SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Task 48
Quality Assurance and Support
Measures for Solar Cooling

EMCG
ENERGY MANAGEMENT CONSULTING GROUP

Potential of Solar Air-Conditioning Technology in Morocco

CMPP

MOROCCO GREEN BUILDING COUNCIL

Eco-villes : quel modèle?

Casablanca – November 15, 2011

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Managing Director at *Energy Management Consulting Group* (EMCG)

Agenda

- Introduction
- Market Analysis
- Market Actors
- System Cost
- Potential of SAC in Morocco
- Politics : Incentives and Financial Schemes
- Successful Story

International Energy Agency Solar Heating & Cooling Programs

Objective of IEA SHC TASK 48:

- Make the solar thermally driven heating and cooling systems more:
  - efficient
  - reliable
  - cost competitive

Morocco Green Building Council

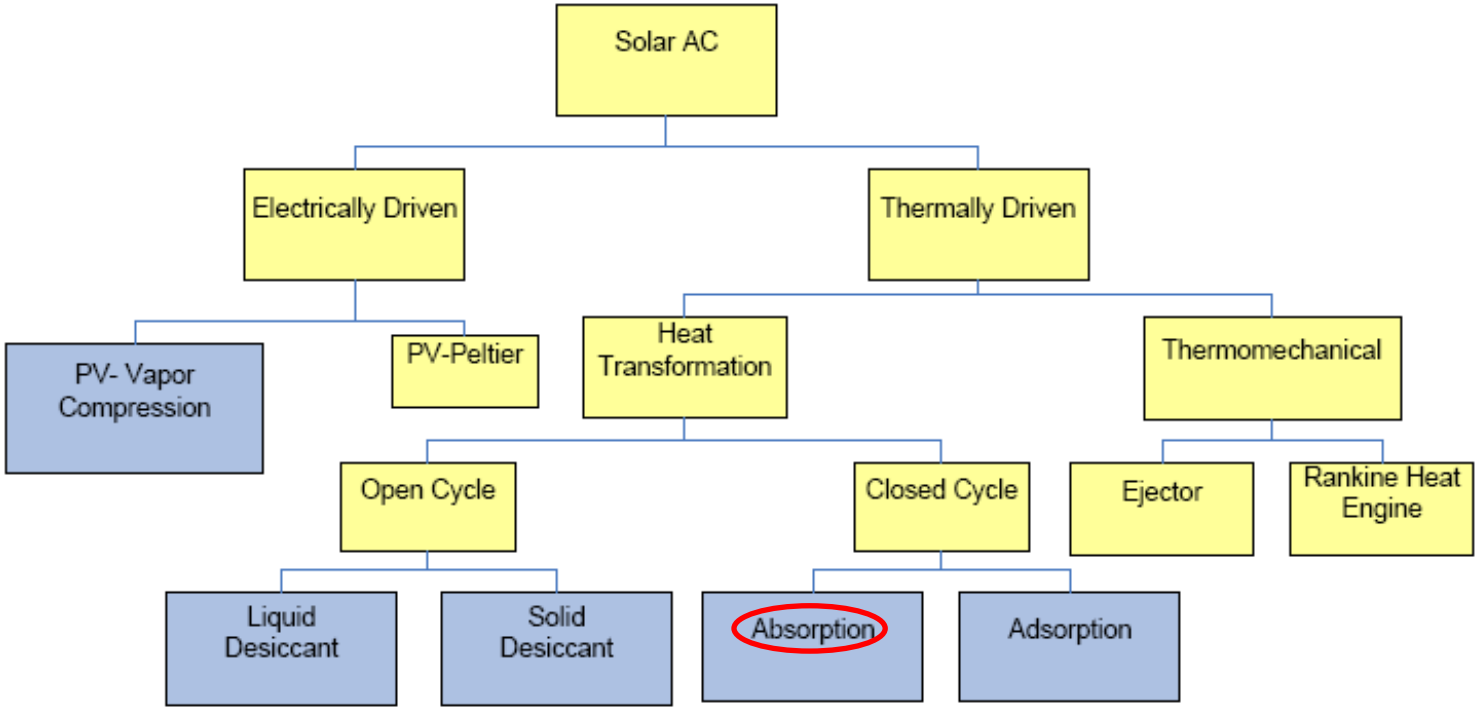
- Part of the World Green Building Council (WGBC)

- Currently offering online LEED classes for US as well as for international professionals

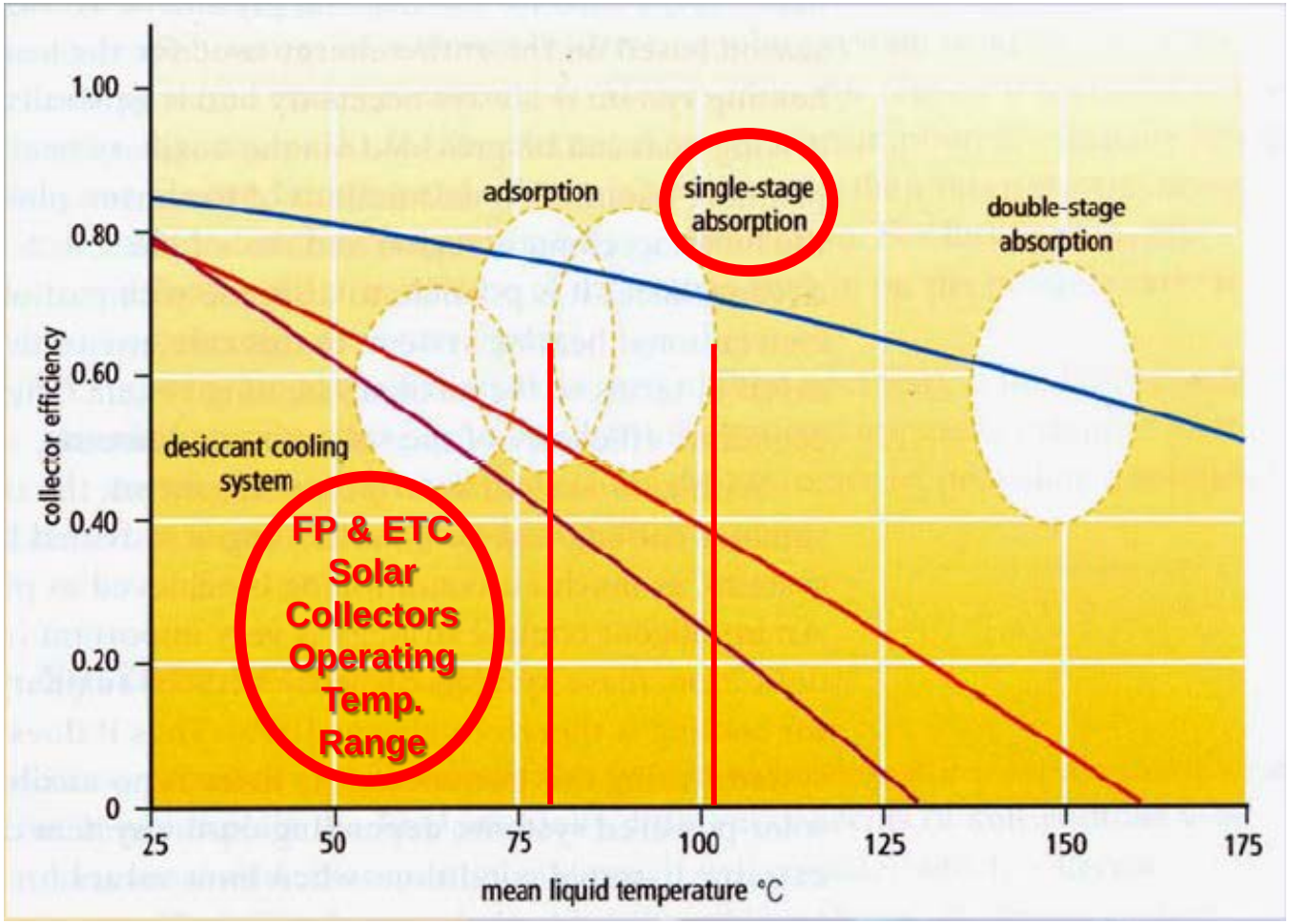
- Promoting Green Schools in US and abroad

- MGBC and its partners are working in facilitating communities and cities retrofitting with solar technology

Solar Air-Conditioning Types

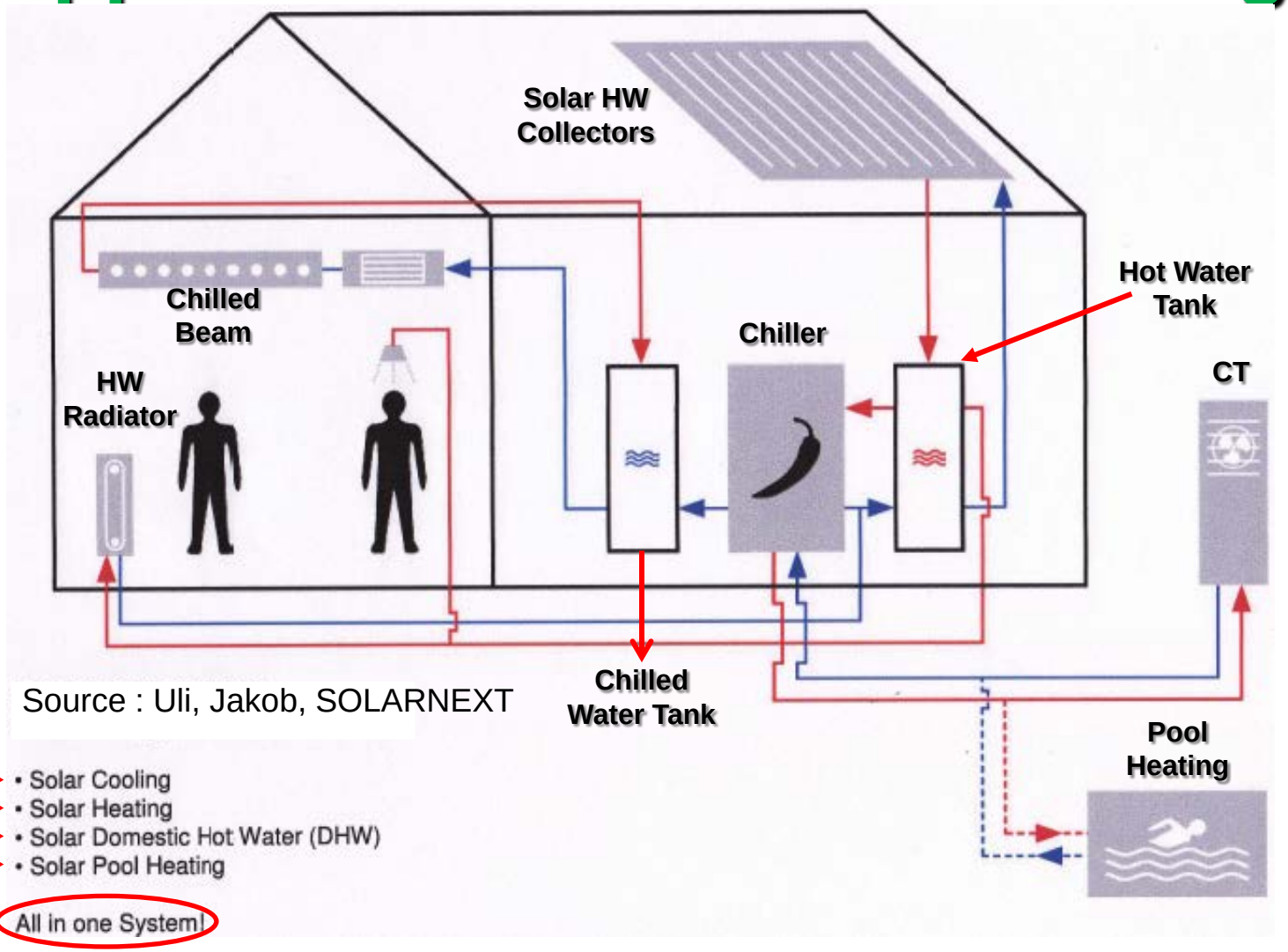


Solar Cooling Applications



Source : From “Planning and Installing Solar Thermal Systems”, James & James/Earthscan, London, UK

Application of SAC in a Building



Source : Uli, Jakob, SOLARNEXT

- Solar Cooling
- Solar Heating
- Solar Domestic Hot Water (DHW)
- Solar Pool Heating

All in one System!

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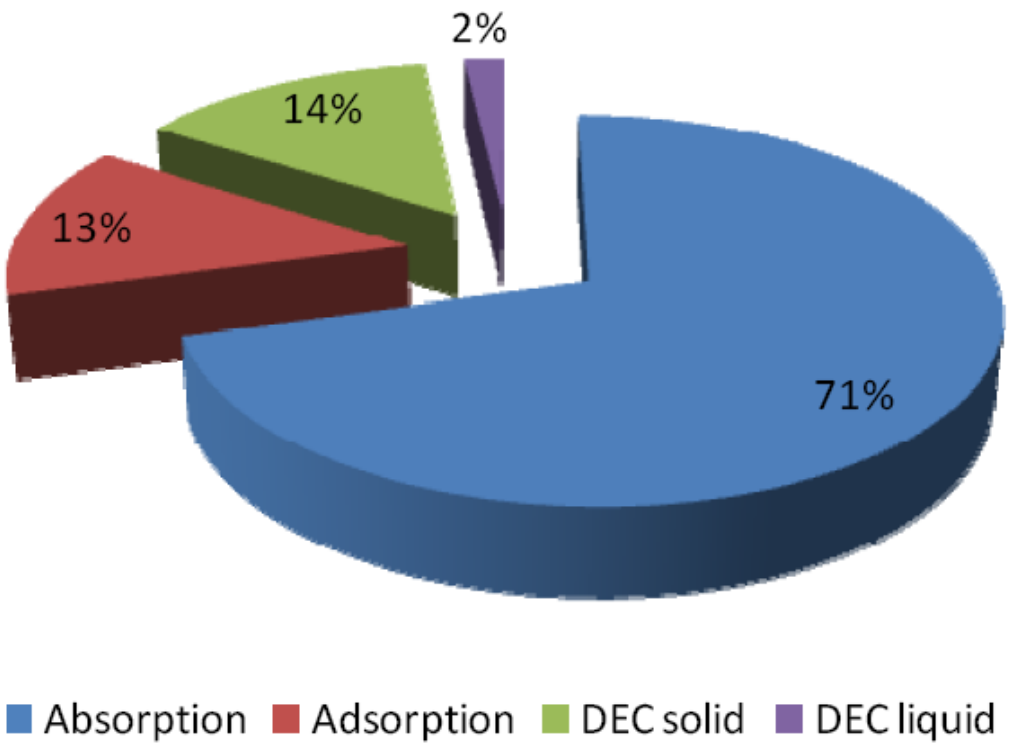
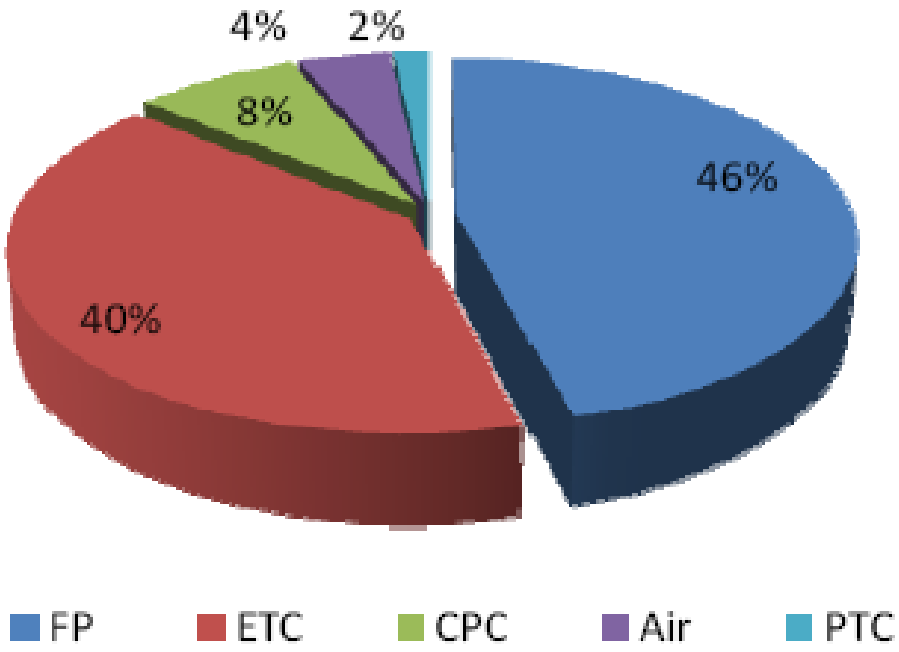
Market Analysis



Source : IEA SHC TASK 38, 2009

- **Percentage of use of different technologies for thermally driven chillers within 113 large scale systems.**

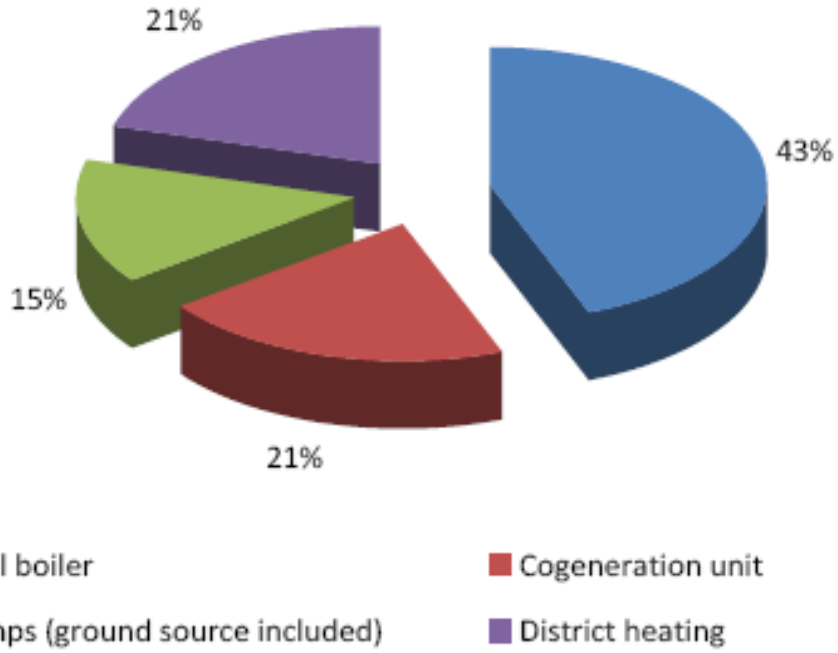
Market Analysis (Cont.)



Source : EA SHC TASK 38, 2009

- **Percentage of use of different technologies for solar thermal collectors within 112 large scale systems.**

Market Analysis (Cont.)



Source : IEA SHC TASK 38, 2009

- **Used heat back up in 34 installations .**

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Market Actors - Europe

8.75 kW

Sortech

Invensor

SonnenKlima

Pink

Climatewell

EAW

Ago AG

Robur

Market Actors – Out of Europe

Broad (China)

SWAC-10 (China)

Maekawa (Japan)

Yazaki (Japan)

Dunham Bush (Russia)

York (USA)

Thermax (India)

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System Cost: Chillers

Some indicative cost for chillers
(For Europe incl. transport+start up, 2009)

- **Absorption**
  - 5-7 kW LiBr Chiller : 11,500 €*
  - 10 kW LiBr Chiller : 33,500 €*

(*Incl. delivery, installation, controls & start up)

  - 35 kW LiBr Chiller : 33,500 €
  - 105 kW LiBr Chiller : 35,200 €

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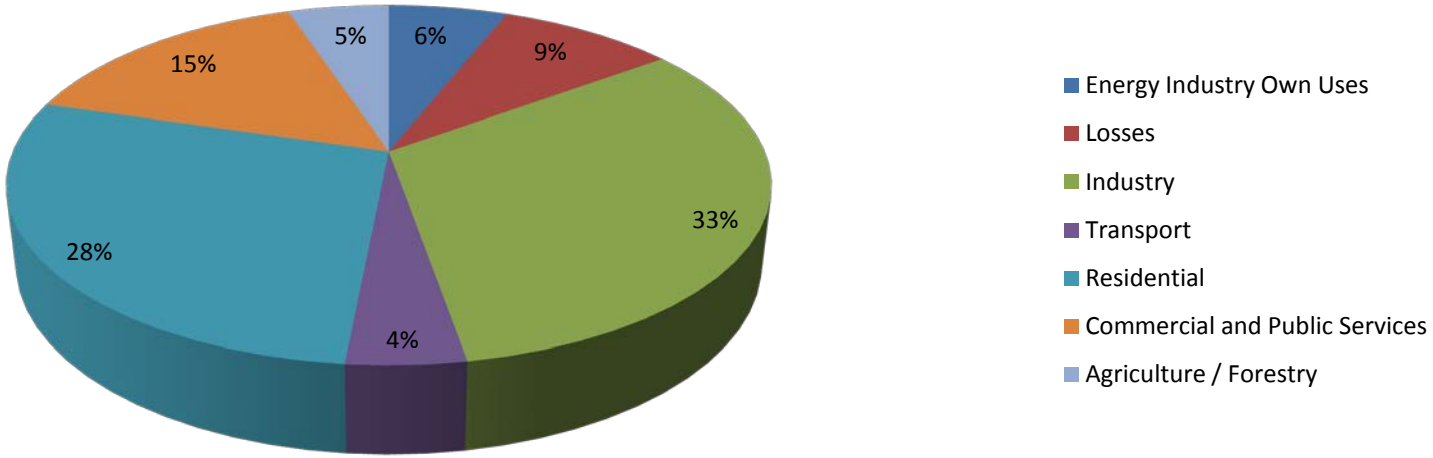
Morocco Energy Context

Electricity Consumption By Sector in 2008 (25, 529 GWh)



Source : IEA

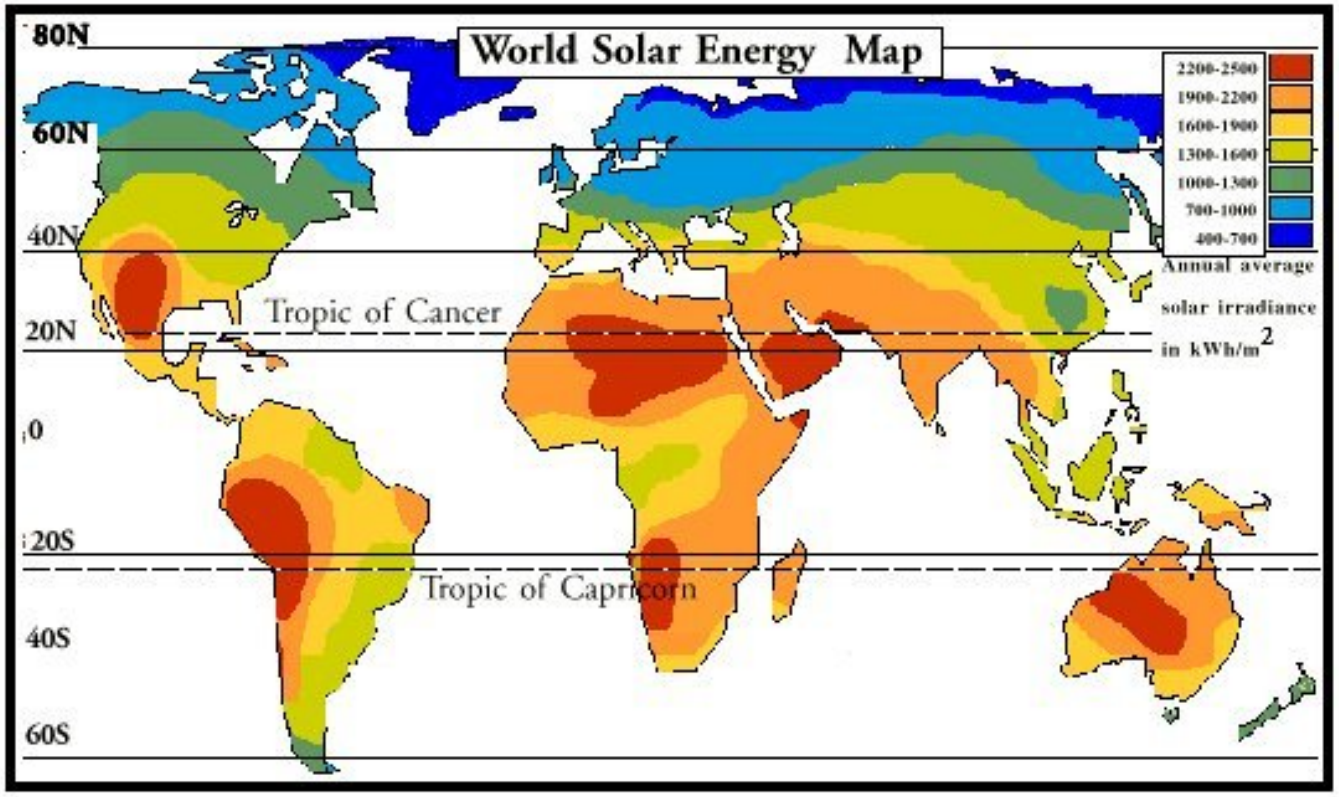
Morocco Energy Context (Cont.)

- Morocco imports close to 97% of its energy needs

- The energy consumption has reached 15 MTOE last year

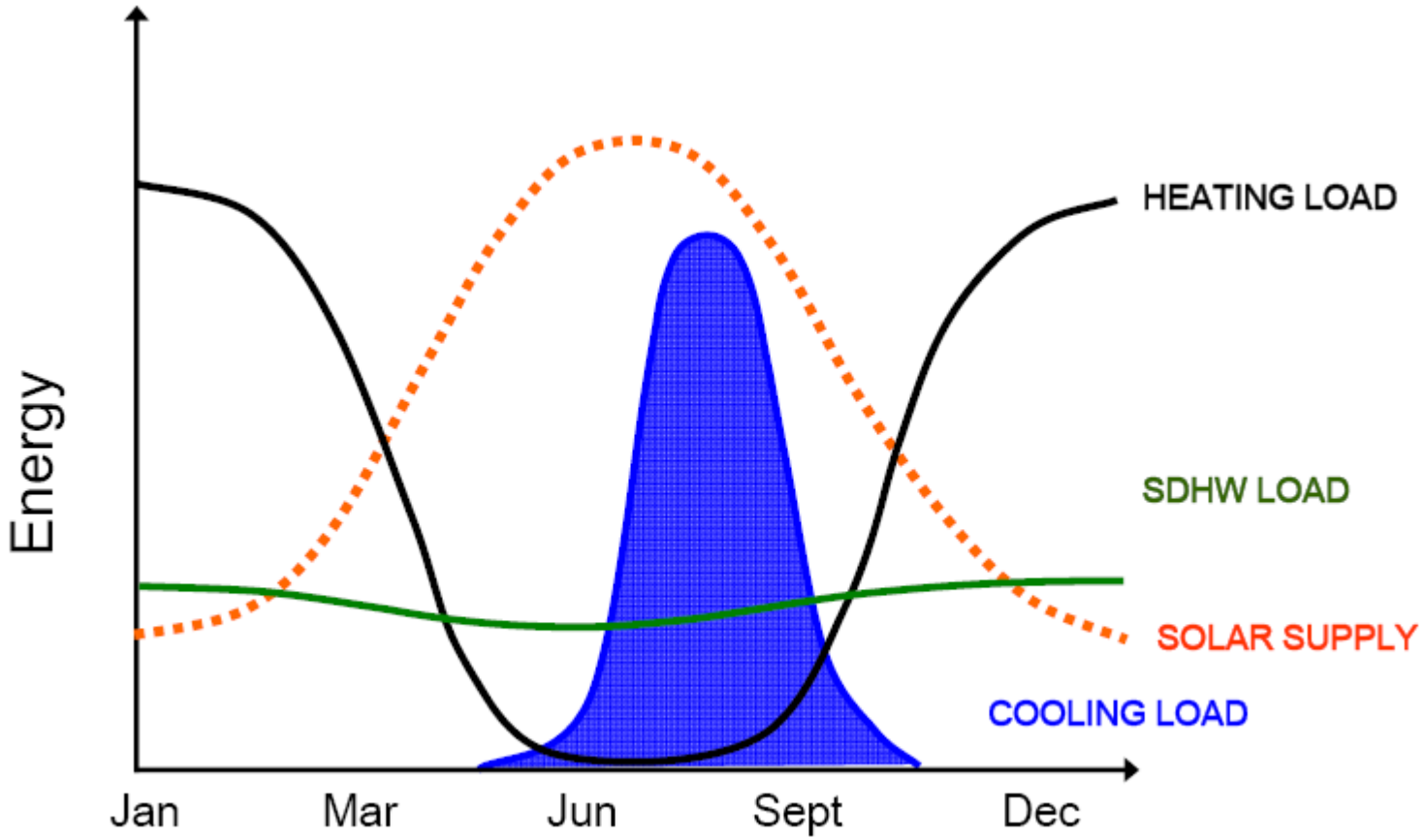
- Our annual electricity consumption is rising by almost 7%, therefore, by the year 2020, our energy consumption would reach 30 MTOE

Morocco Solar Resources

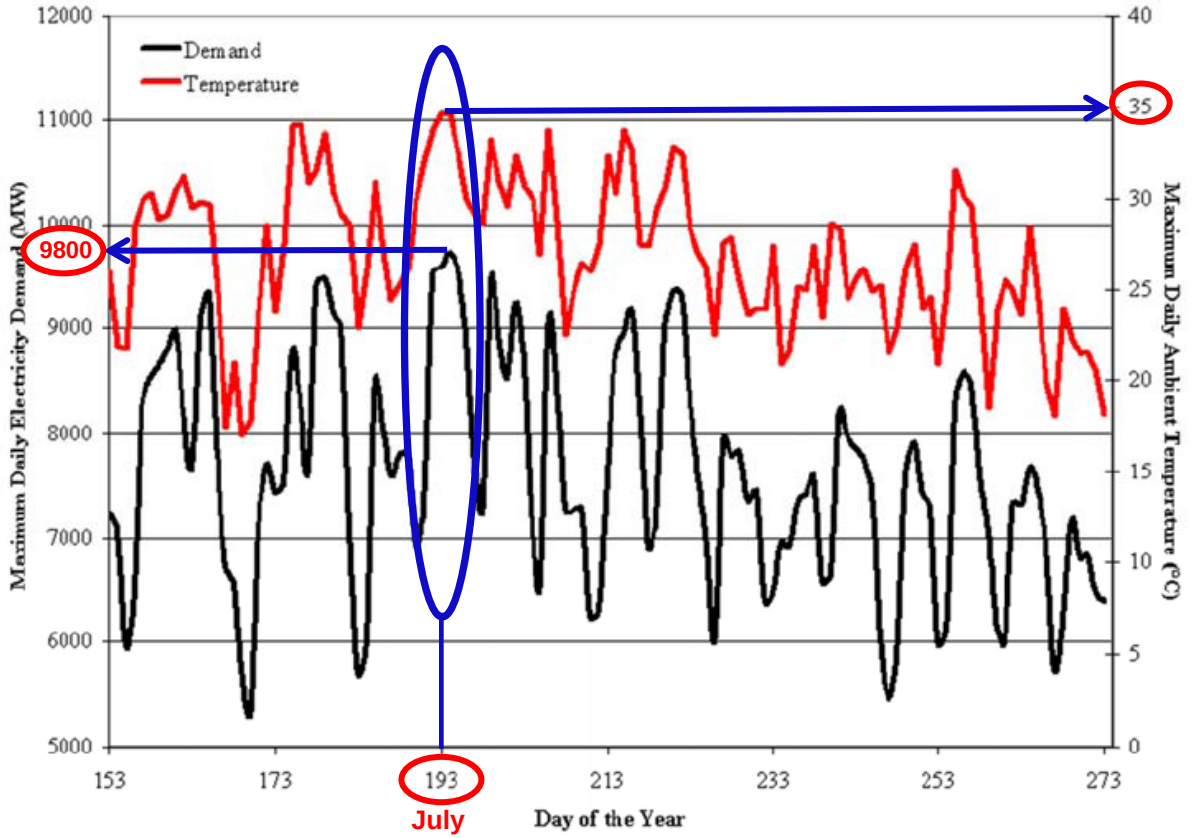


- Average Solar Potential: 5.5 kWh/m²/day
- More than 3000 hours of sunshine in some areas

The Logic of SAC



The Logic of SAC (Cont.)



- **Look at the correlation between Hi. Temp. & Hi. demand. The higher the temperature the higher the demand.**

Why SAC for Morocco?

- Saves energy (we import 97% of our energy…)

- Usage of an un-exhaustible source of energy (which we have plenty of it – 5.5 kWh/m^2/day)

- Does not use any toxic or harmful refrigerant (only water + lithium bromide)

- Reduces the strain on our electric grids, and therefore, avoid large capital investment for upgrades

Target Market

- Hotels
- Hospitals and nursing homes
- Large office buildings
- National education (Student Halls)
- Industry
- Private homes

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Politics : Incentives & Financial Schemes

Source : OECD/IEA RETD Report, 2007

- **Carrots : stable, long-term incentive and secure low interest loan programs to help the deployment of SAC**
- **Guidance : public information campaigns, training of work force, and construction of demonstration projects**
- **Sticks : Rules and regulations. But no red tape**

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Successful Story
The Steinway & Sons Project, New York

Primary System Equipment:

Source : Henkel Solar Inc.

Abengoa-IST 38 PT-1 tracking trough receivers, roof mounted

Broad 83/99-ton multi-energy source (hot water and natural gas) 2E absorption chiller

Successful Story (Cont.)
The Steinway & Sons Project, New York

- Total system cost: approximately $988,000. Includes new AHUs
- NYSERDA grant: $300,000
- Federal 30% ITC: $270,000
- Federal 5-year MACRS with 50% first year bonus: $367,245
- Various NYS small tax incentives
- First year energy savings: $27,000
- First year sale of SRECs @ $25/MWh: $9,418
- First year maintenance: $4,000
- Appr. installed cost before incentive: $7,500/Ton (1,550 €/kW)
- Simple payback is under 3 years

Thank you!

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