SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

UNIVERSITA' DEGLI STUDI DI PALERMO
DIPARTIMENTO DEIM

Task 53
NEW GENERATION
SOLAR COOLING & HEATING SYSTEMS

Task 53 - 8th Expert meeting

29-30 October 2017

Activities A5-1 and A5-2

LCA and techno-eco comparison between reference and new systems

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University of Palermo – DEIM

Activity A5-1: Techno-economic analysis on comparison between thermal and PV existing solar cooling systems including as well LCA approach and Eco label sensibility.

Techno-economic analysis

The analysis for the two systems installed in Palermo (Freescoo and Air handling unit desiccant cooling) will start in the next months, based on the technical and economic KPI identified in the Activity A5-2.

The results will be presented by using the quality label scheme defined in Action A5-2

Air handling unit desiccant cooling (AHU-DEC)

FREESCOO

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Activity A5-1: Techno-economic analysis on comparison between thermal and PV existing solar cooling systems including as well LCA approach and Eco label sensibility.

LCA analysis

Developed actions: UNIPA is carrying out the following LCA studies:

•FREESCOO: the LCA is completed.

•Air Handling Unit Desiccant Cooling (AHU-DEC) equipped with a hybrid photovoltaic/thermal (PV/T) system: analysis of the manufacturing and end-of-life steps is completed. The assessment of the operational step is in progress.

•SHC system installed in Messina (adsorption chiller): the LCA is completed.

•PVCOOLING system from Tecsol/ATISYS: the LCA is in progress/check of data required

•Midea PV Cooling system from Pedro Vincente: the LCA is in progress//check of data required

Develop actions: UNIPA is carrying out literature review of LCA studies on thermal and PV existing solar cooling systems. The literature studies will be summarized by using a format already developed within Task 38.

Results: The literature review is in progress.

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Activity A5-2: Definition of Key Performance Indicators (KPI) of the market available systems and possible characterization test method (permitting to lead to a quality labeling scheme for new generation solar cooling systems) as well as standards.

Energy indicators

Global Energy Requirement (MJ)
Energy payback time (years)
Energy return ratio (a-dimensional)

Economic indicators

Money savings during the operation (€)
Initial cost ratio
Operation/maintenance costs ratio
Payback period (years)

Social indicators

Customer satisfaction (qualitative)
Ease of use of the systems (qualitative)

Environmental indicators

Global Warming Potential (kg CO_{2eq})
Acidification Potential (kg SO_{2eq})
Eutrophication Potential (kg $PO_4^{3-}{}_{eq}$)
Ozone Depletion Potential (kg CFC-11_{eq})
Photochemical Ozone Creation Potential (kg C_2H_{4eq})
GWP payback time (years)

Technical indicators

Useful life of the system (years)
Thermal Performance Coefficient (COP_{th}) of the ab/adsorption machine
Solar Electric Performance Coefficient ($COP_{Elec-sol}$) of the system
Reliability of the system (%)

Each KPI has been described by using a specific format

This action has been completed

Activity A5-2: Definition of a Quality labeling scheme to be used for showing the energy, environmental, economic, social and technical characteristics of the systems

This action has been completed

SHC SOLAR HEATING & COOLING PROGRAMME INTERNATIONAL ENERGY AGENCY

QUALITY LABEL SCHEME

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Picture of the system	The system
(insert a picture of the system)	(insert a brief description of the system)

Energy KPIs		Environmental KPIs	
GER (MJ):		GWP (kg CO_{2eq}):	
EPT (years):		AP (kg SO_{2eq}):	
ERR:		EP (kg $PO_4^{3-}{}_{eq}$):	
		ODP (kg CFC-11_{eq}):	
		POCP (kg C_2H_{4eq}):	
		GWP-PT (year):	

Activity A5-2: Definition of a Quality labeling scheme to be used for showing the energy, environmental, economic, social and technical characteristics of the systems

This action has been completed

Economic KPIs		Social KPIs	
MSDO (€):		CS:	
ICR (€):		EUS:	
OMC (€):			
PP (years):			
Technical KPIs			
ULS (years):			
COP_{th}:			
$COP_{Elec-sol}$:			
RS (%):			
Key of KPIs			
Energy indicators: Global Energy Requirement (GER); Energy Payback Time (EPT); Energy Return Ratio (ERR); Environmental indicators: Global Warming Potential (GWP); Acidification Potential (AP); Eutrophication Potential (EP); Ozone Depletion Potential (ODP); Photochemical Ozone Creation Potential (POCP); GWP Payback Time (GWP-PT); Economic indicators: Money savings during the operation (MSDO); Initial cost ratio (ICR); Operation/maintenance costs ratio (OMC); Payback period (PP); Social indicators: Customer satisfaction (CS); Ease of use of the system (EUS); Technical indicators: Useful life of the system (ULS); Thermal performance coefficient of the ab/adsorption machine (COPth); Solar Electric Performance Coefficient of the system (COPElec-sol); Reliability of the system (RS).			

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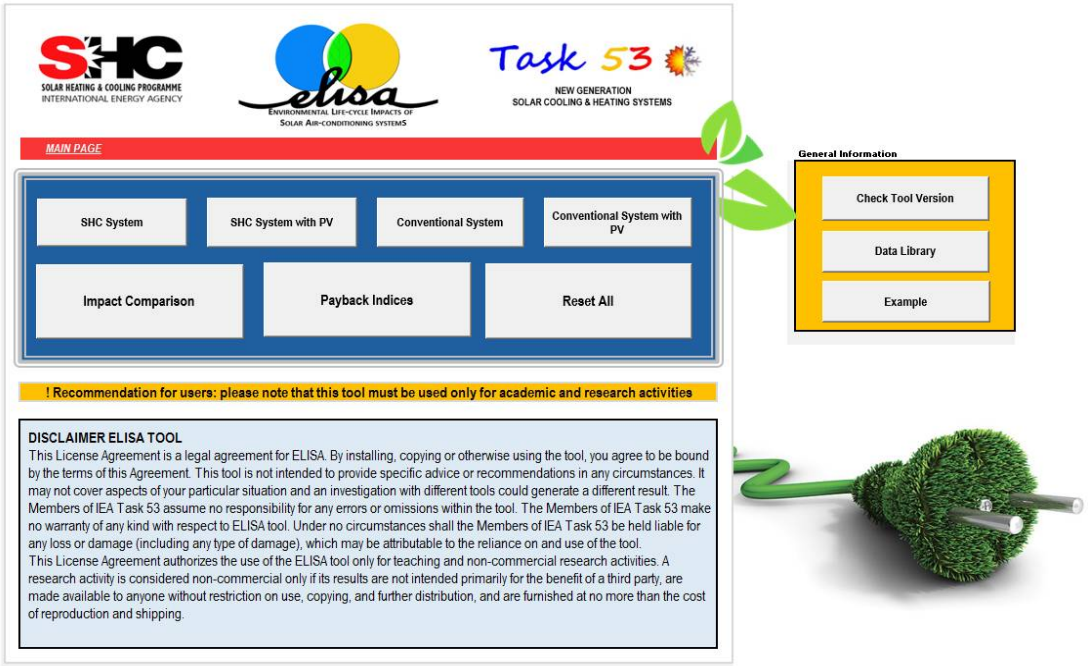
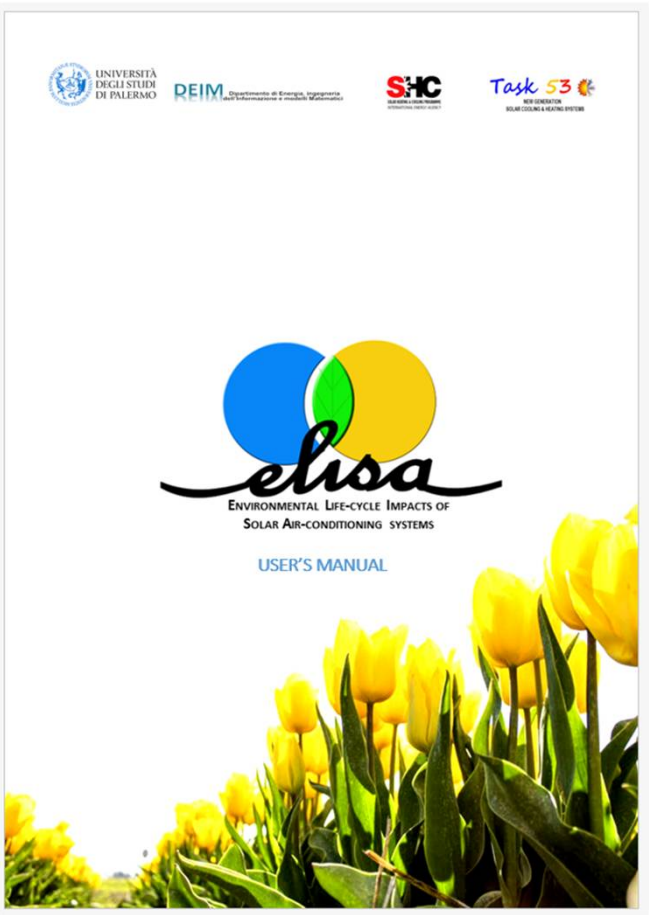
Update of the LCA tool developed within Task 48

ENVIRONMENTAL LIFE-CYCLE IMPACTS OF
SOLAR AIR-CONDITIONING SYSTEMS



The user's manual of the tool has been developed.



This action has been completed

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Update of the LCA tool developed within Task 48

The LCA tool developed within Task 48 has been updated.

What is new?

-New design and functionality (non-editable equations, component selection from a drop down menu, enter new data, export in PDF of each page, etc.);

-Some new components have been added: 2 heat pumps (10 kW, 30 kW); 1 absorption chiller (100 kW) and air cooler;

-Comparing 4 different systems simultaneously: SHC, SHC equipped with PV, conventional, conventional equipped with PV.

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THANK YOU FOR YOUR ATTENTION

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