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The Role of the State and the Economy in the promotion of heat pumps on the market

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Abstract: The laws defining the tasks of the Swiss Federal Office of Energy (SFOE) do not allow it to dictate measures, but to collaborate on the basis of voluntary actions. In the heat pump sector, the SwissEnergy action programme binds together 1 state, 26 cantons, 3000 communes, 50 manufacturers, 3500 installers, 1200 electricity companies and environmental agencies. In order to promote the use of renewable energies, the SFOE took the lead by creating the Swiss heat pump promotion group (GSP) in 1993. The idea was to bundle the market's forces to actively market and promote heat pumps for heating purposes. Under the umbrella of the Energy2000 (1990-2000) and the SwissEnergy (2001-2010) promotion programmes), the disparate heat pump sector was brought together and consolidated into being a key player on the heating market. The role of the SFOE and the GSP has changed with time. At the beginning, the SFOE decided what was to be done and the GSP did the job on a mandatory base. The SFOE was responsible for achieving the goals. The GSP gradually grew, so that since 2001 it has been able to determine the action plans itself. The SFOE sets the goals and the GSP is responsible for fulfilling them. The SFOE assures the coordination and the efficient use of resources. Its domain manager is responsible for the coordination of the whole chain from research and development to market, including quality management for all of the activities and the products as well. In this way, the government laid the foundations for the sector to become a success. This model can be applied to other domains or to other countries if some of the assessments and conditions described in the article are met.

Key Words: ***heat pumps, market, dissemination, promotion, law, policy, quality, economics, renewable, energy***

1 INTRODUCTION

This is not a historical review of heat pump promotion in Switzerland, but an analysis of the role played by the government's bodies and the economy in promoting heat pumping technologies. In summary, it can be claimed that only the cooperation between the government, research and development institutes, manufacturers, HVAC-consulting firms, contractors and energy-suppliers has led to the success experienced, whereby the Swiss Heat Pump Association GSP has played an active role in the national programme for promoting renewable energies and especially heat pumps.

2 Basic data on Switzerland

Switzerland has a population of 7.4 million. Furthermore, 1.3 million buildings are used for residential, administration, education, transport, and industry. 700’000 of these buildings are classed as residential housing.

With regard to the climate, temperatures in the winter period usually fall below 0°C for several weeks. In some areas, temperatures can drop as low as minus 25 °C. In the colder seasons, much of the country is covered by snow. The annual mean temperature is around 4°C. Based on these facts, it is necessary to have reliable heating systems. The sink temperature of new low-temperature heating systems ranges from 35 to 50 °C, whereas older existing heating systems operate between 70 to 90 °C. All of these facts place high requirements on any heating systems.

3 The heating market

The heating market in Switzerland is worth about CHF 500 million a year as part of the building sector, which accounts for roughly CHF 17 billion. The energy sector as a whole (fuel, gas, gasoline, electricity) accounts for about CHF 24 billion. In comparison, the automotive market accounts for about CHF 78 billion.

Compared with usual marketing and economic fundamentals, the heating market has some specific characteristics.

- It is not expandable. The number of heating units sold every year is determined by the number of new houses built and the retrofitting of existing heating systems. Both are quite constant and mainly depend on the state of the global economy. About 12-15'000 new residential houses are built annually, and about 30-35'000 heating systems are replaced or retrofitted every year.
- It is a long-term market. Heating systems have a life of between 15 and 20 years. When it gets old, it is likely for the most part to be refurbished or partly retrofitted to minimize costs. So on average, a total retrofit of heating systems will only occur every 35 years.
- It is conservative. People know what they like and like what they know. Changes of heating systems are rare. It is much simpler and cheaper to keep or refurbish or retrofit the same system.
- It is of little interest. The heating system is a basic part of the house and as such is not particularly interesting. A house has to be heated, the rooms must be warm and hot tap water must flow on demand. Heat is also not consumed in the same manner as other goods. Heat is a basic requirement for living in a house and must be fulfilled. Heating systems are not chosen like a car, although they may cost

about the same. There are no emotions for the heating system.

- There is no need for change. Heat pumps are not a new solution. They have existed for decades. Its use was not widespread because other systems, such as oil and gas furnaces, came on strong in the 1950s and overwhelmed the market in the 1960s. Coal and wood heating was pushed out. Attempts to bring in another system would have meant running up against well-established, efficient, cheap and reliable furnaces. Customers are satisfied. Companies, manufacturers and installers are living well from the existing furnaces. Few people experience problems, so they do not need any solutions! Why should they learn to manufacture and install a new expensive and technically more complicated system? Under the economic and legal conditions of the 1980s, there was no need to change. That is why there were only a few pioneers making a small number of heat pumps on the market.

4 Role of the state and the economy from 1990 to 2007

The key to the successful promotion on the market lies in the dynamic behaviour of the state and the economy. The role of the state in particular has to change and adapt to changes in the market. The following section analyzes the past experiences in Switzerland from a critical perspective.

4.1 Emergence (1990-1992)

The promotion of renewable energies on a political, national level was launched in 1990 with the passing of the Federal Energy Act. The sparing use of energy and increased use of renewable energies were made top priorities. In the heating sector, the goal was set at achieving an additional 3 TWh from renewable energies. From the very beginning, heat pumps for heating purposes were integrated into systems using renewable energy, such as solar collectors and biomass.

Bundling all these together however is not that simple under the Energy Act because it seeks to encourage, not enforce: "The Federal Office of Energy can support activities for the rational use of energy and for the use of renewable energies". The "can" means that the state cannot force people, but instead has to seek collaboration with partners and convince them to reach the goals together.

The situation at the beginning of the 1990s did not favour heat pumps. They were expensive to buy, expensive to run, unknown technology with a bad name. The current market players were also not at all interested in promoting heat pumps.

- Utilities: should have had a big interest in promoting electrically driven heat pumps to sell more electricity? Not at all! The bad name of the expensive and unreliable technology was a great barrier.
- Installers: are small companies, loving free enterprise. For them the state means red tape and regulations.
- Potential buyers: knowledge of heat pumps was very low. The usual heating system is the good old oil furnace.
- Cantons and communes: did not really know what a heat pump was, but knew that "if you want trouble, buy a heat pump!"

- Heat system manufacturers: pioneered making tailor-made and expensive installations, which were neither efficient nor reliable. The 50 heat pump manufacturers delivered 2'000 units a year, and the 5 furnace manufacturers 40'000 units a year. Well established manufacturers did not want to compromise their good name with heat pumps. So it remained the business of a handful of outsiders. Some great innovations and a few older products are still running now.

For the head of the promotion programme, Mr. Hansulrich Schärer, it was clear that the public sector had no business intervening in the heating market. The State is the state and the market is the economy. The Swiss Heat Pump Association (GSP) was also founded in late spring 1993 with the goal of promoting heat pumps in Switzerland and establishing an international network with other institutions. The foundation of the GSP was the first important act of the Swiss Federal Office of Energy in the heat pump promotion programme. The GSP serves as a platform for engineers, contractors, manufacturers, energy-suppliers and governmental organizations.

4.2 Bundling (1993-1995)

The best way of bringing people closer is to make them work together to increase the market share of heat pumps. Fortunately, the government provided the SFOE with a budget. Responsibility for the promotion programme shifted to Mr. Fabrice Rognon and became a full-time job.

The SFOE adopted clear rules to avoid a gold rush. First, the SFOE only supports projects. Second, the financial participation of the SFOE across all GSP projects should not exceed 60%. It may be higher on some projects, but then has to be lower on others in order to remain under the maximum.

The SFOE managed the budget and the contracts together with partners. The GSP had the responsibility of coordinating the activities. The responsibility for the activities and for the fulfilment of the contract's goals rested with the SFOE. See figure 1.

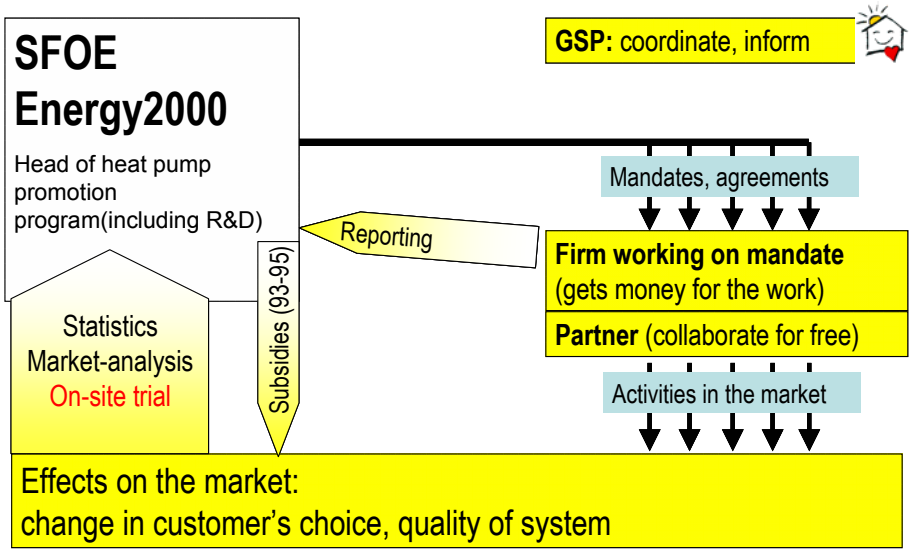

Figure 1: Swiss heat pump promotion programme 1993 – 1995, structure and organization

The aim of the promotion programme was to balance the activities between pulling partners along the quality and training path and undertaking marketing with/for them. It was crucial to keep all the key players on board to prevent the GSP from disintegrating resulting in everyone working on their own. Companies wanted more units sold and few quality controls. The SFOE wanted maximise use of renewable energy by promoting reliable heat pumps with satisfied owners. The economy prefers a free market which is not automatically a guarantee of quality and performance: look back at the heat pump peak of the year 1980 as in figure 2.

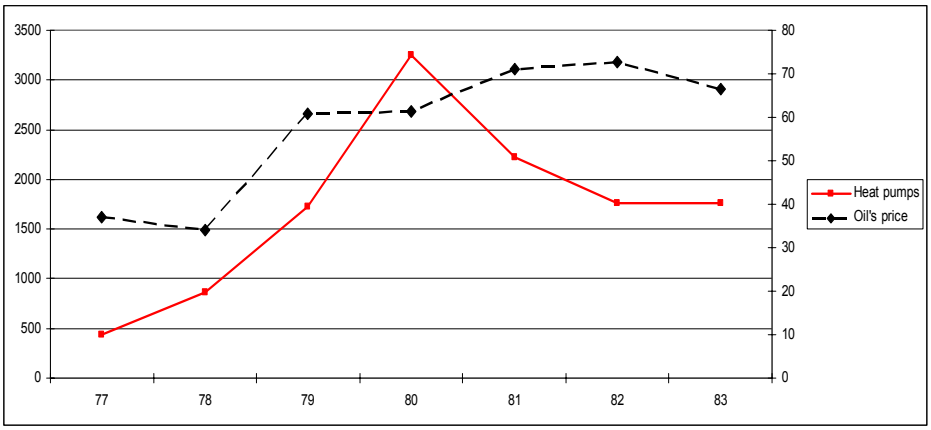

Figure 2: heat pump sales and oil price between 1977 and 1983

Due to steadily rising oil prices (from CHF 33 to 70 for 100kg), heat pump sales climbed quickly from some hundred units to over 3'000 units. Due to poor quality and bad installations, the figure fell to 1'700 units within just 2 years. See figure 2.

In this first bundling phase, the SFOE had a great influence on the definition and choice of the projects. Some companies had doubts about the direction: they wanted more marketing and broad communication instead of testing and training. Although the legal framework does not allow for regulation or enforcement, the money gave the SFOE the opportunity to shift activities. In economics he who pays has the say. But a certain degree of diplomacy was still necessary as some key market players did not need money from the SFOE and were not interested in heat pumps.

Promotion measures began by working on framework conditions, procedures and authorization and quality assurance. Simplifying matters and coordinating the 26 cantons, 3000 communes and 1200 utilities was not an easy task, but was necessary in order to open up the market. The GSP, in close collaboration with the SFOE, was nevertheless able to achieve significant improvements. The first milestone in the quality assurance of heat pumps was achieved with the opening of the first Swiss testing facility in Töss near Zurich in summer 1993. The test results were broadly communicated, especially to end-users. Training was also started at this time because the dimensioning and installation of heat pumps requires more skill than furnaces. With these activities, the SFOE wanted to increase confidence in heat pumps. Without confidence, end-users would not buy them and professionals would not sell them.

In 1993, the SFOE introduced subsidies to stimulate the market. They were only available for retrofits to help the segment of the market the greatest potential. Success was modest: the number of heat pumps installed as retrofits for existing systems rose from 300 to 800 a year. This was far below the target: 30'000 regular furnaces were being replaced annually. More surprising still was the evaluation of the subsidies which included surveys of recipients. 85%

would have done it without subsidies! Consequently, the subsidies were stopped in 1995. The effect was limited: the state brought 4'000 units onto the market at a cost of CHF 8 million and only 15% of these were really due to the subsidies.

The strategy was adapted: there were no more subsidies, but in addition to greater emphasis on training and quality, communication was also boosted. This did not take the form of advertising which would have been much too expensive, but the GSP organized local events with installers, manufacturers and utilities to increase awareness about heat pumps as a heating system.

The first segment of the market to develop was that of new single-family houses. It is easier to convince private owners to spend more money on a uneconomical system to protect the environment. Professional investors are not.

At the end of this first phase, annual sales of heat pumps increased from 2500 in 1992 to 4603 in 1995.

4.3 Consolidation (1996-2000)

The number of GSP members grew, especially among installers. More and more companies noticed that heat pumps were turning into a business. The common interest was recognized. The abandonment of subsidies was well received in the economy. Respect for the free market and enterprise was a key issue in the perception of the GSP's actions under the umbrella of the SFOE.

These successful first few years paved the way to establishing the GSP and heat pump promotion more solidly in the economy. The GSP reorganized its structures to become more operational. The GSP took over responsibility for defining and selecting its activities and proposed an annual plan of action to the SFOE. Responsibility for managing the whole promotion budget remained with the SFOE. The mandates were divided between the SFOE and firms. However responsibility for determining the share of the budget to be used for the different kinds of activities was gradually assumed by the GSP. The GSP was responsible for the projects and for reporting to the SFOE. On this basis, the bills were paid by the SFOE. See figure 3.

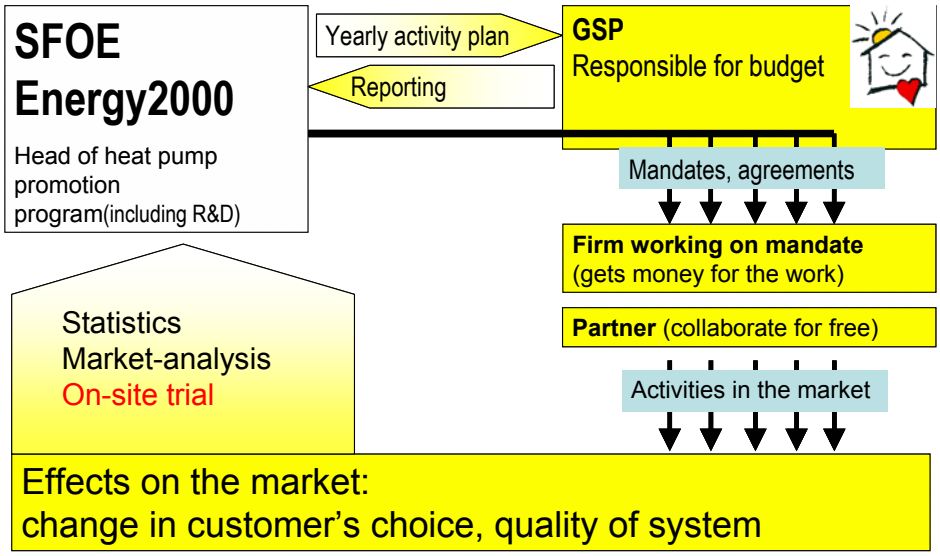

Figure 3: Swiss heat pump promotion programme 1996 – 2000, structure and organization

The success was proven: the oil price for heating fell from CHF 37 to 30 for 100kg between 1993 and 1999. However, heat pump sales rose over the same period from 2693 to 7033 units. See figure 4.

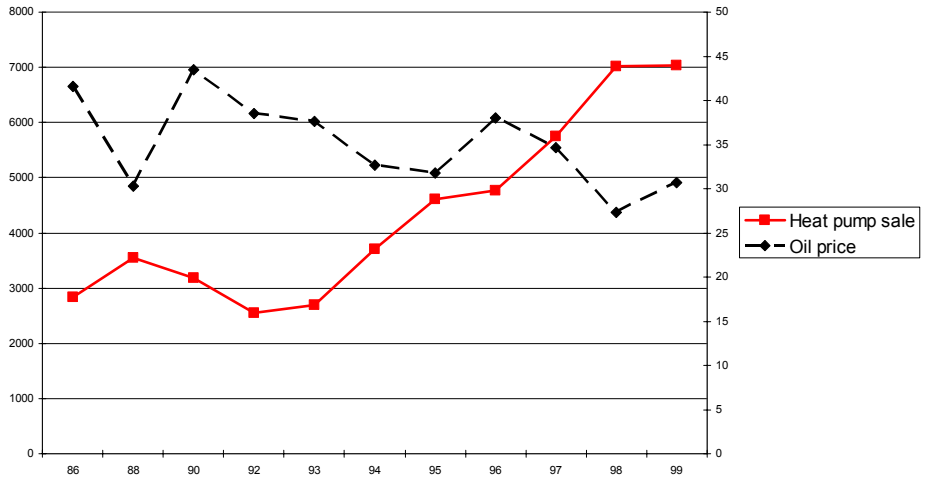

Figure 4: heat pump sales and oil price between 1986 and 1999

For the first time in the long history of heat pumps the market trend did not follow that of oil prices. This remark illustrates the new topic of reporting. As long as subsidies were granted by the federal government, the reporting was straight forward: it was purely statistical. However, knowing exactly who receives how much money does not reveal anything about the effect of the money spent… And the above mentioned evaluation proved to have little impact. Other evaluations of similar programmes provided equivalent results.

Note that the activities of the GSP focus on quality and training and objective information in order to increase trust in heat pump technology. Pure marketing and advertising is undertaken by companies.

Since the GSP is working with federal money to stimulate the market, it must provide detailed reports. The reporting runs on three levels.

The first is pure accounting: numbers of brochures printed and distributed, numbers of telephone calls, faxes, e-mails, number of invitations to training courses and the detailed amount of money for each of these activities, including participation by partners and sponsoring.

The second level concerns the straight effects: number of participants at training courses, number of heat pumps tested and number of certified drilling companies. At this level, the SFOE realized on-site trials of installations to check the the level of quality achieved under field conditions. This project, called FAWA (German abbreviation for on-site trial of heat pumps), gathered information on running heat pumps and made it possible to determine precisely efficiency and quality on-site.

As part of this second level, the SFOE developed a statistical tool on a half-yearly basis with two purposes: first, to gather reliable data on the number of heat pumps by heat source, output power, new or retrofit installations. Second, to calculate the amount of energy from the number of installations on a half-yearly basis and of all installed heat pumps. The half-yearly calculation is straight forward enough . But measuring the total number of heat pumps installed is not as easy as it seems: the total number of heat pumps installed is the sum of units already installed plus the number of unitys installed annually minus the number of retrofits by heat pump minus retrofits by other systems. The rate of retrofitting of existing heat pumps depends on the average lifetime of the heat pump. The model applies a probabilistic method: a heat pump installed in year n has 100% probability of still running in year n+1. The probability then decreases with each year down to zero after the average lifetime.

The third level deals with the attribution of the effects on sales and energy statistics. Unfortunately, there is no economic model for calculating the exact effects of these marketing and quality activities on sales of heat pumps. The SFOE had to develop its own way of estimating the effects of the money spent. The best way to quantify the effects is to reverse the thinking: what would happen if an activity was cancelled? Some would be continued by the economy, maybe on a reduced scale. Some would be stopped.

Without an existing model, the SFOE developed its own way of estimating based on a deep knowledge of the market and the market's actors. Collecting data and conducting interviews are essential in order to produce a reliable set of data and facts to analyze.

The activities can be divided into three categories: fuzzy, clear and killing.

- Fuzzy: the effect is can only be estimated. In this category are all the information activities.
- Clear: the effect can be quantified by market actors. Examples:
    - if company staff attend a training course on retrofitting and then carry out installations, that figure is recorded by the company.
    - If there was a system of heat pump certification, the minimal efficiency would be a condition for manufacturers. Without it, the efficiency would lie lower.
- Killing: the elimination of the activity reduced the effect to zero. Example: without certification of drilling companies, drilling would quickly be forbidden by the cantons. So this market would collapse within a short space of time.

The conclusion is that without promotion on the part of the GSP together with the SFOE, there number of heat pump sales would have remained stagnant at about 3'000 heat pumps a year, unchanged since 1990.

By the end of 2000, annual sales had risen to 7264 heat pumps.

4.4 Towards independence (2001-2010)

The success drew more and more firms into the heat pump business. GSP membership grew steadily, ensuring a better financial basis for the association. In the meantime, the market changed: the number of manufacturers decreased from 50 to 12. Heat pumps were becoming a serial, industrial product.

In 2001, the SFOE therefore made far-reaching changes to the organization. The GSP alone is now responsible for overall promotion and the budget. On a five-year basis, the GSP proposes yearly action plans to the SFOE. Once these have been accepted, the GSP arranges mandates with firms. Reporting has become more important than ever. Full use can now be made of experiences from the previous year. See figure 5.

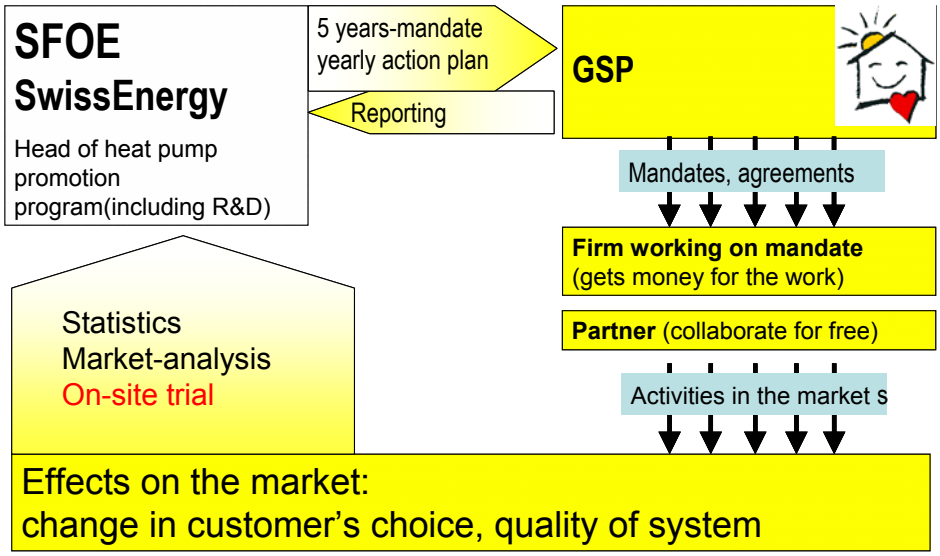

Figure 5: Swiss heat pump promotion program since 2001, structure and organization

The government continued to pursue its energy policy in the form of the SwissEnergy programme as a follow-up to the Energy2000 programme. The budget was reduced from CHF 55 million to CHF 42 million a year. Consequently, the budget of the heat pump programme also fell from CHF 2 million to CHF 1 million a year. The GSP therefore had to increase its share of partners working for free or providing sponsoring activities in order to maintain the level and intensity of its activities.

The new oil price trend since 2000 also boosted the heat pump market. Fortunately, the quality of the product was good enough and the technology was ready at the right time to take sales to unexpected new heights. The result is shown in figure 6.

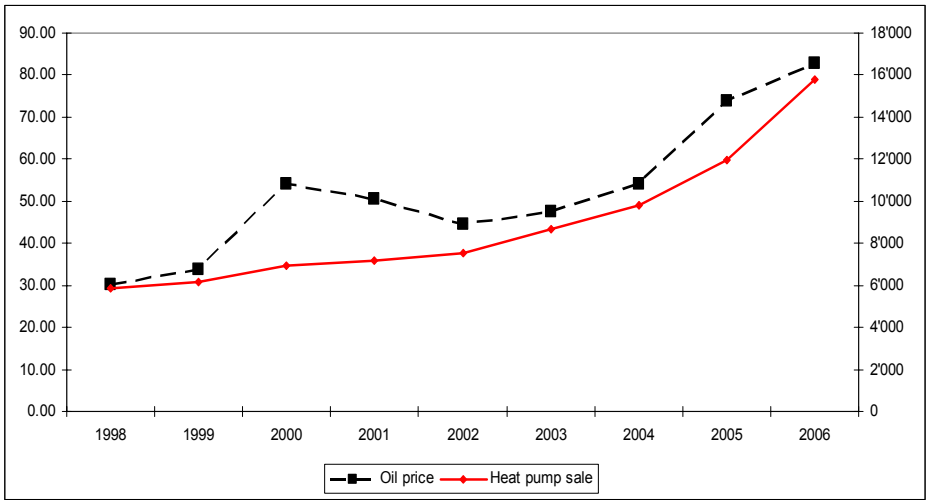

Figure 6: heat pump sales and oil price between 1999 an 2007

Bear in mind past figures and note the difference: in 1980, the peak in the oil price also marked a single peak in heat pump sales. Since 2000, the rising oil price has driven the heat pump market. The technology was ready, drilling companies were under control, installers were trained, engineers were competent.

The heat pumps of today have almost nothing more in common with the heat pumps of the 1990s. They are smaller in size, better designed, much quieter, more efficient, cheaper, more reliable, and deliver better performance; thy are easier to install and use. Serial products now cover a heating power range from 3 kW to 1'000 kW.

The heat pump is now the reference heating system, as shown in figure 7.

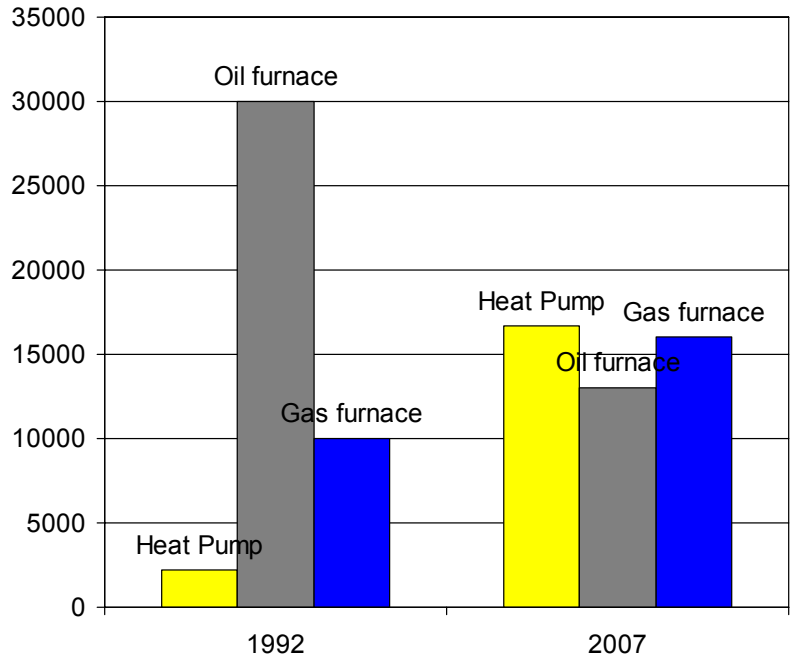

Figure 7: Annual sales of heat pumps and gas and oil furnaces in 1992 and 2007

Figures for furnaces for 2007 are estimates, but the trend is clear: heat pumps are the number one, and the long-dominating oil furnace is now number 3. Gas is still growing and remains number 2. This great achievement took 15 years.

5 Outlook

The current organization runs until the end of 2010. From 2011 on, there will be a subsequent policy and energy programme. The GSP should and will be able to play an independent part, as a mature and strong economic organization.

The key to the success of heat pumps was the continuous adaptation of the role, structure and evolution of the growing and maturing technology and new way in which it was organized. The essential contributing factors were the know-how and feeling on the part of the SFOE as to how to proceed and make the right changes with the right people at the right time. Financial management alone is not enough: knowledge of technology, the market and companies must be continuously updated.

Another key feature is the close collaboration with the SFOE's research and development programme: so R&D works for the market not for the glory of science. Technology transfer also works better and is quicker when industry and researchers know each other.

The GSP achieved a new record last year: the level of activities was at its highest and the financial contribution of the SFOE was at its lowest (one-third of 2.4 million). Independence is becoming possible, as was expressed in the first promotion paper of 1992: the creation of a new organization with government money only makes sense when it can be taken over by the economy. The GSP became one of the strongest associations in the heating sector with almost 300 members, including key companies: In the last four years, they shifted their business from furnace-only to heat pump and now form the core of the GSP.

Studies on the potential and prospects of the market show that a great deal of potential remains for heat pumps: from the present 110'000 units, it should be possible to reach 300'000 to 500'000 units by 2025, which means sales of 25'000 to 30'000 units a year. Given the strength of the GSP and the high level of quality this will become a reality.

6 Glossary

GSP Swiss heat pump promotion group (called FWS in German)
SFOE Swiss Federal Office of Energy
WPZ Swiss testing facility

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