LIFE ClimatePath2050 International Conference: Designing Pathways toward Climate Neutrality

Results of the LIFE ClimatePath2050 project for industry

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Jožef Stefan Institute – Energy Efficiency Centre

Hybrid event: Ljubljana and Online, 7.10.2021

LIFE CLIMATE PATH 2050

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LIFE CLIMATE PATH 2050

Lead partner of the LIFE Climate Path 2050 project:

Institut "Jožef Stefan"
Center za energetsko učinkovitost

LIFE Climate Path 2050 project partners:

- ELEK, načrtovanje, projektiranje in inženiring, d.o.o.
- Gradbeni Inštitut ZRMK, d.o.o.
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Legal framework and policy framework

Paris Agreement

- In accordance with the Paris Agreement, Slovenia submitted its **Long – Term Strategy (LTS)** up to 2050 to reduce GHG emissions contributing to a joint effort to limit temperature growth by 1.5° C or 2° C

Regulation on Governance of the Energy Union and Climate Action, (EU) 2018/1999

- The EU must strive for a balance between emissions and sinks as soon as possible, and establish net negative emissions at a later stage

NECP

- LTS up to 2050 was prepared in accordance with the guidelines and assumptions used for the NECP

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Objectives of the Slovenian LTS

Slovenia's goal, which is in line with the Paris Agreement, is to achieve net zero emissions by 2050 (sinks will exceed the remaining GHG emissions) or achieving climate neutrality by 2050

Sector	GHG emissions [kt CO_2 ekv]		Objectives in relation to 2005
	2005	2018	LTS 2050
Transport	4.416,5	5.824,0	90 – 99%
Energy supply	6.974,5	5.189,6	90 – 99%
Industry	3.912,5	3.014,4	80 – 87%
Agriculture	1.732,8	1.721,7	5 – 22%
Services+HH	2.680,0	1.310,8	87 – 96%
Wastes	740,5	441,7	75 – 83%
Sum	**20.456,8**	**17.502,1**	**80 – 90%**
LULUCF	**-7.120,8**	**243**	**Sinks: -3.000 kt CO_2 ekv.**
Sum	**13.336**	**17.745**	**Achieving net zero emissions**

Objectives of the Slovenian LTS

2030 NECP: -36% of GHG

2040 LTS: reduction between 55 and 66%

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Objectives of the Slovenian LTS

LTS: 2040 reduction between 60% and 70%

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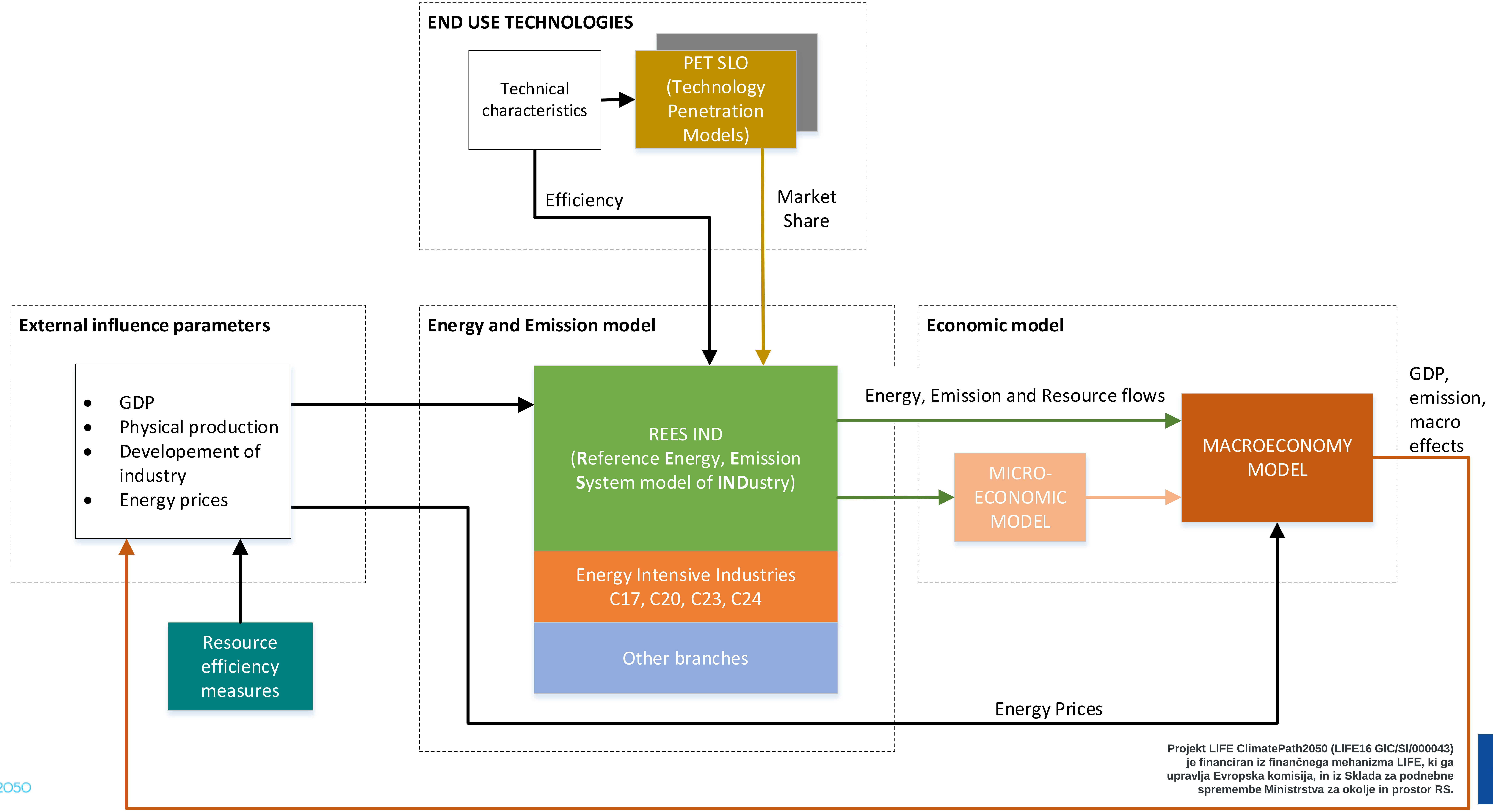
Methodology and key assumptions



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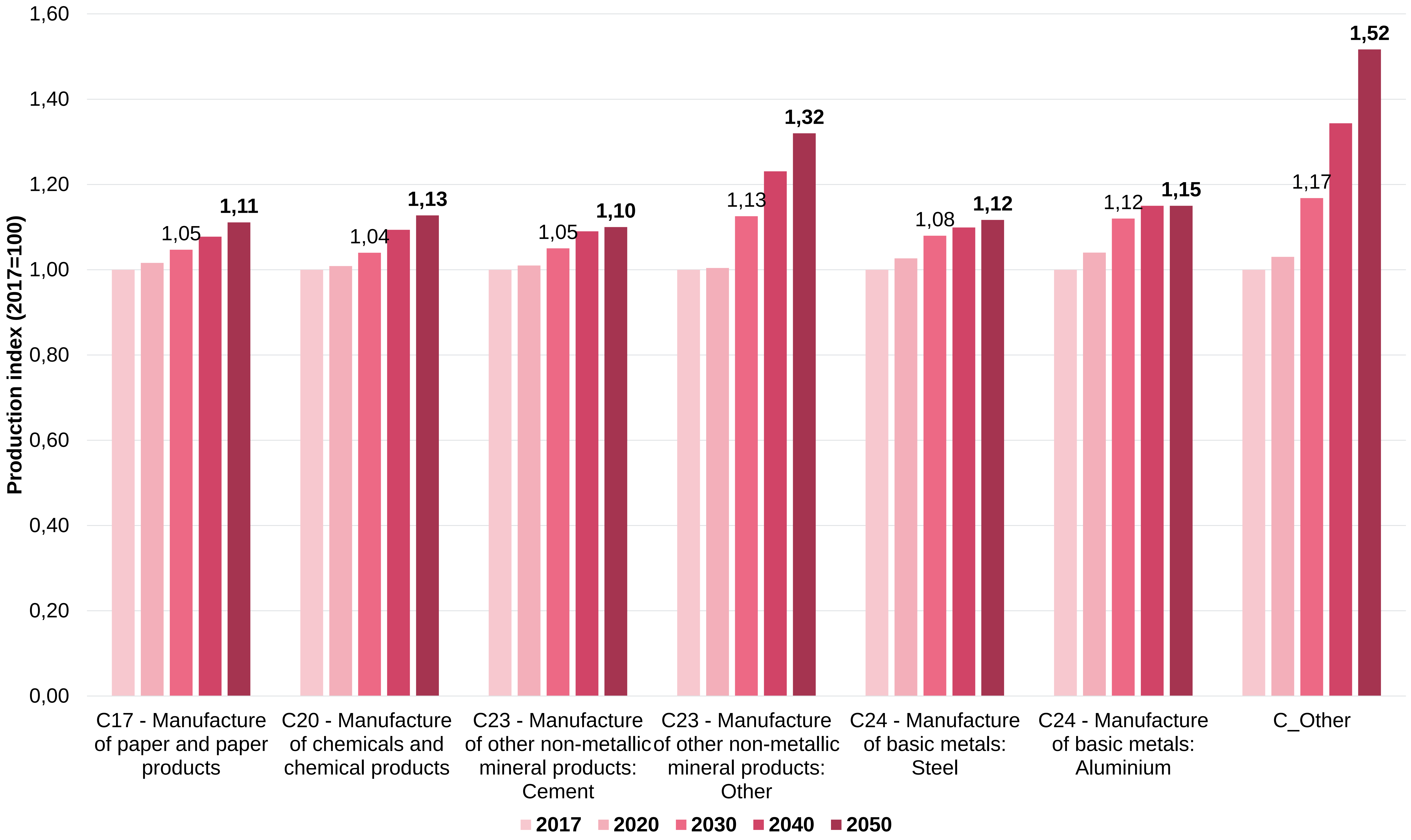
Industry sub-model: leading parameter **economic activity** for individual industries (paper & paper products, steel, cement, aluminium, **index of physical production** has been used



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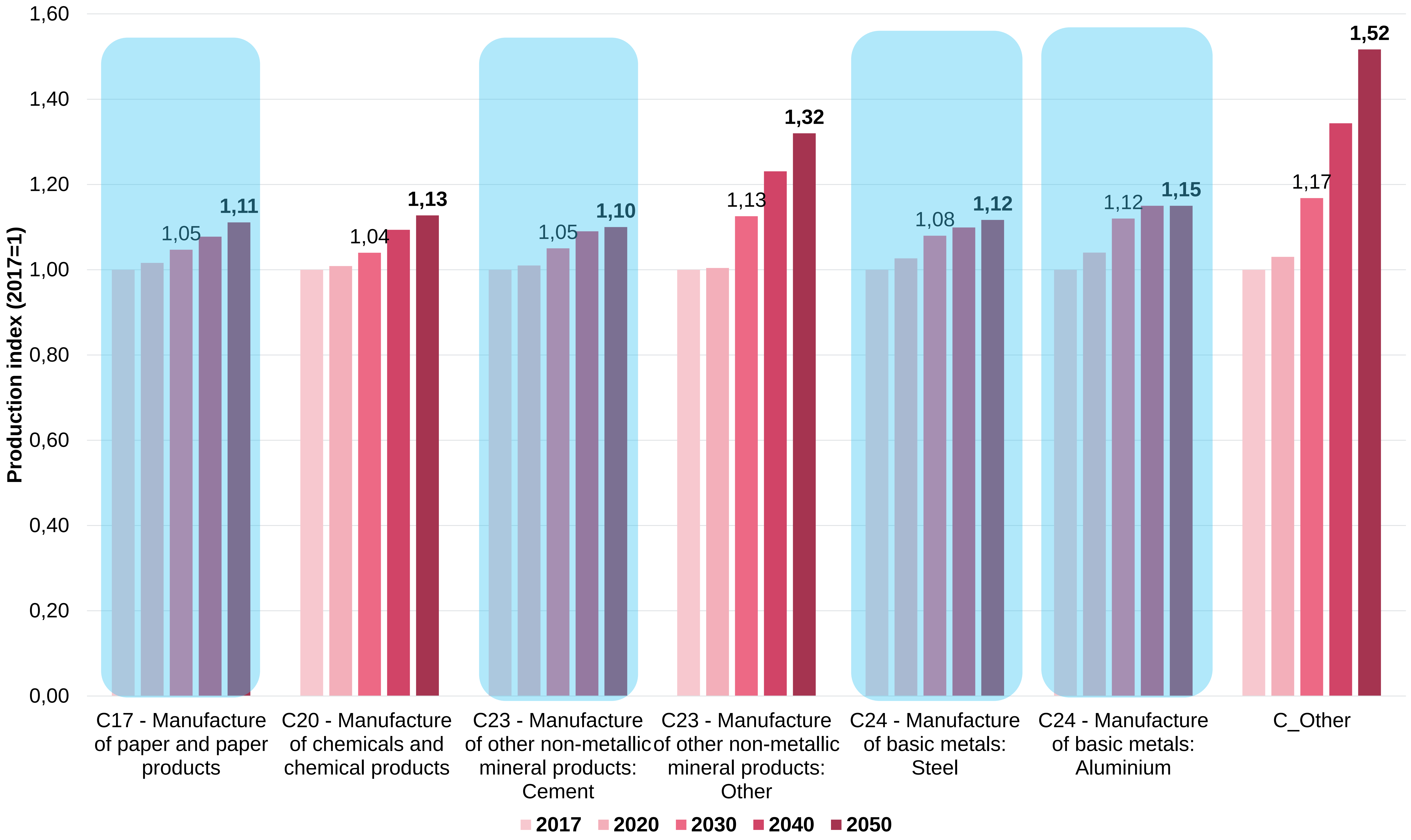

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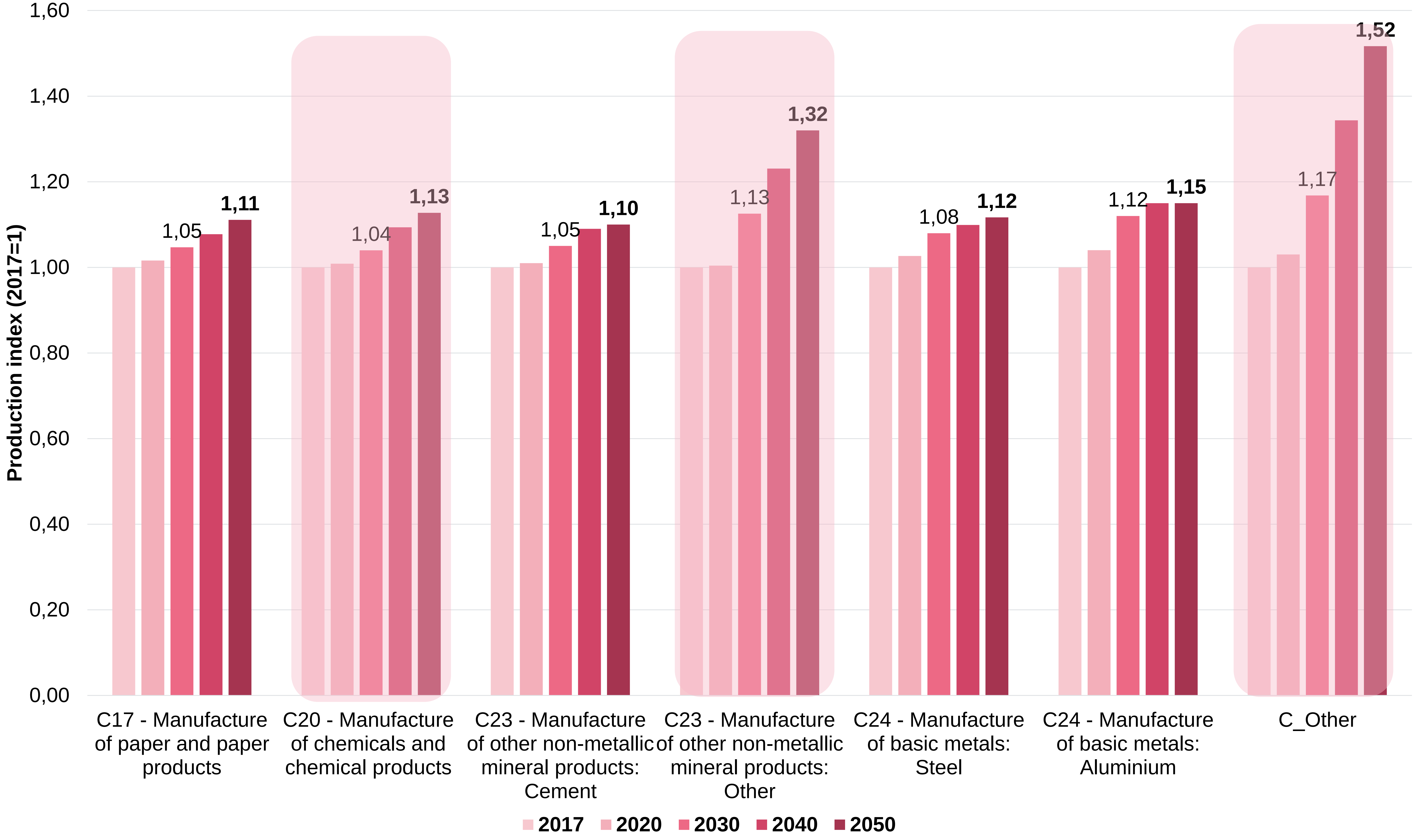

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Methodology and key assumptions(2)

2018 — **2050**

Existing measures | **Uncertain dynamics of technology development**

EEFF and RES

Fossil fuels are replaced by **electricity** (HPPs, furnaces) obtained from RES and/or CO_2-neutral fuels (**biogas, biomass**);

Utilization of **excess heat**;

CHP - especially in industries where there is a high need for heat (paper, chemical and pharmaceutical industries);

Use of trigeneration in industries where there is a strong need for refrigeration (food and beverage industry);

System services - district heating, demand response;

Gradual increase of energy efficiency (EMS, Educational programs, Audits).

Resource efficiency

EEFF and RES measures are upgraded with **material efficiency measures**, such as:

increasing the use of waste materials;
light-weighting - less material, easier manipulation;

product reuse - refurbished products; increasing product life; recycling.

Synthesis gas and Hydrogen

Synthesis gas as a substitute for natural gas in energy-intensive industries and in industries where biological waste is generated (possibility of own biogas production).

Use of **hydrogen** as a substitute for natural gas.

CCS and CCU

Envised technologies for carbon capture and storage and reuse (**CCS and CCU**), with the possibility of storage or reuse being close enough to the production site (or on site).

Methodology and key assumptions(3)

- Upgrade of **electric arc furnaces** for steel production (Oxy fuel, oxygen injection,…)
- Thermal processes (**reduction of specific consumption** → recuperation WH utilisation, load management,…)
- Energy efficient **electric motors, pumps and fans, frequency regulation** (2040, all IE2+VSD, IE3 or IE4)
- **Compressed air**: leakage reduction, distribution optimization and optimization
- **Industrial boilers**: increased efficiencies and replacement of boilers
- Increased volume of **industrial CHP**
- Reduction of energy intensity of **all other processes** by 1.0% per/y (EMS, org. measures)
- **WH Utilization** (both HT and LT, is expected, the share of excess heat in the required heat is between **10 and 20% by 2050**)
- Steel and glass (switch from gas to electricity **30% of potential by 2040 and 100% by 2050**)
- Use of synthesis gas: **10% share of synthesis gas (2030) and 100% by 2050** assuming a central distribution of synthesis gas produced from RES

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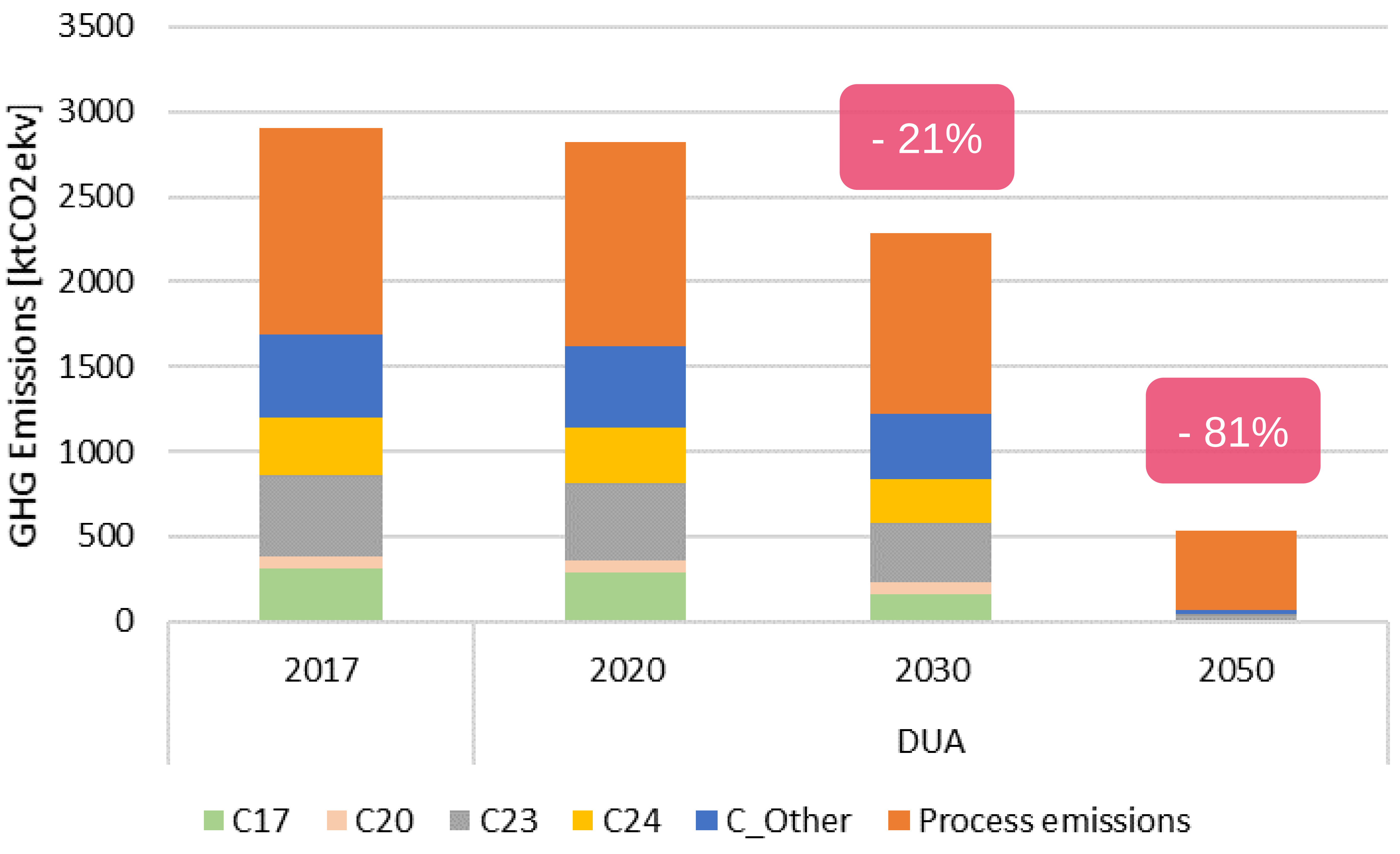
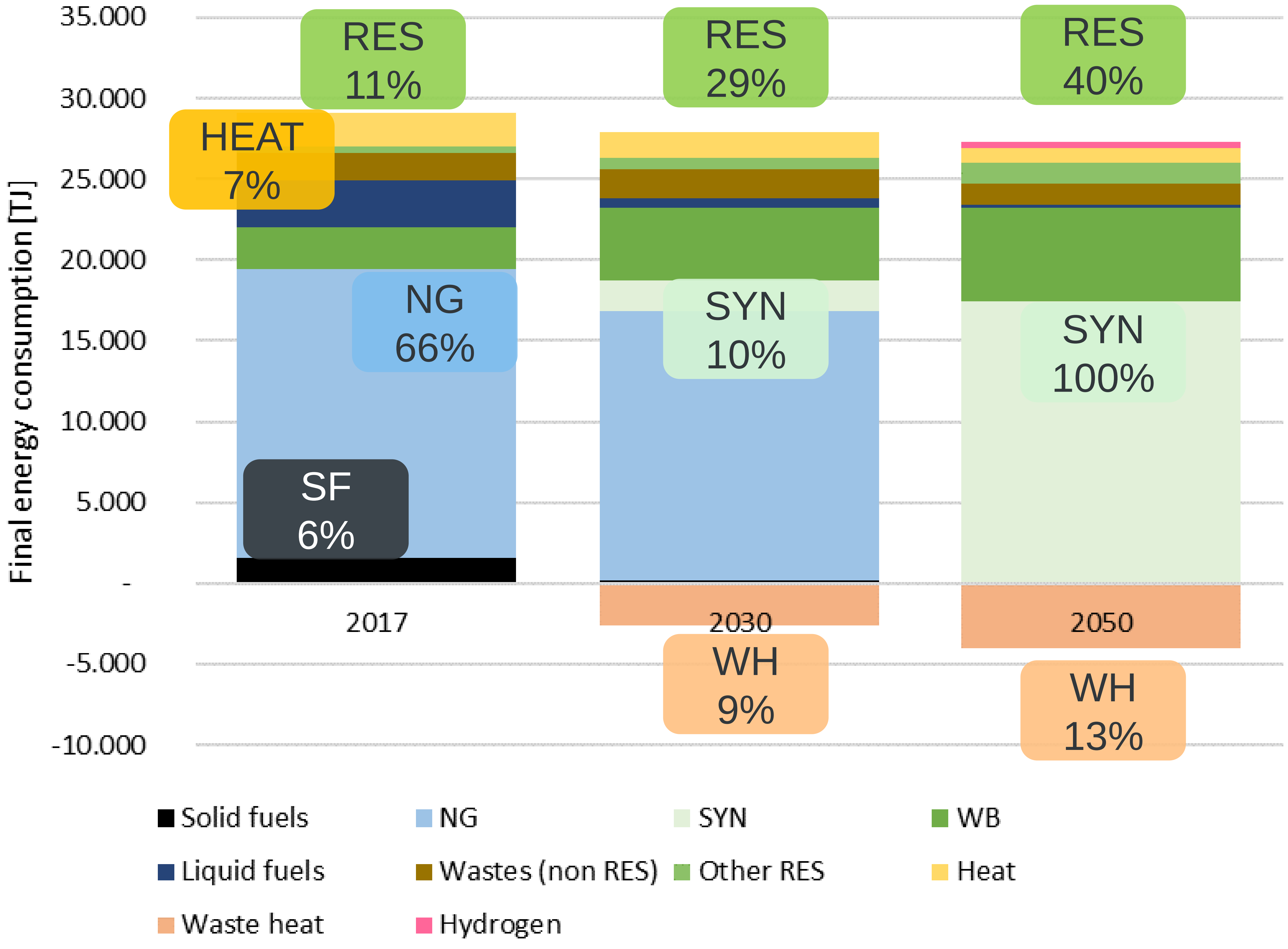
Results - Industry

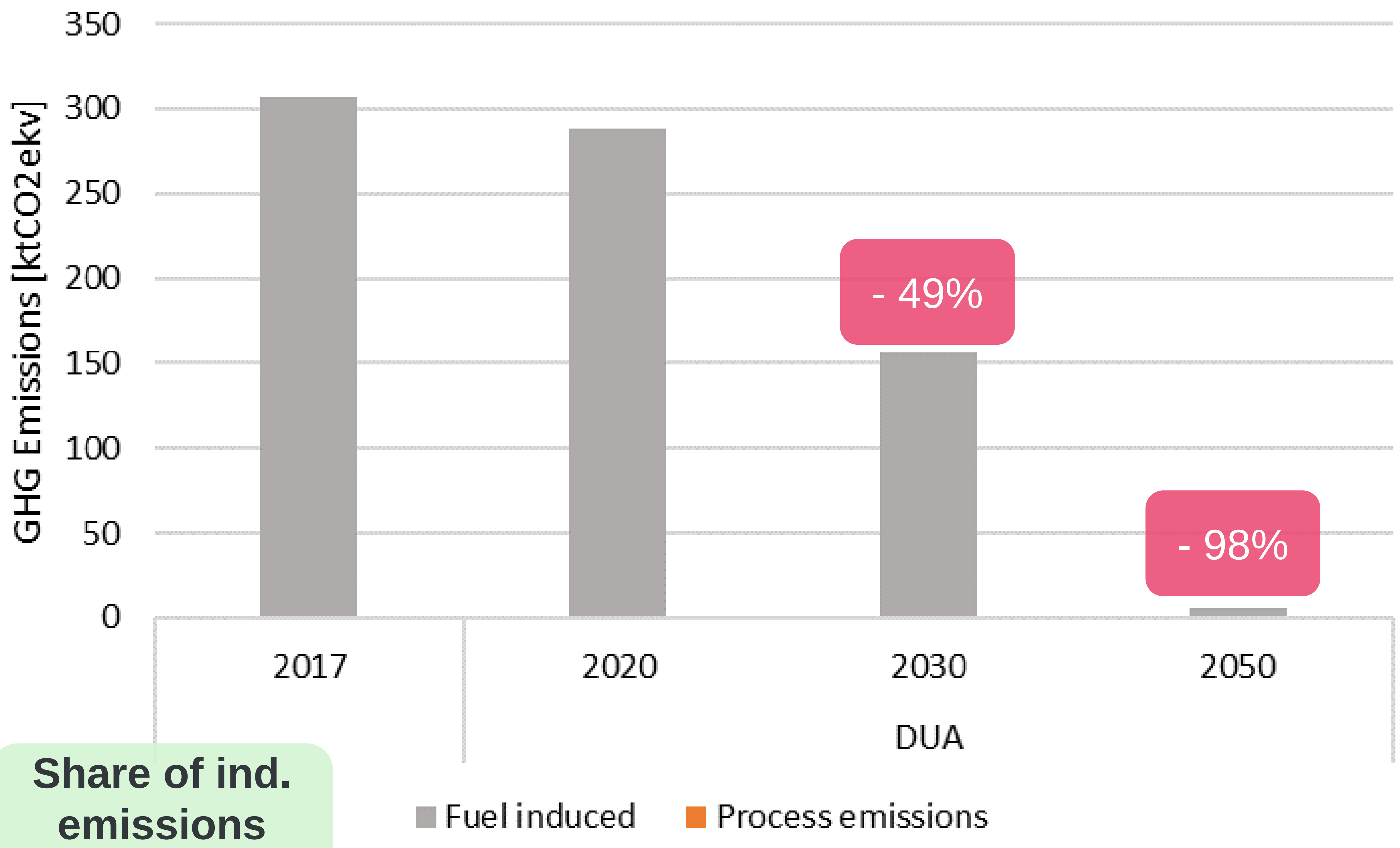
By 2030, GHG emissions are reduced for 21% and for 81% by 2050, relative to 2017 → intensive use of waste heat, intensive transition of some gas technologies to electricity, use of synthesis gas and CCS technology (C23 after 2040)

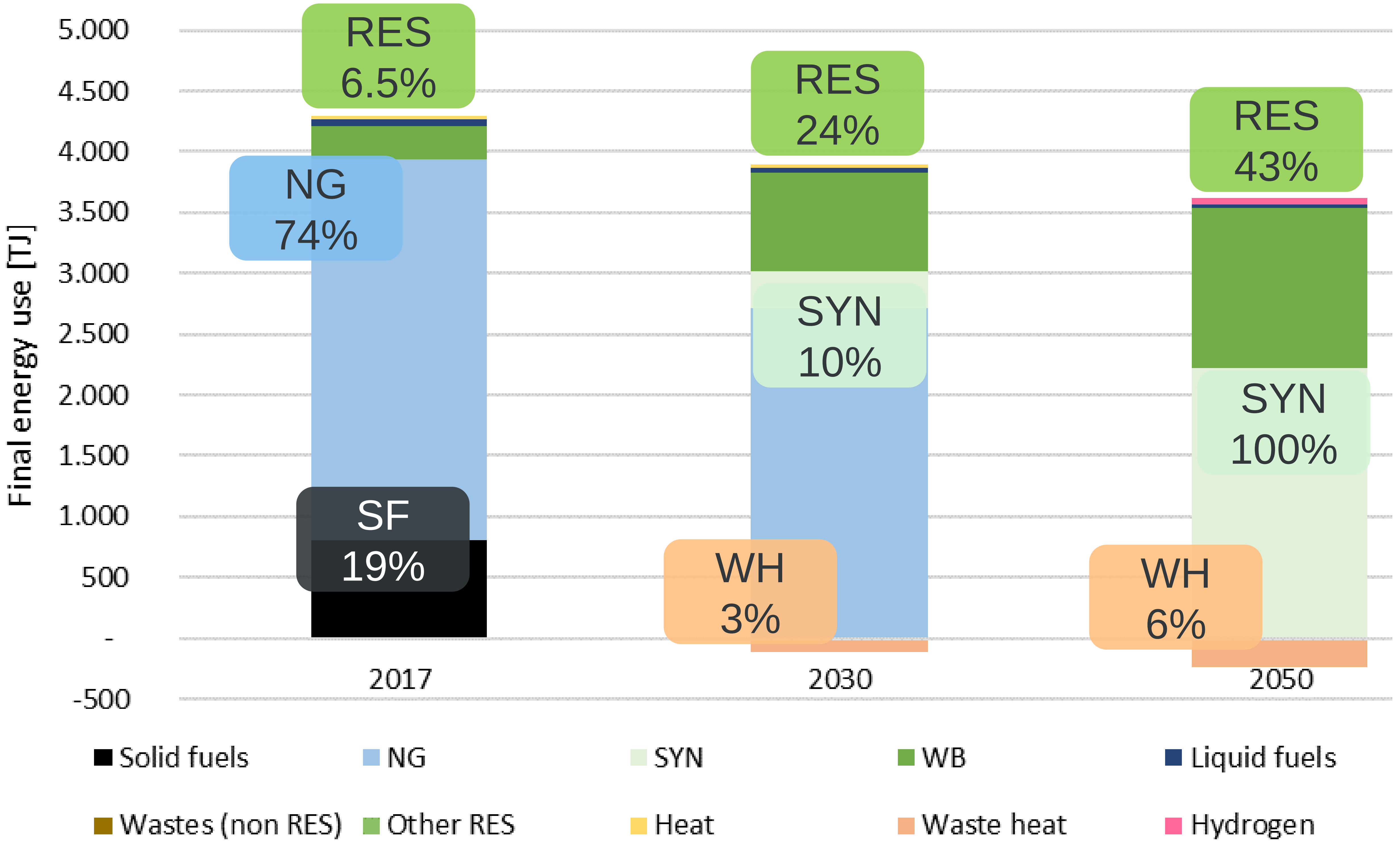




Results: C17 Man. of paper and paper products

By 2030, GHG emissions in C17 are reduced for 49% and for 98% by 2050 → the reduction is achieved through energy efficiency measures, fuel shift (solid fuels phase out), introduction of renewable sources and the use of excess heat and synthesis gas





Share of ind. emissions 10 %

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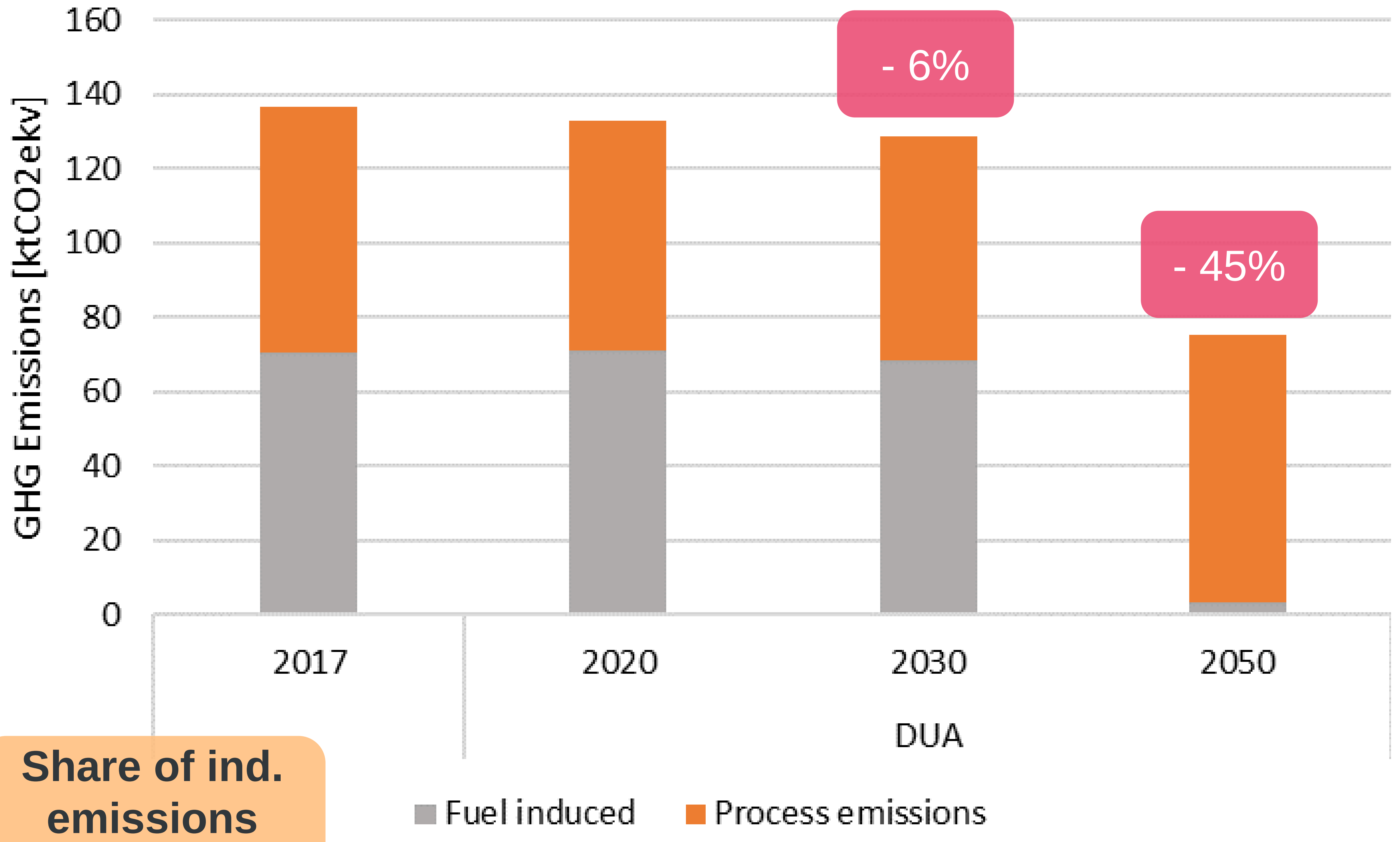
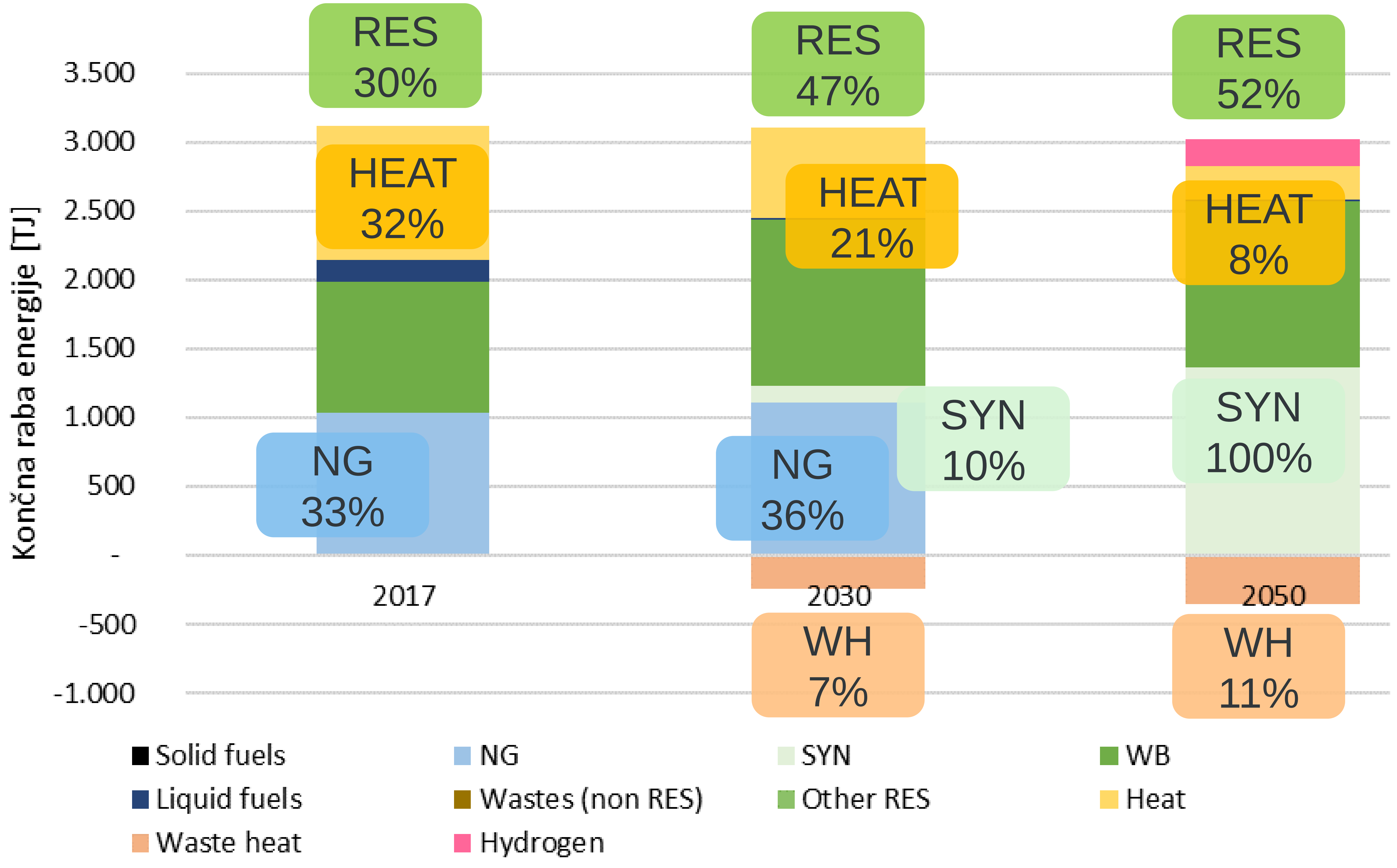
Results: C20 Man. of chem. and chemical products

By 2030, GHG emissions in the C20 are reduced for 6% and for 45% by 2050, the reduction is achieved through energy efficiency measures, fuel shift, introduction of renewable sources and the use of excess heat and synthesis gas





Share of ind. emissions 5%

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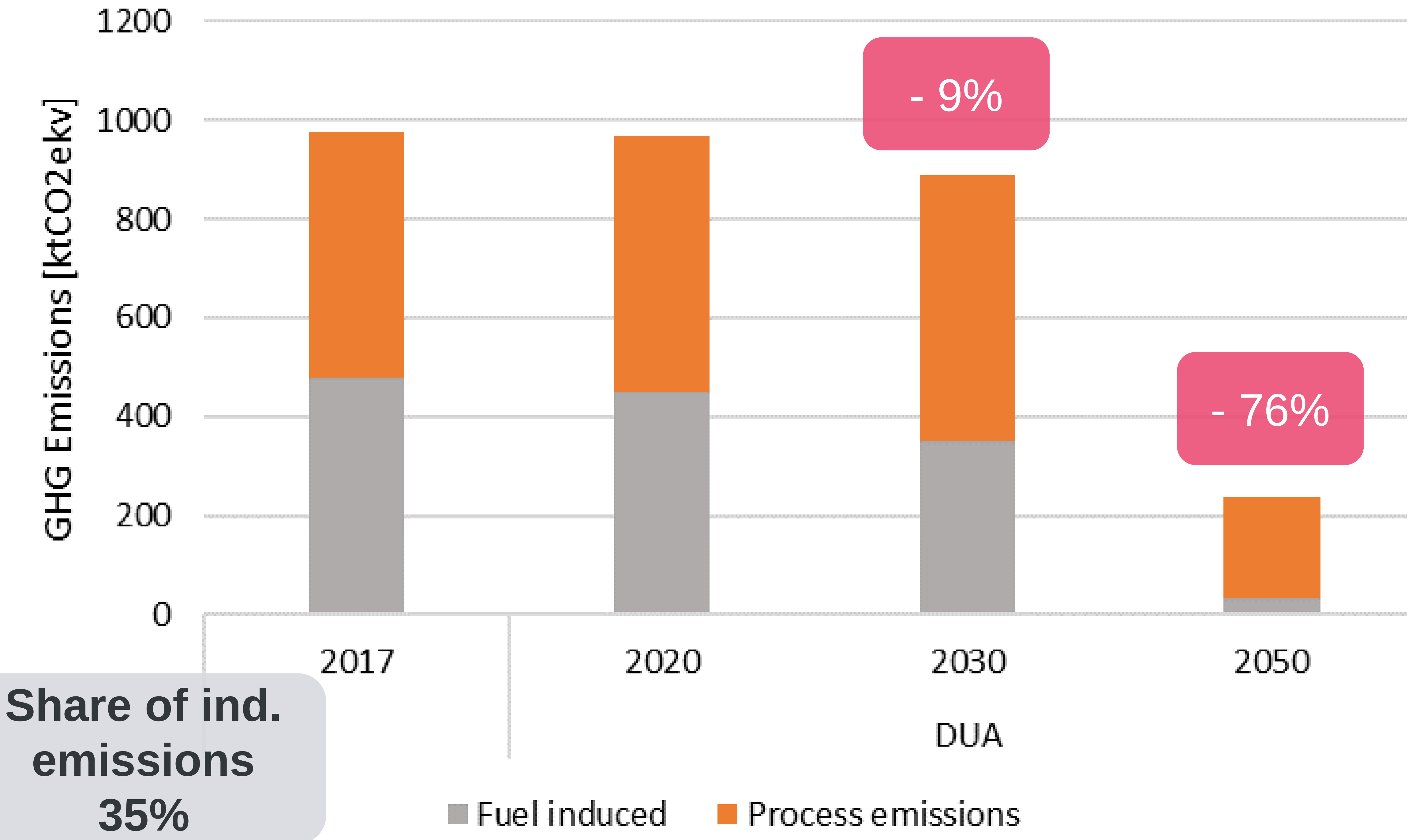
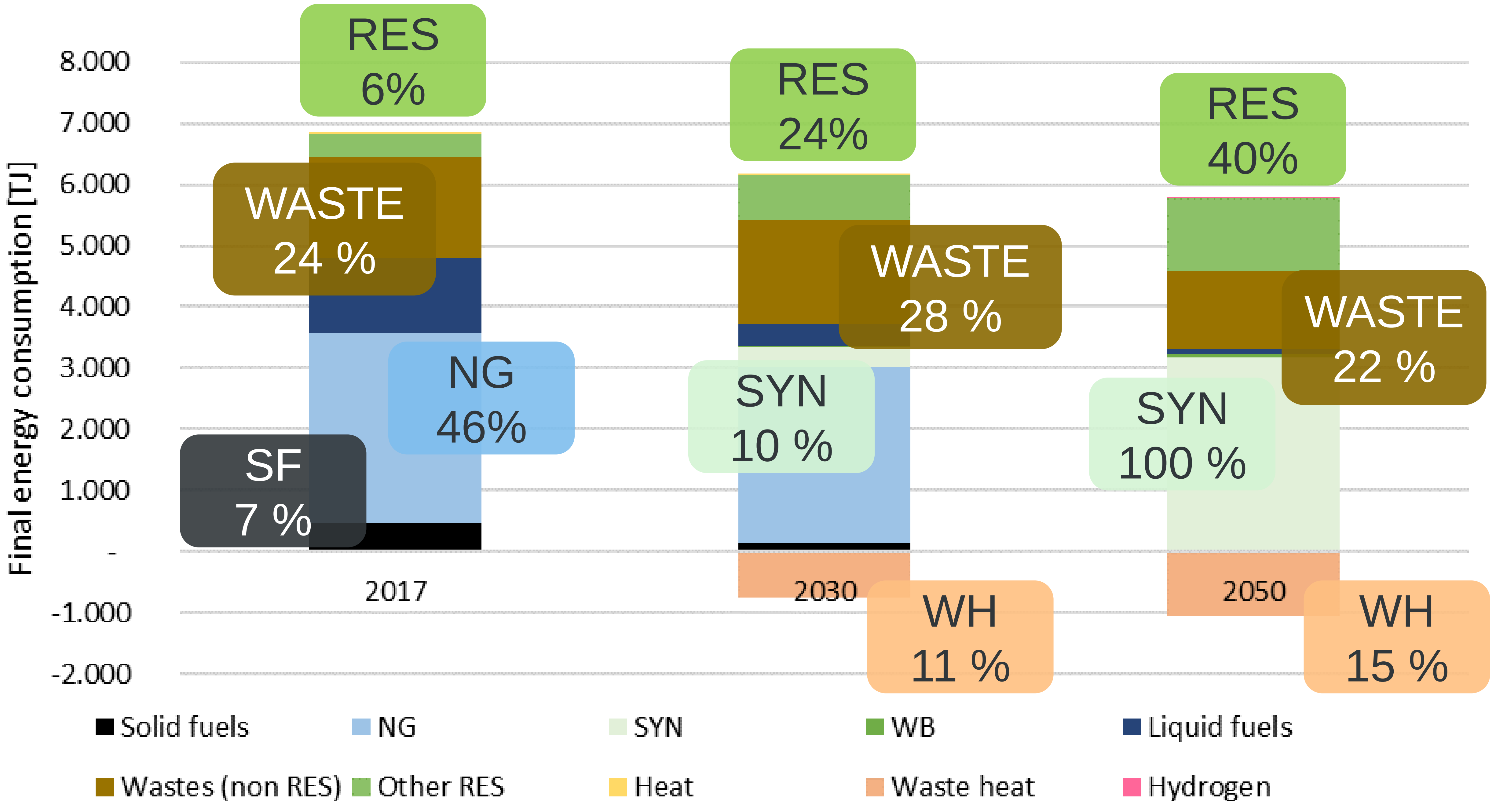
Results: C23 Man. of other non-metallic min. prod.

By 2030, GHG emissions are reduced for 9% and for 76% by 2050, the reduction is achieved through the introduction of biogenic waste in cement production, transition to electricity in heat treatment furnaces in glassworks, energy efficiency, fuel switch, use of excess heat, use of synthesis gas and CCS/CCU (80% of process emissions in cement production in 2040)



Share of ind. emissions 35%



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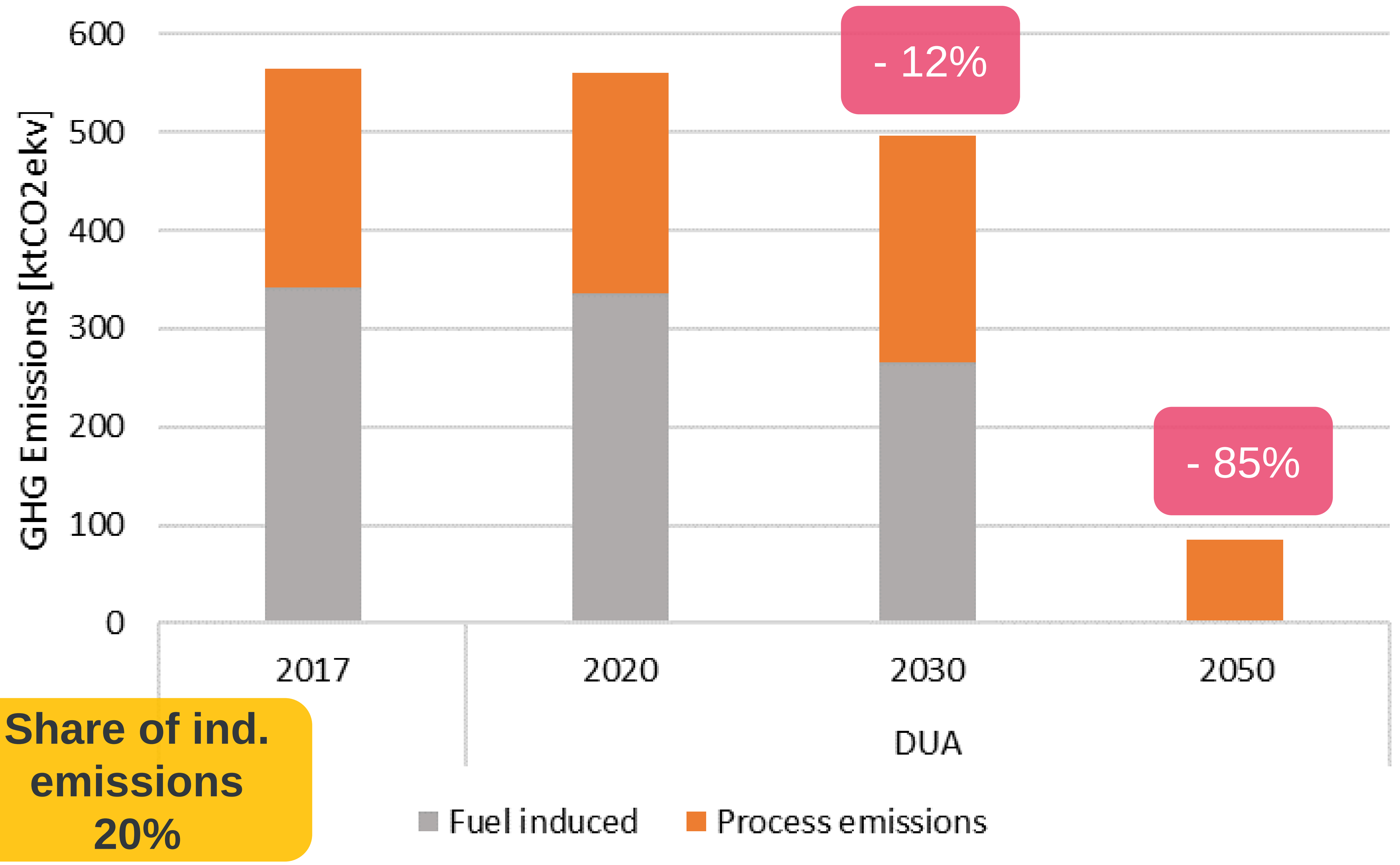
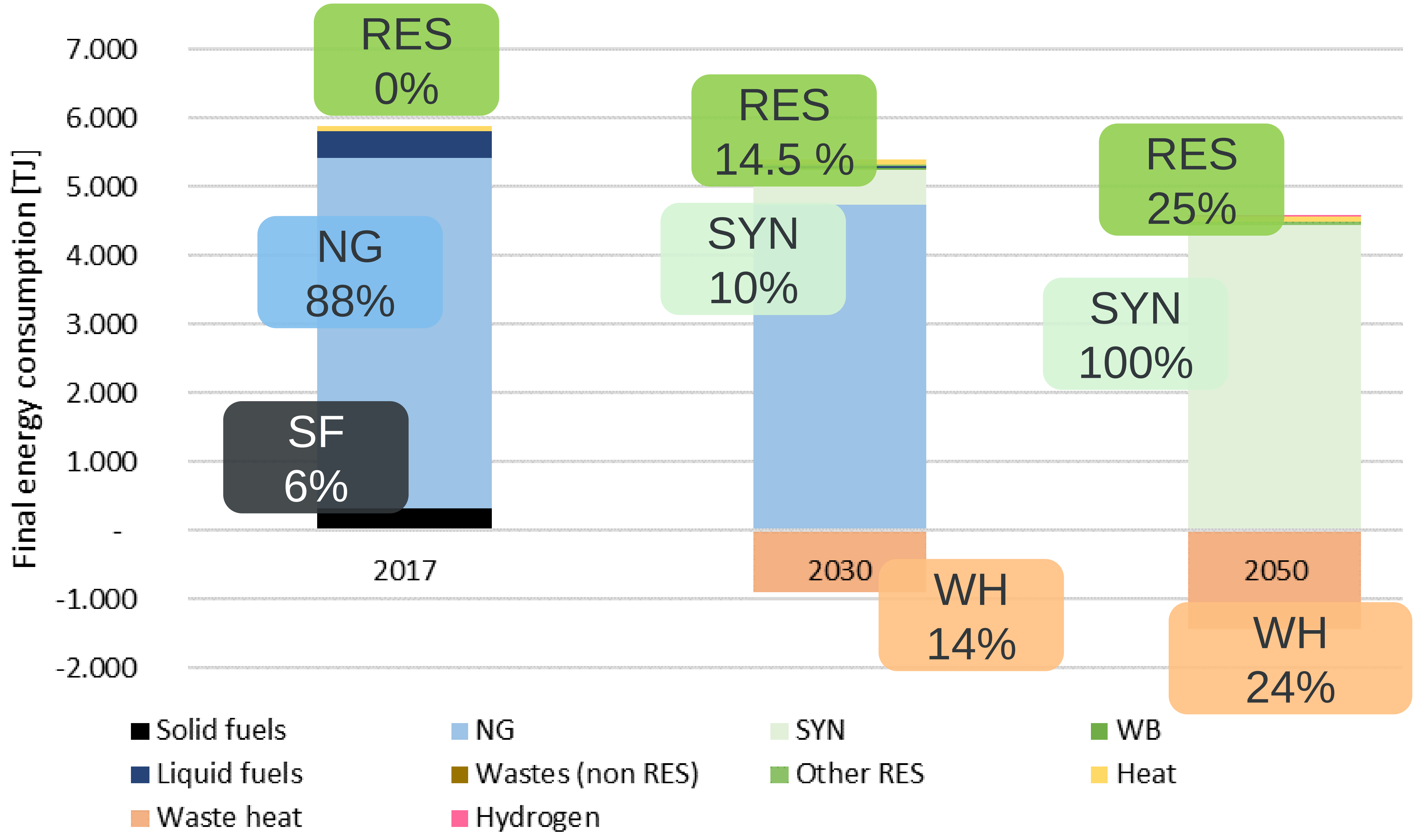
Results: C24 Manufacture of basic metals

By 2030, GHG emissions are reduced for 12% and for 85% by 2050, the reduction is achieved through switching to electricity in steel furnaces for heat treatment, intensive use of secondary aluminum, energy efficiency, fuel switching, use of excess heat and use of synthesis gas





Share of ind. emissions 20%

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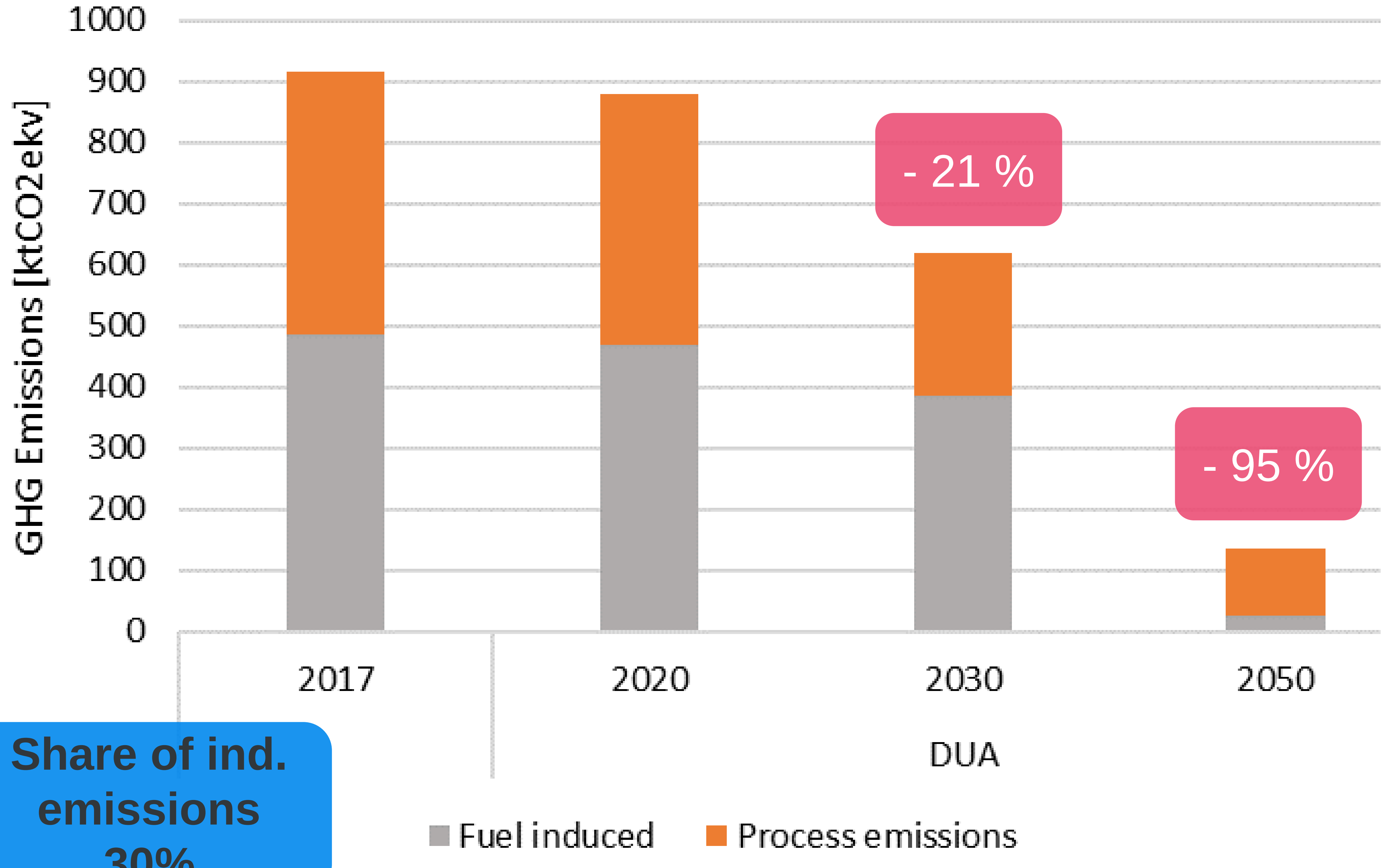
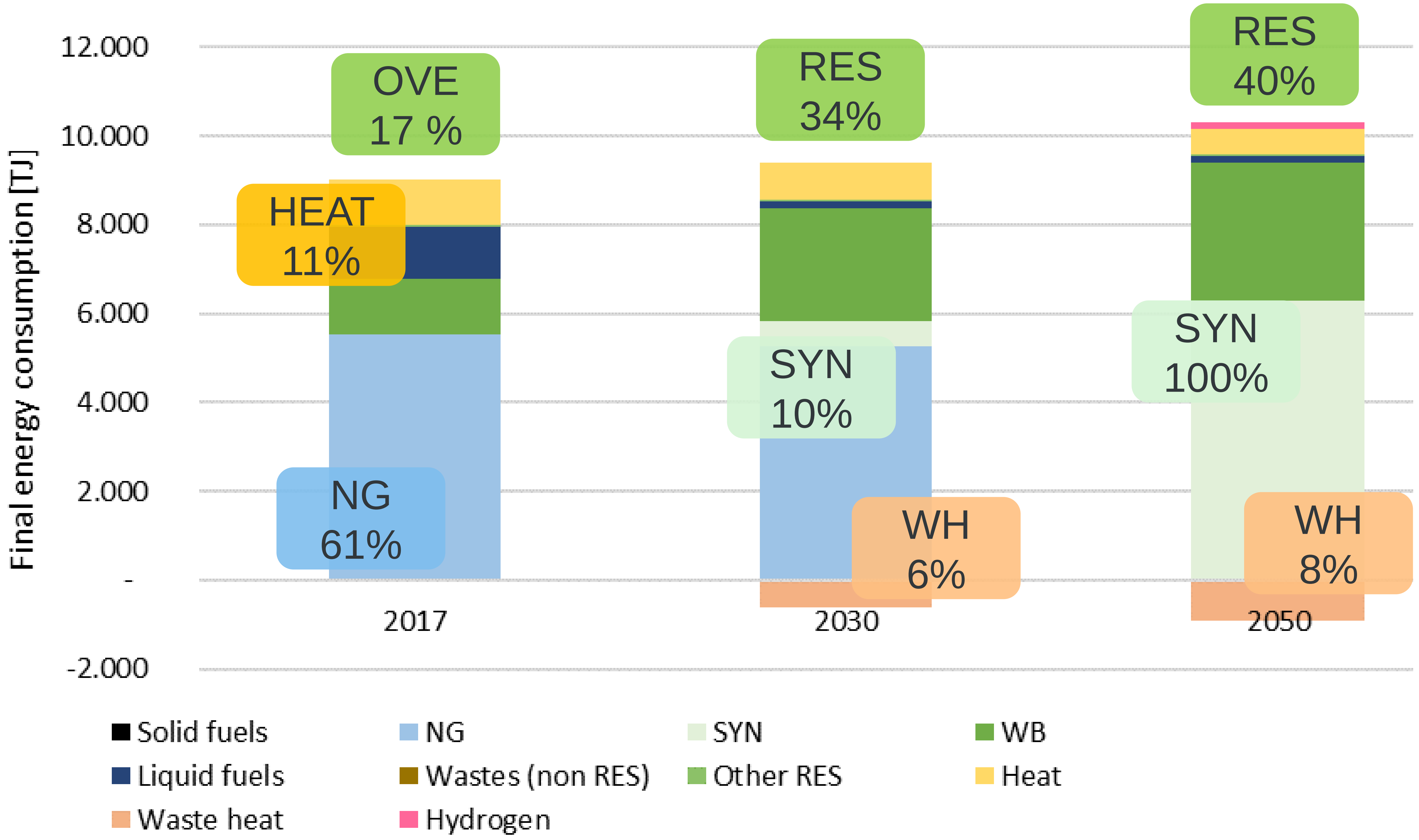
Results: Other industries

By 2030, GHG emissions in other industries are reduced for 21% and for 95% by 2050, the reduction is achieved through the introduction of energy efficiency measures, replacement of fuels, introduction of RES, use of excess heat and the use of synthesis gas





Share of ind. emissions 30%

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Conclusion

Necessary conditions for the transition to climate neutrality:

- **Awareness and competence** for the transition to climate neutrality
- **A culture of cooperation, trust and acceptance** for necessary investments (multi disciplinary approach)
- **Proactive role of the state,** opportunities for different actors (decision makers + R&D + industry + energy companies + utilities → development of advanced energy services, technologies)
- **EU funds for recovery and just transition** → important support for strategic investments

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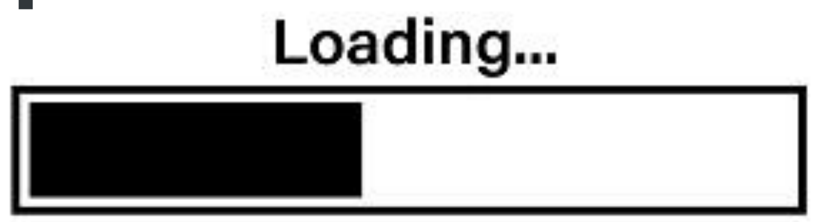

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Challenges

- **Circular economy**, resource efficiency, product design and sustainability
- Evaluation of **socio-economic effects** (behavior, energy poverty)
- Addressing changes in the **economic and social paradigm** (energy efficiency vs. energy sufficiency)
- Evaluation of the **impact** of scenarios **on the structure of the economy** (national vision of economic development, strategies, policies, bases?)

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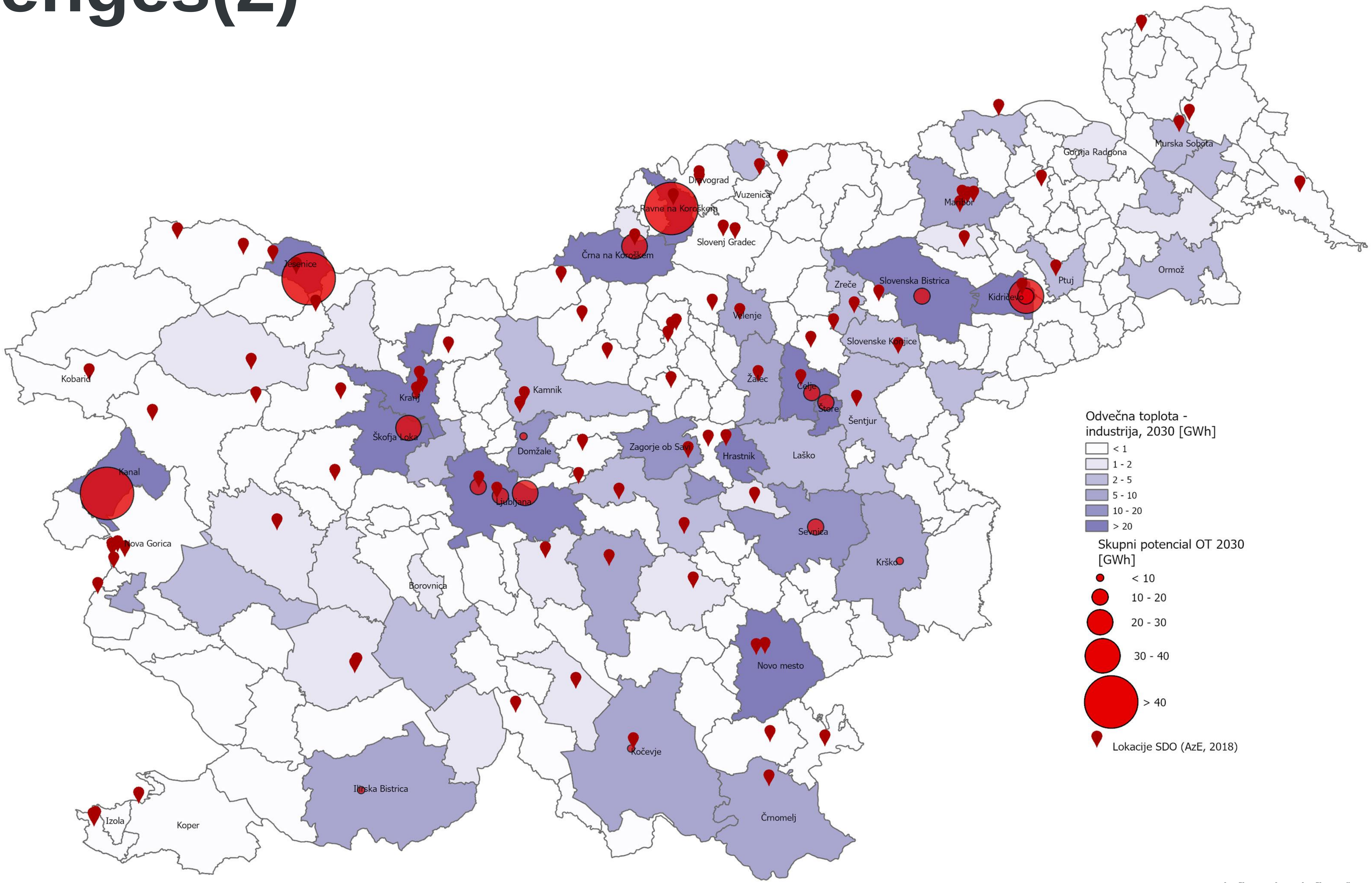
Challenges(2)



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Challenges(3)

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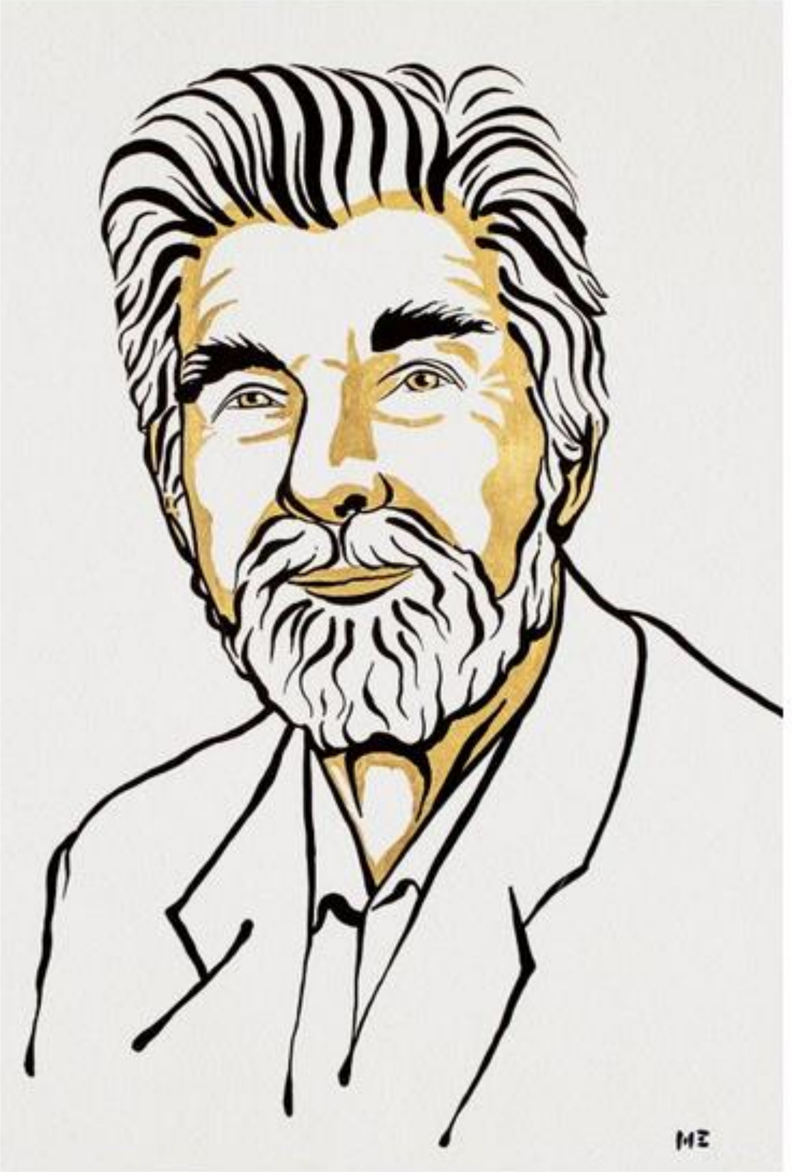
Syukuro Manabe

Prize share: 1/4



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Klaus Hasselmann

Prize share: 1/4

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Giorgio Parisi

Prize share: 1/2

https://www.nobelprize.org/prizes/physics/2021/summary/

The Nobel Prize in Physics 2021 was awarded "for groundbreaking contributions to our understanding of **complex systems**" with one half jointly to Syukuro Manabe and Klaus Hasselmann **"for the physical modelling of Earth's climate, quantifying variability and reliably predicting global warming„** and the other half to Giorgio Parisi "for the discovery of the interplay of disorder and fluctuations in physical systems from atomic to planetary scales."

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Thank you for your attention.

matevz.pusnik@ijs.si

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