Policies supporting heat pump technology in Europe

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SWEDISH HEAT PUMP ASSOCIATION

Energy markets in transformation

Governing forces

- Energy price development
- Policies
- Technological development

Challenges

Security of supply

- Generation of electricity with low carbon footprint
- Renewable electricity Wind- and hydro power ,PV
- Nuclear and Carbon capture and storage (CCS)

Challenges

Road transport

- Plug-in hybrid cars
- Bio fuels

Third industrial revolution

- Focus on energy efficiency
- Renewable energy
- Low carbon technologies

20-20-20 by 2020

- Energy from renewable energy sources
  20 % renewable energy in EU as a whole

- Reduction of emissions
  20 % reduction of green house gas emissions

- Energy efficiency
  20 % improved efficiency

Political tools available and under development

- Addressing the use of renewable energy
  - RES-Directive (existing)

- Addressing energy efficiency
  - Energy performance of buildings Directive (existing)
  - Energy labelling Directive (under development)
  - ECO-Design Directive (under development)
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- Addressing GHG-emissions
  - Kyoto
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RES-Directive

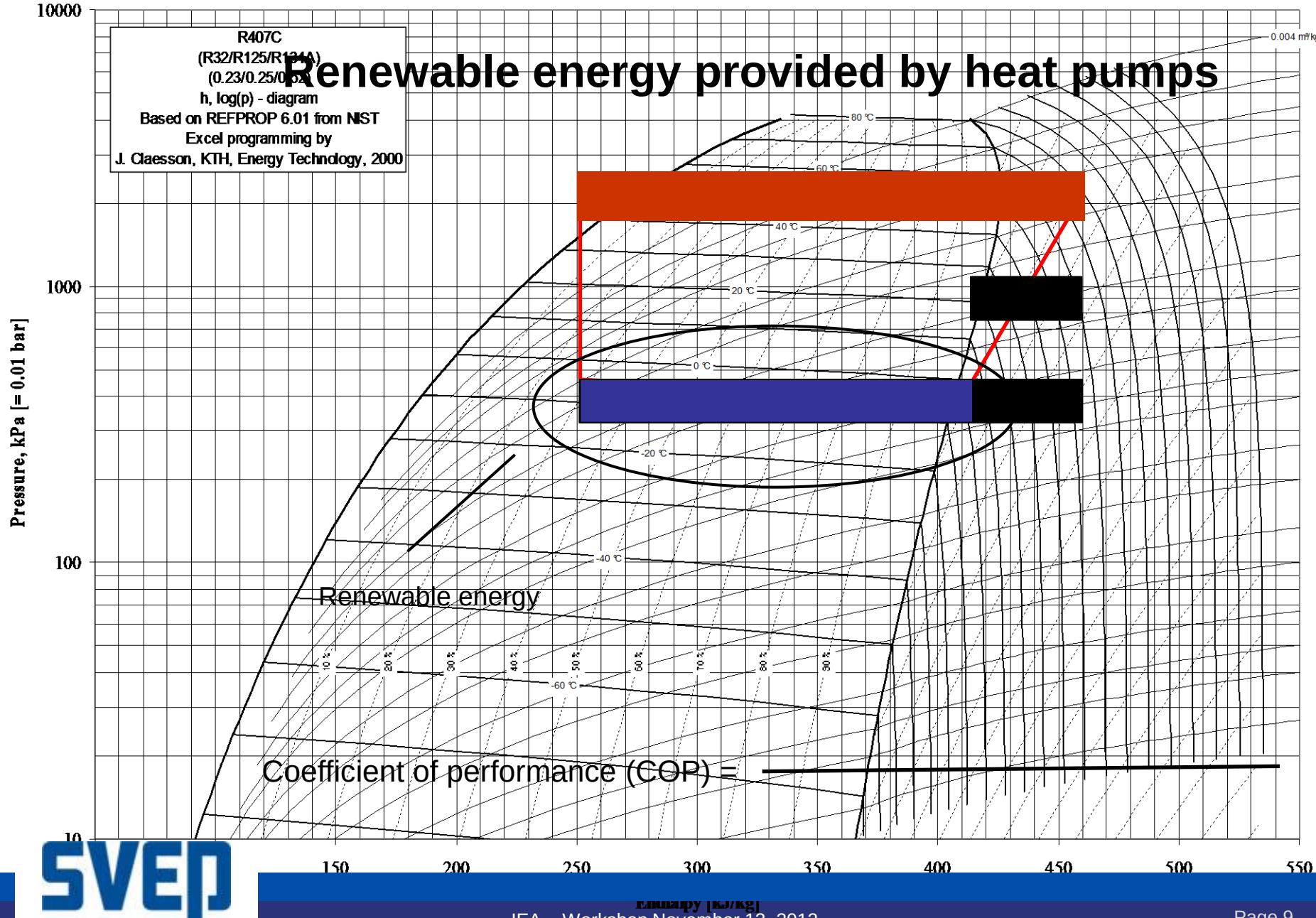
- Energy from renewable energy sources

  20 % renewable energy in EU as a whole

  10 % fixed target for the transport sector

<u>Heat pumps in RES</u>
"Aerothermal, geothermal and hydrothermal heat energy captured by heat pumps shall be taken into account for the purposes of paragraph 1(b) provided that the final energy output significantly exceeds the primary energy input required to drive the heat pumps."

Renewable energy provided by heat pumps



RES-Directive

E_{RES} = [redacted] - [redacted]

or

$E_{RES} = Q_{usable} \times (1 - 1/SPF)$

Requirement stated in the RES Directive

1,15 > [redacted] / [redacted]

SPF > 1.15 * 1/ η ⟹ SPF > 2.63 *(presently)*

η=European average efficiency in electricity generation, stated by Eurostat

η = 43,8% Revised spring 2010

Calculation of renewable energy

Unknown

$$E_{RES} = Q_{usable} * (1 - 1/SPF)$$

Measurements Estimations Measurements Estimations

Three general approaches may be used

A: Sales statistics + Estimations
B: Surveys + Estimations
C: Calculations EN 14825

Calculation of renewable energy

$$E_{RES} = Q_{usable} * (1 - 1/SPF)$$

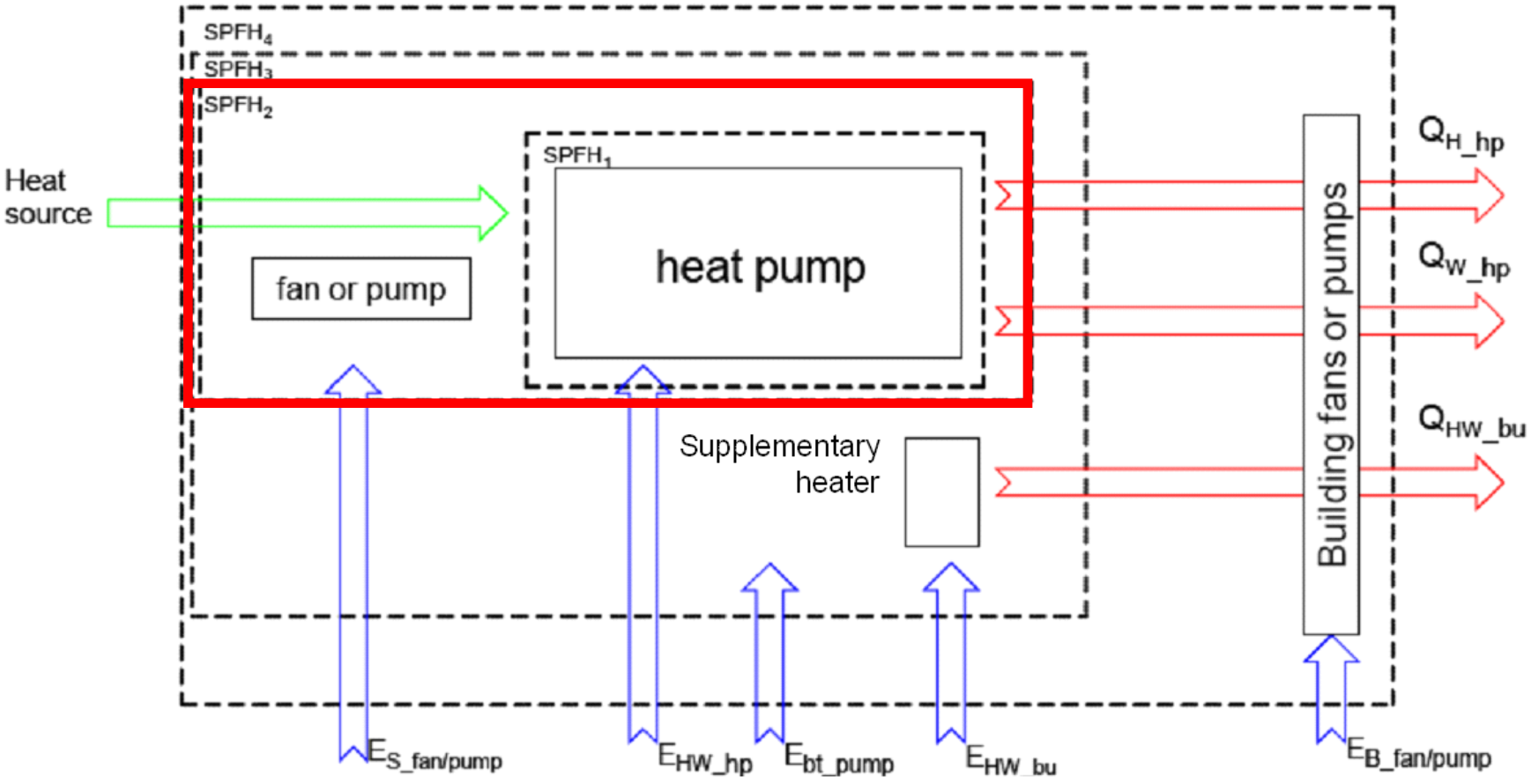
Q_{usable}

- Installed capacity [kW] × $Q_{usablefactor}$ [h]
- Air | Water | Ground
- Energy source Climate

SPF

- Survey Data
- Air | Water | Ground

System boundary



System boundaries as defined in the EU – SEPEMO project

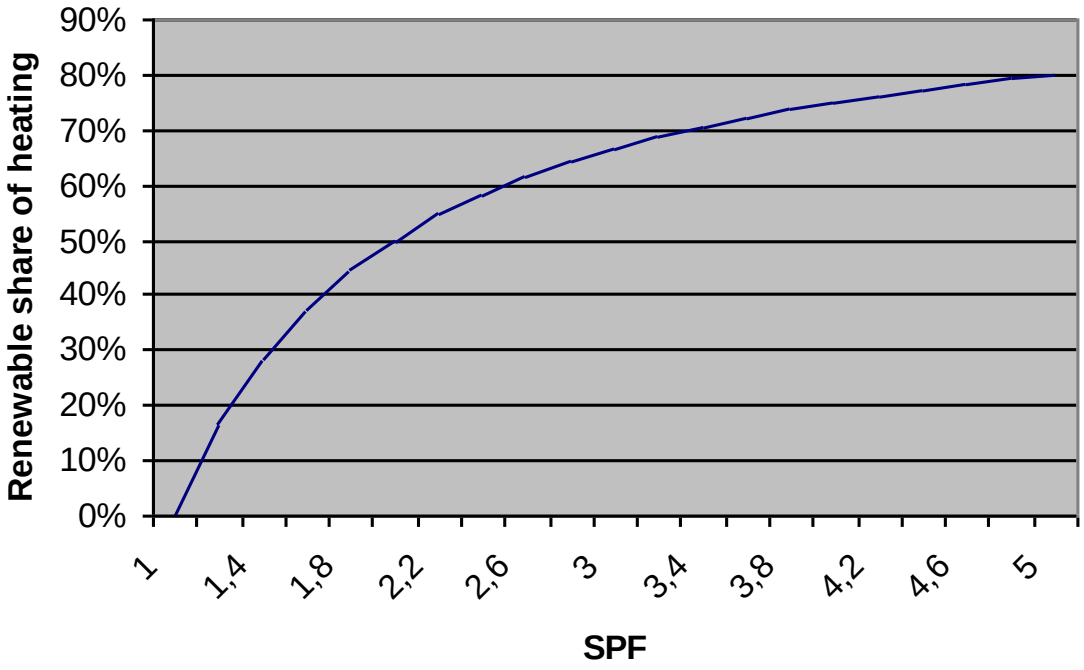
Proposed default values Q_{usable} and SPF

		Warmer climate conditions		**Average climate conditions**		Colder climate conditions	
Heat Pump Energy source (s):	Heat pump technology	$Q_{usablefactor}$	SPF ($SCOP_{on}$)	**$Q_{usablefactor}$**	**SPF ($SCOP_{on}$)**	$Q_{usablefactor}$	SPF ($SCOP_{on}$)
Ambient energy	Air-Air	1336	2.7	**2066**	**2.7**	2465	2.7
	Air-Water	1336	2.7	**2066**	**2.7**	2465	2.7
	Air-Air reversible	610	2.7	**2066**	**2.7**	2465	2.7
	Exhaust Air-Air	850	2.7	**770**	**2.7**	750	2.7
	Exhaust Air-Water	850	2.7	**770**	**2.7**	750	2.7
Geothermal energy	Ground-Air	1336	3.2	**2066**	**3.2**	2465	3.2
	Ground-Water	1336	3.5	**2066**	**3.5**	2465	3.5
Hydrothermal heat	Water-Water	1336	3.2	**2066**	**3.2**	2465	3.2

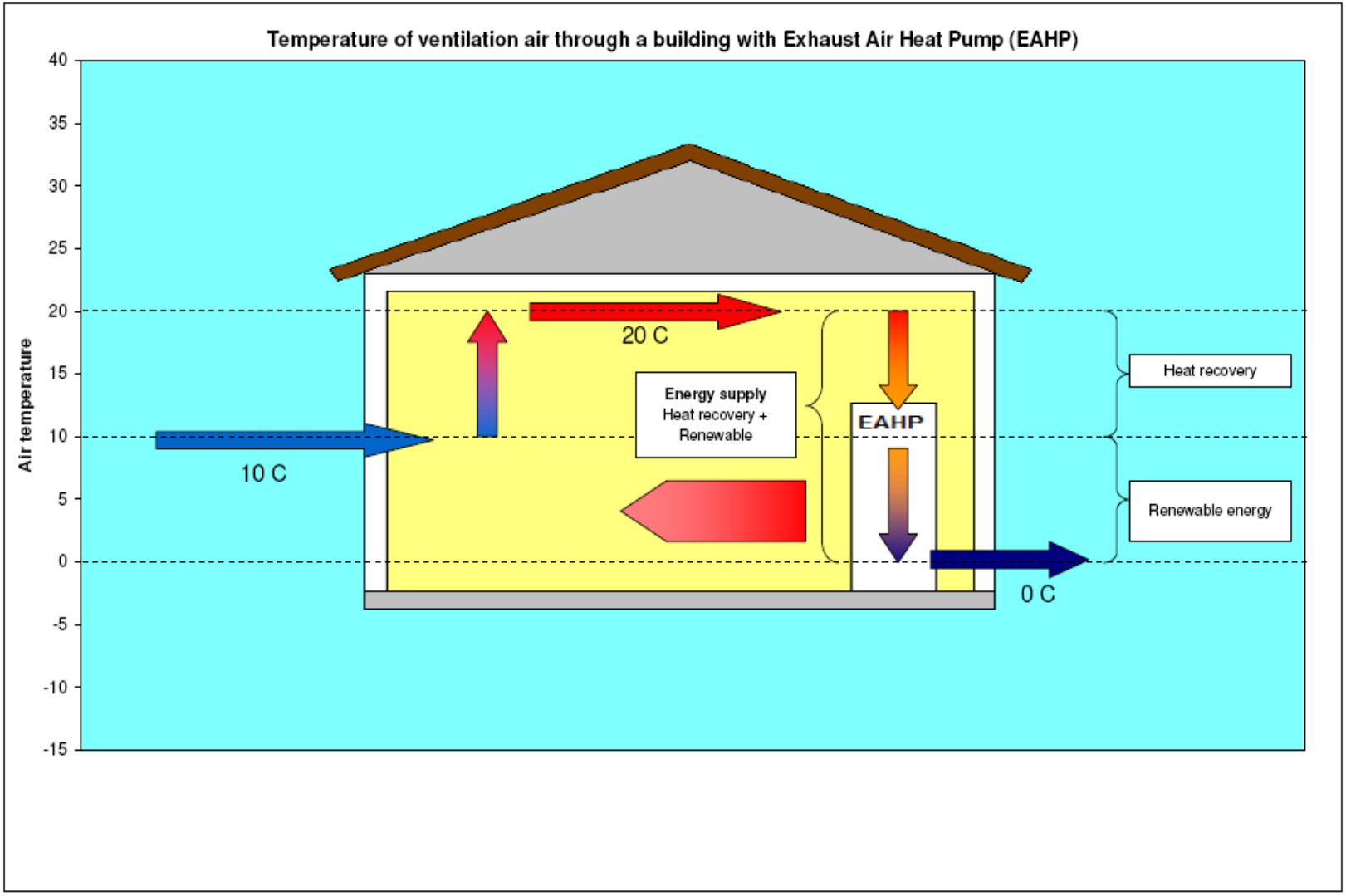
Renewable share of heating

Sensitivity analysis of variations of SPF

SPF	
5	80%
4,8	79%
4,6	78%
4,4	77%
4,2	76%
4	75%
3,8	74%
3,6	72%
3,4	71%
3,2	69%
3	67%
2,8	64%
2,6	62%



Schematic view of the exhaust air heat pump



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Energy performance of buildings Directive

Published recast of the Directive, May 2010

- All new buildings finalised after December 31, 2020 must be of "Nearly Zero Energy Standard"
- Energy performance certificates of buildings are to be available at the point of sale
- National plan on refurbishment of existing buildings to meet "Nearly Zero Energy"

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Challenges

- Refrigerants
- Quality assurance
- Smart grid ready
- Efficiency requirements

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Overall aim

- Impose more energy efficient products
- Extend energy labelling scheme
- Improve customer information
- **Ban inefficient products from the European market**

Energy related products Directive

Framework Directive for setting of energy efficiency criteria requirements

Examples of prioritised product groups

- Boilers
- Water heaters
- Computers
- Imaging equipment
- Televisions
- Stand-by
- Battery charges
- Residential room conditioners
- Domestic freezers
- Dishwashers/washing machines
- Laundry dryers
- Vacuum cleaners

Energy using products Directive

- Lot 1 boilers
  Oil-, gas- and electric boilers, heat pumps, solar thermal and combinations thereof
  (http://www.ecoboiler.org)
- Lot 2 Water heaters
- Lot 6 Air-conditioners and ventilation systems
- Lot 10
  Room air-conditioners (RAC), Local air-conditioners (LAC), Comfort fans
- Lot 21 Central air heating products

http://ec.europa.eu/energy/efficiency/ecodesign/eco_design_en.htm

Implications of a cross technology label

- Improved consumer information
  Enables straight forward performance comparisons

- Systems approach necessary
  Definition of system boundaries

- Primary energy efficiency

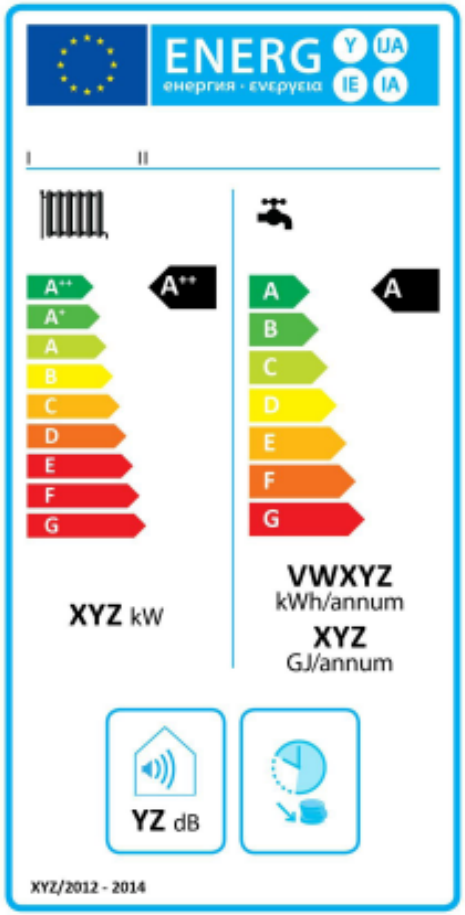
- Annual performance rating

Main parameters considered for performance calculation

- Primary energy factor (electricity)
- Three climate zones
- COP at various operating conditions
- Two heat distribution systems (radiators, underfloor heating)
- Buffer tank losses
- Type of distribution pumps (varying efficiency)
- Control systems
- Does not address green house gas emissions

(http://www.ecoboiler.org)

Boiler combination heaters in seasonal space heating energy ef
G and in water heating energy efficiency classes A to G



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F-gas Regulation

- Official proposal recently published
- Entry into force 1 jan 2014 tentatively
- Phase down – no complete phase out of HFC's
- A number of question marks existing

Phase down scheme

- Phase down expressed in CO_{2eq}
- The reference value corresponds to annual mean emissions during 2008-2011
- The system allows for a certain degree of flexibility

ANNEX V

Maximum quantities of hydrofluorocarbons as referred to in Article 12(1)

Years	Maximum quantities as a percentage of the annual average of the total quantities, expressed in tonne(s) CO2 equivalent, produced and imported in the Union during the period from 2008 to 2011
2015	100%
2016 - 2017	93%
2018 - 2020	63%
2021 - 2023	45%
2024 - 2026	31%
2027 - 2029	24%
2030	21%

Article 7 Training and Certification

Training and certification shall in the future include technologies that replaces or reduces the use of F-gases.

1 jan 2015 shall new training and certification programmes be notified to the Commission

Article 11 Pre-charging of equipment

Article 11
Pre-charging of equipment

1. Refrigeration, air-conditioning and heat pump equipment shall not be charged with hydrofluorocarbons before it is placed on the market or before it is made available to the end-user for its first installation.

   The equipment shall be charged at the site of its envisaged use, and the charging shall be carried out by persons certified in accordance with Article 7.

2. Paragraph 1 shall not apply to hermetically sealed equipment or to equipment containing a quantity of hydrofluorocarbons corresponding to less than 2% of the foreseen maximum capacity of the equipment.

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  - ~~ECO-labelling Directive (under revision)~~
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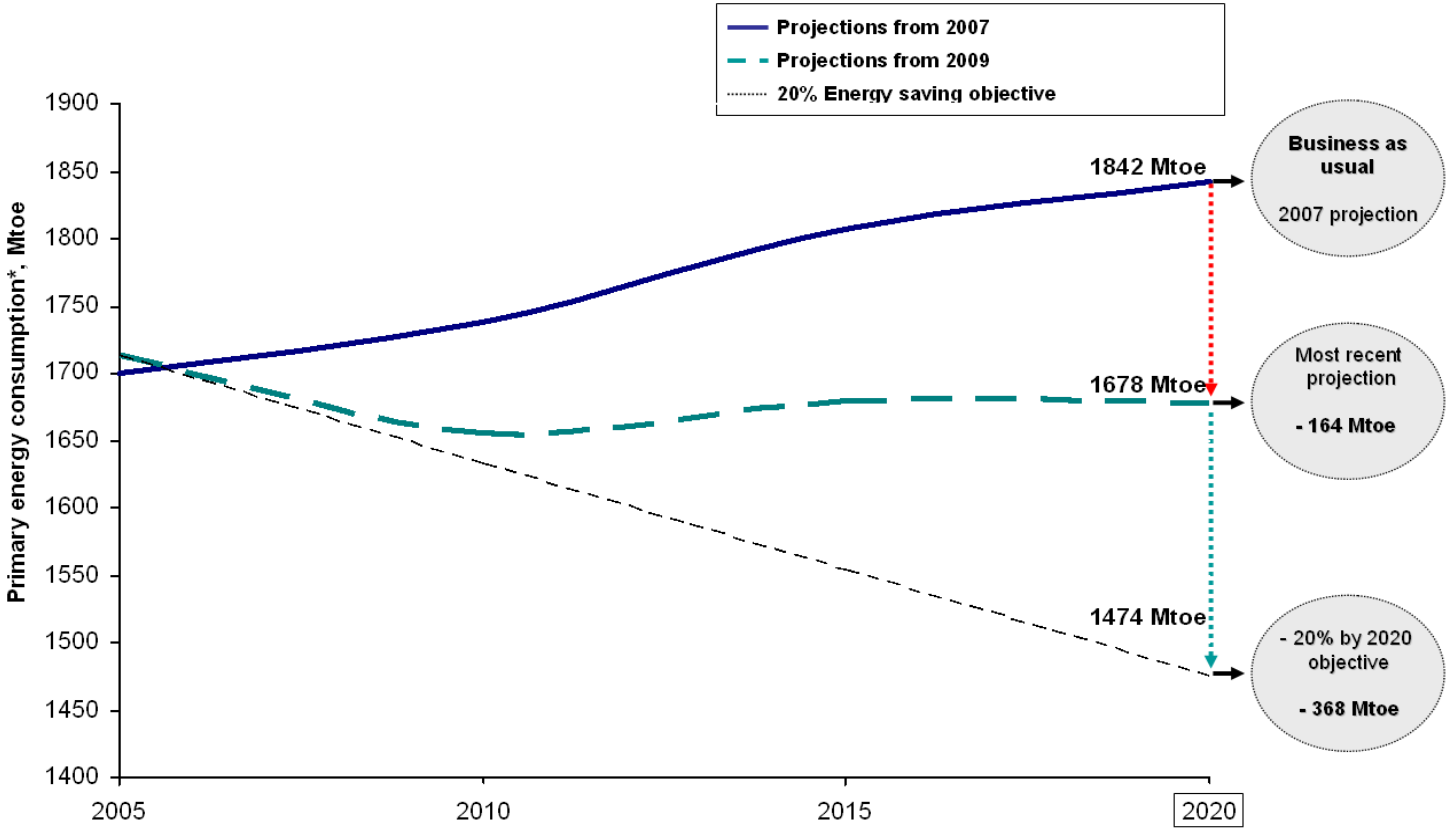
Energy Efficiency Directive

Flagship initiative

- Given priority in the EU strategy plan for 2020
- Replaces the energy service- and the cogen Directive
- Technology prescriptive
- District energy the only technology mentioned as energy efficient heating and cooling

Energy Efficiency Directive



* Gross inland consumption minus non-energy uses