

# **COMPRESSION HEAT PUMPS IN ITALY MARKET – APPLICATIONS – FUTURE DEVELOPMENTS**

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***Aicarr, Refrigeration Committee***

***CoAer, HP Italian Group – Marketing***

# Summary:

- **Scope**
- **Aicarr and CoAer – who we are**
- **HP sectors and common applications in Italy**
- **2008 A/C Industry and compression HPs**
- **Compression HPs – an energy overview**
  - **Air-to-Air**
  - **Air-to-Water**
  - **Water-to Water**
- **HPs for all-year comfort and energy savings**
- **conclusions**

# what we aim to demonstrate

- **Integrative\*** use of Reversible Compression Heat Pumps as valid means for energy savings in heating and cooling for the entire year
- **By 2020 Compression Heat Pumps might allow up to 20-25% reduction in primary energy consumption through partial replacement of traditional gas or other fuel heating systems (boilers)**  
**(EPBD 20/20/20)**

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\* Integrative = that puts together parts to make a whole

# some restraints against HPs

(in Italy)

- **H.P.s use electric power ....**
- **Other heating systems (boilers) use fuels ready available (gas, coal, biomass etc.)**
- **First investment for boilers is less expensive**
- **Boiler's installation is by far easier (A-A and A-W H.P.s, the most common in Italy, need external space availability, W-W and GSHPs long and expensive interventions)**
- **Thermosolar easier to utilize with boilers**
- **Photovoltaic preferable with H.P.s but expensive and difficult to install and use**

# AiCARR and CoAer



**AICARR**

Cultura e Tecnica per Energia Uomo e Ambiente

## **ASSOCIAZIONE ITALIANA CONDIZIONAMENTO DELL'ARIA, RISCALDAMENTO, REFRIGERAZIONE**

- **Aicarr is the Italian Association of HVAC&R Engineers**
- **is a cultural society with the objective of achieving a sustainable comfort through**
  - better environment
  - energy savings and
  - conscious use of energy resources



**AICARR**

Cultura e Tecnica per Energia Uomo e Ambiente

- **more than 2600 members**
  - **professionals**
  - **designers of equipment and systems**
  - **researchers**
  - **academy**
  - **students**



**AiCARR**

Cultura e Tecnica per Energia Uomo e Ambiente

- **1 international convention**
- **6 annual congresses**
- **technical visits and meetings**
- **HVAC school of excellence**
- **association's monthly journal, CDA**
- **technical books – Collana Aicarr**



Co.Aer

ASSOCIAZIONE COSTRUTTORI  
DI APPARECCHIATURE  
ED IMPIANTI AERAILICI

## COSTRUTTORI APPARECCHIATURE E IMPIANTI AERAILICI

- **Co.Aer is the Italian Association of HVAC Manufacturers (compression technology)**
- **60 associate manufacturers**
- **represents over 90% of the Italian manufacturing capacity**
- **federated in ANIMA**



Co.Aer

ASSOCIAZIONE COSTRUTTORI  
DI APPARECCHIATURE  
ED IMPIANTI AERAUICI

- **8 technical working groups**
  - Fans
  - Air pollution control systems
  - A/C equipment and terminal units
  - Liquid chillers
  - Self-contained air conditioners
  - Air handling units
  - Heat exchangers
  - Cooling towers



Co.Aer

ASSOCIAZIONE COSTRUTTORI  
DI APPARECCHIATURE  
ED IMPIANTI AERAILICI

- **direct participation to prominent exhibitions**
- **annual survey and statistics of production, domestic sales, export and import**
- **participation and contribution to domestic and international standards**
- **technical overviews and assistance**



Co.Aer

ASSOCIAZIONE COSTRUTTORI  
DI APPARECCHIATURE  
ED IMPIANTI AERAILICI

## GRUPPO ITALIANO POMPE DI CALORE, GIPC

- **GIPC is a group of manufacturers for the advancement and diffusion of Heat Pumps in Italy including their “annual” utilization**
- **communications and learning committes**
- **white book and literature for the diffusion of HPs (download [www.pompedicalore.org](http://www.pompedicalore.org))**
- **actions to influence standards and legislation**

# HP sectors and common applications in Italy

# HEAT PUMPS APPLICATION SECTORS

- **RESIDENTIAL (AND LIGHT COMMERCIAL)**  
SPACES INDIVIDUALLY AIR CONDITIONED
  - HOMES RESIDENCE – SINGLE ROOM
  - SMALL OFFICES –
  - SMALL SHOPS – SHOW ROOMS
- **INDIVIDUAL AIR CONDITIONERS**
- **MOSTLY SINGLE SPLIT SYSTEMS**
- **ALSO MULTI-SPLIT**

# HEAT PUMPS APPLICATION SECTORS

- **COMMERCIAL (institutional and tertiary)**  
SPACES SIMULTANEOUSLY AIR CONDITIONED
  - OFFICE BUILDINGS (institution and private firms)
  - HOTELS
  - HOSPITALS – NURSING HOMES - RESIDENCE
  - LARGE OFFICES IN PRIVATE HOUSES
- **CENTRALIZED AIR CONDITIONING SYSTEMS**
- **VARIABLE REFRIGERANT FLOW SYSTEMS**

# HEAT PUMPS APPLICATION SECTORS

- **BOTH RLC AND CML APPLICATIONS HAVE SEPARATE SOURCES FOR HEATING AND COOLING**
- **INDIVIDUAL HOMES OR APARTMENT ROOMS HAVE A RAC AND (USUALLY CENTRALIZED) BOILER FOR HEATING AND DHW**
- **LARGE BUILDINGS USUALLY HAVE CENTRAL A/C SYSTEM AND SEPARATE CENTRAL BOILER FOR HEATING AND DHW**

# HEAT PUMPS IN THE RESIDENTIAL

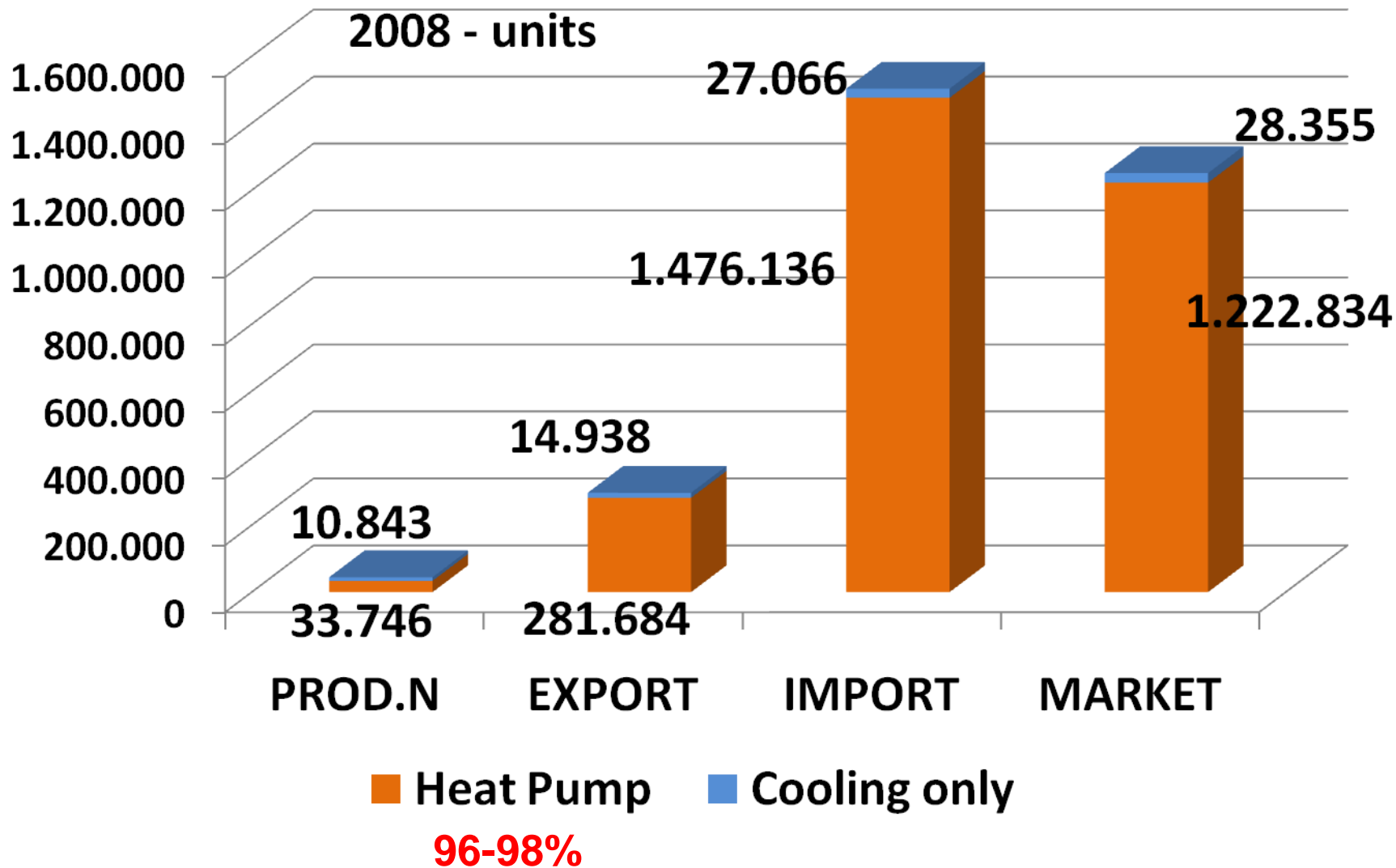
- **AIR-TO-AIR**
  - DUCTLESS SINGLE SPLIT, MULTISPLIT  
*(mainly high-wall, very little percentage used for full season heating)*
- **AIR-TO-WATER**
  - MINICHILLERS < 17 kWt
- **WATER SOURCE**
  - *practically not existing*
- **GROUND SOURCE**
  - *a rare application confined to individual homes*

# HEAT PUMPS IN THE TERTIARY

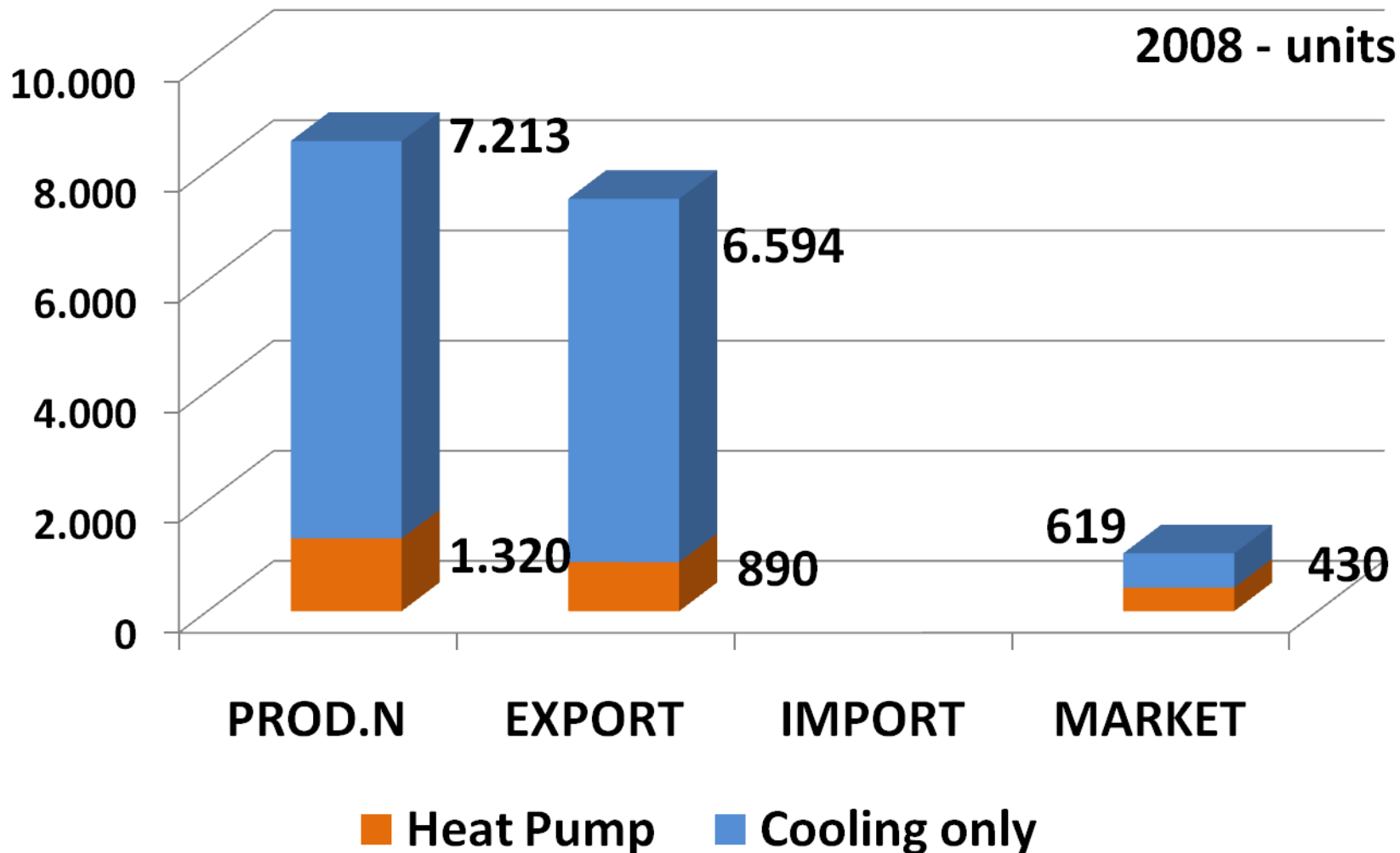
- **AIR-TO-AIR**
  - DUCTED SINGLE SPLIT, MULTISPLIT, ROOF-TOP, PACKAGED UNITS (*mainly vertical split*)
  - VRF SYSTEMS (*in very fast growth*)
- **AIR-TO-WATER**
  - MINICHILLERS > 17 kWt, CHILLERS
- **WATER-TO-WATER (*all types of waters*)**
  - CHILLERS
- **GROUND SOURCE**
  - *an application in remarkable development*

# 2008 A/C Industry and HPs

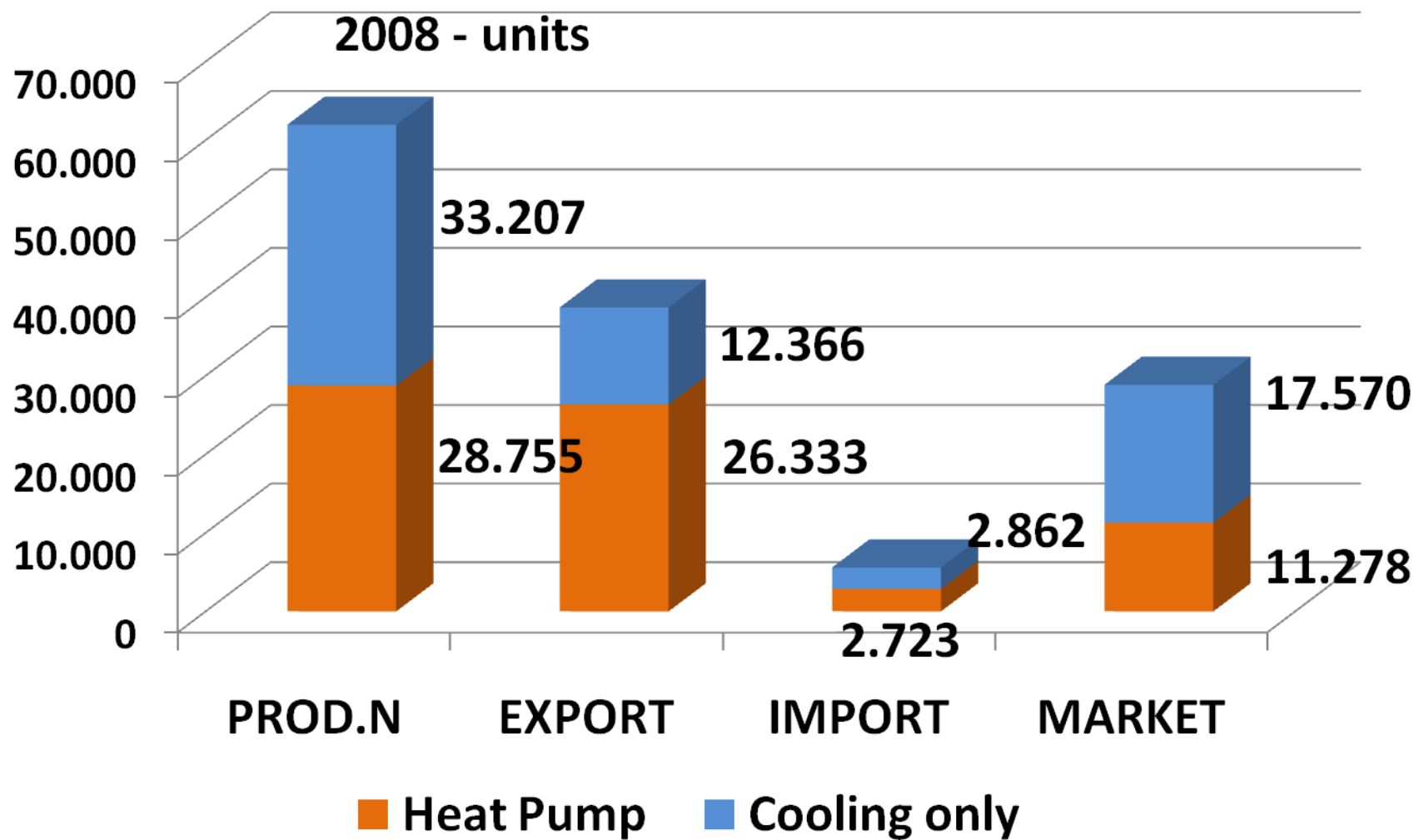
# LRC SPLIT SYSTEMS (A-to-A)



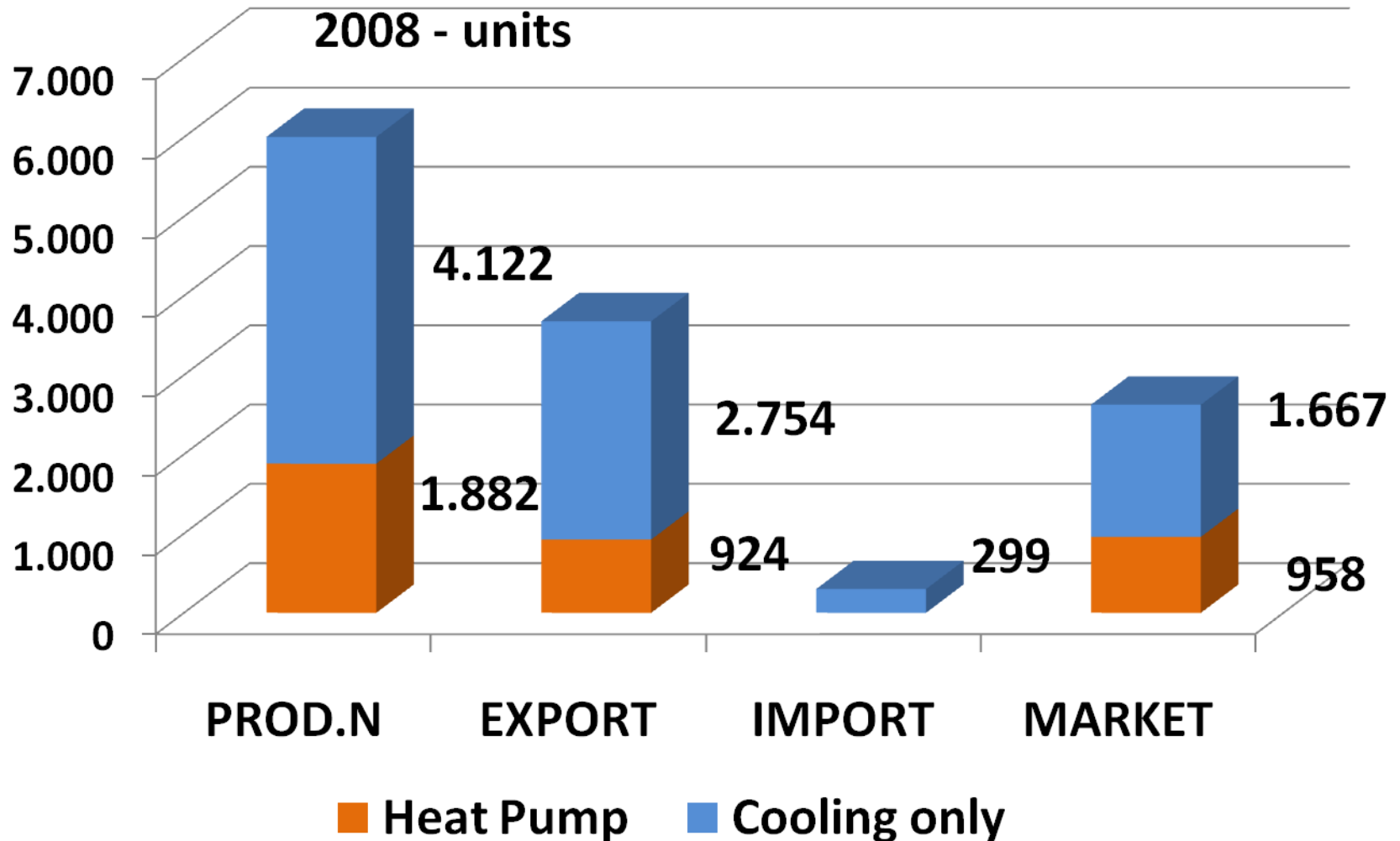
# ROOF-TOP (A-to-A)



# AIR COOLED CHILLERS (A-to-W)



# WATER COOLED CHILLERS (W-to-W)



# **MARKET RLC DEALERS OPERATING WITH THEIR OWN BRAND**

**(participation to 2008 CoAer annual survey - 41)**

- AERMEC ARTEL BALTUR BLUE BOX CARRIER  
CLIMAVENETA CLIVET DAEWOO DAIKIN DE'  
LONGHI EMMETI FAIR FINTERM GALLETTI  
FERROLI HAIER A/C HITACHI ITELCO LG  
McQUAY MERLONI MITSUBISHI ELECTRIC  
OLIMPIA SPLENDID ORIEME PANASONIC RHOSS  
RIELLO SAMSUNG SANYO /EUROPE SANYO/  
ARGO CLIMA SAUNIER DUVAL TATA TERMAL  
THERMOCOLD TOSHIBA MULTICLIMA TOYO  
TOMI TRANE VALLAINT VORTICE**
- Total over 100 brands operating in the market**

# **MARKET DEALERS - ROOF-TOP AND PACG.D OPERATING WITH THEIR OWN BRAND**

**(participation to 2008 CoAer annual survey - 10)**

- ACM KAELTE KLIMA      BLUE BOX GROUP**  
**CLIMAVENETA      CLIVET      EMICON      GALLETTI**  
**G.I.HOLDING      ITELCO      R.C.      UNIFLAIR**

# **MARKET DEALERS WATER CHILLERS OPERATING WITH THEIR OWN BRAND**

**(participation to 2008 CoAer annual survey - 27)**

- A2B ACM AERMEC BALTUR BLUE BOX  
CARRIER CLIMAVENETA CLIVET DAIKIN  
EMICON EMMETI FINTERM GALLETTI  
G.I.HOLDING FERROLI IC ITELCO JOHNSON  
CONTROLS LAMBORGHINI OLOMPIA SPLENDID  
McQUAY MTA R.C. GROUP RHOSS RIELLO  
SABIANA SANYO/EUROPE SANYO/ARGOCLIMA  
SAUNIER DUVAL TATA TECNOCLIMA  
THERMOCOLD TRANE UNIFLAIR**

# HPs – a full scale energy overview

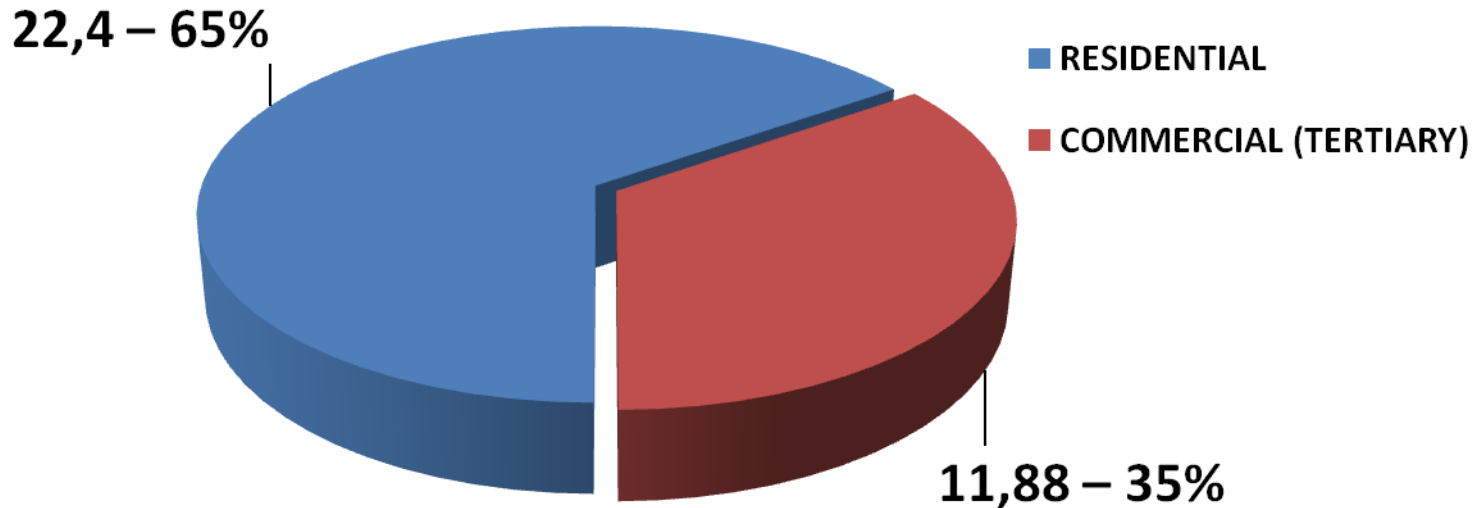
# ITALY 2008

## PRIMARY ENERGY CONSUMPTION FOR COMFORT COOLING AND HEATING

*source: CoAer GIPC – White Book September 2008*

PRIMARY ENERGY (cooling, heating and DHW)

Total 34.38 MTOE – source ENEA



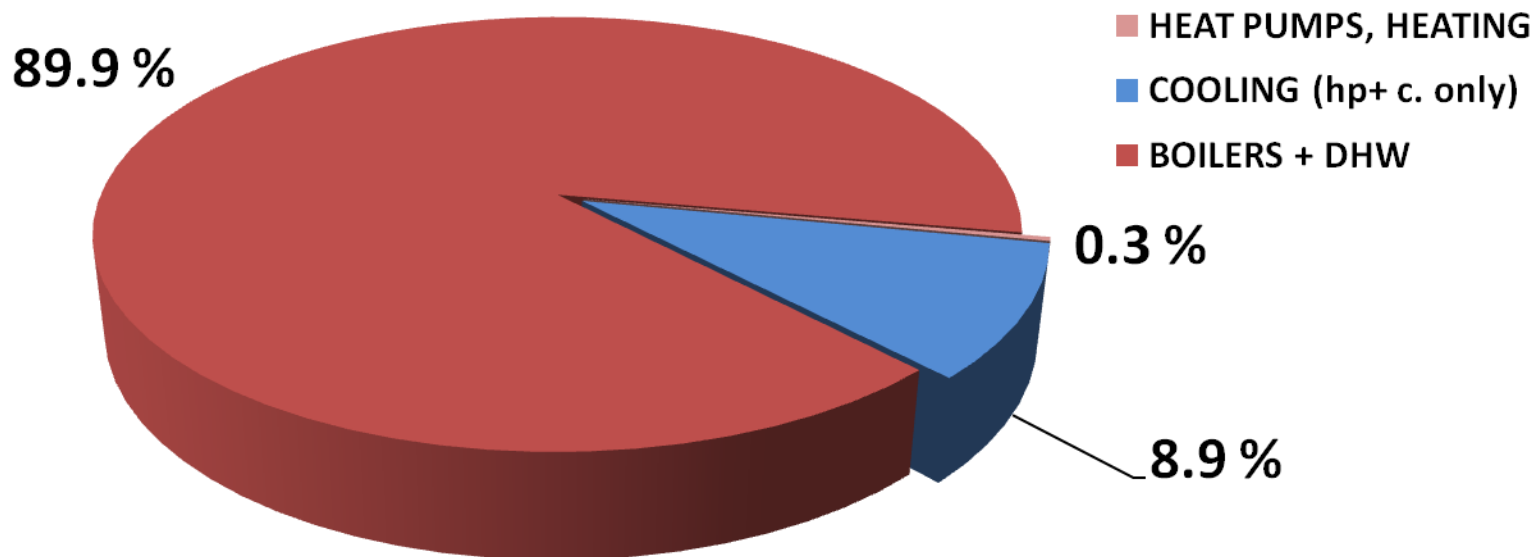
1 TOE = 42 GJ = 11.63 MWh

# ITALY 2008

## PRIMARY ENERGY CONSUMPTION FOR COMFORT COOLING AND HEATING

### RESIDENTIAL

PRIMARY ENERGY (cooling, heating and DHW)  
22.4 MTOE (ENEA)



1 TOE = 42 GJ = 11.63 MWh

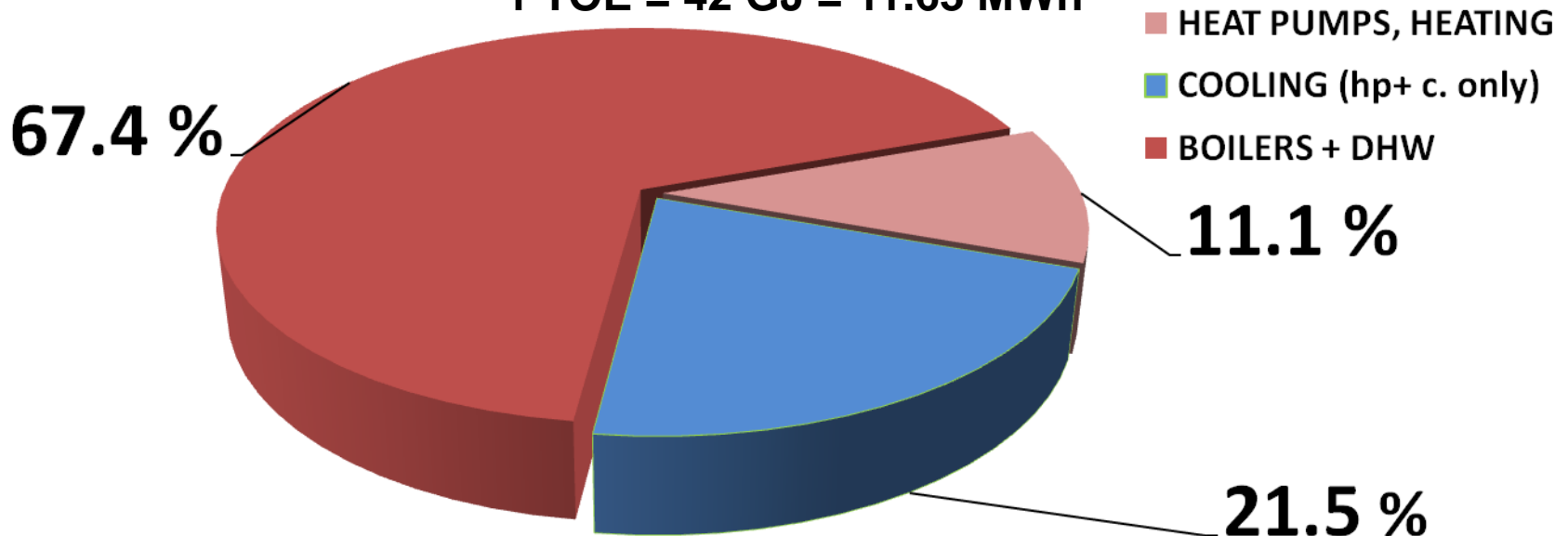
# ITALY 2008

## PRIMARY ENERGY CONSUMPTION FOR COMFORT COOLING AND HEATING **COMMERCIAL (TERTIARY)**

PRIMARY ENERGY (cooling, heating and s. w.)

11.88 MTOE (ENEA)

1 TOE = 42 GJ = 11.63 MWh

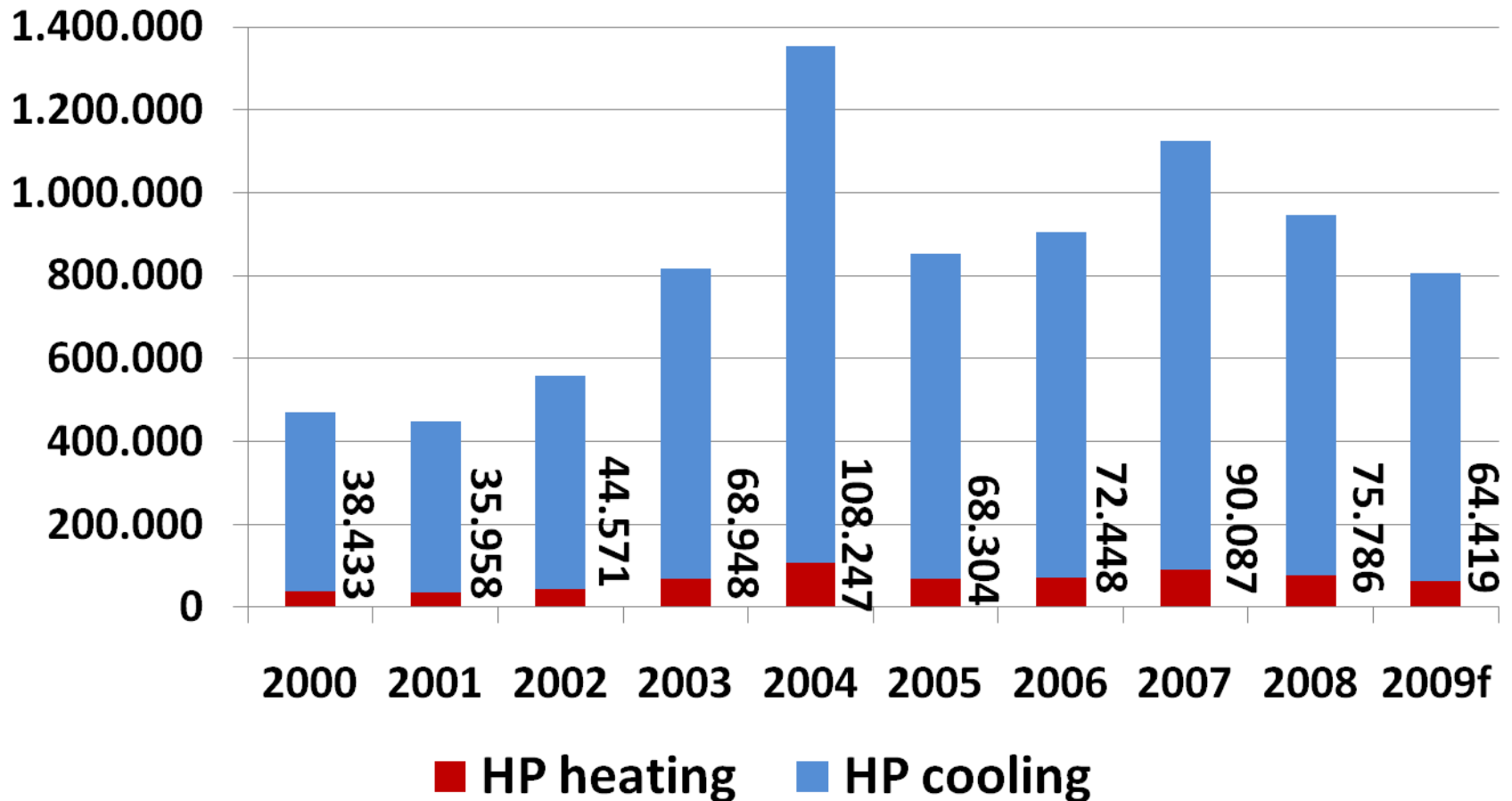


# AIR-TO-AIR

- **DUCTLESS SPLIT (some multisplit)**
  - RANGE OF CAPACITY: 2 to 7 kWt
  - AVERAGE WEIGHTED CAPACITY: 3,5 kWt
  - HEATING USAGE : 8%
- **DUCTED SINGLE SPLIT + MULTISPLIT**
  - RANGE OF CAPACITY: 4 to 18 kWt
  - AVERAGE WEIGHTED CAPACITY: 7 kWt
  - HEATING USAGE: 12%

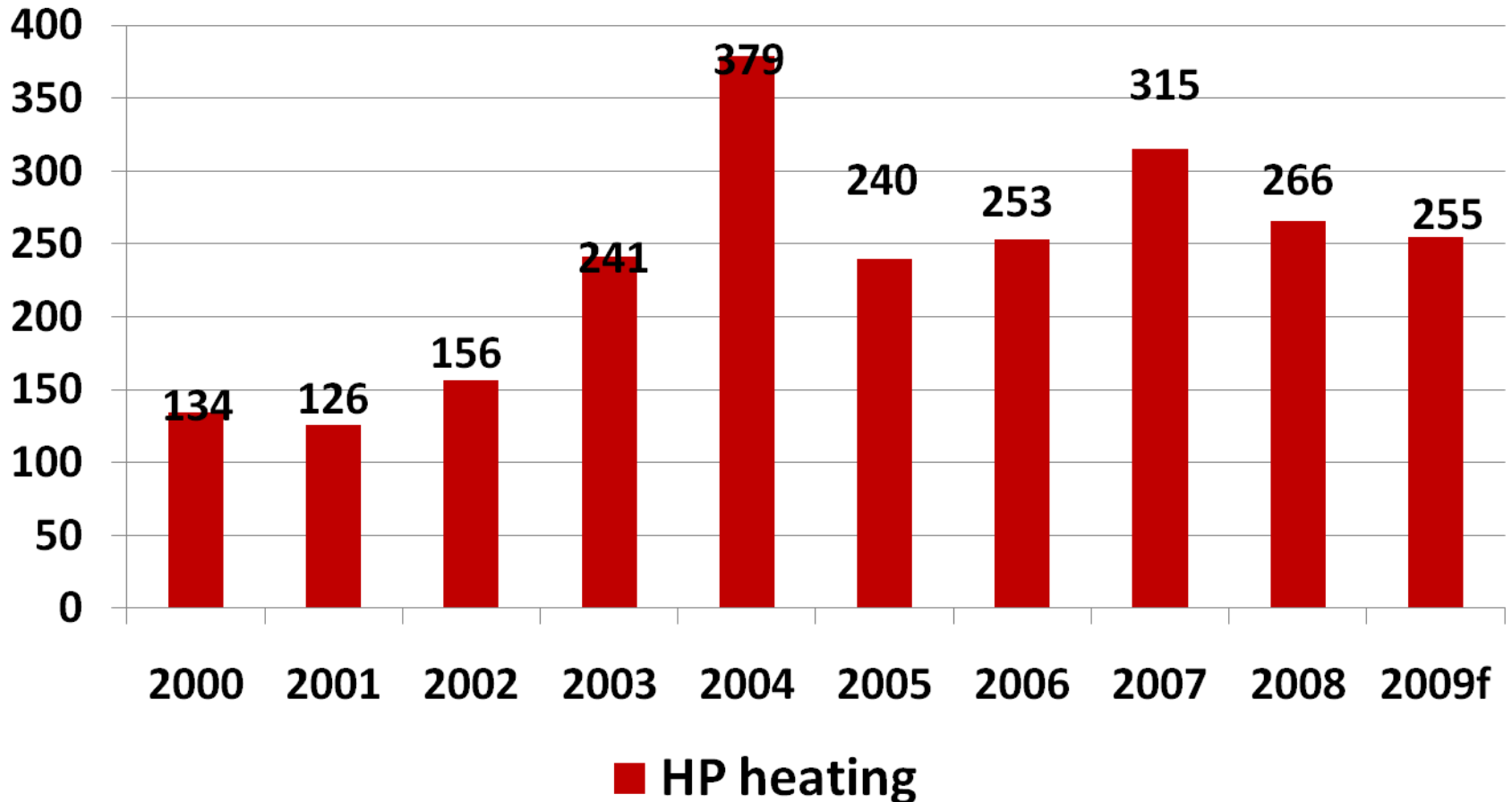
# DUCTLESS SINGLE SPLIT - HPs

## 10 year sale history, units



# DUCTLESS SINGLE SPLIT - HPs

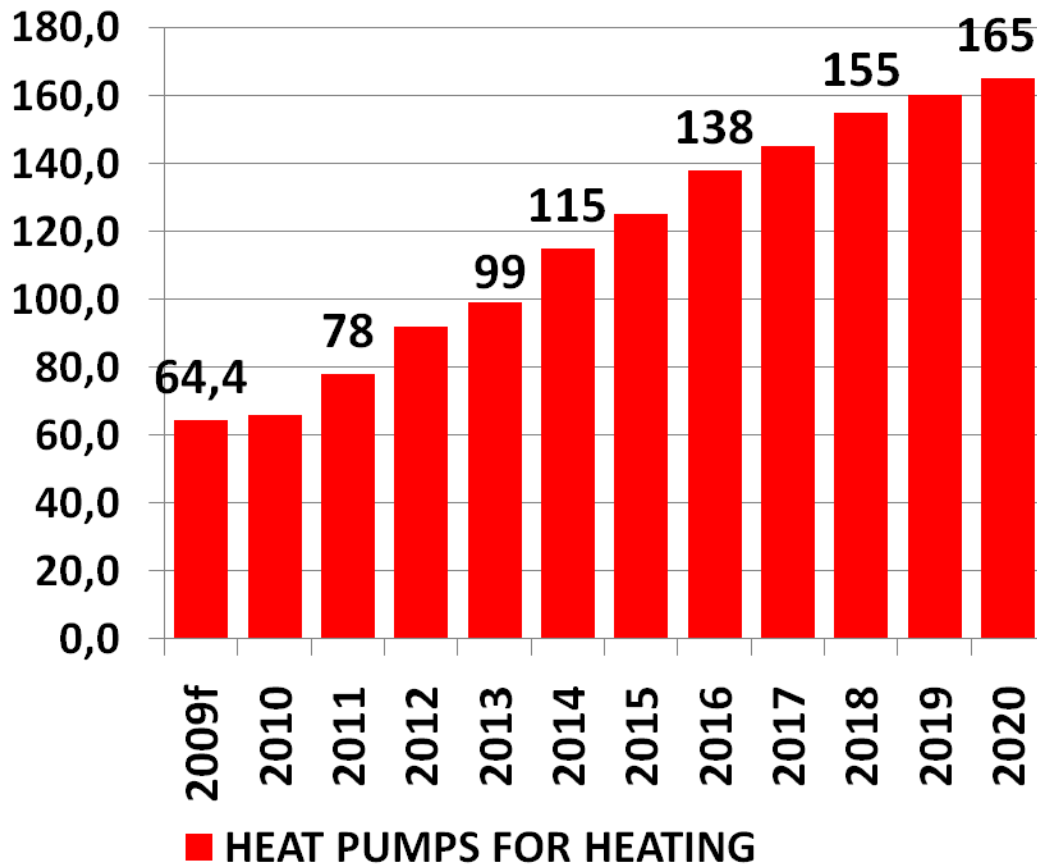
## 10 year sale history, MWt



# DUCTLESS SINGLE SPLIT – HPs

sales development, BAU – 000 units

BAU conditions

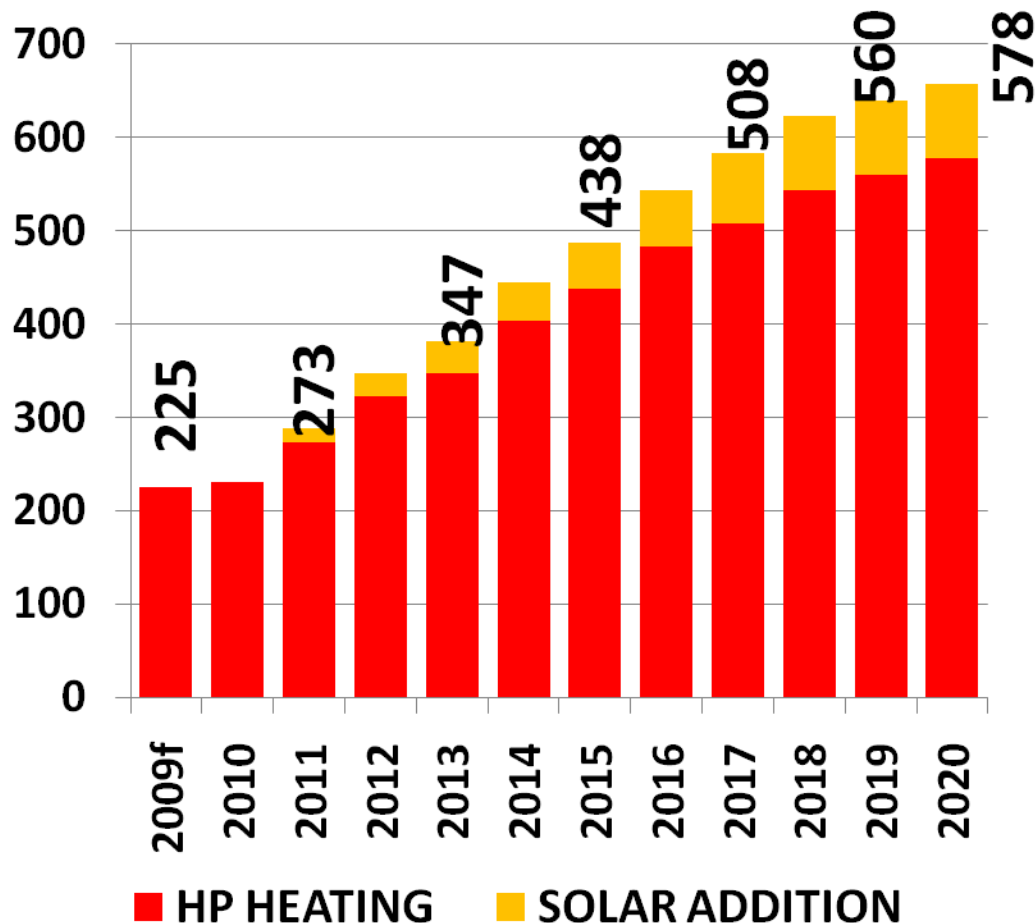


- Components technology advancement (compressors, heat exch.s, fans)
- Circuiting development
- New refrigerants
- Solar assistance (thermal and photovoltaic)

# DUCTLESS SINGLE SPLIT – HPs

sales development, BAU – capacity MWt

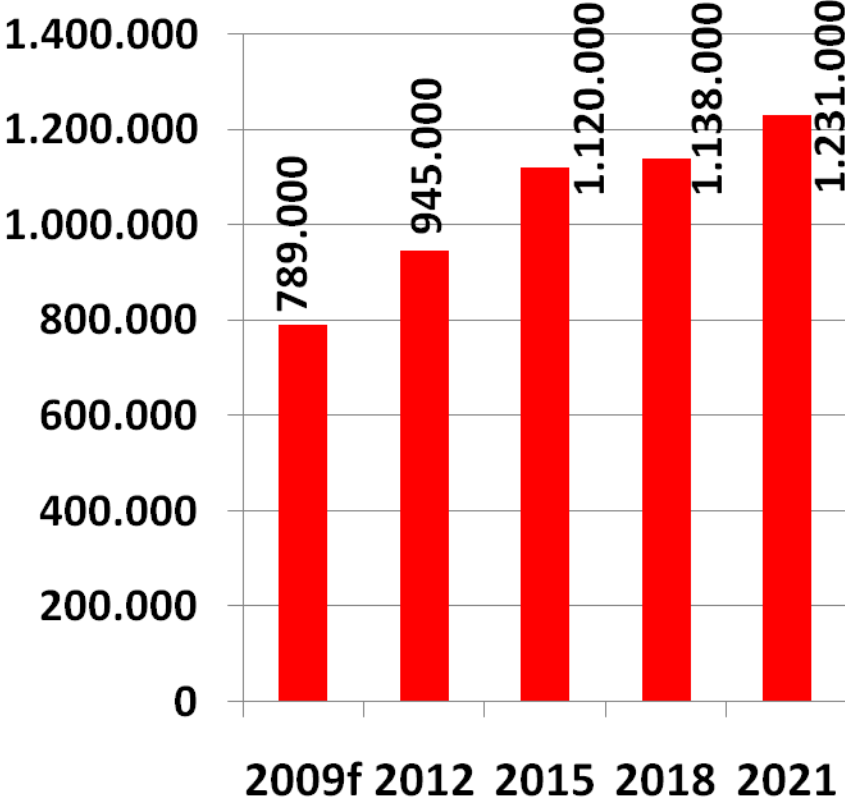
BAU conditions



- Components technology advancement (compressors, heat exch.s, fans)
- Circuiting development
- New refrigerants
- Solar assistance (thermal and photovoltaic)

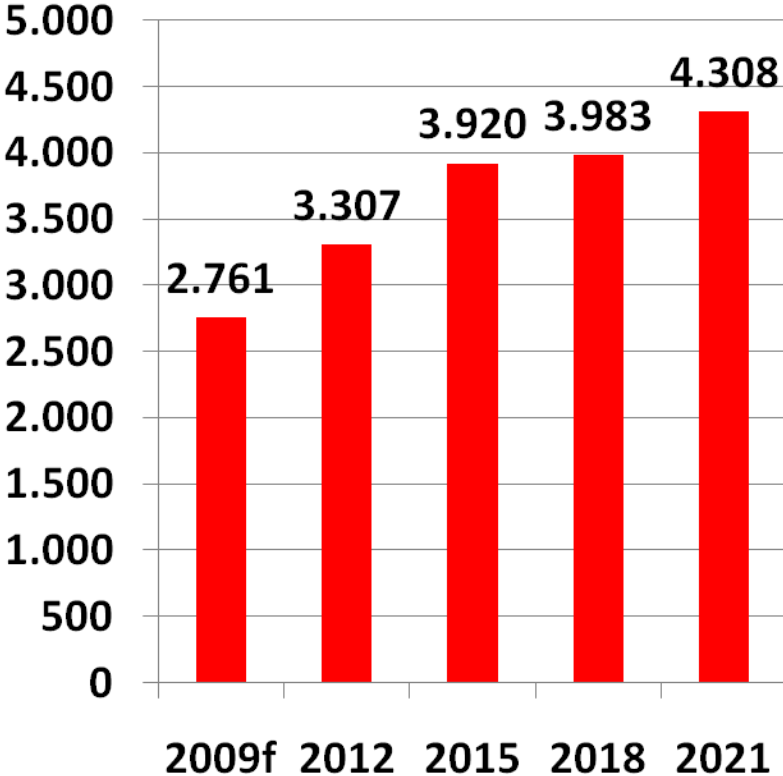
# DUCTLESS SINGLE SPLIT – HPs

### STOCK DEVELOPMENT, units



■ HP FOR HEATING

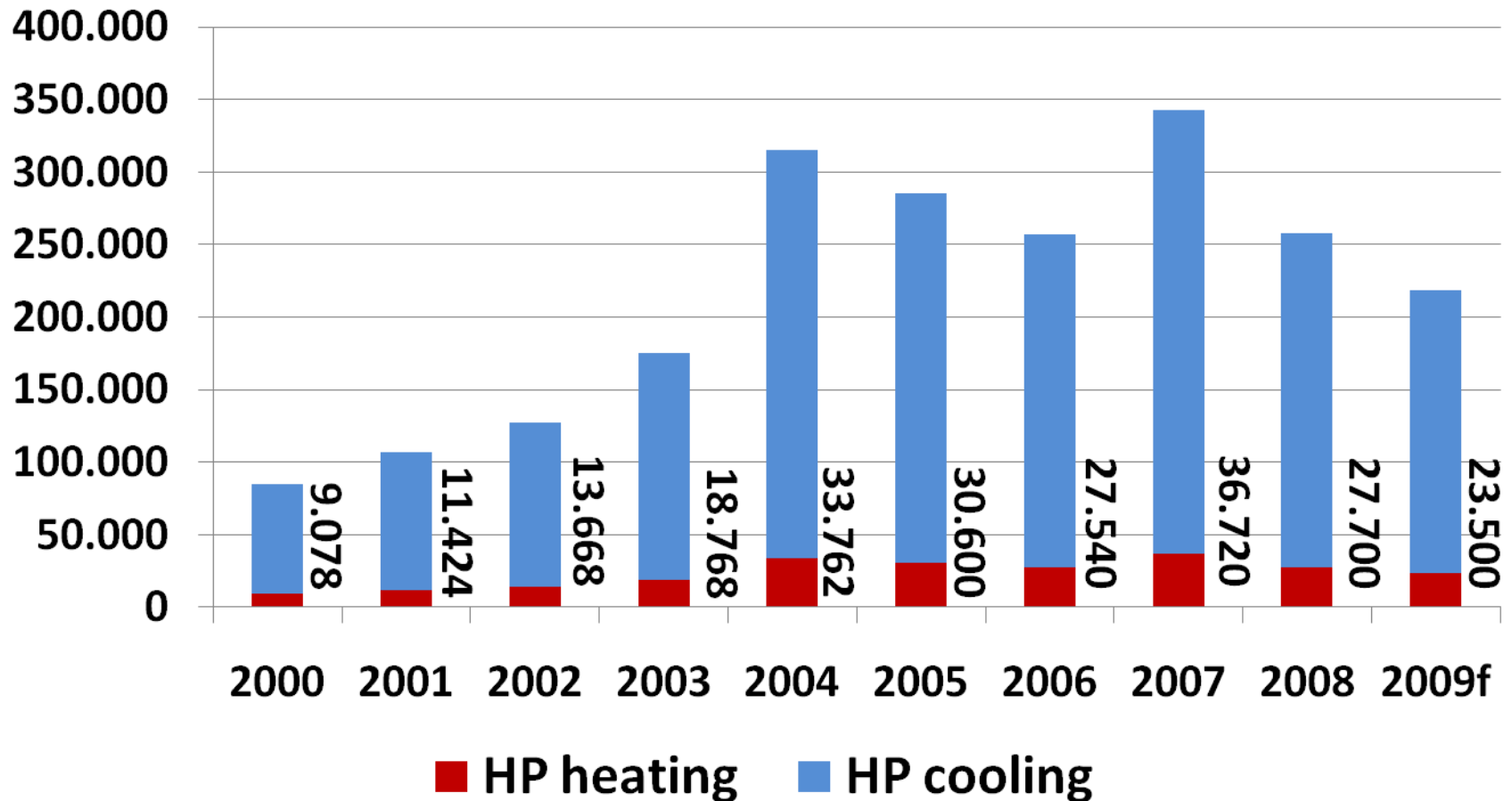
### STOCK DEVELOPMENT, MWt



■ HP FOR HEATING

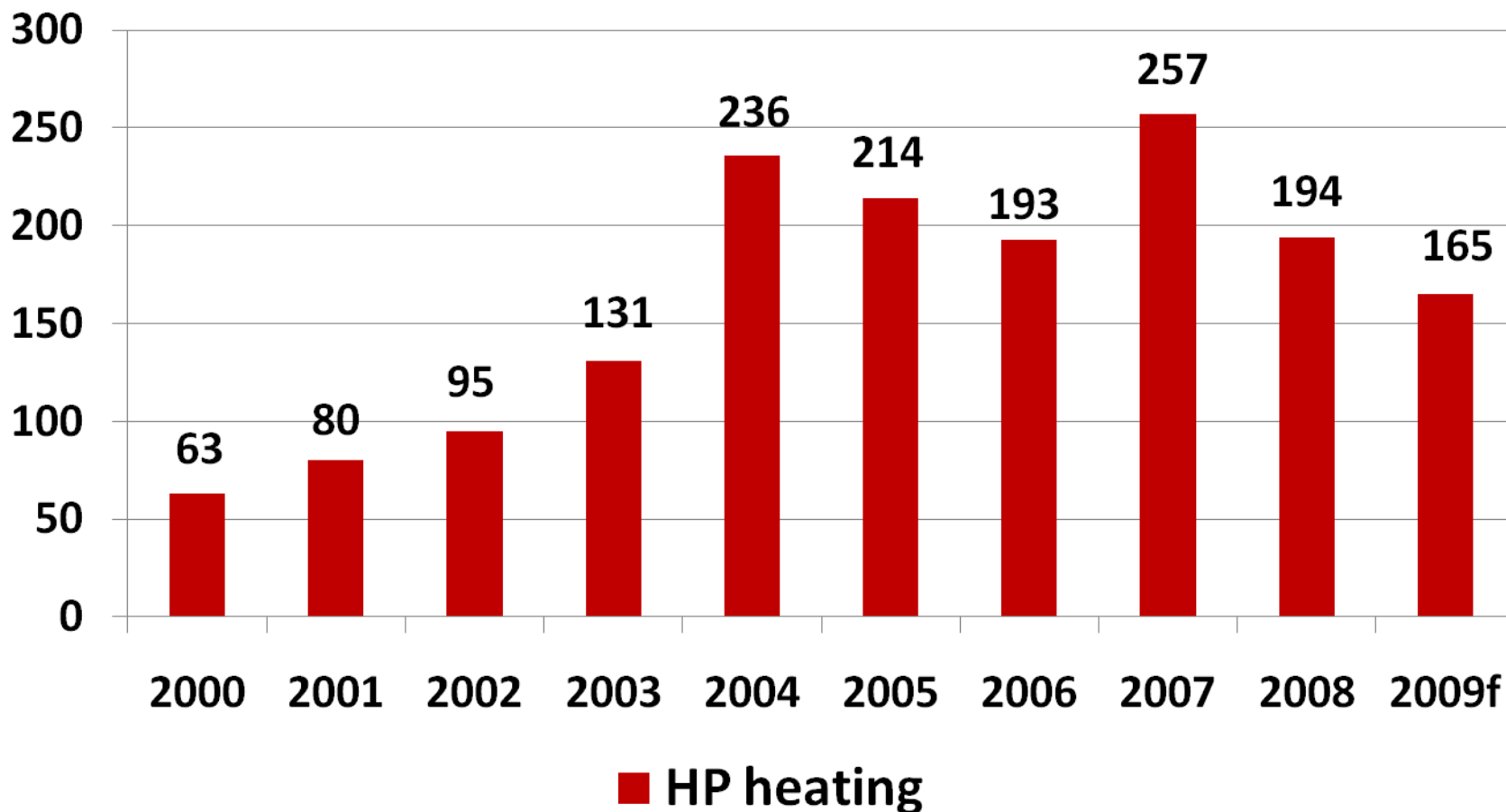
# DUCTED SINGLE SPLIT + MULTISPLIT

## 10 year sale hystory, units



# DUCTED SINGLE SPLIT + MULTISPLIT

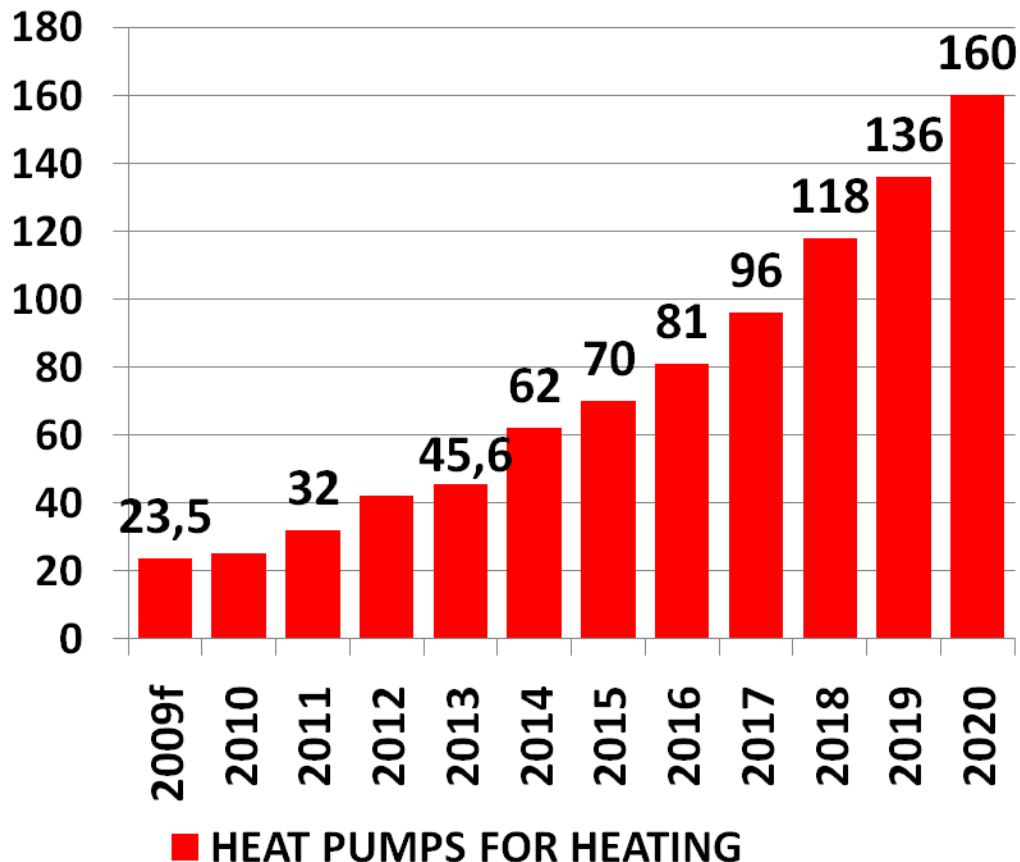
## 10 year sale hystory, MWt



# DUCTED SINGLE SPLIT + MULTISPLIT

sales development, BAU – 000 units

BAU conditions

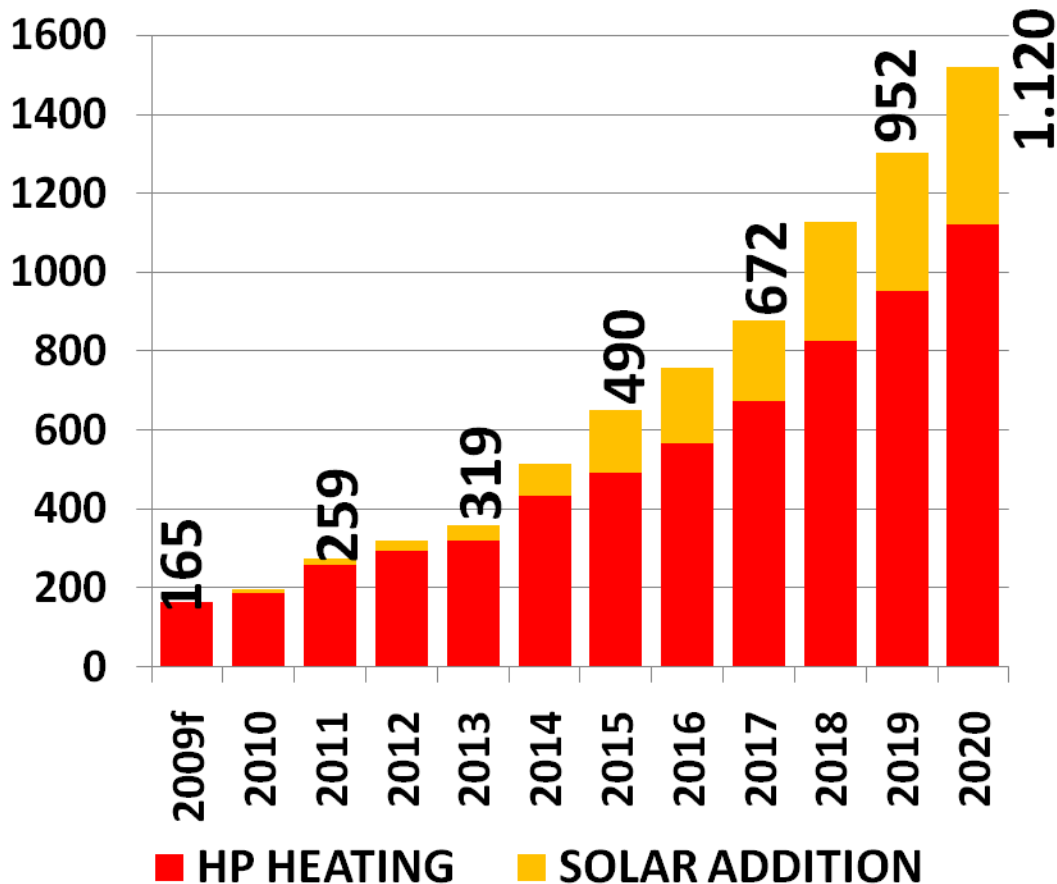


- Components technology advancement (compressors, heat exch.s, fans)
- Circuiting development
- New refrigerants
- Solar assistance (thermal and photovoltaic)

# DUCTED SINGLE SPLIT + MULTISPLIT

sales development, BAU – capacity MWt

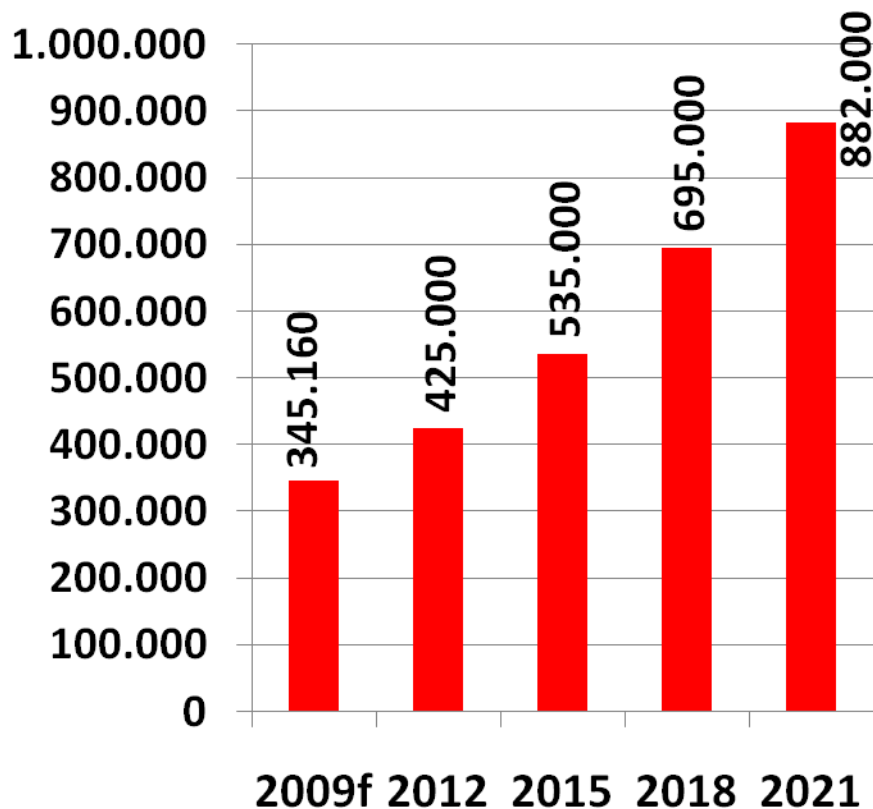
BAU conditions



- Components technology advancement (compressors, heat exch.s, fans)
- Circuiting development
- New refrigerants
- Solar assistance (thermal and photovoltaic)

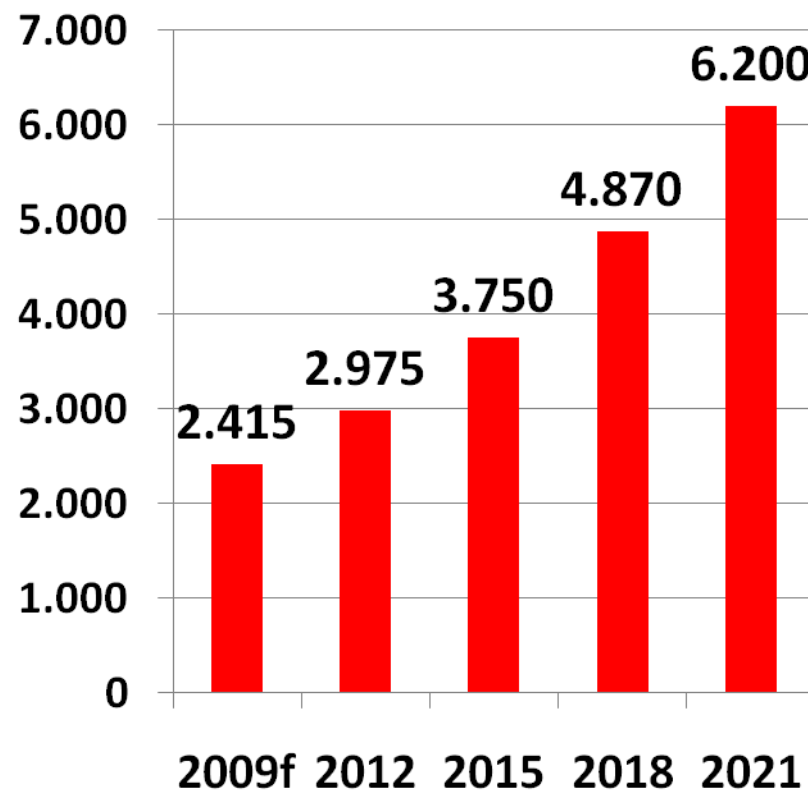
# DUCTED SINGLE SPLIT + MULTISPLIT

STOCK DEVELOPMENT, units



■ HP FOR HEATING

STOCK DEVELOPMENT, MWt



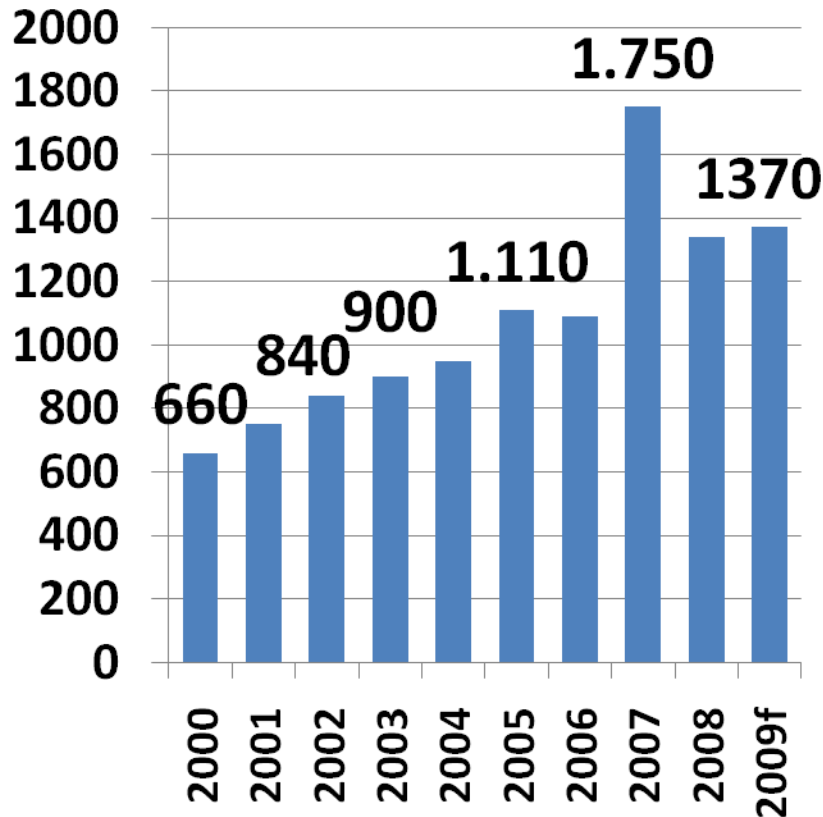
■ HP FOR HEATING

# AIR-TO-AIR

- **ROOF TOP AND PACKAGED UNITS**
  - **RANGE OF CAPACITY: 35 to 250 kWt**
  - **AVERAGE WEIGHTED CAPACITY: 88 kWt**
  - **HEATING USAGE: 75%**

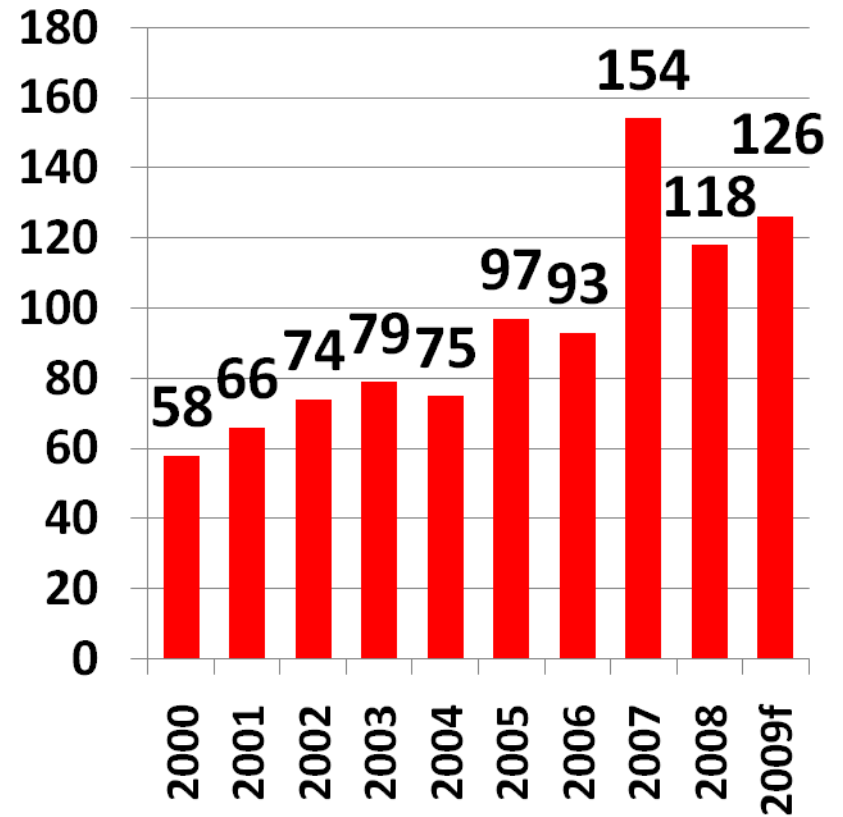
# ROOF TOP and PACKAGED

10 years sales history, units



■ HP s USED IN HEATING

10 years sales history, MWt

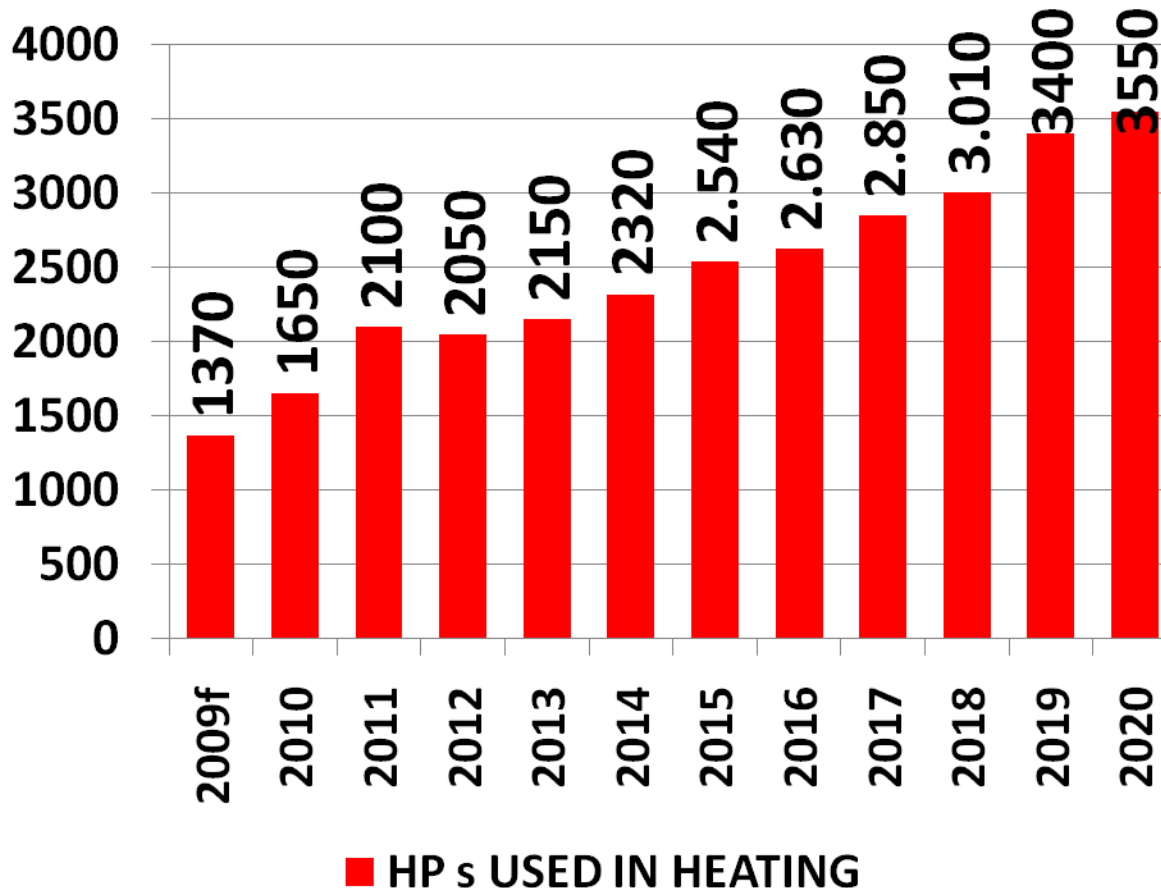


■ HPs USED IN HEATING

# ROOF TOP and PACKAGED

sales development, BAU - units

BAU conditions

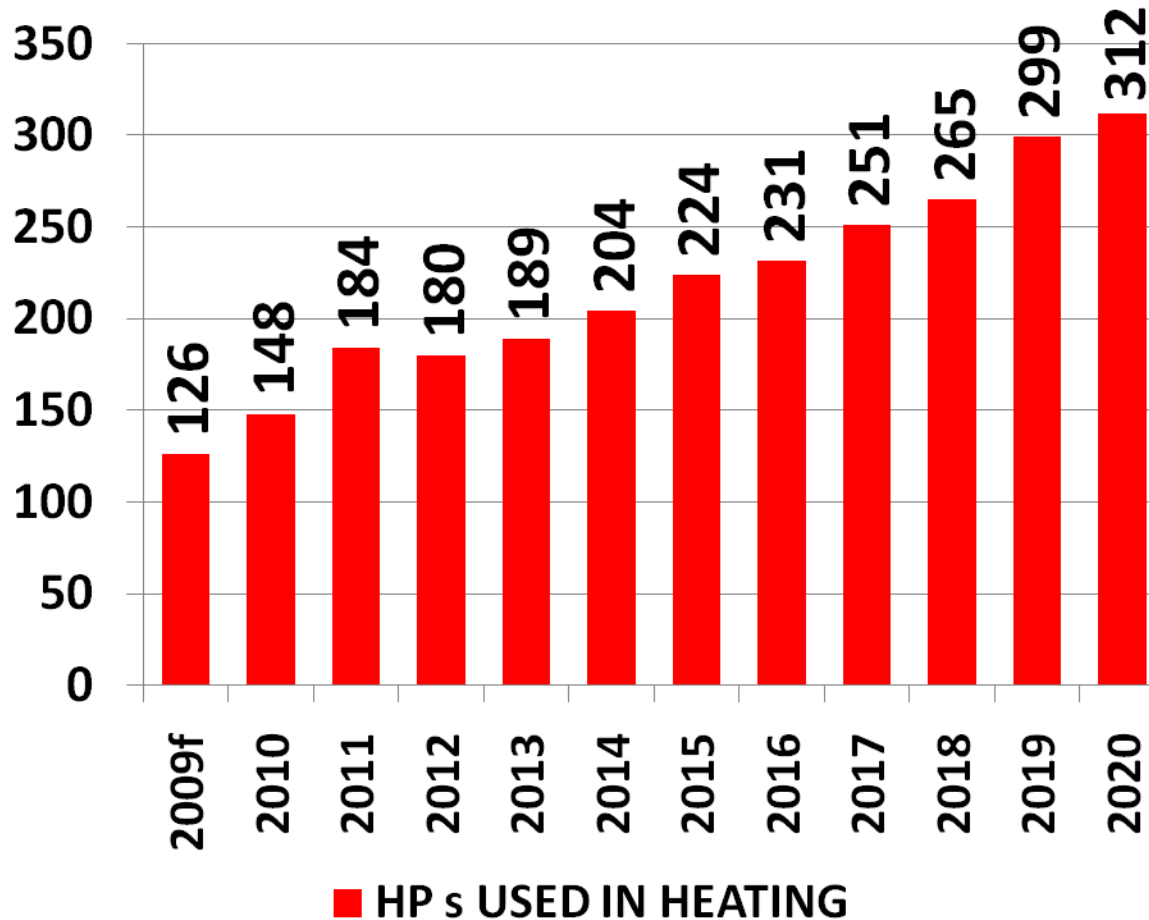


- Components technology advancement (compressors, heat exch.s, fans)
- Circuiting development
- New refrigerants
- Solar assistance (thermal and photovoltaic)

# ROOF TOP and PACKAGED

sales development, BAU – capacity MWt

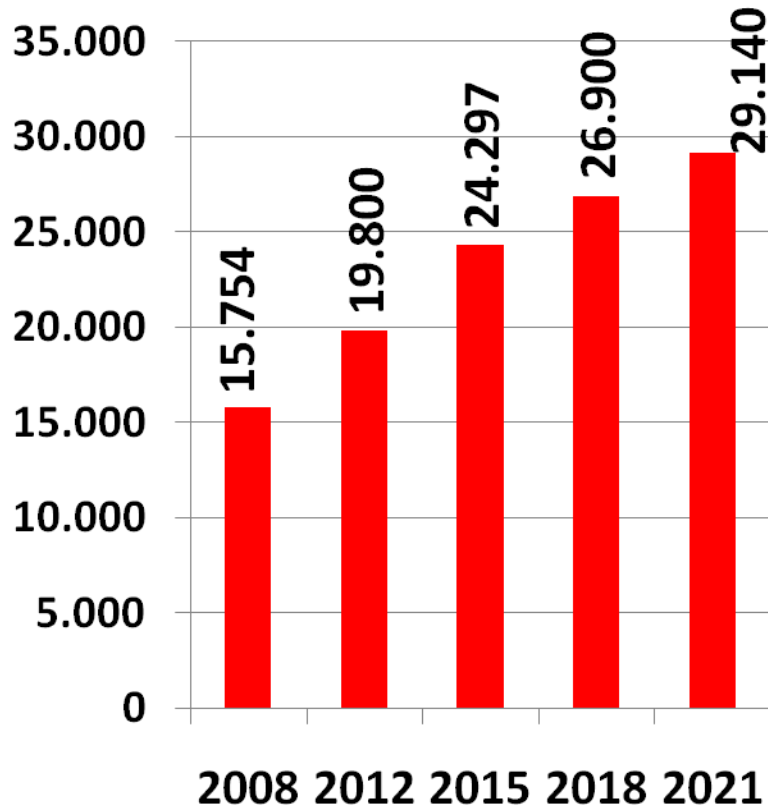
BAU conditions



- Components technology advancement (compressors, heat exch.s, fans)
- Circuiting development
- New refrigerants
- Solar assistance (thermal and photovoltaic)

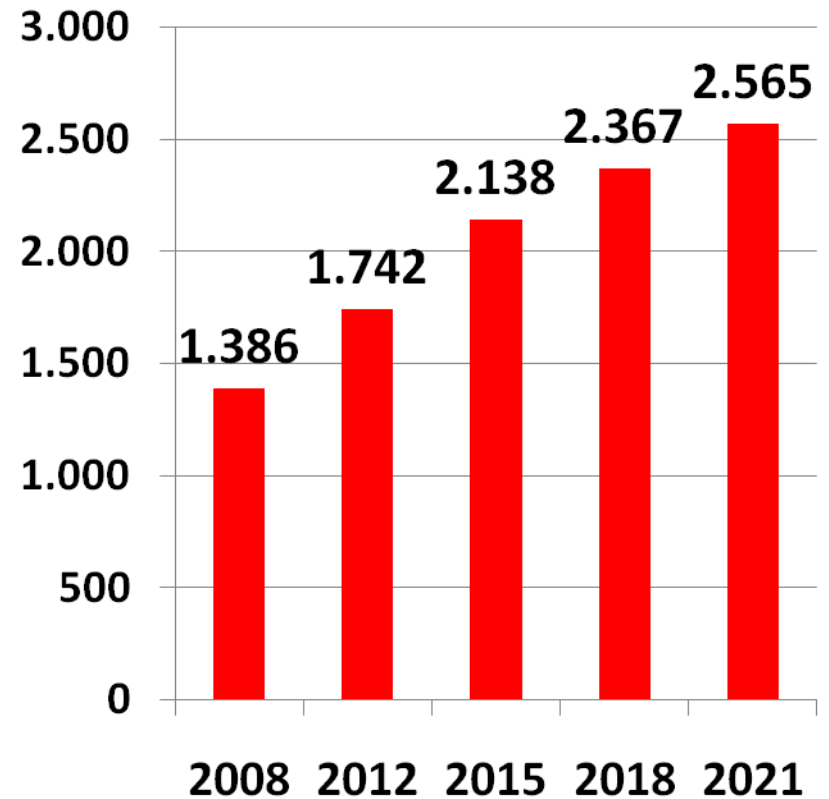
# ROOF TOP and PACKAGED

STOCK DEVELOPMENT, units



■ HP FOR HEATING

STOCK DEVELOPMENT, MWt



■ HP FOR HEATING

# **AIR-TO-WATER**

- **MINICHILLERS and CHILLERS**
  - **RANGE OF CAPACITY: 8 to 900+ kWt**
  - **HEATING USAGE: 97%**

# MINICHILLERS AND CHILLERS

## WEIGHTED AVE CAPACITY

### CLASS OF CAPACITY

- < 50 kWt
- 51 – 200 kWt
- 201 – 350 kWt
- 351 – 700 kWt
- > 700 kWt

WEIGHTED AVE CAPACITY  
based on the quantity of  
units dispersed in each class

- 18 kWt
- 91 kWt
- 280 kWt
- 507 kWt
- 1120 kWt

# A-W HP USED FOR HEATING

## Minichillers and Chillers

UNITS	< 50 kWt	51 - 200	201 - 350	351 - 700	> 700 kWt	total
2000	6.951	1.137	255	93	25	8.425
2001	8.960	1.400	305	119	32	10.816
2002	8.825	1.448	305	118	32	10.728
2003	8.405	1.368	295	112	31	10.211
2004	9.045	1.448	310	121	33	10.993
2005	9.595	1.590	325	128	35	11.673
2006	10.980	1.799	365	147	40	13.330
2007	10.670	1.635	353	141	39	12.838
2008	9.785	1.646	278	132	37	11.878
2009f	9.650	1.540	270	129	35	11.624

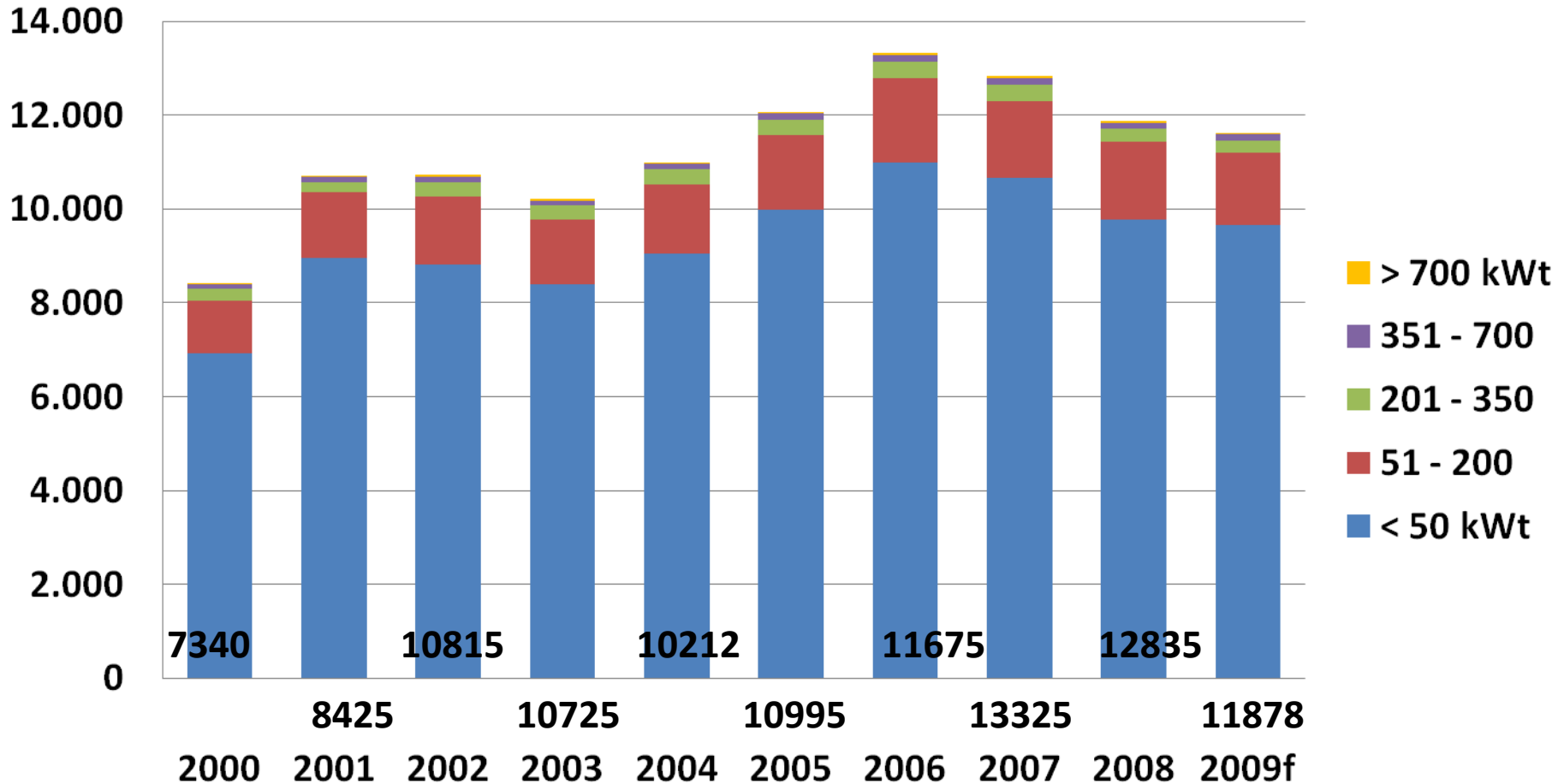
# A-W HP USED FOR HEATING

## Minichillers and Chillers

MWt	< 50 kWt	51 - 200	201 - 350	351 - 700	> 700 kWt	total
2000	124	104	71	47	28	375
2001	161	127	85	60	36	471
2002	159	132	85	60	36	472
2003	151	124	83	57	34	450
2004	163	135	87	61	37	483
2005	173	145	91	65	39	513
2006	198	164	102	74	45	583
2007	192	149	99	72	43	554
2008	176	150	78	67	41	512
2009f	173	140	76	65	40	494

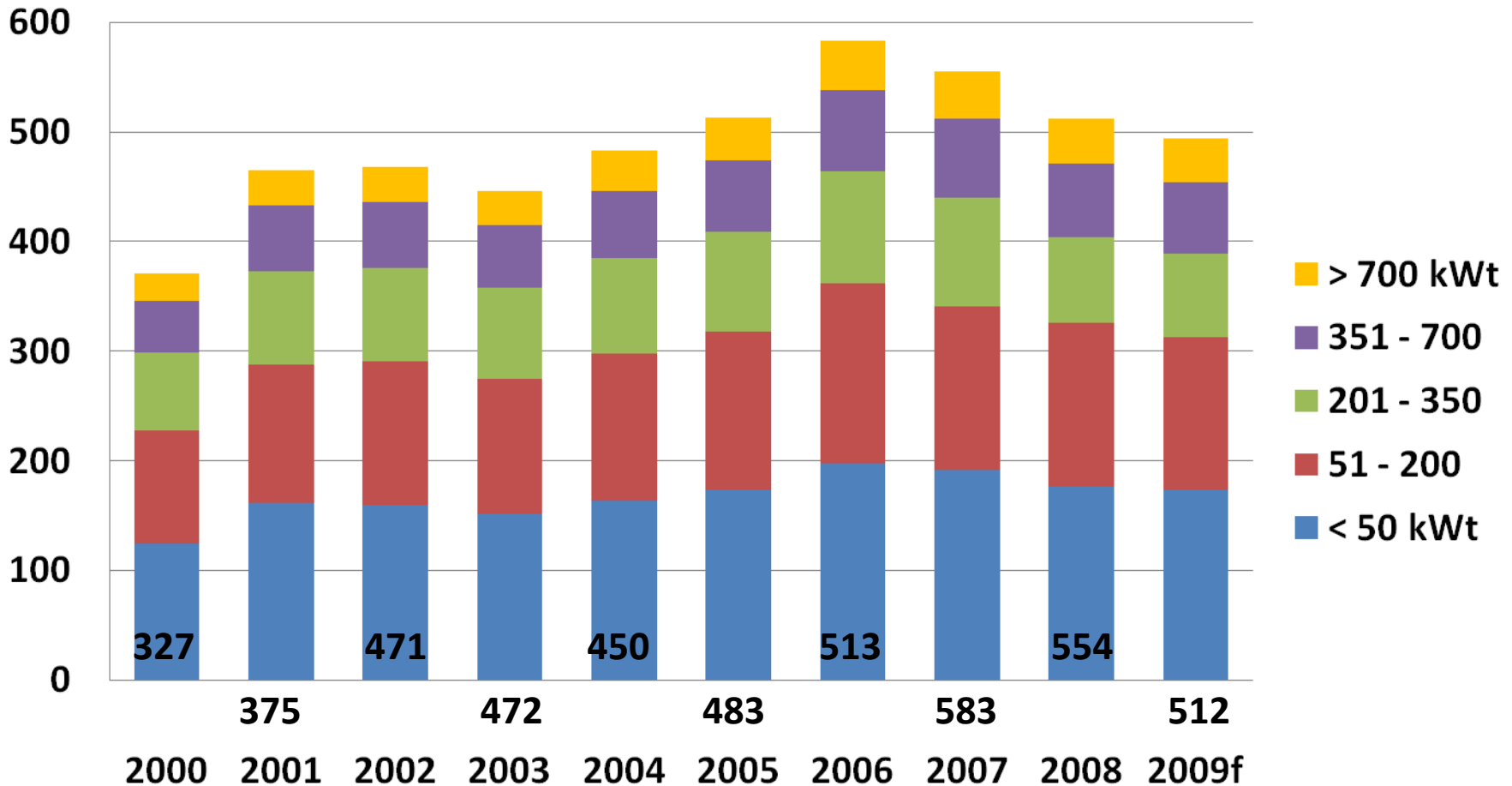
# A-W HP USED FOR HEATING Minichillers and Chillers

10 years history, units



# A-W HP USED FOR HEATING Minichillers and Chillers

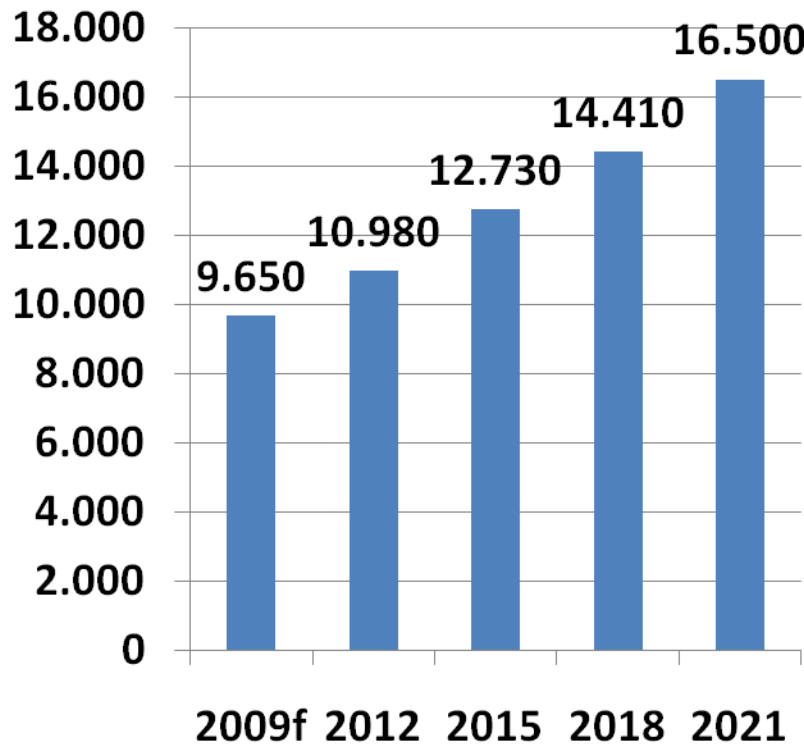
10 years history, capacity MWt



# A-W HP DEVELOPMENT (BAU)

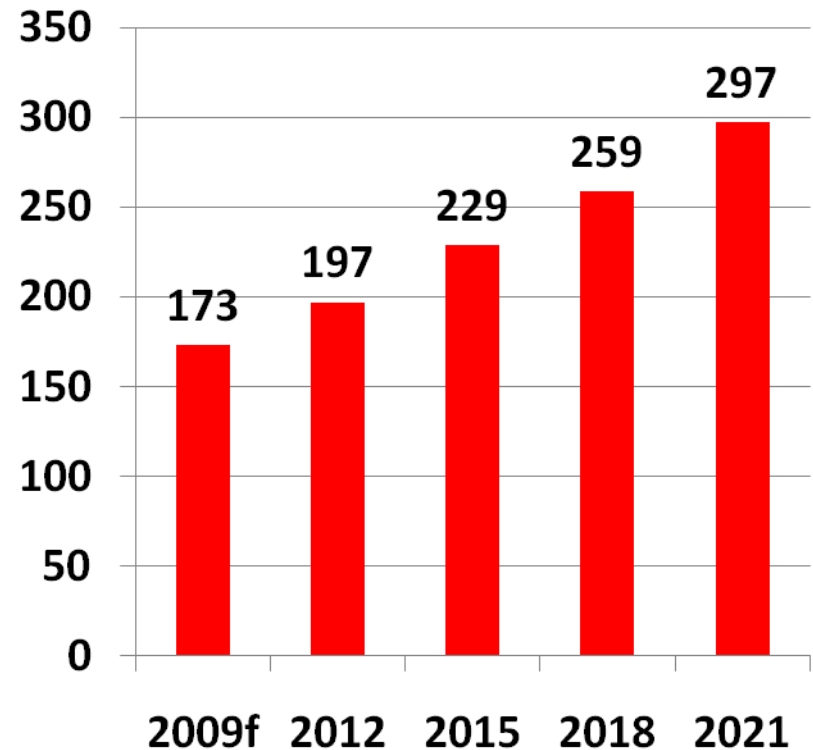
## MINICHILLERS AND CHILLERS < 50 kWt

units



■ HPs for heating

Capacity MWt

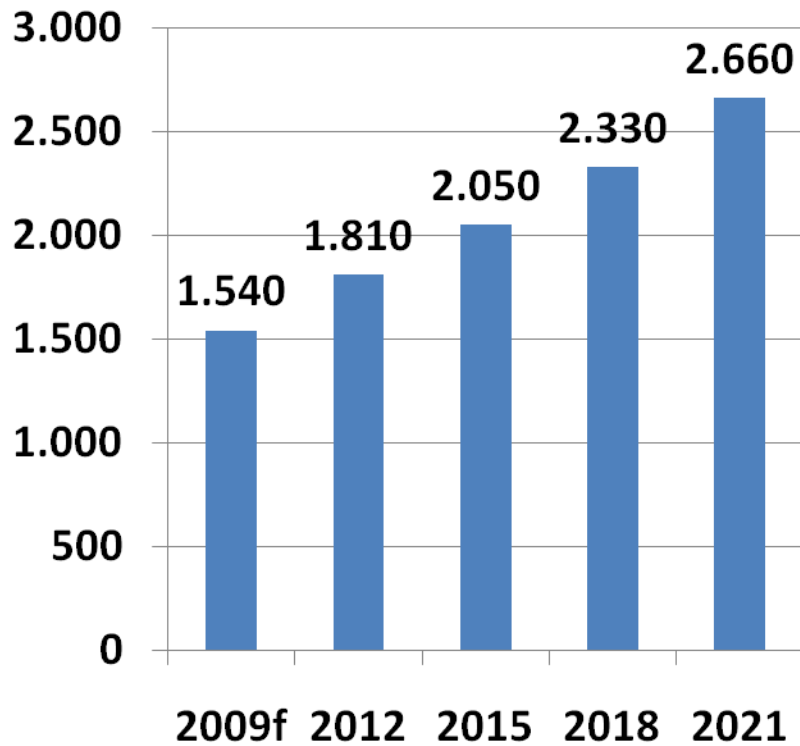


■ HPs for heating

# A-W HP DEVELOPMENT (BAU)

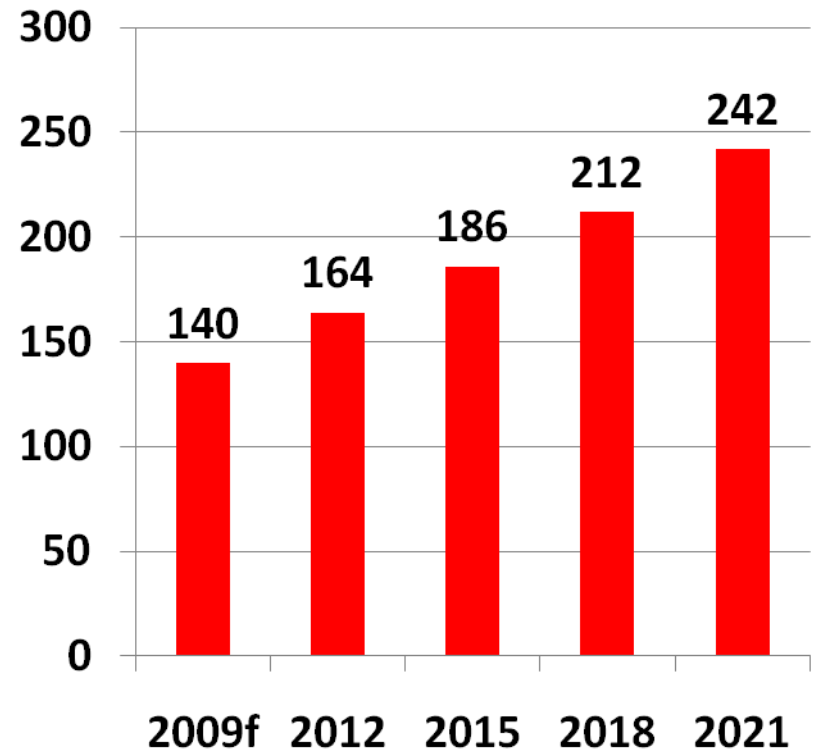
## CHILLERS 51 – 200 kWt

units



■ HPs for heating

Capacity MWt

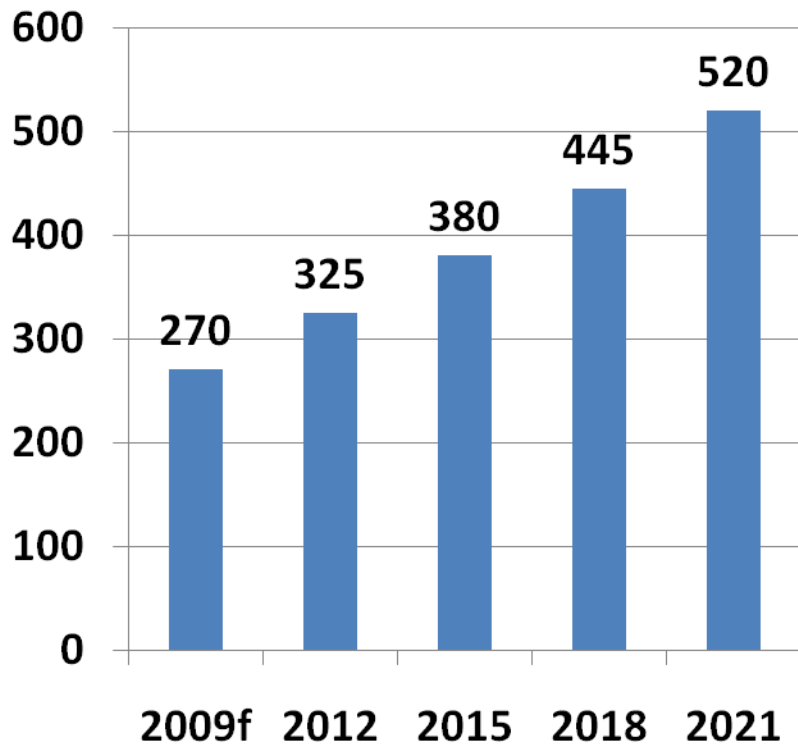


■ HPs for heating

# A-W HP DEVELOPMENT (BAU)

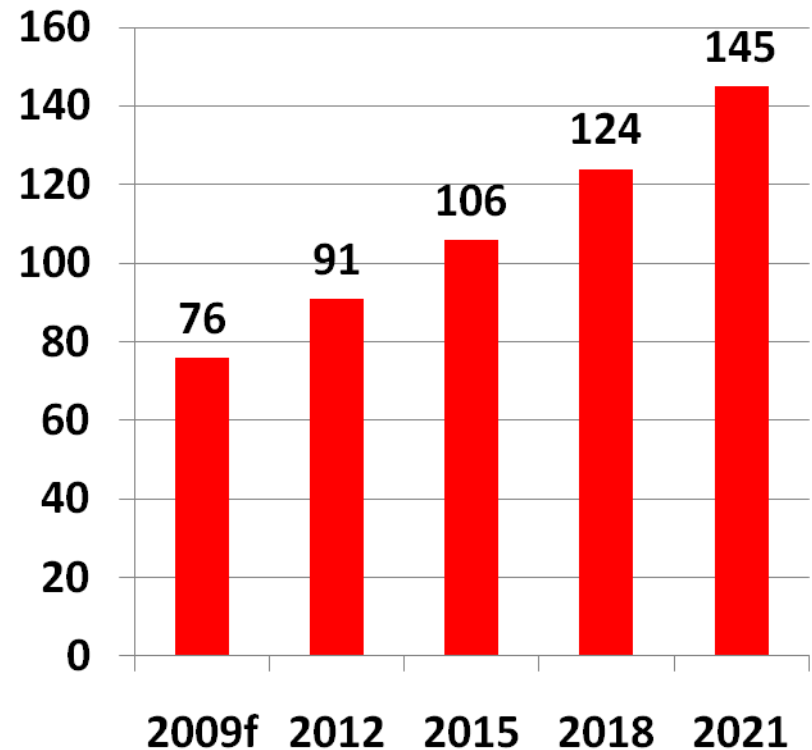
## CHILLERS 201 - 350 kWt

units



■ HPs for heating

Capacity MWt

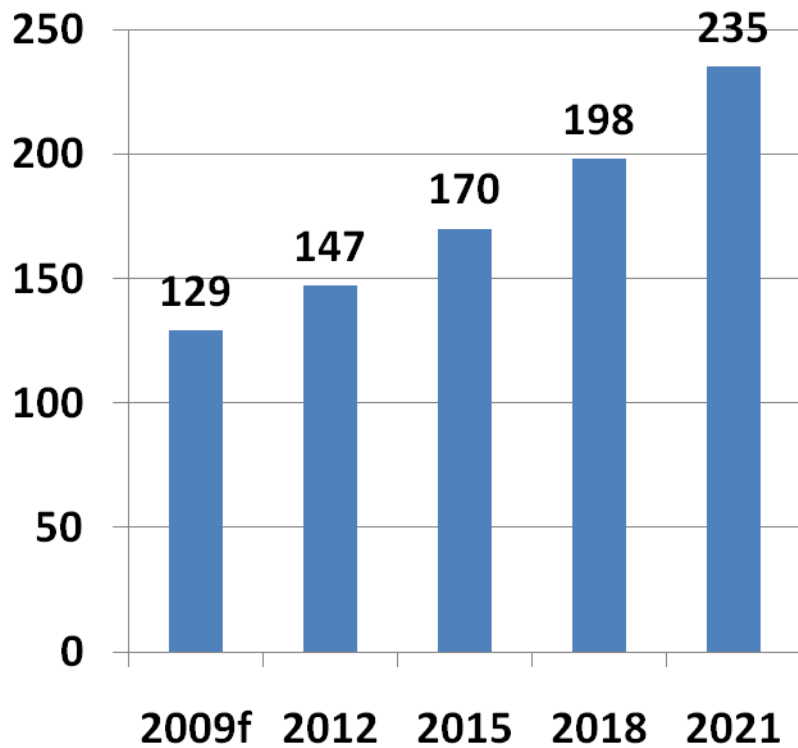


■ HPs for heating

# A-W HP DEVELOPMENT (BAU)

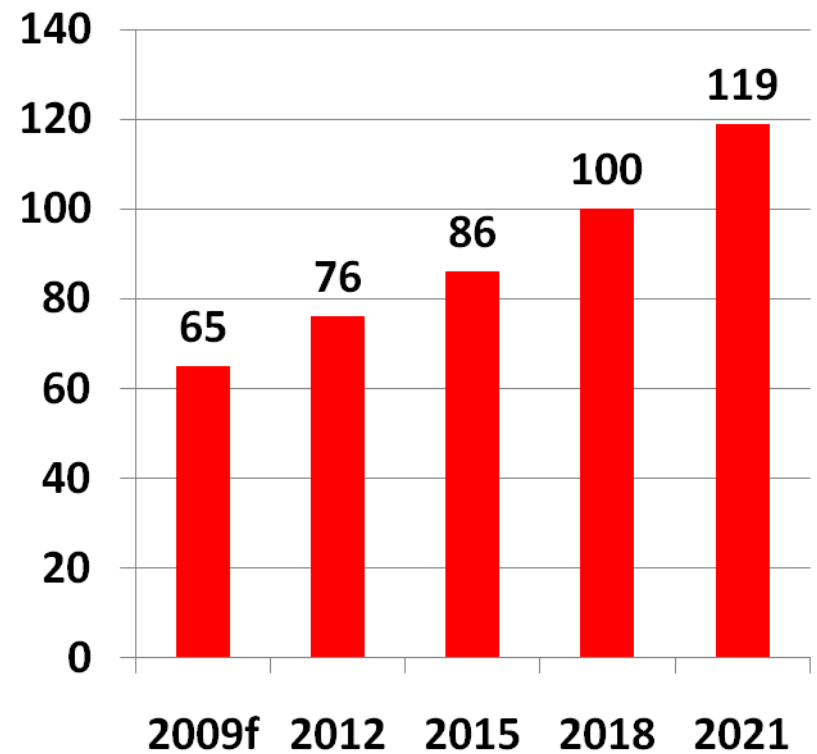
## CHILLERS 351 - 700 kWt

units



■ HPs for heating

Capacity MWt

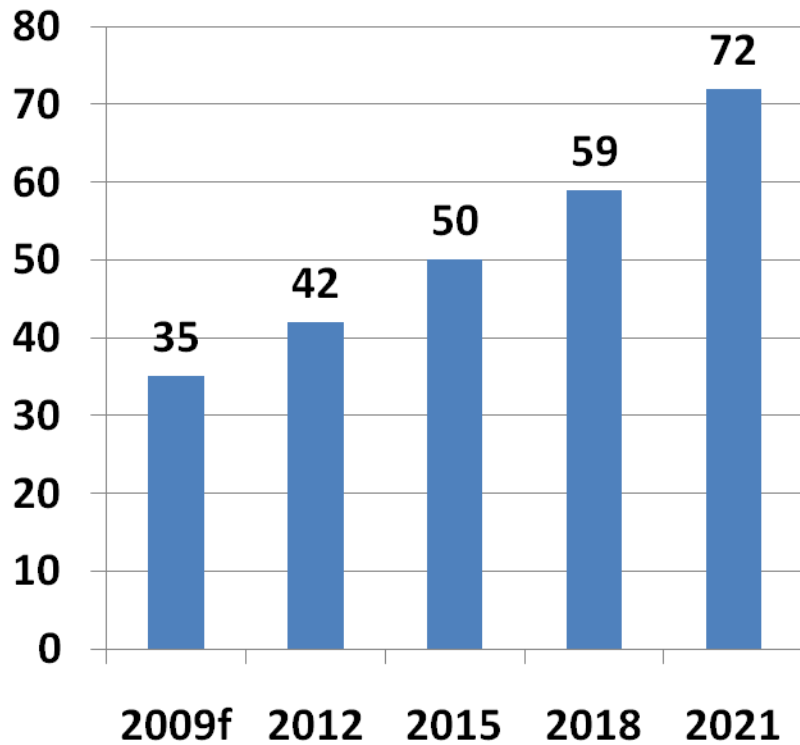


■ HPs for heating

# A-W HP DEVELOPMENT (BAU)

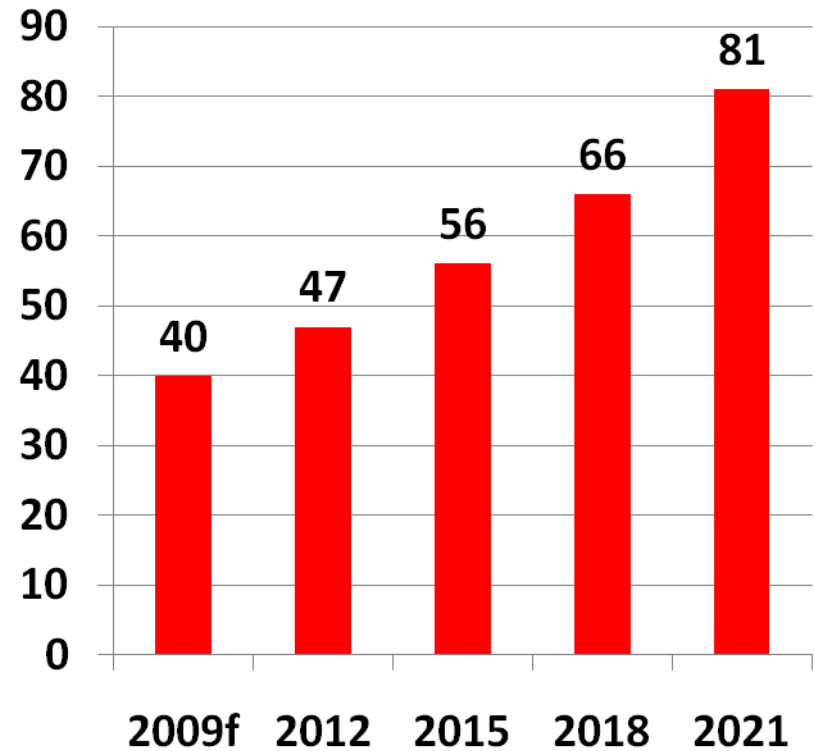
## CHILLERS > 700 kWt

units



■ HPs for heating

Capacity MWt



■ HPs for heating

# W-W HP USED FOR HEATING

## Minichillers and Chillers

UNITS	< 50 kWt	51 - 200	201 - 350	351 - 700	> 700 kWt	total
2000	417	72	8	5	5	507
2001	477	83	10	5	5	580
2002	470	82	10	5	7	574
2003	425	75	9	6	9	524
2004	467	81	10	5	7	569
2005	702	122	15	5	7	851
2006	667	115	14	5	7	808
2007	772	134	17	5	7	935
2008	792	137	17	5	7	958
2009f	802	135	18	6	9	970

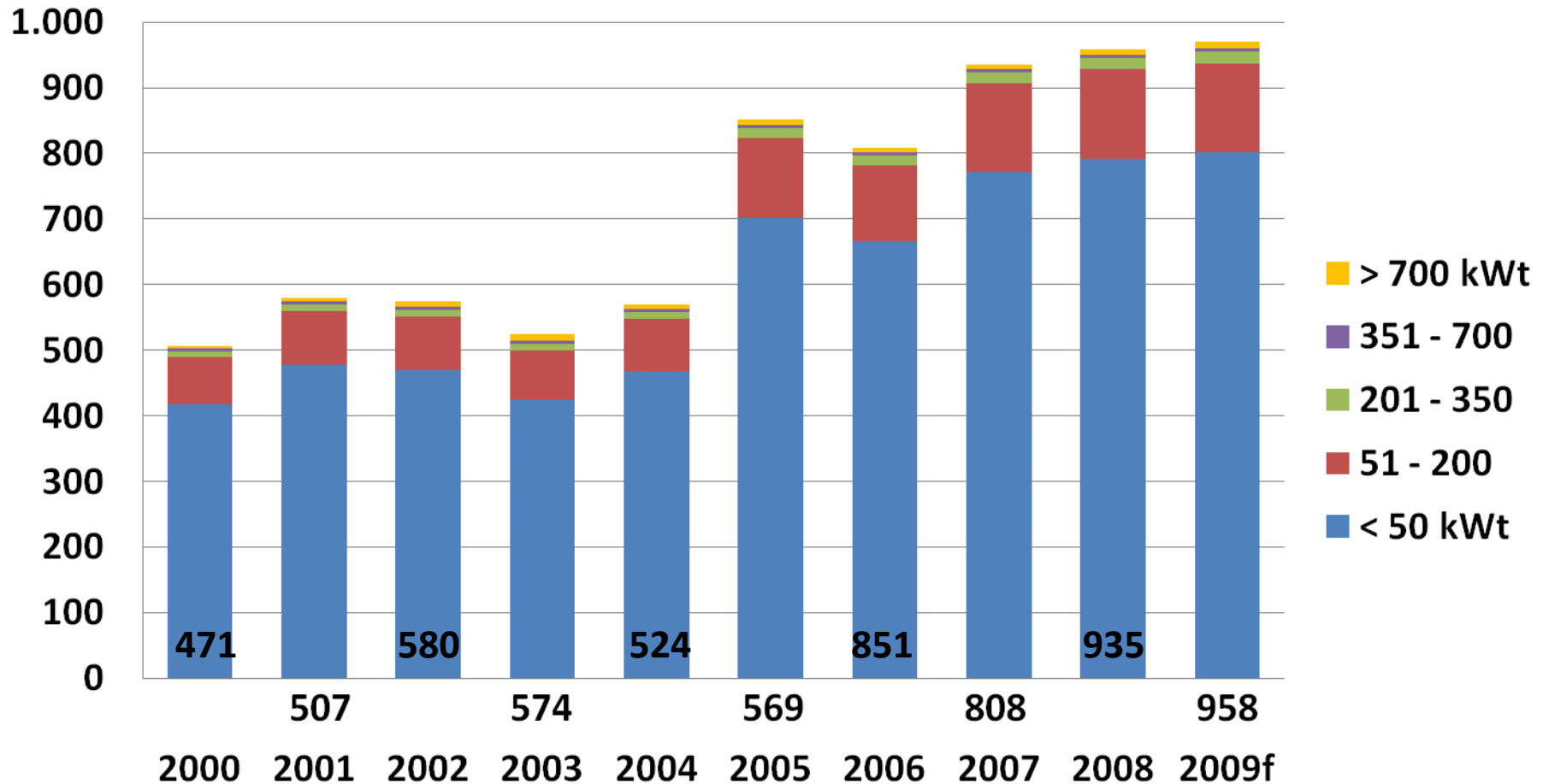
# W-W HP USED FOR HEATING

## Minichillers and Chillers

MWt	< 50 kWt	51 - 200	201 - 350	351 - 700	> 700 kWt	total
2000	8	7	2	3	6	24
2001	9	8	3	3	6	27
2002	8	7	3	3	8	29
2003	8	7	3	3	10	30
2004	8	7	3	3	8	29
2005	13	11	4	3	8	38
2006	12	11	4	3	8	37
2007	14	12	5	3	8	41
2008	14	12	5	3	8	42
2009f	14	13	6	3	9	45

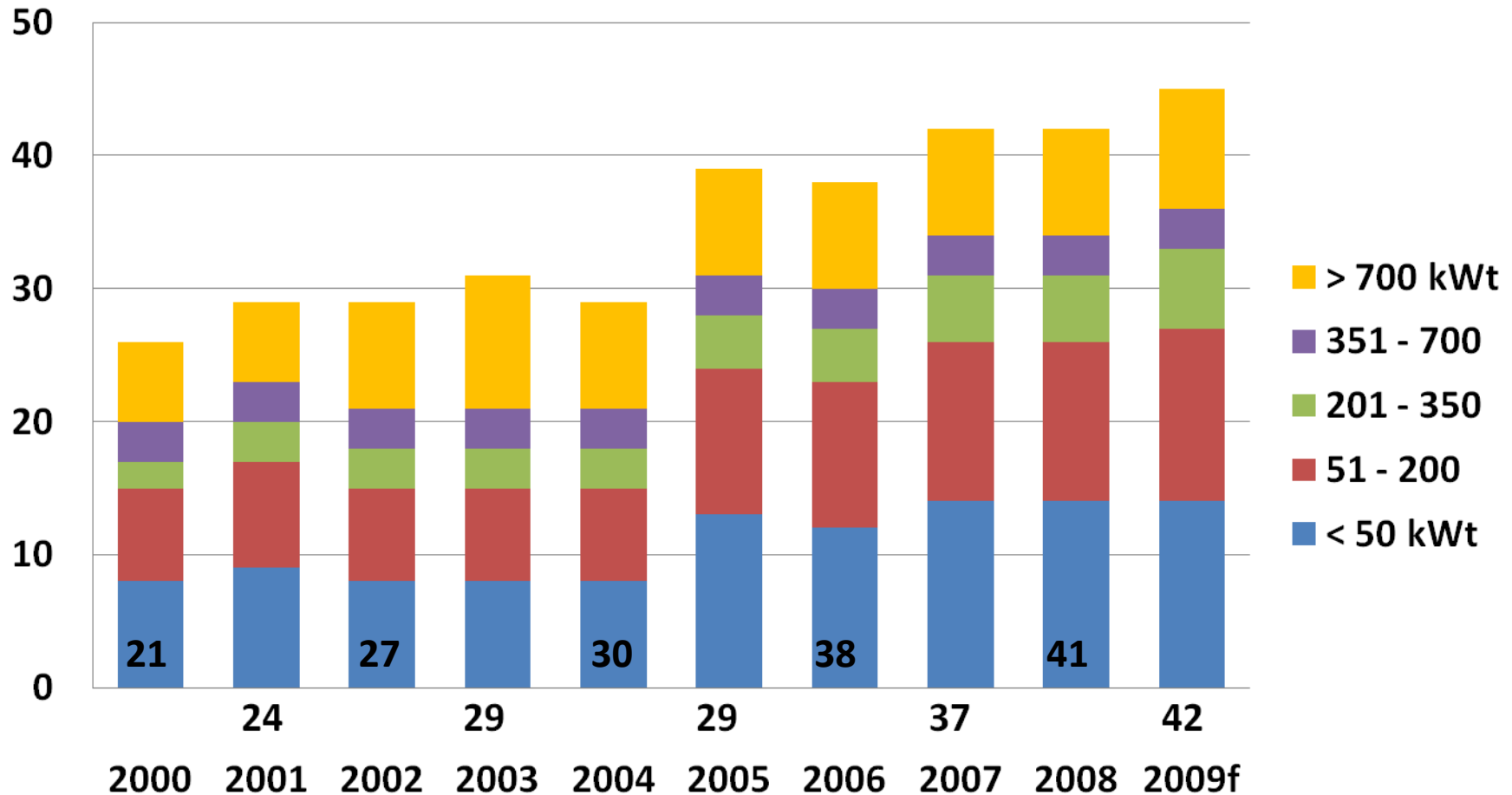
# W-W HP USED FOR HEATING Minichillers and Chillers

10 years history, units

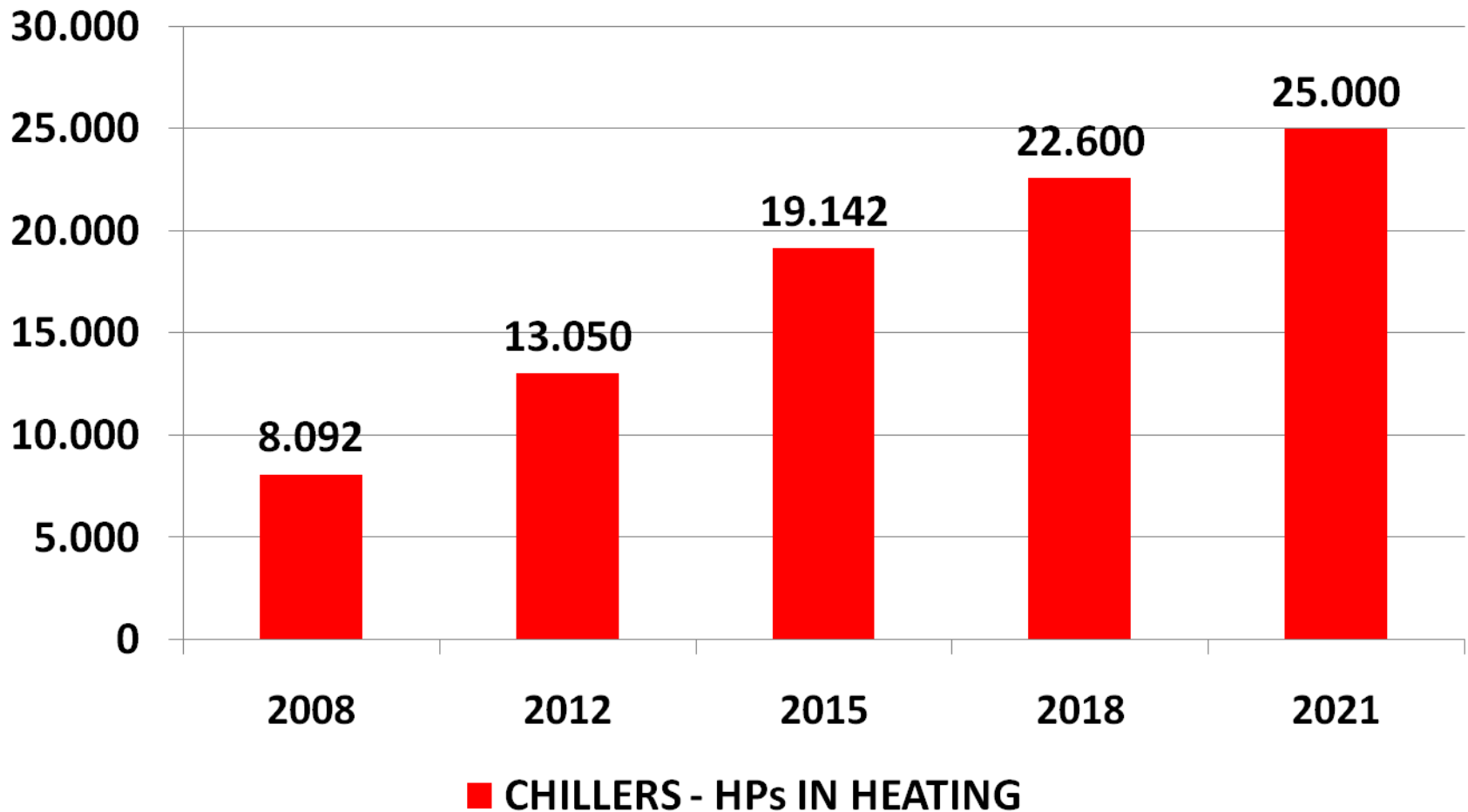


# W-W HP USED FOR HEATING Minichillers and Chillers

10 years history, capacity MWt

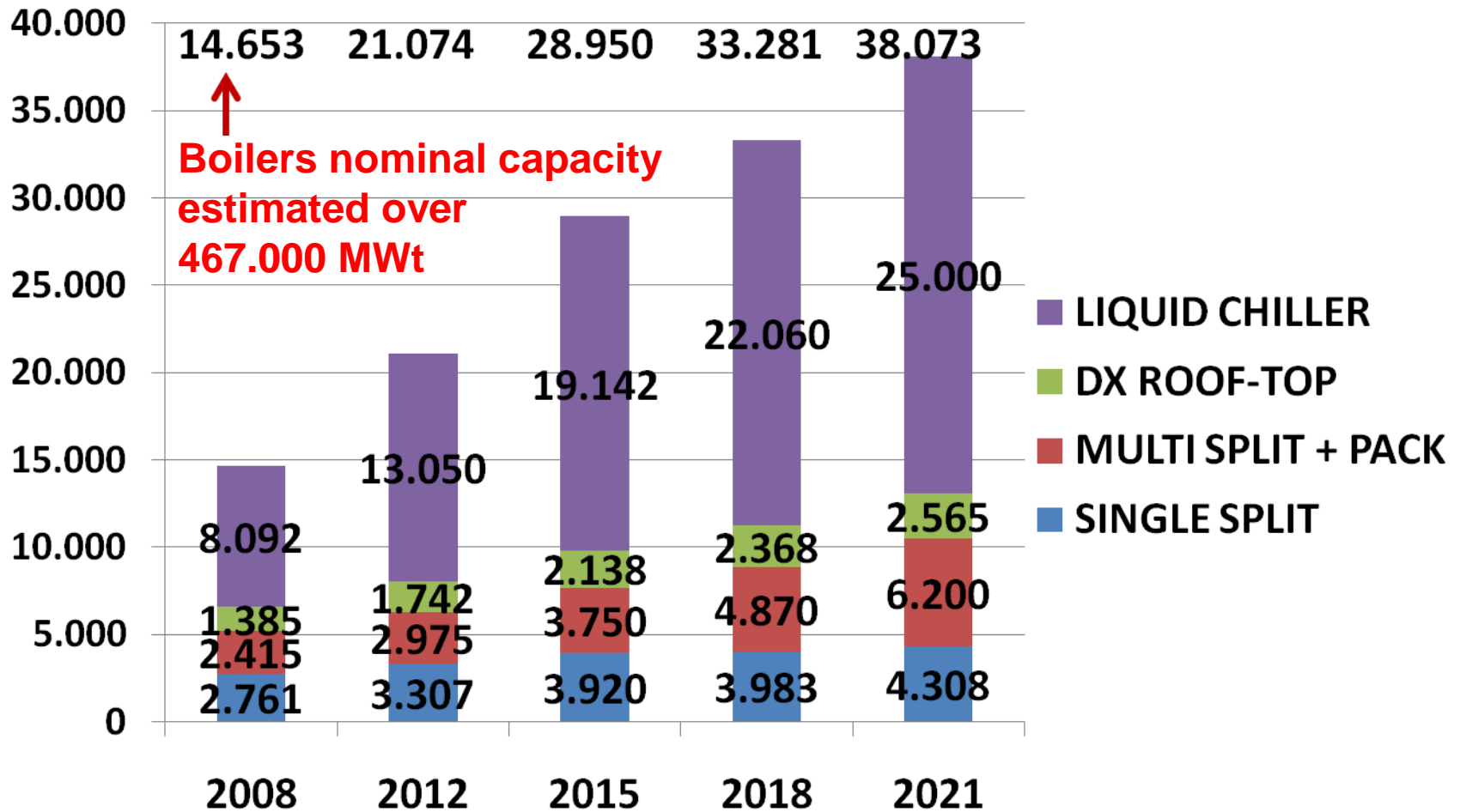


# ALL CHILLERS – THERMAL CAPACITY STOCK DEVELOPMENT, MWt



# HPs IN HEATING

## TOTAL STOCK CAPACITY, MWt



# PRIMARY ENERGY CONSUMPTION

**HPs - comfort all the year long**  
**– an efficient tool to save energy**

# Starting data for 2005 energy situation

- **From ENEA and CRESME: total Primary Consumption, stock of apartments**
- **From associations: stock of equipment (boilers, HP for integral heating, HPs cooling only)**
- **Unitary PE = total PE/n. of apartments**
  - **For boilers  $UnPE * \text{boiler eff.} = UnSecondaryE$**
  - **For HPs  $UPE * HPCOP / 2.17$  (power factor because electric consumption) = UnSeE**
- **If heating (and cooling) of apartments has been satisfied, it means that absorbed Secondary Energy = Load Demand**

# Reference year 2005

REFERENCE YEAR 2005						
Apartments heated continuously 19 000 000	Number of Apartments	Total Primary Energy Consumption	Unitary Primary Energy Consumption	System Efficiency	Unitary Secondary Energy / Load Demand	Total Load Demand
		TOE	TOE		TOE	TOE
by boilers	18 145 000	21 490 000	1.18	0.67	0.79	14 334 555
with integrated HPs*	1 500 000	55 500	0.03	3/2,17**	0.04	50 431
<b>TOTAL HEATING</b>		<b>21 545 600</b>				<b>14 384 981</b>
HPs used for cooling only	5 500 000	575 391	0.10	2.6/2.17**	0.12	678 363
<b>TOTAL COOLING</b>		<b>575 391</b>				<b>678 363</b>
<b>TOTAL CONSUMPTION H + C</b>		<b>22 120 891</b>				<b>15 063 344</b>
* HPs are used in special occasion to integrate heating requirement						
** HPs not used in heating mode, but only used in cooling mode in summer.						

# Evolution to 2020

- **Cumulative apartments growth**  
 **$250,000 * 15 (2005-2020) = 3,750,000$**
- **Apartments totally heated in 2020 =**  
 **$18,145,000 + 3,750,000 = 21,895,000$**
- **Increase of Cooling demand**  
**11,000,000 apartments vs 5,500,000 with**  
**total 8 million individual units**

# Base situation – Load Demand for 2020

<b>2020 SCENARIO – HEATING DEMAND</b>			
<b>type of apartments heated</b>	<b>apartments</b>	<b>Unitary Load Requirement</b>	<b>Total Load Requirement</b>
		<b>TOE</b>	<b>TOE</b>
<b>Stock 2005</b>	<b>18 145 000</b>	<b>0.79</b> <b>(traditional boilers)</b>	<b>14 334 550</b>
<b>with integrated HP</b>	<b>1 500 000</b>	<b>0.03</b>	<b>50 431</b>
<b>New apartments</b>	<b>3 750 000</b>	<b>0.55</b> <b>(***boilers)</b>	<b>2 073 750</b>
<b>Total apartments</b>	<b>21 895 000</b>		
<b>Total Load Requirements</b>			<b>16 458 731</b>

# Development at BAU conditions

- **A little part of the old boilers (load d. 0.79) are replaced by three star boilers (0.55)**
- **All new buildings have three star boilers (0.55); a little part (2%) is replaced by HPs for year round operation**
- **Additional 5,500,000 apartmentst have HPs operating in cooling mode in summer (11 million dwellings airconditioned)**

# Heating consumption details

## BAU CONDITIONS

<b>HEATING</b>					
Apartments heated continuously 21 895 000	Number of Apartments	Unitary Secondary Energy / Load Demand	Total Load Demand	Total Primary Energy Consumption	Unitary Primary Energy Consumption
		TOE	TOE	TOE	TOE
<b>by boilers:</b>	<b>21 453 047</b>				
existing	17 778 047	0.79	14 105 481	0.95	16 889 145
New (**boilers)	3 675 000	0.55	2 021 250	0.65	2 388 750
<b>total heating by boilers</b>			<b>16 126 731</b>		<b>19 277 895</b>
<b>by HPs:</b>	<b>442 953</b>				
replacing boilers	266 823	0.79	210 000	0.75	200 484
refurbishments	103 797	0.79	82 000	0.46	47 451
new	72 333	0.55	40 000	0.32	22 907
<b>total apartments</b>	<b>21 895 000</b>				
<b>Total heating by HPs</b>			<b>332 000</b>		<b>270 742</b>
<b>TOTAL HEATING</b>			<b>16 458 731</b>	<b>0.12</b>	<b>19 548 637</b>

# Cooling consumption and total H+C

## BAU CONDITIONS

COOLING					
	Number of Apartments	Unitary Secondary Energy / Load Demand	Total Load Demand	Total Primary Energy Consumption	Unitary Primary Energy Consumption
Apartments A/C as of 2005	5 500 000				
New apartments	5 500 000				
Replacements		0.12	1 774 572		1 172 148
Retrofit		0.12	12 600		10 256
New		0.08	6 300		5 256
<b>TOTAL COOLING</b>			<b>1 793 472</b>		<b>1 187 998</b>
<b>TOTAL HEATING + COOLING</b>					<b>20 736 634</b>

Still 2 systems

# Development at BAT conditions

- **70% installations with condensation boilers**
- **30% installations with HPs on year-round operation (50% in new buildings)**

# Heating consumption details

## BAT CONDITIONS

HEATING					
Apartment heated continuously 21 895 000	Number of Apartments	Unitary Secondary Energy / Load Demand	Total Load Demand	Total Primary Energy Consumption	Unitary Primary Energy Consumption
		TOE	TOE	TOE	TOE
<b>by boilers:</b>	14 678 000				
old systems	3 603 000	0.79	2 864 370	0.90	3 242 700
existing	9 200 000	0.79	7 268 000	0.80	7 360 000
new	1 875 000	0.55*	1 050 000	0.57	1 068 750
<b>total heating by boilers</b>			11 164 370		11 671 450
<b>by HPs:</b>	7 263 910				
replacing boilers	2 763 910	0.79	210 000	0.75	200 484
refurbishments	2 625 000	0.79	82 000	0.46	47 451
new	1 875 000	0.55*	40 000	0.32	22 907
<b>total apartments</b>	21 895 000				
<b>Total heating by HPs</b>			2 294 114		3 195 739
<b>TOTAL HEATING</b>			16 458 731	0.12	14 867 189

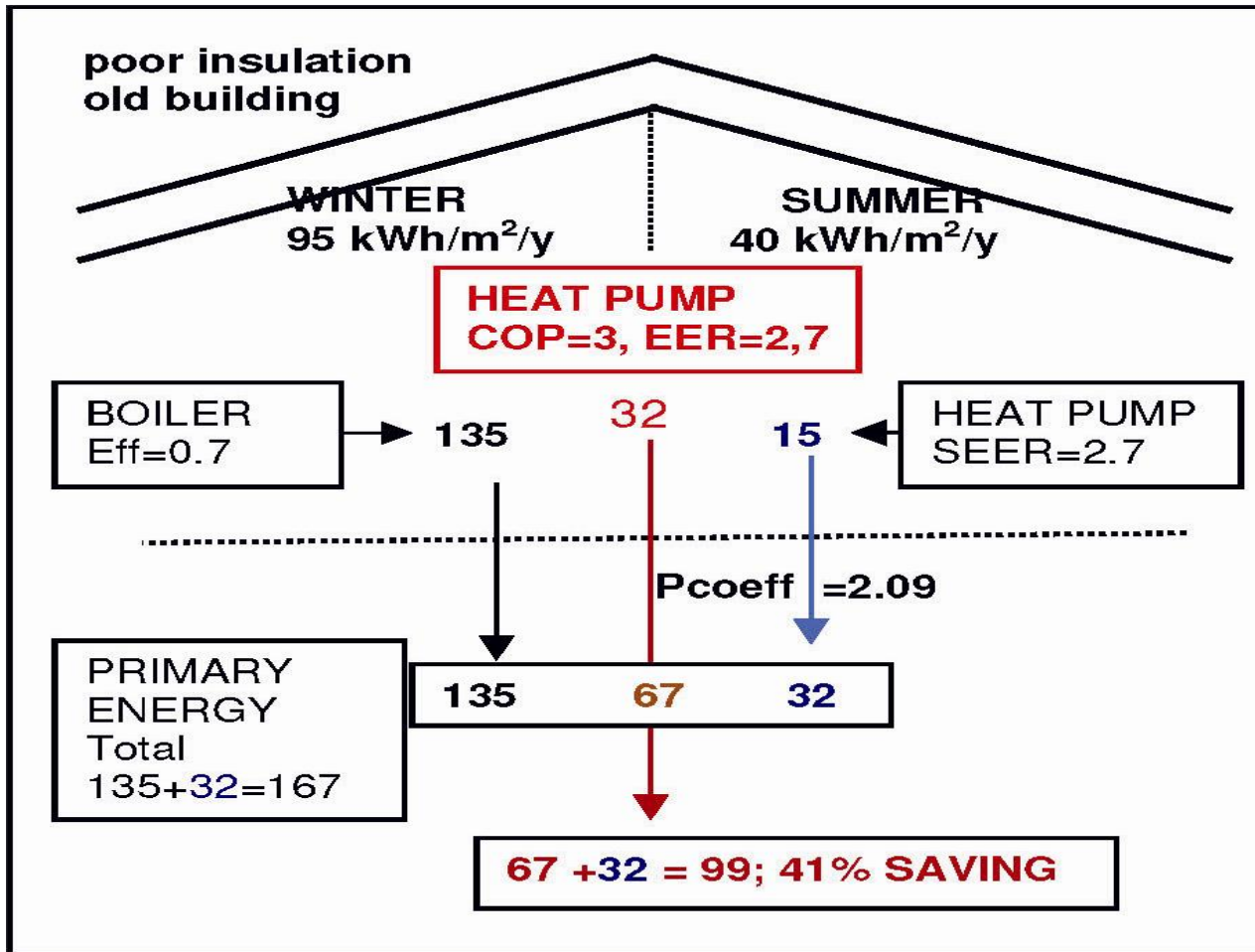
# Cooling consumption and total H+C

## BAT CONDITIONS

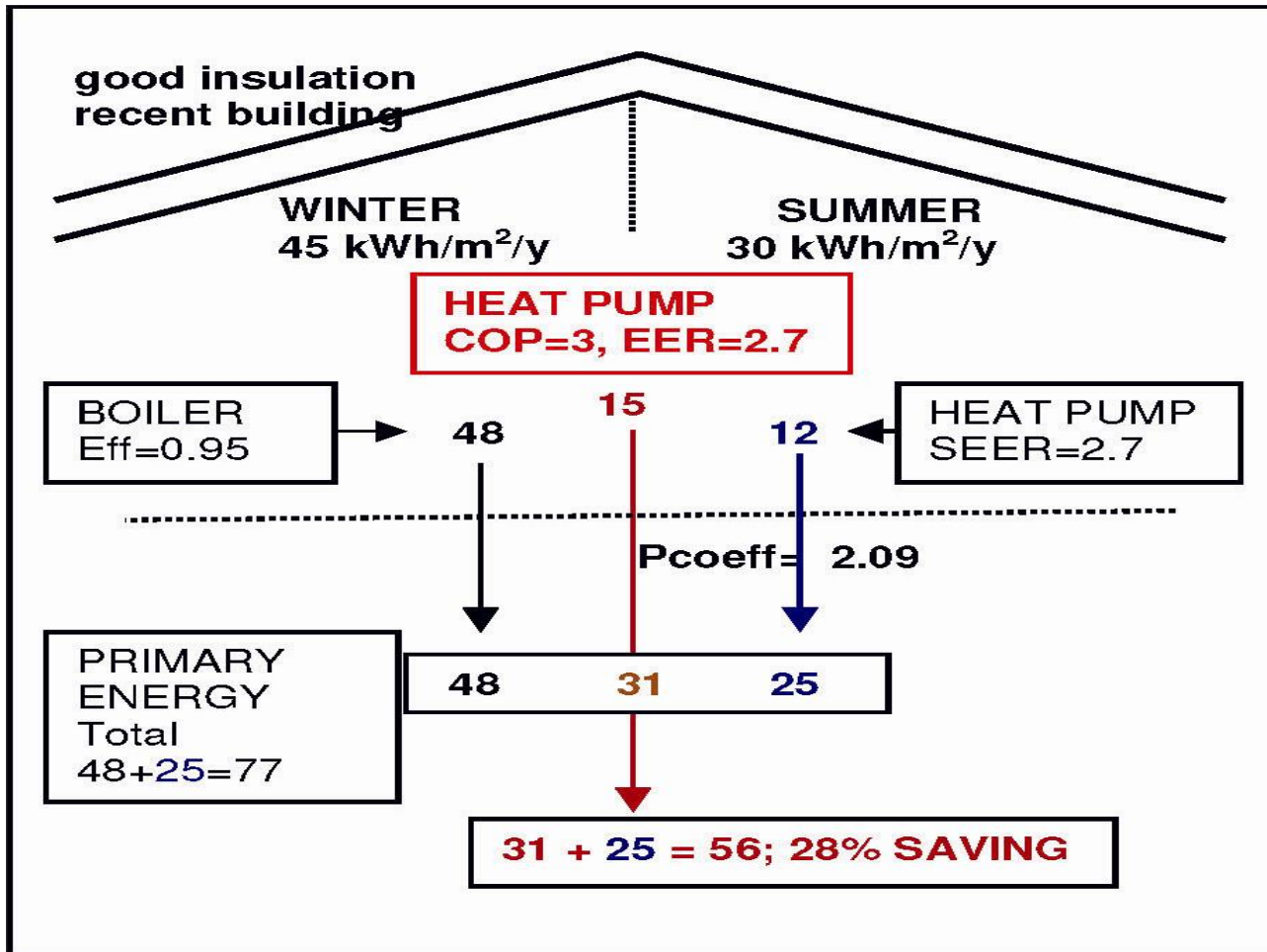
COOLING					
	Number of Apartments	Unitary Secondary Energy / Load Demand	Total Load Demand	Total Primary Energy Consumption	Unitary Primary Energy Consumption
Apartments A/C as of 2005	5 500 000				
New apartments	11 000 000				
replacements	11 008 000	0.12	1 320 960		719 130
retrofit	2 625 000	0.12	315 000		239 983
new	3 750 008	0.08	157 500		119 577
<b>TOTAL COOLING</b>			<b>1 793 462</b>		<b>1 087 690</b>
<b>TOTAL HEATING + COOLING</b>					<b>15 945 879</b>
<b>SAVINGS BAU vs BAT with <u>annual</u> AC</b>					<b>23%</b>

One system only for 7 million ap.s

# a simple role of thumb



# a simple role of thumb



# conclusions

# conclusions

- Italy is a Mediterranean country where both heating and cooling are requested with high seasonal demand
- The Italian cooling market has a rapid and unrestrainable development (unless forbidden by law)
- Two different systems, one for cooling and one for heating, are not sustainable
- There is a strategic problem regarding the cost of electric power in order to make HPs competitive in the LCA

# Thank you for your attention

**Carmine Casale**

**AICARR**

**CO.AER**