Description and Visual Representation of Most Promising Markets

Statement of the Problem:

The main idea is the creation of maps that, in a graphical way, permit an easy evaluation of the locations that are suitable for this kind of application. Data of the solar thermal collector market in Europe were studied as a first step of the analysis, in order to individuate which markets are the most sensitive to the solar energy exploitation for thermal applications (domestic hot water and heating production). Then meteorological data were studied to evaluate the maximum amount of solar energy that can be obtained from a given collector technology (flat plate and evacuated tube collectors were considered) at different temperatures, relative to different distribution systems installed in the building. At the same time, the demand of heating and cooling of buildings in Europe, over the whole year, was evaluated. Comparing demand and availability of energy, the most promising markets were defined.

Methods:

On the basis of existing systems for the production and distribution of DHW, heating and cooling and the related required temperature levels, two different solar technologies were compared and the useful radiation for different European climatic zones calculated.

For the distribution/production systems, the following temperature levels including 5°C for the losses were considered:

- 40°C for space heating in winter
- 60°C for DHW all over the year
- 70°C to drive adsorption chillers in summer
- 90°C to drive absorption chillers in summer

Evacuated tube and flat plate collectors existing on the market were used and evaluated at :

- 40° Title Angle and South Azimuth

Useful Radiation:

To calculate the amount of solar energy that can be collected, the concept of Useful Radiation, as a function of the reached temperatures and the physical characteristics of the collectors, was used.

$$I_{Useful}^{temp,coll} = I_{total} - I_{Critical}^{temp,coll}$$

$$I_{Critical}^{temp,coll} = \frac{k_1^{coll}}{IAM \times k_o^{coll}} * (T_{process} - T_{amb})$$

IAM [%] = *Incident Angle Modifier*, amount of energy that arrives to the collector depending on transversal and longitudinal relative angle sun-tilted

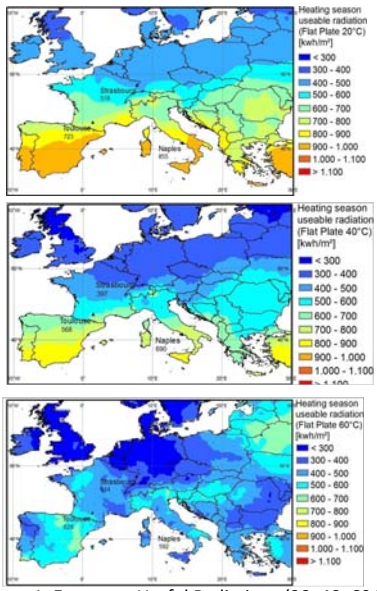

Figure1: European Useful Radiations (20, 40, 60 °C) (8 months of heating season) (Flat Plate 40° tilted)

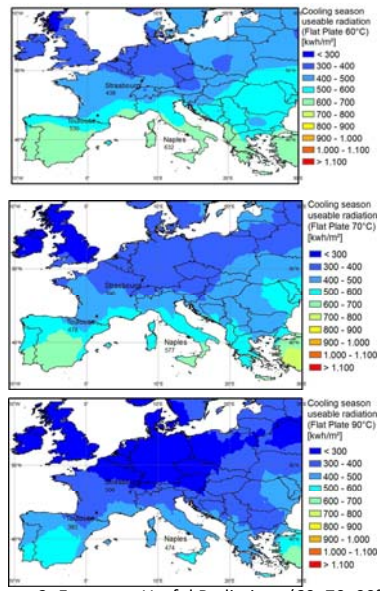

Figure 2: European Useful Radiations (60, 70, 90°C) (4 months of cooling season) (Flat Plate 40° tilted)

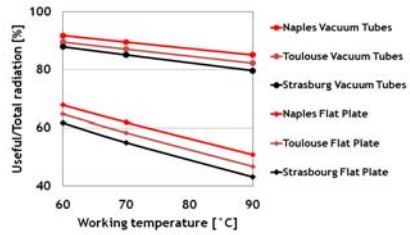

Figure 3: Summer Useful/Total Energy (%) at 60,70 and 90ºC

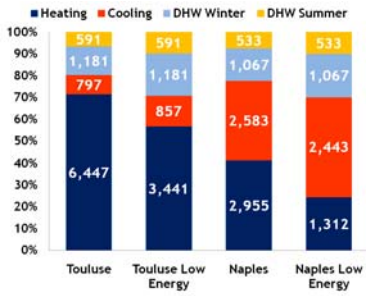

Figure 4: Energy Demands for Two Different Residential Buildings (kWh/year)

Results:

All the investigated locations are suitable under the point of view of the heating needs and potential coverage of the loads through a high fraction of solar energy, due to the low temperatures needed (40°C were considered as heating temperature level). Southern countries are obviously more suitable for cooling applications due to the significantly higher radiation, which is available, while passive cooling could be a more adequate solution to cover northern countries requirements.

Solar Combi+ Partners :

AEE INTEC, ikerlan ik4 research alliance, ISE Fraunhofer Institut Solare Energiesysteme, KAPE CRES, EURAC research, tecsol

Project Coordinator:

EURAC
Viale Druso/Drususallee, 1
I-39100 Bolzano/Bozen

tel: +39 0471 055610
fax: +39 0471 055699
web: www.eurac.edu
www.solarcombiplus.eu
e-mail: roberto.fedrizzi@eurac.edu

Industry Partners:

SONNENKLIMA suninverse, rotartica, SOLution Solartechnik GmbH, SorTech AG, ClimateWell

Intelligent Energy Europe