Concentrated Solar Air Conditioning for Buildings Project

"GLOBAL COLLABORATION IN ENVIRONMENTAL AND ALTERNATIVE ENERGY STRATEGIES"

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

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

- Unit Cost - Consumption

![Chart showing unit cost and consumption over years]

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)
Energy

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 three components of this infrastructure, as well as the wide diversity of installation building types, provide a rich setting for continued exploration of energy conservation and efficiency. The Department's use of energy is crucial in the development and deployment of the next generation of energy technologies. To meet its strategic, environmental, economic, and security needs, DoD requires rapid and effective deployment of new (clean, secure, low-cost) energy technologies. To address these issues, SERDP and ESTCP focus 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 already focused on developing and demonstrating renewable energy sources technologies on an operational basis. These technologies must be ready available at the appropriate scale for DoD installations. Improvements in micro-turbines, combined heat and power, and other modular or distributed applications that may not be feasible to install are also supported.

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

Overall conceptual schematic of technology
Plumbing and Instrumentation Diagram

Solar Collectors

- Sopogy SopoNova MicroCSP Data Sheet
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

Alternatives:
- Parabolic solar collectors coupled with absorption chiller

Progress: Planning for testing

Period of Performance: May 2010 to February 2013

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- TEERM Program Manager: Chuck Griffin, NASA, 321-867-6225, chuck.griffin@nasa.gov
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- Questions?