



# Concentrated Solar Air Conditioning for Buildings Project

***“GLOBAL COLLABORATION IN ENVIRONMENTAL AND ALTERNATIVE ENERGY STRATEGIES”***



## **International Workshop on Environment and Alternative Energy**

University of California at San Diego, San Diego, CA

November 4, 2010

**Presenter:** Mr. Al Sorkin, Senior Principal Engineer, ITB



## Believe It Or Not!

- ***Solar heating for staying cool in buildings!?***
- ***NASA is doing a project with the Navy at an Air Force Base!?***
- ***A Hawaiian company is installing a Chinese chiller in Arizona!?***



## Believe It! It's true!

- ***NASA organized a collaborative technology demonstration project with the DOD ESTCP Program to get performance data on concentrated solar collectors supplying the energy for absorption chillers to air condition building***
- ***Project team developed proposal; went through ESTCP project selection and funding process***
- ***Demonstration site was selected from list of potential sites based on feasibility of facility and eagerness of base energy managers***



## Partners in the Project

– **ESTCP**



– **Naval Facilities Engineering Service Center**



– **NASA TEERM**



– **ITB**



– **Sopogy**



– **TESS**



– **Enovity**



– **Davis-Monthan AFB**





## Roles of Partners in the Project

- ***ESTCP – Major funding source***
- ***Naval Facilities Engineering Service Center – Principal Investigator***
- ***NASA TEERM/ITB – Co-principal investigator***
- ***Other NASA Centers (JSC, DFRC) – Peer review***
- ***Sopogy – Technology provider***
- ***TESS – Modeling & Simulation***
- ***Enovity – Measurement & Verification***
- ***Davis-Monthan AFB – Demonstration Site***



## Federal facilities energy use reduction mandates

Topic	Requirement
Energy Intensity	Reduce Btu/gsf 3% annually from FY 2003 baseline for FY 2006-2015 (30%)
Water Intensity	Reduce gal/gsf 2% annually from FY 2007 baseline for FY 2008-2020 (26%)
Renewable Energy	Increase percentage of total electricity from renewable sources 3% FY 2007-2009 5% FY 2010-2012 7.5% FY 2013+

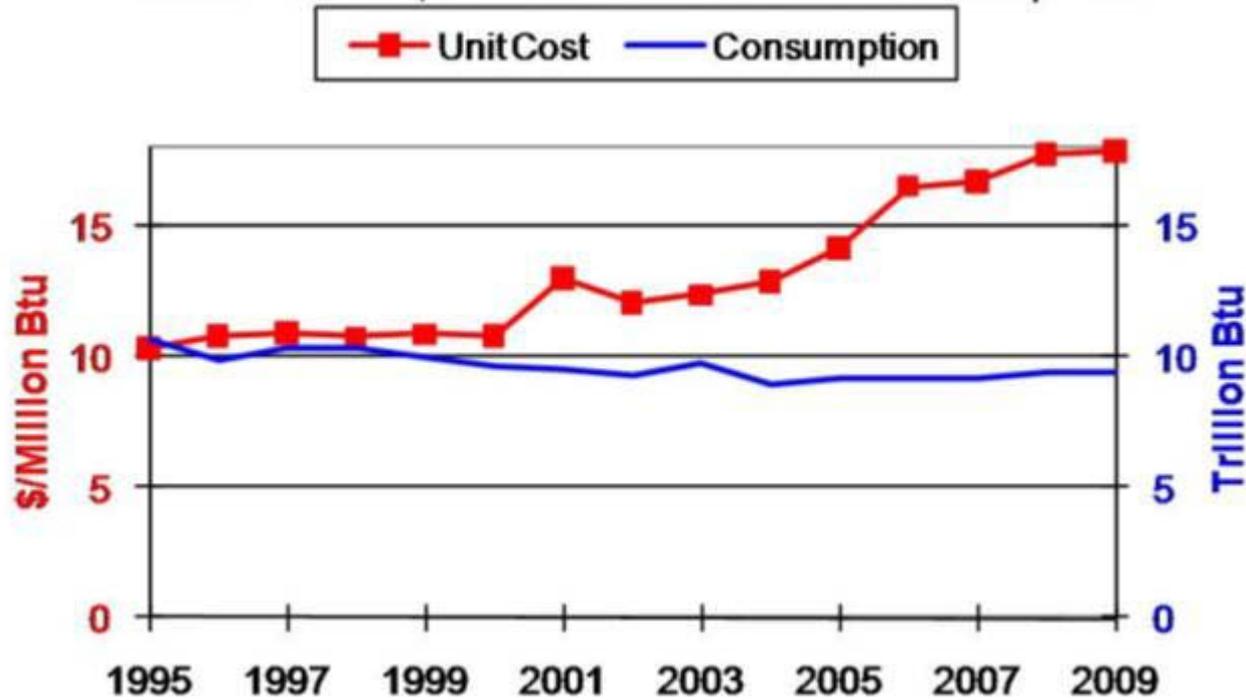


# Risk to Mission

– *Rising energy unit costs eroding mission funding*

– Trend: Buying less yet spending more

- Since FY 1995, use down 12% and unit costs up 73%





## Significance of air conditioning

- ***DOD studies have concluded that air conditioning accounts for 30-60% of total energy expenditures***
  - ***Gas-Fueled Cooling Technologies at DOD Fixed Facilities***
    - <http://oai.dtic.mil/oai/oai?verb=getRecord&metadataPrefix=html&identifier=ADA309231>
  
- ***Why use solar thermal energy? To offset energy provided from the grid***
  - ***Concentrating Solar Power Outlook***
    - <http://www.greenpeace.org/international/en/publications/reports/concentrating-solar-power-2009/>
  - ***Particularly in the southwest***
    - <http://www.nrel.gov/csp/maps.html>



# Environmental Security Technology Certification Program



Meeting DoD's Environmental Challenges

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## Energy

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The Department of Defense is the single largest energy consumer in the nation. It consumes more than three quarters of the energy used by the federal government. In many areas of the nation, the Department is the largest local consumer of power. The sheer size of its infrastructure, as well as the wide diversity of installation building types, climatic conditions, and available energy sources, puts DoD in a unique position to play a significant role in the development and deployment of the next generation of energy technologies. To meet its energy, environmental, economic, and security needs, DoD requires rapid and effective deployment of new clean, secure, low-carbon energy technologies. To address these issues, SERDP and ESTCP invest in three areas.

**Conservation and Efficiency** – Technologies that support sustainable building design and operations to reduce energy demand. Innovative energy efficient lighting, heating, air conditioning, and other technologies can improve conservation and energy efficiency in buildings and other mission-support structures.

**Distributed Generation** – Renewable energy sources and efficiency improvements in other non-centralized energy generation alternatives. Investments are primarily focused on developing and demonstrating renewable energy source technologies on or in proximity to installations. These technologies must be mission compatible and at the appropriate scale for DoD installations. Improvements in micro-turbine, combined heat and power, and other modular or distributed applications that may not involve renewable energy also are supported.

**Microgrids and Storage** – Control and storage technologies that will enable grid-compatible operation and improved efficiency of an installation's power network. Control and storage technologies enable increased use of distributed generation, especially renewable energy sources. Such advances in achieving energy self-sufficiency promote an installation's energy security.

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**Symposium & Workshop**  
November 30 – December 2, 2010  
Washington, D.C.

### Technical Program Highlights

#### Technical Sessions:

- ♦ Military Installations as Test Beds for Innovative Energy Efficiency Technologies

For the complete agenda, visit [symposium.serdp-estcp.org/Agenda-at-a-Glance](http://symposium.serdp-estcp.org/Agenda-at-a-Glance).

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### Featured Initiatives

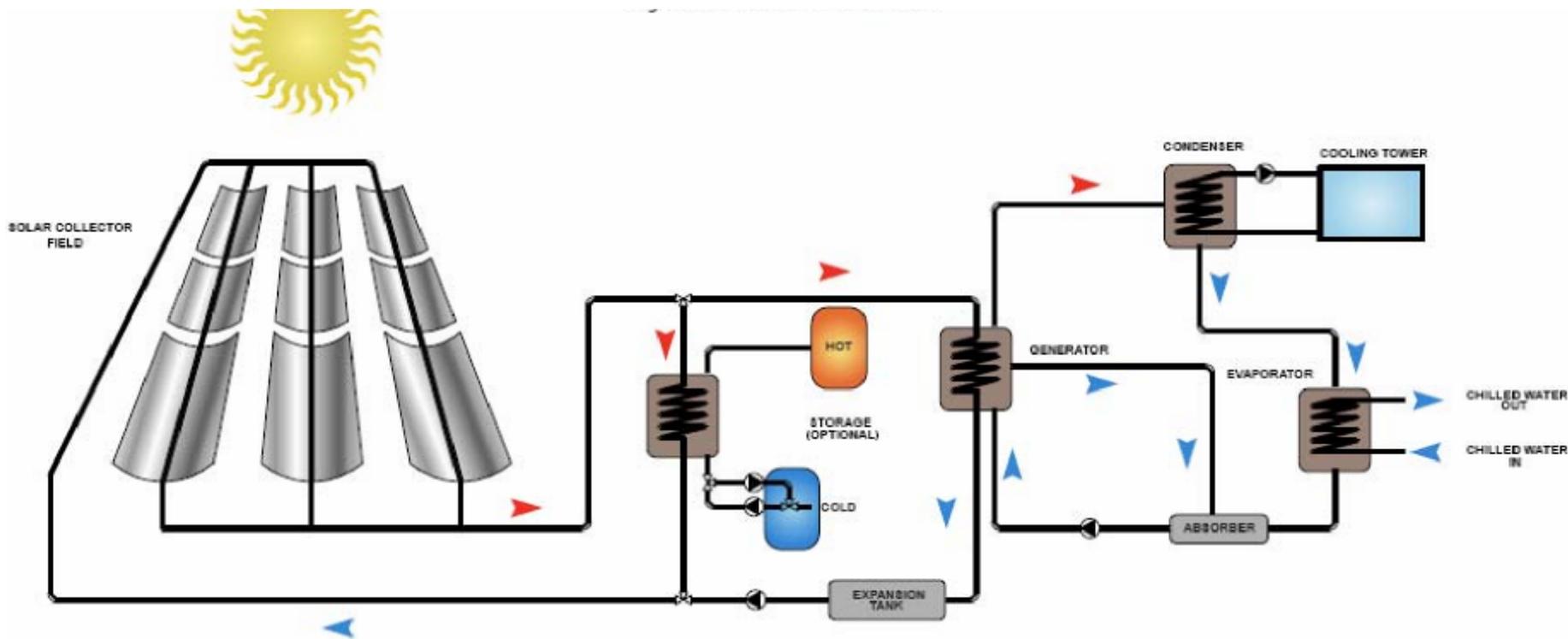
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Strategic Environmental Research and Development Program (SERDP)  
 Environmental Security Technology Certification Program (ESTCP)  
 Phone (703) 696-2117 | Fax (703) 696-2114  
 901 North Stuart Street, Suite 303 Arlington, VA 22203

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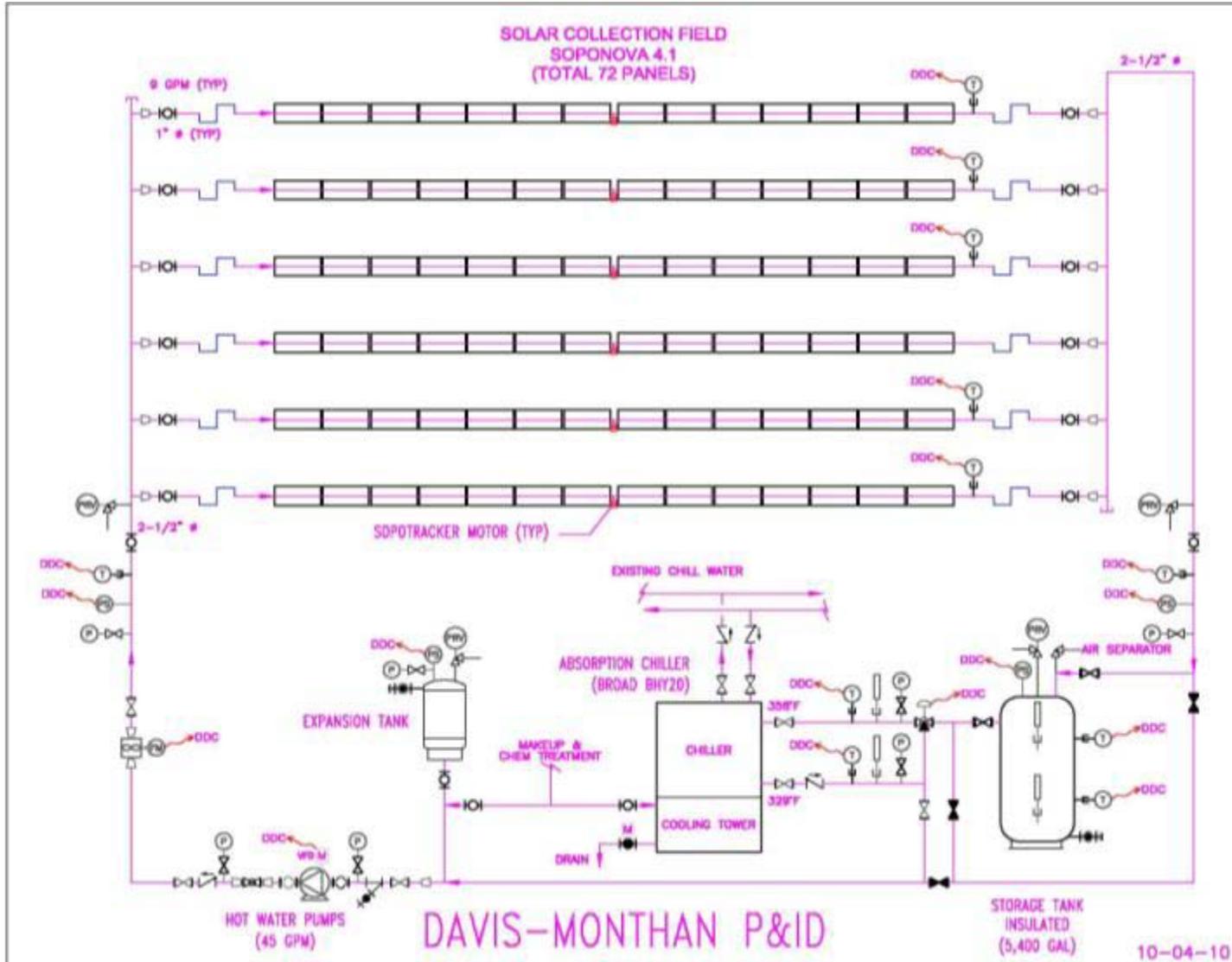


# Overall conceptual schematic of technology



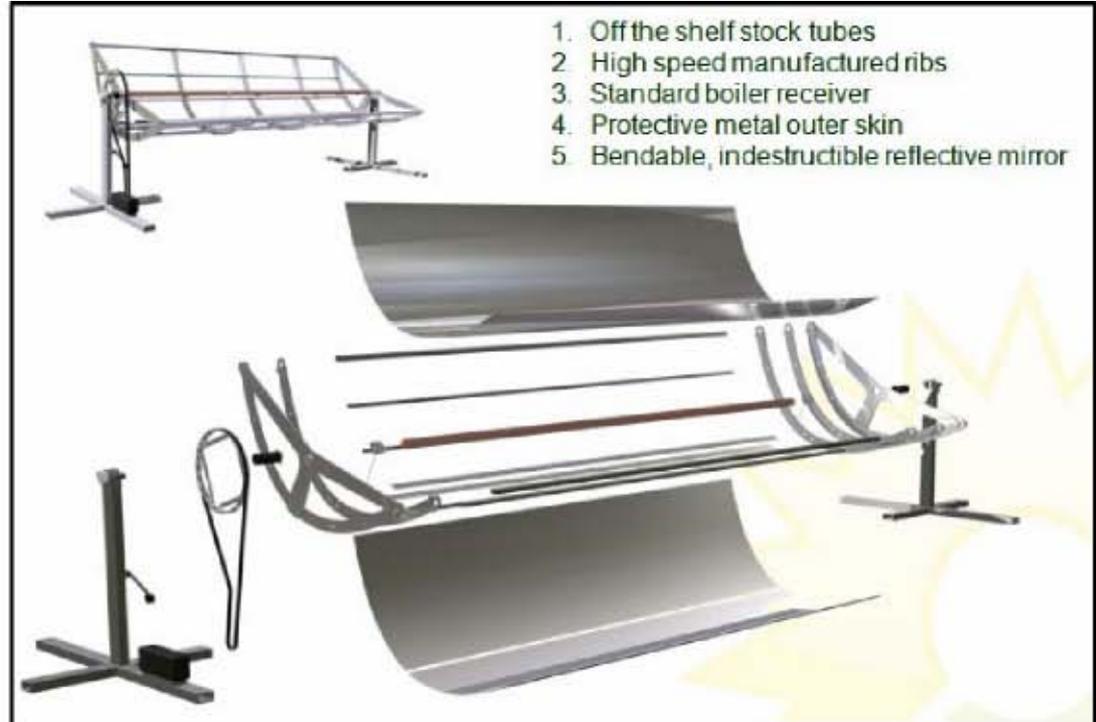


# Plumbing and Instrumentation Diagram





# Solar Collectors



– **[Sopogy SopoNova MicroCSP Data Sheet](#)**

– [http://sopogy.com/pdf/contentmgmt/Data\\_Sheet\\_SopoNova\\_Web.pdf](http://sopogy.com/pdf/contentmgmt/Data_Sheet_SopoNova_Web.pdf)



# Photo of Youth Center



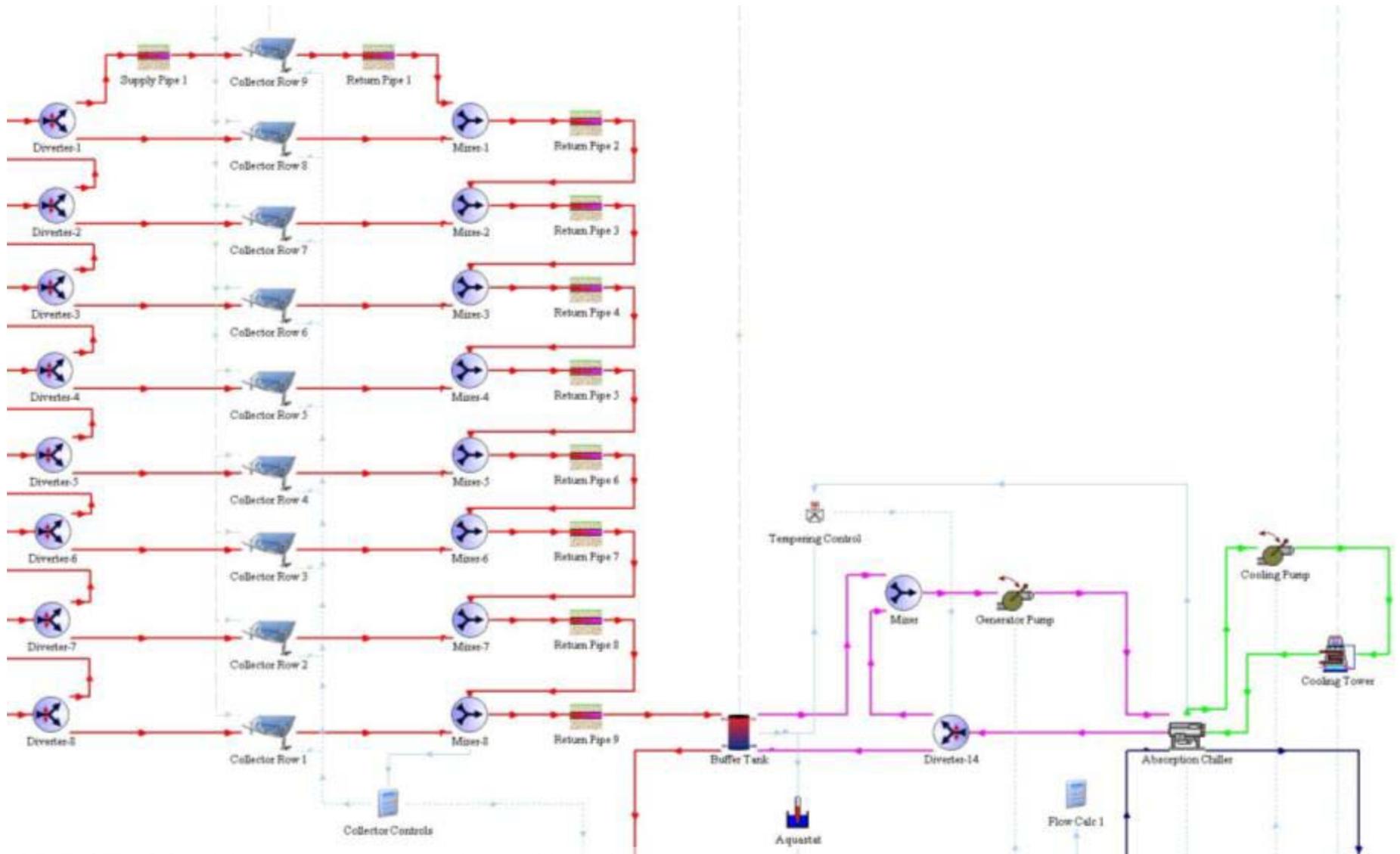


# Photo of collector field



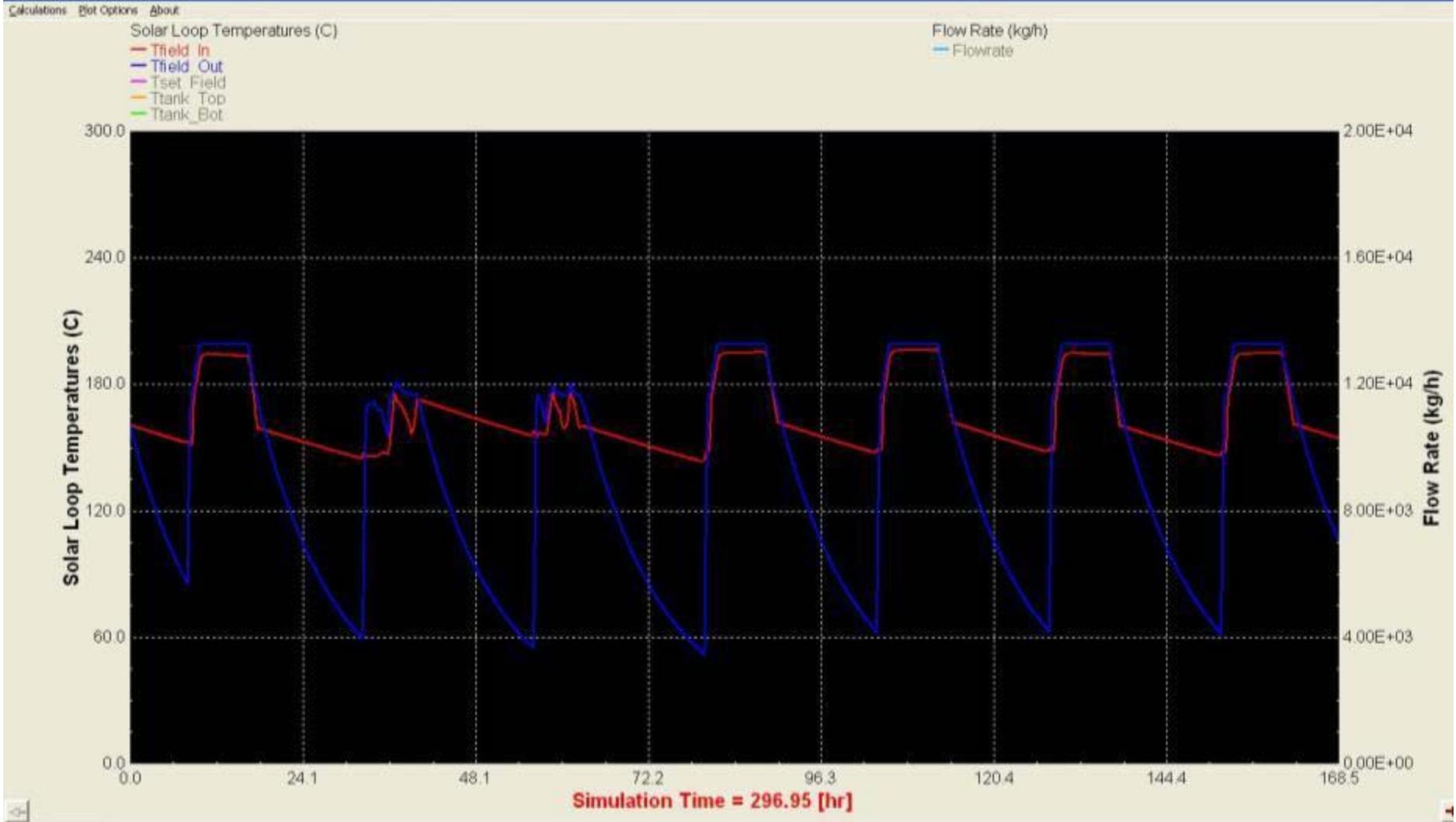


# TESS modeling in TRNSYS



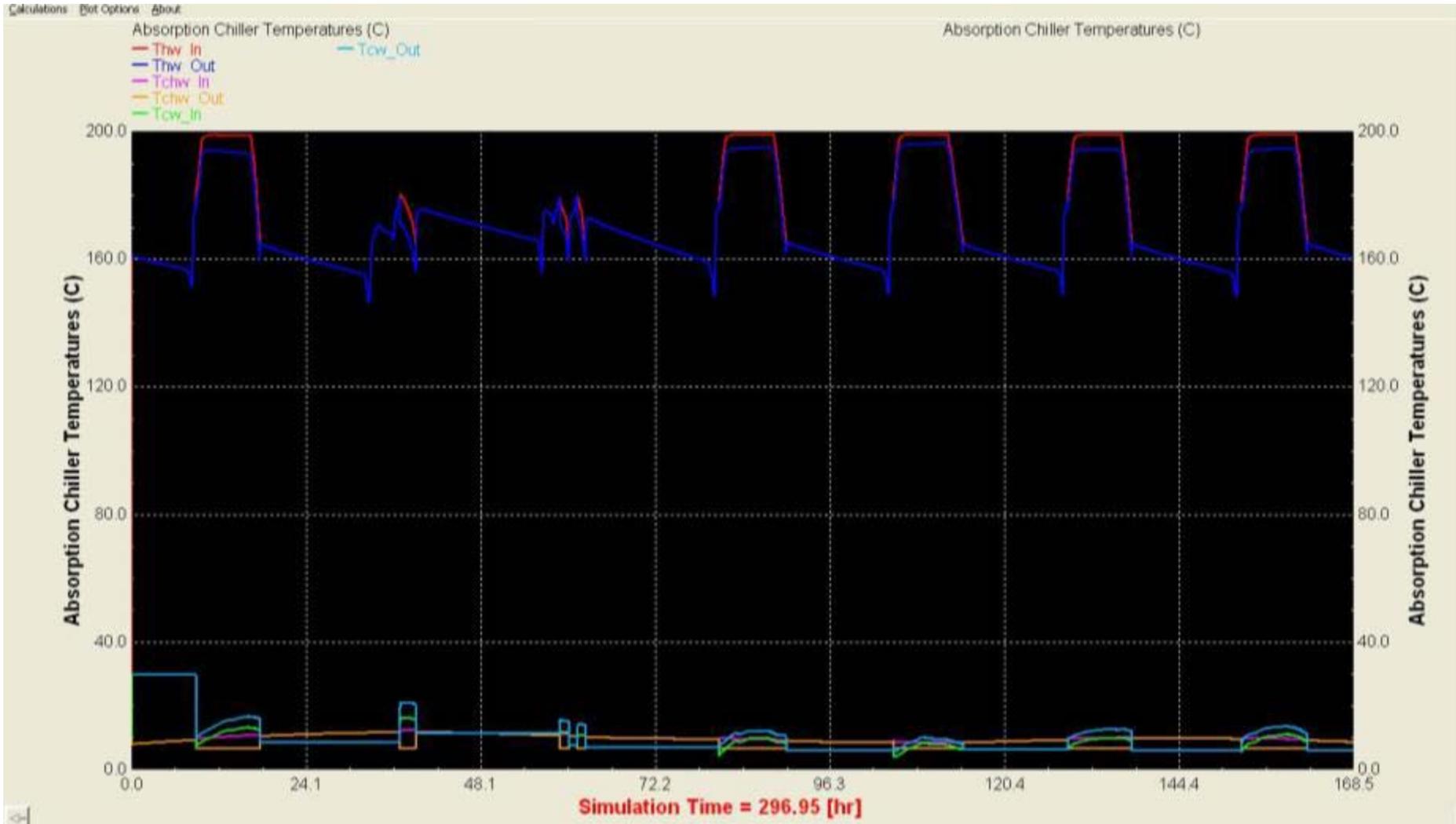


# TESS modeling in TRNSYS





# TESS modeling in TRNSYS





# Concentrated Solar Air Conditioning for Buildings

## Description:

- Reliable access to affordable, stable energy supplies at facilities/installations. Small-footprint, easily installed solar thermal energy system utilizing proven technology to drive industrial-sized absorption air conditioning systems.
- Increase energy efficiency, and percentage renewable consumption. (Summer AC loads account for 30-60% of total energy expenditures at DoD facilities.) Helps agency meet regulatory requirements (e.g., EO 13423, EPA 2005, EISA 2007, EO 13514).
- Demonstrate that solar collectors can be integrated with absorption chillers to provide a renewable energy based source of air conditioning.

## Stakeholders:

- Work Partners: Navy [Principal Investigator], Sopogy [Turnkey], TESS/Enovity [subcontractors]; Davis-Monthan AFB (demo site in AZ)
- Other: NASA (JSC & DFRC), HQ EMD

## Project Approach:

- Collect baseline operational data
- Install MicroCSP™ and absorption chiller
- Collect at least 12 months of operational data
- Determine offset electrical grid energy quantities and savings
- Prove cost-effective alternative to fossil fuel based energy



MicroCSP™ Solar Collector “SopoNova 4.0™”  
(Illustration courtesy of Sopogy)

## Alternatives:

- Parabolic solar collectors coupled with absorption chiller

**Progress:** Planning for testing

**Period of Performance:** May 2010 to February 2013

## Contact:

- Project Manager: Rusty McLaughlin, ITB, 321-867-3351, [russell.l.mclaughlin@nasa.gov](mailto:russell.l.mclaughlin@nasa.gov)
- TEERM Program Manager: Chuck Griffin, NASA, 321-867-6225, [chuck.griffin@nasa.gov](mailto:chuck.griffin@nasa.gov)



# Project Schedule

	FY10			FY11				FY12				FY13				
Project Initiation			█													
Project Planning			█	█												
Requirements Definition			█	█	█											
Materials Preparation				█	█	█	█									
Testing					█	█	█	█	█	█	█					
Analysis and Reporting												█	█			
Follow-up / Closeout													█			

– **Questions?**

