An Overview Sandia's Renewable Energy Work With the DoD

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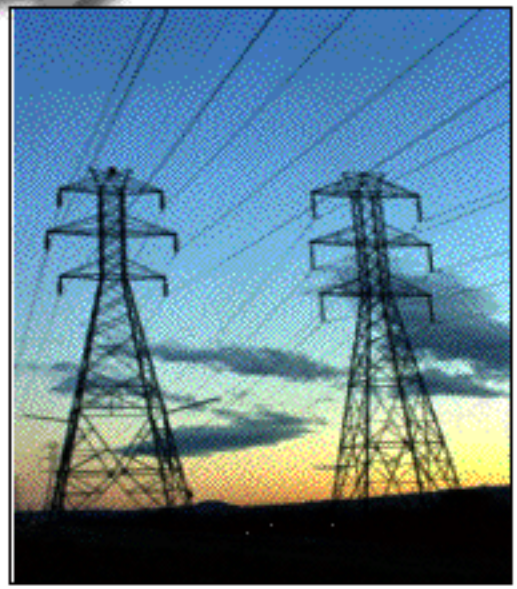
A Little Background on Sandia

- Largest DOE National Lab, 8000 staff, $1.4B
- Multi-program lab with defense emphasis
- Work in renewable energy for 25 years—longer than any other lab
- Service to DOD is one of our priorities

Energy Research Underway at Sandia National Labs



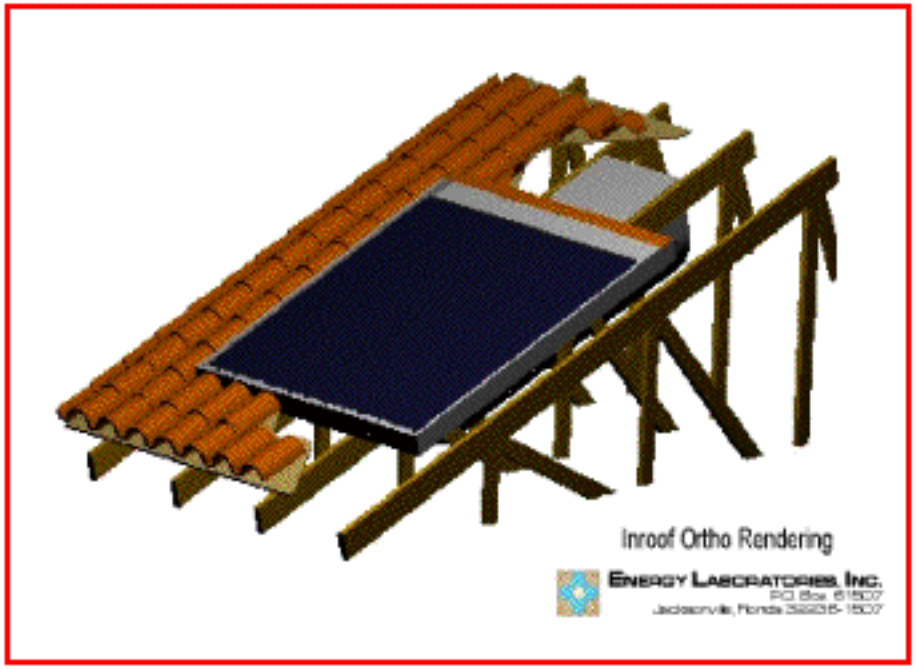
- Enhancing the safety, security, reliability of energy systems
- Cleaner fossil fuel processes (coal, oil, gas)
- Safe operation of nuclear plants
- Alternative energy (PV, microturbines, etc,) for civilian and defense applications

How Sandia Helps DOD to Apply Renewable Energy Technologies

- Direct technical assistance on projects for all branches of military
- Project management — complete oversight of renewable energy projects for USMC and Pentagon
- Consulting and training for military personnel
- Applied Research & Development and Test & Evaluation
- Special projects for DOD Tri-Service Renewable Energy Committee (TREC)
- Support provided by DOE/FEMP and DOD/TREC

A New Solar Hot Water Heating Technology Development

- Cooperative Research and development with SRP, a major Arizona utility, to develop, a unique solar water heating system for new homes
- All passive design, all stainless steel construction integrates into roof, tank under collector, resembles skylight
- Cost goal of $1500 to homeowner is about 1/2 cost of traditional systems
- Field testing in Phoenix and Ft. Huachuca, USMC



RITH Installation in Phoenix

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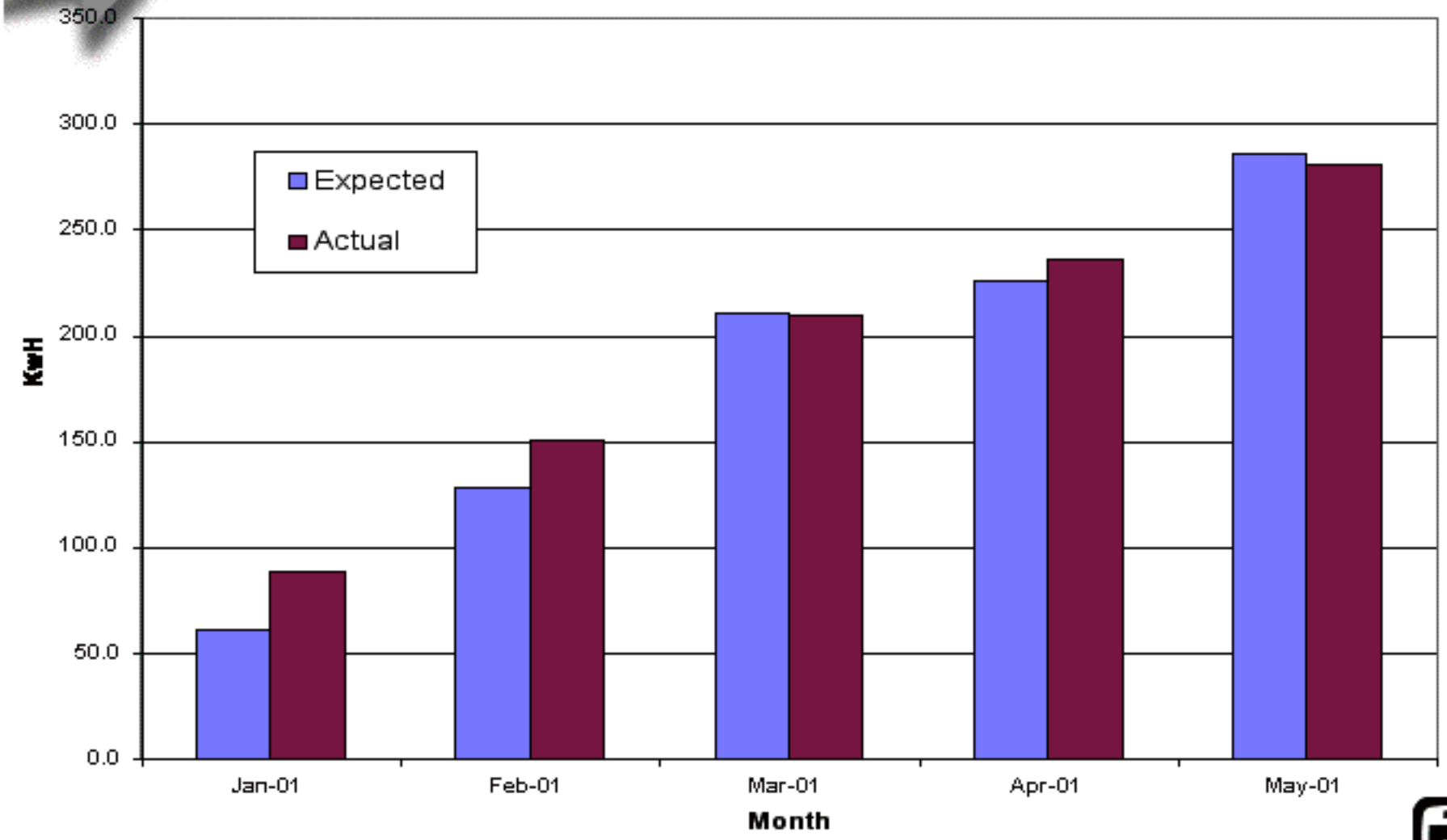
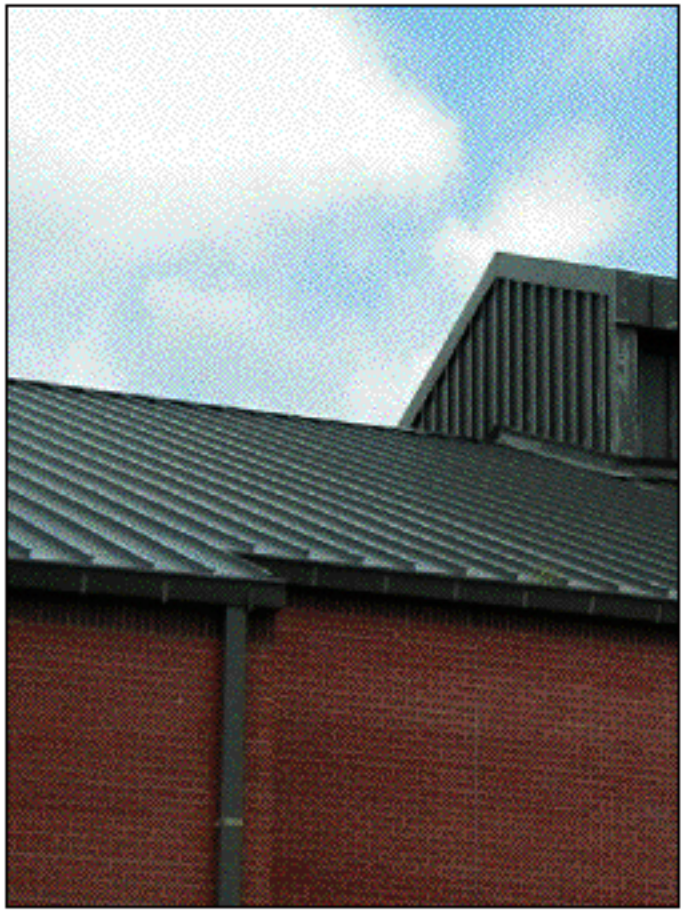
RITH Performance

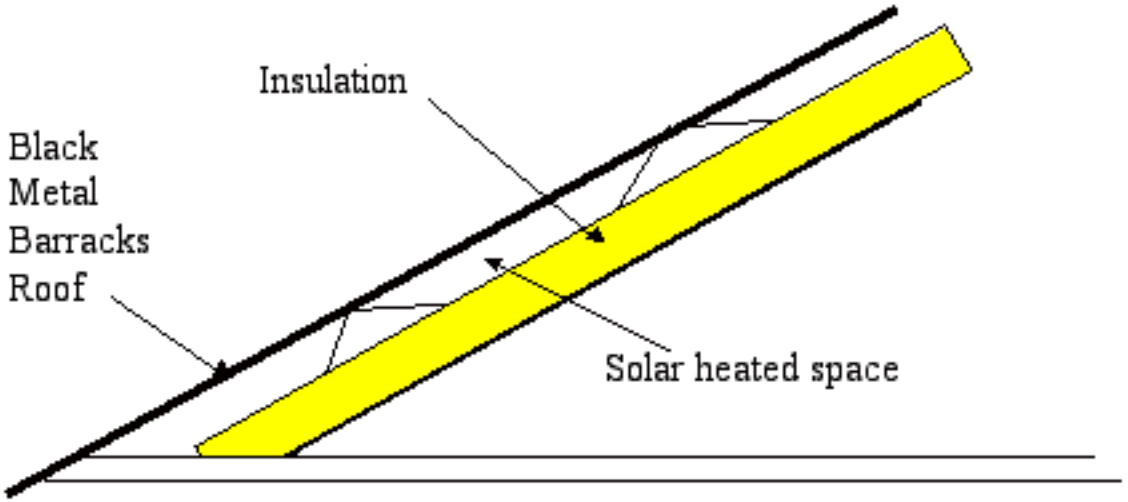


Solar Attic Hot Water Project at Ft. Huachuca

Experimental project to scavenge heat from attic to heat water

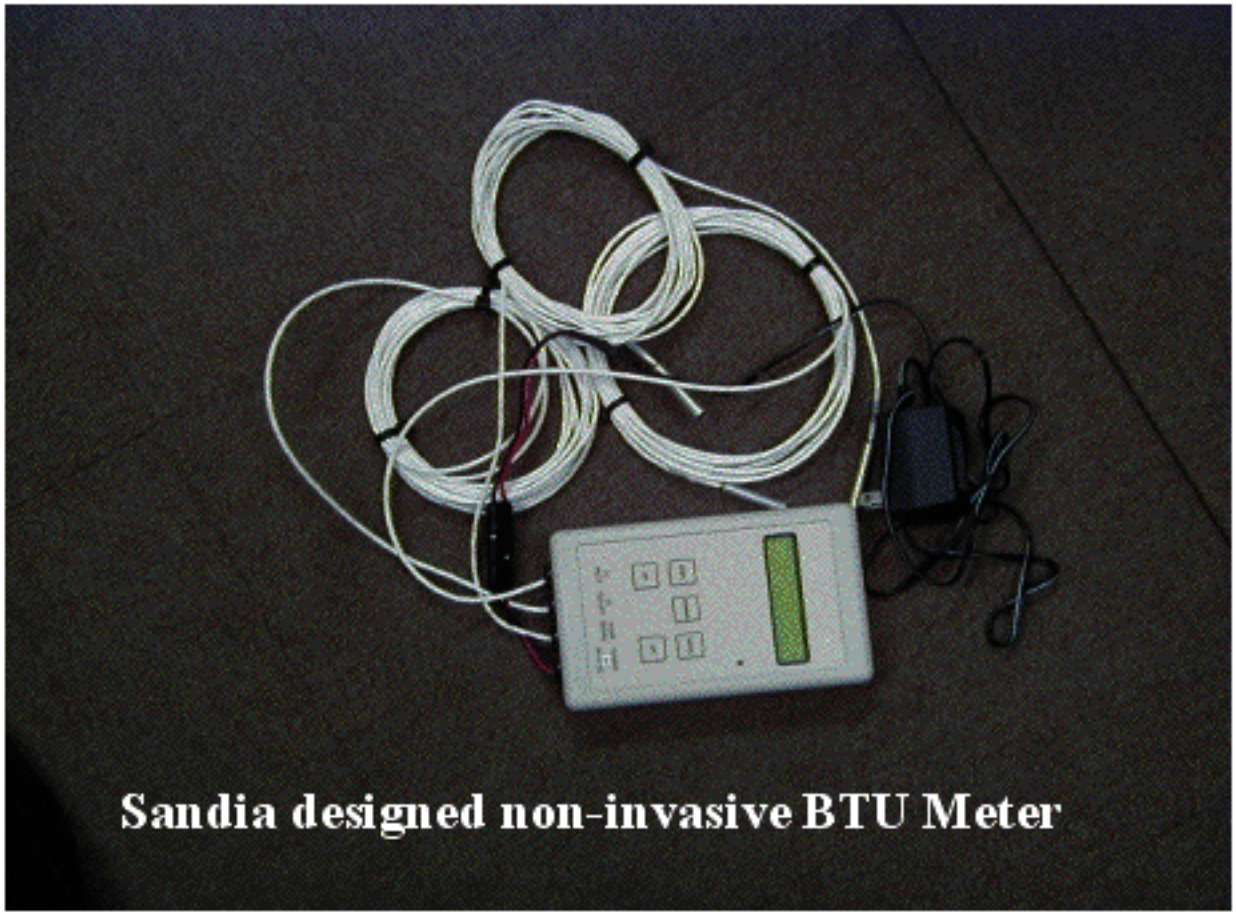


STANDARD CORPS of ENGINEER BARRACKS ROOF



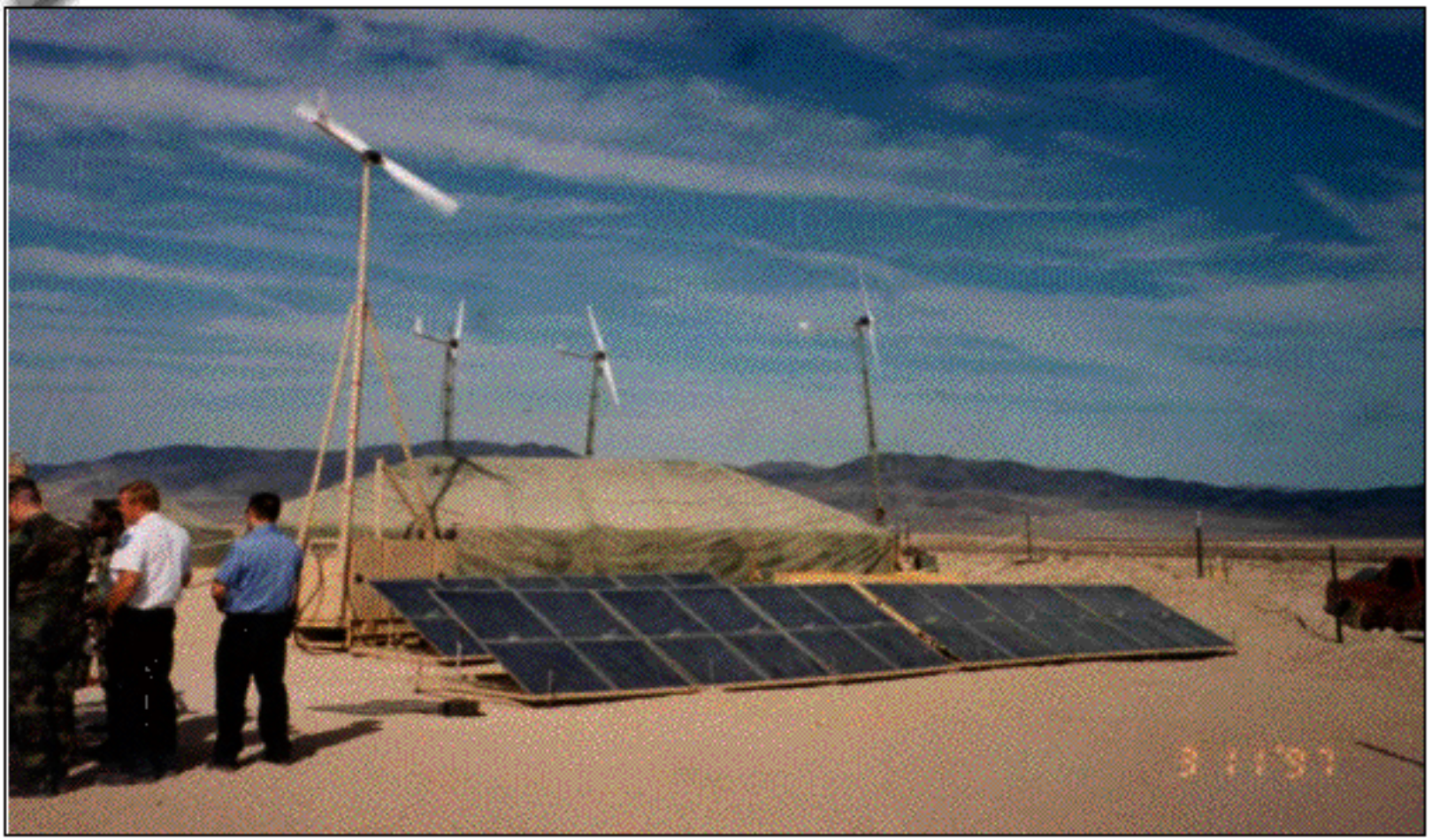
Sandia Designed Low-Cost BTU Meter for Solar Thermal Applications

- Sandia designed BTU meter allows solar hot water systems to be monitored easily and cost effectively.
- The meter can be installed without cutting any pipes and is fully portable
- Under test in various DOD facilities; available to all
- Low cost; works with fixed and variable flow systems.



Sandia designed non-invasive BTU Meter

MOBILE POWER CENTER FOR TACTICAL APPLICATIONS



3.4Kw Mobile Photovoltaic Array, part of the Mobile Power Center created for USMC and tested at 29 Palms (was damaged by tornado)

Second Generation Tactical PV Mobile Power Center for Military

Thin Film Photovoltaic Power Center Used for Tactical Power Center Under Test at Ft. Stewart

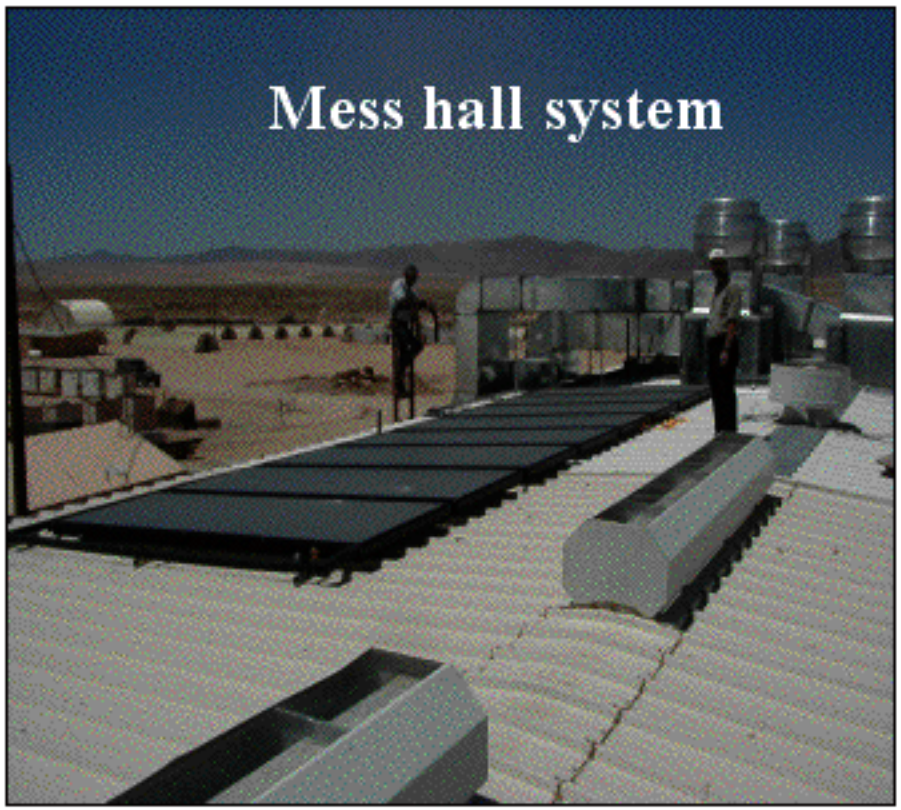
What Makes a Good Potential Renewable Energy Project on a Base?

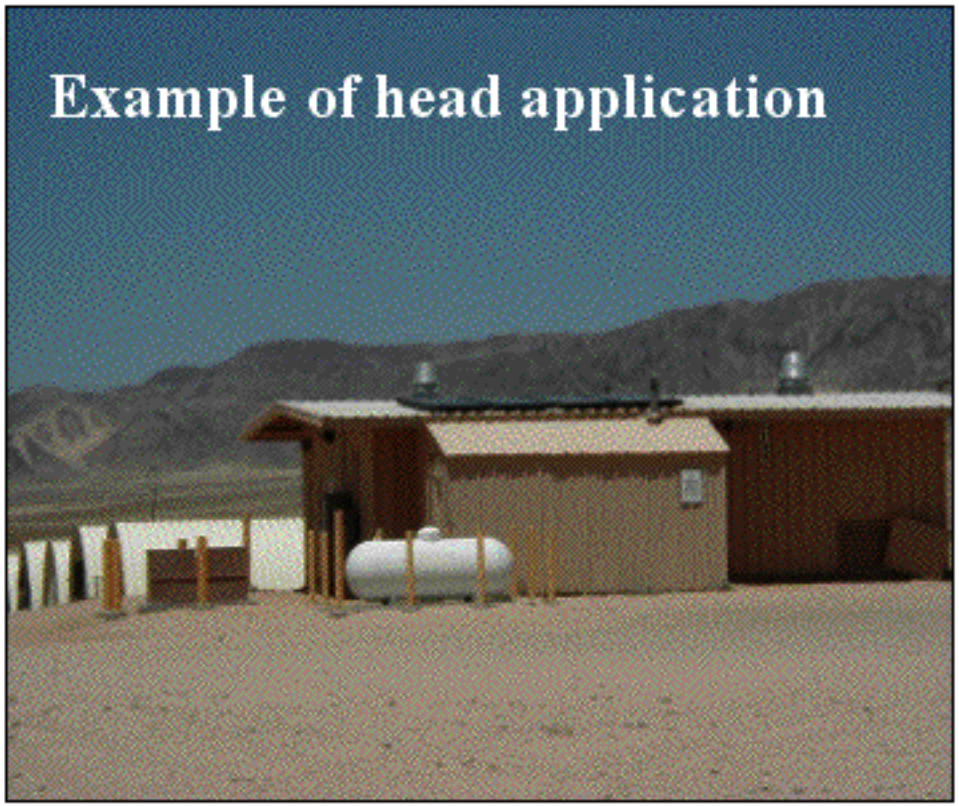
- Good resource (i.e., solar, wind, geothermal, etc)
- Applicable loads (e.g., loads that match solar production profiles)
- Competing fuel costs that are high or could be high in the near term.
- Applicable infrastructure on the military facility and above
  - Command interest in renewables
  - Facilities personnel buy-in; willingness to invest
  - Enthusiastic on-site champion (an energy manager)
  - HQ support

Solar Hot Water and Solar Pool Cost Break-Even Points

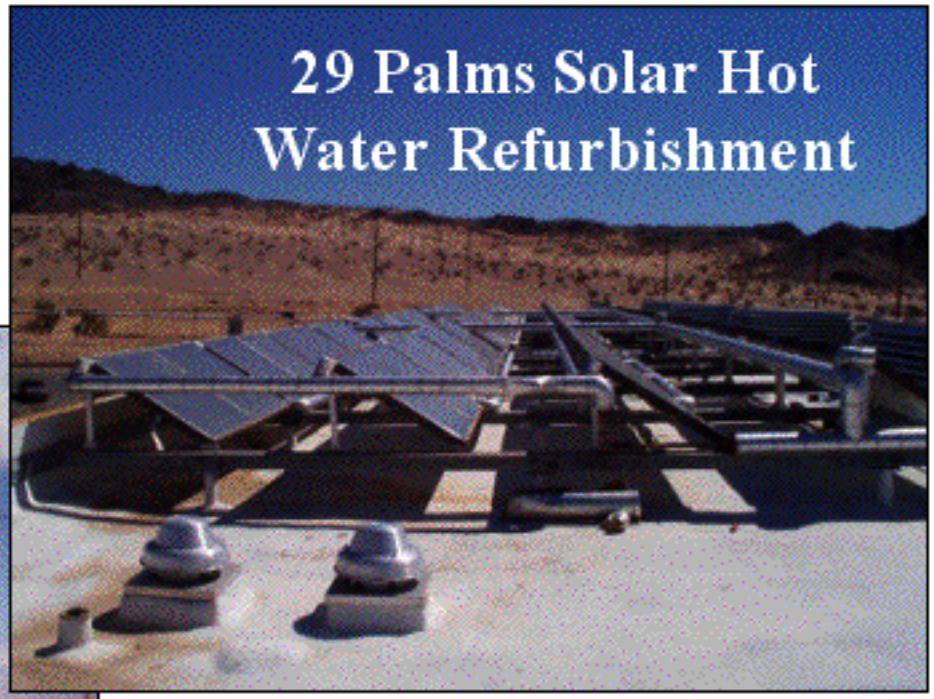
- Solar hot water systems begin to compete with natural gas at a cost of about $7/MMBTU; with electricity at about $0.03/kWH
- Solar pool systems begin to compete with natural gas at a cost of about $4/MMBTU

17 New Solar Hot Water Systems at Camp Wilson (MCB 29 Palms)





Solar Refurbishment Projects at Camp Pendleton and 29 Palms



MCAS Yuma Warehouse Daylighting Project

Daylighting With Lights

Daylighting Without Lights

Sandia's PV Projects with DOD

FACILITY	*APPLICATION*	*DOD CONTACT*	*INVOLVED INDUSTRY*	*STATUS*	*SIZE*
Yuma Proving Ground	Grid-Tied	Roch Ducey (217) 398-5222	UPG/Siemens/Kenetech	In System Startup	450kW
Wide Area Munitions	Facility Power	Roch Ducey (217) 398-5222	Photovoltaic System Manufacturers	In Design	105kW
Range 500	Facility Power	Wayne Taylor (619) 939-2323	UPG	Under construction	70kW
Superior Valley	Facility Power	Mike Crom (619) 939-0076	Photocomm/ASE/ Abacus	Complete 2/96; DAS installed	350kW
Remote Ranges	Facility Power	Sam Edwards (619) 939-1280	Plateau Electric/ASE/ Kenetech	In System Startup	420kW
REWS	Facility Power	Meg Fix (619) 545-6353	IPC/ASE/Kenetech	Under construction	90kW
Santa Cruz Island Communication Site	Facility Power	Wayne Taylor (619) 939-2323	Southern California Edison (Applied Power; Solar Connection; Photocomm)	Under Construction	150kW
Mobile Power Center	Portable Power	Wayne Taylor (619) 939-2323	NRAD	Complete 3/97	3.4kW
Training Ranges	Facility Power	Roch Ducey (217) 398-5222	Plateau Electric	In Design	200kW
Grasmere Point	Facility Power	Col. Len Wheelis (208) 828-6392	Idaho Power/Solarex/ AES	Complete 7/95; DAS installed	80kW

Sample PV Projects with DOD

300 kW System at China Lake, CA

Grasmere Pt, Mountain Home AFB

Summary of Displaced Annual Energy Resulting From Sandia's DOD Projects

	MWh	Value[1]
Fiscal Year 2001	16,300	$1,630,000
Fiscal Year 2002	26,400	$2,640,000
TOTAL	42,700	$4,270,000

Notes:

[1]Displaced electricity cost of about $0.10/kWh

Summary

- Solar technology is improving its performance, reducing its cost, and can compete in specific applications within DOD
- R&D is producing some new technologies that have potential for widespread application within the services
- DOD offers new and unique opportunities for renewable technologies--FEMP and TREC are helping to identify and implement these applications