Solar Cogeneration
Maximizing Resources with High Efficiency Hybrid Solar

Eric Brown
Director of US Sales
Presented at E2S2
May 24 2012
**Cogenra at a Glance**

<table>
<thead>
<tr>
<th>SOLUTION</th>
<th>Cogeneration of solar hot water &amp; electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>BENEFIT</td>
<td>Solar heating (high-temperature option), solar cooling and solar electricity</td>
</tr>
<tr>
<td>APPLICATIONS</td>
<td>Bachelor Enlisted Quarters, laundry, fitness centers, etc</td>
</tr>
<tr>
<td>LEADERSHIP</td>
<td>Experienced executives, Khosla Ventures</td>
</tr>
</tbody>
</table>

**AWARDS**

[Prism Awards Finalist](#)  
[Greenberg Efficiency Awards Winner 2011](#)  
[Renewable Energy World Award Winner](#)  
[Energy Star Partner of the Year](#)  
[Cool Vendor](#)
What does Cogenra Offer?

Cogenra provides solar cogeneration solutions that produce solar hot water and low-cost electricity in a single array for solar heating (space and water), solar cooling, and solar electricity on demand for commercial, institutional and industrial customers.
Solar Cogeneration
Solar Hot Water and Electricity

Cogenra Delivers 75% Efficient, Renewable Electricity and Heat with Rapid System Paybacks
PV Utilizes a Fraction of the Solar Potential

~15% Usable Electricity

~85% Wasted Energy (mostly Heat)
Solar Cogeneration
Photovoltaic Electricity + Solar Hot Water

Lost Heat

Solar Energy

15% Electricity

Traditional 1-Axis PV
~ 15% Efficiency

Cogeneration
~ 75% Efficiency

60% Hot Water
15% Electricity
One Solution: Two Receiver Options

Cogenra's SunPack solution can be equipped with one of two receivers that are identical in form factor but are tailored for different temperature applications.

<table>
<thead>
<tr>
<th>Photovoltaic Thermal (PVT)</th>
<th>High Temperature Thermal Only (HTTO)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Produces both electricity and thermal energy</td>
<td>• Space heating &amp; district heating</td>
</tr>
<tr>
<td>• Solar heating, cooling and electricity</td>
<td>• Absorption chillers</td>
</tr>
<tr>
<td>• Max water temperature out: 70C / 158F</td>
<td>• Industrial applications &amp; process heat</td>
</tr>
<tr>
<td></td>
<td>• Max temperature out: 150C / 300F</td>
</tr>
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</table>

Used interchangeably with Cogenra’s SunDeck® module
Solar Cooling
The next big thing in solar cogeneration
DoD Applications

- With solar cogeneration, the thermal energy can be used for space heating, cooling and hot water:
  - Bachelor Enlisted Quarters
  - Hospital
  - Laundry
  - Fitness centers
  - Vehicle & facility cleaning
  - Absorption chillers
  - Space heating
  - Veterans facilities
  - District services
  - High temperature industrial uses

- Electricity connects to the facility’s existing power supply and offsets electricity consumption.
Direct-Cooled High-Efficiency Modules

Low Cost Module
- Single-axis autonomous tracker
- Approximated parabola*
- Staggered flat mirror edges*

Technology Innovation
- High efficiency (75%)
- Proprietary thermal-electrical stack*
- Direct-laminated extruded channel*


Low Cost. Efficient PV. Valuable Heat.
SunPack: Turnkey Solution
Available in 2 X 4, 2 X 5, and 2 X 6 Configurations

- Integrated inverter, hydronics & control
- Remote monitoring & diagnostics
- Plug & play design

SunPack Array Equipped with iBOS™ and Multiple SunDeck® Modules

SunPack-12*
- 5 kW_e + 25 kW_th
- 6 lb/sqft
- 71 kWh/sqft

*Also available in SunPack-8 and SunPack-10 configurations
Typical Installation
Site Integration
SRCC, IEC, UVEC and Keymark Certifications

Achieved Both Solar Thermal & Solar Electric Certifications
DoD Benefits

MEET OBJECTIVES AND MANDATES
• Help meet solar hot water and renewable electricity mandates
• Assist with achieving Net Zero Energy on Base
• Achieve Energy Security
• Appropriate for ~60% of buildings at these sites (more with tri-gen)

SAVE ON COSTS
• Lifecycle cost effectiveness
• Grid parity
• Financial models that increase deployments (e.g. lease, HPPA)
• Remote Monitoring minimizes O&M expenses

OPTIMIZE RESOURCES
• Scale to district heating
• Made /assembled in the U.S., utilizing local production resources
• Monitoring solution integrated with building automation systems
More Savings than PV or SHW

<table>
<thead>
<tr>
<th>Solar Electric</th>
<th>Solar Hot Water</th>
<th>Solar Cogeneration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>🌊💧💧💧💧💧💧</td>
<td>☀️💧💧💧💧</td>
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<tr>
<td>CO₂ Reduction</td>
<td>🌳🌳🌳🌳</td>
<td>🌳🌳🌳🌳</td>
</tr>
<tr>
<td>Value</td>
<td>💰💰💰</td>
<td>💰💰💰💰</td>
</tr>
</tbody>
</table>

Solar Cogeneration = Highest Efficiency
Cogenra is committed to advancing renewable energy within the DoD segment

Awards & Memberships
• Selected by ESTCP for a $2.1 million contract
• Participated at the Marine Corps ExFOB, Twenty Nine Palms – 2011
• Member of SAME and NDIA

Events
• Army and Air Force Energy Workshop (Arlington)
• Camp Pendleton Day (Camp Pendleton)
• DECS - Defense Energy Challenge Showcase (Honolulu)
• Energy Efficient Technologies for Government Buildings (Las Vegas)
• GovEnergy (Cincinnati)
• Military Business and Community Expo (Ventura)
• Navy DeVenCI Workshop (DC)
System Monitoring
Real-time & Historic Performance & Savings

System Size: 50.0 kW DC + 222 kW Thermal
Generating Since: October 12, 2010
Last Updated: 12:20pm Jul 14, 2011

Total Energy Generated Equals
110 Tons of CO2 Saved

Total CO2 Offset Equals
2,765 Trees
Production & Installation

- Source Locally
- Ship Flat
- Merge on Site
- Scalable Production
- Rapid Installation
Financing Options
Purchase & HPPA

TURNKEY FACILITY PURCHASE

• Attractive IRR, NPV
• Tax benefits

HEAT & POWER PURCHASE AGREEMENT (HPPA)

• Immediate savings on gas & electricity
• No debt or upfront expense
Marine Corps Warfighting Laboratory (MCWL)

Segment
Military (Marines)

Installation Date
March 2012

Application
• Experimental Forward Operating Base (ExFOB) evaluation
• Heating living and working spaces, food preparation, and hygiene requirements
Department of Defense
Demonstration through Energy Test Bed Initiative Program

Segment
Military (Army & Navy)

Installation Date
2012

Application
• Technology evaluation for future expansion to other DoD sites
• Dining Hall at Port Hueneme Naval Base, Ventura County, CA and Army Parks Reserve Forces Training Area in Dublin, CA

Capacity
• 242 kW – Port Hueneme
• 121 kW – Army Parks
Kendall-Jackson

System size
96 SunDeck® PVT modules

Capacity
241 kW (41 kW_e + 200 kW_th)

Percent energy offset
60% of energy offset by solar cogeneration

Industry
Wine

Installation Date
December 2011

Application
Tank washing/cleaning

“We’re thrilled to take this leadership position with Cogenra by installing the largest rooftop solar electricity and hot water system rooftop array to date. It’s a win for the environment and our bottom line.”

- Robert Boller, VP of Sustainability
La Posada

System size
84 SunDeck® PVT modules

Production
212kW (36kW_e + 176kW_th)

Percent energy offset
70% of energy offset by solar cogeneration

Industry
Retirement Facility

Installation Date
January 2012

Application
Fitness pavilion and laundry center
University of Arizona

Industry
Student Housing

Installation Date
April 2012

Application
Showering, laundering, and cleaning

System size
50 SunDeck® PVT modules

Production
127 kW (22 kW_e + 105 kW_th)

Percent energy offset
50% of energy offset by solar cogeneration
Facebook

System size
24 SunDeck® PVT modules

Capacity
60kW (10kW_e + 50kW_th)

Percent energy offset
60% of energy offset by solar cogeneration

Industry
High-tech company

Installation Date
March 2012

Application
Hot water + Power for fitness facility

“We believe these kind of projects can help facilitate further innovation, while also advancing our own understanding of what these kind of investments mean for our business”.

- Marcy Scott Lynn, Sustainability Lead
UA Tech Park

System size
84 SunDeck® PVT modules

Production
227 kW (36 kW_e + 191 kW_th)

Industry
Education

Installation Date
Q2 2012

Application
Space heating
### Utility

<table>
<thead>
<tr>
<th><strong>System size</strong></th>
<th>20 SunDeck® PVT modules</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production</strong></td>
<td>50.2kW</td>
</tr>
<tr>
<td><strong>Industry</strong></td>
<td>Utility</td>
</tr>
<tr>
<td><strong>Installation Date</strong></td>
<td>Q1 2012</td>
</tr>
<tr>
<td><strong>Application</strong></td>
<td>Absorption chiller</td>
</tr>
</tbody>
</table>
RO Membrane Cleaning and Restoration

Location
San Marcos, CA

System size
18 SunDeck® PVT modules

Production
37 kW (7 kW_e + 30 kW_th)

Industry
Water treatment chemical company

Installation Date
Q2 2012

Application
Cleaning process
Fitness Center

Location
Palo Alto, CA

System size
70 SunDeck® PVT modules

Production
175 kW (30 kW_e + 145 kW_th)

Industry
Recreation

Installation Date
Q2 2012

Application
Showers, cleaning
So Why Solar Cogeneration?

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<thead>
<tr>
<th>Maximize Efficiency</th>
<th>Save</th>
<th>Reduce Footprint</th>
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<tr>
<td>Maximize use of available <strong>area</strong> &amp; <strong>dollars</strong> with solar cogen</td>
<td>Save immediately with HPPA (no upfront expense or debt) OR Purchase the system = rapid paybacks</td>
<td>Reduce greenhouse gas emissions and meet renewable energy mandates:</td>
</tr>
</tbody>
</table>
| ![oil drops and fire icon](image) | ![Currency bag icon](image) | • 30% solar hot water  
• 25% renewable electricity  
• ≥50% of Navy’s total energy |
Thank You

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