Workshop on Macro Demand Forecasting tool

Methodology description

Elia

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Brussels
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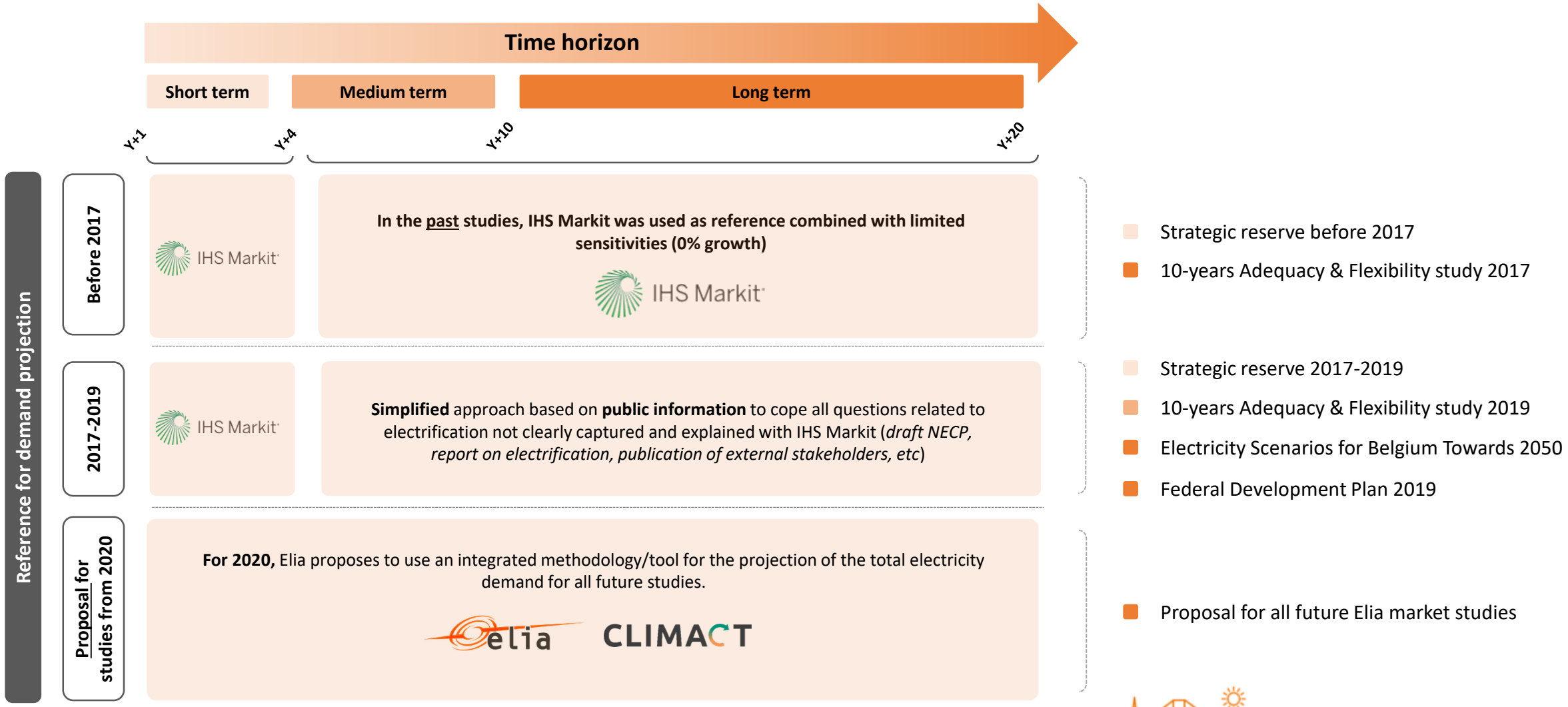
Agenda

- Scope and goals definition
- Tool description
- Methodology description
- Next steps

Scope and goals definition

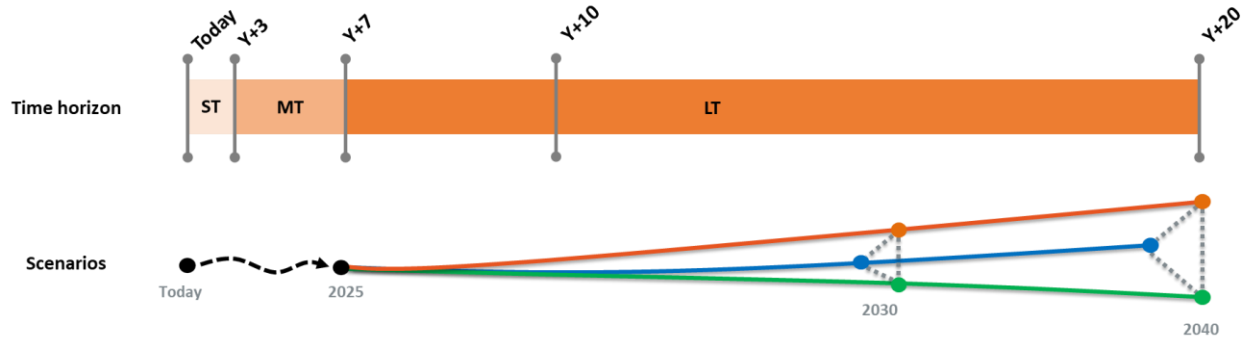
Elia relies for around 5 years on forecasts provided by IHS Markit (CERA) although the transparency of the methodology and the assumptions are limited



Elia initiated a project to improve the current projection modelling of total electricity demand for Belgium

Scope

- Projection of **total Belgian electricity demand**
- Projection for the **electricity sector**
- Projection at **national level**
- Projection from **Y+1** to **Y+30** through different scenarios



Goals

- **Improve current methodology** in Elia in order to replace the IHS Markit forecast for future studies
- More detailed approach in order **to better understand** t**he main drivers** behind the evolution of total demand
- **Better integration of policy changes** in the demand forecasting (e.g. LEDs, electric vehicle penetration, energy efficiency measures, etc.)
- **Open-source** tool with **transparent methodology** and **assumptions**

Climact developed the solution based on their strong expertise in energy modelling at global, European, national, regional levels

CLIMACT

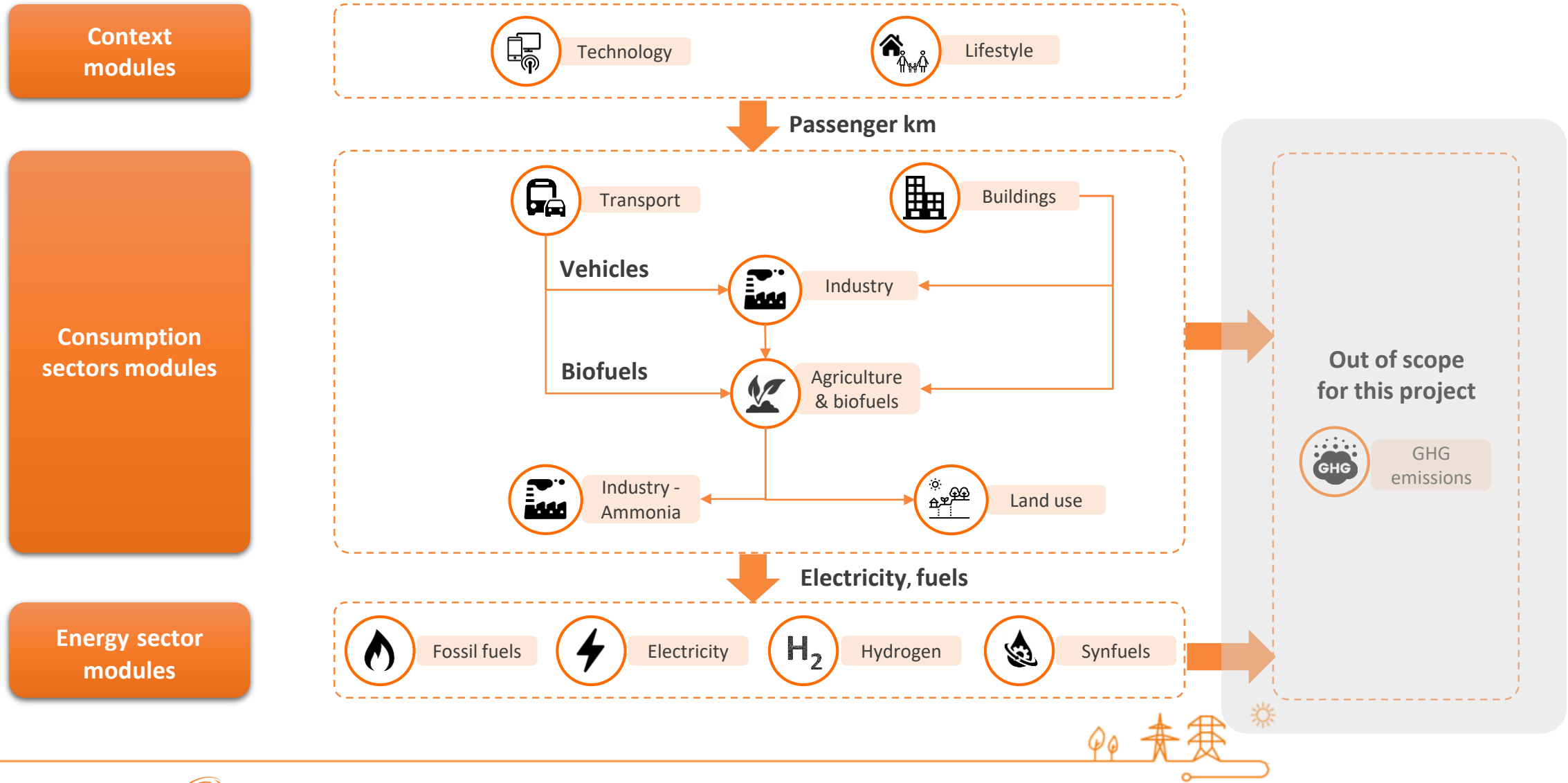
Project	Subproject or content
Global Calculator (for DECC)	• **Model** energy, emissions & resources
Climate Transparency Initiative (CW Foundation)	• Regional models for **EU**, India, China, Americas, Brazil
Science Based Targets	• Technical Board advisory
Climate Transparency Initiative (for ECF)	• **Net zero scenarios by 2050** • Focus on policy angle
Low Carbon group (Bruegel)	• Net zero by 2050 analysis
EUCalc (for commission)	• **Model** of energy, emissions, socio economic and resources
2050 Calculators (for administrations)	• > 15 countries (1)
National analysis (SPF, BE.FIN, Heinrich Böll Stiftung, Greenpeace)	• Carbon pricing, circular economy strategy, macro economic impact, nuclear phase-out impact, Energy efficiency impacts
2050 Calculators & analysis	• **Federal** ,Wallonia, Flanders, Brussels
Sector roadmaps	• Walloon Buildings renovation strategy • Federations: Agoria, Cobelpa, FIV, Fedustria, GSV, Fetra, Febelgra
Regional analysis (AWAC, DGO4, IBGE)	• Socioeconomic impact of low carbon plans • Regional energy balance
City roadmaps	• Various analysis (2)

NOTES: (1) Non-exclusive list: **Albania**, Algeria, **Belgium, Bosnia, Croatia, Kosovo, Macedonia, Montenegro, Serbia**
(2) Ans, Les Bons Villers, Louvain-la-Neuve, Mons, Namur, Pont-à-Selle, Seneffe, Visé

Comprehensive expert consultation for 2013 SPF study

Tool description

The BECalc model that we developed in 2019 is a simulation tool that computes energy and GHG emissions



Current solution will provided needed projection on total electricity demand in the framework of strategic reserve evaluation

Energy carriers

- Electricity
- Fossil fuels
- Hydrogen
- Biofuels
- Synfuels

Multi-energy model used to project Belgian electricity consumption

Demand sectors

- Buildings
- Industry
- Transport
- Agriculture
- Energy supply

Projection in all **sectors & sub-sectors** is quantified

Geography

- National
  - Brussels region
  - Flemish region
  - Wallonia

Calculation at **national level**. **Possbile** to derive consumption for Belgian **regions** in future version

Time horizon

- Projections
  - Short-term: Y+1 -> Y+5
  - Medium-term: Y+5 -> Y+10
  - Long-term: Y+10->Y+30

Calculation from Y+1 to Y+10 in this first version. Future release can include calculation until Y+30

Legend

- Output for Macro Demand Forecasting
- Other outputs of BECalc
- Future other outputs of BECalc

CLIMACT elia

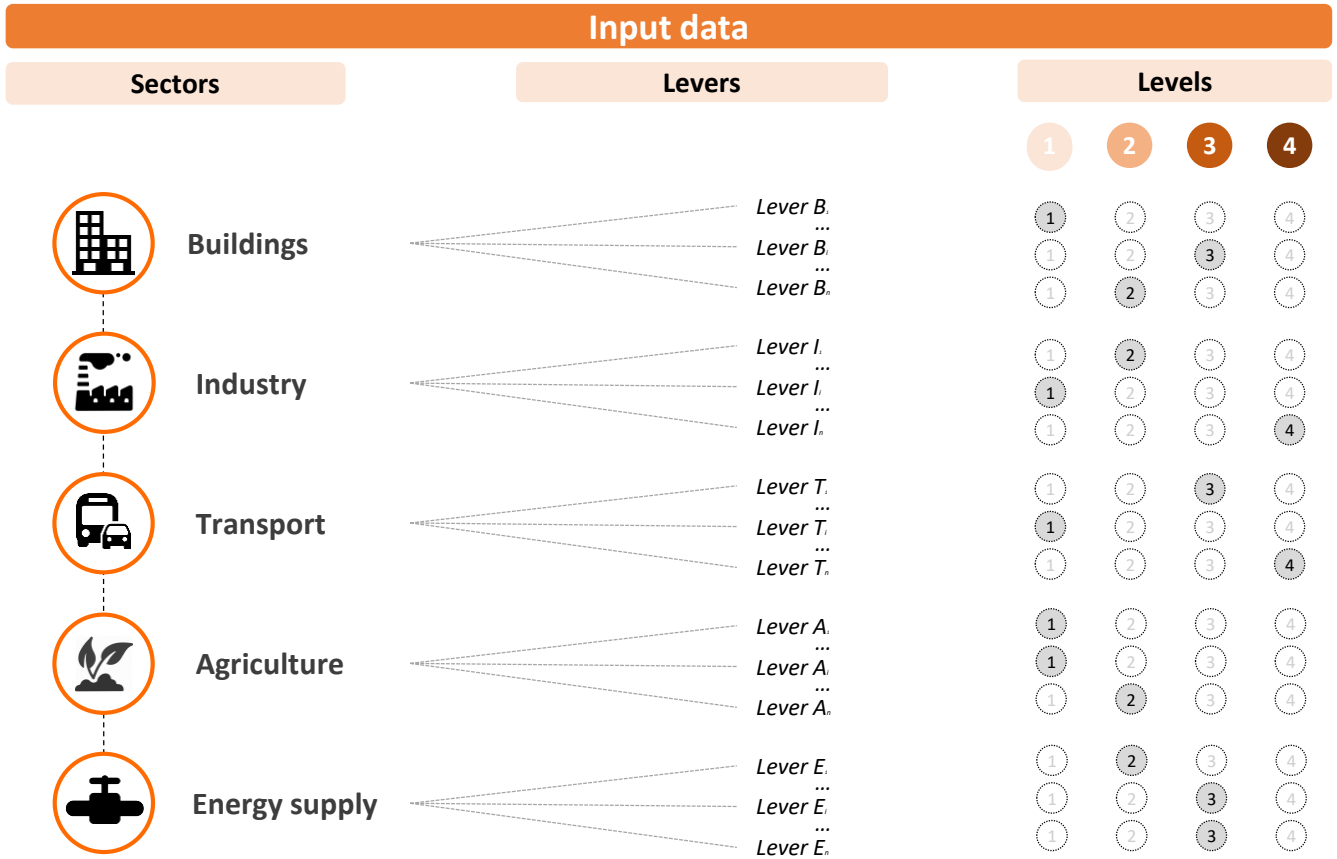
Input levers driving evolution of future consumption for each sector can be set to 4 different ambition levels

Levels : harmonized ambition level definitions are used across all levers

1. Projections of **historical trends**
2. **Intermediate** level, more ambitious than a projection of historical trends but not reaching the full potential of available solutions
3. **Very ambitious** level, given the current technology evolutions and the best practices observed in some geographical areas
4. **Transformational** and requires some additional breakthrough or efforts such as important costs reduction for some technologies, very fast and extended deployment of infrastructures, major technological advances, strong societal changes, etc.

Possible to select decimal levels (1.1, 1.2, etc) for each lever to match foreseen evolution

Input levers driving evolution of future consumption for each sector can be set to 4 different ambition levels



This tool is used to project total electricity consumption for Belgium based on input assumptions

What it covers

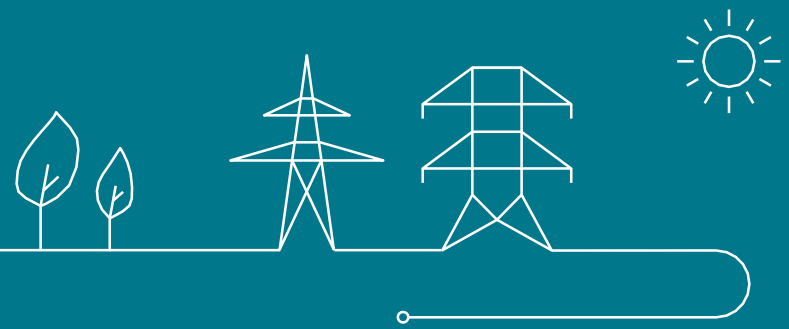
- A comprehensive and dynamic model, covering **all energy sectors**
- An **open-source** model (which could be complemented by an **online version** to increase reach and use)
- The **development of energy transition scenarios** based on realistic and transparent assumptions
- The insights and sector findings gathered through a **large amount of previous engagements and expert consultations**

What it does NOT do

- **Macro-economic analysis** and climate change co-benefits are partially covered in EUCalc but not in BECalc
- **Scenarios are in no-way forecasts**, no specific likelihood is attached to them
- There is **no cost-optimization** in the model, taxes or subsidies are not considered

Methodology

- Buildings
- Transport
- Industry
- Agriculture
- Energy supply



Methodology

- **Buildings**
- Transport
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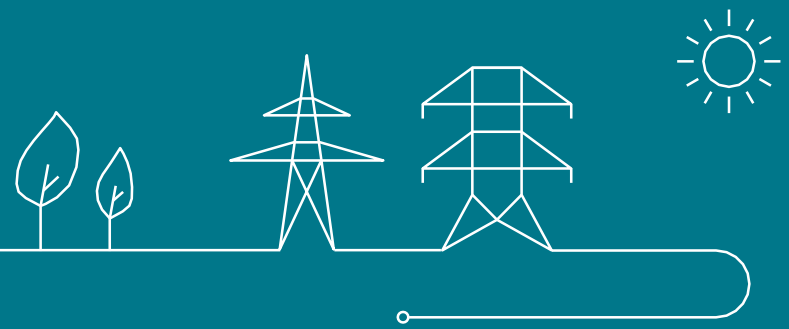


Building module takes into account future type of building, end-uses, heating/cooling technology and fuels

Type of building

- **New** buildings
- **Renovated** since base year
- **Non-renovated**

End-uses

- **Space** heating
- **Water** heating
- **Ventilation**
- **Space** cooling
- **Lighting**
- **Cooking** (residential)
- **Other** (non-residential)
- Appliance **white** (fridges, washing machines, dryer, dishwasher)
- Appliance **black** (TV, DVD, computer, tablets, mobiles)

Heating/Cooling technology

- 10 **heating system technologies**
  - Boilers (solid, gas, liquid)
  - CHP (gas, solid, liquid),
  - Heat pump (hybrid & full electric)
  - Solar thermal
  - District heating (covered by heat supply module)
- 5 **cooling system technologies**
  - Central air Conditioners
  - Room Air Conditioners
  - Heat Pumps
  - Evaporative Coolers
  - Free/night cooling

Fuels

- **Solid:** Fossil (Coal), biomass
- **Gas:** Fossil (Natural Gas), Biogas, Synthetized (Hydrogen)
- **Liquid:** Fossil (Oil), Bioliquid
- **Electricity:** local, grid
- **Heat**: local (solar thermal, envir. heat from heat pumps), grid

Building module takes into account materials needed for building (cement, steel, bricks, timber) to make the link on the impact for industrial sectors

Calculation sequence of levers for the computation of energy and emissions in buildings

Household size [people/household]

This set of levers determines the **average household composition**

Dwelling size [m²/dwelling]

This set of levers determines the **type** of dwellings (appartment, single family home, multi family home) and their **sizes**

Buildings envelope efficiency [kWh/m²/y]

This set of levers determines the **share of renovation** and **demolition** of the **existing building** area, and new constructions

Demand for other energy services *[kWh/m²/y] and [kWh/m²/y]*

This set of levers determines the energy consumption of the other **energy end-uses per m²** (space cooling, lighting, ventilation) **or per capita** (appliances)

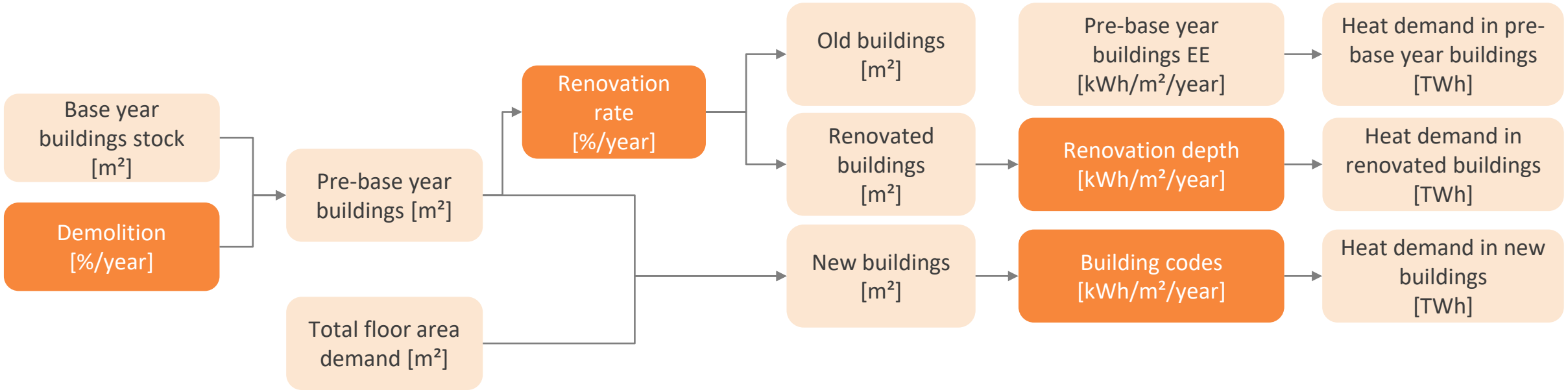
Technology share for heating *[%]*

This lever sets the **mix of technologies used** to provide heat/cool/appliances demand.

Energy efficiency *[%]*

This lever enables to improve the **energy efficiency** (ratio between the energy consumption in a specific year and in the base year)**.** It is declined for each technology

The demolition and renovation levers drive the heat demand of the building stock



Legend :

Lever

Model result

Uptake of decarbonized technologies and fuels

1 Heat district technologies — First defining the heat district share

Then the mix of energy vector is defined — This lever determines the specific mix of energy vectors

2 Level of decarbonization of heating — First the remaining share of fossil-fuel heating in residential buildings is defined

3 Heat pumps contribution — Clarifying how much of heat pumps cover the remaining

4 Biomass — Then how much of biomass covers the remaining after heat pumps

The remaining is then covered by direct electricity heating (variable) and solar (fixed assumptions)

5 E fuels — The remaing gas consumed by heating can be converted to green gas

6 CHPs or heat only — Clarifying how much is combined with electricity production

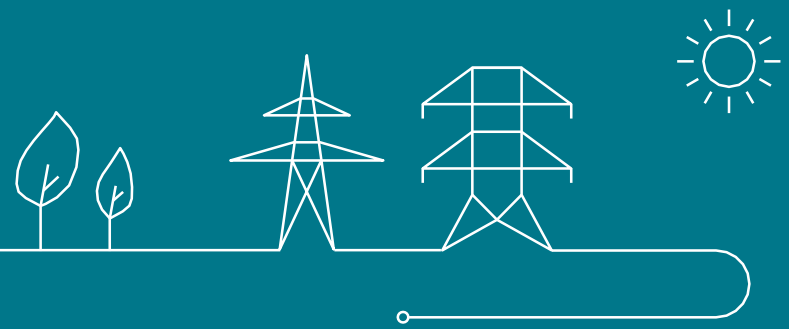
Legend :

Lever

Model result

Methodology

- Buildings
- **Transport**
- Industry
- Agriculture
- Energy supply



Transport module takes into account future demand, modal shift, powertrain technologies and fuels

Subsector

- Passenger
- Freight

Mode

- Car
- Bus
- Train
- Active (bike & walk)
- Aviation
- Trucks
- Ships

Powertrain technology

- Internal Combustion Engine
- Plug-in Hybrid
- Fuel Cell Electric Vehicle
- Battery Electric Vehicle

Fuels

- **Fossil:** Diesel, Gasoline, Gas, Kerosene, Marine fuel oil
- Biofuels
- Synfuels
- Electricity
- Hydrogen

Transport module computes the **demand for new vehicles** (cars, buses, trains,…) to take into account the **impact for industrial sectors**

Calculation sequence of levers for the computation of energy and emissions in transport

Transport demand [pkm]
This lever determines the total transport demand

Urban share [%/transport demand]
This lever determines the share of urban and non-urban transport demand

Modal share *[%/mode]*
This lever determines the share of transport demand for each transport mode
Multiplied by the transport demand, this results in the total transport demand for each mode in [pkm]

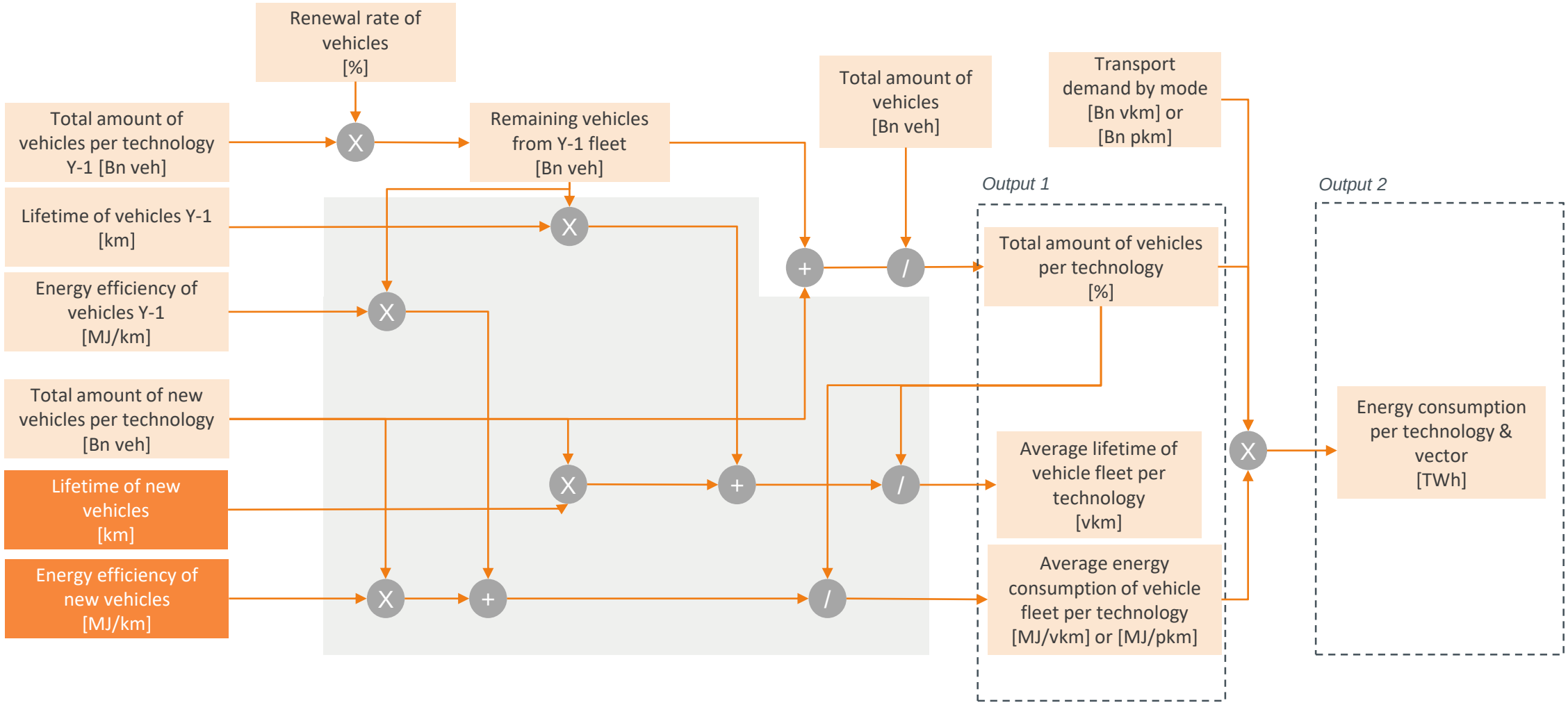
Occupancy & Utilization rate *[pkm/vkm] & [vkm/veh]*
Occupancy lever determines the number of person per vehicles and allows to translate [pkm] to [vkm] for LDV and buses
Utilization rate determines the number of km per vehicle each year and allows to compute the number of vehicles needed to answer the demand

Energy efficiency *[MJ/pkm] or [MJ/vkm]*
This lever sets the energy consumption for each mode & each technology.
This allows to translate transport demand into energy consumption

Technology share *[%]*
This lever determines the share of each technology in each mode

E-fuels-Biofuels *[% fuel]*
This lever sets the share of vectors of energy

The fleet evolves to integrate new vehicles that are more efficient



Calculation sequence of technology mix lever

Zero-emission vehicles (ZEV) [%]

This lever determines the share of ZEV in the vehicle new sales

ZEV mix [%]

This lever determines the share of Fuel-cell vehicles in the ZEV mix (the rest being battery-electric vehicles)

Low-emission Vehicles (LEV) [%]

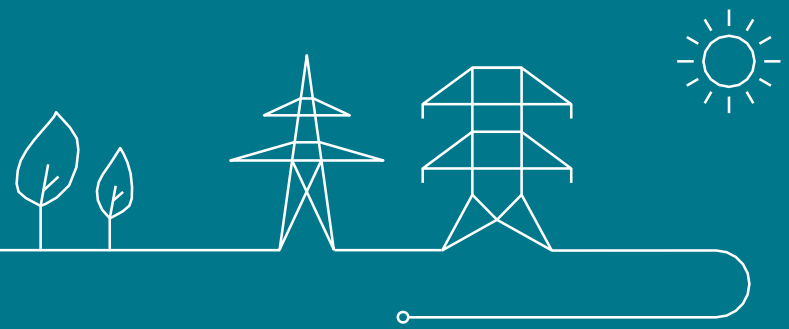
This lever determines the share of LEV in the remaining (non-ZEV) vehicle new sales

LEV mix [%]

This lever determines the share of gas vehicles in the LEV mix (the rest being Plug-in hybrid and Catenary trucks)

Methodology

- Buildings
- Transport
- **Industry**
- Agriculture
- Energy supply



Industry module takes into account different industries, products, technologies and fuels

Products

- **Vehicles:** cars, trucks, boats, trains, planes
- **Infrastructures:** roads, rails, cables
- **Fertilizers**
- **Buildings:** new constructions, renovation materials
- **TV, smartphones, computers**
- **Fridges, freezers**
- **Washing machines, dryers**
- **Dishwashers**
- **District heating pipes**
- **Processed food**
- **Packaging:** plastic, paper, sanitary products

Industries

- **Steel**
- **Cement**
- **Lime**
- **Glass**
- **Chemicals:** olefin, chlorine, ammonia, others
- **Paper**
- **Food, drinks & tobacco**
- **Non-ferrous metals**
- **Ceramic**
- **Wood and wood products**
- **Other industries**

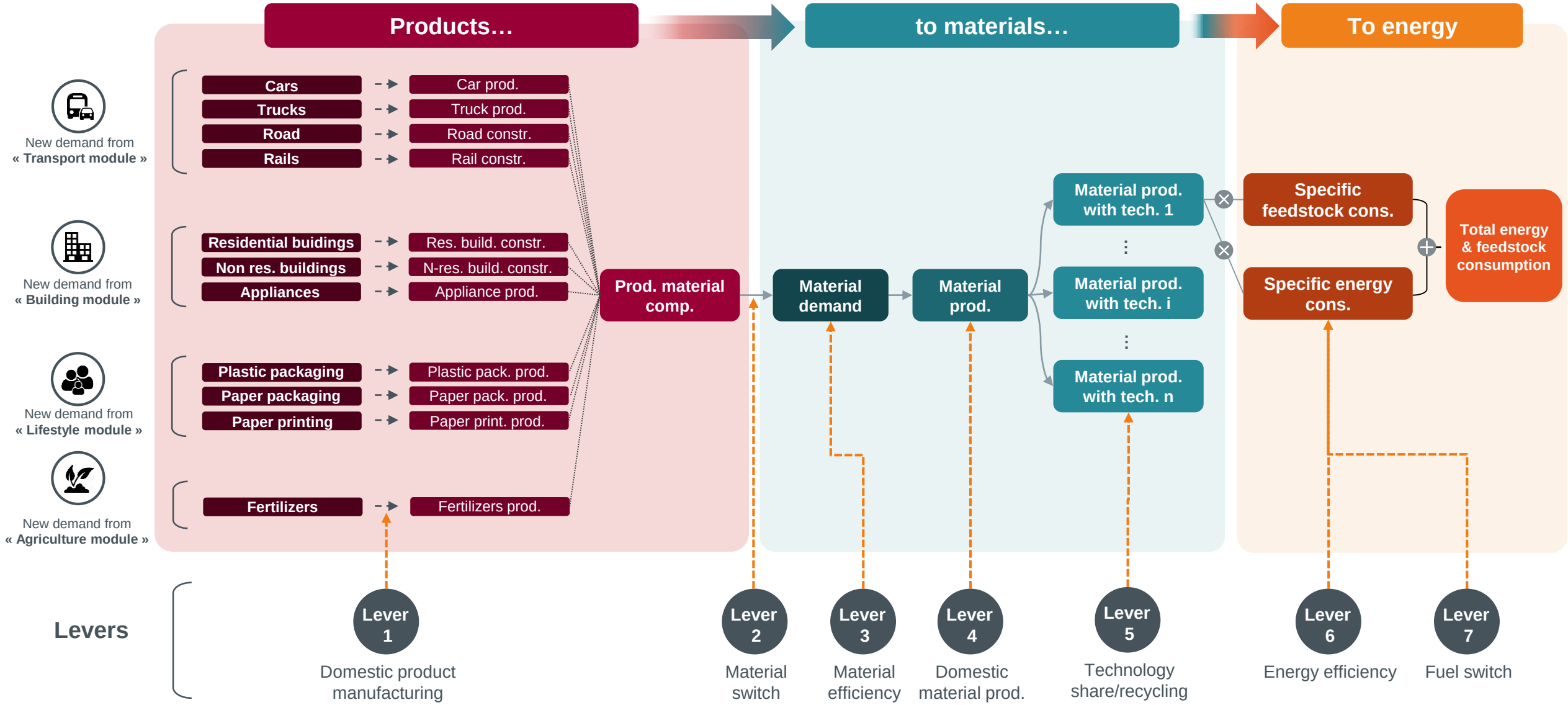
Technologies

- **Steel**
  - BF-BOF
  - Scrap-EAF
  - Hydrogen-DRI
  - Hisarna
- **Cement**
  - Dry kiln
  - Wet kiln
  - Geopolymers
- **Paper**
  - Primary
  - Secondary
- **For other industries**
  - A technology considered

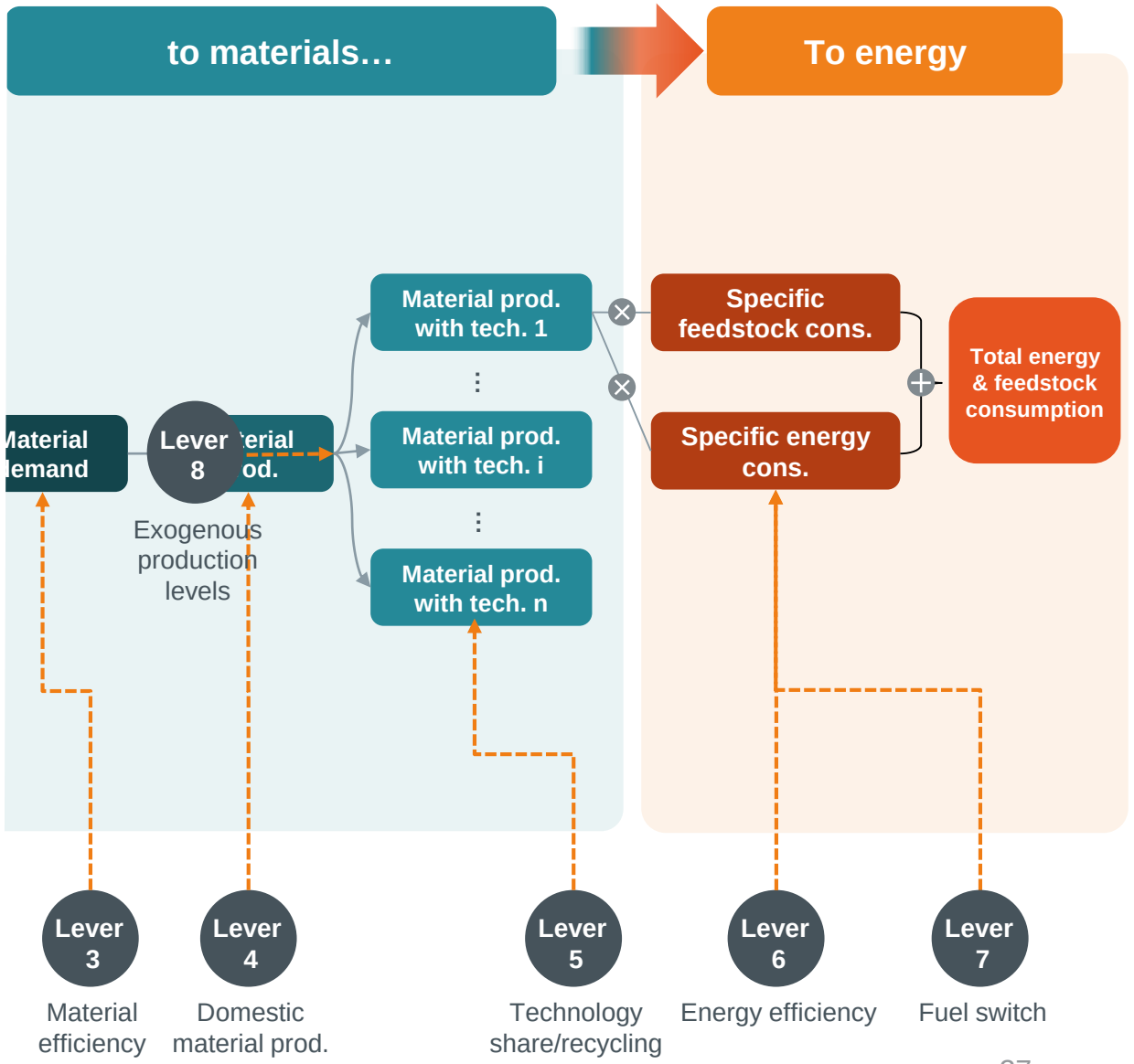
Fuels

- **Coal**
- **Oil**
- **Natural gas**
- **Solid biomass**
- **Liquid biomass**
- **Gaseous biomass**
- **Electricity**
- **Hydrogen**
- **Waste**
- **Heat**

Main steps and levers to derive industrial activity in a endogenous way

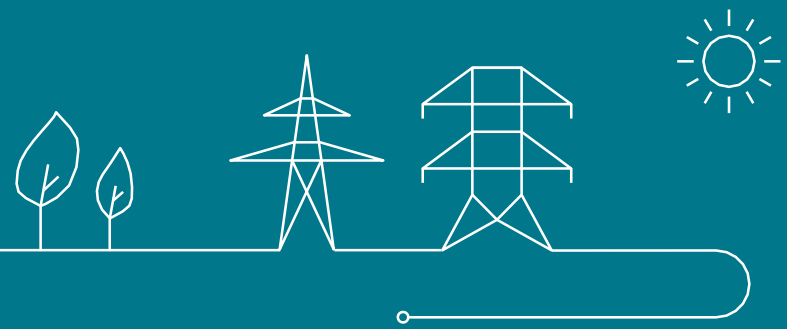


The industrial activity can also be determined in an exogenous way

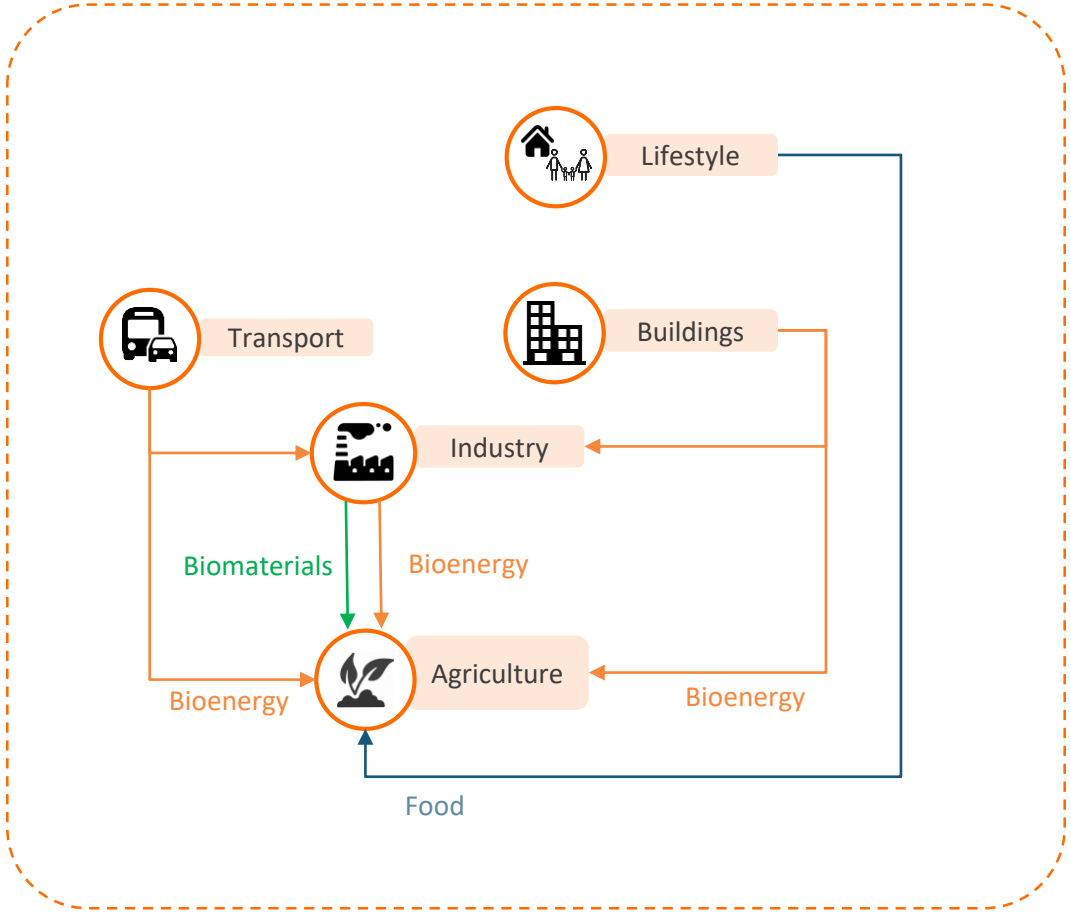


Methodology

- Buildings
- Transport
- Industry
- **Agriculture**
- Energy supply



The agriculture module is addressing the demand for food, bionenergy and biomaterials from other modules



Lever 1
Lever 2

Demand for food, bionenergy and biomaterials
Incl. Trade balance
Change diet
Change the hierarchy of Biomass uses

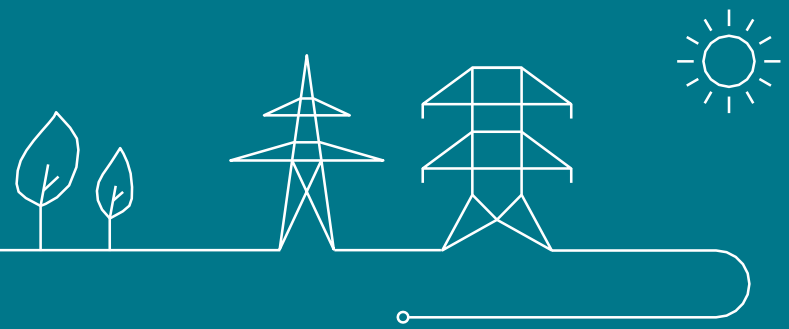
Lever 3
Lever 4

Agriculture and forestry practices
Shift agriculture practices (organic, agroforestry, …)
Shift livestock practices (intensification vs extensification, …)

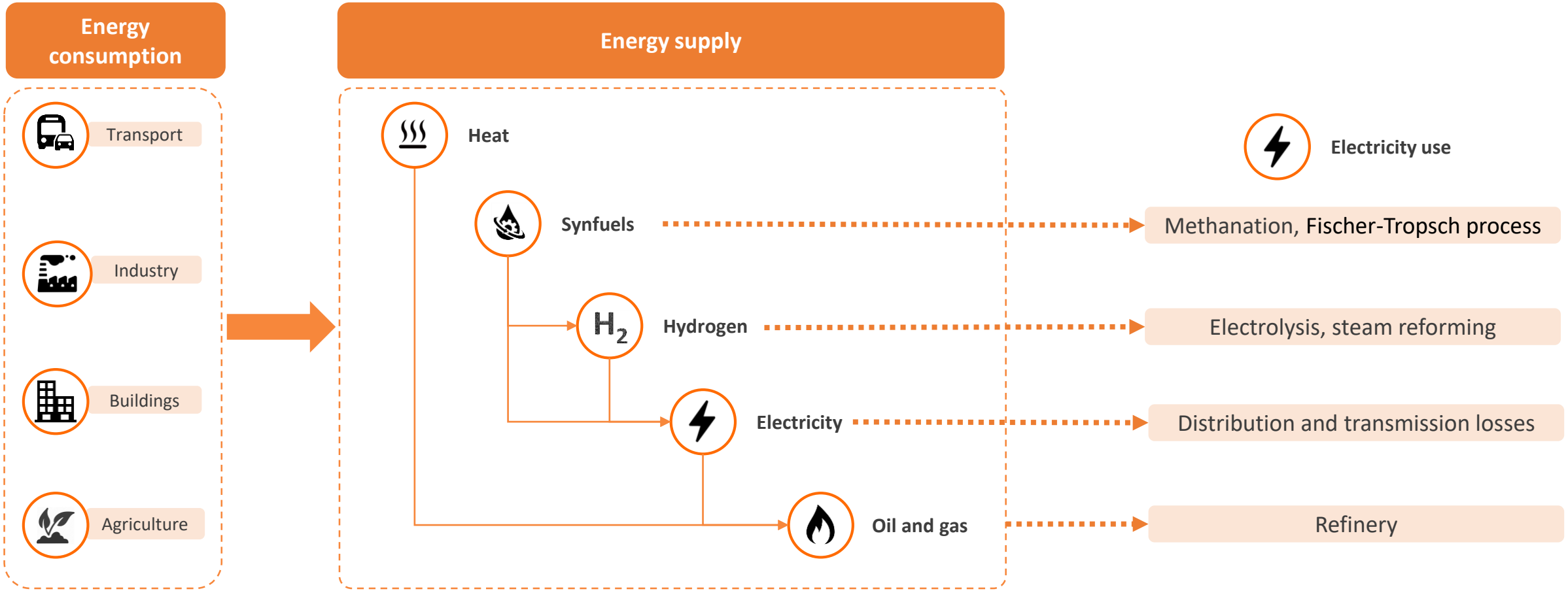
Resources and Energy consumption
Energy, Fertilizers, feed, land demand

Methodology

- Buildings
- Transport
- Industry
- Agriculture
- **Energy supply**



The energy supply sector answers the energy demand, leading to an electricity self-consumption



Losses computation: **fixed percentage** of total electricity demand + **additional losses** due to network evolution until 2030 (source: Elia)

Next steps

Next steps foreseen for 2020 and scenario for strategic reserve 2020

Interface will be publicly available on Elia website end Q2 - beginning Q3

Interface will be **publicly available** on **Elia website** *end Q2 - beginning Q3* before public consultation of input data for Strategic Reserve study with:

- **Data** for each sector/sub-sector (Excel export)
- Underlying **assumptions** for each sector
- **Report** on **methodology** and **assumptions** for 'CENTRAL' scenario

Process for scenario definition this year and next years

- **2020 :** based on the last NECP **and** public consultation on input data available on website with description of assumptions. Exercise will be done with Climact for the construction of this 'CENTRAL' scenario
- **2021 and next years :** update of 'CENTRAL' scenario with best estimate assumptions in concertation with a working group before public consultation for strategic reserve

Many thanks for your attention !