

Distributed Power Systems Overview



Path 1: Distributed Power Systems

Task Leader: Tom Mancini, Sun ♦ Lab

Industry Partners:

SAIC	SES
Boeing	STM Corp.
WGA	Thermacore
Winsmith	PanelTec
Porous Metals Inc.	

Sun ♦ Lab:

Rich Diver	Chuck Andraka
Mark Mehos	Gary Jorgensen
Tim Wendelin	Jim Moreno
Tim Moss	Scott Rawlinson

* Note: CPV is part of Distributed Power Systems and is addressed under Advanced Components and Systems.

Distributed Power Systems Overview

Distributed Power Systems are



Dish-Engine Systems

- 2-axis tracking solar concentrators
- Thermal receiver, engine, generator at focal point
- Capable of hybrid operation (solar OR fuel)
- Primarily Stirling engines (evaluating concentrating PV and microturbines)

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Dish-Engine Systems

- are capable of modular deployment (9 to 25 kW units) in fields of few kW to MWs.
- can be demonstrated on the basis of a single unit at relatively low cost.
- have achieved highest levels of performance ~ 30% net peak conversion and 22 – 25% annual net conversion efficiencies.
- are the least developed (require the most R&D) of the three CSP technologies

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Our Objective: Commercialization of Dish-Engine Technology.

Our Approach:

- **O&M and Dish Development – SAIC/STM grid-connected system development**
 - **Dish-Engine Critical Components – SES and Boeing – focus on engine operation**
 - **Advanced Dish Development System – SunLab/WGA remote operation, new tech.**
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Project Characteristics:

- Different engines (STM, Kockums, Solo)
 - Different Concentrator Designs (continuous and faceted)
 - Shared technology improvements (system diagnostics, operation)
 - ADDS system – remote issues, heat pipe, Web-based operation
 - Heavily cost shared
 - Technology Road Mapping
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Dish-Stirling Accomplishments (5 years)

- Operating 8 systems in U.S. (4 designs)
- Accumulated > **17,000** hrs on sun*
- Generated > **200** MWhrs
- Demonstrated hybrid operation solar or gas on natural gas, hydrogen, and landfill gas
- Demonstrated remote (non-grid-tie) operation
- Demonstrated **AUTONOMOUS** operation

* Does not include > 50,000 hours of operation on older systems and systems operating in Europe.

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Technical Barriers

RELIABILITY, RELIABILITY, RELIABILITY

- Reliability database under development. Data will guide future R&D directions.
- The problem is that 10s or 100s of systems are needed to develop the required database.
- **Solution – leverage prototype deployment opportunities like the 1- MW Nevada Solar Dish-Engine Project.**

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Technical Barriers (cont.)

- **Installed Cost (tech. and production levels)**
- **Operating Cost (tech. and reliability)**

In parallel with addressing RELIABILITY, we are addressing new component designs and materials that reduce costs and increase reliability.

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Installed Cost

- Current Prototype Costs ~ \$10,000/kW
- Intermediate targets -- \$2500 – 3500/kW
- Long-term goals < \$1200/kW

O & M Costs

- Current O & M at prototype cost levels
 - Intermediate targets – 2 - 4 ¢/kWhr
 - Long-term goals < 1 ¢/kWhr
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R&D Directions

(B) Blue we're working on

(R) Red working on minimally

- **Solar Concentrators:**
 - **Advanced, lower-cost designs to reduce (B) construction and installation costs (B)**
 - **Optical surface develop. to reduce cost (B)**
 - **Azimuth drives to reduce cost (R)**
- **Engines: focus on solar-specific issues (B)**
 - **Engine seals and controls to increase reliability (R)**

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R&D Needs and Directions (cont.)

- **Engines (cont.)**
 - advanced heat pipes to reduce cost and improve reliability and performance (B)
 - **Advanced converters (cpv and micro turbines) with potential for low cost and high reliability (R)**
 - **Balance of System**
 - **Prototype, diagnostic controls need to be turned into commercial controls (R)**
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Dish-Engine Progress (Last 5 Years)

5 YEARS AGO

- Fielded 3 demo units
- Focus -- technology demonstration
- Not ready for deployment

TODAY

- Operating 8 Dish-Stirling systems daily
- Focus – RELIABILITY and component improvement
- Leveraging deployment to develop systems further

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Following Presentations:

- **SAIC/STM O&M and Dish Development – directed at grid-connected systems**
 - **Boeing/SES DECC Project – aimed at engine operation and development**
 - **SunLab/WGA ADDS – new technology development for all systems**
 - **Initial Dish-Engine Deployment opportunity in Nevada**
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