

Solnet - First Structured International PhD-courses on Solar Heating

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Abstract

Starting in June 2006, the European Union supports a PhD-network on solar heating and cooling systems (Solnet). It consists of nine university research groups from seven different European countries and several commercial enterprises, working in the fields of civil, mechanical, and environmental engineering, as well as architecture. The program will be coordinated by Kassel University, Germany. Ten students will receive scholarships and shall prepare a PhD-thesis in the framework of Solnet. The common scope of the research activities is to contribute to the foundations for a new generation of solar heating and cooling systems with high solar fraction.

Keywords: Early Stage Research Training Network, PhD education

1. Introduction

The aims of the training activities are to bring together European expert knowledge and education experience in solar thermal engineering. Seven bi-annual courses will be offered to the network students to different topics, e.g. to collectors, storages, solar cooling etc. Completely new education modules on PhD-level will be developed and shall be made generally accessible via an Internet platform. Other PhD students and university teachers working in the field are cordially welcome to join the courses, a participation will be free of charge.

The participating institutes of the consortium are listed in table 1.

Table 1: Participating universities in the Solnet consortium.

University	Department	Country
Högskolan Dalarna	Solar Energy Research Center	SE
Lund University	Dpt. of Construction and Architecture	SE
Technical University of Denmark	Dpt. of Civil Engineering	DK
Kassel University	Inst. of Thermal Engineering	DE
Czech Technical University	Dpt. of Environmental Engineering	CZ
Univ. of Appl. Science Stuttgart	Dpt. of Building Eng. and Building Physics	DE
Graz Technical University	Inst. of Thermal Engineering	AT
Politecnico di Milano	Dpt. of Energetic	IT
Lleida University	Dpt. of Engineering and Environm. Science	ES

2. Research Activities

The common target of the research project is to develop and investigate solar heating and combined solar heating and cooling systems as well as the necessary components that pave the way for covering a greater fraction of the total heating and cooling load. Experimental and computational studies shall be carried out on systems, components and applications. For example, solar heating systems for the northern and central European region will be investigated, as well as their interaction with CO₂-neutral back-up systems like pellets and wood burners. Another focus

will be on cooling- and de-humidification of office buildings and houses for southern European climate.

In annual plenary network meetings, supervisors as well as PhD students and external experts will evaluate results of the ongoing research and the network activities.

The **research topics** cover:

- system components (e.g., advanced collectors, stores, cooling cycles),
- system integration aspects (interaction of the solar thermal system with an auxiliary energy supply system and the different heat consumers),
- new materials (e.g., phase change materials),
- new applications (air-conditioning, solar sorption cooling), and
- numerical system modelling (system investigations, mathematical optimisation).

Table 2: PhD topics in Solnet.

	Location	Subject	Focus
1.	Borlänge (SE)	Investigations of solar and pellet heating systems	experiments, simulations
2.	Lund (SE)	Radiation balanced solar collectors for high solar fraction for electrically heated houses	experiments, simulations
3.	Kgs. Lyngby (DK)	Design of solar combi systems	theoretical and experimental investigations
4.	Kassel (DE)	Mathematical optimisation of the planning of solar heating systems.	theoretical investigations, simulations
		Components of a solar cooling system using liquid desiccants	theoretical and experimental investigations
5.	Prague (CZ)	Building integrated solar thermal collectors for SHC	component development, simulations, experimental work
6.	Stuttgart (DE)	Research on solar heating and cooling for building	simulation, field and experimental work solar cooling, control strategies
7.	Graz (AT)	Applications of heat storages with Phase Change Materials (PCM) in solar energy systems	theoretical and experimental investigations
8.	Milan (IT)	Development and optimisation of a novel desiccant and evaporative system for solar air conditioning	simulations, experiments, potential assessment
9.	Lleida (ES)	PV- thermal generator optimised for solar heating and cooling applications	experiments, simulations

Collaboration between groups will be based on exchange of students, modelling tools and common boundary conditions. The individual research topics for the individual PhD projects are listed in table 2. They are in line with the priorities within the field of solar thermal as defined by the EUREC agency.

3. Course Program

The overall research training project will be monitored during project meetings taking place in the framework of the bi-annual course modules, with student presentations, forums, and project discussions. The courses cover system components, innovative materials, system evaluations and optimisation strategies, the overall energy situation in Europe, societal issues and they convey complementary skills. The preliminary course schedule is shown in table 3.

Table 3: Course schedule: Modules M1-M7.

Course Module	Date	Host	Main topic	Secondary topic
M1	~10/06	SERC Sweden	Dynamic System simulations using TRNSYS and other simulation programs: Development of network program & joint subsystems	Social-anthropological aspects
M2	~ 4/07	TUGraz Austria	System integration of solar thermal plants: Components, guidelines, characterization, analysis of applications, hydraulics, control systems, dimensioning and optimisation, design exercise and an excursion to built examples.	Presentation skills, Computational Thermal Engineering
M3	~ 10/07	HFT / POLIMI Italy	Solar cooling: Cooling load calculations, impact on system design, on thermodynamics and planning issues of open sorption, absorption and adsorption cooling systems	International standards and norms (SWT-Stuttgart)
M4	~ 4/08	DTU Denmark	Thermal stratification in solar heat storage tanks: Importance, establishment, maintenance, modelling, experimental investigations	Particle Image Velocimetry
M5	~ 10/08	CTU / Uni-Lund Sweden	Advanced solar collectors: Flat plate & concentrating, liquid & air collectors, optical properties, selective coatings, non-tracking systems, dynamic characterization, integration into the building envelope, hybrid solar air-water and PV-thermal collectors, solar walls, numerical models	Climate Policies, Project Management
M6	~ 4/09	Uni-Lleida Spain	Design and simulation of PCM (phase change material) applications to low energy-buildings: Material properties, heat transfer analysis, micro- and macro encapsulation of PCMs, passive and active applications, TRNSYS modelling	Differential Scanning Calorimetry
M7	~ 10/09	UniKassel Germany	Renewable energy and energy efficiency: Technologies, energy economics, global environmental situation, resources, energy transformation, rational energy utilization, and electrification in rural areas	Energy economics

4. Contact

Interested early stage researchers are cordially invited to join the network by participating in the Solnet courses. Applications are necessary. Application forms can be downloaded from

www.solar.uni-kassel.de/solnet

The deadline for PhD scholarship applications already passed in May, 2006.

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