EUROPEAN COMMISSION
DIRECTORATE-GENERAL JRC
JOINT RESEARCH CENTRE
Institute for Prospective Technological Studies (Seville)
Sustainable Production and Consumption

1st Meeting of the AHWG for the Development of Ecolabel and Green Public Procurement Criteria for Hydronic Central Heating Systems

Sevilla, 28 June 2011

Agenda

1.	**Opening and welcome** – Tour de table **Political objectives of Ecolabel and Green Public Procurement**	**09:30 – 10:00**
2.	**Ecolabel and Green Public Procurement criteria** – Process description	**10:00 – 10:15**
3.	**Product group scope and market analysis** – Presentation followed by discussion	**10:15 – 10:45**
	Coffee break	**10:45 – 11:00**
4.	**Background information on hydronic central heating systems** – Presentation followed by discussion	**11:00 – 12:00**
5.	**Process leading to criteria areas for hydronic central heating systems + Common benchmark approach** – Presentation followed by discussion	**12:00 – 13:00**
	Lunch break	**13:00 – 14:15**
6.	**Energy efficiency and GHG emissions** – Presentation followed by discussion	**14:15 – 15:30**
7.	**Other air emissions and noise** - Presentation followed by discussion	**15:30 – 16:00**
	Coffee break	**16:00 – 16:15**
8.	**Design of materials** - Presentation followed by discussion	**16:15 – 16:45**
9.	**Corporate criteria** - Presentation followed by discussion	**16:45 – 17:15**
10.	**Hydronic central heating systems and Green Public Procurement** – Discussion contribution	**17:15 – 17:30**
11.	**Conclusions and close of the workshop**	**17:30 – 17:45**

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Ecolabel and Green Public Procurement Criteria - Process Description

IPTS - Institute for Prospective Technological Studies

Seville - Spain

www.jrc.ec.europa.eu/

IE – Petten, The Netherlands
Institute for Energy

IRMM – Geel, Belgium
Institute for Reference Materials and Measurements

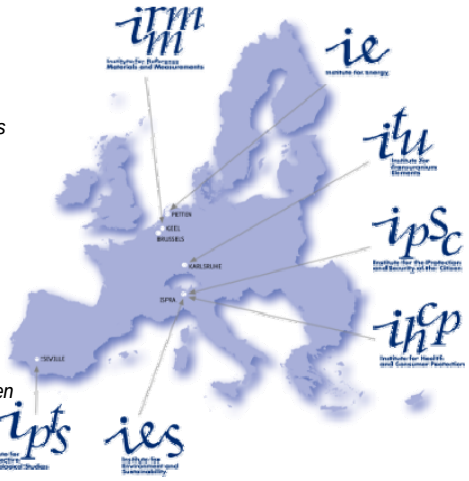
ITU – Karlsruhe, Germany
Institute for Transuranium Elements

IES/ IHCP/ IPSC – Ispra, Italy
Institute for Environment and Sustainability

Institute for Health and Consumer Protection

Institute for the Protection and Security of the Citizen

IPTS – Sevilla, Spain
Institute for Prospective Technological Studies



Product Policy Support Activities

Within the European Commission IPTS supports the development and implementation of environmental product policies, amongst them the Ecolabel Regulation and the Green Public Procurement Communication.

Objective: Concentrate product policy implementation support to harmonise methodologies and procedures

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Product Policy Support Activities

Activities:

- **Identification of priority product groups according to environmental assessment**
- **Development of workplans for the different instruments**
- **Scientific analysis of environmental aspects and impacts of each product group**
- **Develop criteria and implementing measures until the stage of voting in committee**

Criteria development step by step (1)

Technical Analysis

Product scope and definition
Economic and market analysis
Technical analysis
Improvement potential

Preliminary Report → **Draft Criteria Proposal + Technical Report**

Published on the dedicated website: http://susproc.jrc.ec.europa.eu/heating/

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Criteria development step by step (2)

Stakeholder consultation

Preliminary Report
Draft Criteria Proposal + Technical Report

Today!

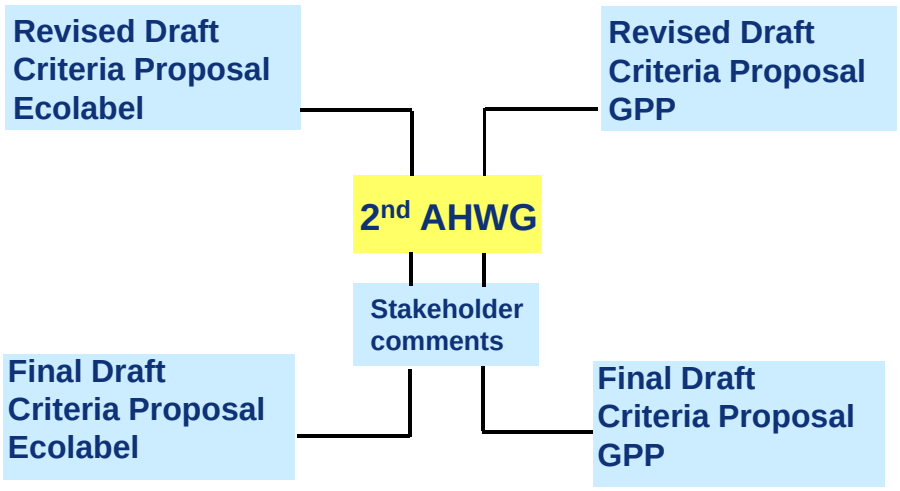
Input to 1st AHWG

Stakeholder comments

Revised Draft Criteria Proposal Ecolabel

Revised Draft Criteria Proposal GPP

Criteria development step by step (3)



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Criteria Development for Hydronic Central Heating Systems

Stakeholders can comment on working document up to 4 weeks after the meeting (end July 2011)

Separate draft criteria proposals for Ecolabel and GPP will be prepared and published 4 weeks ahead of next AHWG

Second AHWG to take place end November 2011

Again 4 weeks to comment on draft criteria proposals

End 2012 final draft criteria available

1st AHWG - Today

- Begin a discussion on the key issues concerning the potential ecological criteria
- Agree on identified criteria areas
- Discuss criteria areas and sub-criteria one by one

The goal of today meeting is not to define exact criteria formulations and values

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Thank you!

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Development of ecological criteria for Hydronic Central Heating Systems

General overview

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Content

- Scope, product group definition and economic/market analysis
- Preliminary results of base case assessment, results of impact assessment - VHK
- Concept of seasonal space heating efficiency, and reference to Ecodesign Lot 1 - VHK

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Content

- **Scope, product group definition and economic/market analysis**
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Scope: Hydronic central heating systems
Motivation: High environmental relevance of this product group

- **Energy consumption in buildings accounts for ~40% of the total primary energy consumption in the EU-27 (of about 76 700 PJ, 2005)**
- **A large fraction of the primary energy consumed in buildings is used for heating and cooling:**
  - **Residential buildings: this fraction is 60-70%**
  - **Considering all kinds of buildings, on average, this fraction is 50-60%**
- **This means that 20-30% of the total primary energy consumption in the EU-27 is used in the heating and cooling of buildings (mostly heating), that is, roughly 20 000 PJ per year (this quantity is equal to total energy used for transport in the EU)**
- **Hydronic CH systems represent ~86% of the total use-phase primary energy consumption by heating systems in the EU-27, and therefore account for most of the environmental impact of all heating systems as a whole**
- **Because of large energy consumption for heating in residential, commercial and industrial buildings, there is a high potential for saving due to Ecolabel and GPP criteria**

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Scope and product group definition: Hydronic central heating systems

- **Product scope mainly based on draft Implementing Measures for the Energy Labelling and Ecodesign of boilers (May 2011) plus Ecodesign preparatory study for biomass boilers (Lot 15)**
  - Harmonization of product policy schemes
  - Reduced additional burden

- **The scope of this Ecolabel study is "water-based (i.e. hydronic) central heating system", in all relevant combinations, up to a maximum input power of 400 kW (in consistency with the Boiler Directive and Ecodesign)**

- **Scope is consistent with the LCA methodology in this study, which compares different technologies where all share a common function: the production of one unit of heat for ambient heating, e.g. 1 kWh of useful heat**

- **A technology neutral approach: No technology excluded *a priori***

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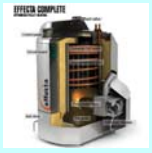
Overview of hydronic central heating systems

Generation of central heating

CH boiler

Hydronic heat pump

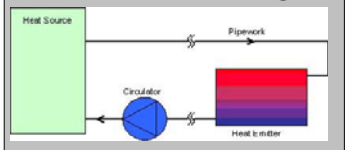


Solid biofuel boiler

Cogeneration (CHP)

Other: solar, hybrid technologies

Hydronic distribution of central heating



Circulators

Radiators

- **Scope is restricted to the "heat generator", i.e. the part of a boiler that generates heat to a water-based central heating system, using one of the following processes:**
  - Combustion of gaseous, liquid or solid fossil fuels
  - Combustion of gaseous, liquid or solid biofuels
  - Use of the Joule effect in electric resistance heating elements
  - Capture of ambient heat from air, water or ground source, and/or waste heat
  - Cogeneration (the simultaneous generation in one process of heat and electricity)
  - Solar (auxiliary)
  - Hybrid systems: certain combinations of the above (e.g. boiler + heat pump, boiler + solar)

Summary of scope of product group

Technology	Fuel	Nominal power input	Working principle
Gas/oil boiler	Gas (natural or propane) or oil	4-400 kW	Combustion
Biomass boiler	Biomass (logs or pellets)	4-400 kW	Combustion
Heat pump boiler	Electricity	4-50 kW (indicatively)	Electric compressor, driving a vapour cycle
	Gas (possibly in combination with waste heat and/or solar heat)		Gas driven engine, driving a compressor for a vapour compression cycle Gas-fired combustion, driving a sorption process
Cogeneration boiler	Gas (natural or propane) or oil (including bio-oil)	4-400 kW	Micro: external combustion (Stirling engine) Mini: internal combustion (piston engine driving a generator) Other: fuel cells, based on electrochemical principles
Solar thermal	Solar energy in combination with electric energy for pumps/controls (needs other heat generator to fulfil heating demands in all circumstances)	Not applicable (sized depends on location, budget and application)	Capturing and storage of solar irradiation

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Sales

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- Reliable sales data difficult to obtain (competitive market) with only a few companies responsible for over 70% of the sales
- Sources of sales and stock data:
  - Data from 2006 during the Lot 1 study (VHK + BRG Consult)
    - Slow renewal rate of central heating boilers (average product life ~15-20 years, which means that annually only 5-7% of the stock is renewed, conclusions still largely apply
  - Added data from Ecodesign Lot 15 on biomass boilers
  - Sales of heat pumps, cogenerators, solar thermal assessed using data from EHPA, COGEN, ESTIF (including industry outlook for future sales)

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Sales

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Product group	Unit	1990	1995	2000	2005	2010	2015	2020	2025
Central heating boilers	in '000 units	4 765			6 989	7 374			8 900
Solid fuel [1]	in '000 units	288	220	200	250	436	367	325	296
- 50% of which are biomass boilers [2]	in '000 units	140	120	100	150	250	300	300	280
Heat pumps	in '000 units				250 [3]	490	1 000		
Cogeneration	in '000 units					20	140	300	
Solar heating [2]	In '000 m^2	42,9	71,4		2 100				

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Stock

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Product group	Unit	1990	1995	2005	2010	2015	2020	2025
Boilers	in '000 units	74 660	86 236	10 9709	12 0975	13 1058	14 0638	15 0734
Solid fuel boilers	in '000 units	8 864		6 500	+/- 8 000			
- of which biomass (50%)	in '000 units	4 400		3 250	4 000			
Heat pumps	in '000 units				1 400 [1]			
Cogeneration	in '000 units				38	498	1 658	
Solar heating	In '000 m^2				31 625 [2]			

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Market trends

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Product mix, under "a business as usual" scenario:

- The trend towards wall hung boilers is expected to continue in the long term, and within that a marked shift towards condensing boilers, even without the introduction of additional legislation
- The share of floor standing boilers (including and jet burner) is expected to fall, and a similar trend towards condensing is likely to continue
- Biomass boilers have experienced a "revival" over the last few years, reasonable to expect that this growth will continue to some extent, although a "natural ceiling" to the penetration of this type of boilers is posed by the cumbersome requirements in terms of storage and fuel supply
- Electric boilers are expected to maintain their marginal position, and their future is particularly related to overall energy policy decisions
- Sales of heat pumps are expected to grow, although the pace of this growth is very difficult to evaluate. It is possible that the forecast presented could be conservative.

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Market trends

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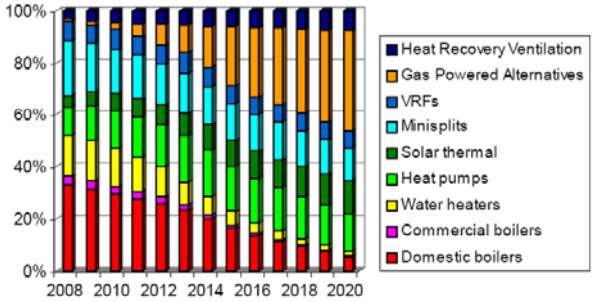
- As will be seen in the LCA study, no single technology appears to have all of the advantages; there are tradeoffs
- Indications that the hydronic central heating market will become more diversified over the coming decade: different technologies, different fuels
  - No single technology will dominate the market
- Decrease in combustion boilers, increase in gas powered alternatives (example gas heat pumps, hybrid technologies (heat pumps + solar), and cogeneration



BSRIA, 2010

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Market trends: Emerging technologies

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- **Biomass boilers** are enjoying an upsurge. Saturation could come at some point. From LCA study: although they use renewable energy they are still responsible for significant polluting emissions
- **Heat pumps** do look like an attractive energy efficient alternative, sales growing. However (still) high initial investment, subsidies and incentives needed. Development of ever more efficient air-source heat pumps, installation requirements are less costly. Gas heat pumps are gaining ground as well, though slowly
- **Solar thermal** has been at the forefront of discussion, because of the initiatives in Spain, but since Spain has removed its favorable regulations, the market is in decline. In other countries the situation has changed little, with on/off incentives provided by governments. Keeping in mind that solar thermal works best under circumstances when space heating is least needed, this technology is likely to remain primarily associated with water heating, together with a supplementary role for space heating
- **Micro CHP boilers** have finally left the development stage and witnessed a full scale market introduction in 2010 (mostly BDR Thermea products). Most micro-CHP products that have or will enter the market shortly are based on Stirling engines, with limited electric efficiency. Somewhat larger CHP systems (Enertec Dachs, with 5 kW electric output) have been on offer for a few years, but sales are still below 20.000 units/year. Hydrogen fuel cells for space heat are still in the development stage.

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Limitations in the installation of specific heating technologies

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•**Condensing boilers** require a flue gas systems that can withstand corrosive wet flue gases. Many chimneys in existing multi-family buildings need to be retrofitted for this purpose in order to enable installation of condensing boilers. In buildings with multiple-owners and a collective flue gas shaft this may pose problems. This was also the reason for not raising the space heating seasonal efficiency of low capacity boilers (4-15 kW) beyond 75% (Ecodesign Implementing Measures)

•**Ground-coupled heat pumps** need space for installing the ground probes or to dig/bore wells. Especially existing buildings in urban environments have severe space constraints

•**Air-based heat pumps** emit noise and show lower efficiencies in colder temperatures. The noise can be a limiting factor in installation

•**Solar thermal energy systems** require space on roof-level. Sloped or flat roofs are technically not a problem, but in multi-family housing it is difficult to realise individual systems since the roof space is either shared and/or too far away from lower level apartments. Collective systems have a better chance in multi-family, multi-owner buildings

•There are however also options that foster the take-up of new energy efficient technologies: Buildings with collective heating systems may be converted to using central heat pumps, with individual transfer stations per apartment.

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Economic/market issues relevant to GPP

•As part of the data gathering, it is planned to contact public procurers from individual member states, to estimate procurement volumes

•Issues regarding capacity and availability of technologies in public procurement

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Introduction to the life cycle analysis

- Aim of the technology analysis: Not to benchmark product by product, but to put together a "basket of heating systems products" which is representative enough to later derive thresholds for all heating systems
- A number of 9 representative base cases were selected for analysis. If a specific heating system is not included in the base cases, it does not mean that it later cannot apply for a label
- The results of the analysis are in terms of "base cases", i.e., the environmental best but average values

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Thank you for the attention

Environmental Product Policy for Central Heating Systems

Technical Background Study (interim)

VHK for DG JRC Institute for Prospective Technical Studies
Stakeholder meeting 28 June 2011, Sevilla

Content

- **Selection base cases**
- **Analysis**
- **Seasonal efficiency**
- **Interim results**

Selection basecases hydronic CH boilers

Aim is to cover the most relevant product groups for Ecolabel/GPP in

- **Market numbers**: gas/oil >90% sales (→2 types to cover size range);
  cf. biomass 3,3%, heat pumps 6,6% (2010)
- **Carbon saving**: biomass (but multitude of emissions→ 3 types)
- **Clean renewables**: solar-assist, heat pump
- **Hybrid and mixed solutions**: CHP, 'smart hybrid' (el. heat pump/gas boiler)
- Total: **9 base cases** (manageable)

What is not explicitly included:

- **No distinction gas/oil**
  Cf. Lot 1: identical efficiency requirements and label classifications; CO, VOC(CxHy), CH4 may be different but no adequate dynamic test procedure; SOx emissions depend on fuel. Only difference in NOx (70 vs. 120 mg/kWh for gas vs. oil) does not warrant separate basecase.
- **Electric air-source HP representative for HP, because most critical COP**
  water- and brine-source, as well as gas-fired absorption types have generally better COP
- **Analysis based on average residential heat demand ('M')**
  Normalisation factor to make outcome generally applicable
  …and Average climate
- *Cf. Lot 1: 'Average' climate determines minimum requirement and labeling class; 'Colder' and 'Warmer' climate performances are information items. 'Warmer' can have 40% more and 'Colder' climate have 20% less contribution of solar-assist.*

Analysis

- Life-cycle-approach 'cradle-to-grave' (EcoDesign approach)
- EcoReport analysis (MEEuP) for data relating to production, distribution, indirect emissions and auxiliary resources in use phase, end-of-life;
- Resources efficiency and direct emission data taken from Ecodesign studies (Lot 1, Lot 15)
- Normalised on heat demand (177.000 kWh over 17 years)
- Seasonal space heating efficiency

Seasonal space heating efficiency

- **Today**: Efficiency/ COP represented as 1 single value, measured at 1 single steady-state condition
- **Seasonal efficiency**: Hourly weighted average of several efficiency values, representative of real-life heat demands/conditions that occur during the heating seasons, taking also into account cycling; expressed in primary energy .

Questions:

- How many different test conditions do you need to make a representative calculation?
- How do you know the number of hours that a certain heat demand ('load') occurs in a heating season ?

How many different input conditions do you need to make a representative calculation?

- **Depends on how sensitive the efficiency of a boiler-type is to the heat demand.**

  E.g. gas/oil boiler is relatively less sensitive: Difference between full load (worst) and lowest steady-state part-load (best) is 6-8% for a condensing boiler. At still lower part loads the efficiency decreases again.

  Electric air-source heat pump is very sensitive to both the load (heat demand) and the (outdoor temperature) conditions. Low load and high outdoor temperature → best efficiency (COP 6-7); High load and low outdoor temperature → worst efficiency (COP 2-3).
- **Depends on relative contribution/importance:** E.g. solar contribution is very sensitive to circumstances, installation, etc. but the contribution to the overall space heating of solar-assist is relatively small (10-25%) and therefore the error in not testing all possible conditions is small.
- **Depends on testing costs and lab capacity:** Heat pump and solar testing is more expensive than gas/oil boiler testing.

Overview input points declaration required for heating efficiency and capacity (Ecodesign April 2011)

- **gas/oil boiler** 2 points →100% load at 60/80 oC and 30% part load at 30/37/50 oC return temperature (depending on condens/LT/standard type). Cycling correction for <30% using defaults.
- **air-source heat pump** 6-8 points, i.e. at -7, 2, 7, 12 oC, Tbiv, Tol, Tcyc(or default), -15 oC (only 'Cold' climate). Back-up heat included at COP 2,5.
- **water/brine-source heat pump** 4-5 points, i.e. at 0,88/0,54/0,35/0,15 part load (fixed source 10/0 oC). Back-up heat included at COP 2,5.
- **auxiliary electricity heat pumps**: off-mode, thermostat-off, crankcase heater mode; for gas-fired heat pumps all electric energy (incl. source fan/pump).
- **solar-assist** (installer label only): collector efficiency and coefficient a1 (formula from tests 4 points at different inlet temperature, at solar irradiation >700 W/m2).
- **storage tank**: 1 test-point: standing loss in W. Default correct for in/outdoor (with solar)
- **biomass**: no Commission proposal yet. Assumption: input points as gas/oil.

How do you know the number of hours that a certain heat demand ('load') occurs in a heating season ?

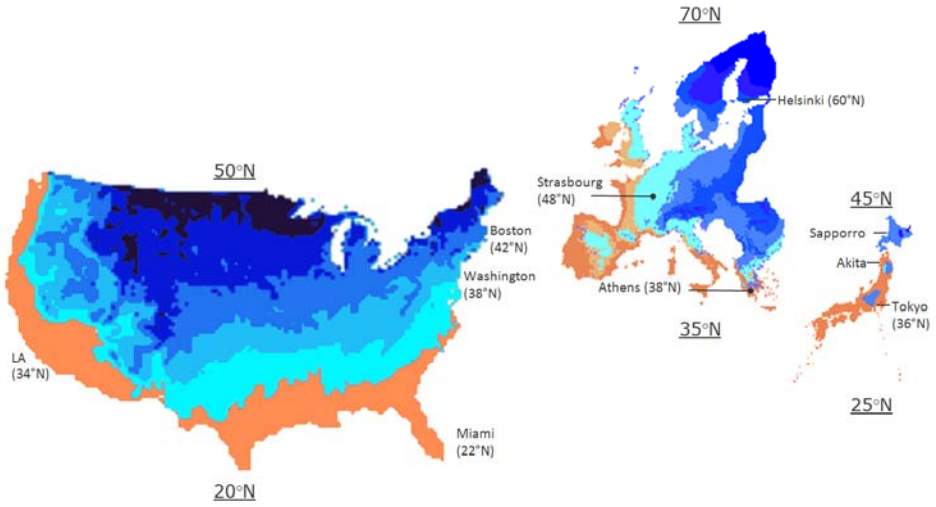
- **Climate**: Average meteo-data Strassbourg ('Average'), Athens ('Warmer'), Helsinki ('Colder') for last 20 years → 'bins' = number of hours per year that a rounded outdoor temperature value occurs.
- Load formula corrects **solar and internal gain**, i.e. the corrected indoor temperature is 16 oC (and not 19 oC).
- **Load in a 'bin'** is relative to the difference between the bin-temperature and 16 oC as a fraction of the difference between design temperature (-10 oC for 'Average' climate) and 16 oC.
- Formula:

LOAD= (Tbin – 16) / (Tdesign – 16)

Design Temperatures EU ref. climates

Strassbourg ('Average'): -10, Athens ('Warmer') +2, Helsinki ('Colder') -22 oC

Climate comparison EU/Japan/US

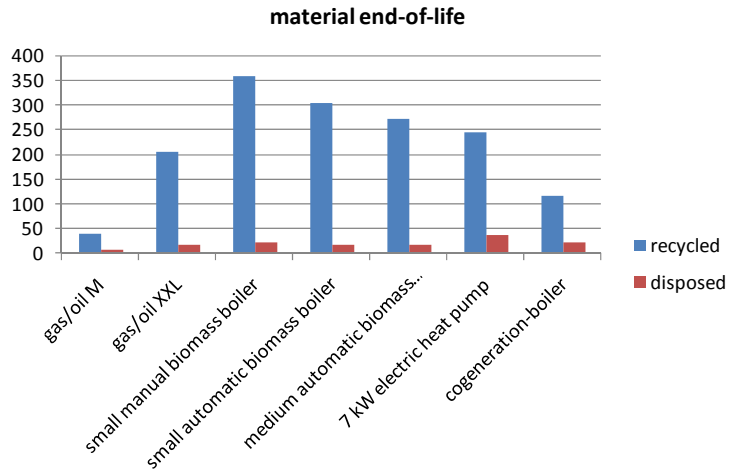


Important for heat pump comparison: Japan Average (Tokyo) = EU 'Warmer' climate (Athens)

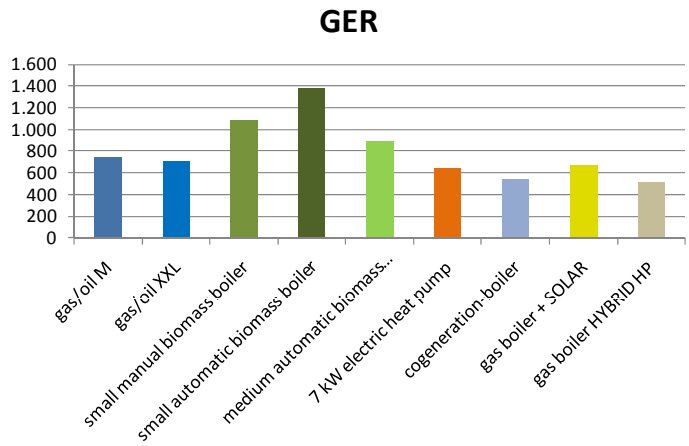
BaseCases Comparison (normalised)

	Resources use						emissions (to soil		emissions to air							emissions to water	
~~BASE CASES~~	materials disposed	materials recycled	GER total	elec. (as prim.)	process water	cooling water	non haz. waste	haz./incin. waste	GHG	AP	VOC	POP	HM	PAH	PM	HM	EP
	kg	kg	GJ	GJ	m3	m3	kg	kg	tCO2 eq.	kgSOx	kg	mg i-Teq	g Ni	g	kg	g Hg/20	g PO4
gas/oil M	7	39	744	42	3	110	119	6	42	27	1	1	2	0	2	1	13
gas/oil XXL	3	34	704	41	3	110	60	2	43	37	1	0	1	0	1	0	3
small manual biomass	20	321	1086	15	2	26	1114	2	7	147	8	125	54	277	270	2	68
small automatic biomass	12	223	1377	15	1	31	606	1	3	124	3	329	75	258	48	1	68
medium autom. biomass	3	38	888	6	1	13	464	1	1	84	2	123	42	213	39	0	16
7 kW electric heat pump	37	243	638	621	49	1630	1336	33	30	169	0	10	16	3	14	11	131
cogeneration	21	113	542	-369	-31	-989	-132	6	34	-68	1	1	-3	0	0	0	40
gas boiler + SOLAR	36	217	669	69	5	180	889	26	36	38	1	3	14	3	9	10	212
~~gas boiler HYBRID HP~~	13	87	510	297	19	790	556	15	25	82	0	4	7	1	8	3	54

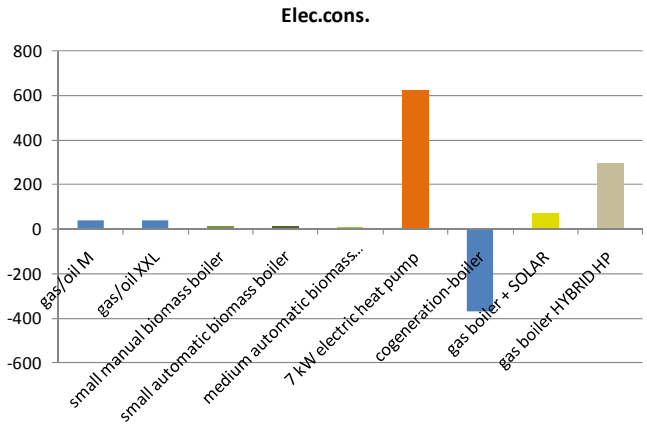
Materials (resource efficiency)



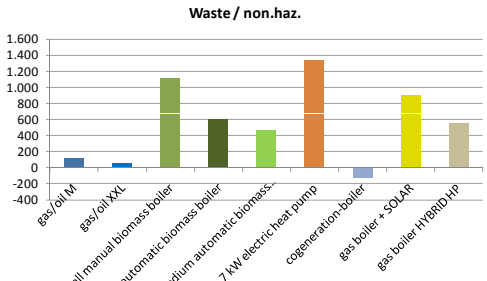
Gross Energy Requirement (total)

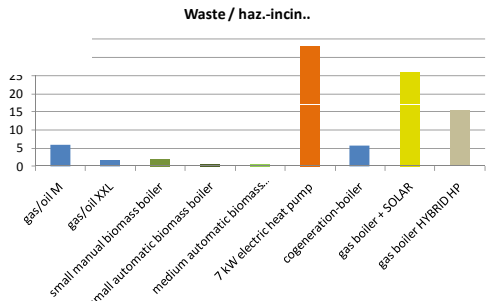


Electricity consumption (part of GER)

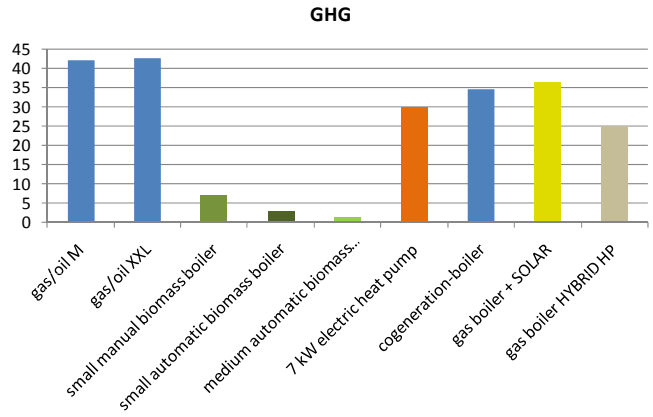


Waste (emissions to soil)

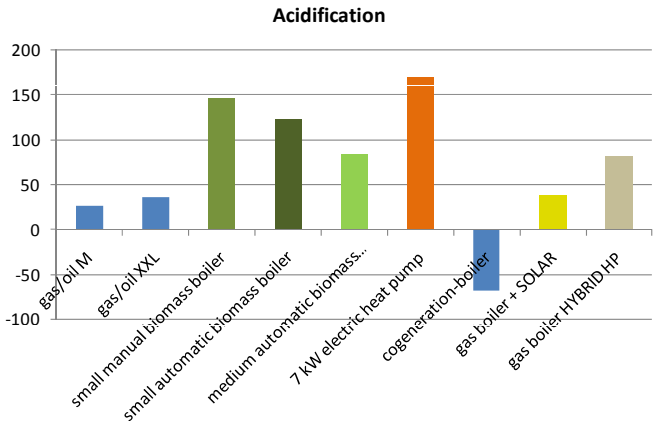




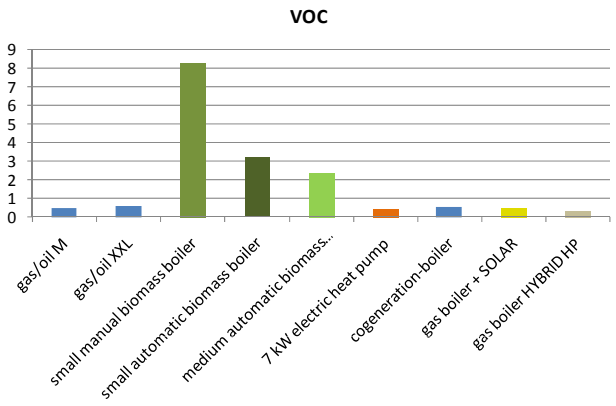
GreenHouse Gases (GWP-100)



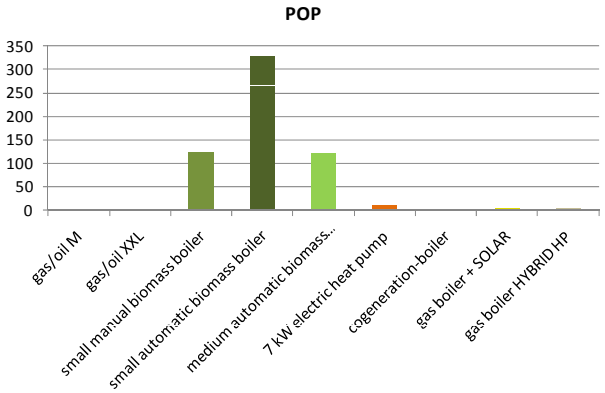
Acidification



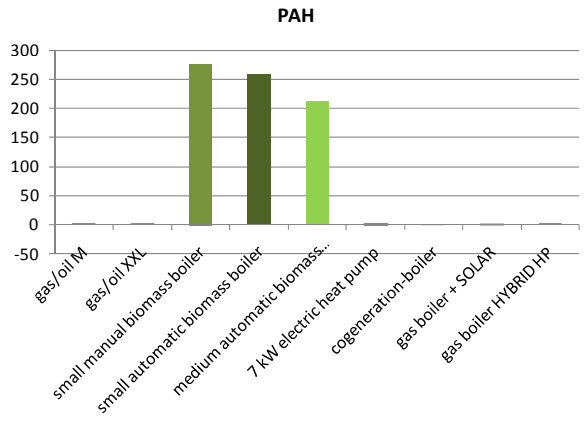
Non-Methane Volatile Organic Compunds (VOC)



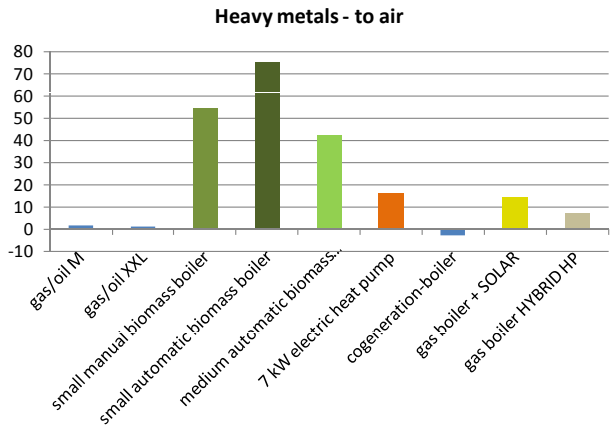
Persistent Organic Pollutants



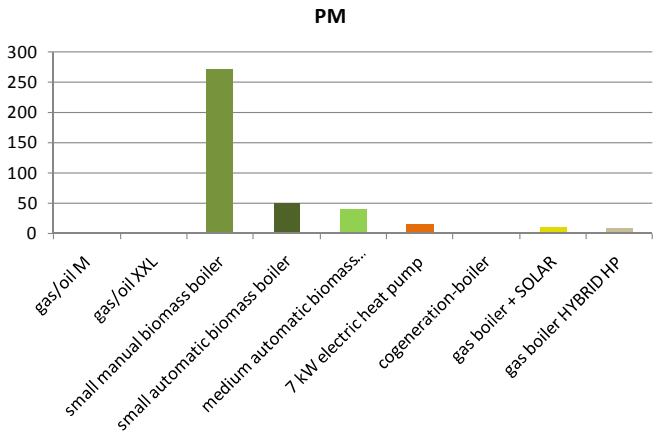
Polycyclic Aromatic Hydrocarbons



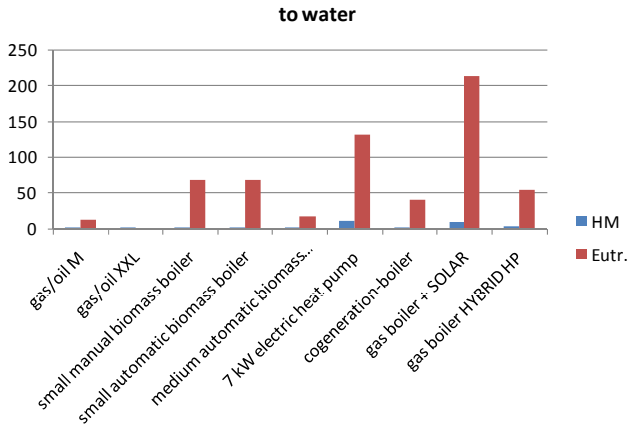
Heavy Metals to air (HM)



Particulate Matter (PM)



Emissions to water (HM & EP)



Thank you!

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Joint Research Centre (JRC)

Development of ecological criteria for Hydronic Central Heating Systems

Process leading to criteria areas & Common benchmark approach

IPTS - Institute for Prospective Technological Studies

Seville - Spain

http://ipts.jrc.ec.europa.eu/

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EcoReport Results for Hydronic Central Heating Systems

	Resources use						emissions (to soil)	
BASE CASES	materials disposed	materials recycled	GER total	elec. (as prim.)	process water	cooling water	non-haz. waste	haz./incin. waste
	kg	kg	GJ	GJ	m^3	m^3	kg	kg
gas/oil boiler (M)	7	39	744	42	3	110	119	6
gas/oil boiler (XXL)	3	34	704	41	3	110	60	2
small manual biomass	20	321	1086	15	2	26	1114	2
small automatic biomass	12	223	1377	15	1	31	606	1
medium autom. biomass	3	38	888	6	1	13	464	1
7 kW electric heat pump	37	243	638	621	49	1630	1336	33
cogeneration	21	113	542	-369	-31	-989	-132	6
gas boiler + solar	36	217	669	69	5	180	889	26
gas boiler + heat pump	13	87	510	297	19	790	556	15

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EcoReport Results for Hydronic Central Heating Systems

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	emissions to air							emissions to water	
BASE CASES	GHG	AP	VOC	POP	HM	PAH	PM	HM	EP
	tCO_2 eq.	kg SOx	kg	mg i-Teq	g Ni	g	kg	g Hg/20	g PO_4
gas/oil boiler (M)	42	27	1	1	2	0	2	1	13
gas/oil boiler (XXL)	43	37	1	0	1	0	1	0	3
small manual biomass	7	147	8	125	54	277	270	2	68
small automatic biomass	3	124	3	329	75	258	48	1	68
medium autom. biomass	1	84	2	123	42	213	39	0	16
7 kW electric heat pump	30	169	0	10	16	3	14	11	131
cogeneration	34	-68	1	1	-3	0	0	0	40
gas boiler + solar	36	38	1	3	14	3	9	10	212
gas boiler + heat pump	25	82	0	4	7	1	8	3	54

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Conclusions from life-cycle analysis study

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- There is no entirely “clean” technology
- While some technologies do well in energy efficiency, they perform worse in GHG emissions
- There are also significant differences in performance in e.g. air emissions parameters

Content

- Sources for proposing criteria areas:
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Criteria in other product policy schemes

	Oil boilers	Gas boilers	Biomass boilers	Heat pumps	Cogeneration
Ecodesign implementing measures	x	x		x	x
Energy label implementing measures	x	x		x	x
EU Ecolabel				x	
Blauer Engel		x	x	x	x
Nordic Swan			x	x	
Austrian Ecolabel			x		
GPP	x	x	x	x	x

Ecodesign implementing measures

- Technologies covered: fossil-fuel boilers, heat pumps, and cogeneration
- Criteria on:
  - Energy efficiency
    - Different energy efficiency requirement depending on the GWP of the heat pumps
  - Limit on NOx air emissions
  - Limit on sound power level for heat pumps

Energy label implementing measures

- **Technologies covered: fossil-fuel boilers, heat pumps, and cogeneration**
- **The energy label provides information on the energy efficiency of the heating system only**

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Criteria in other ecolabelling/GPP schemes

- EU Ecolabel
- EU Member States
  - Blauer Engel
  - Nordic Ecolabel
  - Austrian label
- Green public procurement (GPP)

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Criteria in other ecolabelling schemes

The EU Ecolabel Regulation EC 66/2010 advices to take into consideration *"criteria established for other environmental labels, particularly officially recognised, nationally or regionally, EN ISO 14024 type I environmental labels, where they exist for that product group so as to enhance synergies"*.

EU Ecolabel

ELECTRICALLY-DRIVEN, GAS-DRIVEN, AND GAS-ABSORPTION HEAT PUMPS

Criteria areas:

- Energy efficiency
- GWP of refrigerant
- Limitations of hazardous substances (heavy metals, flame retardants)
- Recyclability
- Instructions

Blauer Engel

BOILERS

- Low-emission and Energy-saving Gas-fired Calorific-Value Heating Devices (RAL-UZ 61)
- Wood pellet boilers (RAL-UZ 112)

HEAT PUMPS

- Energy-Efficient Heat Pumps using Absorption and Adsorption Technology or operating by use of Combustion Engine-Driven Compressors (RAL-UZ 118)
- Energy-Efficient Heat Pumps using an Electrically Powered Compressor (RAL-UZ 121)

COGENERATION

- Small-Scale Gas-Fired Cogeneration Modules (RAL-UZ 108)
- Small-Scale Liquid-Fired Cogeneration Modules (RAL-UZ 109)

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Blauer Engel criteria areas

BOILERS
- Gas boilers: efficiency, NOx and CO air emissions
- Wood pellet boilers: efficiency, NOx, OGC and PM air emissions

HEAT PUMPS
- Gas: efficiency, NOx, CO and PM air emissions
- Electric: No efficiency requirement; instead a TEWI limit (combination of efficiency and GHG emissions); no air emissions limits

COGENERATION
- Gas cogeneration: efficiency, NOx and CO air emissions
- Liquid cogeneration: efficiency, NOx and CO air emissions

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Nordic Ecolabel criteria areas

BIOMASS BOILERS
- Efficiency
- NOx, CO, OGC, HC, PM air emissions
- Limits on content of hazardous substances (flame retardants, heavy metals)

HEAT PUMPS
- Efficiency
  - Different efficiency whether refrigerant is or not HFC, and depending on the GWP of the refrigerant
- Limit on GWP of refrigerant
- Limits on content of hazardous substances (flame retardants, content of phthalates in plastics, heavy metals, solvents used in surface treatments)
- Recyclability, instructions

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Austrian ecolabel

WOOD PELLET BOILERS

- Efficiency
- NOx, CO, OGC, PM air emissions
- Sound power level
- Recyclability, instructions

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Green Public Procurement (GPP)

GAS/OIL BOILERS

- Efficiency
- NOx, CO air emissions

BIOMASS BOILERS

- Efficiency
- NOx, CO, PM air emissions

HEAT PUMPS

- Efficiency
- GWP of refrigerant

COGENERATION

- Efficiency

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Proposed key criteria areas

(1) Criteria related to energy efficiency:

- seasonal space heating energy efficiency

(2) Criteria related to GHG emissions:

- TEWI approach

Energy efficiency and GHG emissions are the most important criteria in other Ecolabels

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Proposed additional criteria areas

(3) Criteria related to other air emissions
- NOx, PM, OGC, CO → commonly found in other labels

(4) Indoor/outdoor acoustical noise

(5) Criteria related to design of materials: Preventing the use of hazardous substances and materials

(6) Criteria related to design of materials: Promotion of reuse, recycling, and generally a sound end-of-life management

(7) Corporate criteria (including user information)

EU Ecolabel EC 66/2010 states that the label criteria shall be determined on a scientific basis considering the whole life cycle of products,
thus, additional criteria may be required

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Common benchmark approach outline

- Aim: to develop one common set of criteria for all technologies
- We plan to combine the criteria and set the thresholds in a way which allows the environmentally most favourable ones to pass through
- If we set this framework right, the best environmentally-performing technologies will be automatically selected
- It will not be necessary to:
  - Exclude technologies from the start, or
  - Develop thresholds for each technology independently

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Common benchmark approach

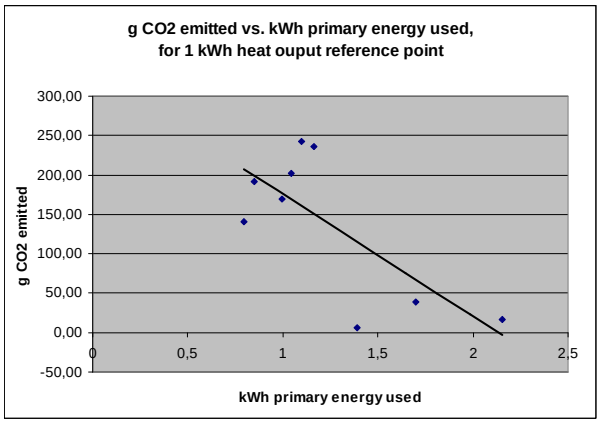
	Energy efficiency (heat output/primary energy input)	g CO2/kWh heat output
gas/oil M	0,86	236,44
gas/oil XXL	0,91	242,07
small manual biomass boiler	0,59	39,41
small automatic biomass boiler	0,46	16,89
medium automatic biomass boiler	0,72	5,63
7 kW electric heat pump	1,00	168,89
cogeneration-boiler	1,18	191,40
gas boiler + solar	0,96	202,66
gas boiler + heat pump	1,25	140,74

- **A weighted combination of energy efficiency and GHG emissions**

Feedback received:
GHG emissions threshold = 200 g CO_2/kWh heat output

Efficiency threshold = 80%

Primary energy consumption vs. CO_2 emissions



	kWh primary energy used/kWh heat output	g CO2/kWh heat output
gas/oil M	1,16345024	236,4412218
gas/oil XXL	1,100899152	242,0707747
small manual biomass boiler	1,698262044	39,40687031
small automatic biomass boiler	2,153321211	16,8886587
medium automatic biomass boiler	1,388634158	5,629552901
7 kW electric heat pump	0,997689857	168,886587
cogeneration-boiler	0,847567245	191,4047986
gas boiler + solar	1,04616695	202,6639044
gas boiler + heat pump	0,797526374	140,7388225

Common benchmark approach

MANDATORY CRITERIA	OPTIONAL CRITERIA
Performance of any given technology shall be better than a threshold which is a weighted combination of energy efficiency and GHG emissions	The remaining criteria (other air emissions, noise, design of materials, etc.) are optional, and a minimum number of points must be earned in order to obtain the Ecolabel

Feedback received: The result of the Ecolabel/GPP criteria for hydronic central heating systems could be one single document with:

- **Main body: the common benchmark threshold requirement**
- **Appendix: With different sections addressing voluntary criteria for different specific heating technologies (specifying the point system)**

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Proposed criteria areas and common benchmark - Points for discussion

- Are the proposed key and additional criteria areas appropriate?
- Is the proposed benchmark, combining energy efficiency and GHG emissions the right approach?
  - If so, what would be possible appropriate weights to these two key criteria areas
- What could be alternative criteria areas? Alternative approach to the proposed common benchmark? Expected challenges to this or other proposals?
- What are potential measurements and testing methods?

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Thank you for the attention

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Joint Research Centre (JRC)

Development of ecological criteria for Hydronic Central Heating Systems

Key criteria areas – energy efficiency and GHG emissions

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Content – Energy efficiency

- Ecodesign and Energy Label Implementing Measures
  - The common benchmark approach of Lot 1
- EU Ecolabel for heat pumps & national ecolabelling schemes
- Other standards
- GPP
- Test standards

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Content – GHG emissions

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Energy efficiency in Ecodesign Implementing Measures

- Technologies covered: fossil-fuel boilers, heat pumps, and micro-cogeneration (up to 50 kW electrical capacity)
- "Seasonal space heating energy efficiency"

Defined as the ratio between the space heating demand pertaining to a designated heating season provided by a boiler, and the annual energy consumption required for its generation, expressed as percentage (energy consumption in primary energy units)

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Ecodesign Implementing Measures

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Technology	Seasonal space heating energy efficiency
4-15 kW rated input fossil fuel (oil/gas) boilers	75%
15-70 kW rated input fossil fuel (oil/gas) and cogeneration boilers	86%
70-400 kW rated input fossil fuel (oil/gas) boilers	88% (at full rated input) 96% (at 30% rated input)
Heat pump* with GWP > 150	86%
Heat pump* with GWP < 150	73%
Low-T heat pump with GWP > 150	111%
Low-T heat pump with GWP < 150	94%

***With exception of low temperature heat pumps**

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The common benchmark approach of Lot 1

- **Ecodesign Lot 1 addressed several boiler technologies: gas/oil combustion, heat pump, and cogeneration. The seasonal space heating efficiency was developed to benchmark a variety of central heating technologies, regardless of fuel type or working principle**
- **Ecodesign Lot 1 did not address biomass boilers**
- **The scope of this Ecolabel study combines Ecodesign Lot 1 central heating technologies, plus the biomass boilers of Ecodesign Lot 15**

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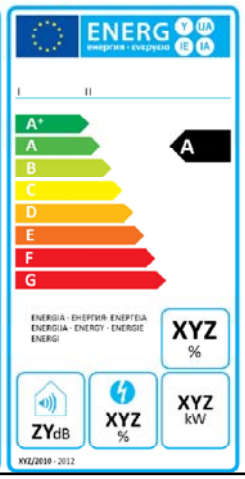
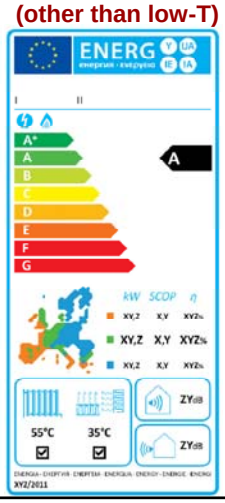
Energy label - A mandatory labelling system to indicate the energy efficiency of heating systems based on standardised test methods

Fossil fuel boilers

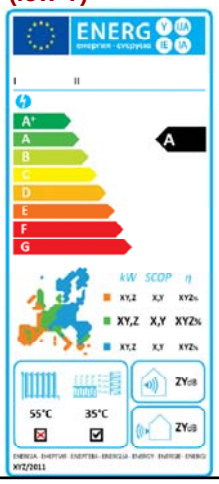
Cogeneration boilers



Heat pumps (other than low-T)



Heat pumps (low-T)



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EU Ecolabel of hydronic heat pumps (Max. capacity = 100 kW)

Type of heat pump: heat source/heat sink	Min. COP (electric heat pump)	Min. COP (gas heat pump)
Air/water Min. PER: 1,24	3,10	1,36
Brine/water Min. PER: 1,72	4,30	1,89
Water/water Min. PER: 2,04	5,10	2,24

Coefficienct of performance (COP) = heat output / electricity or gas input
Primary energy ratio (PER) = heat output / primary energy used

PER = 0,40 * COP, for electrically-driven heat pumps
PER = 0,91 * COP, for gas-driven or gas absorption heat pumps

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Blauer Engel

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Blauer Engel for boilers

GAS BOILERS

- Max. capacity (nominal thermal output) = 70 kW
- Emit much less NOx and CO, have higher energy efficiency, have lower auxiliary power demand
- Max. limits for NOx and CO
- Efficiency ("nominal utilization ratio") requirement:
  - 100% for 10 kW, and 101% for 70 kW, at T = 75/60 ºC
  - 103% for 10 kW, and 104% for 70 kW, at T = 40/30 ºC
- Requirement for auxiliary power demand

WOOD PELLET BOILERS

- Max. thermal output = 50 kW
- Fuel: Only wood pellets
- Min. efficiency = 90% whether full or partial load
- Limits for NOx, CO, and other pollutants (total carbon and dust)

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Blauer Engel for heat pumps

GAS DRIVEN, GAS ABSORPTION, GAS ADSORPTION HEAT PUMPS

- Max. capacity (nominal thermal output) = 70 kW
- Min. efficiency = 120%
- Criteria for NOx, CO and dust

ELECTRICALLY-DRIVEN HEAT PUMPS

- Max. thermal output = 100 kW, at a flow temp. of 45 ºC
- No efficiency requirement; instead, TEWI approach (combines efficiency and GHG emissions)
- No other air emission limits

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Blauer Engel for cogeneration

GAS-FIRED COGENERATOR

- Max. capacity (nominal thermal output) = 30 kW
- Emit much less NOx and CO, have higher energy efficiency
- Max. limits for Nox and CO
- Min. efficiency requirement:
  - 89% at full load, 87% at half-load

LIQUID-FIRED COGENERATOR

- Max. thermal output = 30 kW
- Emit much less NOx and CO, have higher energy efficiency
- Max. limits for NOx and CO
- Min. efficiency requirement:
  - 85% at full load, 83% at half-load

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Nordic Ecolabel for biomass boilers

- Max. heat output capacity = 300 kW
- Fuel: wood, wood pellets, briquettes, straw, chips
- Efficiency requirement:
  - Eff. (%) = 73 + 6 log Q_N (Q_N capacity in kW)
    - 83-85% (50 kW)
    - 88-90% (300 kW)

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Nordic Ecolabel for heat pumps

- Max. heat output capacity = 300 kW
- Efficiency requirement (Class II, strictest)
  - Efficiency = 80% (if refrigerant not HFC)
  - Efficiency = 90% (if refrigerant is HFC, GWP < 1000)
  - Efficiency = 92% (if refrigerant is HFC, GWP < 2000)

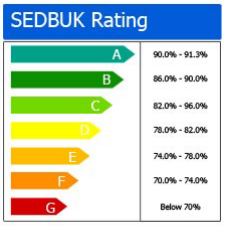
Austrian Ecolabel

- Only renewable fuels – Criteria for wood-fired heating systems (relevant here: wood-fired boilers)
- Possible fuels: wood, wood chips, compressed wood (briquettes, pellets)
- Max. heat output capacity = 400 kW
- Fuel: wood, wood pellets, briquettes, straw, chips
- Energy efficiency requirement
  - Manual: Eff. (%) = 71.3 + 7.7 log Q_N (Q_N cap. in kW)
    - 84% (50 kW, manual)
    - 90% (300 kW, manual)
  - Automatic: Eff. = 90%
- Other criteria on: noise, NOx, CO, OGC, PM

UK - SEDBUK

Energy efficiency limits

Band	SEDBUK Range
A	90% and over
B	86% - 90%
C	82% - 86%
D	78% - 82%
E	74% - 78%
F	70% - 74%
G	Below 70%



Energy efficiency in GPP

Magnitude of energy efficiency:

- **Nominal utilisation ratio**
  - **At full and part load**

1. Energy efficiency	Criteria			Standards
Gas condensing boilers (<70 kW)	For 10 kW	Nominal utilisation ratio must not fall below 100% at temp 75/60°	Nominal utilisation ratio must not fall below 103% at temperatures 40/30°	DIN 4702
	For 70kW	Nominal utilisation ratio must not fall below 101% at temp 75/60°	Nominal utilisation ratio must not fall below 104% at temp 75/60°	DIN 4702
Gas boilers and oil boilers (<120 kW)	Y=(1/60)z +b, Where b is			CEN 303 and 204

Fuel	B	
	Measurement at nominal effect	Measurement at low effect
Liquid	91,77	89,77
Gas	85,83	93,83

Solid fuel biomass boilers (<300 kW)	Manual feed: nk = 73 + 6log Qn, at full load Automatic feed: nk = 75 + 6log Qn, at full load and part load		

SUMMARY:
Oil boilers: 94% (non-condensing, 120 kW)
Gas boilers: 101% (condensing, 70 kW); 88% (non-condensing, 120 kW)
Biomass boilers: 83-85% (50 kW); 88-90% (300 kW)

Minimum energy efficiency criteria
(C = "condensing")

	Oil boiler	Gas boiler	Biomass boiler	Heat pump	Cogeneration
ED impl. Meas.	75% (4-15 kW input) 86% (15-70 kW input) 88% (full load, 70-400 kW input) 96% (30% load, 70-400 kW input)			86% (GWP > 150) 73% (GWP < 150) 111% (GWP > 150; low T) 94% (GWP < 150; low T)	86% (15-70 kW input)
Energy label impl. meas.	> 130% (A+++) 114-130% (A++) 98-114% (A+) 90-98% (A)			> 155% (A+++) 139-155% (A++) 123-139% (A+) 115-123% (A)	> 130% (A+++) 114-130% (A++) 98-114% (A+) 90-98% (A)
EU Ecolabel				124% (air/water) 172% (brine/water) 204% (water/water)	
Blauer Engel		100-104% (70 kW)	90% (50 kW)	Gas: 120% Electric: None	87-89% (gas) 83-85% (liquid)
Nordic Ecolabel			83-85% (50 kW) 88-90% (300 kW)	80% (if ref. not HFC) 90% (if ref. HFC, GWP < 1000) 92% (if ref. HFC, GWP < 2000)	
Austrian Ecolabel			84% (50 kW, man.) 90% (300 kW, man.) 90% (autom.)		
GPP	94% (non-C, 120 kW)	101% (C, 70 kW) 88% (C, 120 kW)	83-85% (50 kW) 88-90% (300 kW)	124% (air/water) 172% (brine/water) 204% (water/water)	75-80%

Criteria related to energy efficiency – – Points for discussion

- What is most suitable measure unit of energy efficiency? Is seasonal space heating efficiency appropriate in consistency with Ecodesign Lot 1?
- Feedback from Sweden: A suggested **threshold of energy efficiency should be set at ~80%, also as a seasonal mean value**

Energy efficiency – Test methods

	Oil boilers	Gas boilers	Biomass boilers	Heat pumps	Cogeneration
Ecodesign impl. measures	EN 304	EN 15502-1		EN 14825	EN 50465
Energy label impl. measures	EN 304	EN 15502-1		EN 14825	EN 50465
EU Ecolabel				EN 14511:2004 (elec- and gas-driven) - COP EN 12309-2:2000 (gas absorption) - COP	
Blauer Engel		DIN 4702 DIN 3368 DIN EN 677	DIN 18894 DIN EN 14784	DIN 4702 (gas) EN 255/EN 14511 (elec)	DIN 3046
Nordic Ecolabel			EN 303-5	EN 14511:2004	
Austrian Ecolabel			EN 303-5		
GPP	EN 304	DIN 4702, DIN 3368, DIN EN 676, EN 303	EN 303-5	EN 14511 EN 12309-2	Ref. to cogeneration directive

Energy efficiency – – Test methods – Points for discussion

- Which methods can suit best for measuring the energy efficiency?
- How to convert previous efficiency measures (COP, etc.) to seasonal space heating efficiency? (ongoing international test standard)
- Is it necessary to conduct testing by a third party (accredited laboratory) or should the compliance with the Ecolabel requirement should be confirmed by a producer's 'Declaration of Compliance' supported by results of tests conducted within a company?

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GHG emissions

- Ecodesign and Energy Label Implementing Measures
  - The common benchmark approach of Lot 1
- EU Ecolabel for heat pumps & national ecolabelling schemes
- Other standards
- GPP
- Test standards

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GHG emissions - sources

Sources of GHG emissions	Possible Ecolabel/GPP criteria
GHG (mainly CO_2) emissions from primary energy consumption	• g CO_2 / kWh heat output (possible)
Leakage of refrigerant in heat pumps	•Max. limit for the global warming potential (GWP) of the refrigerant •Energy efficiency dependent on GWP •Controlling leakage of refrigerant

GWP: The measure of how much 1 kg of the refrigerant applied in the vapour compression cycle of a heat pump is estimated to contribute to global warming, expressed in kg CO2 equivalents over a 100 year time horizon

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GHG emissions in Blauer Engel gas heat pumps

- GWP_{100} < 15

Refrigerant (code designation)	Refrigerant (chemical name)	GWP_{100}
R 717	Ammonia	0
R 290	Propane	3
	Water	0
R 744	Carbon dioxide	1
R 1270	Propylene	3

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GHG emissions in Blauer Engel electric heat pumps: The TEWI approach

TEWI limits for electric heat pumps in Blauer Engel

Type of heat pump	Thermal output (kW)	TEWI value (flow temperature 35°C) [kg CO_2]
Water-to-Water	0 - 20	32 500
	> 20	65 000
Brine-to-Water	0 - 20	39 000
	> 20	78 000
Air-to-Water	0 - 20	48 000
	> 20	96 000
Exhaust air-to-Water	0 - 20	43 000
	> 20	86 000

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GHG emissions in Blauer Engel electric heat pumps – GWP values

Refrigerant (Code designation)	Refrigerant (Chemical designation)	Global Warming Potential (GWP100)
R 134a	Tetrafluoroethane	1300
R 290	Propane	3
R 404A	Mixture of trifluoroethane, tetrafluoroethane, pentafluoroethane	3260
R 407C	Mixture of difluoromethane, tetrafluoroethane, pentafluoroethane	1526
R 410A	Mixture of difluoromethane, pentafluoroethane	1725
R 417A	Mixture of butane, tetrafluoroethane, pentafluoroethane	1965
R 744	Carbon dioxide	1
R 1270	Propene (propylene)	3

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Summary table – Criteria related to GHG emissions

	Oil boilers	Gas boilers	Biomass boilers	Heat pumps	Cogeneration
Ecodesign impl.measures	None	None		•Efficiency dependent on GWP of refrigerant	None
Energy label impl.measures	None	None		None	None
EU Ecolabel				•Limit for GWP of refrigerant •Efficiency dependent on GWP of refrigerant	
Blauer Engel		None	None	•TEWI limit	None
Nordic Ecolabel			None	•Limit for GWP of refrigerant •Efficiency dependent on GWP of refrigerant	
Austrian Ecolabel			None		
GPP	None	None	None	•Limit for GWP of refrigerant •Efficiency dependent on GWP of refrigerant	None

Limits for the GWP of refrigerant (heat pumps)

	GWP of refrigerant over 100 year period, GWP_{100}
Ecodesign implementing measures	No GWP limit Efficiency requirement: lower efficiency allowed for GWP < 150
Energy label implementing measures	None
EU Ecolabel	GWP < 2000 If GWP > 1000: higher COP efficiency required If GWP < 150 : COP efficiency requirement reduced by 15%
Blauer Engel	GWP < 15
Nordic Ecolabel	GWP < 2000 If GWP > 1000: higher COP efficiency required If GWP < 150 : COP efficiency requirement reduced by 15% If GWP > 100: unit must be leakage-free
GPP	GWP < 2000 If GWP > 1000: higher COP efficiency required If GWP < 150 : COP efficiency requirement reduced by 15%

Criteria related to GHG emissions – – Points for discussion

- What is most suitable measure unit of GHG emissions? Is the TEWI approach appropriate? Is it appropriate to be consistent with Ecodesign Lot 1? Is it appropriate to use g CO_2 equivalents / kWh useful heat output?
- Feedback from Sweden: **The very most important parameter is the climate aspect**. It is suggested to propose a limit that will allow the natural gas fired boiler, e.g. **200 g CO_2 equivalents / kWh useful heat output, as a seasonal mean value**
  - This requirement will exclude the oil boiler, unless fitted with e.g. a solar panel or liquid biofuel mixed with the fossil oil

Criteria related to GHG emissions – – Test methods – Points for discussion

- Which methods can suit best for measuring the GHG emissions?
- Is it necessary to conduct testing by a third party (accredited laboratory) or should the compliance with the Ecolabel requirement should be confirmed by a producer's 'Declaration of Compliance' supported by results of tests conducted within a company?

Summary

- High energy saving and GHG emissions reduction potential of hydronic central heating systems
- Proposed key criteria
  - Minimum energy efficiency
  - Maximum GHG emissions
- Common benchmark – Threshold will be set using a combination of weighted contributions from energy efficiency and GHG emissions parameters

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Development of ecological criteria for Hydronic Central Heating Systems

Additional criteria areas – Other air emissions, noise

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<u>Potential criteria related to other air emissions</u> (from LCA studies and other product policy schemes)

- **Emissions related to acidification potential: NOx and SOx**
  - **Most product policy schemes have limit only for NOx**
- **Particulate matter (PM)**
- **Carbon monoxide (CO)**
- **Total organic carbon (OGC), also called total C**

<u>Other parameters (from LCA studies only, not found in policy schemes)</u>

- **Volatile organic compounds (VOC)**
- **Persistent organic pollutants (POP)**
- **Policyclic aromatic hydrocarbons (PAH)**
- **Heavy metals to air (HM)**

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Criteria related to sound power level (noise)

- **Noise criteria only found in a few policy schemes:**
  - **Ecodesign implementing measures for heat pumps: Quantitative limits**
  - **Nordic Ecolabel for heat pumps: Provision of information on noise**

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Main conclusions from LCA regarding other air emissions:

- **Acidification potential (NOx and SOx) → Emissions by biomass boilers and EU electricity production appear most significant. Cogeneration boilers achieve net reduction of acidifying emissions**
- **Volatile organic compounds (VOC) → The manual stoked wood boiler performs the worst (related to combustion efficiency and type of fuel)**
- **Persistent organic pollutants (POP) → The automatic stoked pettet boiler performs the worst (related to the type of fuel – pellets)**
- **Heavy metals to air (HM) → The pellet boiler performs the worst. Electric heat pump has significant emissions as well**
- **Policyclic aromatic hydrocarbons (PAH) → The biomass boilers emit the most PAHs**
- **Particulate matter (PM)→ Biomass boilers perform the worst. Manual stoked wood log boiler represents exceptionally high source of emissions**

NOx emissions in product policy schemes

	Oil boilers	Gas boilers	Biomass boilers	Heat pumps	Cogeneration
Ecodesign impl. measures	120 mg/kWh	70 mg/kWh		None	120 mg/kWh (gas) 200 mg/kWh (liq)
Energy label impl.meas.	None	None		None	None
EU Ecolabel				None	
Blauer Engel		60 mg/kWh (34 ppm)	150 mg/m^3	60-250 mg/kWh, 250-2500 mg/m^3 (gas) Electric: None	250 mg/m^3 (gas) 2500 mg/m^3 (liq)
Nordic Ecolabel			340 mg/m^3	None	
Austrian Ecolabel			100-120 mg/MJ (360-432 mg/kWh) (150-180 mg/m^3)		
GPP	120 mg/kWh	60 mg/kWh (C) 70 mg/kWh (non-C)	340 mg/m^3	None	None

OGC emissions in product policy schemes

	Oil boilers	Gas boilers	Biomass boilers	Heat pumps	Cogeneration
Ecodesign impl. meas.	None	None		None	None
Energy label impl. meas.	None	None		None	None
EU Ecolabel				None	
Blauer Engel		None	5 mg/m^3	Gas: None Electric: None	Gas: None Liquid: None
Nordic Ecolabel			25-70 mg/m^3	None	
Austrian Ecolabel			3-5 mg/MJ (11-18 mg/kWh) (4,5-7,5 mg/m^3) (full load) 3-10 mg/MJ (11-36 mg/kWh) (4,5-15 mg/m^3) (part load)		
GPP	None	None	25-70 mg/m^3	None	None

CO emissions in product policy schemes

	Oil boilers	Gas boilers	Biomass boilers	Heat pumps	Cogeneration
Ecodesign IM	None	None		None	None
Energy label	None	None		None	None
EU Ecolabel				None	
Blauer Engel		50 mg/kWh (46 ppm)	90 mg/m^3 (full load) 200 mg/m^3 (part ld)	50-300 mg/kWh, 300 mg/m^3 (gas) Electric: None	300 mg/m^3 (liq) 300 mg/m^3 (liq)
Nordic Ecolabel			400 – 2000 mg/m^3	None	
Austrian Ecolabel			60-150 mg/MJ (216-540 mg/kWh) (90-225 mg/m^3) (full) 135-300 mg/MJ (486-1080 mg/kWh) (203-450 mg/m^3 (30%)		
GPP	20 mg/kWh	50 mg/kWh (C) 20 mg/kWh (non-C)	400 – 2000 mg/m^3	None	None

PM emissions in product policy schemes

	Oil boilers	Gas boilers	Biomass boilers	Heat pumps	Cogeneration
Ecodesign	None	None		None	None
Energy label	None	None		None	None
EU Ecolabel				None	
Blauer Engel		None	20 mg/m^3 (full load)	Gas: 150 mg/m^3 Electric: None	Gas: None Liquid: 150 mg/m^3
Nordic Ecolabel			40-70 mg/m^3	None	
Austrian Ecolabel			15-30 mg/MJ (54-108 mg/kWh) (23-45 mg/m^3) (full load)		
GPP	None	None	40-70 mg/m^3	None	None

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Criteria on other air emissions – Test methods

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	Oil boilers	Gas boilers	Biomass boilers	Heat pumps	Cogeneration
Ecodesign impl. measures	EN 304	EN 15502-1		EN 14825	EN 50465
Energy label impl. measures	EN 304	EN 15502-1		EN 14825	EN 50465
EU Ecolabel				EN 14511:2004 (elec- and gas-driven) - COP EN 12309-2:2000 (gas absorption) - COP	
Blauer Engel		DIN 4702 DIN 3368 DIN EN 677	DIN 18894 DIN EN 14784	DIN 4702 (gas) EN 255/EN 14511 (elec)	DIN 3046
Nordic Ecolabel			EN 303-5	EN 14511:2004	
Austrian Ecolabel			EN 303-5		
GPP	EN 304	DIN 4702, DIN 3368, DIN EN 676, EN 303	EN 303-5	EN 14511 EN 12309-2	Ref. to cogeneration directive

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Criteria related to air pollution emissions – Test methods – Points for discussion

- Which methods can suit best for measuring air pollution emissions?
- Is it necessary to conduct testing by a third party (accredited laboratory) or should the compliance with the Ecolabel requirement should be confirmed by a producer's 'Declaration of Compliance' supported by results of tests conducted within a company?

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Sound power level (indoor/outdoor)

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	Oil boilers	Gas boilers	Biomass boilers	Heat pumps	Cogeneration
Ecodesign implementing measures	None	None		60/65 dB(A); for <6 kW rated capacity 65/70 dB(A); for > 6 kW rated capacity	None
Energy label implementing measures	None	None		None	None
EU Ecolabel				None	
Blauer Engel		None	None	None	None
Nordic Swan			None	Noise must be tested and reported	
Austrian Ecolabel			None		
GPP	None	None	None	None	None

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Criteria related to air pollution emissions and noise – Points for discussion

- Which air emissions should be taken into account?
- Should noise be a parameter?
- What is the level of importance of each of the parameters? Should some of these criteria areas be moved to an annex?

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Additional criteria areas - Criteria related to design of materials

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Content

- Preventing the use of hazardous substances and materials
- Promotion of reuse, recycling, and generally a sound end-of-life management
  - Recycled material content
  - Design for repair/warranty and spare parts
  - Design for recycling

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Content

- **Preventing the use of hazardous substances and materials**
- Promotion of reuse, recycling, and generally a sound end-of-life management
  - Recycled material content
  - Design for repair/warranty and spare parts
  - Design for recycling

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Considerations concerning hazardous substances

- Ecolabel Regulation EC 66/2010 states that *'the substitution of hazardous substances by safer substances, as such or via the use of alternative materials or designs, should be considered wherever it is technically feasible'.*

Design of materials (material composition) – Preventing the use of hazardous substances

- **Potential hazardous materials in heating systems**
  - Flame retardants: Used in cables and plastic parts, including synthetic foamed or expanded thermal insulation
  - Heavy metals: Mainly limited to substances found in electronic components
  - Hardeners: used in foamed thermal insulation
- **The use of these materials is now restricted due to their potential harmful effects on human health and ecotoxicity. The RoHS Directive (2002/95/EC) already banned substances such as:**
  - Lead (Pb)
  - Mercury (Hg)
  - Cadmium (Cd)
  - Hexavalent chromium (Cr+6)
  - Polybrominated biphenyls (PBB)
  - Polybrominated diphenyl ether (PBDE)

Design of materials (material composition) – Preventing the use of hazardous substances

- **Trends in the use of these or substitute substances:**
  - **Lead is used in soldering of electronic components, and is now phased out following industry-wide replacement program**
  - **Lead also used in plasticizer of PVC cables – this application is also phased out**
  - **In February 2011, six hazardous chemicals were banned (REACH): a flame retardant (HBCD), a hardener (MDA), various plasticizers and a synthetic fragance enhancer. It is possible that HBCD and MDA is used as thermal insulating material in heating systems**
- **Several ecolabel schemes explicitly exclude certain hazardous substances, mainly heavy metals, certain flame retardants, certain plastics**
- **The result of the environmental assessment show that the environmental impacts from the production and manufacturing phase are much lower then the impacts caused by the use phase**

Considerations concerning material composition – For discussion

Should the issue of material composition of hydronic central heating systems be included in the process of ecological criteria development?

Content

- Preventing the use of hazardous substances and materials
- **Promotion of reuse, recycling, and generally a sound end-of-life management**
  - **Recycled material content**
  - Design for repair/warranty and spare parts
  - Design for recycling

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Recycled material content

- Several labels address the issue of recyclability of material components, and recycled material content:
  - **EU Ecolabel**
  - **Nordic Ecolabel**
  - **Austrian Ecolabel**

- For discussion

Should the issue of the recycled content in heating systems be considered as a potential EU Ecolabel criterion?

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Content

- Preventing the use of hazardous substances and materials
- **Promotion of reuse, recycling, and generally a sound end-of-life management**
  - Recycled material content
  - **Design for repair/warranty and spare parts**
  - Design for recycling

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Design for repair/warranty and spare parts
Life-time extension

The Ecolabel regulation states that '*in the process of determining the criteria among others the potential to reduce environmental impacts due to durability and reusability of products shall be considered*'.

- In order to ensure that product can be appropriately maintained and, if needed, repaired, spare parts for the products should be available for purchase several years after the production of certain models is stopped
- In order to ensure that products not fulfilling set quality requirements (i.e. working improperly) can be repaired or exchanged, the warranty terms should be given and valid for a given amount of years

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Design for repair/warranty and spare parts
Life-time extension – Points for discussion

Which aspects, e.g. materials, technical solutions, can positively influence the durability and appropriate functionality of the product group under study and could be considered in the criteria development process?

How long should warranty be valid?

How long should the producer ensure that spare parts are available after the production has been ended?

Assessment and verification: A sample of the product packaging/attached leaflet containing information on warranty terms and spare parts availability shall be provided when submitting the application, together with a corresponding declaration of compliance with this criterion.

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Content

- Preventing the use of hazardous substances and materials
- **Promotion of reuse, recycling, and generally a sound end-of-life management**
  - Recycled material content
  - Design for repair/warranty and spare parts
  - **Design for recycling**

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Design for recycling

- A heating system should be designed in a way that it can be dismantled with simple tools in order to recover most of the material, which can be then recycled and used again for production processes
- The materials should be as much as possible recyclable: plastics, metals

Assessment and verification: A declaration of compliance with this criterion shall be provided by the producer.

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Design for recycling – Other product policy schemes

- From GPP preparatory work on heat pumps:
  - **The EOL management of heat pumps is regulated by requirements of the WEEE directive: heat pump units have to be collected for proper disassembly, treatment and recycling of parts.**
  - **Much of the components of the heat pumps can be recycled with a minimum of treatment, for example plastics and metals.**
  - **Under the EC F-gas regulation, when a heat pump is recycled, reclaimed or destroyed, certified personnel must recover all the fluorine-containing gases in order to limit the amount of fugitive emissions from disposal of the units, and thereby mitigate environmental impacts related to: climate change and ozone layer depletion**

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Design for recycling
- Points for discussion

- Which aspects of the product design should be particularly considered in this point?
- Are there any established best practices on the easy of dismantling of heating systems and their suitability for recovery?

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Additional criteria areas – corporate criteria

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Content

Corporate criteria

- Packaging
- Consumer information/User instructions
- Information appearing on the Ecolabel

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Content

Corporate criteria

- **Packaging**
- Consumer information
- Information appearing on the Ecolabel

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Corporate criteria – Packaging

- The Packaging Directive (94/62/EC) – regulates general measures concerning the management of packaging and packaging waste
- Packaging materials: paper, cardboard, plastics, metals
- Relevance of packaging as environmental impact depends on: product lifetime, types of materials used in the packaging
- Long lifetime of the product group under study, estimated as ~15-20 yrs

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Corporate criteria – Packaging – For discussion

Should additional requirements beyond those established by the Packaging Directive concerning packaging of heating systems be included in the Ecolabel/GPP criteria sets?

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Content

Corporate criteria

- Packaging
- **Consumer information**
- Information appearing on the Ecolabel

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Corporate criteria – Consumer information/User instructions

- **Energy saving and generally environmental performance of the heating systems are to a large extent dependent on the user behaviour**
- **The energy consumption of heating systems is the key operating parameter that can be influenced by consumer behaviour, and which has a direct impact on: energy efficiency, and GHG emissions (the two key criteria)**
- **It is also important that the heating system has adequate control mechanisms to ensure heating is only on and at the required temperature when there is a demand for it.**
- **Following issues proposed to be part of consumer information (leaflet attached to product):**

  → thus, the product shall be sold with relevant user information, which provides advice on its proper environmentally friendly use

  → appropriate consumer information, including e.g. installation, and maintenance instructions are of importance

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Corporate criteria – Consumer information/User instructions

- The following shall appear on the packaging or an attached leaflet:
  - correct installation instruction
  - correct operation instruction
  - information concerning appropriate disposal at end-of-life
  - Information on appropriate dimensions of heating systems for different building characteristics/size
  - 'For more information as to why this product has been awarded the Flower please visit the web-site: http://ec.europa.eu/environment/ecolabel.'

A number of stakeholders have already indicated the key importance of consumer information/user instructions

Corporate criteria – Consumer information – For discussion

Should additional issues be covered by consumer information appearing on the leaflet attached to a product's packaging?

Assessment and verification: A sample of the product packaging shall be provided when submitting the application, together with a corresponding declaration of compliance with this criterion.

Content

Corporate criteria

- Packaging
- Consumer information
- **Information appearing on the Ecolabel**

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Corporate criteria – Information appearing on the ecolabel

- The ecolabel shall contain information on advantages related to the purchase and use of the ecolabelled products
- A text such as the following is proposed to be placed on the packaging (to be discussed)

'improved energy efficiency
and reduced climate change impact'

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Corporate criteria – Information appearing on the ecolabel – For discussion

The stakeholders are encouraged to comment on the appropriateness of this criteria area, and/or propose other issues, which should, in their opinion, appear on the ecolabel.

Assessment and verification: The applicant shall provide a sample of the product packaging showing the label, together with a declaration of compliance with this criterion.

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Thank you for the attention