Estimation des investissements nécessaires pour des bâtiments et un transport bas carbone en Belgique

CFDD – 5 octobre 2017 - Financement de la transition

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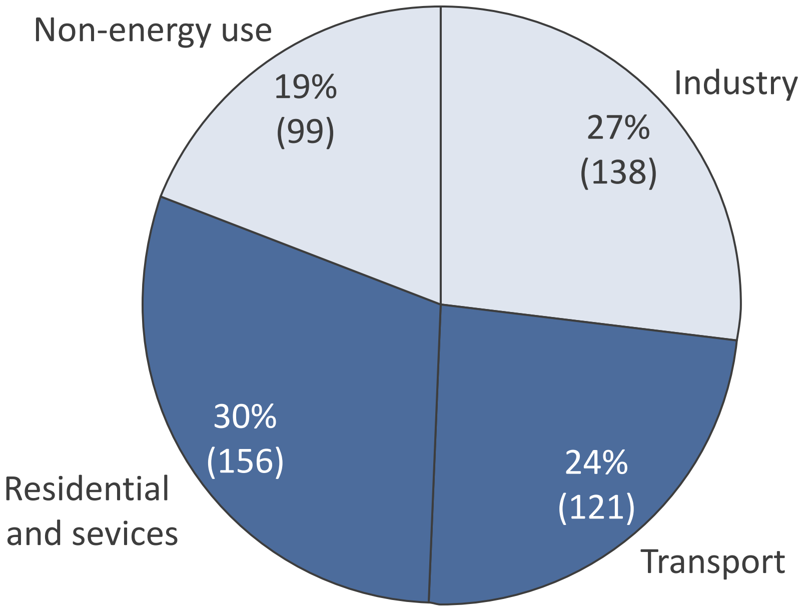
Agenda

- Context and historical trends
- Towards low-carbon Buildings
- Towards low-carbon Transport
- Macro-economic implications
- Conclusion

Buildings and transport are responsible for 54% of energy consumption

Final energy consumption in Belgium 2015
[TWh]



Total: 515 TWh

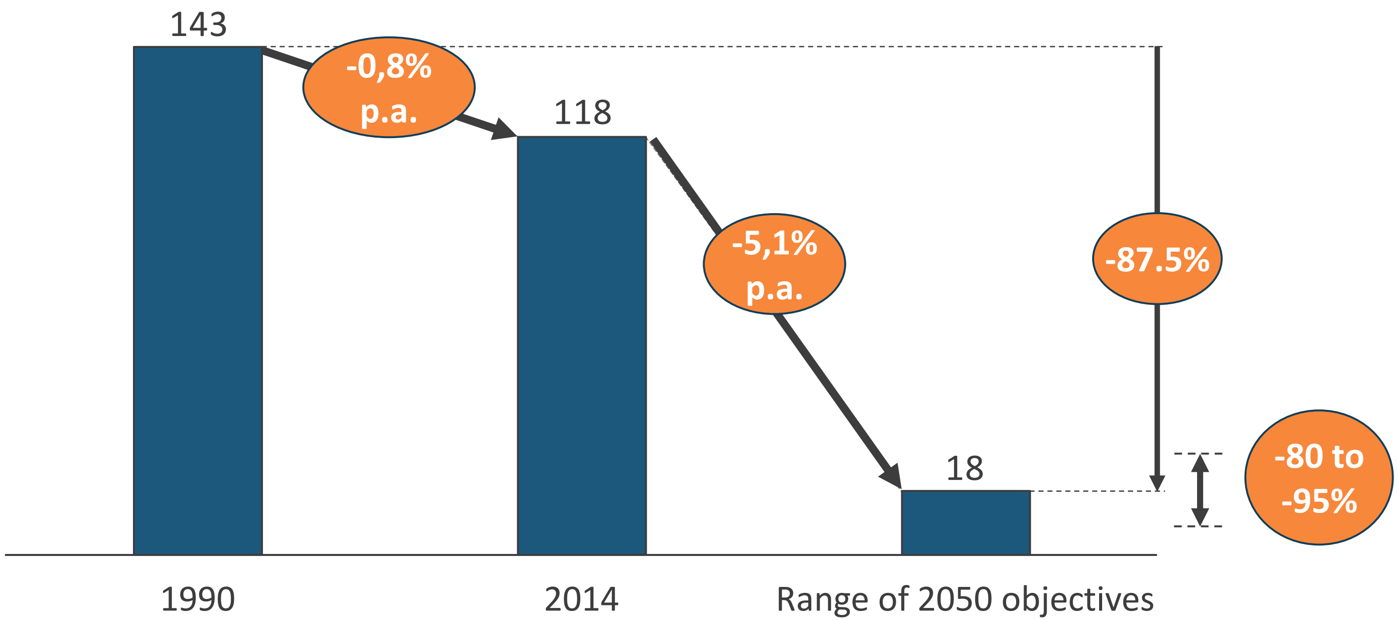
- Industry:
  Gas (34%), Electricity (27%), Oil (15%)
- Transport:
  Oil (96%), biofuels and elec. (4%)
- Residential and services:
  Gas (38%), Oil (29%), Electricity (27%)
- Non-energy use:
  Oil (86%), Gas (12%), Solid fuels (3%)

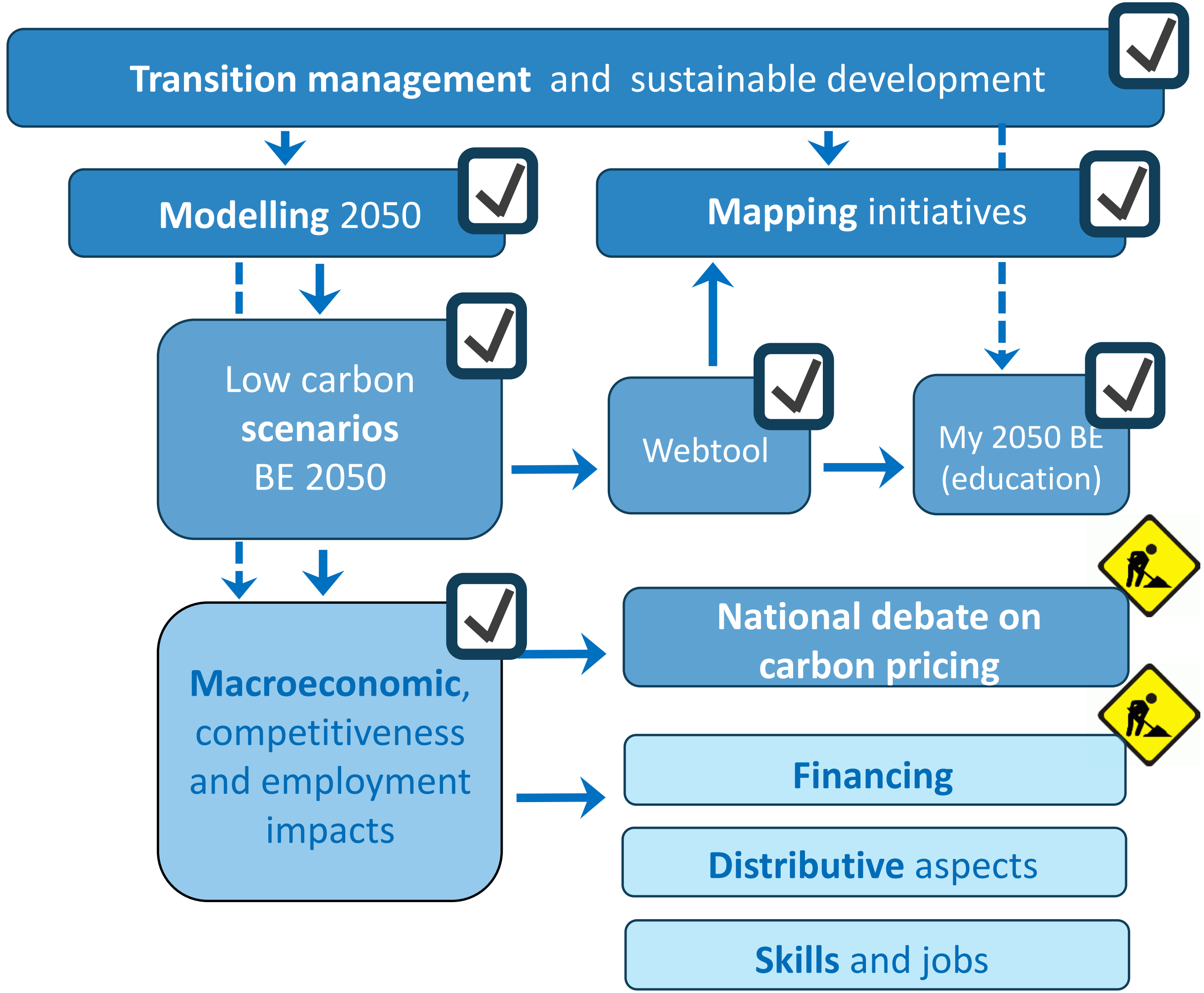
Source: Eurostat Energy Balance, 2017 version

Belgium needs to drastically increase its yearly GHG reduction pace in order to be in line with 2050 European objectives

Belgian GHG emissions and 2050 objectives

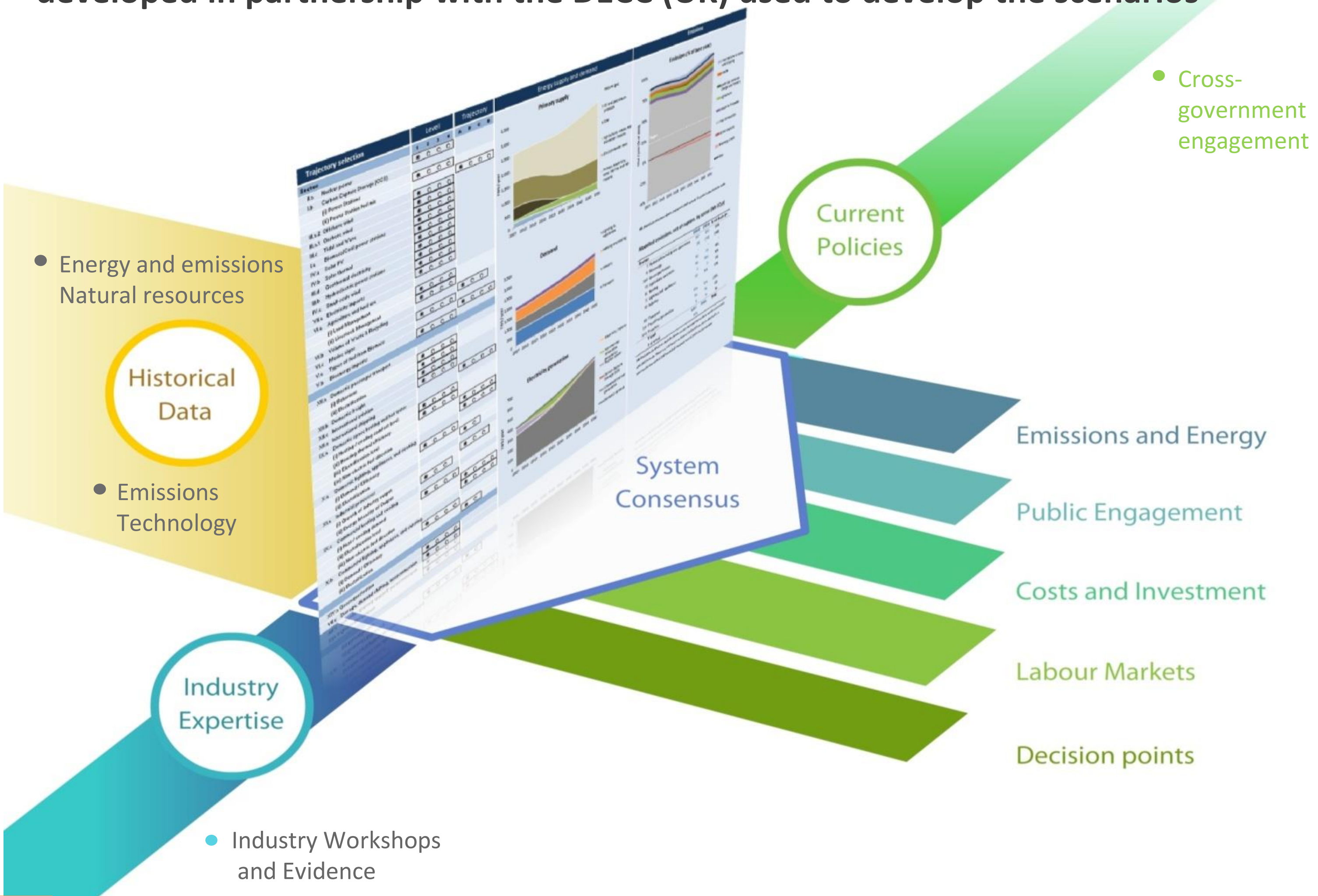
[$MtCO_2e$ per year]





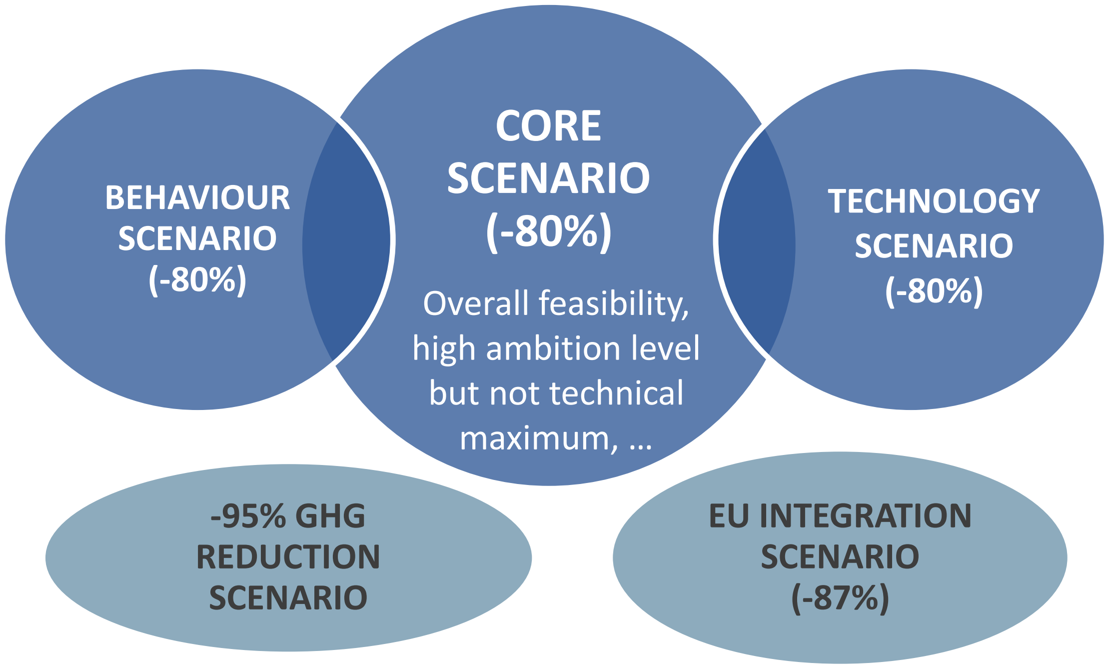
TOWARDS A LOW CARBON SOCIETY

The Open-source Prospective Energy and Emissions Roadmap Analysis tool (OPEERA) developed in partnership with the DECC (UK) used to develop the scenarios



A set of 5 scenarios reaching 80 to 95% GHG emission reduction

Spatial planning, working arrangements, social innovation and networks, reducing meat consumption, …



Role of technologies, risks and opportunities, R&D, …

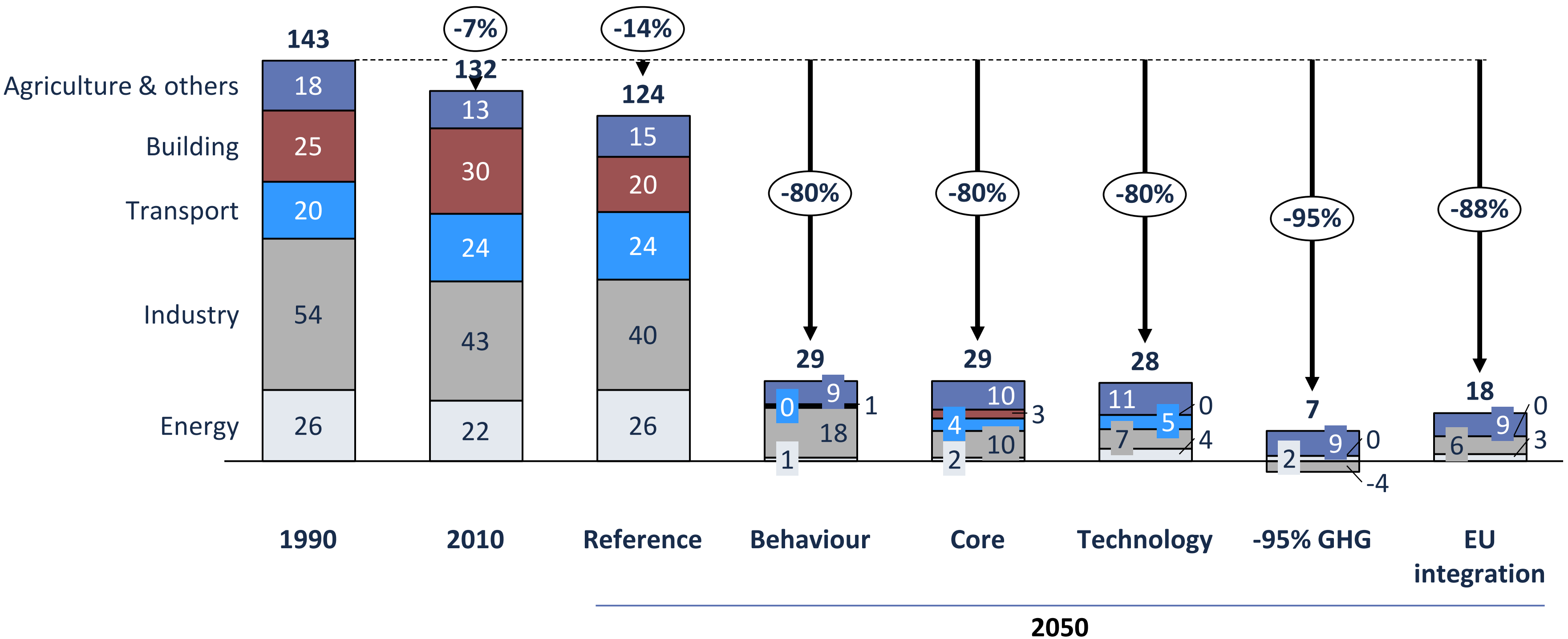
Stretch all levers to reach the higher end of the reduction range

Transmission and back-up requirements, EU energy integration, …

A set of 5 scenarios reaching 80 to 95% GHG emission reduction

Belgian GHG emissions

[$MtCO_2e$ per year]



Source: Belgium OPEERA model (Climact, VITO)

Structure of the cost modeling

Total direct system costs covered

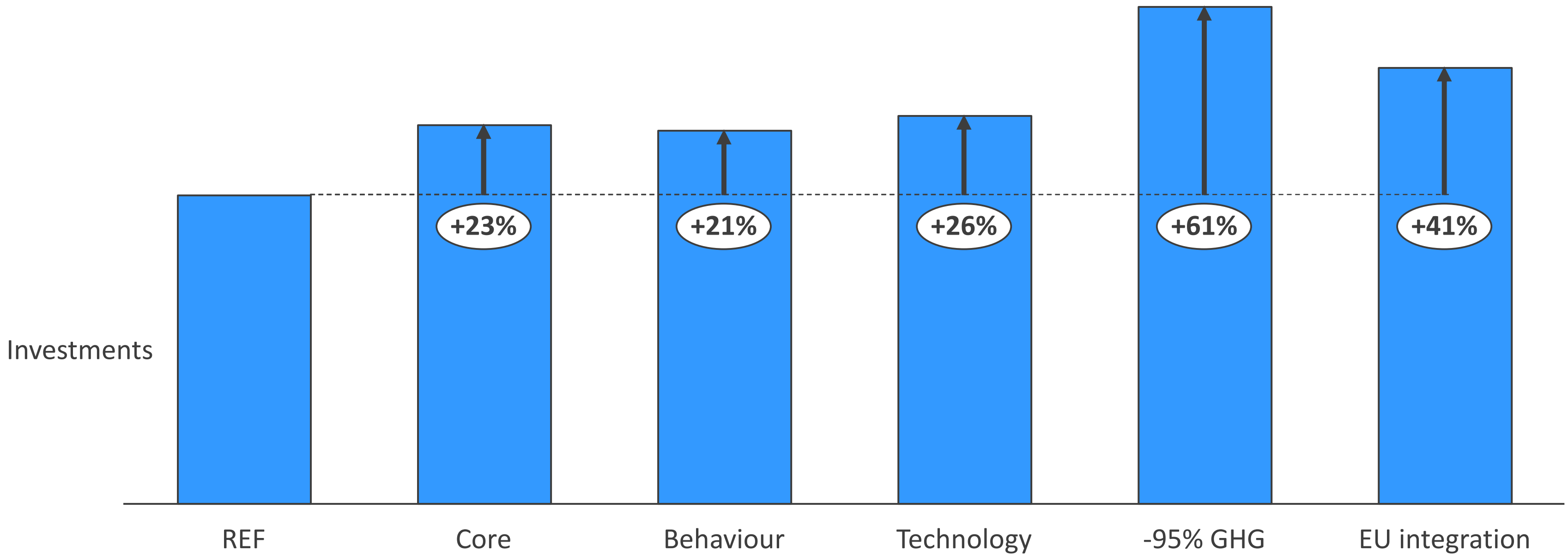
Capital investments + Fuel costs + Operations and Maintenance

Not covered:

- Externalities
- Feedback loops or rebound effects
- Carbon price
- Discounting/WACC

Required investments vary according to the ambition and the options to achieve it

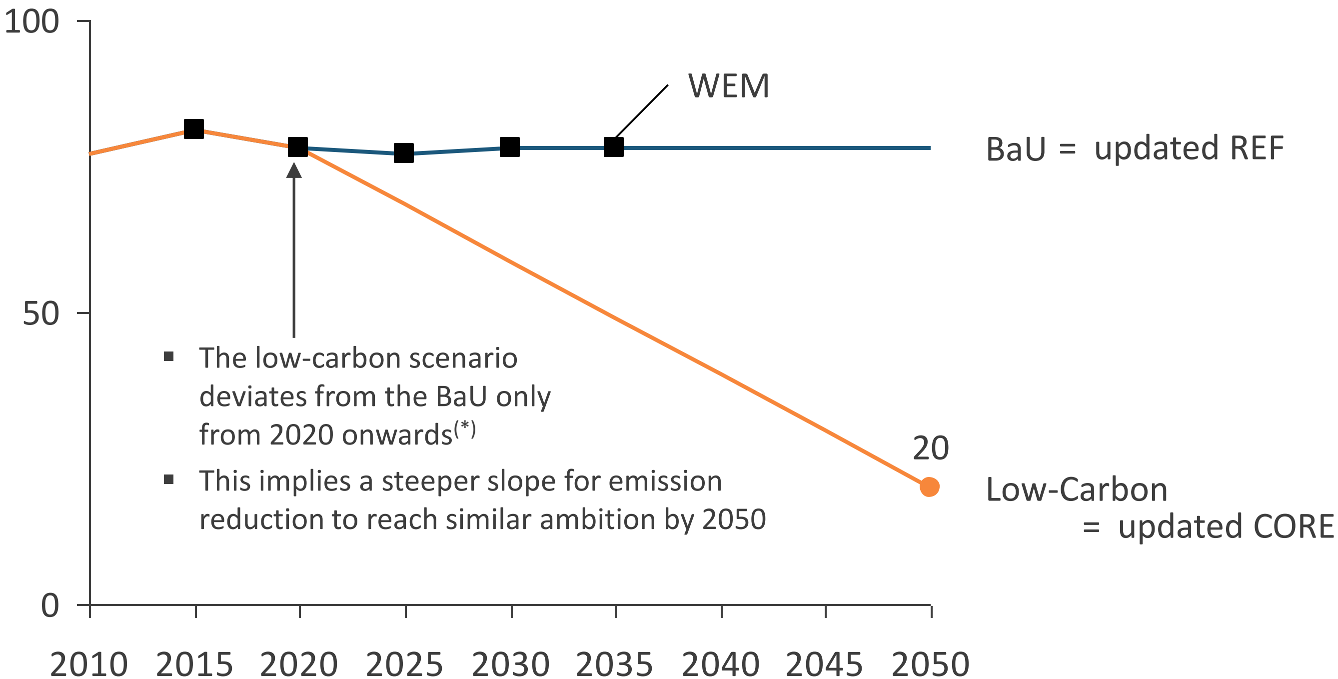
Average yearly investments for Buildings
undiscounted (2010-2050), million EUR



Source: Belgium OPEERA model (Climact, VITO)

The results shared today are based on the scenarios of the Low-Carbon Belgium 2050 updated for consistency with the last available projections

Illustration of the BaU and low-carbon scenarios considered to assess [base 100 w.r.t. 1990]



- The business as usual scenario consists of a bottom-up update of the REF scenario from the study Low-Carbon Belgium 2050, calibrated on the last available WEM projections
- The low-carbon scenario consists of a bottom-up update the CORE scenario taking into account the following:
  - No difference with the BaU up to 2020
  - Similar GHG reduction ambition by 2050

Note: (*) instead of 2015 in the study Low-Carbon Belgium 2050

Caveats on the results shared today

- As for now, there was **no stakeholder consultation** to discuss required choices
    - The BaU is an updated version of the REF scenario. Most projections on underlying variable are available up to 2030. Choices had to be made for the evolution 2030-2050.
    - Cost assumptions are updated based on literature review
- Total costs associated to scenarios are **average values at macro level**.
  They do not aim to demonstrate any business cases for specific situations
- The update should be refined in the coming months,
  including a revision of the assumptions for the low-carbon scenario

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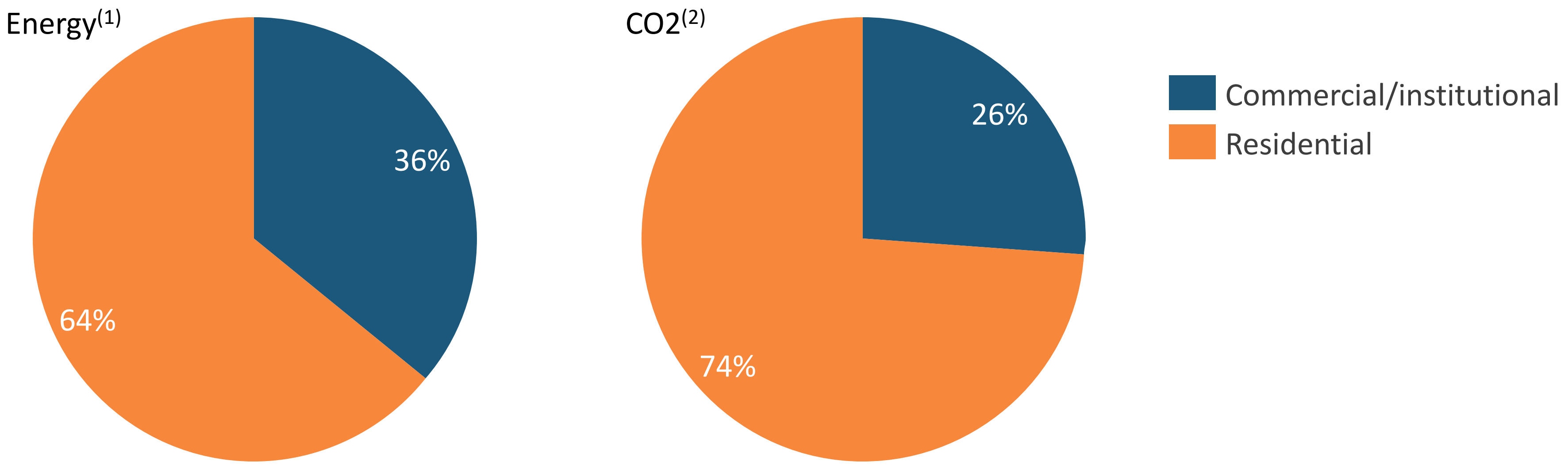
Residential buildings are responsible for 74% of direct emissions from buildings

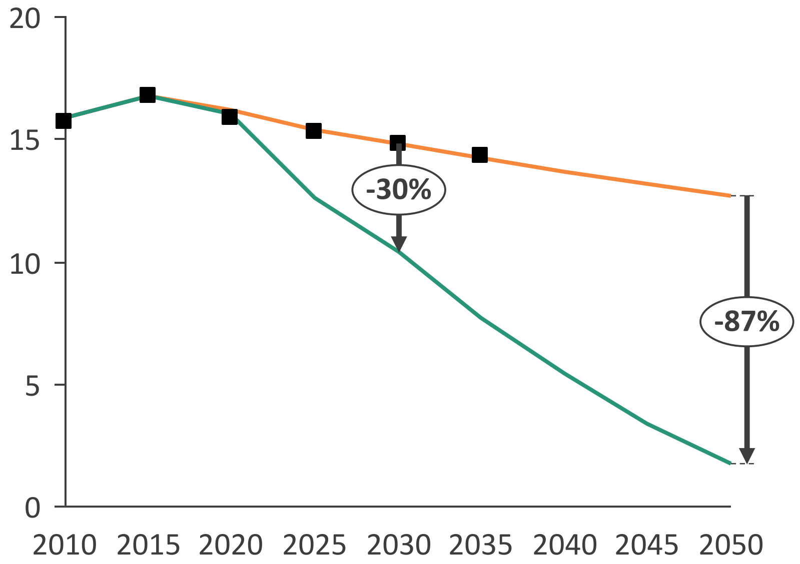
Energy consumptions and GHG emissions in buildings
[%, in 2015]



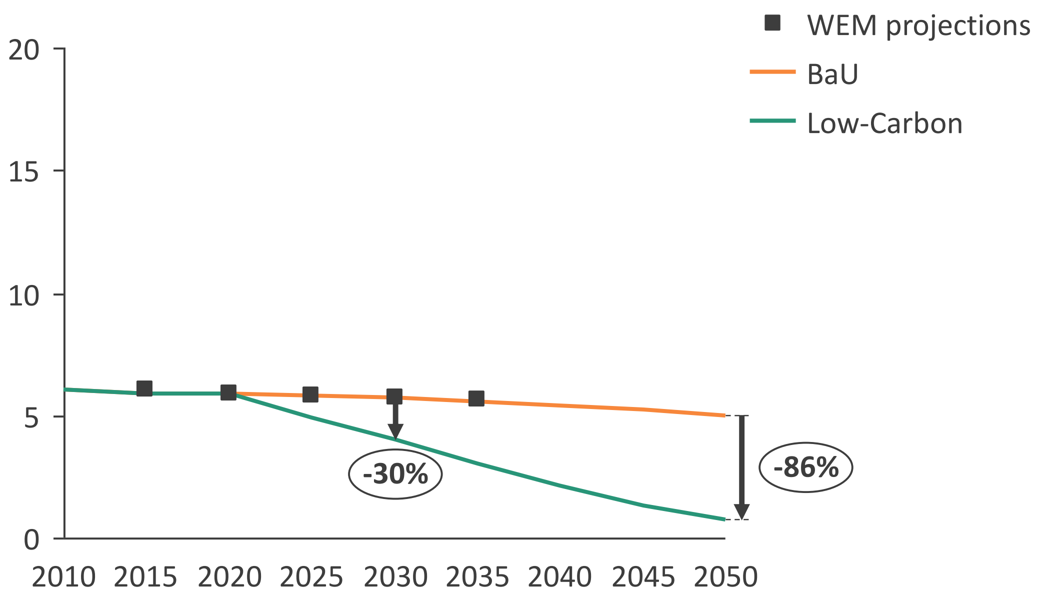
Source: (1) Eurostat Energy Balance (2) NIR 2017

Updated low-carbon scenarios are considered to assess the amount of GHG emissions in buildings

Scenarios for GHG emissions in <u>residential</u> buildings
[MtCO2e]



Scenarios for GHG emissions <u>non-residential</u> buildings
[MtCO2e]



Emissions corrected for HDD (15/15, ref 1705HDD, applied to 90% of the emissions)

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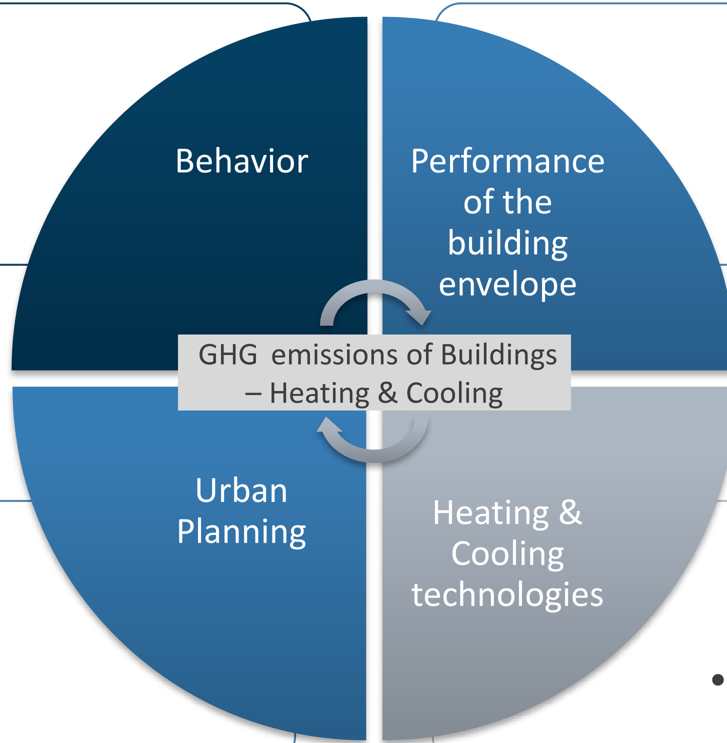
4 main groups of factors are covered to test the potential for decarbonizing the heating/cooling of building sector

- Heating demand: desired internal temperature
- Cooling demand
- Hot water demand

- New buildings & existing buildings
- Renovation speed
- Speed of demolition/new buildings

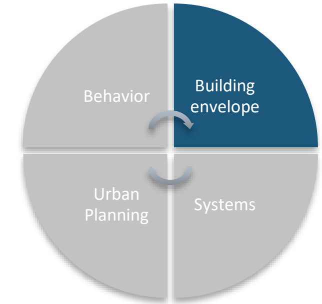


- Evolution of surface per building
- Evolution of compactness: Share of flats

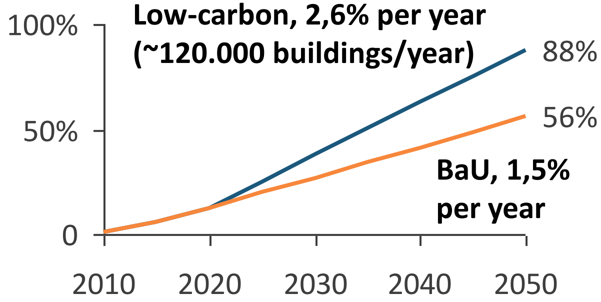
- Evolution of type of heating/cooling/hot water technologies
- Efficiency of these technologies
- Life span of technologies

Additional drivers are Evolution of the population & Number of dwellings; Evolution of the services sector (value added)

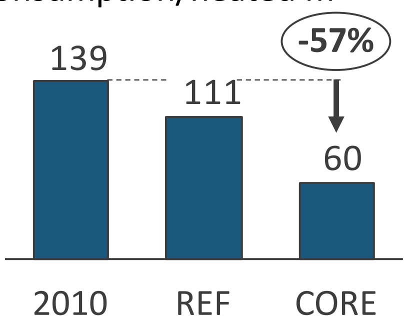
Key in the buildings sector is to reach the massive renovations required



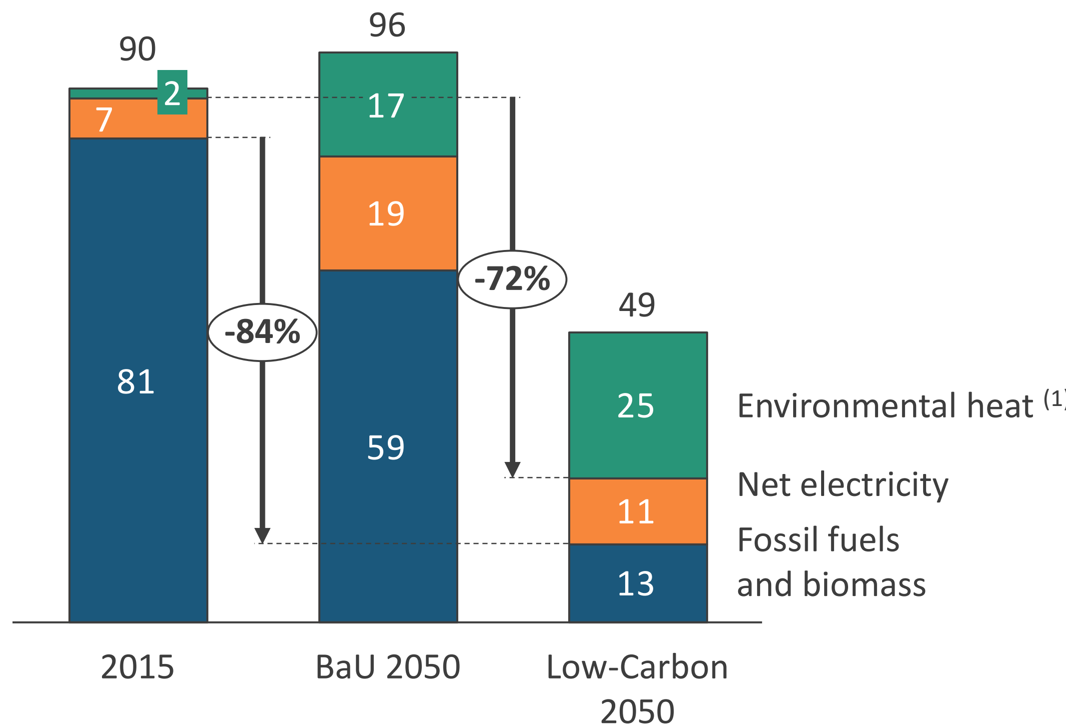
Share of renovated building stock, %



Level of renovation
kWh of final consumption/heated m²

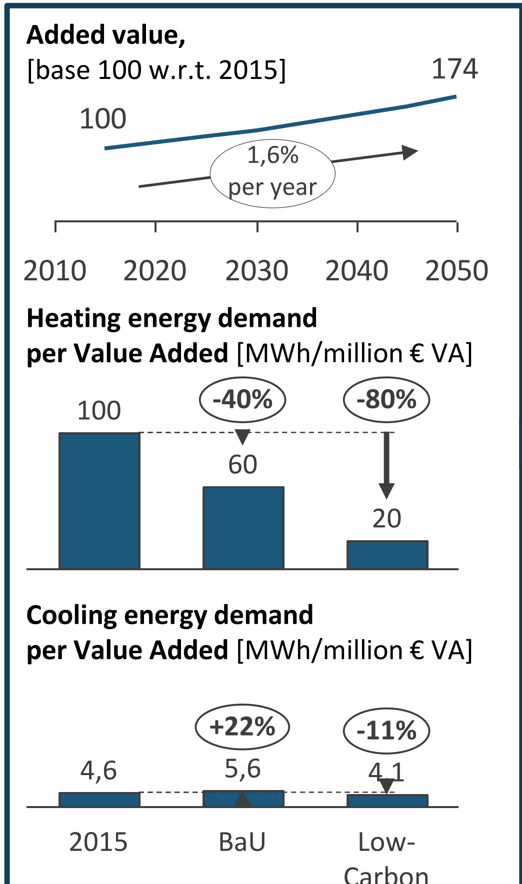


Total energy required for residential buildings – domestic space heating, cooling and hot water
TWh per year



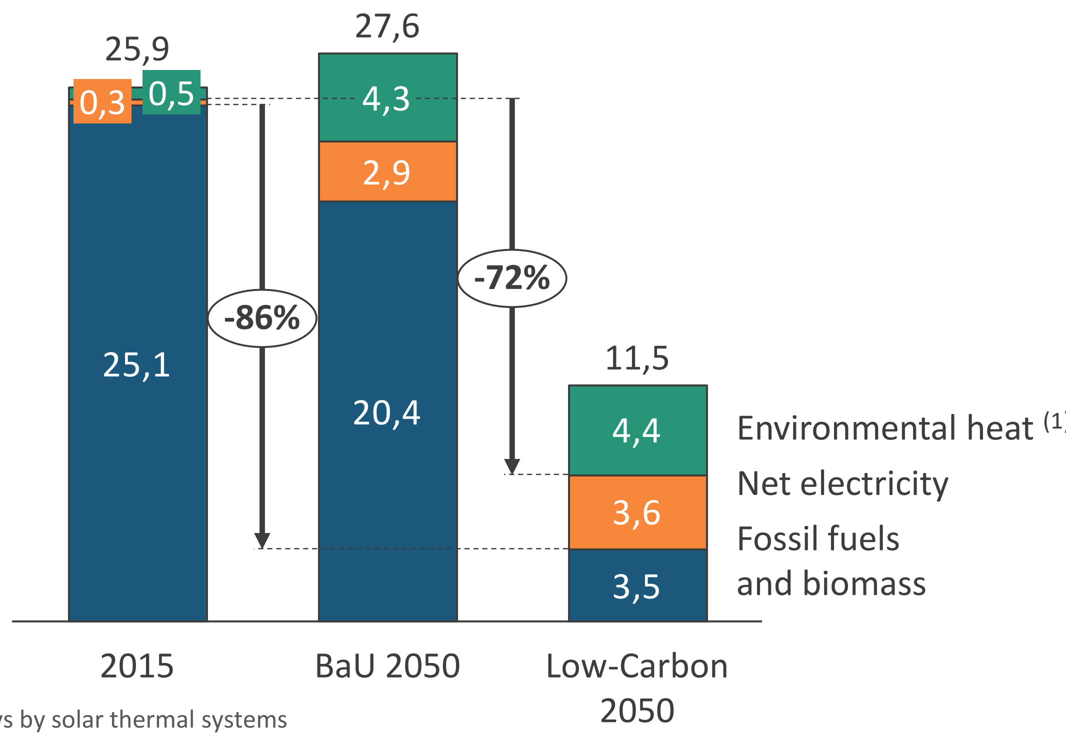
(1) Extracted from the atmosphere by heat pumps and from sun rays by solar thermal systems
SOURCE: Climact

Similar ambition is required for non-residential buildings



Total energy required for non-residential buildings – space heating, cooling and hot water

TWh per year



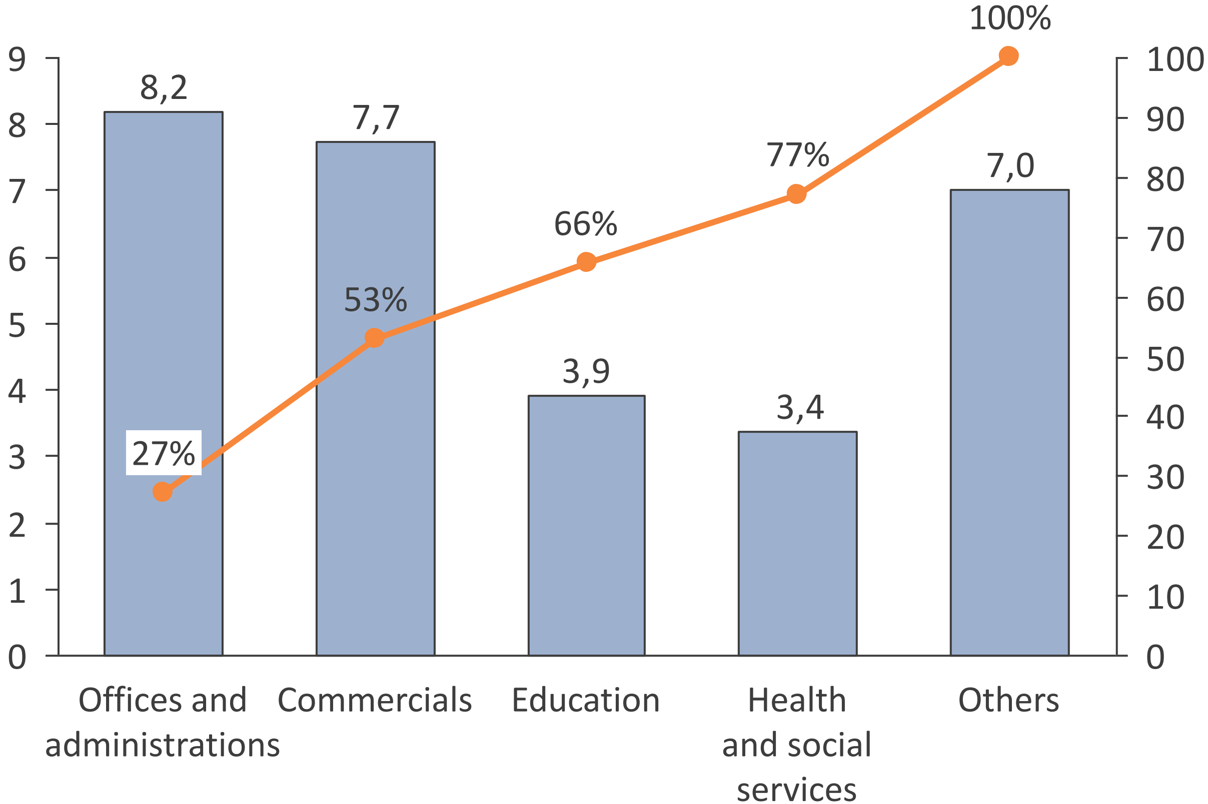
(1) Extracted from the atmosphere by heat pumps and from sun rays by solar thermal systems

SOURCE: Climact

Offices, administration and commercial buildings are responsible for half of the fossil fuel consumption of non residential buildings in Belgium

Energy consumptions in non-residential buildings, excluding electricity

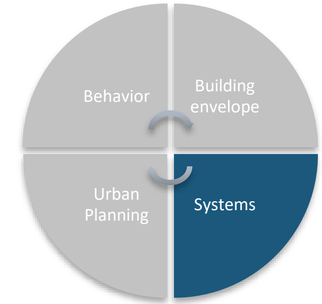
[TWh per year, left – Cumulated share %, right]



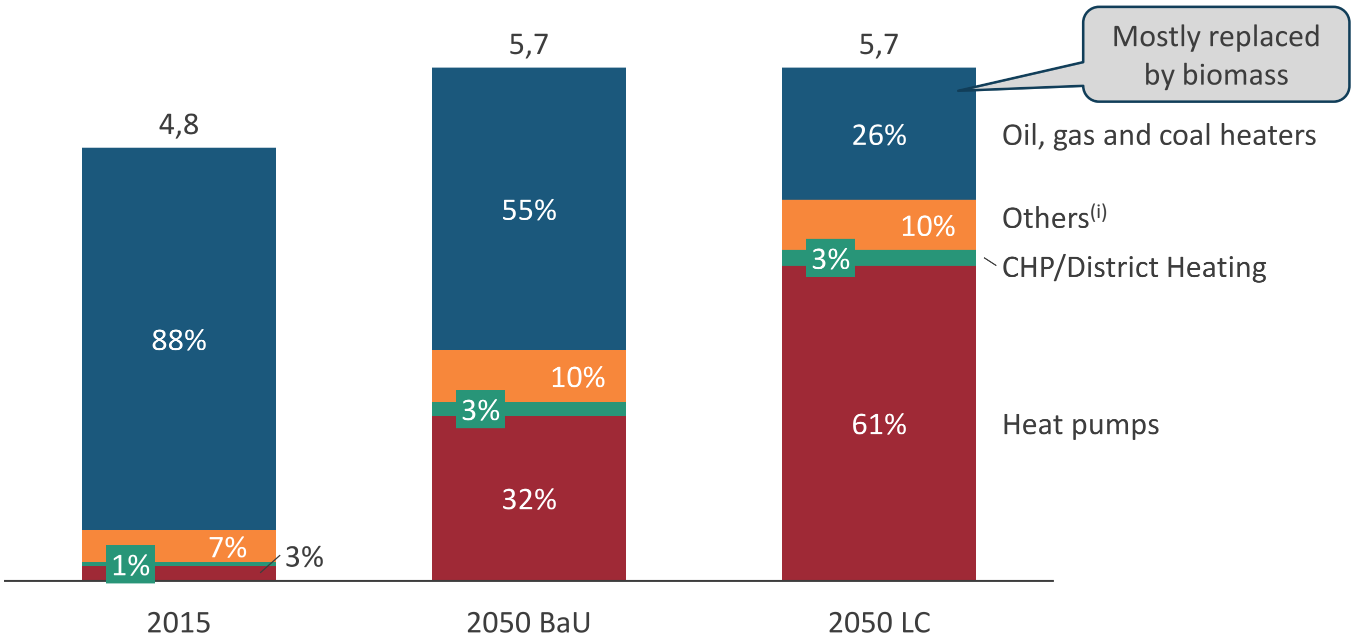
Others:
- Sport and culture
- Energy and water
- Transport & telecom
- Hotels and restaurants
- Other services

Source: CLIMACT, based on regional energy balances (data 2013)

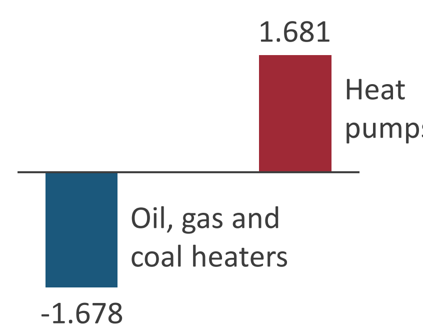
This also requires a major shift in heating systems, leading to large electrification



Share of technologies in residential buildings heating systems
[millions of installations]



Delta LC - BaU
[x10^3 of installations]



(i) Resistive heating, stirling and fuel cell micro-CHP, geothermal

Source: CLIMACT, OPERAA Belgium

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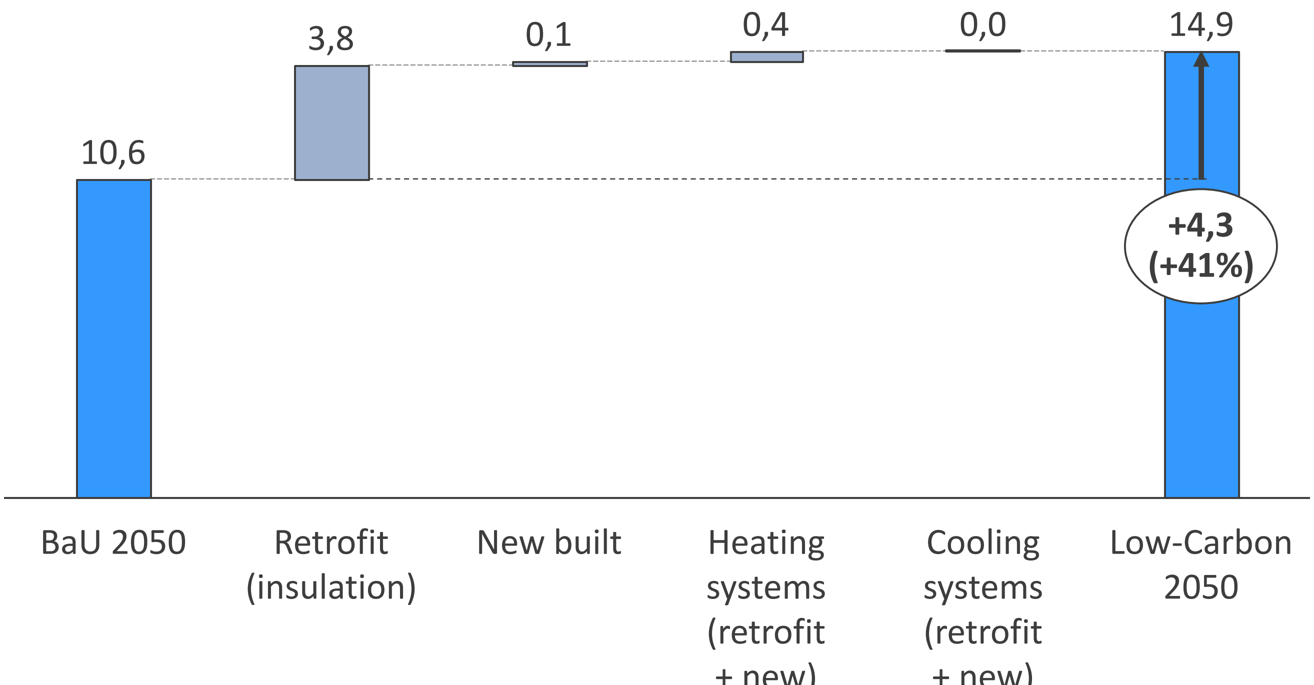
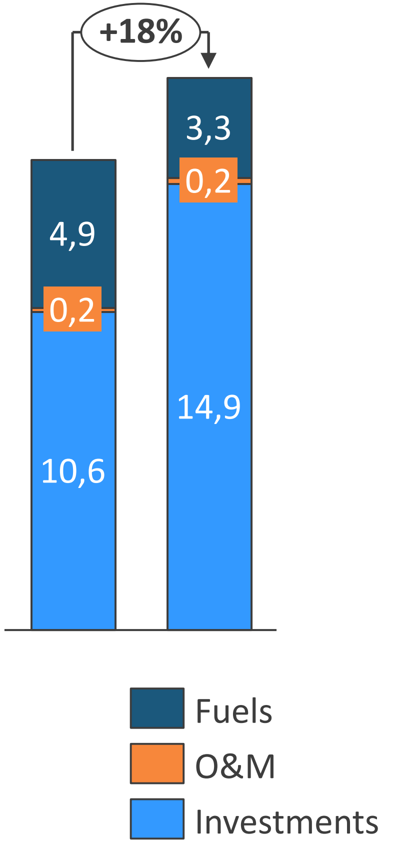
Residential buildings energy renovation requires additional average yearly investments of ~4b€ partially compensated by the reduction of the energy consumption costs

Average yearly investments for residential buildings in the two scenarios and drivers of the difference
(undiscounted 2020-2050, in billion €)

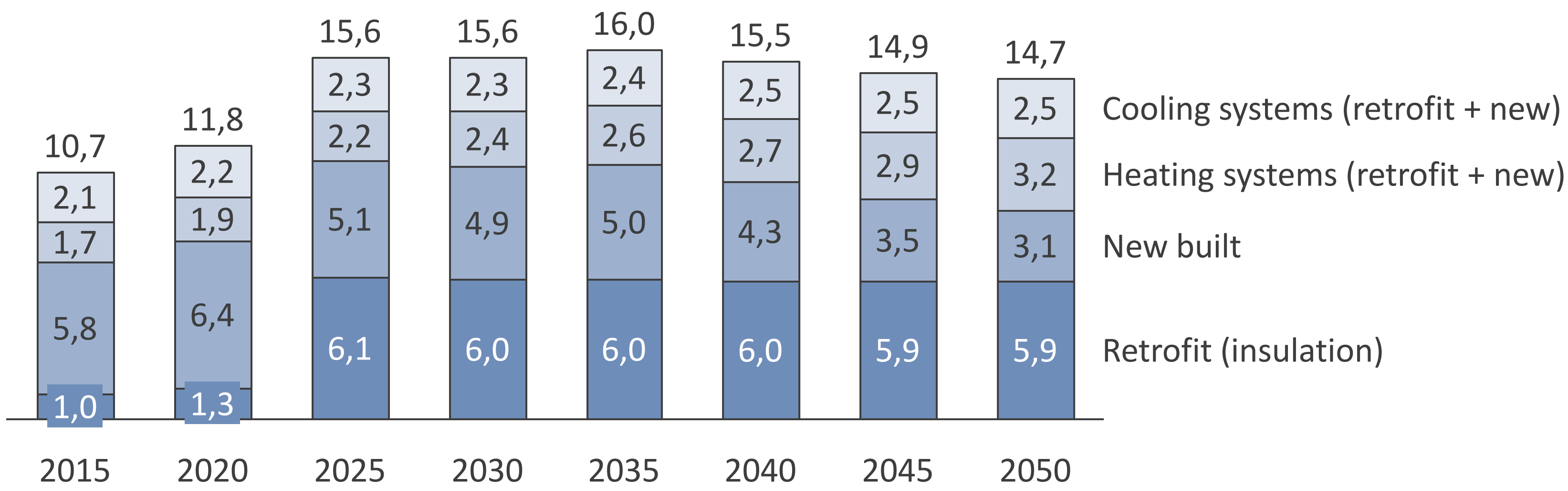


Average yearly total costs
(undiscounted 2020-2050, in billion €)



Note: fuel costs based on 2016 final energy prices

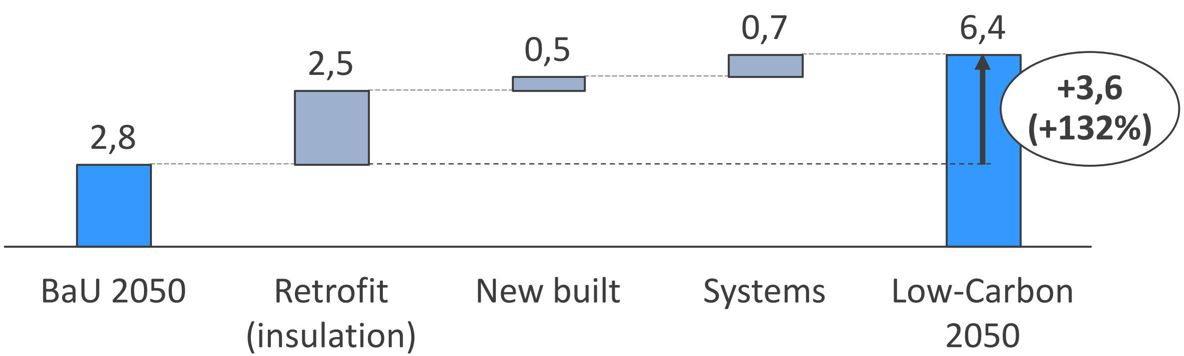
Time evolution of yearly investments for residential buildings in the low-carbon scenario (undiscounted, in billion €)



Source: CLIMACT

Additional average yearly investments of 3,6b€ in non-residential buildings result from higher ambitions on the energy efficiency of buildings envelope

Average yearly investments for non-residential buildings in the two scenarios and drivers of the difference
(undiscounted 2020-2050, in billion €)



Average yearly total costs
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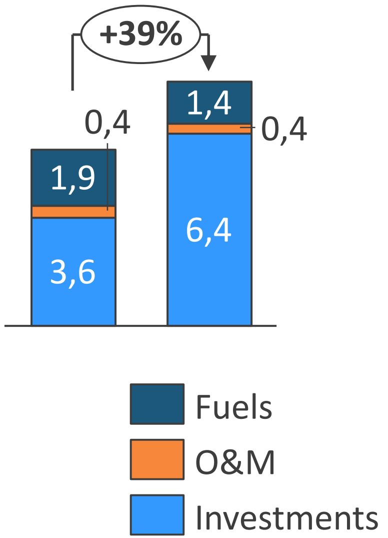
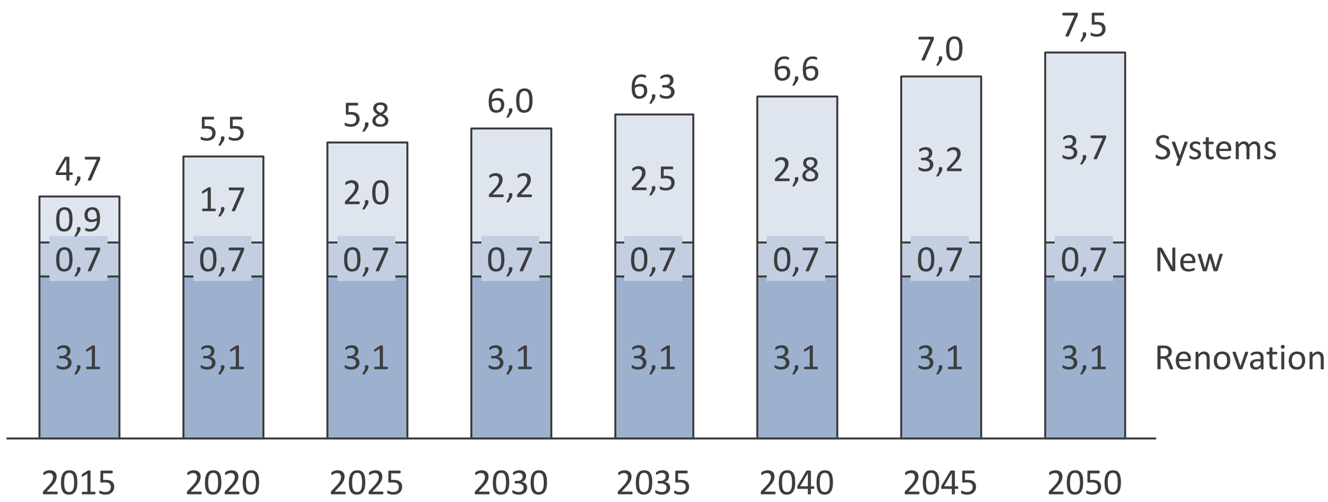


Note: fuel costs based on 2016 final energy prices

Time evolution of yearly investments for non-residential buildings in the low-carbon scenario (undiscounted, in billion €)



Source: CLIMACT

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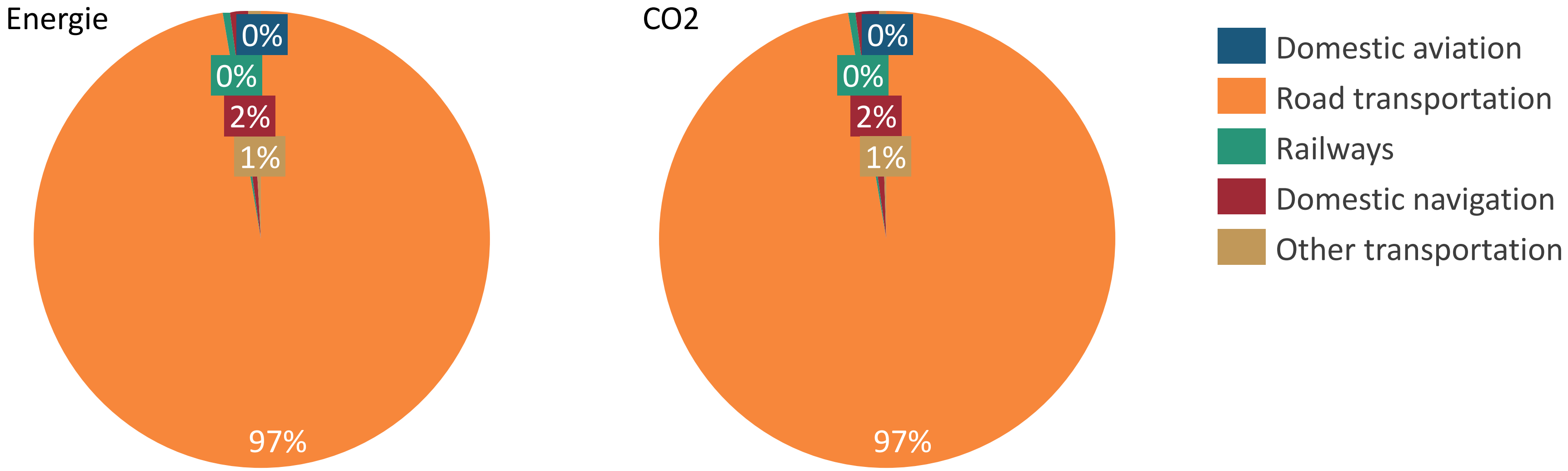
Road transport constitutes most of accounted GHG emissions

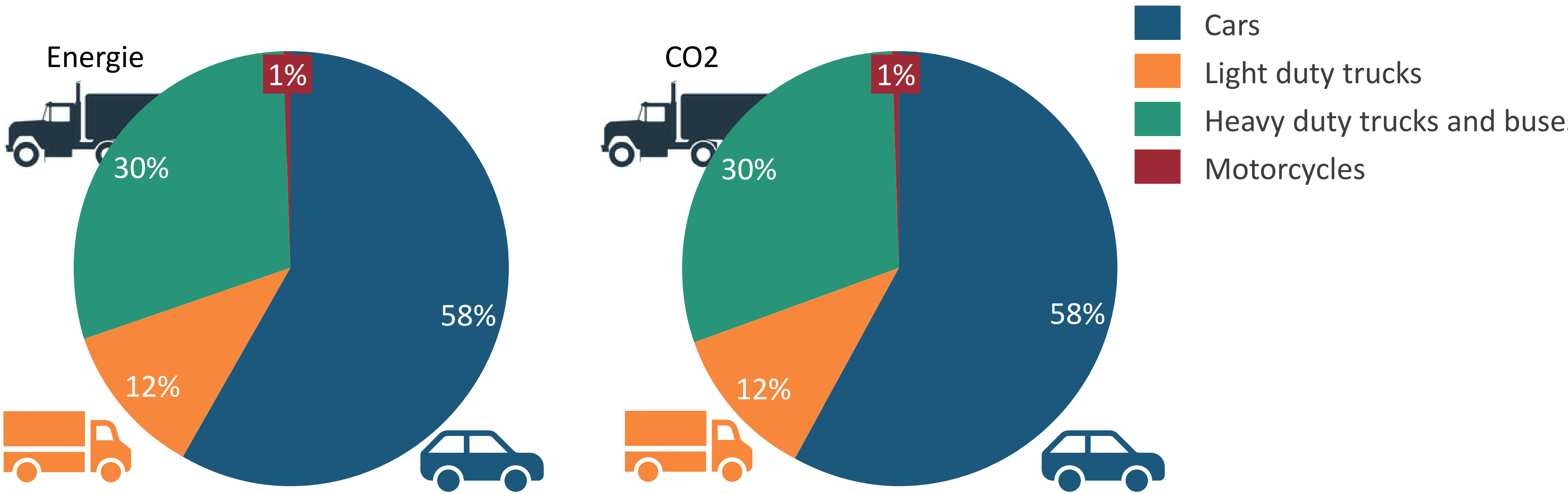
Consommation d’énergie et émissions de CO2 dans le transport par sous-secteur en 2015 [%]



Source: NIR BE 2016

Cars are responsible for 58% of energy consumption and GHG emissions of transport

Consommations d'énergie et émission de CO2 du transport routier par catégorie de véhicule [%]



6,4 tCO_2/véhicule/an

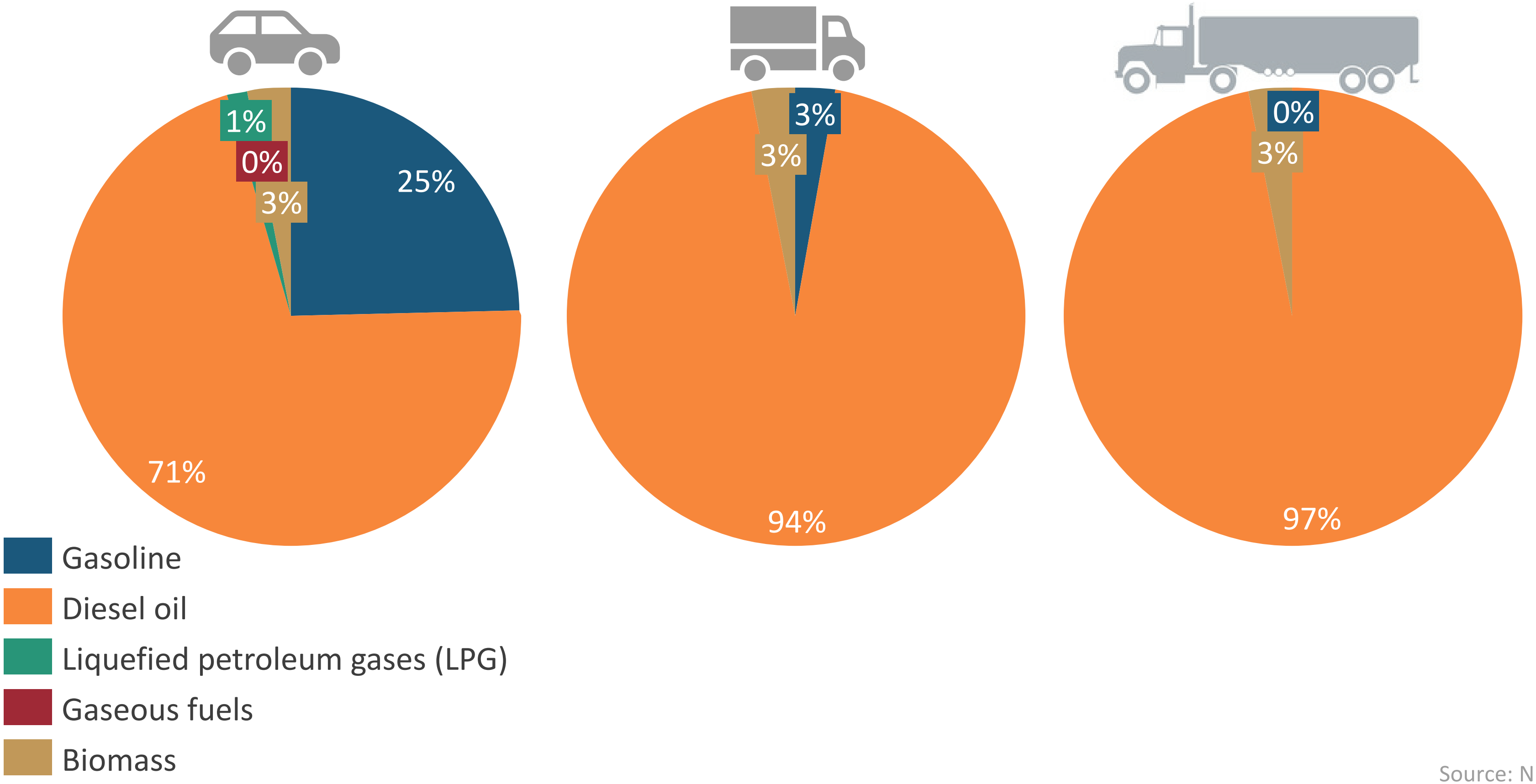
0,3 $kgCO_2$/t.km

2,5 tCO_2/voiture/an

Source: NIR BE 2016

Le diesel est la source principale de consommation d'énergie du transport

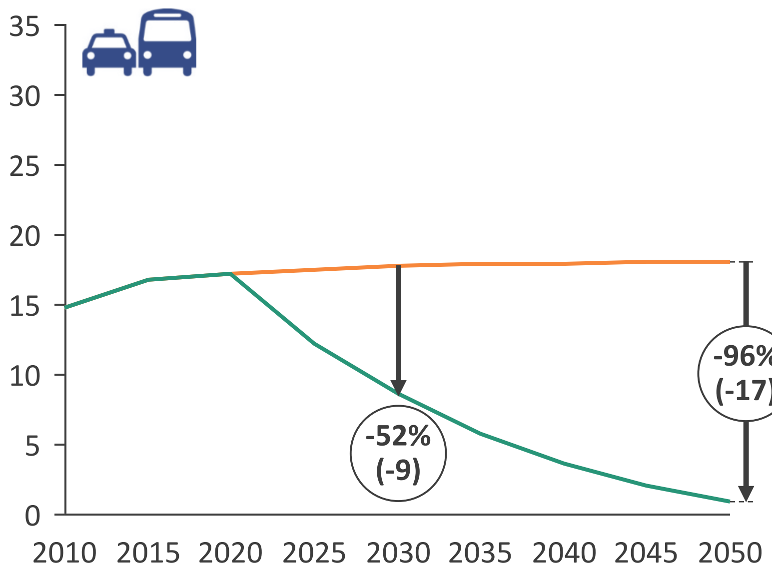
Consommations d'énergie par type de combustible en 2015 [%]



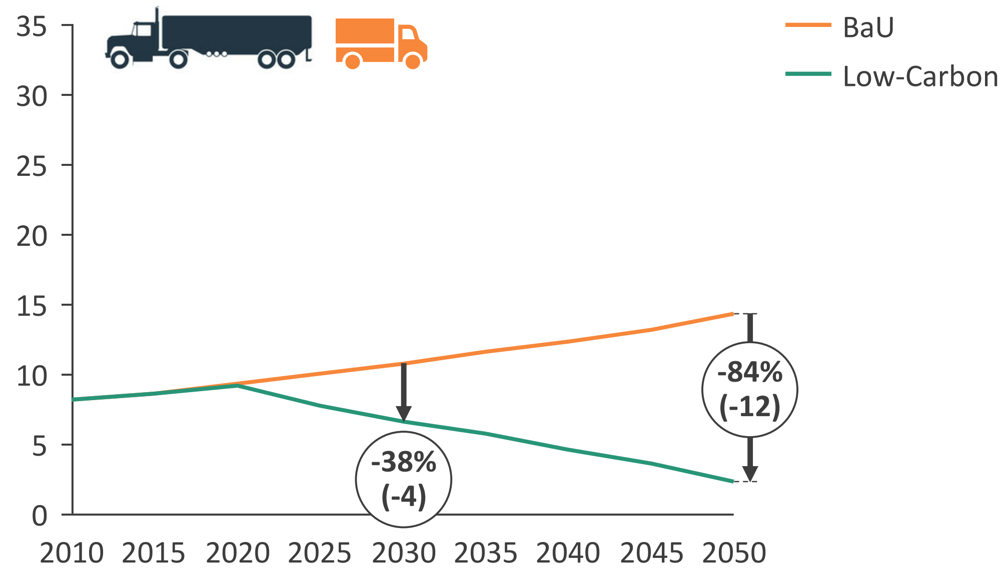
Source: NIR BE 2016

Updated low-carbon scenarios are considered

Scenarios for GHG emissions in passenger transport [$MtCO2_e$]



Scenarios for GHG emissions freight transport [$MtCO2_e$]



Note: projections are not available for passenger and freight transports separately

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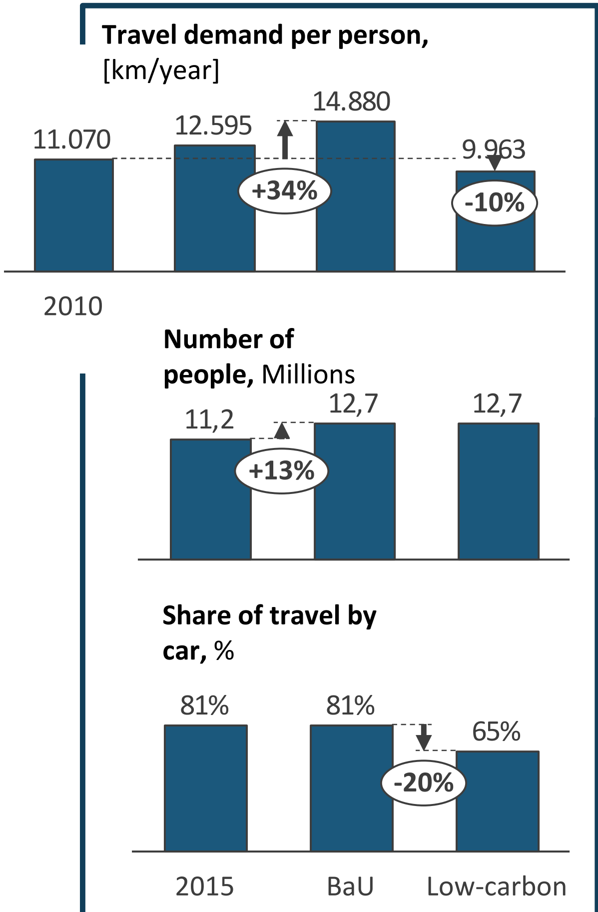
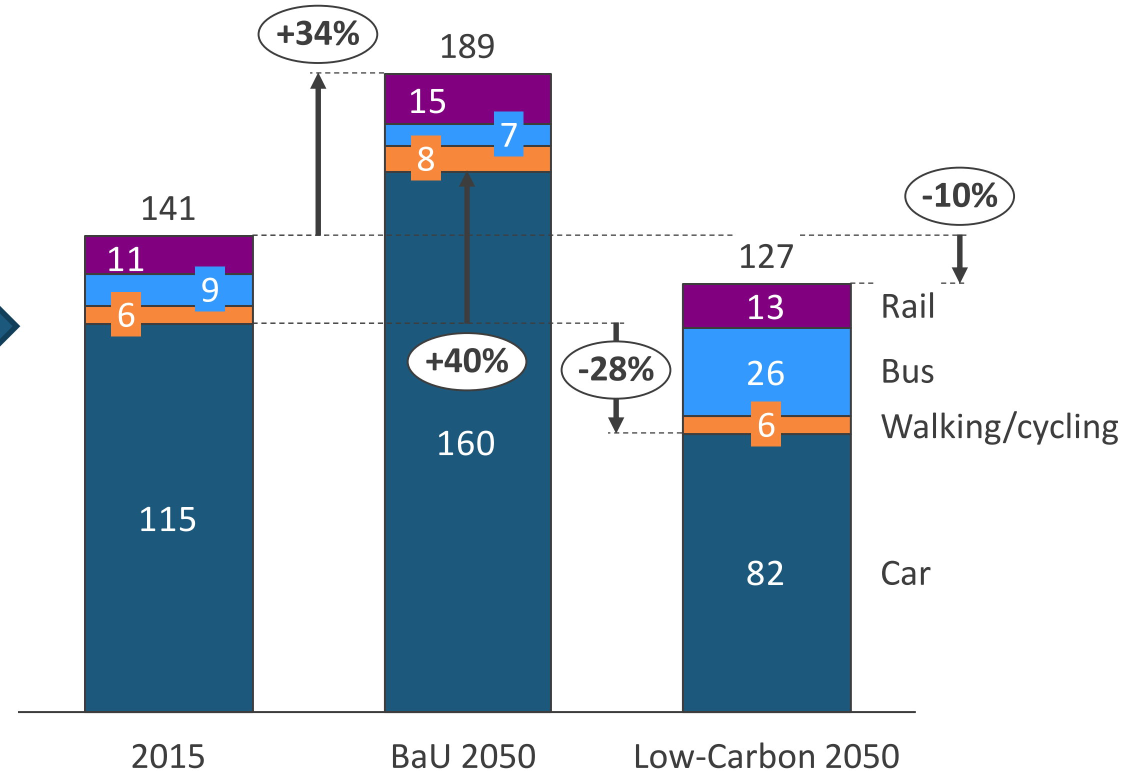
It is imperative to reduce travel demand per person and to reduce the share of car travel

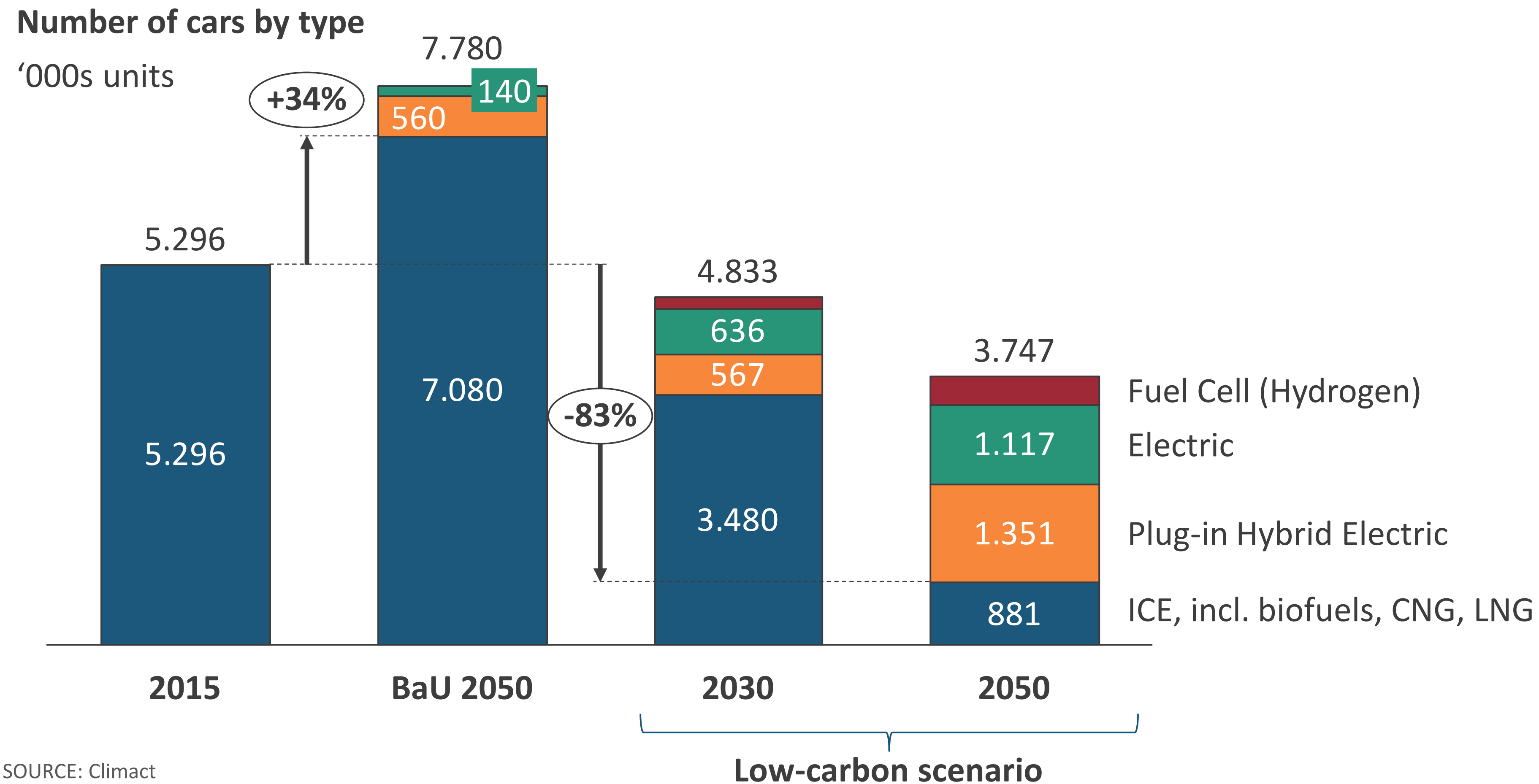


Volume of total transport demand and distribution per mode
billions of p-km



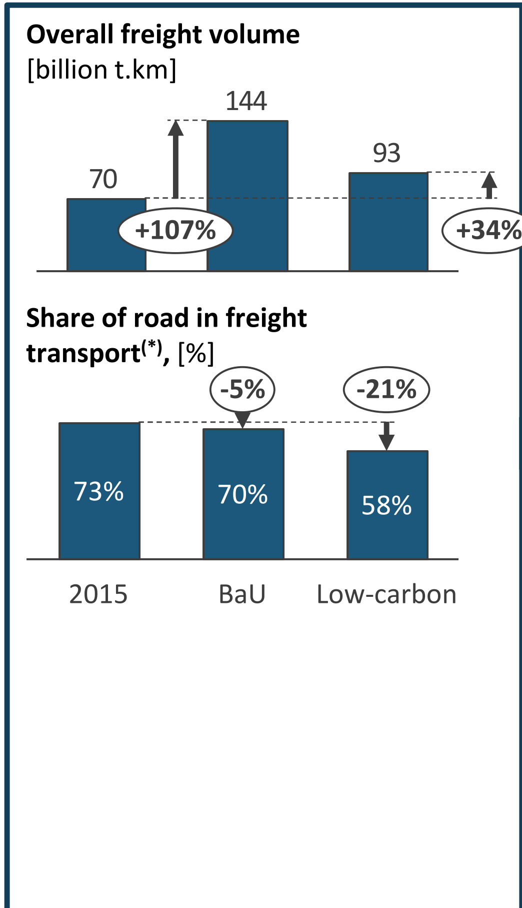
SOURCE: Climact

While at the same time operating almost a complete shift to electric mobility that will impact the power mix and market design



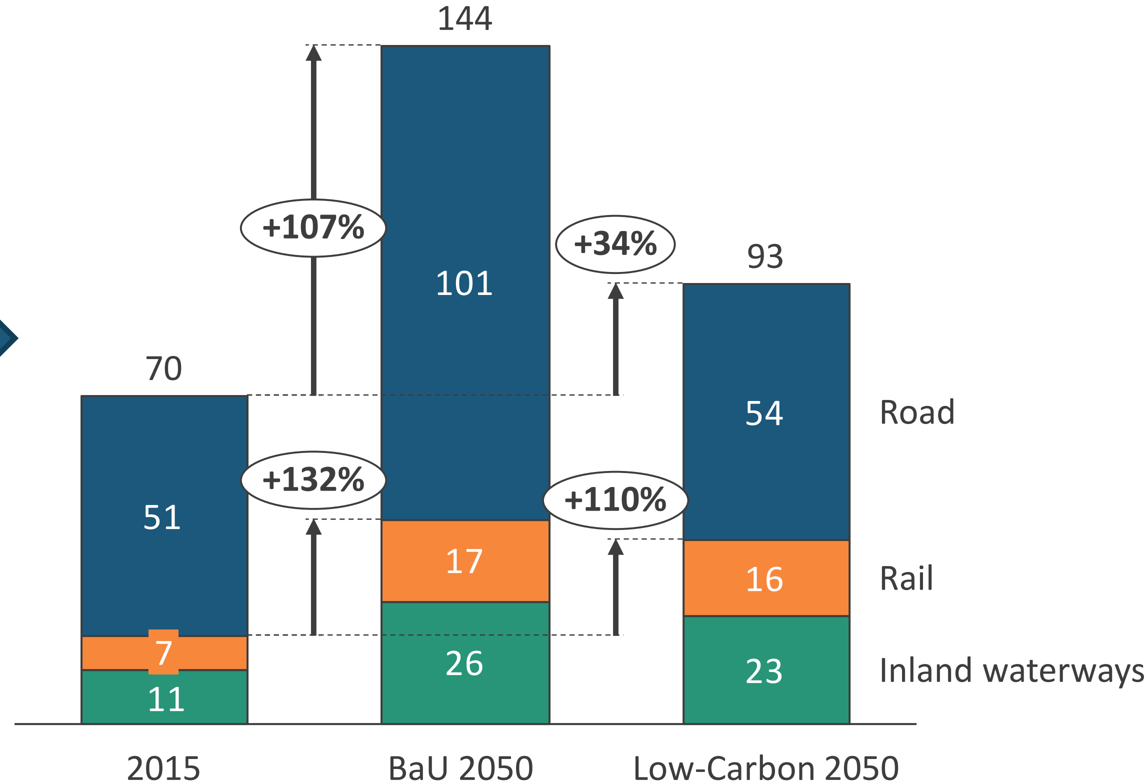
SOURCE: Climact

Emission reductions in freight transport
rely on a decoupling of economic growth and transported volumes of goods



Volume of total freight transport demand and distribution per mode

billions of t.km



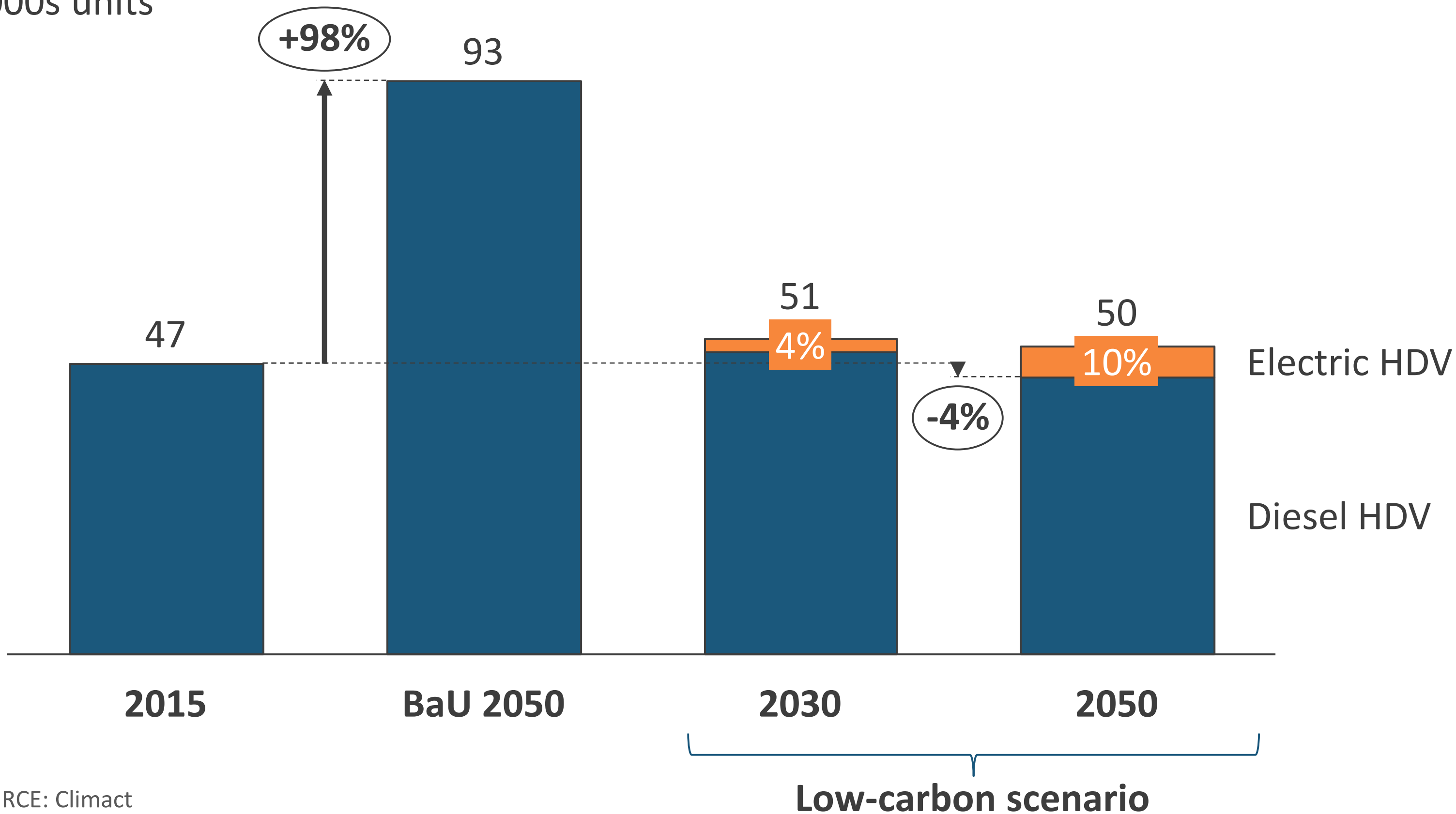
SOURCE: Climact

NOTE: (*) Projections are available (BFP) up to 2030. The value suggested for 2030 is considered constant up to 2050 in the BaU

This is combined with a light shift to electric transport

Number of trucks by type

‘000s units



SOURCE: Climact

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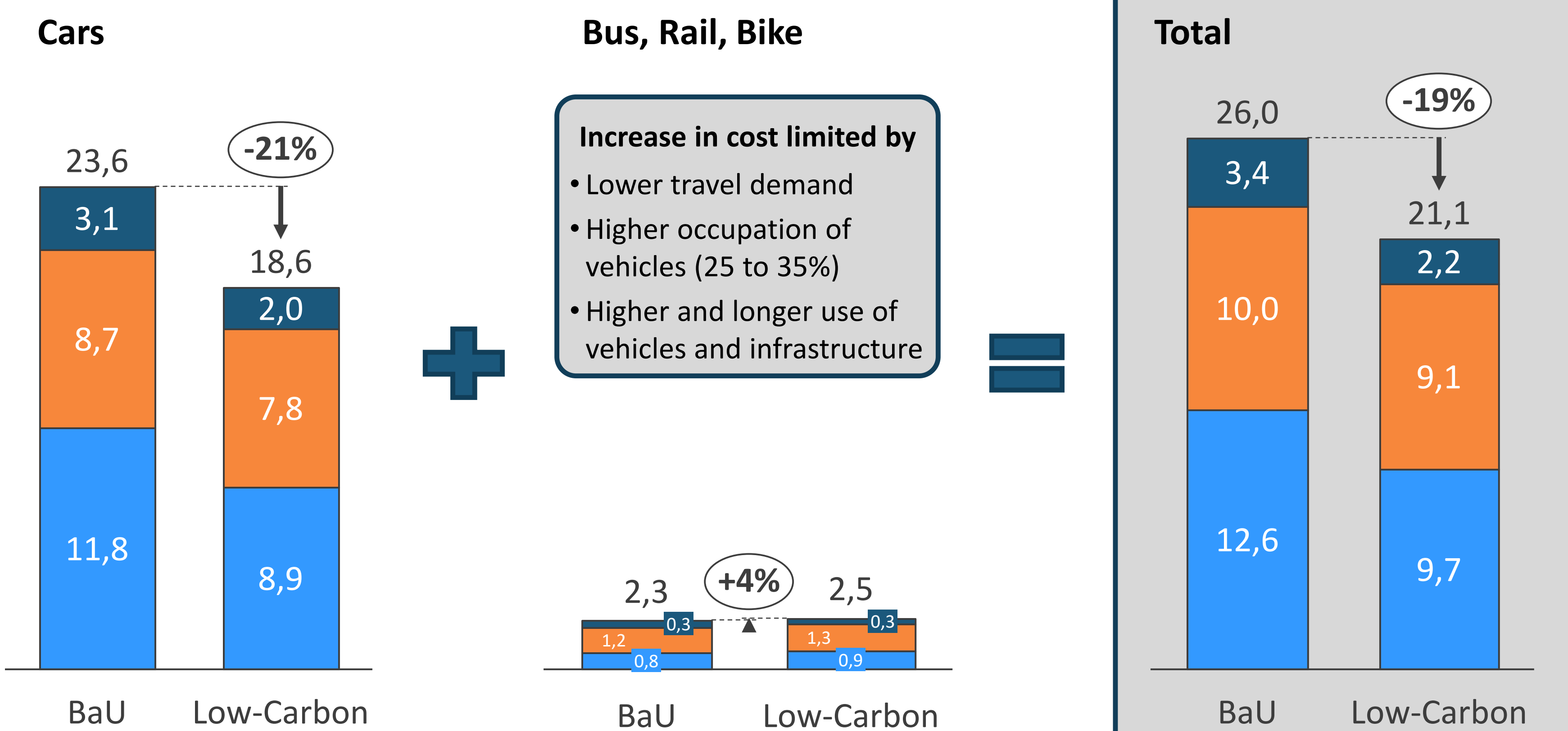
While very challenging, this could lead to lower costs

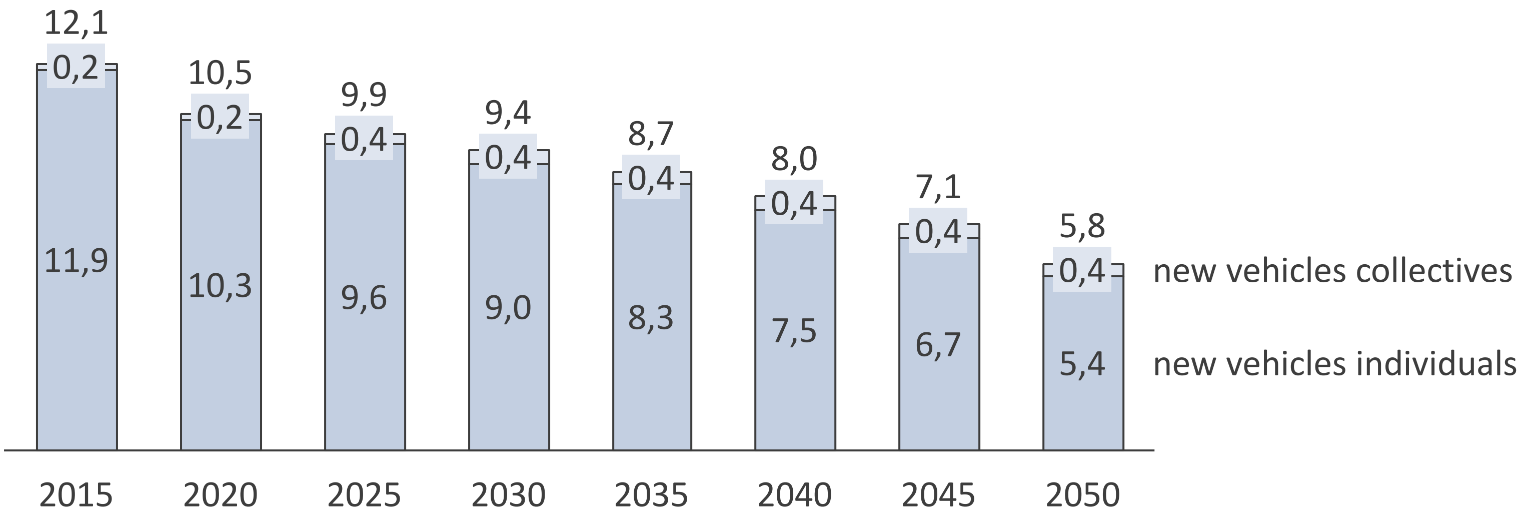
Average yearly expenses for passenger transport
(undiscounted 2020-2050, in billion €)

Fuel
O&M
Capital



SOURCE: Climact NOTE: not all infrastructure costs taken into account

Time evolution of yearly investments for road passenger transport in the low-carbon scenario (undiscounted, in billion €)



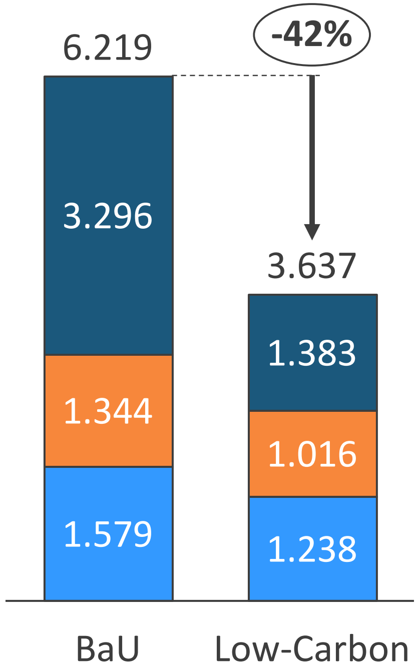
NOTE: not all infrastructure costs taken into account

Source: CLIMACT

While very challenging, this could lead to lower costs

Average yearly expenses for freight transport
(undiscounted 2020-2050, in billion €)

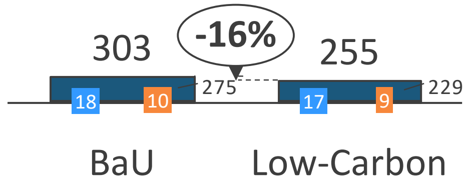
Trucks



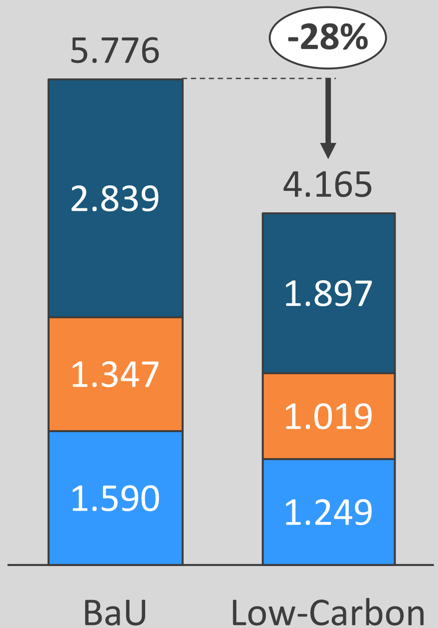
Rail, Inland waterways

Decrease in costs resulting from

- Lower transport demand
- Higher vehicle efficiency



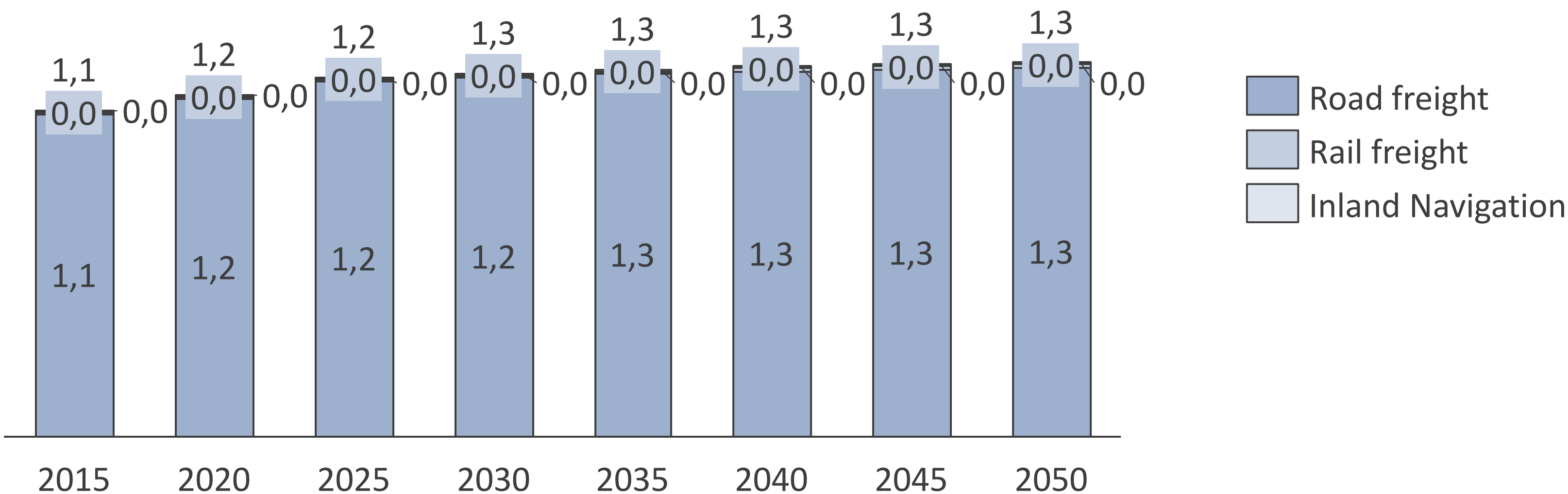
Total



SOURCE: Climact

NOTE: not all infrastructure costs taken into account

Time evolution of yearly investments for freight transport in the low-carbon scenario (undiscounted, in billion €)



NOTE: not all infrastructure costs taken into account

Source: CLIMACT

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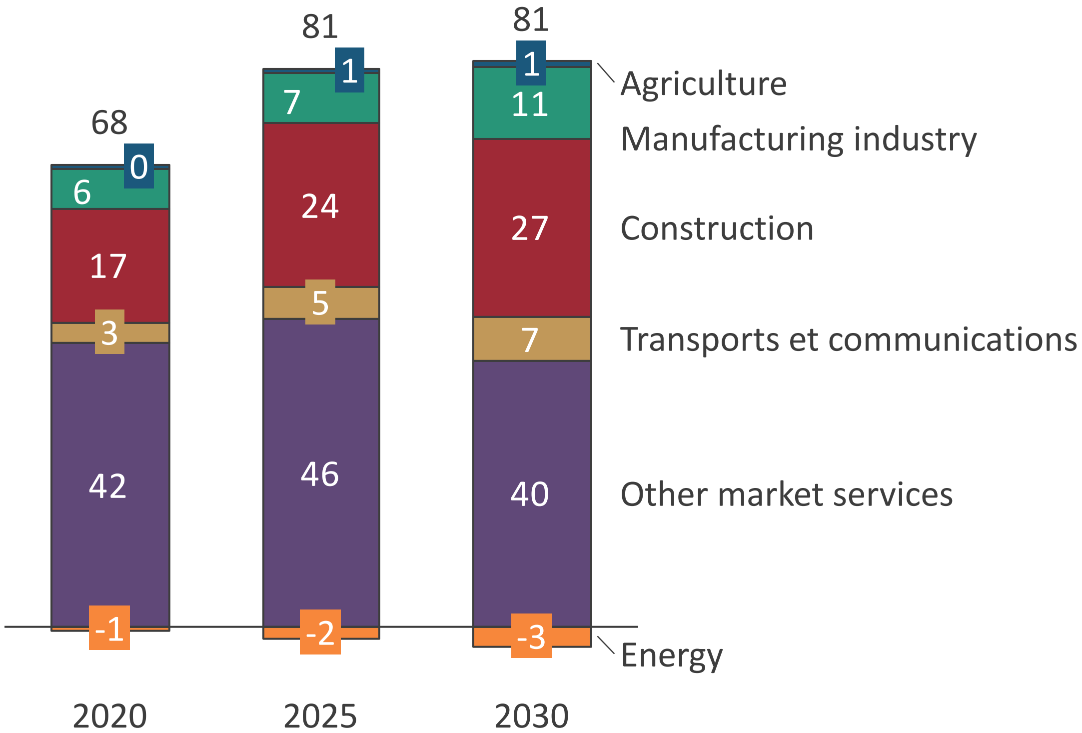
Overall impacts - Jobs

~80,000 additional jobs are created in 2030

Jobs creation by sectors in 2030, CORE LOW CARBON scenario

(Hermes, thousands of jobs in that year wrt Reference scenario)



Source: Climact, Federal Plan Bureau, Prof. T. Bréchet

Key messages:

- The main driver for job creation is the **demand push**: mostly in market services, construction and manufacturing industries
- Market services benefit from all abatement levers and is job intensive
- There is a loss of 3.000 jobs in the energy sector (which includes both power and refining in Hermes)

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Potential co-benefits of climate action

Implementing low carbon scenarios could bring additional benefits

Evaluation of potential monetary impact

Air pollution

- Fossil fuel use is the main factor of air pollution and impacts public health
- Climate policy can enable **savings in air pollution policies and public health**

up to **~4% of GDP** (BE)[1]

Congestion and road accidents

- Growth of congestion and accidents impact **productivity of the overall economy**
- Climate policy is expected to encourage the shift to more collective transport

up to **~3 to 4% of GDP** (BE)[2]

Living environment

- Weak insulation and ventilation of homes has impact on **health and comfort of inhabitants**
- Climate policy is expected to accelerate the retrofit of large number of houses and buildings with higher standard of energy efficiency

up to **~1 to 2% of GDP** (EU)[3]

Healthy diet

- Unbalanced healthy diet is source of diseases (cardiovascular and cancer)
- Climate policy is expected to encourage a shift from animal proteins towards a mix of sustainably produced animal and vegetal proteins

up to **~6% of GDP** (UK)[4]

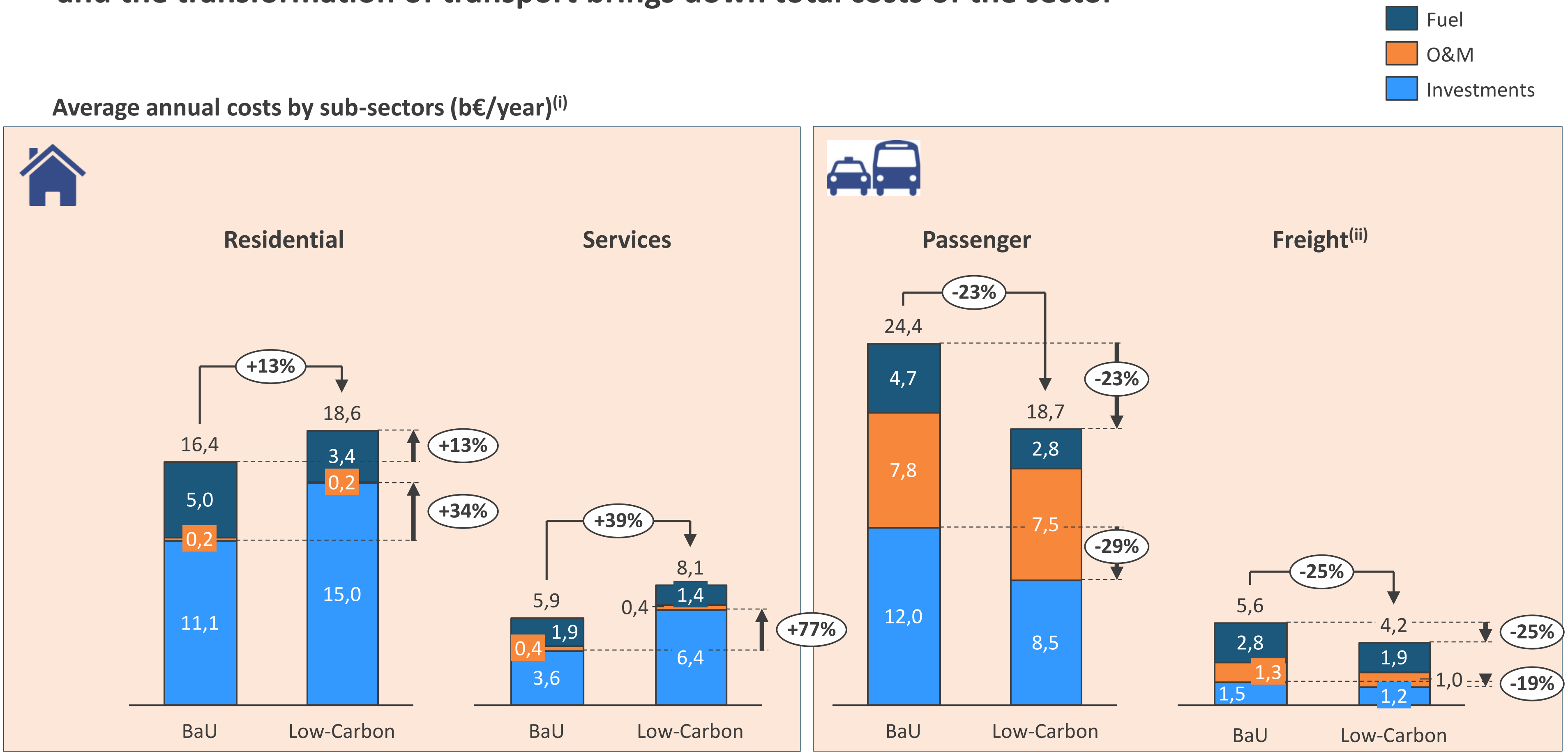
Sources: (1) OCDE (2014) – (2) van Hessen et al. (2011) + Christidis et al (2012) – (3) IEA (2014) – (4) Scarborough et al. (2012)

Agenda

- Context and historical trends
- Towards low-carbon Buildings
- Towards low-carbon Transport
- Macro-economic implications
- Conclusion

Higher investments in buildings are partially compensated by lower energy bills and the transformation of transport brings down total costs of the sector

Average annual costs by sub-sectors (b€/year)(i)



Note: (i) Fuel prices kept constant and equal to 2016 prices (commodity + distribution) (ii) Investment costs not updated (iii) Option B: 10, 70, 190 €tCO2e by 2020-30-50

Thank you.

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