REGIONAL REPORT ON THE SELECTION OF PRIORITY APPLICATIONS - Upper Austria

The regional context

Introduction of the region

In Upper Austria, renewable energy sources have a high political priority. The first energy strategy and action plan was passed in 1994, leading to an increase in the share of RES from 25 to 30% and to a reduction of energy consumption in housing (private sector) of 30% in the year 2000. Currently, the energy strategy 2000-2010, is being implemented which again sets ambitious targets, for example doubling biomass and solar thermal installations, which was already achieved in 2009! In November 2008, the regional government decided that by 2030 all electricity and space heating will be covered by renewable energy sources.

Current solar thermal market development

In 2008, 93,000 m² of solar thermal panels were installed in Upper Austria, in total the collector surface amounts to more than 1 million m², yielding an annual heat output of 335 million kWh and saving about 100,000 CO_2. The potential for the utilisation of solar thermal systems is by far not fully exploited yet – Upper Austria's goal is a total of 3 million m² of solar panels by the year 2030.

The large majority of the solar systems is installed in single-family homes, with a typical size of 12 m², many of them are also larger, as combi-systems (providing space heating during spring and fall) are very popular. Increasingly, apartment buildings, public and commercially used buildings are also equipped with solar thermal installations. There are about 5 plants which use solar for cooling and one installation where a solar system is connected to a biomass district heating (300 m²/212 kW).

So far one solar process heat installation is known and was presented at the "So-Pro round-table event" to stakeholders.

Market actors and industrial sectors

- **Solar companies**
  Over the last few years, the production of solar collectors has grown into an important economic sector in Upper Austria. In 2008, Upper Austria's solar thermal industry produced more than 300,000 m² of solar collectors. The export share of these companies amounts to over 70 %, the total turnover is in excess of 125 million Euros per year and increased by 300% since 2002. The employment (production, sales, installation) - about 1,800 jobs in 2008 - increased by 200% since 2002.

- **Oekoenergie-Cluster (OEC / Eco Energy Cluster)**
  The producers of solar collectors, energy advisers, ESCOs, VAC planners and most other relevant actors in the field of renewable energy and energy efficiency co-operate in the Oekoenergie-Cluster (OEC / Eco Energy Cluster), the network of the sustainable energy sector in Upper Austria which is managed by the O.Ö. Energiesparverband on behalf of the regional government of Upper Austria. More than 150 companies are partners of the network of green energy companies which employ more than 4,500 and have a turnover of more than 1.6 billion Euro.

- **ESCOs**
  A number of "Energy Service Companies" (ESCOs) are located in the region and energy contracting is also supported by the regional government by the "Energy Contracting Programme" (ECP). Despite the high number of contracting projects realised in the last years (over 100), so far no solar thermal contracting projects were implemented.

- **Energy advisers**
  A number of energy advisers are specialised for (industrial) companies. Their know-how on industrial processes and the decision making mechanisms in industry are of great importance for implementing solar process heat installations.

- **Companies participating in the regional energy advice programme**
  About 350 companies apply for energy advice at the O.Oe. Energiesparverband every year. These companies are possibly more interested in innovative renewable energy technologies.

- **HVAC companies**
  Companies specialised in building services and HVAC engineering are also an important target group to trigger solar process heat installations. As they know about the industrial processes in detail, their awareness and know how is important.

Industrial sectors of special interest

In the course of the first months of the project and based on the research and analysis carried out in the preparation of the project, it seemed that metal industries and food industries might be among the most relevant business sectors.

However, it turned out that in general those industries which need basic processes as washing, raw material production with hot water and heating in low temperature baths are of particular interest for solar process heat. Economic implementation of solar process heat application can be done, if low temperature process heat is required throughout the year (not only during heating season), less waste heat is available and oil is the main fuel. Of course space availability (for the buffer storage and the solar thermal collectors) has to be taken into account.

Based on the experiences gained from the screenings, it turned out that these factors are probably more important than the industry sector. The first pilot project for example was implemented in an industry company producing prefabricated concrete components, a sector which was not identified in any of the scientific studies carried out previously.

Main stakeholders & regional approach to companies or screenings and for pilot projects

The stakeholder groups approached were the solar thermal companies, HVAC planners, ESCOs, energy advisers, solar R&D organisations and networks of industrial companies. These were informed about the project in bilateral meetings, in the course of other events and also by inviting them to the first regional workshop.

This workshop was the first time that in Upper Austria stakeholders from different sectors came together to discuss solar process heating. One important aspect of the meeting was to understand the role of different actor groups and to try to identify ways to interest them in solar process heat.

The approach for the screenings included the following mechanisms:

As described above, O.Ö. Energiesparverband is in charge of an energy advice programme for companies - in the course of the last years, more than 2000 companies (from very small SMEs to the largest industrial companies) were advised by the specialised team of energy advisers. These companies represent a large fraction of the overall economy of the region and include most of the larger industrial companies. Also, these are in general companies more interested in energy issues and energy innovation and therefore potentially more interested in solar process heat. An analysis of the advice reports was done and from them, companies were filtered which seemed to be interesting for solar process heat applications.
These were contacted to verify the current conditions (as some of the reports date back several years) and their interest in the subject.

Additionally, the project and the possibility of screenings was made known through networks of companies and respective events to make this possibility known to other companies as well.

Results from the screenings

Screened companies - business sectors and main products

As there were a number of indicators that the potentially interesting sites for solar process heat could be found in different industrial sectors, the screenings were selected to cover a wider range of technologies. Additionally, the interest of the companies contacted was also a decisive factor:

1. chemical industries (cleaning detergents, cosmetics)
2. food production (pasta)
3. meat processing (sausages)
4. metalworking (components for motor vehicles, trains, ships, aircraft and power plants)
5. coating technology (metal coating (garage doors))
6. construction company (pre-fabricated concrete components)
7. butchery (meat)
8. aquatic animals for aquarium (aquatic animals)
9. vehicle body production (vehicle bodies)
10. health (therapeutic equipment)
11. hatchery (chicks)
12. ceramic manufacturing industry (bricks)
13. metalworking (steel panels)
14. waste treatment and processing (recycling products)
15. industrial materials (gravel, concrete)

Overview of the 15 screenings

The following table summarises key facts from the 15 screenings and provides the findings which are positive ("pros") for the application of solar process heat and those which are negative ("cons").

Screening 1	
- type	chemical industries
- product	cleaning detergents, cosmetics
- main process	hot water for production and cleaning, heating of tanks
- main conclusions	pros: - solar process heat would be possible for hot water provision for production and for heating the raw material - the company would like to shut off the boiler outside the heating season and to reduce the demand of heating oil cons: - temperature level (of about 90°C) is relatively high for solar thermal; - waste heat from compressed air would be available throughout the year
Screening 2	
- type	food production
- product	pasta
- main process	drying
- main conclusions	pros: - use of waste heat difficult because for the process humidity is needed - interesting option as it is planned to increase production by 150% cons: - temperature levels (temperature for drying: 55 - 65 °C air, 70°C for the heating system) may make it less economical
Screening 3	
- type	meat processing
- product	sausages
- main process	hot water provision for cleaning
- main conclusions	pros: - 20 m³ hot water at 60°C needed daily cons: - less space for buffer storage available - heat recovery (cooling system) existing, but could be improved

Screening 4	
- type	metalworking
- product	components for motor vehicles, trains, ships, aircraft and power plants
- main process	electroplating (bath)
- main conclusions	pros: - constant demand of hot water (50-60°C) 24 hours throughout the year cons: - main sources of waste heat are already harnessed; continuous optimisation on-going - technical risks for the production anticipated when changing from electric to solar heating - less space for the buffer storage available - economically it seems not to be feasible
Screening 5	
- type	coating technology
- product	metal coating (garage doors)
- main process	cleaning and degreasing of metal elements, pre-treatment of sputter plant
- main conclusions	pros: - use of solar heat for heating baths technically feasible - constant demand of hot water (50°C) all day throughout the year cons: - solar process heat highly competitive to waste heat from compressed air system - new "burning-in stove" will change energy consumption and therefore solar process heat has no priority at the moment
Screening 6	
- type	building and civil engineering
- product	pre-fabricated concrete components
- main process	heat supply paint box, heating of "process oil"
- main conclusions	pros: - new central heating system is planned anyway which might increase economically feasibility of solar process heat cons: - presently fuel costs are low (wood chips, waste wood) - one process ("paint box") requires heat only during the heating season, the other process (heating of process oil) requires heat at a quite high temperature level (80-100°C)

Screening 7	
- type	butchery
- product	meat
- main process	scalding (boiling meat), heating, hot water for cleaning
- main conclusions	pros: - enlargement of the production and changes in the energy supply planned - solar cooling is presently under consideration because of relatively high electricity consumption for provision of cold cons: - high temperature level (~ 90°C) - waste heat of chiller units is used for pre-heating
Screening 8	
- type	wholesale trade for aquatic animals for aquarium
- product	aquatic animals
- main process	hot water provision
- main conclusions	pros: - very low temperature level (25°C) cons: - the first step should be to use other available processes (de-humidification) to heat the water
Screening 9	
- type	vehicle body construction
- product	vehicle bodies
- main process	space heating
- main conclusions	pros: - solar thermal system is planned at the new roof together with company enlargement - low temperature level (22-30°C) cons: - economically not feasible because no heat is used during summer
Screening 10	
- type	wellness
- product	therapeutic fasting
- main process	hot water provision
- main conclusions	pros: - daily demand of hot water at 52°C - presently oil boiler - enough space for buffer storage available
Screening 11	
- type	hatchery
- product	chicks
- main process	washing
- main conclusions	pros: - low temperature level, demand period all year cons: - waste heat from the biogas plant and of compressed air production available

Screening 12	
- type	ceramic manufacturing industry
- product	bricks
- main process	humidification (water pre-heating), firing, drying (air preheating)
- main conclusions	pros: - there is n higher energy demand for air pre-heating - solar process heat could be used when using of waste heat is exhausted and geothermal energy cannot be used for free any more cons: - high availability of waste heat which is not already used in existing processes - geothermal energy can be supposed to be used for free making solar process heat economically not feasible
Screening 13	
- type	metalworking
- product	steel panels
- main process	dehumidification of air
- main conclusions	pros: - company owner interested in solar thermal - waste heat is already used cons: - pay back period has to be below 8 years - temperature level very high (120°C)
Screening 14	
- type	waste treatment and processing
- product	recycling products
- main process	cleaning, steaming, drying
- main conclusions	pros: - environmental considerations and emission reduction are important for the company - use of waste heat is difficult, heat recovery of waste water is difficult - presently energy supply by fuel oil cons: - due to partly relatively high temperature levels of the processes the efficiency of a solar thermal plant could be reduced
Screening 15	
- type	industrial materials
- product	gravel, concrete
- main process	cleaning (hot water)
- main conclusions	pros: - presently energy supply by fuel oil - presently a new heating plant – probably a biomass plant – is planned, combination with solar thermal possible cons: - heat is primarily used in cold seasons for tempering water - potential waste heat of air compressors

Selection of priority applications

Based on the energy screenings carried out in the project regions, the following three priority applications for solar thermal process heat were selected:

- cleaning and washing
- heating of baths and vessels
- drying

In many companies, a combination of these processes can be found. These processes were selected for the following reasons:

- **Cleaning and washing:**
  Cleaning and washing is one of the most wide-spread applications in all sectors of industrial processes. Hot water is needed for cleaning of machineries and equipment, for surface treatment (e.g. in the chemical industry) as well as in the textile and in the food industry where cleaning all of the daily used machinery and equipment are absolutely necessary. Cleaning can also be part of the production process itself, as it is required e.g. in food industry to prepare the goods for preparation, the final washing before drying and packaging, cleaning of packaging materials etc. There is a wide range of specific applications for water at different temperature levels. Depending on the process, the systems are continuous and discontinuous and differ between open systems without any water or heat recover technology and semi-closed systems in which waste water heat recovery systems are included.

  Current systems are presently often de-central oil and gas combustion boilers producing steam which is distributed to all consumers. Also systems with boilers producing hot water are in operation. For smaller demand of heat, electrical heaters are in use as well.

  The integration of solar thermal heat in washing processes is comparatively easy to realise from a technical point of view. The solar heat is used for heating a buffer storage. If the solar plant cannot cover the whole heat demand, the existing conventional system can provide back-up heating.

  Cleaning was the most important process which occurred in 7 of the screenings described above.

- **Heating of baths/vessels:**
  Wherever baths filled with very different liquids (water, grease, oil, chemicals, etc.) which need to be heated, in principle solar heat can be used. Present heating systems are supplied by oil or gas boilers which produce either steam or hot water, either centrally for the whole plant or decentrally for the specific process.

  For most applications, vessels with large capacities are installed and (re-)filled,

frequently more than once a day. In these cases, solar heat can be suitable as storage tanks can be designed exactly for the expected demand of heat. In processes which require hot baths, the hot liquid as such can be used as storage medium for solar heat.

Heating of baths together with other heating and hot water applications in general occurred in 8 of the screenings described above.

- **Drying:**
  The process of drying includes many applications in a wide range of industrial sectors. Drying is usually the final step in a series of operations and the product from a dryer is often ready for final packaging. Drying is a very energy intensive process as it is the process of evaporating water out of solid materials. For many drying processes, temperatures below 70°C are required which allows the usage of waste heat from other steps of the production. Dryers are often run continuously with a constant heat demand, what makes them interesting for the use of solar heat. Solar heat integration solutions can be found for a wide range of different system concepts.

  Drying was relevant in 3 of the screenings carried out.

Screened companies - main conclusions

The following main conclusions can be drawn from the screenings concerning potential of solar process heat:

- the lower the temperature levels required for the process, the more economically interesting is a solar process heat installation
- if a change in the energy system or - even better - a new production facility is planned where solar process is included in the planning process from the beginning, economic feasibility is much easier to achieve
- plants where fossil fuels are needed in summer for process heat production are the most interesting
- one main "competitor" often found for solar process heat is unused waste heat from other processes which should of course be used first

Generally, solar process heat can be realised economically, if the following requirements are given:

- process heat at low temperature level (best < 50°C)
- continuous heat demand throughout the year
- changes in the heat supply are necessary (e.g. because of enlargement of the site or age of existing heat supply)
- if oil is used for heat production

4) Market development - outlook

Implementing solar process heat is a potentially interesting solution, however, there are significant barriers, as for example:

- economic barriers (low prices for fossil fuel in industry, comparatively high investment costs for solar thermal);
- lack of awareness about using solar thermal in industrial processes (ST is a well established solution for domestic hot water) including the lack of pilot projects;
- technical reasons (availability of waste heat, high process temperatures, available space for buffer storage)

The main results of working groups and stakeholder discussions on how to overcome the deficits can be summarised as follows:

- Identifying the main information deficits of the important stakeholder groups:
  - solar companies need a better understanding of industrial processes
  - decision makers, planners, technicians in industry need to know more about application possibilities of solar process heat
  - installers have to know more about solar thermal and process technology

- Alliances (strategic cooperation) could be helpful:
  - between different planners (of industrial processes, of solar thermal plants)
  - between energy advisers & investors (company owners)
  - between solar thermal companies & industries

  Networks (e.g. Oekoenergie-Cluster) can be very helpful in establishing these alliances.

- Role of solar thermal companies (what can they contribute)?
  - access to installers (which may then have access to industrial companies)
  - active marketing (including information on potentials and limits of solar process heat)
  - support to training

- Triggering pilot projects
  - finding suitable sectors and active information on solar process heat
  - make best use of screenings
  - personal, direct approach

Positive market development of solar process heat in the region would be triggered, if a few pilot installations could be established within the next months/years and awareness and skills of relevant actors need to be increased.

Therefore, the project activities will focus on the following:

- doing a wide information reach out: awareness levels and know-how about solar process heat are nearly non-existent, therefore, an effort needs to be made to reach potentially interested companies along the value chain.
- building up skills in the relevant products and service provider companies
- identifying and triggering pilot projects which would help to demonstrate economic viability and help to gather planning and operation experience. At this stage of the project, it seems that pilot projects will not come from one economic sector but from individual companies depending on the matching of specific conditions.