PROJECT FINAL REPORT

FINAL PUBLISHABLE SUMMARY REPORT

Grant Agreement number: 230882

Project acronym: SOLARIS

Project title: A novel solar air source heat pump system

Funding Scheme: FP7 Research for SMEs program

Period covered: from 1st March 2009 to 28th February 2011

Name, title and organisation of the scientific representative of the project's coordinator[1]:

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Project website[2] address:

http://solaris.pera.com

[1] Usually the contact person of the coordinator as specified in Art. 8.1. of the grant agreement

[2] The home page of the website should contain the generic European flag and the FP7 logo which are available in electronic format at the Europa website (logo of the European flag: http://europa.eu/abc/symbols/emblem/index_en.htm ; logo of the 7th FP: http://ec.europa.eu/research/fp7/index_en.cfm?pg=logos). The area of activity of the project should also be mentioned.

1. Part (A) Final Publishable Summary Report

"A novel solar air source heat pump system"

SUMMARY

Solaris is a 2 year €1.1 million project supported by the Seventh Framework Programme of the European Commission. The project brings together renewable energy and engineering expertise from across 6 European countries to deliver a system capable of combining solar thermal and air-source heat pump technologies. This efficient system will result in significant savings for the European consumer and greatly reduce CO_2 emissions.

PROBLEM BEING ADDRESSED

There are 195 million households in Europe whose combined domestic heating needs account for over 26% of Europe's energy demand and 500 billion tonnes of CO_2 emissions annually. Reducing this is very important if Europe is to achieve ambitious emission reduction targets (ie Kyoto and beyond), decrease our excessive reliance on imported energy and reduce costs to households and industry. The most effective way to decentralise energy production is to increase the amount of generation at source, in this case within the home. A common barrier to the adoption of most energy generation/saving technologies is the high initial investment cost which results in long payback periods even considering current high energy prices. However, with prices increasingly on the rise, existing technologies such as solar thermal heating systems and heat pumps are becoming more popular (growth rate of approximately 50% in 2006). Although both are reasonably efficient, existing solar thermal heating systems generally only provide up to ~60% of a typical household's annual hot water demand. Air source heat pumps are more effective and can provide up to 100% of total household heating requirements but their performance decreases significantly in winter and they suffer from frost-build up. As these technologies are becoming commodity products, SME's in these markets are coming under increasing pressure from cheap low-quality imports from Asia and technologies from the US. It is paramount that European SME's keep a technological edge over these competitors if they are to remain competitive. The Solaris consortium therefore propose to develop a modular novel solar air source heat pump system (ASHP) which is 25% more efficient than a typical air source heat pump and 7% more efficient than a combination of a standard ASHP and a

solar thermal system while only costing 60% of the combined price of these separate systems.

PROJECT OBJECTIVES

The Solaris consortium brings together experts in a number of fields including air source heat pump technology, heat exchanger design, renewable system installation and eco-home building. The Solaris consortium propose to develop a modular novel solar air source heat pump system (ASHP) which is 25% more efficient than a typical air source heat pump and 7% more efficient than a combination of a standard ASHP and a solar thermal system while only costing 60% of the combined price of these separate systems.

PROGRESS AND ACHIEVEMENTS

During the first year of the project significant effort was expended in three key areas. These being; (1) the design and manufacture of the solar collector, (2) the development of the ASHP heat exchanger elements and (3) the development of a low power control system. The three RTD partners, Fraunhofer, Re/genT and ISRI focussed their efforts in each of these areas respectively.

During the second year of the project significant effort has been expended to integrate the system components developed in the first year. These were (1) the solar collector developed in WP2, (2) the ASHP heat exchanger elements developed in WP's 3 and 4 and (3) the low power control system developed in WP5. These elements were integrated and four SOLARIS prototype units have been fabricated. Two have been installed in the field; one in Ireland (QRS) and one in Spain (Teican), one unit has been installed in a climatic chamber (Re/genT) and one has been installed on a fully instrumented mobile test rig (ISRI). The variety of installation sites and types meant that the partners were able to analyse the system performance in a number of environments and additionally solve any issues remotely by working on the nearest installation. The second period of the project has seen the transition from research focussed work to validation and dissemination with the SME partners increasing their efforts in each of these areas respectively.

The initial results show that Solaris is more efficient than currently available systems, however the Consortium have identified a number of significant design improvements that are currently being implemented to improve the efficiency further. These improvements will then be validated over the remaining six month testing period extending past the conclusion of this project. One objective that has been significantly exceeded is the costs of the unit and the cost gain calculations over currently available alternatives. The payback analysis

completed by the partners indicates that Solaris will be a cost effective product in the market for delivering space heating and hot water solutions throughout much of Europe.

The Consortium have produced dissemination material such as a number of 6ft free standing banners, which have been displayed around Europe at numerous trade shows and events. The Consortium, led by TEV have also embarked on a robust IPR protection strategy and intend on finalising a number of applications already made for protection of the project results in the coming months.

The technical work programme over the period 1st March 2009 to 28th February 2011 has involved the following:-

Work Package 1:	Preparatory research
Work Package 2:	Development of the solar air collector panel
Work Package 3:	Development of the solar air source heat pump infrastructure
Work Package 4:	Development of a hydrophobic anti-fouling coating
Work Package 5:	Development of a low power control system
Work Package 6:	System integration and testing
Work Package 7:	In-field trials

In-field validation trials on two Solaris units will continue following the conclusion of the Framework Programme project with project partners Teican Medioambiental and Quinn Renewable Systems in Spain and Ireland respectively.

These developments which were achieved within the Solaris project, will make a significant contribution to energy consumer across the EU by reducing CO_2 emissions and providing a cheaper and more efficient alternative to those products currently on the market. Solaris can be scaled to fit individual requirements and supplies energy on demand without the need for expensive thermal stores and due to the reduced installation costs (vs two independent units) and improved performance it also has a payback period significantly less than its competition.

The activities in the Solaris Project have been conducted by a consortium consisting of 10 organisations from 5 different European countries. The project has been coordinated by TEV Ltd in the UK. The Consortium partners are listed in the table below:

Beneficiary Number	Beneficiary Name	Beneficiary Short Name	Country	Date Enter Project	Date Exit Project
1	TEV Ltd	TEV	United Kingdom	Month 1	Month 24
2	Teican Medioambiental S.L.	Teican	Spain	Month 1	Month 24
3	HRS Heat Exchangers	HRS	Spain	Month 1	Month 24
4	QRS Renewable Systems	QRS	Ireland	Month 1	Month 24

6	FEW Chemicals GmbH	FEW	Germany	Month 1	Month 24
7	The UK Intelligent Systems Research Institute	ISRI	UK	Month 1	Month 24
8	Fraunhofer Gesellschaft zur Forderung der angewandten Forshung e.V.	FHG	Germany	Month 1	Month 24
9	Re/genT BV	RGT	The Netherlands	Month 1	Month 24
10	Stamford Homes Ltd	STH	UK	Month 1	Month 24

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PROJECT FINAL REPORT

USE AND DISSEMINATION OF FOREGROUND REPORT

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Section A (public)

This section includes two templates

- Template A1: List of all scientific (peer reviewed) publications relating to the foreground of the project.

- Template A2: List of all dissemination activities (publications, conferences, workshops, web sites/applications, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters).

These tables are cumulative, which means that they should always show all publications and activities from the beginning until after the end of the project. Updates are possible at any time.

TEMPLATE A1: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES

NO.	*Title*	*Main author*	*Title of the periodical or the series*	*Number, date or frequency*	*Publisher*	*Place of publication*	*Year of publication*	*Relevant pages*	*Permanent identifiers[5] (if available)*	

[5] A permanent identifier should be a persistent link to the published version full text if open access or abstract if article is pay per view) or to the final manuscript accepted for publication (link to article in repository).

[6] Open Access is defined as free of charge access for anyone via Internet. Please answer "yes" if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES							
Type of activities[7]	Main leader	Title	Date	Place	Type of audience[8]	Size of audience	Countries addressed
Exhibition	*TEV*	*AHR Expo 2011*	*January 2011*	*Chicago, USA*	Industry	*30,000+*	
Exhibition	*TEV*	*Mostra Covegno*	*March 2011*	*Milan, Italy*	Industry		
Exhibition	*TEV*	*Inter Solar*	*June 2010*	*Munich, Germany*	Scientific Community (higher education) and Industry		
Exhibition	*TEV*	*Renewable Energy Exhibition*	*June 2010*	*Paris, France*	Industry		
Exhibition	*TEV*	*Renewable Energy 2010*	*June 2010*	*Amsterdam, The Netherlands*	Industry		
Exhibition	*TEV*	*Solar Power International*	*October 2010*	*Los Angeles, USA*	Industry		
Conference	*TEV*	*Energy Action Scotland*	*December 2010*	*Glasgow, Scotland*	Scientific Community (higher education) and Industry		
Exhibition	*TEV*	*Installer Live*	*September 2010*	*Coventry, UK*	Industry		
Conference	*TEV*	*National Energy Action*	*June 2010*	*Liverpool, UK*	Scientific Community		

[7] A drop down list allows choosing the dissemination activity: publications, conferences, workshops, web, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters, Other.

[8] A drop down list allows choosing the type of public: Scientific Community (higher education, Research), Industry, Civil Society, Policy makers, Medias ('multiple choices' is possible.

					(higher education) and Industry		
Conference	*TEV*	*Yorkshire Humber Microgeneration Partnership Conference*	*February 2011*		Industry		
Exhibition	*Teican*	*Genera Trade Show*	*May 2011*		Industry		
Exhibition	*ISRI*	*Pera Demonstration Day*	*December 2010*	*Melton Mowbray, UK*	Scientific Community (higher education) and Industry		
Flyers	*ISRI*	*All events above*	*June 2010*	*N/A*	Scientific Community (higher education) and Industry		
Posters	*ISRI*	*All events above*	*January 2010*	*N/A*	Scientific Community (higher education) and Industry		
Press article	*Teican*	*Eldiario Montanes*	*February 2011*	*Santander, Spain*	Society		
Web	*TEV*	*www.heatking.com*	*January 2011*	*Brighouse, UK*	Society		
Web	*QRS*	*www.qrsrenewables.ie*	*January 2011*	*Dublin, Ireland*	Society		
Web	*FHG*	*www.igb.fraunhofer.de/www/prfil/intnl/eurpoe/en/solaris.html*	*February 2011*	*Stuttgart, Germany*	Society		
Web	*Stamford Homes*	*www.lindenhomes.co.uk/stop-press*	*February 2011*	*Stamford, UK*	Society		

Section B (Confidential)

TEMPLATE B1: LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS, ETC.					
Type of IP Rights: Patents, Trademarks, Registered designs, Utility models, etc	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Application reference(s) (e.g. EP123456)	Subject or title of application	Applicant (s) (as on the application)

Formulation of Project Results into a Protectable Form

The objective of this task was to formulate the project results into protectable (patentable) form and report on potentially competitive patents and a plan for patent application(s) with exploitation agreements between the partners.

Initial consultations with a patent attorney concluded that the a number of developments made during the Solaris project were sufficiently novel to gain patent protection.

The strategy for protecting the IP contained within Solaris is one of secrecy, combined and eventually replaced by patent protection, together with Brand Protection and either partnership or licensing of larger European organisations capable of bringing about effective exploitation of the Solaris Consortium's achievements.

The probability that we will be able to create, and defend, "Solaris" as a name is unlikely due to the popularity of it as (part of) a name in many heating businesses (manufacturers, installers, or distributors) through out Europe and the world. However, several names are available to us Solairis, Solairheat, solairwarm etc. that describe the product well yet have very little usage in the heating world currently. The eventual name will be decided through marketing prior to application. Applying for trademark protection will follow.

TEMPLATE B2: OVERVIEW TABLE WITH EXPLOITABLE FOREGROUND

Description of exploitable foreground	Exploitable product(s) or measure(s)	Sector(s) of application[9]	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
Solar panel with glycol/water and refrigerant pipes	*Panel design*		*2011*		*Beneficiaries – TEV - ownership, Teican, HRS,QRS, FEW - licensing*
The use of the heat-pump evaporator to prevent over-heating of the Solar collector	*Control system algorithm and circuit design*		*2011*		*Beneficiaries – TEV, HRS - ownership,Teican, QRS - licensing*
The use of a low pressure receiver to regulate the amount of refrigerant, to ensure a thermo cycle does take place.	LOW PRESSURE RECEIVER DESIGN AND CONTROL SYSTEM ALGORITHM		2011		*Beneficiaries – TEV - ownership, Teican, HRS,QRS, FEW - licensing*
Use of water tubes in evaporator to defrost the heat pump evaporator	EVAPORATOR DESIGN		2011		*Beneficiaries – TEV - ownership, Teican, HRS,QRS, FEW - licensing*
Use control algorithms to initiate the defrost mode, based on ambient and refrigerant temperatures.	CONTROL SYSTEM ALGORITHM		2011		*Beneficiaries – TEV - ownership, Teican, HRS,QRS, FEW - licensing*
Use of refrigerant pressure to stop defrost			2011		*Beneficiaries – TEV - ownership, Teican, HRS,QRS, FEW - licensing*
Anti-bacterial Coating	COATING FORMULA AND		2011		*Beneficiaries – FEW - ownership, TEV,*

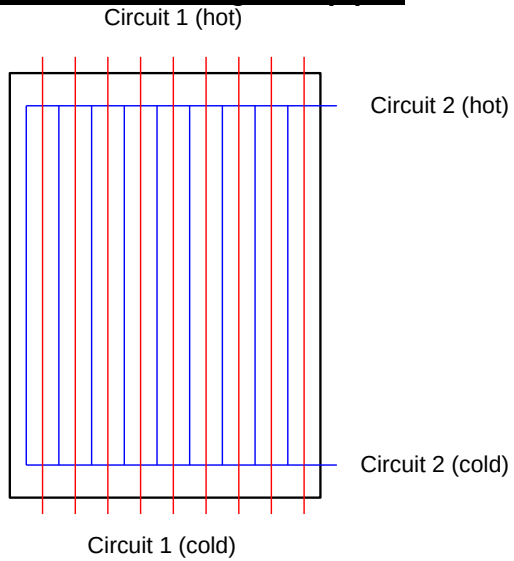
[9] A drop down list allows choosing the type sector (NACE nomenclature) : http://ec.europa.eu/competition/mergers/cases/index/nace_all.html

Description of exploitable foreground	Exploitable product(s) or measure(s)	Sector(s) of application[9]	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
	APPLICATION METHOD				*Teican, HRS,QRS, - licensing*
The positioning of the air source evaporator on a pitched roof for maximum use of available wind energy	METHOD OF CALCULATING POSITION		2011		*Beneficiaries – TEV - ownership, Teican, HRS,QRS, FEW - licensing*

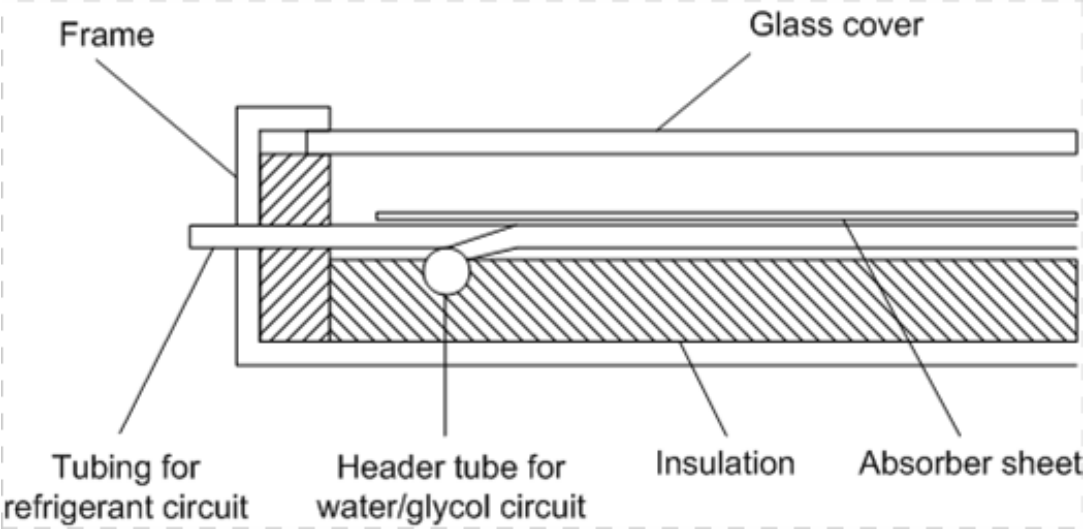
Discussions with a Patent Lawyer have taken place and searches were carried out to ensure that the original concept did not infringe any patents early in the project. Despite significant improvements to the original concept, we are reasonably sure that we are not infringing any patents held by third parties.

Within the complexity of the design and as a result of the research done by our consortium partners we believe we have at least four distinct areas that warrant patent protection. TEV ltd has employed Derek Jackson Associates to advise both trademarks and patents. The areas of opportunity identified are:

Solar panel with glycol/water and refrigerant pipes



The collector comprises of a continuous absorber sheet, enabling heat transfer over the whole of the collector area together with refrigerant(red) and glycol(blue) pipe-work arrays. Both refrigerant and glycol arrays are evenly distributed throughout the absorber assembly, the result being that each is able to interact with the whole of the solar collector efficiently when they are required to operate. The outer appearance and handling of the Solaris solar collector assembly is almost the same as a standard solar thermal collector. The addition of the refrigerant arrays being the only noticeable difference



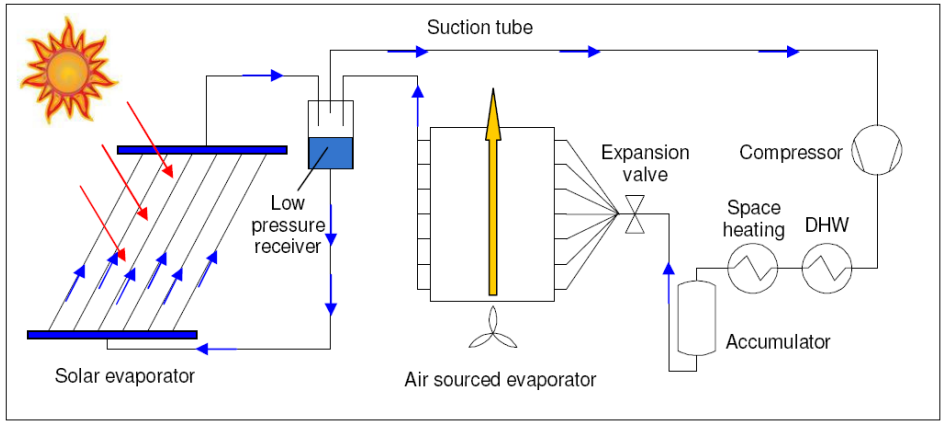
The inclusion of refrigerant pipes in the solar collector allows us to utilise radiant heat energy in the air- source heat pump operating mode for space heating: this will happen when there is space heating demand and the levels of solar radiation are insufficient to bring the solar collector water temperatures up to temperatures higher than the stored water or when the solar collected water temperature has reached it's set point.

The use of the heat-pump evaporator to prevent over-heating of the Solar collector

The evaporator coil has a small array of water tubes running through it. These connect through to the solar collector in such a way as to be come available for avoidance of the overheating of the water/glycol system when the hot water requirement has been satisfied. By adjusting various valves it is possible to promote a natural (thermo-siphon effect) circulation of the glycol solution from the solar collector, where it collects the heat energy, through to the air source heat pump evaporator, where it loses the heat to the air and refrigerant**.**

The use of a low pressure receiver to regulate the amount of refrigerant, to ensure a thermo cycle does take place.

The design of the system is as such that two level switches within the low pressure receiver control the superheat settings of an electronic expansion valve. This ensures that there is always liquid refrigerant within the solar evaporator. When solar radiation energy is available the refrigerant will naturally evaporate in the heat and create a thermo-siphon effect. This will start to lower the level of refrigerant within solar evaporator which will in turn trigger the low liquid level switch within the low pressure receiver. This will effectively open the electronic expansion valve, letting a little more refrigerant through and effectively improving the efficiency of the system. When the amount of solar radiation energy reduces, the reverse occurs. This elegant control method ensures that the solar heat is utilised completely automatically and there is no need for extra refrigerant valves, sensors, pumps or complex software algorithms. Finally the addition of the solar evaporator has no negative effect on efficiency when running without solar assistance because the solar evaporator operates in parallel with the system and is completely bypassed in this mode. It is also possible to use the liquid level switches within the low pressure receiver to initiate alarms warn of potential under(or over)-charging of refrigerant. Both conditions would reduce the effectiveness of Solaris.



Use of water tubes in evaporator to defrost the heat pump evaporator

This is expected to be more efficient (+~200%) than the established methods of defrosting using hot gas by -pass or reverse cycle defrost techniques. The improvement is partly due to improved controllability when compared to the established methods; the hot gas by-pass method returns heat into the evaporator at ambient temperatures where ice is expected to build up, no matter whether ice present; the reverse cycle approach is also invoked in a limited range of ambient temperatures, and tends to be initiated on a regular basis, say every 30 minutes and will run until the coil temperature raises, or until a certain time has passed. This often results in overshoot where a

significant amount of the ice is taken through two phase changes , solid-liquid and liquid-gas, with the associated wasted energy of the second phase change.

The control of the defrost process using hot water supplied through the water pipe arrays is far easier, suffering little of the overshoot. In addition the heat energy within the water will have been derived from solar, or have been derived from only one vapour compression cycle.

Use control algorithms to initiate the defrost mode, based on ambient and refrigerant temperatures.

This is the detection of the need for defrosting modes using ambient temperature and refrigerant pressure, and then, in combination with 3d, the use of a pre- programmed “mask” of expected pressures within the system for given ambient temperatures allows better interpretation of the state of the evaporator coil, so allows more precise setting of the defrost switching parameters:

The effectiveness of an evaporator heat exchanger can be measured by the temperature difference between that of the air that crosses it and that of the refrigerant evaporation temperature. As the temperature of the air that crosses it increases, the amount of duty produced by the evaporator also increases but the effectiveness of the evaporator reduces because the temperature difference increases. The effectiveness of the evaporator with no frost can be logged across a range of ambient temperatures and entered into a control algorithm. When frost/ice occurs, the effectiveness of the evaporator reduces, resulting in the temperature difference between the air and the refrigerant increasing. Measurement of this temperature difference, and the setting of a threshold, will be used to trigger a defrost routine. This system ensures that a defrost routine is only triggered when required. Many current defrost systems use a set temperature to trigger a defrost routine and then set a fixed period before the next defrost can start. However this will result in defrosts occurring when there is no need, i.e. low humidity situations etc. Only through the measurement of the effectiveness of the evaporator can any system truly know whether defrosting is required. It is also possible through the measurement of the effectiveness of the evaporator to detect whether there is a blockage to the airflow through a collection of debris. If the effectiveness of the evaporator is reduced at a higher ambient than frost is expected to occur, or effectiveness is lower than expected immediately after a defrost routine, then this indicates there is a refrigerant circuit blockage for which it is appropriate to create an alarm sequence.

Use of refrigerant pressure to stop defrost

Termination of defrosting through measurement of the refrigerant pressure - the refrigerant pressure is suppressed whilst there is any ice on any part of the evaporator coil. This is due to the refrigerant pressure being determined by the coldest point in the system. The refrigerant pressure has an equivalent temperature at which it evaporates. When a pressure occurs at which the temperature of the refrigerant evaporates is above zero, we can be certain that all the ice on the evaporator has melted. As soon as all the ice has taken all the energy it needs to melt, the pressure will begin to rapidly rise.

Measuring the pressure of the refrigerant as opposed to the temperature allows us to determine exactly when all the ice has been removed from the evaporator and to switch back to a heating operation with little control overshoot.

Method for energy efficient removal of frost from evaporator coil

Switch off compressor, close valves to isolate evaporator coil, refrigerant will then equalise (pressure) throughout coil.

Switch on water pump to pass hot water through evaporator coil to melt the frost.

The refrigerant will migrate to the lowest pressure area ensuring that the whole coils remains the same temperature with no "hot" or "cold" spots.

By sensing the refrigerant it can then be easily determined when the ice has been cleared (the coil will be above 0^{o}C).

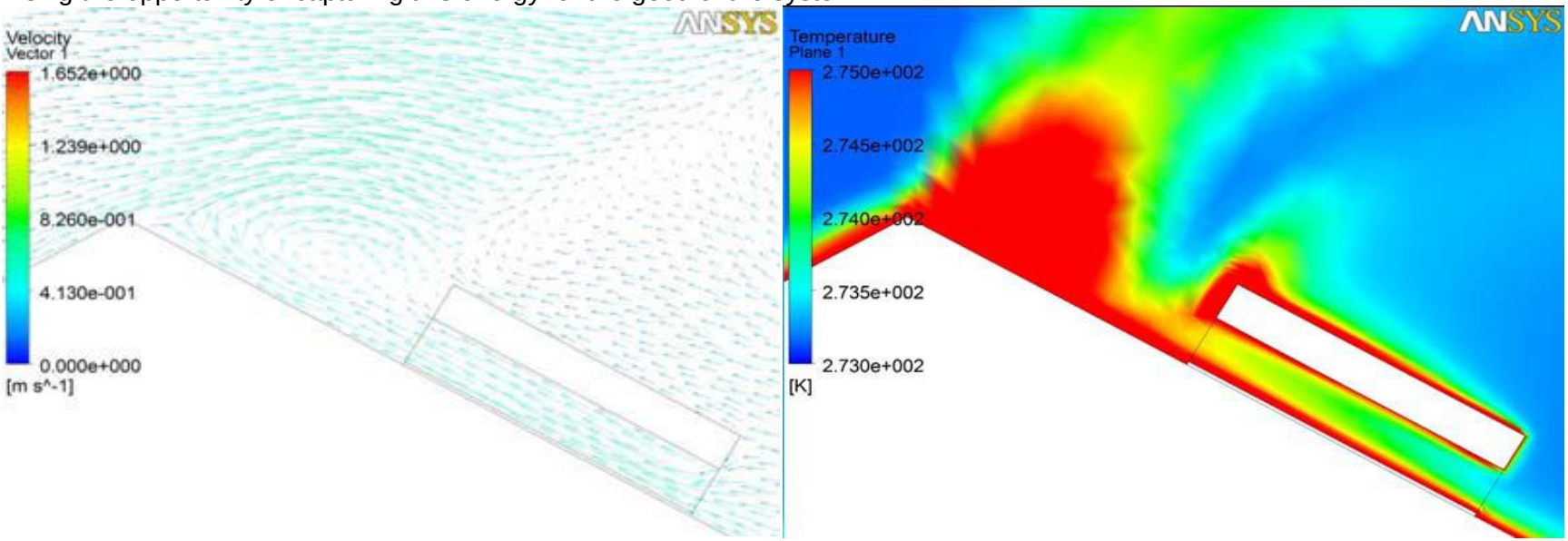
When above 0^{o}C turn off pump to stop hot water and recommence the compressor.

The advantages of this over the traditional methods of defrost, by hot gas by pass or reverse cycle, is that typically:-

- **Hot Gas Bypass uses 1kW of electricity to produce 1kW of heat to defrost coil**
- **Reverse cycle will typically use 1kW of electricity to produce 2kW of heat**
- **Proposed method given same conditions would use 1kW to produce approx 4kW of Heat to defrost coil – thus less energy – more efficient**

Anti-bacterial Coating: A result of the investigations into hydrophobic and hydrophilic coatings, FEW GMBH developed an antibacterial coating. There are question marks about its longevity in solution but it, or a derivative, may help prevent legionnella, and allow the storage of water at consistently low temperatures (At present, it is a requirement that stored hot water is heated to above 60^0C once a week. This requires further investigation

The positioning of the air source evaporator on a pitched roof for maximum use of available wind energy.
When the wind is blowing in the direction of the required unit airflow it is obvious that this will assist the system and reduce or completely remove the requirement to run the fans. However the research at the Fraunhofer Institute has shown us that if the wind is blowing in the opposite direction and if the air source evaporator is correctly positioned the air will continue to flow in the correct direction through the unit. This is due to the fact that when the wind blows over the peak of the roof, air is dragged up the opposite side, and in turn through the unit maximising the opportunity of capturing this energy for the good of the system.



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SOCIETAL IMPLICATIONS

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PART (C) REPORT ON SOCIETAL IMPLICATIONS

Socio-economic and Societal Implications

There are 195 million households in Europe whose combined domestic heating needs account for over 26% of Europe's energy demand and 500 billion tonnes of CO_2 emissions annually. Reducing this is very important if Europe is to achieve ambitious emission reduction targets (ie Kyoto and beyond), decrease our excessive reliance on imported energy and reduce costs to households and industry. The most effective way to decentralise energy production is to increase the amount of generation at source, in this case within the home. A common barrier to the adoption of most energy generation/saving technologies is the high initial investment cost which results in long payback periods even considering current high energy prices. However, with prices increasingly on the rise, existing technologies such as solar thermal heating systems and heat pumps are becoming more popular (growth rate of approximately 50% in 2006). Although both are reasonably efficient, existing solar thermal heating systems generally only provide up to ~60% of a typical household's annual hot water demand. Air source heat pumps are more effective and can provide up to 100% of total household heating requirements but their performance decreases significantly in winter and they suffer from frost-build up. As these technologies are becoming commodity products, SME's in these markets are coming under increasing pressure from cheap low-quality imports from Asia and technologies from the US. It is paramount that European SME's keep a technological edge over these competitors if they are to remain competitive. The Solaris consortium therefore proposed to develop a modular novel solar air source heat pump system (ASHP) which is 25% more efficient than a typical air source heat pump and 7% more efficient than a combination of a standard ASHP and a solar thermal system while only costing 60% of the combined price of these separate systems.

Replies to the following questions will assist the Commission to obtain statistics and indicators on societal and socio-economic issues addressed by projects. The questions are arranged in a number of key themes. As well as producing certain statistics, the replies will also help identify those projects that have shown a real engagement with wider societal issues, and thereby identify interesting approaches to these issues and best practices. The replies for individual projects will not be made public.

A General Information *(completed automatically when **Grant Agreement number** is entered.*

Grant Agreement Number:	230882
Title of Project:	SOLARIS
Name and Title of Coordinator:	Mr Tony Hammersley, TEV Ltd.

B Ethics

1. Did your project undergo an Ethics Review (and/or Screening)? • If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports? Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 *'Work Progress and Achievements'*	***Yes***
2. Please indicate whether your project involved any of the following issues (tick box) :	
RESEARCH ON HUMANS	
• Did the project involve children?	No
• Did the project involve patients?	No
• Did the project involve persons not able to give consent?	No
• Did the project involve adult healthy volunteers?	No
• Did the project involve Human genetic material?	No
• Did the project involve Human biological samples?	No
• Did the project involve Human data collection?	No
RESEARCH ON HUMAN EMBRYO/FOETUS	
• Did the project involve Human Embryos?	No
• Did the project involve Human Foetal Tissue / Cells?	No
• Did the project involve Human Embryonic Stem Cells (hESCs)?	No
• Did the project on human Embryonic Stem Cells involve cells in culture?	No
• Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	No
PRIVACY	
• Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	No
• Did the project involve tracking the location or observation of people?	No
RESEARCH ON ANIMALS	
• Did the project involve research on animals?	No
• Were those animals transgenic small laboratory animals?	No
• Were those animals transgenic farm animals?	No
• Were those animals cloned farm animals?	No
• Were those animals non-human primates?	No
RESEARCH INVOLVING DEVELOPING COUNTRIES	

• Did the project involve the use of local resources (genetic, animal, plant etc)?	No
• Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	No
DUAL USE	
• Research having direct military use	No
• Research having the potential for terrorist abuse	No

C Workforce Statistics

3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).

Type of Position	Number of Women	Number of Men
Scientific Coordinator	3	13
Work package leaders	1	4
Experienced researchers (i.e. PhD holders)	3	8
PhD Students	0	1
Other	1	12

4. How many additional researchers (in companies and universities) were recruited specifically for this project?	
Of which, indicate the number of men:	

D Gender Aspects

5. Did you carry out specific Gender Equality Actions under the project? | | No

6. Which of the following actions did you carry out and how effective were they?

		Not at all effective				Very effective
NA	Design and implement an equal opportunity policy	○	○	○	○	○
NA	Set targets to achieve a gender balance in the workforce	○	○	○	○	○
NA	Organise conferences and workshops on gender	○	○	○	○	○
NA	Actions to improve work-life balance	○	○	○	○	○
NA	Other:					

7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

No

E Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

No

9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

No

F Interdisciplinarity

10. Which disciplines (see list below) are involved in your project?

○ Main discipline[12]: 2.1, 2.3, 2.2

G Engaging with Civil society and policy makers

11a Did your project engage with societal actors beyond the research community? *(if 'No', go to Question 14)* | | No

11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

○ No
○ Yes- in determining what research should be performed
○ Yes - in implementing the research
○ Yes, in communicating /disseminating / using the results of the project

11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)? | | No

[12] Insert number from list below (Frascati Manual).

12. Did you engage with government / public bodies or policy makers (including international organisations)

No

13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?

○ Yes

13b If Yes, in which fields?

Consumers		Energy Environment		Regional Policy Research and Innovation	

13c If Yes, at which level?

YES

- ○ Local / regional levels
- • National level
- ○ European level
- ○ International level

H Use and dissemination

14. How many Articles were published/accepted for publication in peer-reviewed journals?	**0**
To how many of these is open access[13] provided?	**0**
How many of these are published in open access journals?	**0**
How many of these are published in open repositories?	**0**
To how many of these is open access not provided?	**None**
Please check all applicable reasons for not providing open access:	
❑ publisher's licensing agreement would not permit publishing in a repository ❑ no suitable repository available ❑ no suitable open access journal available ❑ no funds available to publish in an open access journal ❑ lack of time and resources ❑ lack of information on open access ❑ other[14]: ……	

15. How many new patent applications ('priority filings') have been made? *("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).*		**None**
16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	**0**
	Registered design	**0**
	Other	**0**
17. How many spin-off companies were created / are planned as a direct result of the project?		**0**
Indicate the approximate number of additional jobs in these companies:		

18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:

❑	Increase in employment, or	❑	In small & medium-sized enterprises
X	Safeguard employment, or	❑	In large companies
❑	Decrease in employment,	❑	None of the above / not relevant to the project
❑	Difficult to estimate / not possible to quantify		

19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (*FTE = one person working fulltime for a year*) jobs:	*Indicate figure:*

[13] Open Access is defined as free of charge access for anyone via Internet.
[14] For instance: classification for security project.

Difficult to estimate / not possible to quantify	❑

I Media and Communication to the general public

20. As part of the project, were any of the beneficiaries professionals in communication or media relations?

No

21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?

No

22 Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?

❑	Press Release	❑	Coverage in specialist press
❑	Media briefing	❑	Coverage in general (non-specialist) press
❑	TV coverage / report	X	Coverage in national press
❑	Radio coverage / report	❑	Coverage in international press
X	Brochures /posters / flyers	X	Website for the general public / internet
❑	DVD /Film /Multimedia	X	Event targeting general public (festival, conference, exhibition, science café)

23 In which languages are the information products for the general public produced?

Language of the coordinator	X	English
Other language(s)		

***Question F-10*:** Classification of Scientific Disciplines according to the Frascati Manual 2002 (Proposed Standard Practice for Surveys on Research and Experimental Development, OECD 2002):

FIELDS OF SCIENCE AND TECHNOLOGY

1. NATURAL SCIENCES

1.1 Mathematics and computer sciences [mathematics and other allied fields: computer sciences and other allied subjects (software development only; hardware development should be classified in the engineering fields)]

1.2 Physical sciences (astronomy and space sciences, physics and other allied subjects)

1.3 Chemical sciences (chemistry, other allied subjects)

1.4 Earth and related environmental sciences (geology, geophysics, mineralogy, physical geography and other geosciences, meteorology and other atmospheric sciences including climatic research, oceanography, vulcanology, palaeoecology, other allied sciences)

1.5 Biological sciences (biology, botany, bacteriology, microbiology, zoology, entomology, genetics, biochemistry, biophysics, other allied sciences, excluding clinical and veterinary sciences)

2 ENGINEERING AND TECHNOLOGY

2.1 Civil engineering (architecture engineering, building science and engineering, construction engineering, municipal and structural engineering and other allied subjects)

2.2 Electrical engineering, electronics [electrical engineering, electronics, communication engineering and systems, computer engineering (hardware only) and other allied subjects]

2.3. Other engineering sciences (such as chemical, aeronautical and space, mechanical, metallurgical and materials engineering, and their specialised subdivisions; forest products; applied sciences such as

geodesy, industrial chemistry, etc.; the science and technology of food production; specialised technologies of interdisciplinary fields, e.g. systems analysis, metallurgy, mining, textile technology and other applied subjects)

3. MEDICAL SCIENCES

3.1 Basic medicine (anatomy, cytology, physiology, genetics, pharmacy, pharmacology, toxicology, immunology and immunohaematology, clinical chemistry, clinical microbiology, pathology)

3.2 Clinical medicine (anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, dentistry, neurology, psychiatry, radiology, therapeutics, otorhinolaryngology, ophthalmology)

3.3 Health sciences (public health services, social medicine, hygiene, nursing, epidemiology)

4. AGRICULTURAL SCIENCES

4.1 Agriculture, forestry, fisheries and allied sciences (agronomy, animal husbandry, fisheries, forestry, horticulture, other allied subjects)

4.2 Veterinary medicine

5. SOCIAL SCIENCES

5.1 Psychology

5.2 Economics

5.3 Educational sciences (education and training and other allied subjects)

5.4 Other social sciences [anthropology (social and cultural) and ethnology, demography, geography (human, economic and social), town and country planning, management, law, linguistics, political sciences, sociology, organisation and methods, miscellaneous social sciences and interdisciplinary , methodological and historical S1T activities relating to subjects in this group. Physical anthropology, physical geography and psychophysiology should normally be classified with the natural sciences].

6. HUMANITIES

6.1 History (history, prehistory and history, together with auxiliary historical disciplines such as archaeology, numismatics, palaeography, genealogy, etc.)

6.2 Languages and literature (ancient and modern)

6.3 Other humanities [philosophy (including the history of science and technology) arts, history of art, art criticism, painting, sculpture, musicology, dramatic art excluding artistic "research" of any kind, religion, theology, other fields and subjects pertaining to the humanities, methodological, historical and other S1T activities relating to the subjects in this group]