



<p align="center"><b>HIGH SOLAR FRACTION HEATING AND COOLING SYSTEMS WITH COMBINATION OF INNOVATIVE COMPONENTS &amp; METHODS</b></p>	<p>Contract No: TREN/07/FP6E N/S07.68923/0 38659 HIGH-COMBI</p>	<p align="center"><b>2<sup>nd</sup> E-Letter</b></p> <p align="center">Updated: 31/3/2009</p>
		<p>Programme: DG TREN EUROPEAN COMMISSION</p>
<p><b>Project Coordinator: CRES</b></p> <p>Project duration: 01/06/07 - 31/05/11 Period of project: 01/06/07 - 31/03/09</p>	<p>Contact Info: Dr. K.Karytsas</p> <p>Tel.: +30-210-6603375 Fax: +30-210-6603301 Email: kkari@cres.gr</p>  <p><b>Centre for Renewable Energy Sources</b></p>	
<p><b>Aim of the project</b></p>		
	<p>The project aims at developing high solar fraction systems by an innovative combination of optimized solar heating, cooling and storage technologies. Demonstration plants will be constructed (in Greece, Italy, Austria and Spain) using different technologies, components and control strategies in order to achieve high solar fractions values. Innovative techniques, components and/or configurations will be examined (new storages, use of rejected heat during cooling, combined heating and cooling control). Demonstration plants' monitoring data will be analyzed, the simulation and design tools validated and the plants performance evaluated. Market analysis will be carried out in order to estimate the potential</p>	

	penetration for these systems in the European heating and cooling market.												
<b>Potential end-users</b>	<p>Greece, Italy, Spain and Austria are the countries in which implementation is concerned. The sectors of the implementation are all medium and large buildings end-users having heating and cooling loads along the year.</p> <p>A Survey on end users has resulted into the identification of the following in each country: a building in the premises of CRES in Greece, the Province of Milan, a social housing building in Spain and administration buildings in Gleisdorf, Austria.</p>												
<b>Pilot Plants' state of progress</b>	<table> <tr> <td>Design</td> <td><input checked="" type="checkbox"/></td> </tr> <tr> <td>Manufacturing</td> <td><input checked="" type="checkbox"/> *</td> </tr> <tr> <td>Erection</td> <td><input checked="" type="checkbox"/> *</td> </tr> <tr> <td>Commissioning</td> <td><input checked="" type="checkbox"/> *</td> </tr> <tr> <td>Monitoring</td> <td><input checked="" type="checkbox"/> *</td> </tr> <tr> <td>Completed</td> <td><input type="checkbox"/></td> </tr> </table> <p>* on one demo plant</p>	Design	<input checked="" type="checkbox"/>	Manufacturing	<input checked="" type="checkbox"/> *	Erection	<input checked="" type="checkbox"/> *	Commissioning	<input checked="" type="checkbox"/> *	Monitoring	<input checked="" type="checkbox"/> *	Completed	<input type="checkbox"/>
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<b>References</b>	<p>Knowledge and pre-existing know how of partners is being supported by the use of TRNSYS Code Simulations and the work of IEA SHC Task 32 "Thermal energy storage for solar and low energy buildings" and IEA SHC Task38 "Solar Air-Conditioning and Ventilation" which are used as references.</p>												
<b>Progress of the Project</b>													
<b>End user identification</b>	<p>A Report with the building types, energy consumption patterns and climates of the countries where the end-users will be located has been prepared. Three types of buildings ("Residential Buildings", "Office Buildings" and "Tourist Applications") are addressed. Data have been proved to be quite differing between countries and therefore the Thermal Energy Saving Measures recommended to be considered prior to the installation of any active heating and cooling system in a building are quite country-specific.</p>												

<p style="text-align: center;"><b>State of the art</b></p>	<p>State of the art of similar to high-combi applications has been identified. There is no standardised configuration available on the market, however there are promising prospects for small scale storage applications.</p>
<p style="text-align: center;"><b>Demo plant concept</b></p>	<p>Identification of demo plants concept is related to the final choices on buildings:</p> <p>In <b>Greece</b> the offices of CRES in Pikermi, Attica are examined for being the Greek demo plant. In <b>Italy</b>, the initially identified building has proved to be inappropriate due to low (cooling) loads. A new building has been identified recently, which is owned by Province of Milan. In <b>Spain</b>, the final building has not yet been identified due to necessary contract changes, ie change of partner.</p> <p>In <b>Austria</b> two demo plants have been designed in office buildings namely that of the Servicecenter Gleisdorf and of the Feistritzwerke Gleisdorf. The demo plant, 'Servicecenter Gleisdorf' has been designed in detail and has been installed. Commissioning of the plant has been accomplished while monitoring has started and is ongoing.</p> <p>For the second plant, the building and location is fixed, but since it is an existing building the process of proving the possible concepts which can be installed is still in progress.</p>
<p style="text-align: center;"><b>Laboratory Tests</b></p> 	<p>Laboratory Tests in order to test the thermal conductivity of waste material as low insulation material have been undertaken. Tests were made on Bubble Wrapping, Empty plastic bottles with perlite and Chipped tyres.</p> <p>Chipped tires gave the best results and showed a significant potential for insulation replacement. Its combination with empty bottles could minimize the cost of the insulation even further, but the bottles have to be completely dry in order to avoid high thermal insulation performance drop due to humidity. On the contrary, it has been concluded that the bubble wrapping material (or empty plastic bags that theoretically perform worse than the bubble wrapping) do not perform as expected with very high thermal conductivity.</p>

<p><b>Simulation method</b></p>	<p>A model is being built in order to calculate energy demands within the four end users-building's. METEONORM Version 5.0 the global meteorological database for applied climatology is being used. For generating heating/cooling demand files the simulator routine TRNSYS 16.1 was used. Results of the dynamic building simulation are exact time-dependent sensible and latent building loads tables of the procedures in a building as a function of the external climate, the user profiles, the building construction and the technical building equipment. The building and the generation system were split due to the necessity to realise sensitivity analysis over a great amount of parameters in the generation side, which could bring non-convergence to the building side and continuous correction of the stability parameters.</p> <p>A TRNSYS type 209 has been created and optimised in order to simulate various water cooled closed cycle chillers whereas performance maps have been created, based on data for three type of chillers ( Yazaki WFC SC 10/20/30, Climasol XCR, Pink PSC 12) and extrapolation has been made.</p> <p>A <b>Cost Analysis Tool (CAT)</b> has been designed, for the identification of optimal design using the Levelised Cost of Energy (LCOE) as the main indicator.</p>
<p><b>Dissemination</b></p>	<p>The project's web site [ <a href="http://www.highcombi.eu">http://www.highcombi.eu</a> ] is being regularly updated. A private area of the website serves as an interactive platform among partners of the project.</p> <p>Active participation in conferences include the following:</p> <ul style="list-style-type: none"> <li>• Alex Thür. "<i>Solares Heizen und Kuehlen fuer die Stadt Gleisdorf</i>". OTTI thermie, Austria 2008</li> <li>• P. Tsekouras, M. Motta, A. Aidonis, D. Chasapis, C. Hatzilau, C. Balaras. "<i>High solar fractions for buildings' heating and cooling, through an innovative seasonal storage design in southern European countries</i>". Proceedings of 1<sup>st</sup> International Conference on Solar Heating, Cooling and Buildings. Lisbon October 2008".</li> </ul> <p>In addition the HC project has been promoted in several occasions through partners such as in ESTIF's Workshop in Athens (12/08), at the international conference of the IEA SHC and ECBCS Program in Graz, Austria.</p>