TOWARDS A LOW CARBON SOCIETY

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BARI, 10 November 2014

Agenda

Context

Selected modelling option : OPEERA

Main findings

What is the model for?

From national calculators to Global calculator

Global context

UNFCCC

Cancún Agreements (December 2010):

The Conference of the Parties,

…

45. *Decides that developed countries should develop* ***low-carbon development strategies or plans****;*

EU

European Council (February 2011):

"Reaching the EU objective, in the context of necessary reductions according to the IPCC by developed countries as a group, of reducing greenhouse gas emissions by ***80-95% by 2050 compared to 1990*** *as agreed in October 2009 will require* ***a revolution in energy systems, which must start now****."*


PARIS CLIMAT 2015

Belgium Projections and Reporting

- BELGIUM is a federal state with 3 autonomous Regions and 3 communities

- Bottom-up projections are based on a combination of models:
  - **Flemish Region:** new Flemish energy and greenhouse gas **simulation** model was developed in 2011 to build short term projections to be used in the Flemish Climate Policy Plan 2013-2020

  - **Walloon Region:** EPM (Energy/Emissions Projection Model) is a **projection** model for energy demand and atmospheric emissions that covers all relevant emission sectors

  - **Brussels Capital Region:** Environment Brussels Energy Emissions Projections Model, **projection** model for energy demand and atmospheric emissions from stationary sources

- Macro-economic projections (top-down) are used at national level:
  - HERMES + information from PRIMES. HERMES is the macrosectoral model used by the Belgian Federal Planning Bureau for its national short and medium term forecasts

Belgium. Modelling 2050: why?

Objective #1: To contribute to the development of a Low Carbon Development strategy for Belgium by implying all key stakeholders

- UNFCCC and EU Monitoring Mechanism Regulation requirement

EU Monitoring Mechanism Regulation:
Article 4 - Low-carbon development strategies
1. Member States, and the Commission on behalf of the Union, **shall prepare their low-carbon development strategies** in accordance with any reporting provisions agreed internationally in the context of the UNFCCC process, to contribute to …
2. Member States **shall report to the Commission** on the status of implementation of their low-carbon development strategy by … or in accordance with any timetable agreed internationally in the context of the UNFCCC process.

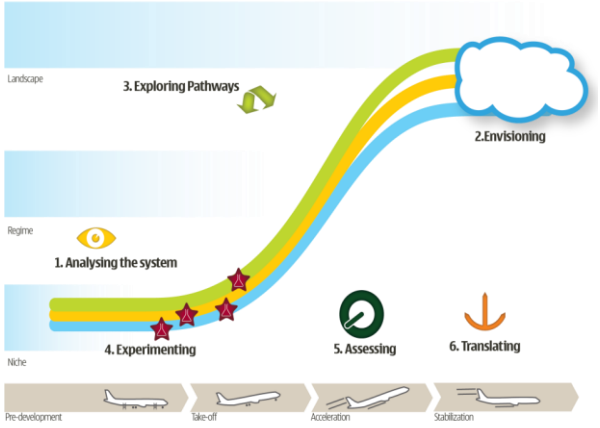
- This will require:
  - Coordination with Regional authorities
  - Further complementary analyses for the strategy to be very specific

Belgium. Modelling 2050: why?

Objective #2: To foster the transition by providing key actors with a framework at the national level that is coherent with EU and international contexts

- Many initiatives do exist
  - At different levels of public engagement (eg local authorities, citizens, companies)
  - In different fields (eg energy, food, sustainable development)

- In the spirit of 'transition management'



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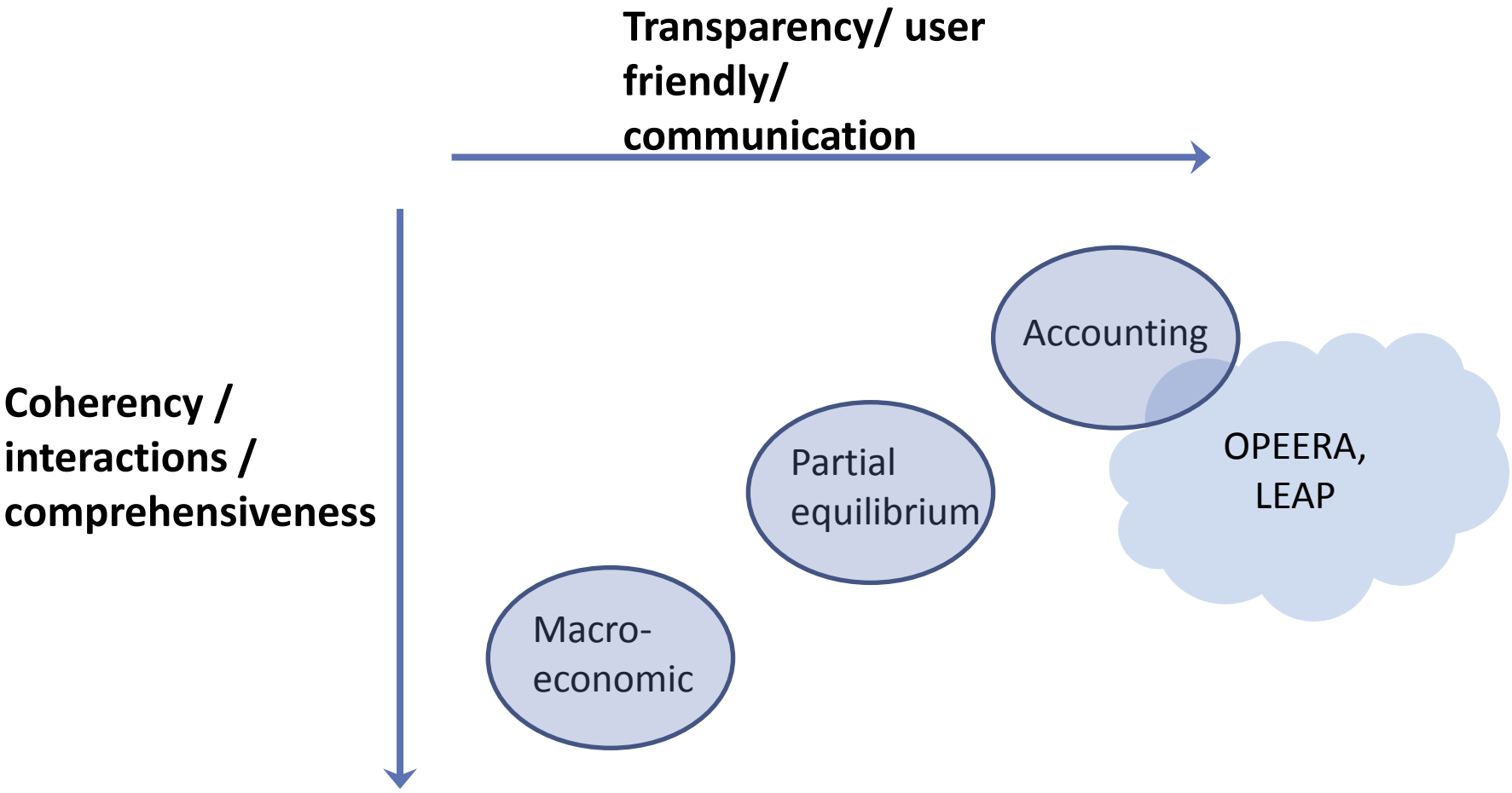
Main findings

What is the model for?

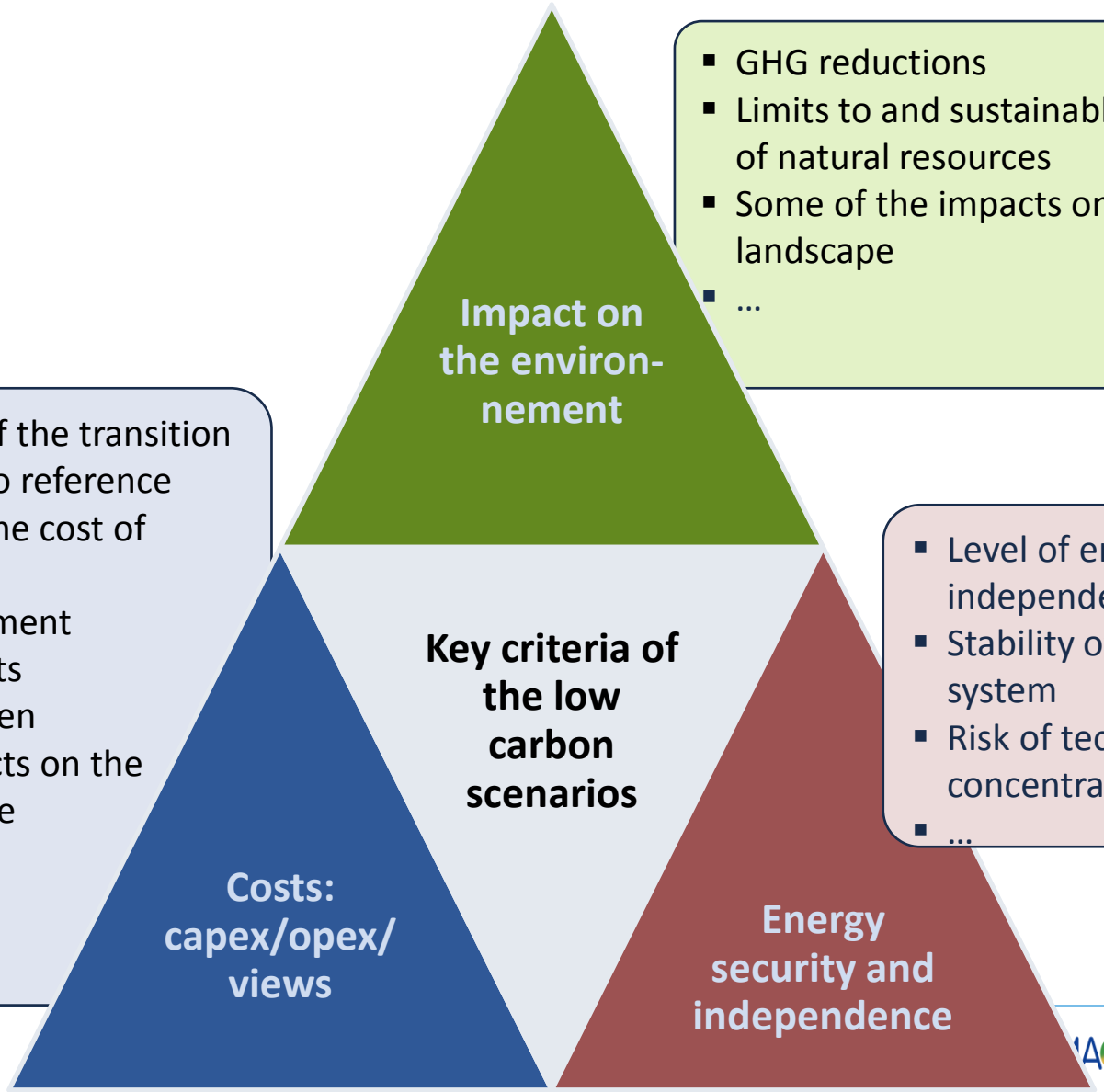
From national calculators to Global calculator

OPEERA = Open Source Emission and Energy Roadmap Analysis

This **accounting** model, like LEAP, is designed to explore possible pathways



The model allows to test key implications of a low carbon transition along 3 main dimensions



- GHG reductions
- Limits to and sustainable use of natural resources
- Some of the impacts on the landscape
- …

- Delta cost of the transition compared to reference
- Impact on the cost of electricity
- Total investment requirements
- Cost by citizen
- Some impacts on the quality of life
- …

- Level of energy independence
- Stability of the power system
- Risk of technology concentration
- …

What the model covers and does not cover

What it covers

- **Development of realist scenarios**
- **An iterative process, involving a lot of stakeholders**
- **An open-source model, flexible and dynamic**
- **The implications on investments and costs**
- **Identification of key decision points**

What it does not cover

- **Shows no projection or privileged way**
- **The model does not optimize costs, but performed a detailed analysis**
- **No macro-economic and social analysis of the implications**

OPEERA : Open-source Prospective Energy and Emissions Roadmap
Analysis tool developed in collaboration with DECC UK

Historical data

- Energy balance sheet
- GHG Emissions
- Demography
- GDP
- Drivers

Policies

- EU or national legal constraints

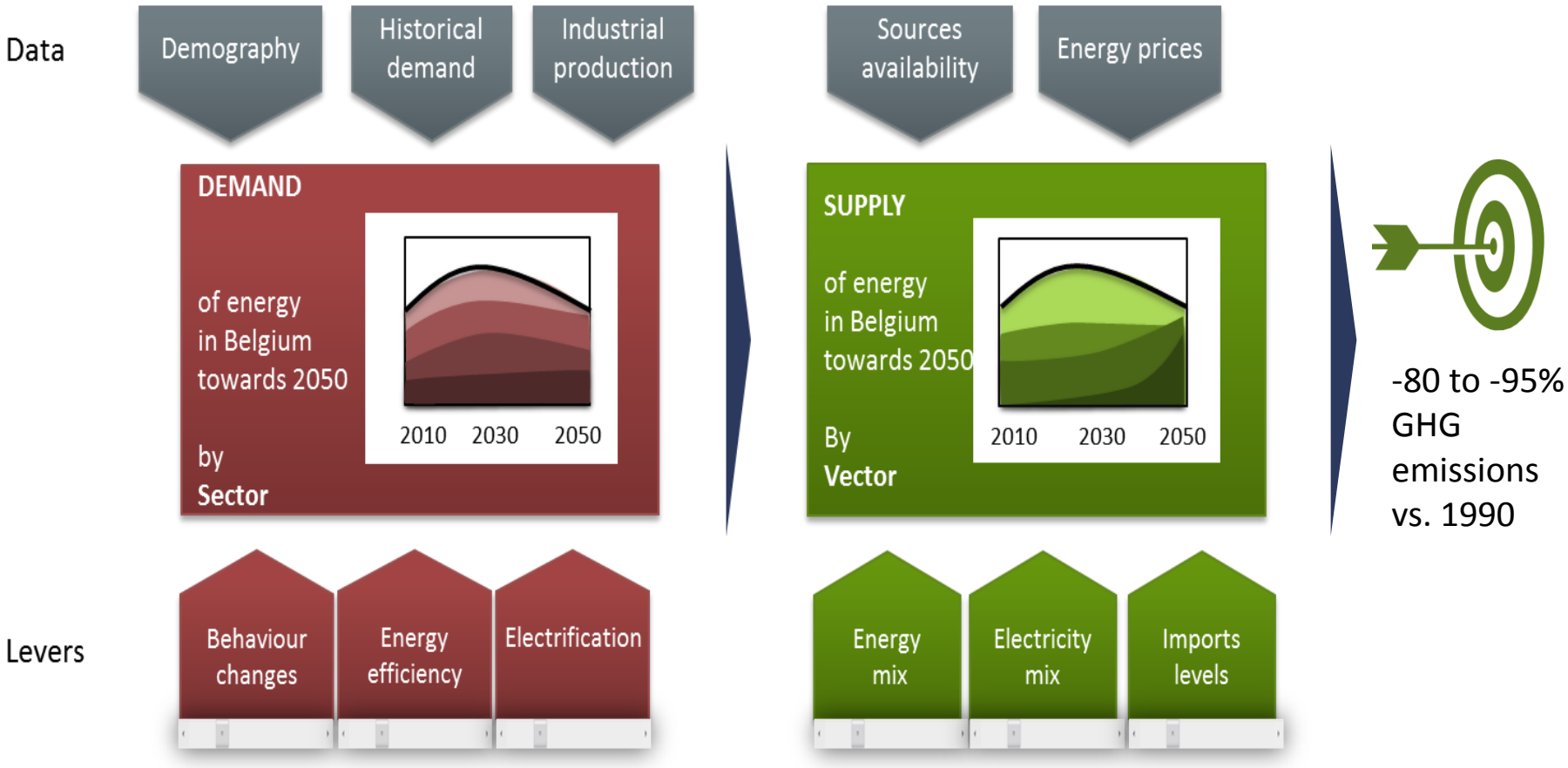
Stake-holders expertise

- Workshops
- Consultations

- Primary and final energy demand
- Electricity and heat
- GHG emissions
- Cash flows
- Energy flows
- Energy security
- Land surface usage

Source: DECC, Climact

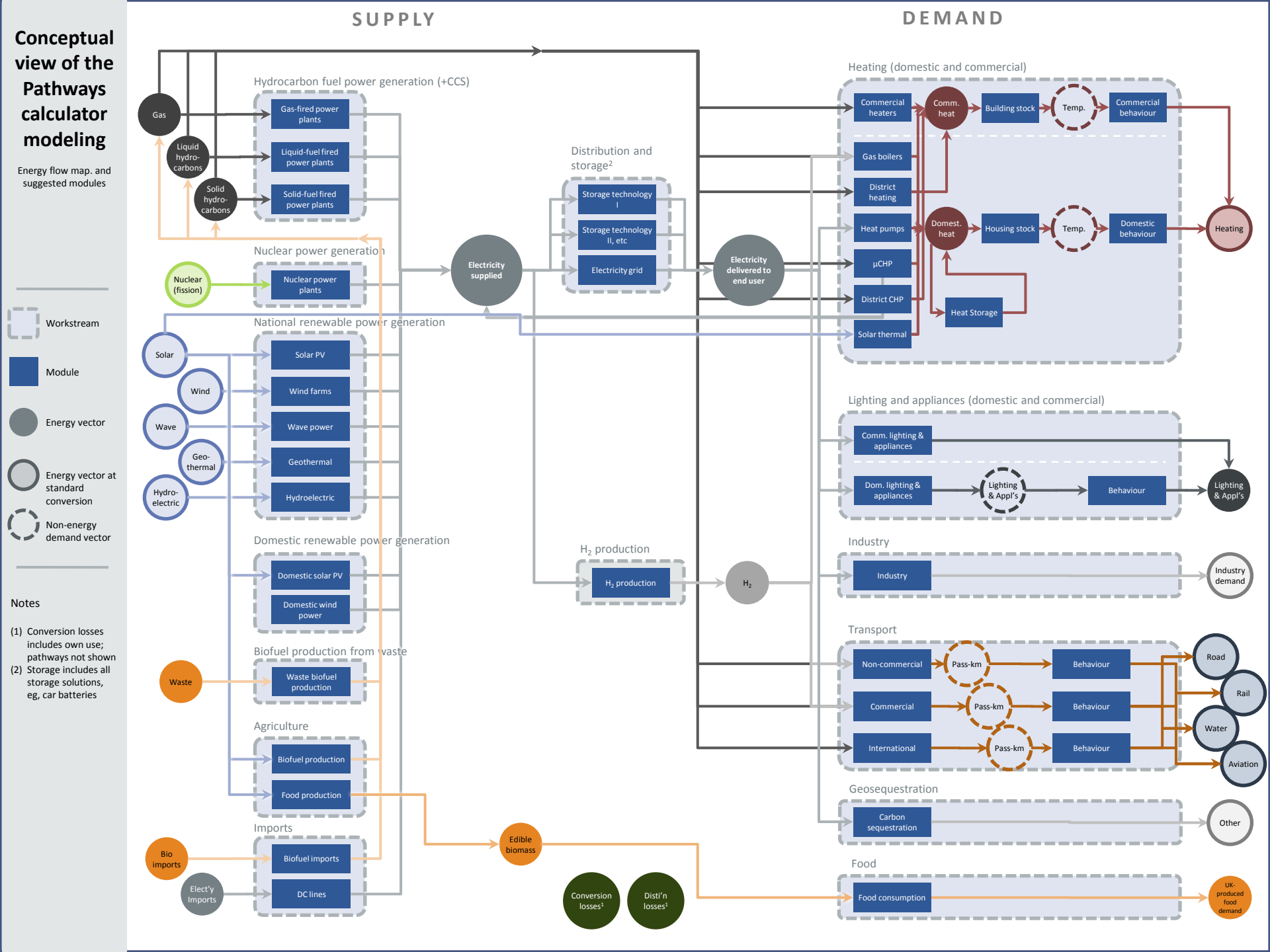
OPEERA balances demand and supply based on fixed input parameters as well as modifiable levers



Source: Climact

Conceptual view of the Pathways calculator modeling

Energy flow map. and suggested modules



Workstream

Module

Energy vector

Energy vector at standard conversion

Non-energy demand vector

Notes

(1) Conversion losses includes own use; pathways not shown

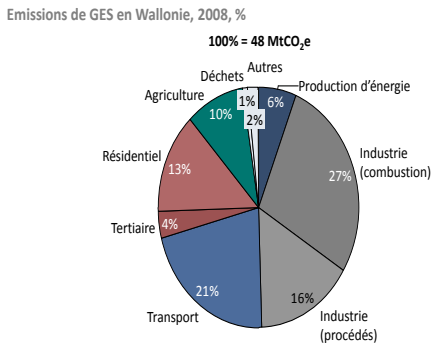
(2) Storage includes all storage solutions, eg, car batteries

Methodology

Each lever can be activated from a minimum effort to the maximum technical potential

A stakeholder based approach is used to develop the scenarios

1 **« Bottom up » study of potential GHG reduction**

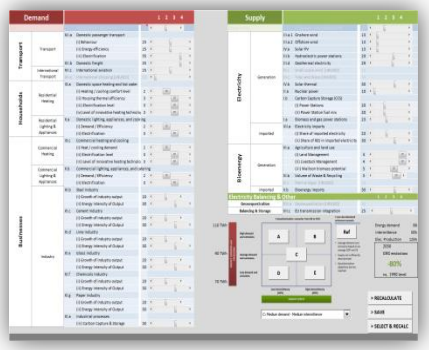


2 **Test each sector with external experts**

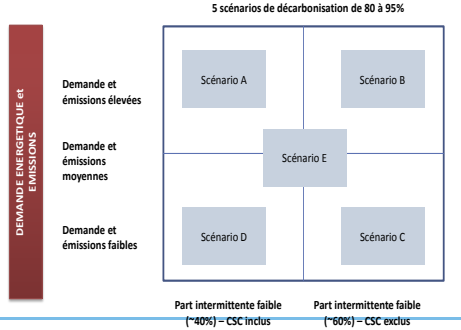
Workshops by sector with external experts

Discussions with international experts

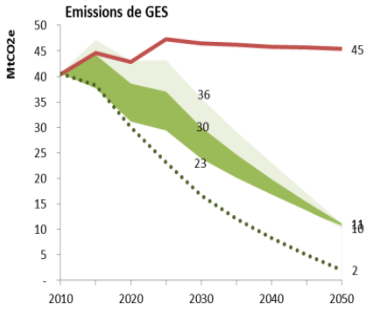
3 **Adapt the DECC model to regional data and improve it**



4 **Define and model various scenarios**



5 **Detail the implications for these scenarios**



6 **Review conclusions with the steering and expert committee**

- Administration
- Industry
- Civil organisations
- Academia

SOURCE: Climact

Key Succes factor: transparency

By “transparent” we mean…

Model and assumptions are published

- Excel model is published
- Methodology and assumptions are set out clearly in presentations/ reports

Calculator is easy to understand and use

- User friendly, easy-to-use interface (web tool and My2050 simulation).
- User driven, not optimiser.

Close collaboration during design

- Extensive stakeholder engagement.

Subject to Calls for Evidence

- Presentations to various audiences at various stages and open to better assumptions.

Example: levers for domestic passenger transport
(ambition levels 1 and 4)

Demand

Level 4	Mobility demand per person decreases by ~20%; occupation levels of cars increase by ~15%; occupation levels of buses increase by ~50% and trains by ~33%
Level 1	Mobility demand per person increases by ~20%; occupation levels of cars decrease by ~5%; occupation levels of buses and trains increase by ~10%

Energy efficiency

Level 4	ICE vehicle fleet is ~19% more efficient than current fleet, plug-in hybrids and electric cars are ~30% more efficient; ICE, hybrid and electric buses are ~15% more efficient; Rail transport's efficiency is ~10% more efficient
Level 1	ICE vehicle fleet is ~50% more efficient than current fleet, plug-in hybrids are 50-55% more efficient and electric cars are ~55% more efficient; ICE, hybrid and electric buses are ~30% more efficient; Rail transport's efficiency is ~40% more efficient for diesel and ~30% more efficient for electric traction

Agenda

Context

Selected modelling option : OPEERA

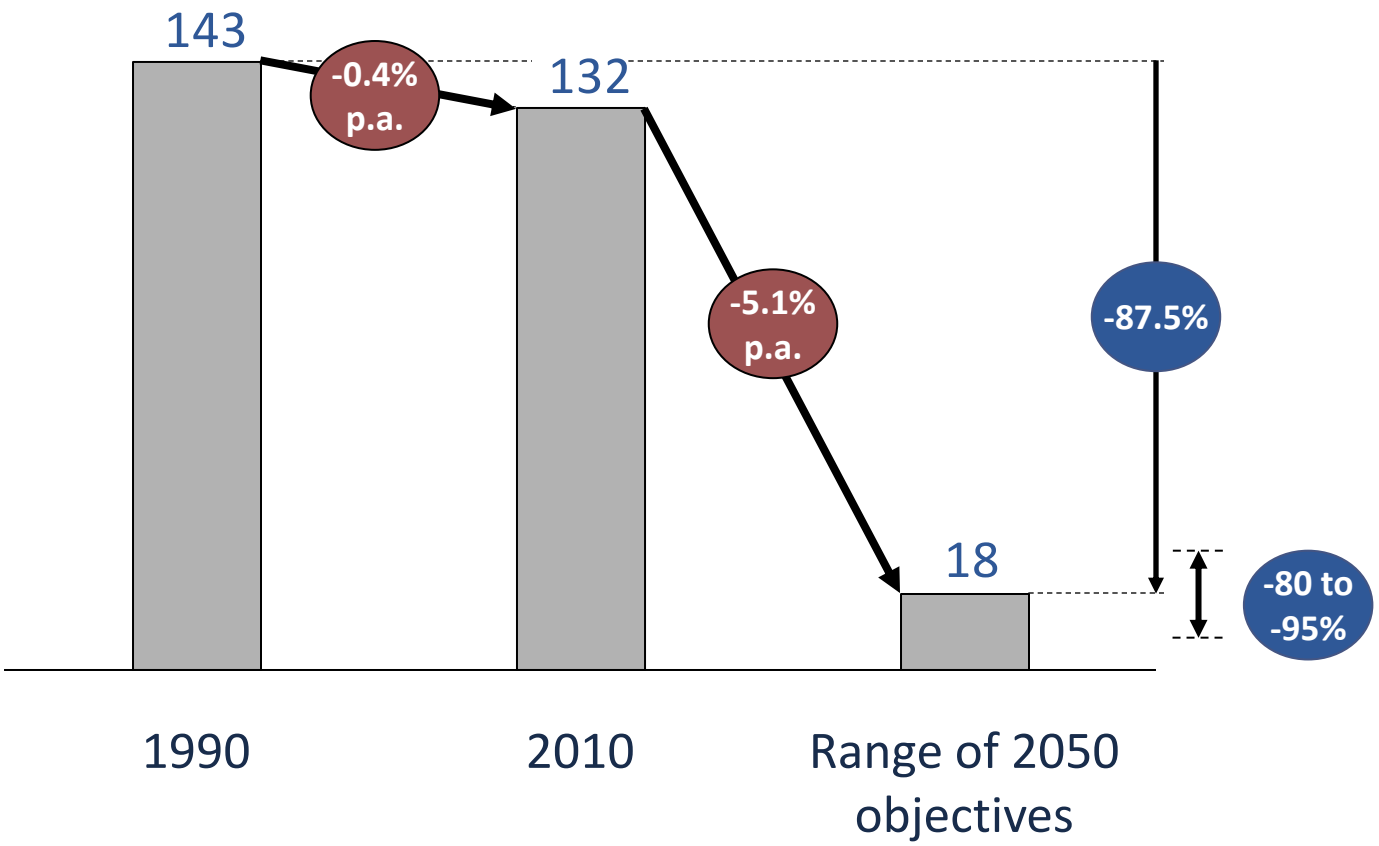
Main findings

What is the model for?

From national calculators to Global calculator

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

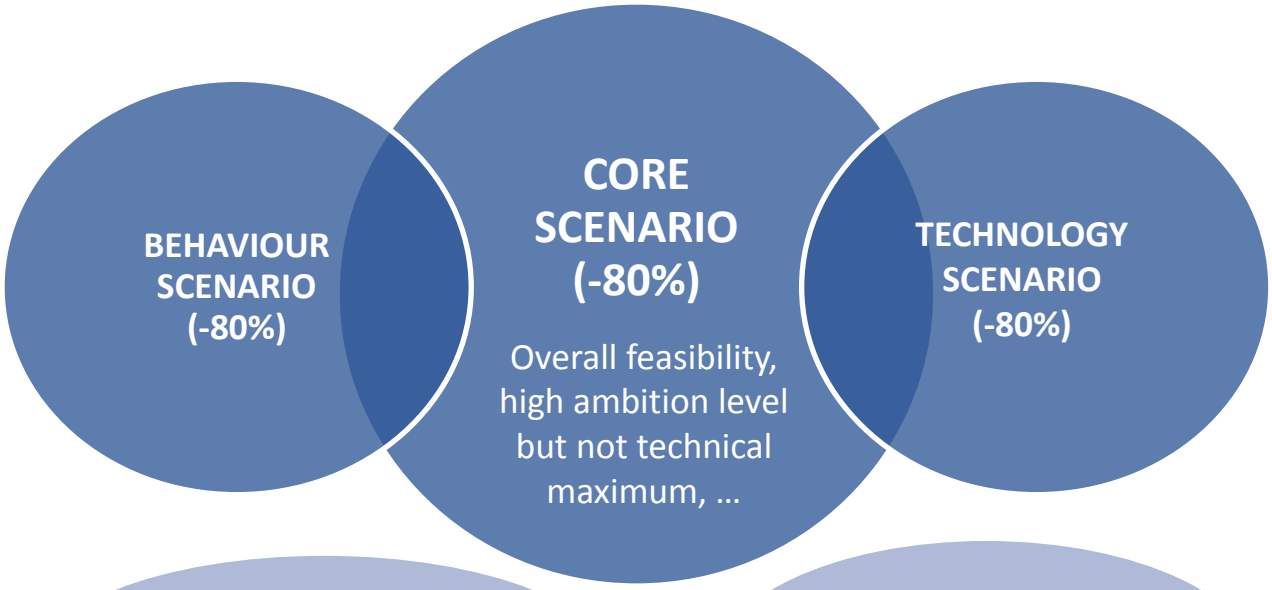
Belgian GHG emissions, $MtCO_2e$ per year



Source: Belgium GHG emissions inventory, Climact

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

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



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

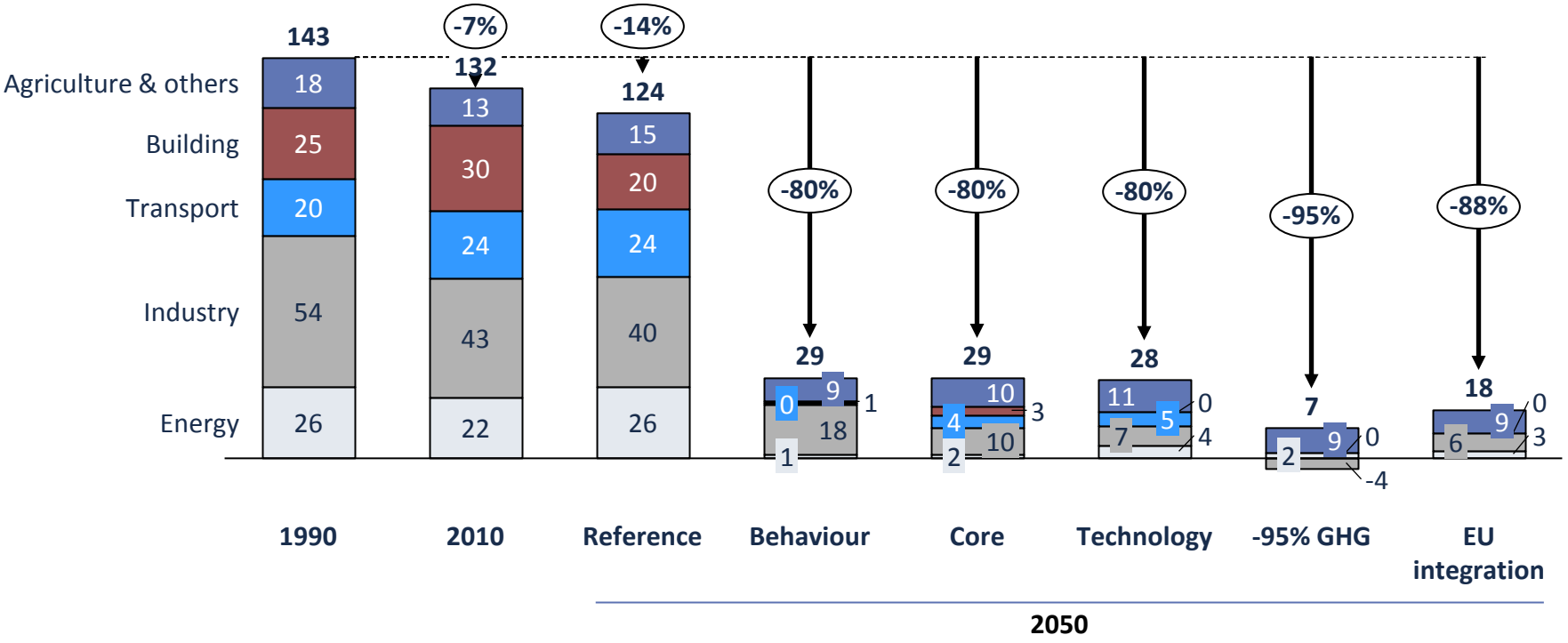
Stretch all levers to reach the higher end of the reduction range

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

Source: Belgium OPEERA model (Climact, VITO)

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

GHG emissions in Belgium ($MtCO_2e$ per year)



Main Findings at Sector level

#1: In the **transport** sector, reduced mobility demand and electrification play a key role.

#2: In the **buildings** sector, the renovation rate of existing buildings must increase and fossil fuel heating systems must be replaced by environmental heating systems.

#3 : In the **industry** sector, energy efficiency and process improvements will allow further emission reductions. International competition needs to be taken into account.

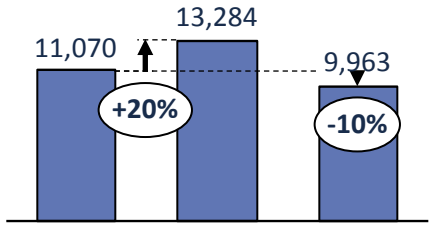
#4 : In the **agriculture** sector, the potential for reduction is limited. Behavioural changes, such as eating less meat, can play an important role.

#5: The share of **electricity** in the energy mix must rise significantly and can be provided by renewables.

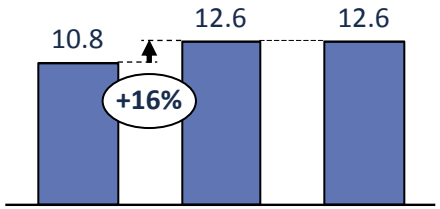
Source: Belgium OPEERA model (Climact, VITO)

#1 Transport

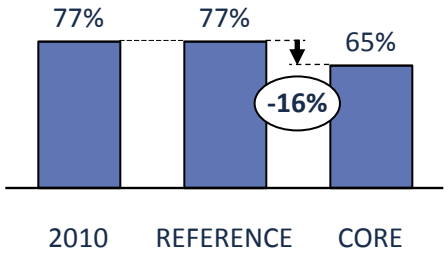
Travel demand per person, Km/year



Number of people, Millions



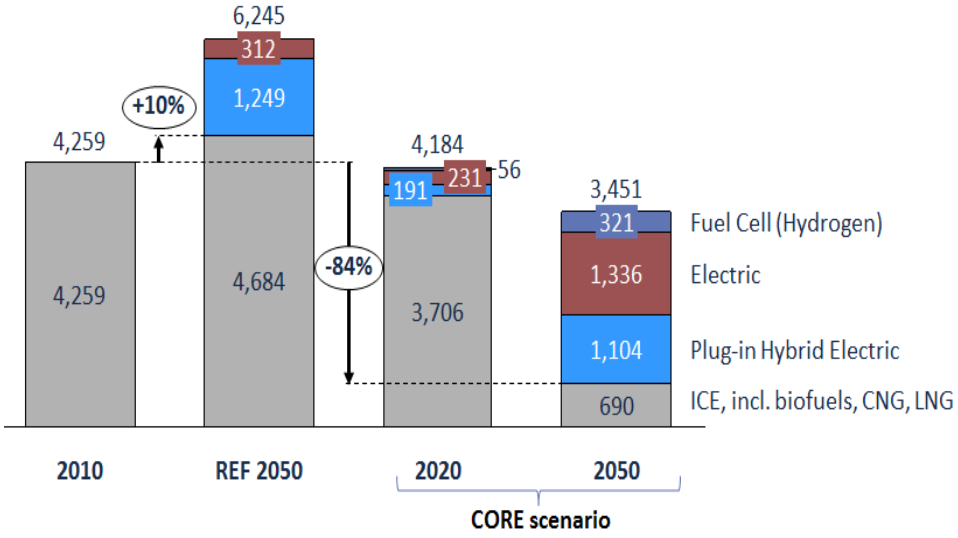
Share of travel by car, %



- Reduced mobility demand
- Energy efficiency/Electrification play a key role

Number of cars by type

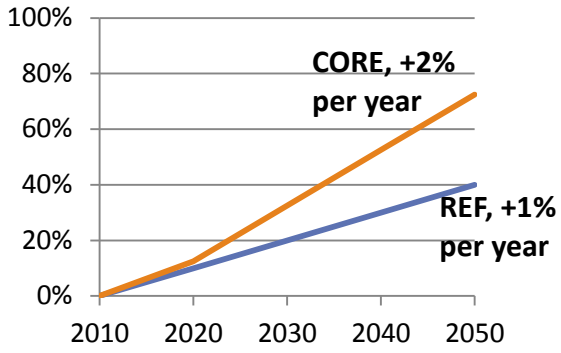
'000s units



Source: Belgium OPEERA model (Climact, VITO)

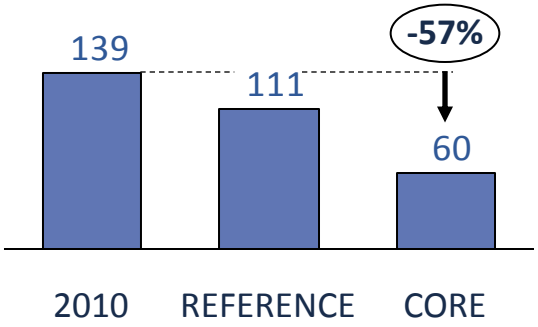
#2 Buildings

Increase in the share of renovated building stock, %



Level of renovation

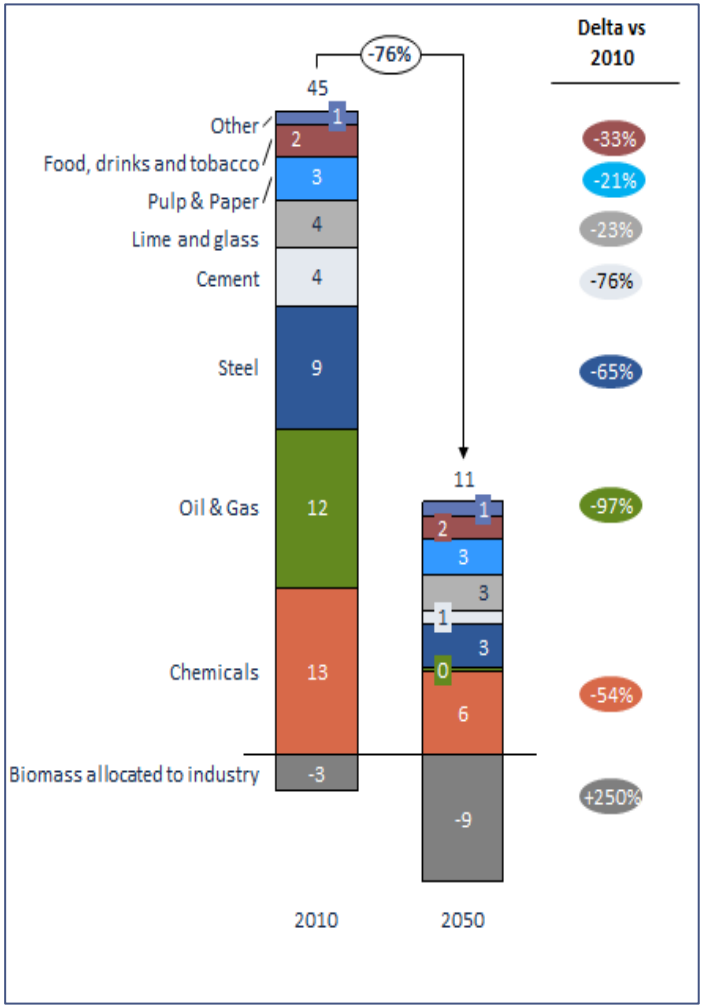
kWh of final consumption/heated m²



- The renovation rate of existing buildings must increase
- Fossil fuel heating systems must be replaced by environmental heating systems

Source: Belgium OPEERA model (Climact, VITO)

#3 Industry



- International competition needs to be taken into account
- Efficiency/processes measures are key
- CCS is needed to reach large reductions

Source: Belgium OPEERA model (Climact, VITO)

Main Findings

#6 Lowering **energy demand** is key.

#7 Fossil fuels are drastically reduced and **renewables** increase manifold.

#8 Sustainable biomass will likely be important for the low carbon transition. **Carbon capture and storage** could also play a significant role but raises concerns regarding its feasibility and potential risks.

#9 Intermittent energy sources will increase significantly. They are manageable but require large interconnection, back-up and demand-side management measures.

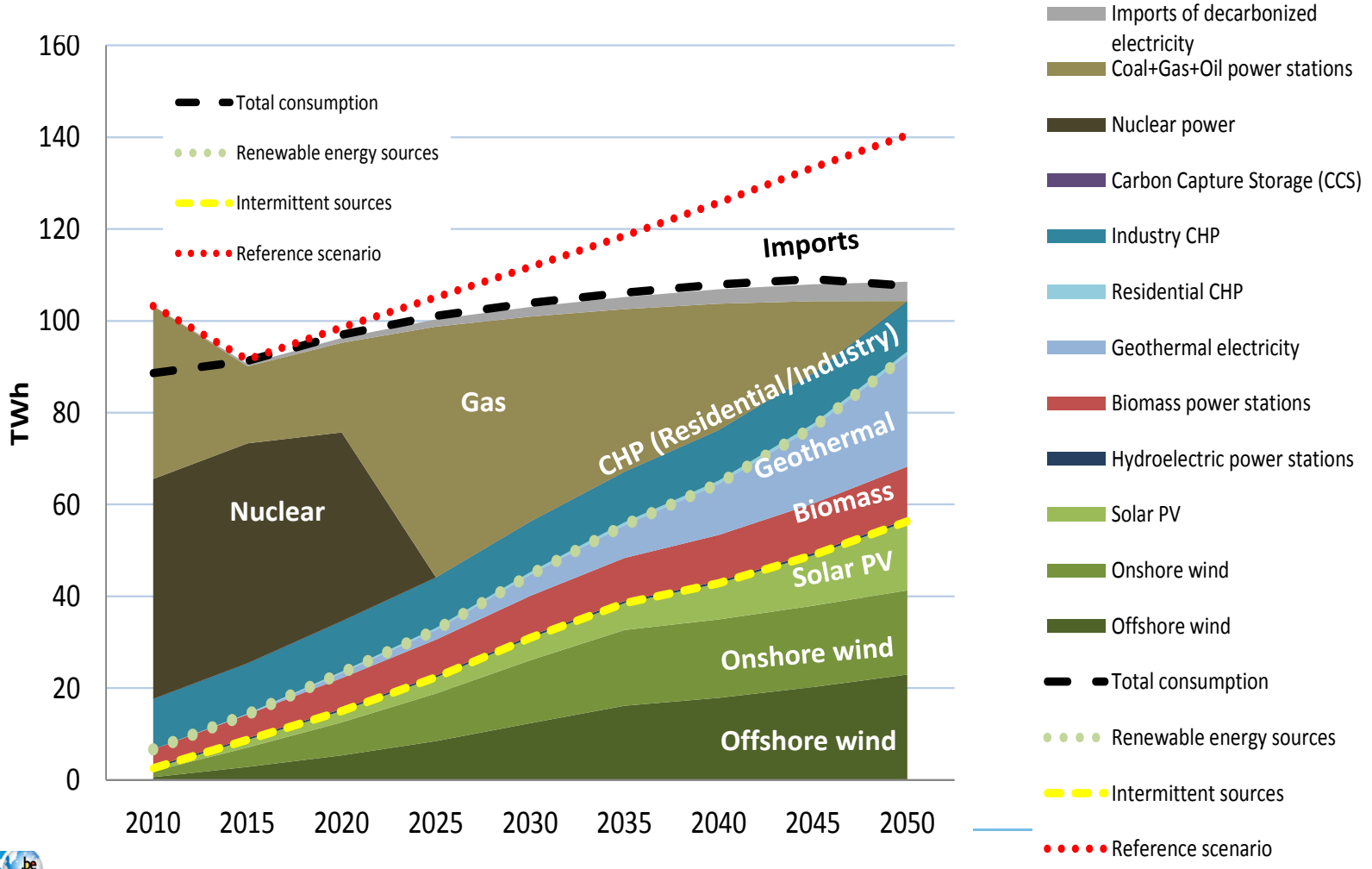
€

#10: The low carbon transition requires **additional investment expenditures that are compensated by reduced fuel expenses**.

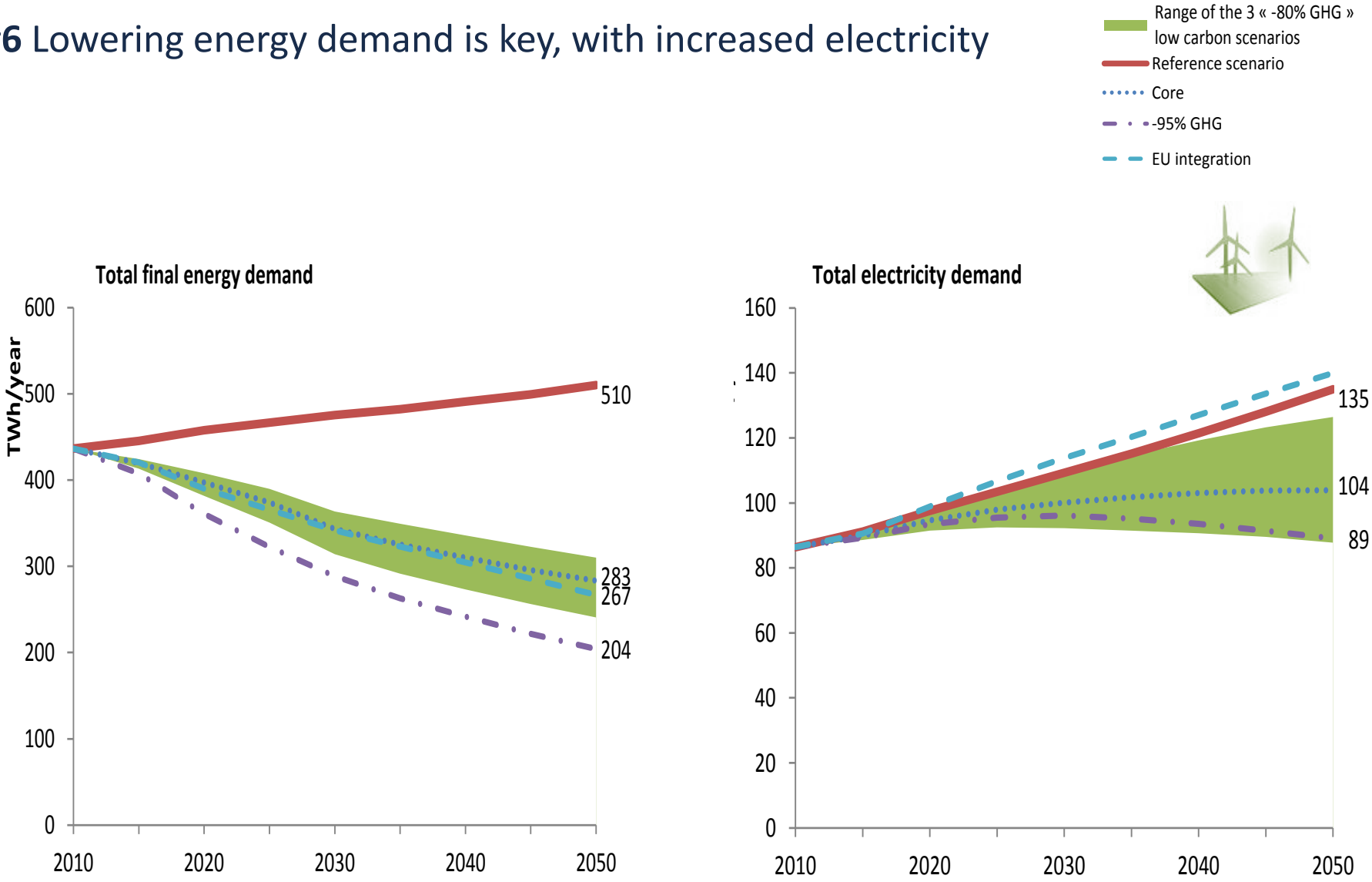
Source: Belgium OPEERA model (Climact, VITO)

#5 Electricity production shifts to Renewables

Electricity production by source in Belgium, TWh per year



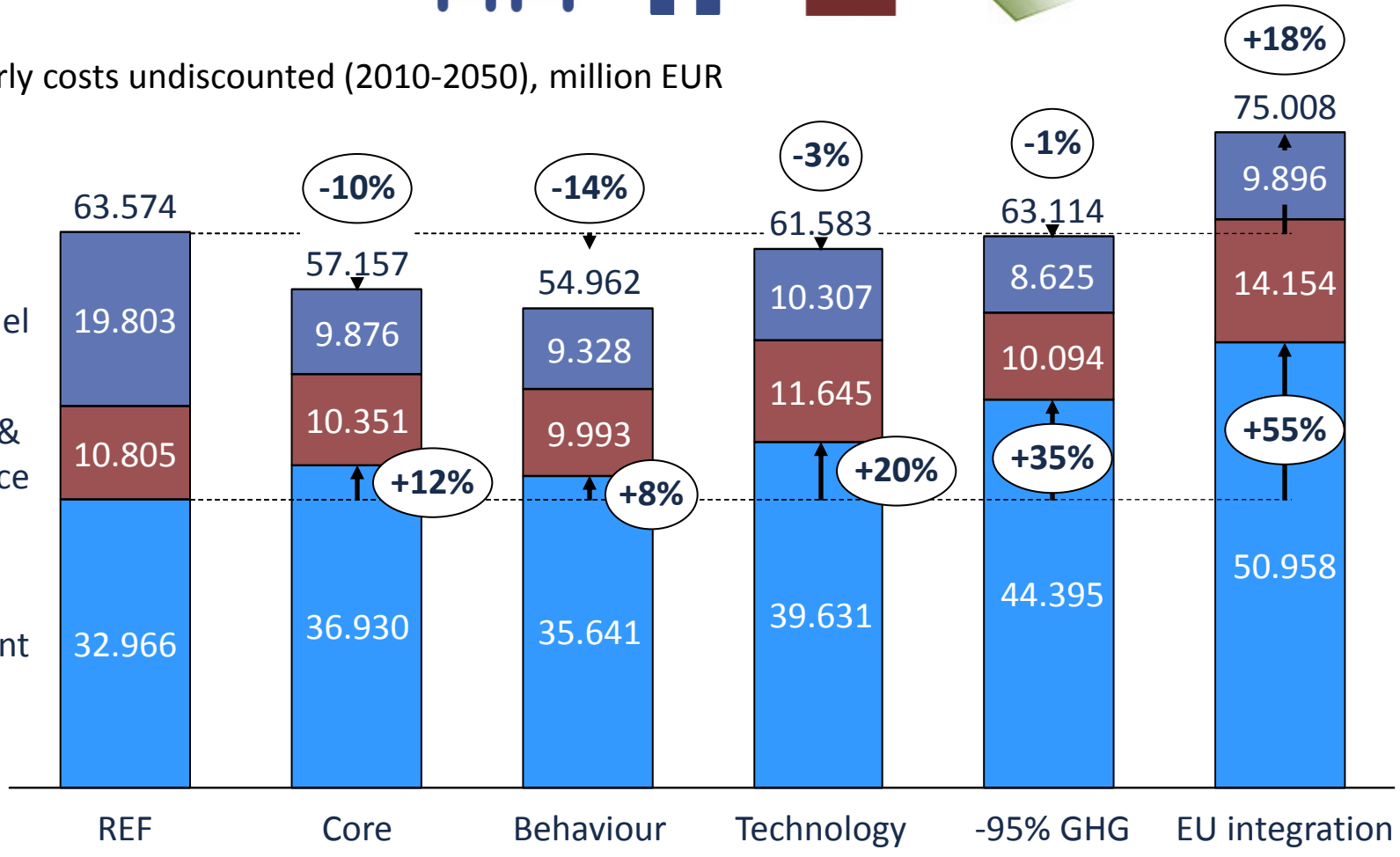
#6 Lowering energy demand is key, with increased electricity



Source: Belgium OPEERA model (Climact, VITO)

#10 Additional investment expenditures are compensated by reduced fuel expenses

Average yearly costs undiscounted (2010-2050), million EUR



Source: Belgium OPEERA model (Climact, VITO)

Belgium needs to drastically increase its yearly GHG reduction pace

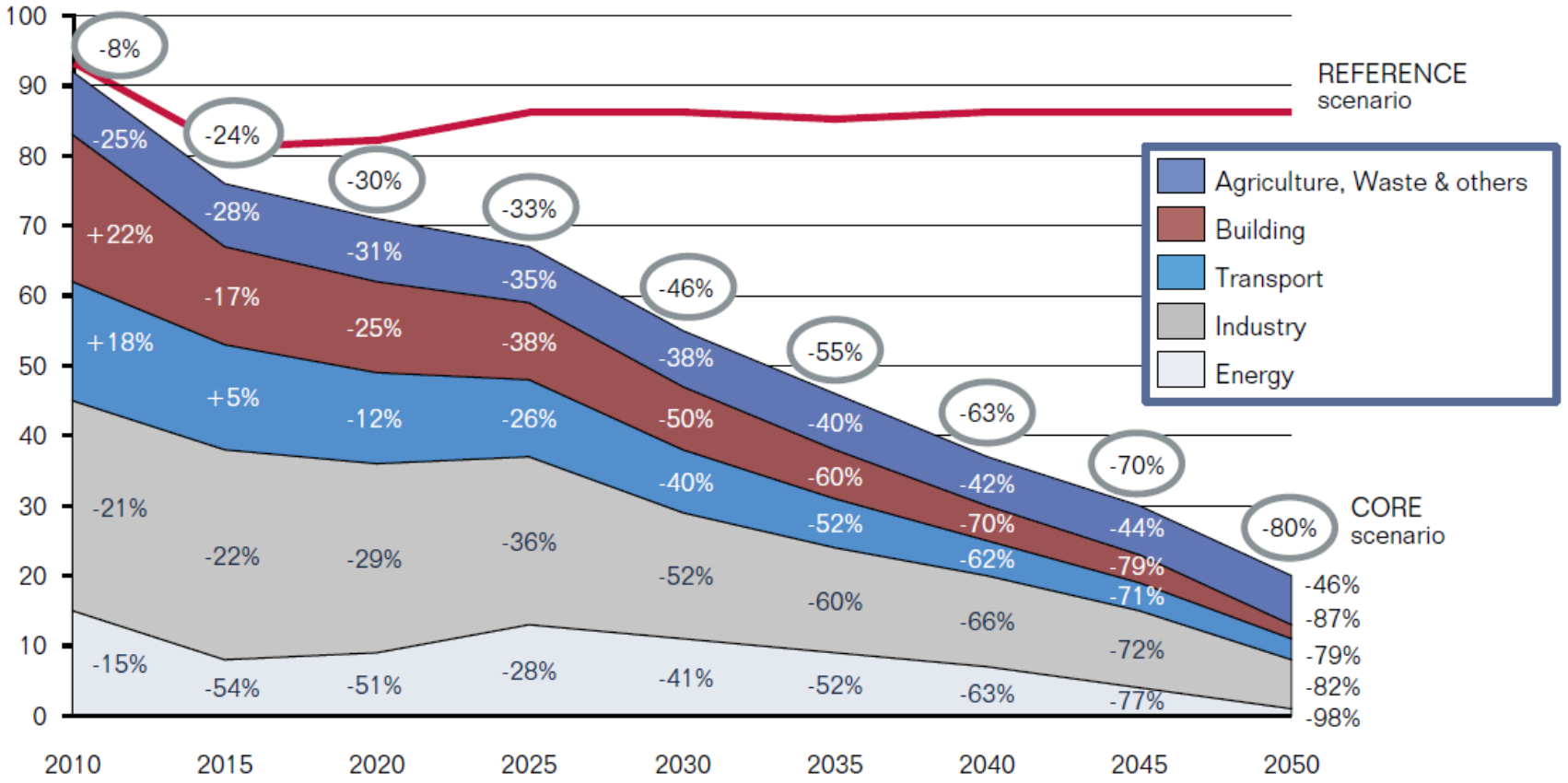


Figure 14. Evolution of GHG emissions per sector and in total w.r.t. 1990 (in %) in Belgium in the CORE scenario (index: 1990 = 100).

Source: Belgium OPEERA model (Climact, VITO)

Agenda

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Main findings

What is the model for?

From national calculators to Global calculator

Different formats of the Calculator can be used for different audiences

Walloon region: the 'décret wallon' uses the study/tool to define the carbon budgets by periods of 5 years

Different formats of the Calculator can be used for different audiences

2050 Analysis

Product	My2050	Web Tool	Excel Spreadsheet
Audience	• Educational tool • and initial engagement for the general public	• Technical expert stakeholders • and well-informed public	• Technical expert stakeholders • and policy-makers

Complexity

Source: DECC

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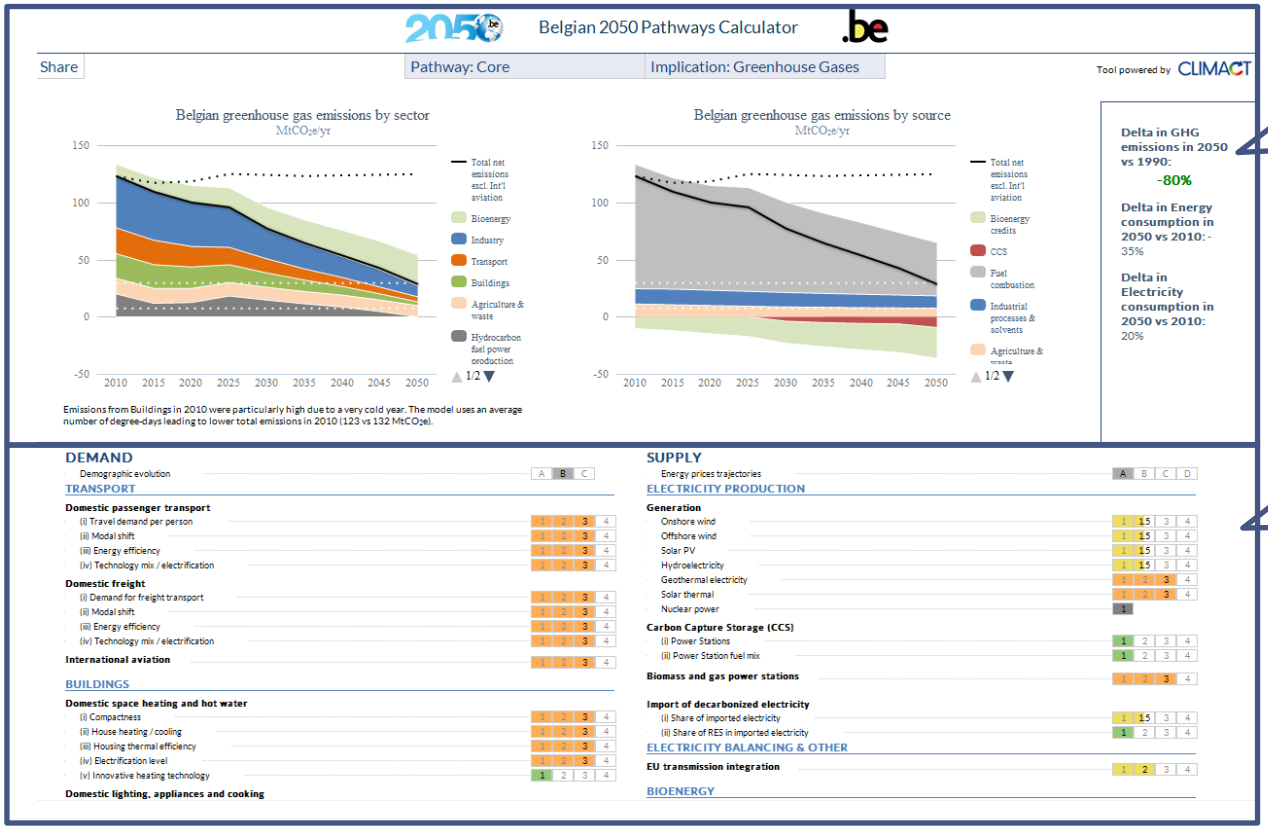
Follow-up with stakeholders, key actors, citizens, students and many others: “build your own pathway” webtool



Main results and charts

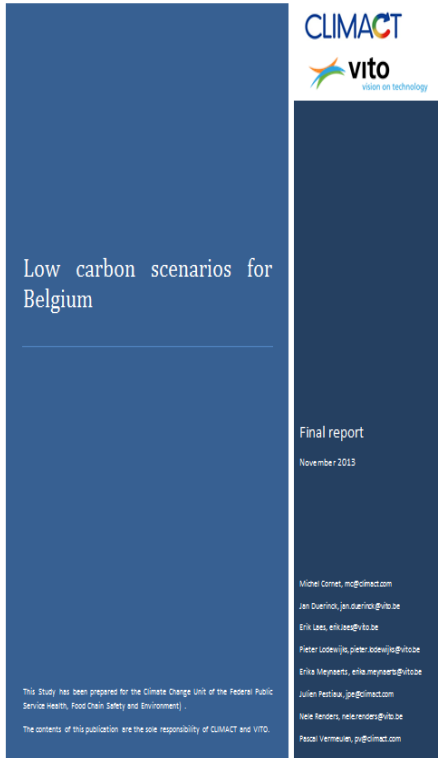
Levers

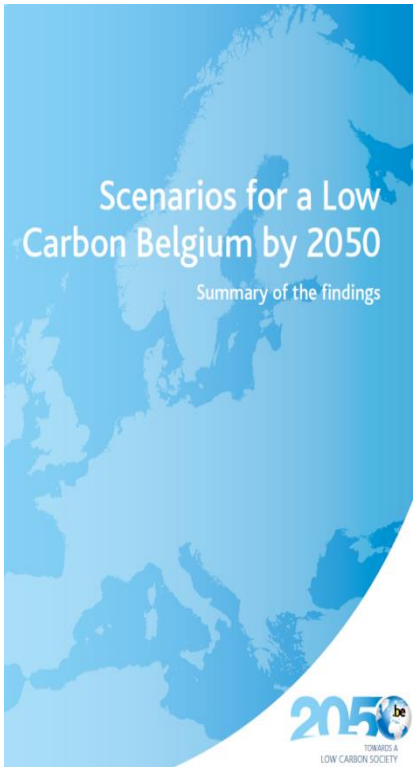
One can easily assess the impact of each of the lever separately

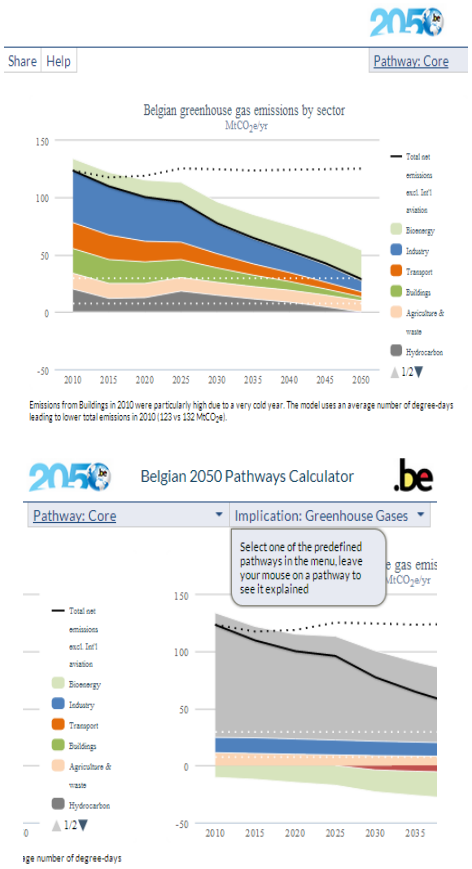
More information about the Belgian work

Sectoral analyses	Full report	Executive summary	On-line Belgian calculator

1. Transport
2. Buildings
3. Industry – Ceramic
4. Industry – Cement
5. Industry – Chemicals
6. Industry – Food
7. Industry – Glass
8. Industry – Lime
9. Industry – Non-ferrous metals
10. Industry – Pulp & Paper
11. Industry – Refineries
12. Industry – Steel
13. Agriculture
14. Energy







2050 be

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Climact view on key questions

Greenhouse Gas Modelling Seminar key questions	
Historical data are required: GHG emissions and energy consumption per sector and per activity; statistics on activity levels;	
Analysis of the national and regional/international situations, including **indicators other than GHG or energy**, is necessary;	
Sensitivity analyses are recommended ;	
Impacts other than GHG: growth, employment, air pollution, energy security, public revenues…etc.	
The choice of modelling tool used to prepare baseline scenarios tends to be driven by **a trade-off between performance** (in the form of sophistication & anticipated accuracy) **and resources available** (including human capacities and data availability)	
To model **energy sector emissions**, most participating countries rely on **bottom-up models**, which provide a fairly detailed representation of the energy system	
Most countries use **existing models** to develop their baseline scenarios	
Baseline scenarios support broader national and often international processes	

Further work

- On public engagement
- Further analyses on:
  - **Competitiveness, macro-economic and employment** impacts of the low carbon scenarios
  - **Financing** the necessary investments
  - **Distributive** impacts of the transition

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From national calculators to Global calculator

Evolution of the « 2050 Pathways calculator »

2010

The UK Department of Energy and Climate Change (DECC) developed the 2050 Pathways calculator, a model that analyses the options on how to reach the 2050 target of 80% GHG reduction with varying levels of ambition by sector

DEPARTMENT OF ENERGY & CLIMATE CHANGE

2011

The UK Government published a strategy to deliver the 4th carbon budget in autumn 2011 where the UK DECC Calculator is a central piece

2011/2012

The DECC model was first adapted for Belgium/Wallonia, where it supported the implementation of a carbon budget law similar to the UK, and then to countries like China and India

2012/2013/2014

Other regions are now using the same approach (e.g., Climact is supporting 7 countries in the Balkans and Algeria), and is now recognized as a very effective way for governments to analyze a wide series of scenarios, to create consensus with the key stakeholders, and to share their plans to a wider audience

2013/2014

The DECC with a large consortium incl. the IEA, the Energy Research Institute of China, WRI and Climact are developing a Global 2050 Calculator

DEPARTMENT OF ENERGY & CLIMATE CHANGE

CLIMACT

ENERGY RESEARCH INSTITUTE

iea

China 2050 Pathway

—Our Most *Optimistic* Scenario, Our *Ambitious* Pursuit in the Future

2050.be

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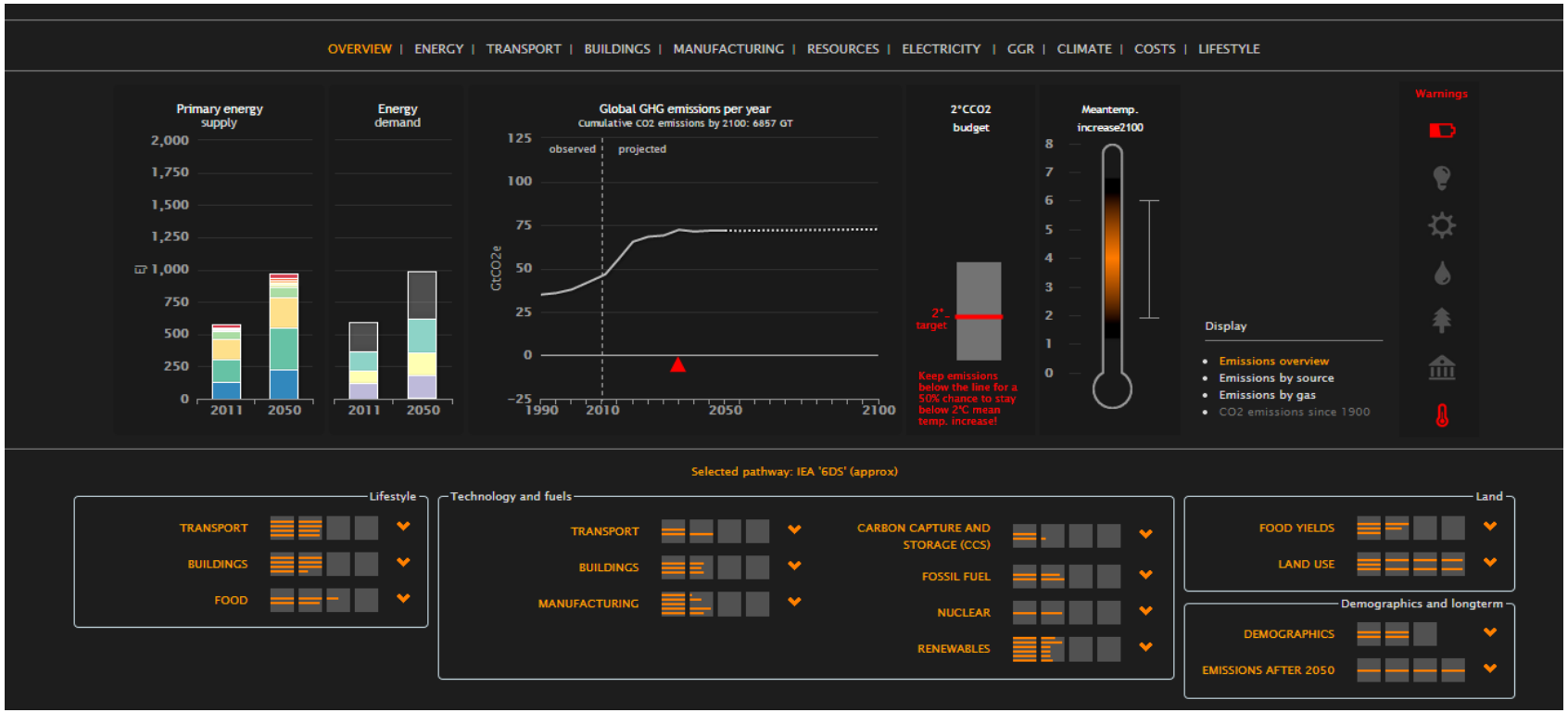
SOURCE: DECC, Climact

We are developing a Global Calculator

Country Calculators illustrate solutions at the country level…



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