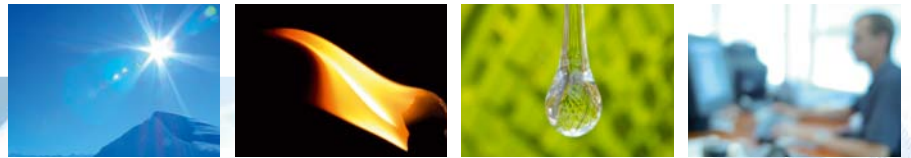


# Renewable Energy

Technological competence from Austria



UMBRELLA ORGANIZATION  
ENERGY-CLIMATE PROTECTION



WIRTSCHAFTSKAMMER ÖSTERREICH



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# Renewable Energy

Technological competence from Austria

## Red-White-Red Advanced Technology

Renewable energy technology always was and remains red-white-red. Austria has been able to maintain its pioneering role in this sector and further expansion is expected. Domestically the branch is in favor of research and development, production and implementation. The success of this strategy is confirmed by the huge demand from abroad.

## Finite nature of fossil fuels

The continual reduction of the fossil fuel resources naturally leads to increasing energy prices. In order to escape the volatility of the prices for energy and to ensure a permanent supply, a shift in the generation of energy from fossil fuels to renewable energy technologies is crucial. Austria has the technologies and the resources for the energy turnabout and is ready and able to implement them.

## Trend on the pulse of the time

An awareness and a market for the renewable energy technologies has not only developed because of natural disasters and the volatility of the energy markets for fossil fuels. Energy efficiency and saving energy, the reduction of CO<sub>2</sub> and the utilization of regenerative energy are omnipresent subjects, that no longer only affect the classic sectors such as heating, cooling and fuel, but in the meantime have also found their way into all areas of life. To be able to offer continually improved systems, re-



Ing. Dr. Ernst Hutterer, Chairman  
UMBRELLA ORGANIZATION  
ENERGY-CLIMATE PROTECTION

search and development is continuously promoted by the enterprises in Austria.

## Export market as sales market

The political-economical significance of the renewable energy technologies can also be seen in the export quotas of the products. The percentage of

### CO<sub>2</sub>-saving through renewable energy 2009

Electricity sector	19.76 million tons
Heat sector	8.86 million tons
Biofuels sector	1.64 million tons
Total	30.26 million tons

Source: Erneuerbare Energie in Zahlen 2010, BMLFUW



the export market of total sales in 2009 was about 47 percent for heat pumps, 70 percent for biomass boilers, 75.8 percent in the thermal collector sector and for photovoltaic modules even 91 percent.

#### Employment rate continuing to rise

In 2009 almost 37,000 people were employed in the sector of renewable energy technology in Austria, a rise of 4.8 percent compared to the previous year. The largest share of employment is the solid biomass sector, to which, with about 17,000 employees, almost 50 percent of the overall number of employees can be allocated. An increase in the employment figures in the sector is also expected in future. Currently there are already 185,000 so-called "Green Jobs" in Austria, meaning that every 20th job is green.

#### UMBRELLA ORGANIZATION ENERGY-CLIMATE PROTECTION: The official representation of the branch

It is in the basic interest of the UMBRELLA ORGANIZATION ENERGY-CLIMATE PROTECTION to utilize the market chances resulting from the implementation of the unavoidable energy turnaround.

To hold its ground in international competition and develop the energy turnaround, Austria needs a regulatory framework to accelerate the expansion of renewable energy. The UMBRELLA ORGANIZATION ENERGY-CLIMATE PROTECTION also supports the balance of interests of energy-consuming and energy-generating industries.

#### Information about products and companies

This brochure provides you with an overview of the technologies for the utilization of renewable energy manufactured in Austria. In the enclosed list of firms you will find the best contacts for your investments.

#### Effect of the technologies on jobs in 2009

Technology	Jobs
Biomass solid	17493
Biomass liquid	1869
Biomass gaseous	395
Geothermal energy	61
Small hydroelectric power	6857
Photovoltaics	2892
Solar heat	4906
Heat pumps	2164
Wind power	322

Source: Erneuerbare Energie in Zahlen 2010, BMLFUW

The UMBRELLA ORGANIZATION ENERGY-CLIMATE PROTECTION, the official representation of the branch within the Austrian Federal Economic Chamber (Wirtschaftskammer Österreich), is ready to support you in establishing company contacts.

Please visit our website:  
[www.energieklima.at](http://www.energieklima.at)

Ing. Dr. Ernst Hutterer



# Electricity, Heating and Cooling from Combined Heat and Power

Utilization of biomass in the steam power process

The coupled generation of electrical and thermal energy, precisely with regard to the preservation of resources and environmental protection, offers considerable benefits compared to the separate provision of these forms of energy. The principle of this technology is based on the specific uncoupling of steam from the steam turbine, which then covers the thermal energy requirement of the heat consumers. As a result very high total utilization rates of the plants can be achieved and the operators of the plants can reckon with proceeds from the sale of electricity and heat.

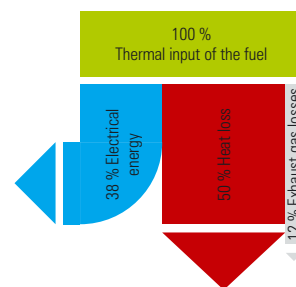
The use of biomass as primary fuel also offers the benefits of CO<sub>2</sub>-neutral generation of electricity and heat as well as the regional availability of the fuel. In addition the plant operator can profit from state promoted feed-in tariffs. There is an increasing use of biogenic waste, such as material from landscape management, screen overflows and mature timber as fuel in these plants. Precisely these fuels, with in some cases very high contents of water and ash, place the highest demands on the furnace and the steam generator. For a boiler output of 20 to 80 MWth, as a rule grate furnaces and fluidized-bed furnaces with water tube boiler are used since this guarantees high levels of efficiency and low emission values.



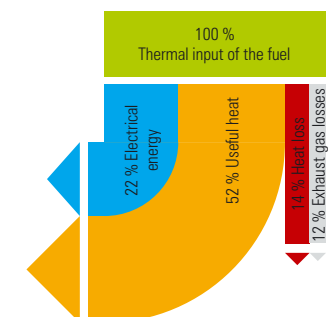
Biomass CHP

Therefore, as far as efficiency, environmental protection and availability are concerned, furnace and steam generator are advancing to become the heart of the plant.

## Energy flux steam process for electricity production

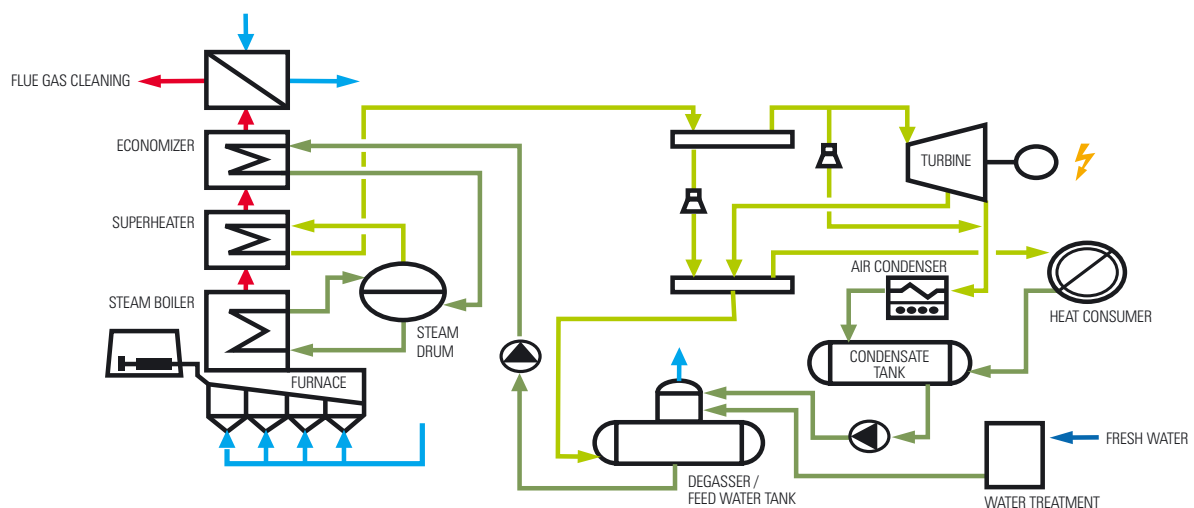


## Energy flux steam process with combined heat and power



© Source: BERTSCHenergy

## Process diagram of combined heat and power



# Biomass Biogas

Engines, Gen-sets and Cogeneration District Heating Plants



## Multitalent Biogas

Biogas is a gas rich in energy and similar to natural gas, that is produced from regional raw materials such as biogenetic waste, green waste, animal byproducts and renewable raw materials through fermentation. Intermediate crops and residues from the food industry are also possible raw materials for the production of this environmentally friendly supplier of energy. Biogas can be used as electricity, heat and fuel. It is independent of location and can also be stored.

## In line with the trend

At present in Austria 297 biogas plants with CHP-utilization, at an output of 77 MW, feed 535 GWh into the public power grid. In addition there are already eight biogas plants which treat the biogas produced to natural gas quality and then subsequently either use it directly as fuel or feed it into the natural gas network. In a bundle of measures the biogas technology can make an important contribution towards achieving 34 percent renewable energy. The versatile fuel presently contributes more than ten percent towards the eco-power produced in Austria (excl. hydroelectric power). Thereby about 215,000 tons of CO<sub>2</sub> are saved (compared with electricity produced in UCTE-Mix).

## Highly efficient: Biomethane

So much biomethane can be produced from one hectare of field or grassland, that these days on average 65,000 motor car kilometers can be driven with it. If

## Facts & Figures 2010

Jobs 2010	1,500 employees
CO <sub>2</sub> -saving 2010	215,000 tons CO <sub>2</sub>

Source: arge kompost & biogas

the biomethane is produced from pure NAWAROs (= renewable raw materials), it is even possible to drive twice around the world (equatorial circumference: 40,075.7 km) – and that also climate neutral – since only as much CO<sub>2</sub> is discarded, as was previously linked with the plant growth.

## Versatile use

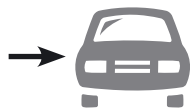
Depending on the conditions a local direct CHP or fuel application is possible or the treatment to produce valuable biomethane and its supply into the natural gas network. Consequently biogas is used where it is needed and is again ready as energy carrier for electricity, heat and fuel. Therefore biogas is an important element in the decentralization of the energy supply and can be used regionally as well as in a sustainable manner. A cover of five percent of the present natural gas consumption is striven for. This means a further expansion to 450 to 600 million Nm<sup>3</sup> of green biomethane, through which Austria's energy supply will again become more independent.

## Calculation basis of driving performance methane gas car 4.5 kg/100 km > emission reduction compared with petrol with 7.5 l/100 km

Excrement of 100 cows/year



Driving performance 430,000 km

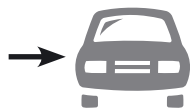


Emission reduction  
- 49 000 kg CO<sub>2</sub>-equivalent

Bio-waste and feces from 1,000 people/year



Driving performance 166,000 km

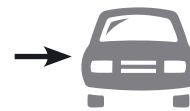


Emission reduction  
19 000 kg CO<sub>2</sub>-equivalent

1 ha or 1 1/2 football fields



Driving performance 81,000 km

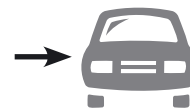


Emission reduction  
- 9 400 kg CO<sub>2</sub>-equivalent

1 ha or 1 1/2 football fields



Driving performance 40,000 km



Emission reduction  
- 4 700 kg CO<sub>2</sub>-equivalent

© Source: Umweltbundesamt, 2007



# Billet Wood, Wood Chip and Pellet Furnaces

Comfortable heating with wood

The energetic use of wood is the most traditional form of the utilization of renewable energy but also modern wood heating has its origin in Austria.

More than four decades ago native wood boiler manufacturers began to invest in research in the field of this forward-looking technology. With success: Their products are in great demand throughout the world.

### Technological market leadership and high export quota

Today in the biomass sector Austria is one of the technological market leaders in the world.

Austrian biomass boiler manufacturers export about 70 percent of their production. At individual companies the export quotas are even up to 99 percent.

The main export countries for biomass boilers from Austria are Germany and Italy. However the markets in France and Great Britain as well as Switzerland and Scandinavia are very much in the ascendancy. Initial export successes have also been recorded in Japan, the USA and Canada.

### Comfort, that has made itself worthwhile

Because of the continually rising sales and export figures, in recent years well-known Austrian manufacturers have made large investments in research, development and increasing production.

Modern billet wood, wood chip and pellet furnaces\* now refer to a comfort that is not inferior in any

### Forest and other forested areas in a national comparison 2010

Country	Area of forest in M ha	Area of forest as % of the country area
Austria	4	50
Germany	11	31
Great Britain	3	13
Finland	23	77
France	18	29
Greece	7	54
Italy	11	37
Sweden	31	76
Spain	28	55

Source: FAO, Global Forest Resources Assessment 2010

way to oil or gas firing. Also as far as efficiency and environmental compatibility are concerned, wood heaters from Austria are in first place. The high percentage of forest in many countries of the world enables the sustainable security of supply of the wood fuel.

### Heating for multi-family houses and entire cities

Better operability as well as the increased comfort (for example the automation of the fuel supply) have lead to a strong increase in the number of wood chip and pellet heaters installed. Branch insiders estimate the future potential as enormous. Medium performance biomass heating systems will in future also increasingly find entry into multi-family houses. Today entire cities are already supplied with heat via heating plants. Thereby the combination of heat production and electricity generation in biomass combined heat and power plants is a trend that opens up an even greater field of activity for the branch.



\*Pellets are pure, pressed saw- and wood chippings (without chemical bonding agent), which are distinguished by a high energy content, excellent heat value and environmentally compatible combustion. The ash can be used as valuable garden compost.

### Facts & Figures 2010

Turnover 2010	2,173 billion Euro
Jobs 2010	17,399 employees
CO <sub>2</sub> -saving 2010	9.4 million tons CO <sub>2</sub>

Source: Innovative Energietechnologien in Österreich – Marktentwicklung 2010, BMVIT



# BioFuels

Fuels of the future

In comparison to other sectors the biofuels in Austria are a relatively recent form of the utilization of renewable sources of energy. In 2009 its share in the total renewable energy in Austria was 6.6 percent. The fact that biofuels are greatly in trend – 26 percent growth from 2008 to 2009 – is linked both with the increasing prices for fossil fuels as well as with the EU-Climate-Strategy.

The EU-Biofuels-Directive, which is part of the EU-Climate-Strategy, called for 5.75 percent of all fuels to be biogenetic by 2010.

Austria converted the directive into national law in 2004 in the framework of an amendment of a fuel regulation, with the aim of already achieving this 5.75 percent by 2009. In 2009 the energetic share of the biofuels in the Austrian fuels market even rose to seven percent – a good starting basis, in order to connect with the EU objectives for 2020. These call for a share of ten percent for alternative fuels, the majority of which should come from biofuels. With that, in future even more opportunities will open up for this important segment.

## Production and potentials

In 2009 there were 14 biodiesel plants and one plant for the large-scale industrial production of bioethanol in operation in Austria. In the reference year the biodiesel plants produced about 325,000 tons of biodiesel with a capacity of 650,500 tons per year and an export quota of about ten percent. At the same time the bioethanol plant produced 138,000 tons of ethanol, of which about 37 percent were exported. The production capacity of this plant is thereby 191,000 tons per year.

## Facts & Figures 2009

Turnover 2009	242 million Euro
Jobs 2009	1,869 employees
CO <sub>2</sub> -saving 2009	1.64 million tons CO <sub>2</sub>

Source: Erneuerbare Energie in Zahlen 2010, BMLFUW

Through the substitution a reduction of the CO<sub>2</sub>-equivalent of 1.34 million tons could be achieved in the fuel sector.

(Sources: Biofuels in the traffic sector, 2010)

## Generation of electrical energy

Besides the use as fuel, biomass in liquid form is also used for the generation of electrical energy. In 2009 39 GWh of electrical power were fed into the Austrian power grid this way.

For the Austrian manufacturers of biodiesel plants the EU-Directive and the 2020-Objectives not only open a large domestic market. Austrian technology is also very much in demand on international markets such as Europe, USA, Australia and China.



# SolarHeat

Hot Water – Heating – Cooling

In an international comparison, thermal solar plants developed and produced in Austria are in first place. When it comes to installed system area per inhabitant, Austria is fourth behind Cyprus, Israel and Barbados. Many years of experience and intensive research as well as the excellent quality of the products have turned Austrian companies into technology leaders in the world market. The range of products offered extends from applications in the sectors of hot water heating and heating systems through to the complex sector of cooling. Austria also assumes a pioneering role in the research and development of solar process heat.

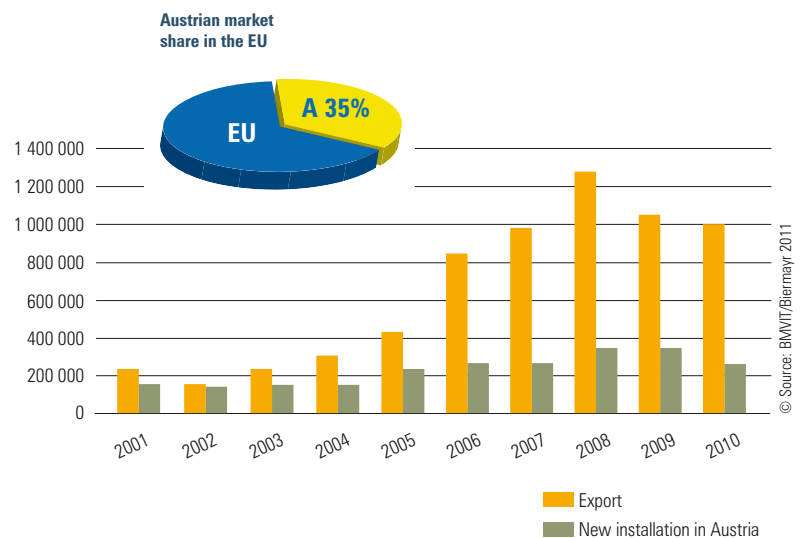
### The costs are falling, the turnover is increasing

Modern production methods, the development towards compact systems and plug-ready connections as well as strong market growth have lowered the costs of manufacture and installation considerably in recent years. That has made solar heat even more attractive for private persons and

### Solar thermal installation



### Collector area exported and installed in domestic market in m<sup>2</sup>



companies at home and abroad. Experts forecast an ongoing trend.

### Remarkable upturn of solar heat

In Austria thermal solar plants contribute greatly towards the creation of value. A large market has developed inside and outside the country, which is marked by dynamics and upturn. Altogether about Euro 420 million per year are turned over with solar plants.

44 percent of the entire creation of value thereby goes on the installation, which also makes solar heat a particularly interesting business segment for installation engineers.

### Facts & Figures 2010

Turnover 2010	420 million Euro
Jobs 2010	4,700 employees
CO <sub>2</sub> -saving 2010	412,000 tons CO <sub>2</sub>

Source: Innovative Energietechnologien in Österreich – Marktentwicklung 2010, BMVIT

# Photovoltaics

Electricity from sunlight

Excellent quality standards as well as an intensive exchange with research facilities are the basis for Austrian companies having become players to be taken seriously on the international photovoltaics market.

## Leading technology that convinces globally

Austrian products are in great demand internationally because of their innovative power and quality. This applies especially in the sector of building-integrated installations (e.g. façade systems or solar glazing), for solar tracking systems (movers) as well as in the sector of photovoltaic application technologies. One of the leading international manufacturers of inverters produces in Austria, but with an export quota of 99 percent, the market is abroad. For the modules produced domestically, the export quota is 77.2 percent.

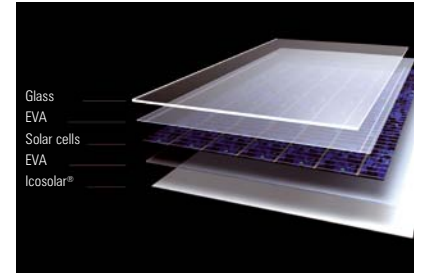
## World market leadership and growing markets

An Austrian company can even enjoy world market leadership in the encapsulation of PV-cells. Products from the photovoltaic branch are exported throughout the world. Because of the international volume of expansion, above all in Europe, this market increasingly represents a field of activity for the domestic companies.

The amendment to the Eco-Power Law in 2011 will also bring with it a considerable improvement of the market situation in Austria. The official objectives of the federal government will be quadrupled, the actual expansion will be significantly above that.



Inverter



Module structure: EVA (Ethylene Vinyl Acetate) as intermediate layer. Icosolar brand name for the encapsulation film.

## Global research for innovation as exciting challenge and cost optimization

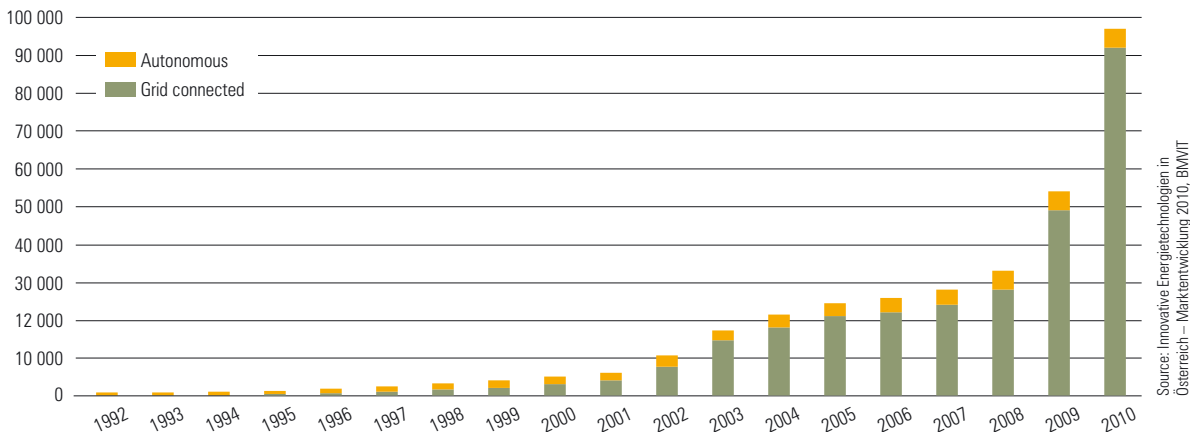
2010 was a gratifying year for the photovoltaics branch – the next year will bring a new record. In the meantime, in Austria photovoltaic plants with a total output of over 95,500 kWp are installed, which corresponds to a produced amount of electricity of about 89,000 MWh. The costs for photovoltaic plants were able to be lowered by about 15 percent from year to year – a trend that is set to continue according to branch experts. Continual technological improvements and innovations make photovoltaics a powerful, future-oriented energy partner.

## Facts & Figures 2010

Turnover 2010	824 million Euro
Jobs 2010	4,414 employees
CO <sub>2</sub> -saving 2010	36,733 tons CO <sub>2</sub>

Source: Innovative Energietechnologien in Österreich – Marktentwicklung 2010, BMWT

## Cumulated PV-output in kWpeak





# HeatPump

The efficient form of heating

The heat pump, which today can be regarded as a particularly efficient form of alternative heating and cooling technology, was invented about 150 years ago in Austria. It is one of the most environmentally friendly forms of energy production. Already more than half of Austria's single- and multi-family houses are equipped with heat pumps. Decisive thereby are the low operating costs and the high level of environmental compatibility.

## Heat sources are water, ground, air and waste heat

Heat pumps can collect on average three quarters of the heat released by the energy sources water, ground, air and waste heat and convert the existing environmental heat quickly and cleanly into heating energy.

## Scopes of application of the heat pump technology

- Indoor heating
- Hot water heating
- Living space cooling
- Living space ventilation with environmental heat
- Swimming pool dehumidification

In addition to these classic fields of use, new scopes of application are gaining greatly in significance:

- The role of the heat pump for the load balance in "Smart Grids"
- Heat pumps as innovative approach in "Smart Cities"
- Utilization of waste water heat using heat pumps
- Industrial waste heat utilization using heat pumps
- Heating and cooling in one process (usage in large-volume industrial and residential buildings)

## Maximum efficiency for reconstruction and new construction

Heat pumps have a great future potential, because they can be used both in new construction as well as for renovations.

They are very versatile and are particularly efficient for

## Facts & Figures 2010

Turnover 2010	206.8 million Euro
Jobs 2010	1,101 employees
CO <sub>2</sub> -saving 2010	375,495 tons CO <sub>2</sub>

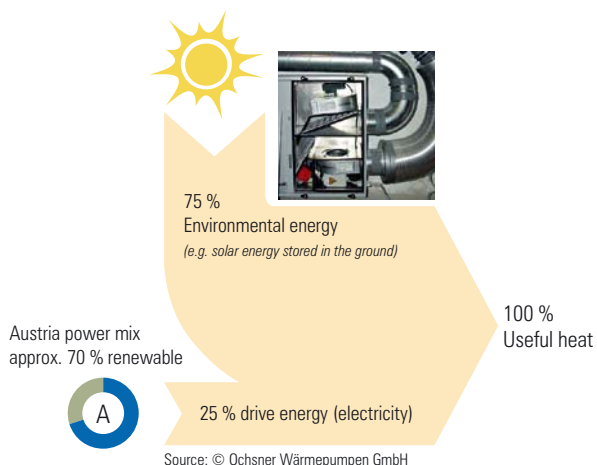
Source: Innovative Energietechnologien in Österreich – Marktentwicklung 2010, BMVIT

low-temperature heating systems and for the cooling operation. When the decisions are to be taken for a sustainable energy future for our country, the heat pump is one measure that can be recommended. CO<sub>2</sub> savings can be realized with it at very low costs.

## Upturn without end?

At the end of 2010 about 177,000 heat pump installations were in operation in Austria. Since 2000 the market volume for heating heat pumps has been marked by strong growth. In the period from 2000 to 2010 the number of heat pumps installed in Austria has almost quadrupled. Experts forecast an ongoing upward trend. In the latest studies for the energy future of Austria, ambient heat, utilized via heat pumps, plays a major part for the coverage of the heating and cooling requirement.

## Heat pump principle



# Hydroelectric Power

Source with a long tradition

## Source with a long tradition

The utilization of water power has a long tradition in Austria. The discovery and optimization of machines and plants for hydroelectric power has always been regarded as the domain of Austrian planners and industry. Austrian know-how in hydroelectric power technology is therefore very much in demand throughout the world.

## Development of small hydroelectric power as main objective

With over 60 percent, electricity from renewable water power has the greatest percentage in the domestic power mix.

Consequently more than 43,000 GWh can be produced using water power. The further expansion of hy-

droelectric power stations up to 2020 is a logical next step since this is the only way to achieve the target set by the EU, to produce 34 percent of the total domestic energy consumption from renewable sources of energy.

Special focus is on small (up to 10 MW) and medium-sized hydroelectric power.

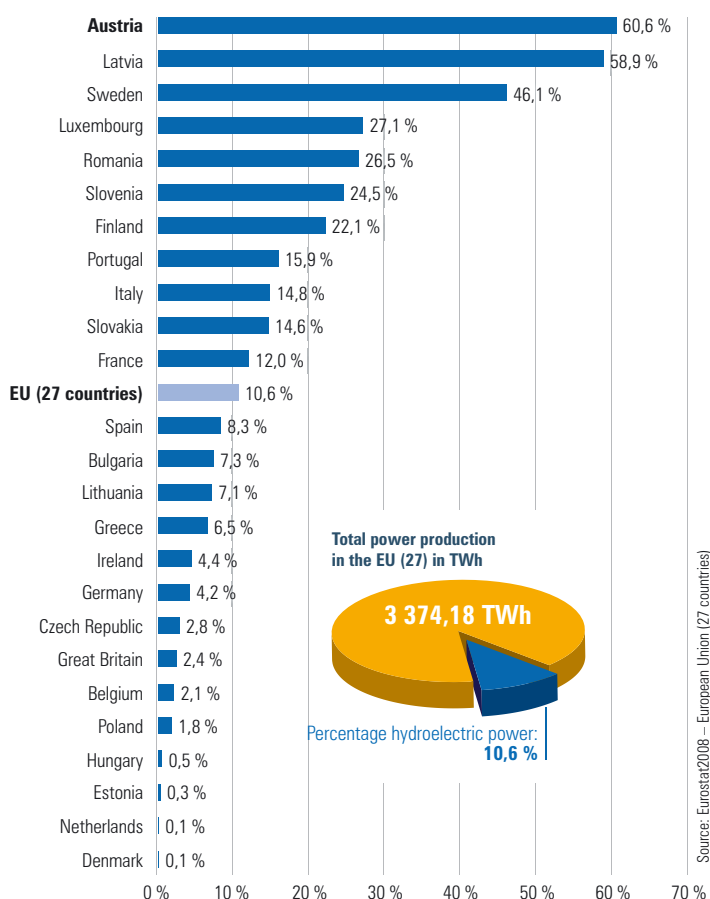
## Great potential

According to estimates by experts, an expansion of the annual production by 1,500 GWh is possible through the new construction of small hydroelectric power plants. A further 1,000 GWh per year is expected through the revitalization and reactivation of already existing small hydroelectric power plants. The output from large hydroelectric power plants can also be increased by seven TWh by 2020. This will not only achieve a domestic creation of value of 300 million euro, but also secure 6,000 jobs over 10 years. For the construction of power stations in Austria domestic companies are used almost exclusively: 90 to 95 percent of the order volume will be allocated to Austrian firms. Thereby the Austrian planners and manufacturers are particularly concerned about the protection of nature and the climate. Here the alpine country assumes a pioneering role throughout the world.

## Sustainability for the Third World

The knowledge concerning the factors of environmental protection and sustainability is also incorporated when Austrian companies export their technologies to their European neighbors and those countries of the Third World. Small and medium-sized hydroelectric power stations above all play a major role for the success of Europe in the achievement of its objectives in energy and environmental policy. In the countries of Asia and Latin America the technical knowledge of Austrian manufacturers contributes decisively towards the sustainable development of rural regions.

## Percentage of hydroelectric power in the entire generation of energy in Europe



## Facts & Figures 2009

Turnover 2009	1.096 billion Euro
Jobs 2009	6,857 employees
CO <sub>2</sub> -saving 2009	17,819 million tons CO <sub>2</sub>

Source: Erneuerbare Energie in Zahlen 2010, BMLFUW



# Engineering Offices

Know-how in Planning and Consulting

Nature supplies far more energy than people can consume. Despite this, with the effective utilization of renewable energy, proportionally we are still considerably behind fossil fuels.

International legal framework conditions indeed force us to be careful with our CO<sub>2</sub>-equivalent, but are still not yet implemented accordingly. New plants force the spread of environmentally friendly energy. The Austrian engineering offices provide the know-how required for development and planning.

## Cooperation is the recipe for success

Also contributing towards the success of the Austrian engineering offices is the close cooperation with research institutes and leading companies. The engineering offices profit from the many years of practice-tested knowledge of the market leaders, while in turn planning innovations are quickly established due to the close cooperation with the industry.

## Planning in all areas of renewable energy

Sustainable use of energy and installations for the utilization of renewable energy are planned independently and neutral by the Austrian engineering offices. The application and the success of the planned investment in the sense of the building owners and the environment are always the focus of interest. Comprehensive specialist knowledge enables competent and qualified consulting in all areas of renewable energy.

## Waste material recycling

How should one manage the ever larger mountains of trash in densely populated areas – and not only there? The main aim has to be to recycle waste as best as possible. In recent decades district heating installations have shown, how the air quality in densely

populated urban areas could be improved by substituting domestic fuel with the supply of district heat. District cooling systems are the next step for the reduction of the CO<sub>2</sub> emissions. In future one must dedicate oneself more intensively to the subject of raw materials from waste. This way the target of "Zero Emission Cities" – a recurring event initiative of the engineering offices – will soon be within reach.

## In demand throughout the world: Austrian know-how

The export of the necessary technical know-how and the associated services is one of the core competences of Austrian engineering offices. The possible saving on energy imports that this enables is not only of ecological relevance, but rather represents the most important contribution towards achieving the energy autonomy of Austria.



Planning of wind parks



District cooling center Spittelau, District Heating Vienna

Source: © Christian HOUBEK für Fernwärme Wien



**Electricity, Heating and Cooling**  
from **Combined Heat and Power**



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**Biogas**



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# Renewable Energy



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