Welcome to

Heat pumps for a competitive Europe: Driving clean tech and industrial growth

3 April 2025 I 10:00 - 12:45 CEST

Heat Pump Technologies, Allianz MiCo Milano

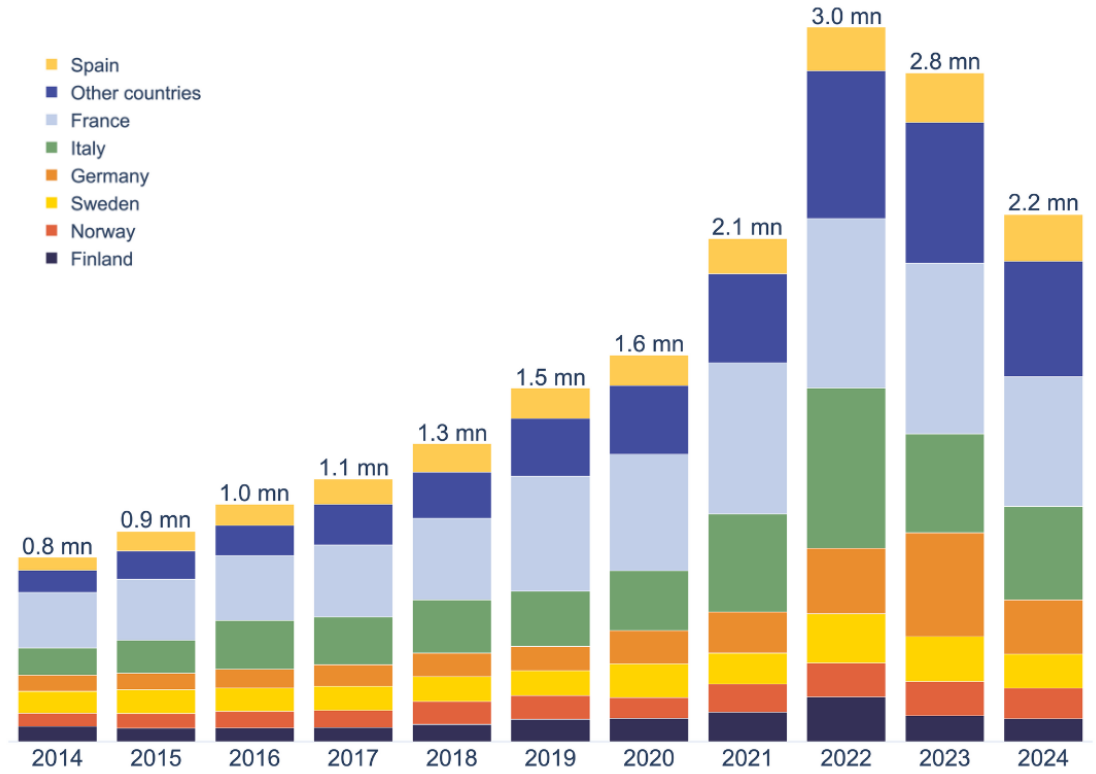
3 April 2025 I 10:00 – 10:15 CEST

European Heat Pump Market

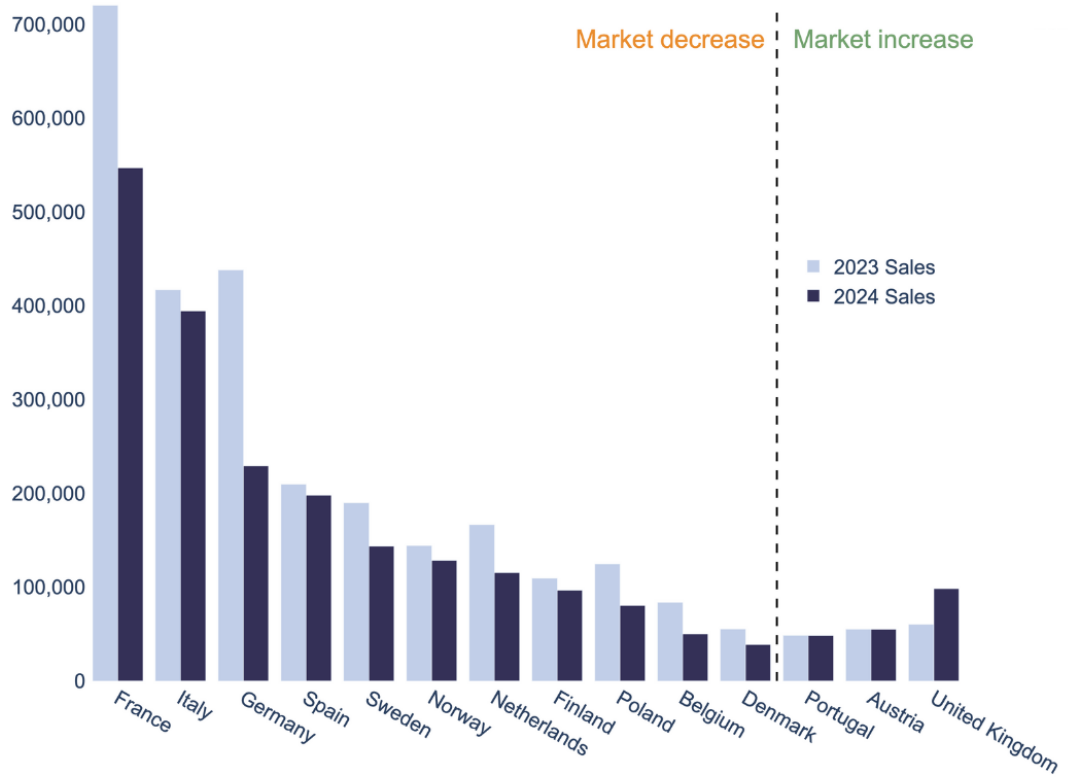
Paul Kenny

Director General, European Heat Pump Association

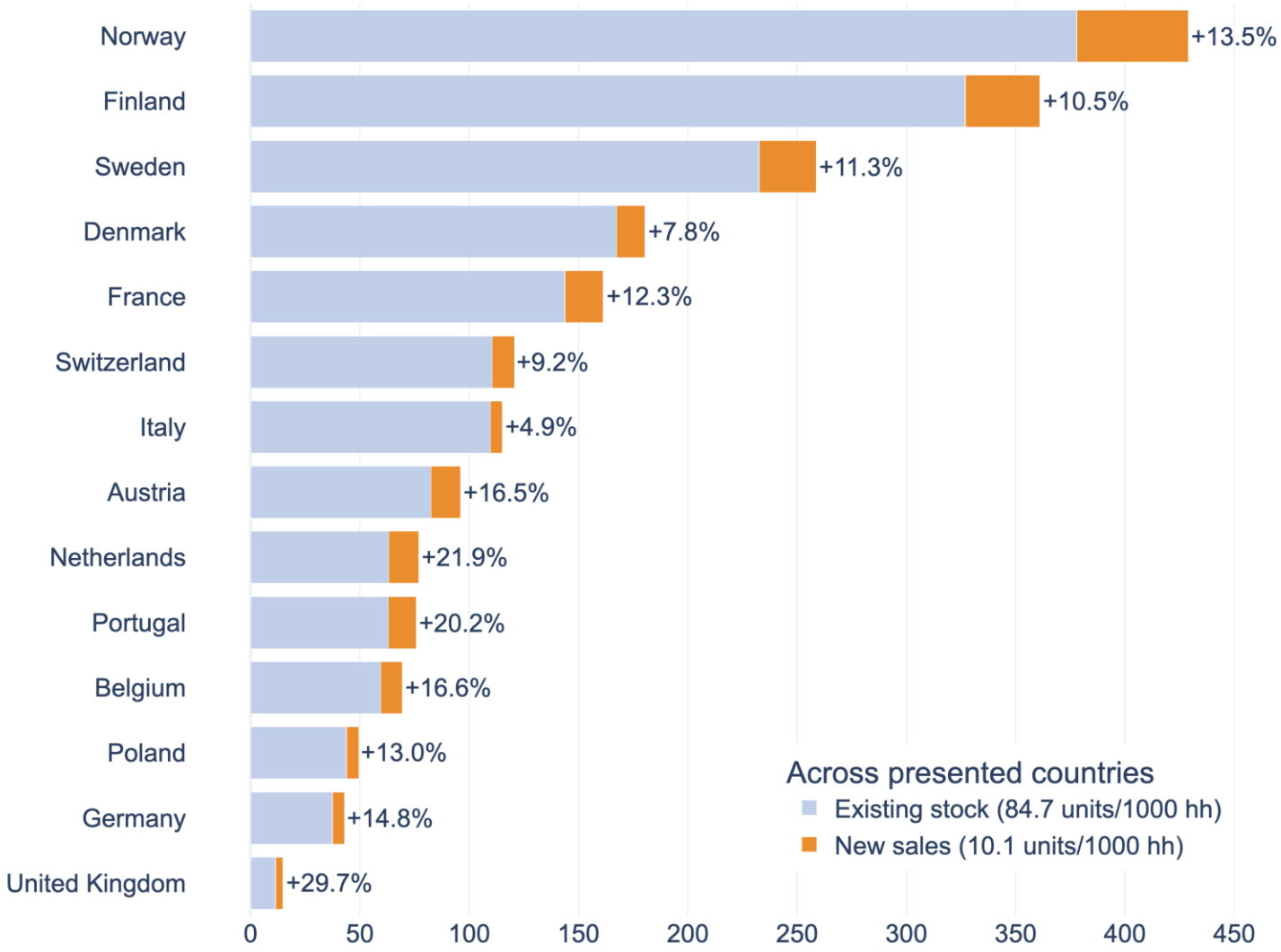
Heat pump sales from 2014 to 2024 - 14 European countries



Heat pump sales 2023 to 2024 per country



Existing heat pump stock + 2024 sales per 1,000 households



Source: European Heat Pump Association

Geopolitics is now energy policy

NEWS > ENERGY AND CLIMATE

EU looks at an electric alternative to Russian gas: The heat pump

But skilled worker shortages may hinder efforts to ramp up deployment.

‘I didn’t want to fund Putin’: Heat pumps find favour in Europe

They can produce 3kWh or more of heat for every kWh of electricity used to power them. Yet the rollout is not as straightforward as that equation might suggest.

Heat pumps, renovations could slash Europe's Russian gas use -report

One **more** heat pump = €10,500 **less** to Russia

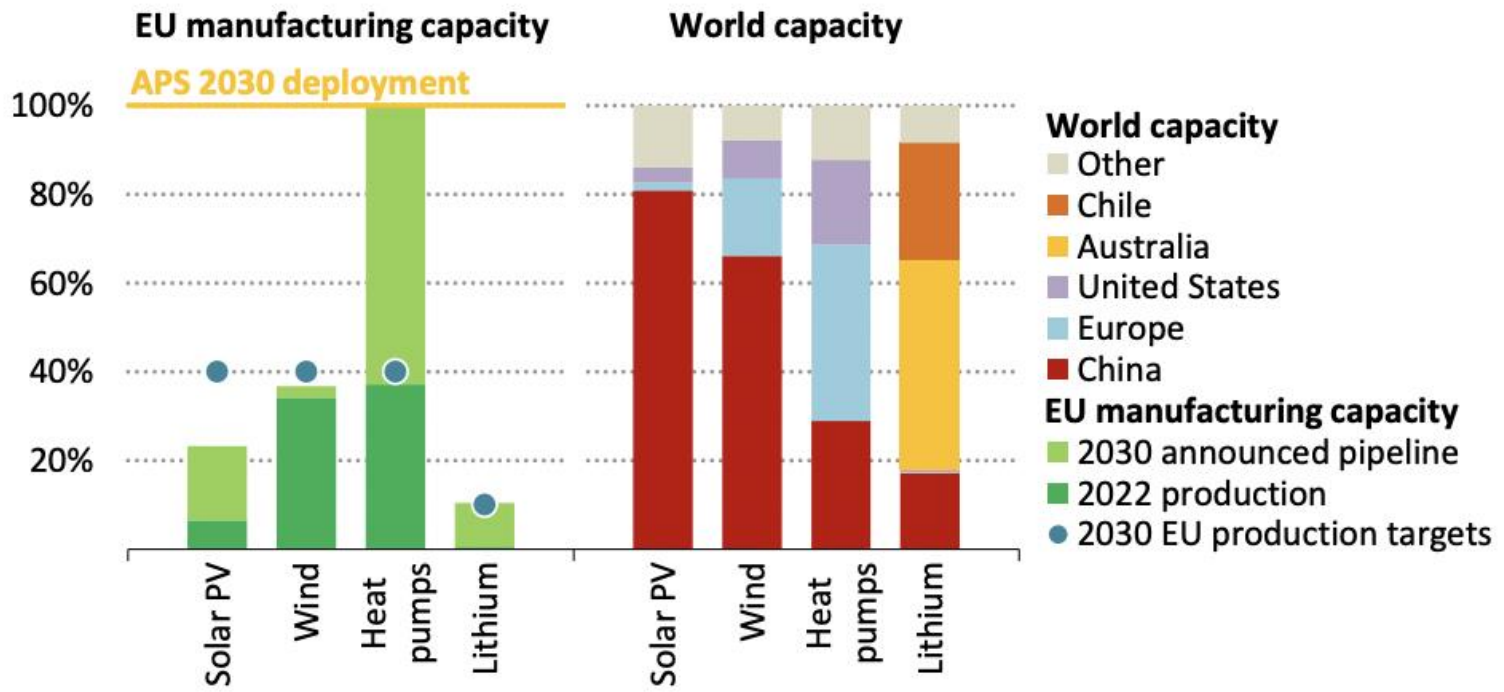
How heat pumps can help save Ukrainians from Putin and the rest of us from climate change

CLIMATE • ENERGY

Heat Pumps Are a Weapon in the E.U.’s Energy Face-Off With Russia

Heat pumps have a strong European local value chain

Figure 5.8 ▷ Manufacturing capacity in the European Union as share of APS deployment levels and global capacity by region, 2030



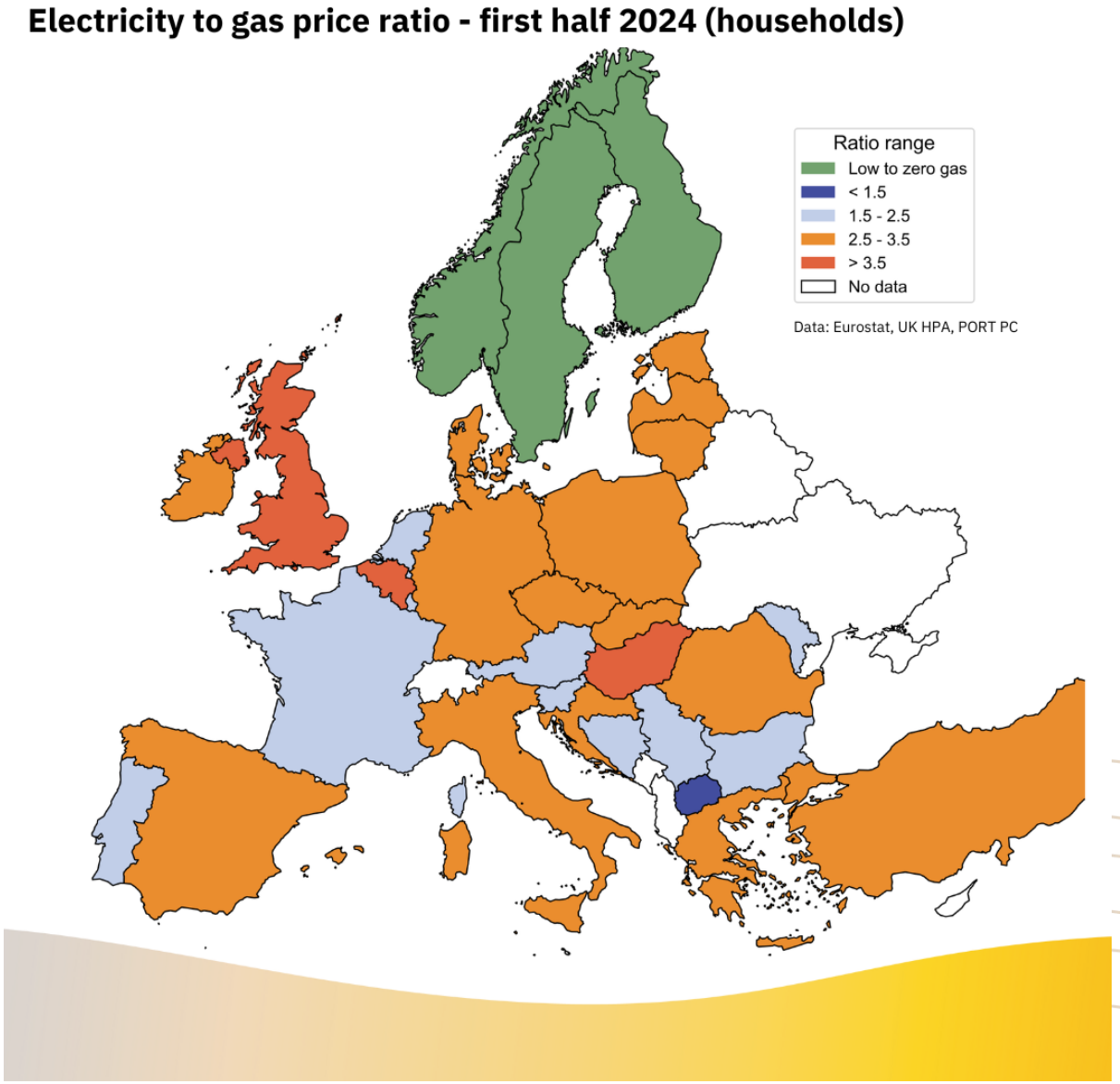
IEA energy outlook 2023. APS means “announced pledges scenario”

60-73% of heat pumps installed in Europe are currently **manufactured in Europe**

European Manufacturers need European demand

To drive EU heat pump demand:

- Stable long term policy framework to decarbonise heat
- Communication of the benefits and opportunities
- Make Heat pumps affordable to purchase and to run
- Scale up installers and skills
- Streamline the single market



Agenda

10:15 I Panel discussion "What does the Clean Industrial Deal mean for heat pumps?", moderated by Marco Dall'Ombra, Chair - Gruppo Pompe di Calore, Assoclima

🎤 Benedetta Scuderi (MEP, Greens, Italy), Daniele Agostini (ENEL), Stefano Bellò (Clivet), Jacopo Tattini (European Commission, DG GROW)

11:00 I Presentation "The industrial heat pump market", Mathieu Canal, *Director Heat Pump Solutions*, Danfoss

11:15 I Panel discussion "Industrial heat pumps to decarbonise Europe's industry", moderated by Jozefien Vanbecelaere, Policy Director, European Heat Pump Association

🎤 Miguel Ramirez (TNO), Gian Luca Agliardi (European Climate Foundation), Josh Gartland (CEFS), Chiara Di Mambro (ECCO), Jacopo Tattini (European Commission DG GROW)

12:15 I Presentation " Introduction to Heat Pump KEYMARK, your (only) European certification", Leopoldo Micò, Head of KEYMARK, European Heat Pump Association

12:30 I Presentation "Refrigerant Detection System", Stefano Traversi, Senior Product/Service Specialist, UL Solutions

12:45 I Conclusions, Paul Kenny, Director General, European Heat Pump Association

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What does the Clean Industrial Deal mean for heat pumps?

Marco Dall'Ombra
Chair - Gruppo Pompe di Calore
Assoclima
(Moderator)

Benedetta Scuderi
MEP
Greens, Italy

Jacopo Tattini
Policy Officer
European Commission
DG GROW

Daniele Agostini
Head of Energy and Climate Policies
ENEL

Stefano Bellò
CEO
Clivet

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What does the Clean Industrial Deal mean for heat pumps?

Benedetta Scuderi
MEP
Greens, Italy

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Heat Pump Technologies

Paul Kenny

Director General, European Heat Pump Association

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The industrial heat pump market in the EU

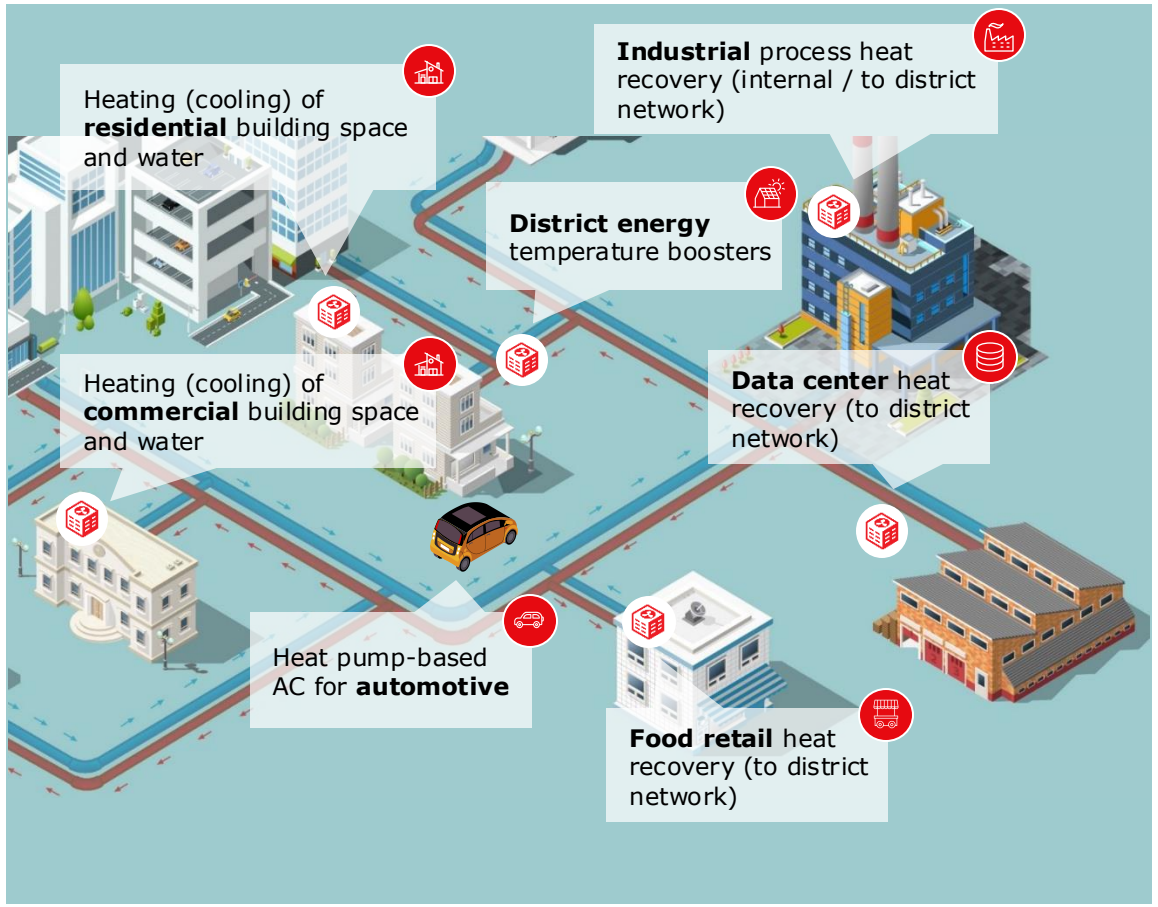
Matthieu Canal
Director Heat Pump Solutions, Danfoss

ENGINEERING
TOMORROW

Industrial Heat pump market

By Danfoss Climate Solutions

Heat pumps play a crucial role **to enable heat recovery and decarbonization** in urban environments



HEAT PUMP TAKEAWAYS

Adoption and applications

- Global market to grow by +10% p.a. until 2030 – Heat pumps' potential to reduce emissions in **buildings** by 50%
- Food, chemicals, and paper to become the largest **industrial** adopters of heat pumps – Regulators forcing to decarbonize process heat.

Regulatory and regional drives

- Growth especially in **Europe in commercial & industrial segment**, likely followed later by North America
- Shift towards **natural refrigerants** (F-Gas Regulation in Europe, Kigali Agreement globally) especially in Europe region.

Market landscape

- System **connectivity**, flexibility and integration with renewables/storage to become increasingly important

EU industrial energy demand

- Industrial heatpumps (up to 100 °C and 100°C – 200 °C)

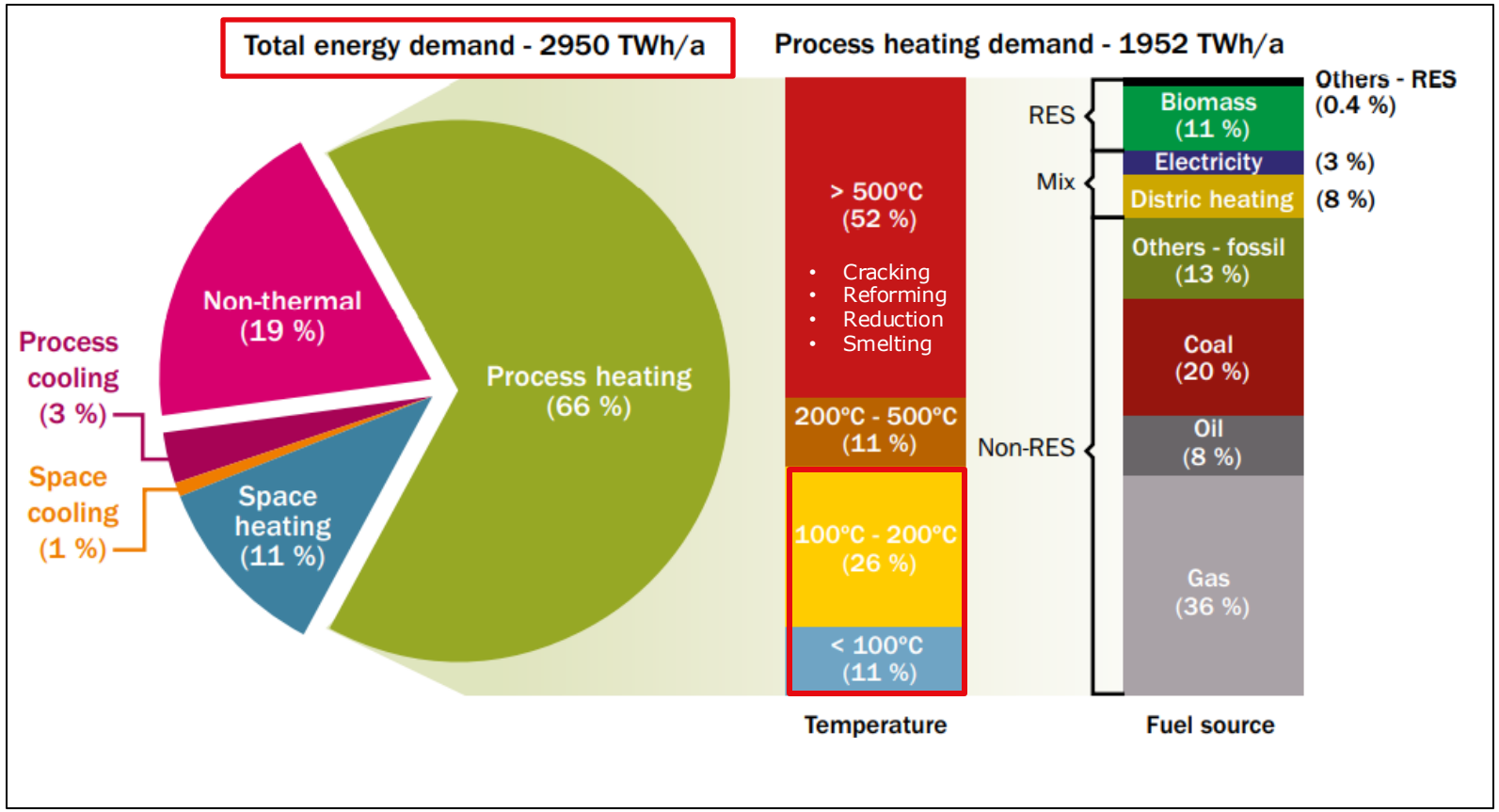
	TWh/a	100%
Total EU energy demand	2950	100
Non thermal energy	560,5	19
Thermal energy	**2389,5**	**81**

	TWh/a	100%
Thermal energy	2389,5	100
Cooling	118	5
Heating	**2271,5**	**95**

	TWh/a	100%
Heating	2271,5	100
Space heating	319,5	14
Process heating	**1952**	**86**

	TWh/a	100%
Process heating	1952	100
< 100 °C	**215**	**11**
100 °C - 200 °C	**508**	**26**
200°C -500 °C	**195**	**10**
> 500 °C	**1035**	**53**

Industrial energy demand breakdown



Key take away:

Potential for IHPs with heat sinks in the range 100 °C - 200 °C is more than double compared to < 100 °C

Source: Strengthening Industrial Heat Pump Innovation, Sintef, 2020

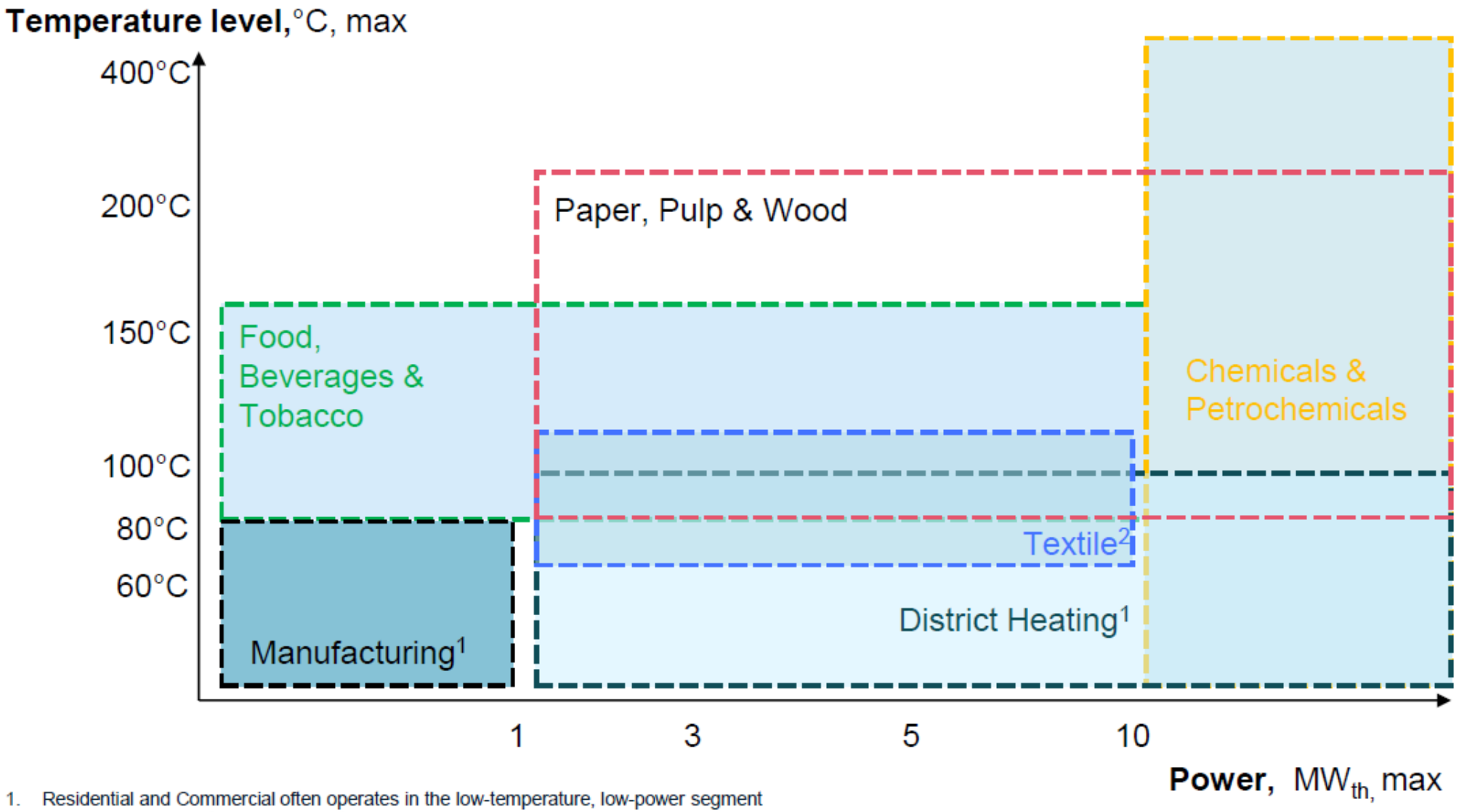
IHP opportunities in different segments

✓ Combined Cooling & Heating + optimized temperatures = Greatest potential with fastest payback

		Cooling			Heating[2]				
Industry[1]	**Sub-industry**	**<-30°C**	**-30°C-0°C**	**0°C-15°C**	**<100°C**	**100°C-200°C**	**200°C-500°C**	**>500°C**	**Total heat demand (TWh/pa)**
Chemical	Carbon black	20%	30%	50%	-	-	-	100%	128
	Ethylene	15%	50%	35%	-	-	-	100%	69
	Poly sulfones	-	40%	60%	-	100%	-	-	53
	Methanol	-	40%	60%	-	-	-	100%	30
	Ammonia	20%	30%	50%	-	-	-	100%	23
	Soda ash	**5%**	**45%**	**50%**	**30%**	**40%**	**-**	**30%**	**22**
	TDI	-	30%	70%	-	100%	-	-	57
	Oxygen	80%	10%	10%	-	-	-	-	5
Food & Beverages	**Meat processing**	**-**	**30%**	**70%**	**40%**	**60%**	**-**	**-**	**36**
	Sugar	-	20%	80%	10%	60%	-	30%	54
	Dairy	**-**	**30%**	**70%**	**90%**	**10%**	**-**	**-**	**22**
	Bread & bakery	**-**	**10%**	**90%**	**20%**	**33%**	**47%**	**-**	**39**
	Brewing	**-**	**35%**	**65%**	**55%**	**45%**	**-**	**-**	**14**
Non-metallic minerals	Clinker calcination-dry	-	-	-	-	-	10%	90%	27
	Lime burning	-	-	-	-	-	-	100%	28
	Flat glass	-	-	100%	2%	21%	43%	34%	106
	Container glass	-	-	100%	2%	19%	19%	60%	54
	Bricks	**-**	**-**	**-**	**20%**	**-**	**-**	**80%**	**12**
	Gypsum	-	-	-	-	50%	30%	20%	9
Pulp, paper and printing	Paper	-	-	100%	5%	88%	5%	2%	66
	Chemical pulp	-	-	-	-	100%	-	-	134

1: Heat demand based on historic data. Large opportunity expected in strategic focus areas beyond selection such as horticulture, aquaculture, and data centers. These are assessed in separate processes.
2: Heating processes based on current production process. In some instances, temperature ranges etc. can be altered depending on available temperatures.
3: Growth rate in components for production equipment, not heat pumps specifically. Based on numbers from Drives Market Intelligence (Interact Drive market report & HIS Markit)
Sources: https://heatroadmap.eu/wp-content/uploads/2018/11/HRE4_D3.3andD3.4.pdf & https://ee-ip.org/nl/articles/detailed-article/the-technical-potential-of-large-and-industrial-heat-pumps-1122

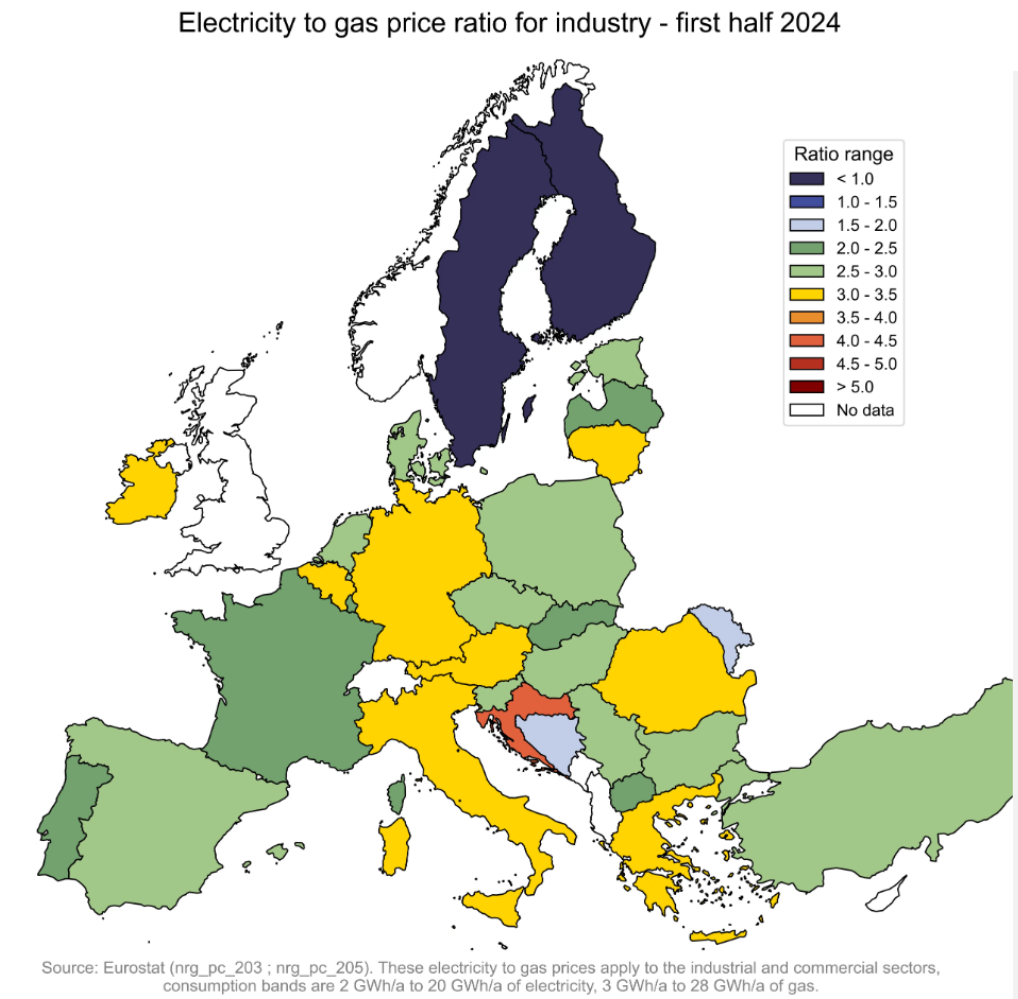
Dominant fields for heat pumps (from >150°C onwards in combination with MVR)



1. Residential and Commercial often operates in the low-temperature, low-power segment
2. Included in Manufacturing for market modeling

Source: McKinsey Heat Pump model, McKinsey Global Energy perspective, EHPA, Expert Interviews

IHP penetration relies on the cost differential between HP & alternative fossil fuel methods.



INDUSTRIAL HEAT PUMP TAKEAWAYS

Nordics

- **Nordics** generate large share of electricity with renewable means (hydro in Norway, wind & solar in Sweden & Denmark).
- Price of electricity is then reduce to a certain extent making IHP technology relevant.

Germany

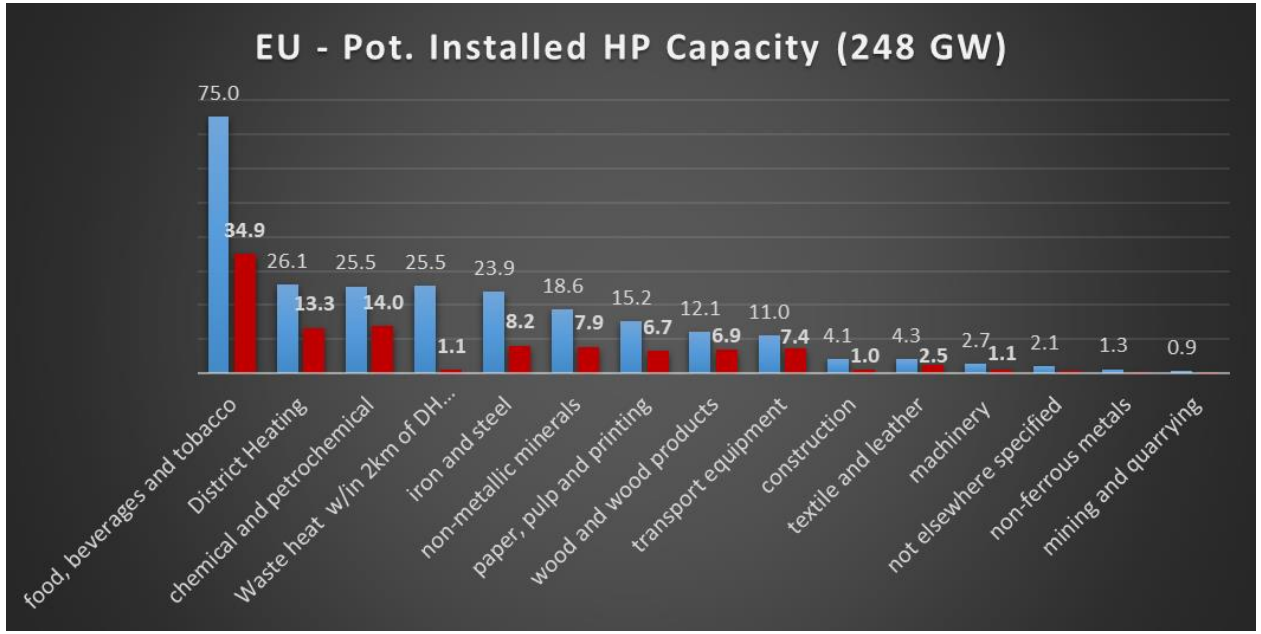
- High reliance on gases.
- Increase of share of renewables in the energy mix but investments had been passed to consumers.

France/Italy/Spain

- Diverse energy mix (France relies on nuclear while Italy & Spain have a significant share of wind & solar).
- France & Spain could be a good market for IHP in the future as long as awarenessof technology increases

Conversion into required HP capacity

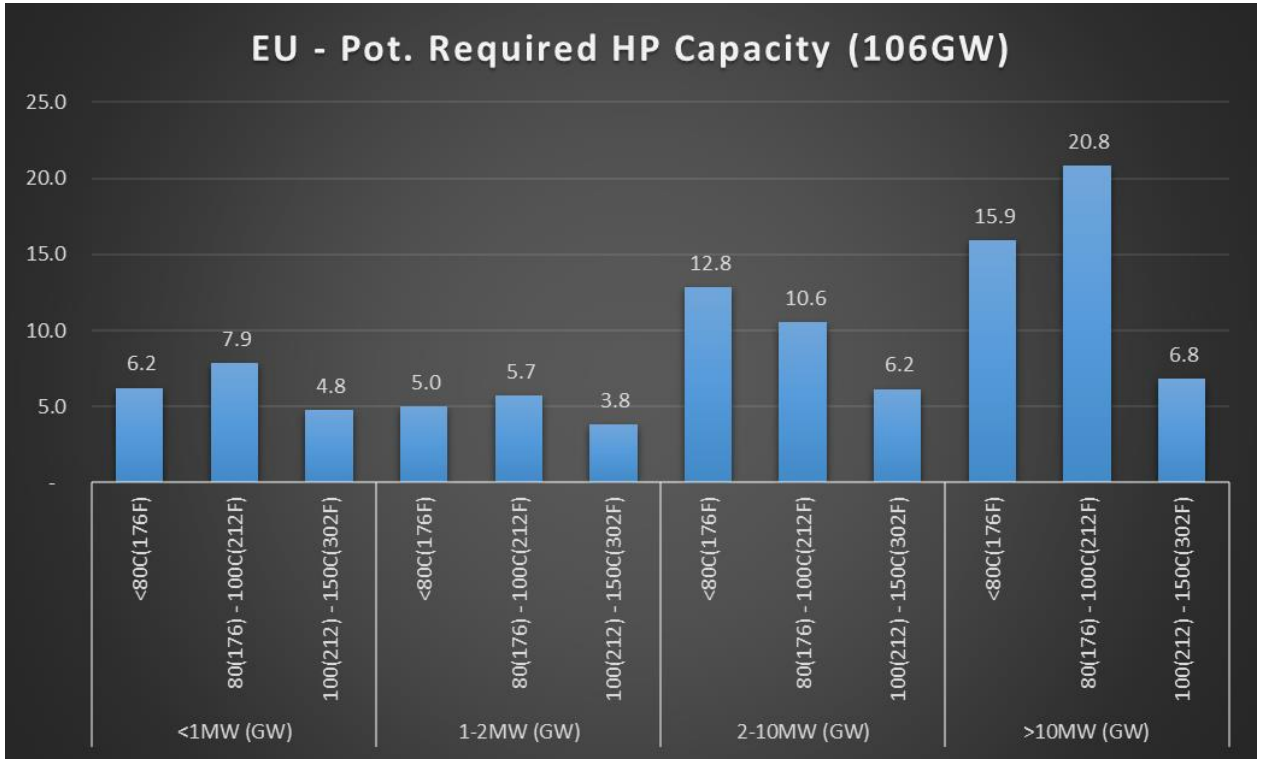
Considering ad-hoc number of operating hours x day/year by specific process



Reduced to a more reasonable scenario considering entry barriers of HP technology (ROI, installation & service networks, end-user predisposition,…)
EU: 43% -> 106 GW

Total Potential Required HP Capacity

Classified by capacity segment & sink temperature requirements

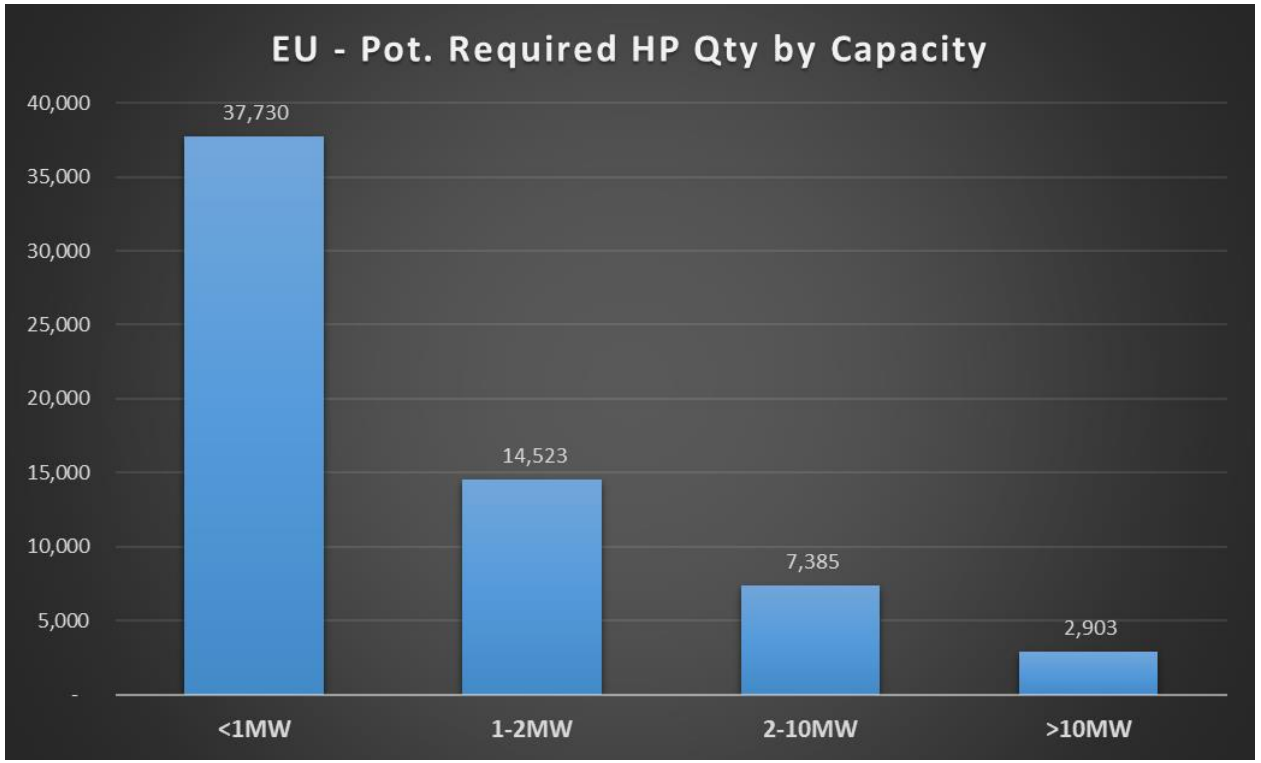


Hypothesis:

- Considering a lower adoption rate for solutions above 100°C.
- Favoring industries where there's a chance to couple heating & cooling (such as F&B for example).

Converted into HP Quantity (Pcs)

By Capacity Segment

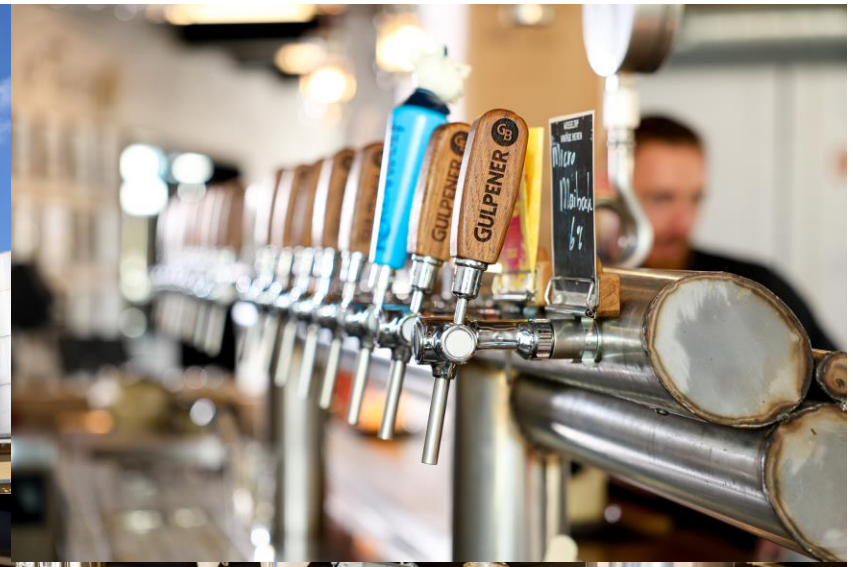


Avg. Capacity Considered to calculate quantities:

500 kW	1 MW	4 MW	15 MW
192 TR	385 TR	1,540 TR	5,770 TR

- Total potential of HP needed in the industry per capacity (not HP/yr).
- Vast majority of pieces (not value) will be below the 1MW.

Conclusions



<u>Industrial heat pump market outlook:</u>

In Europe, there's a huge untapped potential to decarbonize industry sector via electrification through HP technology.

Sectors such as **Food & Beverages or Pulp & Paper** where there are cooling needs are no brainer to couple it with heat pump to decarbonize process heating.

Given that industrial heating is mostly dominated by gas fired burners, **OPEX parity** (ratio between electricity & natural gas) is driving the adoption willingness of industrial HP.

Adoption will also rely on governemtal policy **regarding energy taxation**.

Estimation of a total HP capacity output of 60,000 IHPs in Europe that will lead to a market (based on lots of assumptions). In 2023, sales of IHPs are around 500pcs/yr.

3 April 2025 I Allianz MiCo Milano

Heat Pump Technologies

Paul Kenny

Director General, European Heat Pump Association

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Industrial heat pumps to decarbonise Europe's industry

Jozefien Vanbecelaere
Policy Director
EHPA
(Moderator)

Miguel Ramirez
R&D Energy Transition
TNO

Gian Luca Agliardi
Senior Associate Industry & Innovation
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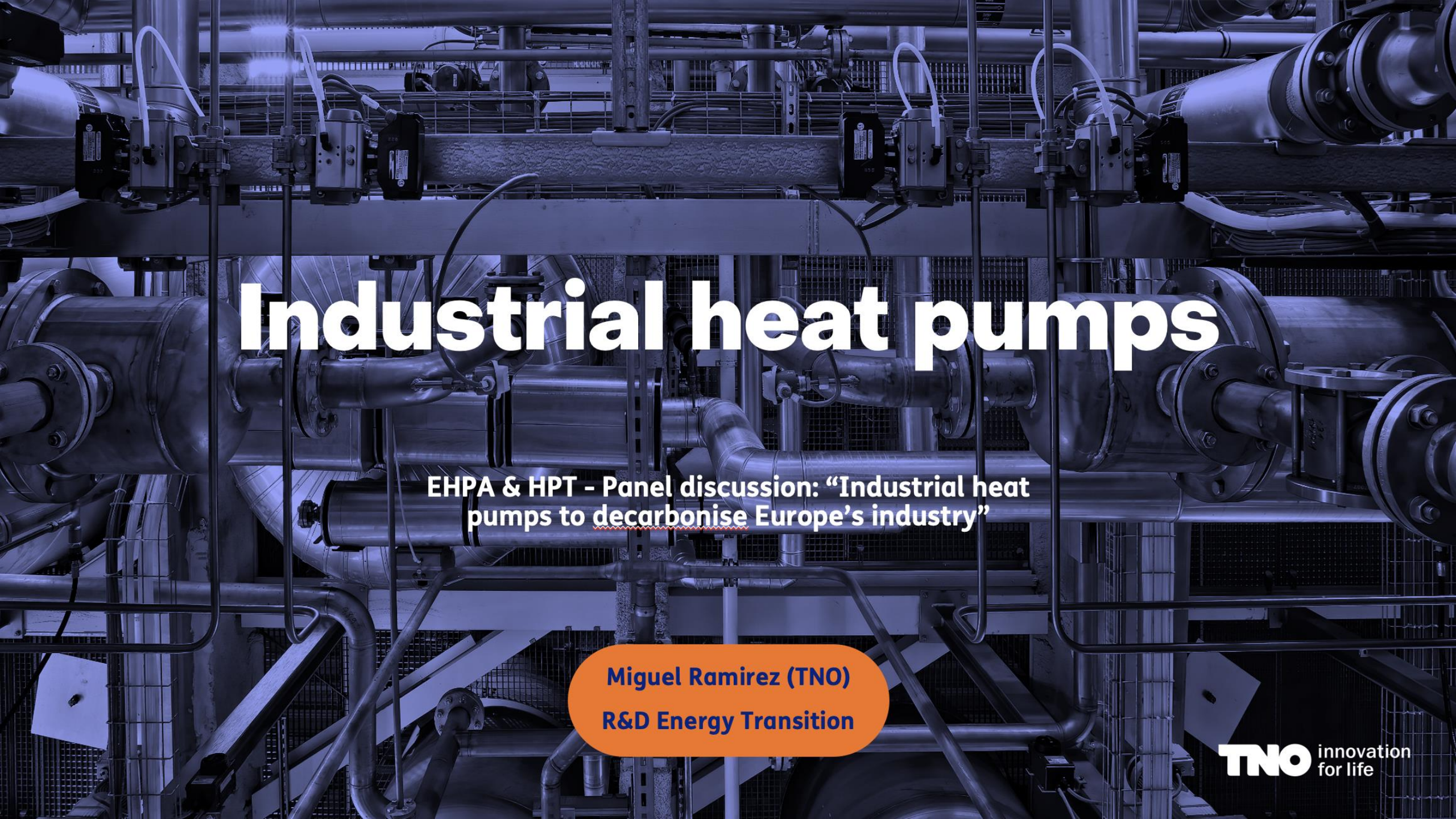


Industrial heat pumps

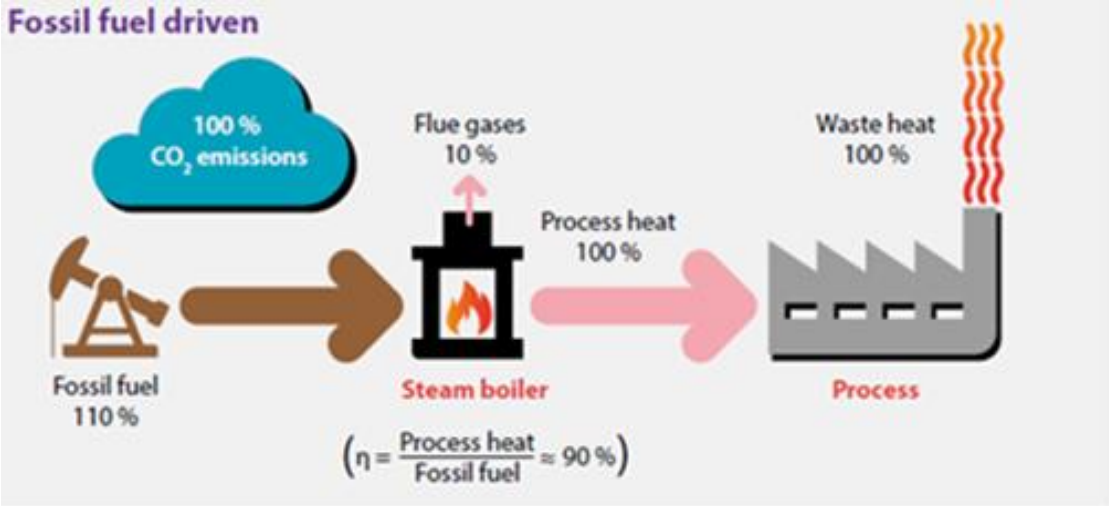
EHPA & HPT - Panel discussion: “Industrial heat pumps to decarbonise Europe’s industry”

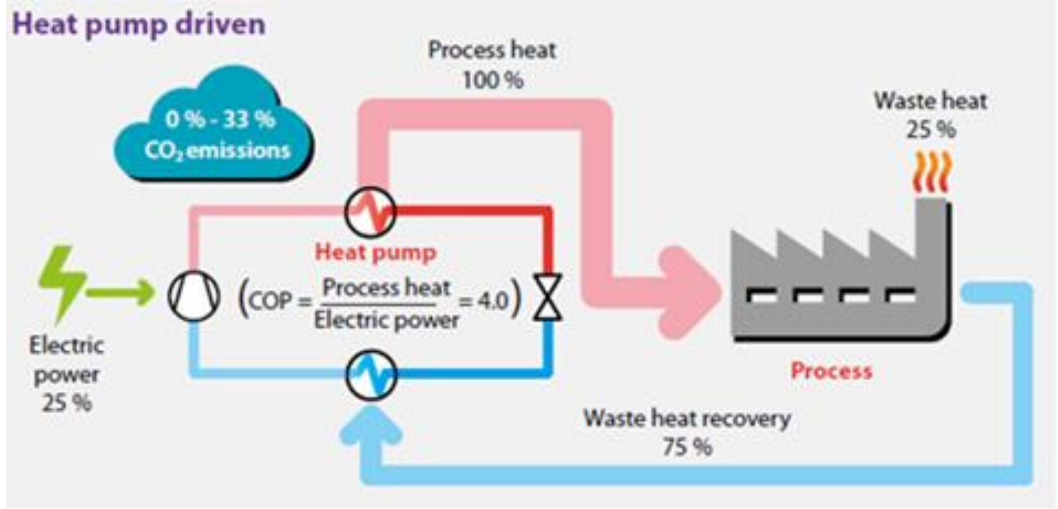
Miguel Ramirez (TNO)

R&D Energy Transition

TNO innovation for life

Towards circular heat in industry





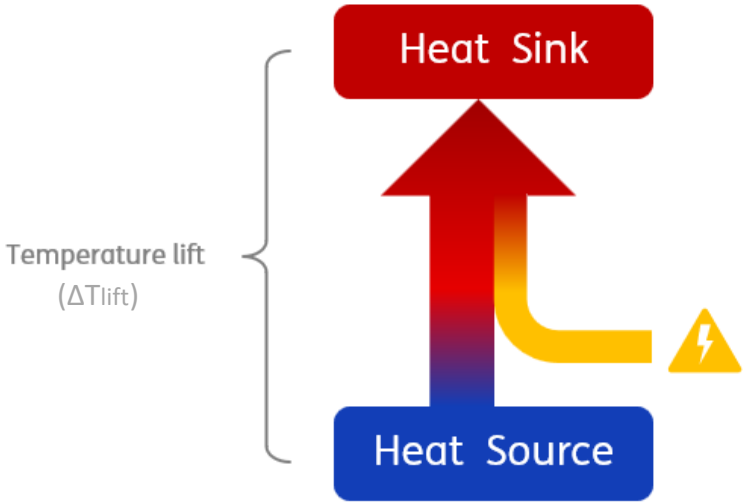
Industrial heat pumps (IHP)

REQUIREMENTS

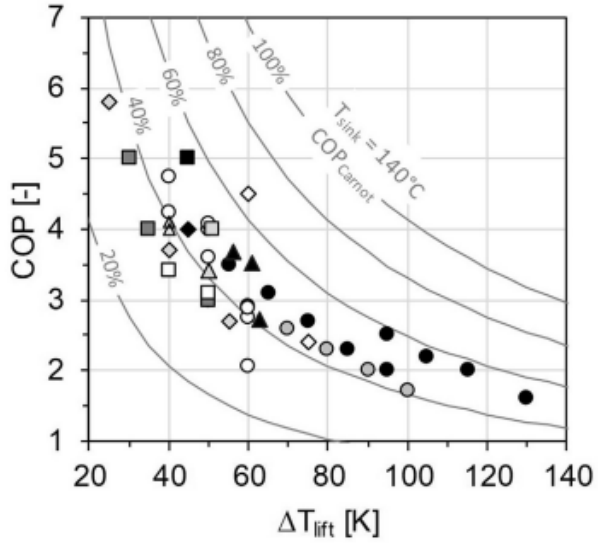
- **Load/Sink**: Steam or other (>100°C)
- **Heat Source**: Waste heat
- **Electricity**

OUTCOME

- High COP, high efficiency
- Electrification of heat
- Reduction of CO2 emissions



Energy flow of electrically driven heat pumps



Arpagaus C. et al. (2018) Energy (link)

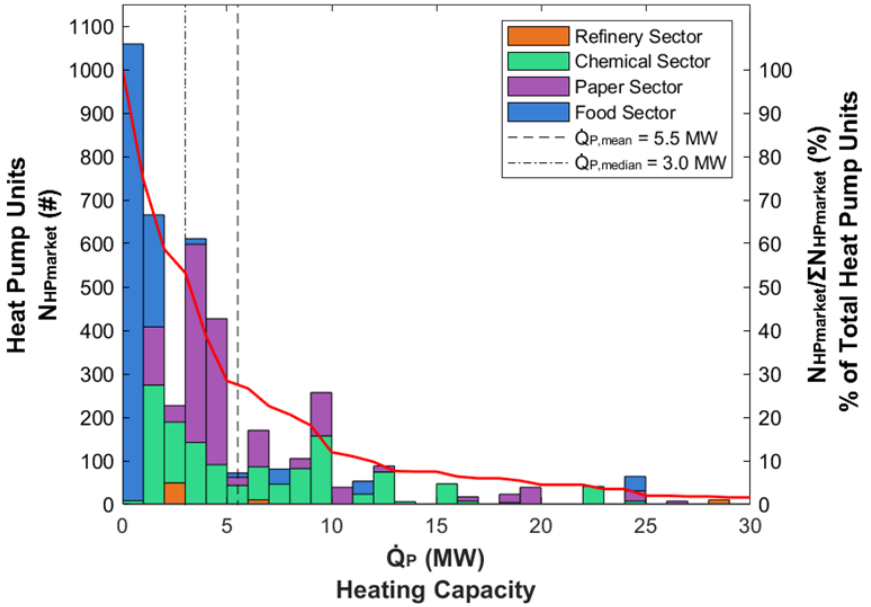
EU industrial heat pump market

Industrial Heat Pump size distribution per sector

- Heating/cooling profiles per production process
- Heat pump sizes based on typical plant capacities
- Production statistics from Eurostat

Savings

- Avoided fossil fuel use **371 – 724 PJ/a**
- CO_2-emission reduction **37 – 53 Mton/a**



Source: “An estimation of the European industrial heat pump market potential”

	Thermal power (GW)	# units	Process heat (PJ/a)
Refining	0.5	69	14
(Petro)chemical	9.1	1291	283
Food	5.5	1463	98
Paper	7.9	1351	245
Total	23.0	4174	641

SPIRIT demonstrations

Stella Polaris (Norway), food sector

- Technology supplier: Mayekawa
- Steam @ 145°C, 700 kW
- RTO involved: TNO

Tiense Suiker (Belgium), food sector

- Technology supplier: GEA
- Steam @ 138°C/114°C, 4 MW
- RTO involved: DTI

Smurfit Kappa (Czech Republic), paper production

- Technology supplier: Spilling
- Steam 6 bara, 800 kW
- RTO involved: DLR

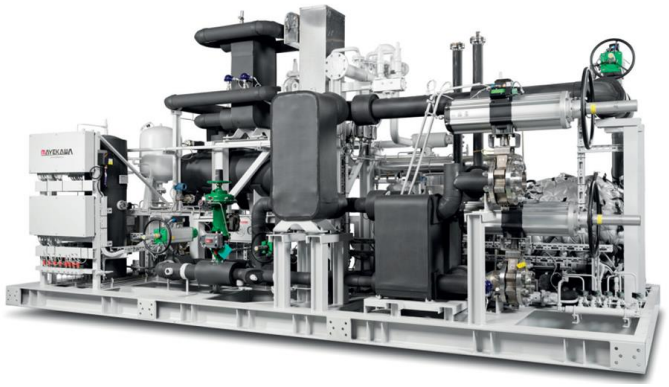
[Project SPIRIT]

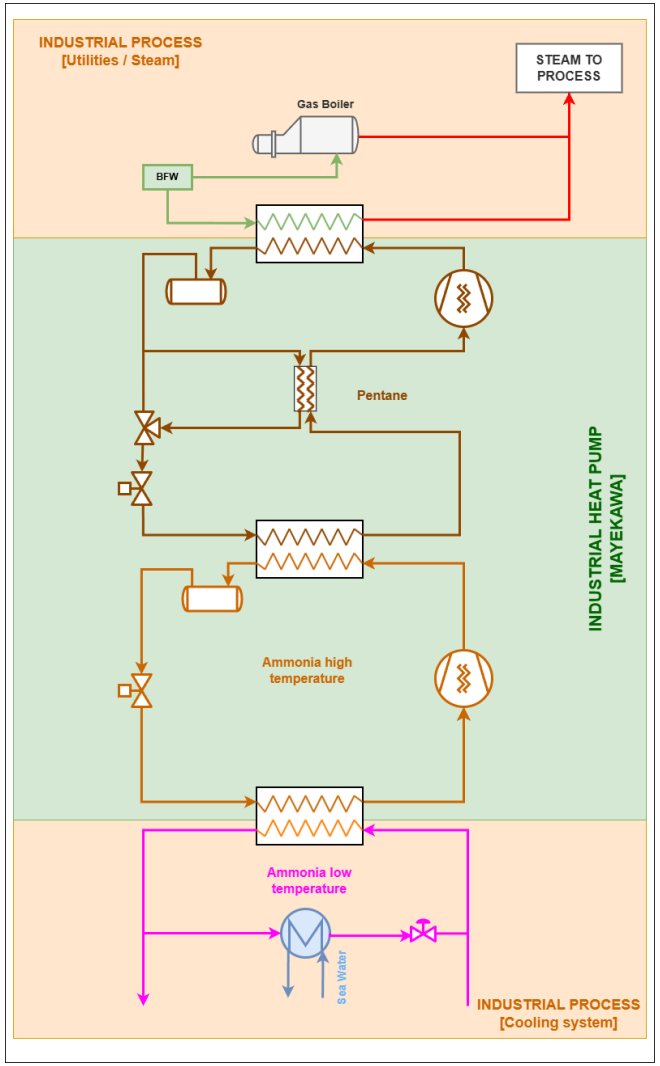
Demo at Stella Polaris

- Prawn processing
- Annual production of 5000 mt prawns
- Steam for cooking prawns by propane boiler
- 9000 MWh/year
- Emissions equivalent **to 2600 ton CO_2/year**

Heat pump operating conditions

- Heat source: 20°C,
- Heat sink: 145°C
- Capacity: 700 kW





Challenges of IHP

- IHPs are not boilers
- Gas/electricity ratio
- Investment cost
- Availability of the technology (already rising)
- Complexity of integration
- Know-how
- Change of mindset

THANK YOU

Miguel Ramirez – TNO

miguel.ramirez@tno.nl

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Presentations

Harmonising EU certification standards for heat pumps

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Introduction to Heat Pump KEYMARK, your (only) European certification

Leopoldo Micò
Head of KEYMARK
European Heat Pump Association

What is Heat Pump KEYMARK?

What is Heat Pump KEYMARK

- **Voluntary third-party** certification for products and services.It is owned by the European standarisation organisation **CEN/CENELEC**.
- Covers a **large scope** of electrically driven heat pumps (space heating/cooling, DHW, combination heaters).
- **Recognised across Europe**, meaning there's no need for retesting in each country where the certification is recognised.
- Compliant with **European standards and regulations** (Ecodesign Lot 1 & 2).
- **Reliable**, with over 10 Certification bodies and 30 Testing Laboratories across Europe, ensuring **safety** of the products and **transparency** of the performances

What makes Heat Pump KEYMARK successful?

What makes Heat Pump KEYMARK successful?

Heat Pump KEYMARK

Empowered Certification Bodies

11

Heat Pump KEYMARK

Recognised Testing laboratories

30

What makes Heat Pump KEYMARK successful?

What makes Heat Pump KEYMARK successful?

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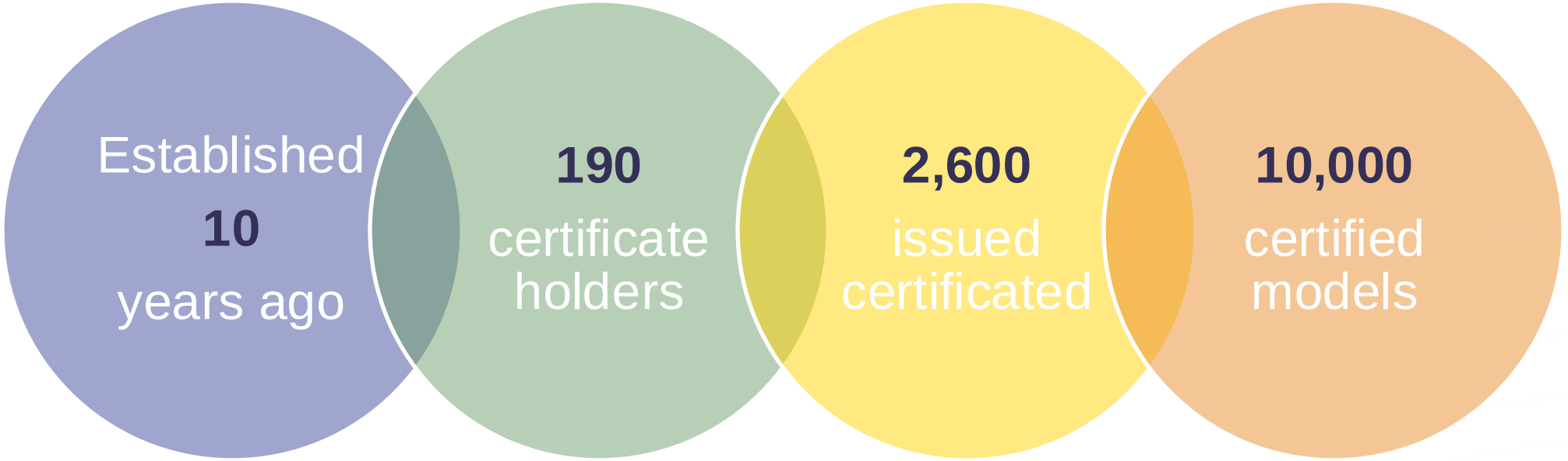
CENTRALNY OŚRODEK CHŁODNICTWA
Jednostka naukowa
CVC
威凯
CETIAT
ensemble, innover et valider
POLITECNICO MILANO 1863
ILK Dresden
RELAB
RENEWABLE HEATING AND COOLING LAB
DANISH TECHNOLOGICAL INSTITUTE
Fraunhofer ISE
DEKRA
GMPI
HLK STUTTGART
itecons
IMQ
kiwa
SGS
intertek
Total Quality. Assured.
TÜV SÜD
STROJÍRENSKÝ ZKUŠEBNÍ ÚSTAV
TÜVRheinland®
Genau. Richtig.
VDE INSTITUT
WPZ
Wärmepumpen-Testzentrum
ehpa

What makes Heat Pump KEYMARK successful?



What does the future hold?

What does the future hold?

- **Ecodesign** regulations will evolve to include the EPD (Environmental Product Declaration).
- The Heat Pump KEYMARK Scheme will **adjust accordingly** to be compliant with the new changes.
- The Heat Pump KEYMARK Certification is **flexible and agile** to adapt to the **needs of the industry** as they evolve.
- The Secretariat is **advocating for the adoption** of standards and the Heat Pump KEYMARK as the method of the delivery for these **harmonised standards**.

Upcoming events

Upcoming Events

Decarb Cities 2025
13-14 May 2025, Krakow, Poland

InstallerSHOW
24-26 June 2025, Birmingham, UK

Heat Pump Forum
25-26 Setember 2025, Brussels, Belgium

European Heat Pump Summit
28-29 October 2025, Nuremberg, Germany

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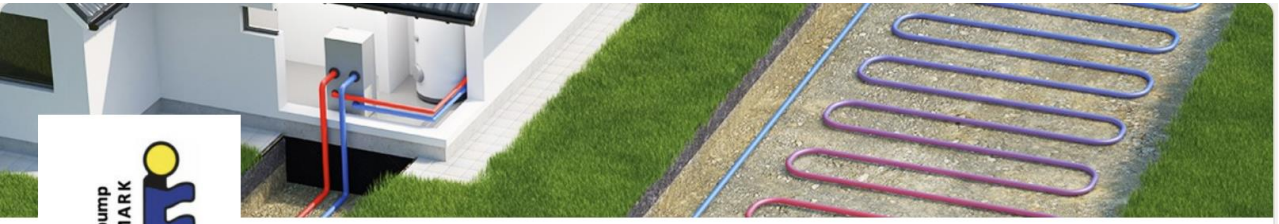

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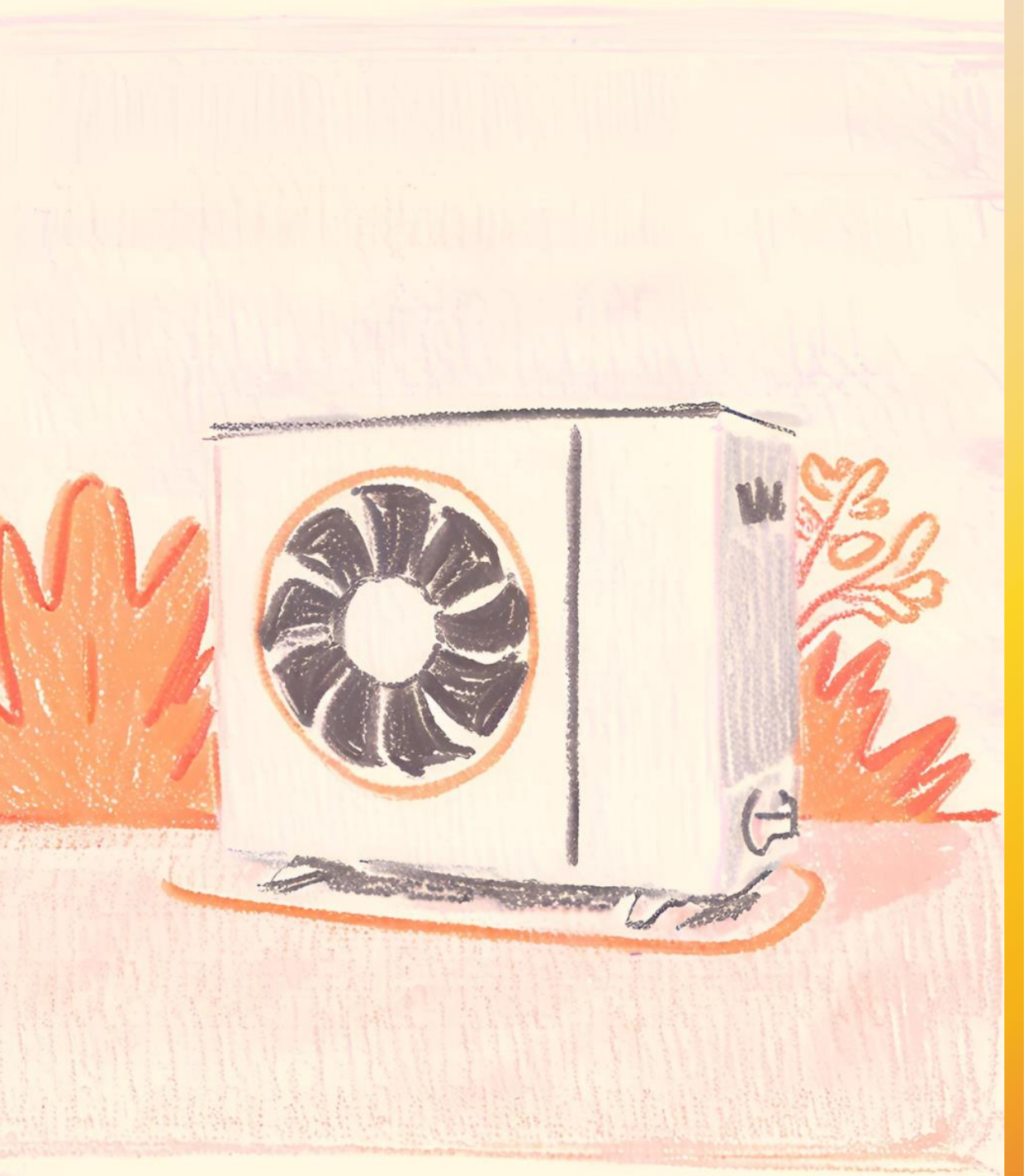

Thank you!

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3 April 2025 I 12:30 – 12:45 CEST

Refrigerant Detection System (RDS)

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Refrigerant detection system (RDS)

Stefano Traversi
April 2025

Safety standards

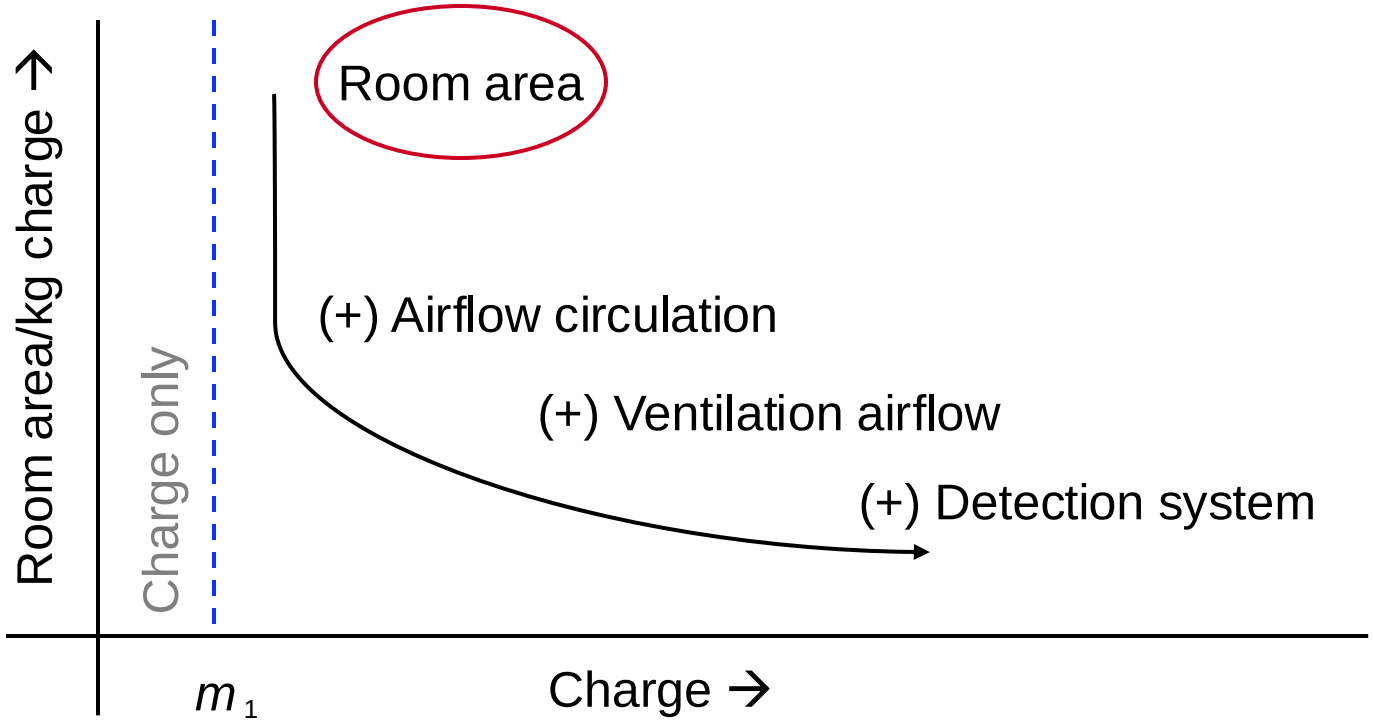
	IEC	UL	EN
	IEC 60335-2-40:2024, Ed. 8.0	**UL 60335-2-40, Ed. 4.1, the Standard for Household and Similar Electrical Appliances – Safety – Part 2-40: Particular Requirements for Electrical Heat Pumps, Air-Conditioners and Dehumidifiers Dec. 15, 2022**	**EN IEC 60335-2-40:2024 + A11:2024**
Note	Published December 2024	Based on IEC 60335-2-40:2018, Ed. 6.0	Based on IEC 60335-2-40:2022, Ed. 7.0
Note 2	-	-	Not harmonized standard for Low Voltage Directive (LVD) and Machinery Directive (MD) EN 60335-2-40:2003 based on IEC 60335-2-40, Ed. 4.0

Flammable refrigerant charge: Annex GG, Mitigations

When flammable refrigerant is used, there are **mitigation methods** to prevent or minimize any potential flame or explosion hazard.

Mitigation methods

- Charge only
- Charge and room area
- Airflow circulation
- Outside ventilation
- Detection system



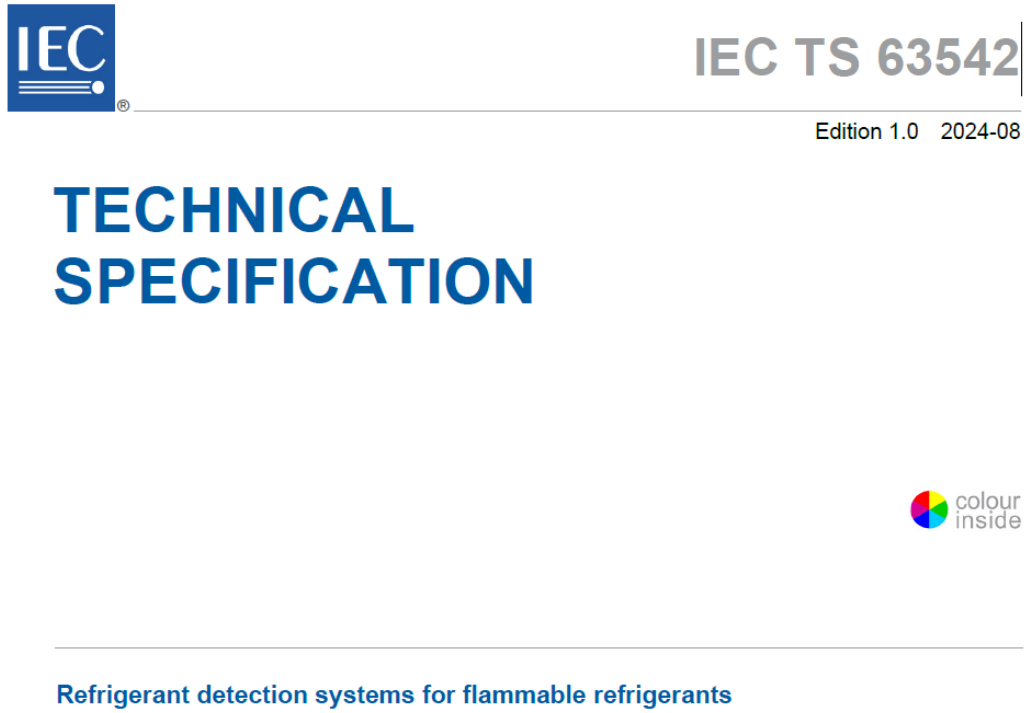
IEC TS 63542

Source: https://webstore.iec.ch/en/publication/90378

This technical specification addresses the construction requirements of the refrigerant detection system for use in appliances complying with the following IEC 60335 standards:

- IEC 60335-2-40 (heat pump/AC)
- IEC 60335-2-89 (commercial refrigerating appliances)
- IEC 60335-2-114 (recovering and/or recycling)
- IEC 60335-2-118 (ice cream makers)

Based on Annex LL of IEC 60335-2-40:2022



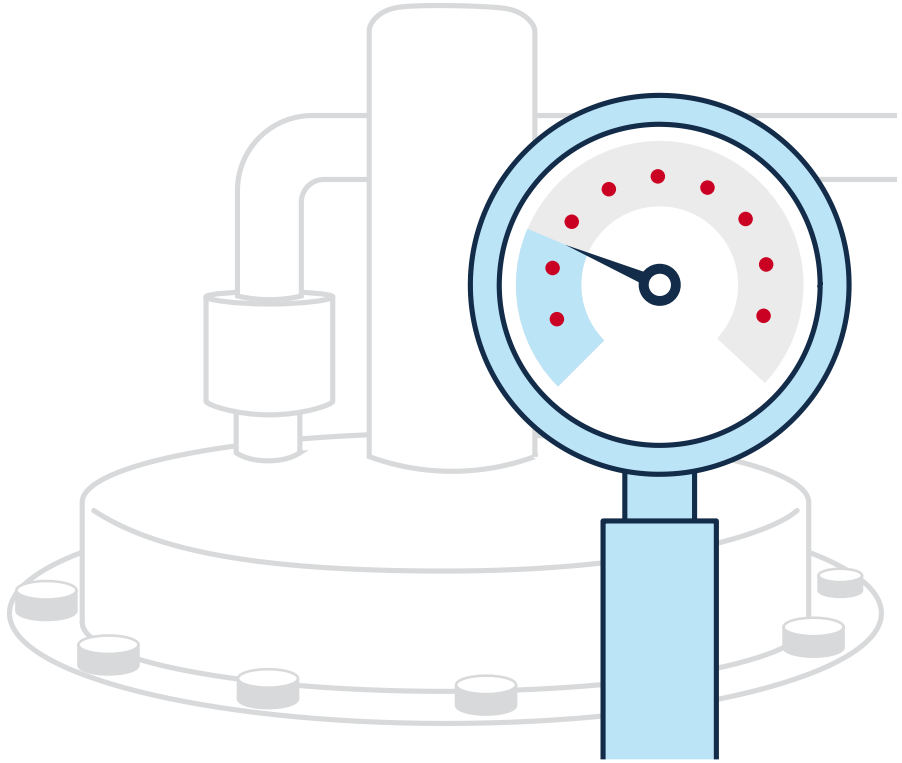
Refrigerant detection system (RDS)

Sensing system that gives **an output signal in response to a preset concentration of refrigerant** in the environment

Sensor (sensing element and housing) combined with an electronic circuit that provides a digital or analog output

How to design

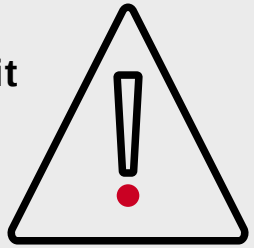
Refrigerant detection systems shall be capable of **detecting refrigerant** concentration **above the alarm set point**, for the refrigerant marked on the appliance, **over the full range of operating temperature and humidity** as specified by the appliance manufacturer.



When the refrigerant detection system senses a concentration of refrigerant gas that is

25% **of the lower flammability limit (LFL)**

for that gas, the refrigerant detection system **must initiate a system response to mitigate the potential hazard.**



Testing requirements

1	**Response time** Shall give output signal within 30 seconds when refrigerant sensor is put into refrigerant concentration of 25% of LFL
2	**Calibration** Shall be calibrated; shall consistently give an output signal at the alarm setpoint; alarm setpoint shall not be adjustable
3	**Selectivity and poisoning test** Shall not have false or nuisance trips when exposed to various gases
4	**Refrigerant poisoning and oil spry test** Shall not be damaged or poisoned by refrigerant(s) marked on appliance mixed with oil
5	**Long-term stability** Shall consistently give an output signal at alarm setpoint over a period of 90 days

Testing requirements

6	**Humidity test** Shall consistently give an output signal at alarm setpoint over humidity range (30 ± 5)/(90 ± 5)% relative humidity (RH)
7	**Temperature test** Shall consistently give an output signal at alarm setpoint over temperature range (minimum/maximum)°C
8	**Vibration** Shall withstand vibration without breakage or damage of parts and shall continue to function
9	**Ignition test** Shall not be a source of ignition for leaked refrigerant
10	**Self test routine** Shall self-test to include missing refrigerant sensor (open circuit), bypassed refrigerant sensor (shorted circuit) and refrigerant sensor output out of range

Identification and serviceability

The refrigerant sensors or the parts of the appliance containing refrigerant sensors shall be marked:

- “Service indicator; read technical manual” (symbol for ISO 7000-1659 (2004-01))
- Year of manufacture
- Reference number or other means of identifying the refrigerant sensor

Serviceability:

- Shall be accessible for inspection and replacement
- Shall be accessible for replacement, specified by the manufacturer

Thank you

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Questions & Answers

Harmonising EU certification standards for heat pumps

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Heat Pump Technologies, Allianz MiCo Milano

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Conclusions

Paul Kenny

Director General, European Heat Pump Association

Thank you

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