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SunEdison
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Concentrating Solar Panels: Bringing the Highest Power and Lowest Cost to the Rooftop

Photovoltaics Team

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Overview

Timeline

- Start: September 1, 2007
- Finish: August 31, 2010
- 90% complete

Barriers

- PV installed cost too high
- Large skill reservoir for flat-plate solar panels
- Si slowing efficiency growth

Budget

- Total project funding
  - DOE share: $4.9m
  - Contractor share: $9.3m
- DOE funding plan
  - for FY09: $1.4m
  - for FY10: $0.9m

Partners

- Lead: Soliant Energy
- Spectrolab (cell provider)
- MIT (research in supply-chain dynamics)
- SunEdison (voice-of-customer and field tester)

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Challenges, Barriers or Problems

- Market Barriers Addressed:
  - Photovoltaics LCOE uncompetitive because of high total installed cost
  - Wholesale, central station CPV proves the concept but faces land use and transmission-cost issues
  - Established ecosystem around the flat-plate value chain
  - Efficiency growth of Silicon is slowing

- Soliant mission aligned with DOE SETP
  - Reduce LCOE to beat retail grid without special solar subsidies
  - Make use of the rooftop, an underutilized resource
  - Leverage the existing ecosystem and reduce BOS cost
  - Use advanced cell with efficiency growth potential

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Relevance

- Mar ‘09 – May ‘10 Project Objectives
  - Establish pilot-scale manufacturing capacity
  - Achieve panel energy production objective
  - Receive provisional safety certification
  - Install panels and conduct field test
- Impact on addressing barriers
  - Innovative manufacturing processes will show path to lower module cost
  - Panel achieves high efficiency today, significant increases by 2012
  - Field test shows how this design will reduce BOS & installation cost
- Other specific targets & milestones
  - Safety certification as rooftop product

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Approach

- Needed: manufacturing processes for long-life, outdoor, reliable, low-cost
- Found: automotive development model
  - EV engineering validation
  - DV design validation
  - PV production validation

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Approach

- EV Sep/07 – Mar/08
  - Working prototype
  - Manufacturing plan
- DV Apr/08 – Dec/08
  - Design for manufacture
  - Prove-out methods
  - Build & test lots of product
- PV Jan/09 – current
  - Production tooling
  - Production automation
  - Production workflow
  - QA, testing, customer ship

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Approach

- Production today
  - 1MW/yr capacity
  - Not running at full cap.
  - Islands of automation
    - Speed
    - Accuracy
  - Shows path to low cost
- Objective for 5/2010
  - # of panels deployed
- Current status
  - 85% built by 4/2010
  - Full deployment expected by end of August 2010

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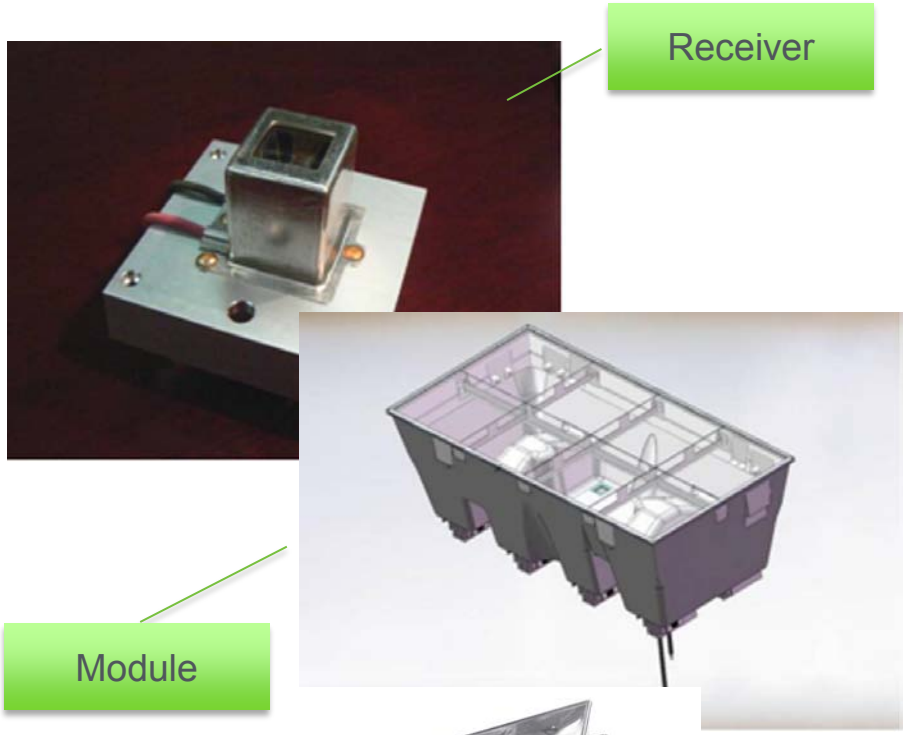
Approach



- Tracking CPV for the commercial rooftop
  - Mounts like a flat plate
  - Low profile
  - Superior area efficiency
  - More time at peak energy
- Objective: kWh/m2
- Status:
  - Energy output objective confirmed by SNL

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Approach

- Certified for rooftops
- Collaborate with UL/IEC
- Objective:
  - Provisional safety cert
- Current:
  - Certification to UL 8703 expected by June 30

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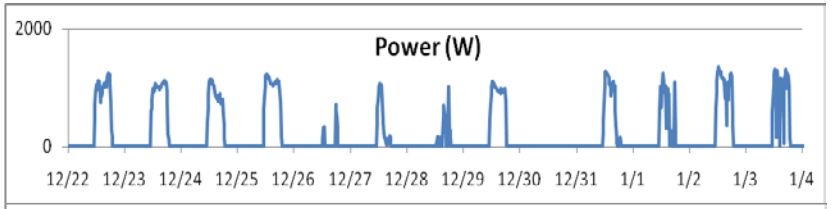
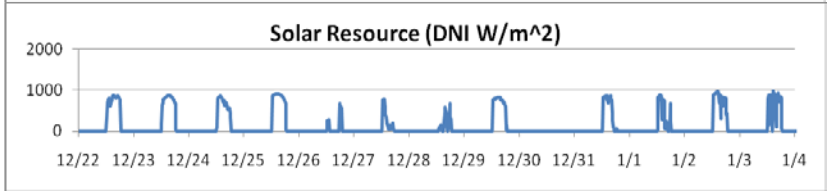
Approach

- Field tests
  - Small systems on customer rooftops
  - Larger system on Soliant HQ
- Objective: Field tests and satisfied customers

"It was so easy and self explanatory we bolted the panels on and connected them – it was the most straightforward install I've ever been a part of."





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Approach

Objective: Develop 500X first, then 1000X

- SE-500X
  - 6 modules per panel
  - 500x concentration
  - Currently in pilot production
  - Systems being installed on customer roofs
  - Validation at SNL
- SE-1000X
  - 8 modules per panel
  - 1000x concentration
  - Prototyping now
  - Beta systems expected 1Q11
  - Target of large-scale commercial production

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Collaborations

- Technology Partners
  - 3M – supplier
  - Spectrolab (TPP partner) – supplier
  - Isuzu Glass – supplier
  - Danaher Motion - supplier
  - SunEdison (TPP partner) – field test
  - Emcore – supplier
  - GE – technical solutions
  - MIT (TPP partner) – advanced research
- Channel Partners
  - Sunlight Electric
  - Morrow-Meadows Alternative Energy
  - Meridian Green Partners
  - SunEdison
  - Turiprojecto
- Customers
  - Caltech
  - Chevron Energy Systems
  - MBK Enterprises, Inc.
  - A major entertainment company

Budget Status and Potential for Expansion

- Total funding received through Mar/2010
  - DOE: $3.1m
  - Soliant: $15m (cash)
- Original budget through Mar/2010
  - DOE: $4.1m
  - Soliant: $8.8m (cash)
- Variances
  - Market timing & macroeconomic issues
  - Development delays
  - Plan modification: schedule slip, will end program with 500X product ready for commercialization; 1000X product in prototype (Engineering Validation) stage
- Task adjustment with additional funding
  - Complete 1000X product through Design Validation & Pilot

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Future Plans (FY 2011 and beyond)

- Plans & milestones through Sept 2010
  - SE-1000X design complete and prototypes tested (7/2010)
  - Safety certification of SE-500X complete (6/2010)
  - Additional field test results (6/2010)
  - Solid order book (8/2010)
  - Progress towards full receiver assembly automation (8/2010)
- 2010 Decision Points
  - Scale of full production factory *depends on market & funding*
  - Design details of SE-1000X *depends on prototype results*

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Summary

- Soliant objectives align with key DOE SETP goals
  - Low LCOE, low BOS cost, high efficiency, robust manufacturing processes
- Soliant has achieved its key objectives under this program
  - Designed a system for reliable, low-cost rooftop CPV that installs like flat plate
  - Demonstrated energy production capabilities of that system
  - Proved manufacturability at pilot scale
  - Field-tested and accepted by customers
  - Shows path to LCOE under $0.08/kWh retail

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