FINLAND

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1. PROGRAM STRUCTURE

In broad terms, the energy policy in Finland is dominated by two major themes: meeting the GHG emission targets of the Kyoto agreement and securing cheap and reliable electricity supply. The focus in the RE policy is on biomass and indeed 21% of all energy in Finland was biomass based (26 % if peat is included) in year 2000. Over one half of the biomass stems from the powerful forestry industry and industrial waste and by-products. The whole electricity sector has been deregulated since 1995.

The government's policy in the area of renewable energy sources is stated in the National Climate Strategy from 2001 and in the MTI's RE Programme from 2000. These programs have a time horizon up to year 2010. Solar energy is mentioned as one of the RE sources to be promoted both in terms of markets and technology.

The national targets for solar energy by year 2010 as stated in the government's energy policy documents above are the following:

- increase the use of solar energy in Finland with 100 GWh/yr by year 2010;
- increase solar export business value up to 160 million euro/yr by year 2010.

Solar energy covers here both active solar and photovoltaics applications.

In 2001, a road map has been prepared to meet the government's goals for solar energy (Finnish action plan for solar energy). This includes specific biannual milestones and actions. In organizing the practical work, the government has not established a separate solar program, but the activities are instead organized mainly through a national actor network and an industry driven cooperation group (FSI). FSI, or the Finnish Solar Industries group, was established in 2001 by strategic market actors to support the government's solar goals, to create new business in the area of solar energy and to concentrate the joint activities on areas showing strongest added value. The FSI group has now some 20 organizations covering the whole innovation chain (research, industry, buyers, public organizations) and represents a solar business value of about 10 million euro.

The Finnish action plan for solar energy from year 2001 as described above is a market driven initiative. Domestic markets are important to bring solar energy forward in Finland but the global markets is the driving force to industries considering investments in this field. The action plan is by structure virtual and networked and its success will depend on how actively the market actors and stakeholders will perform. The coordination is within the industry and activities are supported by various government agencies.

Figure 1 illustrates the government or public agencies that are responsible for supporting solar energy activities in Finland. The main body is the Ministry of Trade and Industry,

which is responsible for all energy policy including RE, and market deployment support. Ministry of Environment is responsible for the energy use in the residential housing sector and its main instrument is the building energy code. In 2003, a new code is perceived which would also include solar energy through a building minimum energy performance index approach.

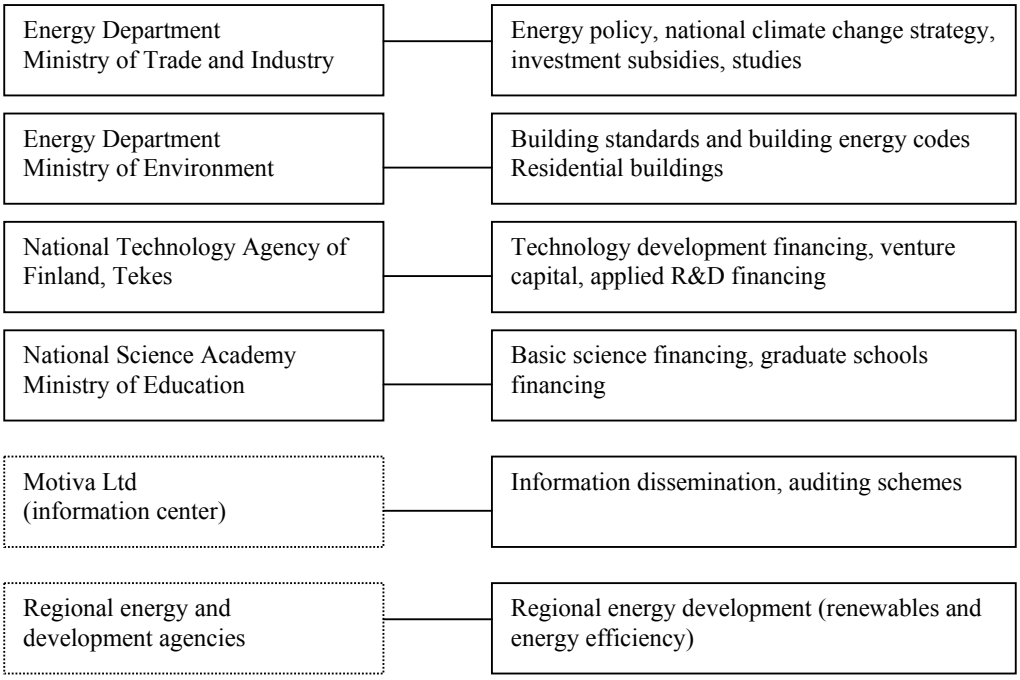

Figure 1: Main government agencies and public organization involved in solar energy.

The National Technology Agency of Finland (Tekes) is responsible for all public support to national technology development. Tekes finances e.g. industrial R&D projects on solar energy. Main goal of Tekes is to create new business and business value in companies through technology and innovations.

Motiva Ltd is a 100% state owned company. Its mission is to support government's energy efficiency and RE plans through information, dissemination and other support (soft) activities.

2. FUNDING

There are no official statistics on the funding levels of solar energy as it is embedded in several type of activities spread over many organizations. The figures in Table 1 are therefore crude estimates only. For wind and bioenergy, the numbers are more accurate.

Table 1: Estimated public funding levels in millions. (R&D&D and information)

	Year 2000		Year 2001	
	Euro	US$	Euro	US$
Active solar	0.2	1euro = 0.9 US $	0.2	1euro = 0.9 US $
Passive solar	0.3		0.3	
Photovoltaics	0.3		0.3	
High T solar thermal	0		0	
Wind energy	0.6		0.8	
Bioenergy (incl. waste)	9.7		8.4	
Geothermal (heat pumps)	0.3		0.3	
Other	0		0	
All renewable energy	11.4		10.3	

The leverage factor of public funding is typically 60-70%, i.e. one public euro brings 1.2-1.3 euros private funding into a project.

3. RD & D PROGRAM

The guidelines applied for solar energy RD&D public funding are the same as for any other technology or RE source.

During 2001-2002, the National Technology Agency has prepared a technology strategy for Finland which is based on cluster thinking and accounting for global trends. 9 national industrial clusters and 9 perspectives for the renewal of industries and creating new businesses were identified (Figure 2). ICT, bio and material technology will be the key technologies guiding the process of social and economic change in the network economy. Also shown in Figure 2 is the positioning of the Finnish industrial clusters in terms of market growths. Tekes supports the clusters' growth through focussed R&D funding and programs.

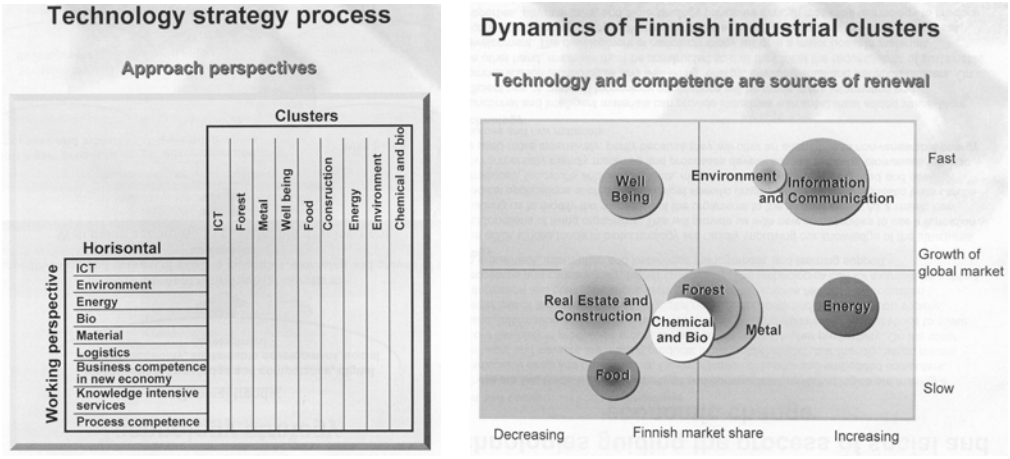

Figure 2: Technology strategy process and national industrial clusters.

Where do solar energy technologies fit in? Solar is mainly part of the energy and construction clusters. The strength of the Finnish industries is in RE technologies (e.g. bioenergy, wind energy components), ICT and software applications, design and consulting. Again Tekes tries to strengthen mainly these dimensions of solar energy.

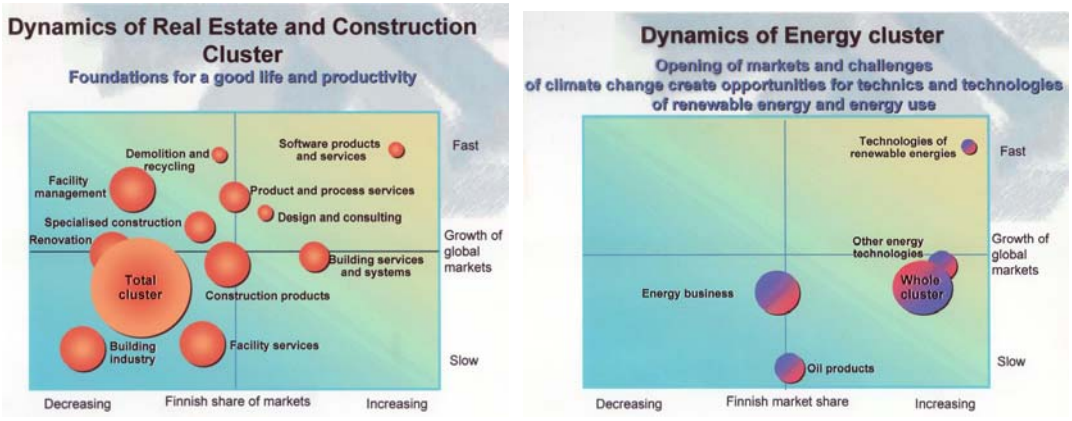

Figure 3: Cluster analysis of areas close to solar energy.

Based on technology strategy logic, there is not any isolated solar R&D programme but solar comes in through different channels. A few Tekes programs are worth mentioning:

- CLIMTECH - R&D program to locate and create business from the climate change mitigation (the Solar Road Map project was made under this program);
- CUBE - program launched in late 2001 on building and facility services and systems. Sustainable energy and solar is one part but in an integrated way to facilitate building service businesses e.g. using solar building technologies.
- ENVIRO- program on enviromental issues in the building and construction sector. Several sustainable building projects with solar building technologies were financed e.g. Ekoviikki sustainable suburb, Kiasma modern art musem with advance daylighting technologies (both in Helsinki), solar collector kit for house owners, etc.

The major solar energy project during 2000-2001 was the Ekoviikki sustainable urban area demonstration project in Helsinki. Ekoviikki is located close to the Viikki campus area where the Europe's largest biotechnology centers are located. Ekoviikki was subject to strict sustainability criteria (e.g. energy, water, health, environment) and brought solar energy into the picture from the very beginning. Ekoviikki has 1,500 inhabitants and some 64,000 m2 of building area. Finland's largest solar project with 8 solar heating systems integrated into multi-family houses in an urban area was realized here. The project supported by the EU-Thermie comprised 1250 m^2 of collector combined with passive solar features and energy efficiency. Integration aspects on all levels were given high priority. Sophisticated ICT applications e.g. broad-bandwidth internet for monitoring and diagnostics of solar heating systems can also be found.

The Ekoviikki solar project produces both hot water and low-temperature floor heating (wet spaces) for some 800 persons. The extra investment cost paid for solar was under 1% of the total construction costs. The life-cycle costs are positive. Solar heating produces 15% of the total heat demand of the houses. The solar systems will be monitored up to 2004. The solar

yields in a few systems have provided so far highest figures in Finland. As a whole, the thermal energy demand in Ekoviikki is about one half of that in average new construction. The construction at Viikki area will continue in Ekoviikki 2 area with even stricter criteria and incorporating the experiences from Ekoviikki.

Figure 4: Ekoviikki sustainable suburb in Helsinki.

The major research institutions active in solar building technologies are the following:

- Helsinki University of Technology
- materials research (collectors, PV, storage)
- systems research (daylighting systems, multi-component solar systems, design tools)

  - field testing (ageing, collectors, PV)
- Technical Research Centre of Finland (Building Technology Department)
  - materials research
  - building components, testing
- Jyväskylä University (materials research)

Industrial involvement in RD&D is high as no financing is in practice given to projects without industry participation. Each Tekes financed R&D project at research institutes must have industries involved who take care of the further exploitation of the results. For industrial R&D projects, the public financial support ranges from 25% to 50% depending on the size of the company and risks involved.

As a part of the Finnish Action Plan on solar energy and the Finnish Solar Industries cooperation, 2 regional energy agencies on the western coast out of the ten existing in Finland have included solar energy in their activity portfolio based on the local market and industry interest. This has lead e.g. to growing solar self-building activities and R&D on storage and collectors.

4. OTHER GOVERNMENT SUPPORT ACTIVITIES

MTI gives a 30% subsidy to companies and municipalities investing in solar energy (active solar or PV). The subsidy may increase to 40% in 2003. This funding to investments have been negligible partly because of the small interest shown e.g. due to low energy prices and ignorance of the possibilities of solar technologies. For the time being, private households do not receive subsidies, but in 2003 a 20-25% subsidy may be possible through the Ministry of Environment.

In the field of standards and certification, Finland relies on the European (EU, CEN) work done.

The Finnish Solar Industries group and Motiva Ltd mainly handle information and promotional activities. These include e.g. FSI newsletter, seminars, workshops, handbooks and guidelines, Internet pages, etc.

5. COMMERCIAL ACTIVITY

State of the industry

The number of solar installations during 1999-2001 corresponds to about 3,500 m^2 installed collector area. The amount of PV installed was about 600 kW_p, mainly solar remote home systems.

The number of companies involved in solar energy in Finland is about 50 - this includes architects and designers, manufacturers (core + subcomponents), end users groups. The number of manufacturers of active solar systems and PV systems is 6. New companies possessing knowledge in areas that can be applied to solar energy systems (ICT, HVAC, district heating components, roofing systems, etc.) are entering gradually the solar field.

In 2001, a few industrial development highlights can be mentioned. NAPS Systems Ltd. developed a new PV-building integration system in which the balcony glazing can be replaced by PV-modules (this kind of system will be demonstrated in Ekoviikki in 2003). Another example comes from Rautaruukki Ltd which is a major steel product manufacturer. They have launched so-called energy roof products (solar air, solar water, solar PV) which are fully integrated into steel roofing - a customer may easily choose the solar option when purchasing the roof. The solar air system is a low-cost option with a full roof steel collector including an innovative heat recovery equipment.

Figure 5: PV balcony and different kind of solar roof products.

State of the market

Finland has an extensive energy efficiency auditing scheme of buildings. In 2003, there are plans to include RE and especially solar into this scheme. In this context, the market potential of solar thermal applications (multi-family apartments, commercial and public buildings, industrial process heat, district heating) was analyzed in detail and considering the various boundary conditions for solar. The findings are shown in Table 2 and indicate a market potential of about 1,500 GWh/yr or some 3.8 million m^2 of collectors. Solar heating mainly competes with electric and light oil for heating.

Table 2 Cost-effective market potential for solar heating in Finland (GWh/yr).

Sector	Without subsidies	With subsidies	Collector area (m2)
Small industries	0	100	290000
Service buildings	3	1050	2620000
Appartments	0,5	200	496000
Power plants	0	0	0
District heating	5	140	400000
Total	13	1490	3806000

The solar collector market has been for last years around 1000 m^2/yr and has increased to about 1,000-1,500 m^2/yr during 2001. The solar market is in an interesting stage as the interest in solar is increasing and also the public support is now much stronger than ever. Simultaneously, the growing market opportunities globally make solar interesting.

6. OUTLOOK

The outlook for solar building technologies in Finland during the 5 next years is positive. Government policies and public support are favorable. Largest challenges relate to overcoming perceptual barriers and increasing the number of market actors showing an

interest in solar. The small size of the solar market so far imposes inherent non-financial barriers that need to be addressed properly (e.g. quality issues, information).

When choosing between heating systems, buyers and customers give high priority to the investment costs, trends in fuel prices, familiarity with the technology and quality. The cost factor may be the most important one and should be possible to be overcome with perceived public measures.

7. PROGRAM INFORMATION DISSEMINATION

The IEA Solar Heating and Cooling Programme is marketed in Finland to key actors. The Program is considered as an important additional support element to national R&D work. Taken the strong industry driven R&D policy in Finland, the industrial needs and long-term opportunities often determine the Finnish participation in IEA SHC Tasks.

IEA SHC outcomes are distributed in several different ways described in the following:

- IEA SHC newsletter Solar Update is distributed to some 80 persons and organizations
- IEA SHC annual reports are distributed to key government agencies
- Task outcomes (e.g. final reports) are directly distributed to persons/organizations who may exploit the results
- One copy of each task final report is kept in the library of Helsinki University of Technology for lending - the publication names are in databases available for interested parties
- IEA SHC internet pages have been marketed
- A short memo of each IEA SHC meeting with emphasis on issues relevant for Finland is supplied to Tekes who puts it to a national IEA database open to potential participants in IEA SHC Tasks or who may exploit IEA SHC results
- In connection with IEA task meetings in Finland, national seminars are sometimes arranged

8. SINGLE MOST SIGNIFICANT CHANGE IN PROGRAMME SINCE JANUARY 2001

The most significant change has been the establishment of the Finnish Action Plan on Solar Energy and the establishment of the Finnish Solar Industries group. These have had a positive impact on the public interest in solar energy and increasing the industrial involvement in solar energy.

The Ekoviikki solar energy project may be the most important single event in Finland during 2001. Being the largest solar project in Finland and having a strong demonstration character, Ekoviikki made much publicity for solar energy.