EUCALC

Explore sustainable European futures

Trade-offs and co-benefits of decarbonisation in various sectors

& how to analyse them with EUCalc

Trade-offs & co-benefits in EUCalc through

Demand for goods, services & infrastructure

- Lifestyles: Travel, Homes, Diet

Energy and Product demand

- Transport
- Buildings

Product supply > energy and material demand

- Industry

Energy supply > resource demand

- Electricity
- Fossil Fuels

Resource supply

- Agriculture
- Forestry
- Land use
- Air Pollution
- Biodiversity

An example … what happens in a decarbonising-only-power-scenario

EUCALC

Pathway

Choose example pathway for Europe:

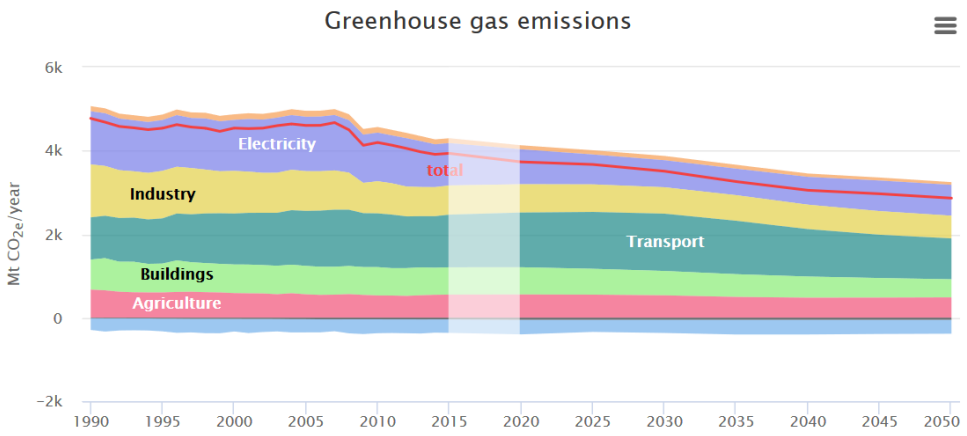
Europe

Key behaviours
- Travel
- Homes
- Diet
- Consumption

Technology and fuels
- Transport
- Buildings
- Manufacturing
- Power

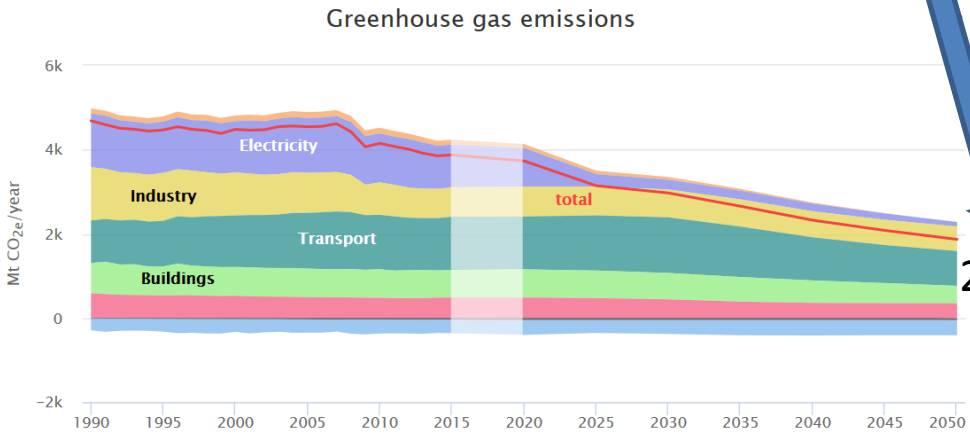
Resources and land use
- Land and food
- Biodiversity

Boundary conditions
- Demographics & long-term
- Domestic supply
- Constraints



2700 Mt CO2

- 21% GHG emissions



2100 Mt CO2

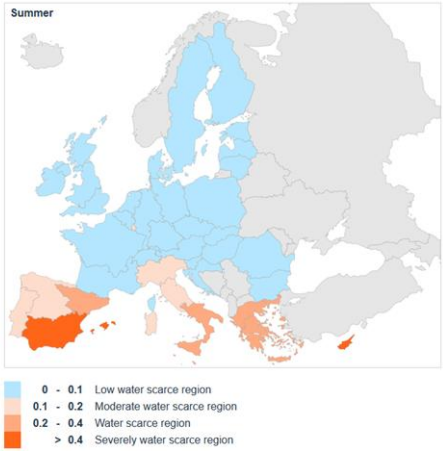
Warnings – negative consequences of the only-power-scenario

Emissions Energy ! Transport Buildings Industry Land-use Agriculture Water ! Minerals ! Air Climate ! Jobs Costs World

Annual oversupply is 50% higher than the annual charging capacity of storage units.

Levers that have the biggest influence on this issue are highlighted in the levers table, they are:

- Coal phase out
- Nuclear
- Wind
- Solar
- Hydro, geo & tidal
- Bioenergy capacity



Mineral extreme supply risk.

Levers that have the biggest influence on this issue are highlighted in the levers table, they are:

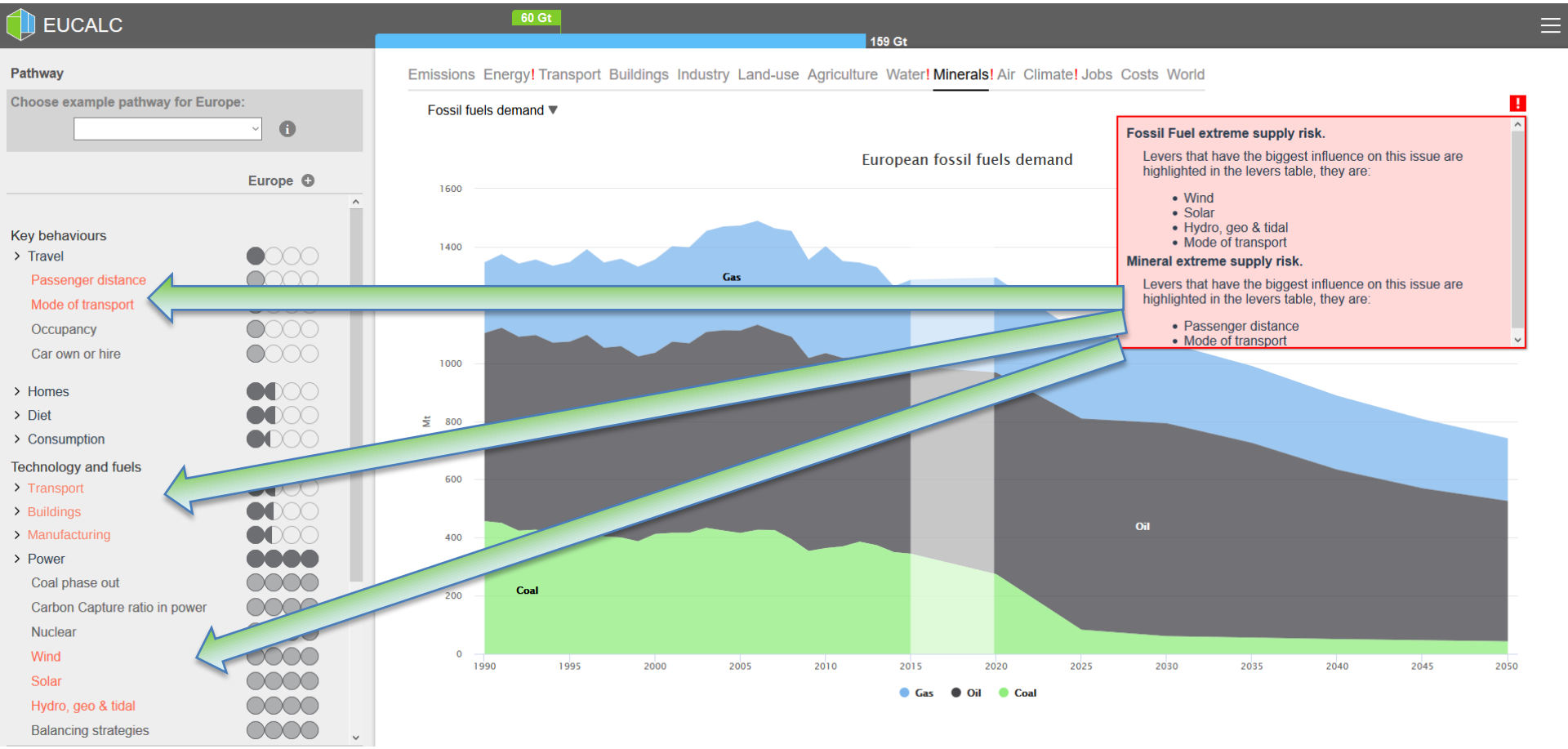
- Passenger distance
- Mode of transport

Extreme flood risk

Levers that have the biggest influence on this issue are highlighted in the levers table, they are:

- Global mitigation effort
- EU emissions after 2050

EUCalc highlights assumptions suggested for improvement to avoid negative consequences



Increasing the decarbonisation effort in power, transport, buildings, manufacturing and lifestyles to ambition level 3

EUCALC

Pathway

Choose example pathway for Europe:

Europe

Key behaviours
- Travel
- Homes
- Diet
- Consumption

Technology and fuels
- Transport
- Buildings
  - Building envelope
  - District heating share
  - Technology and fuel share
  - Heating and cooling efficiency
  - Appliances efficiency
- Manufacturing
- Power

Resources and land use
- Land and food
- Biodiversity

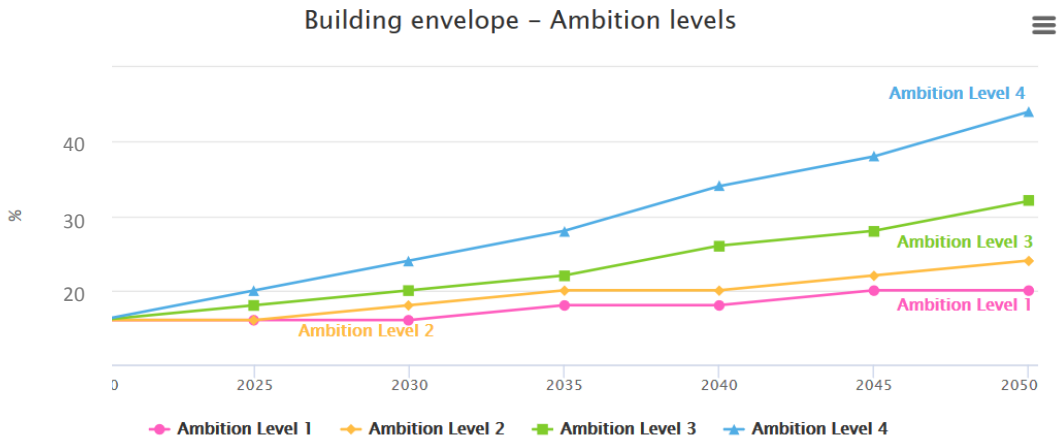
Boundary conditions
- Demographics & long-term
- Domestic supply
- Constraints

Click

Online description

Building envelope

This lever sets the average heat loss reduced with insulation and affects the energy need per floor area.

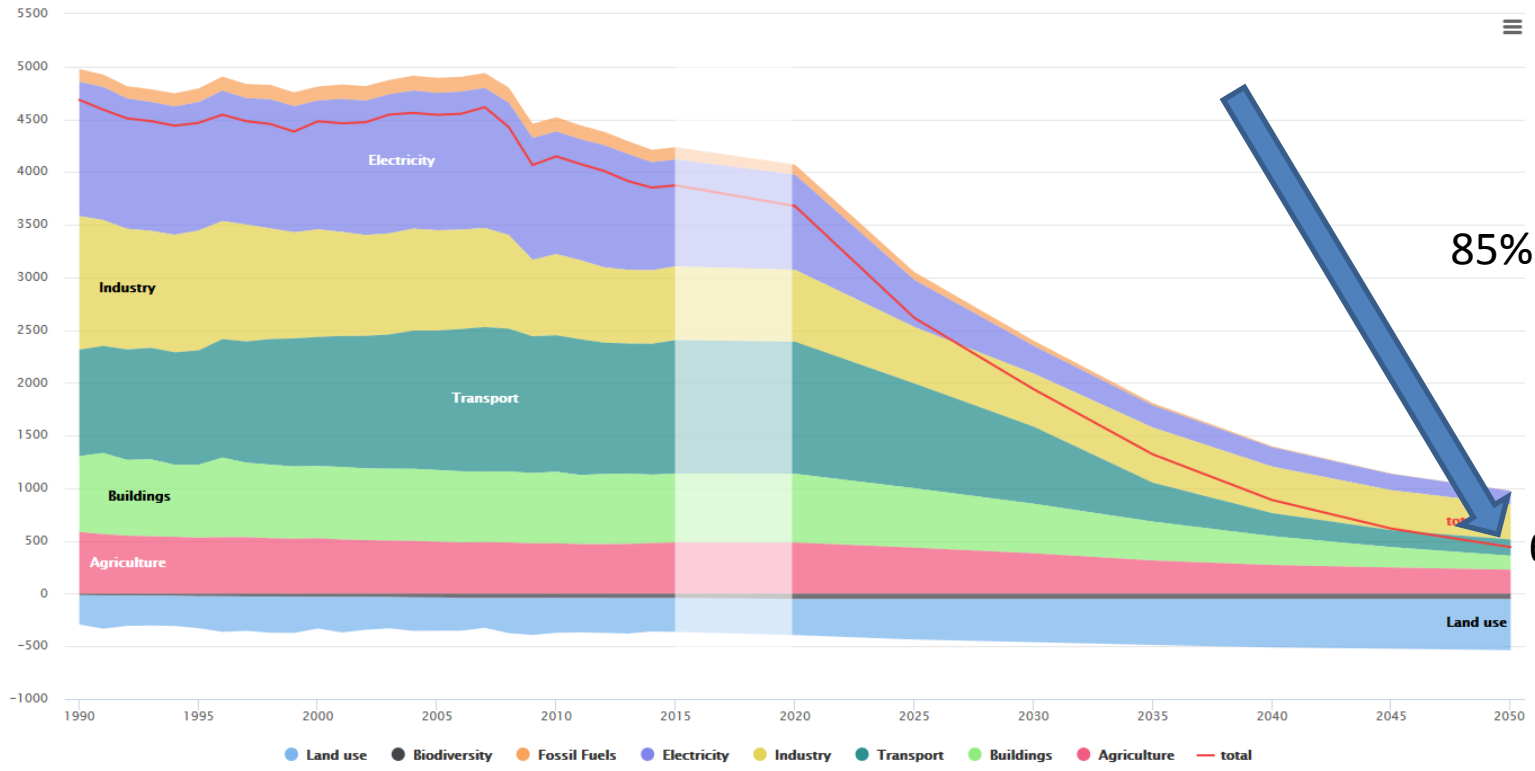


Representation of the energy improvement of building envelopes of the whole building stock resulting from the combination of the renovation rate and the mix of renovation ambition

- Ambition Level 3

  The annual renovation rate is 2.0%. 10% of the renovations are shallow (-30% energy demand), 70% are medium (-40%) and 20% are deep (-60%). 10% of new constructions have the lowest level of efficiency, 70% are medium efficient and 20% highly efficient. The demolition rate is 0.7%/annum.

Effect of a balanced & combined decarbonisation effort on GHG emissions

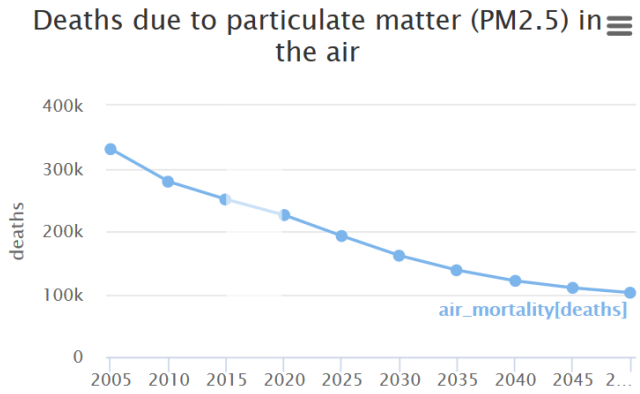


85% reduction

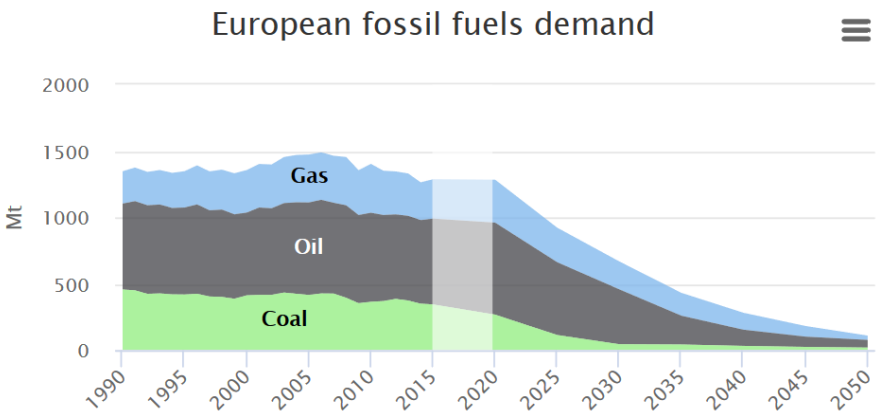
643 Mt CO2

At the same time we have positive effects on health, biodiversity, jobs, economy

Health: reducing air pollution



Energy Security: importing less fossil fuel



Biodiversity: keeping preserved land

Economy and Society: Employment

What are the main trade-offs and co-benefits

Land use

EUCALC Changes in land use will have effects on health, water, biodiversity jobs, economy

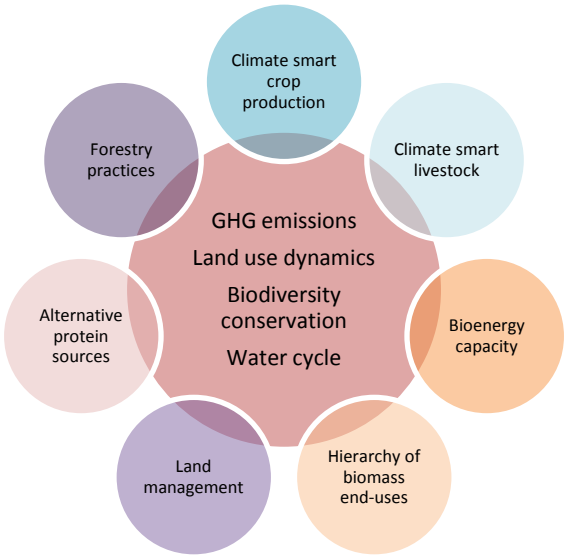
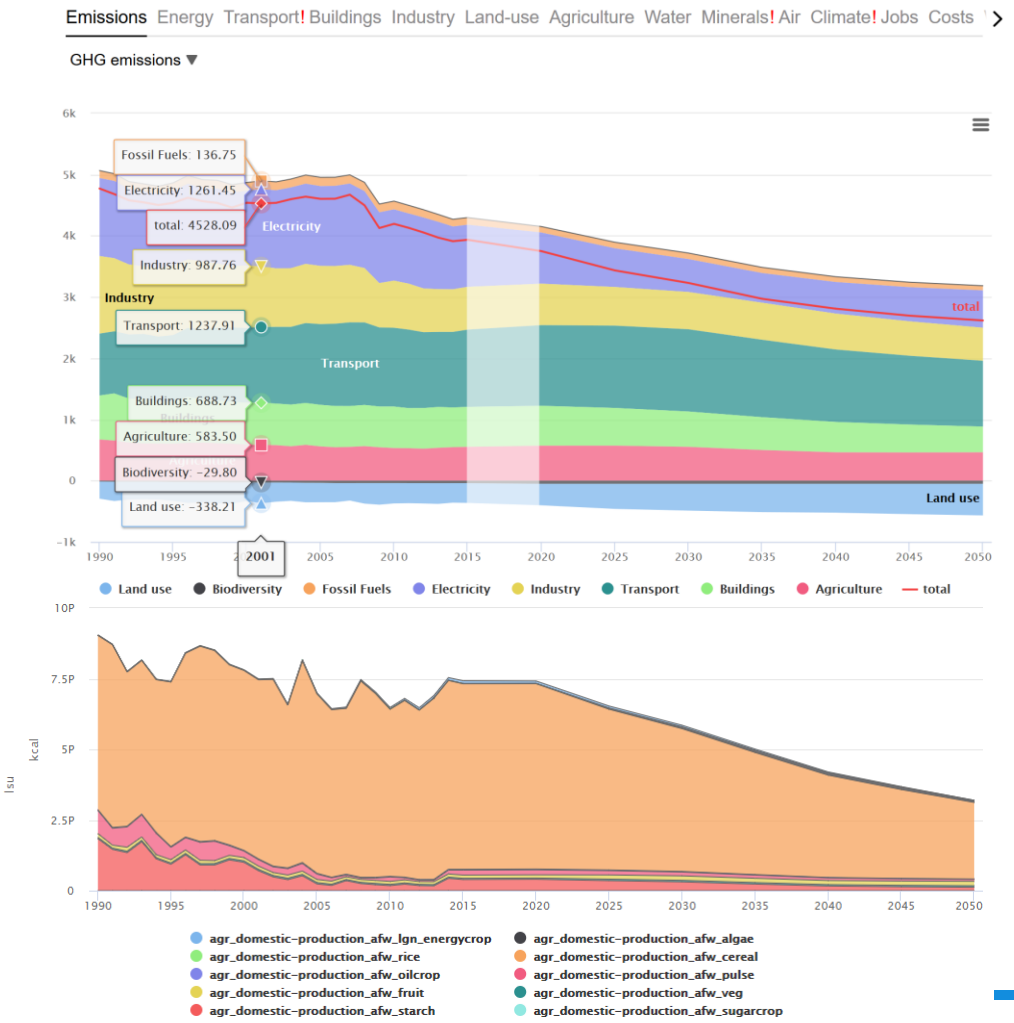


***Figure 1**: Agriculture and Land-Use Levers in the EUCalc*



Warning!

Trade-offs and co-benefits and complex interactions are likely to result from changes to ANY and ALL of the 7 Land Use & Food Production levers

What are the main trade-offs and co-benefits

Buildings

Scenarios for the buildings sector

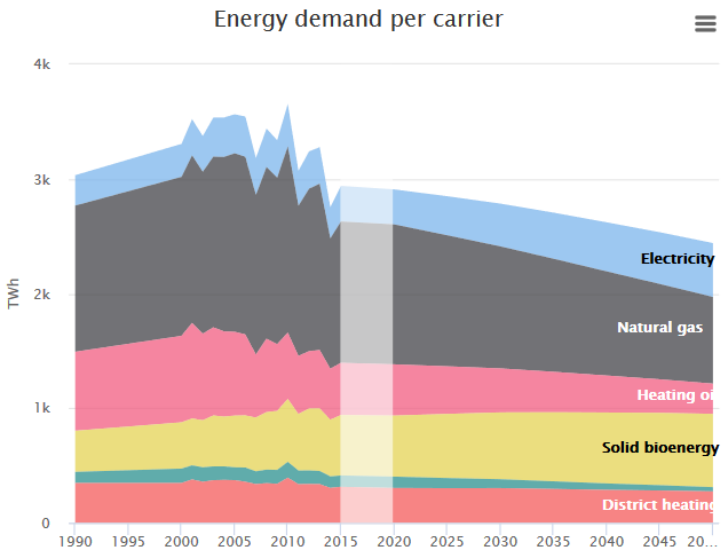
ideally decarbonisation pathways are combining actions, such as:

- cutting energy demand through **improved e**
  the building envelope and
- **switching to electricity and renewable ener**
  cooling,

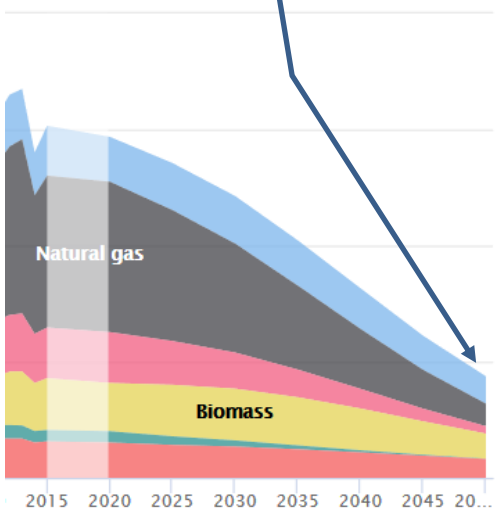
Note that biomass and electricity demand decrease slightly, which supports the decarbonisation of other sectors

Note how this scenario reduces the use of fossils but increases the dependency on the decarbonization of electricity

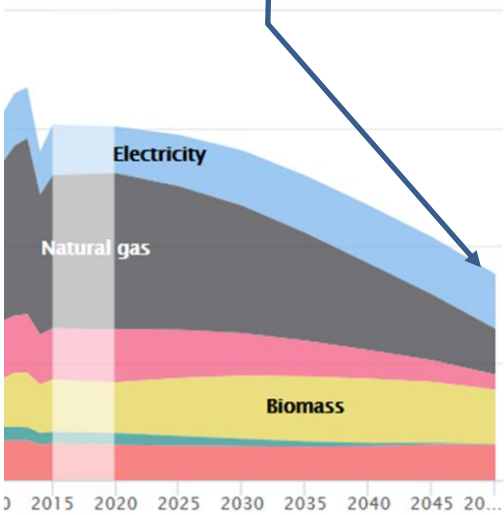
European Reference Scenario



+ Building envelope improvement
+ fossil fuel demand reduction



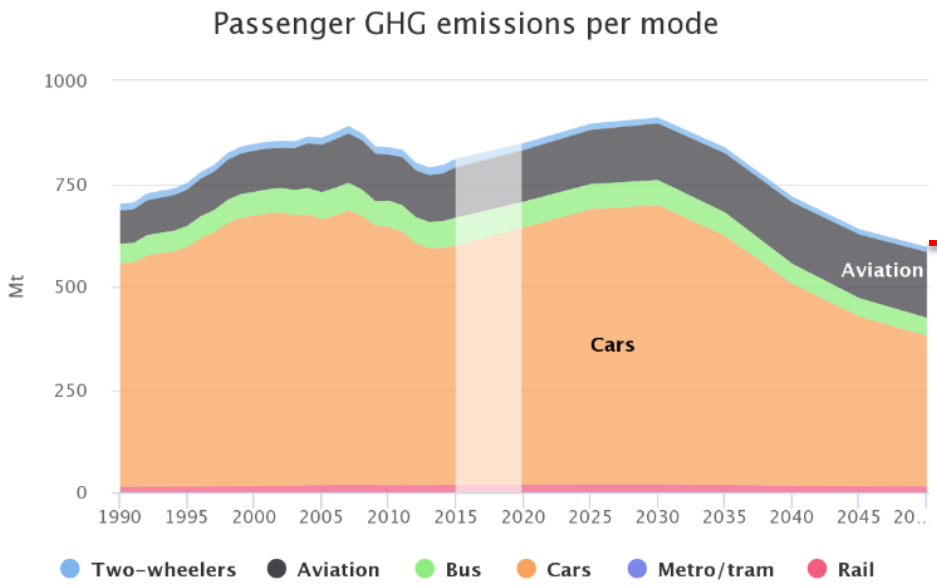
+ only fuel switch & technology improvement

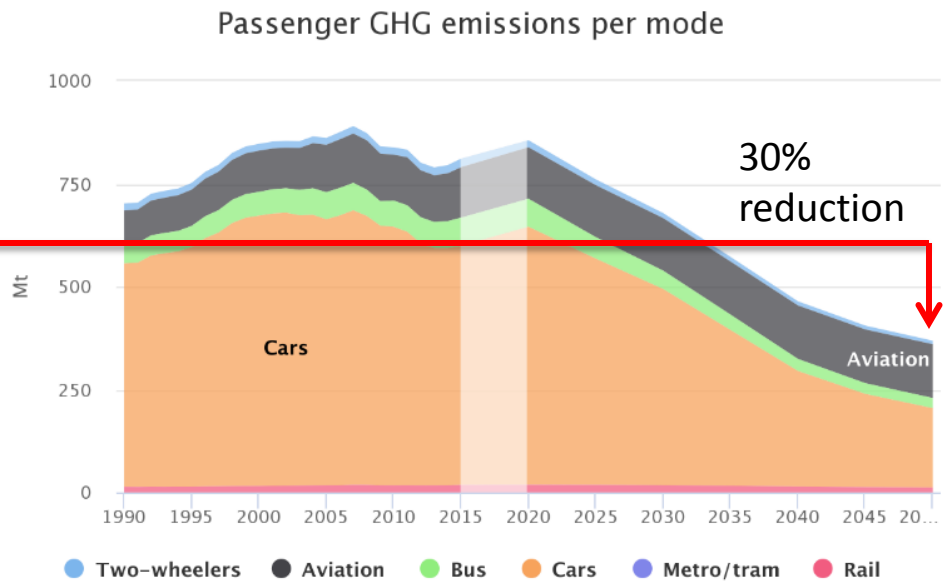


What are the main trade-offs and co-benefits

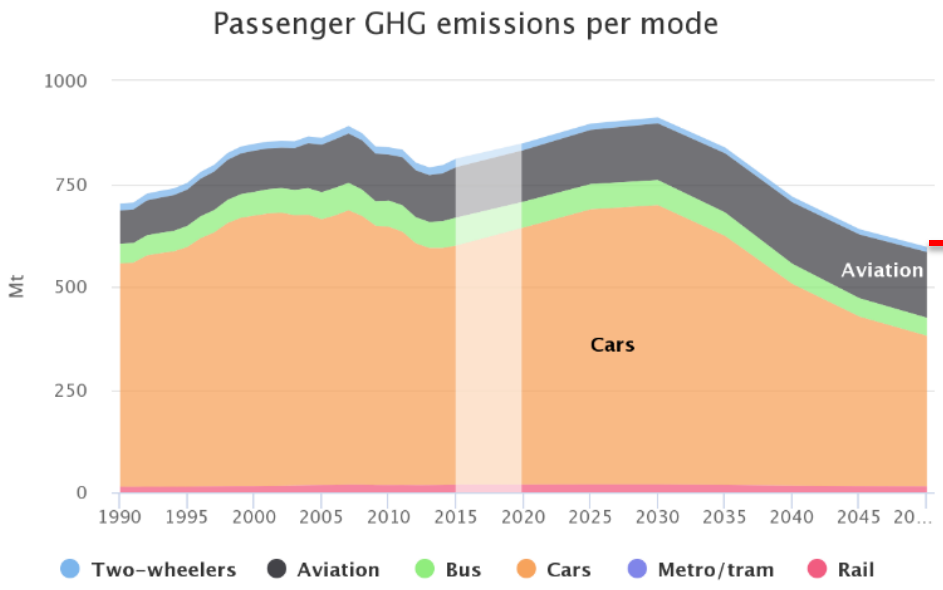
Transport

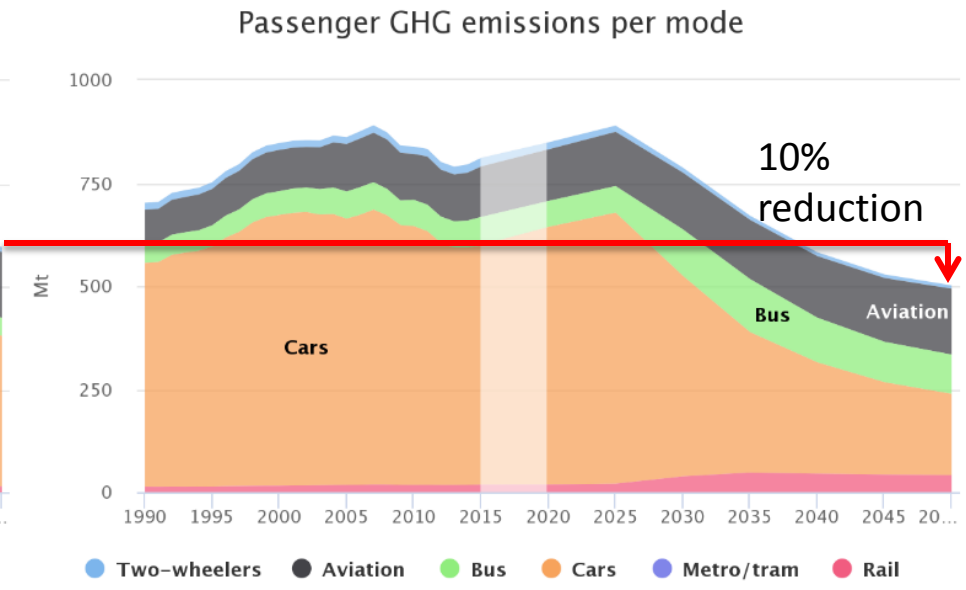
AVOID: behavioural and territory planning changes



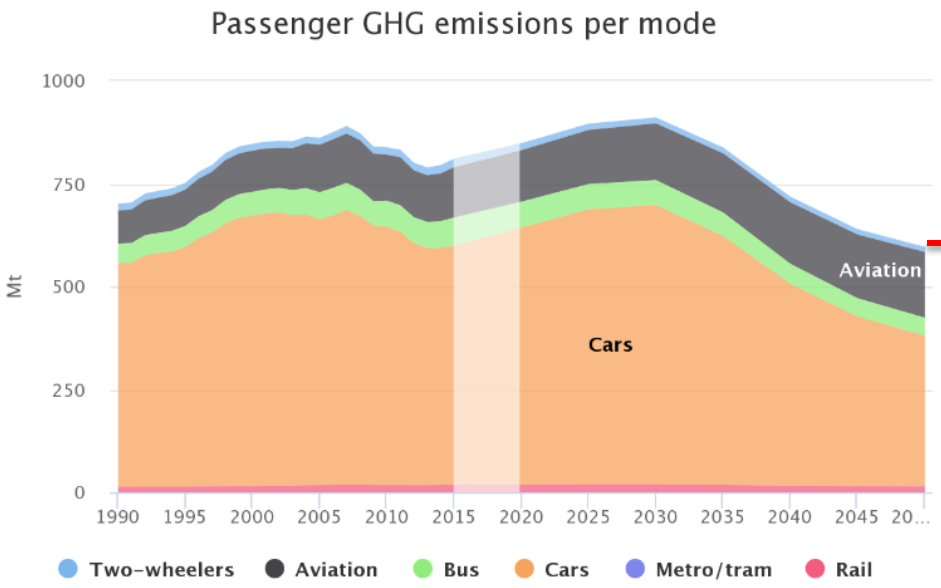


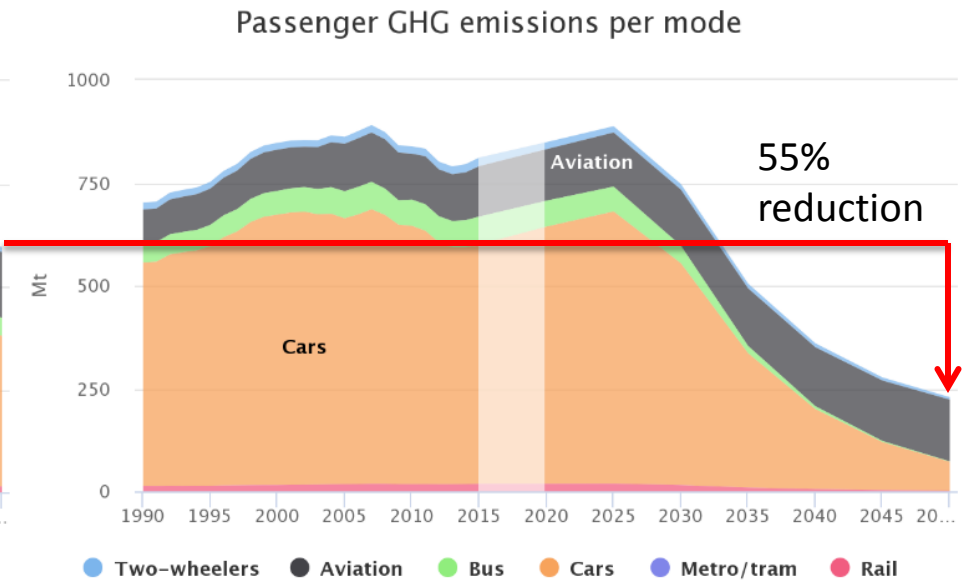
SHIFT: modal shift to soft modes



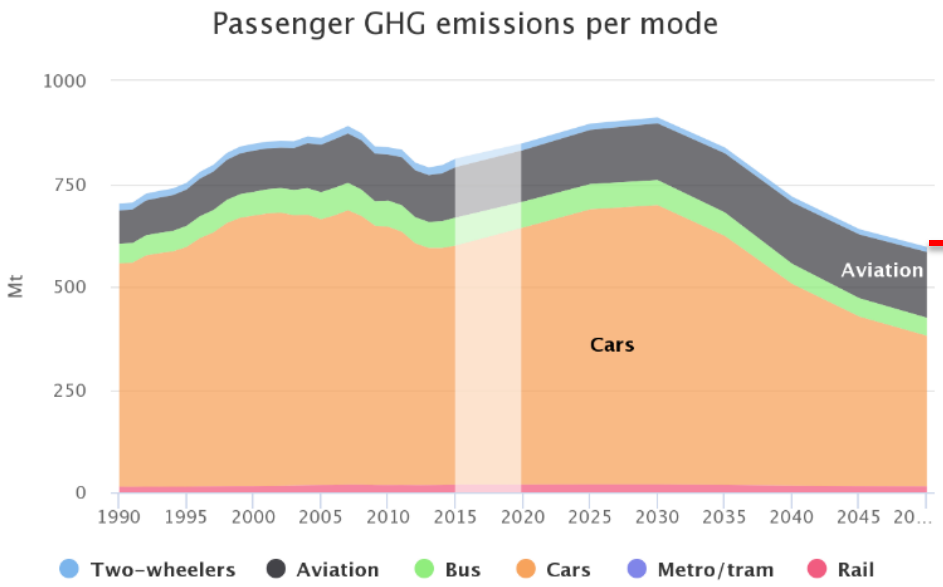


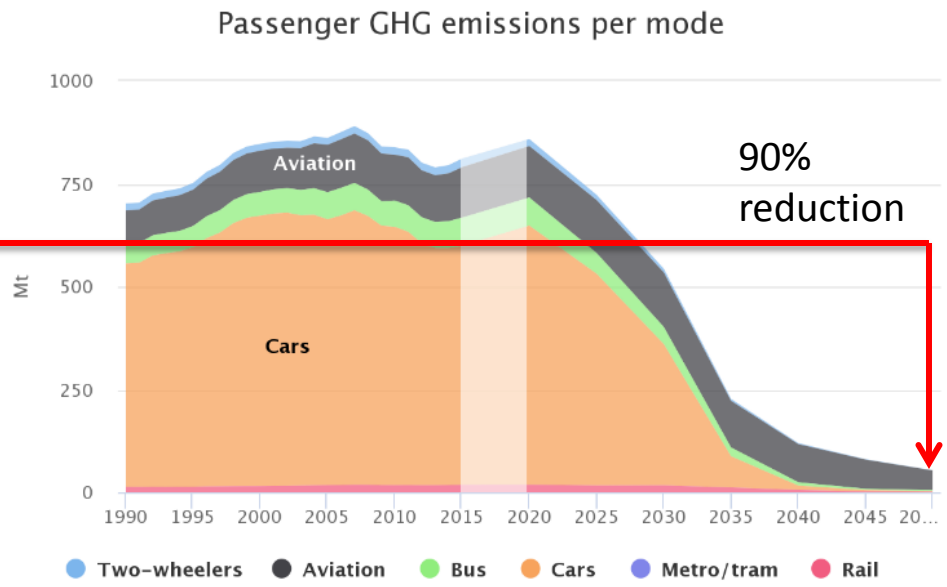
IMPROVE: technology shift, efficiency and fuel switch





IMPROVE: technology shift, efficiency and fuel switch



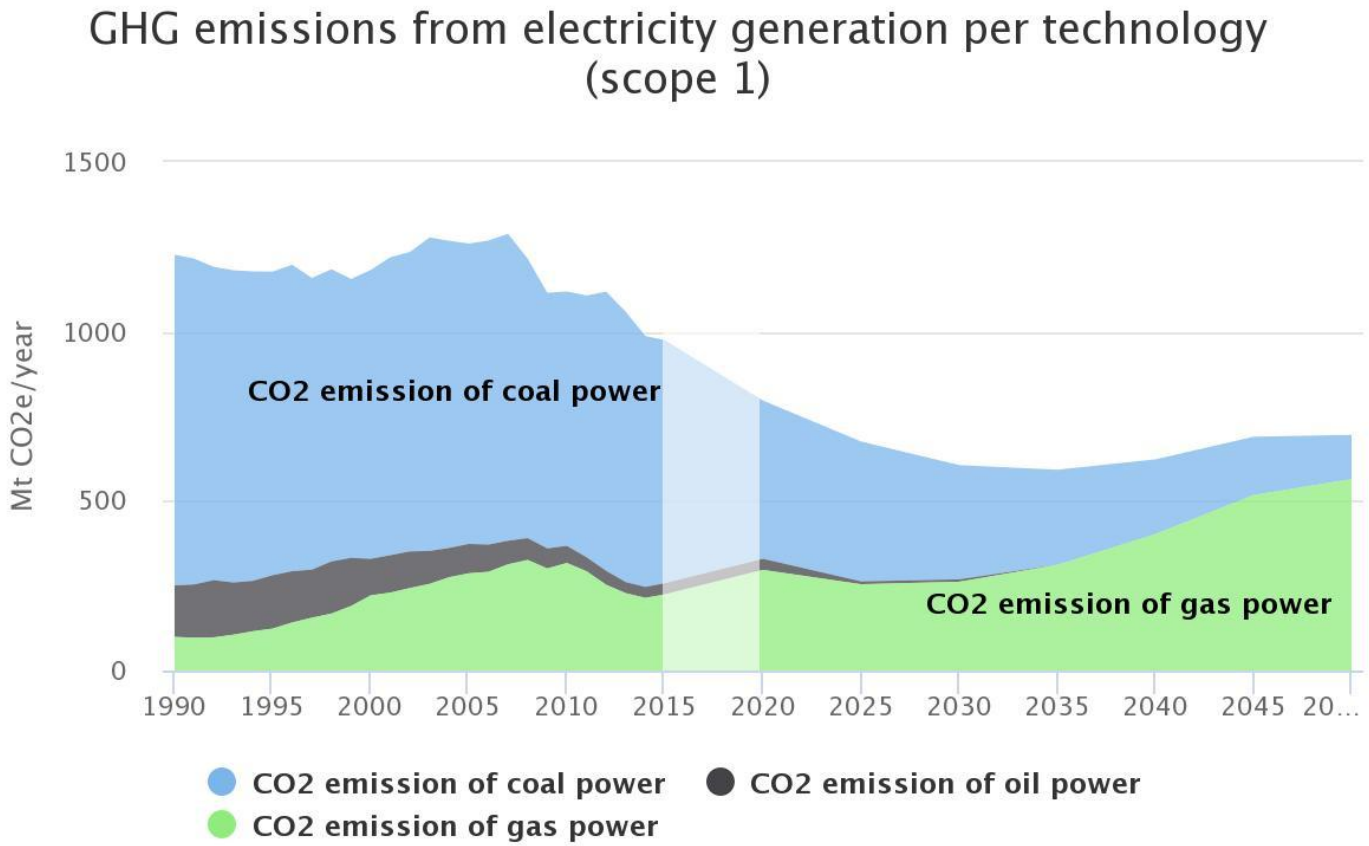


What are the main trade-offs and co-benefits

Power

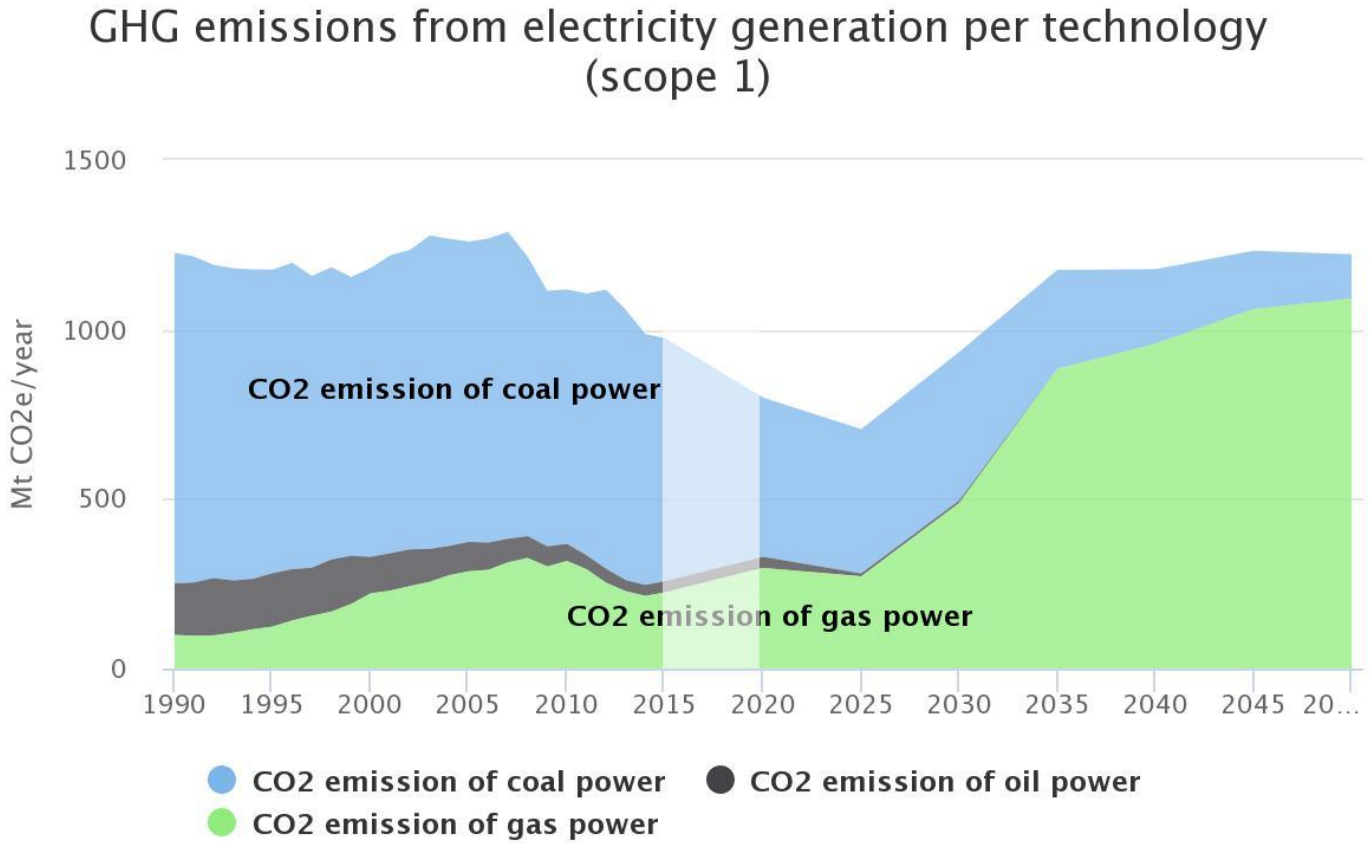
Scenarios for power generation

EU reference scenario



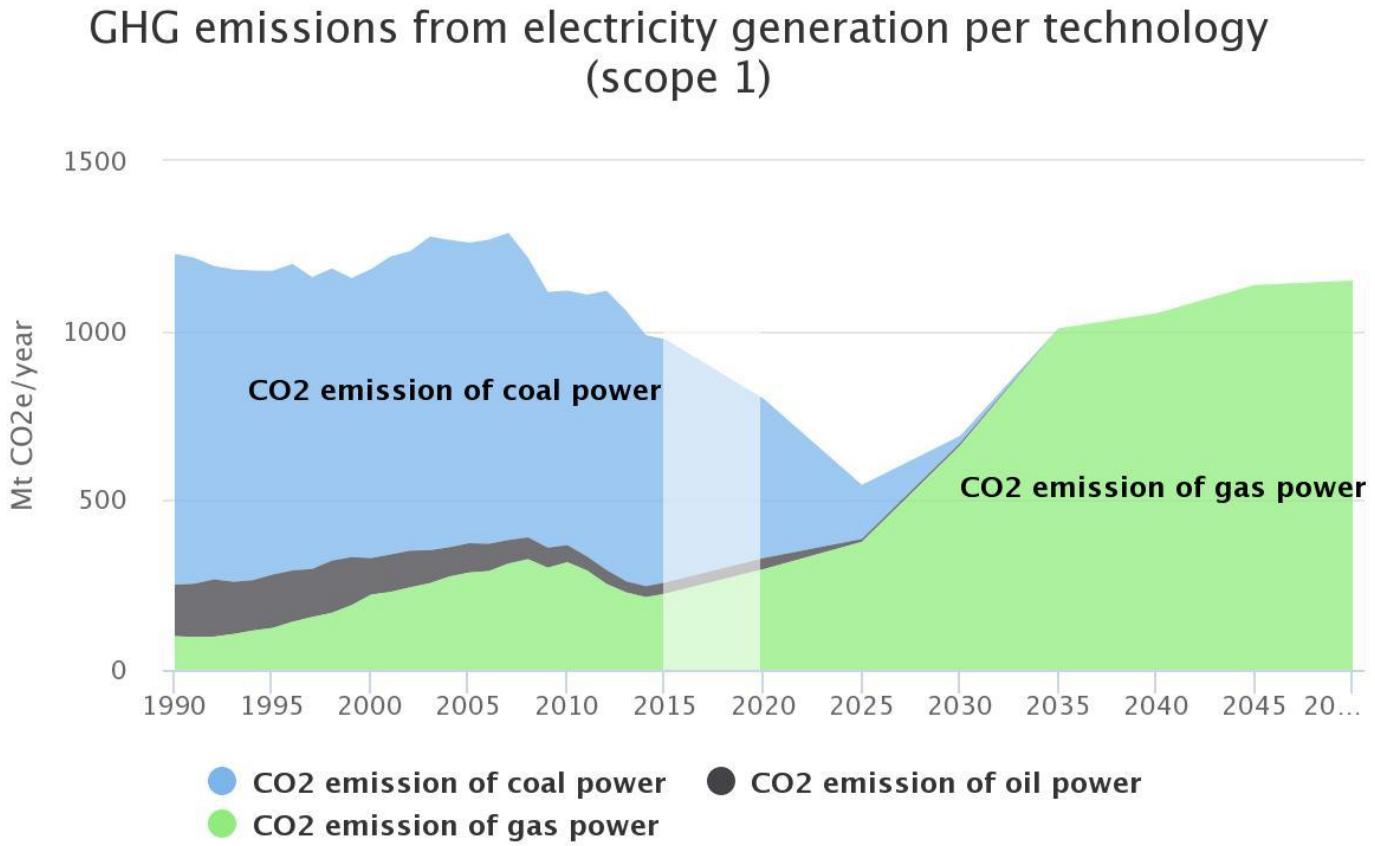
Scenarios for power generation

EU reference in supply but significant electrification on demand side



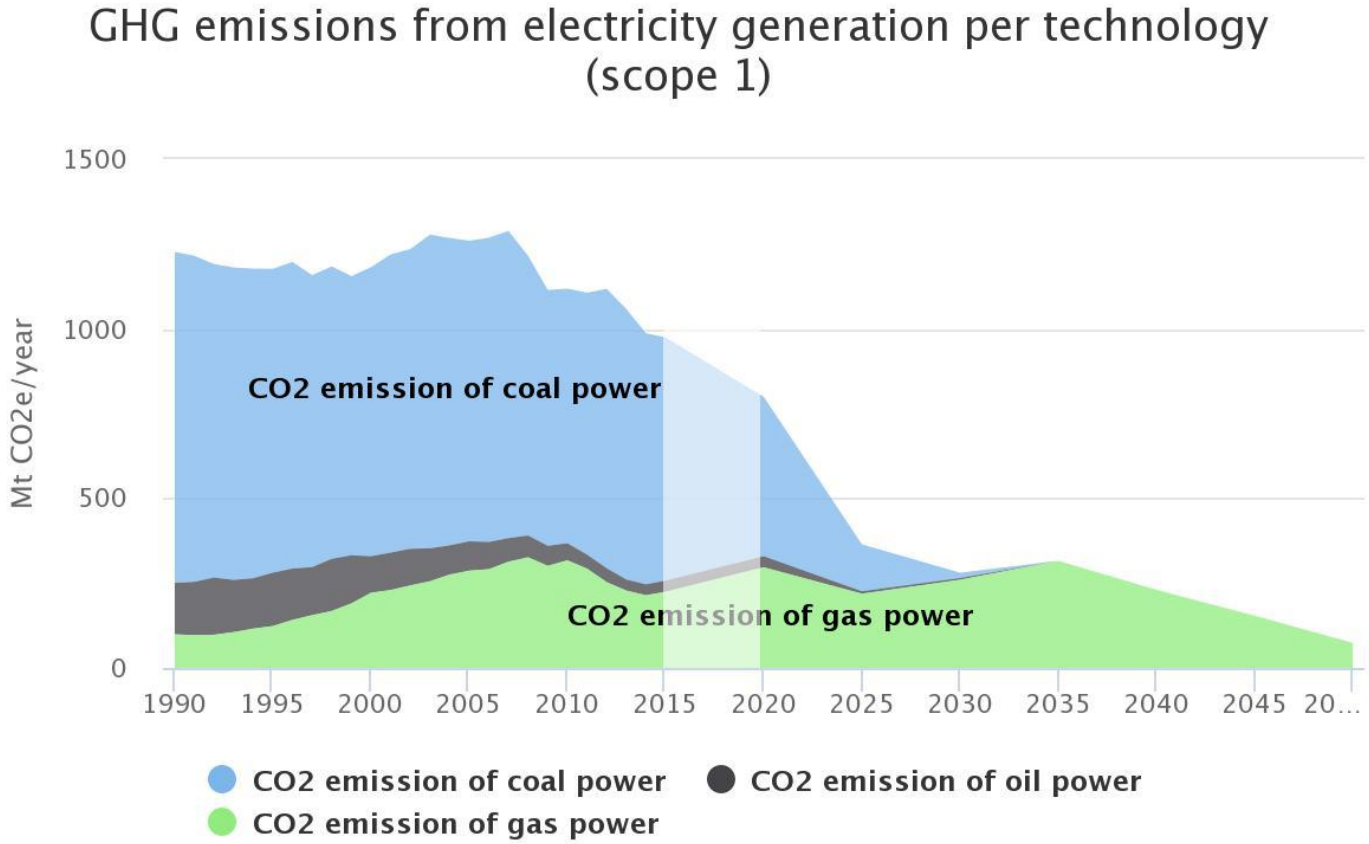
Scenarios for power generation

EU reference in supply but significant electrification on demand side coupled with coal phase-out



Scenarios for power generation

EU reference in supply but significant electrification on demand side coupled with coal phase-out and ambitious renewables trajectories and low carbon flexibility portfolio

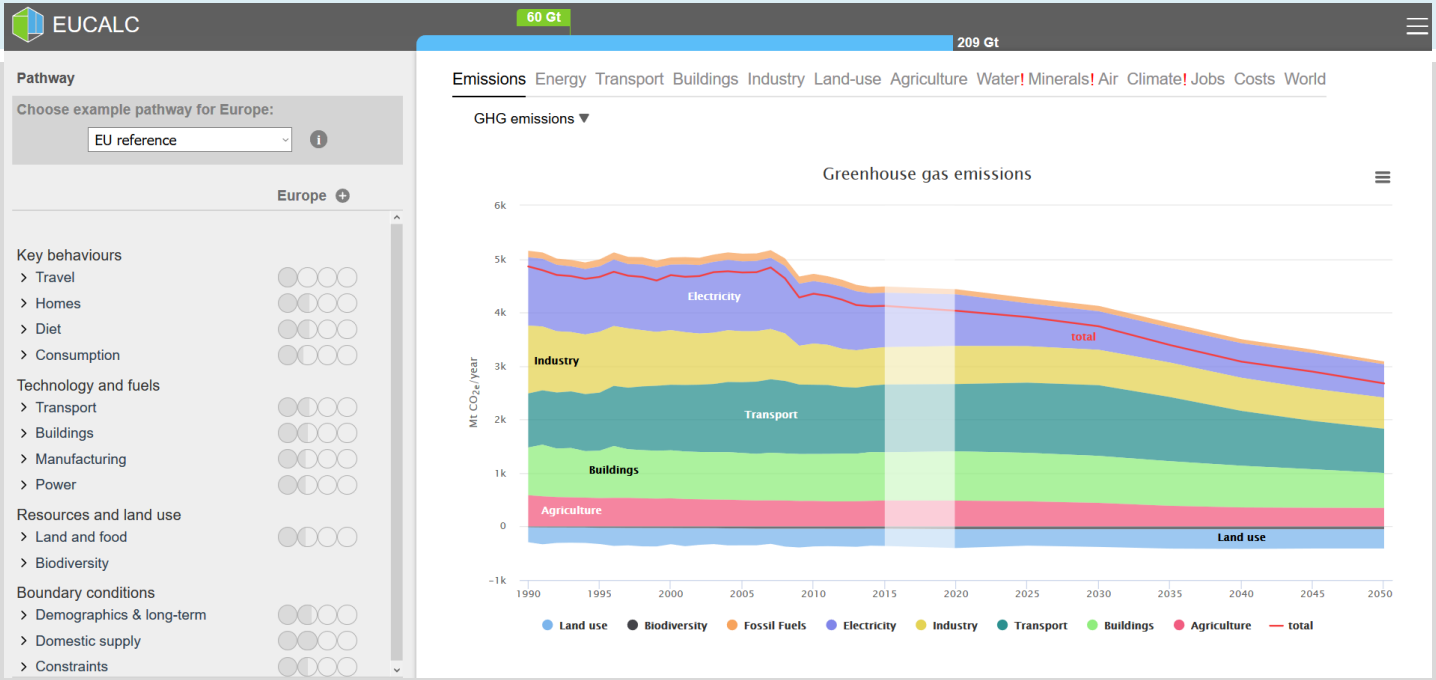


Policy messages

Policy messages

- Due to the growing intermittency of electricity supply, policies may switch from supporting certain technologies into a systematic approach in order to decarbonize the operation of the whole electricity grid. This would secure that the further development of the electricity grid will include low carbon flexibility solutions (including battery storage, pumped hydro storage and other technologies).
- Trade-offs – decarbonization measures on demand sides often are coupled with electrification that can lead to growing emissions if not making effective actions on supply side
- The closure of old powerplants, lag in development of low carbon flexibility solutions and insufficient investments into renewables can lead to scenarios in which natural gas (with associated emissions) would be required.

EUCALC



DEVELOPE YOUR PATHWAY TO DECARBONIZE EUROPE

http://tool.european-calculator.eu

http://www.european-calculator.eu/policy-brief/