

# Air source heat pumps in Europe technology, policy and market

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**HPP workshop, November 13, 2013, Tokyo, Japan**



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# Objectives of the presentation

- “ Technology overview
- “ Current and future policy
- “ Market and market development
- “ Conclusions



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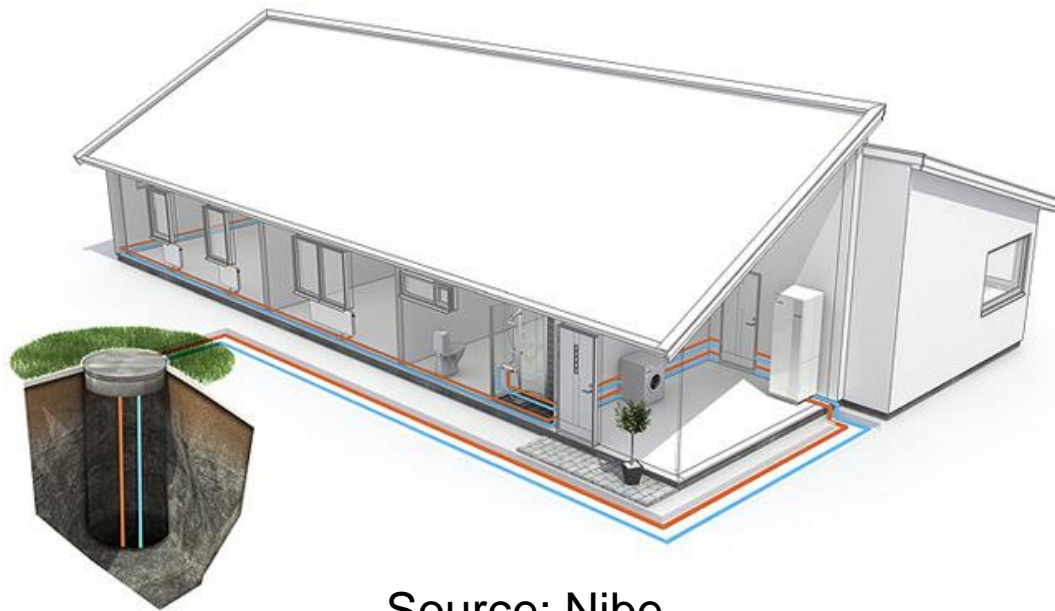


# Existing systems in the market

” Combined heating and DHW

” DHW only

Heat Source: Outdoor air, ground



Source: Nibe

Heat Source: Outdoor air, exhaust air



Source: SensoTherm



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# Competing systems in the market – DHW heating

“ EI, Gas, HP

New electric  
water heaters



Gas storage  
water heaters



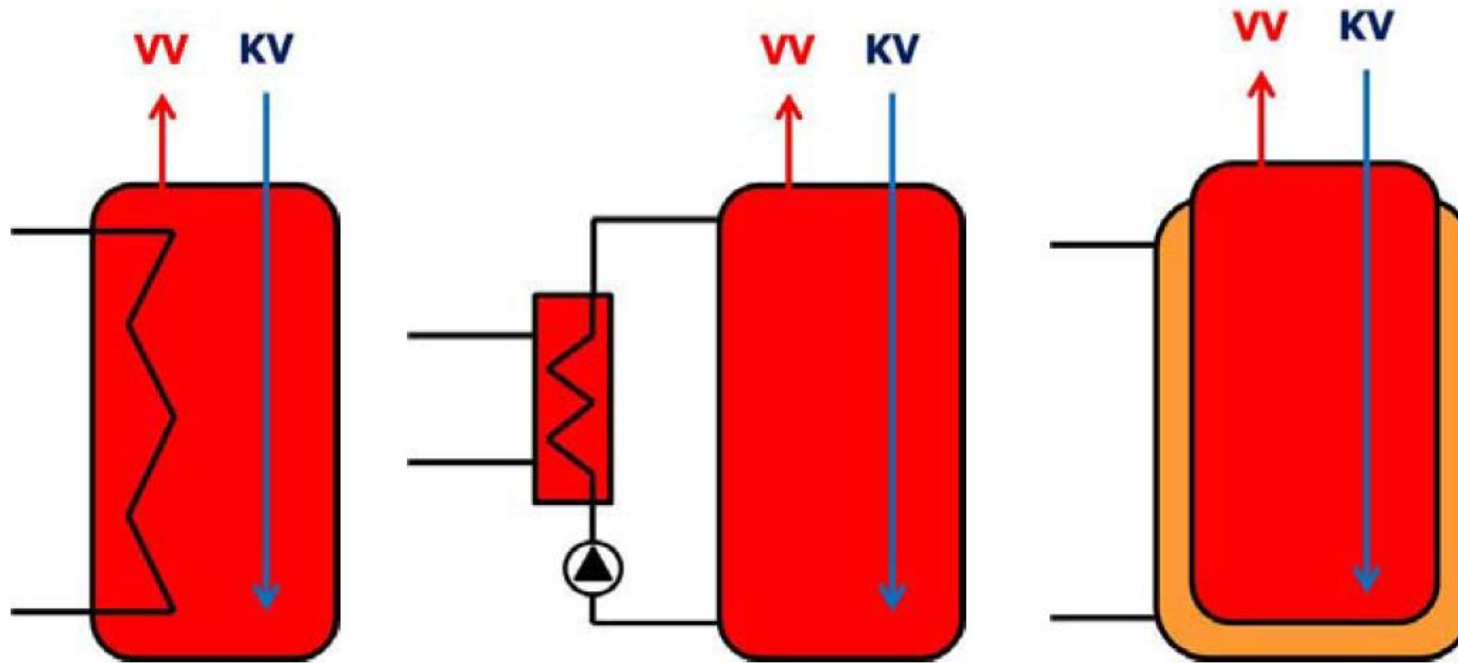
Sources: Baxi, Brötje



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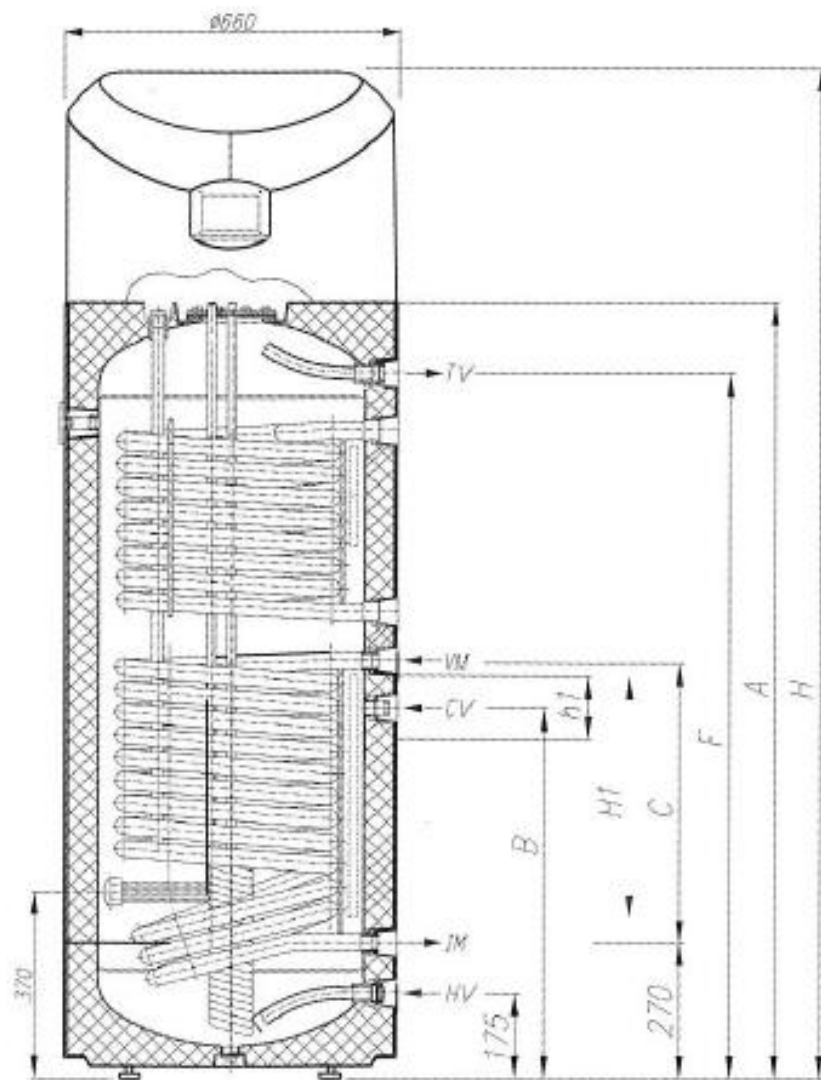
# Principles of operation – DHW cylinder



Interior coil in the hot water cylinder

External heat exchanger

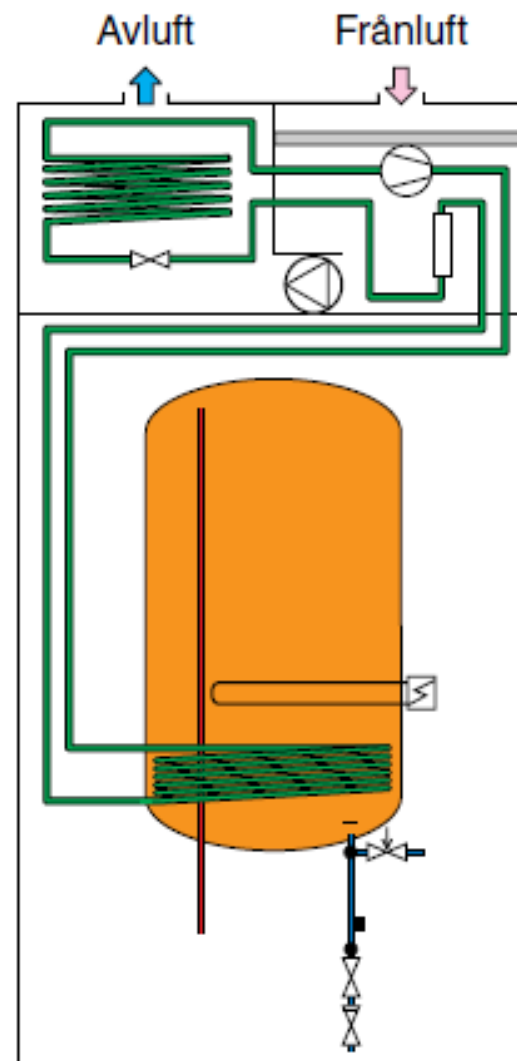
Indirect heating through double wall cylinder



Source: Gorenje



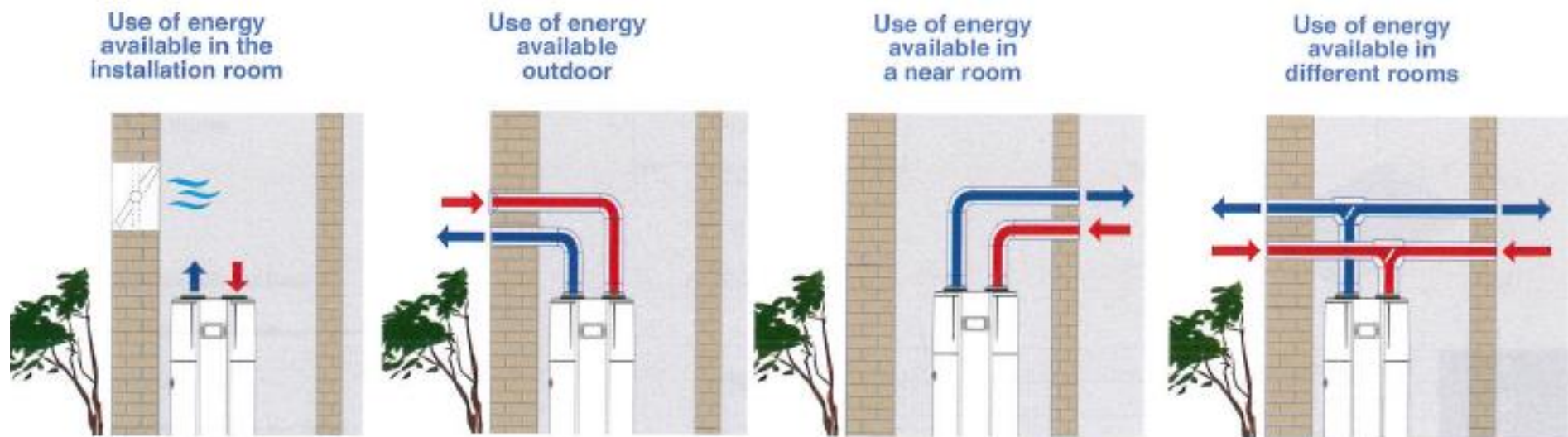
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Source: Nibe



# Principles of installation/ heat sources



Source: Ferrol



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## Boundary conditions

“ Legionella growth: Minimum temperature of 47 °C common, with heating cycles up to 65 °C



“ Hot water temperature: No risk of burning injuries at tapping point

“ Poor stratification of the cylinder: poor stratification leads to mixing, which in turn leads to inefficient operation



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# Typical tapping volumes

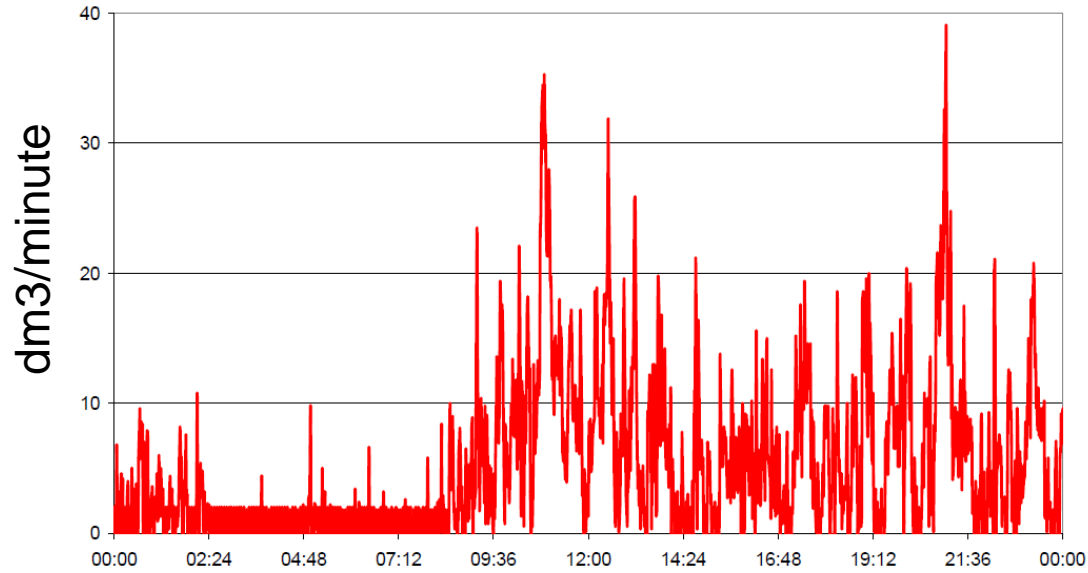
Country	Volume DHW	Temperature	Year
	Daily average [dm <sup>3</sup> /person]	[°C]	
Netherlands	36,3	60	1997
Denmark	38	60	1996
Germany	43	60	1995



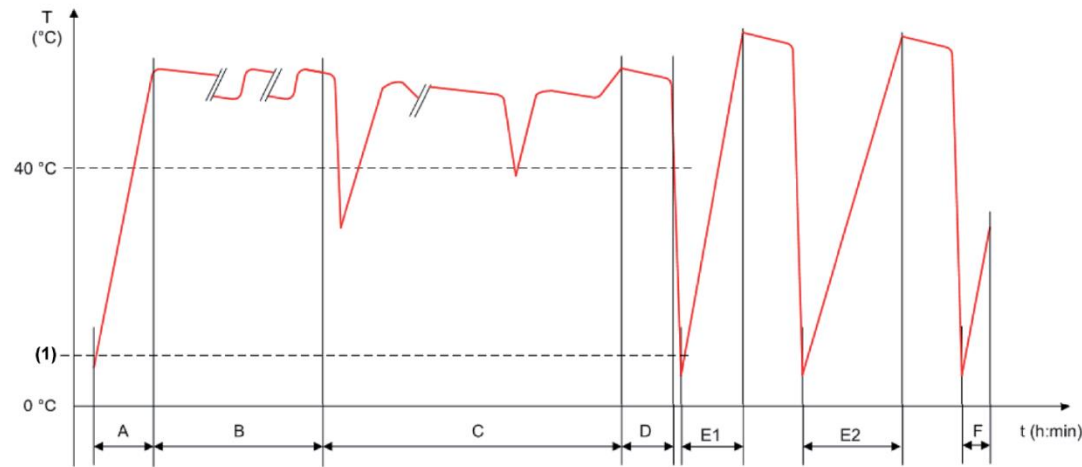
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# Tapping patterns



Tapping pattern according to field monitoring



Tapping pattern according to EN16147:2011

# Refrigerant choice

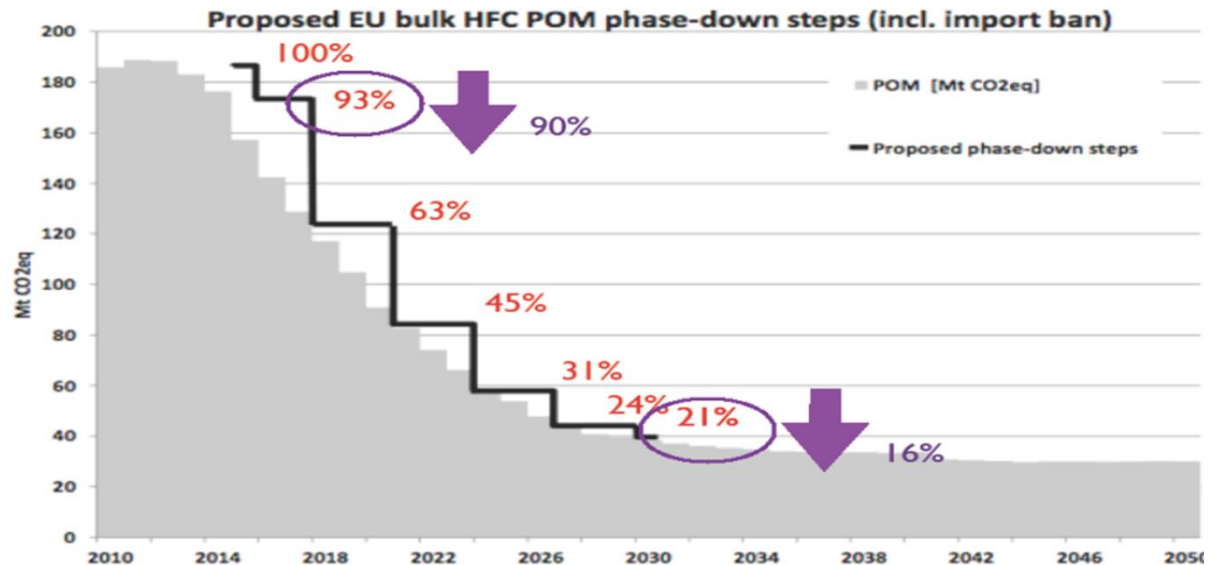
“ Current refrigerants used in Europe

- R134a: 84,2 %
- R407c: 5,3 %
- R410a: 10,5%
- R290 (propane)

Current F-gas proposal:  
Refrigerants with GWP > 2150 banned after 2016  
HFC's banned after 2020

“ Future options

- CO2
- NH3
- R1234ze
- ??
- ??
- Low GWP !!!



Follow: <http://ec.europa.eu/clima/policies/f-gas/>

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# Market, background

- In 2004/'05 there was an installed base (“stock”) of [redacted] of which
  - 2,6 mln. (1,5% of primary water heaters) based on district heating ,
  - 87 mln. units linked to a central heating boiler as a ‘combi’ or with an indirect cylinder (48,9% of primary water heaters) and
  - 146 mln. dedicated water heaters (49,6% of primary and 100% of secondary water heaters).
  
- Total EU 2004/'05 sales of water heaters were 17,2 mln. units, of which
  - 6,8 mln. units linked to boilers, where
    - 4,5 mln. are ‘combi’-boilers and
    - 2,3 mln. indirect cylinders (including 0,25 mln. solar storage tanks).

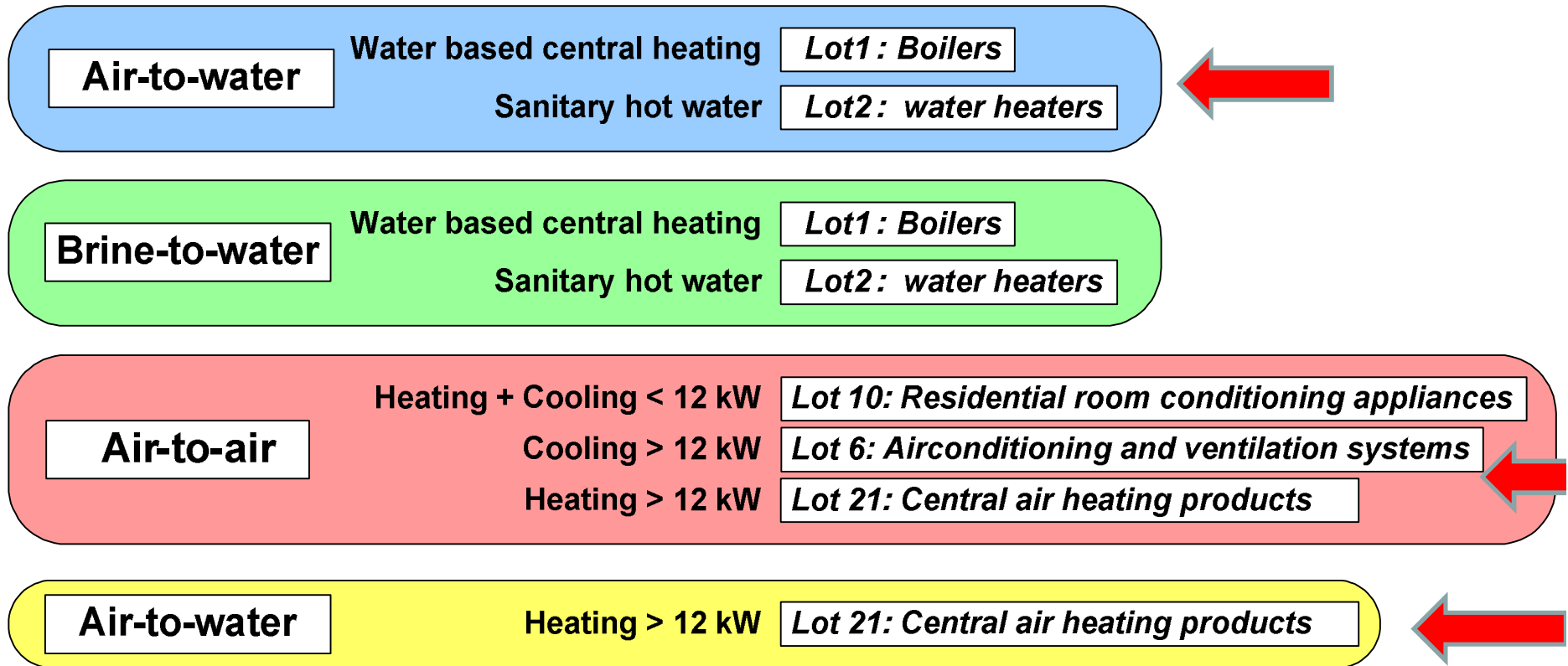


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# Current European policy

” Ecodesign ENER Lot 2 (Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water heaters and hot water storage tanks)



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# Energy performance requirements according to ENER Lot 2

**Table 1:** Energy efficiency classes of water heaters, classified by declared load profiles,  $\eta_{wh}$  in %

	3XS	XXS	XS	S	M	L	XL	XXL	3XL	4XL
A <sup>+++</sup>	$\eta_{wh} \geq 62$	$\eta_{wh} \geq 62$	$\eta_{wh} \geq 69$	$\eta_{wh} \geq 90$	$\eta_{wh} \geq 163$	$\eta_{wh} \geq 188$	$\eta_{wh} \geq 200$	$\eta_{wh} \geq 213$	$\eta_{wh} \geq 225$	$\eta_{wh} \geq 238$
A <sup>++</sup>	$53 \leq \eta_{wh} < 62$	$53 \leq \eta_{wh} < 62$	$61 \leq \eta_{wh} < 69$	$72 \leq \eta_{wh} < 90$	$130 \leq \eta_{wh} < 163$	$150 \leq \eta_{wh} < 188$	$160 \leq \eta_{wh} < 200$	$170 \leq \eta_{wh} < 213$	$180 \leq \eta_{wh} < 225$	$190 \leq \eta_{wh} < 238$
A <sup>+</sup>	$44 \leq \eta_{wh} < 53$	$44 \leq \eta_{wh} < 53$	$53 \leq \eta_{wh} < 61$	$55 \leq \eta_{wh} < 72$	$100 \leq \eta_{wh} < 130$	$115 \leq \eta_{wh} < 150$	$123 \leq \eta_{wh} < 160$	$131 \leq \eta_{wh} < 170$	$138 \leq \eta_{wh} < 180$	$146 \leq \eta_{wh} < 190$
A	$35 \leq \eta_{wh} < 44$	$35 \leq \eta_{wh} < 44$	$38 \leq \eta_{wh} < 53$	$38 \leq \eta_{wh} < 55$				$85 \leq \eta_{wh} < 131$	$90 \leq \eta_{wh} < 138$	$95 \leq \eta_{wh} < 146$
B	$32 \leq \eta_{wh} < 35$	$32 \leq \eta_{wh} < 35$	$35 \leq \eta_{wh} < 38$	$35 \leq \eta_{wh} < 38$	$45 \leq \eta_{wh} < 65$	$50 \leq \eta_{wh} < 75$	$55 \leq \eta_{wh} < 80$	$60 \leq \eta_{wh} < 85$	$64 \leq \eta_{wh} < 90$	$64 \leq \eta_{wh} < 95$
C	$29 \leq \eta_{wh} < 32$	$29 \leq \eta_{wh} < 32$	$32 \leq \eta_{wh} < 35$	$32 \leq \eta_{wh} < 35$	$36 \leq \eta_{wh} < 45$	$37 \leq \eta_{wh} < 50$	$38 \leq \eta_{wh} < 55$	$40 \leq \eta_{wh} < 60$	$40 \leq \eta_{wh} < 64$	$40 \leq \eta_{wh} < 64$
D	$26 \leq \eta_{wh} < 29$	$26 \leq \eta_{wh} < 29$	$29 \leq \eta_{wh} < 32$	$29 \leq \eta_{wh} < 32$	$33 \leq \eta_{wh} < 36$	$34 \leq \eta_{wh} < 37$	$35 \leq \eta_{wh} < 38$	$36 \leq \eta_{wh} < 40$	$36 \leq \eta_{wh} < 40$	$36 \leq \eta_{wh} < 40$
E	$22 \leq \eta_{wh} < 26$	$23 \leq \eta_{wh} < 26$	$26 \leq \eta_{wh} < 29$	$26 \leq \eta_{wh} < 29$	$30 \leq \eta_{wh} < 33$	$30 \leq \eta_{wh} < 34$	$30 \leq \eta_{wh} < 35$	$32 \leq \eta_{wh} < 36$	$32 \leq \eta_{wh} < 36$	$32 \leq \eta_{wh} < 36$
F	$19 \leq \eta_{wh} < 22$	$20 \leq \eta_{wh} < 23$	$23 \leq \eta_{wh} < 26$	$23 \leq \eta_{wh} < 26$	$27 \leq \eta_{wh} < 30$	$27 \leq \eta_{wh} < 30$	$27 \leq \eta_{wh} < 30$	$28 \leq \eta_{wh} < 32$	$28 \leq \eta_{wh} < 32$	$28 \leq \eta_{wh} < 32$
G	$\eta_{wh} < 19$	$\eta_{wh} < 20$	$\eta_{wh} < 23$	$\eta_{wh} < 23$	$\eta_{wh} < 27$	$\eta_{wh} < 27$	$\eta_{wh} < 27$	$\eta_{wh} < 28$	$\eta_{wh} < 28$	$\eta_{wh} < 28$

2 yr- 2015

4 yr- 2017

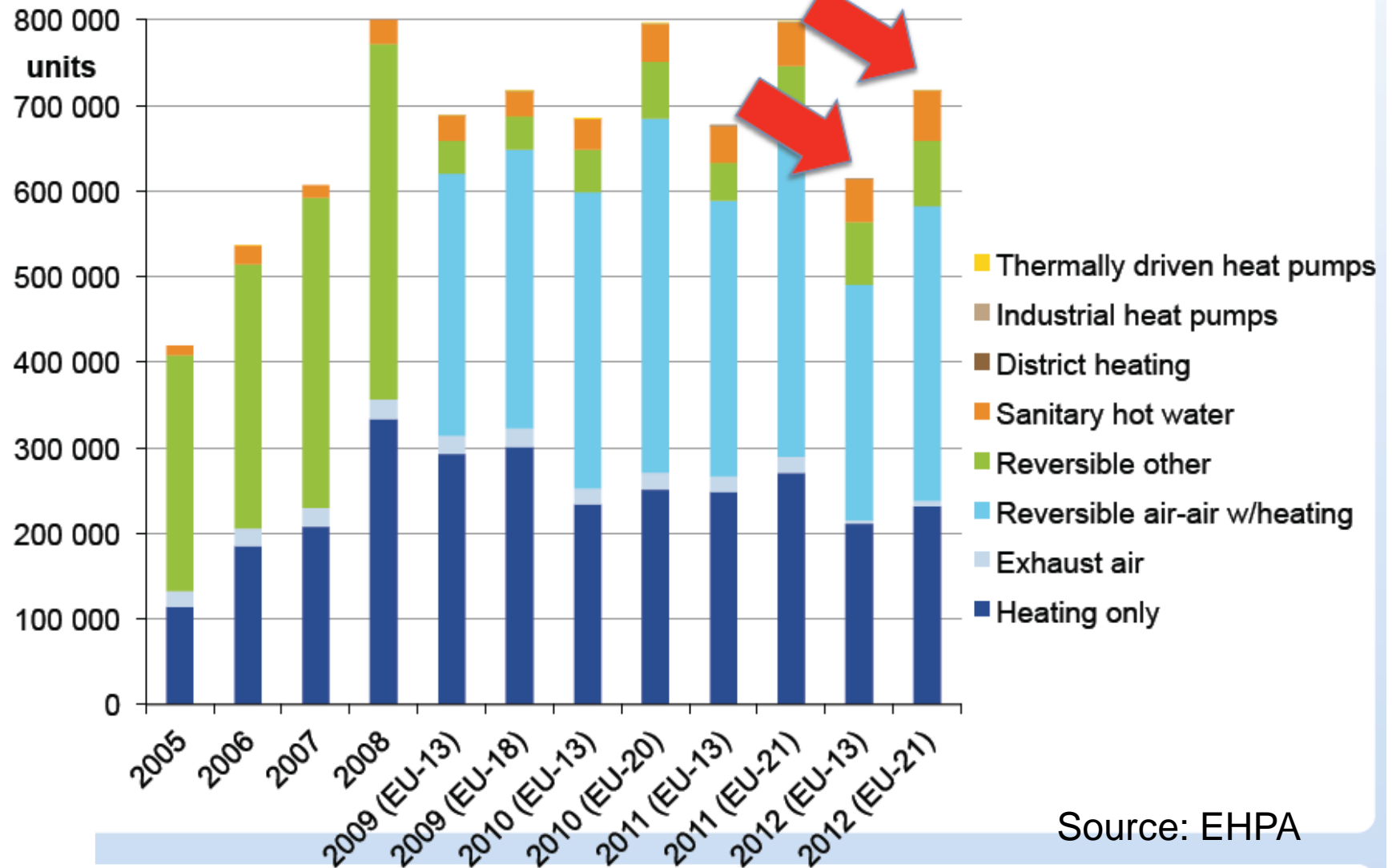
5 yr- 2018



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# Heat pump sales in Europe 2011-2012: - 9 %



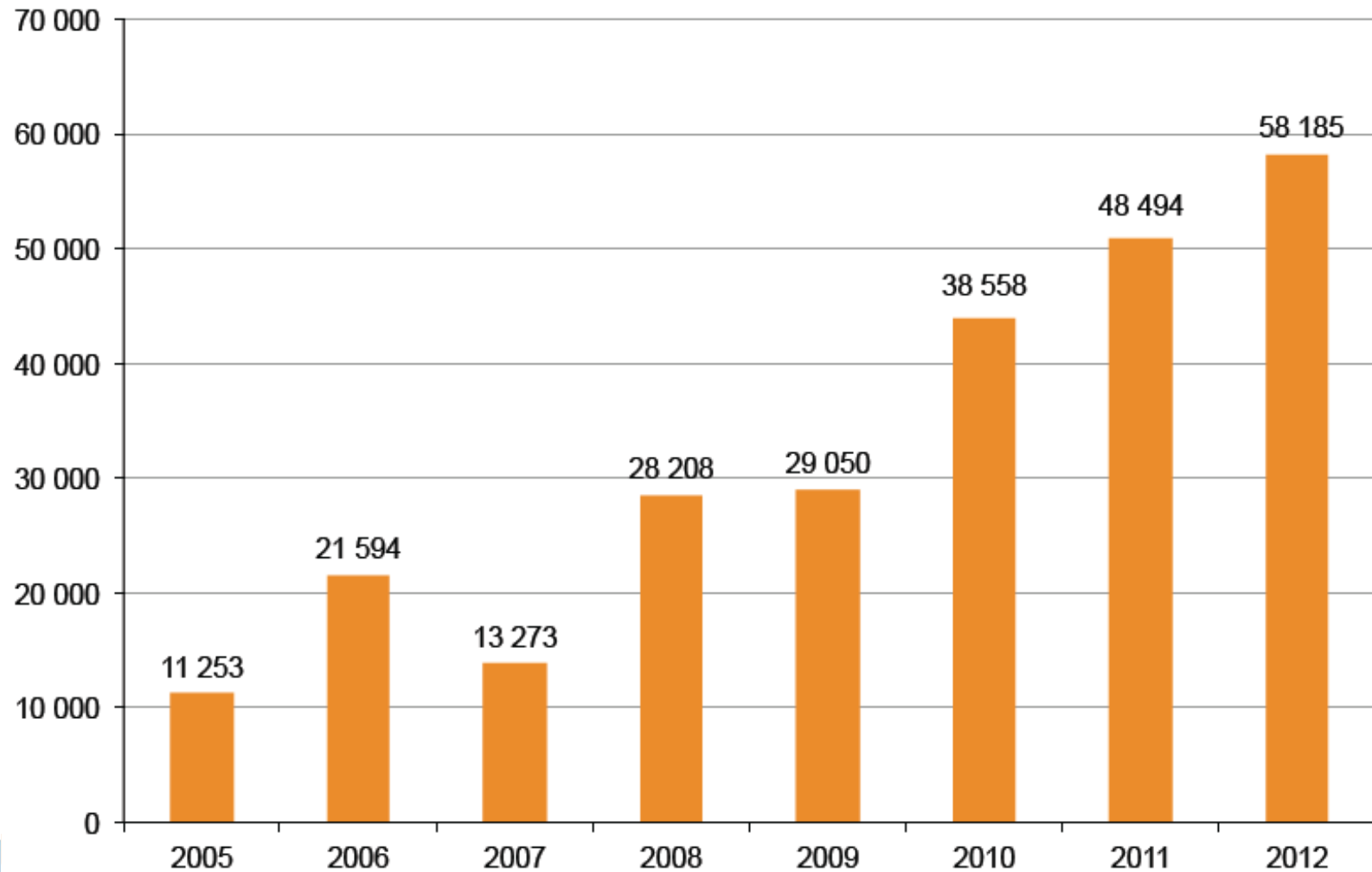
Source: EHPA



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# Sanitary hot water heat pumps

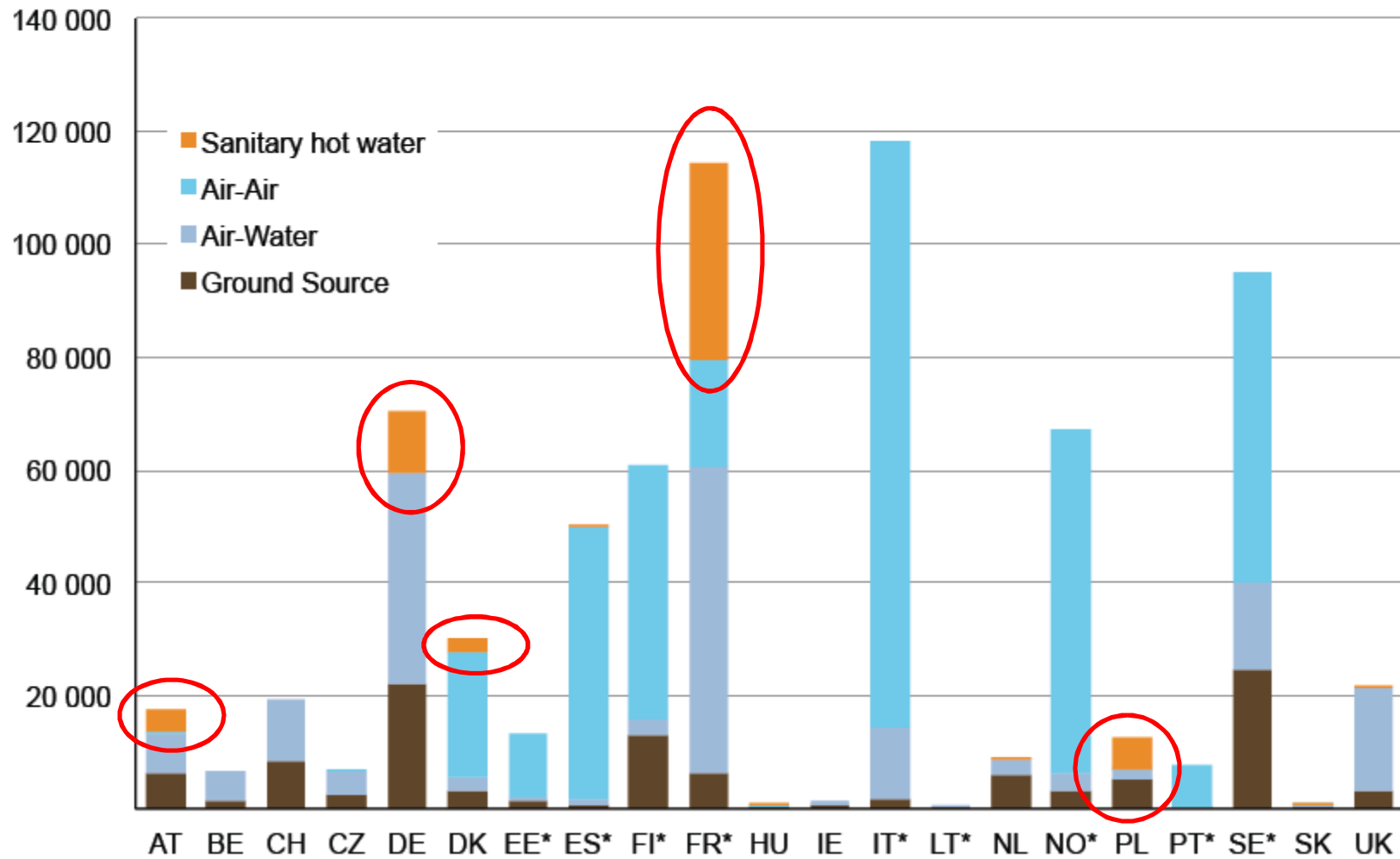


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Source: EHPA 



# Heat pump sales 2012 by country and energy source



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## Conclusions

- “ With more and more NZEB buildings, DHW remains as energy consumer, heating decreases
- “ DHW HPs have a clear market, and a great potential, especially after 2017
- “ Refrigerant could need to be changed from HFC to non-HFC in the future (F-Gas directive)
- “ Still relatively novel technology, with increased interest, technical improvements are expected.
- “ ASHPs in general need to focus on increasing efficiency and decreasing noise simultaneously!  
→ Mission tough, but not impossible!



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