Market Deployment of Solar Thermal Systems in Austria
A Success Story of Interdisciplinary Co-operation

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1. Actual market situation

The market penetration of solar thermal systems since the very beginning in 1976 in Austria was supported by the *Austrian Energy Research Programme*. Mainly demonstration projects and standardisations of collectors and solar systems have influenced the market deployment. Pilot and demonstration systems have made essential contributions and have apparently contributed to partially overcoming the market barriers. Figure 1 to Figure 3 show the market deployment of solar thermal collectors from 1976 until 2001. Since 1975 about 2.4 million m² collector area have been installed in Austria, 2,4 million m² of which are at present in operation: 24% for swimming pool heating, 73% for hot water preparation and space heating, and 3% for drying of biomass products; Figure 4.

The annual heat output of solar technology was of about 759 GWh at the end of 2001, which corresponds to an annual amount of oil saving (oil-equivalent) of about 125,000 tons of oil.

The market development of solar systems in Austria illustrates both the manifold possibilities for the use of solar energy even in areas with a moderate climate and larger seasonal differences in solar radiation.

The use of solar energy in buildings is the main requirement to reach the goal for sustainable buildings.

The remarkable market development of solar thermal systems has only been possible because Austrian firms have in co-operation with research centres developed cost-effective technologies; Figure 5 and Figure 6. The development of large-scale collectors with up to 15 m² absorber area has not only reduced the costs for the collectors and for the installation but also the problems arising when connecting the pipes by means of prefabricated collector modules were reduced by more than 30%; Figure 7 to Figure 9.

With the rapid market development of solar thermal systems, new firms for collector production were formed and today one of the largest European collector manufacturer with an annual production of about 190,000 m² collector area is situated in Austria. The export of solar collectors increased in the last years remarkable: in 2001 251,000 m²; Figure 3 and Figure 10. Today, the collector production as well as the installations of solar thermal systems are new business areas. New jobs have been created and the prospects for the future are favourable; Figure 11.

2. Lessons learned

The market penetration of solar thermal systems in Austria is characterized by a diffusion failure between 1978-1982 and a successful diffusion process in the 1990's; Figure 1. It thus provides a unique opportunity to compare successful and unsuccessful diffusion within the same context.

The first solar collector boom from 1979 - 1981 was a research and business driven approach. Following the 1973 oil crisis solar energy was a main target for scientific research. Public money subsidised pilot projects and testing sites. Media coverage and high public interest led numerous small companies to develop and market solar hot water systems. Many of their designs were technically unreliable and inefficient. None of the involved solar collector producers at the beginning of the market introduction took the trouble to provide maintenance services. As most systems on the market had reliability problems maintenance was really missing. Additional to that, solar systems were very expensive at that time and no significant economic incentive (besides a minor tax incentive after 1980) existed. At that time private consumers were typical innovators: people from the upper middle class, characterized by higher income, higher education, and often a great interest in all forms of alternative energy. Solar energy was simply "in" among certain groups within society, and purchasing a solar energy system added to the buyers prestige. Companies and professional builders of residential homes that set up large solar systems were the other important consumer group.

The breakdown of the first solar boom was the combined effect of an economic recession and the saturation of the market of typical innovators. Technical failure and lack of maintenance services worsened the situation. Heat pumps took the position of solar collectors for innovative consumers. Most producers withdrew from the solar market with the exemption of few dedicated companies specialized on solar collectors that operated on a strictly regional level, with close contacts to their customers. These companies developed technically feasible systems that enabled them to survive on their local markets and to successfully expand their production during the solar boom of the 1990's.

Due to the prohibitive costs and poor performance of commercially available collectors a group of amateurs decided to build a solar hot water system by themselves; Figure 12 and Figure 13. They developed a simple but clever designed solar water heater appropriate for self-construction. In the context of an ecological housing project the residents built several units of this system in a group. The positive experiences of this first self-construction group in 1983 soon spread by word of mouth to neighbouring communities. When the number of interested individuals increased, a few dedicated persons decided to hold evening lectures on how to build a solar collector in a group occasionally. More and more people began organising themselves in groups to build their own solar water heater. Direct access to experiences with construction and operation allowed significant improvements of collector design during this expansion phase. Special tools were invented and later a complete "tool kit" was made available to other groups for a small fee.

The activities of self-construction groups, supported by the local governments and communities have influenced the further market penetration of solar thermal systems. The background of the self-construction groups is the rural culture of cooperation. The increasing interest of new small companies as well as installers were the basis of a faster market diffusion. The self-construction groups were more and more leaded by local installers and commercial small companies. New firms for collector production were formed and today one of the largest European collector manufacturer with an annual production of about 200.000 m² collector area is situated in Austria. Since 1995 the share of self-constructed collectors decreased and the industrial produced collectors increased; Figure 13.

Research activities did not play a significant role for the collector development and market penetration in Austria. Research work became important for systematic testing (demonstration projects) and for the establishment of standards. In the past, the market penetration of solar thermal systems was not affected by remarkable economic benefits. The most relevant barrier

for a faster diffusion is the ownership of the house. More than 90 % of the solar thermal systems are installed in private homes. The diffusion is today also restricted to urban areas, where manufacturers and installers offer systems and maintenance. It is remarkable, that the diffusion success is primary based on local initiatives. For the further market diffusion of solar thermal systems, technology reliability and performance may be the main impacts. The "learning curves" should be improved by more technical monitoring with a guarantee on the heat output. There is a problem, that traditions of wrong design are established, without learning from system optimisation. This problem could be solved within certification of installed systems.

In terms of lessons learned, there was a certain tendency in the past to put too much emphasis on high-technology solutions in the end-user sector. Experience shows that intermediate-technology solutions which are reliable and easy to handle are of more importance, at least for near-term applications and commercialisation. Sufficient experience and operational data exist now to ensure that renewable energy technologies are professionally designed and installed to provide optimum performance.

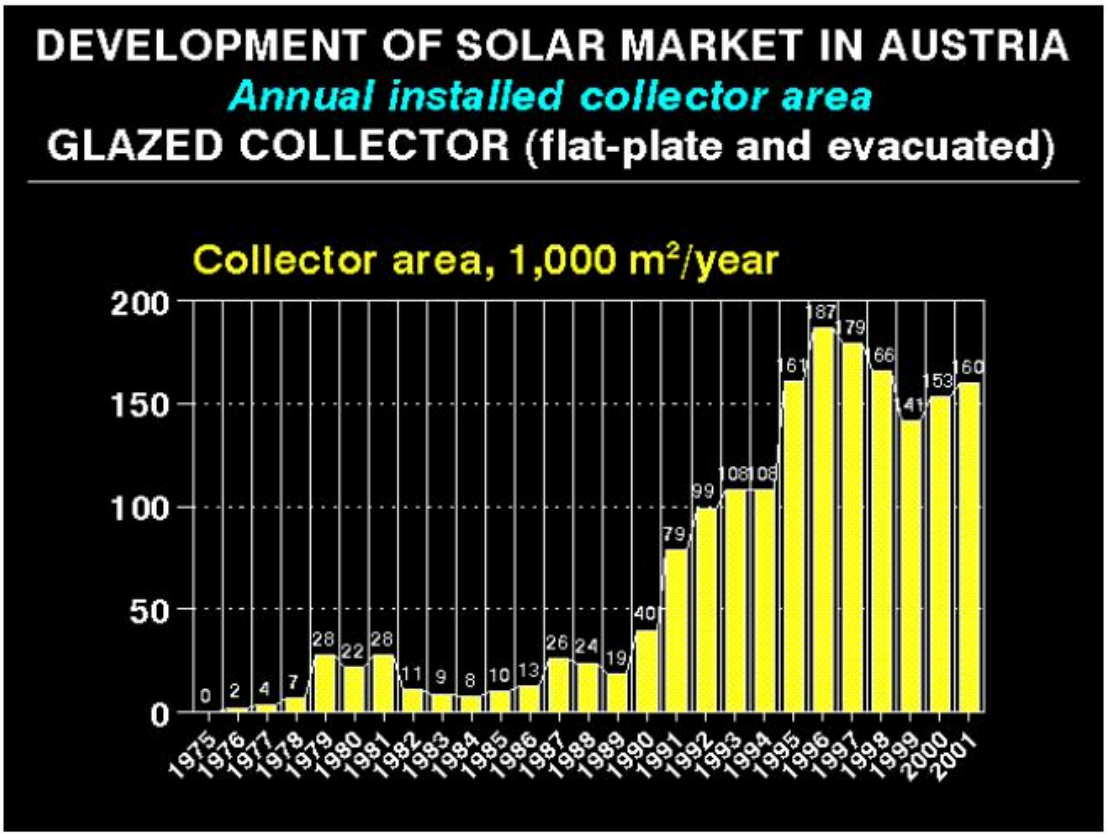

Fig. 1: Market deployment of solar collectors in Austria

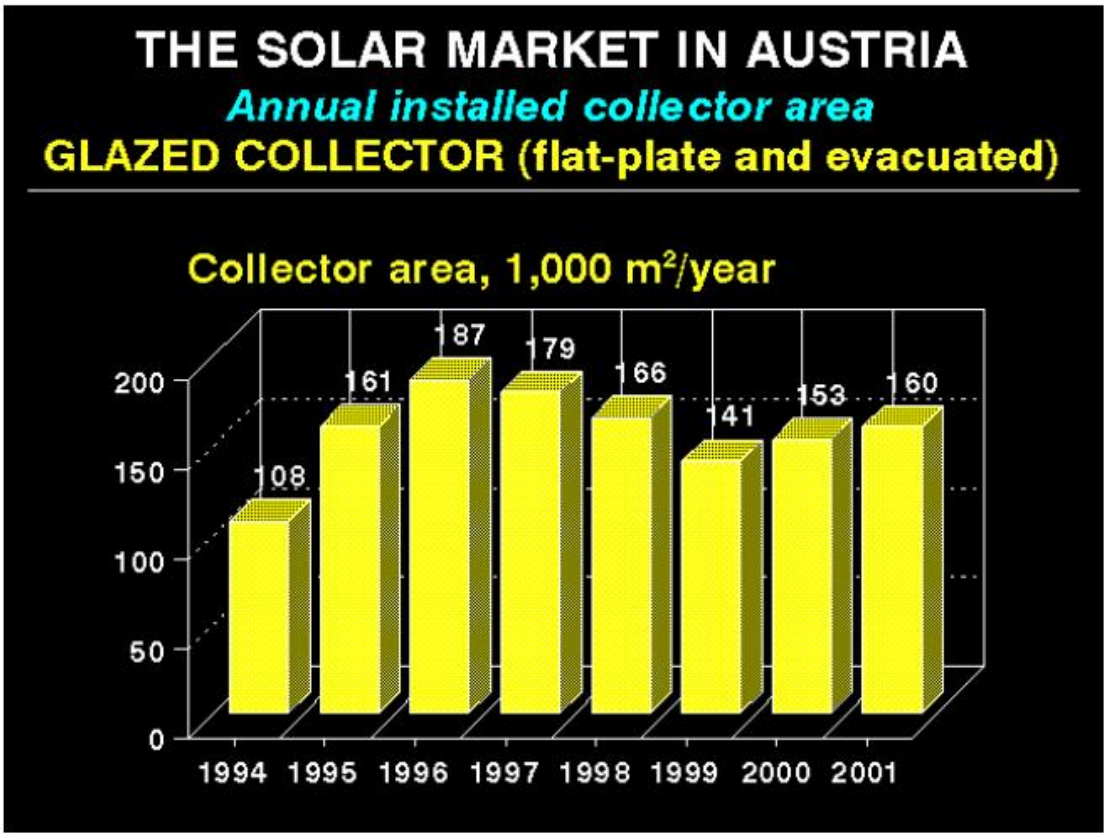

Fig. 2: Annual installed collectors in Austria: 1994 - 2001

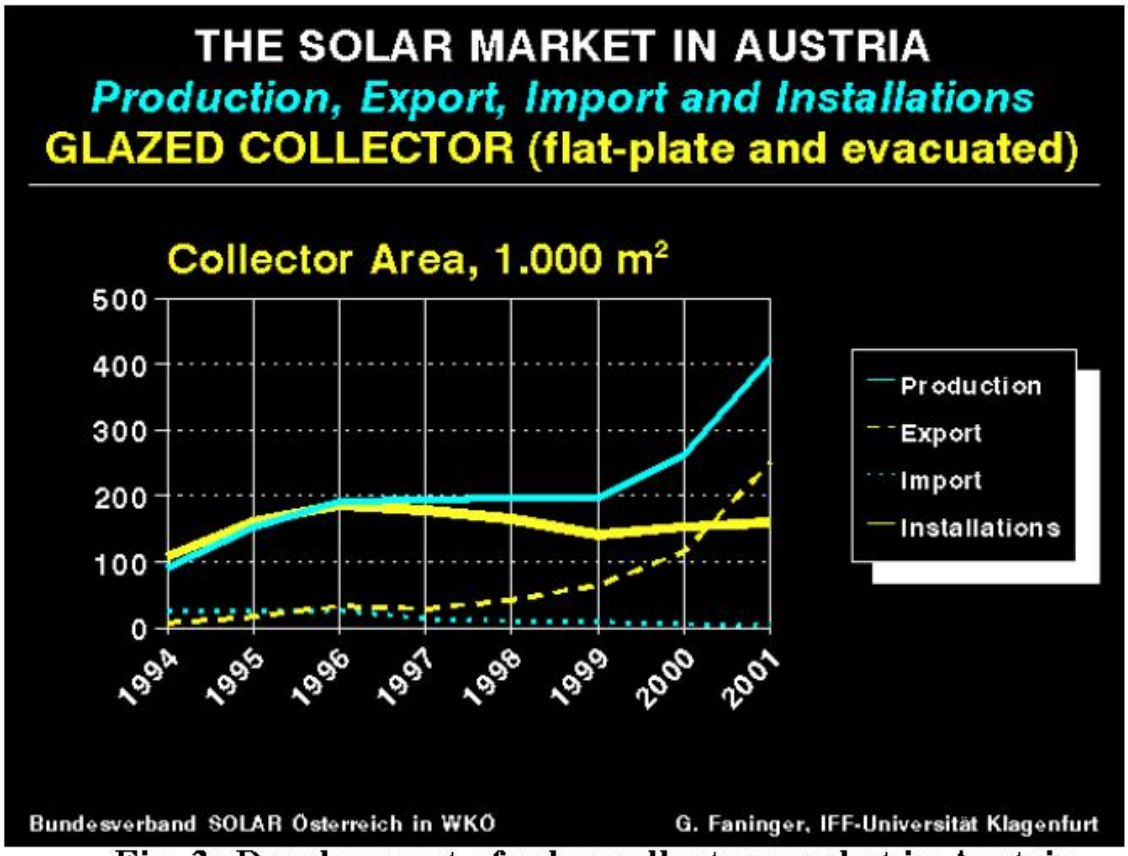

Fig. 3: Development of solar collector market in Austria

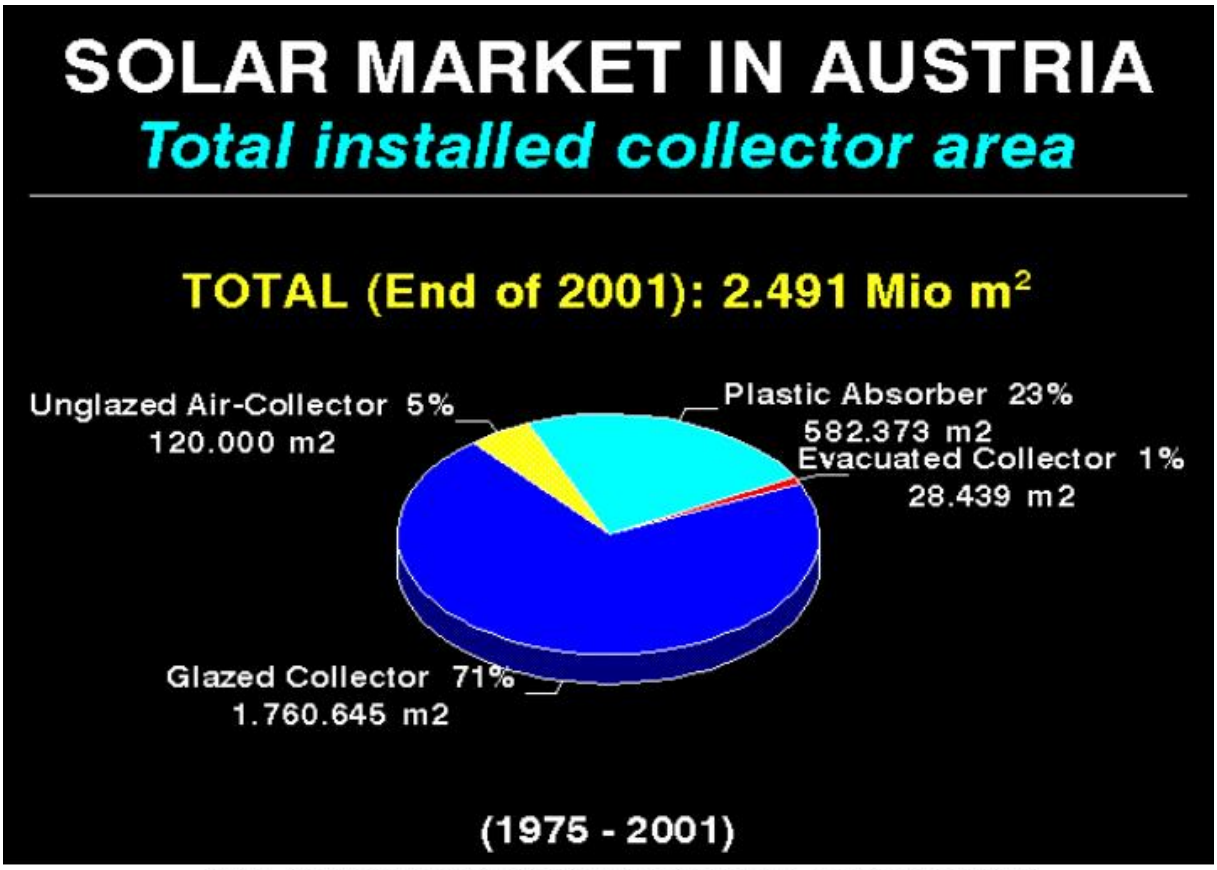

Fig. 4: Total installed collectors in Austria: 2001

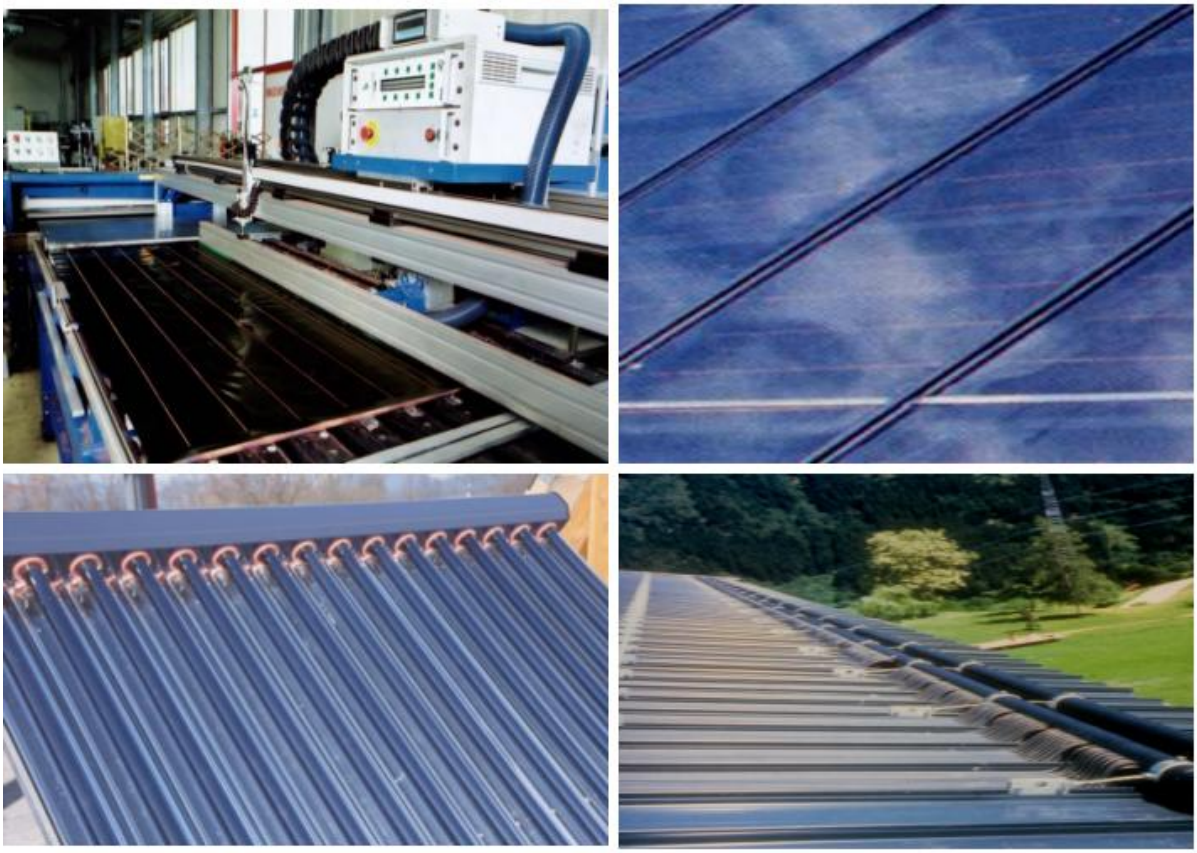

Fig. 5: Solar collector production in Austria

Fig. 6: Collector production by industry in Austria

Fig. 7: Development of collector installation in Austria

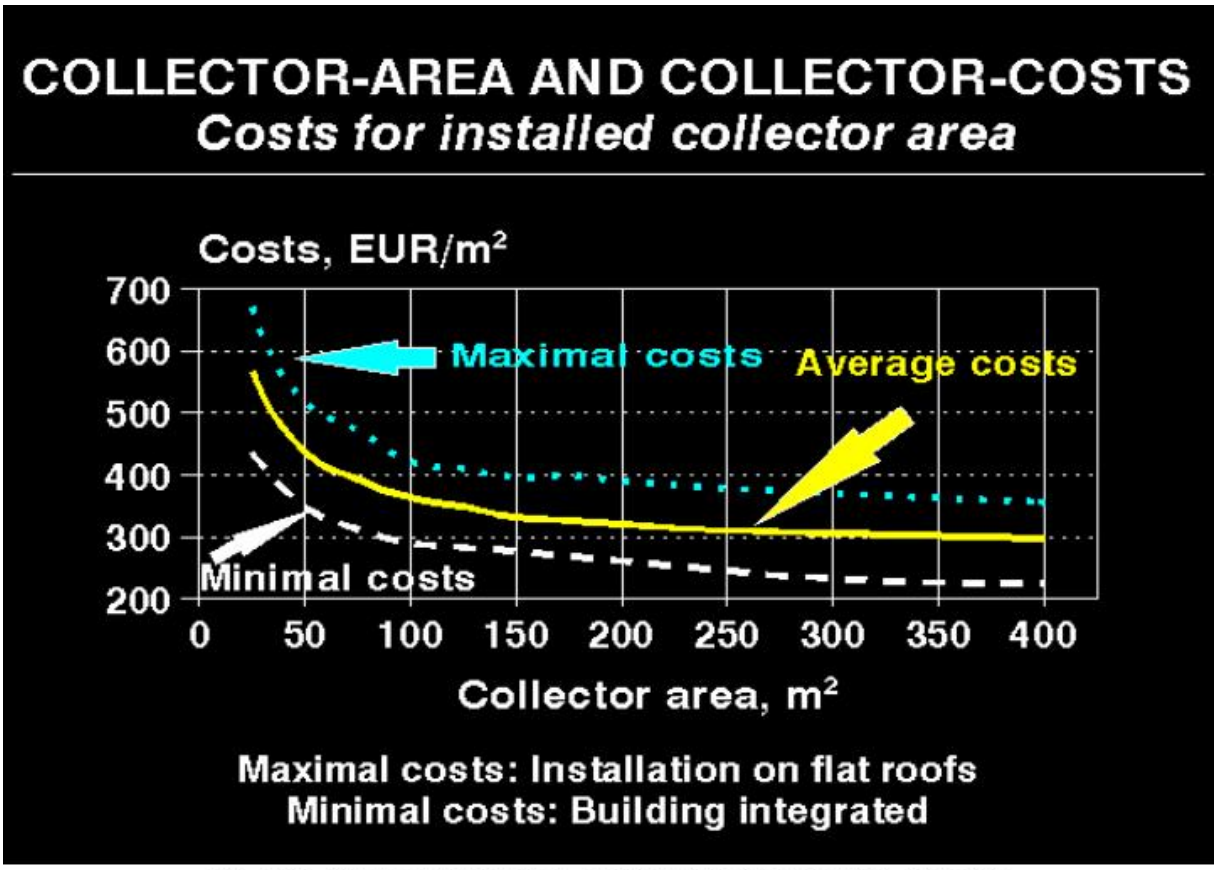

Fig. 8: Collector area and collector costs (2002)

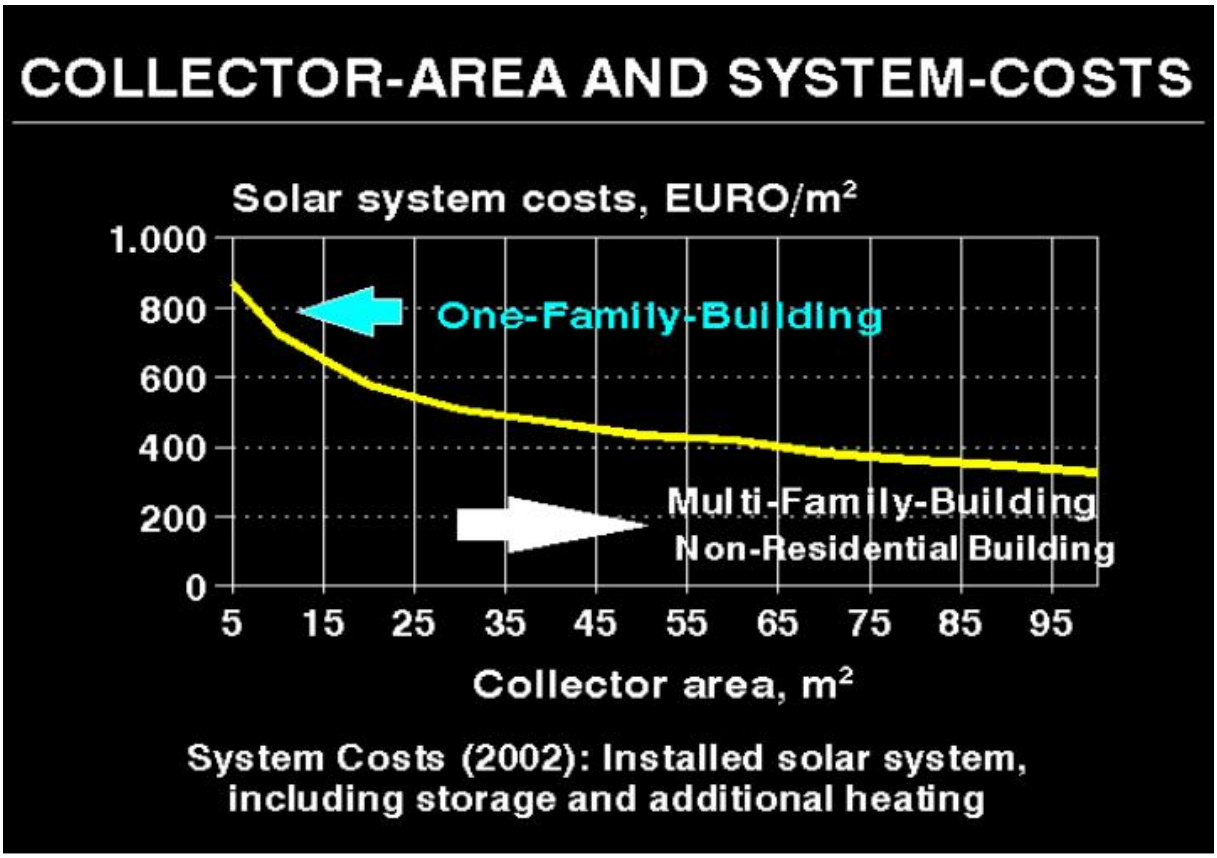

Fig. 9: Collector area and solar system costs (2002)

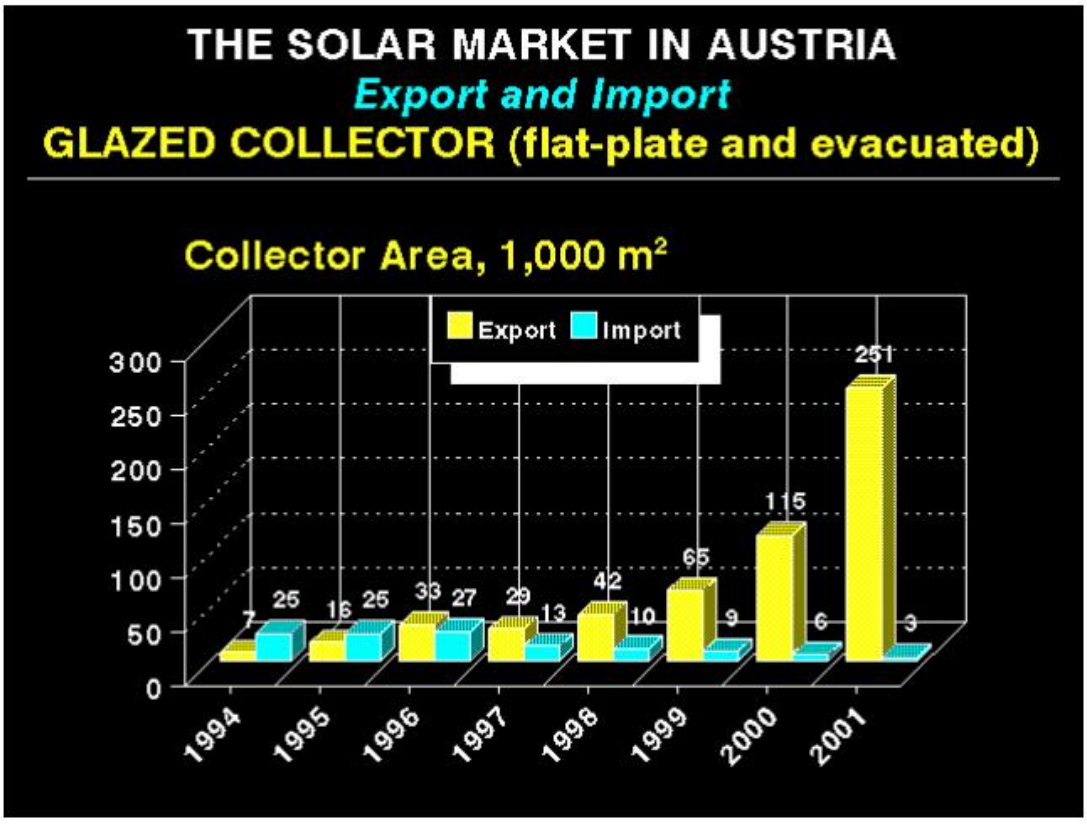

Fig. 10: Export and import of solar collectors in Austria

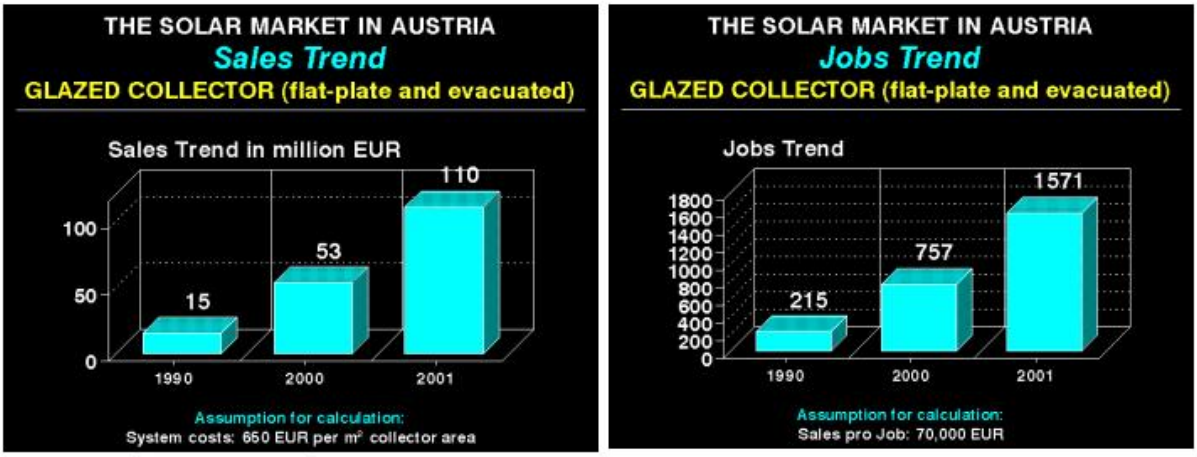

Fig. 11: Sales and jobs trends in the Austrian collector industry

Fig. 12: Collector production by private initiatives in Austria

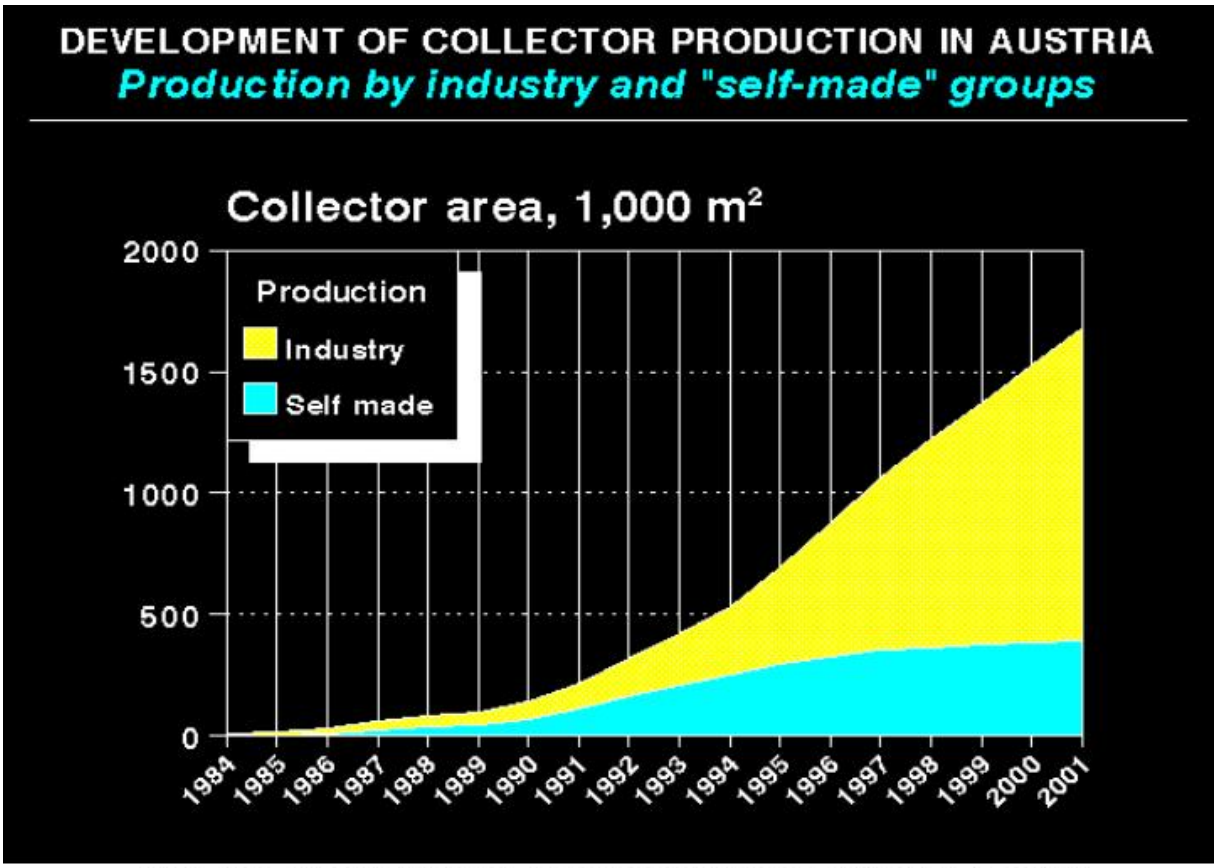

Fig. 13: Development of collector production in Austria