

SOLARCOMBI+ : SOLAIR presentation

Daniel Mugnier – Bolzano – 27/28 September 2007



SOLAIR

Increasing the Market Implementation of Solar Air-Conditioning Systems for Small and Medium Applications in Residential and Commercial Buildings

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Work programme months 13-24

WP	WP-leader	Task	2008											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	target	1.1	Project co-ordination											
		1.2	Transnational meetings											
2	FHG-ISE	2.1	Review of available technical solutions and successful running systems											
		2.2	Preparation of a web-based database of best available examples											
		2.3	Analysis of market potential of small and medium-sized SAC appliances											
		2.4	Preparation of guidelines: Requirements on the design and configuration of small and medium-sized SAC appliances											
3	TECSOL	3.1	Definition of standard training modules, development of a didactic material base and course concepts											
		3.2	Implementation and evaluation of pilot training courses for professionals and technicians in the participating countries											
		3.3	Production and distribution of training materials											
4	Ambiente Italia	4.1	Campaign concept and production of materials											
		4.2	Set-up and implementation of information campaign activities for investors and key market actors											
		4.3	Evaluation and documentation of campaign results											
5	EVE	5.1	Implementation of a project website											
		5.2	Half-day workshops with regional and national policy makers and multipliers											
		5.3	Thematic workshops at the European level											
		5.4	Production and Europe-wide distribution of a SAC brochure											
		5.5	Project presentation at the most relevant European conferences											
6	target	6.1	Contribution to the development of online information systems under IEEA management											
		6.2	Participation and/or contribution to information and dissemination events related to Intelligent Energy - Europe or other relevant EU programmes											
		6.3	Contribution to the preparation of common presentation material related to IEE actions, like the "Intelligent Energy News" newsletter and other printable or audiovisual media developed by the IEEA											



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Work programme months 25-36

WP	WP-leader	Task	2009														
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
1	target	1.1	Project co-ordination				D2									D5	
		1.2	Transnational meetings			D3										D1	
2	FhG-ISE	2.1	Review of available technical solutions and successful running systems														
		2.2	Preparation of a web-based database of best available examples														
		2.3	Analysis of market potential of small and medium-sized SAC appliances														
		2.4	Preparation of guidelines, requirements on the design and configuration of small and medium-sized SAC appliances														
3	TECSOL	3.1	Definition of standard training modules, development of a didactic material base and course concepts														
		3.2	Implementation and evaluation of pilot training courses for professionals and technicians in the participating countries														
		3.3	Production and distribution of training materials														
4	Ambiente Italia	4.1	Campaign concept and production of materials														
		4.2	Set-up and implementation of information campaign activities for investors and key market actors									D16, D17					
		4.3	Evaluation and documentation of campaign results												D18		
5	EVE	5.1	Implementation of a project website														
		5.2	Half-day workshops with regional and national policy makers and multipliers														D20
		5.3	Thematic workshops at the European level											D21			
		5.4	Production and Europe-wide distribution of a SAC brochure													D22	
		5.5	Project presentation at the most relevant European conferences														D23
6	target	6.1	Contribution to the development of online information systems under IEEA management													D24	
		6.2	Participation and/or contribution to information and dissemination events related to Intelligent Energy - Europe or other relevant EU programmes														D24
		6.3	Contribution to the preparation of common presentation material related to IEE actions, like the "Intelligent Energy News" newsletter and other printable or audiovisual media developed by the IEEA														D24

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WP3 Capacity building and training activities

* Goal : To create a comprehensive set of training units and didactic material. For the participating countries, training courses will be prepared and evaluated through pilot courses.

* Audience : Supply side such as plant designers, engineers, technicians and installers



Practical training



Real installation feedback



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WP3 Capacity building and training activities

* **Task 3.1** **Definition of standard training modules, development of a didactic material base and course concepts**

Sources = Experiences (IEA task 25, CLIMASOL, KeepCool, ROCOCO, MEDISCO, IEA Task 38, SOLARCLIM2000,...) + Materials elaborated in WP 2

Production : Training materials on 6 fields.

- A) Available and most promising technologies
- B) Performance indicators, requirements on design and configuration
- C) Technical planning, implementation, quality assurance
- D) Available software and example calculations
- E) Environmental and financial aspects
- F) Realised systems and success stories

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WP3 Capacity building and training activities

* **Task 3.2 Implementation and evaluation of pilot training courses for professionals and technicians in the participating countries**

A) Organisation and implementation of two pilot training courses per partner country for professionals and technicians (DE, AT, IT, GR, PT, ES, FR, SI)



B) Evaluation of the training courses



C) Cross-country analysis



D) Improvement of the training contents and didactic materials

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WP3 Capacity building and training activities

* Task 3.3 Production and distribution of training materials

- Didactic guidelines will be developed taking into account the most important knowledge for dissemination to the technical targeted groups.
- Content may differ for the participating countries according to the national requirements.
- Master version in English (electronic data base form) = basis for the preparation of the country versions.
- Materials available on the project website.

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Project n° TREN/05/FP6EN/SO7.54855/020094

Acronym : ROCOCO

Title : Reduction of costs of
Solar Cooling systems

Instrument : Specific Support Action
Thematic Priority : [6.1.3.1.1] [Cost-effective supply of
renewable energies]



SIXTH FRAMEWORK
PROGRAMME



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- * **Specific Support Action**

- * **3 countries : Austria, France, Spain**

Austria : Arsenal, Conness, Team GMI

France : TECSOL, Vivale

Spain : Aguasol, Fototerm

- * **Duration : 2 years** (May 2006-May 2008)

- * **Objective** : To identify ways to reduce the costs of solar cooling systems

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Reduction of costs of Solar Cooling Systems

WP0: management, administration and coordination

WP1: state-of-the-art of the existing and upcoming solar cooling technologies => **achieved and report available**

WP2: examination of building sectors, related to previous found applications, that have a high potential for the development of solar cooling technologies => **ongoing**

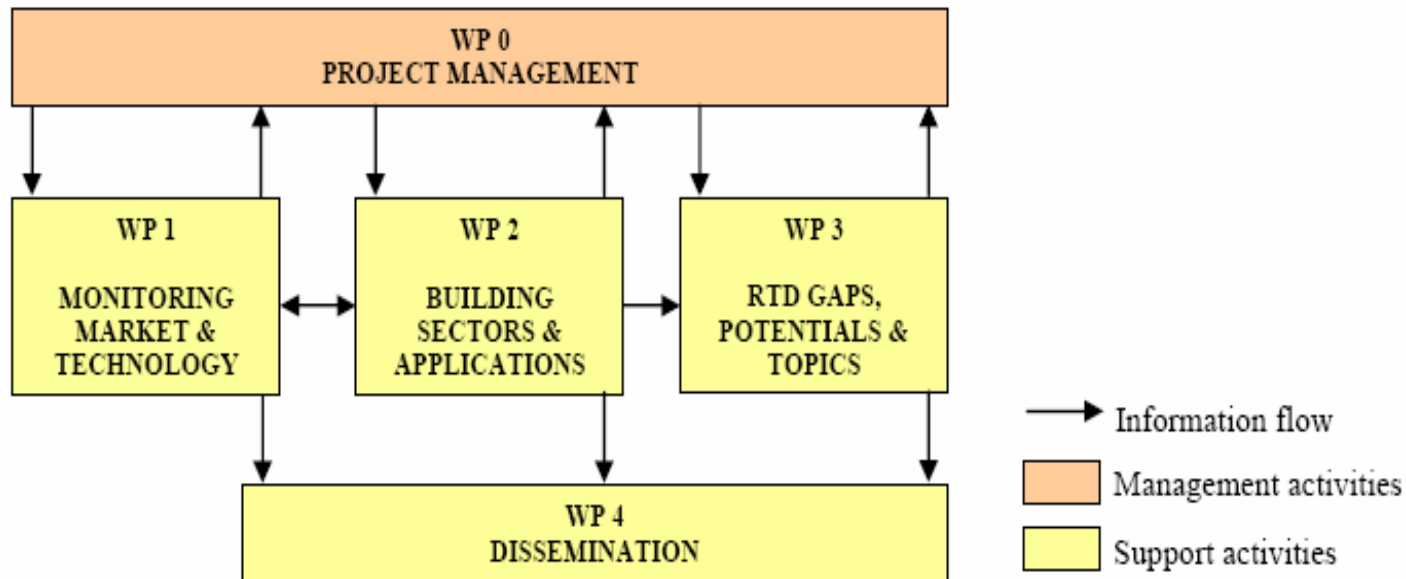
WP3: to identify elements that are still too expensive to lead to a market penetration of solar cooling systems (investment and operating costs for example) => **ongoing**

WP4: dissemination of project results => **ongoing**

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Interaction plan the different tasks and activities



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Dissemination :

- * Presentations at conferences and other events (Task 38, OTTI, Derbi conf.)
- * National expert seminar:
 - Pilot seminar in Austria at the 12th of July (KinG website)
 - France and Spain : end 2007/beginning 2008
- * Final conference
 - International Symposium about ROCOCO results
 - Spring 2008 combined with the 4th Project Management meeting
 - Possible co-operations: IEA Task 38, existing yearly conference in similar field

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ROCOCO : Cost Reduction for Solar Cooling Systems

WP1 : Data collection of past and on-going research project

- * 95 installations in the World
- * 15 questionnaires for transversal analysis
- * 3 DEC solid, 1 DEC liquid, 2 adsorption and 9 absorption
- * Good repartition
- * 6 FPC, 1 AC and 9 ETC (22 m² -> 630 m²)
- * Buildings : 1 hospital, 1 wine cellar, 1 hall and... 12 office buildings

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3	Investment - Material	66. GIVAUDAN		
- all costs excluding VAT - costs per kWf: total cooling nominal power: 105 [kWf] - costs per m²: collector area 471 [m2] <i>excluded: distribution loop : pumps, ducts, controls, fan coils (limit : outlet of the solar cold storage or sorption machine)</i>		Currency used: € [u] Change rate : [u / EUR] Absorber area: <input type="checkbox"/> Aperture area: <input type="checkbox"/> Gross area: <input checked="" type="checkbox"/>		
SOLAR COLLECTORS Description : Collectors, supports Including installation cost: <input type="checkbox"/>		Structure of installation : <input checked="" type="checkbox"/> Flat roof <input type="checkbox"/> Pergola <input type="checkbox"/> Tilt roof <input type="checkbox"/> Ground <input type="checkbox"/> Fully integrated <input type="checkbox"/> Other :		
Total cost [u]	Lifetime [y]	Annual cost [u / y]	Specific costs [u / m2] [u / kWf]	
152 100 €	25	6084	323	1449
Comments: 100 vacuum tube collector of 3 m² The support is made of hot galvanized steel. Costs is divided in: 94000 € for the solar collectors and 23500 € for the support The building has been reinforced to support the weight of the installation. The cost was 26600 € for the modification of the structure of the building and 8000 € for the sealing.				
SOLAR COOLING SYSTEM AUXILIARIES Description : Piping, pumps, expansion vessel, insulation, valves for all the solar cooling system Including installation cost: <input checked="" type="checkbox"/>				
Total cost [u]	Lifetime [y]	Annual cost [u / y]	Specific costs [u / m2] [u / kWf]	
47 400 €	8	5925	101	451
Comments: This cost includes installation and supply of stainless piping and double pump for the primary circuit.				
AUXILIARY HEATING SYSTEM Description : Gas/fuel/wood boiler Including installation cost: <input checked="" type="checkbox"/>				
Total cost [u]	Lifetime [y]	Annual cost [u / y]	Specific costs [u / m2] [u / kWf]	
3 500 €	8	438	7	33
Comments: none boiler s already in-situ, the costs represent installation and supply of stainless piping.				

Page 1

Example

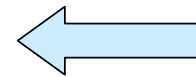
SOLAR COLD PRODUCTION Description : Sorption chiller, DEC (including sorption rotor, humidifier, heat recovery wheel, AHU) Including installation cost: <input type="checkbox"/>				
Total cost [u]	Lifetime [y]	Annual cost [u / y]	Specific costs [u / m2] [u / kWf]	
53 830 €	20	2 692 €	114	513
Comments: The system is a package including the absorption machine, the cooling tower, exchangers and accessories. The price indicated does not include the cost of the tower and the water treatment device. machine = 29 000 steel frame = 7 000 exchangers = 6 300 pumps = 1 800 piping, accessories = 7 730 valves = 2 000				
RECOOLING DEVICE Description : Cooling tower, waste water, drycooler, water treatment device Including installation cost: <input checked="" type="checkbox"/>				
Total cost [u]	Lifetime [y]	Annual cost [u / y]	Specific costs [u / m2] [u / kWf]	
25 840 €	15	1 723 €	55	246
Comments: cooling tower = 11 400 steel frame = 3 000 piping, accessories = 4 530 water treatment device = 6 910				
BACK UP COLD PRODUCTION Description : Back up compression chiller Including installation cost: <input checked="" type="checkbox"/>				
Total cost [u]	Lifetime [y]	Annual cost [u / y]	Specific costs [u / m2] [u / kWf]	
36 245 €	15	2 416 €	77	345
Comments: The back up cold production was already existing with three compression chiller of 200 kw. A gas-fired absorption machine was installed as a packaged machine. The price include the machine, the cooling tower, the steel frame and all the accessories				

Page 2

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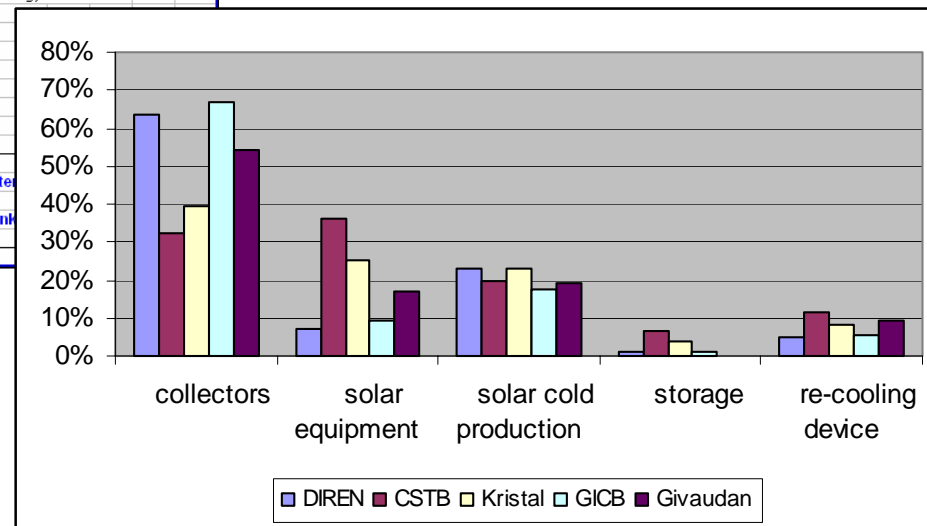
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CONTROL SYSTEM				
Description : Contoller, electric panel, sensors used for control, relays, wiring including installation cost : <input type="checkbox"/>				
Total cost [u]	Lifetime [y]	Annual cost [u/y]	Specific costs	
			[u / m2]	[u / kWf]
12 000 €	15	800 €	25	114
Comments: manufacturer SAUTER Controllers, sensors are used for the automatism of the installation and the analysis of the data.				
For the automatism of all the installation, others controllers and sensors was installed : 1300€ for the gas-fired absorption chiller, 2500€ to pilote the rest of the installation (machines and control panel)				
MONITORING SYSTEM				
Description : Monitoring hardware & software, modem, sensors, flowmeters, wiring, energy meters including installation cost : <input type="checkbox"/>				
Total cost [u]	Lifetime [y]	Annual cost [u/y]	Specific costs	
			[u / m2]	[u / kWf]
1 200 €	15	80 €	3	11
Comments: The material includes the router, IP modem except ADSL router. No building control system. The installation is hosted on the system of Vivale in the form of a annual contract. Temperature sensors and flowmeter was installed later so the cost of the material is unk				



Collected Data

Analysis →



Ratio component/total

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Conclusions to reduce cost (1/2)

process
wet cooling tower future ?

installation overcosts
collector field on tilt roof

user
involvement in
the project

design
choice of the site

design..works..operation
respect design
calculation

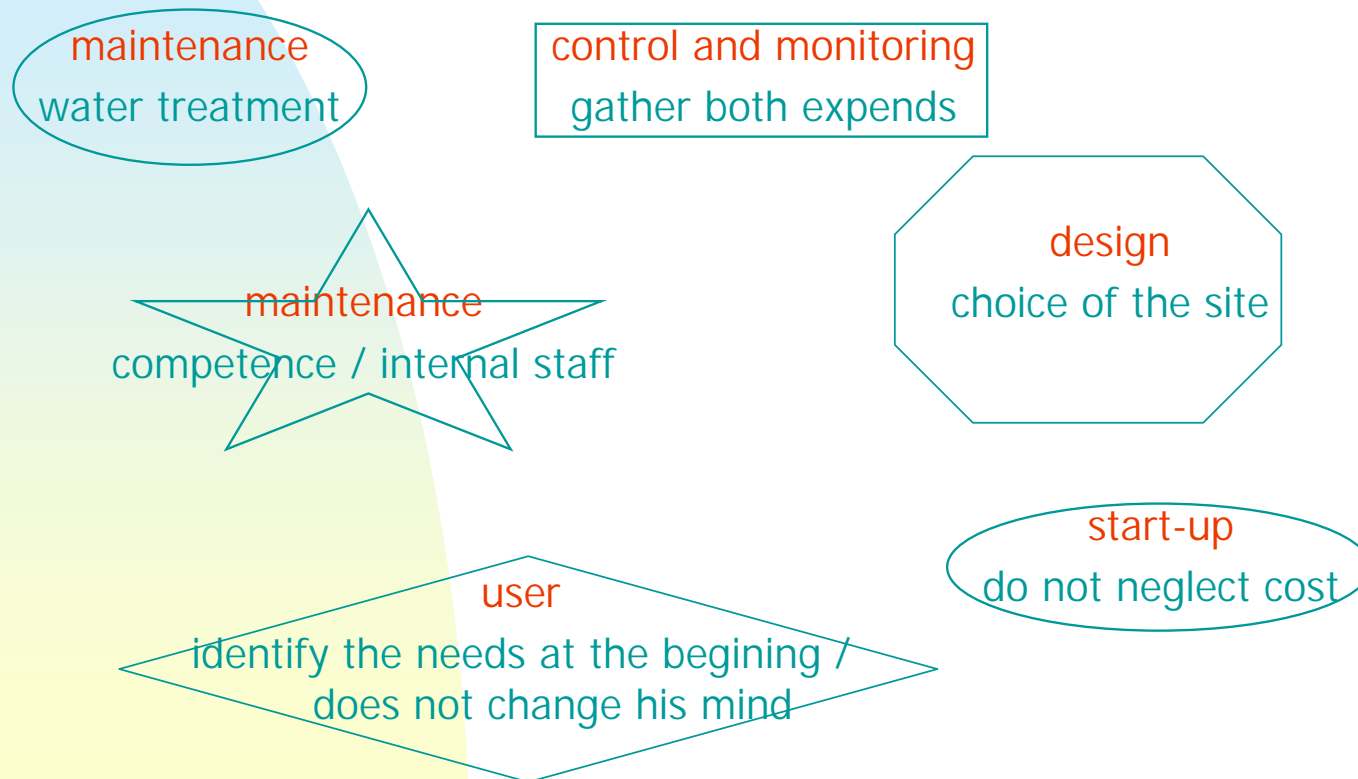
operation
water and electricity
consumption

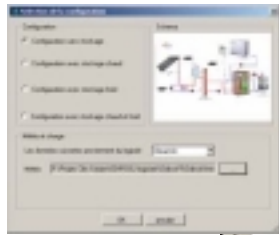
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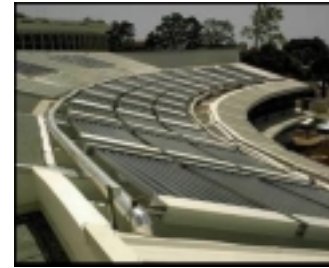
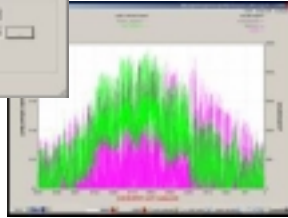
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Conclusions to reduce cost (2/2)





Design



Technology

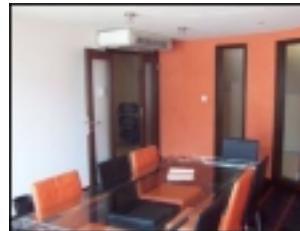


SOLAR COOLING PROJECT
Cost ?

Building



Operation



Installation, start-up



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Main observations from ROCOCO

- Costs : Spain < Germany
- Decrease cost while increasing performance
 - ◆ Equipment efficiency
 - ◆ Cold production / Energy demand
- Maintenance: internal and trained staff, doing monitoring
- Valorize hot water when no cooling needs

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Optimize design and planning cost

Design :

- Need for pre-selection tool (techno vs site, configuration)
- Need for simplified but robust design methods
- Need for best practice

Planning :

- Need skilled participant
- Need high level of engineering

From analysis of current installations, gather knowledge, create best practice and design tool.

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Design : tips

- To optimize investment cost:
 - ◆ Select appropriate technology
 - ☞ Adso / Abso / DEC ?
 - ☞ ETC / FCP / Air / CPC
 - ◆ Design ratio
 - ☞ Collector area / kW cooling capacity ?
 - ☞ Hot/cold storage capacity ?
 - ☞ Hot/Cold back-up capacity ?
- To increase performances:
 - Hot and Dry climate => better performances
 - Important DHW/heating needs

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Project : tips

- * Standardized component are money and time saving
- * Package solutions do not correspond to every project
- * Appropriate system are the most efficient solution (time, money, energy)
- * Installation should be as simple as possible (design, maintenance)

Should we guarantee the performances..?

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Optimize material efficiency

... according its part in investment cost

1. Solar collector

- *Possible in a long term period (high quality mean higher price BUT bigger future market)*
- *Take care of the efficiency curve, as function of radiation and temperature of the fluid*
- *Use research and studies about solar collectors results*

2. Chiller or desiccant process

- *R&D projects*
- *Monitoring existing system*
- *Best practice*

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Optimize installation cost

Solar collector field →

- Heat pipe evacuated tube are easier to install
- In the south region, tilt of the roof are smaller (10 to 30°)
- Prefer flat roof
- Overcost due to installation constraint :
 - Security constraint for very high or very tilted roof
 - Structure reinforcement can be necessary

Select and assess the cost for solar collector field installation in the beginning of the project

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Optimize start up phase

Control parameters, operating strategy →

- Need of studies and R&D project in control strategy and optimization
- Packaged installation should constitute already optimized solution
- Discuss the strategy with user & operating and maintenance staff
- Train operating and maintenance staff
- Used same material for control and monitoring
- Manufacturer should perfectly know their material

A lot of work (studies, engineering, research, optimization) has yet to be done. It is possible if monitoring current installations.

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Optimize operation cost

Re-cooling process

= open wet cooling tower →

- Analysis of the water: 3 times /year (France)
- Water treatment: all the time (same price of water cost itself)
- Maintenance staff: cleaning
- Electricity consumption
- Water consumption

Other kind of process to limit all this constraint (eg: river, swimming pool, industrial process, pre-heating...)