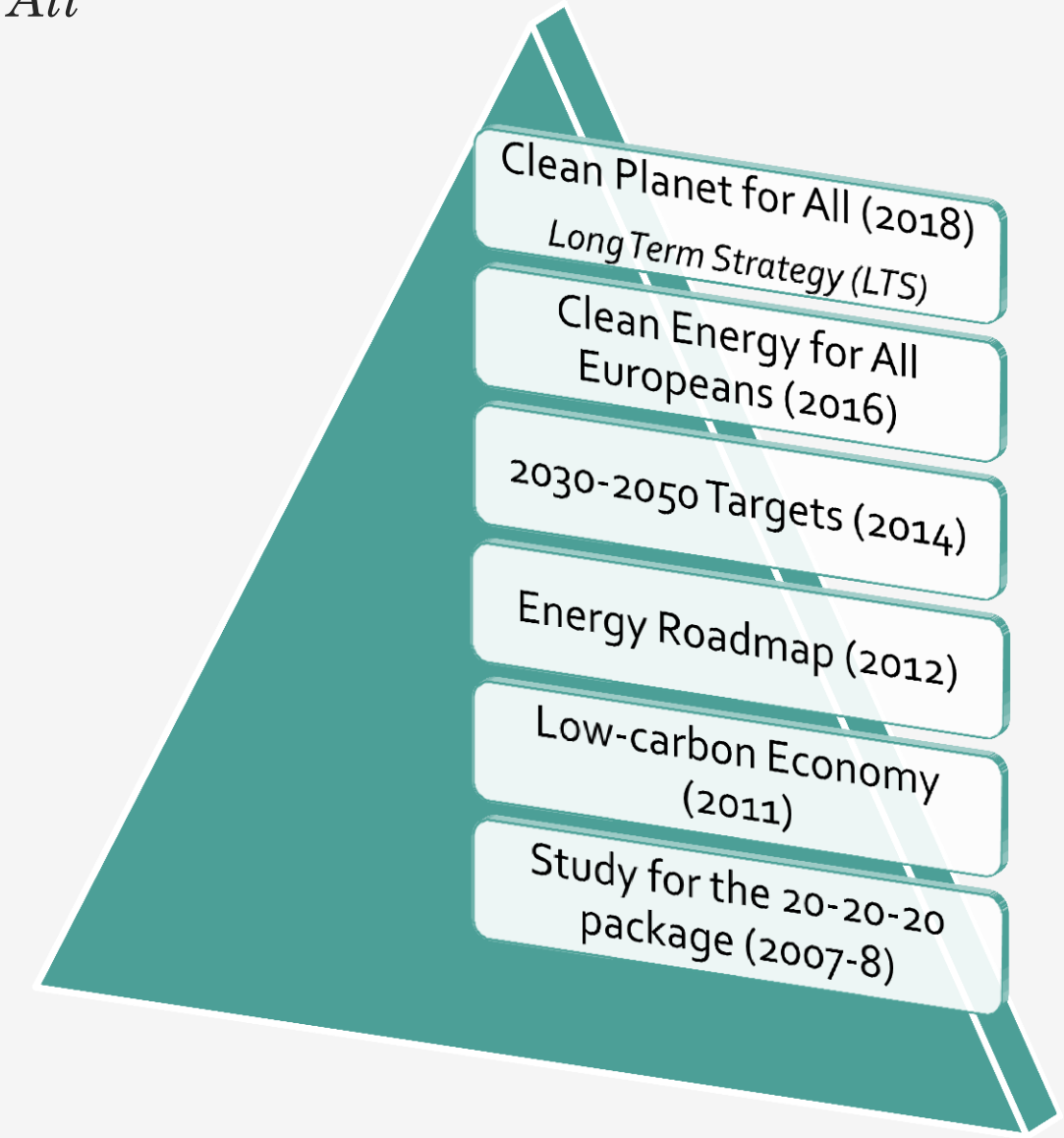
- Long term decarbonisation scenarios:
  - ✓ 2°c scenarios (-80% GHG in 2050 wrt 1990)
  - ✓ 1.5°c scenarios (climate neutral, ~-95% GHG in 2050 wrt 1990)
- All scenarios respect the 2030 energy and climate targets

How has the LTS been modelled?

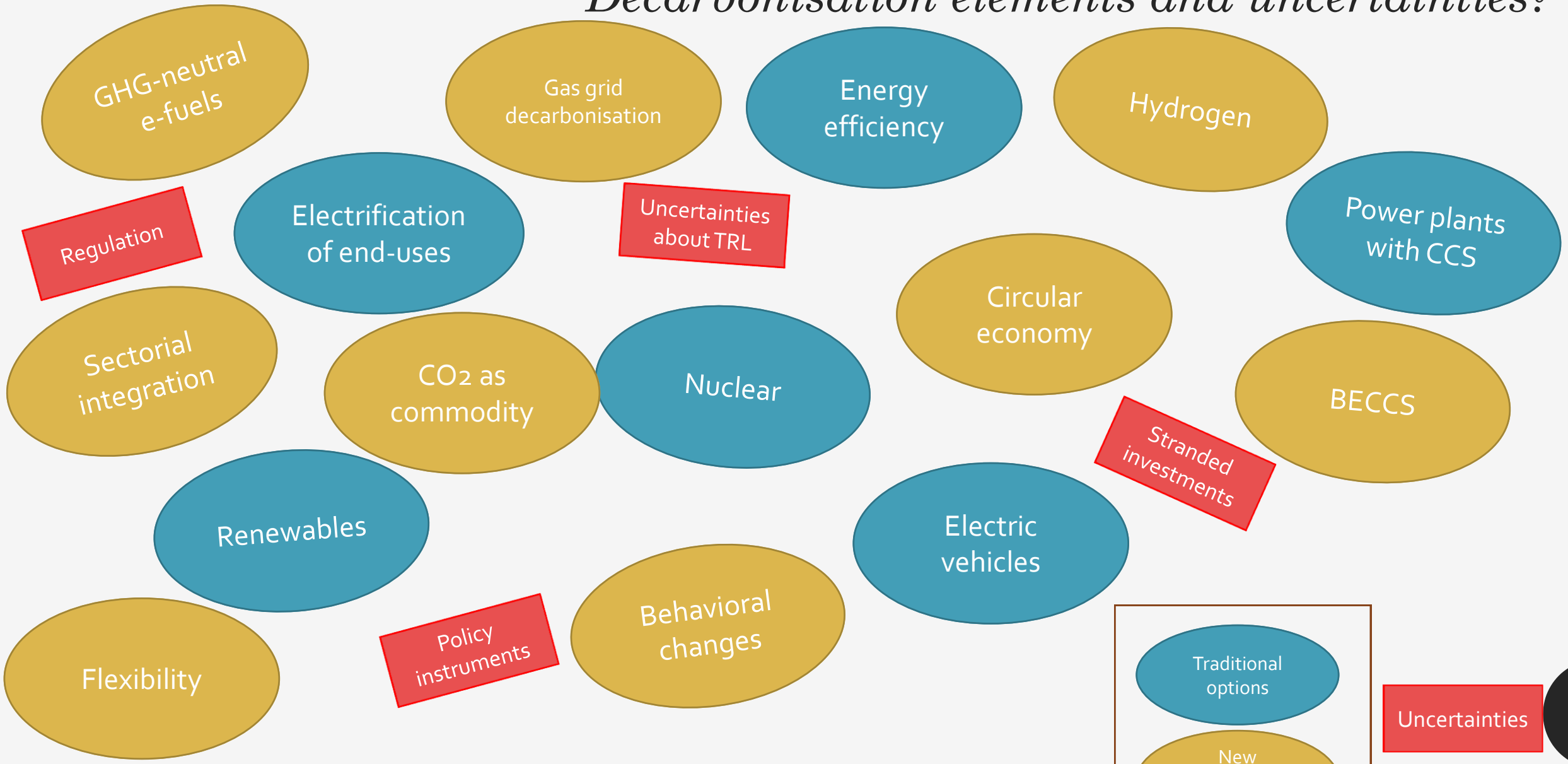
- Using an enhanced version of the PRIMES energy model
- Additional models used for non-CO2 and ALOFU (GAINS, GLOBIOM, CAPRI)

Why enhancements were necessary?

- Increased ambition after COP21; climate neutrality
- Unabated emissions remain using traditional approaches for decarbonisation
- New "disruptive" elements
- Improve coverage of sectorial integration

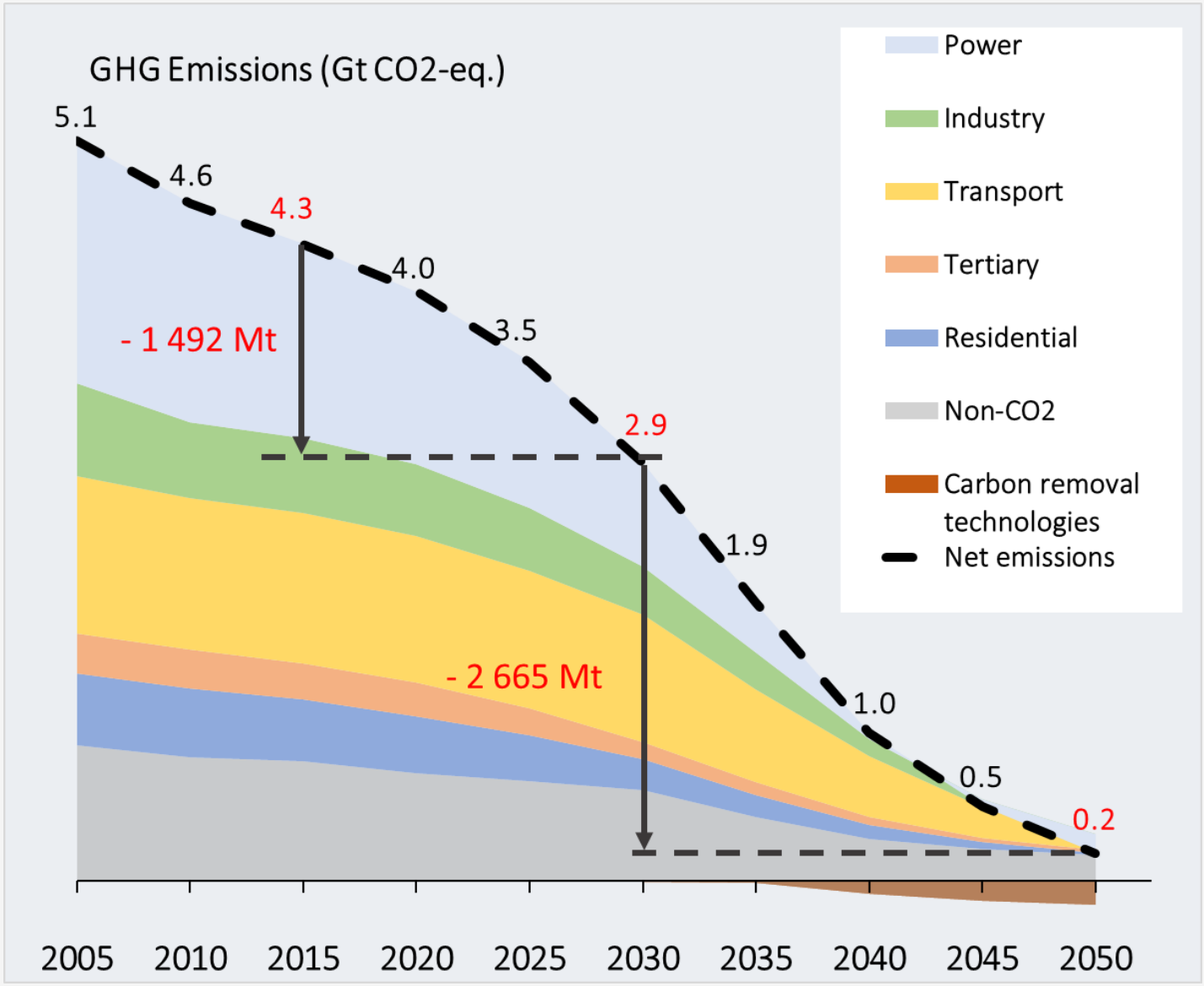


Decarbonisation elements and uncertainties?



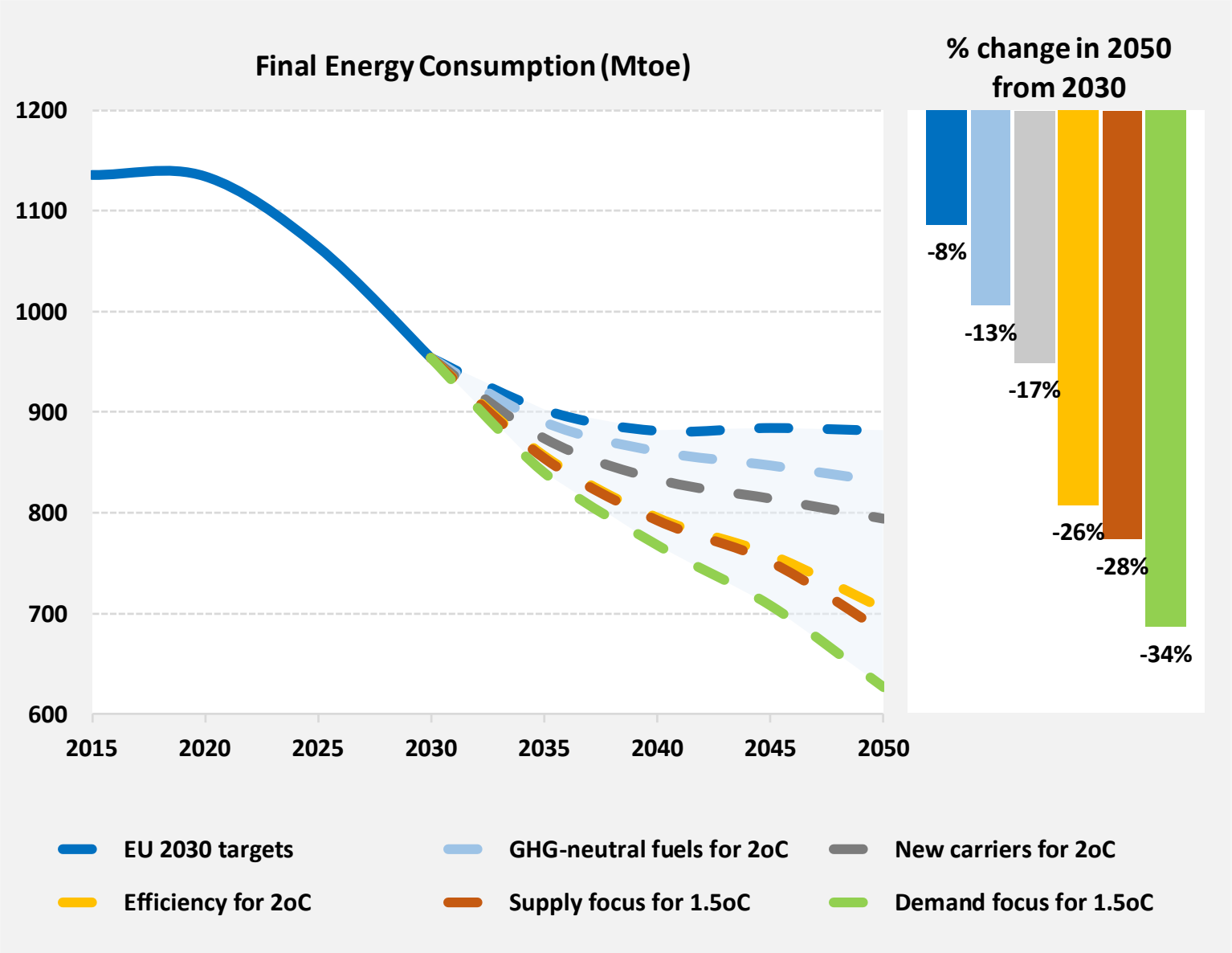
Climate neutrality

- Including the LULUCF emission sink, a climate-neutral EU economy by 2050 is feasible
- Negative emissions, albeit small in magnitude, compensate for remaining emissions in 2050
- Carbon removal technologies related to the energy system are BECCS and carbon sequestration in materials



PRIMES modelling to explore contrasted strategies

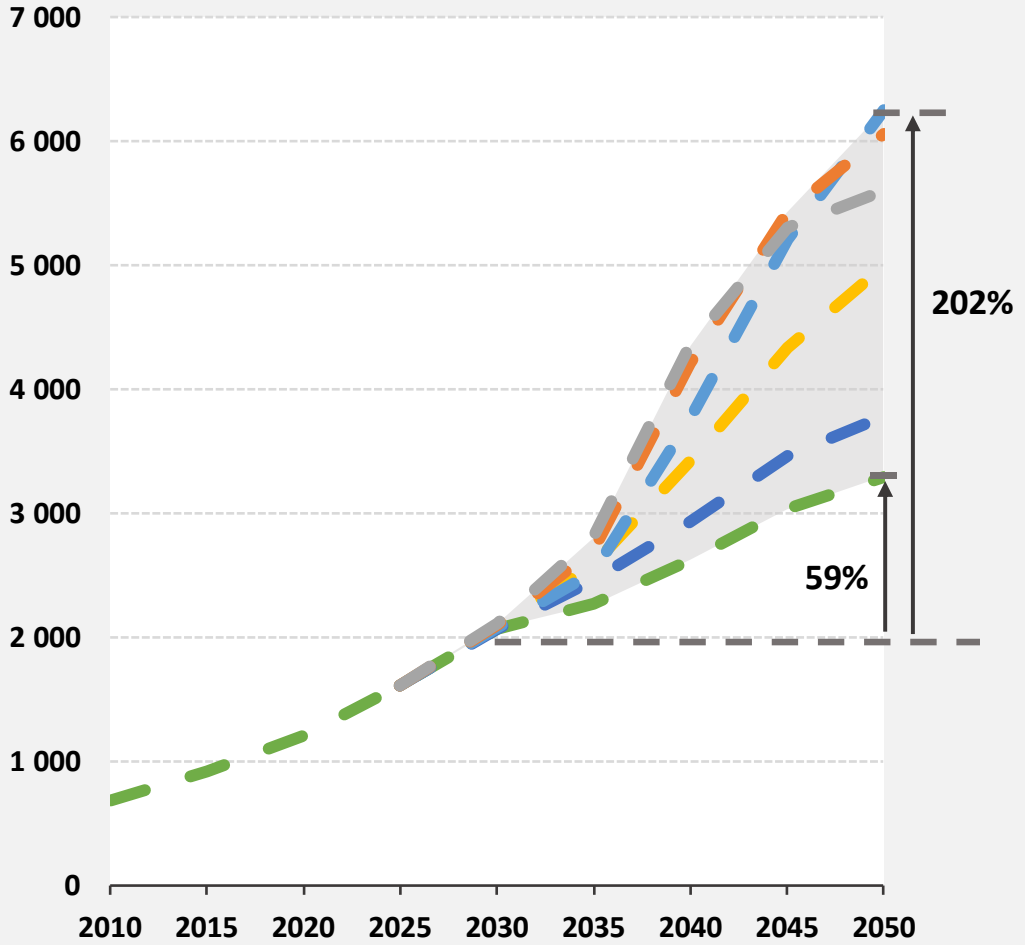
Max Efficiency & Circular Economy	Maximum Electrification	Hydrogen as an end-use carrier	GHG-neutral fuels (gaseous, liquids)
Pros • No pressure in the energy supply potential **Cons** • Depends on investment by individuals • Potential uncertain • Unclear appropriate policy signals • Low demand discourages investment in the supply side	**Pros** • Efficient and convenient • Modest growth of demand for electricity **Cons** • Cannot fully electrify industry and transport • Lack of competition among carriers • High seasonal and daily variability, high balancing costs	**Pros** • H2 can be a universal carrier • Chemical storage of electricity • Less power intensive than e-fuels **Cons** • Infrastructure changes • Uncertain future costs of H2 and fuel cells • Public acceptance	**Pros** • Existing infrastructure and way of consuming energy • Chemical storage of electricity • Competition among carriers **Cons** • Carbon neutral CO2 feedstock (DAC, biogenic) • Uncertain future costs of e-fuels • Vast increase in total power generation

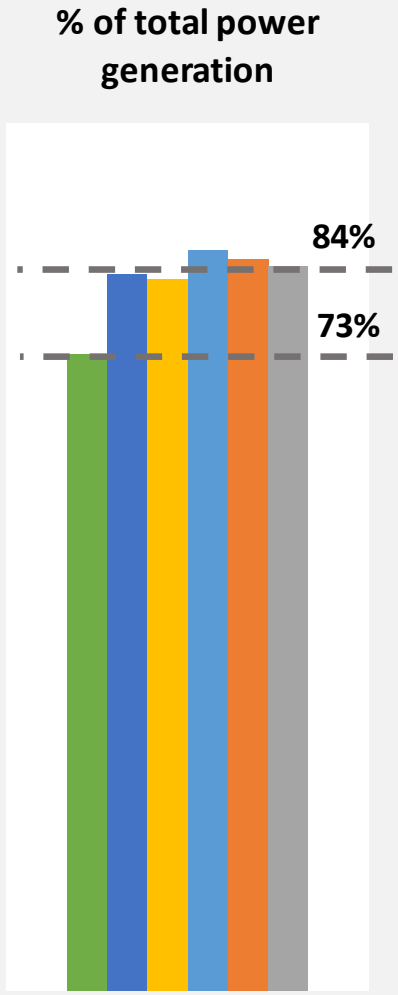


Efficiency in final energy consumption

- The demand-focus strategies aim at very ambitious reduction of energy consumption
- The 1.5°C strategies require even higher reduction of energy consumption irrespective of the focus, on demand or supply
- The largest efficiency gains come from direct energy savings e.g. insulation of houses

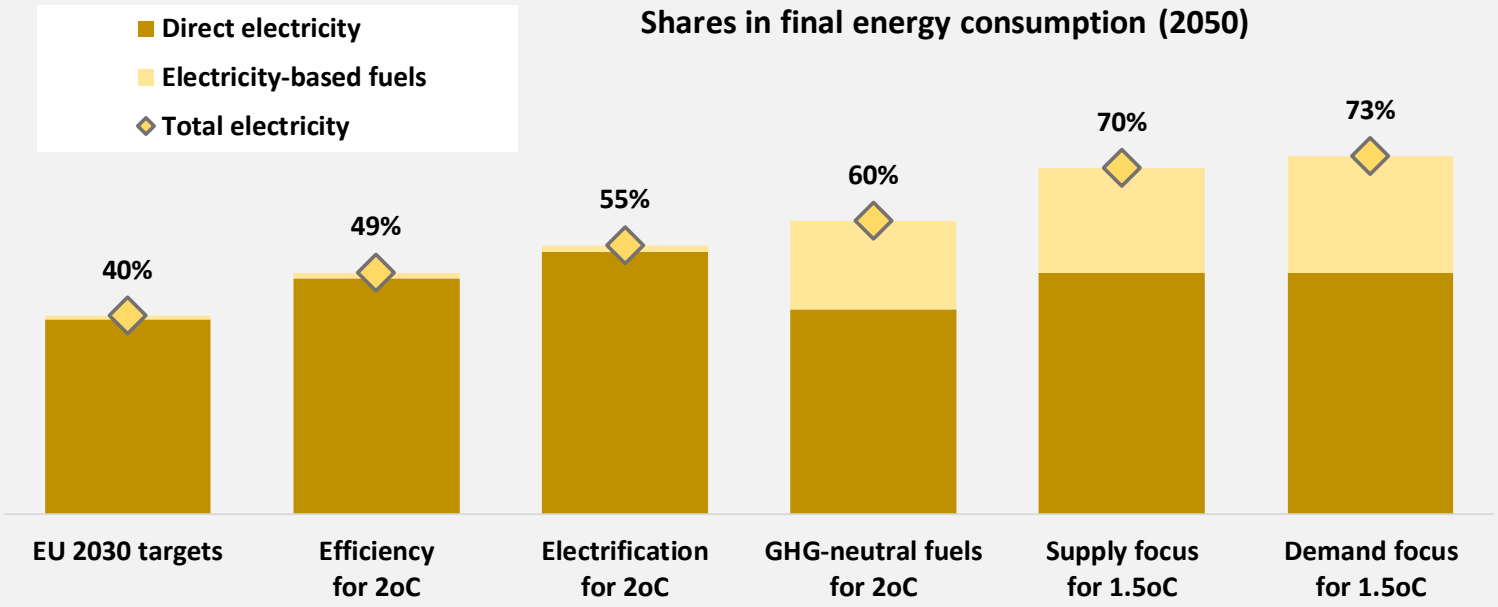
E3Modelling Energy Economy Environment

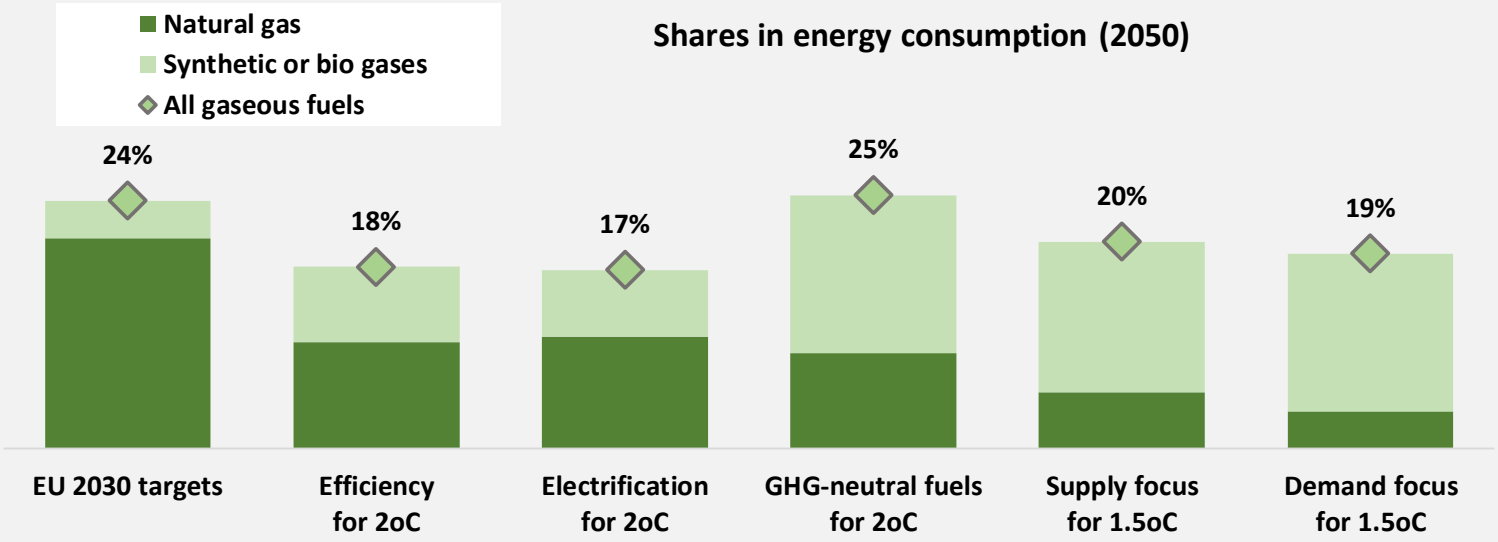




Renewables in Power Generation

- All scenarios foresee renewables close to 85% by 2050 (70% for variable RES), much above the 30% in 2015 and 55% in 2030.
- RES increase at the same pace as total demand for electricity (including the production of H2 and e-fuels)
- The GHG-neutral fuels strategy almost doubles RES compared to the efficiency strategy. The new carriers strategy increase RES by 50%.
- The 1.5°C scenarios demand very high RES irrespective of the demand or supply focus



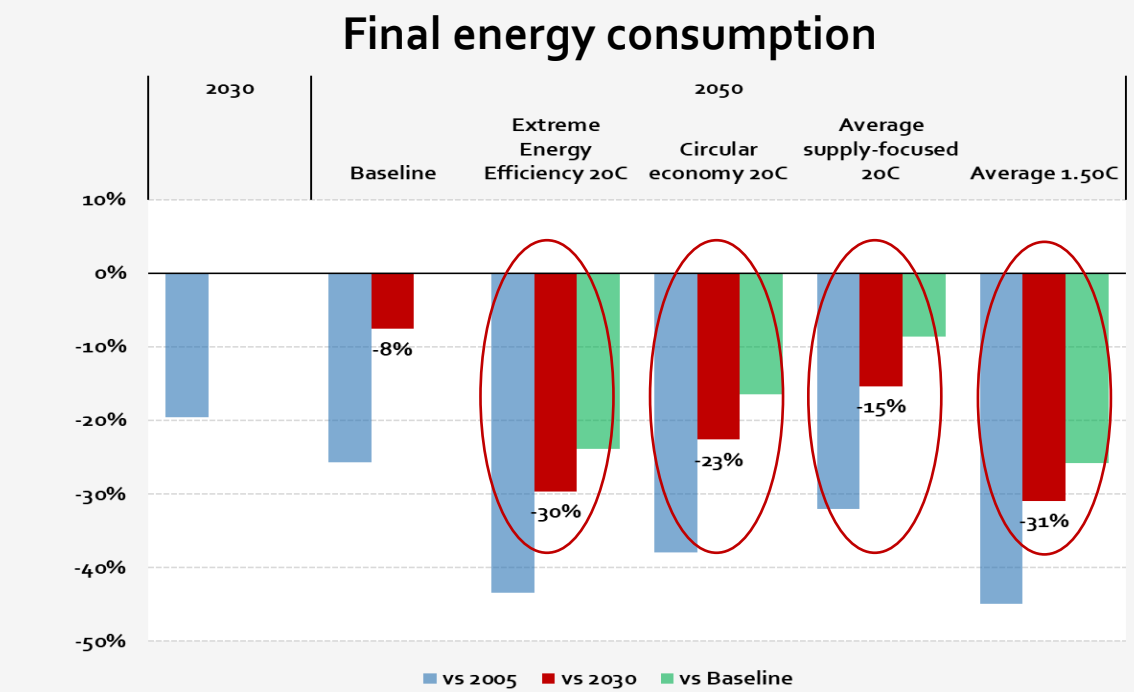


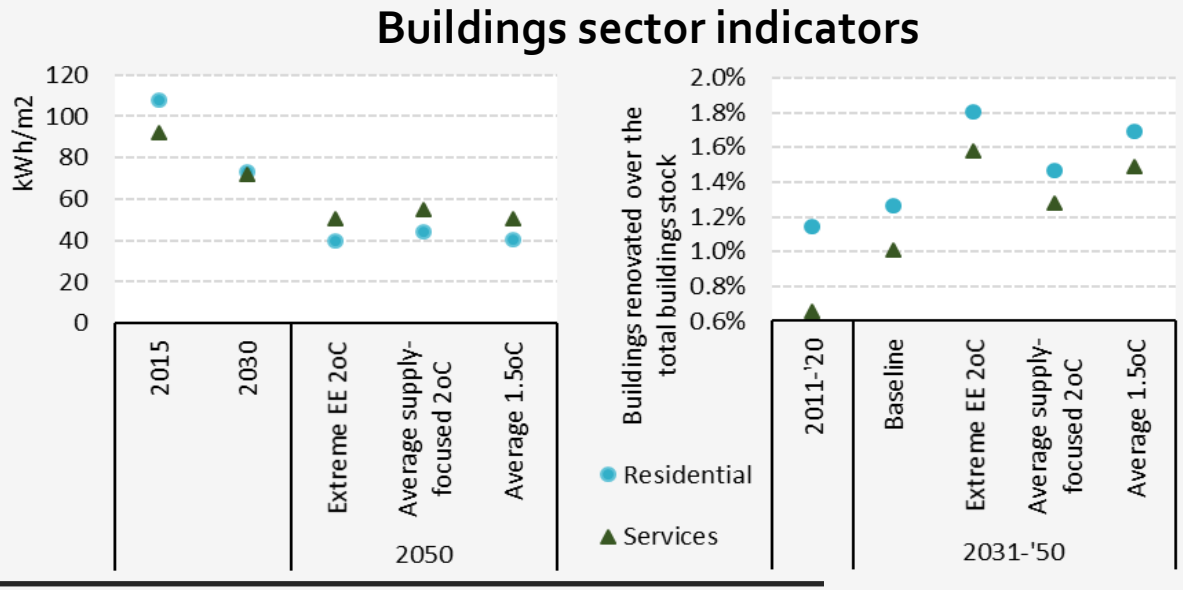
Electricity and gas shares

- Electricity dominates energy supply both directly in final demand and as feedstock for H2 and e-fuels
- The dominant role of electricity is common feature of all 1.5°C strategies, irrespective of the focus
- The share of gaseous fuels decreases in most cases over time, with natural gas dropping dramatically, especially in the 1.5°C strategies

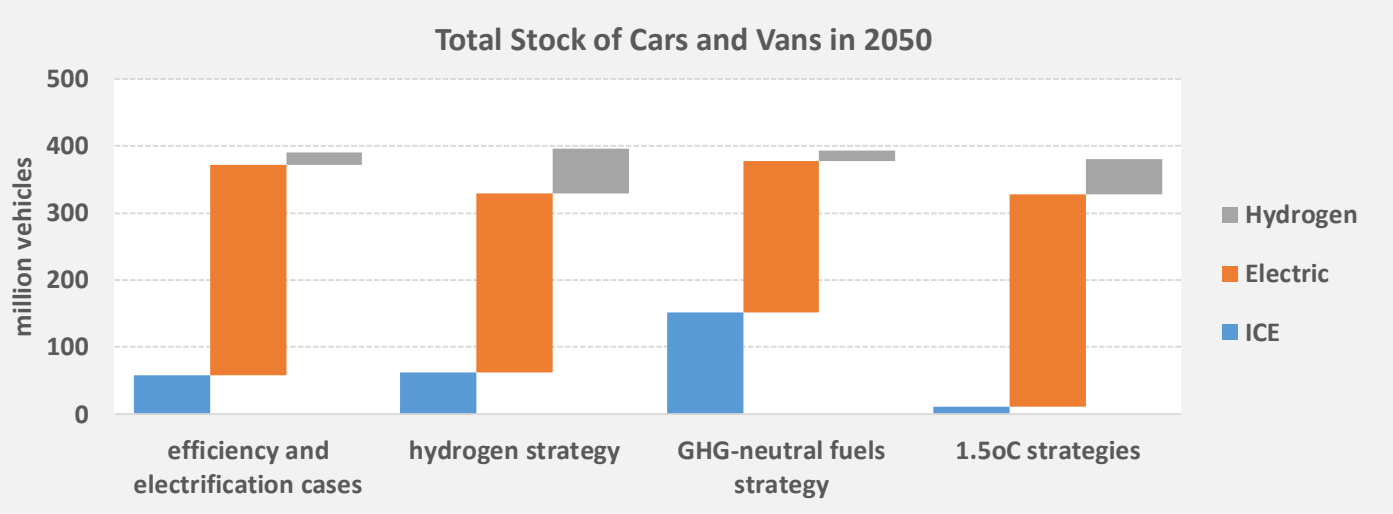
Energy efficiency and the buildings sector

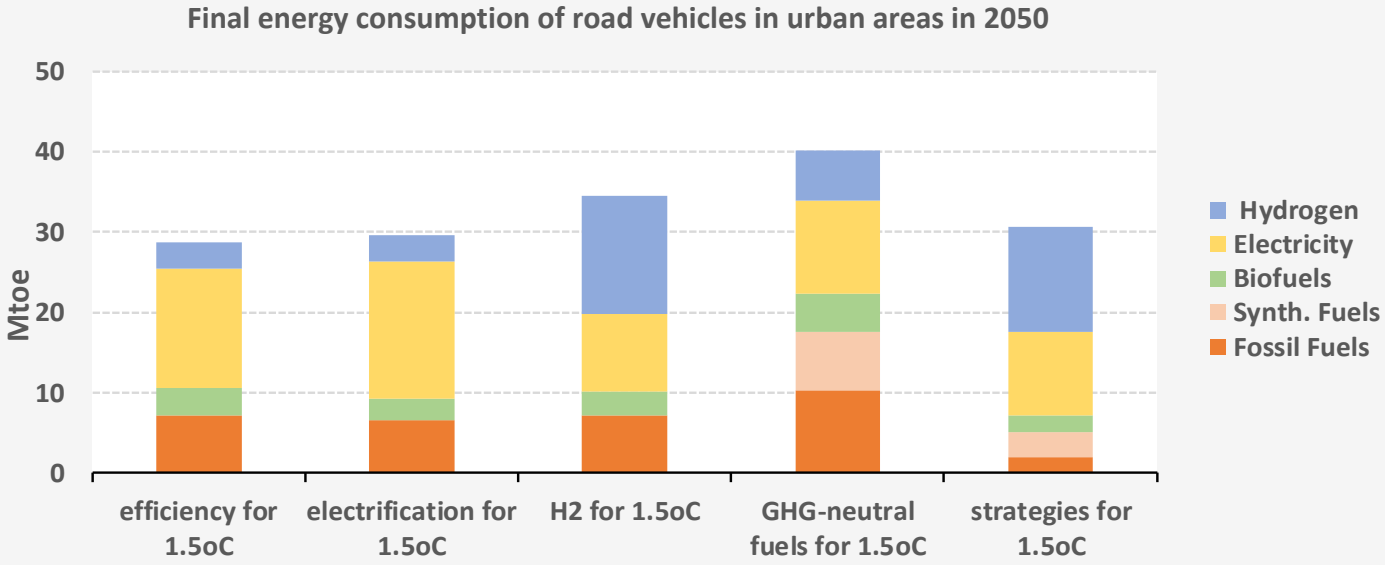
- The renovation of the buildings stock is the largest contributor to final energy savings
- The 2030 policy ambition should be further enhanced post 2030 to drive such strong renovation rates
- Consumers will benefit from lower energy purchasing costs, but only once high upfront investments have been realized





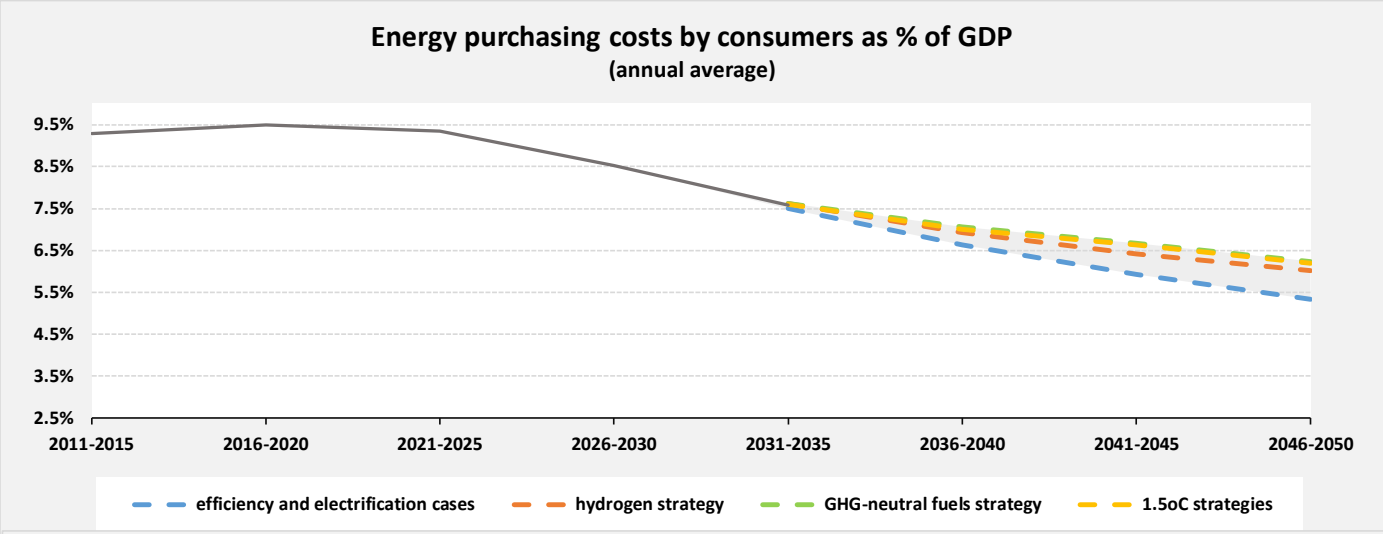
Transport fleet and fuel mix

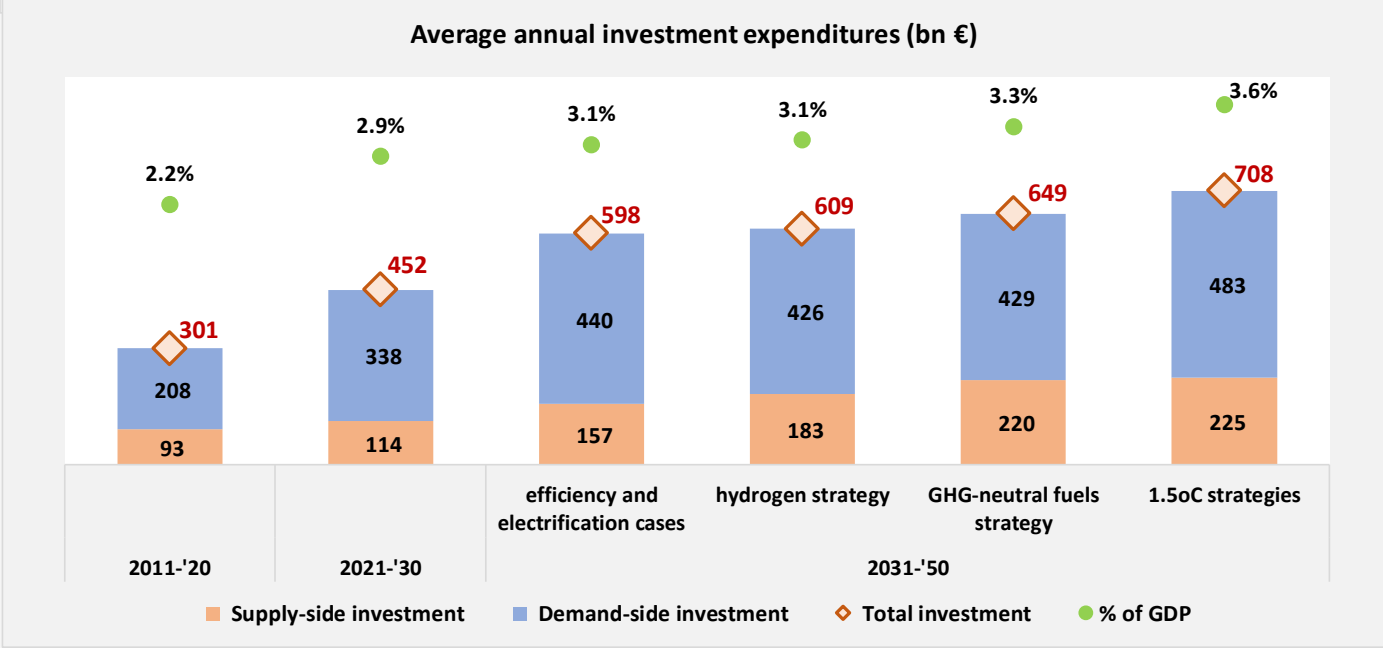




- Electrification of light mobility is a common feature of all strategies. In maximum cases, EVs reaches 80-85% of the market, but in variants with H2 and e-fuels the shares drops to 60-65%
- ICE vehicles remain at close to 40% if synthetic fuels are available, otherwise they drop to 15% (using biofuels)
- Hydrogen enters high mileage market segments (up to 17% in total market of cars and vans)
- The decarbonization of light mobility brings tremendous co-benefits for city centers

Energy system costs and investment



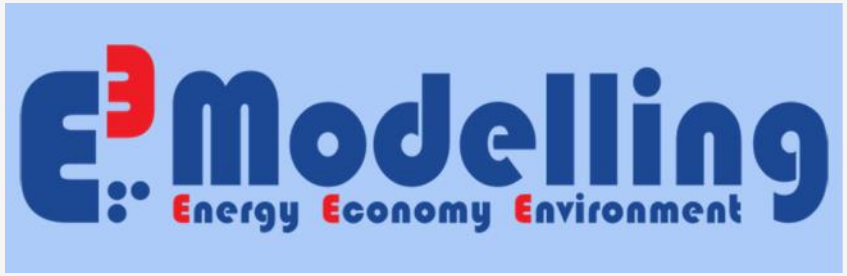


- The long-term strategy needs increasing investment (in both energy demand and supply sectors) but reduces energy purchasing expenditures
- Investment in infrastructure is the fastest growing part of investment in energy supply sectors
- The learning-by-doing dynamics of technologies with low TRL are of crucial importance for the costs of the supply focused scenarios.
- Average costs of electricity are similar in all strategy variants, as the decreasing capital costs of RES and chemical storage offset diseconomies of scale.

Concluding remarks - insights for urban planning and citizens

- The city centers will benefit both form the electrification of the transport fleet and the decarbonisation of buildings (renovation and fuel switching); the fight against local air pollution is a big winner
- Electrification of vehicles bring important co-benefits in terms of reduced noise; the value of properties on large avenues is expected to increase substantially; urban planners should take such developments into consideration
- More and more upfront investment is required by individuals as end-users of energy. Effective measures should be timely set in place in order to avoid introducing "technology poverty", which will replace "energy poverty"; assisting individuals with poor fund raising capabilities constitutes a new policy priority

Thank you for your attention!



INNOPATHS

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