

Heat pump transition in the EU

Regulatory framework, status quo, good practices

Markus Offermann, Mustafa Abunofal (Guidehouse)

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Heat pumps; decarbonisation of heating & cooling; sector coupling

- Germany:
 - Scientific support to the government’s heat pump initiative (heat pump offensive)
 - Simulation of expected impacts of heat pump rollout in existing buildings
- UK:
 - Supporting HP rollout of Western Power Distribution (utility) to pilot new commercial arrangements & use flexibility potential
- MENA region:
 - Cool Up: Upscaling Sustainable Cooling in the MENA region
 - MENA LINKS: Supporting renewable energy integration through smart grids & sector coupling

Upgrading building energy legislation

- MENA region:
 - Build ME: Boosting ambitions to achieve a climate-neutral building standard in the MENA region
- EU:
 - Support to the European Commission’s Impact Assessment for the revised Energy Performance of Buildings Directive
 - Supporting industry associations in assessing impacts of reformed building energy legislation
- Germany:
 - Support to the German government’s reform of the Building Energy Act

Implementing and monitoring building energy regulations

- EU:
 - Updating the cost-optimality framework for minimum energy performance requirements
 - Supporting the EU Building Stock Observatory
 - Analysing Long-term Renovation Strategies and Recovery and Resilience Plans
- Germany:
 - Supporting the government fulfil EU reporting requirements (e.g. on cost-optimality, heating inspections etc.)

Accounting & reducing financed emissions of financial institutions

- Global:
 - Partnership for Carbon Accounting Financials with 470+ financial institutions

Outline



1 EU Strategic and legislative framework [15 min]

Targets for HP rollout, overview of relevant policies to

- Stimulate demand
- Ensure sustainability
- Strengthen value chains



2 Market situation in the EU, incl. solutions with natural refrigerants [15 min]

- Market status
- Technology availability
- Market penetration
- Labour and Capacity Building



3 Selected good practice examples and incentives in EU Member States and beyond [10 min]

- Carbon Tax, Sweden
- Heat Pump System Module, Switzerland
- Heat Pump Offensive, Germany



4 Key takeaways and Discussion [15 min]

Strategic and legislative framework for heat pumps in the EU

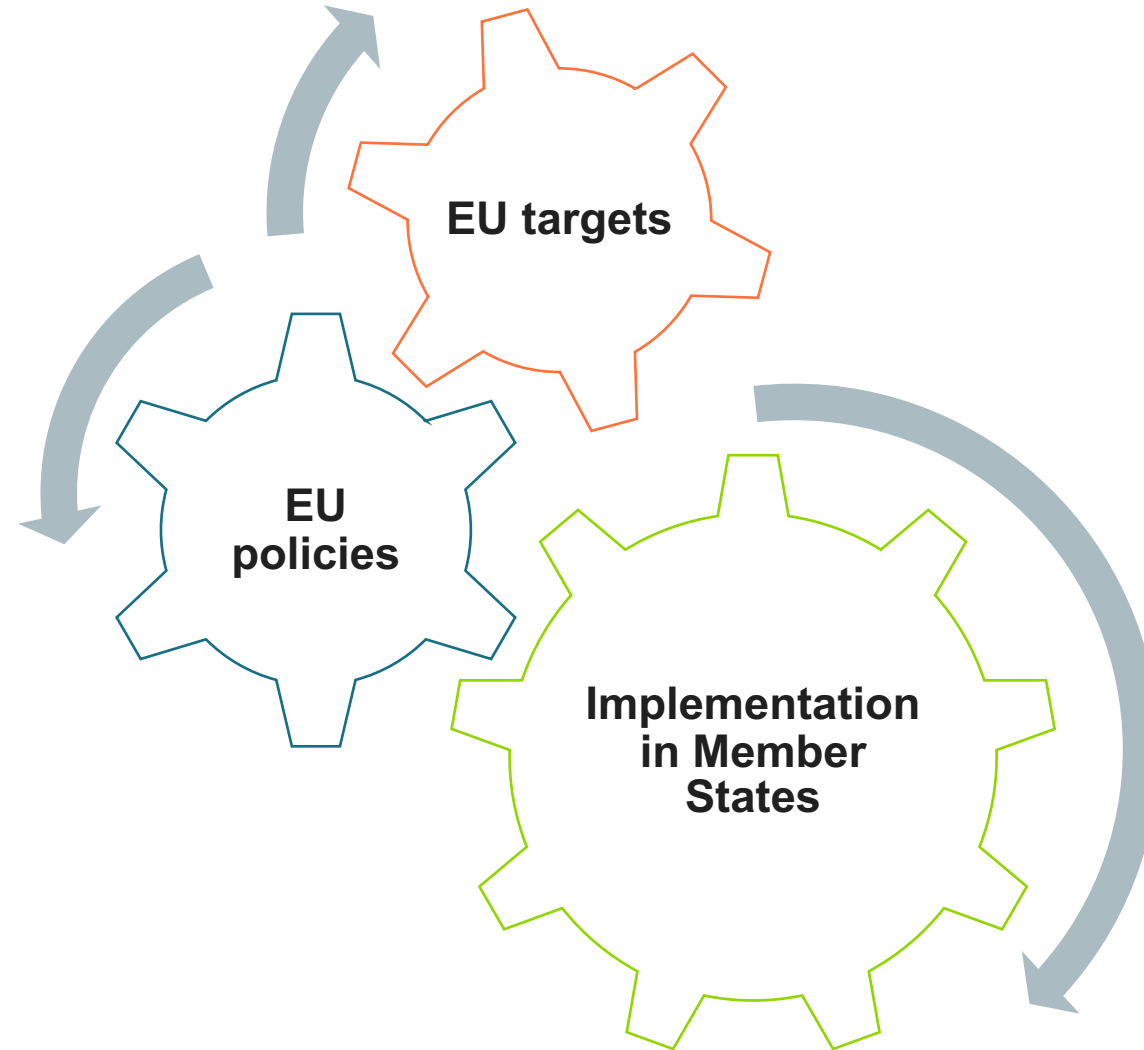


This section's takeaways:

- ✓ Main pillars of the EU framework for the climate-neutral transformation
- ✓ Heat pump-related EU targets and strategies
- ✓ Key EU policies for the uptake of sustainable heat pumps

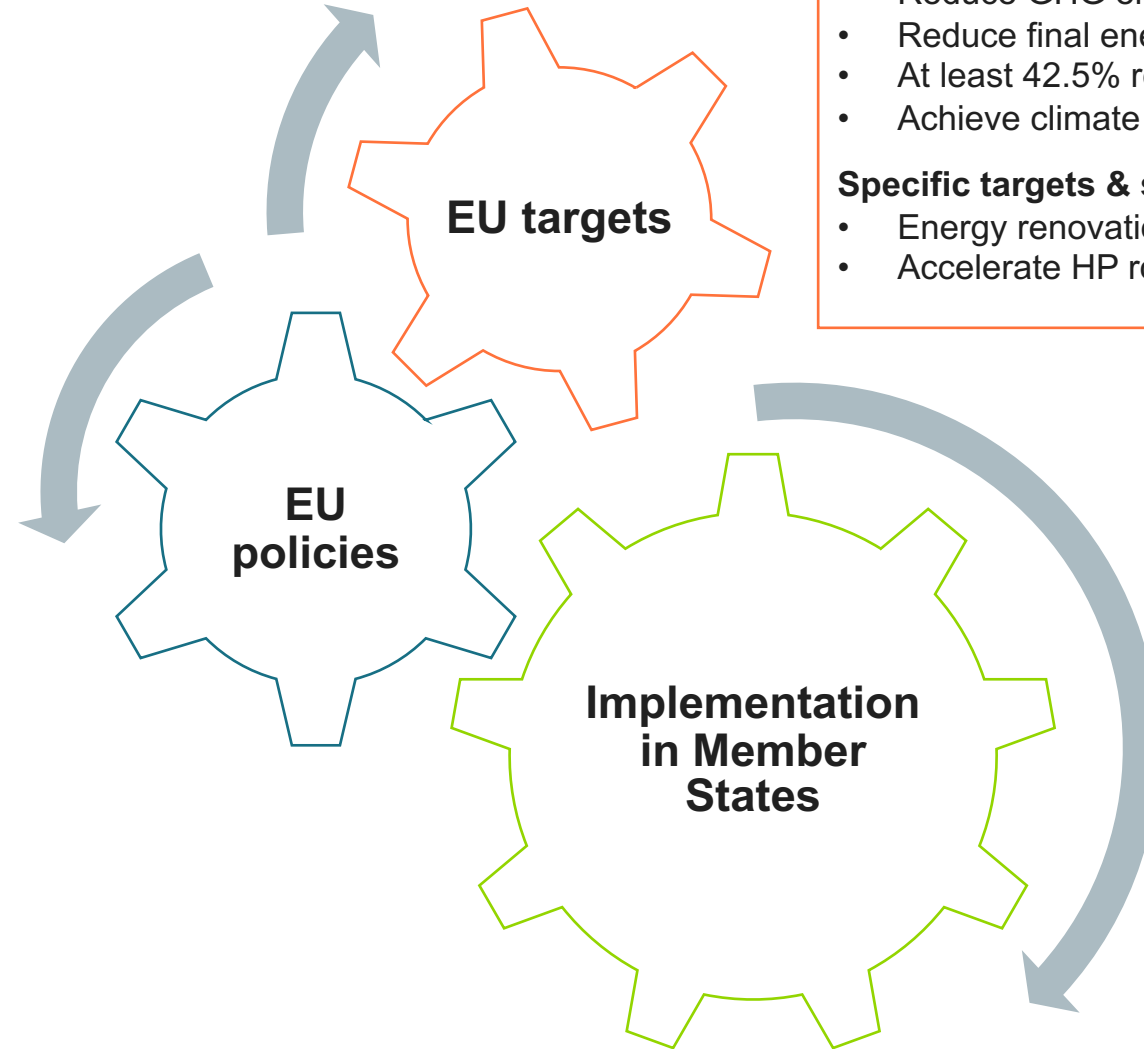
The EU's multilevel governance framework

From targets to policy implementation



The EU's multilevel governance framework

From targets to policy implementation



Overarching objectives:

- Reduce GHG emissions 55% by 2030
- Reduce final energy consumption 11.7% by 2030
- At least 42.5% renewables in FEC by 2030
- Achieve climate neutrality by 2050

Specific targets & strategies, e.g.:

- Energy renovation of buildings
- Accelerate HP rollout

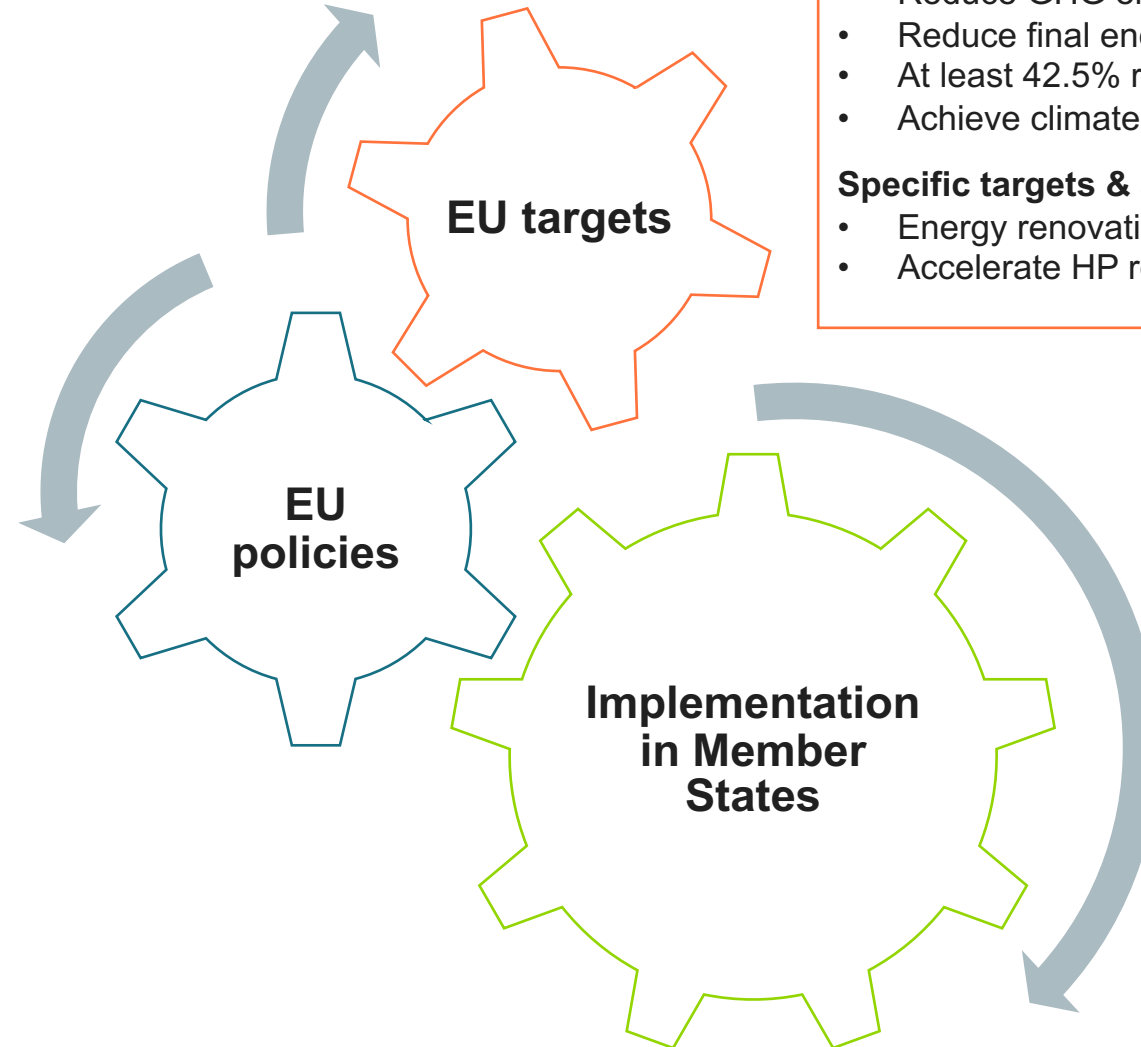
The EU's multilevel governance framework

From targets to policy implementation

Heatpump related EU Policies

Indirectly addressing HPs:

- Regulatory requirements (→ e.g. EPBD)
- Pricing mechanisms (e.g. ETS I & II)
- Support and incentives (e.g. RRF, Horizon Europe)
- Strategy and communication



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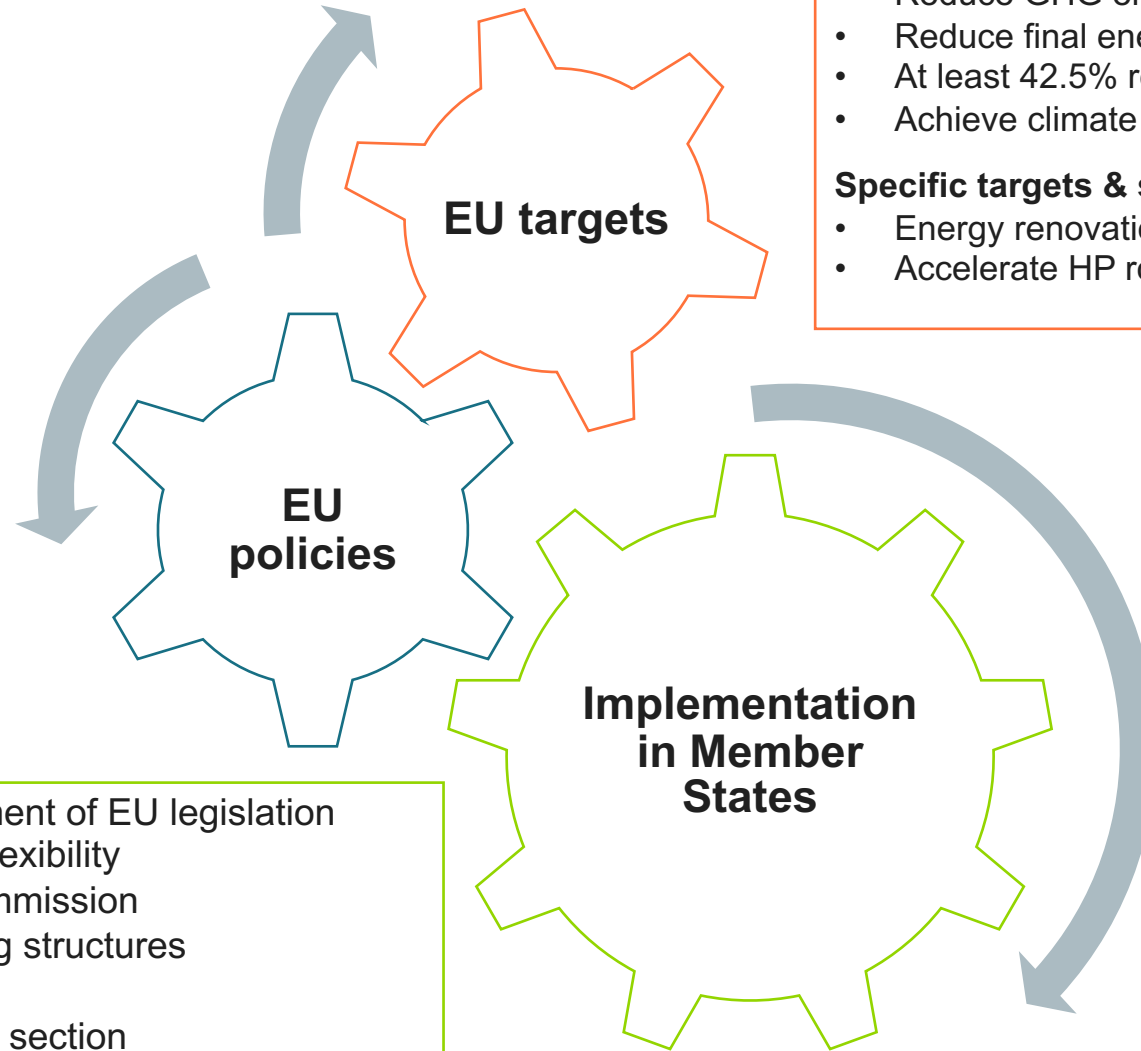
- Energy renovation of buildings
- Accelerate HP rollout

EU policies

Implementation in Member States

- Implementation & enforcement of EU legislation
- National strategies, some flexibility
- Reporting to European Commission
- Use / implement EU funding structures

➡ focus of last presentation section

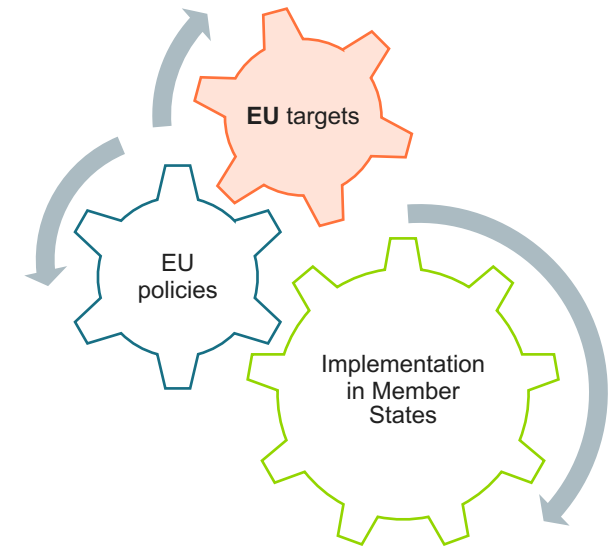


Dedicated EU strategies & objectives

Where we stand:

- Ca. 50% of EU energy consumption is for heating, >70% covered by fossil fuels
- Heating & domestic hot water account for ca. 80% of household energy use in the EU

* Eurostat / EC



Boost energy renovations

Renovation Wave (2020):

- Double renovation rate
- 'mandate' for revising buildings directive (EPBD)
- Decarbonise heating & cooling → increased targets in renewables directive
- Tackle energy poverty

Accelerate RES & HP rollout

REPowerEU & 'EU Save Energy' (2022):

- Aim of 45% renewable energy by 2030; 69% in electricity
- Install ≥ 10m additional HP by 2027 [2022: 3m]; Accelerate HP deployed for DHC
- Possible phase-out of fossil stand-alone boilers envisioned from 2029

Green Deal Industrial Plan (2023):

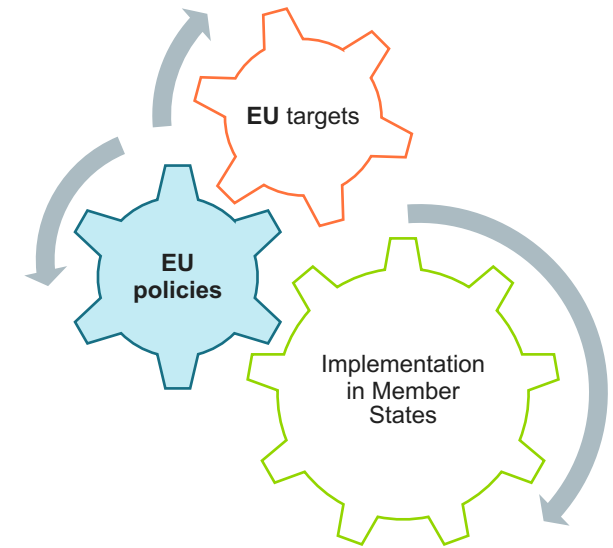
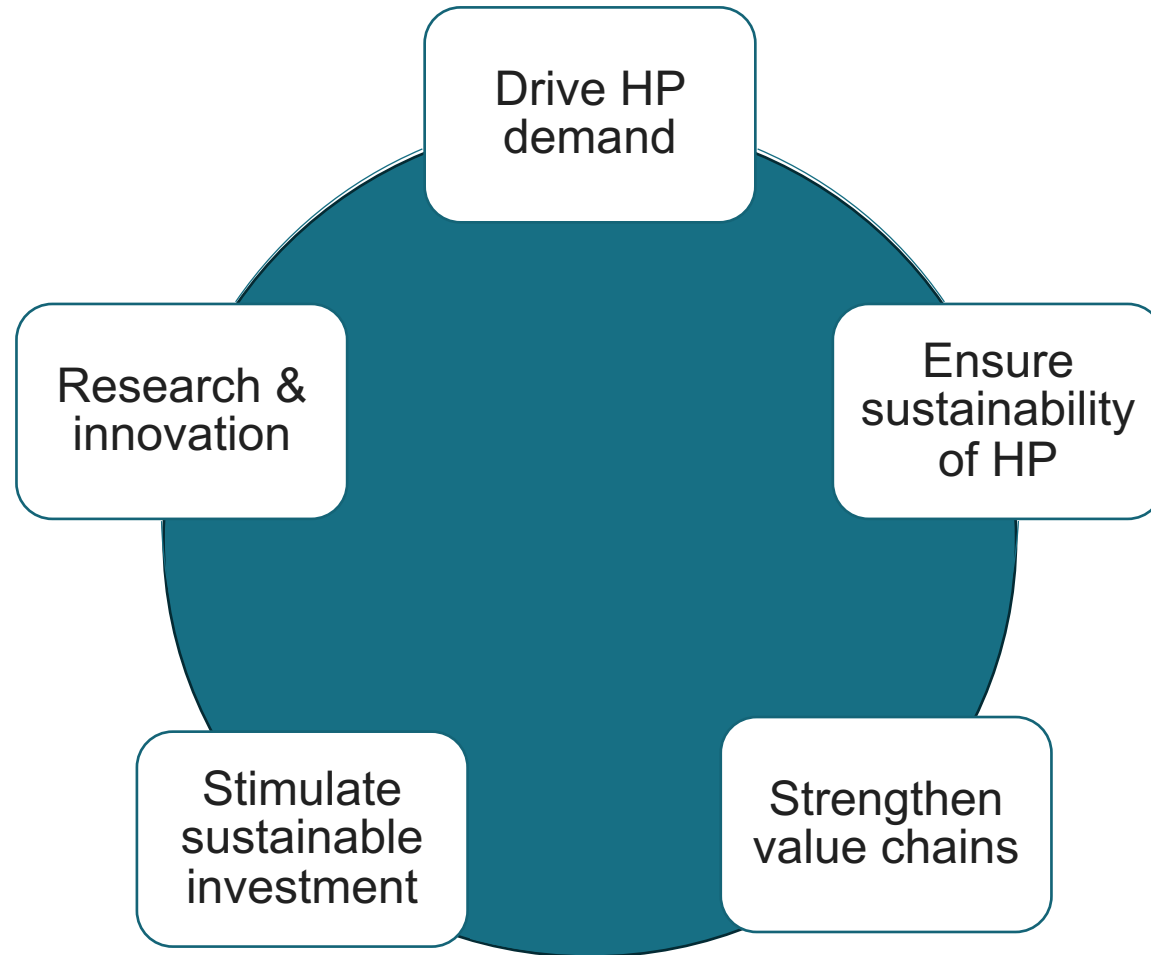
- Aim for +30m HP by 2030 vs. 2020
- Scale-up HP manufacturing

Address HP market barriers

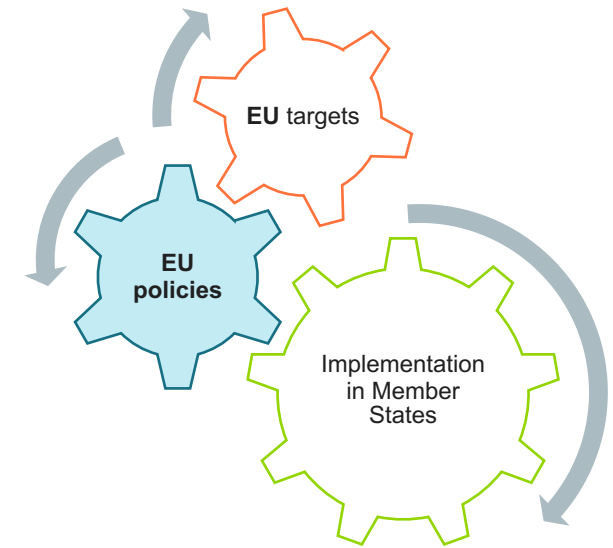
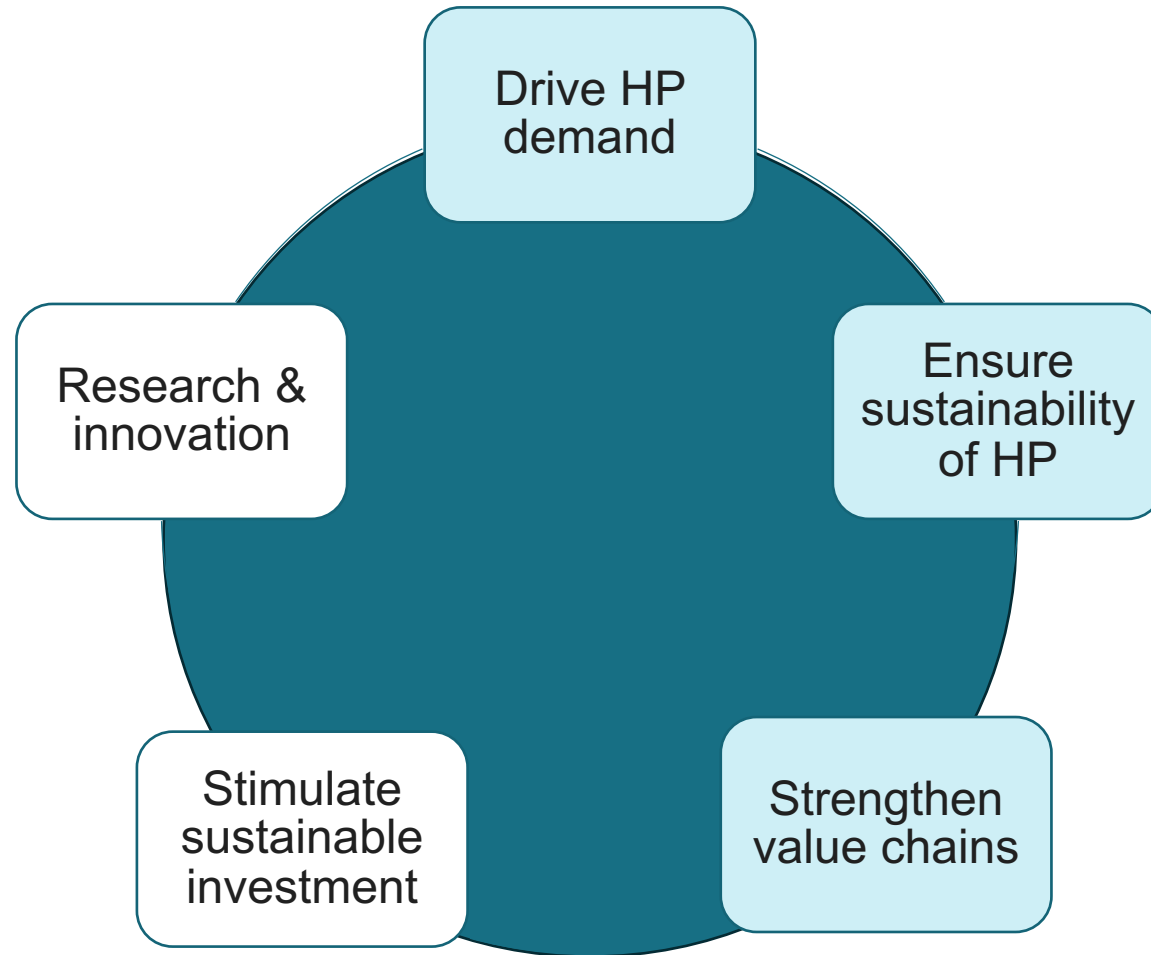
Heat Pump Action Plan (still to be adopted):

- Targeted communication
- Skills partnership
- Legislative changes
- Mapping of financing possibilities

Aspects of heat pumps addressed by EU policies



Aspects of heat pumps addressed by EU policies

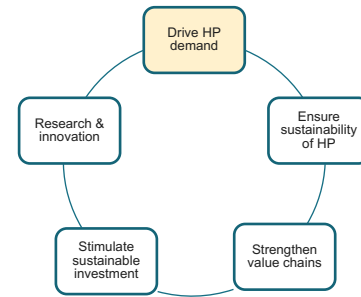


EU policies stimulating HP demand primarily by indirect means

Energy Performance of Buildings Directive (EPBD)

→ Improving building energy performance → HP key technology option

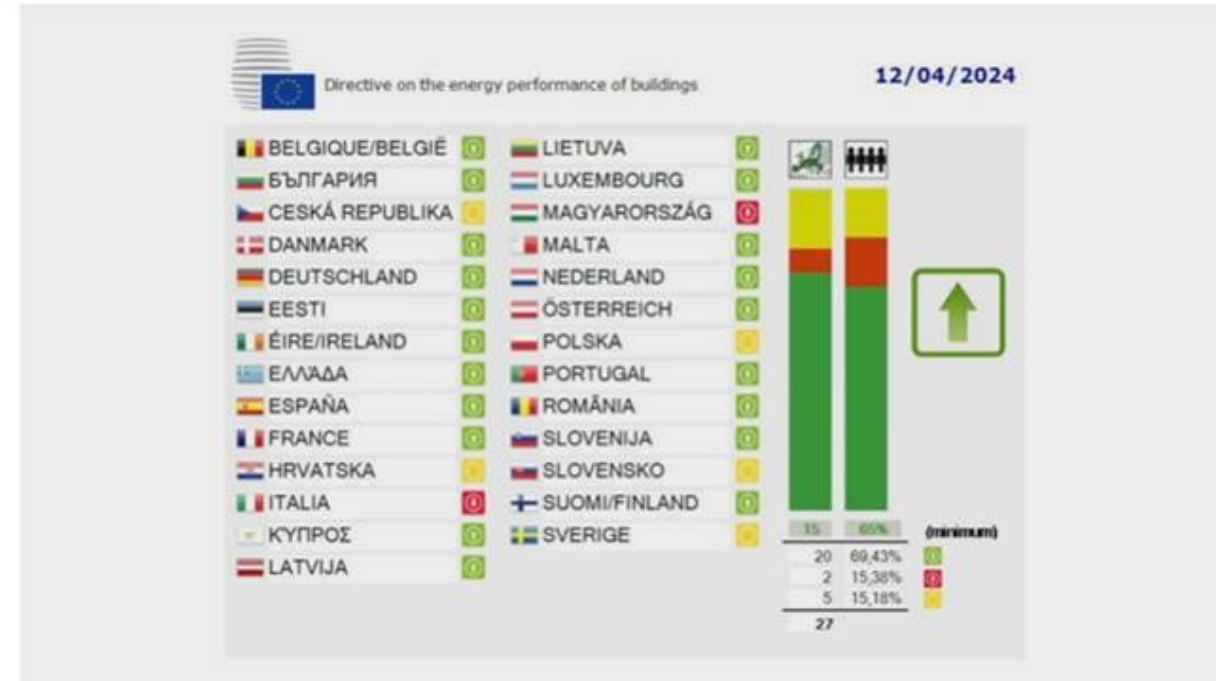
- Aim: Achieve zero-emission EU building stock by 2050
- *Zero-Emission Building* standard for new buildings from 2030*, i.e.
 - zero onsite carbon emissions from fossil fuels
 - very low energy demand, calculation of life-cycle GWP
- *National Building Renovation Plans*, incl. –
 - roadmap to phase out fossil fuels in H&C
 - aim to phase out of fossil boilers by 2040
- Minimum efficiency requirements to be at least cost-optimal
 - In various States, HP more economical over their lifespan (e.g. Germany)
- Trajectories and phased minimum standards for existing buildings (residential vs. non-residential)
 - HP can be an option to address worst-performing buildings



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EU policies stimulating HP demand primarily by indirect means

Renewable Energy Directive (RED) → Boosting renewable energy in H&C

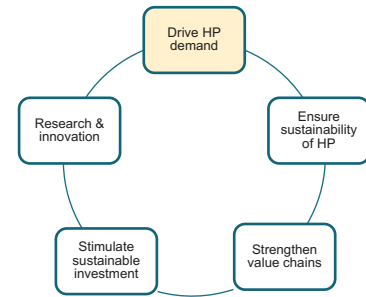
- Member States to increase RES-H&C by 0.8 %p/a (2021-2025) and 1.1 %p/a (2026-2030)
 - Member States collectively to reach at least 49% RES in buildings (indicative)
- *HPs powered by decarbonised electricity as a major technology option*

Energy Efficiency Directive (EED) → Strengthening RES and efficiency in H&C

- Requirement for comprehensive heating and cooling assessment
 - Increasing RES / GHG requirements for 'efficient' DHC systems
 - Until 2027: at least 50% RES, waste heat, 75% cogenerated heat, or combination
 - From 2050: only RES, waste heat, or combination
- *HPs powered by decarbonised electricity as a major technology option*

Emissions Trading Scheme II (ETS II) → EU carbon price on fossil emissions in buildings, starting 2027

- Heating costs with efficient HP will get (somewhat) more attractive
- Social Climate Fund to support efficiency measures



EU policies ensuring HP sustainability

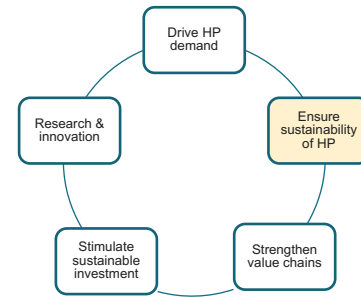
Minimum environmental requirements for marketing HP in the EU

Ecodesign Regulation for Space Heaters (2013/ 2017)

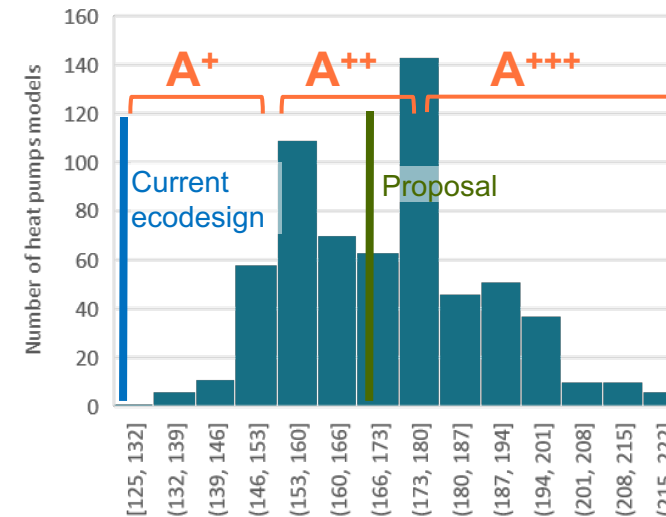
- 110% seasonal space heating energy efficiency (η_s);
125% for low-temp. HP
- Max. sound power output (65 dB \leq 6 kW through 88 dB $>30 \leq$ 70 kW)
- EU Commission proposal (2023) to increase min. efficiency to 145% vs. 170% for low-temp. HP

Ecodesign Regulation for air conditioners and comfort fans (2012/ 2016)

- Relevance: air-air HP with \leq 12 kW for cooling/ or heating if intended use is space heating for thermal comfort
- Efficiency requirement depending on refrigerant GWP (150 threshold) and output (< 6 kW vs. 6-12 kW)
 - SCOP of 3.42 to 3.8 (except single/ double duct AC)
 - Single duct AC: COP_{rated} of 1.84 / 2.04
 - Double duct AC: COP_{rated} of 2.34 / 2.6
- 65 dB Max. sound power level indoor (single & double duct AC)
- Planned revision to introduce SCOP for all & link to F-Gas Regulation



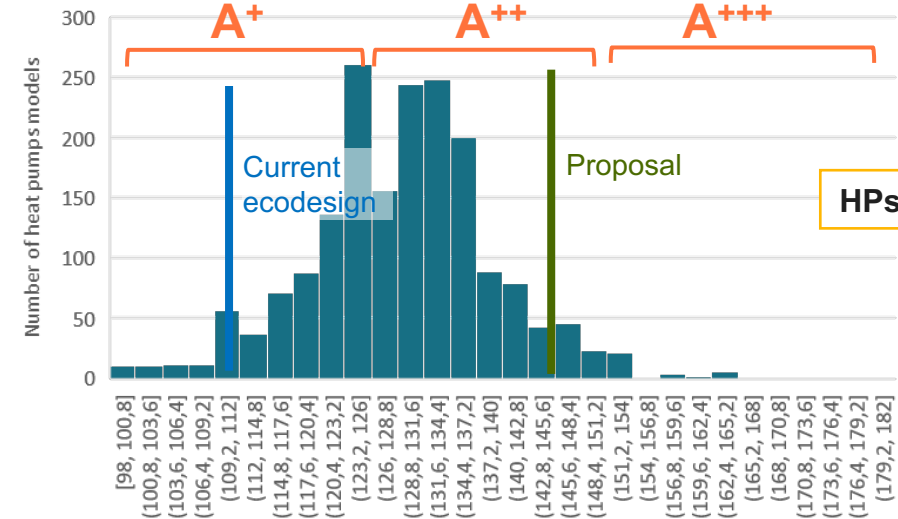
Air-Water heat pumps space heating seasonal efficiency distribution



HPs 35°C (LT)

Source: own evaluation based on [get-database](#)

Air-Water heat pumps space heating seasonal efficiency distribution



HPs 55°C (HT)

EU policies ensuring HP sustainability

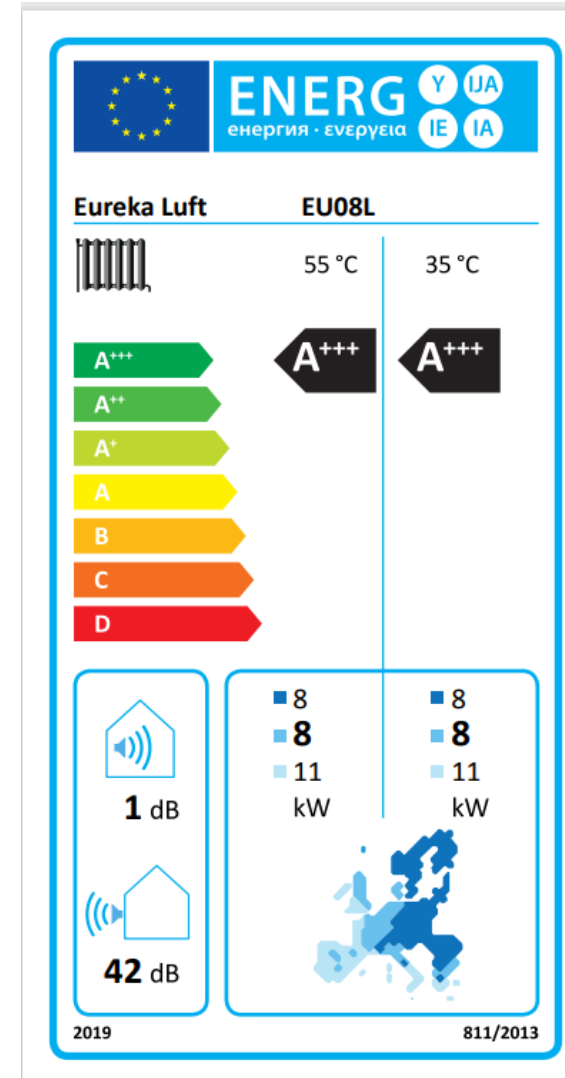
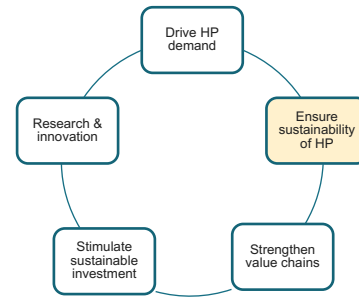
Labelling to enable transparency and sustainable purchasing decisions

Energy Labelling Regulation for [space heaters](#) (2013/2017) and for [air conditioners](#) (2011/2023)

Requirements on:

- Efficiency class (SCOP for space heaters)
- Sound power level (indoors/outdoor)
- Rated heat output under average/ colder/ warmer climate conditions

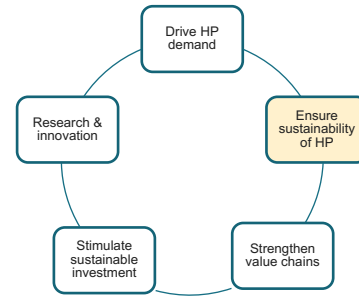
→ Regulation on space heater labelling soon to be revised (cf. next slide)



Example of a space heater label (heat pump)

EU policies ensuring HP sustainability

Labelling to enable transparency and sustainable purchasing decisions

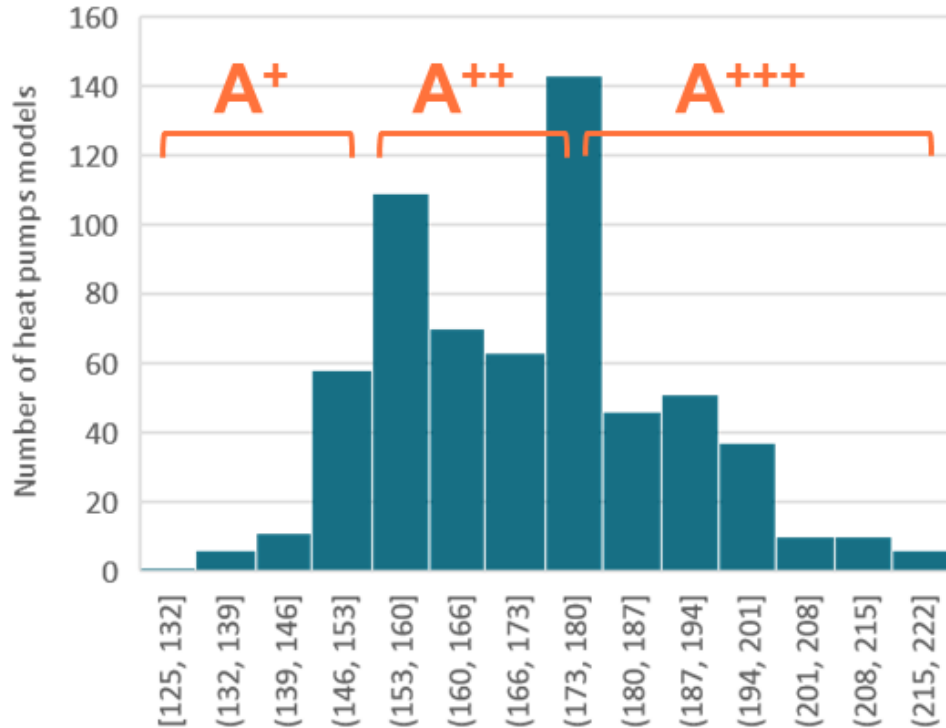


Revision of space heater energy label

HPs 35°C (LT)

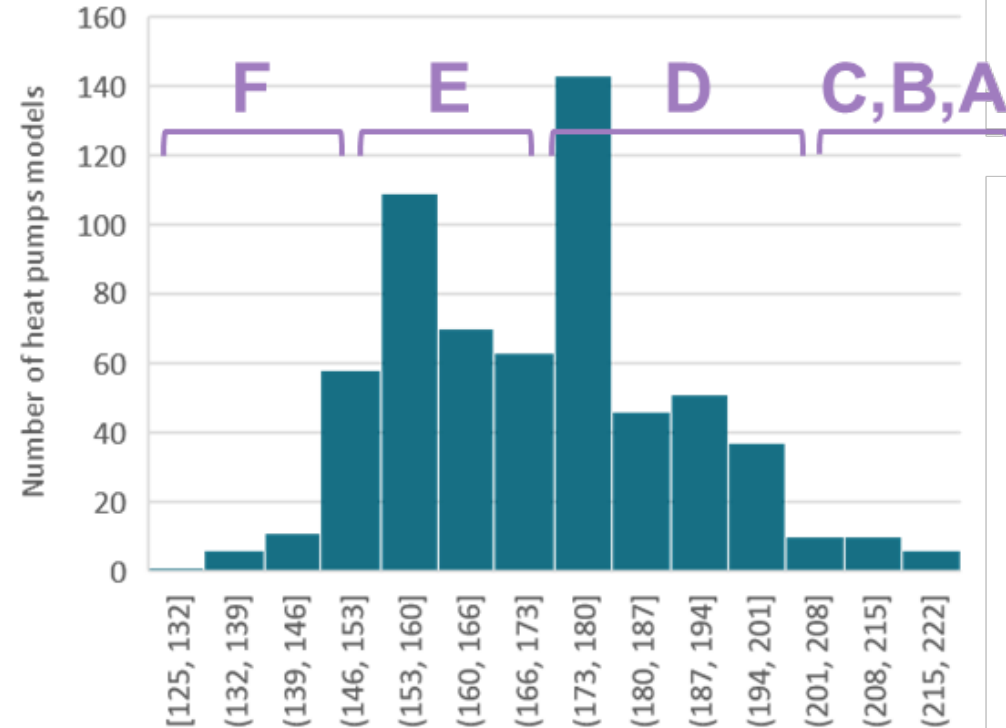
Current:

Air-Water heat pumps space heating seasonal efficiency distribution



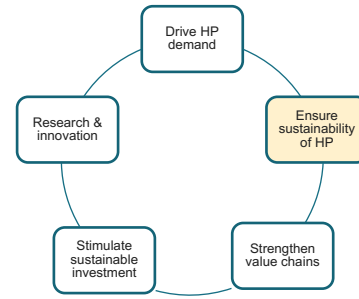
Proposal (final proposal expected Q3 2024):

Air-Water heat pumps space heating seasonal efficiency distribution



EU policies ensuring HP sustainability

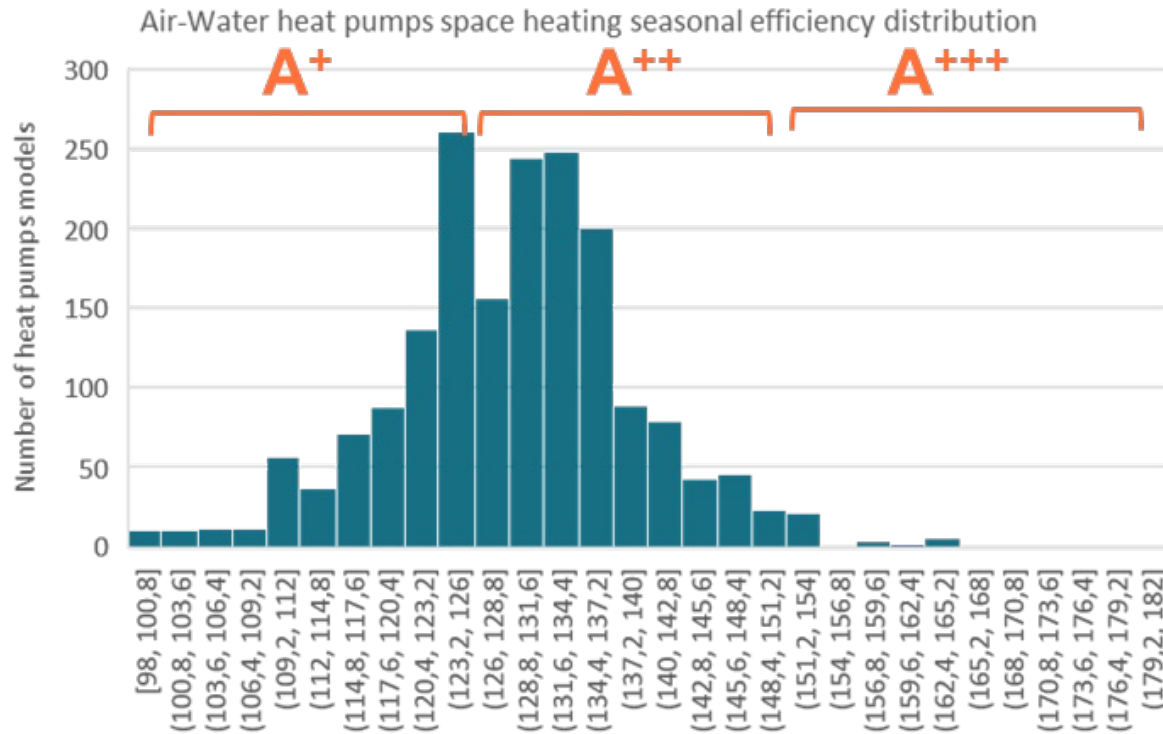
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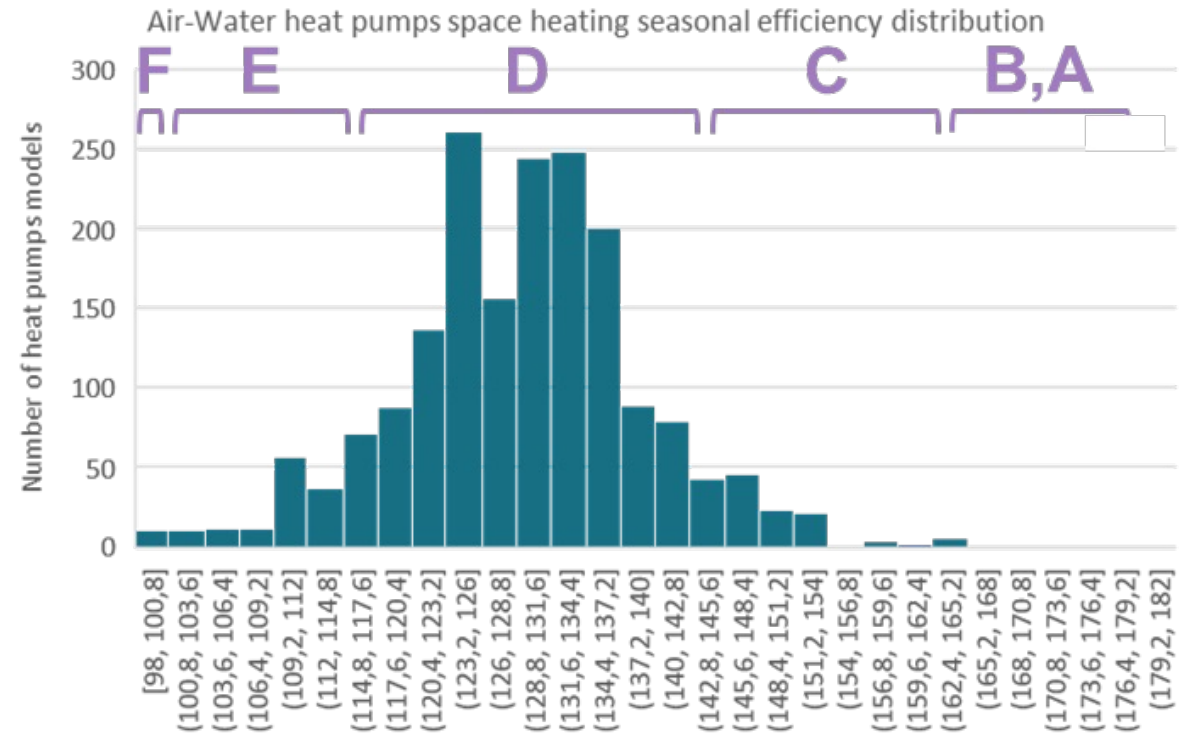
Revision of space heater energy label

HPs 55°C (HT)

Current:



Proposal (final proposal expected Q3 2024):



EU policies ensuring HP sustainability

Transition to sustainable refrigerants

New EU F-Gas Regulation 2024 to phase out refrigerants with high GWP

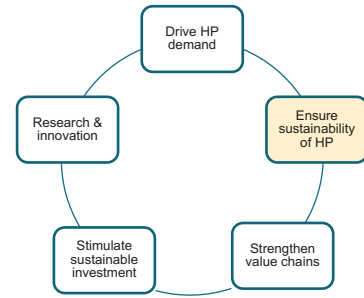
- GWP <150 in small (≤ 12 kW) HP from 2027
- no F-Gases small HP- Split from 2035, - monobloc from 2032

Affected HP types:

- Split systems
 - ≤ 12 kW GWP<150 from 2027
 - > 12 kW GWP<150 from 2033
- Monobloc:
 - ≤ 50 kW GWP<150 from 2027
 - > 50 kW GWP<150 from 2030

Proposed ban on per- and polyfluoroalkyl substances (PFAS)

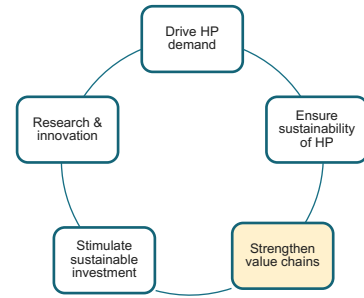
- Framework of REACH regulation
- Ongoing process:
 - Proposal by DK, DE, NL, NO (1/2023)
 - Public consultation (until 9/2023)
 - Evaluation by ECHA (since 3/2024) – risk assessment & socioeconomic analysis
- Commission decision pending
- Initial proposal would practically ban all HFC and HFO refrigerants



EU policies on strengthening value chains

Strengthening manufacturing and supply of strategic technologies

EU Net-Zero Industry Act (2024)



Aims:



- Strengthen the resilience & competitiveness of *net-zero technologies* manufacturing in the EU
 - Simpler & more predictable legal framework for manufacturers
 - Scale-up: Manufacture 40% of technologies needed to reach 2030 targets in the EU (deployment needs p.a.);
 - Reach 15% of world production by 2040
- At least 31 GW of HP manufacturing capacity by 2030

Requirements:



- Permitting of production facilities:
 - Single point of contact, online process
 - Time limits for permitting (12/18 months for <1GW/a / >1GW/a facilities)
 - Priority status for NZ projects recognised as 'strategic'
- Public procurement: Min. env. sustainability & resilience criteria
- Net-Zero Europe platform to advise NZ projects on financing

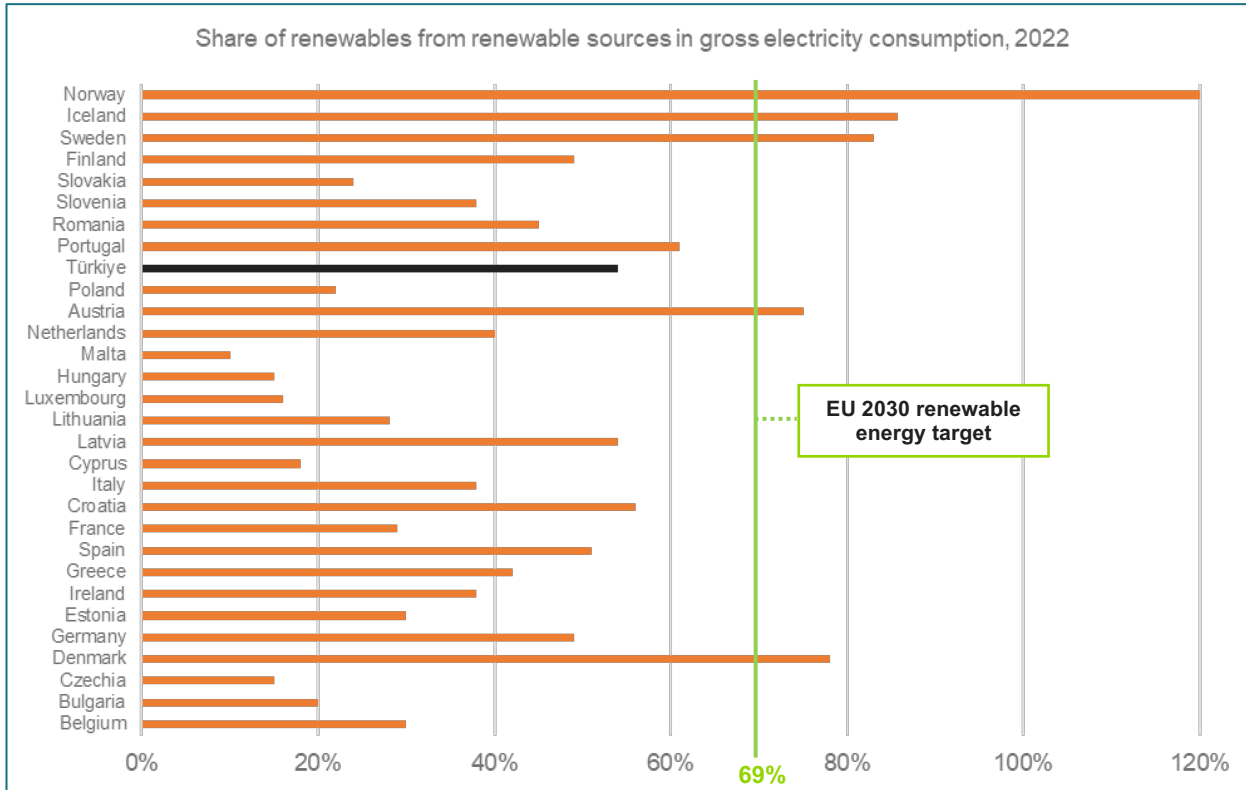
Market situation of Heatpumps in the EU, incl. solutions with natural refrigerants



This section's takeaways:

- ✓ **Market status**
 - ✓ Electricity grids
 - ✓ Energy economics
- ✓ **Technology availability**
 - ✓ Manufacturing capacities across the EU
 - ✓ Applications coverage
- ✓ **Market penetration**
 - ✓ Sales and Stock
- ✓ **Labour and Capacity Building**

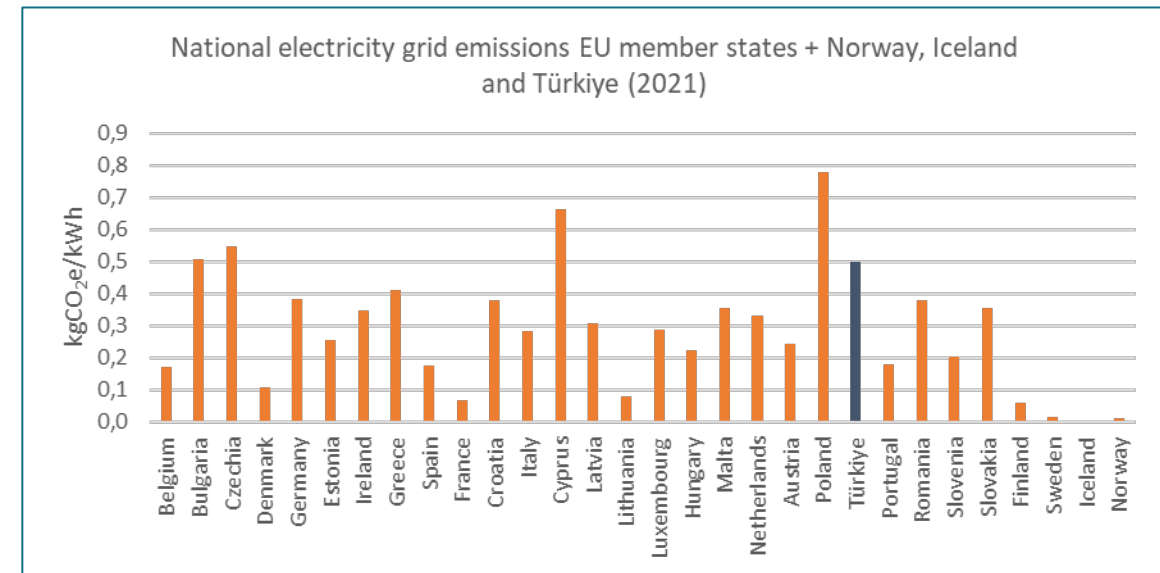
Market conditions: Electricity Grids



Source: [Electricity from renewable sources in 2022 - Eurostat \(europa.eu\)](https://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&plugin=1)

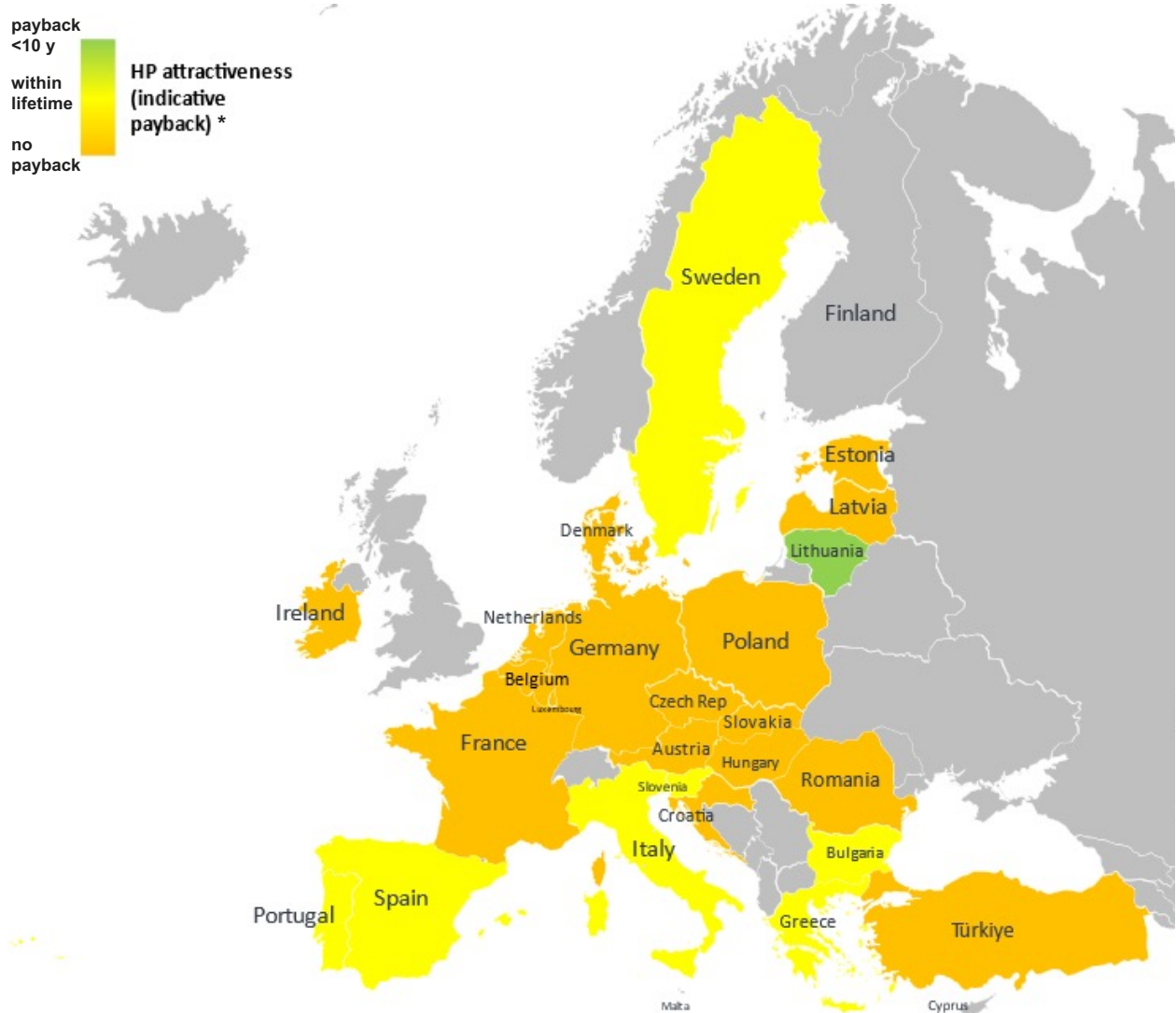
To reach the EU target of 69 % renewable share by 2030 significant efforts by all MS are necessary.

Some MS reached already more 60 % renewable share (Sweden, Denmark, Austria and Portugal), leading to low grid electricity CO₂ emission factors. Also, France, Belgium, Lithuania and Finland have very low carbon emitting grids, but mainly due to the use of nuclear power. Some MS have very ambitious short-term renewable targets (e.g. Germany 80 % by 2030)

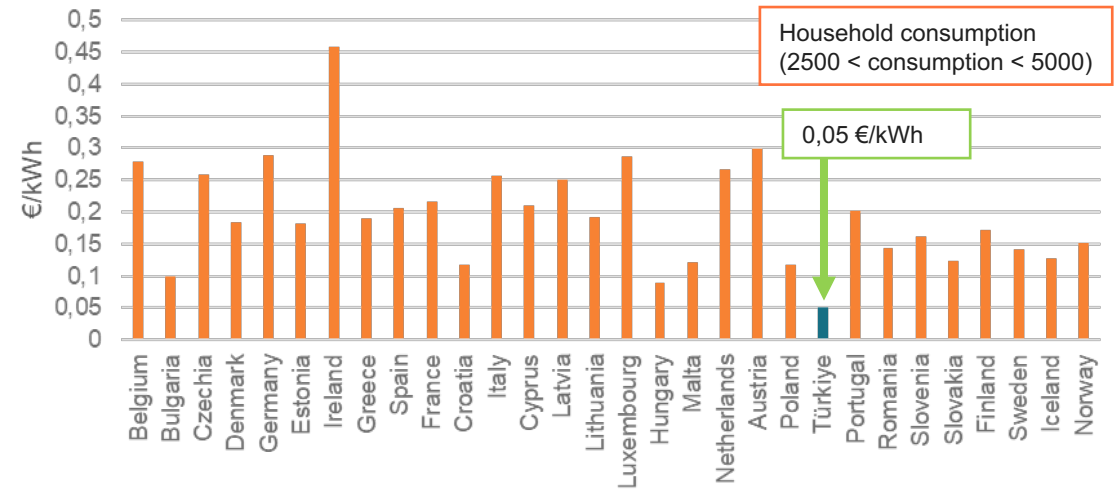


Source: [Joint Research Centre Data Catalogue - GHG Emission Factors for Electricity Consumption - European Commission \(europa.eu\)](https://ec.europa.eu/jrc/data-catalogue/)

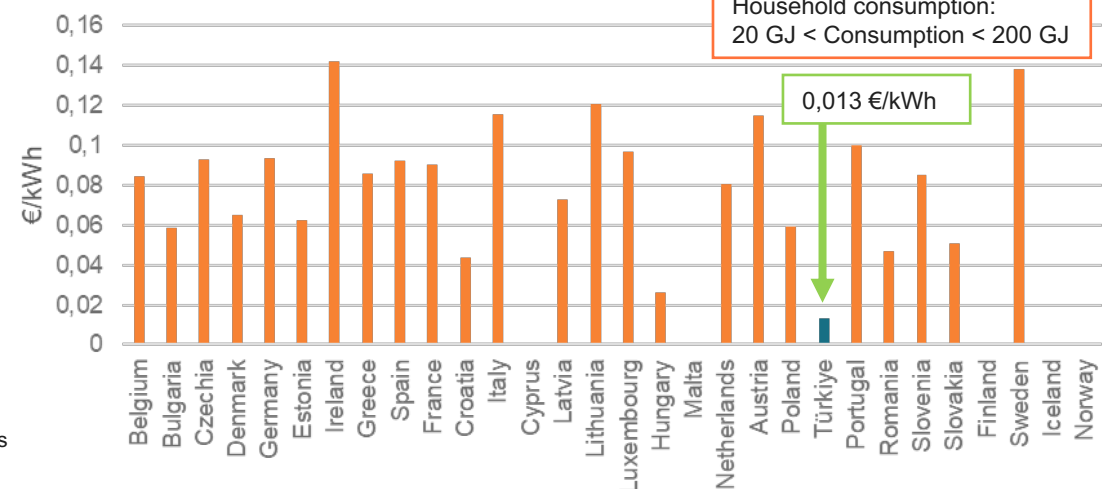
Current market conditions: Energy economics (without subsidies)



National electricity prices EU member states + Norway, Iceland and Türkiye (2023)



National gas prices EU member states + Norway, Iceland and Türkiye (2023)

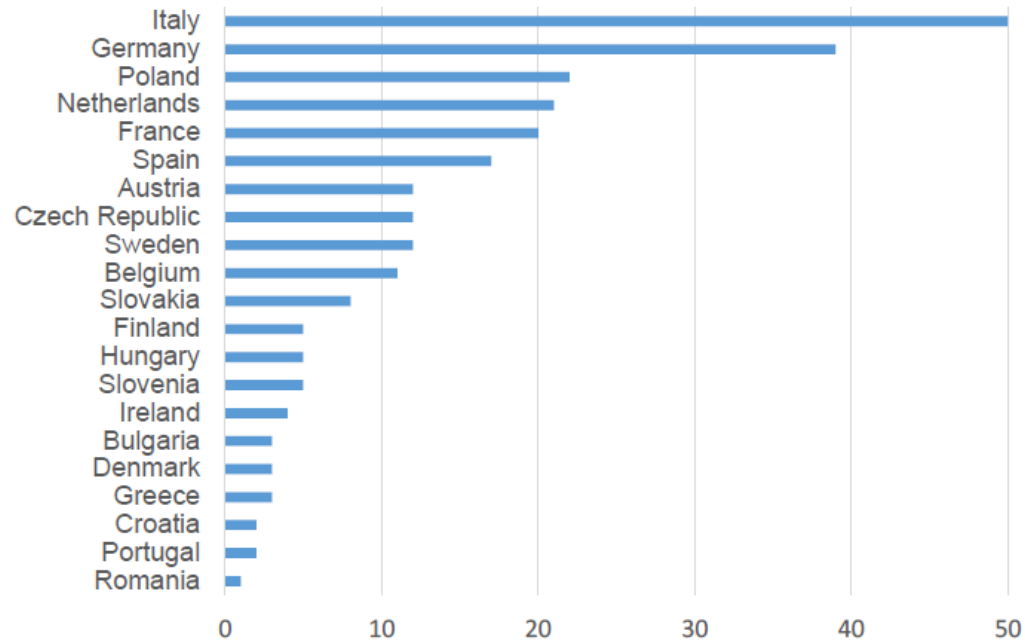


*) for a new air-water heat pump (not subsidised) in comparison to an alternative new gas boiler, considering the current energy prices

Technology availability: Manufacturing capacities across EU

There are more than **255 facilities** in the EU that manufacture (i.e. assemble) heat pumps, across 21 Member States

Figure 23. Heat pump manufacturer locations in the EU by country



Source: JRC based on various sources.

Note: Includes companies present in multiple countries but does not count multiple manufacturing sites in the same country. Excludes component manufacturers.

Source: JRC Publications Repository - Clean Energy Technology Observatory: Heat pumps in the European Union - 2023 Status Report on Technology Development, Trends, Value Chains and Markets (europa.eu)

In **unit** terms, France, Germany, Sweden and Italy are likely the Member States that manufacture the largest number of heat pumps

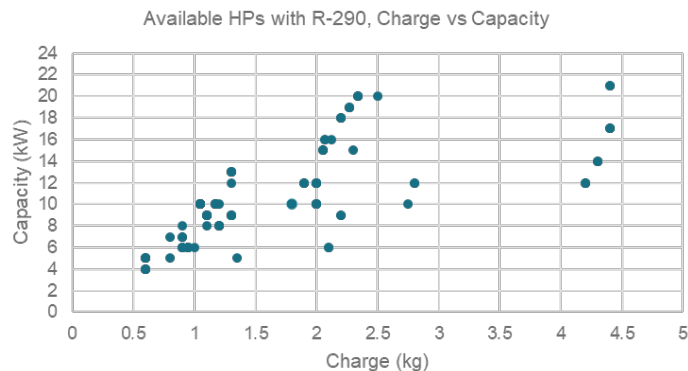
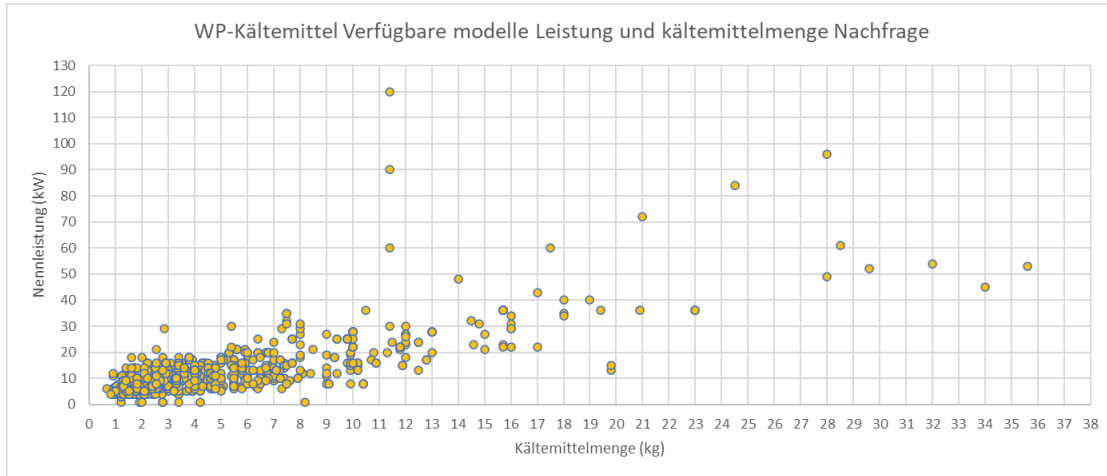


A distribution of companies / manufacturers that already have or announced natural refrigerants-based solutions in their portfolio

Source: Heat Pumps Report 2023 - ATMOSphere

Technology availability: Applications coverage

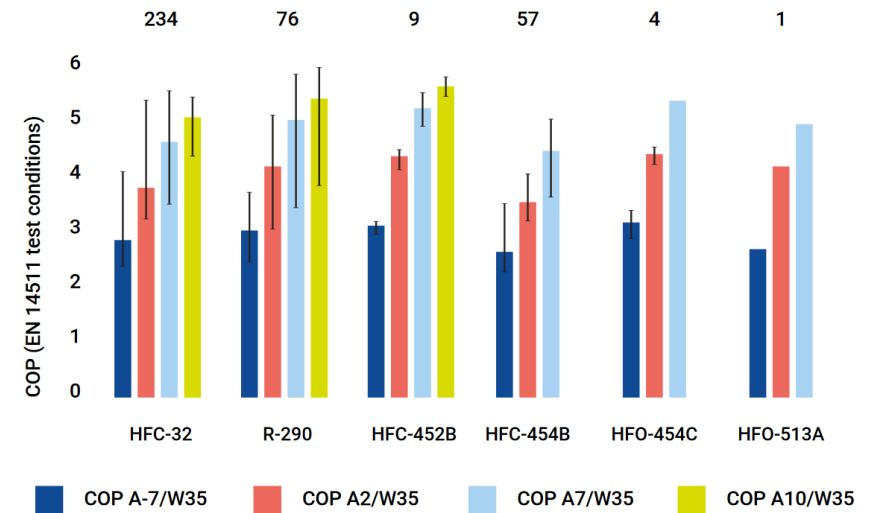
The heat pumps available on the market that use conventional refrigerants cover a wide range of applications with powers from **1 kW** to **120 kW** with different amounts of refrigerant across different capacities and manufacturing models.



Source: Own evaluation based on [get-database](#)

R-290 applications are available for various types of heat pumps and cover a wide range of application capacities, ranging from small applications with capacities of **4 kW** to capacities of more than **22 kW**.

This range of available capacities covers **most residential applications** (both single-family and multi-family).



Source: [Heat Pumps Report 2023 - ATMOsphere](#)

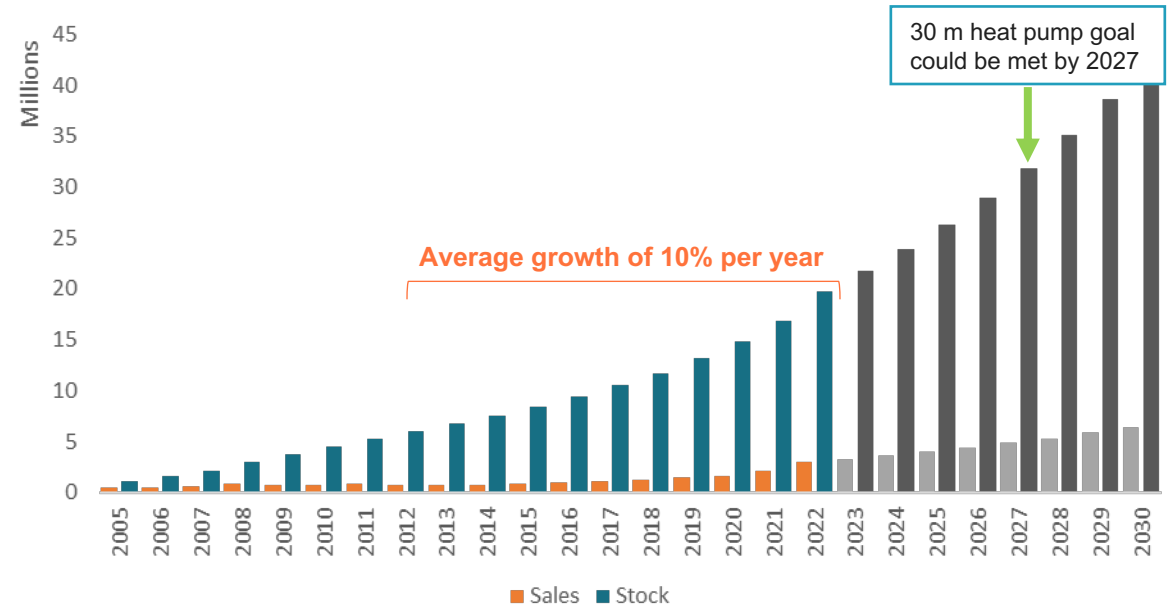
Several R290 HPs models are comparable with their HFC and HFO “low GWP” counterparts and in several instances outperform them

Market penetration and sales

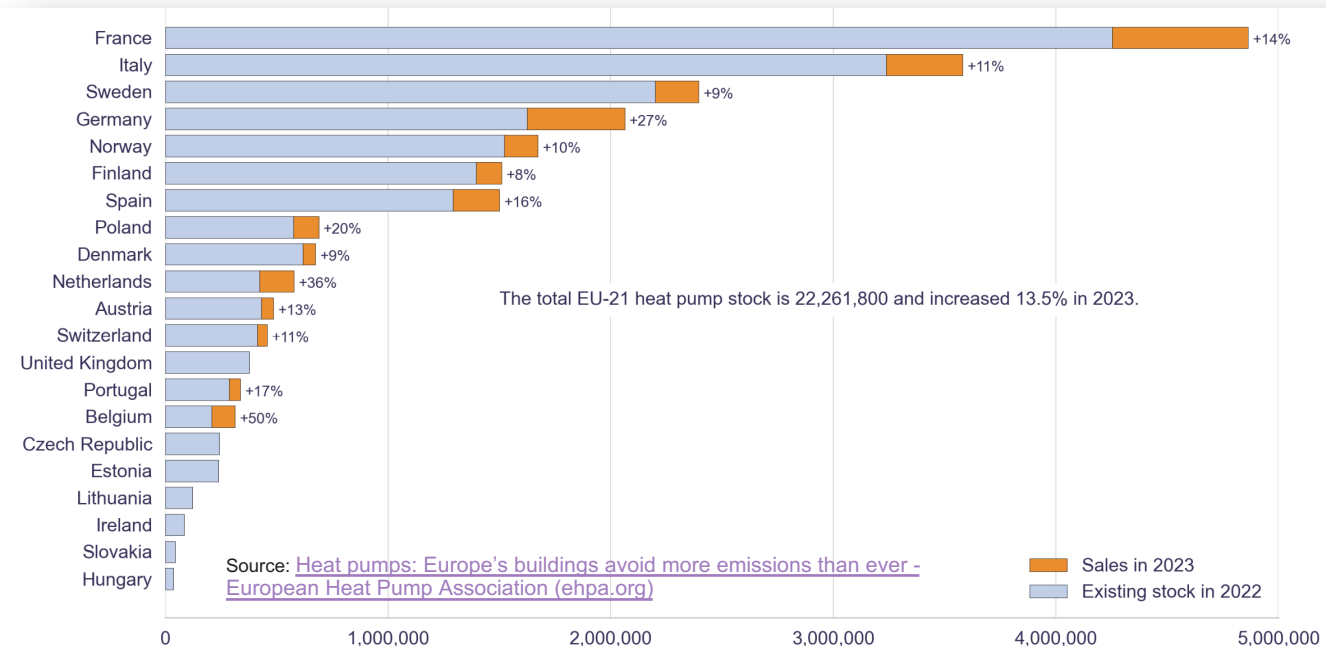
- ❖ The world heat pump market is about **EUR 56 billion** today, and is projected to rise to about **EUR 108 billion** in 2030
- ❖ In Europe, there were almost **20 million** heat pumps installed by the end of 2022
- ❖ Europe accounts for about **34%** of all heat pumps globally, compared to about 15% of world GDP and 10% of world population
- ❖ Most heat pumps installed in the EU are made in the EU, with the domestic market share estimated between 55-60%
- ❖ The stock of heat pumps is not evenly spread by Member State, with **colder Member States** (Sweden, Finland, Estonia) having more heat pumps **per capita**.
- ❖ Ground-source heat pumps in particular are concentrated in key markets such as Sweden (more than 600 000 installed) and Germany (more than 400 000), which together account for half of installed ground-source heat pumps in **Europe**



Development of heat pump sales and stock, EU-21



Source: Own evaluation based on [EHPA_market_report_2023_Executive-Summary](#)

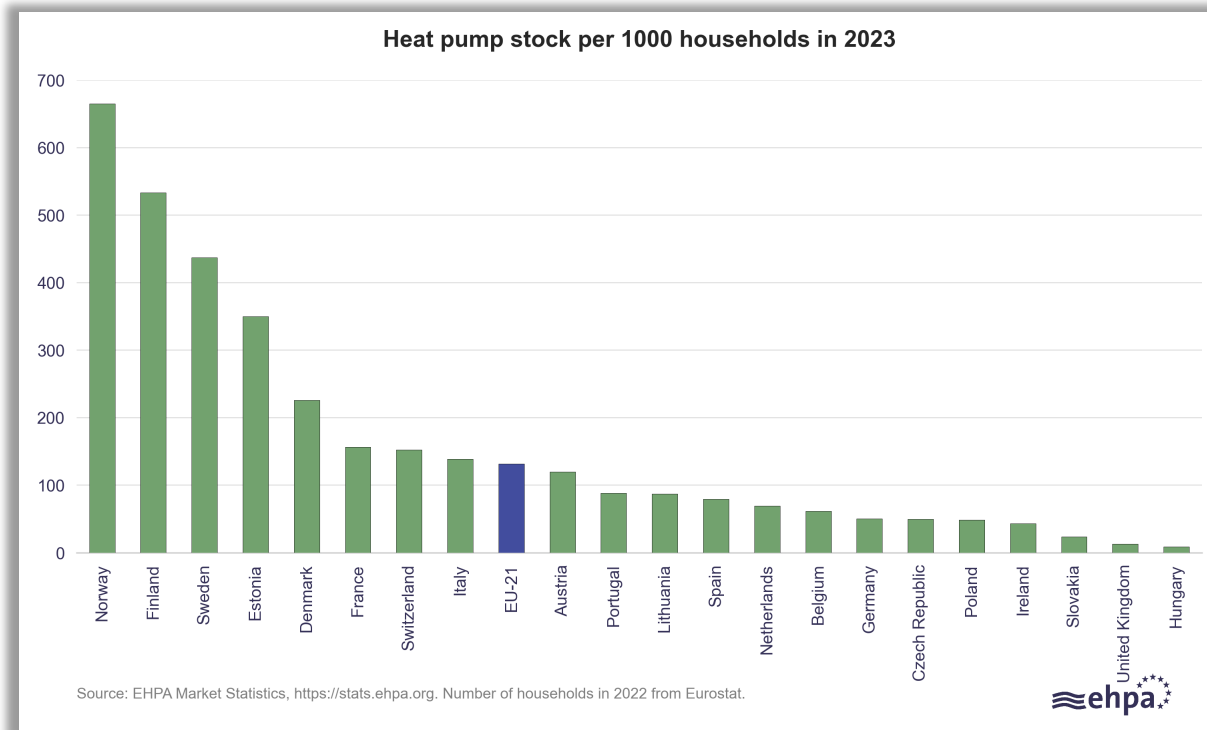


Source: [Heat pumps: Europe's buildings avoid more emissions than ever - European Heat Pump Association \(ehpa.org\)](#)

Legend:
■ Sales in 2023
■ Existing stock in 2022

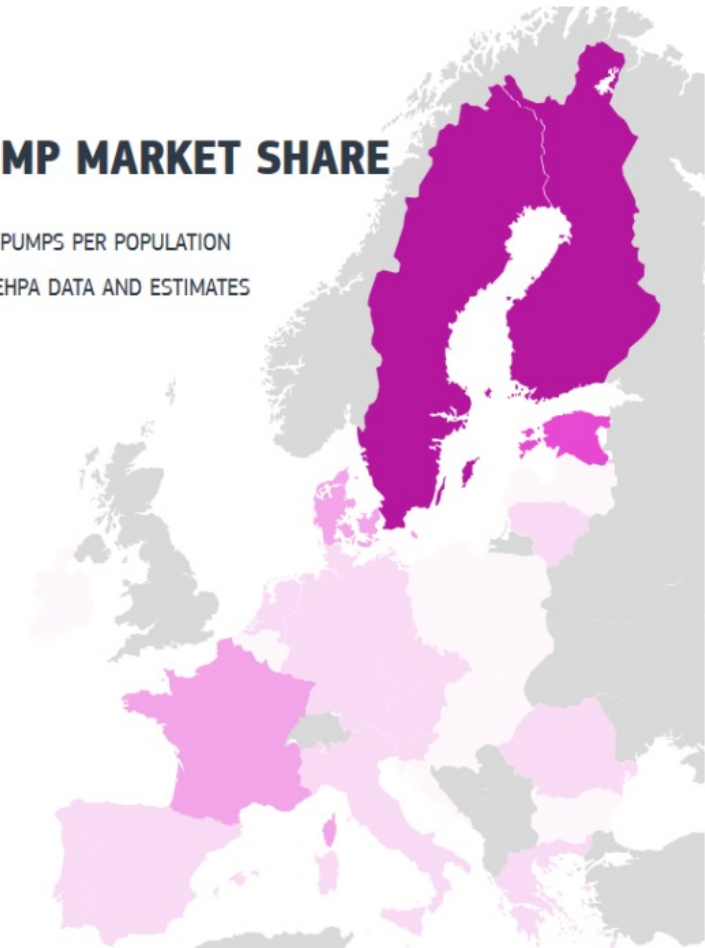
Market penetration and sales

- ❖ Europe is recognized as a market leader in all types of heat pumps, and especially in hydronic heat pumps (especially ground-source) and large heat pumps.
- ❖ Evenly spread across the complete range of heat pump types than other markets, some of which are more specialized in air-air systems.
- ❖ The EU is a technology leader in use of natural refrigerants



HEAT PUMP MARKET SHARE

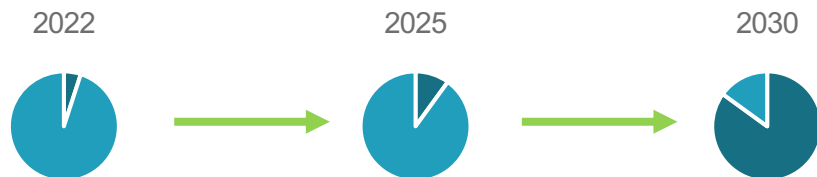
NUMBER OF HEAT PUMPS PER POPULATION
2020 BASED ON EHPA DATA AND ESTIMATES



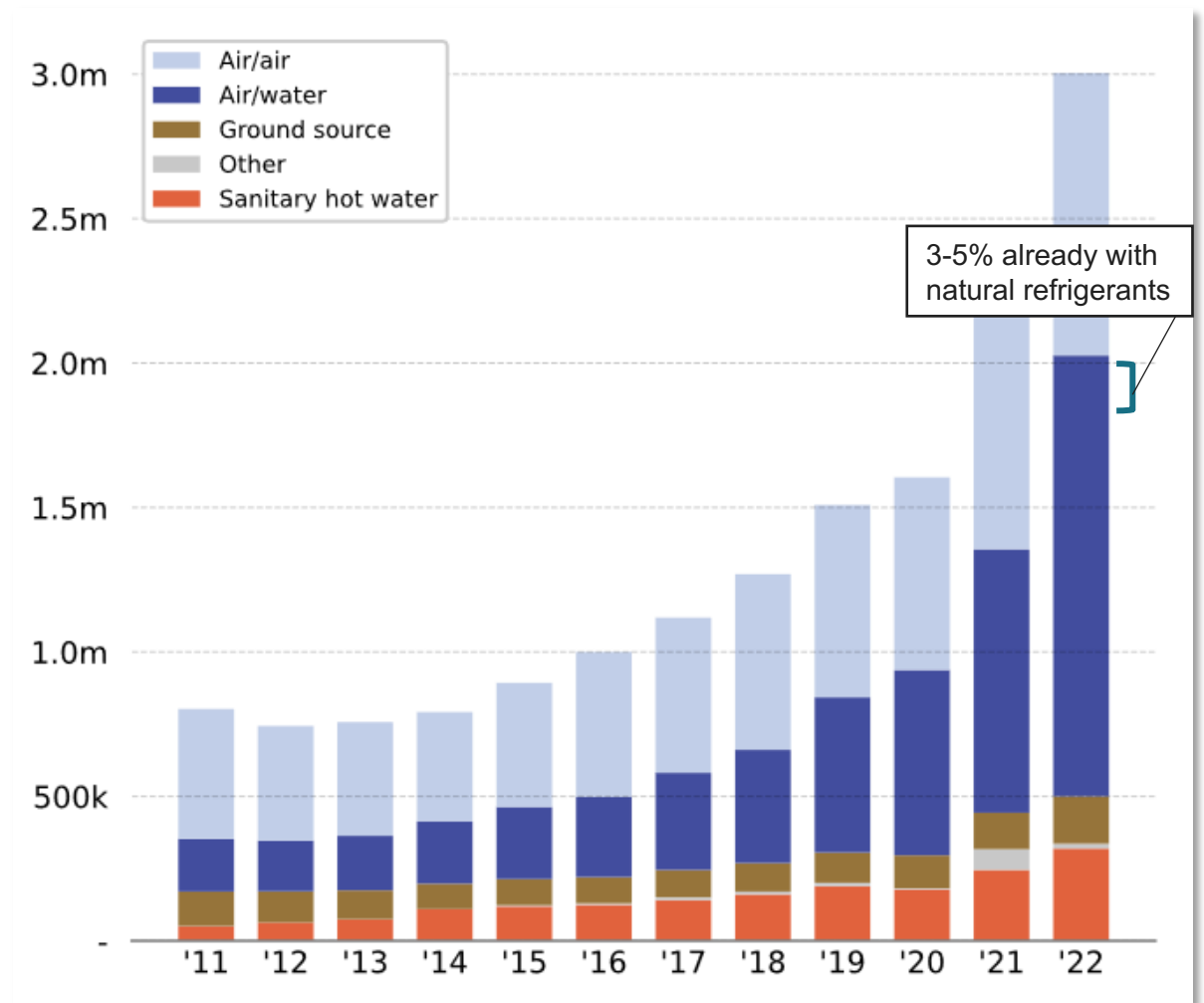
Source: [JRC Publications Repository - The Heat Pump Wave: Opportunities and Challenges \(europa.eu\)](https://publications.jrc.ec.europa.eu/repository/handle/JRC123456)

Market penetration and sales

- ❖ Up until 2020, Air to Air heat pumps had the highest number of annual installations across EU member states
- ❖ As of 2020, Air – Water heat pumps gained more traction and currently hold the highest attractiveness and exhibiting the largest growth.
- ❖ Natural refrigerants based heat pumps, and especially Air – Water heat pumps had a low share of **3%-5%** in 2022. However this has witnessed a spike in sales since then and is expected to account for **10%** of Air – Water heat pump sales by 2025 and up to **85%** by 2030.



According to expert interviews conducted by ATMOSphere Europe, the most widespread opinion among interviewees is that **natural refrigerants** will have a leading position after 2030 in indirect systems for domestic capacities.



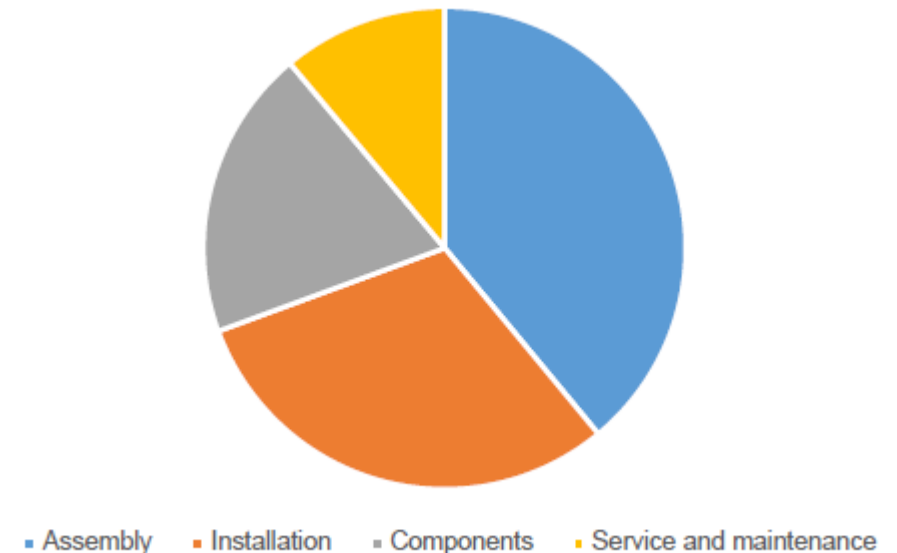
Source: [EHPA_market_report_2023_Executive-Summary](#)

Labour and Capacity Building

- ❖ In Europe alone, employment was 161,632 in 2022, increasing roughly in line with deployment
- ❖ Several labour challenges are present:
 - There is a lack of heat pump-specific skills in the curricula for the relevant trades (e.g. plumber, electrician, heating technician)
 - There are issues with skills recognition across Member States
 - There are particular needs for skills in installing integrated systems, in digitalisation, in refrigerants and in ground-source heat pumps
- ❖ Training courses are currently provided by heat pump manufacturers themselves

Action is required at sectoral, national and EU levels!

Employment in the Heat Pump sector by stage of the value chain in 2022



Source: Based on EHPA, 2023a.

Source: JRC Publications Repository - Clean Energy Technology Observatory: Heat pumps in the European Union - 2023 Status Report on Technology Development, Trends, Value Chains and Markets (europa.eu)

Selected good practice examples and incentives in EU Member States and beyond

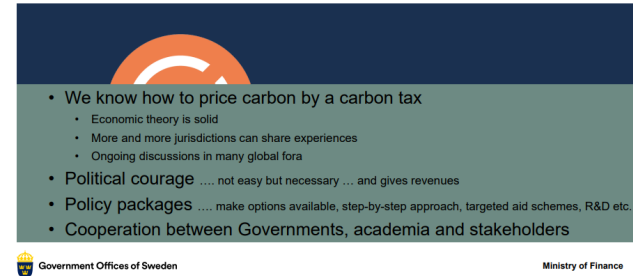


Carbon tax, Sweden

...a Nordic success story!

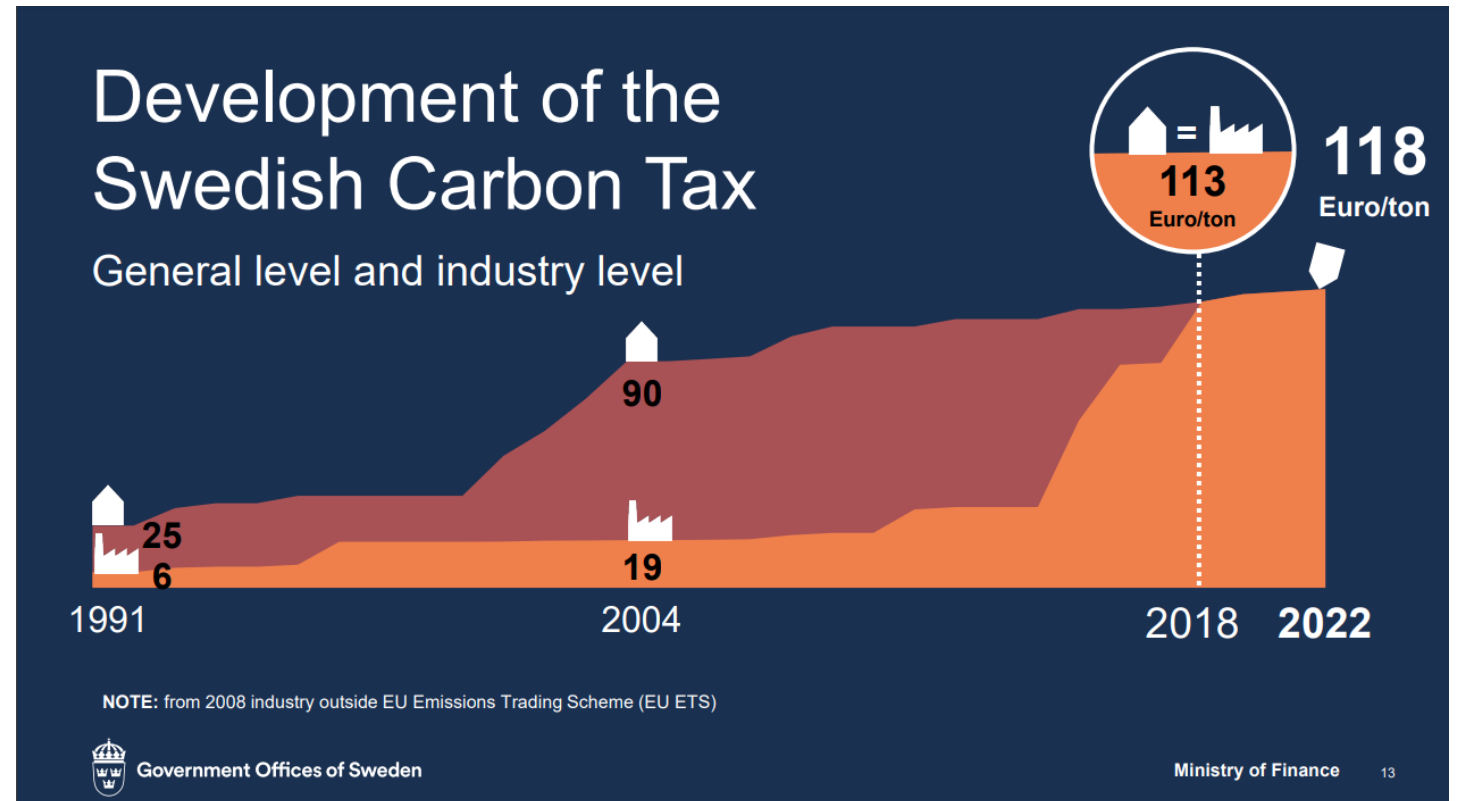
- Already established in 1991 as part of a major tax reform with reduced labour taxes
- About 95 % of the Swedish fossil carbon emissions are covered by carbon tax or EU ETS
- Distribution to support i.a. low- and middle-income households and welfare
- over 80 % shares of renewables in the grid => low electricity prices
- Fossil heating fuel use has dropped by 85 % since 1990 and now represents 2 % of Sweden's total greenhouse gas emissions.

Carbon Taxation is NOT Rocket Science
Make it happen – now!



- We know how to price carbon by a carbon tax
 - Economic theory is solid
 - More and more jurisdictions can share experiences
 - Ongoing discussions in many global fora
- Political courage not easy but necessary ... and gives revenues
- Policy packages make options available, step-by-step approach, targeted aid schemes, R&D etc.
- Cooperation between Governments, academia and stakeholders

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Heat Pump System Module, Switzerland

Quality assurance mechanism



Background: The Heat Pump System Module (WPSM) is a Swiss standard for the planning and construction of heat pump systems, particularly for those with a heating capacity of up to approximately **15 kW**. It is a joint development of well-known heat pump manufacturers and suppliers, leading industry associations and installers.

Operating principle:

- The WPSM is designed to optimize the components and processes involved in the planning, installation, and commissioning of heat pump systems.
- The module ensures that the heat source, heat pump, circulation pump, storage, hydraulics, heat distribution system, water heating, and control are all perfectly coordinated as a comprehensive system.

Benefits:

Standardization

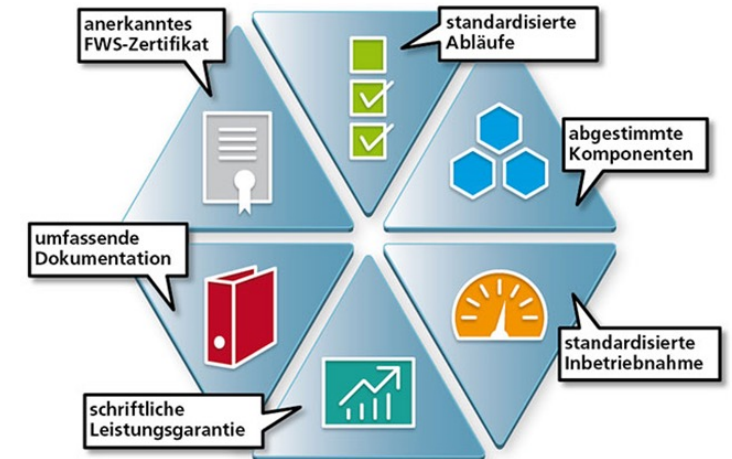
Standardized approach to heat pump installations

Energy Efficiency

Optimally coordinated system components

Financial incentives

Eligible to financial incentives in many Swiss cantons



Source: <https://www.wp-systemmodul.ch/de/>

Heat Pump Offensive, Germany

Framework-project to support the government

Background:

Based to the plans to decarbonise the grid (2030: 80 % renewables) the German government has signed a letter of intent with industry to *aim for 500,000 new HP per year from 2024 onwards**

Goal:

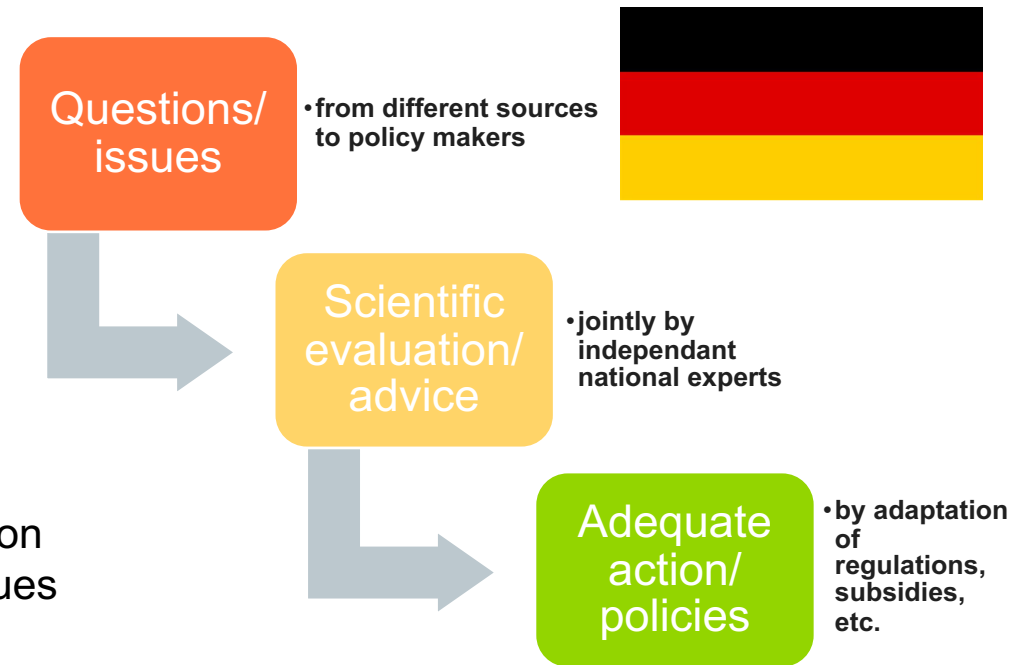
Provide policy makers with independent science-based background information and expert advice to enable effective heat pump policies to tackle current issues

Setup:

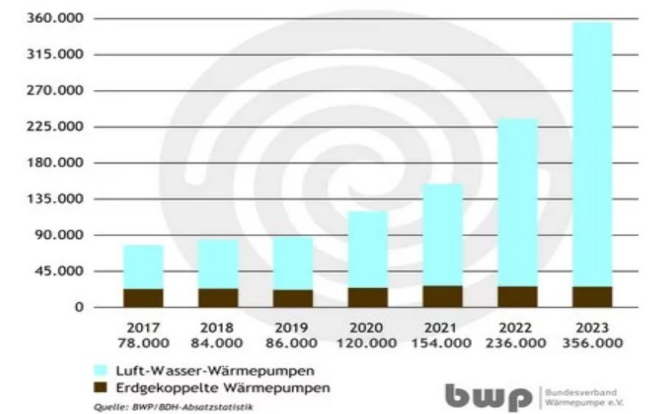
- Government (BMWK) provides since 2022 budget for adhoc scientific advice by a pre-selected team of national heat pump experts (lead by Guidehouse)
- Depending on the specific questions, the most suitable experts prepare analyses (usually short reports, to be delivered within 2 to 8 weeks after adhoc request)

Topics (selection):

Current technology prices, Skilled workers capacities, Solutions with natural refrigerants, Securing efficiency, Securing supply chains, LCA, Storage and flexibility potentials and need:



Development of heat pump sales in Germany



*) https://www.bmwk.de/Redaktion/DE/Downloads/A/absichtserklaerung-waermepumpen.pdf?__blob=publicationFile&v=1

Key Takeaways



Key Takeaways

Heat Pumps are crucial to decarbonize heating

Rapid, effective and courageous action is needed in various fields for a successful Heat Pump rollout:

- ✓ HP rollout needs to go hand in hand with the decarbonization of electricity system transformation
- ✓ Secure financial attractiveness (esp. fossil- vs. electricity-price structure)
- ✓ Ensure efficient HP operation and a fast transition to sustainable refrigerants
- ✓ Align with industry and stakeholders on goals and pathways
- ✓ Base policies on independent scientific evidence & monitoring to ensure effectiveness

Disclaimer:

This document is a draft and provided as a courtesy. This document is not to be considered as final, and all information contained herein is subject to change upon further review by the Cool Up Programme.



Cool Up

Upscaling Sustainable Cooling

coolupprogramme.org | info@coolupprogramme.org | [@WeAreCoolUp](https://www.instagram.com/WeAreCoolUp)

Contact

Markus Offermann

markus.offermann@guidehouse.com

Mustafa Abunofal

mabunofal@guidehouse.com

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Supported by:



based on a decision of the German Bundestag

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