Energy efficiency measures in the building sector in Norway

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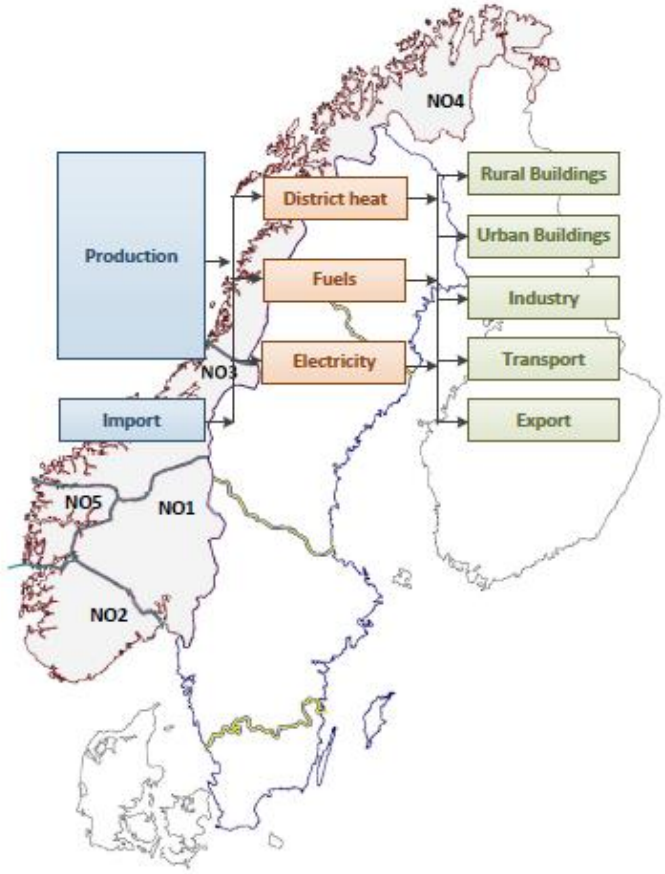
- Summary

What are the drivers, barriers, motivations, risks, and uncertainties for the realisation of energy efficiency measures in the building sector?

- The building sector accounts for 40% of final energy consumption and 36% of energy related emissions in the EU
- The European Commission estimates that roughly 75% of the EU building stock is energy inefficient
- High technical energy savings potential, but on average, 0.4–1.2% of the national building stock is renovated each year in the EU
- The energy efficiency gap is often explained with market failures (e.g., imperfect information), principal-agent problems, split incentives, capital market failures, and behavioural factors
- The EU recently introduced new ambitious policies to help steer member states towards better energy efficiency in buildings

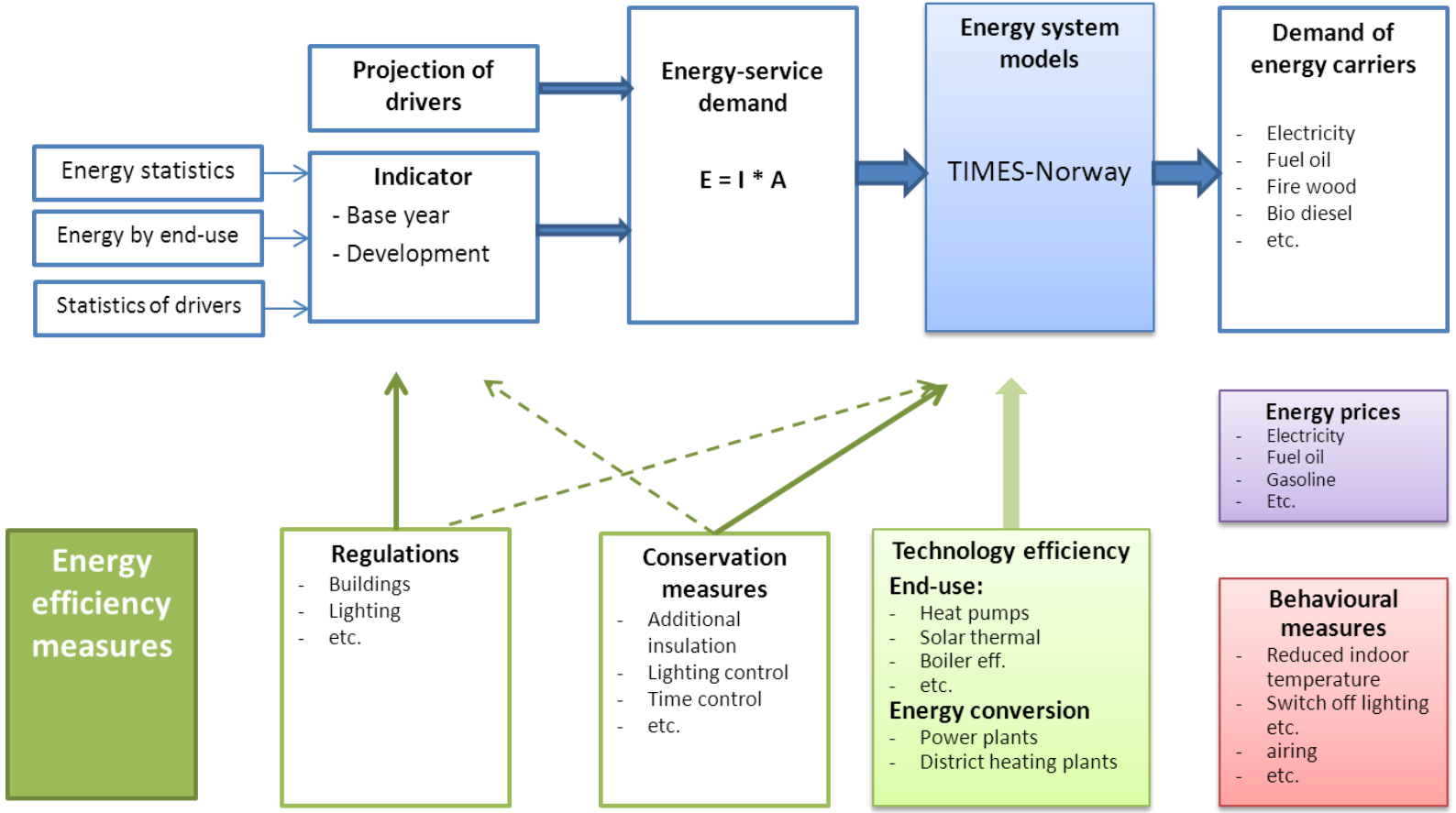
IFE-TIMES-Norway

- IFE-TIMES-Norway is a technology-rich model of the Norwegian energy system
- Spatial resolution: five regions corresponding to the current electricity market spot price areas in Norway
- Temporal resolution: modelling horizon from 2018 to 2050
  - Each model period is divided into 96 sub-annual time slices



How can different energy efficiency measures in the building sector be included in energy system models?

- Energy efficiency measures can be included as exogenous or endogenous input
  - Energy efficiency improvements in new buildings are included in the demand projection
  - Energy efficiency improvements in existing buildings are included as technology options



Technical energy efficiency potential in the building sector in Norway

Energy efficiency measures:

1. Insulation of walls
2. Insulation of roof
3. Insulation of floor
4. New windows and doors
5. Reduced indoor temperature at nights and weekends
6. Improved heat recovery in ventilation
7. Improved power efficiency
8. Improved ventilation regulation
9. Lighting regulation
10. Energy efficient lighting
11. Automatic sun protection
12. Demand controlled ventilation (DCV)
13. Energy management systems

Building categories:

Residential buildings:

1. Single-family houses
2. Multi-family houses

Commercial buildings:

1. Kindergarten
2. Offices
3. Schools
4. University/higher education
5. Hospitals
6. Nursing homes
7. Hotel
8. Sports
9. Wholesale and retail
10. Culture
11. Light industry / workshop

Building standards:

1. TEK97
2. TEK87
3. TEK69
4. TEK49 or older

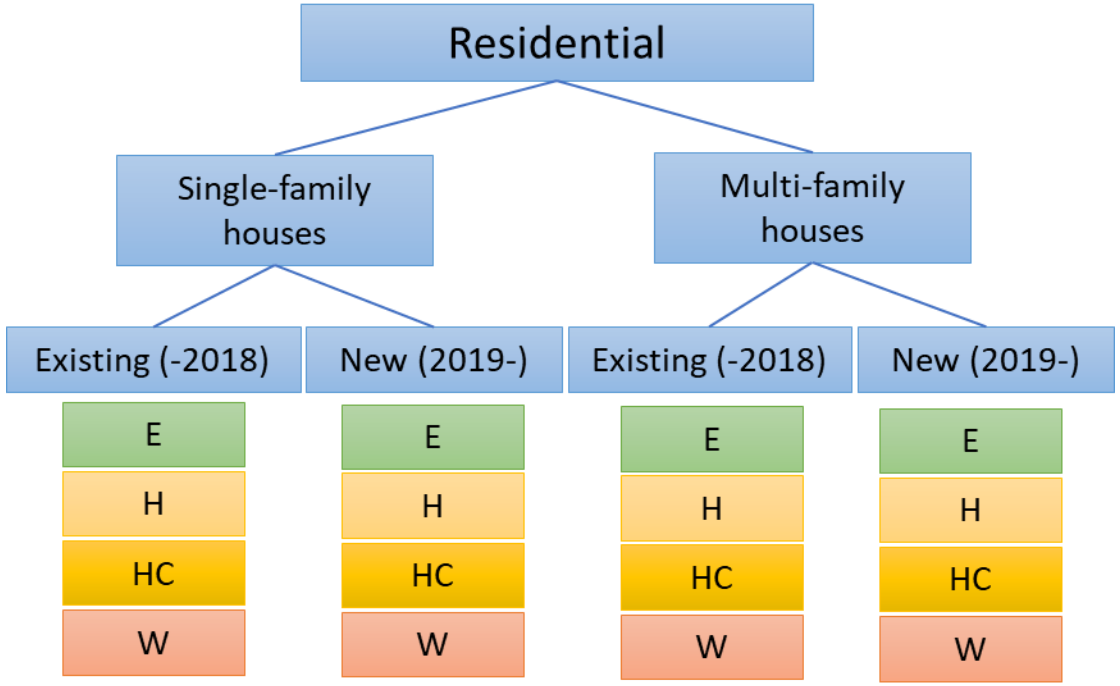
Climate zones:

1. Bergen
2. Kristiansand
3. Oslo
4. Tromsø
5. Trondheim

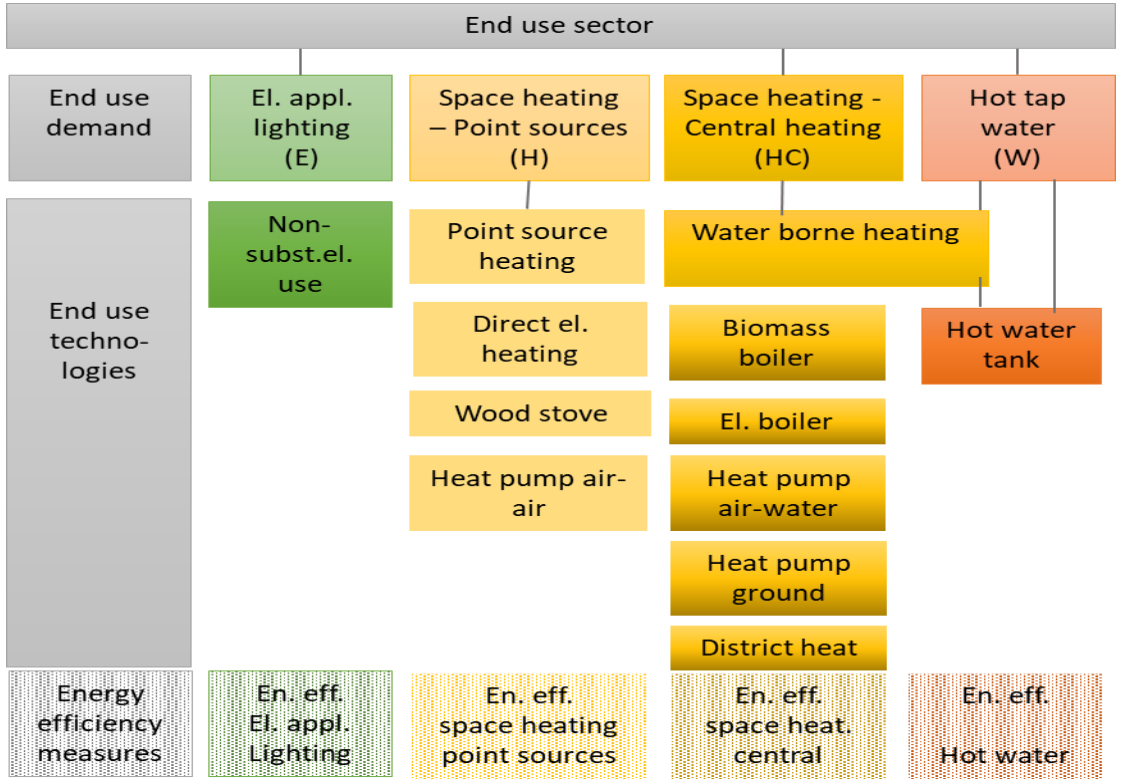
*Technical potentials and costs for the energy efficiency measures are based on the NVE and Multiconsult studies. Available at www.nve.no

IFE-TIMES-Norway: representation of residential buildings

- 4 Residential end-use sectors each with 4 end-use demand

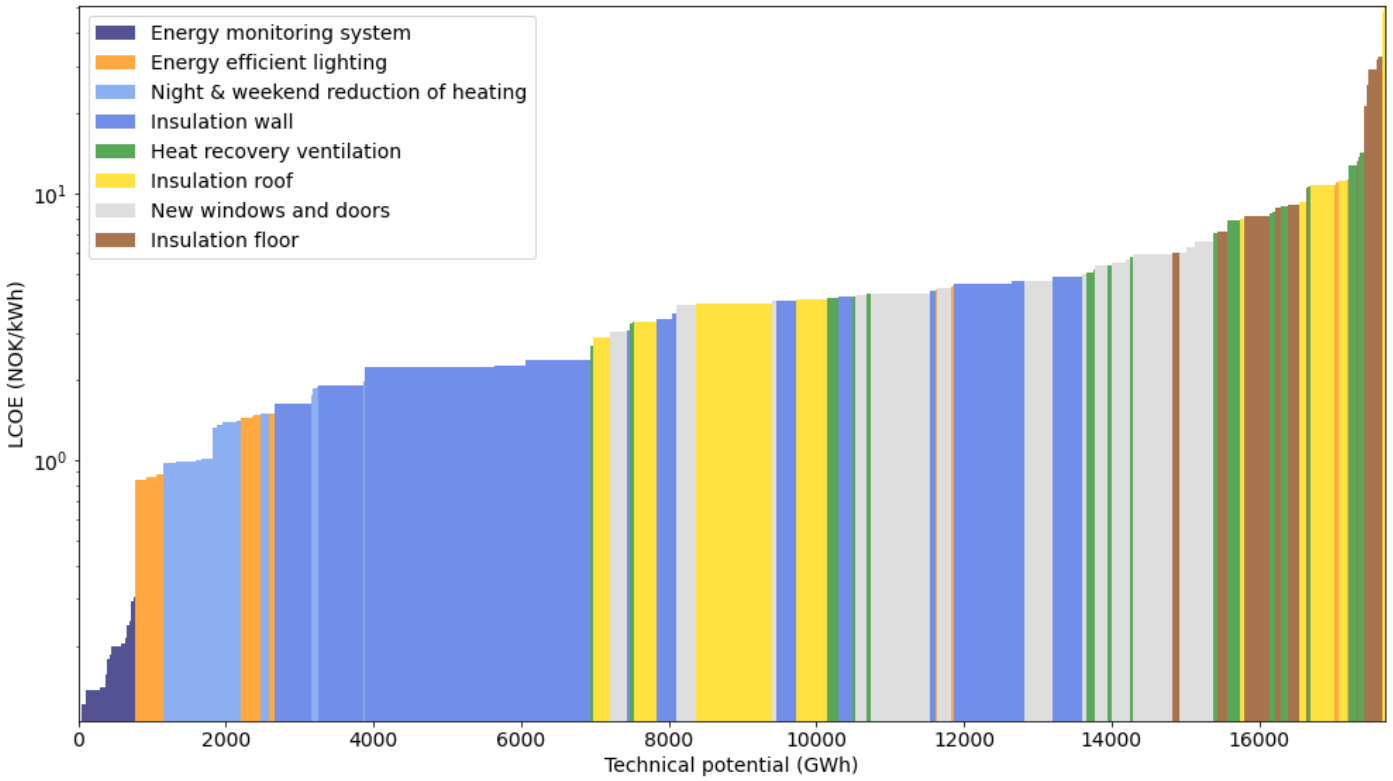


- End-use demand & End-use technologies



Technical energy efficiency potential in the building sector in Norway

- Estimated potential: 37 TWh in 2025
  - … decreases in the future due to demolition of existing buildings, being around 30 TWh annually in 2050
- Technical energy savings potential varies based on the building type
  - 17.7 TWh in the single-family houses
  - 2.7 TWh in the multi-family houses
  - 17 TWh in the commercial buildings

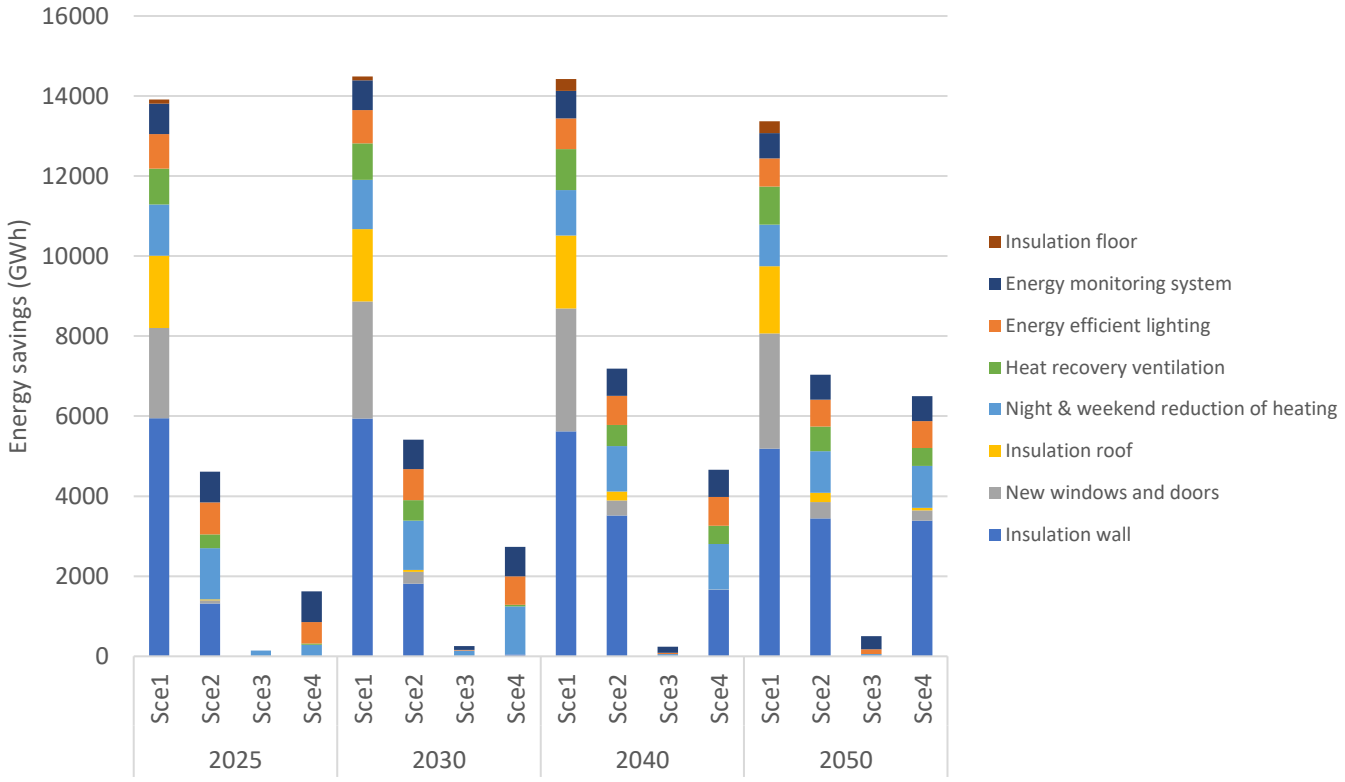


How large is the techno-economic potential of energy efficiency measures in the building sector in Norway?

- Techno-economic energy savings **potential**: 30 TWh (2025) and 27 TWh (2050) (Sce1)
- Impact of higher **private discount rates**: 20 TWh reduction in 2025 and 2050 (Sce2)
- Impact of **constrained growth rate:** 0.5 TWh and 2.2 TWh reduction in 2025 and in 2050 (Sce3)
- **Rate of energy efficiency improvement** must be increased by 1.8–2.7% to achieve Norway's target of 10 TWh reduction in annual demand for existing buildings (Sce4)

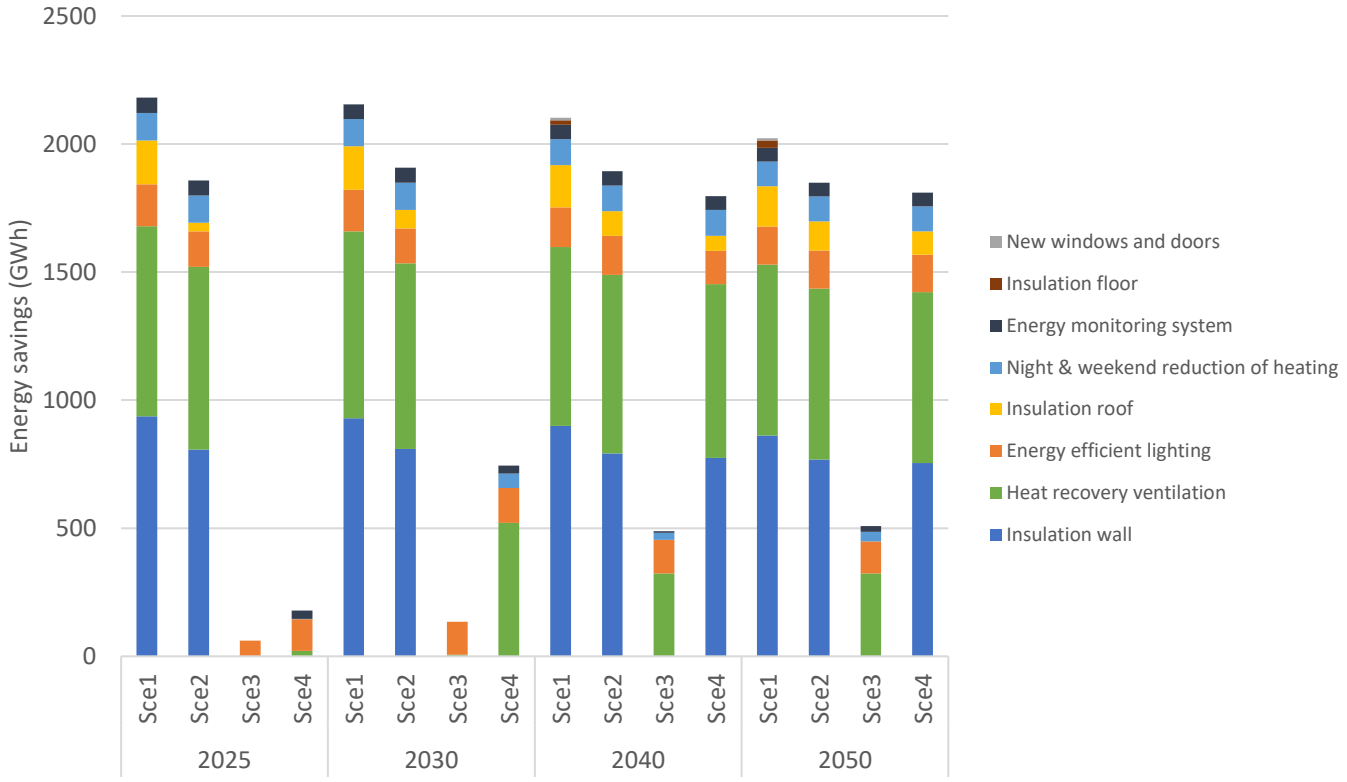
Techno-economic energy efficiency potential in the existing residential buildings (single-family)

- The highest potential comes from post-insulation of walls and roofs, and post-installation of energy efficient windows and doors



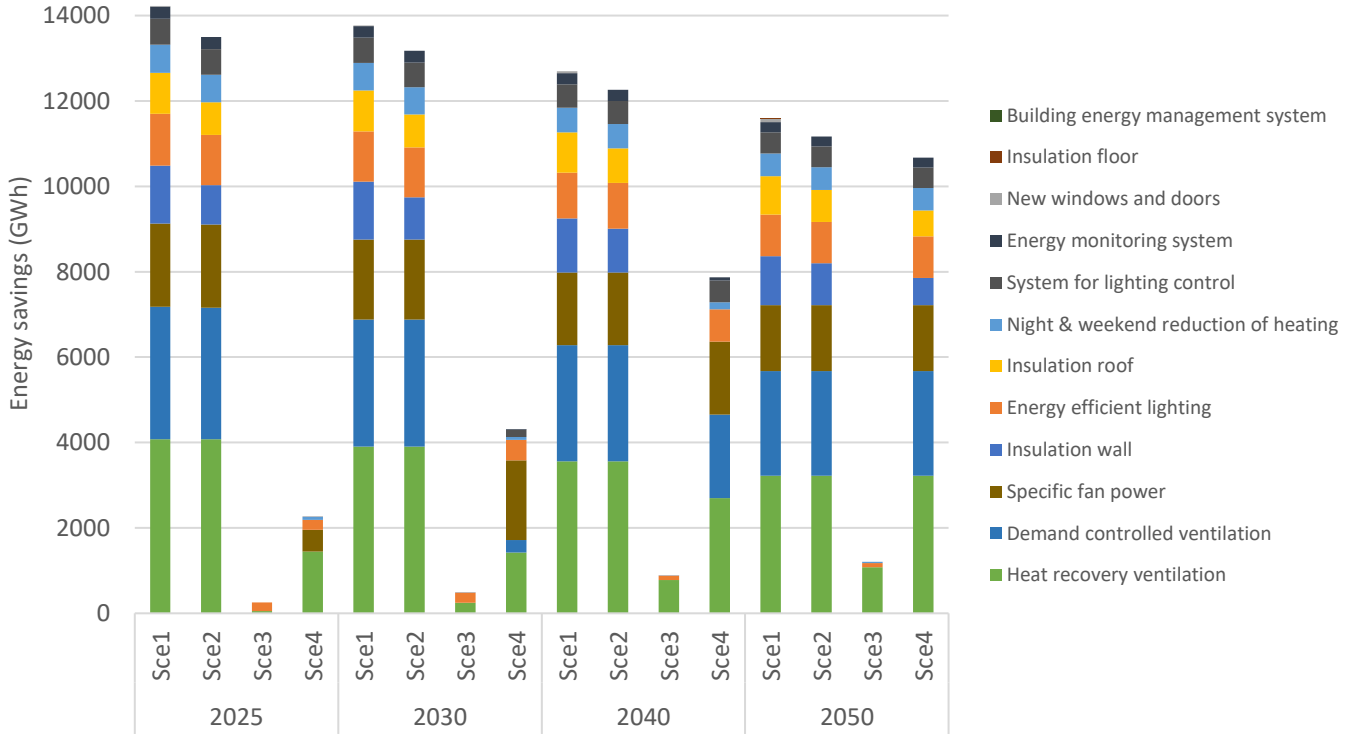
Techno-economic energy efficiency potential in the existing residential buildings (multi-family)

- The highest potential comes from post-insulation of walls, heat recovery, and from changing to energy-efficient lights

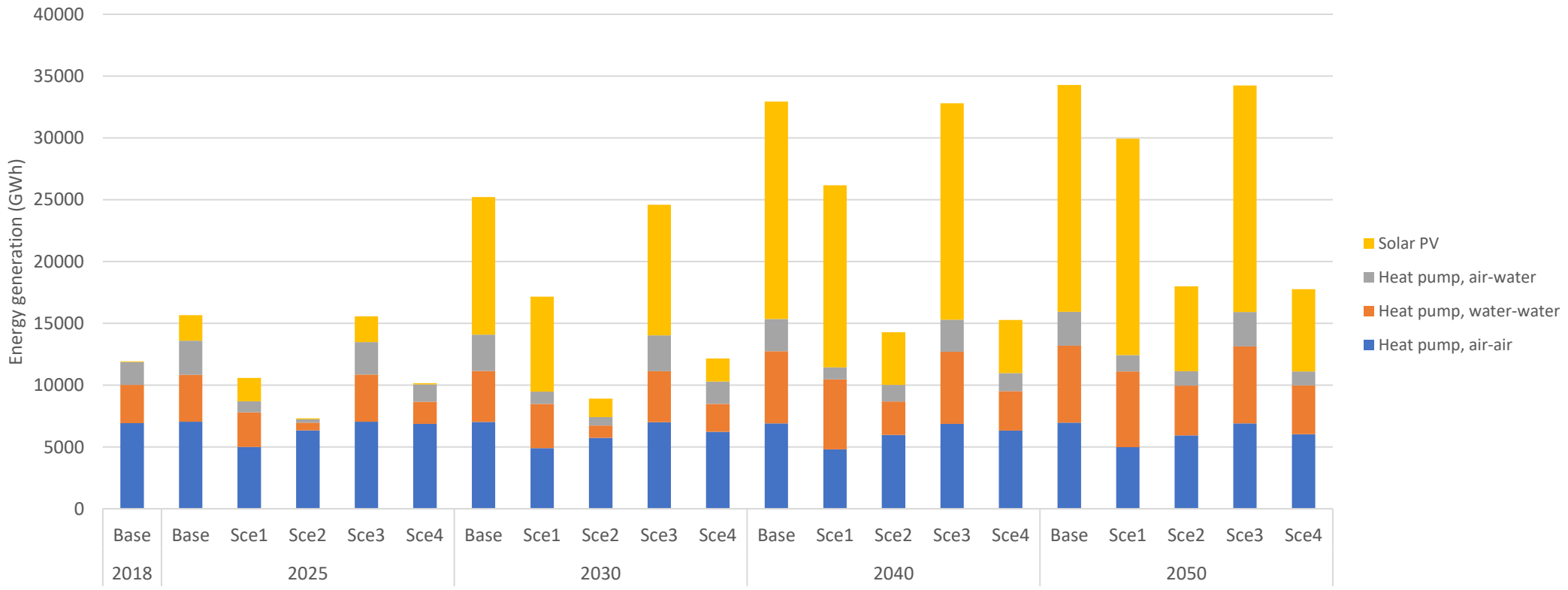


Techno-economic energy efficiency potential in the existing commercial buildings

- The highest potential comes from heat recovery and control strategies in the ventilation systems, post-insulation of walls, and from changing to energy-efficient lights

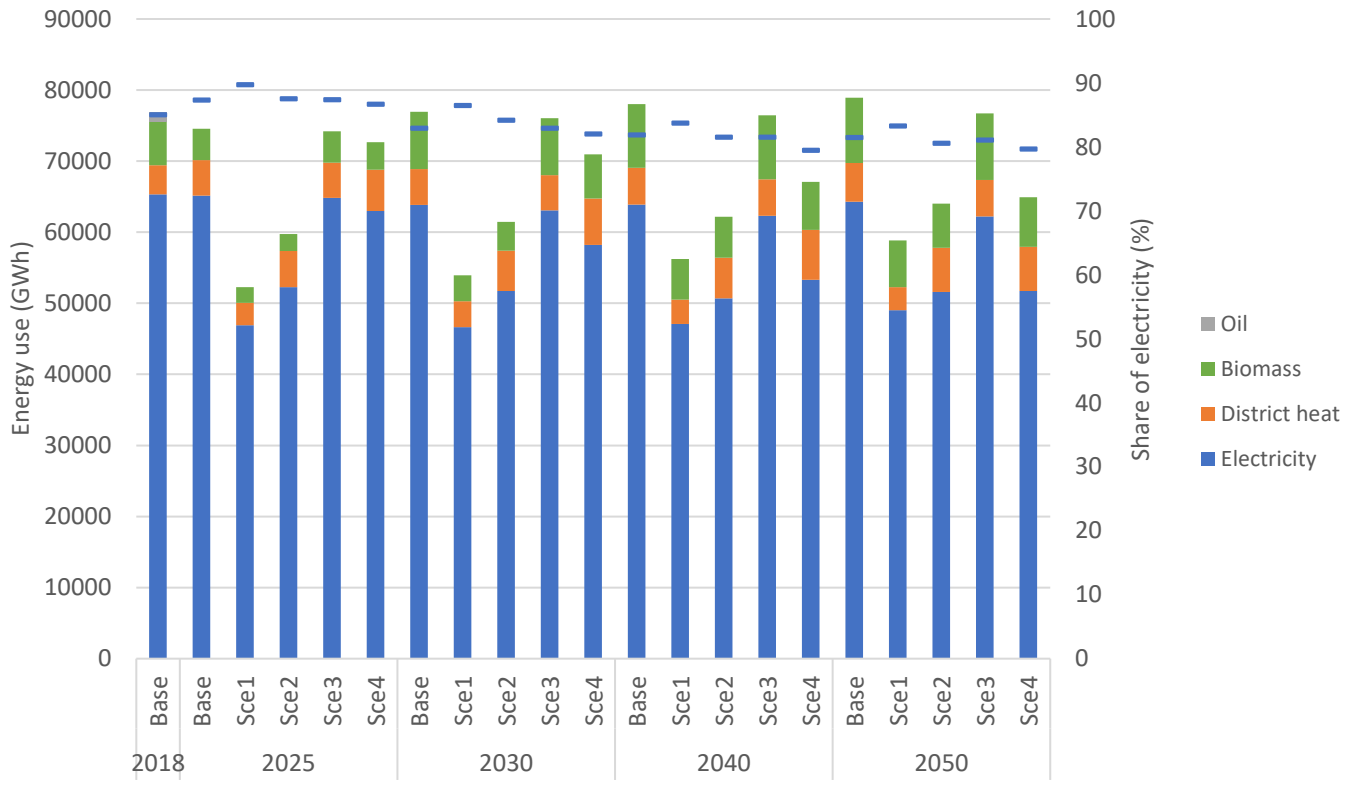


Energy efficiency improvements through integration of renewable energy technologies



Energy use in the building sector

- Energy use is observed to decrease around 1–23 TWh and 2–22 TWh in 2030 and 2050, respectively
- Electricity will continue to be the dominant energy carrier in the Norwegian building sector in the long-term
- The use of district heat is observed to increase, especially in the multi-family residential buildings



Summary

- The potential for energy efficiency measures are significant for buildings for a wide range of measures for energy saving and flexibility. For Norway, it is estimated to between 25 and 30 TWh
- Some of the investments are cost-effective only when applying a social discount rate. If a higher private discount rate is applied, some capital intensive energy efficiency investments are reduced
- When applying the constrained growth rate of energy efficiency improvements of 0.2% per year and 0.3% per year for the residential and commercial sectors, respectively, the savings are reduced by one order of magnitude
- Electricity continues to be the dominating energy carrier in the building sector until 2050, and at the same time, the energy saved throughout this period is also due to reduced electricity demand

Thank you for your attention.

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