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Explore sustainable European futures

Presentation on the underlying methodology, scope and initial findings of the EUCalc model

EUCalculator - Town-hall event

Vienna, 14th February 2020

Luís Costa

Potsdam institute for Climate Impact Reseach

RD2 - Climate Resilience

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Outline

- Motivation
- Objectives
- EUCalc in the existing modelling landscape
- Defining features of the EUCalc model
- Demonstration
- Results of the EUCalc model
- My2050

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Objectives

- New energy model for non-experts to support European and National decarbonisation plans. **User-centric**

- Access to model results and ability to modify its assumptions (within plausible boundaries). **Accessible**

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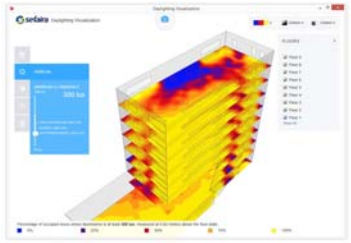
Objectives

- New energy model for non-experts to support European and National decarbonisation plans. **User-centric**
- Access to model results and ability to modify its assumptions (within plausible boundaries). **Accessible**
- Explore the option space for decarbonisation across sectors and associated impacts. **Wide option space**
- Promote the transparency via model co-design with sectoral experts, open-source and detailed documentation. **Transparent**

EUCalc model in the existing modelling landscape

Engineering-based, sector specific



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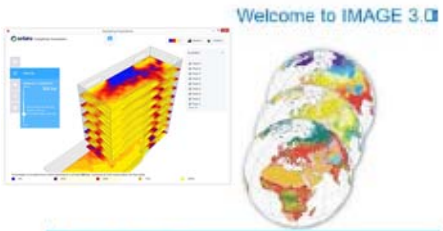
GEM-E3

General Equilibrium Model for Economy - Energy - Environment

Comprehensive energy system, economy interactions

EUCalc model in the existing modelling landscape

Depth of insights (e.g., carbon pricing, building block)



GEM-E3

General Equilibrium Model for Economy - Energy - Environment

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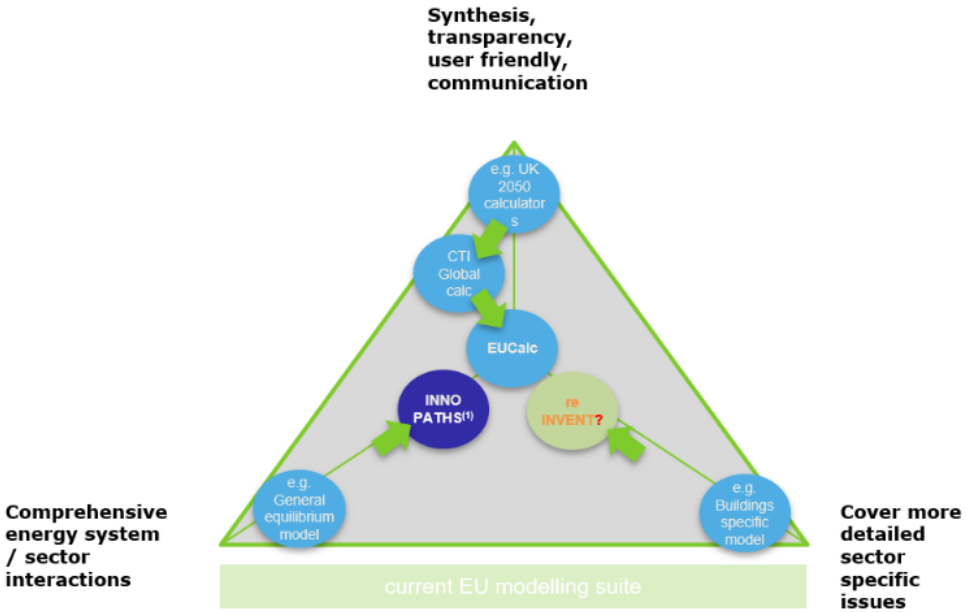
Target group: Policy makers, active in developing sustainable low carbon development pathways for Europe.

Transparency and usability by non-experts

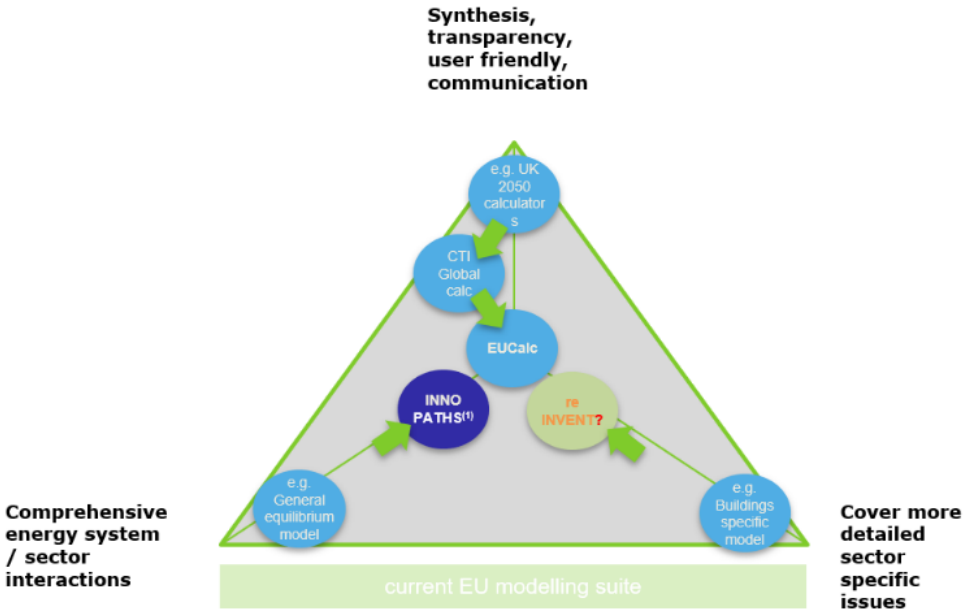
EUCalc model in the existing modelling landscape

Searching for the "sweet spot"



EUCalc model in the existing modelling landscape

Searching for the "sweet spot"



Historical development of modelling tools used by the EU

PRIMES — 1993/1994

GEM-E3 Model / E3M - Lab — 1998/2002

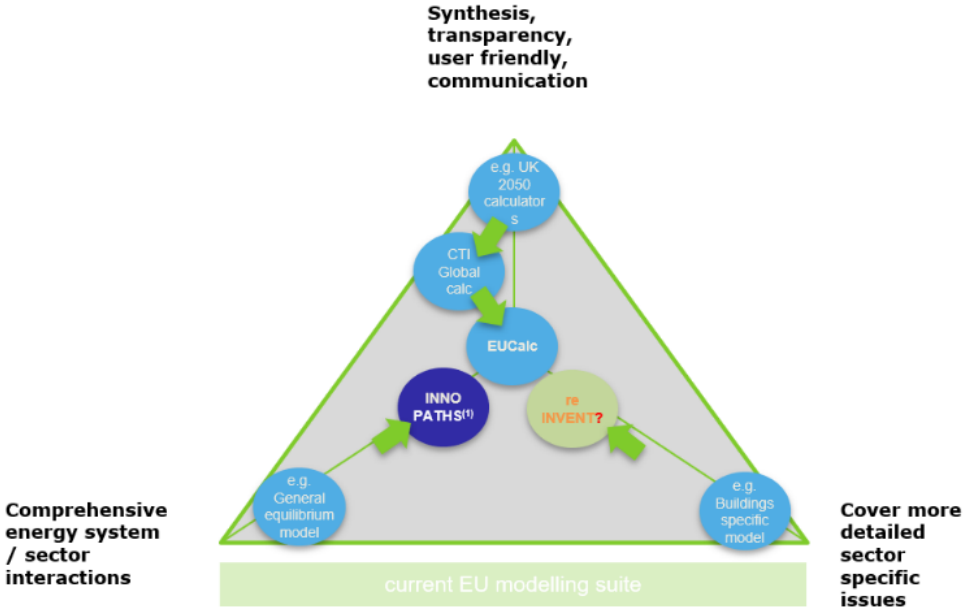
GAINS (IIASA) — 2006

GLOBIOM .org — late 2000s

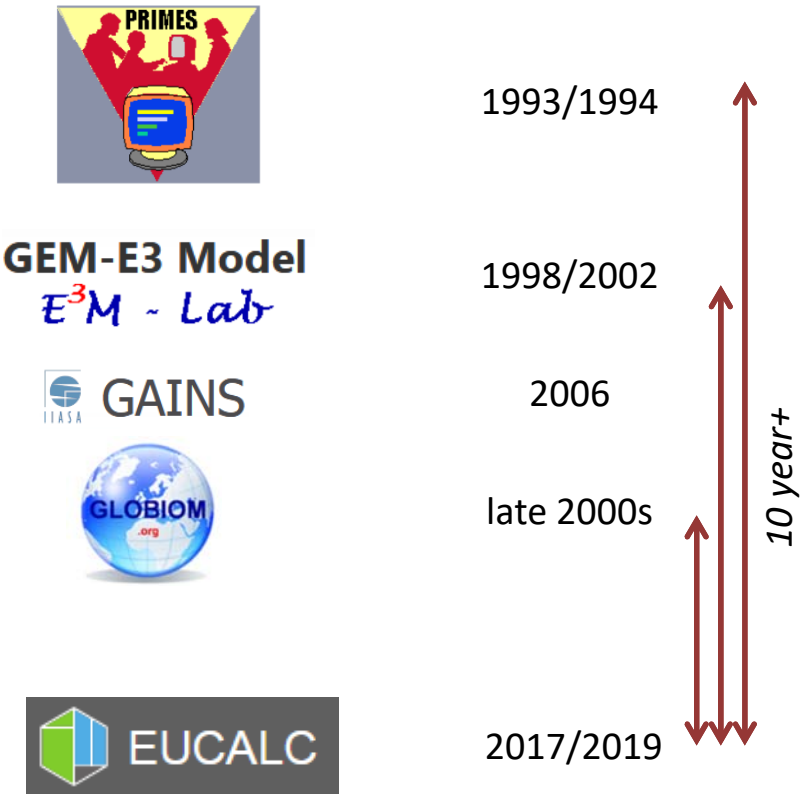
EUCALC — 2017/2019

EUCalc model in the existing modelling landscape

Searching for the "sweet spot"



Historical development of modelling tools used by the EU



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From idea to final product

Transition Pathway Explorer
(user-centric web-interface)

From idea to final product

Transition Pathway Explorer
(user-centric web-interface)

User

From idea to final product

Transition Pathway Explorer
(user-centric web-interface)

User

The framework
(co-creation, stakeholder, open-source)

From idea to final product

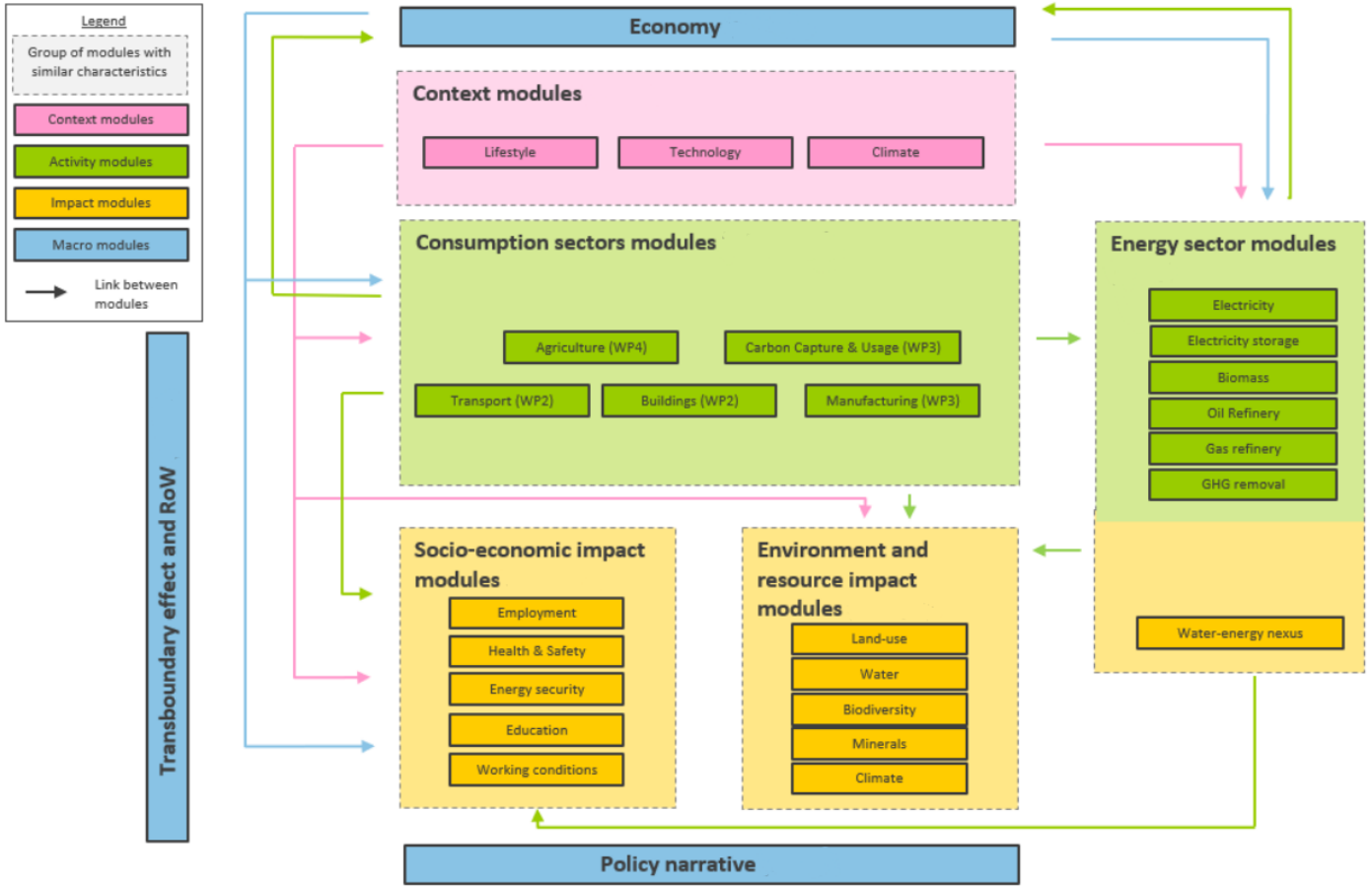
Transition Pathway Explorer
(user-centric web-interface)

EUCalc-model
(granular, multi-sector, 29 countries)

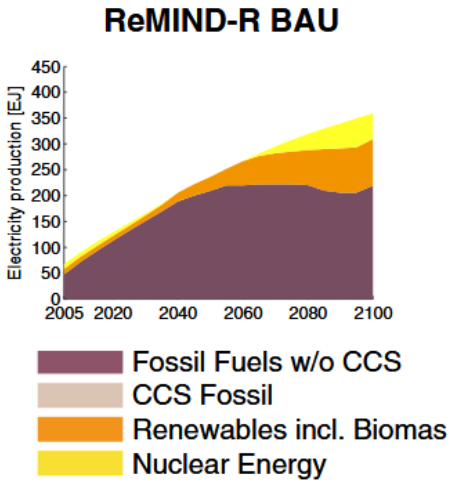
The framework
(co-creation, stakeholder, open-source)

User

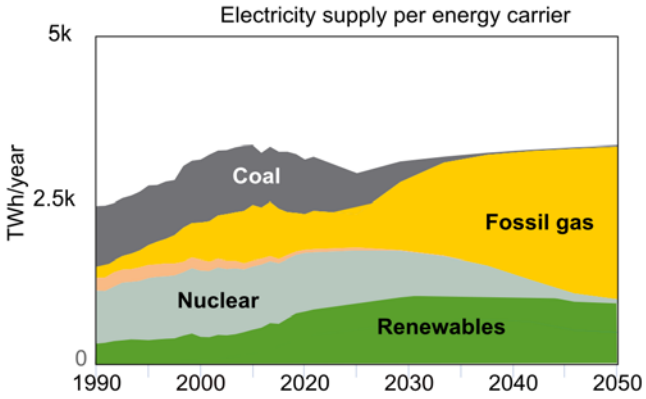
The EUCalc model



Defining features of the EUCalc



Luderer, et al. Climatic Change 2012

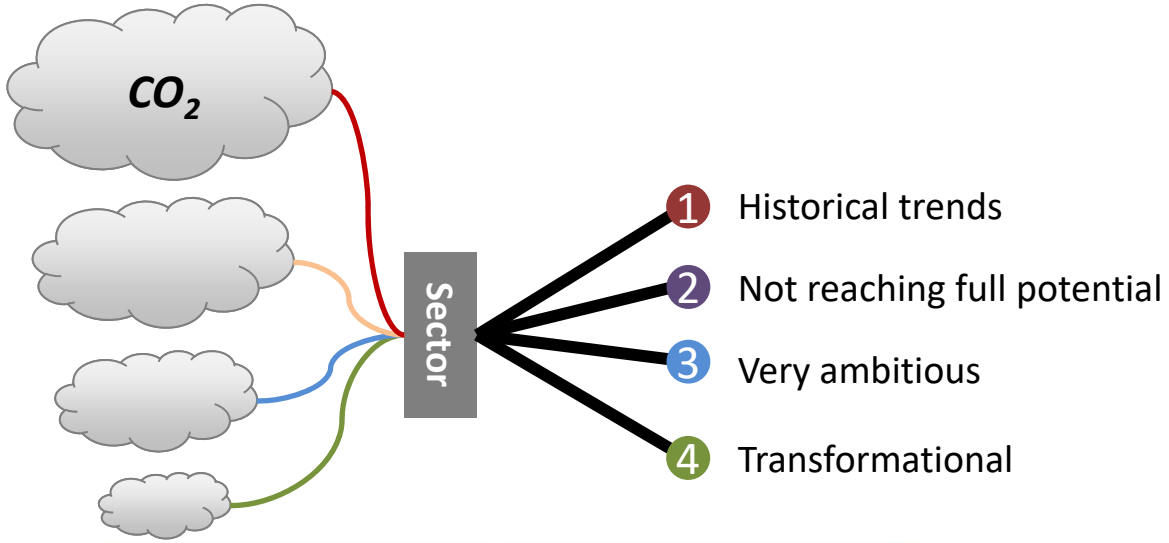


EUCalc Reference scenario

- **No optimization**
- Levers & ambition levels
- Consultation workshops
- Open source/transparent
- Transboundary

- The EUCalc is a *simulation* model.
- Bounded by physical limits, current policy outlook and best system knowledge.
- The user is the “optimizer”.

Defining features of the EUCalc



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Level 1	Level 2	Level 3	Level 4
Projections of **historical trends**	**Intermediate scenario**, more ambitious than a projection of historical trends but not reaching the full potential of available solutions	**Very ambitious but realistic** scenario, given the current technology evolutions and the best practices observed in some geographical areas	**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.
No TRL below 9	No TRL below 9	No TRL below 7	No TRL below 5

Defining features of the EUCalc

Consultation workshop on lifestyles (Brighton 2017)

***170+** participants in 9 consultation workshops*

***+1000** stakeholders mapped*

Schiphol DareDisrupt SUSCO BUDAPEST SCORAI EUROPE

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Defining features of the EUCalc

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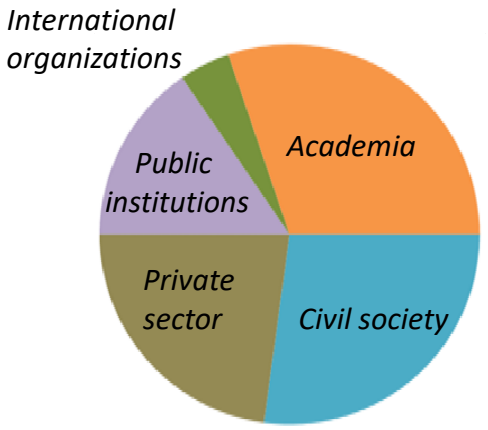
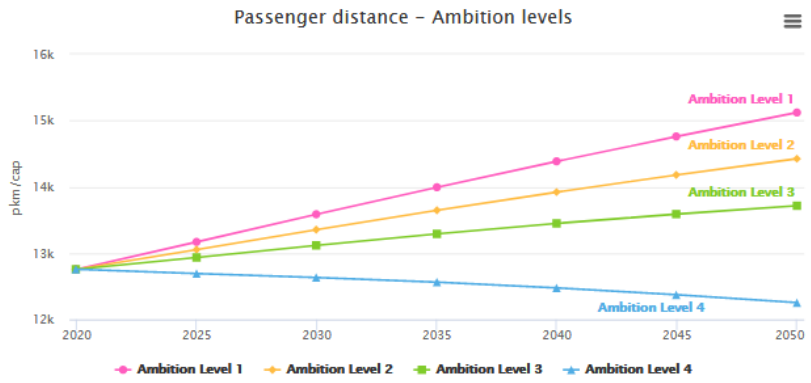
Participation breakdown



Defining features of the EUCalc



The transport sector represented circa 33% of primary energy needs in Europe in 2015 and contributed 25.8% of total EU-28 greenhouse gas emissions. Without the implementation of extensive and sustained mitigation, transport emissions could increase at a faster rate than emissions from the other energy end-use sectors. The transport sector is recognized as particularly difficult to decarbonize given the investment costs needed to build low-emissions transport systems or the slow turnover of stock and infrastructure. Accordingly, a shift towards demand-side solutions for mitigating climate change is now gaining traction.

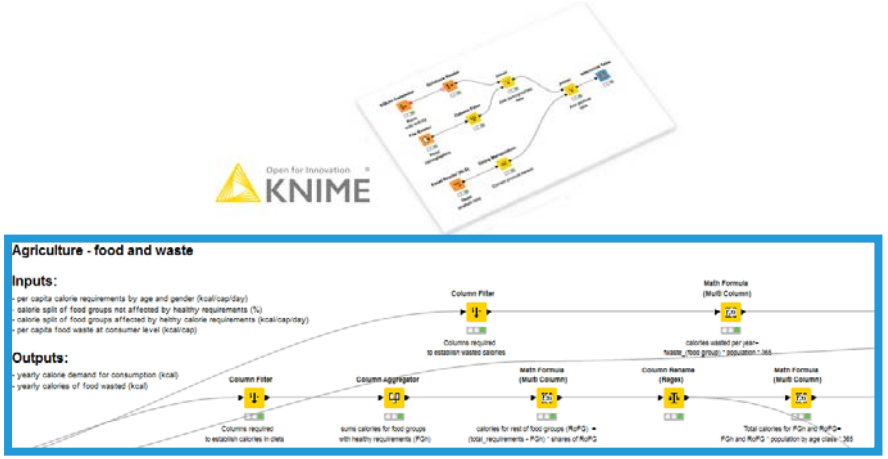
The demand for passenger travel is controlled by the amount of time a person spends traveling and the average speed of transportation systems. There are three major activities that compose most of the time spent travelling; to go to work/study (depending on the age class), for recreation and social activities, and to access services like shopping or medical care. Growth in wealth is usually related to more time spent on travelling for leisure and social activities. The best opportunities to reduce travel demand therefore emerge by lowering the need to travel for work/study purposes (e.g. via teleworking or home-based work) and to access services (e.g. via automation or tele-medicine).

- Ambition Level 1

  Growth in travel distance per person continues to follow current trend mostly due to longer travel time dedicated to leisure activities, with time spent to go to work/study and access services also remaining unchanged.

Documentation

- No optimization
- Levers & ambition levels
- Consultation workshops
- **Open source/transparent**
- Transboundary

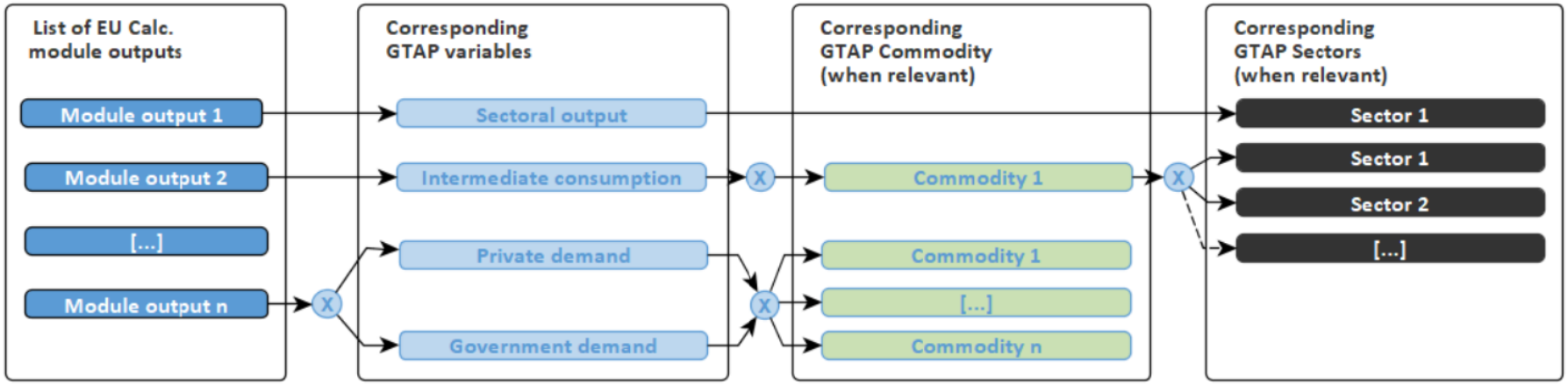


Source code

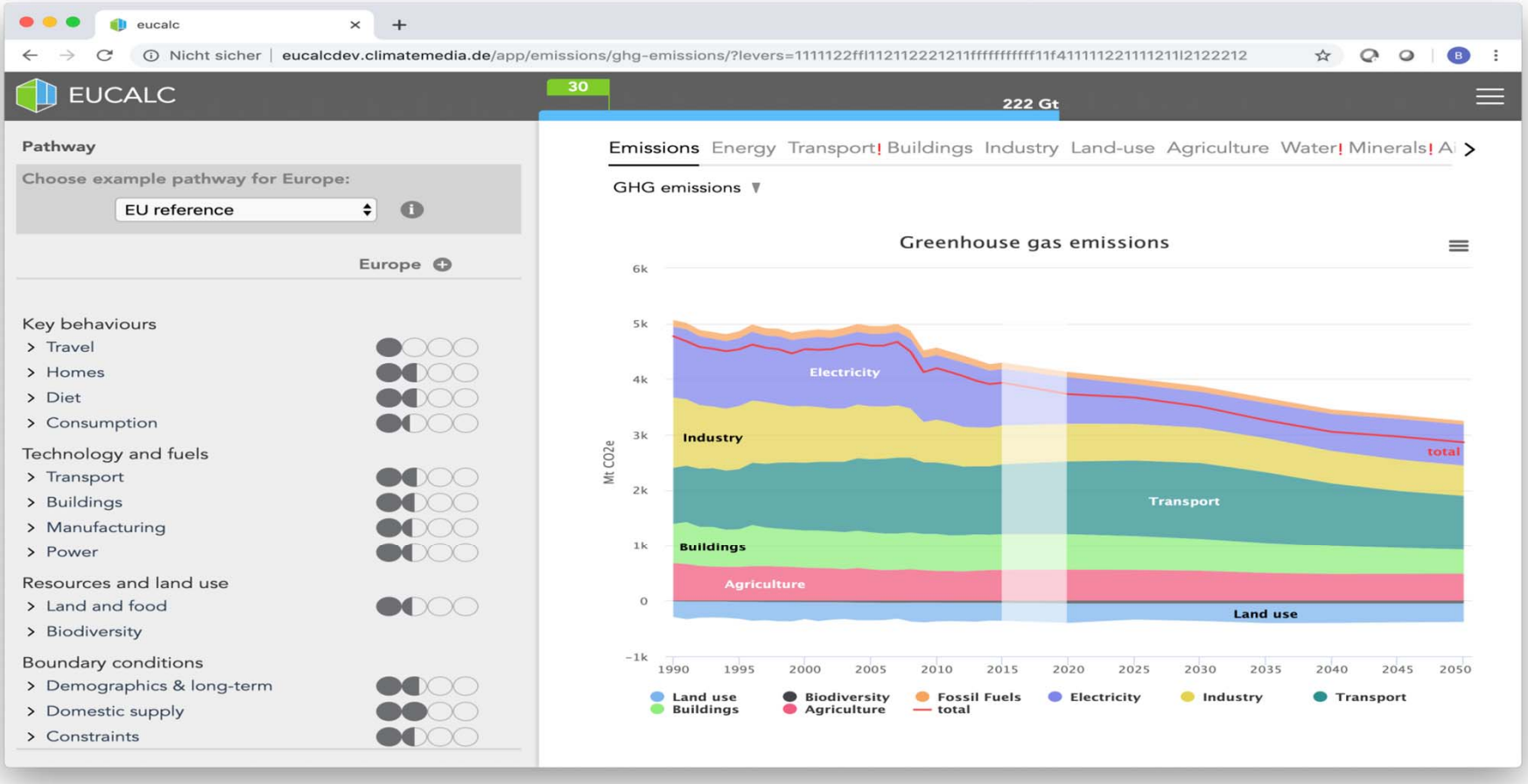
Defining features of the EUCalc

- EUCalc outputs from pre-defined scenarios (consistency)
- Interfaced to GTAP via aggregation
- Constitute in effect a “European” perturbation to the world
- Perturbation resolved by GTAP

- No optimization
- Levers & ambition levels
- Consultation workshops
- Open source/transparent
- **Transboundary**



The Transition Pathway Explorer (TPE)



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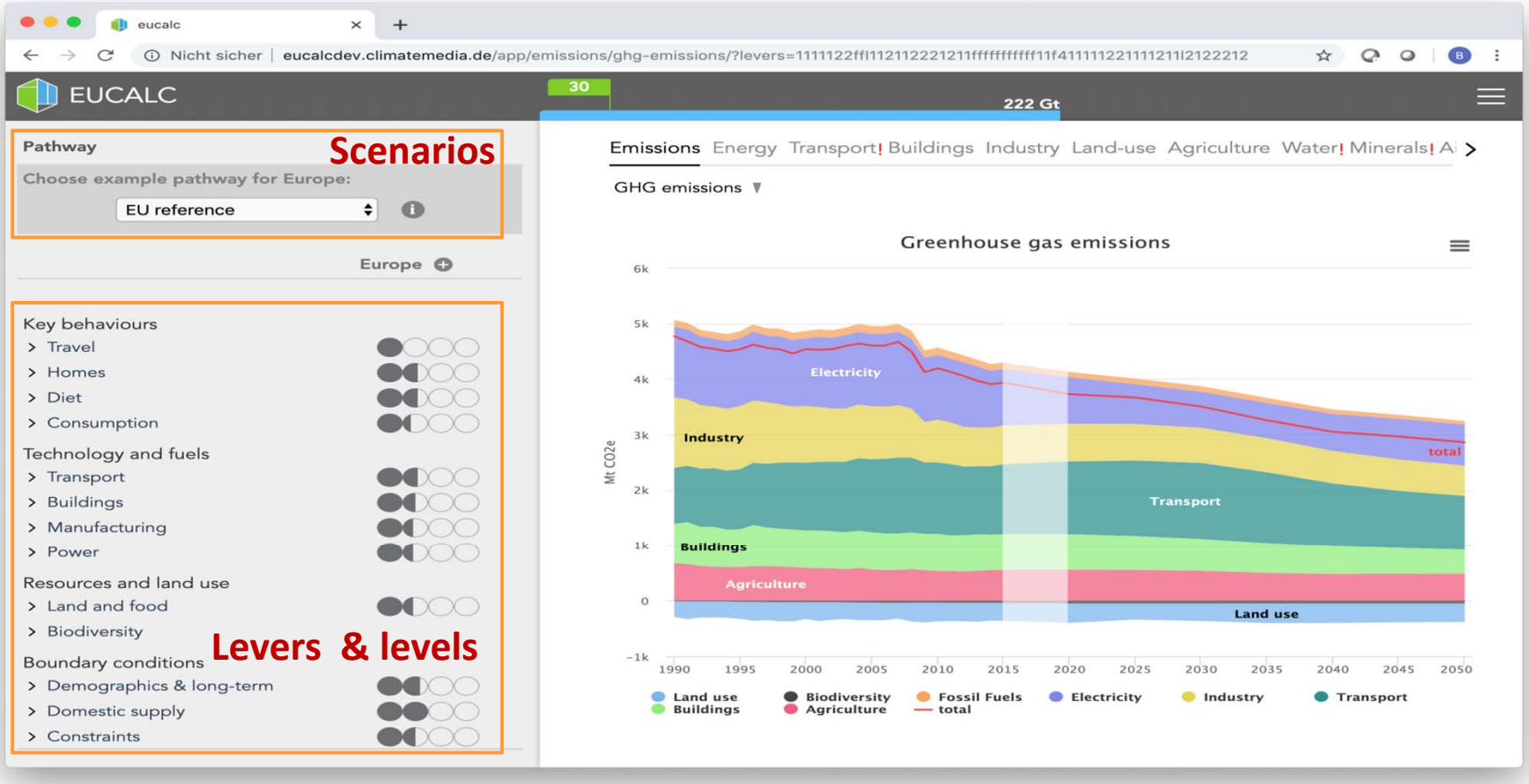

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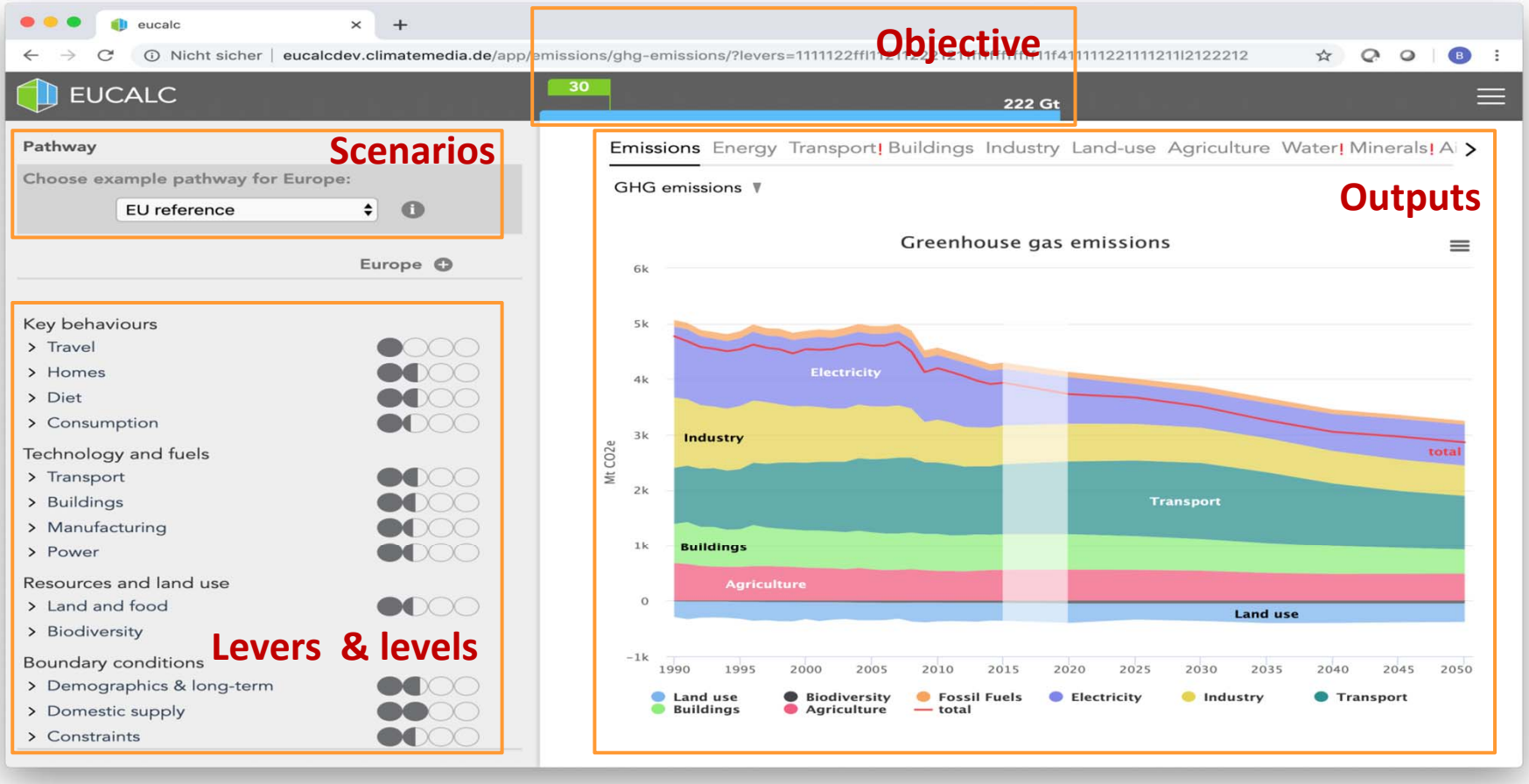

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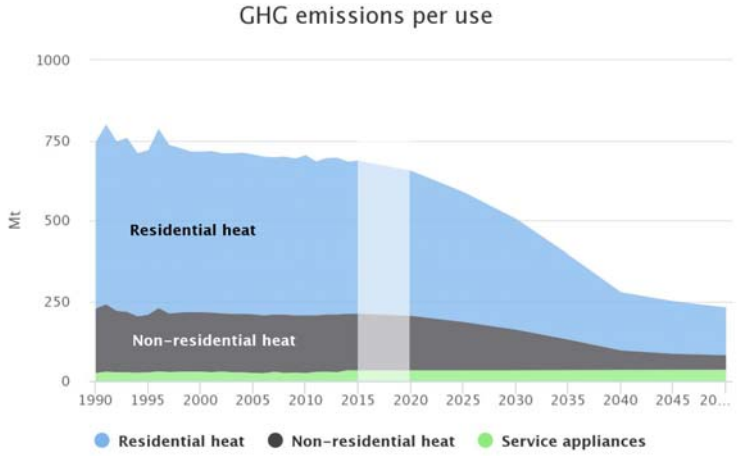
The Transition Pathway Explorer (TPE)

Demonstration

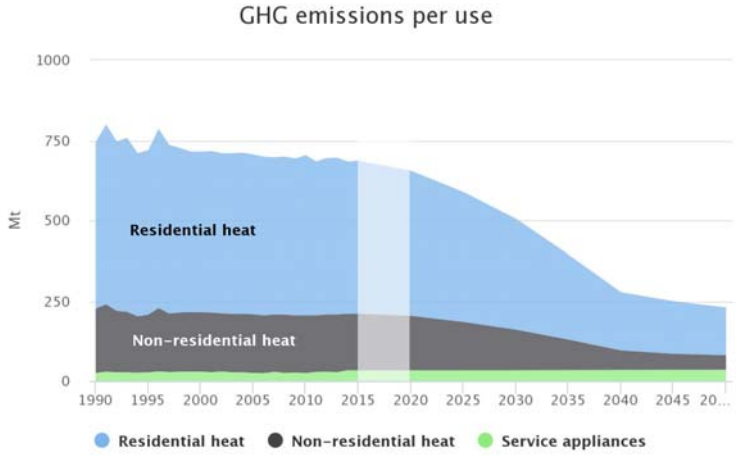
http://tool.european-calculator.eu

Decarbonization of the building sector



- Renovation rate is 3% p.a.
- Demolition rate is 1% p.a.
- 30% of the renovations are medium and 70% deep.
- 30% of new buildings are medium efficient, 70% are highly-efficient.

Decarbonization of the building sector



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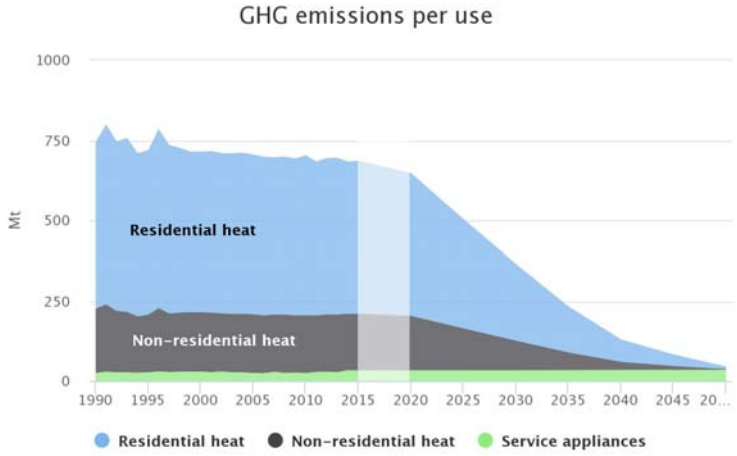
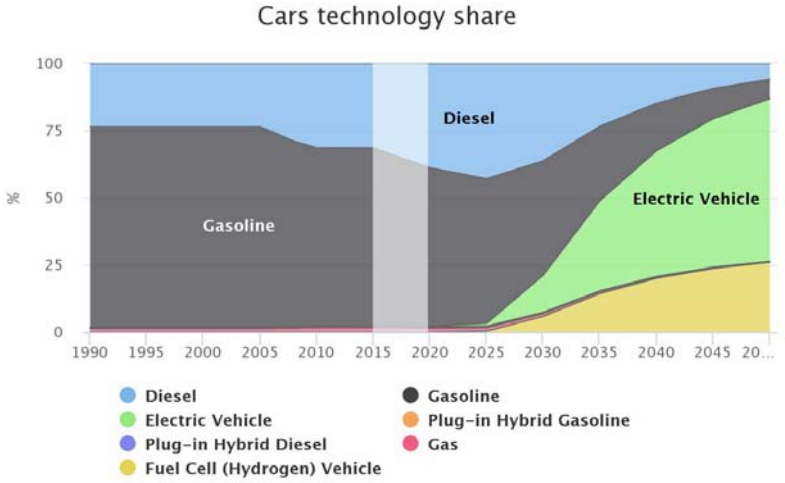
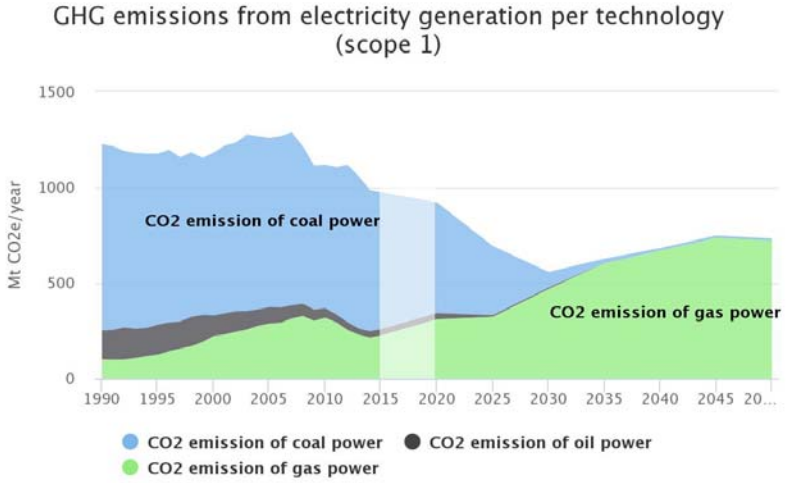


- Fossil fuel phase-out for heat : gas -95%; coal -95%; oil -95% in 2050.
- Substitution by heat pumps (60%), biomass (20%), solar (12%), geothermal (4%), biogas (2%), and biofuel (2%).

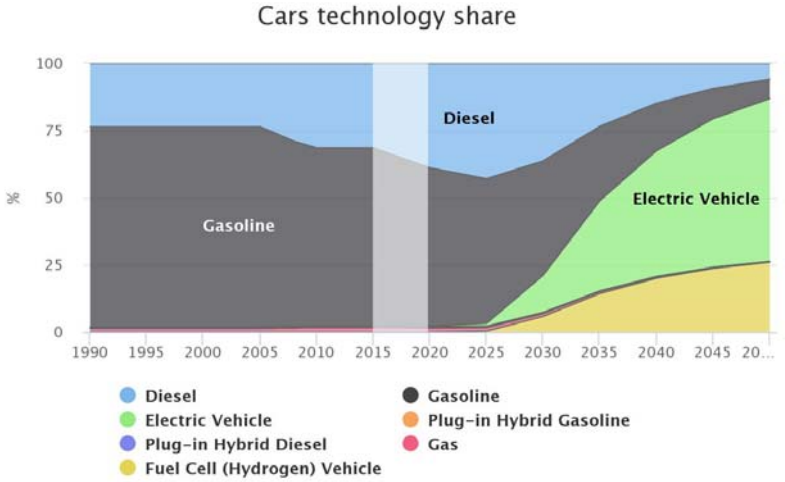
Electrification of transport

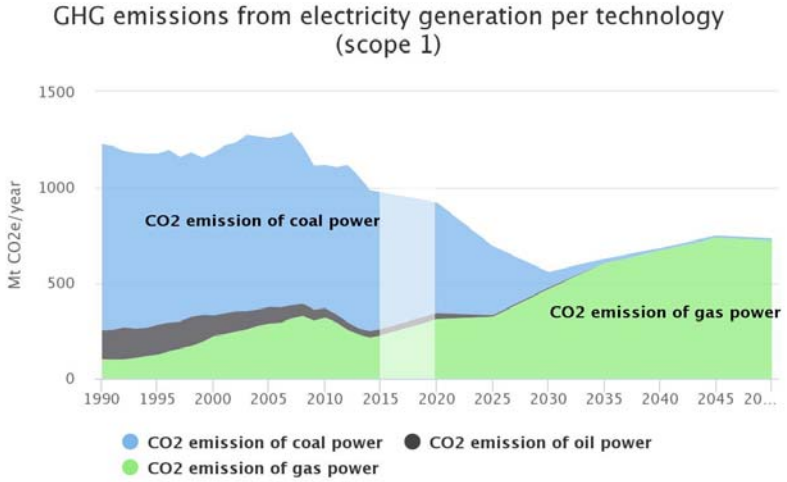


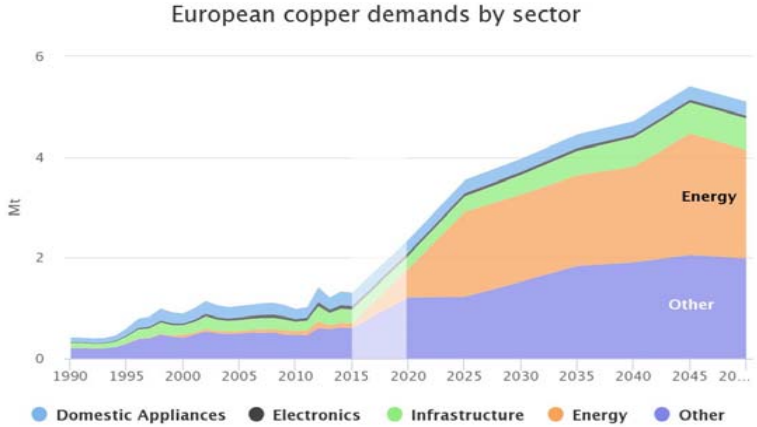


- Electrification of transport without shift to renewables leads to rebound emissions in power (even with coal phase-out by 2030).
- Decarbonisation pathways need to be defined as concerted across sectors.

Electrification of transport

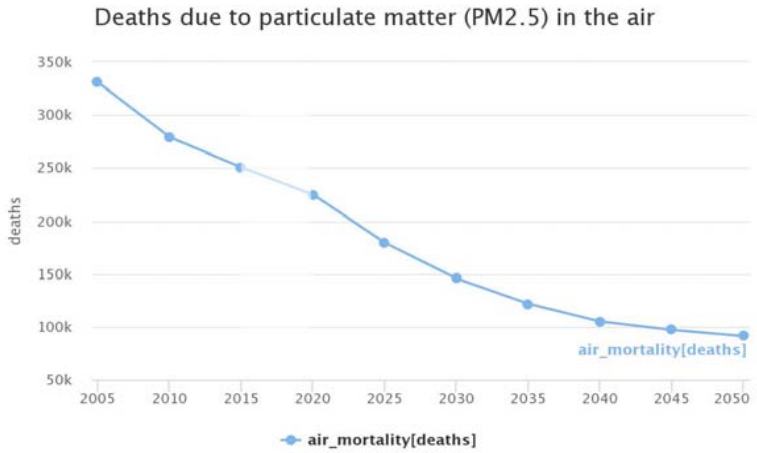


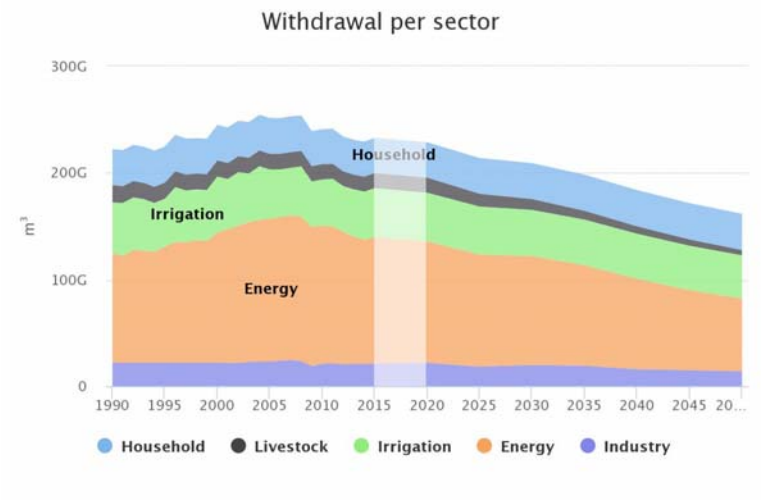




- "Downstream" implication on minerals by scaling-up renewable energy.
- Very-high but isolated ambition increases the chances of rebound effects.

More than materials and emissions





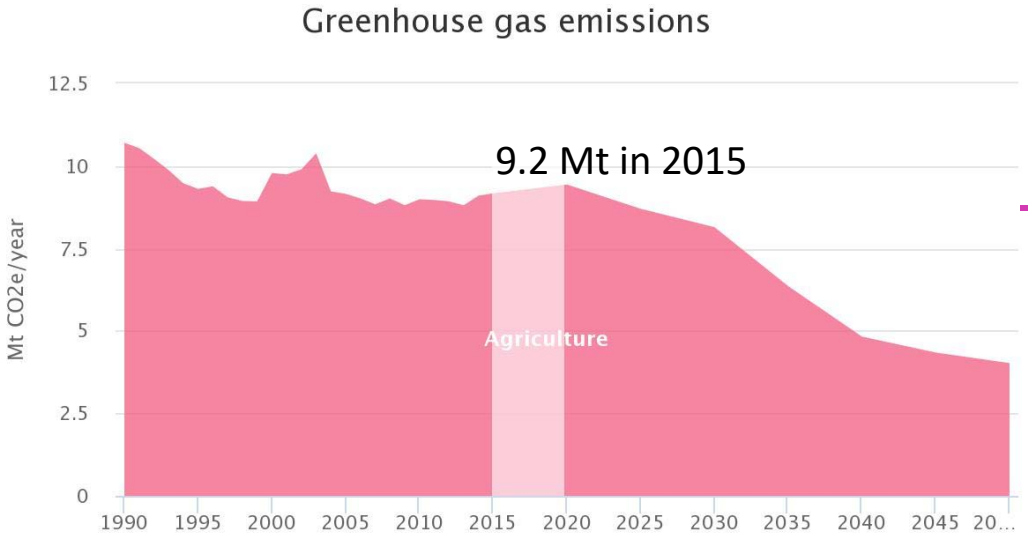
Reductions of excess deaths in due to PM2.5 compared to 2015

2050 (EUREF)	2050 (Ambitious)
-45%	-64%

Still to come:

- Employment
- Transboundary effects

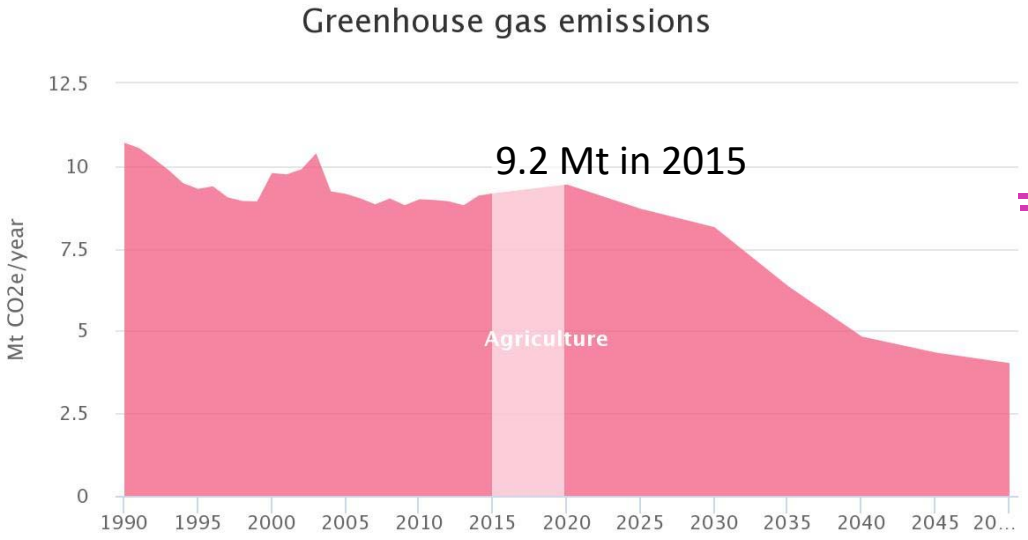
Agriculture GHG savings from changing diets in Austria



8.1 Mt under agriculture intensification

Climate smart crop production

Agriculture GHG savings from changing diets in Austria



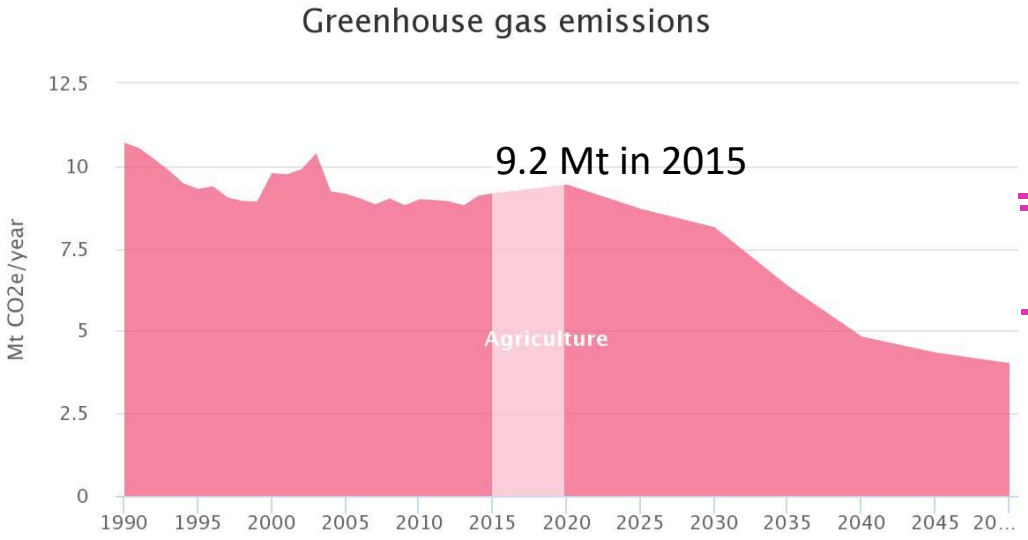
Climate smart crop production

8.8 Mt under agro-ecology aproach

8.1 Mt under agriculture intensification

Climate smart crop production

Agriculture GHG savings from changing diets in Austria



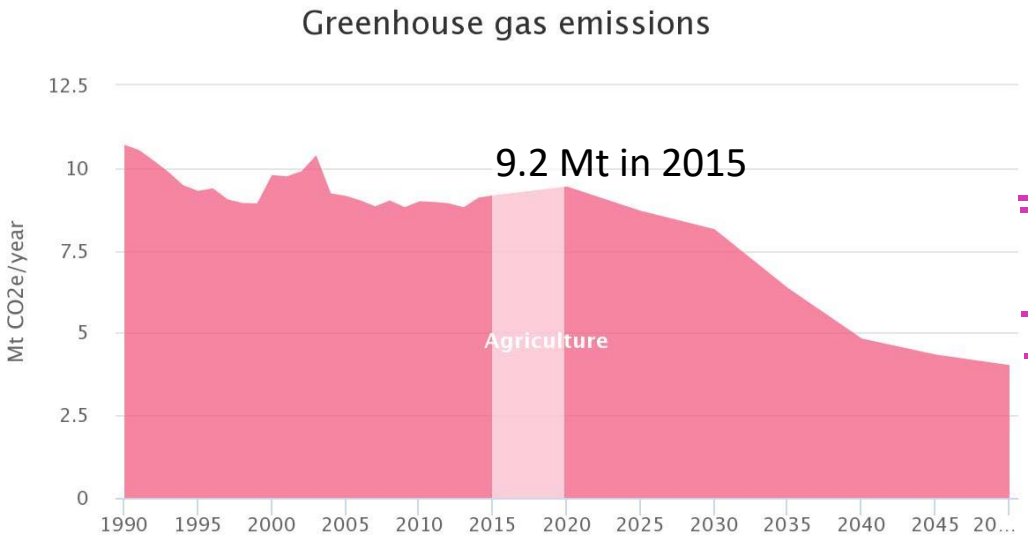
8.8 Mt under agro-ecology aproach

8.1 Mt under agriculture intensification

5.9 Mt under dietary shift

Type of diet

Agriculture GHG savings from changing diets in Austria



8.8 Mt under agro-ecology aproach

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4.1 Mt if domestic food products declines

Type of diet

Climate smart crop production

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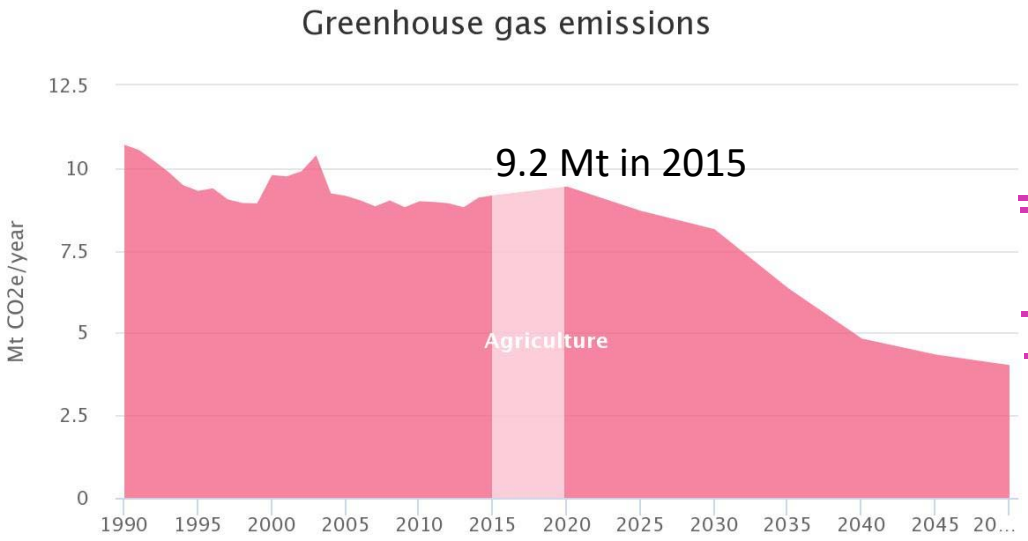


8.8 Mt under agro-ecology aproach

8.1 Mt under agriculture intensification

5.9 Mt under dietary shift

4.1 Mt if domestic food products declines

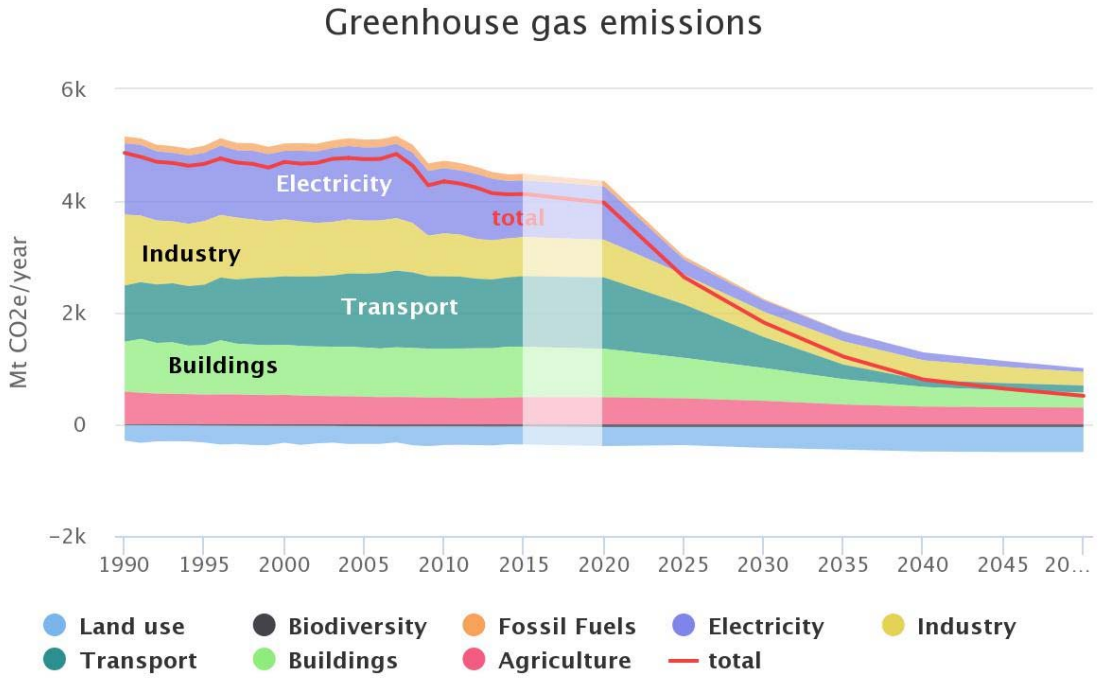
Type of diet

Climate smart crop production

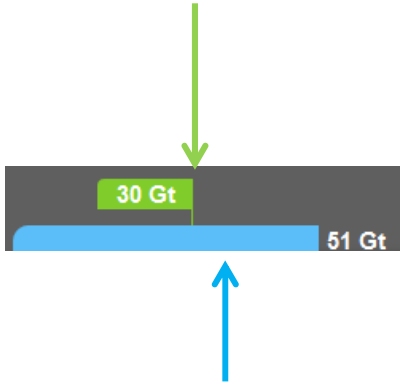
- Intensification of agriculture alone does not lead to significant reduction of GHG emissions from agriculture.
  - Nor does a strategy focusing only in agroecology.
- Only with dietary shifts you make agricultural a relevant sector for mitigation.

The role of changing lifestyles

Scenario of maximum technological ambition **without** changes in Lifestyles



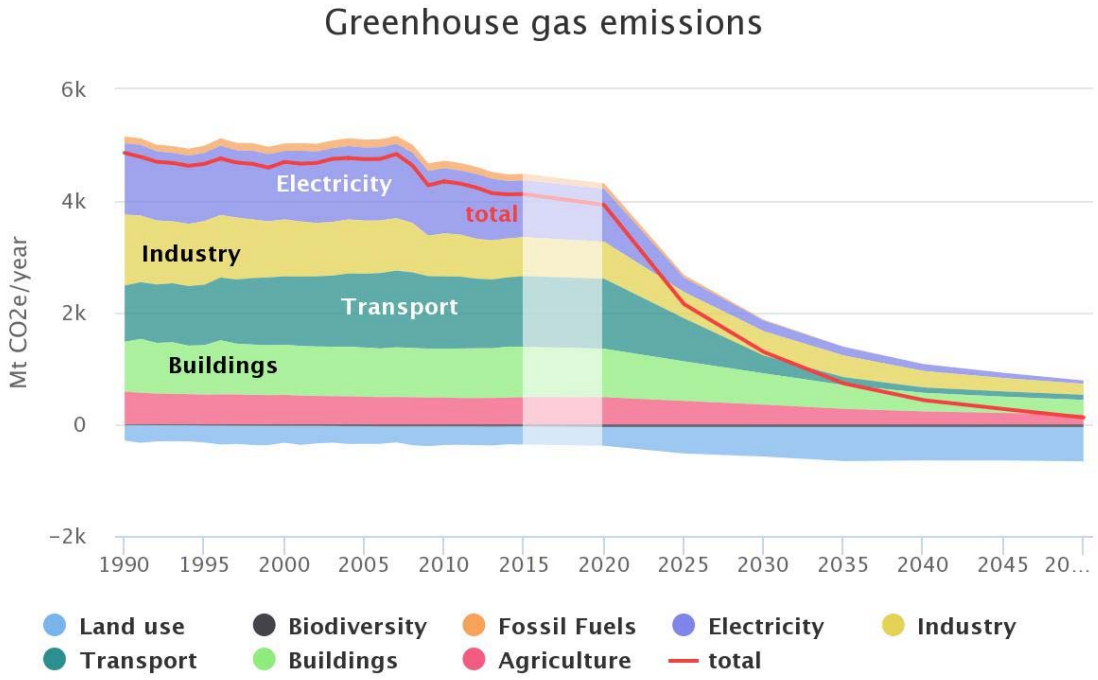
GHG budget for EU to stay below 1.5 degrees.



GHG emissions from the EU until 2050.

The role of changing lifestyles

Scenario of maximum technological ambition **with** changes in Lifestyles



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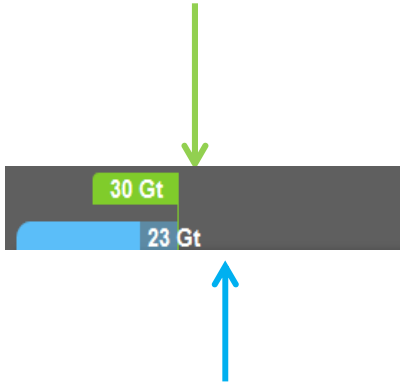

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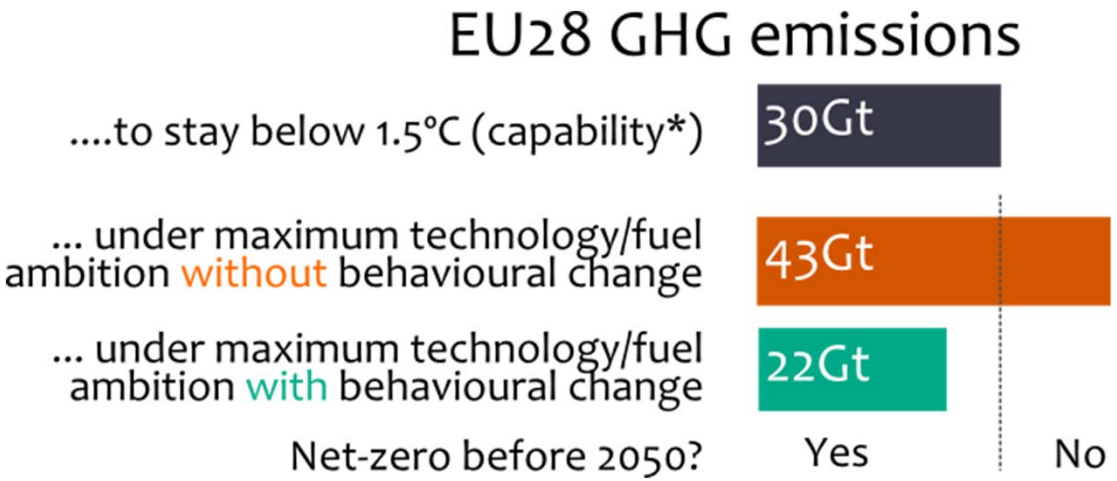
The role of changing lifestyles



- Changes in lifestyles are crucial but not sufficient for reaching net-zero.
- They are complementary in easing some of the technological efforts needed but not a solution in itself.

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My2050

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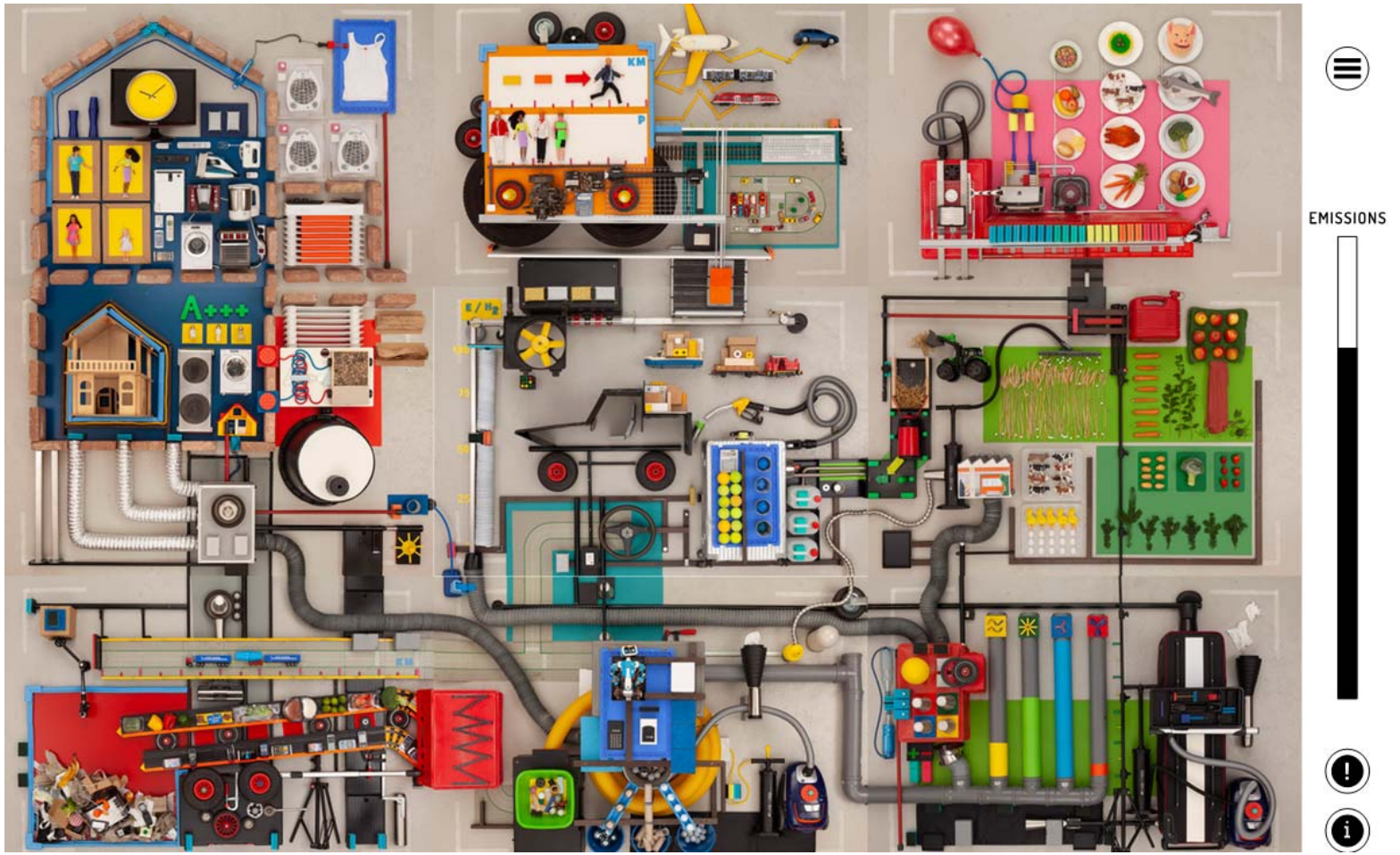
My2050



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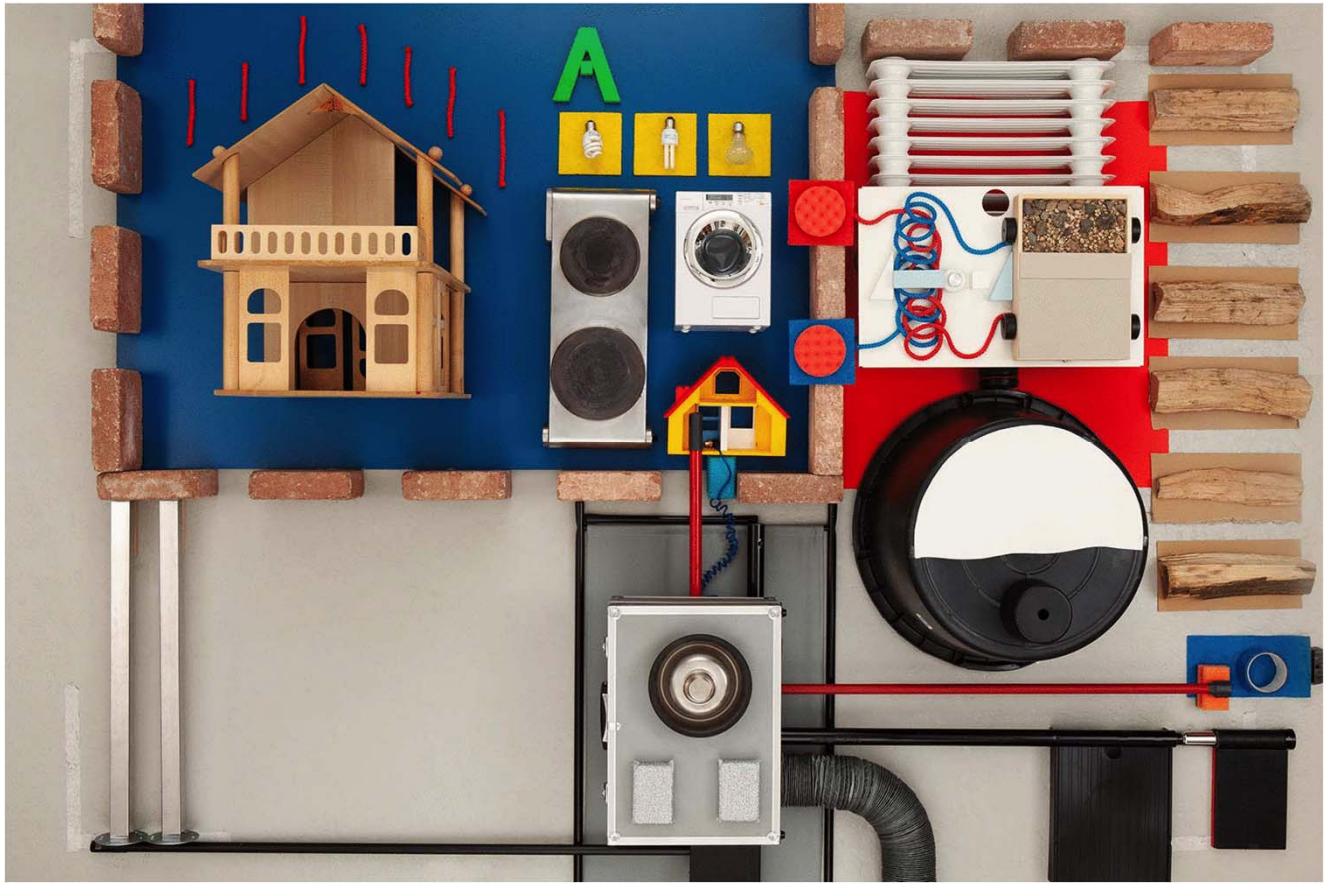

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Thank you!

EUCALC

Explore sustainable European futures

Luís Costa

Potsdam Institute for Climate Impact Research (PIK)

RD2: Climate resilience/Urban transformations

Email: carvalho@pik-potsdam.de

EUCalculator project: http://www.european-calculator.eu

Transition Pathway Explorer: http://tool.european-calculator.eu