HEATING IN THE SPOTLIGHT

ehi

EUROPEAN HEATING INDUSTRY
ENERGY EFFICIENT SOLUTIONS AND RENEWABLE ENERGIES
FOR THERMAL COMFORT

FOREWORD

The Heating Sector is in the spotlight of the ongoing energy and climate debates, being recognised as the sector with the biggest energy-saving potential in Europe. The European Heating Industry acknowledges its key role in achieving the ambitious EU goals and brings its active contribution to energy efficiency, sustainability, competitiveness and security of supply.

The Association of the European Heating Industry (EHI) builds its strength on a long history and continuity of representing the European heating sector, its predecessor organisations going back to the 1960s.

Today EHI represents and promotes the common interests of 40 market leading companies and 14 associations in the European sector for thermal comfort systems. The member companies produce technically advanced, safe and energy efficient solutions for heating, hot-water and steam generation which are used in residential and commercial buildings as well as in industrial applications. The portfolio supplied to the markets include space heaters and renewable energy systems (boilers, heat pumps, solar-thermal, biomass, micro-cogeneration), industrial boilers, burners, decentralised electricity generators, water heaters, heating controls and components, heat distribution, heat storage and heat emitters (radiators, surface heating and cooling systems) as well as relevant ventilation and air conditioning products.

Our industry has total annual sales of over 20 billion euro and directly employs more than 120.000 people in Europe.

This brochure gives an overview of the great variety of available modern thermal comfort solutions, demonstrating their specific benefits and potential for energy savings that can already now be achieved with highly efficient heating products and renewable energies.

Ulrich Schmidt

EHI Chairman

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HEATING IN THE SPOTLIGHT: CHALLENGES AND OPPORTUNITIES

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The building sector offers the largest energy efficiency opportunities

European buildings are responsible for more than 40% of the final energy consumption in Europe, by far the largest share. The majority of the existing building stock in Europe is older than 50 years and has a low energy performance: more than 40% of the residential buildings were constructed before the 1960s when energy building regulations were limited, insulation systems and heating technologies not as advanced as today. This high level of energy consumed is coupled with significant related CO_2 emissions and contributes therefore to the generally poor energy performance of buildings across Europe.

New buildings can, however, reach high performance levels due to improved building technology and better building envelope conditions. However, annual growth rates in the residential sector are currently only around 1%, as most European countries encountered a decrease in the rate of new build in recent years, reflecting the impact of the financial crisis on the construction sector.

While an EU public policy strategy for high energy efficiency of new buildings exists under the concept of Nearly Zero Energy Buildings, to be reached by the end of 2020 in all new buildings (Energy Performance of Buildings Directive), a clear and consistent direction for the retrofit of existing buildings does not exist.

In order to reach its energy saving targets, Europe needs to unleash the potential for energy efficiency of the European built environment. Given the conditions and the limits mentioned, the greatest challenge is how to modernise existing buildings and how to increase the rate of this modernisation, particularly during a time of economic crisis. The heating sector has an important role to play in this modernisation process: it can contribute to the largest portion of carbon savings by 2030 in retrofitting existing buildings and replacing energy-using equipment.

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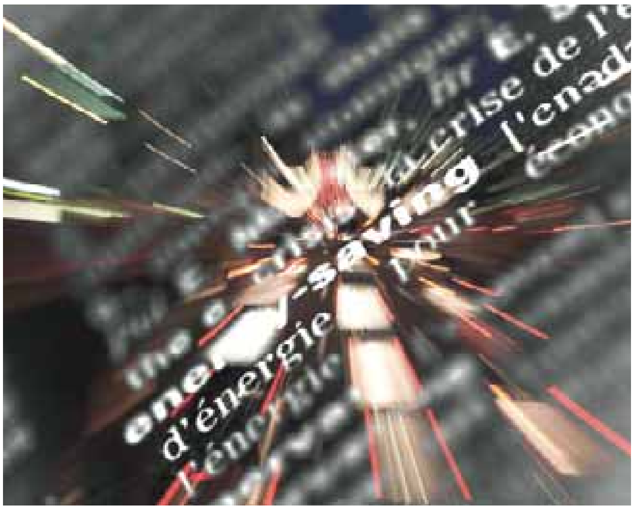

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Modernise heating systems to increase energy efficiency

Within a building, about 85% of the energy consumption is required for space heating and domestic hot water; space heating alone (around 70%) is by far the most energy intense end-use in EU homes.

There are vast differences from country to country in terms of the energy mix commonly used, and subsequently the type of technologies used for space heating. The most widespread way in which heating of European buildings is performed is central heating, where heat is generated and spread to the whole interior of a building, or a portion thereof, from one point to multiple rooms (e.g. boilers, heat pumps, residential cogeneration units). In Europe central heating takes normally the form of hydronic central heating systems (heat produced by the space heater is circulated, through hot water, via heat emitters, e.g. radiators or/and surface heating).

There are currently about 120 million central space heaters in EU homes. EHI estimates that more than 85% of this installed stock is old non-condensing gas or oil boilers. Modernising a heating system alone (i.e. excluding a full building renovation) to bring it to state-of-the-art, heating technology will contribute to an energy efficiency gain of at least 20% compared to current levels.

These figures point to both opportunities as well as challenges. The largest opportunity for improving the energy consumption of European buildings lays in the replacement of the vast majority of old and less efficient heating equipment with new generation, efficient heating systems and intelligent control technology, to enable end-users optimisation of their energy use for heating.

Key challenges consist of how to raise awareness about energy efficiency opportunities; how to impact consumer behaviour towards making energy efficiency investment and consumption decisions; how to mitigate the influence of short term economic considerations on such decisions; how to overcome the divergence of interests between investors and those who ultimately benefit from the energy savings.

In this brochure, the European Heating Industry gives an overview of the state-of-the-art, energy efficient central heating solutions available on the European market. The following pages show that there are many opportunities to unleash the potential for energy efficiency in European buildings.

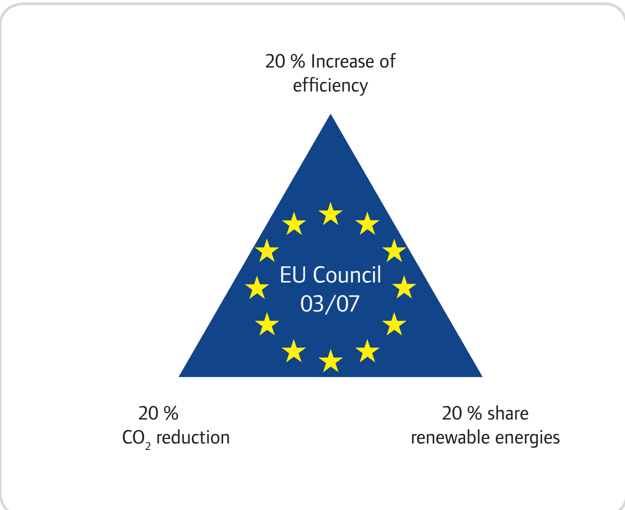
HEATING IN THE ENERGY AND CLIMATE POLICY FRAMEWORK

Towards 2020 and beyond

The EU energy and climate policy framework for the medium and long run is based on a series of targets and roadmaps meant to combat climate change, increase the EU's energy security and strengthen its competitiveness. Existing energy and climate legislation is marked by the "20-20-20" targets, set back in 2007 by EU leaders, and aims for 20% reduction of CO2 emissions, 20% increase in energy efficiency and a 20% renewable energies share by the year 2020.

Looking even further, the European Commission put forward the "Roadmap for moving to a competitive low carbon economy in 2050" and the "Energy Roadmap 2050". The European Parliament responded to the EC Energy Roadmap 2050 by calling to "consider the full integration of the heating and cooling sector into the transformation of the energy system"; stressing that "readily available renewable energy solutions (geothermal, biomass including biodegradable waste, solar thermal and hydro/aerothermal), in combination with energy efficiency measures, have the potential to decarbonise the heat demand by 2050 in a more cost-effective way, while addressing the problem of energy poverty". Moreover, the Council's conclusions on the renewable energy Communication, agreed in December 2012, stated that "more attention should be paid to the widely untapped potential of renewables in the heating and cooling sector".

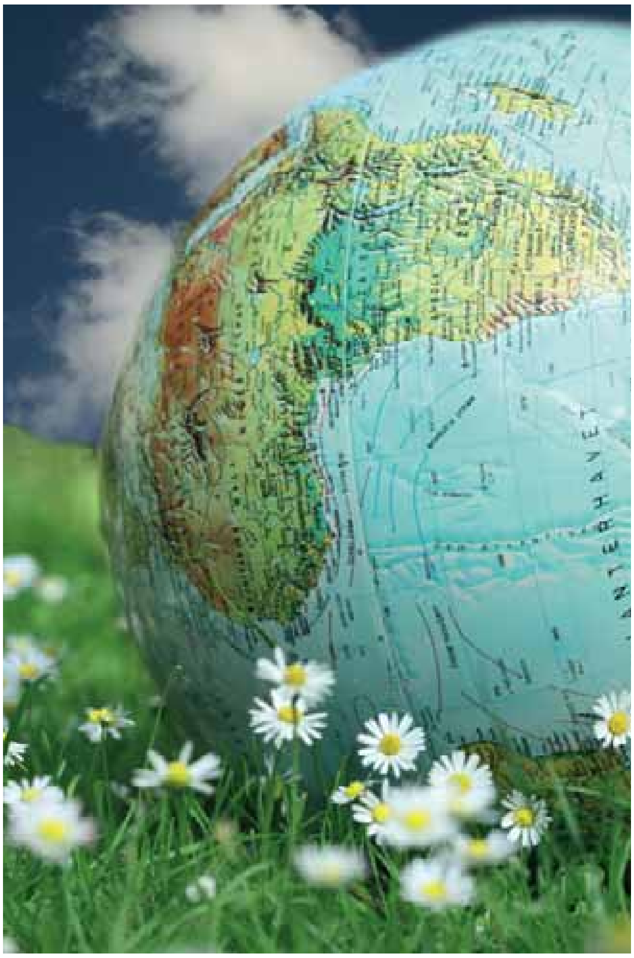
The European Heating Industry shares the European Parliament and Council's opinion. European buildings represent more than 40%, and by far the largest share, of the final energy consumption in Europe. An estimated 85% of the buildings energy consumption is required for space heating and domestic hot water.



The heating and cooling industry can positively contribute to reaching the EU energy and climate targets by offering thermal comfort solutions which are readily available in the European market and which can critically improve the energy efficiency of European buildings as of today.

Our technology-driven industry has been investing heavily in R&D in order to increasingly offer highly energy efficient heating systems with integrated smart controls and use of renewable energies.

In this chapter we show how our industry can answer to the current EU policy demands while the latter part of this brochure presents the state-of-the-art heating solutions that are readily available on the European market.



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Delivering energy efficiency and renewable energies for European buildings

A series of key directives set the framework for overall energy efficiency and uptake of renewable energies in European buildings: the 2009 Renewable energies directive (RES), the 2010 Energy Performance of Buildings Directive (EPBD) and the 2012 Energy Efficiency Directive (EED).

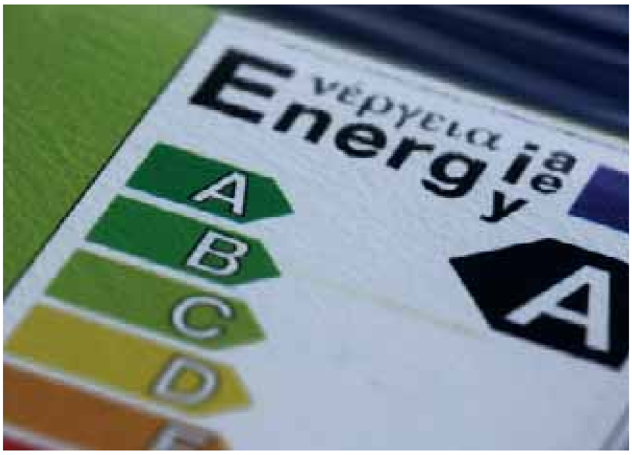
While setting up ambitious national targets, the RES directive aims to create a positive climate for the long-term development of renewable energies across different sectors. Renewable heat is however far from being used to its full potential, with significant barriers still hindering the widespread deployment of available solutions.

Under the EPBD, Member States must apply minimum requirements as regards the energy performance of new and existing buildings, ensure the certification of their energy performance and require the regular inspection of boilers and air conditioning systems in buildings. The heating industry is currently working to introduce adequate solutions for "Nearly Zero Energy Buildings", based on a significantly reduced heat demand and compulsory use of renewable energies, which will constitute the level playing field for all new buildings by the end of 2020.

In addition, the EED establishes a common framework of measures for the promotion of energy efficiency within the EU in order to ensure the achievement of the 20 % headline target on energy efficiency by 2020. The directive requires the establishment of a national long-term strategy for mobilising investment in the renovation of the national stock of residential and commercial buildings, both public and private. Moreover, the directive requires Member States to set up national energy efficiency obligation schemes or alternative measures in order to save 1,5% of the annual energy sales to final customers each year. These measures are key opportunities for the heating sector, already able to bring significant energy efficiency gains in retrofitting old installations across Europe.

Raising product standards and consumer information

The Ecodesign (laying down minimum requirements for individual products) and Energy Labelling directives, together with their specific implementing measures, go hand in hand to continuously raise product standards for energy efficiency and other ecological parameters, as well as promote most efficient appliances available on the market. They have a significant impact in shaping the heating sector, by phasing out inefficient products and speeding up the uptake of state of the art solutions. Through the use of the energy label, consumers will be able to better assess and compare their options. Product marketing, as well as the key role of installers in guiding consumer choices, will be vital for the success of the energy label across the heating market.



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EHI members are fully committed to ensuring a consistent and harmonised application of the ecodesign and energy labelling requirements. EHI believes that a key contribution to the adequate implementation and enforcement of the adopted regulations will be given by effective, proportionate and consistent market surveillance at European and national levels, aimed at ensuring a level-playing field for market operators as well as protecting European consumers and the environment.

Protecting the climate and the environment

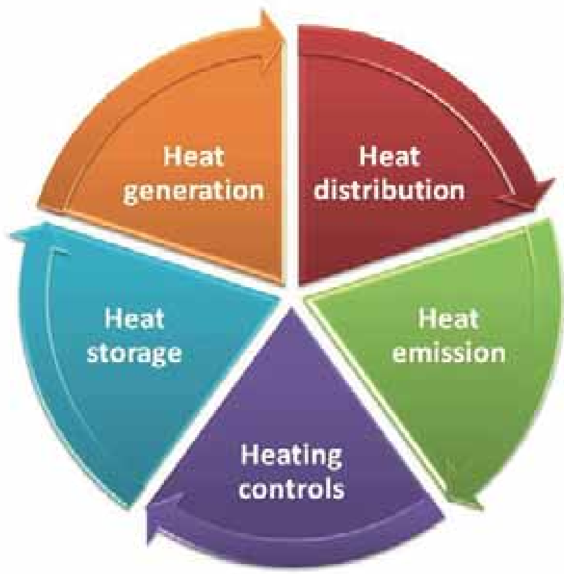
The heating sector can positively contribute to the reduction of air pollution, as increased energy efficiency is directly linked to improved ecological characteristics. More efficient heating products produce fewer emissions from the combustion of fuels such as gas, oil or biomass, therefore helping to improve air quality.

Furthermore, in the fight against climate change, the heating and cooling industry can make a substantial contribution to achieve the EU goals for reducing fluorinated greenhouse gases emissions (F-gases, contained as refrigerants in heat pump applications). This can be done by eliminating hydrofluorocarbons (HFCs) with high global warming potential, where feasible, from a health and safety, energy efficiency, technological and economic perspective. This approach is fully supported by the heating sector during the current review of the F-gases regulation.

MODERN HEATING SYSTEMS

The heating system at the forefront

From publicly available data and general information, it is commonly understood that the function (and energy efficiency) of space heating is performed to a great extent by separate products / equipment (e.g. the heat generator). The current policy framework covering heating is mainly focused on product specific requirements (Boiler Efficiency Directive, Gas Appliances Directive, Ecodesign and Energy Labelling Directives, etc). Setting ambitious requirements for energy efficiency, product health and safety, and other ecological criteria for individual products is of great importance.



Nevertheless, it is vital to understand that the true **energy performance of the heating function is realised at system level**, with the close interdependence and influence of each system component.

In this way, the energy-saving potential of modern heat generators will be realised only if the remaining components of the heating system are optimally coordinated with one another. Thus, the generation, storage, distribution, emission and control of heat should always be viewed as a complete system.

Optimum system solutions are available in the field of heating for new buildings and old buildings that are being renovated, as well as for all energy sources. The right choice for a system depends upon the framework conditions, particularly upon the heat demand of the building, its use, its positioning (climatic zone and facade orientation), its ground surface size, and, last but not the least, the preferences of the investors.

	SOLAR THERMAL SYSTEM	VENTILATION SYSTEM	SURFACE HEATING & COOLING	RADIATOR
Gas condensing boiler	✓	✓	✓	✓
Oil condensing system	✓	✓	✓	✓
Wood boiler (pellets, wood logs, wood chips)	✓	✓	✓	✓
Micro-CHP	✓	✓	✓	✓
Heat pump (air-water, brine-water, water-water, gas)	✓	✓	✓	✓

Adequate design and choice of system components

No one solution fits all. Choosing the appropriate system for the right conditions, as well as promoting all available highly efficient heating system solutions in an energy and technology-neutral way, are key to maximising energy performance.

- In order to design an appropriate heating system for a certain building, the **heating demand** has to be properly assessed and calculated. Possible heat losses also heed to be taken into account in a correct assessment (level of insulation of the walls / roof / heat distribution, type of windows, etc). This process has to lead to a correct dimensioning of the system components.

- The **differences in climate** across Europe greatly influence the choice and efficiency of a heating system. It obviously influences the heat demand itself as well as the number of days per year during which heating is needed.

- The **type of building** is also an influencing factor (single or multiple family houses, apartment buildings, space for offices, etc), as well as the positioning of the facades and roof area – for example, a well positioned roof (S / SE / SW) is favourable for the integration of a solar thermal component in the system. The surface and location of the building area are also key factors in the choice for geothermal systems.

- **Economic feasibility and affordability** are also of great importance. While it is generally acknowledged that investing in energy efficiency solutions is a win-win situation for all parties involved, it is desirable that the investment in the retrofit of a heating system should be made at a reasonable cost level for the end-user, instead of not being made at all.

Heating system temperature

From the over 120 million heating systems installed across Europe, it is estimated that three quarters of these systems run with high system temperatures (between 50˚C and 80˚C inlet temperature). Modernisation of these systems into low temperature systems (between 35˚C and 50˚C inlet temperature) can be an additional way to increase system efficiency and save energy (in this way, energy savings of +30% can be realised). The general principle is that the lower the system temperature, the more efficient the heating system.

Low temperature heating systems are suitable for office buildings, service buildings and residential buildings and can use a variety of fuels and renewable energy sources. These systems are available for different investment levels as well as for different building situations (new build or modernisation), using energy efficiently while providing a comfortable indoor climate.

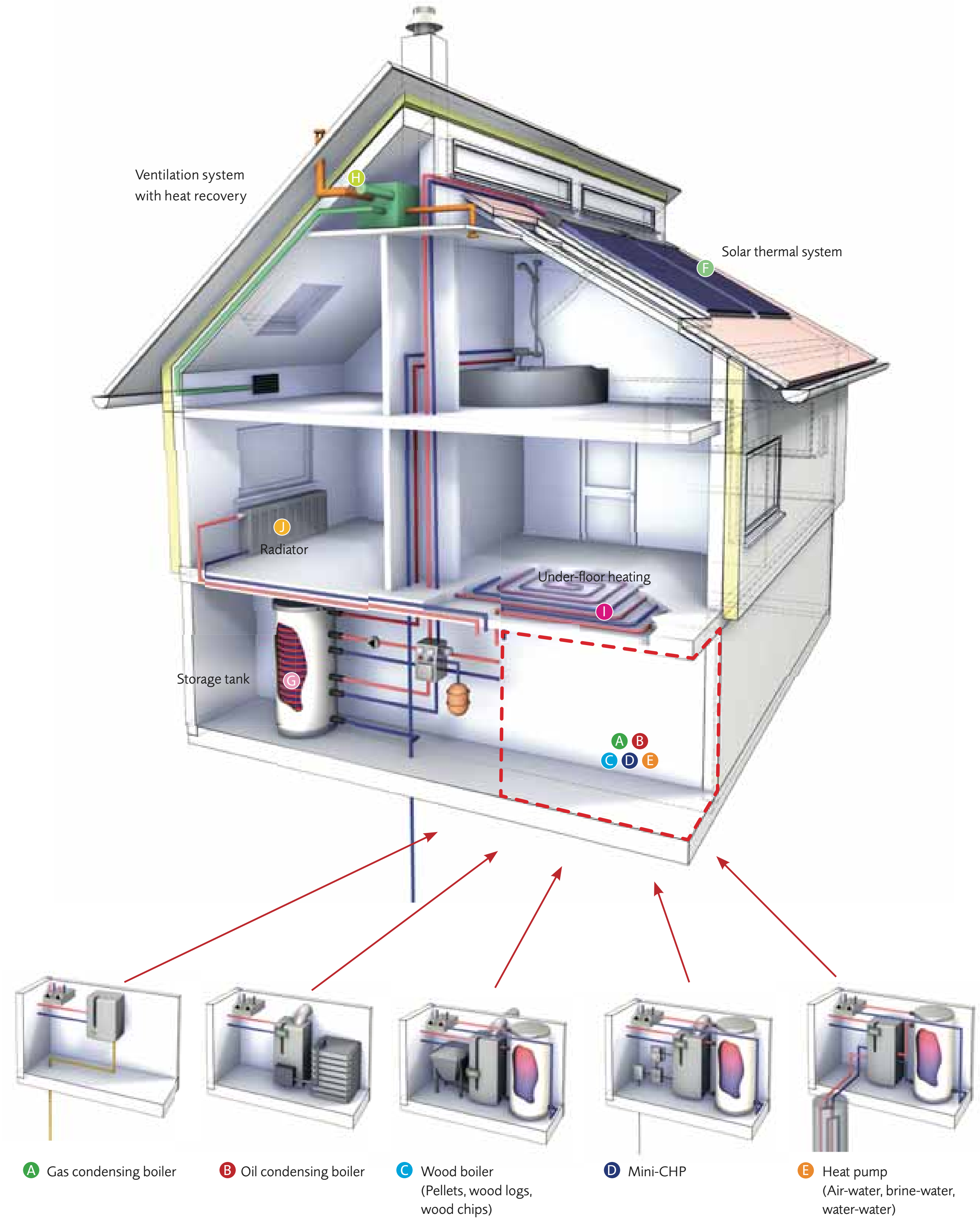
Installation and maintenance

A vital role in ensuring and improving the energy performance of heating systems is held by installers in terms of adequate system choice, correct installation, maintenance and efficiency recommendations to end-users.

Knowledgeable and motivated installers are the first to be asked about heating systems by private households and may take over an active role in marketing of the different available solutions. Moreover, the landscape of available solutions has significantly changed and multiplied throughout the years, and a correct installation is vital for the adequate performance of the heating function.

The perception of modern heating technologies as well as user comfort risk to suffer greatly from bad installations. Such occurrences may lead users not to invest in new heating systems for fear of losing their known thermal comfort – correct installations and happy customers are often the best multiplier for positive modernisation messages.

During the use phase, preventive and regular maintenance of the different heating system components will lower energy costs, prevent costly repairs and prolong the life of the system. Different requirements apply across Europe for inspection and maintenance of central heating systems. In order to drive ahead the modernisation process, regular maintenance should also result in recommendations for system improvement, especially in terms of change instead of repair of old systems.


Ventilation system
with heat recovery
H
Solar thermal system
F
J
Radiator
Under-floor heating
I
Storage tank
G
A B
C D E
A Gas condensing boiler
B Oil condensing boiler
C Wood boiler
(Pellets, wood logs,
wood chips)
D Mini-CHP
E Heat pump
(Air-water, brine-water,
water-water)

ENERGY EFFICIENT SOLUTION AND RENEWABLE ENERGIES FOR THERMAL COMFORT

CONDENSING BOILER TECHNOLOGY - GAS

SOLUTION ADVANTAGES

- Increased energy efficiency & reliability
- Easily installed & maintained
- Suitable for modernisation in existing buildings and new buildings
- Connection to the expanding gas network
- Easily combined with renewable energies
- Well established & continuously perfected technology

Efficient heat generation

A condensing boiler is a high efficiency modern boiler, capable of generating the necessary heat supply for central heating and for domestic hot water. Its name comes from the water vapour produced in the combustion process which 'condenses' back into liquid form, and is reused to pre-heat the cold water entering the boiler. This makes the gas condensing technology highly convenient, resource- and cost-efficient for heat generation.

Condensing boilers cover almost all output ranges. Wall-mounted units deliver up to 100 kW. With boilers in a cascade system (several appliances connected to each other), the output can be increased to several hundred kilowatts. Floor-standing units can supply nominal outputs of more than 10,000 kW.

Condensing boilers running on natural gas are often the first choice both for new installations and for refurbishment of existing central heating systems across Europe.

Heating and domestic hot water

A combination boiler (or 'combi' boiler) is called in this way because it heats water for the central heating system and for the domestic hot water taps on demand (instantaneous hot water). A 'System' or 'Open Vent' boiler provides heated water for the central heating system and is connected to a hot water cylinder (storage tank) to provide hot water to the taps. The choice between the two systems is usually made taking into account various factors such as space, mains water temperature and number of bathrooms.

Perfected technology

For more than twenty years, the gas-fired condensing technology has been constantly advancing: increased comfort and energy efficiency, reduced emissions and noise levels, improved design and reduced size to fit any building setting. Gas-fired condensing devices can also cope very easily with highly fluctuating requirements for heating and hot water.

Maximising performance

Over-sizing will result in lower efficiencies and unnecessary costs: boilers should be capable of providing heat for the size of the property and of the emission system (number of radiators, surface heating) . The size of boiler will therefore depend on the size of the building, the type of the heating system, as well as how well the building is insulated.

For ensuring high efficiency levels and correct functioning, it is essential that the condensing gas boiler be installed, serviced and repaired by qualified personnel.

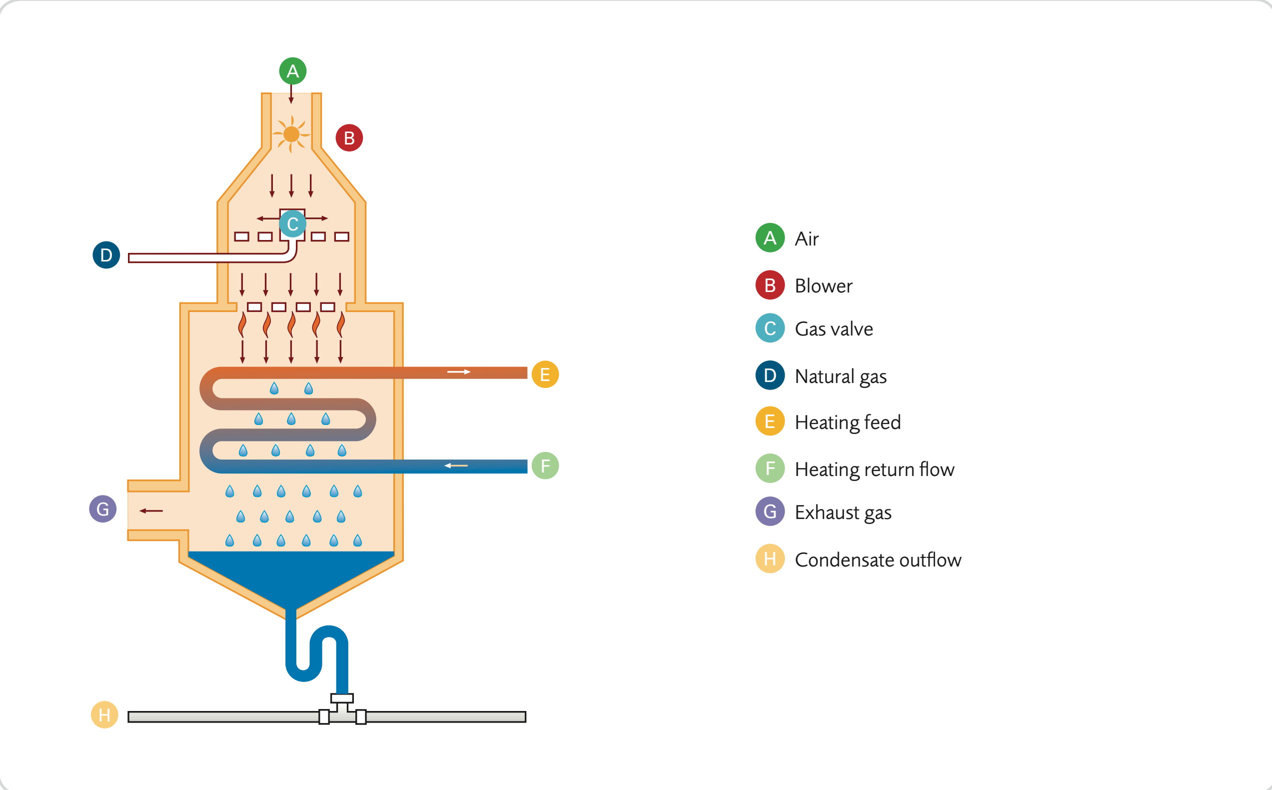
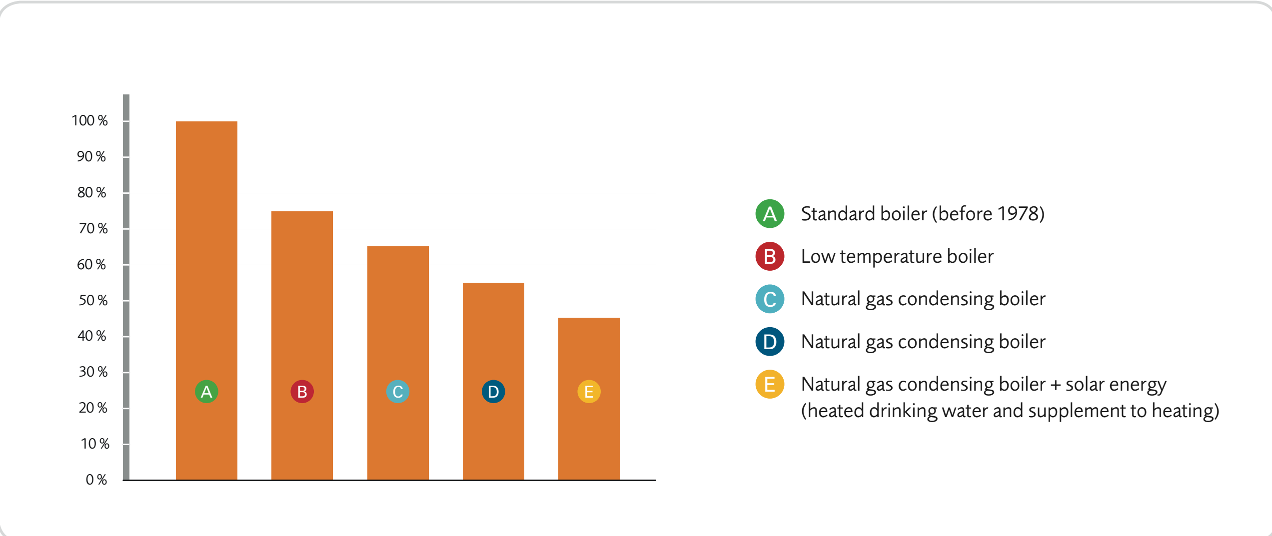


Diagram of a condensing appliance



Carbon dioxide emissions

CONDENSING BOILER TECHNOLOGY – OIL

SOLUTION ADVANTAGES

- Increased efficiency and reduced emissions
- Reduced demand for heating oil
- Future-proof for use with solar energy and biofuels
- Suitable for modernisation in existing buildings and new buildings, especially in remote areas and those not connected to gas networks

High efficiency

The principles of condensing technology are the same for both gas and oil heating – the appliances are designed to use virtually the entire energy content of the fuel, the so-called higher heating value. Compared to standard and low-temperature technology, condensing devices also process the heat of condensation of the water vapour contained in the exhaust gas. Oil-fired condensing boiler technology thus achieves the highest efficiency with the lowest fuel consumption and minimum emissions.

Optimum use of fuel

Heating oil contains hydrogen which, on combustion, is turned into steam. When the exhaust gases from the combustion process are cooled, the steam contained in them condenses and the heat from the condensation process can be used. The flue gases must be cooled to below the so-called "dew-point temperature", in order for them to condense. The dew-point temperature is dependent on the hydrogen content of the fuel and hence on the steam content of the flue gases.

With "extra-light" (EL) heating oil the dew-point temperature is about 47 °C. By using the latent heat of condensation, the efficiency of a heating system can be significantly improved. In practice this results in the production of 0.5 to 1 l of condensate per kg of heating oil. Because of the relatively low temperature of between 45 and 50 °C of the resultant flue gases, flues for their removal can be made of plastic tubing. Modern condensing boiler technology can therefore extract energy from the fuel being used in the most efficient way.

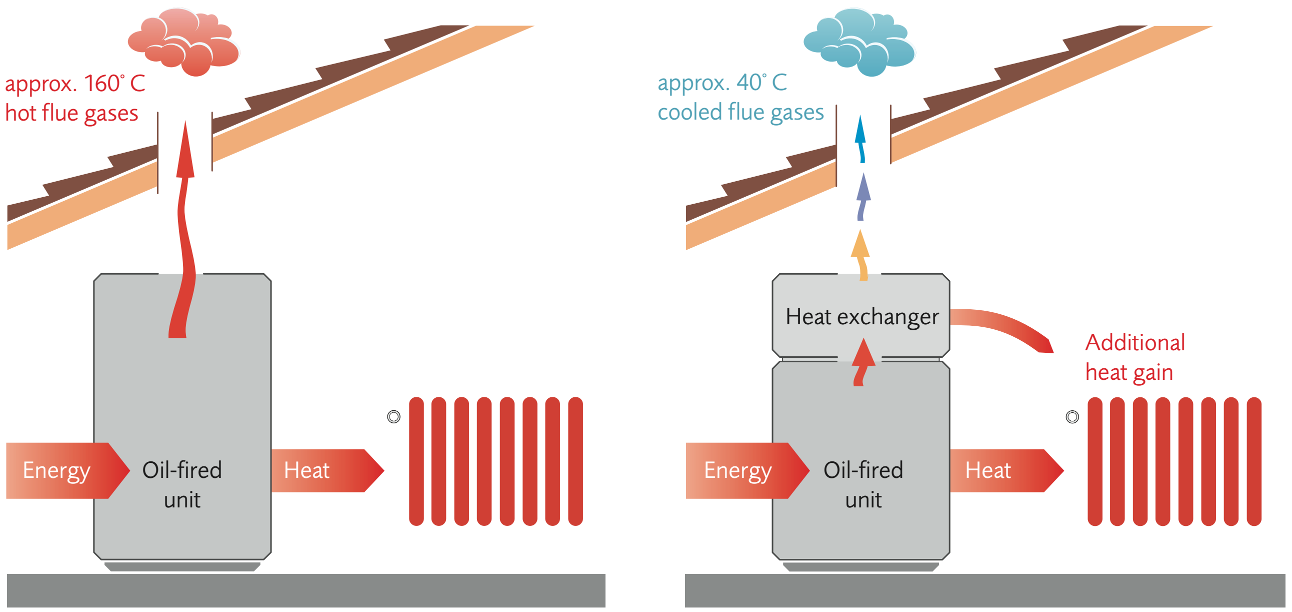
Quality heating fuel

Low-sulphur heating oil (heating oil EL), which conforms to laid-down standards, is a quality fuel, ideally suited to the requirements of condensing boiler technology and demonstrates several essential advantages over normal heating oil. Noxious substances in the flue gases are reduced to a minimum and the condensate does not need to be neutralised. Moreover, low-sulphur heating oil burns very cleanly and makes for consistently good heat transfer in the boiler. This results in boilers which demonstrate continuously high levels of efficiency and a high degree of reliability, consequently reducing the maintenance requirements for boilers and burners.

Combining renewable energies

The oil condensing technology can be easily combined with a solar thermal system. The solar collectors support the domestic hot water preparation as well as partly contribute to meeting the space heat demand. The combination of a solar thermal system with an oil-fired heating system reduces oil consumption by 10–20%.

Moreover, liquid biofuels (produced from biomass) are already used for heating, being added to conventional fuel. They have a high energy density and can be burned without almost any residue or pollutants using modern combusting technology. One example is the so-called "bio-heating oil", a low-sulphur heating oil, to which at least three percent by volume of a liquid fuel from renewable resources is mixed. Bio-heating oil can significantly help to reduce the demand for mineral oil, reduce greenhouse gas emissions and conserve resources. However, sustainable cultivation of raw materials and the most efficient use of the fuel are prerequisites for such benefits. Extensive research has been undertaken to facilitate safe use of liquid bio-fuels in heating systems across Europe.



BIOMASS BOILER TECHNOLOGY

SOLUTION ADVANTAGES

- Efficient use of renewable sources
- Local availability of fuel
- Carbon neutral fuel
- Heating technology for all output level

Heat from wood

In recent years, wood has been gaining popularity as heating fuel. Each year more than 380 million m³ of wood produced sustainably from European forests is on the market, 40 % thereof being used for heat generation in Europe. It is a regional fuel - the economy benefits from short transport routes, local jobs and domestic value creation. Moreover, wood is carbon neutral as a renewable resource: when burned, the same amount of CO_2 that was absorbed by the tree during its growth is released. Automated firing systems provide a lot of comfort, making wood in no way inferior to oil and gas.

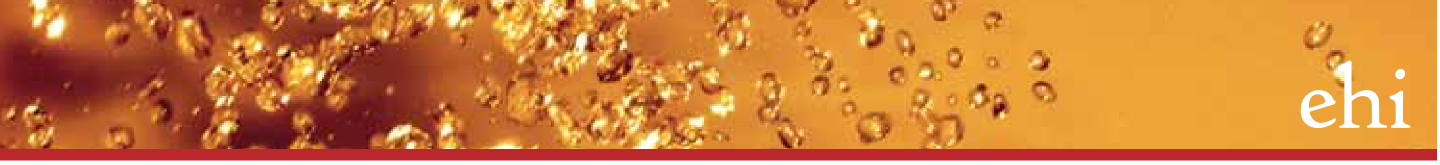
Pellets, split logs and wood chips

Modern heating systems use wood in the form of pellets, wood chips or split logs. Wood pellets are small, standardised, cylindrical pieces made from natural, untreated wood. In order to produce pellets, the wood chips occurring in the sawmill are first dried, then cleaned and pressed into pellets in matrices. 2 kg of wood pellets correspond to the energy content of about 1 litre of heating oil. Pellets have a heating value (energy content) of approximately 5 kWh/kg.

Split logs are also increasingly used for heating in the last few years. Wood should be dry, ideally stored for 2 years, protected from rain water. Wood with water content between 15 and 20 % has an average energy value of 4 kWh/kg.

Wood chips are manufactured in various ways. For example, coniferous wood log pieces that occur in the sawmills and are not suitable for any other processing are crushed directly. They can be used as fuel for boilers in a size of 10 to 50 mm per piece.

Pellet boiler



Central heating with wood

Environmentally friendly and flexible, wood-based central heating systems are capable of supplying an entire house with heat throughout the year and can easily be combined with solar thermal systems.

- **Pellet boilers** Central heating systems, which are operated with wood pellets are particularly convenient. During operation and maintenance, they are comparable to oil and gas heaters. Combination systems can also be loaded with other firewood such as wood chips or split logs. The pellets are kept in a storage room or tank and supplied to the boiler by means of either a suction or screw conveyor system. The systems are fully automated and can be modulated in a power range of 30 to 100 %.

- **Wood gasification boilers** are used to burn split logs efficiently. The individual stages of wood combustion (wood gasification and wood gas combustion) occur separately. This local division – in conjunction with a sufficiently dimensioned heat exchanger surface area – ensures particularly low emissions, low flue gas temperatures and high boiler efficiency. An induced draft fan ensures the correct air supply. The secondary air supply is then responsible for complete combustion. The use of a sufficiently dimensioned buffer tank increases the ease of operation significantly.

- **Wood chip boilers** work on the same principle as pellet boilers: The wood chips are transported automatically from a storage room into the boiler by means of a screw conveyor or similar device. An electronic control system regulates the combustion process and c onstantly optimises it. The output range of wood chip-fired central heating systems ranges from 30 kilowatts to several megawatts. This allows heating of apartment houses and entire business establishments.

Pellet delivery by tanker

Fully automatic regulation ensures effective burn off and a high level of efficiency

HEAT PUMPS

SOLUTION ADVANTAGES

- Using renewable heat from the surroundings
- Can be used both for space heating and cooling
- Highly energy efficient
- Diverse heat pump technologies suitable for a great variety of building contexts
- Can be practically emission-free if driven from electricity produced from renewable energy sources (wind power or photovoltaics)

Air/water heat pump (indoor unit)

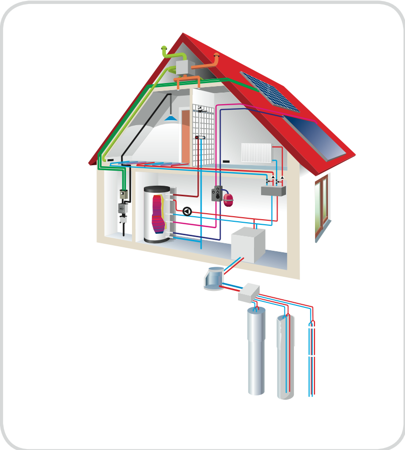
Operation

A heat pump makes the renewable energy stored in the soil, groundwater or the environment usable for heating purposes. The most common are electric heat pumps. A heat pump operates like a refrigerator in reverse: a refrigerant extracts low-temperature heat from the environment, which causes the refrigerant in the system to evaporate; the refrigerant is then compressed; heat is released in a condenser and is transferred to the water circulating in the heating system.

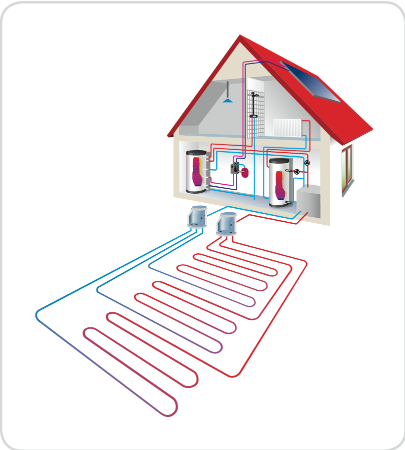
Heat pumps work most efficiently when the source temperature is higher, and when combined with distribution systems that work at lower temperatures. A high standard of comfort can be assured by using sufficiently dimensioned heating emitters (efficient radiators and/or embedded heating systems). Modern heat pumps can be used for space heating, domestic hot water preparations and can also be used for ventilating and cooling a building depending on the technology. They work very quietly and are virtually maintenance-free.

Air/water heat pump (outdoor unit)

Bore-hole for geothermal heat exchanger



Ground collector



Geothermal heat exchanger

Closed-loop heat pumps: ground source heat pumps or brine/water

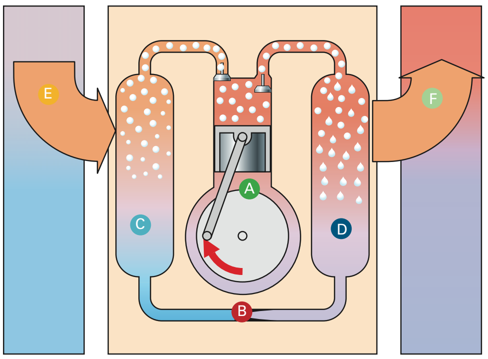
Closed-loop heat pumps are the most common type. They use a closed loop of pipe containing a water and anti-freeze solution to extract heat from the ground or ground water; they are often referred to as ground-source, geothermal or "brine/water" heat pumps. The heat is transferred to water for distribution in the building. The heat can be extracted from the ground or ground water using vertical collectors in boreholes or loops of pipes laid horizontally below the surface of the ground. Sufficient open land area must be available – to sink boreholes, but more so if horizontal collectors are to be used, and permits are often necessary. They are available with or without integrated hot water storage.

Open-loop heat pumps: water/water

Open-loop heat pumps use the almost uniformly level temperature of bodies of water. The water from the source is pumped through the actual heat pump itself where its heat is extracted. Evaporators need to be rustproof. Water/water heat pumps come with or without hot water storage tanks. Building cooling is also possible.

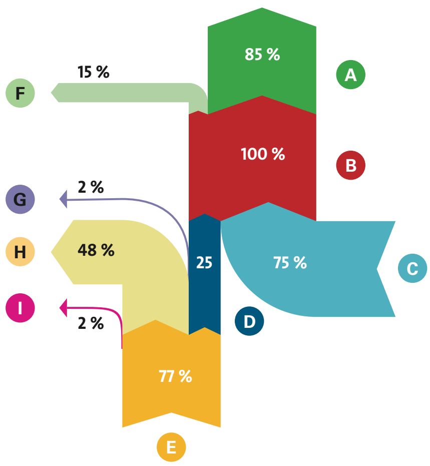
Air-source heat pumps: air/water

Air-source heat pumps extract environmental heat from the air. They are particularly suitable for installation in existing buildings and can be installed both inside or outside the building. They are easier and less costly to install as no boreholes or horizontal pipes are necessary. The air/water heat pumps can also be switched to operate in cooling mode.



HOW THE HEAT PUMP WORKS

- A Compressor
- B Expansion valve
- C Vaporiser
- D Condenser
- E Heat absorbed
- F Heat discharged



ENERGY FLOW - ELECTRIC HEAT PUMP

- A Energy for heating
- B Collectible energy
- C Environmental heat (groundwater)
- D Consumable energy to be paid for by the customer (electricity)
- E Primary energy

Losses

- F Control and distribution
- G Electricity distribution
- H Power house
- I Production and transport

GAS HEAT PUMPS

SOLUTION ADVANTAGES

- Links efficient technologies of condensing boiler and heat pump
- Maximising use of fuel and renewable energy
- Suitable for low temperature heating systems, for new and existing buildings

Maximum efficiency with natural gas by using renewable energies

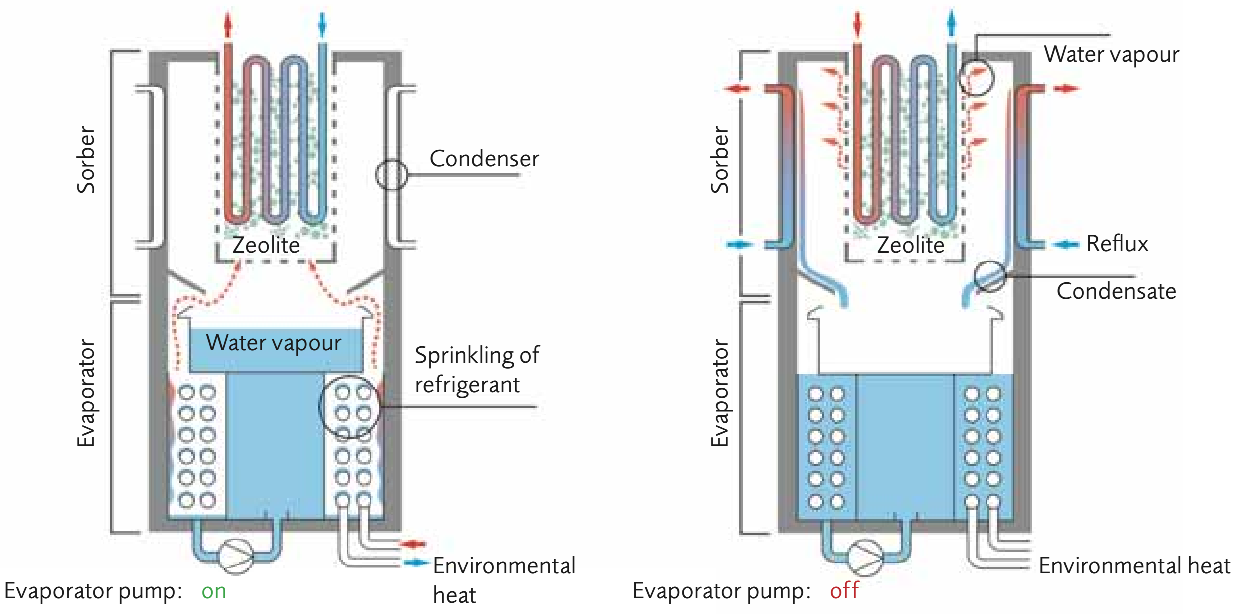
The gas-fired heat pump combines high efficiency gas-fired condensing technology with environmental heat. In this way, renewable energy can be used relatively easily for heat supply to new and existing buildings. The gas-fired heat pump systems are classified into compression, absorption and adsorption systems according to their ways of working.

Gas-fired compression heat pumps

The functional principle corresponds to that of the conventional compression heat pumps: The devices are driven by a combustion engine and additionally utilise the waste heat of the engine.

Gas-fired adsorption heat pumps

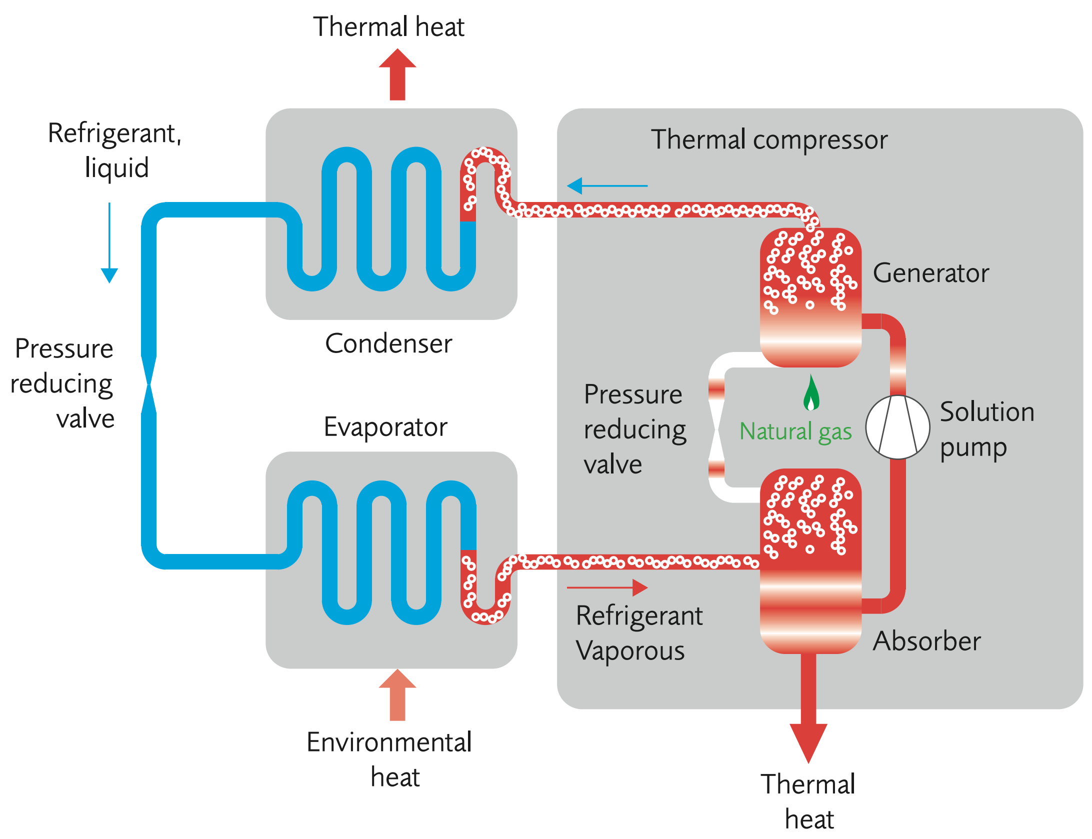
Gas-fired adsorption heat pumps operate under vacuum: The refrigerant water vaporises in a closed container, where it is adsorbed, desorbed and liquefied again. Besides the refrigerant water, the environmentally friendly mineral zeolite is also present in the tank. The actual process takes place in two sub-steps. First, the water is evaporated with free heat from the environment and then absorbed by the zeolite. The heat released by adsorption is used directly for heating purposes. Then the water is expelled (desorbed) again from the sorbent with the help of the gas burner and then condensed. Through condensation, the water also delivers the "saved" environmental heat to the heating system. Then the process can start all over again. Compact gas-fired adsorption heat pumps made of a sorption module and a gas-fired condensing module: The condensing module drives the sorption process and covers the peak load of the heating system. The compact gas-fired adsorption heat pumps have a modulation range from 1.5 to 16 kW. They are particularly efficient in low temperature heating systems. The environmental heat is extracted from the soil, the air or solar radiation.



Gas-fired absorption heat pumps

The gas-fired absorption heat pump operates at excess pressure: Besides the refrigerant, another liquid medium with the absorbent is contained as a solvent. The gas-fired absorption heat pump has a thermal compressor, which consists of the absorber, the solution pump, the generator and the pressure reducing valve. The thermal compression runs continuously in four sub-steps: In the absorber, the refrigerant is absorbed at a low pressure and low temperature by the solvent. The result is a "rich" solution with a high refrigerant content. It is transferred from the solution pump to the generator and heated there with a gas burner. As a result, refrigerant vapour escapes at elevated pressure and is fed to the condenser. The remaining "poor" solution with low refrigerant content flows through a pressure reducing valve back into the absorber where it is cooled. As with compression heat pumps, the environmental heat is absorbed in the refrigerant evaporator and delivered to the condenser. Compact gas-fired absorption heat pumps cover a power range from 20 to 40 kW and can be interconnected to form cascades. They are also used especially in low temperature heating systems. The environmental heat is extracted from the soil, the air or solar radiation.

Gas heat pump



COMBINED HEAT AND POWER

SOLUTION ADVANTAGES

- Allowing the supply of both heat and electricity from a single energy source
- Reducing carbon emissions by generating electricity at the point of use – avoiding the system losses associated with central power production
- Allowing gas to be used more efficiently
- Generating economic savings by reducing imported electricity and selling surplus electricity back to the grid
- Enhancing security of supply by reducing reliance on centralised power production

Wall-hung micro-CHP unit

More than just a heating system

In heating systems, the primary energy source is converted into heat. In contrast to this, combined heat and power generation (CHP) produces both heat and electricity in the one independent appliance. By using the primary energy source economically in this way, cogeneration of heat and electricity not only contributes to an overall reduction in energy consumption, but it also contributes directly to the protection of the environment.

The technology is nowadays also available for small-scale production of heat and power (micro-CHP and mini-CHP) for commercial and public buildings, apartments and individual houses. Small scale CHP generates electricity at the time of day and time of year when heat demand is at its greatest, thereby coinciding with the times when demand on the electricity grid is at its peak.

Europe is a global leader in micro-CHP engine and product technology, with innovation and manufacturing centres in Germany, the Netherlands and the UK.

Current state of technology

As far as the basic technology is concerned, a distinction is to be drawn between internal and external combustion engines (Otto engines and Stirling engines), steam expansion engines and fuel cells. A range of micro-CHP appliances are commercially available in Europe, mainly internal combustion engines and Stirling engines. Fuel cell technology is currently under demonstration phase and will be commercialised in the very near future.

The process heat released by the motor is used for space heating and for domestic hot water. The electricity produced is used as required and any excess power fed into the national grid. Decentralised cogeneration of heat and power is a highly efficient way of supplying both space heating and electricity.

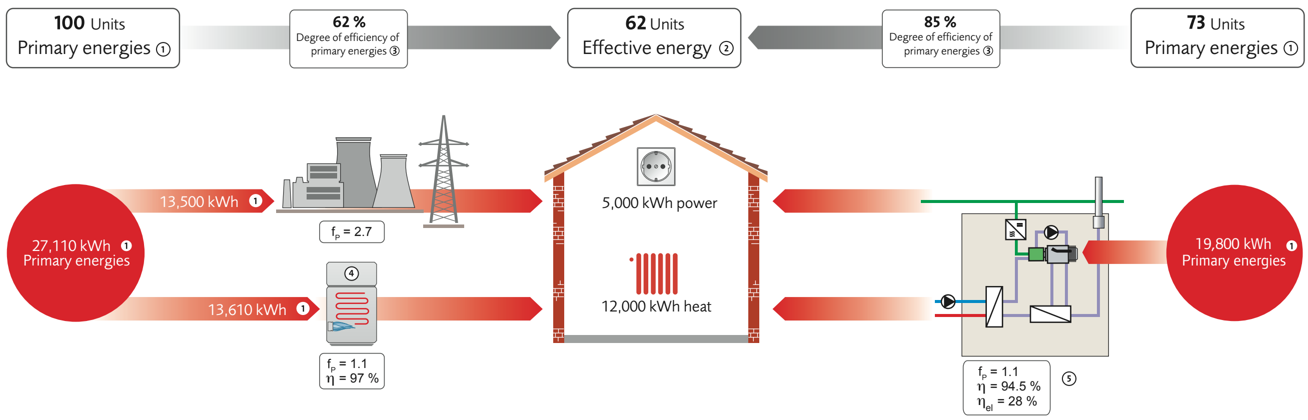
The fuel used, such as natural gas or heating oil, drives a combustion engine with a power generator coupled to it, thus producing electricity. In future, it is entirely conceivable that renewable energy sources such as biogas, vegetable oil, wood pellets and indeed bio-ethanol will be able to be used.

The right solution for every requirement

Consumers have a choice of different CHP solutions from outputs of just a few kW to several hundred MW. Micro-CHP units with power outputs of up to 5 kWel are used for detached and semi-detached houses, while mini-CHP units of up to 50 kWel have been developed for small apartment blocks and business premises. No district heating network is required for these smaller CHP units. Industrial premises and also larger housing estates, hospitals and schools use larger CHP units or block cogeneration plants with outputs starting at around 50 kWel. In these applications, CHP systems can supply up to 100 % of the heat and 80 % of a building's power requirements; moreover, CO_2 emissions can be reduced by up to 40 %. In future a large number of block cogeneration plants working together as a "virtual power station" will help smooth out voltage fluctuations in the public power supply.

Floor-standing micro-CHP unit

ENERGY BALANCE FOR COGENERATION OF HEAT AND POWER



1. Primary energies
2. Effective energy
3. Degree of efficiency of primary energies
4. Condensing boiler unit
5. Cogeneration plant

SOLAR THERMAL SYSTEMS

SOLUTION ADVANTAGES

- Carbon-neutral, effective way to reduce CO_2 and other emissions
- Integrates renewable energy within any heating/hot water system both in existing and new buildings
- One-time investment, low maintenance costs and a long lifespan
- Ease of installation and ease of use
- Solar heat is available and free for everybody

Operation

Solar collectors convert sunlight into heat and produce hot water, and, in larger systems, assist the space heating system. Solar thermal systems can save significant quantities of energy and reduce CO_2 emissions. Most systems work in combination with another heat generator (running on oil, gas, electricity, wood) which only operates when heat demand is too high to be met by the solar system alone.

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Examples of flat plate collector installations

Examples of vacuum tube collector installations

System components

In a solar water heating system, the solar collectors are usually installed on the roof of the building. The circulating fluid in the system, which delivers the solar heat from the collectors to the storage tank, must be both frost and heat-resistant. Flat-plate collectors are the most frequently used type of collector. Vacuum tube collectors – a heat pipe in an evacuated glass tube (vacuum) – can achieve high yields and temperatures. Because of their higher efficiencies, they require less surface area than flat-plate collectors.

The heat is transferred to the water in the storage tank via a heat-exchanger. Solar energy can also be used to top up the central heating system, when the size of the collector surfaces is increased by a factor of about 2 to 2.5. The saving on fuel is somewhere between 10 % and 30 %, depending on the insulation levels of the building. With low energy buildings, savings of up to 50 % are achievable. Where solar heat is used to assist a heating system, either a second storage tank (buffer store) or a combination storage can be used. Stratified tanks or cylinders are also available.

Solar heat opportunities

Solar thermal systems for hot water production and space heating are suitable for a great variety of residential and commercial buildings, in both retrofitting and new-build projects. Moreover, solar collectors can provide hot water for both open-air and indoor swimming pools. In southern countries, there are systems that operate on the thermo-siphon principle with a heat-insulated storage tank above the collector. Solar assisted industrial process heating is still in its early stages but the potential is enormous.

Solar cooling

Solar thermally driven cooling systems – so-called solar air-conditioning – have a great potential, as the highest need for cooling goes hand-in-hand with the sun's presence. Moreover, the widespread use of solar cooling could make an essential contribution to lowering the electricity demand peaks caused by traditional air-conditioning systems.

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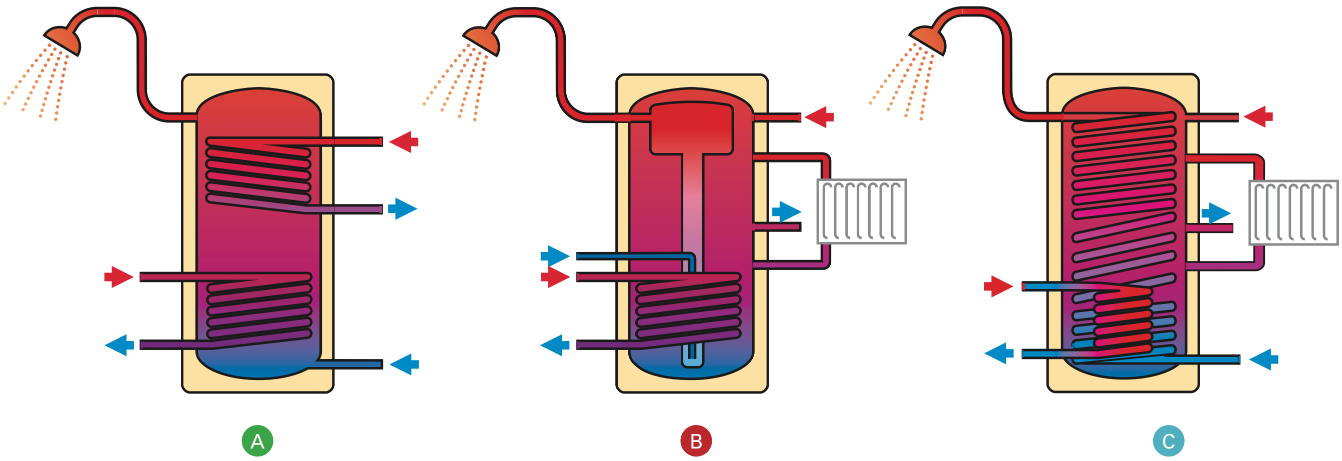


SOLAR (DRINKING) DOMESTIC HOT WATER PREPARATION

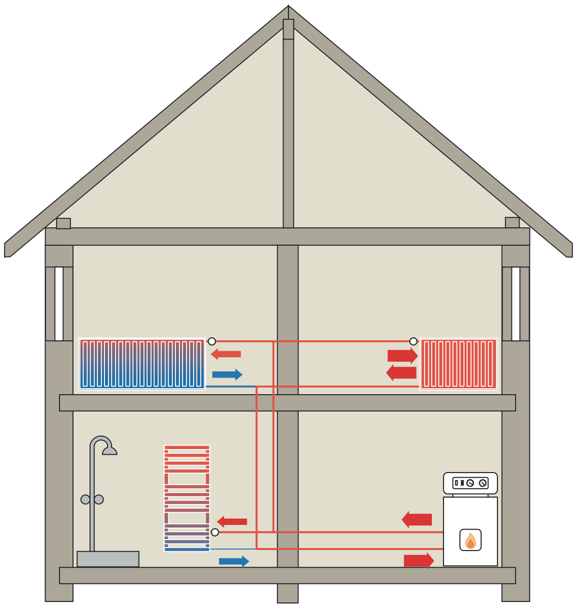
COMBINED (DRINKING) DOMESTIC HOT WATER SYSTEM AND SUPPLEMENTED ROOM HEATING

- A Standard solar storage
- B Tank-in-tank storage
- C Direct flow through heat exchanger

HEAT DISTRIBUTION

SOLUTION ADVANTAGES

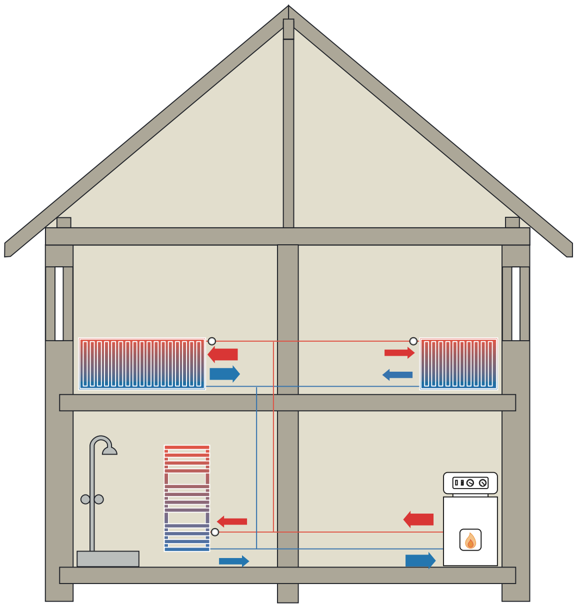
- Ensuring an even flow throughout the central heating system
- Improving heating system control
- Avoiding disturbing noises and maximising comfort
- Assisting in reducing the fuel and electricity consumption



Heat-distribution system not balanced – high return-flow temperatures

The link between heat generation and heat emission

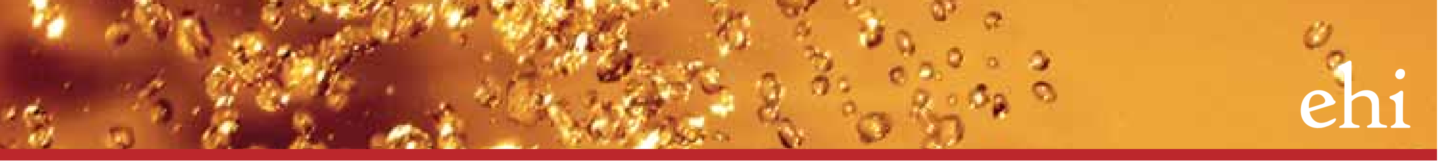
An efficient supply of heat is only possible if the heat is optimally distributed throughout the building and in the individual rooms. This is achieved using pipes, valves, pumps and control technology. These components have a crucial impact both on operating costs and on the comfort of the home environment. The key pre-requisite for this, however, is the hydraulic balance of the whole heating system: through the regulation of the valves and pumps, the system is calibrated so that only the hot water quantity required as per the design or demand will be provided in each room.



Balanced heat distribution system – low return-flow temperature

Importance of hydraulic balance

If the hydraulic system is not balanced, the heat will be distributed unevenly around the building. Sections of the heating system which lie near to the pump with be advantaged by greater supply. In order to avoid partial under-supply, the system automatically boosts the flow temperature, resulting in unnecessary fuel consumption. Too high return flow temperatures lower the boiler's ability to exploit the heating value of the fuel to the full, and thus create additional costs in terms of electrical energy. Moreover, increased noises can be created in the radiators and the thermostatic valves, and the power consumption of the pumps increases steeply.



Calculating the heating load, adjusting the heat output

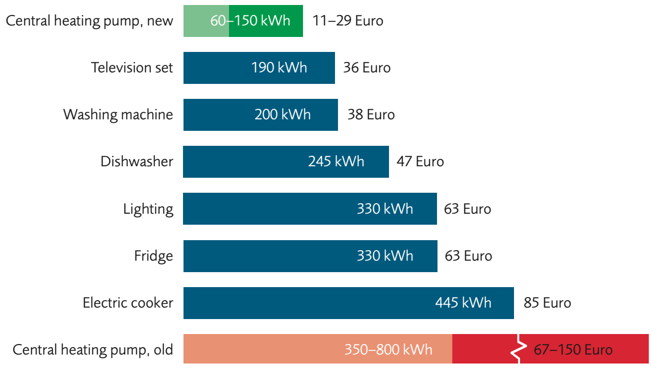
The heating load for each room of the building is calculated at first for hydraulic balancing. The exterior surfaces, walls, ceilings, windows and doors are included in the calculation. According to the calculated heating load, the heating surface with the required heating output is chosen. Moreover, the different pressure drop between the heat generator and the heating surface should be considered. At the end, all these variables result in the settings for the individual heating surfaces. Hydraulic balancing is achieved when all parallel systems each have the same hydraulic resistance. In order to perform the hydraulic balancing, pre-settable thermostatic valves or return fittings on the radiators are required. Modern thermostatic valves are characterised by pre-settable valve body for hydraulic balancing and visually responding thermostat sensor with high control performance.

Efficient circulation pumps controlled based on the demand

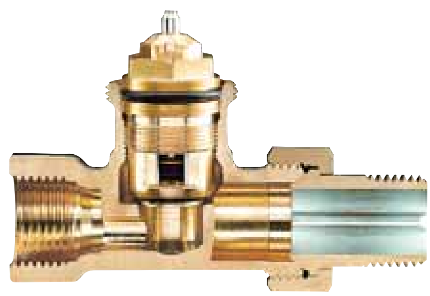
Inspection of the built-in heating pump is always a prerequisite for hydraulic balancing. Unregulated pumps that are oversized in almost all cases need to be replaced. High performance pumps are much more efficient and continuously adapt to changing performance requirements of the system. Thus, they not only save valuable electrical driving power at full load, but also in the predominant partial load operating condition of the heating system. Compared to the old, unregulated heating pump, power savings up to 80 % can be achieved.

THE CENTRAL HEATING PUMP: FROM POWER GUZZLER TO POWER SAVER

Typical power consumption for a detached family house (3 people) – data from the German consumer organisation (Stiftung Warentest) 09/2007



VALVE WITH A PRESETTABLE VALVE INSERT FOR THE ADAPTATION OF THE FLOW RATES TO THE REQUIRED HEAT DEMAND



HIGH-EFFICIENCY PUMP IN ENERGY EFFICIENCY CLASS A

HEAT STORAGE AND DOMESTIC HOT WATER

SOLUTION ADVANTAGES

- Variety of options to meet domestic hot water demand in all contexts
- Allowing combinations and storage from renewable energies
- Efficiently sorting domestic hot water and supporting space heating

Share of domestic hot water energy consumption

An estimated 10-20% of the overall energy consumption for heating purposes within EU is used for domestic hot water (DHW).

Differentiation of domestic hot water systems

The main task of all domestic hot water systems is to provide the user with the desired comfort, which means delivering a minimum requested amount of hot water with a minimum temperature.
Appliances for providing a more or less constant supply of domestic hot water are commonly known as water heaters or DHW systems. The choice of applicable systems depends on the detailed requirements and the situation on-site. Basically it is possible to differentiate the systems into two general principles: on-demand water heater and storage water heater.

On-demand water heater

On-demand systems heat water instantly as it flows through the appliance (also known e.g. as tank-less water heater). The temperature difference between cold (inlet) and hot (tap) water and the required flow rate (e. g. for hand washing, showering or bath) define the necessary heat power.
Small tank-less water heaters could be located right where the water is used and are only linked with this one tap. Larger tank-less water heaters are also common in centralised systems such as single flats up to one or two family houses. Common energy sources are gas or electricity. Appliances which are capable of supplying both space-heating and on demand DHW are known as "combi" boilers.

Gas instantaneous Water Heater

Electric Water Heater

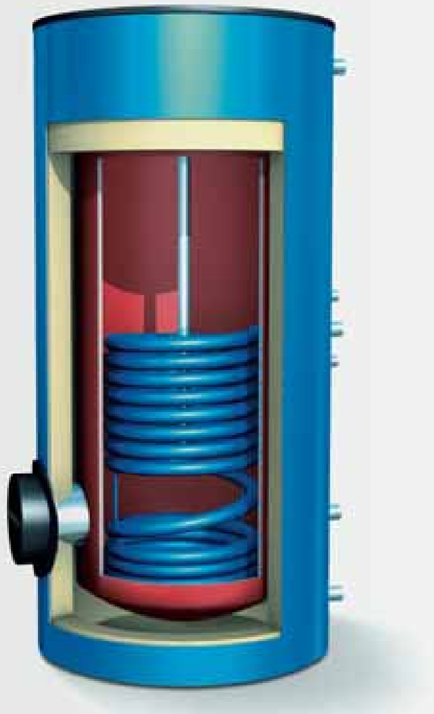
Storage Systems

Direct heated storage tanks are a combination of a vessel with e. g. a gas or oil burner, electric resistance heater or an air source heat pump.

Where hot water space heating appliances are used, drinking hot water cylinders are usually heated indirectly by primary water from the appliance or by an electric immersion heater (often as back-up to the boiler).

Indirect heated storage tanks (unvented cylinders) incorporate one (or more) internal heat-exchanger which could be connected with any appropriate heat source like heat pumps, gas, oil or biomass boilers, solar panels, district heating or combinations of those.

Specific storage technology is the "stratified storage tank" (often use in solar DHW supported systems). This technology is specifically designed to force the effect of difference in mass between cold and hot water to prepare a specific "hot" area on upper part of the tank. This "hot" or "process" area provide the user with domestic hot water, while the lower "cold" area contains the heat exchanger (or directly) fed by the input of the solar panel. Between cold and hot area is a second heat exchanger which could – if necessary – heat up the solar heated water to the desired temperature of the domestic hot water.



CROSS-SECTION COMMON DOMESTIC HOT WATER TANK

CROSS-SECTION STRATIFIED STORAGE TANK

INTELLIGENT CONTROLS AND COMMUNICATIONS

SOLUTION ADVANTAGES

- Efficiently controlling all components of a central heating system
- Facilitating integration of renewable energies
- Maximising energy use and comfort
- User-friendly and future-oriented technology

Technology that thinks

Modern central heating systems are no longer imaginable without intelligent control technology. This is based on innovative micro-electronics and ensures the optimal interplay between all the heating components – including central heating appliances, burners, heating pumps and heat emitters – to deliver the desired temperature in the right place at the right time.

The technology is user-friendly and more energy efficient than ever. As consumers can target heat to just those areas where it is needed, control technology helps to reduce running costs on a long term basis. A display makes the fuel economy data clear, registers the operating status and indicates if any maintenance is needed. Occupants can easily carry out modifications to the programme.

Heat at the press of a button

Today's heating systems offer significantly more than earlier generations: domestic hot water, heating as well as ventilation can be controlled centrally. In addition, they can be run as bivalent systems, that is to say they can be run with two energy sources at the same time, including renewable energies.

For example, control technology integrates the energy from the solar thermal installation into the system. If not enough heat is produced because of adverse weather conditions, then the heat generator cuts in, activated by the control technology running in the background.

Service using a laptop

Remote controlled heating systems

The potential of today's control technology for heating systems can be fully exploited in combination with modern communication technology. It is possible to control the heating system in the cellar from the living room with a remote control unit, or via the internet with the help of mobile devices and specifically developed applications.

Managing energy consumption efficiently

A modern heating system can be controlled by a central computer, which manages all the data, programmes and information. Basically, an "on-board computer" of this kind lends itself to intuitive use by means of a touch screen. With it, residents can create heating profiles for individual rooms, set a minimum temperature or adjust the radiator valves. Sensors detect the ambient conditions, which the system evaluates and reacts to accordingly. Thus control and communication technology makes possible an energy management system, which is exactly tailored to the needs of the occupants.

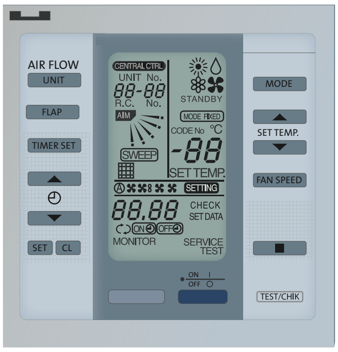
INTELLIGENT CONTROL AND COMMUNICATIONS TECHNOLOGY

Independence

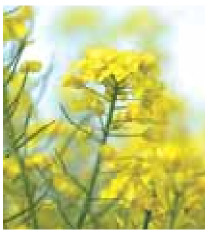
Efficiency

Comfort

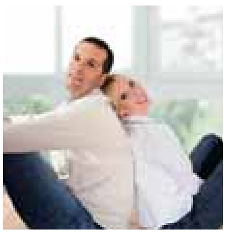
Reliability



Heat generation



Renewable energies



Demand-driven temperature control

Diagnostics

RADIATORS

SOLUTION ADVANTAGES

- Highly efficient, energy saving and providing all round comfort where needed
- Functionally and aesthetically adaptable
- Easy to install, healthy and requiring minimum maintenance
- Flexible and future-proof as can be combined with all modern heating technologies and renewable energies

Today's radiators: efficient, comfortable and sustainable

Successfully increasing the efficiency of a whole heating system is dependent on all components being optimally adjusted to each other in terms of both energy distribution and hydraulic balance. A key aspect of the installation of a heating system is the choice of heat emitters. Radiators can be integrated into any type of heating system regardless of the heating technology used.

Modern radiators with low system temperatures, in combination with state-of-the-art control technology, save energy and, in addition, create a pleasant room climate. Radiators feature a slim-line profile and minimal water content in combination with a large heat-transfer surface. Thus the room temperature can be quickly adjusted to changing user needs. Modern thermostatic valves and hydraulic balancing valves help the heating system maintain exactly the right temperature in individual rooms and at different times.

Between modernisation and comfort

The aim in modernising an existing system is to increase efficiency by means of energy-saving operation and optimal delivery of heat through modern radiators. Alongside financial implications, visual and functional aspects are coming more and more to the forefront: radiators can serve as features in the interior decor or as mirrors, can have a specific purpose (to dry/warm up towels) or can generally improve the design of a room.

However, it is not just the performance of a radiator that determines the quality of heat delivery. Optimum heat distribution can only be achieved if the radiator is installed in the right place. The traditional place under the window is still to be recommended: here, incoming cold draughts are intercepted and the heat is delivered unimpeded into the room. At the same time, the position can be chosen not only with energy savings in mind, but also for reasons of design.

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

Radiators are suitable for all modern heating systems. In order 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 is necessary. The lower the system temperature the higher the efficiency of the heating system.

Comparing high temperature systems (80/60°C or 70/55°C) and low temperature system (45/35°C) shows energy efficiency implications and the important role that radiators play in exploiting the energy saving potential of the entire system.

SURFACE HEATING AND COOLING

SOLUTION ADVANTAGES

- Fully covering the thermal comfort needs all year round
- Highly energy efficient by operating at temperature levels very close to the desired room temperature
- Viable option for all efficient modern heating systems in residential, commercial and industrial buildings
- Ideally combined with renewable energy sources

Heating and cooling in one system

Many new buildings all over Europe opt for a surface heating and cooling system - water is circulated in pipes permanently embedded in floors, walls or ceilings, and thus forming an integral part of the building. These systems fulfil two functions at once: in winter, they heat the rooms, while in summer, they noticeably reduce the operative air temperature within a room. Thus, owners consider them as an investment for the future. Through their large-area installation, they ensure even distribution of heat in the room, and thus contribute to a pleasant indoor climate.

Wide range of solutions also for old buildings

Conventional floor-heating constructions are often unsuitable for older buildings, because the required design height is not given, or problems related to load-bearing capacity of ceilings may arise. Therefore special surface heating and cooling systems that can also be installed in existing buildings without massive interventions are designed for installation in the wall, floor or ceiling and subsequent integration. The variety of surface systems available on the market today ranges from wet systems (screed or plaster) to dry systems to special thin-film systems. This offers builders the best solutions for new construction as well as modernisation.

More comfort, less costs

In embedded heating systems, low system temperatures are generally sufficient (35/28°C) – perfect for heat transfer using condensing boilers, heat pumps and solar thermal systems. Here, the low system temperatures pay off the residents in two ways: the potentially large energy savings and the enormous increase in cosiness and comfort. This can be enhanced by smart individual room control. Another advantage is that the invisible installation of embedded heating systems in walls, floors and ceilings gives the residents a lot of free space for interior decoration.

Effective cooling in summer

With the additional function "cooling", the surface system can be used in summer for indoor cooling in a simple and affordable way. Cold water circulates through the pipes, lowers the temperature of the floor, ceiling or walls, and thus the rooms by up to 6 °C, without the occurrence of any draughts. However, the performance of an surface cooling system cannot be compared with an air-conditioner. The maximum output also depends on the temperature difference between the supply and return flow of the cooling water. While the temperature difference during heating operation is usually around 8 °C and cooling with a spread of less than 5°C should be used. Surface cooling systems are designed to make use of natural heat sinks such as ground water or ground, because of the small temperature difference required between the cooling water and indoor air temperature (e.g. 18°C cooling water supply temperature). This makes the cooling operation extremely energy efficient.

Avoiding condensate formation

A controller which covers both the heating and cooling functions must be installed to regulate the system temperature during cooling operation. It ensures that the system temperature of surface cooling systems always remains above the dew point, so as to prevent condensate formation on distribution pipes and heat-transmitting surfaces. In addition, exposed cooling water pipes should be insulated. Condensate formation occurs on cool surfaces when their temperatures fall below the dew point, namely the temperature at which a relative humidity of 100 % is reached when the air cools. The different typical designs of the embedded cooling system in the living areas of a residential building or office building reach on average a cooling capacity of about 35 W/m2 in the floor, about 35–50 W/m2 in the wall (depending on the layout) and about 60 W/m2 in the ceiling (depending on the layout).

ENERGY AND TECHNOLOGY MIX: HYBRIDS

SOLUTION ADVANTAGES

- Reducing running costs and improving overall system energy efficiency
- Reducing primary energy consumption
- Combining several energy efficiency measures with best practice technologies incorporating renewable energies
- Ensuring security of supply and avoiding peak consumption

Floor-standing hybrid heat pump

Tailored solutions

Decades ago, the choice was limited for the types of heating systems available on the market. Based on continuous research and development, the heating sector has developed in recent years a multitude of solutions for all residential, commercial and industrial needs. Technologies have improved and multiplied, so have the energy sources.

Individual products and systems are tailored today to all needs, leading to a wide range of flexible and complex solutions. The right choice for a system depends upon the framework conditions, particularly upon the heat demand of the building, its use, its positioning (climatic zone and facade orientation), its ground surface size, and, last but not the least, the preferences of the investors.

Wall-hung hybrid heat pump

Mix and match for optimal results

Each technology and energy source has its own advantages as well as downsides. This has led manufacturers to consider the feasible combinations of existing technologies and energy sources, in order to maximise their benefits and compensate their weaknesses.

The possible combinations are limited only by the physical and economic feasibility. Several technical terms are used by specialists, each with their different specifications, such as bivalent systems, dual fuel systems, or hybrids. These combinations provide centrally controlled space heating, cooling, domestic hot water or power, generally from two or more different energy sources.

The most well known combinations bring together heat pumps with (gas or oil) boilers, gas or oil boilers with biomass boilers, any heat generator with solar thermal systems. Recent developments bring these solutions towards integrated appliances, provided as single package solutions suitable for a large variety of building contexts.

SMART METERING AND SMART HOMES

Smart meters

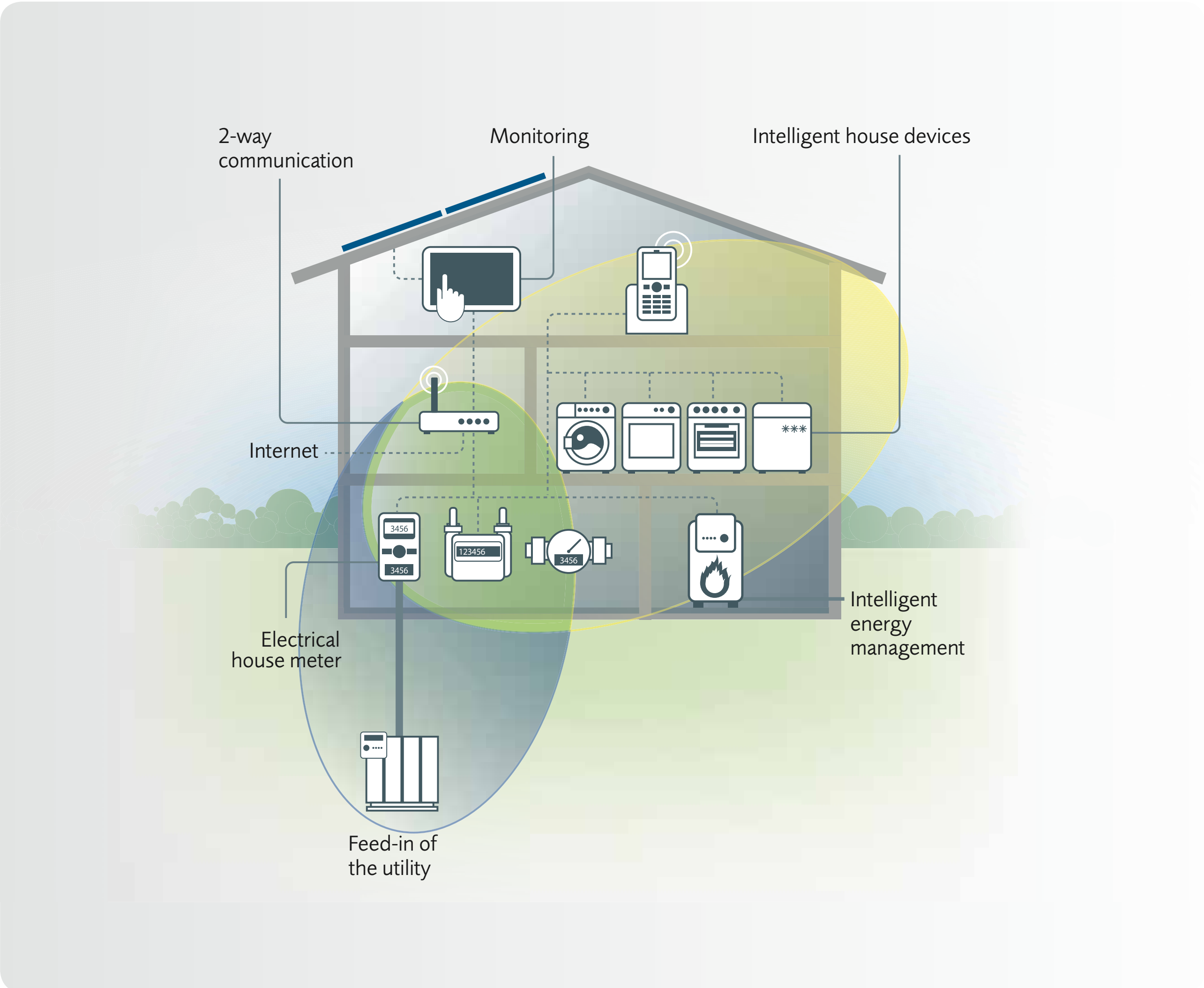
Smart metering technologies provide accurate measurement and transmission of electricity, gas, water or heat consumption data, in a two-way information gateway and communication infrastructure between the metering systems and relevant parties and their systems.

Widespread deployment of smart meters will completely change the way that metering works. They provide customers a direct overview of consumption and cost and thus, contribute to a more energy-efficient behaviour. The utility companies also benefit from improving load planning.

Moreover, electronic meters form the junction between the building's energy management and the Smart Grid, making them an indispensable part of the new energy landscape in the long term.

Smart homes

Home automation, smart building energy management systems in the "Smart Home", optimise energy consumption in residential buildings by linking all electronic systems and sensors of a house with one another – from the controls of the kitchen blinds to the thermostatic controls in individual rooms. This networking and communication among all relevant applications and systems in buildings automatically facilitate maximum energy utilisation of all components, without loss of comfort and in a safe manner. All communication is wireless, via remote control, mobile devices or via the internet.



COMMERCIAL AND INDUSTRIAL APPLICATIONS

Energy efficiency in heating systems in industry and production

Many industrial production processes and methods require large quantities of process heat and this usually entails considerable energy costs for the businesses. Comprehensive energy optimisation of a heating system can considerably reduce energy consumption and costs for combustion plants, on average by 15%. Such energy efficiency measures are highly cost-effective and generally pay for themselves within one to four years.

Various sources of energy are used to generate process heat (for example electricity, oil and gas); there are also very different ways of transporting the process heat (as warm water/hot water, as steam or as hot air), and it is required in a whole range of temperatures.

System optimisation

Measures for increasing energy efficiency in a heating system should always be regarded as part of the optimisation of the complete system because the greatest increases in energy efficiency can be achieved by matching all the components to one another and optimising the plant's control systems.

The first step should be to carry out a detailed actual analysis of the system's energy consumption, its heating demand and its individual system components. Then the energy efficiency of the individual components should be checked so that any old components, such as burners, can be replaced if necessary. Further savings can be achieved by optimising the combustion plant's control systems. When constructing new systems, attention should be paid from the outset to the energy efficiency of the components and of the overall system.

1. MINIMISE DEMAND AND LOSSES

Before optimising the individual components of a heating system, steps should first of all be taken to minimise heating demand and losses. Efficiency can be raised by 10 to 15 percent just by using warm water instead of steam. In many cases, reducing the temperature of the supply medium makes it possible to use heat recovery and cogeneration to reduce energy requirements still further. Moreover, the thermal insulation on heat generators, pipe work and any heat stores should be checked and, if necessary, repaired.

2. USE HEAT RECOVERY

Heat recovery measures maximise the efficiency of the overall system and thus increase its energy efficiency. Heat potential should be used locally and as directly as possible. Waste heat may be put to further use for heating process water, for water heating, for preheating combustion and drying air or as space heating.

3. USE ENERGY-EFFICIENT COMPONENTS

Even when energy-efficient components are used, the goal should always be to optimise the entire system. This is achieved by effectively matching all new and existing components to one another. Modulating (controllable) burners may be used over extensive partial load ranges. They are substantially more efficient than burners which are switched on and off individually. Flue gas temperatures and energy consumption can be reduced thanks to boilers with large heat exchange areas. Speed-controlled drive motors for forced-draught burners and pumps enable considerable savings in energy consumption.

4. OPTIMISE CONTROL SYSTEMS

Combustion plants should in principle be designed on the basis of the actual heating demand. For instance, a multi-boiler control system ensures that only the necessary number of boilers is switched on in accordance with requirements. If a flue gas sensor control system is installed, the flue gas composition can be continuously measured. Air feed is controlled on the basis of the optimum oxygen (O_2) content in the flue gas. Reducing the O_2 content by just one percent results, depending on the age of the system, in a 0.5 to 1% improvement in efficiency. Energy consumption can be further reduced by monitoring and controlling further combustion parameters such as CO content, flue gas temperature, soot index or combustion chamber pressure and by installing automatic flue gas or combustion dampers.

EUROPEAN HEATING INDUSTRY

Scope and history

The Association of the European Heating Industry (EHI) represents and promotes the common interests of 40 market leading companies and 14 associations in the European thermal comfort sector, which produce technically advanced, safe and energy efficient solutions for heating in buildings, including: space heaters and renewable energy systems (boilers, heat pumps, solar-thermal, biomass, micro-cogeneration), water heaters, heating controls and components, heat storage and heat emitters (radiators, surface heating and cooling systems).

Besides its core business of heat, hot water and steam generation, EHI therefore includes heat distribution, heat emitters, heat storage, system controls, decentralised electricity generators, relevant ventilation and air conditioning products and related components and accessories.

The broad and flexible product and system range with energy output between 1kW and 50 MW represented within EHI by its industry members qualifies EHI as a strong supporter of energy efficiency and environmental policy objectives targeting existing and new residential, commercial and industrial applications, operating with conventional and renewable energy sources including bio-fuels.

EHI was founded on 11 June 2002. It is the result of the merger of the former CEB (European Burner Committee), EBA (European Boiler Association), and AFECI (Association of European manufacturers of instantaneous gas water heaters and wall-hung boilers), whose history goes back into the 1960s. Throughout the years, a number of other sector associations also joined forces with EHI: EURORAD, representing radiator manufacturers (2007) and Eu-ray, gathering the surface heating and cooling industry (2013).

The industry has total annual sales of over 20 billion euro and directly employs more than 120.000 people.

Mission and objectives

EHI is the representative and reliable independent association for the evolving sector of thermal comfort solutions, aiming to provide a competent and complete representation of the sector with the biggest energy-saving potential in Europe.

AMONG ITS KEY OBJECTIVES:

- Ensure an appropriate coordination and promotion of the political, economic and technical interests of its members
- Promote at a sensible pace a sustainable market and affordable product development to meet customer demand
- Support a harmonised Single European Market with stable boundary conditions regarding legal and technical requirements to realise the energy saving potential with proven products, systems and technologies
- Encourage the exchange of information and experience amongst its members, as well as co-operation with associations in similar fields

Organisation

The internal organisation of EHI includes a General Assembly, an Executive Council, a Steering Committee as well as specific Departments. This structure is designed in a flexible way, easily adaptable to the association's objectives.

DEPT 1: MARKET RESEARCH & INTERNATIONAL MARKETS	NATIONAL ASSOCIATIONS	DEPT 2: ENERGY EFFICIENCY & ENVIRONMENTAL POLICY
DEPT 3: COMMERCIAL/INDUSTRIAL BOILERS & BURNERS	DEPT 4: DOMESTIC HEATING APPLIANCES	DEPT 5: COMPONENTS INTEGRATION
DEPT 6: CHP	DEPT 7 : RADIATORS	DEPT 8: ELECTRIC HEAT PUMPS
DEPT 9: SOLAR THERMAL SYSTEMS	DEPT 10 : BIOMASS FUELED BOILERS	DEPT 11: GAS & OIL HEAT PUMPS
	DEPT 12: SURFACE HEATING & COOLING	

Member benefits

- Be part of only independent European association covering all current heating technologies through the variety of its members
- Benefit from key information and business developments affecting the heating industry on European, national and international level
- Actively pursue and promote the interests of the industry in front of relevant European organisations and institutions.
- Jointly shape the future industry vision, as well as regulatory and legislative matters impacting the industry
- Benefit from "members only" tailored, timely and accurate information
- Actively contribute to EHI departments, meetings and activities
- Network with European and international industry representatives

MEMBERS

Companies

- ACV
- Arbonia Kermi
- Ariston Thermo Group
- Atlantic Group
- Baltur
- BDR Thermea Group
- Bosch Thermotechnik
- Daikin Europe
- DL Radiators
- Elster
- Enertech
- Erensan
- Fagor Electrodomesticos
- Ferroli
- Grundfos
- Honeywell
- Hoval
- Ideal Stelrad Group
- Immergas
- Korado
- Orkli
- Oventrop
- Quinn Radiators
- Rehau
- Rettig Group
- Riello Group
- Roth
- Saacke
- Sermeta
- Siemens
- SIT Group
- The Heating Company
- Uponor
- Vaillant Group
- Viessmann
- Wavin
- Weishaupt
- Wilo Intec
- Wolf
- Zehnder Group

Associations

- APTT (Czech Republic)
- ASSOTERMICA (Italy)
- ATTB (Belgium)
- BDH (Germany)
- Building Climate (Switzerland)
- DEB (Denmark)
- FEGECA (Spain)
- EUA (UK)
- Eu-Ray (EU)
- MARC (UK)
- SBBA (Sweden)
- UNICLIMA (France)
- VFK (Netherlands)
- VÖK (Austria)

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