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Solar Heating and Cooling in Austria

Status Report 2007

Research, Development and Market Deployment

Gerhard Faninger

Berichte aus Energie- und Umweltforschung

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Austrian National Solar Report 2007 for the IEA-Solar Heating and Cooling Programme

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Solar Heating and Cooling in Austria

Status Report 2007

Research, Development and Market Deployment

Solar Thermal Technologies in Austria
Presented to the
IEA Solar Heating and Cooling Programme, IEA-SHC

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Klagenfurt, June 2008

A Report within the Research Cooperation with the International Energy Agency

**IEA FORSCHUNGS
KOOPERATION**

Supported by the Austrian Federal Ministry for Transport, Innovation and Technology

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1. The Austrian Energy Research and Energy Technology Policy

Public funded energy related R&D in Austria will be guided by the overall strategy, which takes account of a portfolio of different policies and developments. Compared to other research areas, energy research has a special position, due to its significant impact on environmental targets as well as social goals (e.g. affordable energy), and due to the potential damage to economic development that increasing dependence on imports could cause. Austria has taken account of this since more than 3 decades by formulating and repeatedly updating energy concepts and by engaging in international cooperation. In the last few years, the targets set by “traditional” energy research have been readjusted to the goal of developing a *sustainable energy system*.

Apart from fundamental changes in the energy markets (above all the liberalised markets for electricity and natural gas), and an emerging paradigm switch from energy supply to energy services, what made the updating of the energy research and energy technology concept most necessary was the institutional changes surrounding research and technology policy in Austria. Accession to the European Union and the movement towards a European research area have, together with international obligations in the field of climate change, created a whole new context for energy research and technology. These institutional and market changes have led on one side to a shortening of the time horizons for energy research and technological development, and on the other to increased competition between national innovation systems. With this in view, the task of the energy research and energy technology concept is to establish medium term focus points which cover the areas not sufficiently dealt with by existing instruments, and to work out a clear position for Austria within the European Union. Its aim is to strengthen existing competencies in the energy sphere and to intensify research and technological development according to the main principles of sustainable development.

To support the Austrian long-term Energy R&D the Strategy-Process “**Energy 2050**” was initiated by the Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT) in 2005 (www.e2050.at). The objective of this strategy process is to develop and evaluate longterm energy-options (technology paths) and to set up new Research, Technology and Development Programmes. The process is followed by a continuous dialogue process by means of workshops and international conferences, interviews with experts, hearings, studies and technology roadmaps. In 2007 more than 250 contributions were introduced by industry and research organisations and new R&D foci were developed (Energy systems and grids, advanced biofuels production, energy in trade and industry, energy in buildings, energy efficiency and end use technologies, advanced combustion and conversion technologies).

Know-how Transfer is a topic high on the agenda of public financed R&D supporting activities. An easy access is provided by the internet platform www.nachhaltigwirtschaften.at, where publications of public funded RTD-projects (*Schriftenreihe “Forschungsforum”*) as well as information about conferences and workshops can be found there. Another internet-based platform for innovative technologies in Austria is www.energytech.at.

In 2007 **Austrian Energy and Climate Fund** was established per law. It should support the Austrian government to implement the Austrian Climate Strategy. The objectives are the realisation of a sustainable energy supply, reduction of greenhouse gas emissions as well as the increase of the Austrian research rate. the Austrian Energy and Climate Fund has the ambition to spend 500 Million € until 2010. In 2007 it was endowed with 50 Mio € in 2008 with 150 Mio € (www.klimafonds.gv.at).

The Austrian Energy and Climate Fund has 3 main programme lines:

- Energy technology R&D,
- Climate research, energy efficiency and CO₂ reduction in transport,
- Market implementation of sustainable and climate relevant energy technologies.

2. Energy R&D Programmes

Austria has implemented mission oriented research and technology programmes with a thematic orientation and toward a long-term vision.

In November 2001 a new and energy focussed research and technology programme on “*Technologies for Sustainable Development*” was developed by the Austrian Federal Ministry of Transport, Innovation and Technology (BMVIT). It initiates and supports trend-setting research and development projects and the implementation of exemplary pilot projects; www.nachhaltigwirtschaften.at.

The **Austrian Programme on Technologies for Sustainable Development** aims at enhancing the competitiveness of Austrian industry and research while at the same time improving the quality of life and the environment. Research and development of future oriented technologies and solutions foster new opportunities for an eco-efficient economy, create jobs in the advanced technology sectors and lead to more efficient use of natural resources. Yet substantial progress in innovation and technologies will be necessary to achieve these goals. This is why the programme was divided into three sub-programmes covering the domains of

- Innovative construction (sub-programme “*Building of Tomorrow*”),
- Energy (sub-programme “*Energy Systems of Tomorrow*”),
- Industry (sub-programme “*Factory of Tomorrow*”)

with clear goals and a strategy of several years for each of them. Exemplary pilot and demonstration cases (“beacons of innovation”) are being developed through chains of projects, each one building on the results of the previous. Basic research studies, cooperative research involving both companies and researchers and finally the development of components and technologies form the basis for these demonstration cases. Relevant topics are being put out to tender and the best projects selected for funding by an international jury. In addition specific accompanying measures will be used such as project competitions, networking events and qualification and training programmes.

The Austrian Programme on Technologies for Sustainable Development is financed by the Austrian Federal Ministry of Transport, Innovation and Technology (BMVIT), managed by the “Austrian Research Promotion Agency (FFG).

The sub-programme “**Building of Tomorrow**” makes use of the two most important developments in solar and energy efficient building: the passive house and the low energy solar building method. For the purposes of the “*Building of Tomorrow*” sub-programme, these energy centred innovations are expanded to take in ecological, economical and social concerns. “*Building of Tomorrow*” aims to reduce the energy consumption in buildings by using renewable raw materials and alternative sources of energy such as solar energy while not increasing construction costs compared to traditional building designs. “*Building of*

Tomorrow" supports passive house and low energy solar building technologies, the two being the most important current concepts of solar and energy efficient building. Additional attention is given to ecological, economical and social concerns. The costs should be comparable with conventional building methods; www.hausderzukunft.at.

The sub-programme "**Factory of Tomorrow**" aims at acquainting trade and industry with a new quality of innovation, driven by the future-oriented concept of sustainability. Through the development of advanced resource-efficient and environmentally-friendly techniques in companies the sub-programme addresses technologies and innovative approaches in manufacturing processes, the use of renewable raw materials, sustainable products and services as well as non-technical aspects such as management methods, sustainable entrepreneurship and the integration of health and safety. "*Factory of Tomorrow*" started 2001 and contains some energy relevant topics like: Aiming at zero-waste and zero-emission technologies and methods of production and increased use of renewable sources of energy in the production process and in the enterprise as a whole; www.fabrikderzukunft.at.

In 2003 the sub-programme "**Energy Systems of Tomorrow**" started. "*Energy Systems of Tomorrow*" focuses on the development of new technologies and concepts for a flexible and efficient energy system based on renewable energy sources. The intention is to realise demonstration projects (e.g. model systems and model regions) that improve sustainable development and increase the quality of life and economic prosperity. The main topics of "*Energy Systems of Tomorrow*" are energy efficiency, the use of renewable energy sources and systems innovations and strategies. It addresses 3 focus-topics of the Austrian energy research and energy technology concept: Bio-energy & hydro-power; Electricity supply systems orientated towards climate protection; Long-term climate protection technologies in international networks. This sub-programme focuses on the electricity system and will address the challenge of increasing the share of Renewables in the electricity supply system while maintaining a high level of reliability. It will include basic analyses of the Austrian energy system, studies on the interaction of the persons and institutions involved technology development and demonstration activities in a selected region; www.energiesystemederzukunft.at.

BMVIT R&D will launch a new 3 years- programme "**Building of Tomorrow Plus**" with the mission "*From Zero Energy Building to Plus Energy Building*". The aims of the programme are:

- To generate knowledge and the technological basis for buildings in 2020 with a focus on office buildings and premises as well as retrofitting of buildings;
- To support the transition from innovative technologies to industrial production processes;
- To initiate demonstration projects (buildings, settlements, grids ...) to raise visibility of new technologies and concepts.

The Austrian energy related R&D programmes are linked to European Research Area-Net (ERA-Net projects). Austria participates with the national R&D programmes in the following ERA-Nets: Smart Grids, Bioenergy, Photovoltaic, Eracobuild, SUSPRISE and HyCo.

In 2008 the Austrian Climate and Energy Fund has launched the R&D programme "**New Energies 2020**". The programme started in May 2008 with the first call of proposals. The budget for 2008 is 20 Million € At the end of June 2008 240 proposals were submitted. The second call for proposals is planned for 2008, focused on "Green ICT"; (www.neue-energien-2020.at).

The Austrian Programme on Technologies for Sustainable Development

NACHHALTIG wirtschaften

Building of Tomorrow 1999 - 2007

Energy efficiency, use of renewable energy sources,
use of ecological building materials in the building sector,
trend-setting demonstration buildings.

Factory of Tomorrow 2000 - 2008

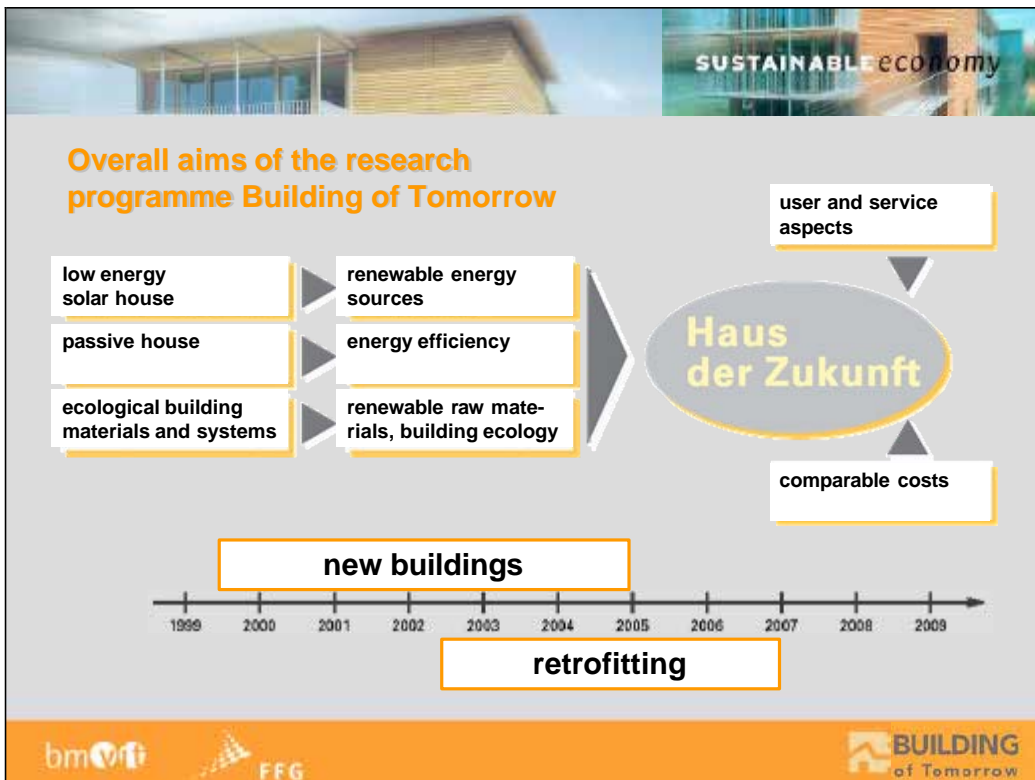
Production processes, product service systems and renewable resources;
trend-setting industrial demonstration projects.

Energy Systems of Tomorrow 2003 - 2009

Renewable energy sources, efficiency,
system innovations and strategies;
trend-setting regional model systems.



Eine Kooperation des Bundesministeriums für Verkehr, Innovation
und Technologie mit der Forschungsförderungsgesellschaft



Programme Status



- Start in 1999
- 5 call for proposals
- 241 projects funded with 26 Mio €
- 28 demonstration buildings
- follow up programme „Building of Tomorrow Plus" will start this year

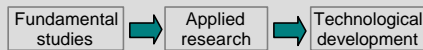
Example: Demonstration building

Ecological alpine refuge hut, eastern part of the alps,
Hochschwab area, Styria (2153 m)



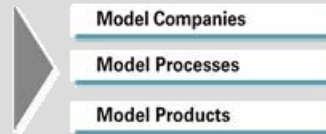
- ☞ Autarkic building maintenance
- ☞ Collection of rain water from roof
- ☞ Warm water/flat thermal collectors integrated in the façade
- ☞ Electricity generated by 70m² of façade integrated photovoltaic panels

R&D-Projects



Accompanying Measures:
Networking and Know-how-Transfer

Demonstration Projects:



Programme status



- Start in 2000
- 5 call for proposals
- 170 projects funded with 19 Mio €
- app. 15 projects in the field of solar process heat, energy and resource efficiency in industry

Factory of Tomorrow

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Example:

Production with solar energy

Study on the potential of thermal solar energy systems in trade and industry depending on the production processes

- Documentation of realized plants for the use of thermal solar energy in trade and industry companies
- Identification of production processes and branches, which have a demand for low-temperature heat
- Determination of the potential of solarthermal systems to provide low-temperature heat
- Case Studies for branches and processes with highest mid-term potential for realization of a solar plant



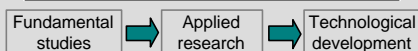
Source: AEE INTEC



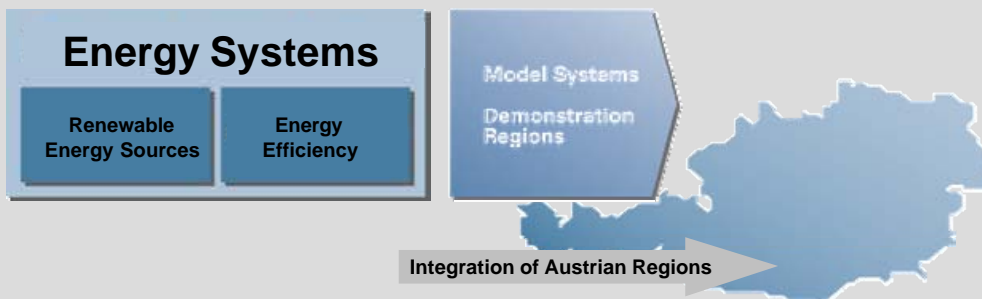
Energy of Tomorrow

NACHHALTIGwirtschaften

R&D-Projects



Accompanying Measures: Networking and Know-how-Transfer



Programme Status

- Start in 2003
- 3 call for proposals
- 214 projects funded with 33 Mio €
- e.g.: solar assisted district heating networks, business models for large scale solar thermal plants, solar cooling and refrigeration, advanced conversion technologies



- **Self-sustaining Energy supply of the city Güssing**
- **Exclusively with regional, renewable Ressources**

Self-sustaining Modell Güssing

Building of Tomorrow plus

„From Zero Energy buildings
to Plus Energy Buildings“

3 years - Research Programme of the Austrian
Ministry of Transport, Innovation and
Technology (BMVIT)

Aims of the Programme

- **Generating knowledge and the technological basis for buildings in 2020 with a focus on office buildings and premises as well as retrofitting of buildings**
- **Supporting the transition from innovative technologies to industrial production processes**
- **Initiating demonstration projects (buildings, settlements, grids ...) to raise visibility of new technologies and concepts**



Programme performance

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- Programme with clear aims and strategy; finally visible 'demonstration projects'
- Expanded funding portfolio: Research/development (industrial research, experimental development...) and market instruments (credits, guarantees ...)
- Joint responsibility of two agencies: FFG and AWS
- Active programme management supporting the industrial implementation and 'demonstration projects'



Four strategic approaches

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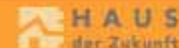
- Key technologies and concepts for buildings in 2020
- Supporting the industrial implementation of innovative technologies
- Demonstration projects: the building in its context (Demo buildings, settlements, grids ...)
- Networking, training and education



Key technologies

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- Intelligent facade systems and building envelopes
- Storage technologies – in regard to buildings – with high impact
- Highly efficient insulation systems
- New solar technologies
- Advanced housing technology systems and system components



Concepts

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- Zero energy or plus energy concepts for office buildings and premises
- Retrofitting concepts for buildings to passive house standard for specific building types
- Cost efficient low tech concepts
- Integration concepts for networks (e.g. use of distant heat or cold for new applications)
- Facade concepts: Optimized facade concepts on energy and lighting demand



- **Lessons learned from the 1. generation**
- **Economic analysis; cost comparisons**
- **Concepts for life cycle assessment; recycling, grey energy; access to rating and appraisal of real estate**
- **Social aspects like age structure, user behavior, lifestyle**
- **Potential for intelligent power generation in the building stock**
- **Bionics – creative ideas for new technologies**

3. Public Expenditures for Energy Research

Austria has to reach its emission reduction targets set out by the Kyoto-Agreement. The energy sector plays a crucial role to meet these obligations. The broad and long lasting consensus regarding the need of emission reduction found also its reflection in the priority setting of public energy R&D spending in the nineties.

According to public strategies, the main focus on public expenditures for Energy R&D in Austria was put on Energy-Efficiency and Renewables. The maximum governmental R&D expenditures were in the year 1985 with 33,548 million Euro, the minimum budget in the year 1990 with 10,000 million Euro. In 2005 the Energy R&D budget was 33,603 million Euro and in 2006 42,400 million Euro (change 2005/2006: +26.2%).

In 2005 the Government funding for R&D on Renewables was 12,111 million Euro and in 2006 13,841 million Euro (change 2005/2006: +14.3%).

The share of Renewables R&D on the total Energy R&D Expenditures was in 2005 41.7% and in 2006 13.9%.

In 2005 the R&D budget for Solar Energy was 5,045 million Euro and in 2006 1,917 million Euro (change 2005/2006: -62%).

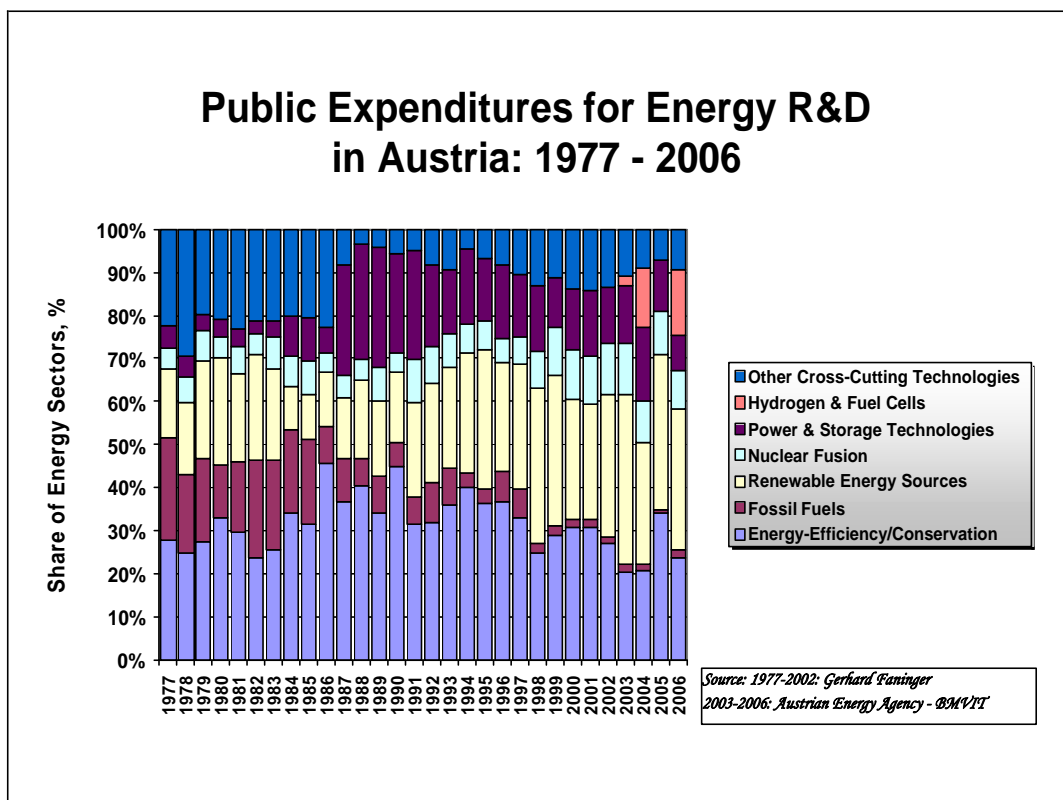
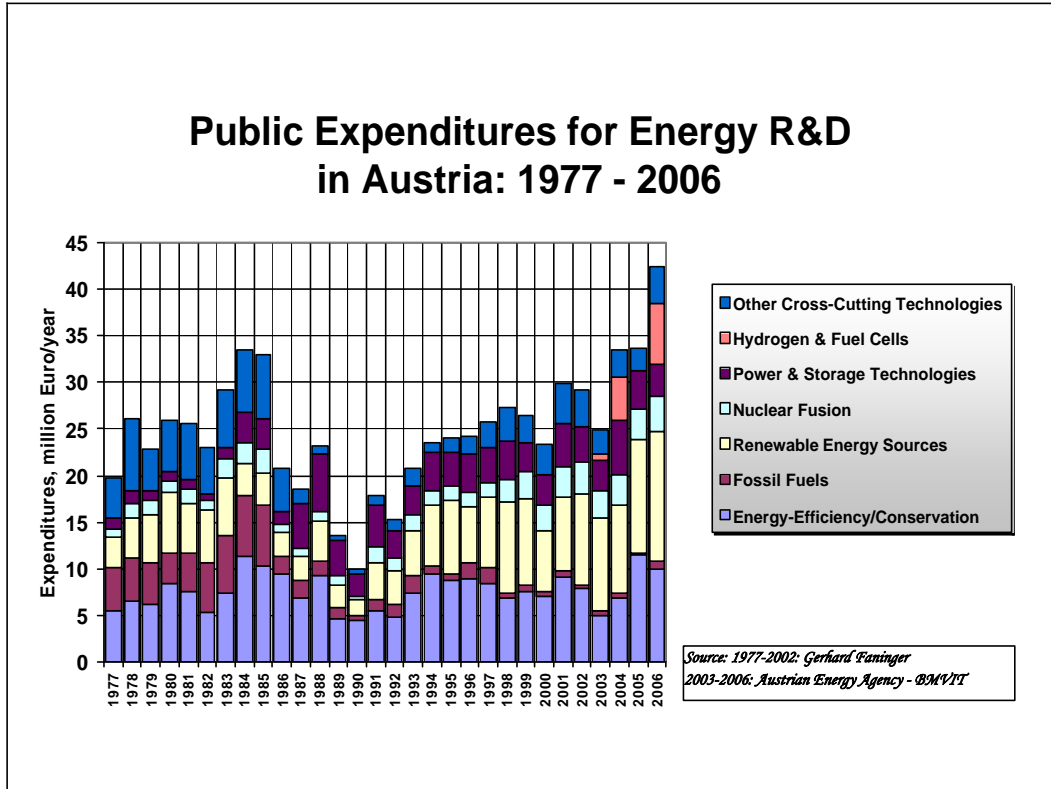
The public expenditures for R&D in the area of Solar Energy with 1,917 million Euro in 2006 were allocated to 58.5% to Solar Heating and Cooling, 28.1% to Photovoltaic, 7.5% to Solar High-Temperature and 5.9% to Other Applications.

In 2005 the R&D budget for Solar Heating and Cooling was 0,563 million Euro and in 2006 1,122 million Euro (change 2005/2006: +69%).

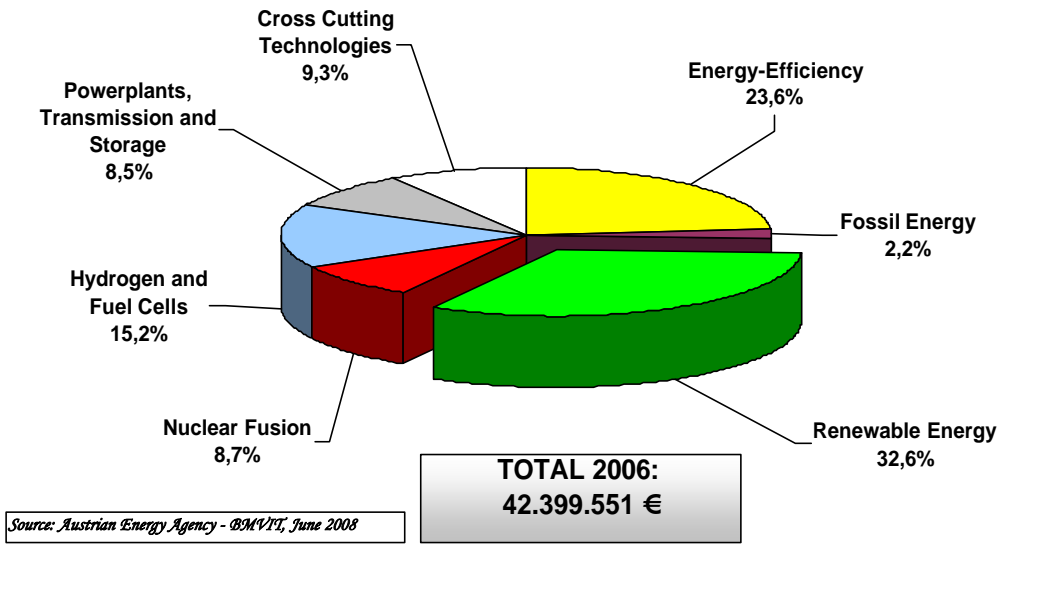
The public expenditures for R&D in the area of Solar Heating and Cooling with 1,122 million Euro in 2006 were allocated to 35.6% for Collector Development, 29.5% for Solar Heating and Cooling, 20.5% for *Solar Combisystems*, 14.0% for Low-Temperature Process-Heat and 0.3% for Solar Water Preparation.

There is a broad consensus in Austria to raise R&D efforts. The Austrian Government declared a target of 2,5 % R&D spending related to GDP, which has to be reached in 2005 (the current status is about 2%, more or less the average value of EU-countries).

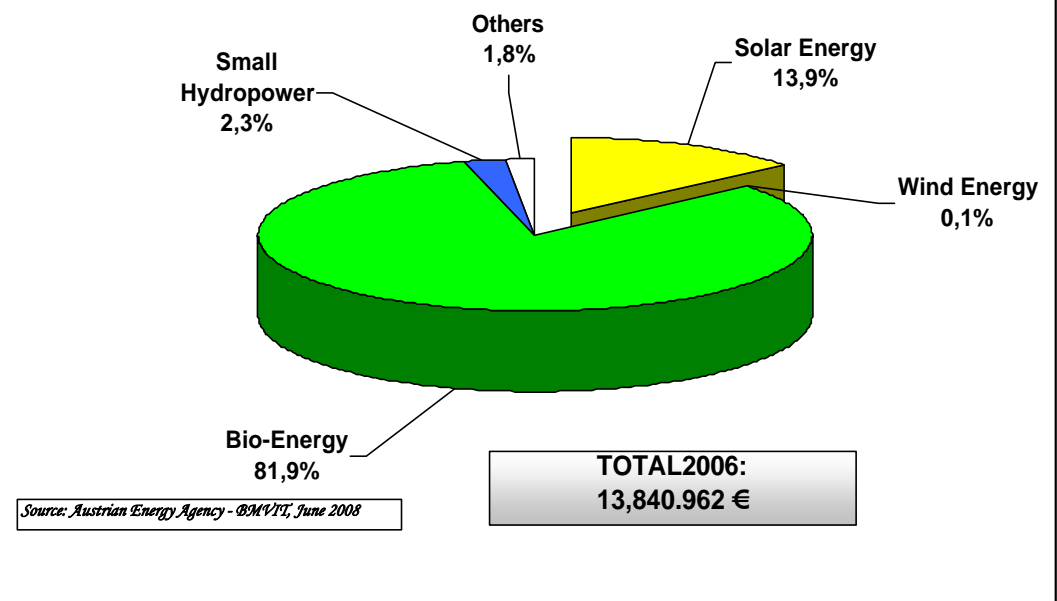
Public Energy R&D-Expenditures in Austria



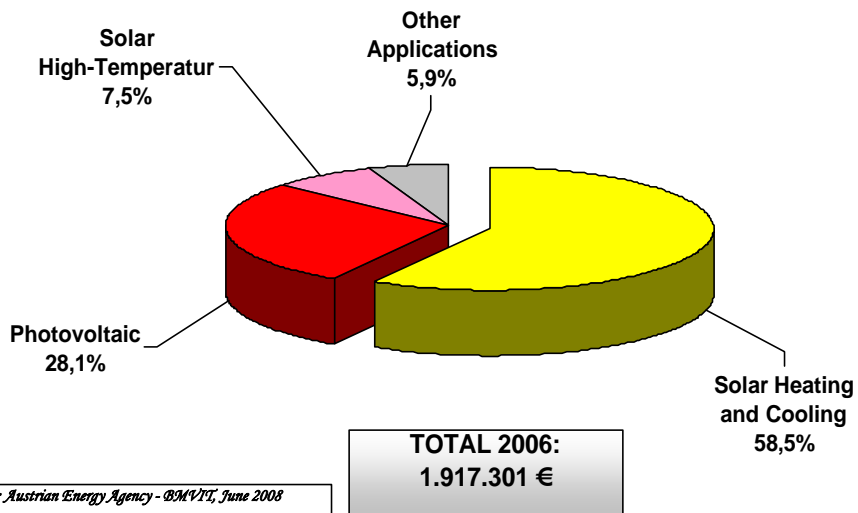
Public R&D-Expenditures in Austria 2006 R&D-Sectors



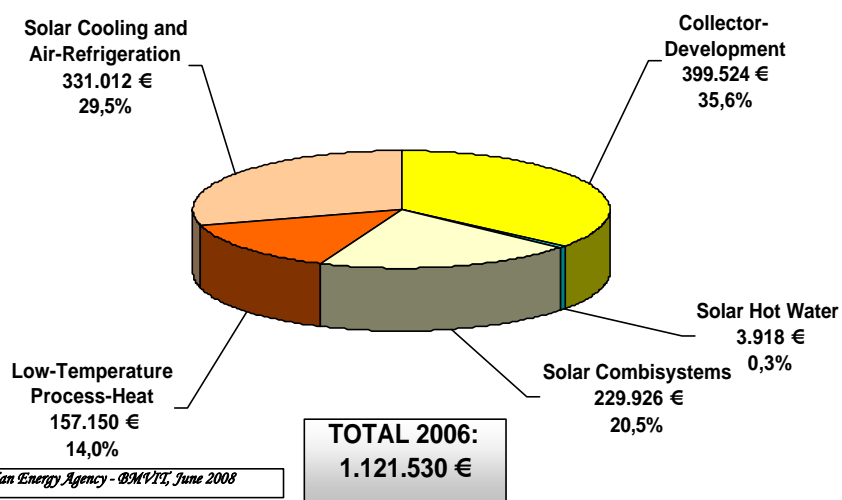
Public R&D-Expenditures in Austria 2006 Renewable Energy



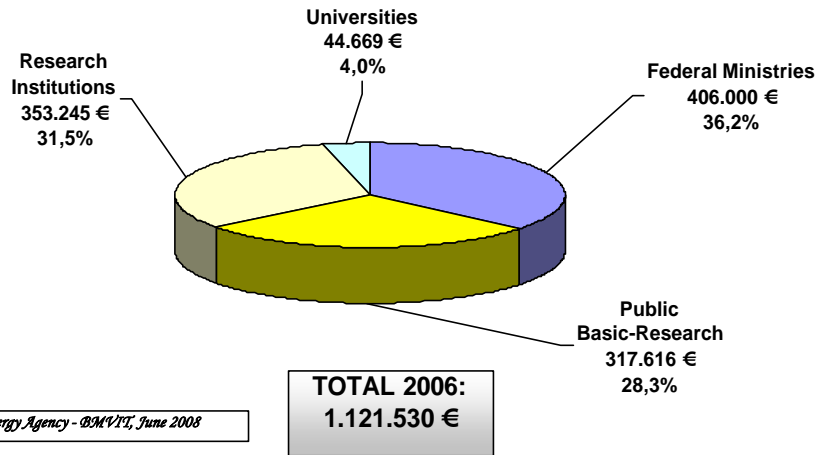
Public R&D-Expenditures in Austria 2006 Solar Energy



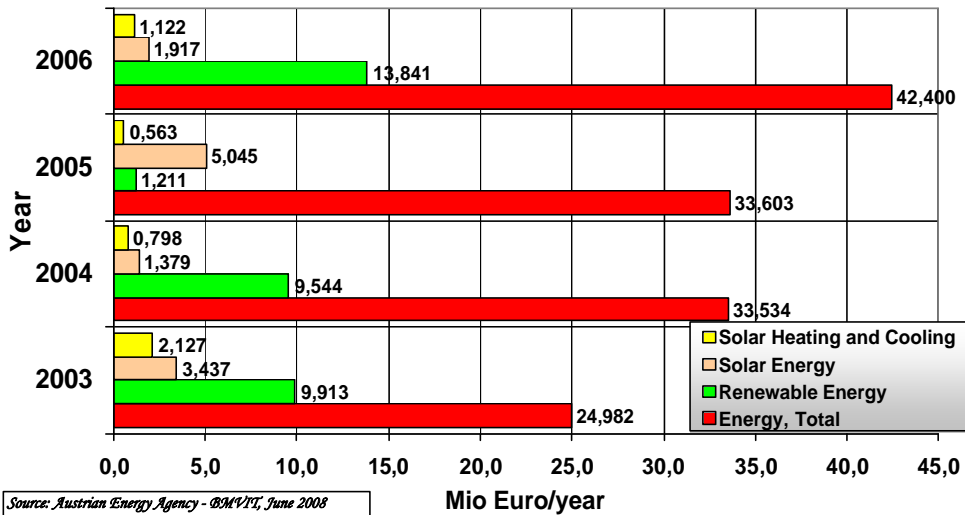
Public R&D-Expenditures in Austria 2006 Solar Heating and Cooling



Public R&D-Expenditures in Austria 2006 Solar Heating and Cooling Financing Institutions



Public Energy R&D-Expenditures in Austria: 2003 - 2006



Austrian Energy RD&D, Million Euro/year								
Year	Conservation	Fossil Fuels	Renewable Energy	Nuclear Fusion	Power & Storage Technologies	Hydrogen & Fuel Cells	Other Cross-Cutting Technologies	TOTAL
1977	5,542757	4,691032	3,130019	0,977450	1,079192		4,411241	19,831691
1978	6,497678	4,761524	4,294238	1,552292	1,295757		7,672071	26,073560
1979	6,251317	4,434496	5,132156	1,621331	0,911317		4,483914	22,834531
1980	8,519437	3,179436	6,510033	1,202009	1,081372		5,411219	25,903506
1981	7,594311	4,153979	5,255699	1,534850	1,064657		5,935917	25,539413
1982	5,429387	5,254972	5,656127	1,110441	0,667137		4,867627	22,985691
1983	7,436611	6,140128	6,177918	2,104605	1,111894		6,193906	29,165062
1984	11,441610	6,531834	3,340043	2,313903	3,188884		6,731684	33,547958
1985	10,323900	6,581979	3,334230	2,584246	3,294260		6,805811	32,924426
1986	9,532496	1,769584	2,592967	0,978903	1,231805		4,738269	20,844024
1987	6,860897	1,861660	2,608446	0,953468	4,774605		1,553019	18,612095
1988	9,337733	1,518135	4,219385	1,110441	6,197539		0,787774	23,171007
1989	4,666323	1,147504	2,400384	1,053756	3,798609		0,569755	13,636331
1990	4,483914	0,553040	1,652580	0,448391	2,299386		0,562488	9,999799
1991	5,606709	1,107534	3,926513	1,779758	4,494815		0,886609	17,801938
1992	4,865446	1,452730	3,498180	1,331221	2,917088		1,258693	15,323358
1993	7,464954	1,803740	4,902509	1,592989	3,150367		1,932371	20,846930
1994	9,449067	0,830505	6,503056	1,567916	4,143805		1,094162	23,588512
1995	8,771538	0,780942	7,832605	1,586593	3,548033		1,612465	24,132176
1996	8,946026	1,670966	6,137730	1,394228	4,167424		1,978881	24,295255
1997	8,519055	1,695094	7,441044	1,682376	3,678117		2,717382	25,732068
1998	6,840912	0,589667	9,824495	2,378000	4,168441		3,584805	27,386320
1999	7,629412	0,649259	9,265423	2,952189	3,030385		3,000298	26,526966
2000	7,153187	0,445048	6,534814	2,705392	3,219843		3,263374	23,321658
2001	9,149000	0,633271	7,926499	3,356322	4,605350		4,201653	29,872095
2002	7,919000	0,411000	9,681000	3,466000	3,789000		3,914000	29,180000
2003	5,066334	0,461276	9,912656	2,906748	3,376260	0,571486	2,687633	24,982393
2004	6,954521	0,451157	9,543798	3,228777	5,784642	4,602332	2,968316	33,533543
2005	11,486000	0,225705	12,110871	3,334014	4,079659		2,366907	33,603156
2006	9,988536	0,924980	13,840962	3,676474	3,585375	6,435914	3,947310	42,399551

Government Funding (Expenditures) for Renewable Energy RD&D in Austria (in EURO thousands)											
Year	Active Solar	Passive Solar	Photovoltaics	High Temperature Solar Thermal	Total Solar	Wind Energy	Bioenergy	Geothermal	Other (large & small hydro)	Total	Total Renewables (Without Passive Solar)
2000	1444	150	649	320	2563	409	3526	25	162	6685	6535
2001	1064	264	771	233	2332	185	4981	71	622	8191	7927
2002	1422	122	1386	92	3022	391	5864	126	362	9765	9643
2003	2128	328	1310	0	3766	844	5289	8	334	10241	9913
2004	798	148	384	196	1526	421	7196	281	267	9691	9543
2005	563	400	1306	135	2404	30	9448	71	558	12511	12111
2006	1122	550	539	144	2355	380	11336		320	14391	13841

4. Promotion Measures for Market Deployment of Solar Thermal Systems

Solar Market Deployment Initiative

The *Solar Market Deployment Initiative* “*klima:aktiv*” is a joint project between the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management and partners from industry. The programme “*Solar Heat*” in the framework of “*klima:aktiv*” supports the faster market deployment of solar thermal systems and the opening of the market to other sectors, e.g. apartment housing, commercial and industrial buildings, hotels and tourist centres. Main activities are information and education, technical support of planners and architects, monitoring of demonstration projects with Know how transfer, improving of technical equipment and systems. The duration of this market deployment initiative is until 2012 with an annual budget of 3 million Euro; www.programm.klimaaktiv.at.

Financial Support of Local Governments

The market deployment of solar thermal systems in housing was supported by the **local governments** with about 50 Million Euro both in the year 2005 and 2006. Additional solar thermal systems in commercial and industrial buildings were supported with 3.547 Million Euro in 2005 and 7.430 Million Euro in 2006.

But the reasons for the positive market development for Solar Thermal Systems is not only the continual promotion by means of Austria’s energy, research and promotional policies (including subsidies), but also the traditionally strong environmental awareness of the Austrian citizens, who have supported the idea of using Renewables right from the outset.

5. Governmental Responsibility for Solar Heating and Cooling Activities

Responsible institutions for R&D Activities in the sector “Solar Heating and Cooling” are the Austrian Federal Ministry for Transport, Innovation and Technology, BMVIT (R&D), the Austrian Federal Ministry of Economics and Labour, BMWA (for commercial and industrial activities) and the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) (for market initiatives).

Regional Governments support the market introduction of solar thermal systems in housing with financial measures.

Responsible for the co-ordination of Solar Heating and Cooling R&D on national and international level is the Austrian delegate in the IEA-Solar Heating and Cooling Programme.

6. International Co-operation

International co-operation plays an essential role for Austrians comparably small national economy. The IEA-Energy R&D programmes as well as the European Energy Programmes (especially the Framework Programmes for R&D) are of high priority for the Austrian Energy Research Programme. Currently Austria actively participates in IEA-Working Parties, expert groups and 12 Implementing Agreements. A broad spectrum from researchers at universities and research centres to industry representatives is working on key energy technologies.

For the energy sector analyses show a high success rate of Austrian R&D in European R&D Programmes. Participation in the Framework Programmes influenced Austrian energy R&D in several ways:

- Fostering of internationalisation.
- Additional budget (energy R&D funding by these programmes is in the range of 25% of the national public expenditures).

In some areas the participation has led to some modifications of R&D priorities.

Vice versa, Austria has supported the position of the European Parliament for a stronger focus of the European programmes on sustainable development, with special emphasis on renewable energy and energy efficiency; this not only with the aim to protect the environment, but also to penetrate an emerging market with huge potential world-wide.

The Austrian Federal Ministry of Transport, Innovation and Technology have commissioned the development of an overall IEA-R&D strategy, including requirements for assessment and evaluation.

7. Market Situation of Solar Thermal Technologies

The market development of solar thermal systems is continuing its positive tendency. About 1.186.575 m² collector areas were produced in Austria 2007, compared with 258.230 m² in 2000. From the produced collector area about 60% to 70% were exported in the last 5 years.

The installed collector area was in 2007 289.681 m², compared with 299.604 m² in 2006. From the installed collector area in 2007 97% are used for hot water and space heating and 3% for swimming pool heating.

At the end of 2007 about 3.6 million m² collector areas were in operation, from which 82% are glazed collectors, 1% evacuated collectors and 17% unglazed plastic absorbers;
www.nachhaltigwirtschaften.at/publikationen.

With the rapidly increased exports of solar collectors, the Austrian collector producers extended both the production capacity and the production process within automation.

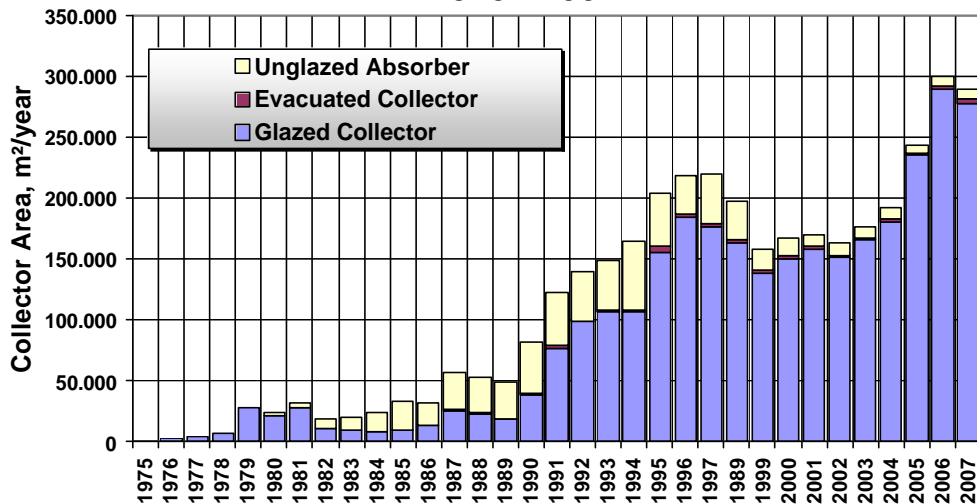


The Solar Market in Austria

2007

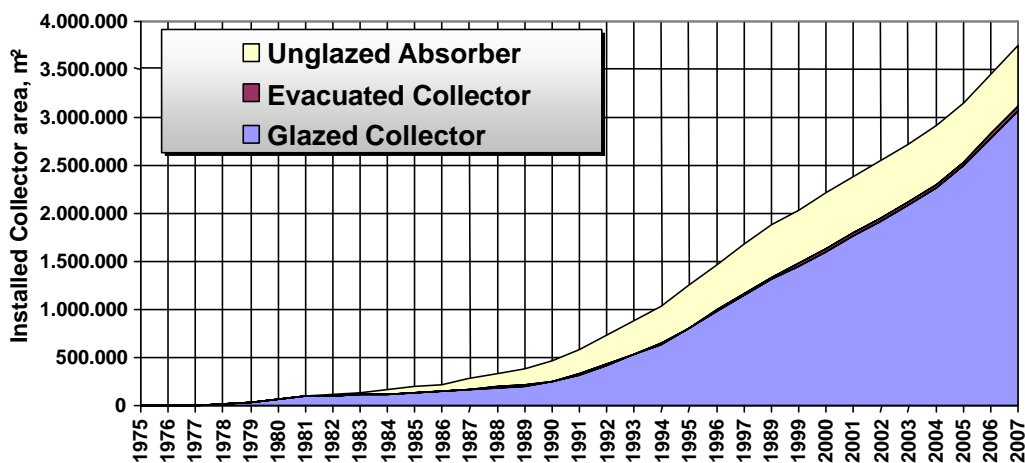
Solar Thermal Technologies in Austria

Yearly installed Collector Area in Austria 1975 - 2007



Source: 1975 - 2006: Gerhard Fanning
2007: AEE INTEC

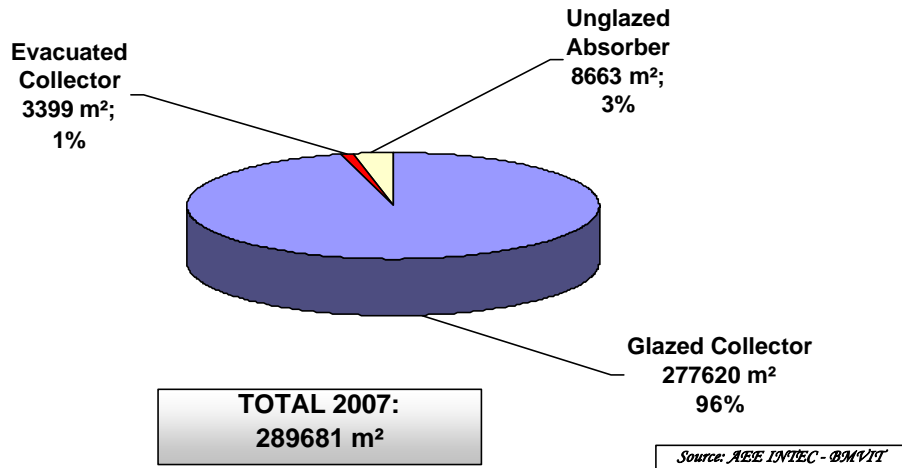
Installed Collector Area in Austria 1975 - 2007 Cumulative Data



Source: 1975 - 2006: Gerhard Fanning
2007: AEE INTEC

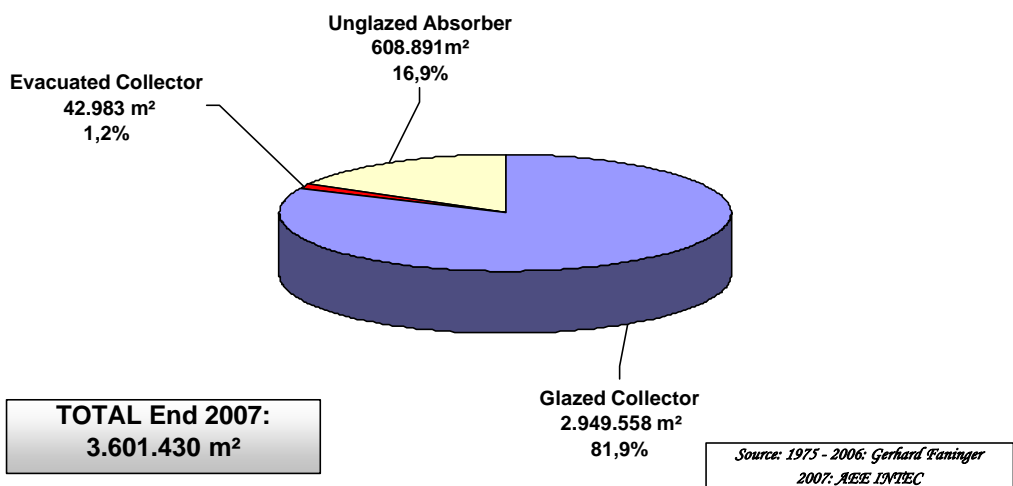
Collector-Market in Austria 2006

Installed Collector-Area, m²/year

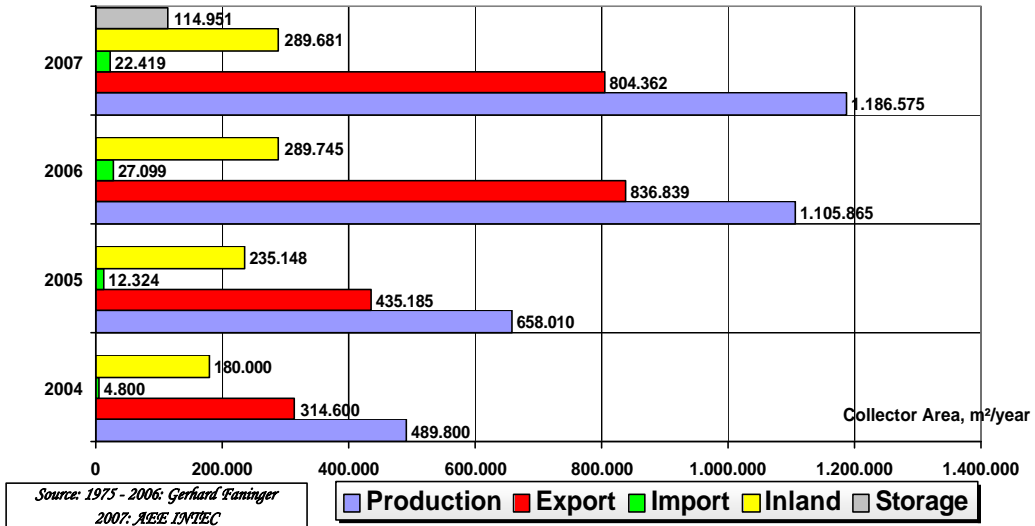


Solar Collectors in Operation in Austria

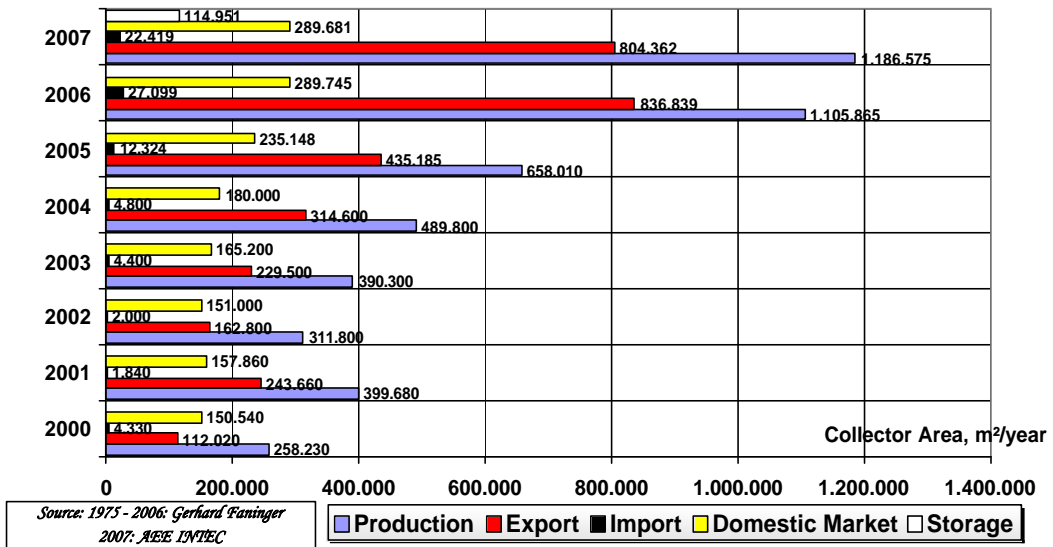
Installed Collector Area, End 2007



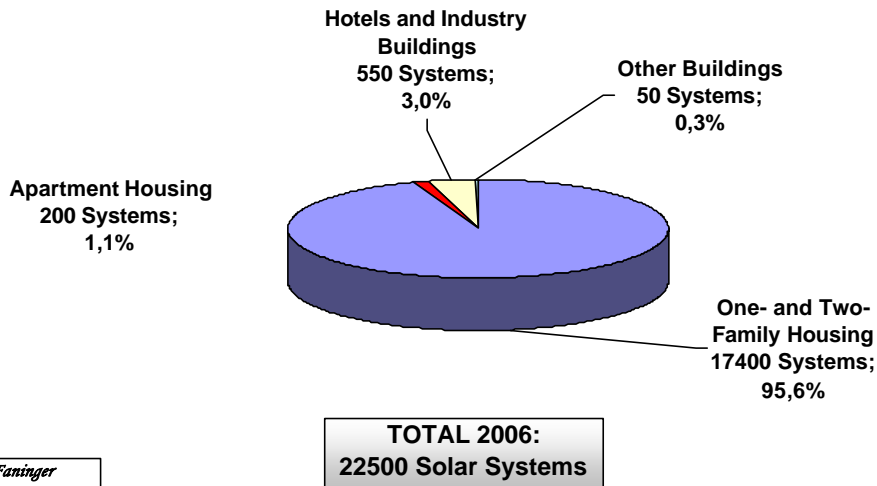
Glazed and Evacuated Collector Area in Austria Production, Export, Import and Domestic Market: 2004 - 2007



Glazed and Evacuated Collector Area in Austria Production, Export, Import and Domestic Market: 2000 - 2007



Solar Thermal Systems in Buildings *Estimated Figures for 2006*



G. Fanning



Share of Solar Thermal Systems in the Building Sector in Austria Status 2004

Single and attached Family Houses	Apartment Houses	Commercial/Tourist Houses
Total: 1.3 million buildings	Total: 1.9 million buildings	Total: 15,000 buildings
Houses with solar thermal system		
182,000 houses (14%)	19,000 houses (1%)	750 houses (5%)
Total solar thermal systems in Buildings		about 202,000 solar systems

8. Solar Thermal Systems on the Market

The hot water preparation in new buildings is today standard in Austria. In the area of building renovation, solar systems for hot water preparation are attractive on the market. Especially ineffective heating systems for hot water preparation outside the heating season have been replaced by solar hot water preparation. Thus pollutant emissions through heating (wood, coal, oil boilers) could be reduced and at the same time a high comfort in hot water preparation could be reached.

In *solar systems for hot water preparation* in residential and commercial buildings flat plate collectors of different designs (non evacuated and evacuated collectors with and without selective coating) are used.

The use of solar energy for space heating in buildings can be justified in the case of *low energy buildings* (new buildings) with a maximum design temperature of the heating distribution system of 40°C. Quite satisfactory technologies and approaches exist for heating systems. Combined solar heating systems increased remarkable in the last five years. About 20% of the installed solar thermal systems are connected to the heating system. Favourite solar combined heating systems are solar assisted biomass and ground-coupled heat pump systems.

Combined solar-biomass heating systems, individual as well as in combination with district heating are attractive applications for *renewable energy heating technologies* in Austria.

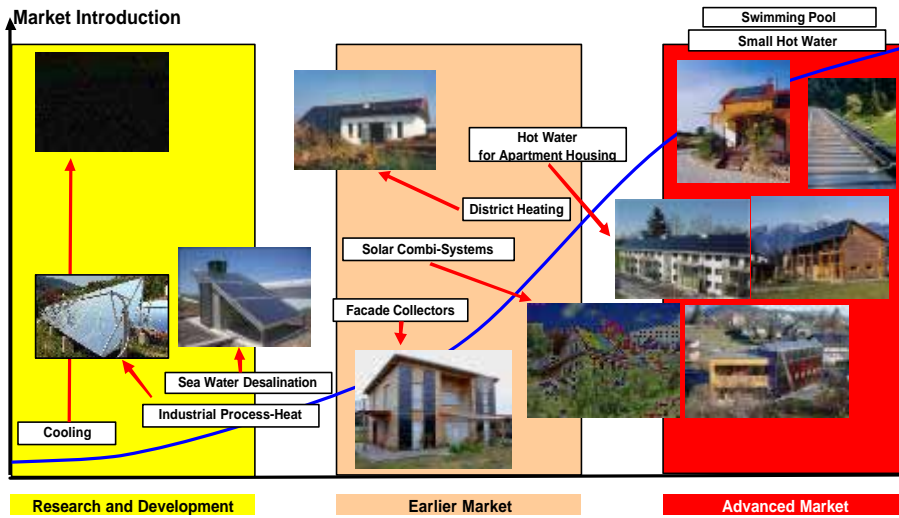
A key factor in the success of solar in Austria is that its use goes beyond small systems for hot water production or swimming pool systems. Compared to other countries, Austria has been using *SolarCombisystems* (systems for space heating and hot water production) in single family houses and multi-family houses for years. Also, solar applications have not been limited to houses, but are used in the hotel, tourism, large-scale district heating and business sectors.

Solar energy technologies of today in Austria range from full economic competitiveness to being ten times more expensive than conventional energy technologies. Some technologies which have not reached commercialisation yet need more development to improve efficiency, reliability or cost so as to become commercial. This would include material and system development, pilot plants or field experiments to clarify technical problems and demonstration plants to illustrate performance capabilities and to clarify problems for commercialisation.

Larger shares of solar energy in total energy consumption require more activities to reduce the energy demand within higher energy-efficiencies in all sectors of energy consumption. For example, to reduce the total energy consumption in a building it is necessary to consider more than one of the systems: energy conservation, day lighting, passive solar, active solar, and photovoltaic.

Solarsystems on the Market

Research ⇒ Development ⇒ Market Introduction



Solarsystems for Housing

Hot Water Preparation



SolarCombi-Systems for Housing



Solar-Heat for District Heating



Solar supported Biomass-District Heating



Graz

Solar supported District-Heating



Lienz, Tirol

Solar-Supported District Heating for Housing Estates



Solar Share for Heating
(Hot Water and Space Heat):
40% - 60%

Hot Water and Space Heating



Mobil Heating Station for Solar-Combined Heatingsystems

EnergyCabin Produktions- und Vertriebs GmbH



Solarsystems for Cooling and Air-Conditioning



Solar System for Cooling
Olympic Games 2008
China / Qingdao: S.O.L.I.D



EAR Tower in Kosovo, S.O.L.I.D



Wine-Cooling and Bottle Washing, Styria

Solar Systems for Industrial Processes



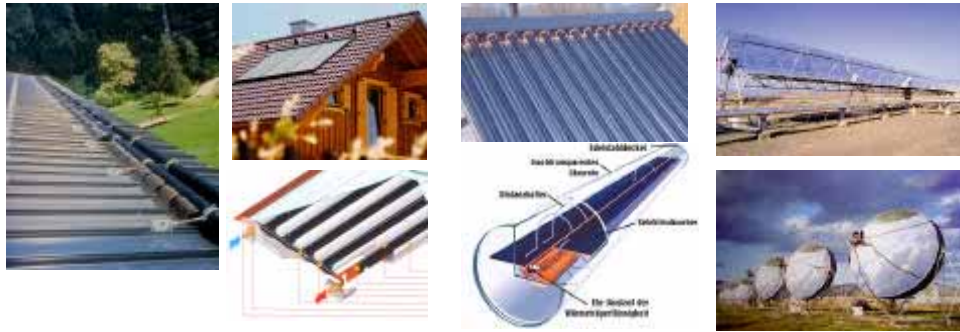
Test Facility, AEE-INTEC-Gleisdorf



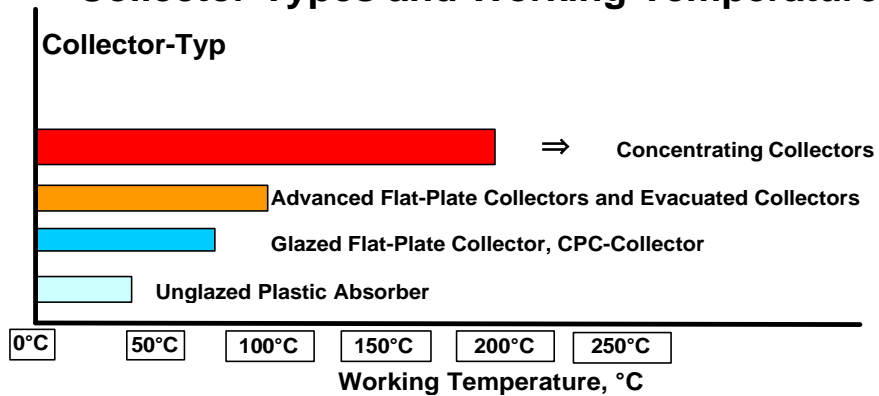
Spice Fabrication, Kirchbichl/Tirol



Car Was-Facility "SunWash", Köflach/Styria



Collector-Types and Working-Temperatures



Collector Types for Solar Thermal Systems

Swimming Pools
Temperature = 35°C

*Unglazed Plastic Collectors
(Absorber).*

Hot Water and Space Heating
Temperature = 80°C

*Glazed Collectors
with selective absorbers,
CPC- und evacuated collectors.*

Cooling and Air-Refrigeration
Temperature = 120°C

*Advanced flat-plate collectors
and evacuated collectors.*

Low-Temperature Process Heat
Temperature $\geq 200^\circ\text{C}$

*Advanced flat-plate collectors,
evacuated collectors,
concentrating collectors.*

Building Integrated Collectors *Advanced Façade-Collectors*



Solar Thermal Systems on the Market (1)

Solar Systems for Swimming Pool Heating *(Outdoor)*



- Economically attractive.
- Today, most swimming pools are heated with solar systems.

- **Collector-Typ:**
Unglazed Plastic Absorber.

Solar Thermal Systems on the Market (2)

Solar Systems for Hot Water (Housing, Commercial and Industrial Buildings)



- State of the Art.
- Pay-Back Time < 15 year.
- With public financial support attractive.
- Collector-Typ:
Glazed flat-plate collectors, CPC- and evacuated collectors.

Solar Thermal Systems on the Market (3)

Solar-Supported Heating Systems (SolarCombisystems for Energy-Efficient Buildings)



- Proofed Technology.
- Pay-Back Time < 20 year.
- With public financial support attractive.
- Collector-Typ:
Glazed flat-plate selective collectors, CPC- and evacuated collectors.

Solar Thermal Systems on the Market (4)

Solar Systems for Air-Conditioning and Cooling



- In Development and Testing:
Cooling Machines and Systems
- Collector-Typ:
Advanced flat-plate collectors, CPC- and evacuated collectors.

Solar Thermal Systems on the Market (5)

Solar Systems for Low-Temperature Process-Heat *Temperature < 200°C*



- In Development and Testing:
Especially for pre-heating.
- Collector-Typ:
Advanced flat-plate collectors, CPC- and evacuated collectors.

Collector-Production in Austria



Production with "Roboter", Sun Master



GreenONEtec: Largest Collector Producer in Europe

With the rapidly increased exports of solar collectors, the Austrian collector producers extended both the production capacity and the production process within automation.

9. Outlook 2010

Some solar thermal technologies which have not reached commercialisation yet need more development to improve efficiency, reliability or cost so as to become commercial. This would include material and system development, pilot plants or field experiments to clarify technical problems and demonstration plants to illustrate performance capabilities and to clarify problems for commercialisation.

Larger shares of solar energy in total energy consumption require more activities to reduce the energy demand within higher energy-efficiencies in all sectors of energy consumption. For example, to reduce the total energy consumption in a building it is necessary to consider more than one of the systems: energy conservation, day lighting, passive solar, active solar, and photovoltaic.

Present research activities in Austria in the IEA-Solar Heating and Cooling Programme are:

- Development of process heat collectors, (AEE INTEC)
- Solar air conditioning and cooling machines, and systems, (AEE INTEC, TU Graz, arsenal research)
- Polymeric materials for solar applications, (University Leoben, PCCL, AEE INTEC)
- Heat storages, (TU Graz, PCM; arsenal research, advanced water storages; AEE INTEC, sorption storage)
- Solar heat for industrial applications, (AEE INTEC, Joanneum Research)

Austrian participations in IEA Solar Heating and Cooling Programme (SHC, June 2008):

- Task 33: Solar Heating for Industrial Processes
- Task 36: Solar Resource Management
- Task 37: Advanced Housing Renovation with Solar & Conservation
- Task 38: Solar Air Conditioning and Refrigeration
- Task 39: Polymeric Materials for Solar Thermal Applications
- Task 42: Task Definition, Advanced Materials for Compact Thermal Energy Storage
- Task 43 (?): Task definition, NET Zero Energy Buildings.

Further R&D activities are planned in the following fields:

- Zero energy solar energy houses.
- Solar air conditioning and cooling.
- New materials for solar thermal applications.
- Large-scale integration of solar heat into district heating.
- Advanced building integration (solar facade and roof).

The expected Solar Thermal Market Growth in the following years (annually) is depending on the policy measures – expected between 5% and 20%/year.