

Efficiency **Plus**

The forward-looking concept
for efficient enterprises



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"All living creatures require heat. Human beings are no exception, and where we cannot find natural heat, we have to provide it ourselves through our ingenuity. Heat has been, and still is, necessary to create a feeling of wellbeing and comfort. This will remain the case in the future, too, and it is what our company in Allendorf stands for – with its innovative products of the highest quality and a forward-looking global concept."



Energy centre and Viessmann Academy
at the Allendorf site.

Introduction

"Efficiency Plus" – our investment for the future

"All mankind fundamentally needs a supply of energy. Without it, there would be no light during the dark hours, no hot meals and no protection against the cold of winter. Heat is fundamental to creating a feeling of wellbeing and is a mark of affluence.

After decades of wastefulness, we are finally coming to realise that energy and other raw materials, as well as mankind's labour, are valuable commodities. We must deploy these resources efficiently, i.e. sustainably, if we want to preserve the standards of our current quality of life for future generations.

At the same time, we are shocked by the predictions issued by climate scientists that the heating of the planet, for which mankind is largely responsible, is progressing much faster than had previously been thought.

Both problems together – the forthcoming shortage of fuel and raw materials plus the threat emanating from the climate change – are probably the greatest challenges facing us today.

However, climate change is no natural event to which we have to succumb without response. Politicians have thrown down an ambitious challenge to combat it – and we can achieve the goals they have set.

With the model "Efficiency Plus", we want to demonstrate in our facilities the things that any business and any household can actively do to promote climate protection and to reduce their own energy bills. With "Efficiency Plus", we are demonstrating at our head office in Allendorf that tomorrow's objectives in respect of global warming can be achieved today with technology that is already on the market.

If nothing else, these actions strengthen our competitiveness and secure jobs."

Dr. Martin Viessmann

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Dr. Martin Viessmann

[1] Current situation

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Responsible handling of resources and the environment is what we need right now.

The global energy situation can be summarised as follows: limited natural gas and oil reserves are being consumed at a rapidly increasing rate. Furthermore, rising CO₂ emissions are heating up the atmosphere, leading to climate change. Events are forcing us to use our energy sources more responsibly and with greater efficiency, and to consider the wider application of renewables.

[1.1] Efficiency in handling resources as a success factor in international competition

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Efficiency in handling resources is of crucial relevance to economic, social and ecological balance. The dramatic increase in the world population and the equally drastic rise in the need for energy threaten this balance and force the need for urgent action.

Efficiency in handling resources encompasses both material and labour efficiency in production processes, as well as the use of raw materials and energy. At current rates of consumption mankind would need the resources of three planets to cover its needs by 2050 unless we use our resources more sustainably from now on. Countries short of raw materials, like Germany, are particularly dependent on the efficient treatment of resources. This realisation increasingly colours political programmes, leading the German Federal Government to formulate its policy aims as striving to double the efficiency in handling resources in Germany by the year 2020 as part of its sustainability strategy.

Politicians may set goals and create framework conditions, but the practical translation has to be implemented as part of the economic process. Our project "Efficiency Plus" shows how an industrial concern can decisively improve its efficiency in resources with a global concept.

Global climate protection concept: consumption of fossil fuels cut in half; CO₂ emissions reduced by a third

Fossil fuel consumption reduced by 40 percent, CO₂ emissions reduced by a third – we are leading the way towards greater energy efficiency with our "Efficiency Plus" model. On the consumption side, this is demonstrated by energy-optimised production processes, heat recovery from test beds and the thermal insulation of buildings.

On the generation side, i.e. in the new energy centre, practically all advanced energy technologies are utilised, such as highly efficient condensing boilers and a CHP unit. More savings are achieved by replacing fossil fuels with renewables. First and foremost, we are looking at the step by step replacement of fuel oil and natural gas with bio-oil and biogas, and the use of solar thermal systems, heat pumps, photovoltaic modules and woodchip boilers.



New production layout at the Allendorf site.

Improving operational efficiency through process optimisation

Production at the Allendorf site has been completely restructured. The creation of lean and flexible structures plus the prevention of processes that add no value have led to a sustainable improvement in operating efficiency and productivity.

The utilisation of production facilities has been improved, workflow paths have been reduced in length, losses through idle times have been brought down and the amount of space taken up has been reduced. As a result, operating efficiency has increased by 10 to 20 percent.

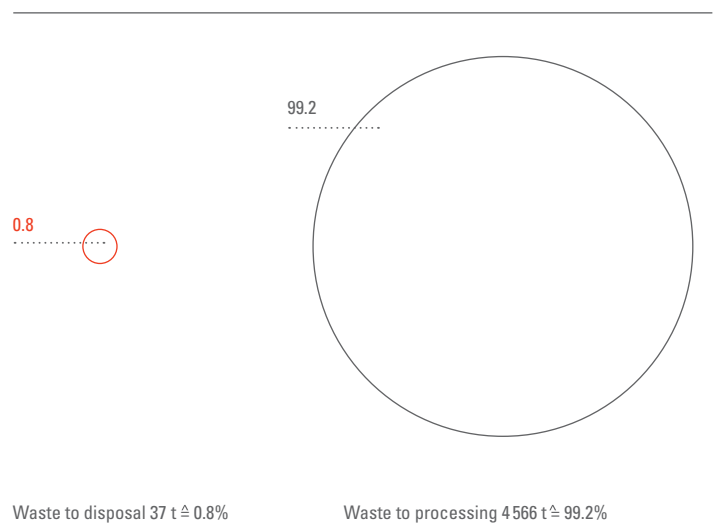
Material efficiency significantly improved through innovative product design and waste prevention

Innovative measures in product design have resulted in a significant reduction in steel consumption. The weight of a Viessmann boiler today is only around 40 percent of that of a predecessor model from 1990, and the utilisation rate has been greatly improved. The proportion of steel scrap, too, has been markedly reduced in production. We have instigated a voluntary return system to take care of disposal – this ensures a comprehensive recycling process.

The re-use of waste, such as steel scrap, old paper, commercial waste, old wood or electrical waste stands at the centre of the high material efficiency achieved by the Allendorf site. In total, some 99.2 percent of waste is returned into the material cycle. The amount of waste that needs to be disposed of has been reduced to a minimum.

Fig. 1
Waste recycling at the Allendorf site

in tonnes and %



Source: Viessmann

[1.2] Increasing energy consumption – limited range

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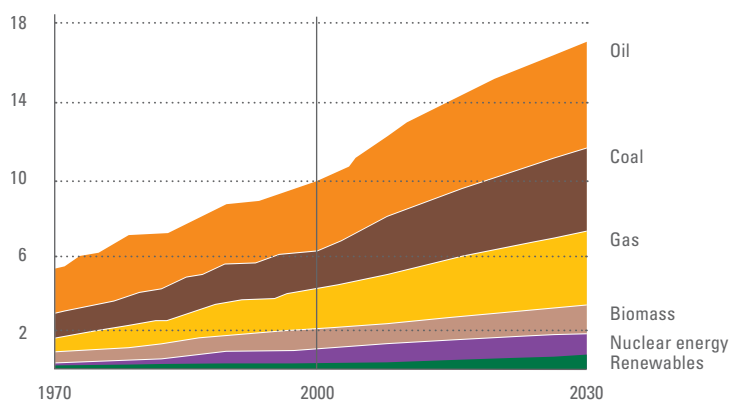
Energy consumption worldwide has doubled since 1970 and will triple by 2030 (Fig. 2). The demand for energy is primarily driven by the increasing hunger for energy of the USA, Russia and the emerging economies of China and India. The fact that Germany has managed to break the link between economic growth and energy consumption and now uses five percent less energy than it did in 1990 is an important step in the right direction. However, safeguarding the future requires additional savings.

High energy prices

Energy prices are becoming ever more crucial cost factors – for manufacturers as for consumers. Following the explosion of crude oil prices in 2008 that reached record levels at \$140 per barrel, prices have since dropped as a result of the international financial crisis. As soon as the economy picks up, energy prices, too, will rise again. Higher prices will also result from the decreasing availability of fossil fuels due to the limited resources of raw materials, as well as the rapid development of global energy consumption.

Fig. 2
Worldwide energy consumption according to fuel type

Consumption in thousand million toe/p.a. (toe: tonnes oil-equivalent)



Source: International Energy Agency 2006

80 percent of total energy mix

In total, fossil fuels account for 79 percent of the energy mix worldwide (Fig. 3). Renewables account for 14 percent, nuclear 7 percent. The limited oil and gas reserves will, in the long term, not be able to cover the growing worldwide demand for energy (Fig. 4), even though the range of availability of oil and gas has hardly changed over the past 20 years because greater yields have been achieved through the continuing development of exploration technology and new findings.

Security of supply

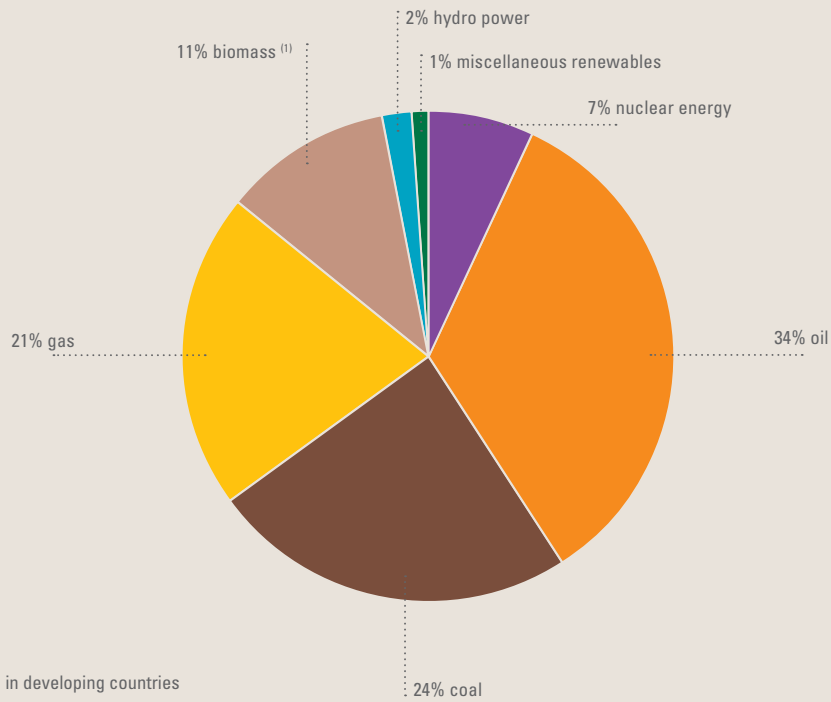
The strong concentration on fossil fuels bears substantial risks, particularly for western industrial nations, as they are largely dependent on imports for oil and gas. As many imports originate in regions with sometimes unstable political systems, there is a risk that raw materials and energy reserves will be misused as means of exerting power.

Reducing energy consumption worldwide

Fossil fuels, that took over 500 million years to accumulate, have been almost completely consumed in less than 200 years. Countries like the USA, Russia and the fast developing economies in Asia has to be persuaded that they also should initiate practical measures for saving energy and reducing emissions.

Fig. 3 Proportions of worldwide energy mix

Fossil fuels account for 79% of the energy mix worldwide

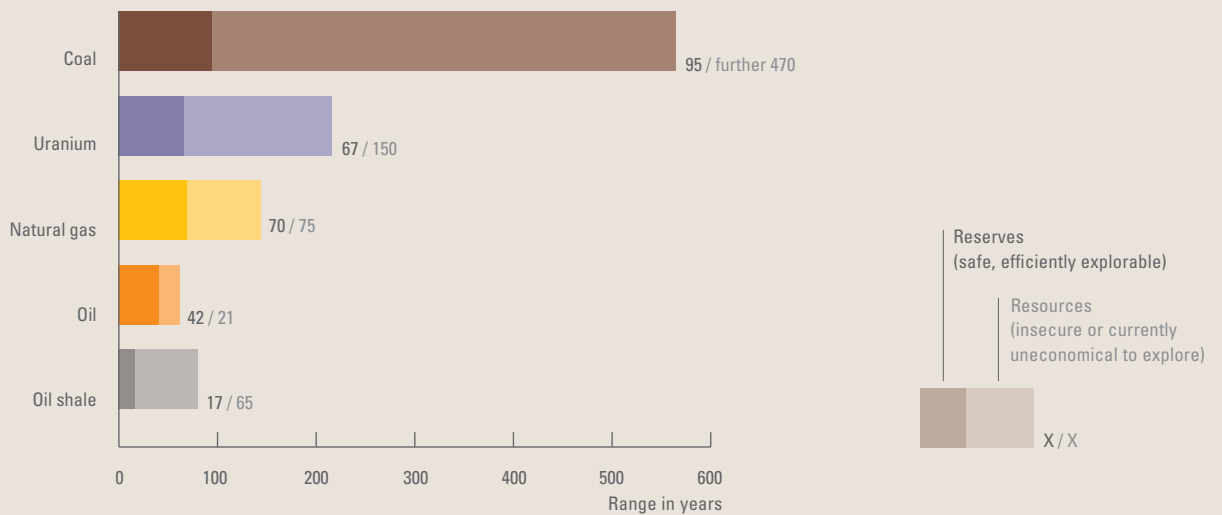


⁽¹⁾ Incl. wood as fuel, manure for heating in developing countries

Source: Handelsblatt online with reference to the IEA (World Energy Agency); German Federal Government "Status report on energy provision 03.04.2006"

Fig. 4 Range for different fuel types, worldwide, in years

Oil and gas reserves will not, in the long term, be available in sufficient quantities



Source: German Federal Government "Status report on energy provision 03.04.2006"

[1.3] Climate protection requires political action

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The increasing consumption of oil and gas has not only economically far-reaching consequences. The harmful influence on our climate of the CO₂ emissions resulting from combustion force us to take action. Here too, the solution is more a question of improved efficiency combined with an increasing use of renewables.

Stopping global warming

According to research by the Intergovernmental Panel on Climate Change of the United Nations (IPCC), if a global catastrophe is to be avoided, the average temperature must not increase by more than 2 °C compared to what it was before the Industrial Revolution. To achieve this, CO₂ emissions would have to be halved by 2050. In reality, however, they have risen by 25 percent to 27 million tonnes per annum compared to 1990 (Fig. 5).

UN climate conferences

Since the Kyoto Protocol of 1997, there have been 14 international climate conferences. The aim of the UN climate conference in Copenhagen in 2009 is the

adoption of a new World Climate Agreement that should come into force in 2012. Part of this new agreement should be an obligation on the developing countries to take unequivocal measures towards protecting the climate, support of the developing countries with climate-friendly technology, as well as the creation of financial incentives to protect tropical rainforest.

EU twin strategy

Away from the global level, concrete aims to protect the climate, save energy and extend the utilisation of renewables have already been agreed at the European level. The EU Commission wants to see annual CO₂ emissions in Europe reduced by at least 20 percent compared to 1990. In addition, by 2020 the proportion of renewables should be increased by 20 percent and total energy consumption lowered by 20 percent.

A twin strategy has been adopted to implement the energy-political goals, envisaging both an increase in energy efficiency and the utilisation of renewables in order to replace fossil fuels.

Heating of the earth's atmosphere by CO₂ emissions must be limited, and the rainforest must be preserved.

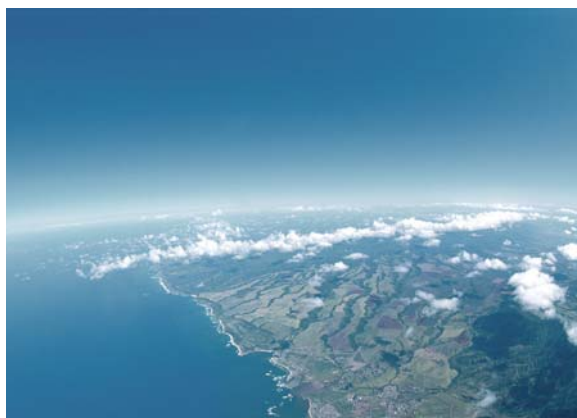
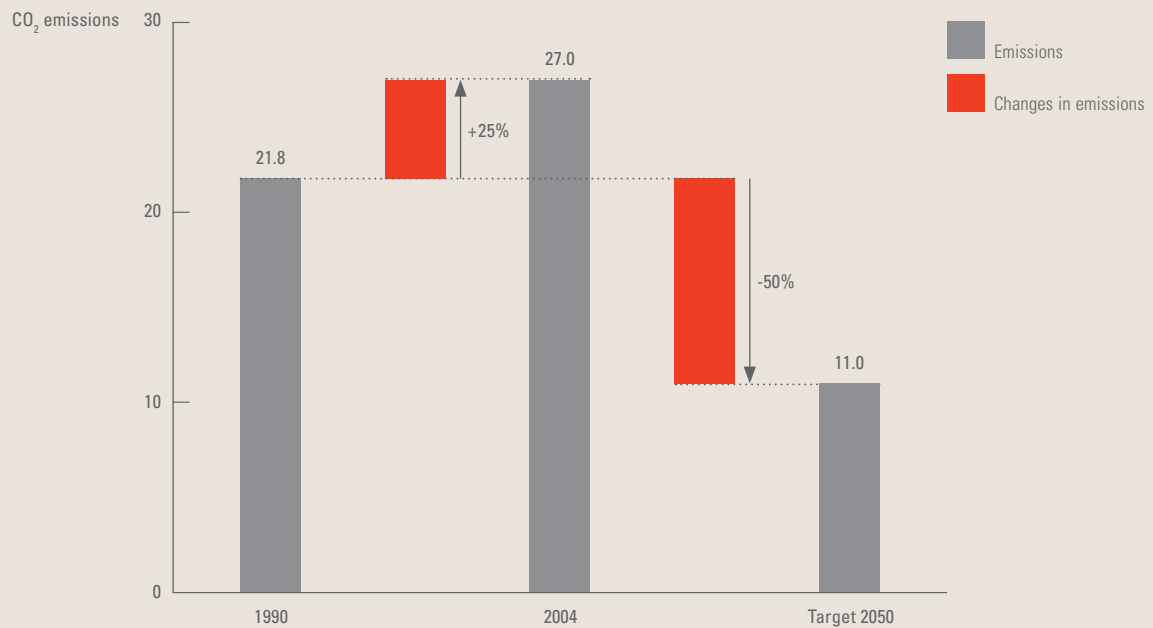


Fig. 5 CO₂ emissions worldwide in thousand million t

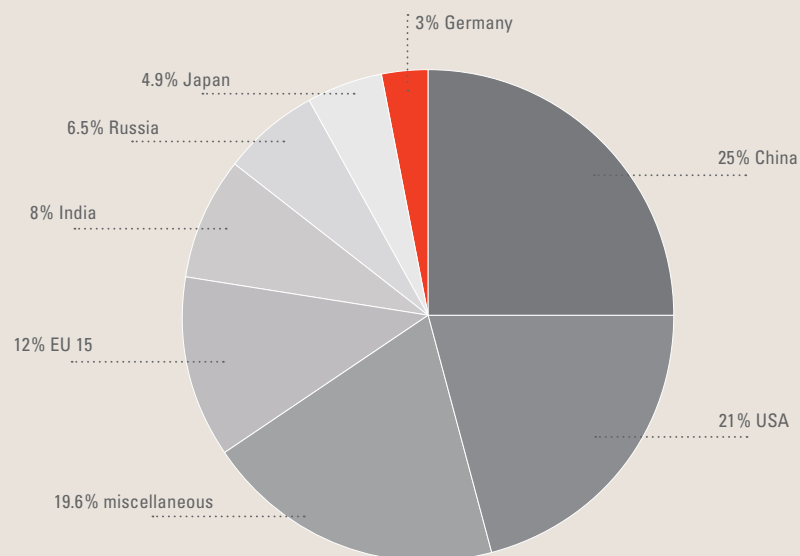
CO₂ emissions must be halved by 2050
if a global catastrophe is to be averted



Source: German Federal Government "Status report on energy provision 03.04.2006" with reference to the working party "Energiebilanzen und Statistisches Bundesamt"

Fig. 6 CO₂ emissions worldwide in %

China has overtaken the USA as the main emitter of CO₂



Source: The Netherlands Environmental Assessment Agency 06/2008 and in-house calculations

[2] Energy and climate policy

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Exploiting market potential.

To implement the political twin strategy, the Federal Government has developed an "integrated energy and climate programme". The heating sector can make an important contribution towards achieving the energy and climate goals. At around 40 percent, heat generation accounts for the greatest proportion of energy consumption – and most CO₂ emissions. In view of the largely outdated heating systems a significant speeding up of modernisation in private homes is an absolute must.

[2.1] Political goals and strategies of the German Federal Government

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With a proportion of only three percent of worldwide CO₂ emissions, reducing consumption and emissions in Germany can only play a subordinate role in the general reduction of environmental pollution. Nevertheless, a highly technical industrial nation such as Germany should be the forerunner when it comes to climate protection and sustainability.

Integrated energy and climate programme

As part of the national energy summit, concepts for greater security of supply, climate protection, energy efficiency and cost stability with realistic chances for the future were developed. On this basis, and as the implementation of the EU twin strategy, the Federal Government has developed its "integrated energy and climate programme". Its quantitative goals for 2020 are:

- 20 percent energy savings
- 20 percent renewables
- 40 percent CO₂ reduction, relative to 1990

In this context, 29 acts of parliament were revised or newly developed. The most important regulations arise from the Renewable Energy Act, the Renewable Energy Heating Act, the CHP Act and the Energy Savings Order.

The larger European countries have already taken individual measures to encourage energy efficiency and the substitution of fossil fuels through renewables.



Limited potential of renewables

Renewables can make an important contribution to achieving the energy and climate-political aims. However, they cannot do it alone. Fossil fuels account for almost 80 percent of the current energy mix. Until now, renewables have only achieved a comparatively low proportion of 8.6 percent, of which biomass accounts for two thirds. All other renewables hardly manage single-digit percentages, relative to total energy consumption.

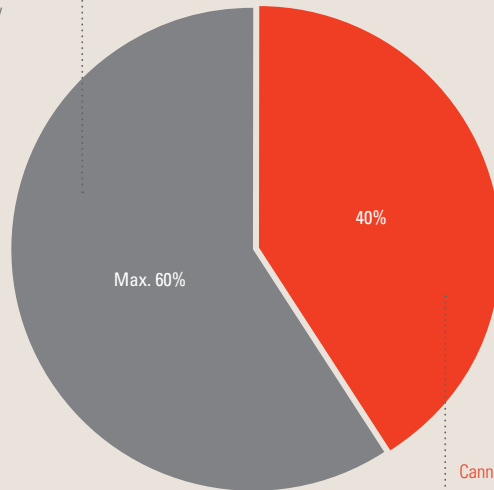
The available potential of renewables corresponds to roughly half the current net energy demand. Even in the long term, almost half the total energy demand will need to be covered by fossil fuels, even if 100 percent realisation of the potential of renewables were achieved (Fig. 7). In other words, oil and gas will retain their major relevance as energy sources for the foreseeable future. Increasing efficiency in the use of oil and gas offers the best potential for achieving efficient and climate-friendly energy provision in the immediate future. One prerequisite for this is the utilisation of highly efficient condensing technology in existing buildings, as it offers efficiency levels significantly in excess of 98 percent.



Fig. 7 Substitution potential through renewables, based on energy consumption in 2005 in Germany

Even in the long term, renewables will not be able to cover the German energy demand

Can be substituted by renewables (at 100% realisation of potential): Up to 1 518 TWh (60% of net energy consumption in 2006, out of 2 541 TWh)



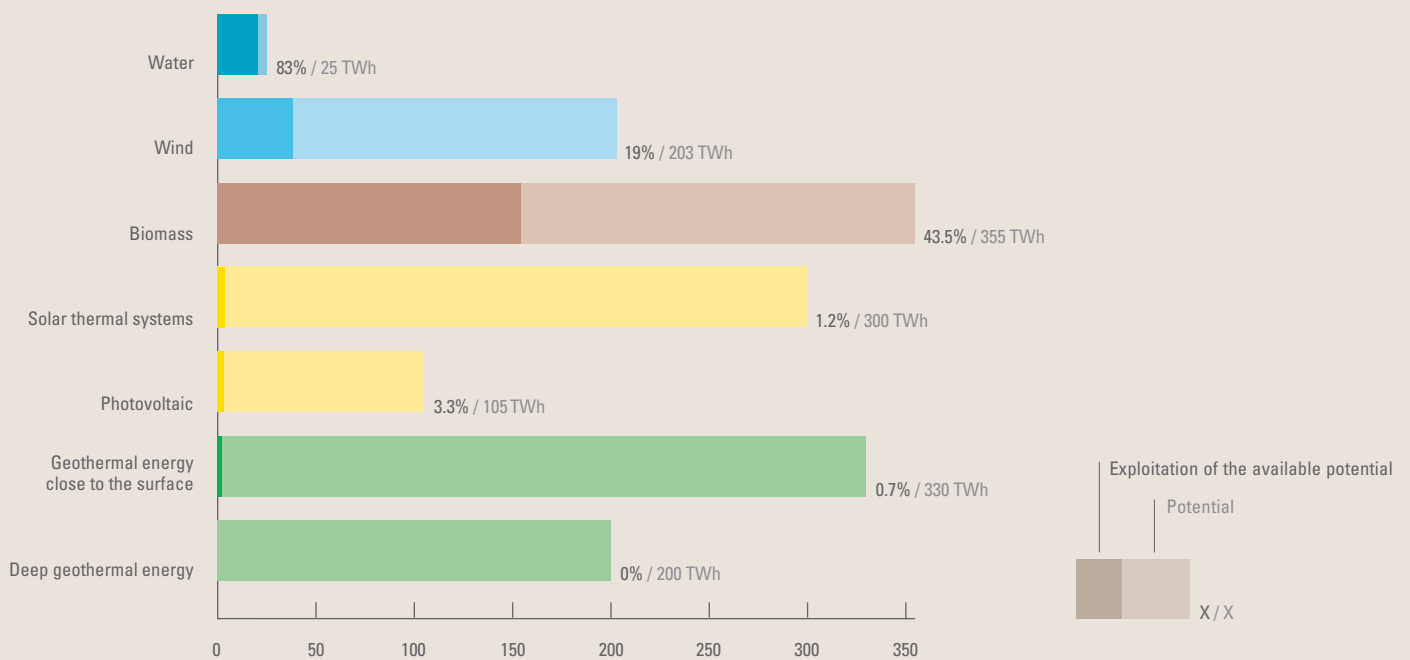
Cannot be substituted – to be reduced through improved efficiency: Remaining portion 1 023 TWh

This distribution applies not only to Germany, but to all western industrial nations.

Source: BMU "Renewables in figures – 2008", Viessmann analysis

Fig. 8 Available potential of renewables according to fuel type

Subject to fuel type, the potential offered by renewables is exploited to a different degree



Source: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety/ Working Group on Renewable Energies (AGEE) "Development of renewables during 2007 in Germany", Viessmann analysis

Total potential: 1 518 TWh
Max. coverage: 60%
(Net energy consumption 2006)

[2.2] The heating market – a sleeping giant

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The heating market has the largest share of energy consumption with around 40 percent, and therefore also the highest CO₂ emissions (Fig. 10). The sectors "Transport", "Traffic" and "Power" follow with significantly smaller proportions. The central lever to reduce energy consumption quickly is an improvement in efficiency (Fig. 11). Additional potential is offered by increased utilisation of combined heat & power units for the generation of heat and power in parallel.

Advancement of the modernisation of existing buildings

The heating sector offers particularly favourable conditions for the consistent translation of the political twin strategy. The prerequisite for this is a significant increase in the rate with which the current stock of properties is modernised, since most heating systems used in Germany are well past their best. At the moment, only ten percent of all heating systems reflect state of the art technology.

30 percent energy savings in the heating sector are feasible in the short term

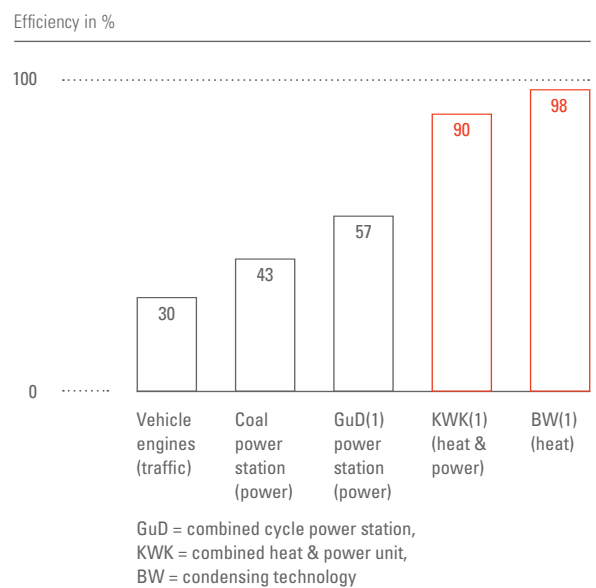
Replacing outdated systems with advanced condensing boilers and enhancing them with solar thermal systems, heat pumps, biomass boilers and thermal insulation would save 30 percent of energy in the heating sector. That represents a reduction in the total energy consumption in Germany of more than 12 percent. Adding biofuels, such as bio-oil and biogas, into the existing infrastructure would enable additional savings to be achieved.

Exploitation of existing potential

Measures to bring about climate protection and energy savings must be designed so that they can be implemented cost-effectively. The potential of renewables is inadequate to cover the net energy

Fig. 9

Condensing technology is the most efficient converter of energy



Source: German Federal Government "Status report on energy provision 03.04.2006"

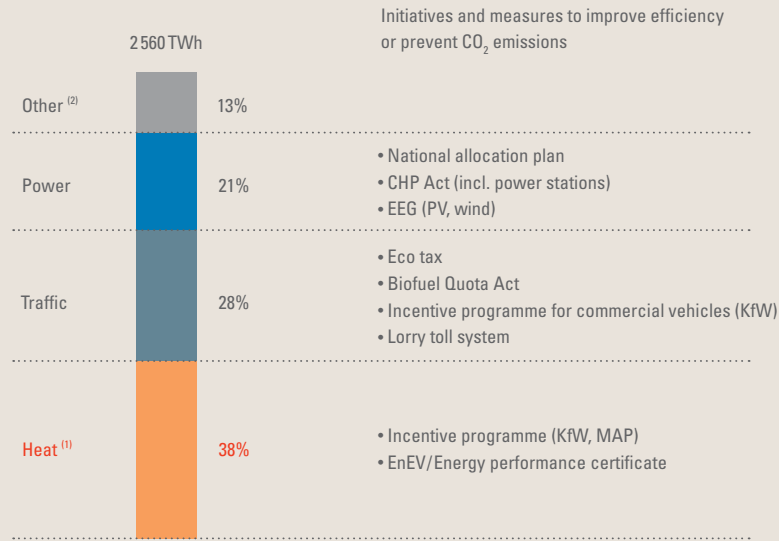
consumption. Consequently energy savings through improved efficiency are a must, which also applies to renewables. Utilising existing efficiency technology is the biggest lever – ahead of substitution. Both approaches are realistic today with technology already available on the market.

A balanced subsidy policy – efficiency, CO₂ reduction and economy as benchmarks

Energy efficiency and a contribution to reducing CO₂ emissions should be the determining criteria for assessing individual technologies. When politicians develop means of support, they must therefore follow an approach that is open to technology. The excellent cost/benefit ratio of condensing technology and its substantial contribution to preventing CO₂ emissions also find an echo in public subsidy policies, such as in the condensing bonus that is part of the market incentive programme (MAP) designed to encourage the modernisation of heating systems.

Fig. 10 Net energy consumption 2006 in Germany

The heating market offers the greatest potential for conserving fossil energy and for CO₂ reduction



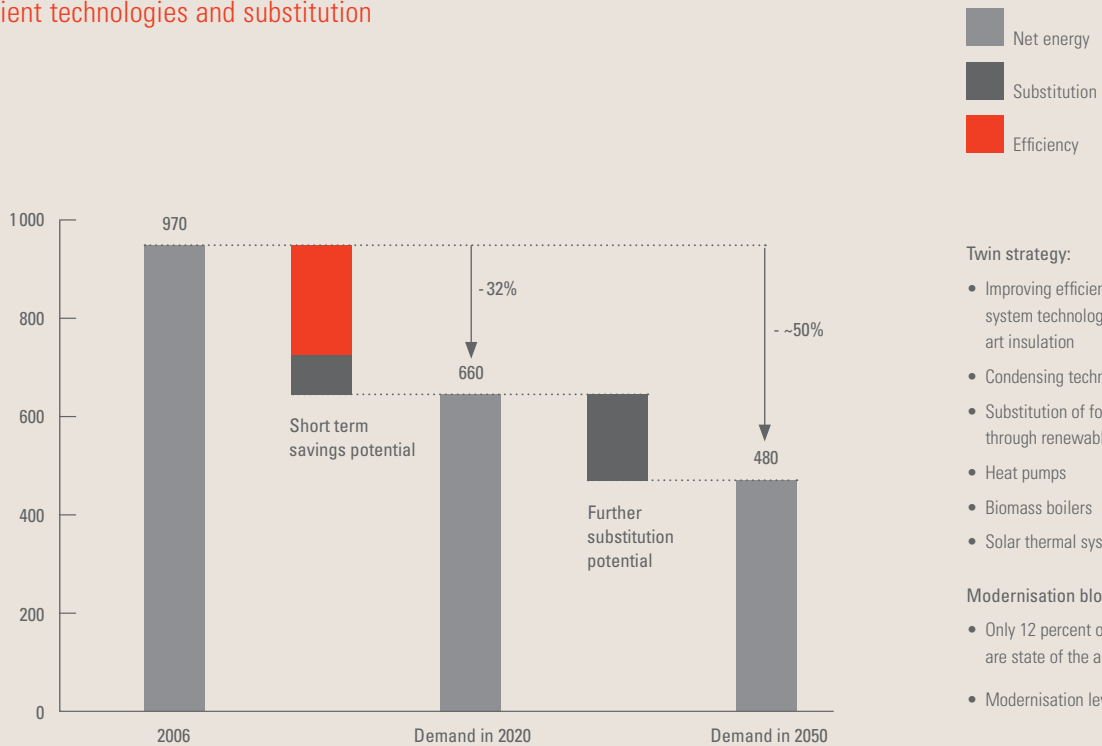
⁽¹⁾ Central heating, DHW (excl. industrial process heat)

⁽²⁾ Especially ind. process heat, ind. mech. energy etc.

Source: Association of the German Electrical Industry (VDEW)/Working Group on Renewable Energies (AGEE), National Climate Protection Programme 2000/2005, Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, Federal Ministry of Economics and Technology

Fig. 11 Fossil fuel savings potential from using efficient technologies; energy consumption in TWh

Oil and gas consumption can be reduced significantly through efficient technologies and substitution



Twin strategy:

- Improving efficiency through advanced system technology and state of the art insulation
- Condensing technology
- Substitution of fossil fuels through renewables
- Heat pumps
- Biomass boilers
- Solar thermal systems

Modernisation blockage:

- Only 12 percent of systems in Germany are state of the art
- Modernisation levels must be doubled

Source: Energy efficiency research by Prof. Kleemann (January 2007)

[3] The Efficiency Plus project – on the way towards sustainability

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Consistently improving resource efficiency in every sector.

The "Efficiency Plus" concept improves overall resource efficiency. The priority here is efficient energy utilisation and frugal consumption. Innovative measures sustainably reduce the use of power, oil and gas. Crucial to this is the increase in efficiency on the consumption and generation side, as well as the substitution of fossil fuels through renewables. With this "Efficiency Plus" model, we highlight our role as an industry leader in innovation and technology.

[3.1] Viessmann – the environmental pioneer

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Hesse Environmental Alliance

Eco Management and Audit Scheme (EMAS) of the EU

European Business Award for the Environment

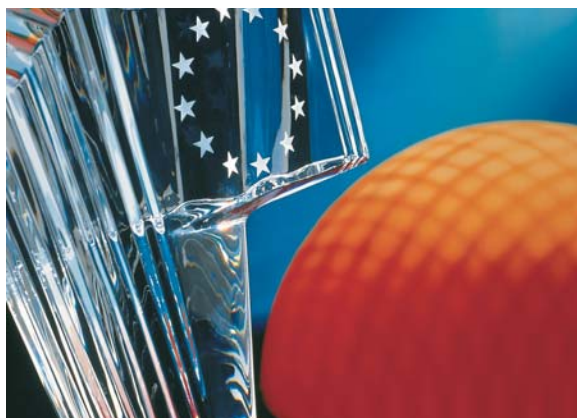
The third generation now leads this family business. This makes us aware of our social responsibility towards our local employees, as well as towards safeguarding the future of generations to come.

Solutions to benefit the environment

The continuing improvement of measures that protect resources and the environment is an essential component of our company philosophy. The efficient handling of available energy reserves and the reduction in CO₂ emissions are an expression of the company's technical ability to innovate.

This not only applies to our advanced, futureproof and environmentally responsible products, but also to the energy-efficient nature of our Allendorf site. These are the cornerstones for retaining and creating jobs, for healthy growth and competitiveness in international markets.

The Matrix radiant burner, winner of the European Business Award for the Environment, ensures extremely clean combustion.



Pioneers in protecting the environment

As a recognised environmental pioneer, we are members of the "Hesse Environmental Alliance" and were the second company in Germany and the first in our sector to be certified according to the EMAS standard. Over the years, we have developed many environmentally-compatible products, such as the Matrix burner, which won the European Business Award for the Environment..

Through our cooperation agreement with the Nature and Biodiversity Conservation Union Germany (NABU), demonstrate our real commitment to preserving and protecting the environment.

Systems for renewables

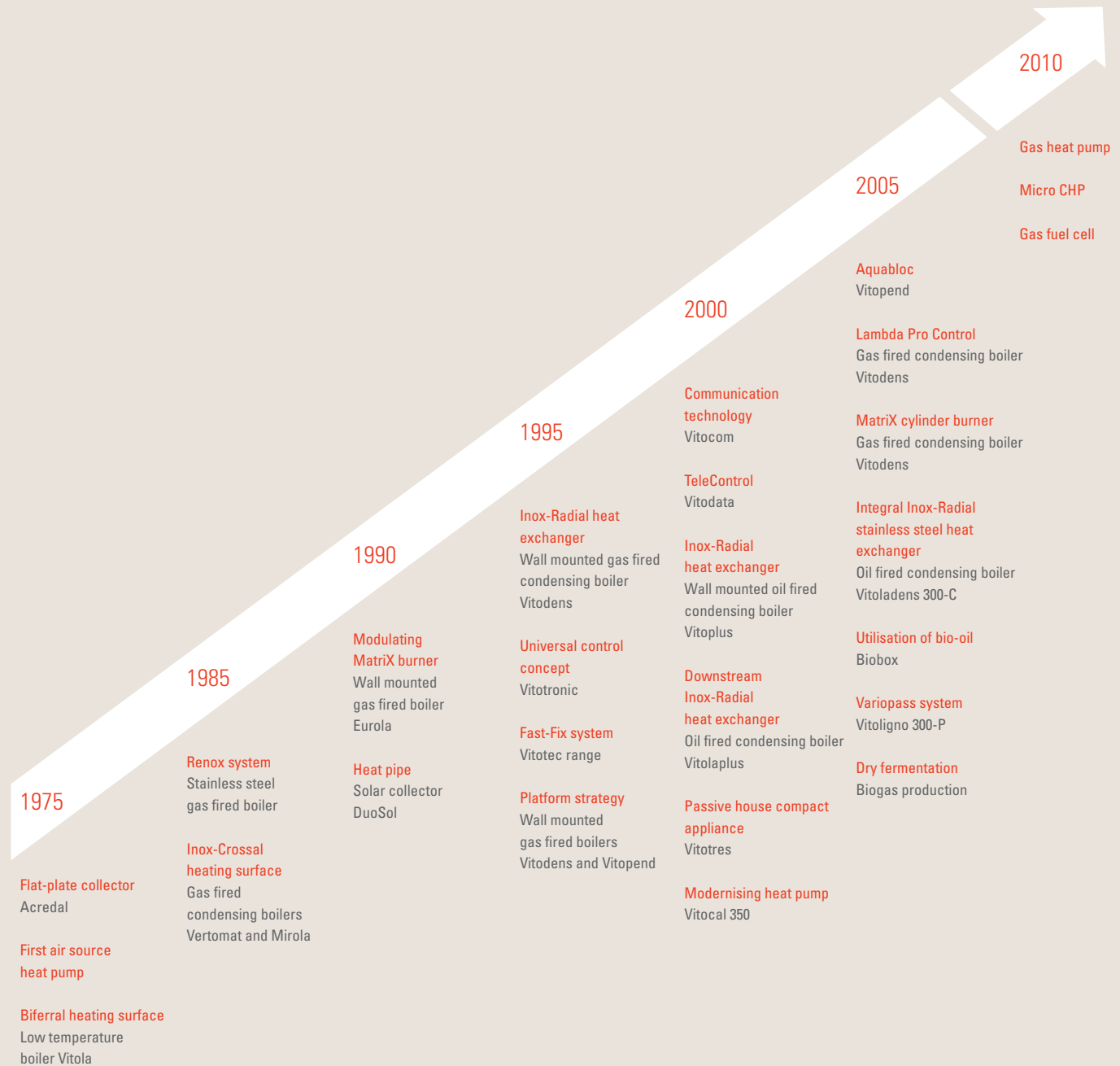
Viessmann began to develop and manufacture powerful systems for the utilisation of renewables more than 30 years ago, and can therefore call on extensive experience. Heat pumps and solar thermal systems were our primary interest, followed by solid fuel boilers that utilise wood, the sustainable fuel.

Efficient and environmentally responsible – solar collectors for DHW heating and central heating backup from Viessmann.



The path to sustainable energy utilisation

We are working on the improvement of existing technologies and the development of new ones. Our aim is to conserve fossil fuels by improving efficiency and the viable use of renewables.



[3.2] Global concept for climate protection, efficient use of resources and job security

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We are one of the leading manufacturers of heating technology, and can therefore offer our customers innovative products that are of top quality and work with energy efficiency and durability. To safeguard the competitiveness and environmental compatibility of our products and processes, a forward-looking concept for greater efficiency has been implemented at our Allendorf site.

Innovative energy provision for the factory/ head office site

Heating and air conditioning technology is our business. We have, therefore, relied on our own expertise to take us forward not just where energy efficiency in our production is concerned, but to also set new benchmarks when it comes to the heat and energy provision of the entire site.

Implementation of ambitious goals

We have cut down on the fossil fuels previously used to provide energy by 40 percent, and at the same time we have reduced CO₂ emissions by 31 percent

(Fig. 12). In addition, technological innovations, such as the use of biogas, make valuable contributions. With the "Efficiency Plus" project, Viessmann demonstrates at its own manufacturing site that the political goals with regard to climate and energy can already be achieved today with commercially available technology.

Improved resource efficiency

Efficiency Plus sets new benchmarks in resource efficiency. Apart from energy efficiency, operational and material efficiency, too, have been significantly improved. Part of this development has involved making structures and processes in production leaner and more flexible and introducing continual improvement processes. Where material usage is concerned, we are committed to designing products for the lowest possible material use, the consistent avoidance of waste and encouragement of recycling.

Viessmann factory/head office site, Allendorf.



Fig. 12 Efficiency and substitution

Aim: 40% reduction in fossil fuels and one third less CO₂ emissions –
incl. utilisation of biogas from our own biogas plant from 2010

Efficiency Plus – short term implementation of political climate
goals with technology available on the market today

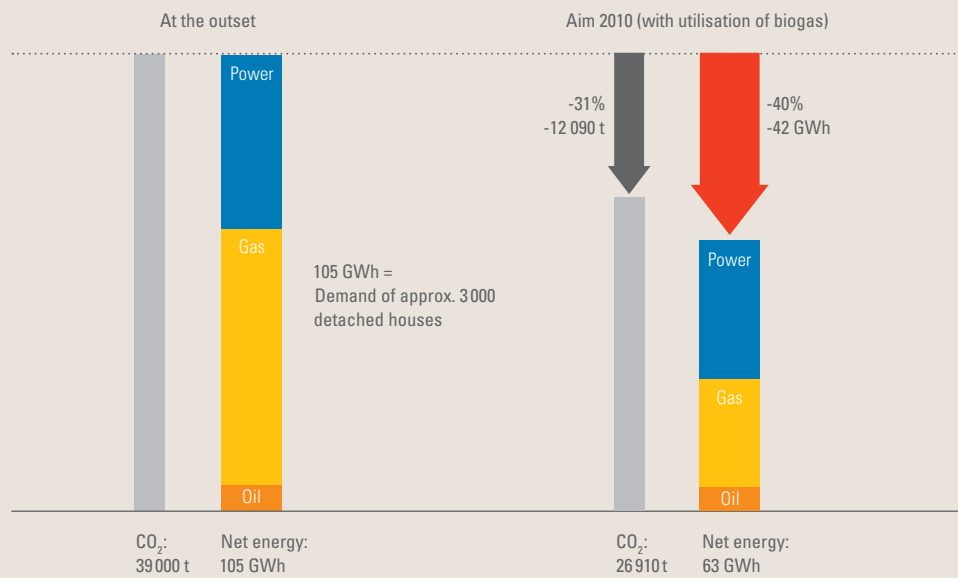
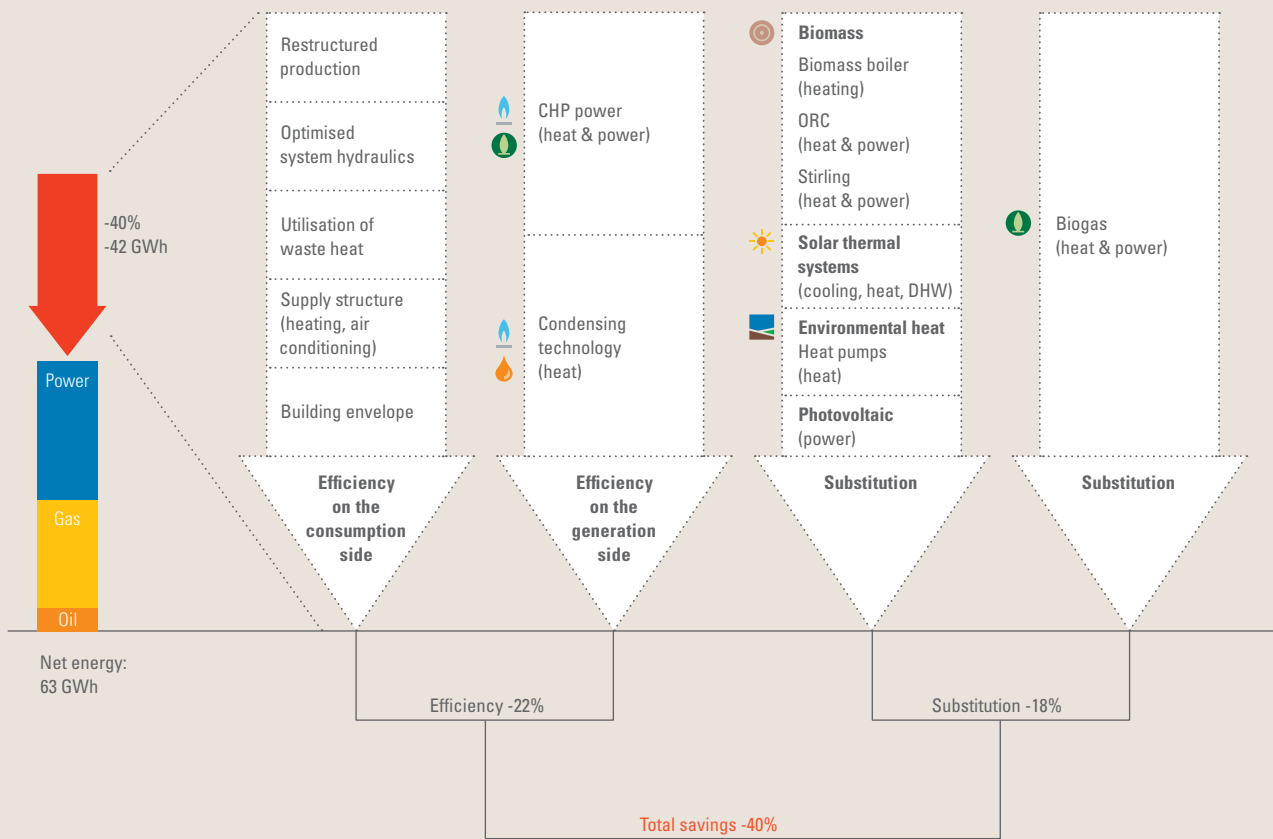


Fig. 13 Efficiency and substitution

Aim: 40% reduction in fossil fuels and one third fewer CO₂ emissions

Effective measures towards substitution, and to raise efficiency levels on the generation and consumption side



[3.3] A factory for the 21st century – operational and energy efficiency on the consumption side

On the consumption side, energy demand has been consistently minimised at the Allendorf site.

Important measures taken to achieve this were the remodelling of processes and company structures, the forward-looking renewal of production facilities, the increased utilisation of waste heat, a consistent supply structure for heating and air conditioning, and the insulation of the building envelope.

Remodelling the production facilities

Remodelling production has resulted in improved utilisation of production facilities and reduced workflow paths. New machines with high efficiency drives consume less energy, and in addition, demand-matched machine control has been able to reduce idle time losses. Even the lighting is controlled subject to demand. Workflow efficiency has been significantly increased by condensing the production area from 109 000 m² to 78 000 m².

Energy savings: 6.3 GWh/p.a.
CO₂ reduction: 1 995 t/p.a.

Optimised system hydraulics

The efficiency oriented modernisation of production facilities optimised the system hydraulics in the entire factory, e.g. through the use of variable speed circulation pumps and variable speed compressed air production.

Energy savings: 345 MWh/p.a.
CO₂ reduction: 134 t/p.a.

Utilisation of waste heat

Recovering waste heat from the test bed and from all compressors, channels additional energy to the heating system, realising savings of 30 percent heating energy in the respective areas. The waste heat is also used in summer (e.g. for washing systems).

Energy savings: 3 733 MWh/p.a.
CO₂ reduction: 850 t/p.a.

Supply structure – heating and air conditioning

By controlling the convector heaters separately and according to demand, plus improved pipework insulation, significant savings have been achieved in connection with heat distribution around the site. The waste heat from the powder coating plant is also utilised for heating fresh air through the deployment of rotary heat exchangers. In addition, a heating centre with heat sources in a cascade has realised further savings potential.

Energy savings: 3 221 MWh/p.a.
CO₂ reduction: 481 t/p.a.

Insulation of the building envelope

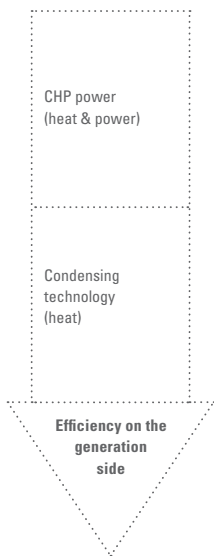
The new entry sluice with door air curtains and quick-acting door closers ensure that less heat escapes when entering or leaving the factory buildings. Thermally insulating the walls and replacing single glazing with thermal glazing has further minimised the heat losses from the factory.

Energy savings: 1 663 MWh/p.a.
CO₂ reduction: 248 t/p.a.



[3.4] The innovative energy centre – energy efficiency and renewables on the generation side

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Apart from the consistent reduction of energy demand on the consumption side, the substitution of oil and gas through renewables, as well as improvement of efficiency on the generation side, are further effective levers to lastingly reduce fossil fuel consumption and CO₂ emissions. In particular, the increasing use of biomass enables substantial potentials to be exploited.

Efficiency

Combined heat and power unit

An advanced gas-driven combined heat & power unit generates heat and power in one. In this process, a combustion engine drives an electric generator, and the generated power is fed directly into the on-site network. The waste heat from the engine and the heat from the exhaust gas are used via a heat exchanger to heat the building. The CHP unit can operate with natural gas or biogas.

Power generation: 1335 MWh/p.a.
CO₂ reduction: 320 t/p.a.

Condensing boiler

Condensing systems sustainably increase efficiency when generating heat from gas and oil. The basis for this lies in yielding additional heating energy from the flue gas. Because of the high demands condensing technology makes of materials, heating surfaces are made from high grade stainless steel. Highly efficient compact condensing boilers ensure a utilisation rate of up to 98 percent. These are also designed for a proportional use of biogas.

Energy savings in natural gas: 1108 MWh/p.a.
CO₂ reduction: 165 t/p.a.

Flue gas/water heat exchanger for industrial/commercial boilers

Industrial/commercial boilers operated with either oil or gas are equipped to utilise condensing technology with flue gas/water heat exchangers. These cool down the flue gas temperatures so that water vapours condense. This releases latent heat, and the low flue gas temperatures ensure an increase in the utilisation rate of up to 12 percent.



Substitution

ORC (Organic Rankine Cycle) for power & heat

A high performance woodchip boiler with integral steam turbine generates not only heat (1 105 kW), but also power (191 kW). This utilises renewables also for the power generation on site.

Power savings: 1 148 MWh/p.a.
CO₂ reduction: 446 t/p.a.

Energy savings in natural gas: 7 195 MWh/p.a.
CO₂ reduction: 1.073 t/p.a.

Woodchip boiler with Stirling engine for heat & power

A woodchip boiler with connected Stirling engine generates 75 percent heat (240 kW) and 11 percent power (35 kW) from biomass.

Power savings: 147 MWh/p.a.
CO₂ reduction: 57 t/p.a.

Energy savings in natural gas: 1 593 MWh/p.a.
CO₂ reduction: 238 t/p.a.

Heat generated from biomass

Through using a pellet and a woodchip boiler with output of 220 kW and 300 kW respectively, natural gas has been replaced by solid biomass.

Energy savings in natural gas: 1 836 MWh/p.a.
CO₂ reduction: 274 t/p.a.

Solar energy for heating and air conditioning

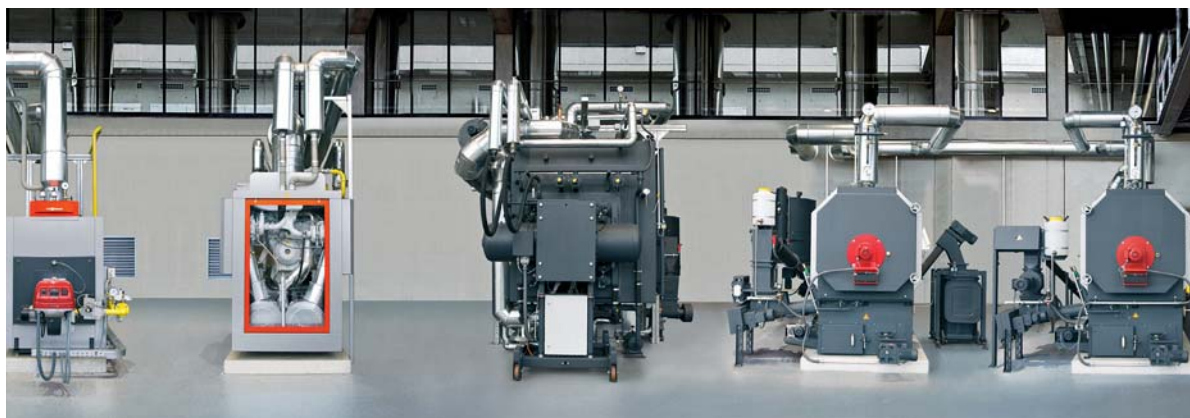
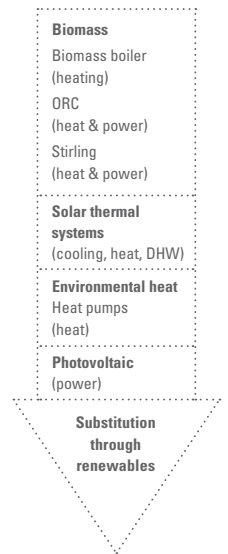
The solar thermal system comprises 70 vacuum tube and flat-plate collectors. The absorption refrigerator with a cooling capacity of 49 kW delivers savings of 14 MWh electrical energy at 1 000 hours of full utilisation per annum. An additional 55 MWh electrical energy are saved per annum through the use of an advanced sorption ventilation system.

Utilisation of heat from the ground and the environment

Eight heat pumps that draw on natural heat are used in the academy for the benefit of the factory areas. With the aid of ambient air and five geothermal probes that reach almost 100 metres into the ground, these heat pumps achieve a total heating output of 60 kW.

Generating power from the sun

Solar energy is also used to generate power. 72 photovoltaic modules with polycrystalline cells generate 19.3 kW_p of power.



Boiler room at the energy centre (from left): Hot water boiler with flue gas heat exchanger, low temperature boiler, hot water boiler with flue gas heat exchanger, condensing boiler, CHP unit, woodchip boiler with generator (Stirling), woodchip boiler, pellet boiler.

The new energy centre not only delivers the total demand for heat and air conditioning to the Viessmann Allendorf site, but also feeds in power from the CHP unit into the grid. In addition, it is a useful part of the Viessmann Academy in that it is used for training and advanced courses for Viessmann staff and trade partners, as well as the advanced training of international experts from the heating industry.

Here, decision-makers and consultants from the worlds of politics and economics can clearly see how the twin strategy can already be implemented today.

Overview of the energy centre

	Biomass	Natural gas	Biogas	Fuel oil	Biofuel oil	Solar energy	Rated output (kW)	Power output (kW)
Hot water boiler + flue gas heat exchanger (condensing)		x	x	x	x		6 860	
Low temperature boiler		x	x	x	x		5 900	
Hot water boiler + flue gas heat exchanger (condensing)		x	x	x	x		1 858	
Condensing boiler		x	x				895	
Combined heat & power unit		x	x				496	344
Woodchip boiler with generator (Stirling)	x						240	35
Woodchip boiler	x						300	
Pellet boiler	x						220	
Woodchip boiler with turbine (ORC)	x						1 105	191
Solar thermal system (heating and air conditioning)							150	
PV modules with polycrystalline cells								19
Heat pumps							60	
Total							18 084	589



[3.5] Biomass and biogas – fuels with a future

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Biomass

Today, biomass already accounts for 70 percent of all deployed renewables. This is of benefit to you because it is an indigenous fuel that does not require transportation from distant regions of the world. In addition, biomass is available all year round and can be stored, unlike solar energy and wind power. We therefore rate its future significance highly.

By integrating the Austrian biomass specialists KÖB and Mawera into the Viessmann Group, we have laid important foundations for successful future development. For the heat provision in our own factory, we also use biomass as fuel. For this purpose, we have planted short-rotation poplar coppices that will be harvested after three years and turned into woodchips. The yield is up to 5000 litres of oil equivalent per hectare/year. In addition, planting the short-rotation coppice also gives us an opportunity to gain experience in this innovative kind of energy generation across the entire process chain to help us to optimise it further.

Utilisation and research

The results from our horticultural enterprise will be used to improve yields and optimise combustion characteristics. In addition, we have set ourselves the goal of driving the development of efficient harvesting methods and innovative solutions for shredding and storing biomass.

Looking towards the future: Oil and gas go green

In the future, biogas and bio-oil will be mixed into natural gas and fuel oil. This enables advanced condensing technology for oil and gas to be combined with the utilisation of liquid or gaseous biomass as fuel. The benefit lies in the unlimited use of the existing heating system infrastructure. The efficient utilisation of biofuels in advanced heating systems is also proven in the new Viessmann energy centre in Allendorf.

After growing for three years, short-rotation coppice wood is machine-harvested and processed into woodchips in the field.



Biogas

We not only bank on solid, but also on liquid biomass as a renewable fuel. Biogas can be yielded through innovative and environmentally compatible processes and can be deployed to generate power and heat. BioFerm GmbH, a member of the Viessmann Group, is building a powerful biogas plant at the Allendorf site. BioFerm is a technological market leader in dry fermentation plants that utilise residuals and waste products from landscape gardening and agriculture to yield biogas.

Benefits of dry fermentation

The fermentation of solids (dry fermentation) requires less preparation than wet fermentation, since the biomass to be fermented does not need to be converted into a state in which it can flow or be pumped. Upon entry into the fermenter, the biomass is mixed with air and methane bacteria and is then stored and fermented. Except for the filling and emptying of the biomass by means of vehicles, the entire system is under full and automatic control and supervision.

No conflicts of use with agriculture

At the Allendorf site, the biogas system is fed with biomass waste from set-aside pasture, greenstuff from the maintenance of public green spaces and with greenery from measures of nature preservation, as well as from the local airfield. The implementation of this concept avoids conflicts of use with agriculture; in fact, quite the contrary is the case. Fermentation residues from this process are supplied to agricultural enterprises where they can be used as high grade fertiliser.

Important contribution to Efficiency Plus

With an output of 2.4 GWh per annum, the biogas plant makes an important contribution to the replacement of fossil energy at the company's head office and factory. This innovation and the other Efficiency Plus measures combined, deliver savings of 40 percent in this sector. At the same time, CO₂ emissions are reduced by the biogas system by 500 t/p.a. which improves the Efficiency Plus balance even further.

Biogas is yielded through an innovative and environmentally sensitive process in a dry fermentation plant.



[3.6] Viessmann comprehensive product range for all fuel types

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Viessmann offers advanced heating technology for every type of fuel.

The perfect solution for every need, by design

Our comprehensive product range is the best preparation for future economical and energy or climate-political challenges. It offers advanced heating systems for every type of fuel – oil, gas, solar, wood, natural heat – and for every output from 1.5 to 20000 kW. The range is clearly divided into the categories 100, 200 and 300, both technically and in terms of price, and so is able to offer a suitable solution for any application – with everything supplied from a single source, with perfectly matching system components.

Objective consultation and independence from fuel type

The comprehensive product range from Viessmann enables our experts to offer their clients objective advice independent of fuel type and to recommend a heating system that ideally suits the individual demand.



Oil fired boilers
13 to 20 000 kW



Gas fired boilers
4 to 20 000 kW

	Oil fired boilers					Gas fired boilers				
300										
200										
100										

Summary of consumer benefits from Viessmann heating technology:



Fuel type

Viessmann offers forward-looking heating systems for oil, gas, solar, wood and natural heat, thus qualifying as an independent partner for all energy questions.



Product range categories

Our product range, categorised in three steps according to price and technology, offers the right solution for every need.








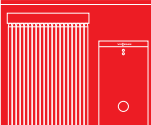










































Output ranges

Our heating systems meet every output demand from 1.5 to 20000 kW.



System solutions

Viessmann matches up all products and consequently offers an optimum level of efficiency – from the initial design to system operation.

 Solar heating and photovoltaic			 Wood boilers/energy from wood 4 to 13 000 kW			 Heat pumps 1.5 to 1500 kW			Air conditioning technology			System components		
														
														
														

[3.7] Summary and prospects

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Efficiency Plus – our contribution to resource efficiency and climate protection

The "Efficiency Plus" project is exemplary for its high resource efficiency and sustainability. The advanced and efficient energy centre, the varied application of renewables, as well as the remodelled production with its lean structures and processes impress with the efficiency potential that can be turned quickly and economically into reality in industrial companies with technologies currently available in the market.

Utilising efficiency in all sectors

- "Efficiency Plus" comprises a global project that represents a total investment over three years of €220 million.
- By avoiding processes that create no value (lean production) we were able to improve our operational efficiency by 10 to 20 percent.
- The "Efficiency Plus" project has enabled us to save 40 percent of oil, gas and power, whilst at the same time reducing CO₂ emissions by a third.

- Basis for this achievement is an integrated energy concept that combines savings in fossil fuels through improved efficiency (on the generation and consumption side) with sensible substitution through renewables.
- A further building block for this concept is the new academy and training centre, both of which make a vital contribution to the efficient advanced training of our employees and partners.

Political goals for 2020 already achievable today

With this model we have demonstrated clearly that the political goals set to be achieved by the years 2020 can already be achieved today. Almost all measures to improve efficiency and substitution on the generation side were achieved with commercially available products made by members of the Viessmann Group.



At Viessmann, we shall not rest on our laurels, since our actions follow the motto "nothing is so good that it cannot be improved".



climate of innovation

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