EFFICIENT SYSTEMS AND RENEWABLE ENERGIES FOR THERMAL COMFORT

Energy Saving Potentials through replacement of radiators

ehi
association of the
European Heating Industry

1. Short description of EHI and Department EURORAD

The Association of the European Heating Industry (EHI) was founded in 2002 by a merger of several former European associations with a history of over 40 years. EHI represents and promotes the common interests of 30 market leaders producing heating systems, burners, radiators, boilers and renewable energy systems, and 13 national industrial associations from the EU Member States. The member companies of EHI reach a turnover in 2008 with more than 15 bn € and employed more than 120.000 persons.

In 2007, EHI and the European industry of radiators decided to join forces in order to emphasize the efficiency of water heating (hydronic) systems. The previous European association EURORAD was dissolved and a Department EURORAD was created within EHI.

Its aim is to be the prime voice on the core issues which affect the activities of our industry and to give thorough and well founded advice to policy makers.

The Department EURORAD within EHI join the leading eleven manufacturers (Arbonia/Kermi, Baxi, Bosch, Caradon, De Longhi, Ferroli, Korado, Quinn-Group, Rettig, The Heating Company, Vaillant Group/Demir Doküm and Zehnder).

Topics covered by the Department are:

- Political Dialogue with European Parliament and European Commission
- European Directives (i.e. EPBD, CPD or EuP)
- Standardization (i.e. EN 442 or EN 15316-2-1)
- CE marking
- Voluntary quality labels (RADMAC)
- Market Analysis

2. European legislative framework

Environmental policy, the efficient use of scarce energy resources together with rising energy prices are crucial topics of EU. Therefore the EU Commission has set in March 2007 the target of 20/20/20 by 2020. In December 2008 EU leaders adopted a comprehensive package of measures to reduce the EU's contribution to global warming and ensure reliable and sufficient supplies of energy. Driving the policy is the EU's bid to achieve a 20% reduction in its greenhouse gas emissions by 2020 (compared with 1990 levels), mainly by boosting the use of renewable energy and curbing energy consumption. For the transcription of these goals two major directives in the field of heating, cooling and air-conditioning are important.

Implications of the three directives for the building sector

The heightened demands on the overall energy efficiency of buildings as a result of the requirements of the Energy Performance of Buildings Directive (EPBD), the establishment of minimum standards for energy-using products and the ambitious targets for raising the proportion of renewable energies are driving the consistent improvement in the quality of buildings as regards energy use. The significance of this for installation engineers is that, in future, only the most up-to-date technology, combined with renewable energies, will be able to be installed. The heating requirement of buildings will drop from today's average of 250 kWh/ m²a per year to 70 kWh/m²a per year or even less (see figure 1). These EU prescriptions are already being reflected in current market developments. In some areas, the market for efficient heating systems that are combined with renewable energies is already showing significant signs of dynamic activity. In Germany in 2008, for instance, 45 % of all newly installed heating systems were linked in with renewable energy sources. This figure has risen by 13 % in less than two years. Similar developments can also be observed in Italy, France, Great Britain and Spain. It must be borne in mind, however, that this development starts, to some extent, from a relatively low baseline. EHI reckons that in the EU the proportion of newly installed and modernised heating systems, which include the use of renewable energy sources, will rise to 50 % by 2015.

a. Directive 2005/32/EC on the eco-design of Energy-using Products (EuP)

The Ecodesign Directive provides with consistent EU-wide rules for improving the environmental performance of energy-using products (EUPs) through ecodesign. It prevents disparate national legislations on the environmental performance of these products throughout the EU from becoming obstacles to the intra-EU trade. This should benefit both businesses and consumers, by facilitating free movement of goods across the EU and by enhancing product quality and environmental protection. The

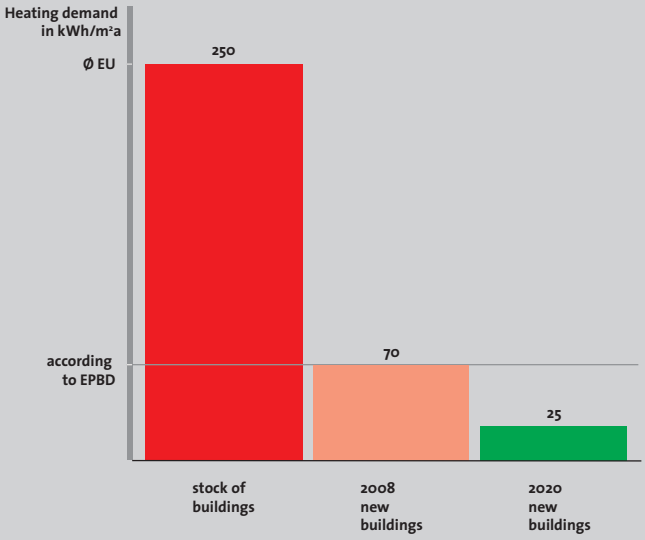


Figure 1: Development of the heat demand in EU.

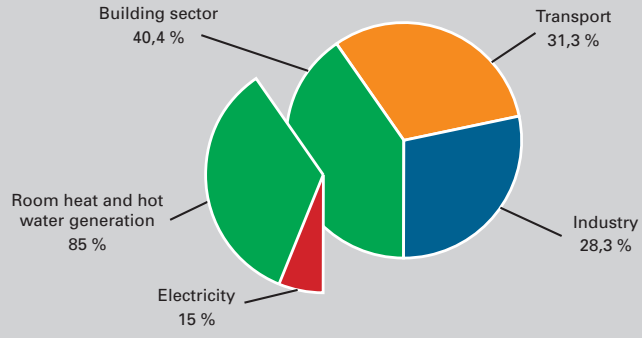


Figure 2: Primary energy consumption in the EU.

Directive is under the responsibility of DG Enterprise and Industry and DG Transport & Energy.

b. Directive 2002/91/EC on the energy performance of buildings (EPBD).

The Directive forms part of the Community initiatives on climate change and security of supply. The Directive concerns the residential sector and the tertiary sector (offices, public buildings, etc.). It covers all aspects of energy efficiency in buildings in an attempt to establish a truly integrated approach. Measures on labelling and mandatory minimum efficiency requirements have already been implemented or are envisaged in the Action Plan for Energy Efficiency. The Directive is under the responsibility of DG Enterprise and Industry.

c. Directive 1989/106/EC to Construction Products (CPD)

The specific mission of the CPD is to improve the framework conditions for the competitiveness of the construction and construction products industries. The Directive is under the responsibility of DG Enterprise and Industry. To harmonise the internal European market the CE marking for products was established. Under the CPD and take into consideration the EN 442 CE marking is obligatory for radiators placed on the European market.

3. Impact of modern heating systems on energy efficiency

The 160 million buildings in the EU use over 40% of Europe's energy and create approximately 30% of its carbon dioxide emissions, and that proportion is increasing (see figure 2).

The primary energy consumption in the building sector is separated in 85% for room heating respectively hot water generation and 15% for electricity. From this amount nearly 30% and more cost-effective savings potential of the present consumption in buildings can be achieved by 2020.

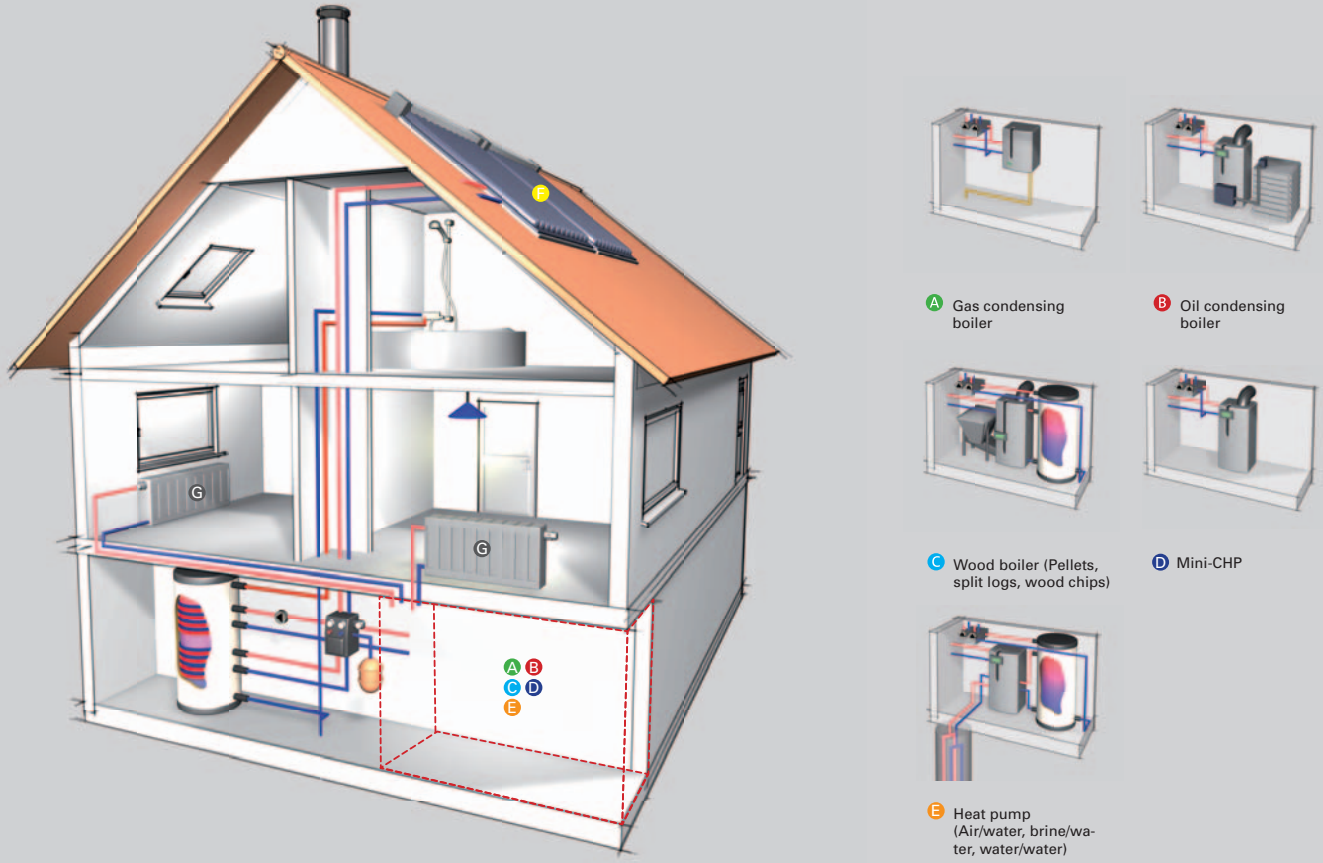


Figure 3: Efficient heating systems and renewable energies: A) Gas condensing boiler, B) Oil condensing boiler, C) Wood boiler, D) Mini Combined heat and power, E) Heat Pump, F) Solar thermal systems and G) Radiators.

Due to the fact that only around 5% of the buildings in the EU are optimized concerning the energy consumption, the modernization of the building stock is the main field to save energy and reduce CO_2 emissions.

In order to achieve the European targets the current pace of modernisation must be doubled. High savings can be achieved by integration and optimization of all measures only (see figure 3). This includes the following parts of the heating system: Generation (boiler or heat pump), Distribution (pump) and Emission (Radiator or embedded system). Only if the whole system is optimized and synchronised between all used components the high energy saving potentials could be achieved.

Modern heating technology is the key to achieve the ambitious goals of the EU in the field of environmental and energy policy. In 1978 heating boilers converted 68% of the fuel they consumed into usable heat. Today, high-efficient condensing boilers convert up to 96%. The integration of renewable energy technologies into heating systems offers additional energy saving opportunities (see figure 3).

With all these new technologies it is necessary to use low systemtemperatures (45/35°C) to obtain an optimum of energy efficiency of the heat generator (boiler or heat pump). For example a gas or oil condensing boiler is working in its aimed area if the water temperatures are below 47°C, because at this level water is condensing out of the flue gas and additionally energy could be gained. Due to that the efficiency of the boiler is increasing (see figure 4).

4. Importance of radiators for the energy efficiency of a modern heating system

For all of the modern heating systems using a condensing boiler and/or renewable energies an emission system with radiators is suitable. But to take advantage of the whole energy saving potential, i.e. of condensing boiler or heat pumps, an adaptation of the system temperature of the heating system

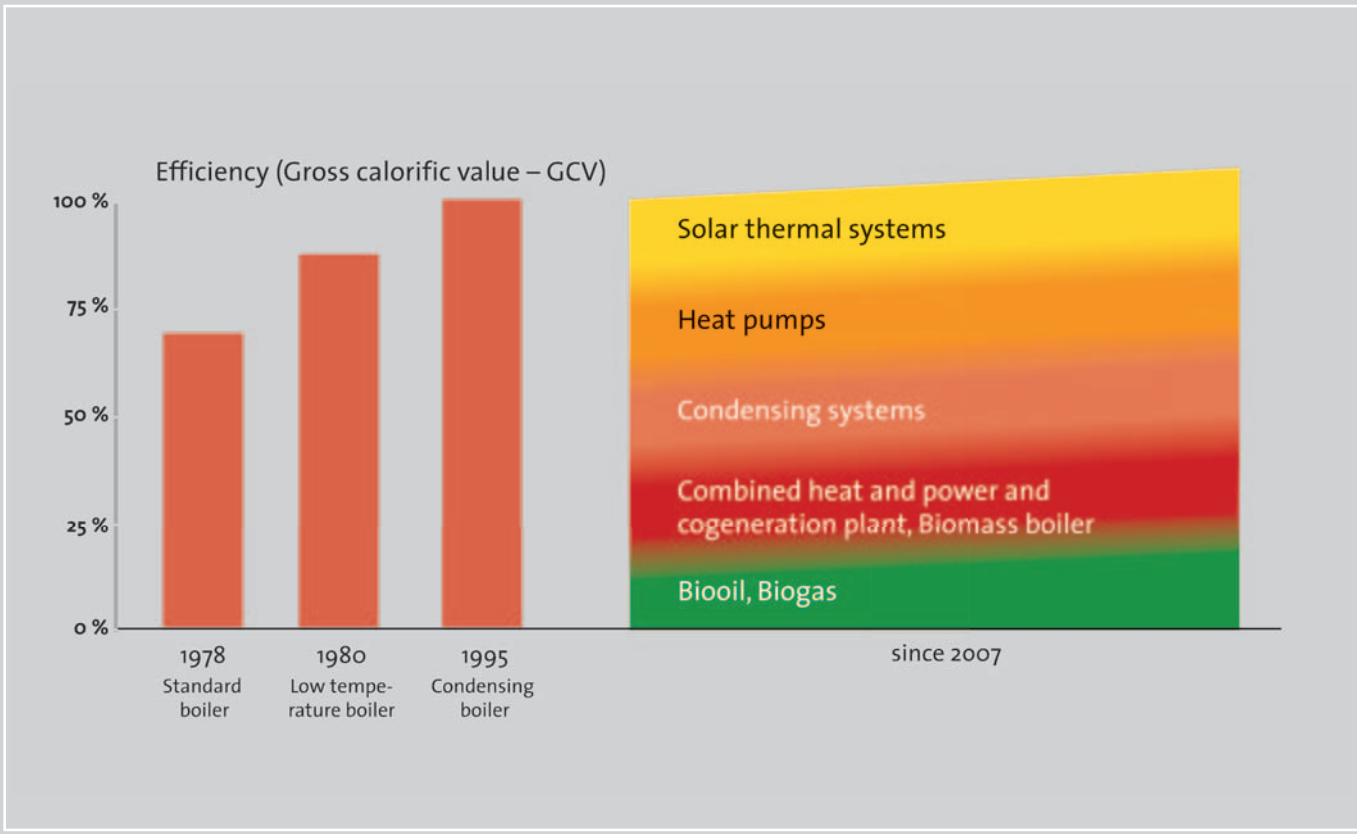


Figure 4: Innovation cycles in the heating industry.

is necessary. In general we could say: "The lower the system temperature the better is the efficiency of the heating system", i.e. instead of 80/60°C or 70/55°C better use design temperature of 45/35°C. Due to this modification in most cases replacement of old radiators will be needed. If further modernisations on the heating system will be made, i.e. decrease of the room temperature (energy saving 6% by 1K) or new thermostatic valve with 1K (energy saving up to 5%) an overall energy saving potential of 50% could be achieved. The low inertia of radiator systems and therefore fast reaction to the adaption of temperature changes supports this energy savings. Taken all this into account the costs for the modernization of the heating system including the radiators will be redeemed in a few years due to the high reduction of energy consumption.

A comparison of a high temperature system (80/60 or 70/55) and a low temperature system (45/35) shows the implications for the energy efficiency and what role radiators play in order to be able to exploit the energy saving potentials when high temperature systems are exchanged and low temperature systems are installed. Investigations show the relationship between heat pumps and radiators. Additionally they calculate the annual COP values taken into account heating only or heating and domestic hot water production (see figures 5 and 6).

Radiators in combination with:

- Heat pumps:The efficiency of heat pumps is mainly influenced by the system temperature. A lower system temperature leads to a higher efficiency. Radiators can be designed for typical system temperatures of heat pumps (i.e. 45/35°C).

- Condensing boilers: Like heat pumps condensing boilers work with low system temperature to extract the heat out of the flue gas. Correctly designed radiators guarantee the fully use of the efficiency from condensing boilers. Therefore the size of the radiators must be adjusted.

If a building will be equipped with a new heating system it is necessary to use modern radiators. Within the necessary replacement the structural expenditure, the possible impairments, resulting dirt and noise has to be taken into consideration. For those issues the manufacturers offer simple solutions by which a 1:1 replacement is possible. The goal of a simple and fast assembly of the heating system could be reached: Empties, unscrews, screws on, fills. These steps complete the replacement of a radiator. That example shows that radiators are a simple and efficient solution to be installed in new and existing buildings independent of the other parts of the heating system.

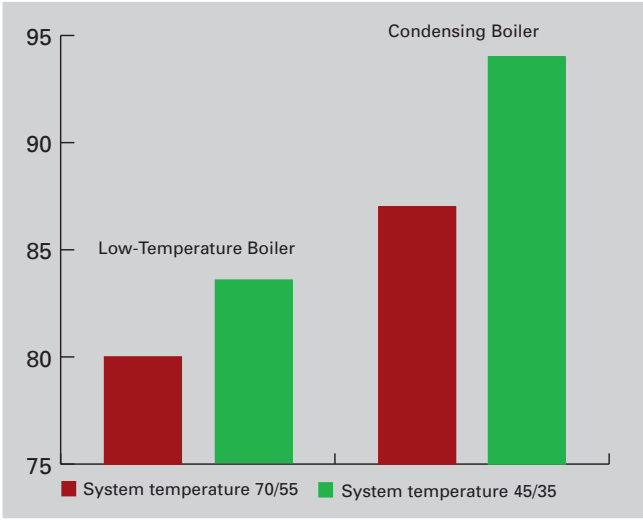


Figure 5: Boiler efficiency depending on the system temperature.

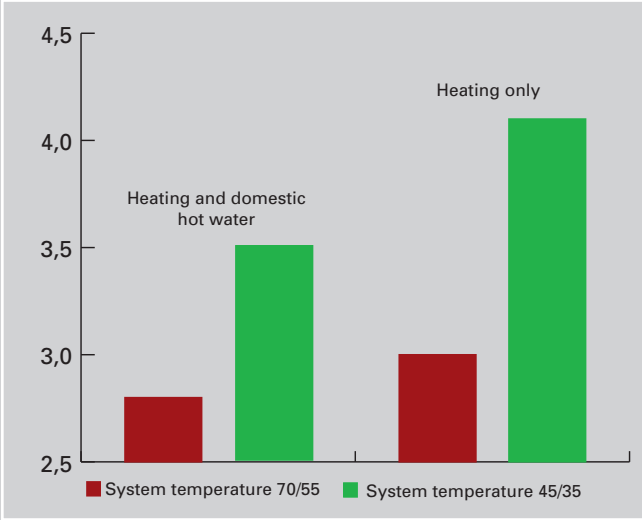


Figure 6: Efficiency of a electrical ground-source heat pump depending on the system temperature.

- New buildings: Radiators fit into every building and heating system and guarantee a high efficiency level. For example: The use of radiators in bath rooms allows a fast and precise control of the room temperature. Therefore radiators are the most suitable products.

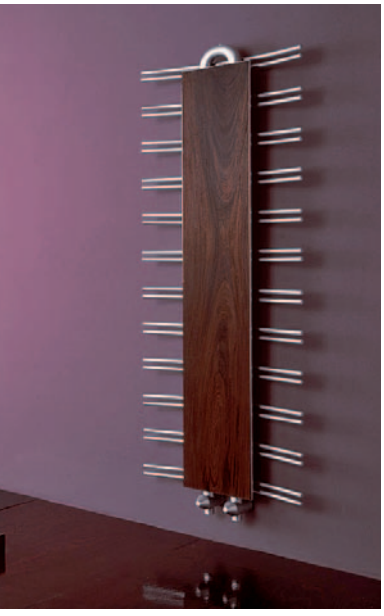
- Modernisation: Without any problem radiators provide a solution for every modernisation to achieve a higher efficiency of the new heating system.

These implications of the different system temperatures and other main drivers for an efficient heating system are postulated within the EN 15316-2-1 “Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies - Part 2-1: Space heating emission systems”.

Furthermore with the exchange of old radiators especially “thermal comfort” could be improved. Additionally a variety of different designs for radiators are available.

5. Conclusion

Radiators are a high efficient and comfortable emission system.
They can be combined with all modern heating technologies and renewable energies.



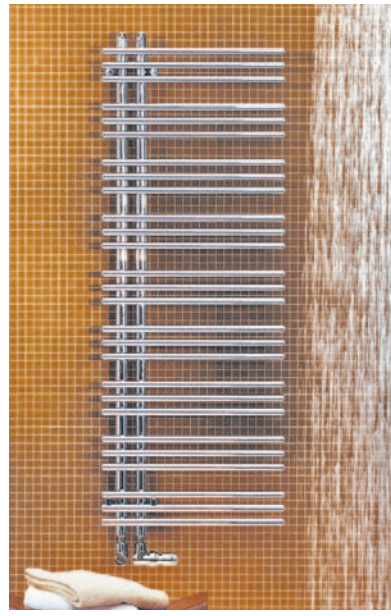



Figure 7: Different designs of radiators.

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