Subject:	ESCo services, best practise example
Description:	Example of Caixa Geral de Depósitos, Lisbon, Portugal
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Download possible at:	http://task45.iea-shc.org/fact-sheets

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Introduction

In Lisbon a large office building of the bank Caixa Geral de Depósitos (CGD) are supported by solar heat and cold. The collector area is installed in roof of the office building. The office building has 17 floors with an office space of 100,000 m². During the working time 6,000 employed persons are permanently in the building. The generated energy is used to power an absorption chiller. Furthermore, the energy is used for the reheating system of the ventilation appliances as well as contributing to the heating of hot water.

Figure 1. Pictures of the Caixa Geral de Depósitos installation

1 Quick facts

LOCATION:	Rua Arco do Cego, Piso 1; Lisbon Portugal
PLANT SIZE:	1,579 sqm
TECHNOLOGY/RES:	Solar thermal HT collectors
SITE OWNERSHIP:	Caixa Geral de Depósitos
INVESTOR:	Caixa Geral de Depósitos
PROJECT COST:	1.04 Mio €
State grants:	0 %
KEY PARTNERS:	S.O.L.I.D. GmbH (Desing & Installation), Energia de Portugal (EdP)
CURRENT STATUS:	Operational
Installation:	1th QT 2008

2 Sales & purchase Agreement

On the one side, CGD wished to install an economical RES to save energy, on the other side the architecture and appearance of the building had to be considered. Because of the location, the only available useful area is the roof of the building. The design of the collectors could be optimal combined with the existing blue tile roof. With the integration of the system, the existing energy distribution system has been optimized, and further energy savings achieved.

Thanks to the system app. 45% of the domestic hot water demand, 15 % of reheating and 8% of the cold demand can be covered with this solar thermal system.

3 Design and construction

The solar energy is for building cooling and air-conditioning in the CGD building, in the months of April to September. Extra thermal energy from the plant may also be used to heat up the water coming from the existing 100 m³ tanks in the basement and to replace the electric energy used by the heat pumps to cover the heat needs for DHW and reheating the air. The solar energy is used for heating purposes mainly in the months of October to March. The energy output and current system data can be displayed on a monitor in the CGD offices as well as online, adding visibility and control of the energy output to the solar solution.

Control priority: 1. DHW, 2. reheating, 3. cooling

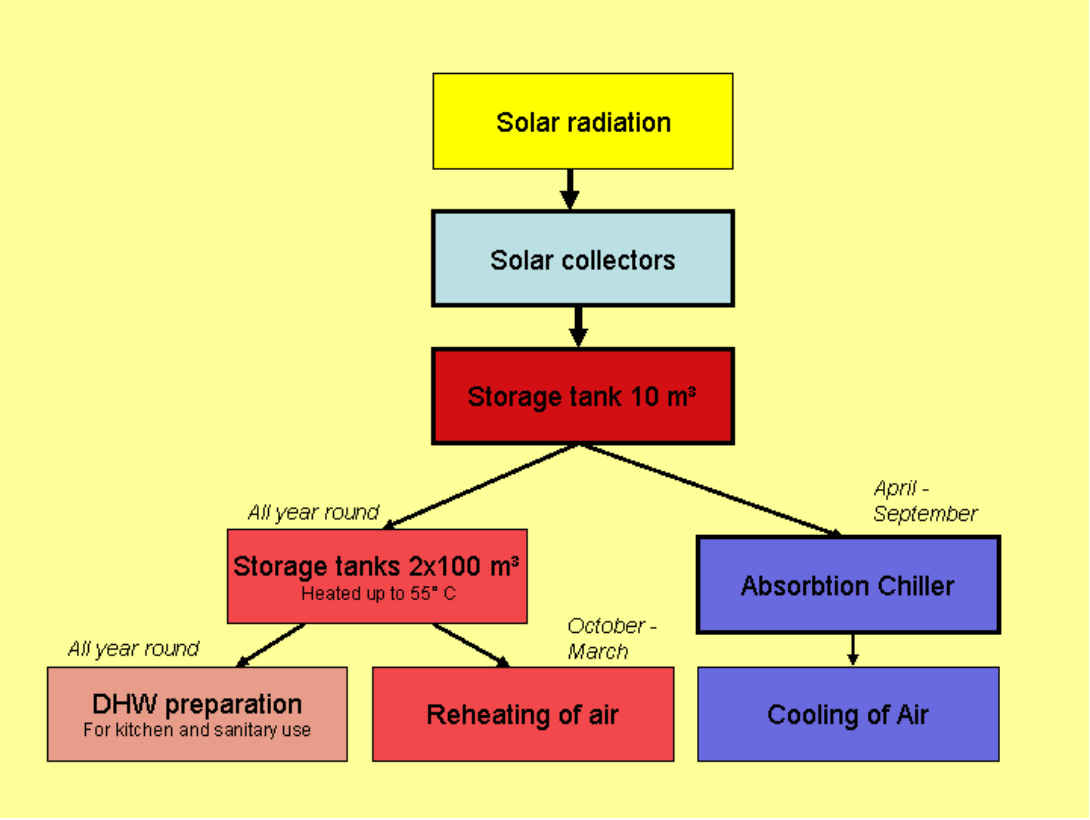

Figure 2. Flow chart on energy supply

3.1 Technical details

TOTAL SURFACE:	1,579 sqm
No. thermal collectors:	~ 112
SOLAR HEAT STORAGE:	10 m³
Capacity [kW_{therm}]:	845
Capacity Absorption Chiller:	545 kW

4 Energy production/savings

4.1 Total annual output/savings

Solar thermal production: 978,2 [MWh/year] ~ 619.5 kWh/m²
Substituted Energy: Elctricity (heat pump and compression chiller)
Price of electricity: 68 [€/MWh]

The total produced solar thermal energy is used locally.

4.2 Yield for the applications

Solar yield cold (cooling): 263 MWh/year
Solar yield reheating: 202.6 MWh/year
Solar yield DHW: 400 MWh/year

4.3 Energy distribution

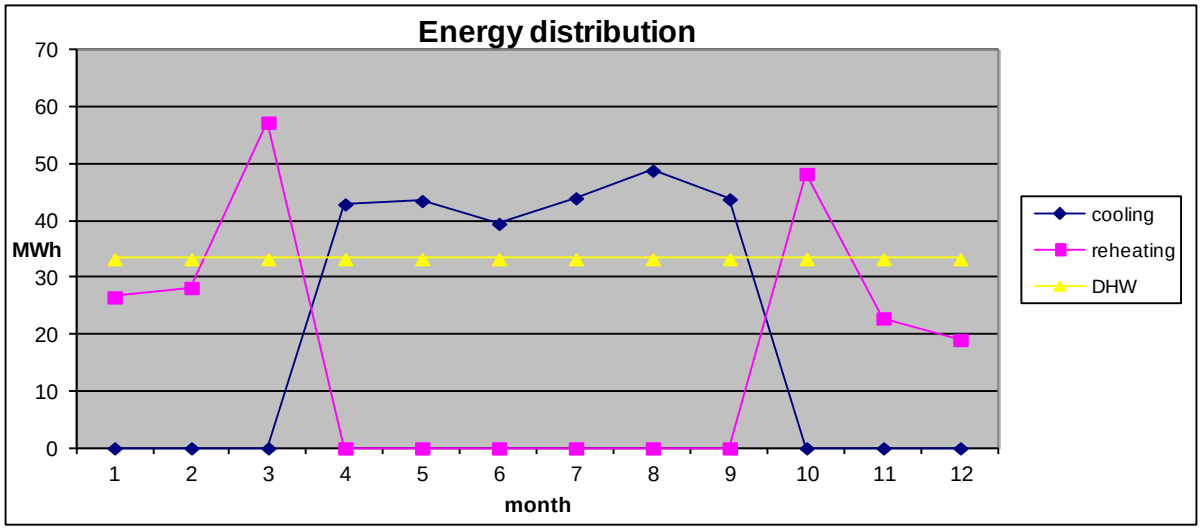

Figure 3. Monthly distribution of energy needed for the building

4.4 Solar fractions

The exact total consumption of the building are not known. Thus, the solar coverage can be roughly estimated.

Solar coverage:

- Cold: 8 %
- DHW: 40 %
- Reheating: 15 %

5 Business plan

5.1 Parameters of economic's simulation sale

Economic parameters:

- Interest rate: 6.0%
- Grants: 0 €
- Maintenance and insurance cost: 6000 €/year
- Depreciation period: 25 years
- System's Depreciation charge: 4 %
- Cost increase fuel: 6 %

From fig. 4 it is seen that:

- Payback time: 10.8 years
- IRR after 25 years: 13.1 %

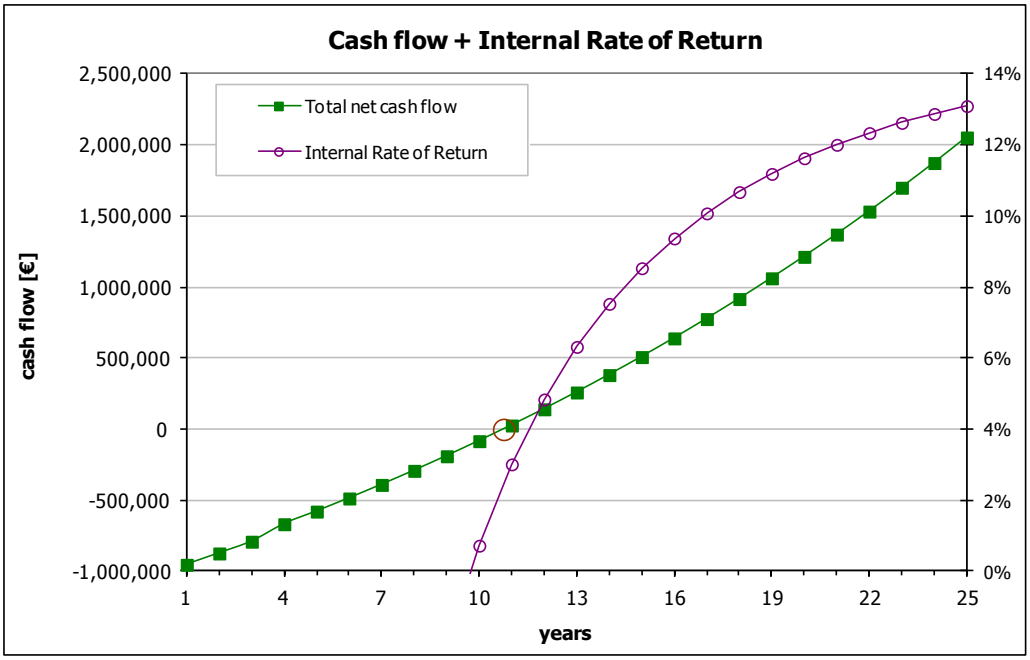

Figure 4. Cash flow and Internal rate of return

A comparison of the two cash flows for solar system (expenses) and electric energy savings results in the "Total net cash flow" in fig.5.

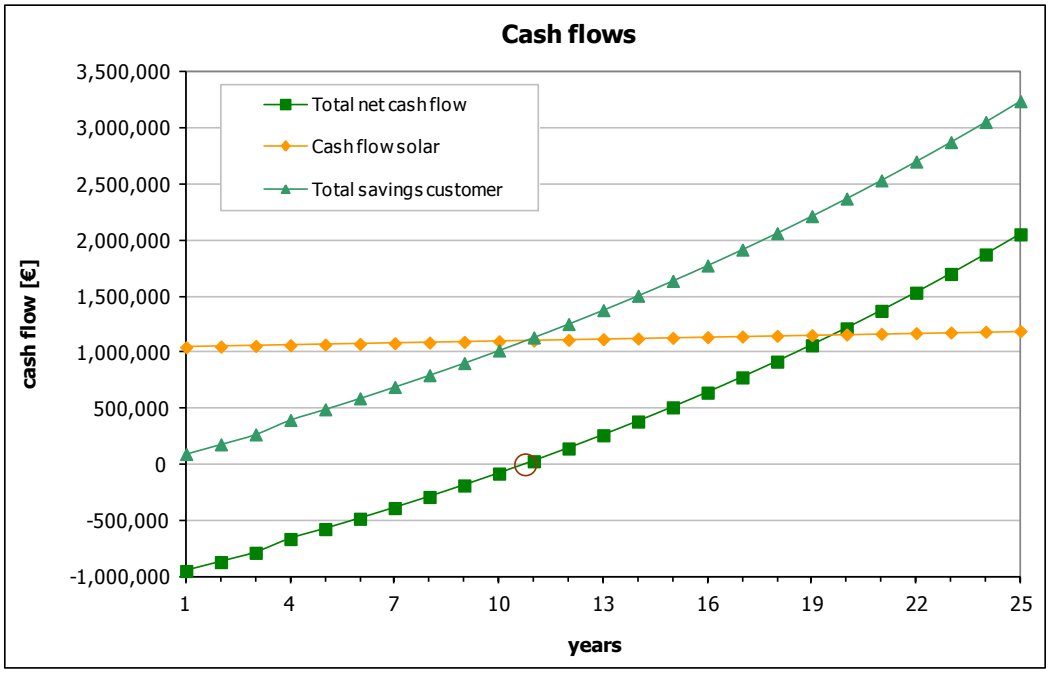

Figure 5. Cash flows

Total electricity savings: 1,252 MWh/year

6 Environmental & economic sustainability

The measured total solar yields are shown in the table and figure below.

	Total solar production [kWh/month]	Total solar production [kWh/brutto m² coll.]
January	59,938	38.0
February	61,594	39.0
March	90,721	57.5
April	94,736	60.0
May	95,581	60.5
June	89,823	56.9
July	96,277	61.0
August	103,228	65.4
September	96,010	60.8
October	81,676	51.7
November	56,228	35.6
December	52,434	33.2
SUM	978,246	619.5

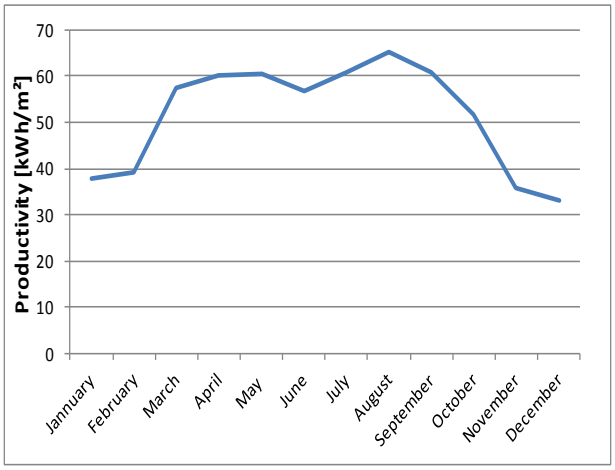

Figure 6. Table and plot of solar yields on monthly basis

Solar thermal energy is CO2-free and therefore environmentally friendly. In determining the CO2 savings following substituted heat source are considered: electricity. The impact of electricity amounts to 417 kg CO2/MWh in Portugal.

Contribution to the environment		
CO_2 Savings	407,928	[tons CO2/year]

Figure 7. Table showing the annual CO_2 savings

Through this investment, the company is less dependent on electricity and unexpected energy price increases.

7 Lessons learnt

This solar thermal system shows us following points:

- Efficiency of a combined solar thermal system - cooling & heating
- The peak of solar radiation and the peak demand of solar cooling match perfectly
- The solar yield depends strongly on the required temperature level of the application.
- Provided energy is often limited by available collector area.
- Often, an optimization of the existing system is possible by the integration of RES.
- Solar cooling cuts off electricity peaks and saves the most expensive electricity.
- Absorption Chillers have a long lifetime (> 25 years).
- Cooling load reduction (external loads) because of the mounted collectors on/in roof.
- Good economy also without grants.

Easy transferability to other office buildings.