

Market analysis: Net-zero technologies for green industrial process heat (Courtesy Translation)



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Agenda



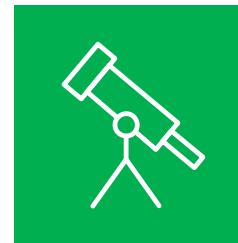
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Initial situation and research question

01

Initial situation

The aim is to reduce GHG-emissions in Germany by at least 65 percent by 2030. The saving of process heat in the industrial sector and its decarbonisation is a central and strategic component of this goal.

- Process heat is of crucial importance for the industry and accounts for around 2/3 of industrial (final) energy consumption, exactly 1509 PJ of 2245 PJ in 2023 [AGEB 2024], but for **around 90 percent of combustion-related emissions** [Prognos 2025b].
- Industrial (high-temperature) heat pumps can play a significant role in the low temperature (<200 °C) and partly in the medium temperature (200-400/500 °C) range, especially in connection with the consistent utilisation of waste heat. In many processes with high temperatures (>400/500 °C), **further energy saving potentials, e.g. through electrification, and/or GHG reduction potentials, e.g. through the use of hydrogen in industrial furnaces, can be realised.** A large part of the energy efficiency potentials has high economic viability [HS NR 2024].

Research questions

How big is the economic potential for climate-neutral industrial process heat?

- The technological potential of industrial process heat has already been sufficiently analysed. But how great is the economic potential of decarbonising this technology? DENEFF has instructed Prognos to analyse this question in detail in a short study.
- The following key questions were analysed:
 - What is the current market volume (gross value added, labour force) in Germany for the technologies required for green industrial process heat, including their components?
 - What is their current economic relevance compared to other transformation sectors and the overall economy in Germany?
 - What market share do German and European companies currently hold in these technologies?
 - How high are German exports of green process heat technologies and what is the global market? Which countries are the most important importers of german goods and on the global import market in general?
 - What could the perspective market volume (gross value added, labour force) of these technologies be, if Germany achieves its climate targets in 2030 and/or 2045?

Key figures for green industrial process heat

02



approx. 60.000
employed people in 2023

The labour force in the green industrial process heat sector is over **70 % higher in 2023** than it was in 2010

€ 5.5 billion
GVA in 2023

The gross value added (GVA) increased by **approx. 16 % in 2023**

23 %* GVA
through industrial heat pumps in 2023

Most dynamic technology sector with **13.3 % growth per year**

* of the total GVA of the green industrial process heat

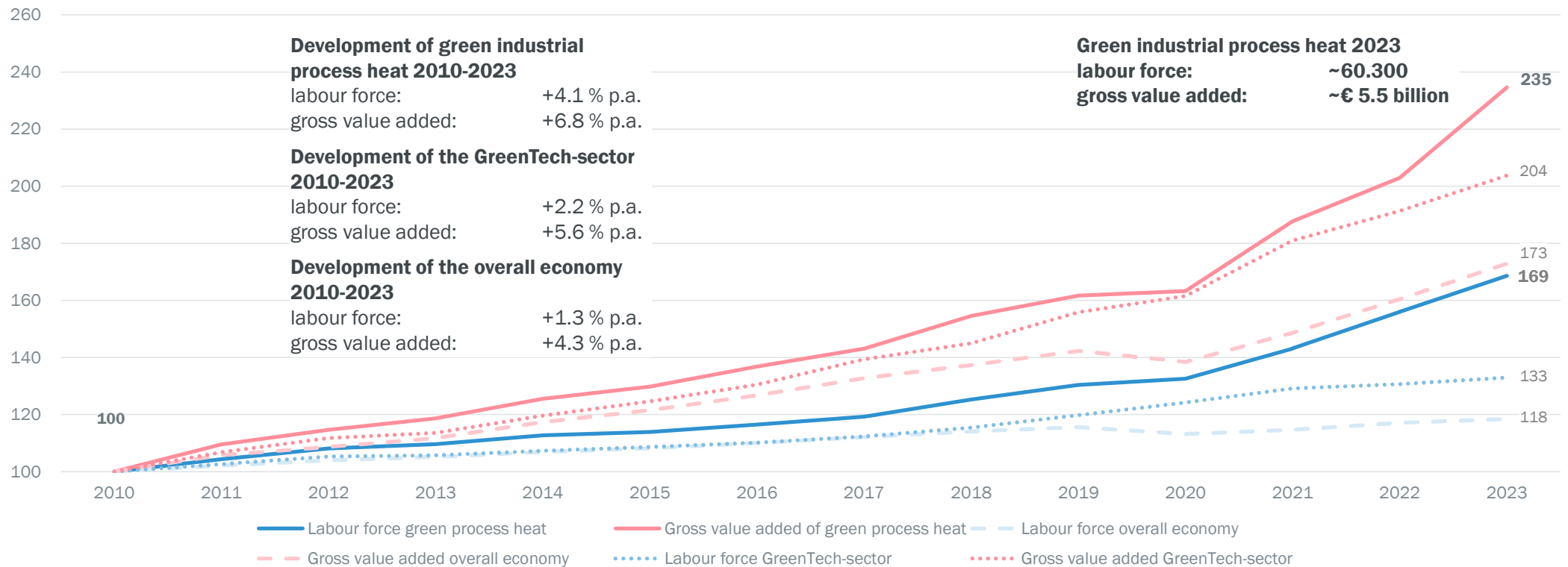
Current modeled market volume

03

Gross value added and labour force of the green process heat show a more dynamic development than the overall economy



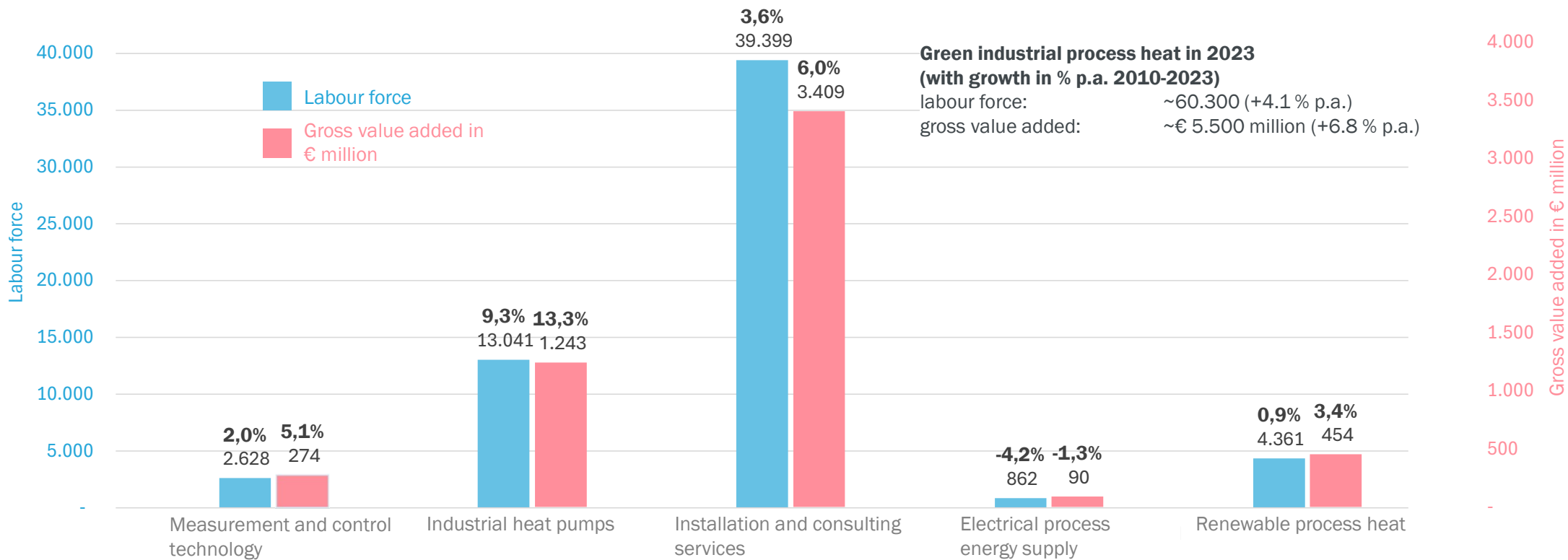
Indexed development of gross value added and labour force 2010-2023



Source: envigos-model based on data from the Federal Employment Agency (BA) and the Federal Statistical Office (destatis)

Installation and consulting services dominate the market for green industrial process heat, followed by industrial heat pumps

Labour force by sector, with growth 2010–2023 in % p.a. (blue), and GVA by sector in € million, with growth 2010–2023 in % p.a. (red)

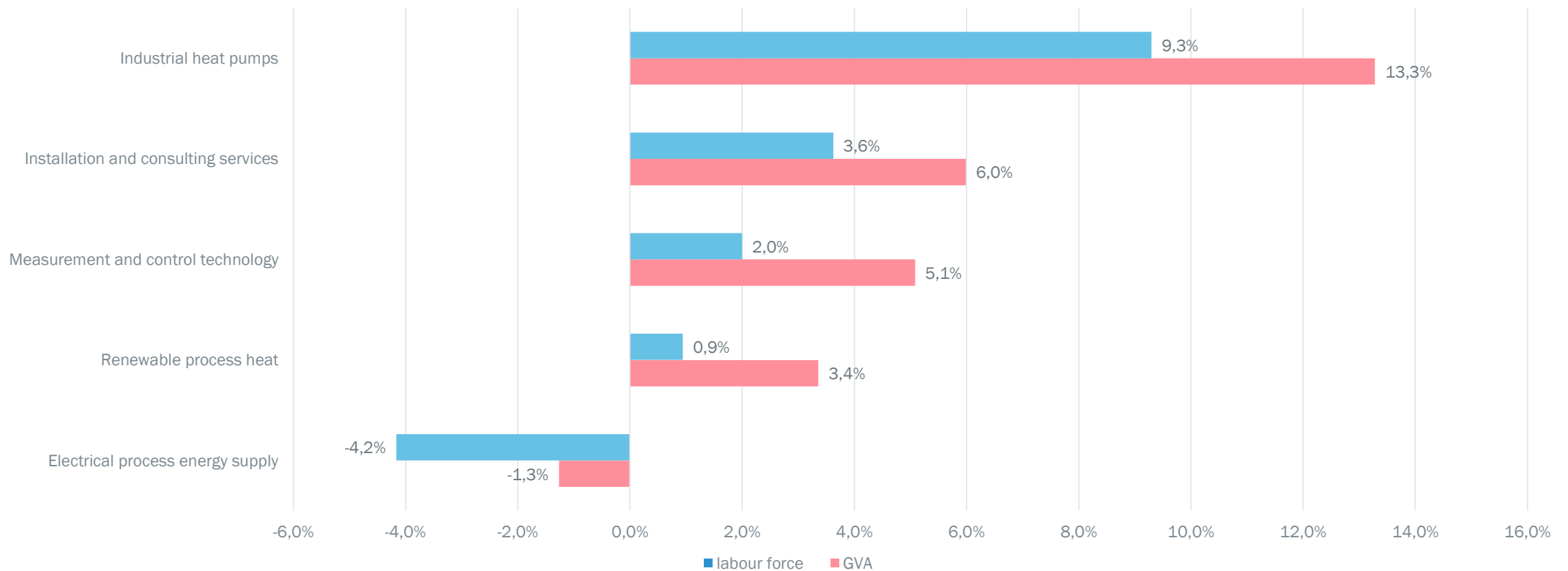


Source: envigos model based on data from the Federal Employment Agency (BA) and the Federal Statistical Office (destatis)

Industrial heat pumps & Installation and consulting services are the most dynamic sectors of the green process heat



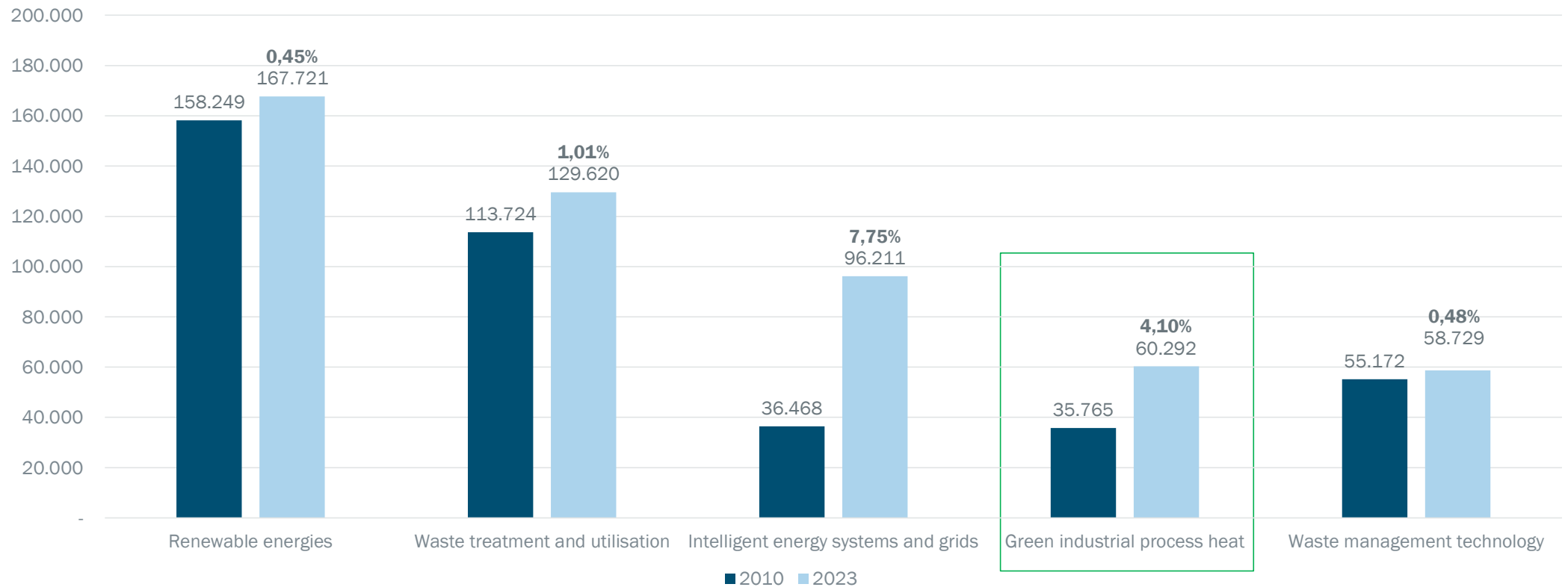
Gross value added (GVA) and labour force growth rates between 2010 and 2023 by sector in % p.a.





Comparison with large transformation sectors within the energy and circular-economy sector

Labour force in 2010 and in 2023 in selected transformation markets, with growth 2010-2023 in % p.a.

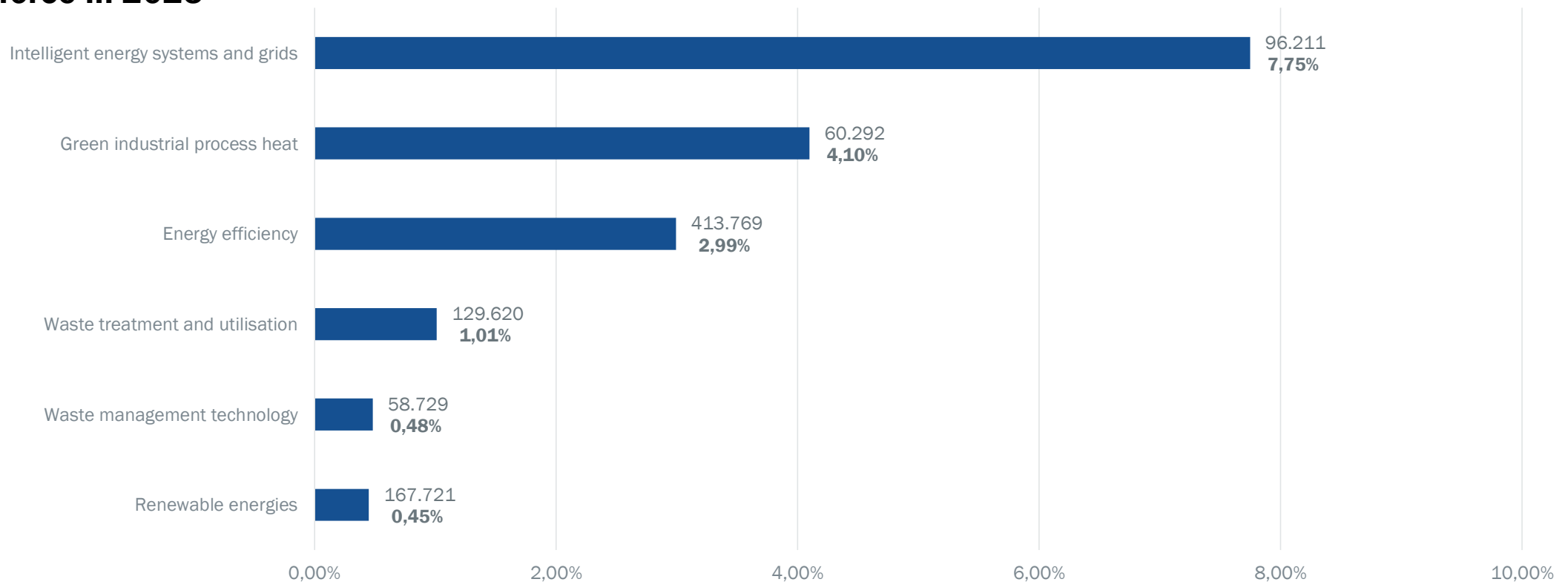


Source: envigos model based on data from the Federal Employment Agency (BA) and the Federal Statistical Office (destatis)



Comparison of growth rates of major transformation sectors within the energy and circular-economy sector

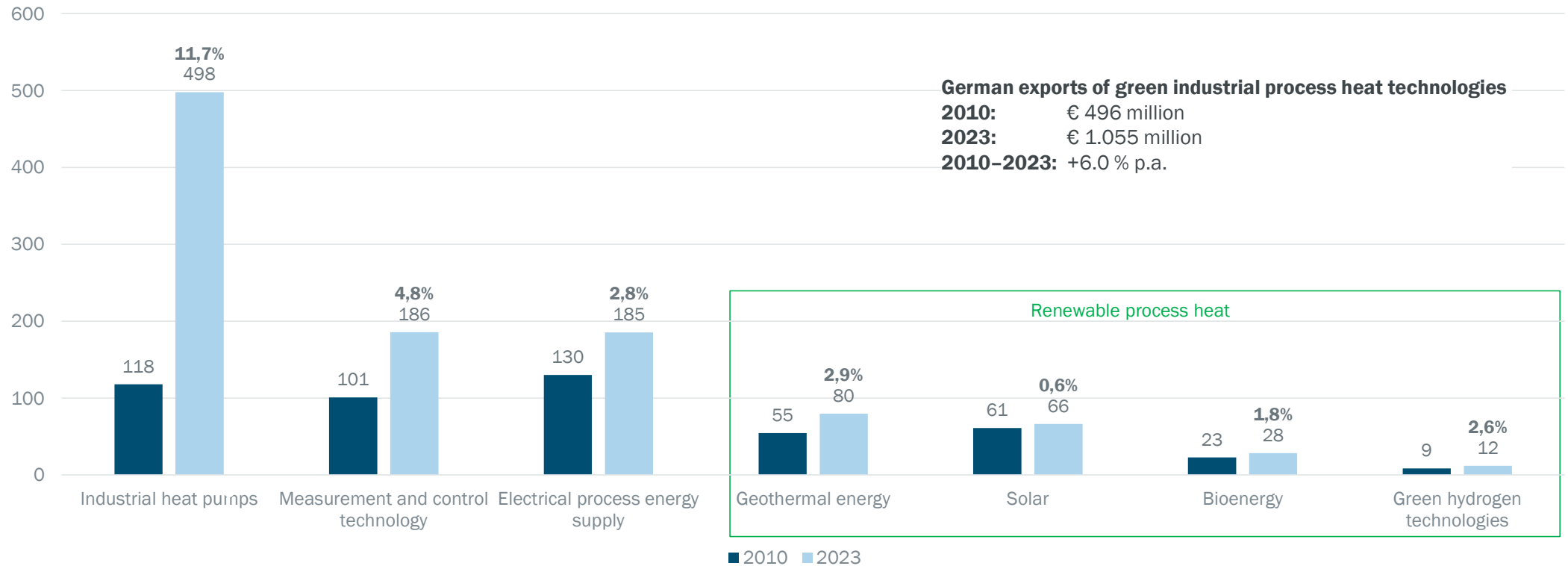
Growth rates of the labour force in selected transformation sectors 2010 - 2023 in % p.a., with labour force in 2023





Industrial heat pumps are the most successful German export among green process heat technologies in 2023

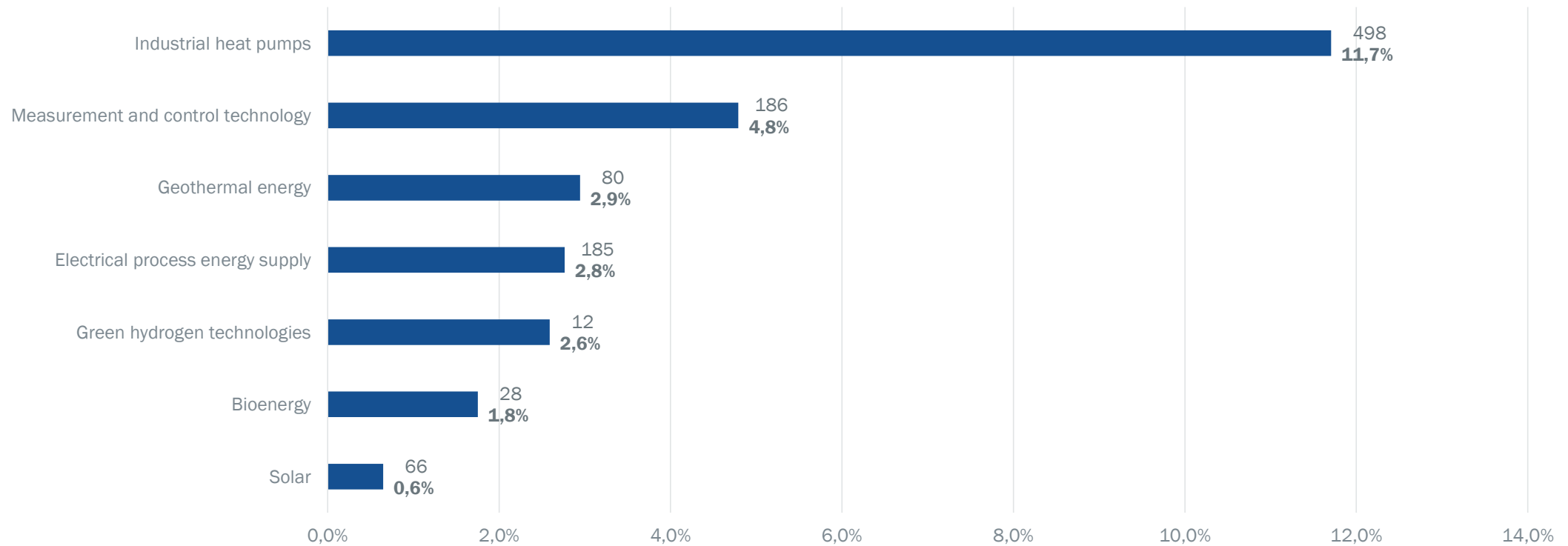
German exports by technology sector in € million, with growth 2010–2023 in % p.a.





In addition to industrial heat pumps, measurement and control technology is also proving to be a dynamic growth market

Growth rates of German exports by technology sector 2010 - 2023 in % p.a. with German export volume in 2023 in € million



European neighboring countries are the most important importers of German green industrial process heat technologies

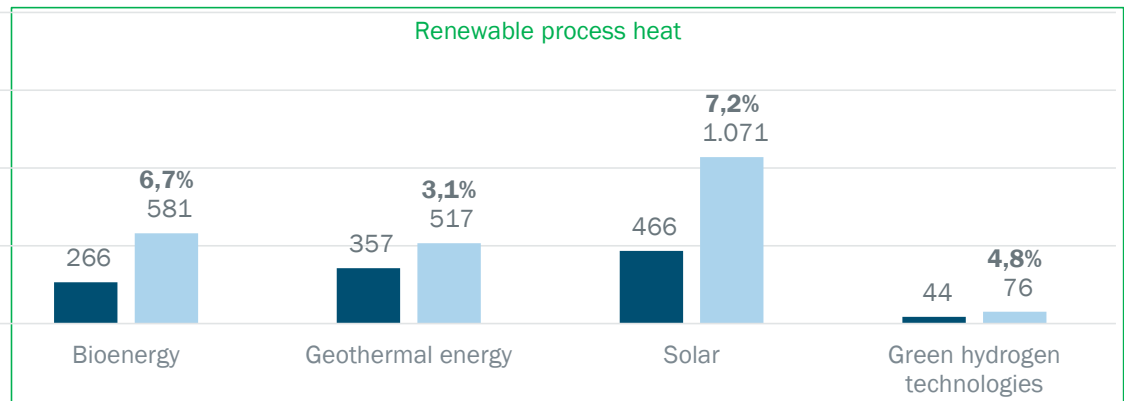
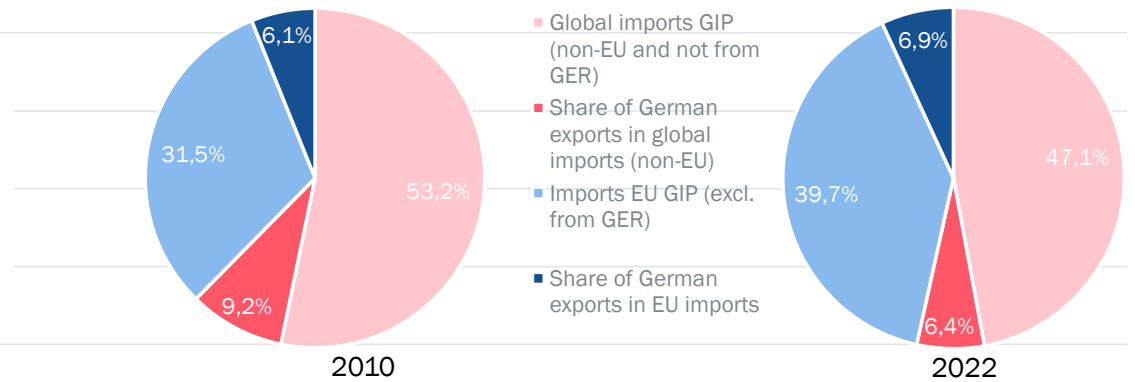
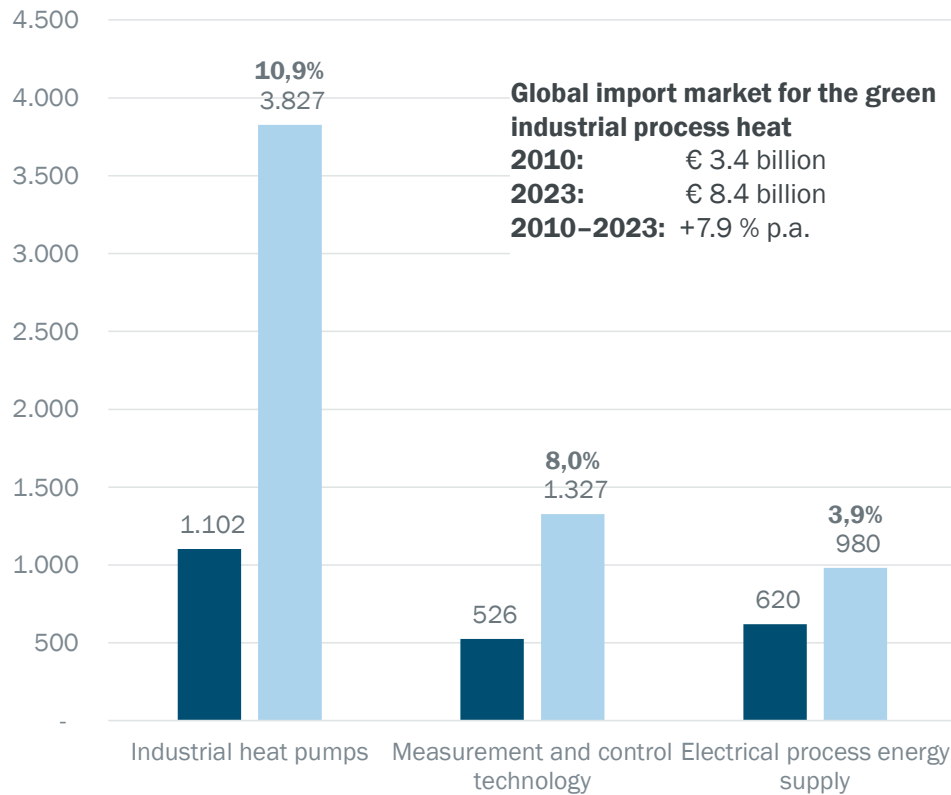


Export rank 2023	German exports 2010 in € thousand	German exports 2023 in € thousand	Country	Growth 2010–2023 in % p.a.
1.	45.191	130.873	Switzerland	8,5%
2.	22.506	83.529	Netherlands	10,6%
3.	27.025	75.513	Austria	8,2%



Heat pumps incl. waste heat utilisation is the most important and dynamic sector of the green industrial process heat (GIP)

Global import market* by technology sector in 2010 and in 2022 in € million, with growth 2010 - 2022 in % p.a.

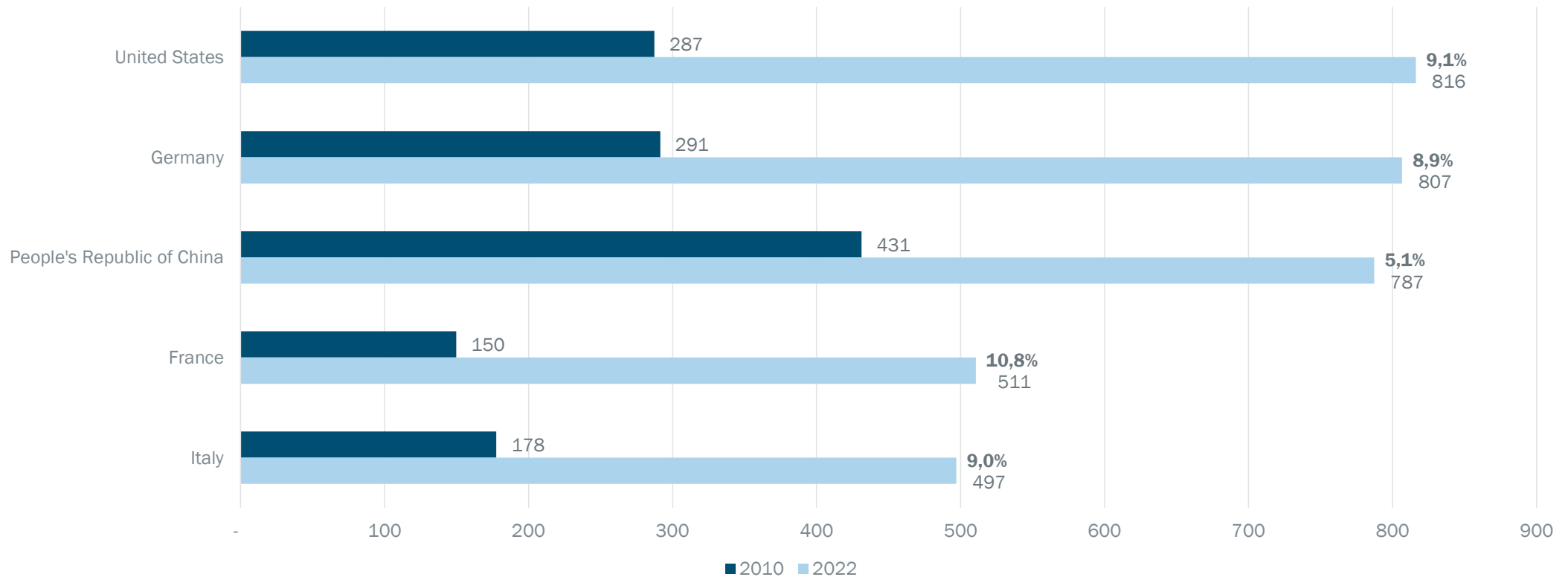


* Global import market is assumed to be the world market in the analysis (national production is excluded)



The USA and Germany have overtaken China since 2010 due to their more dynamic growth as import markets

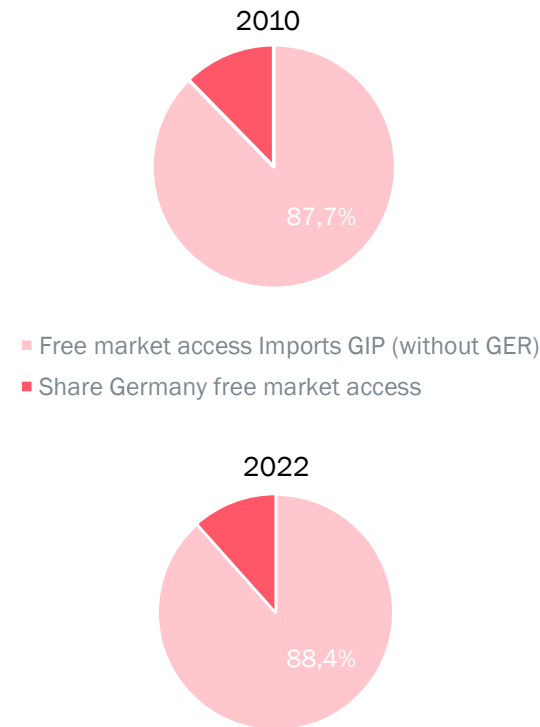
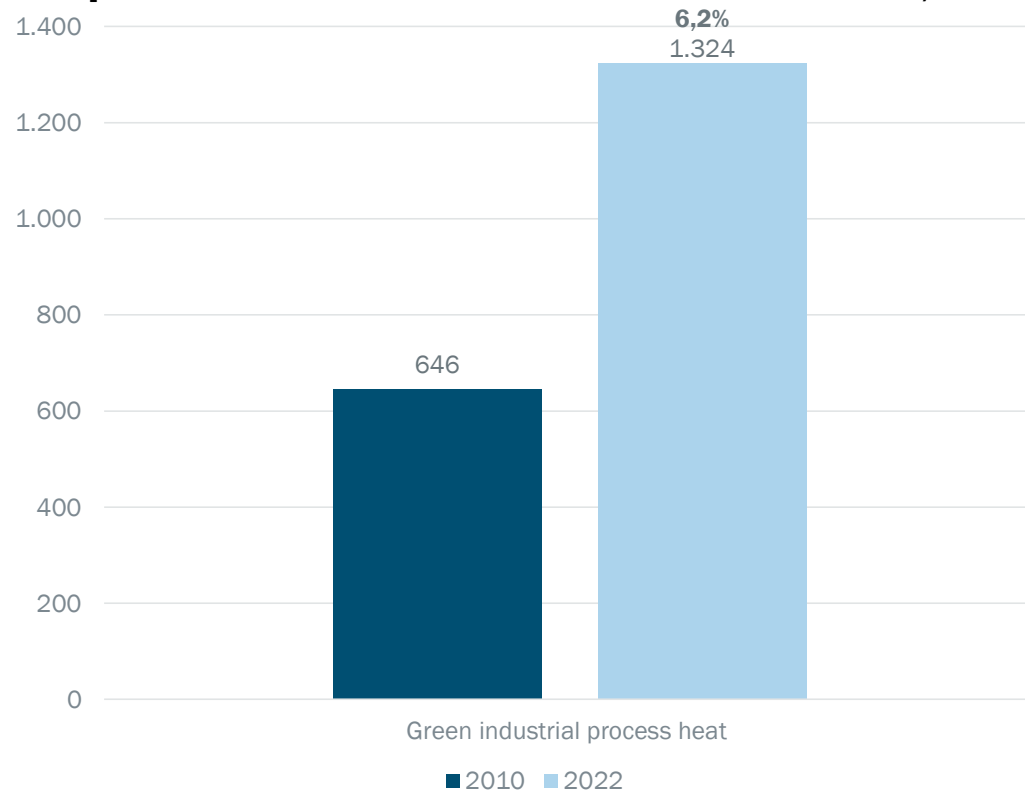
Global top 5 import markets in 2022 in € million and import volume 2010 in € million, with growth 2010 - 2022 in % p.a.



Import market development of green industrial process heat (GIP) in countries with free market access for the EU*



Imports of green industrial process heat technologies from countries with free market access for EU companies* in 2010 and in 2022 in € million, with growth 2010 - 2022 in % p.a.

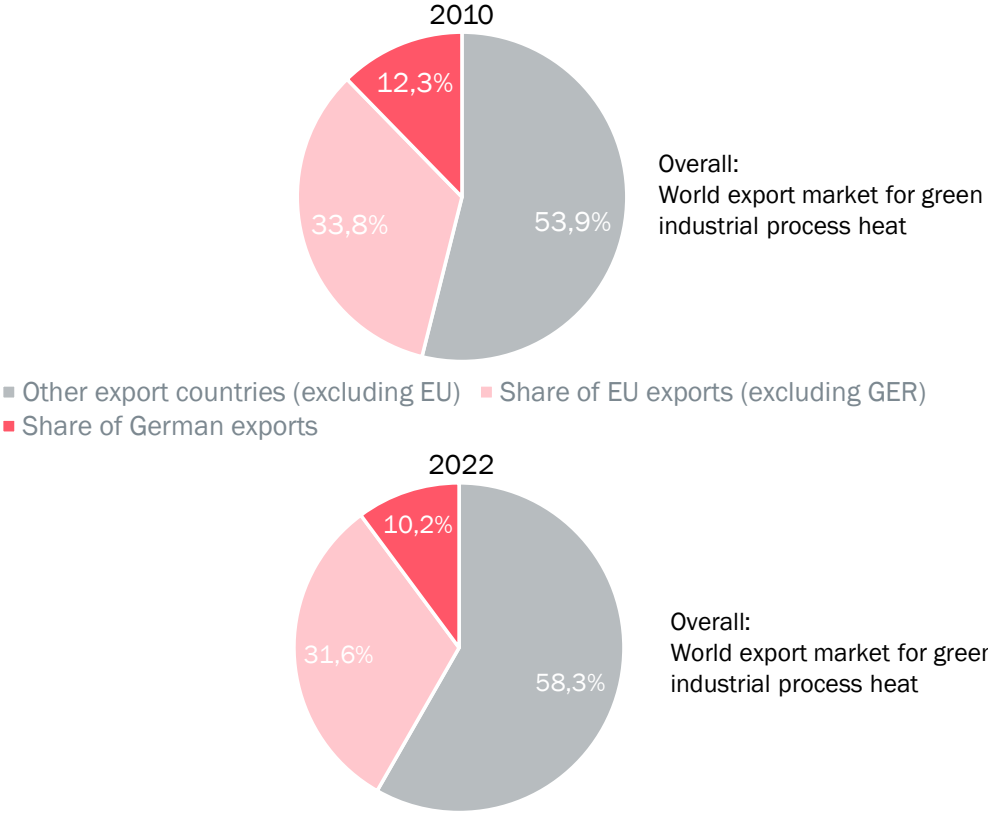
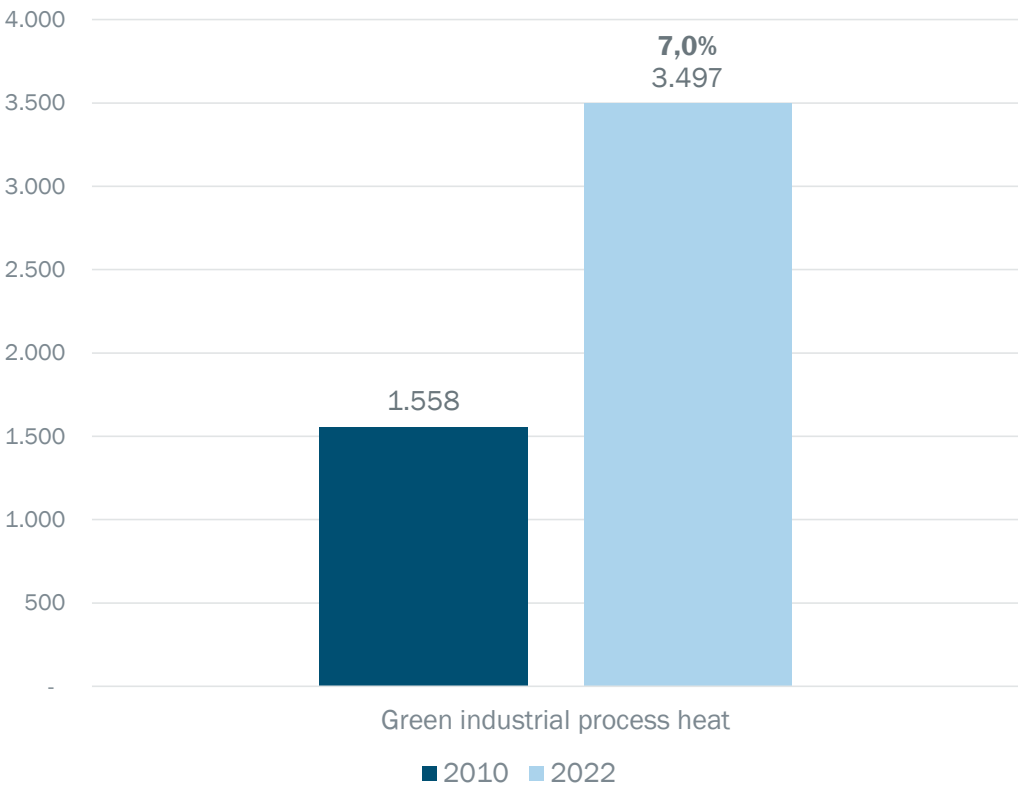


- German share of imports from countries with free market access* is almost constant
- Compared to significant decrease of German share in global imports (see slide 17)
- Increase in market share for industrial heat pumps and measurement & control technology
- Significant decrease in sector of technologies for the renewable generation of process heat (-4.5 %)



Exports from European (EU-27) suppliers of the green industrial process heat are increasing significantly between 2010 and 2022

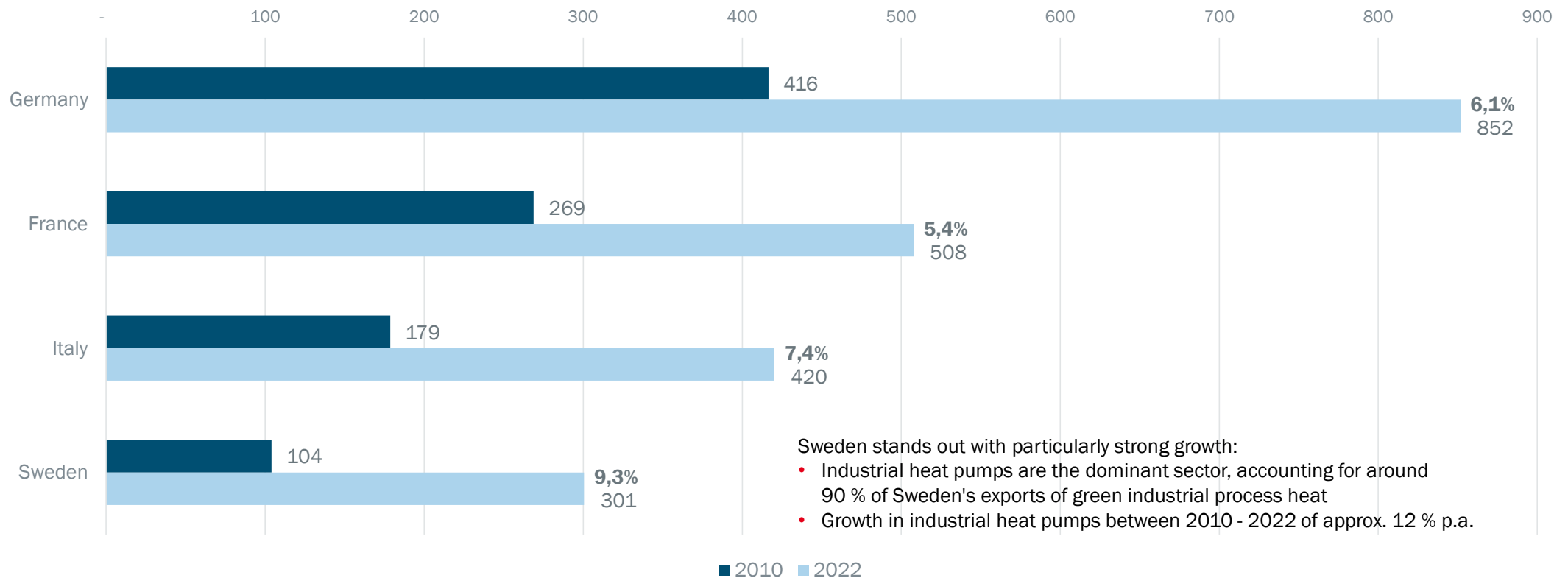
Combined exports of EU-27 countries in 2010 and 2022 in € million, with growth 2010 - 2022 in % p.a.





Swedish exports have tripled since 2010 and France is the second largest exporter of the EU after Germany

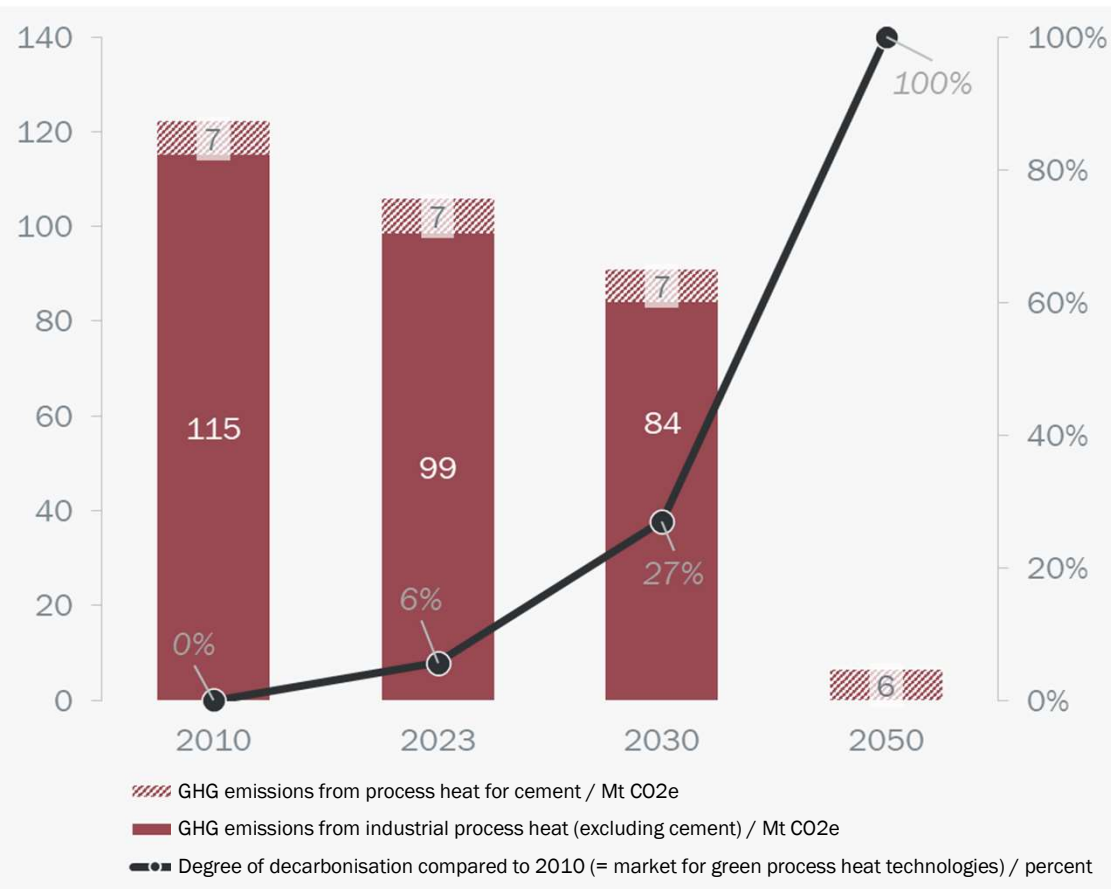
European top-4 export markets in 2010 and 2022 in € million, with growth rate 2010 - 2022 in % p.a.



Perspective market volume

04

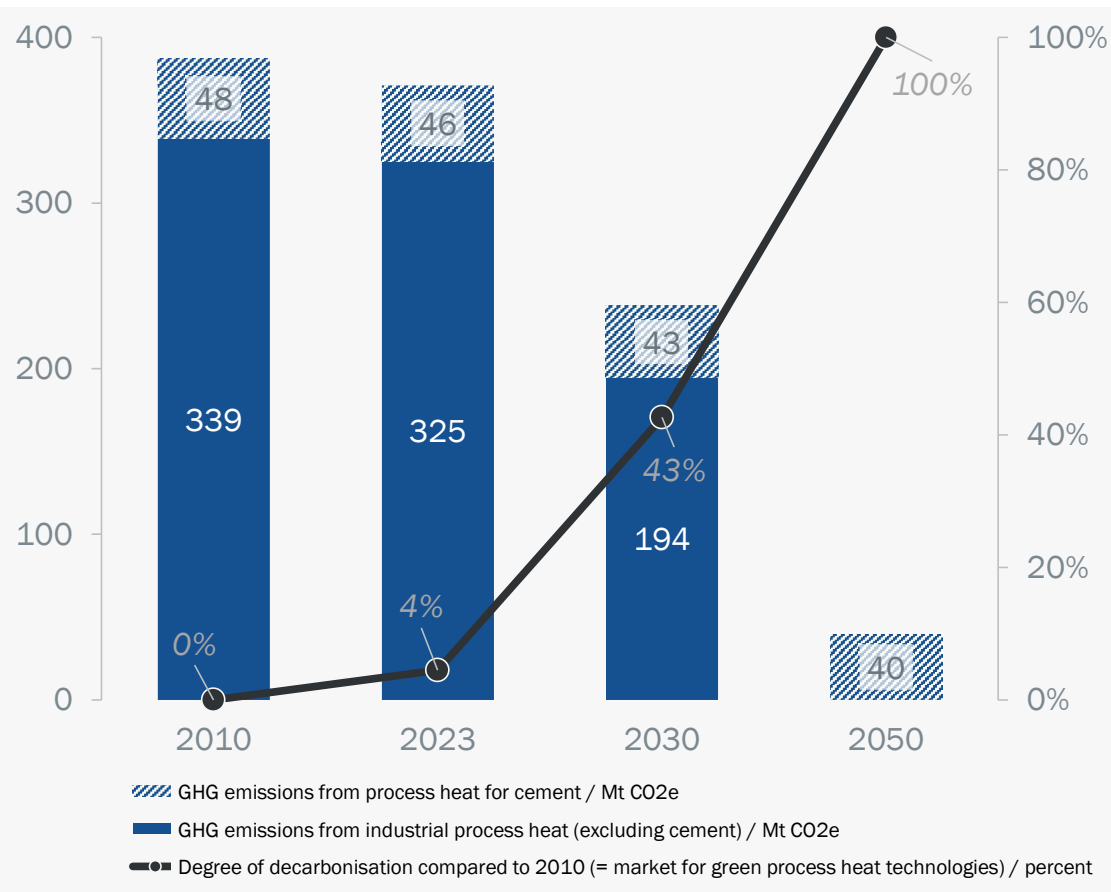
Germany – Market volume for green process heat...



... potentially grows by a **factor of 18** by 2050 ...

- ... and already by a factor of 5 by 2030 - if GHG targets are met
- Potential German market until 2030:
labour force ~270.000
gross value added ~€25 billion (nominal)
- Potential German market until 2050:
labour force ~1.005.000
gross value added ~ €91 billion (nominal)

EU-27 – Market volume for green process heat...



... potentially grows by a **factor of 22** by 2050 ...

- ... and already by a factor of 10 by 2030 - if GHG targets are met
- Significantly faster increase by 2030 in the EU scenario (fit-for-55 mix) than in the German scenario (KSG)
- German market roughly corresponds to a third of the EU-27 market

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