The deep decarbonisation in the European industry: Opening the “modeling space” for decision makers will accelerate necessary transformation

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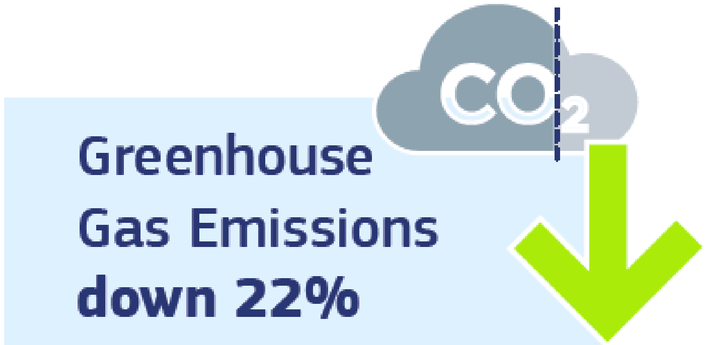
What is needed to accelerate further?

THE EU HAS SUCCESSFULLY DECOUPLED GREENHOUSE GAS EMISSIONS FROM ECONOMIC GROWTH



New Green Deal: „Man in the moon moment“

- **1 trillion € by 2030**
- **2030 minus 50-55%**
- **2050 zero**

Indeed „the commitment is still missing!“

- **Technological Innovation**
- **New vision for a sustainable life style!**

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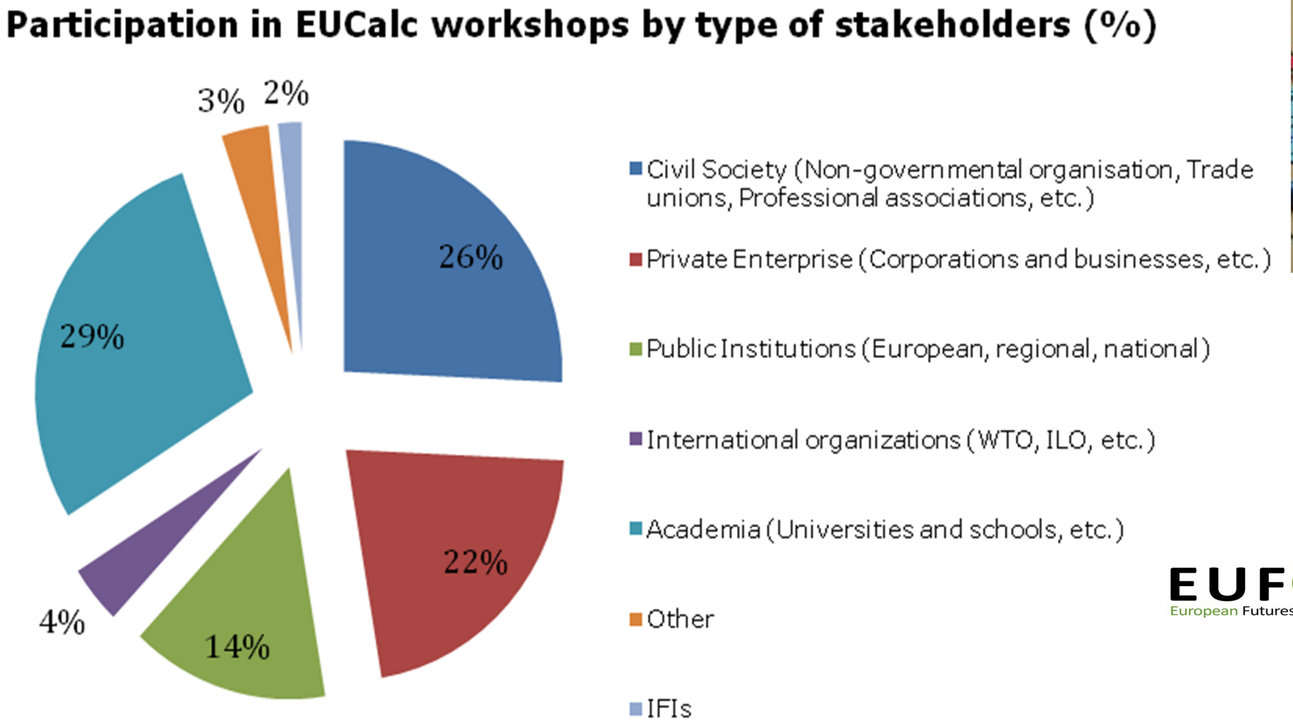
Sector Expert Consultations: ~ 1.000 invited, a few 100 were involved to share expertise, relevant issues and visions with the EUCalc Team



Schiphol ECOFYS EuroACE THE EUROPEAN ALLIANCE OF COMPANIES FOR ENERGY EFFICIENCY IN BUILDINGS

EUFORIE European Futures for Energy Efficiency | Department for Business, Energy & Industrial Strategy | ENERGISE EUROPEAN NETWORK FOR RESEARCH, GOOD PRACTICE AND INNOVATION FOR SUSTAINABLE ENERGY | INNOPATHS

Basis for starting points/readjustments of tour modeling approach!

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Transition Pathways Explorer: EURef as Benchmark (~-60% 1990-2050)

Behavioral choices

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30

222 Gt

Pathway

Choose example pathway for Europe:

EU reference

Europe

Key behaviours

- Travel
- Homes
- Diet
- Consumption

Ambition levels

Technology and fuels

- Transport
- Buildings
- Manufacturing
- Power

Resources and land use

- Land and food
- Biodiversity

Technology choices

Boundary conditions

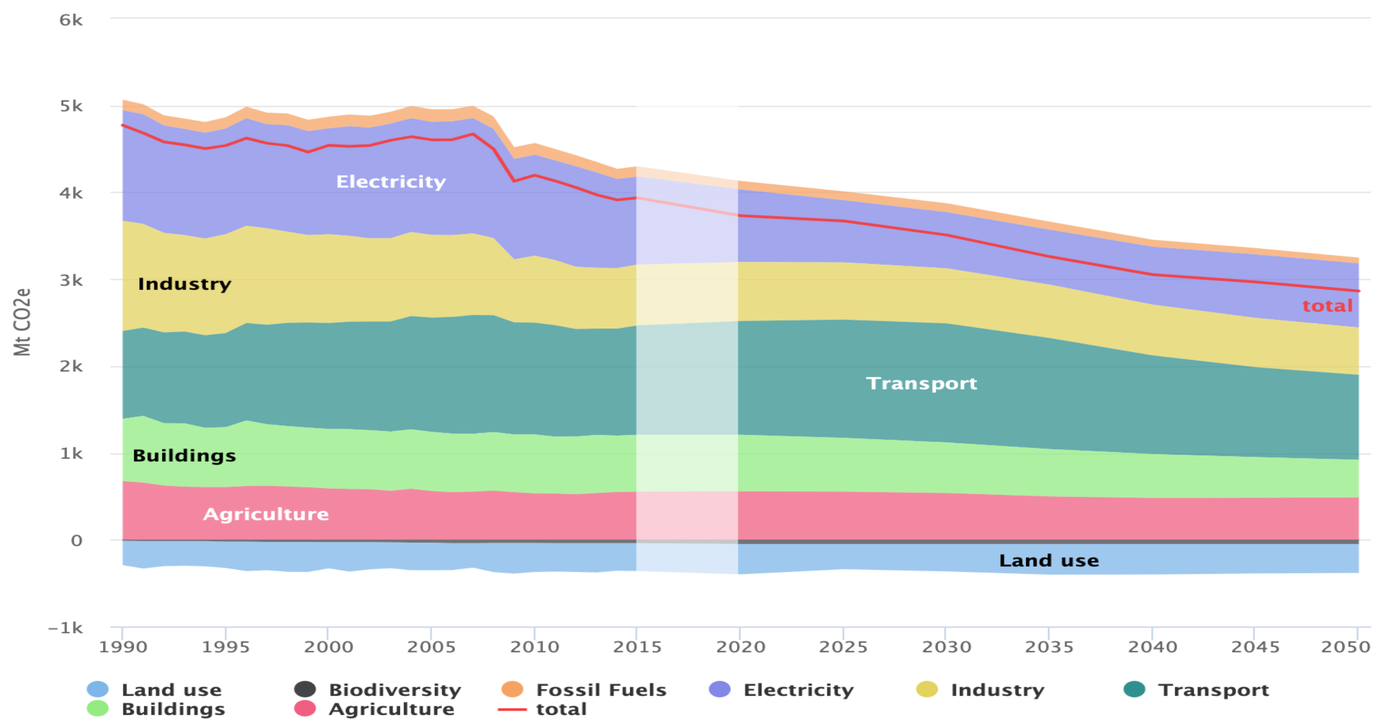
- Demographics & long-term
- Domestic supply
- Constraints

Emissions Energy Transport! Buildings Industry Land-use Agriculture Water! Minerals! Ai >

GHG emissions

Output

Greenhouse gas emissions



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The approach in complex: Industrial production is not independent!

INPUTS

Lifestyle

- Packaging demand
- Paper and sanitary

Buildings

- Floor area (new and renovated)
- Appliances

Transport

- Cars, Trucks, Ships, …
- Transport infrastructure

Agriculture

- Fertilizer demand

Technology

- Costs
- Energy consumption (incl. feedstock)
- Emission factors (combustion and process)
- Material decompositiion

MANUFACTURING AND PRODUCTION MODULE

Iron & Steel (4)
Non-metallic minerals (5)
Non-ferrous metals (3)
Chemicals (2)
Paper & Pulp (2)
Other industries (6)

OUTPUTS

CCUS

Carbon captured

Climate

GHG emissions

Minerals

Material demand

Supply

Energy demand by fuel

Agri. & Land-use

Bioenergy demand

Air quality

PM emissions

Socio-economic

- Costs (CAPEX, OPEX)
- Jobs

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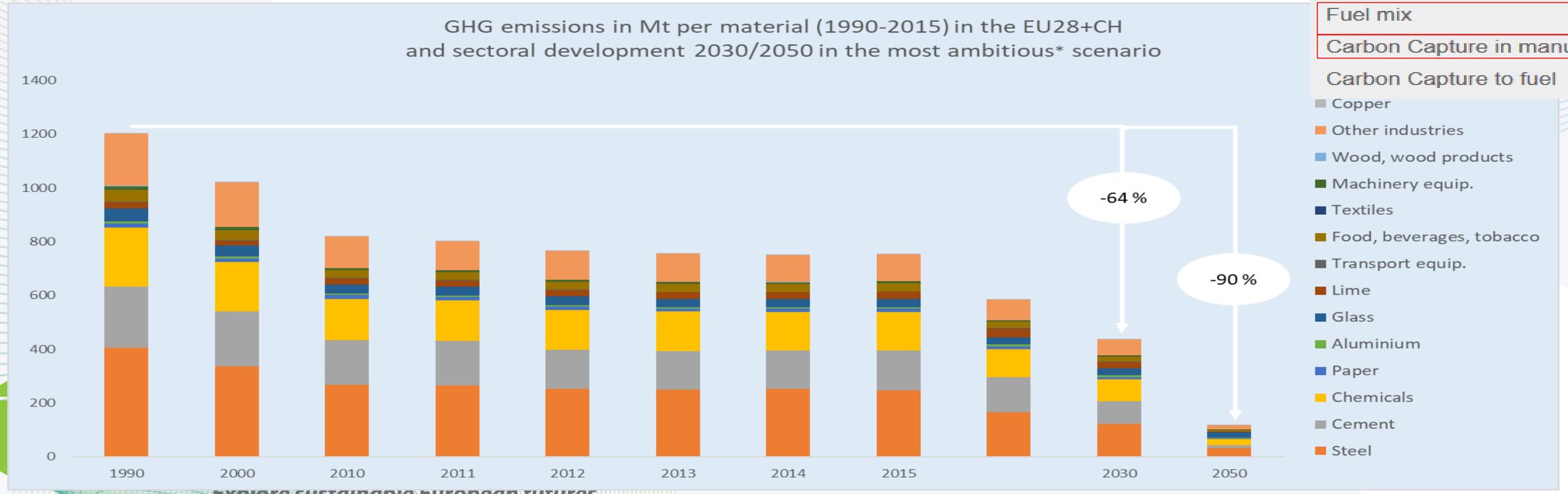
Industrial production/manufacturing

Changing the fuel mix to less carbon intensive fuels (biomass, hydrogen, electrification of heat etc.) GHG emissions can be reduced by 26 %,

but, up to 70 % of carbon emissions could captured in some sectors, reducing emissions by 232 Mt or 45 % compared to EURef

Material efficiency +33 % (smart products, material design, re-use of materials) reduces total material production by 15 %

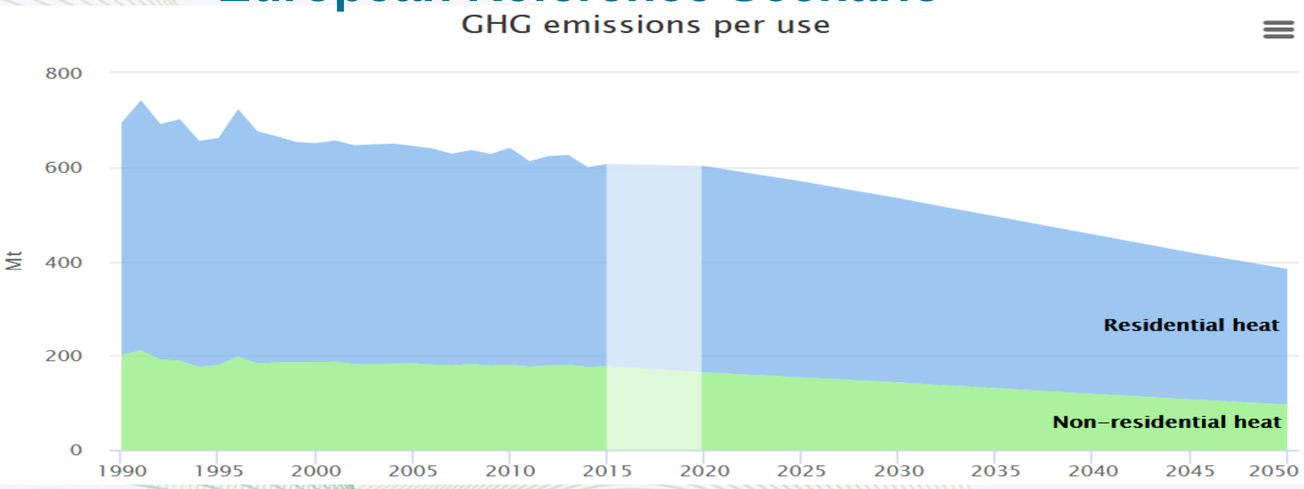
Substitution of carbon-intensive materials by lightweight materials by 30 % reduces material production by 8 % compared to EURef



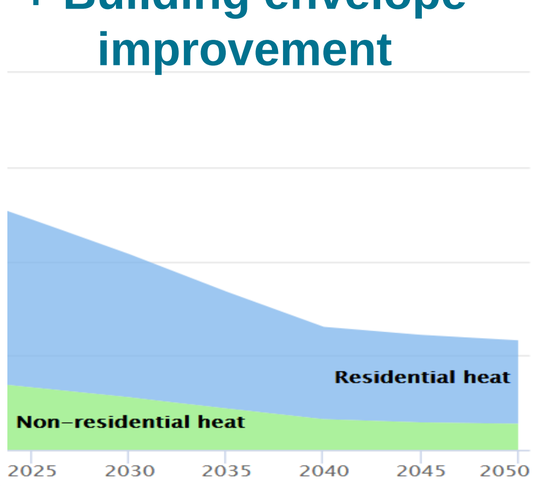
Emission Scenarios for the buildings sector

Fossil fuel phase-out for heat : gas -95%; coal -95%; oil -95% in 2050.
Substitution by heat pumps (60%), biomass (20%), solar (12%), geothermal (4%), biogas (2%), and biofuel (2%).

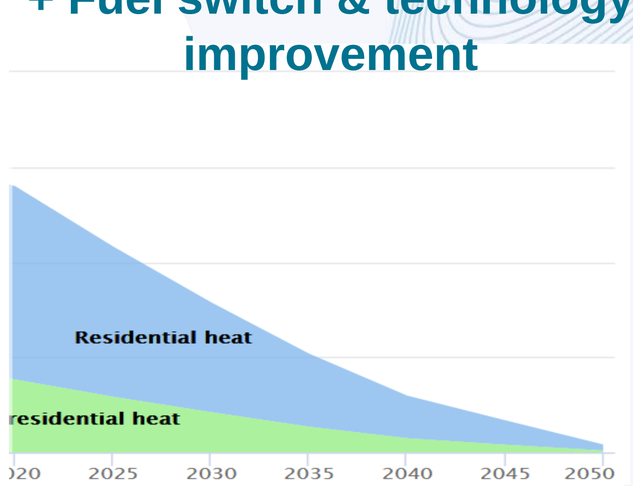
European Reference Scenario



+ Building envelope improvement



+ Fuel switch & technology improvement



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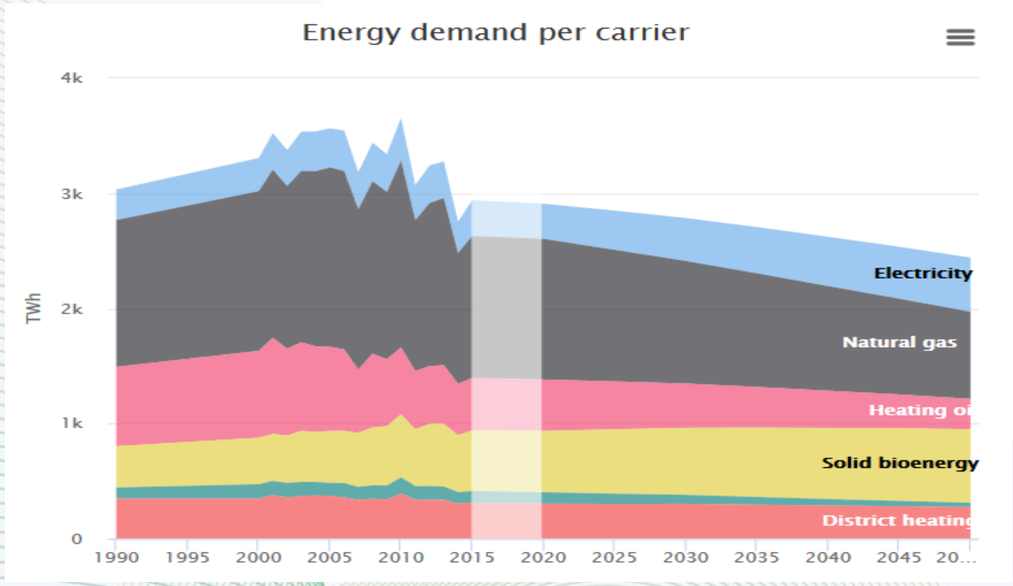
Turnaround in the building energy sector

Ideal decarbonisation pathways need to be defined as concerted across sectors!

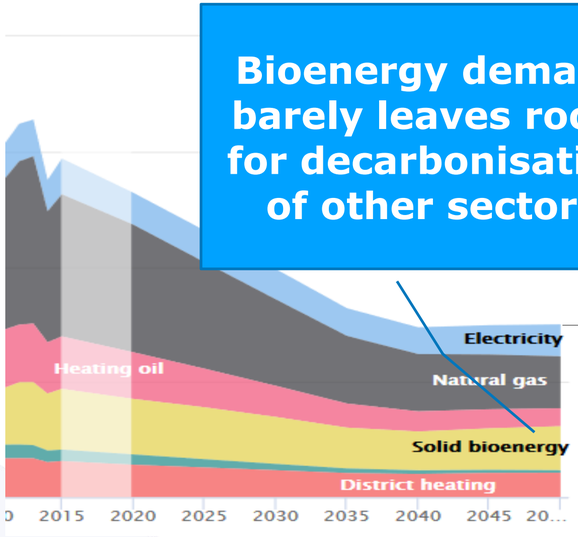
…a cut of energy demand/improved energy efficiency of the building envelope
…switch to advanced electricity and renewable energy tech. for heating and cooling

European Reference Scenario



+ Building envelope improvement

Bioenergy demand barely leaves room for decarbonisation of other sectors



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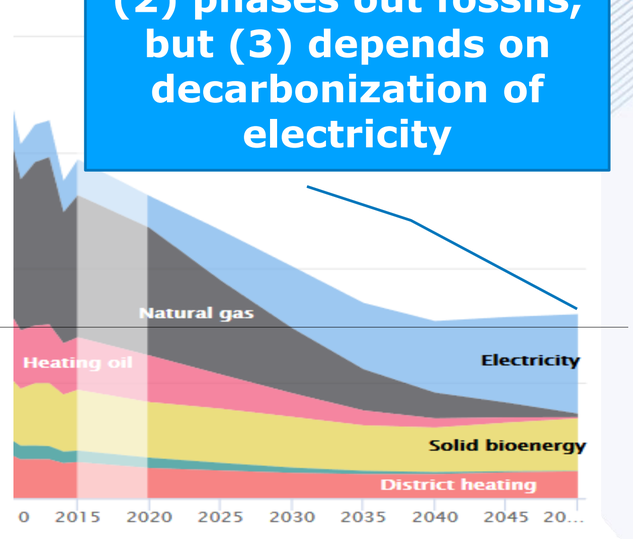
(1) fuel switch alone increases final energy demand,
(2) phases out fossils, but (3) depends on decarbonization of electricity



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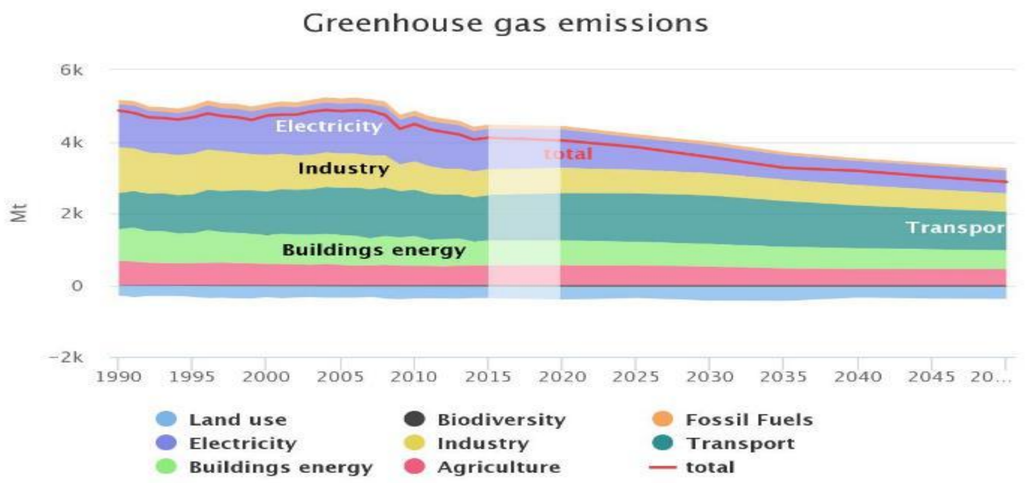
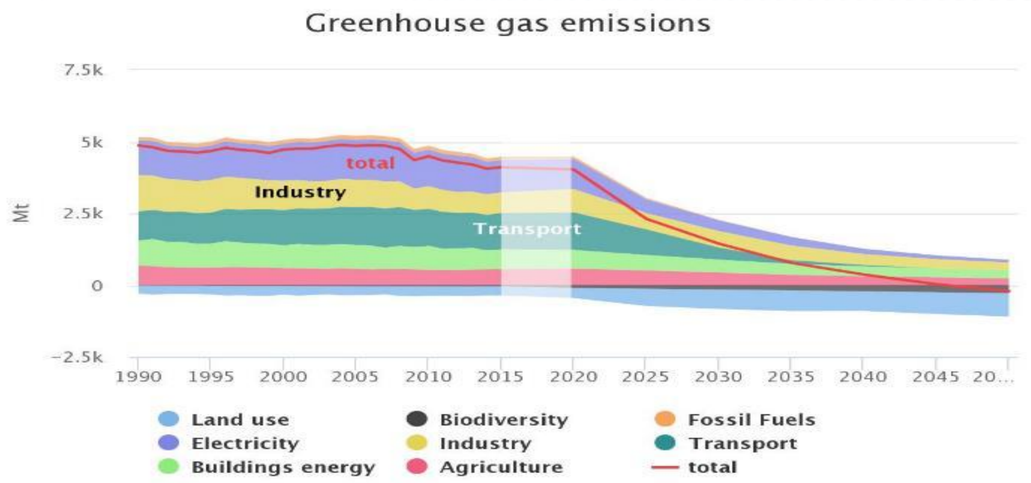
Energy & Health: New & clean technologies

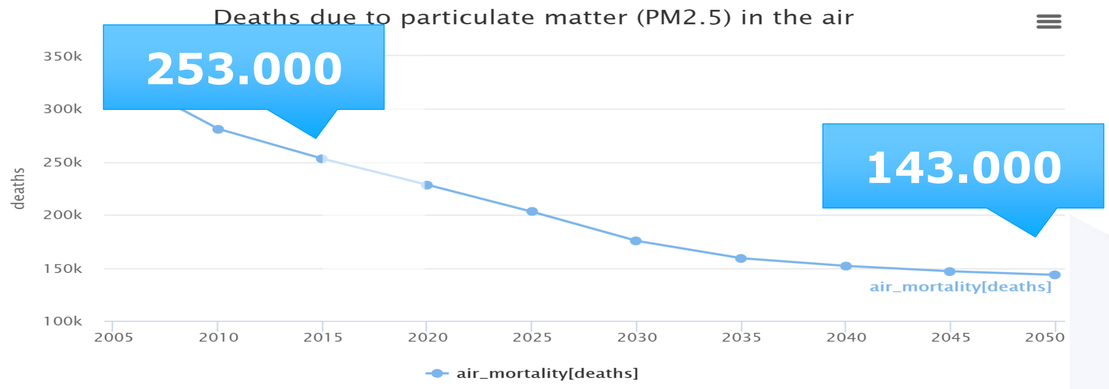




EURef

Emissions Energy Transport Buildings Industry Land-use Agriculture Water! Air Clin >

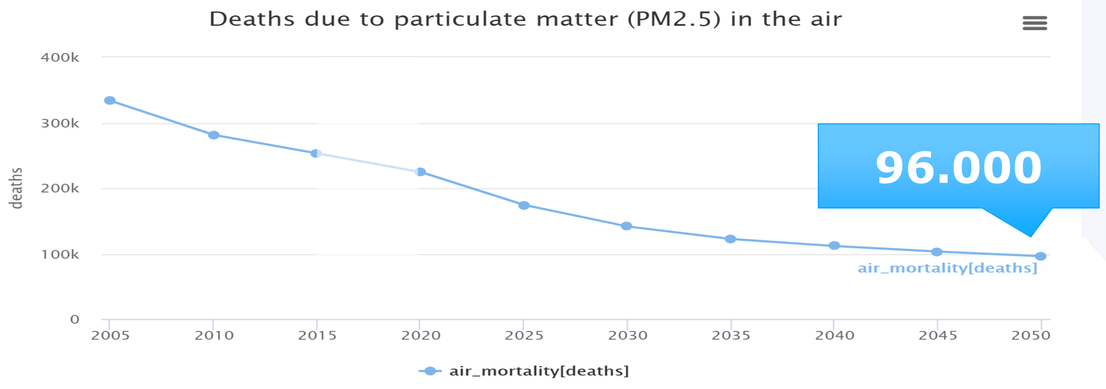
Mortality



Ambitious

Emissions Energy Transport Buildings Industry Land-use Agriculture Water! Air Clin >

Mortality



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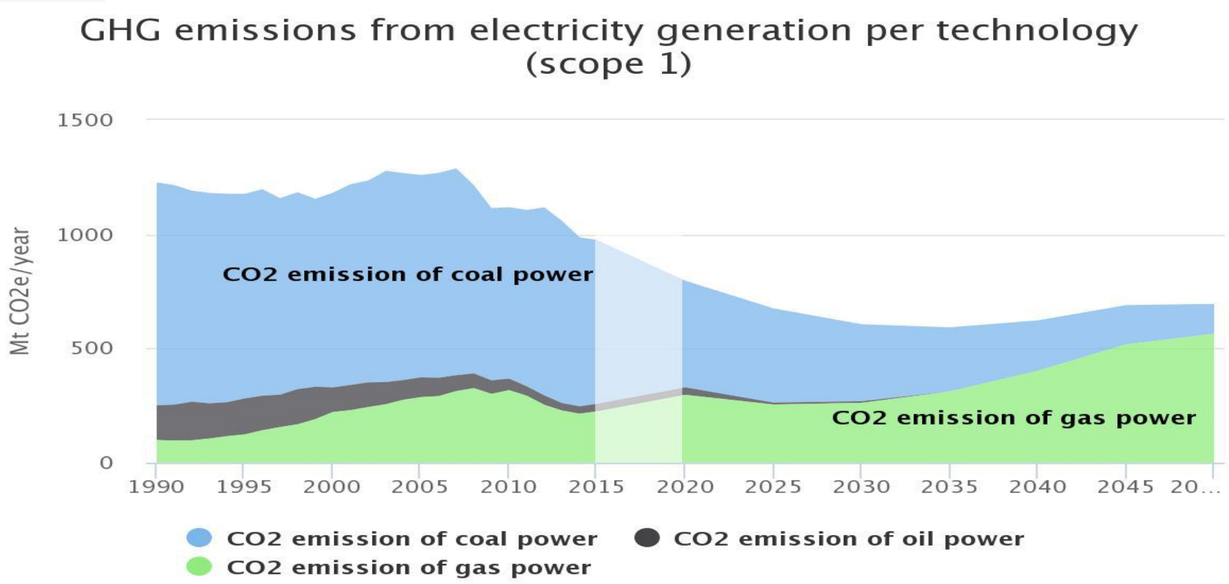
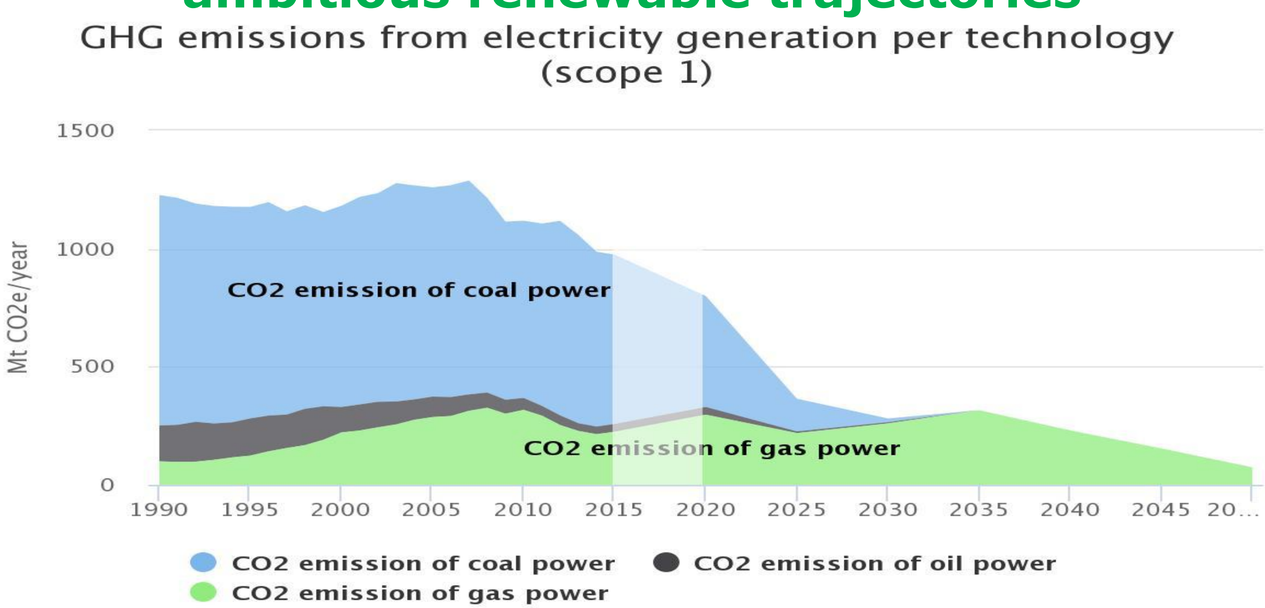
The problem: power generation

EURef



EURef in supply but significant electrification on demand side coupled with coal phase-out and ambitious renewable trajectories



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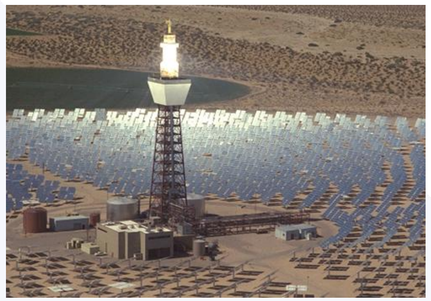
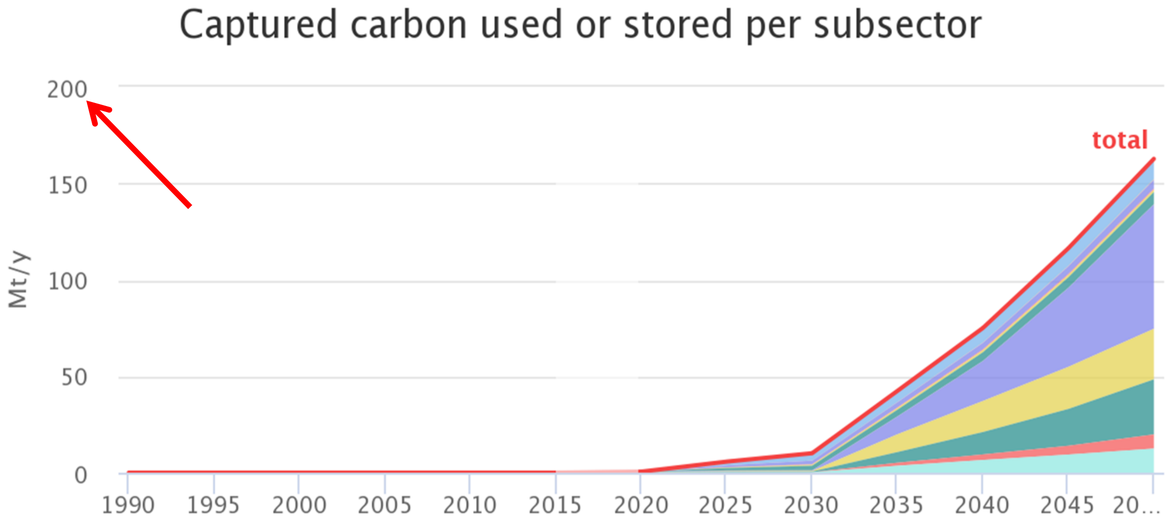
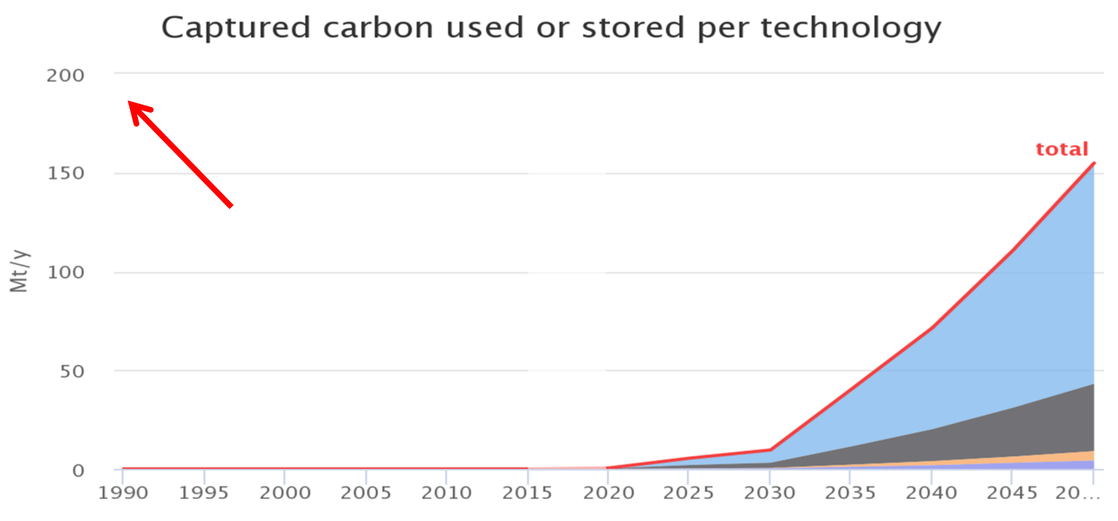
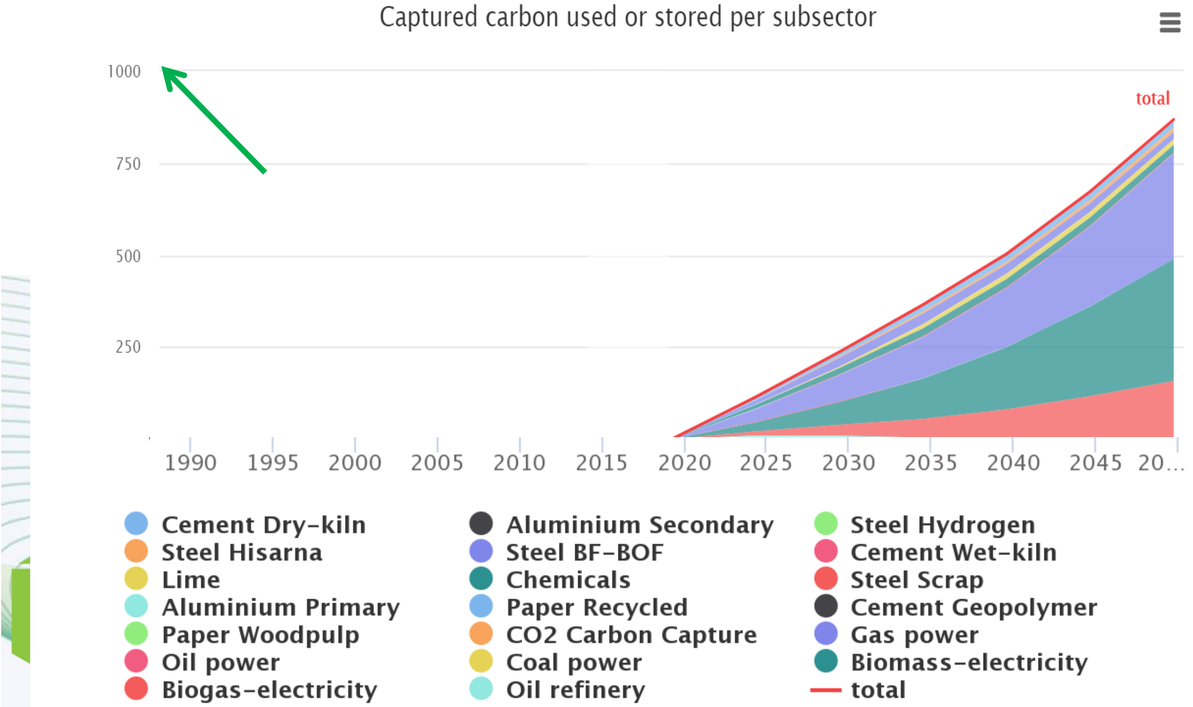


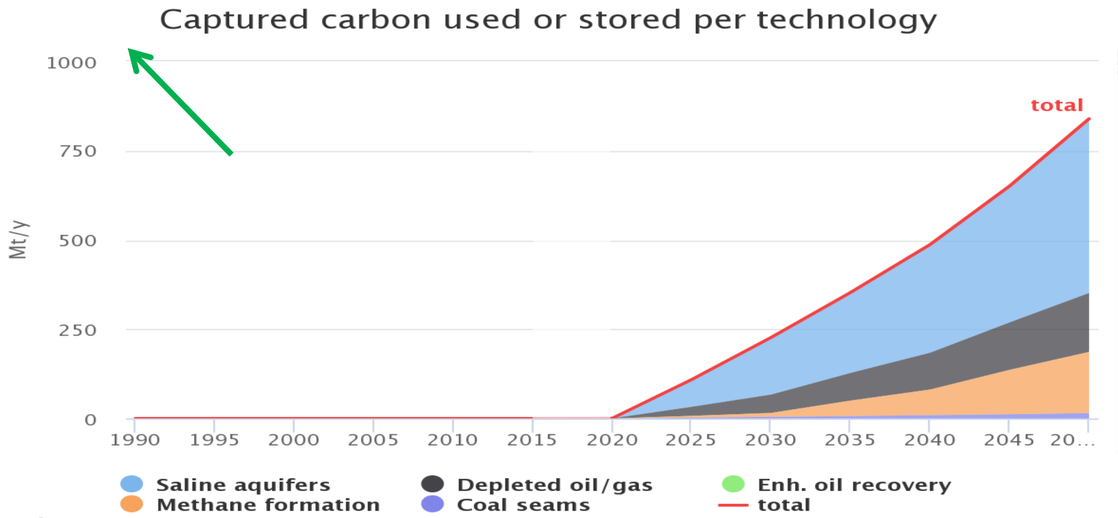
CCUS might be part of the solution



EURef







Ambitious

Valorization or sequestration or both?

Transport	Total EU28 + Switzerland population; % of urban population Passenger distance travelled urban; Passenger distance travelled non-urban; Passenger distance travelled non-shiftable;
Buildings	Residential floor area; Residential floor area cooled; Comfort temperature; Number of appliances; Hours of appliances use; Product replacement rate;
Agriculture	Total calorie requirements; Calorie composition of diets; Calories of food wasted at consumer level;
Manufacturing	Graphics and sanitary paper demand; Paper, plastic, glass & aluminium packaging;
Minerals	Population in the RoW;
Water	Total EU28 + Switzerland population;
Employment	Active EU28 + Switzerland population; Different aggregations of calorie demand; Paper demand; Sanitary and graphics paper;
GTAP	Floor intensity per capita; Passenger travel per capita; Different aggregations of calorie demand; Paper and plastic packaging; Sanitary and graphics paper; ...

Lifestyle outputs > 25 sectors

A few words about lifestyles....

- **Lifestyles module allows to look into *the effect of changing social norms* in resource/energy demand.**
- **Changes in individual behavior e.g. favoring *less distance travel, increased vehicle occupancy* may yield *GHG reductions of 43%*, passenger transport technology 58% (in 2050)**
- **Some pathways show adverse *implications!***

	Aluminum demand	Electricity generation	PM2.5-related deaths	Household investment
Lifestyles pathway	+2%	+8%	-2%	-69%
Technology pathway	+180%	+30%	-2%	-42%

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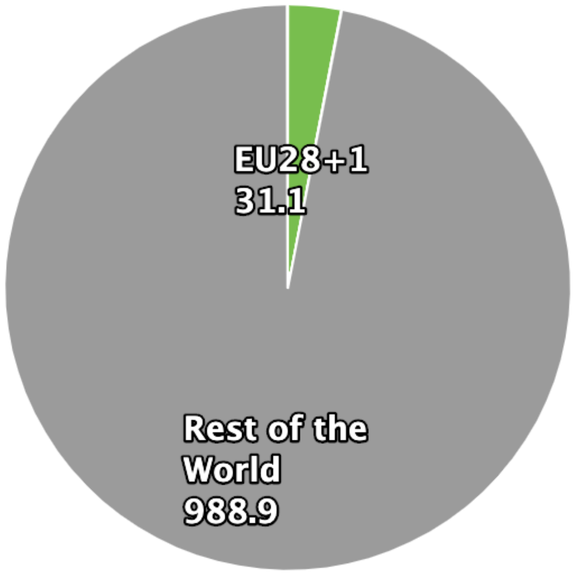
Integrates Fairness Aspects

- Ask for 1.5 ° C or the 2° C threshold and relates European budgets to the world

2,0 °C
✓ 1,5 °C

✓ Capability 31.1
Per capita 62.1
GT CO2 equiv.

Success measure when choosing a pathway: staying within a set GHG budget



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Transition Pathways Explorer
Explore Countries

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30

67 Gt

Pathway

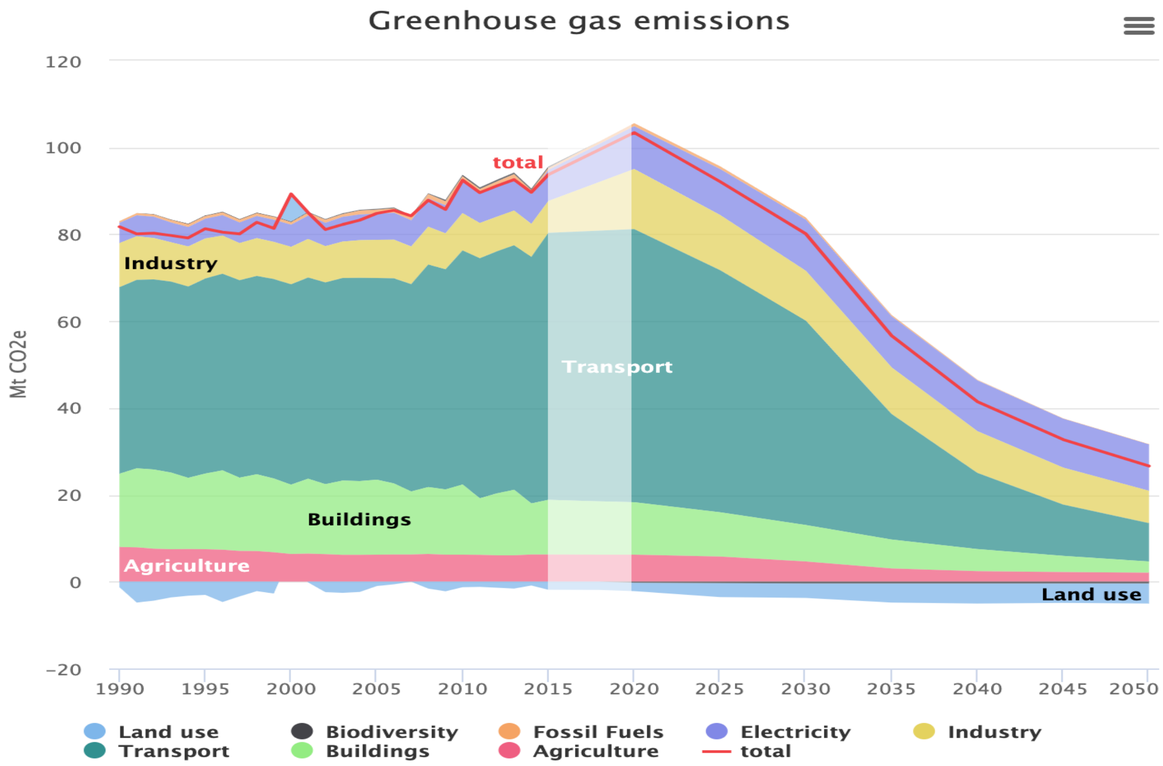
Choose example pathway for Europe:

Middle of the road

	Europe	Switzerland
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		

Emissions | Energy! | Transport! | Buildings | Industry | Land-use | Agriculture | Wat >

GHG emissions | Switzerland



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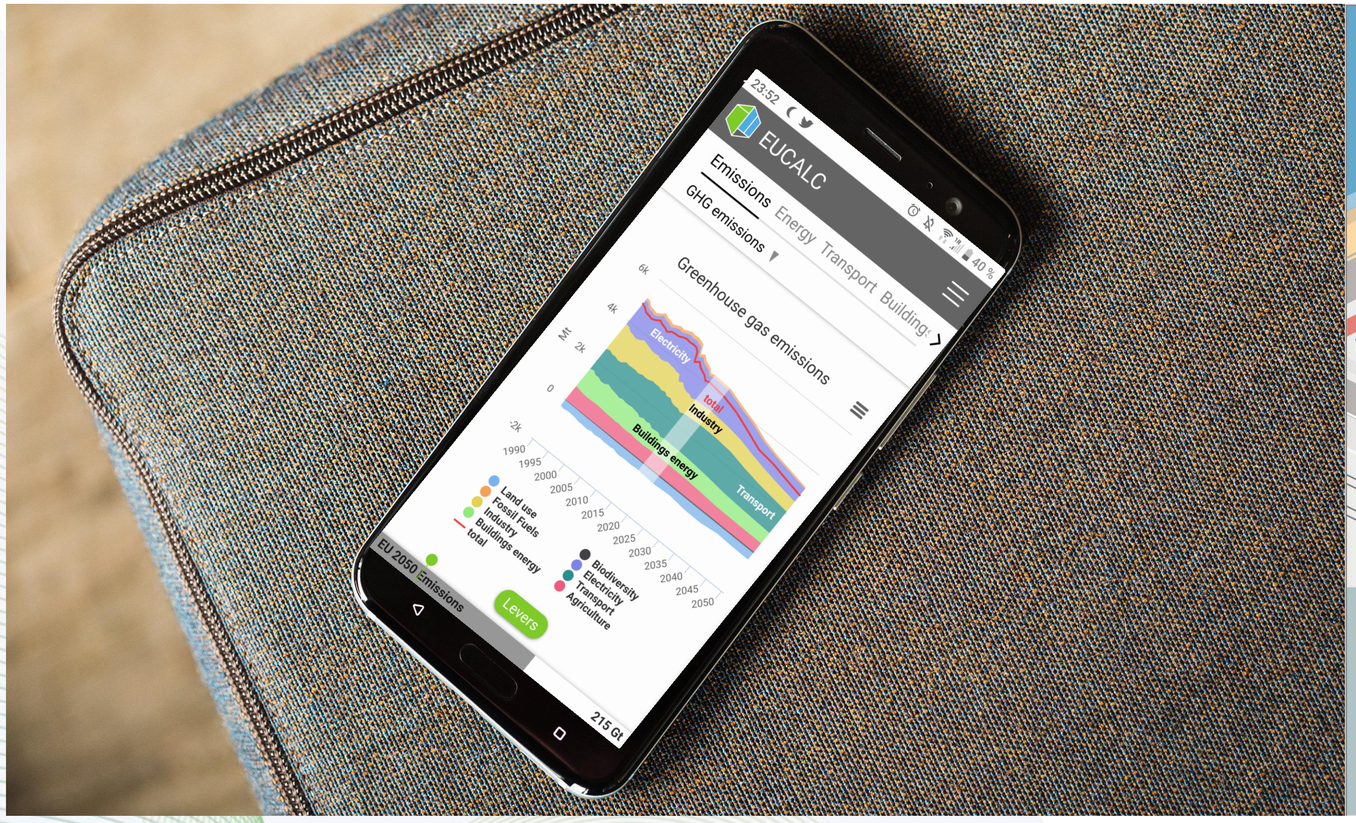
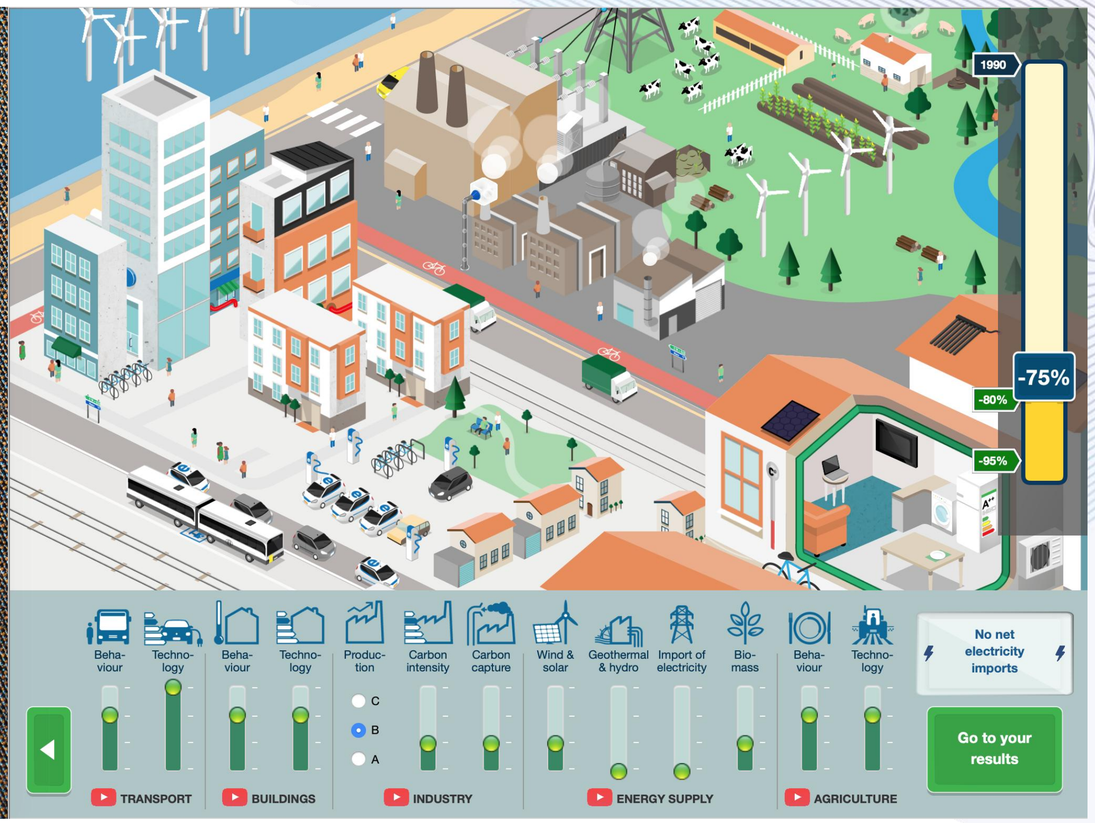
EUCalc: Transition Pathways Explorer
….for daily usage and educational purposes





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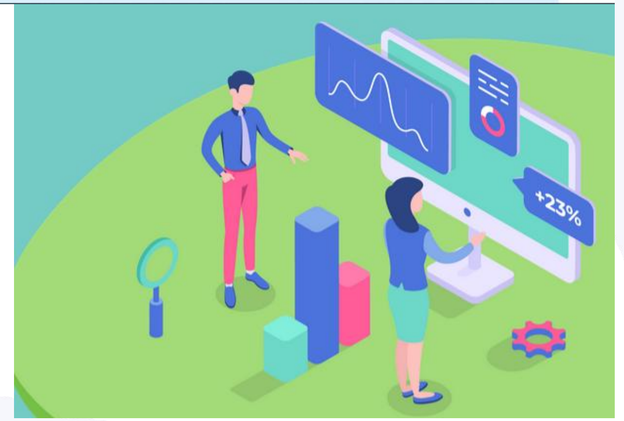
Summary

- Literature/Expert Guess (evidence based reasoning): defines future – structured co-creation process with sector experts
- A model concept which allows users to evaluate carbon pathways considering various sector decisions (represented by approx. 60 levers)
- A pragmatic modelling approach which allows you to think out of the box! Keeps a homogeneous scale! – 28+1 countries!
- Enables users to understand intersectoral trade-offs and co-benefits of sector decisions: **shows needs – and much more efforts are needed!**
- Covers consumptive (behavioral) and productive (structural) aspects – not common!
- Calculates costs and job effects and can help to define European and/or country policies
- Online tool has approached a certain level of complexity, but can interpreted easily after short training (e.g. MOOC, background material)

http://tool.european-calculator.eu/app/ (For test purposes!)



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…..questions/interventions

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