Solar Air Conditioning

1. Commercial-scale solar air conditioning and heating, e.g., solar HVAC.
2. Benefits to Arizona.
3. Required changes to the EPS.

Solar HVAC

- Solar thermal systems that provide energy for space heating and air conditioning, with hot water as a by-product
- Currently being utilized in Europe, Israel, and Asia
- Starting to be used in the U.S.

  So Cool Energy, Inc. - AZ
  Solar Focus – AZ (slightly different process)
  IST – CO (one project in AZ and developing second)
  Solargenix – NC
  Berquam Energy Systems/Sun Utility Network- CA

How It Works

- Solar collectors heat water and feed solar energy into a burner for an absorption chiller.

Solar collectors (in the form of flat plate, trough, vacuum tubes, etc.) have been utilized for centuries to produce hot water.

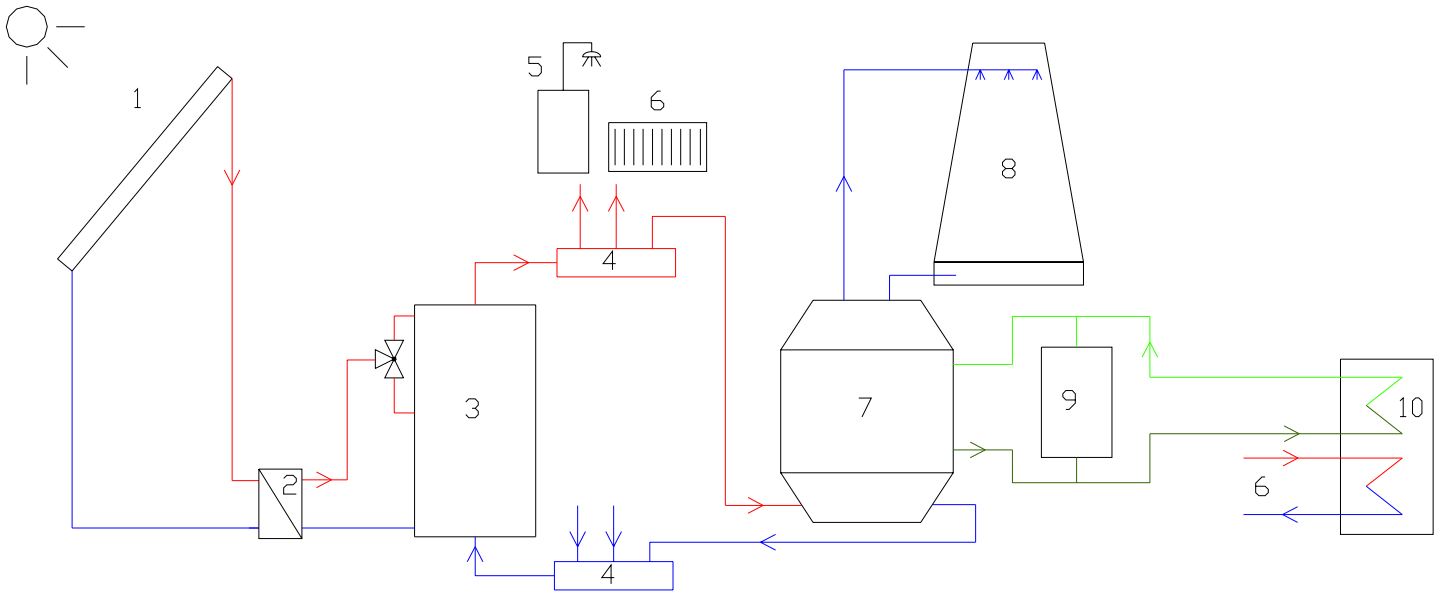
- Absorption chillers produce air conditioning with energy input through a heat absorption process.

Absorption chillers have been used for decades and are more efficient and cleaner than other forms of air conditioning.

- The solar energy replaces fossil fuel energy.
- Back-up can be either an electric chiller or a gas/oil boiler.

How It Works, cont.

Combines solar input with absorption chillers.



1 solar plant
2 heat exchanger
3 storage tank
4 heating manifold
5 domestic hot water circuit
6 space heating circuit (air handling units)
7 absorption cooling machine
8 cooling tower
9 cold water storage tank
10 cooling distribution system (air handling units)

Why Solar HVAC for the EPS?

1. Solar energy that is cost-effective.
2. Clean.
3. Uses Arizona's largest and most widespread energy resource.
4. Very efficient user of solar energy.
5. Addresses the single largest energy use in Arizona.
6. Produces energy when it is most needed.
7. Existing technology that should be utilized.
8. Maximizes land use by allowing siting on buildings.
9. Distributed generation benefits.

Employment Potential

European Union*

(Total population = Over 200 million)

- Solar Thermal Employs over 80,000
- Per Capita Square Footage at the end of 2003 – 8.5 sq. ft./person)
- Goal for 2020 for all Renewables is 20%. Solar thermal is expected to occupy almost 2% of the total renewable market compared to its current 0.02% with projected additional employment of 200,000
- In Europe, **"extension to large-scale applications and heating and cooling will help to increase the market share."**

U.S.

(Total population = Over 200 million)

- 2010 – 50,000
- 2020 – 280,000

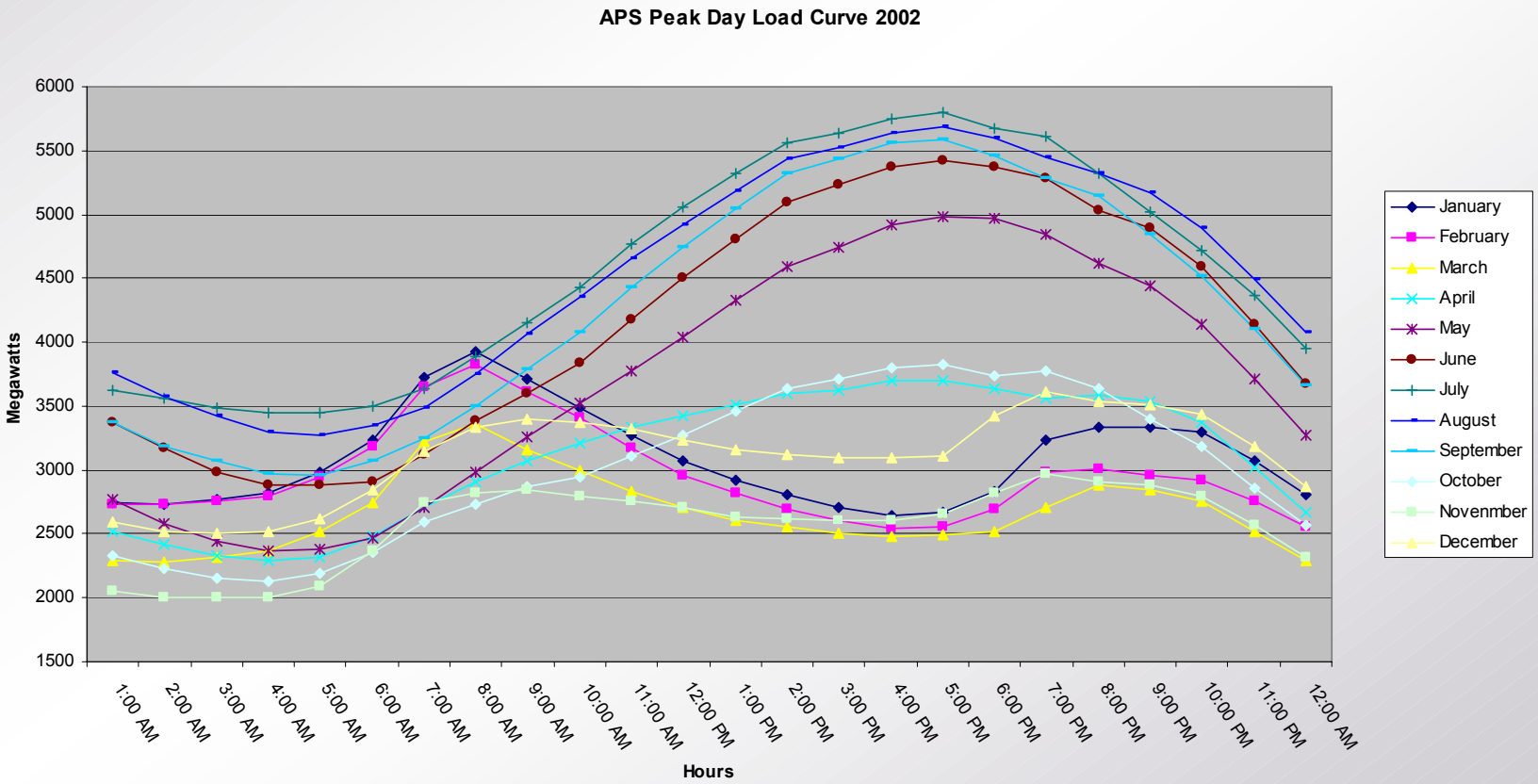
Numbers do not include employment created by need for installation and operation and maintenance services.

The U.S. has a significantly greater solar resource then the European Union, making the market and job potential even higher.

•Sources – European Conference for Renewable Energy, January 2004; European Solar Thermal Industry Federation

Energy Potential for Arizona

- Air Conditioning Comprises a Large Portion of Electric Demand



The So Cool Technology

- Our technology is state-of-the-art, developed by the Austrian company S.O.L.I.D., and utilized in commercial-scale solar plants since 1992.
- It accounts for 7 out of the 35 largest solar plants worldwide in the last 5 years. Project sizes range from 1,000 to 200,000 square feet.
- Each of our projects is guaranteed to reduce the consumption of fossil fuel for HVAC purposes by ***over 60%*** just by using the power of the sun. (Systems do not normally cover 100% of the load for system optimization and price reasons.)

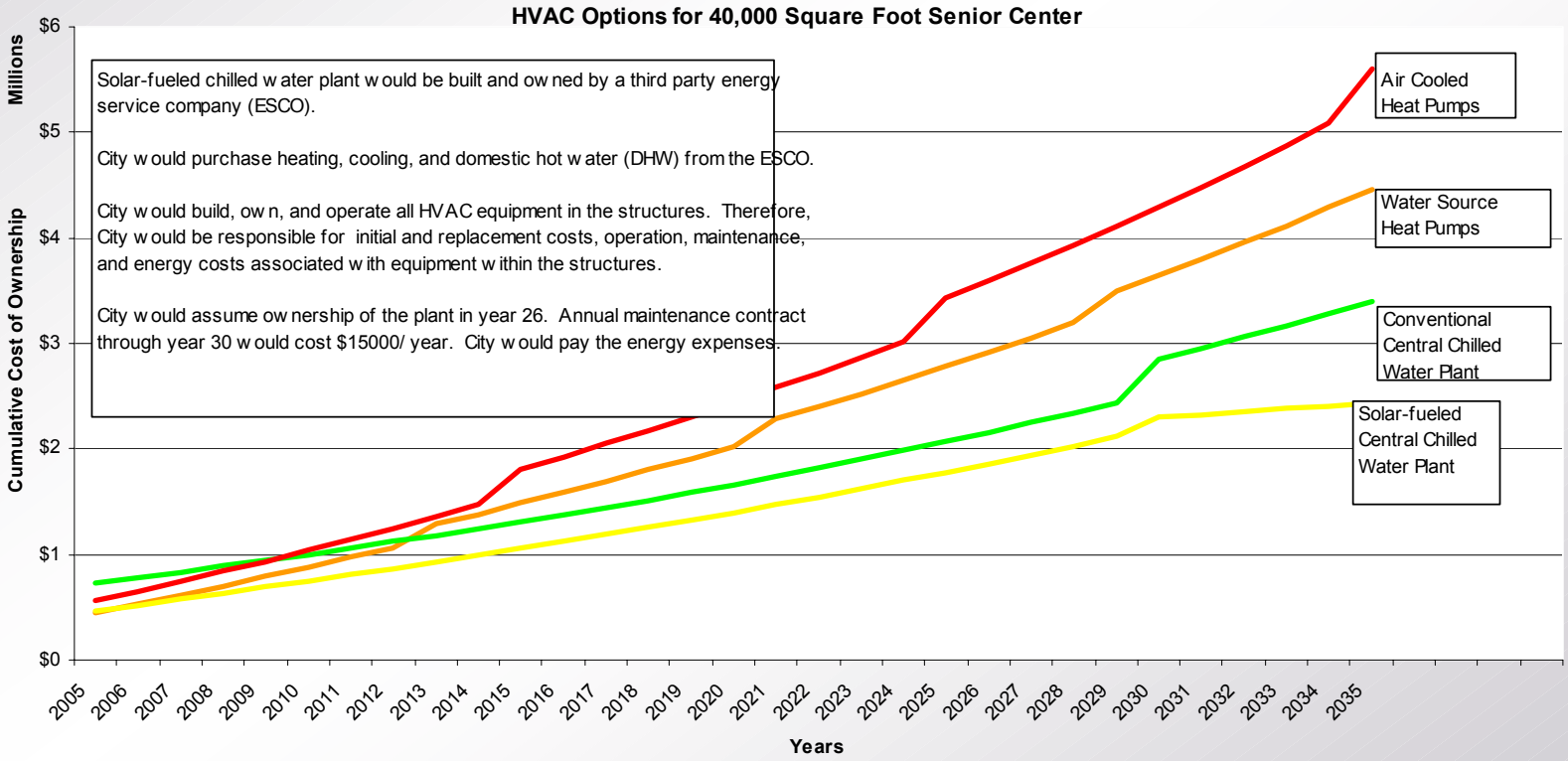
The Arnold Schwarzenegger Stadium in Graz, Austria

Cost

- The So Cool price:
  - $2.50 - $4.00 per watt installed for solar air conditioning
  - ($0.50 - $1.00 for space heating and hot water)
  - The cost has decreased in the last 10 years by 10%
  - Further reductions of 20-30% are expected by 2015
- The most cost-effective application for the current system is a
  - 40,000 square foot or larger building or group of buildings (the larger the better).
  - The system is also cheaper when the building is utilized more hours and more days during the week, while combining air conditioning, heating, and DHW.

Cost Savings

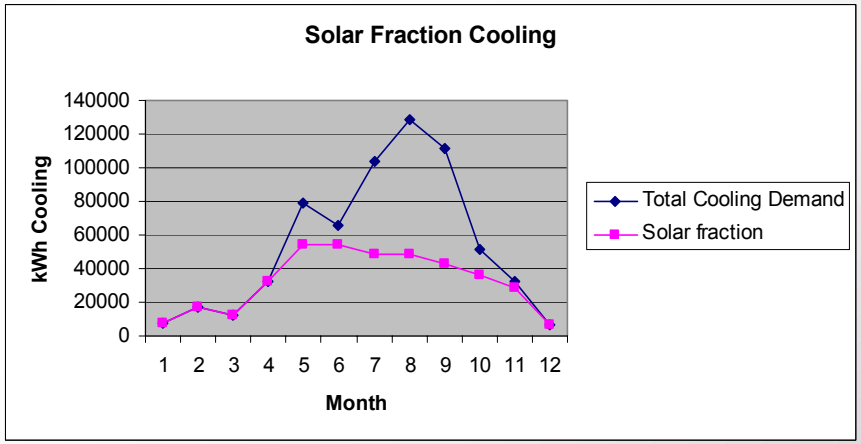
- Comparison with other types of air conditioning systems.



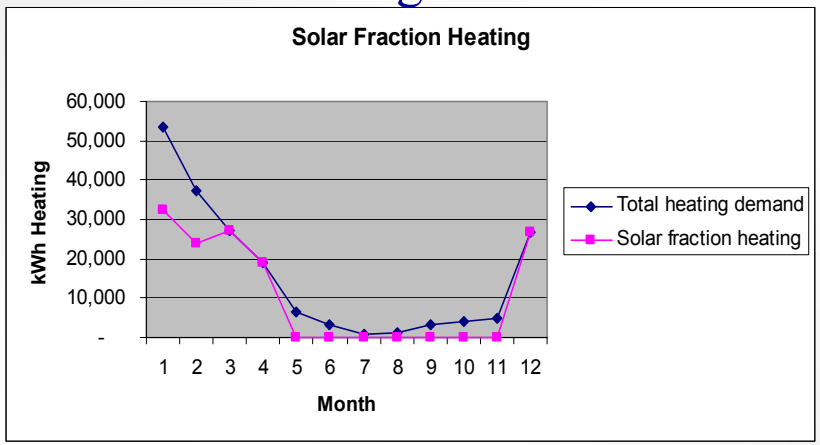
Arizona Case Study

65,000 Square Foot New Elementary School
6,215 square feet of solar collectors
with an absorption chiller
resulting in:

60% of AC load covered



69% of heating load covered



Savings -
Electricity - $25,694
Gas - $6,486
Summary - $32,180 Savings
Goal - $30,000 Savings

100% of the DHW provided

Leveraging the EPS Fund

- So Cool offers energy savings contracts, as follows:

- We finance the system with *zero* capital investment from the customer.
- We enter into a long-term *fixed-rate* contract (10-20 years) with the customer. (There are currently restrictions in AZ for public entities for these types of contracts.)
- We charge for the energy, at or *below* the current local utility prices. (This cannot occur right now in Arizona due to low energy costs.)
- We *guarantee* the savings.
- We warrant the equipment and operate and maintain the system for the duration of the contract at *no additional cost*.

- This concept leverages EPS funds by utilizing other money.

Future Developments

- Currently developing projects that include waste heat recovery
- Combine our system with PV to create stand-alone systems where PV will provide the energy needed (4-6%) to run the control system and pumps
- Examine application to natural gas power plants
- Establish manufacturing capability in the U.S.
- In 3-4 years, deploy residential system currently being developed in Austria

EPS Clarification Needed

Solar AC should be valued the same as solar electric and PV

Section A

"Solar resources include photovoltaic resources and solar thermal resources that generate electricity."

Section K

"A Load-Serving Entity shall be entitled to meet up to 20% of the portfolio requirement with solar water heating systems or solar air conditioning systems . . ."

Section K

" . . . Solar air conditioners shall be credited with kWhs equivalent to those needed to produce a comparable cooling load reduction."

CSP and Solar AC

The solar HVAC process utilizes the same concept to produce energy as do other solar thermal electric technologies.

<u>Trough Plant</u>

- Sun heats a working fluid
- Fluid is passed through a heat exchanger to vaporize a secondary fluid that spins a turbine to make useful energy
- Vapor is condensed and re-utilized

<u>Power Tower</u>

- Sun is absorbed into a working fluid
- Fluid is used to vaporize a secondary fluid to spin a turbine and make useful energy
- Vapor is condensed and re-utilized

<u>Solar HVAC</u>

- Sun heats a working fluid
- Fluid is passed through a heat exchanger where a secondary fluid absorbs heat, vaporizes, and drives a chiller to make useful energy
- Vapor is condensed and re-utilized

So Cool could create steam to generate electricity but creates solar AC instead.

Clarification Will Assist Growth

- Solar thermal used for air conditioning purposes creates solar energy applied in an efficient way.
- The technology performs like electricity when used to power a chiller and, in Arizona, primarily displaces electric-driven AC systems.
- The technical principles are similar to solar thermal electric technologies that are currently recognized under the EPS.
- To treat theses systems otherwise restricts many potential new solar thermal technologies and leaves only CSP and PV.

In the short term, this technology needs a small subsidy to develop and should be counted as a solar technology.

EPS Clarification Needed Today

Three So Cool projects in Arizona, two of which can receive a contract or commitment within 30 days and the other within 90 days, are dependent upon this clarification.

So Cool is asking the Commission to do one of the following:

1. Make the requested clarification today, or
2. Allow So Cool to apply for and receive a waiver for at least one project in the next 30 days, or
3. Direct Staff to propose a language change to be made in the next 30 days.

Questions?