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Identification of most promising markets and promotion of standardised system configurations for the market entry of small scale combined solar heating & cooling applications

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Intelligent Energy Europe

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Solar thermal domestic hot water heating (DHW) — DHW

& space heating — Solar Combi

& space cooling — Solar Combi+

Main Aim: Identify and promote standard system configurations for small scale (up to 20 kW) solar heating and cooling applications

Partnership: 12 partners from 7 countries (Italy, Austria, France, Germany, Greece, Spain, Sweden) including the 5 leading European small scale sorption chiller producers

Approach: To identify standard system configurations and most promising applications, the project proposes to perform **virtual case studies**, where promising system configurations are defined (based on a thorough analysis of the market) and validated by simulations and economical and ecological ratings for different typical conditions (i.e. utilization, climate, building type).

Background

Small scale sorption chillers are now commercially available, but there are several non-technical barriers which can bother a smooth market entry:

① Combined solar heating & cooling needs **high effort in design stage**, which is not affordable for small applications

② Small scale sorption chillers are at the moment expensive due to **low production numbers**

③ Small scale combined solar heating & cooling is **not enough known by key actors**, such as installers and planners on the one side as well as public authorities and consumers on the other side

Objectives & main steps

Proposed solutions to the barriers

① High effort in design stage

→ Reduce design effort, identifying **standardised system configurations** (technology independent) and **package solutions** (for single chiller) through **virtual case studies**

② Low production numbers

→ Trigger application by identifying **most promising markets** (both in the sense of applications and regions)

③ Not enough known by key actors

→ Rise awareness with **targeted dissemination and promotion**, towards professionals (training, presentations), policy makers (pro-active approach) and end users (media campaigns)

Expected results

Standard system configurations, which work best under different circumstances, are described in a **brochure** and disseminated to professionals

Package solutions for the single chiller technologies are broadcasted at fairs and taught in special **trainings** (focusing on solar thermal enterprises and installers)

Most promising markets are identified (both in the sense of applications and regions) and promoted

Knowledge among professionals is increased, inter alia offering access to virtual case studies through an **online tool** enabling early decision on feasibility

Awareness within public authorities is enhanced, assistance for integration in support schemes and implementation of EPBD is given, **pilot installations** are initiated

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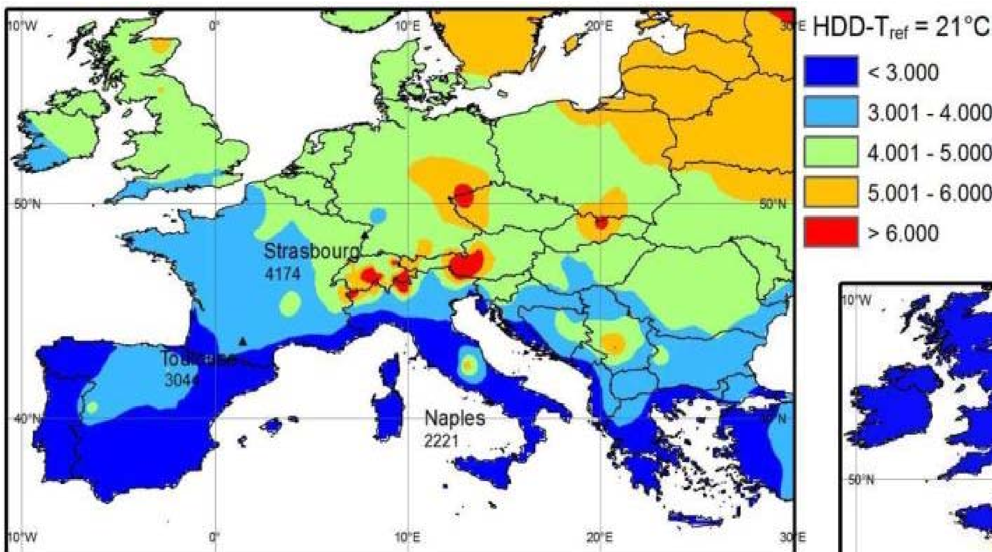
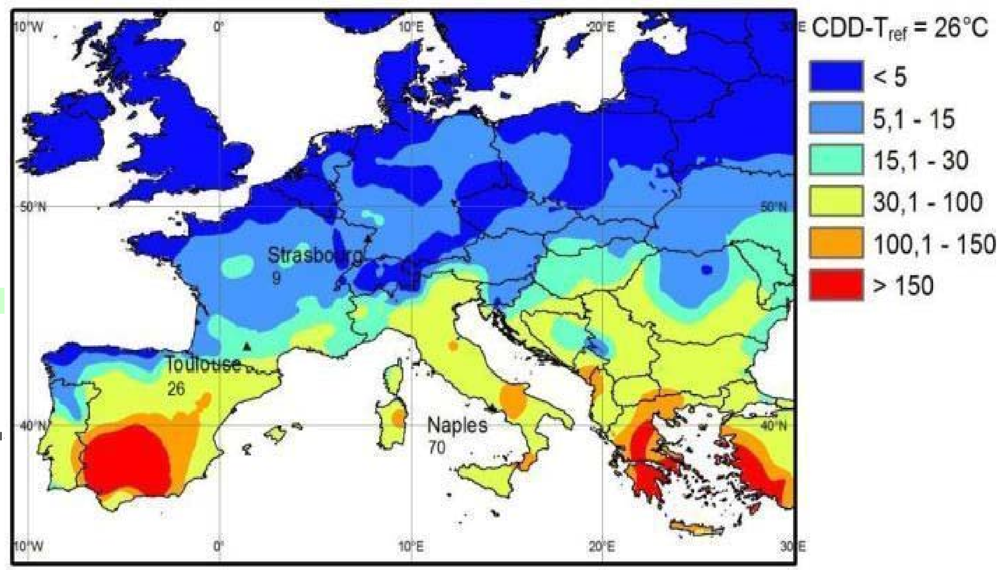
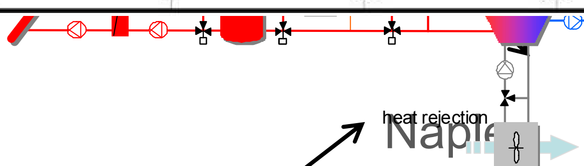
Virtual Case Studies



entified
emulations.

flat plate
acuum tube
Collector types





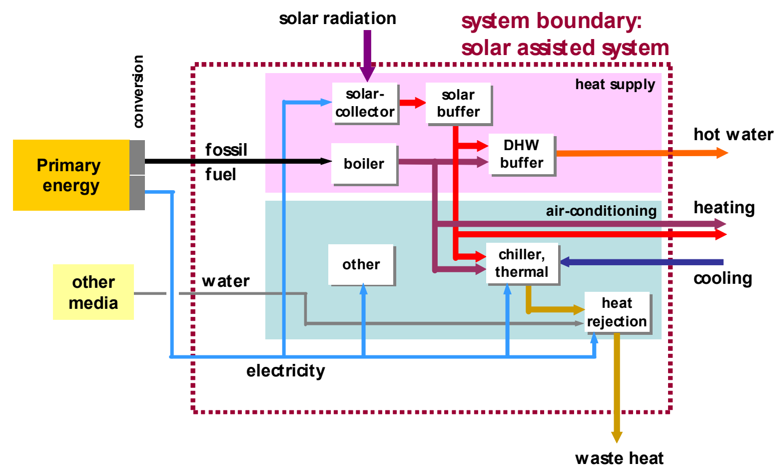
office

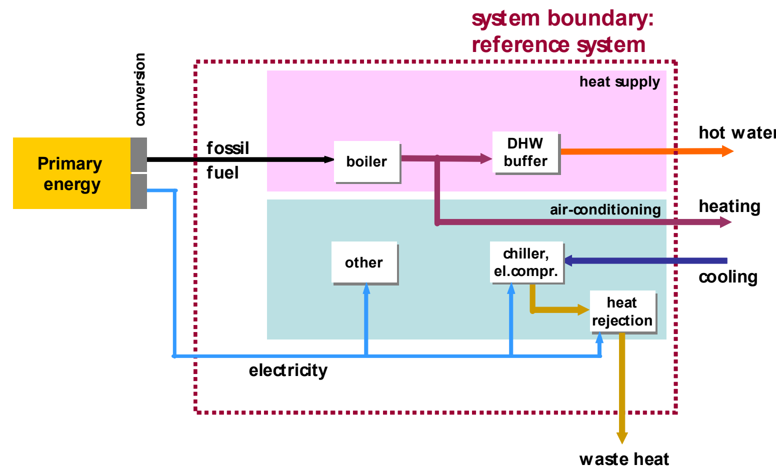
Source: Fraunhofer I

Climate
Naples
Toulouse
Strasbourg

Main figures

- **Performance figures of the system:** Collector efficiency, collector yield, solar fractions, COP, …
- **Environmental performance figures:** PE-savings, PE-COP, CO2-savings, PER, …
- **Economical figures:** Investment costs, annual costs, costs per saved kWh PE, ...





Standard Configurations

- Total solar fraction
- Total electrical efficiency
- Yearly relative primary energy saved

- **Naples**

$$Suitable\ solutions = \{solutions \mid SF_{tot} > 60\%, COP_{el} > 10, PES_{rel} > 0\}$$

- **Toulouse, Strasbourg**

$$Suitable\ solutions = \{solutions \mid SF_{tot} > 40\%, COP_{el} > 15, PES_{rel} > 0\}$$

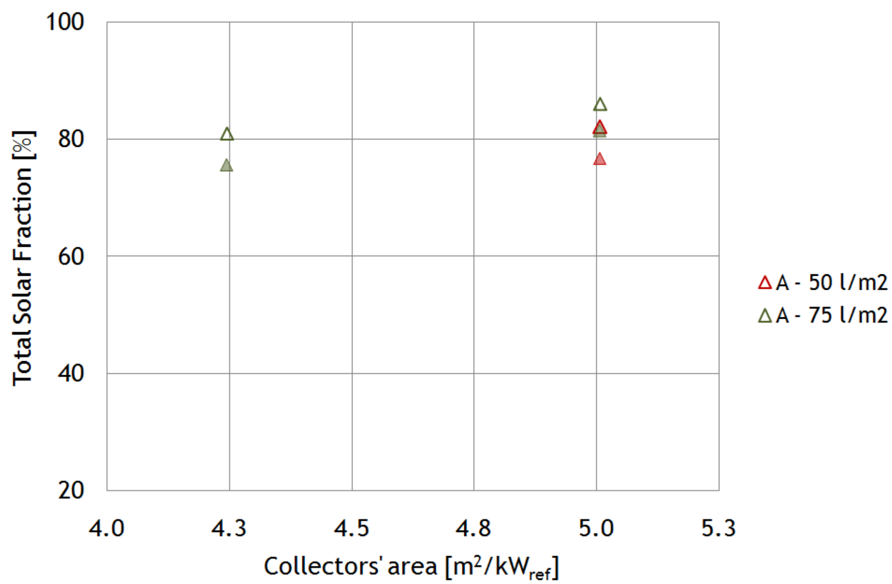
Example of table of results

		WCT				HC				DC			
		ET		FP		ET		FP		ET		FP	
Total Solar Fraction [%]	CC	5.0	m^2/kW	5.0	m2/kW	5.0	m^2/kW	5.0	m2/kW	5.0	m^2/kW	5.0	m^2/kW
		75.0	l/m^2	75.0	l/m2	75.0	l/m^2	75.0	l/m^2	75.0	l/m^2	75.0	l/m^2
		A	86.1	A	81.4	A	86.2	A	81.4	A	0.0	A	0.0
		B	73.3	B	67.1	B	0.0	B	73.1	B	0.0	B	0.0
		C	87.0	C	83.0	C	82.5	C	77.1	C	80.2	C	74.2
		D	82.5	D	77.8	D	81.5	D	76.6	D	0.0	D	0.0
		E	0.0	E	90.3	E	0.0	E	0.0	E	0.0	E	0.0
		ET		FP		ET		FP		ET		FP	
	FC	5.0	m^2/kW	5.0	m2/kW	5.0	m^2/kW	5.0	m2/kW	5.0	m^2/kW	5.0	m^2/kW
		75.0	l/m^2	75.0	l/m2	75.0	l/m^2	75.0	l/m^2	75.0	l/m^2	75.0	l/m^2
		A	87.1	A	81.8	A	86.4	A	81.0	A	0.0	A	0.0
		B	0.0	B	0.0	B	0.0	B	0.0	B	0.0	B	0.0
		C	0.0	C	0.0	C	0.0	C	0.0	C	0.0	C	0.0
		D	0.0	D	0.0	D	0.0	D	0.0	D	0.0	D	0.0
		E	0.0	E	89.1	E	0.0	E	0.0	E	0.0	E	0.0

Sizing and sensitivity

Configurations (collectors' area 4.3-5 m^2/kW_{ref} and storage volume 50-75 l/m^2) for each set of parameters were selected as **standard configurations** and a sensitivity analysis was carried out on the basis of:

- total solar fraction
- cooling solar fraction
- relative primary energy saved
- total electrical efficiency
- gross solar yield



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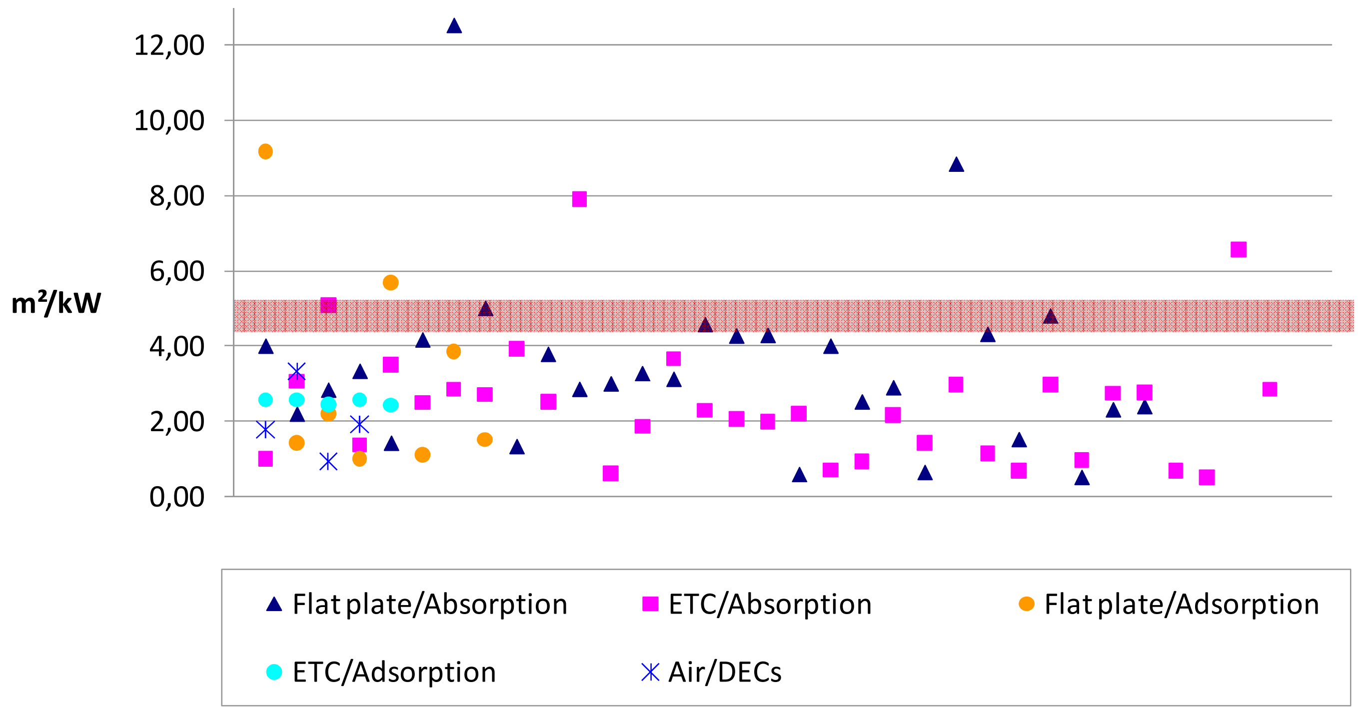
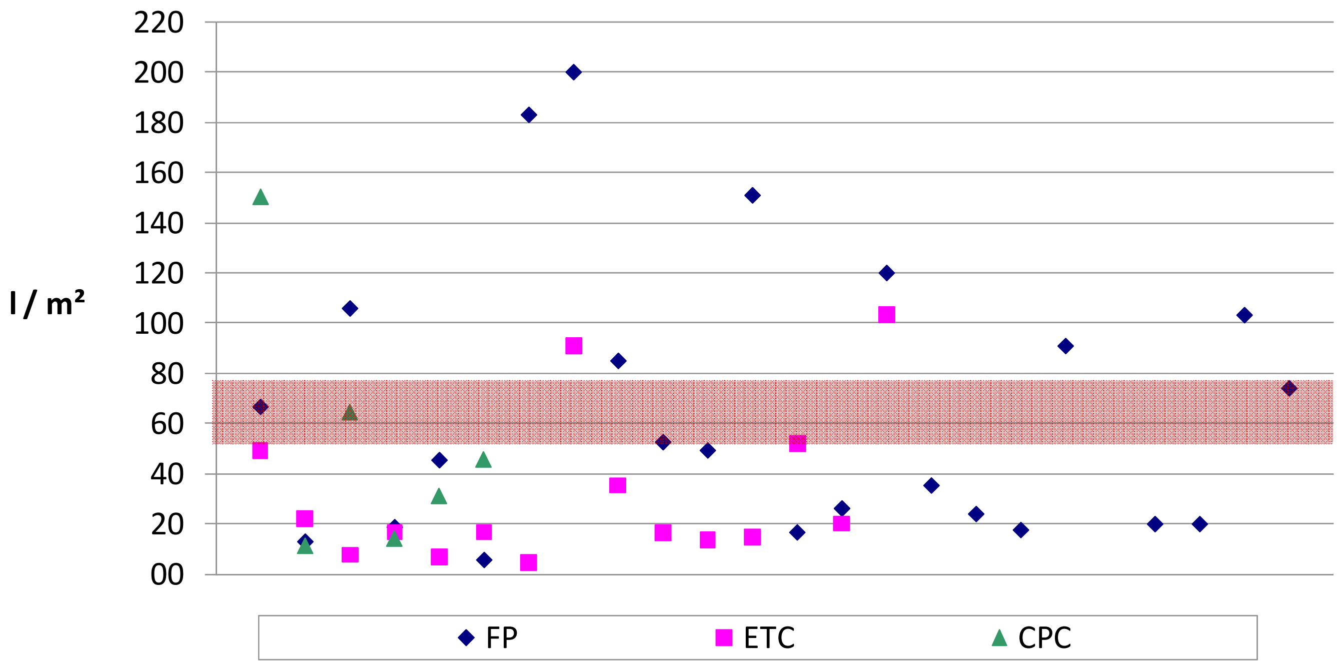
Actual state of solar cooling plants

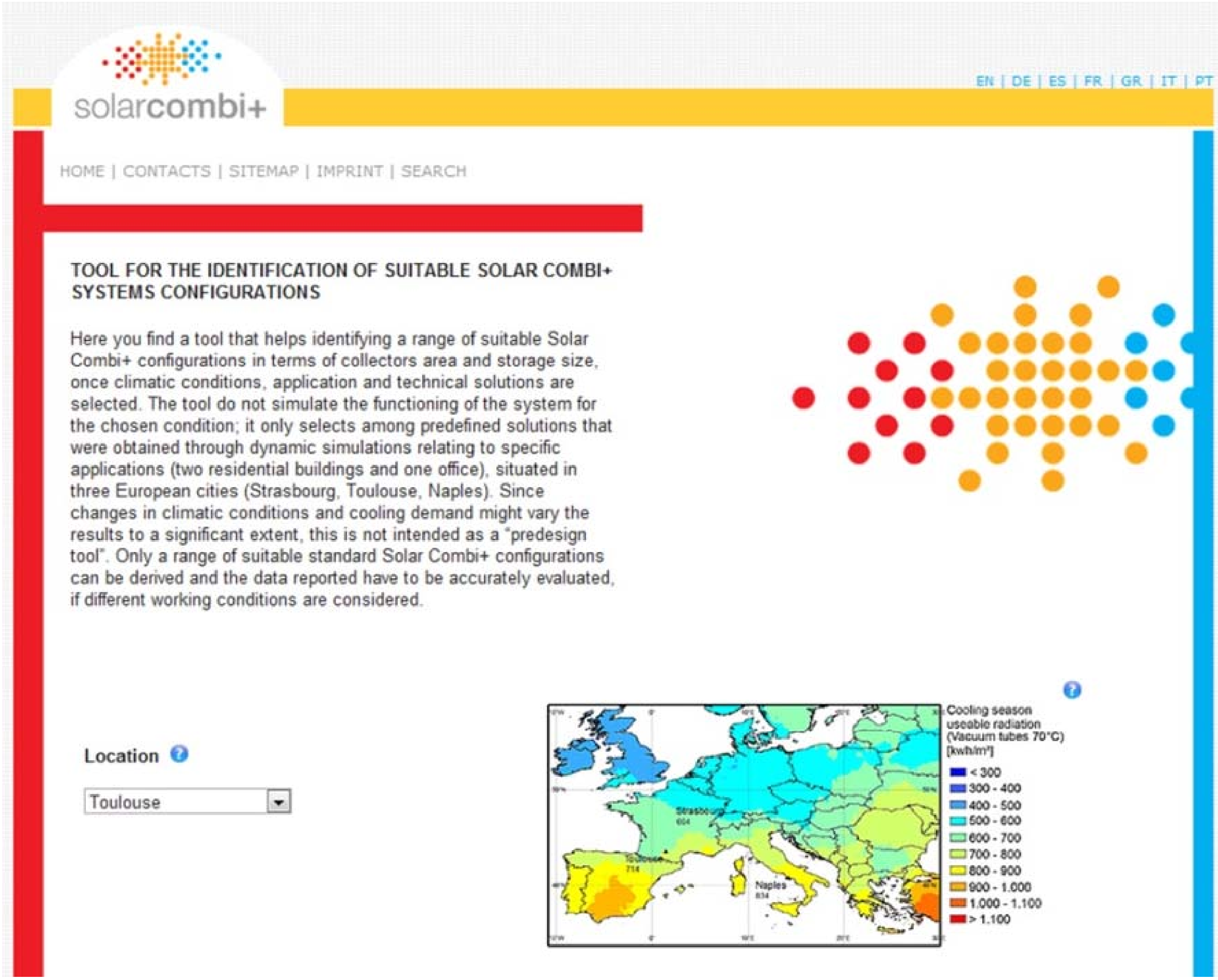


Source: Eurac, IEA-Task 38

Actual state of solar cooling plants



Source: Eurac, IEA-Task 38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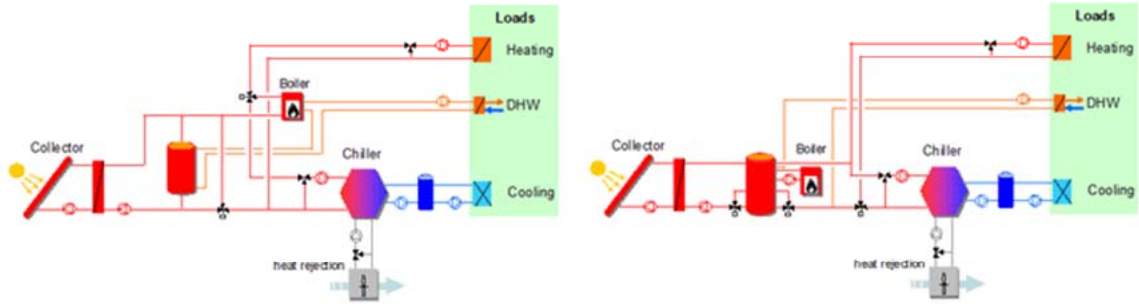
TOOL FOR THE IDENTIFICATION OF SUITABLE SOLAR COMBI+ SYSTEMS CONFIGURATIONS
Here you find a tool that helps identifying a range of suitable Solar Combi+ configurations in terms of collectors area and storage size, once climatic conditions, application and technical solutions are selected. The tool do not simulate the functioning of the system for the chosen condition; it only selects among predefined solutions that were obtained through dynamic simulations relating to specific applications (two residential buildings and one office), situated in three European cities (Strasbourg, Toulouse, Naples). Since changes in climatic conditions and cooling demand might vary the results to a significant extent, this is not intended as a "predesign tool". Only a range of suitable standard Solar Combi+ configurations can be derived and the data reported have to be accurately evaluated, if different working conditions are considered.
Location
Toulouse
Naples
834
Cooling season useable radiation (Vacuum tubes 70°C) [kwh/m²]
< 300
300 - 400
400 - 500
500 - 600
600 - 700
700 - 800
800 - 900
900 - 1.000
1.000 - 1.100
> 1.100



Type	Collectors' Area [m2/kWref]	Storage Volume [l/m2]	Total Solar Fraction [%]	Cooling Solar Fraction [%]	Relative Primary energy Saved [%]	Specific Primary Energy Saved [(kWh/year)/m2]	Gross Solar Yeald [kWh/m2/y]	Electric COP [-]
B	5,0	51	42,3	70,8	31,6	250	450	47,1
B	5,0	75	43,7	73,7	33,2	262	462	46,9
B	5,0	75	43,7	73,7	33,2	262	462	46,9
C	5,0	49	44,6	86,0	38,4	304	402	51,4
C	5,0	73	46,2	89,2	40,0	317	414	51,2
C	4,3	74	42,3	82,4	36,0	337	452	51,2
D	5,0	50	46,1	87,2	32,6	253	421	47,0
D	4,2	75	43,9	85,1	30,4	279	472	46,6
D	5,0	75	48,9	89,4	35,7	277	435	46,8

values computed on 06/2009

Project conclusions

- Standard configurations and sizes have been elaborated
- Standardization of systems should reduce the costs and higher the quality leading to higher energy outputs
- As the technology is still in an early stage regarding the market penetration, incentives are necessary to enlarge the market and drive down production costs.
- Incentives on measured performances are considered as most suitable

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Arbeitsgemeinschaft Erneuerbare Energie – Institut für Nachhaltige Technologien (AEE INTEC),	Austria
Università degli Studi di Bergamo,	Italy
TECSOL SA,	France
Ikerlan Technological Research Centre,	Spain

Industrial partners:

Fagor Electrodomésticos, S.Coop,	Spain
ClimateWell AB,	Sweden
SorTech AG,	Germany
Solution Solartechnik GmbH,	Austria
SK Sonnenklima GmbH,	Germany