



CPV Industry Overview

Presented by
Nancy Hartsoch
Chairman, CPV Consortium
VP Marketing and Sales, SolFocus

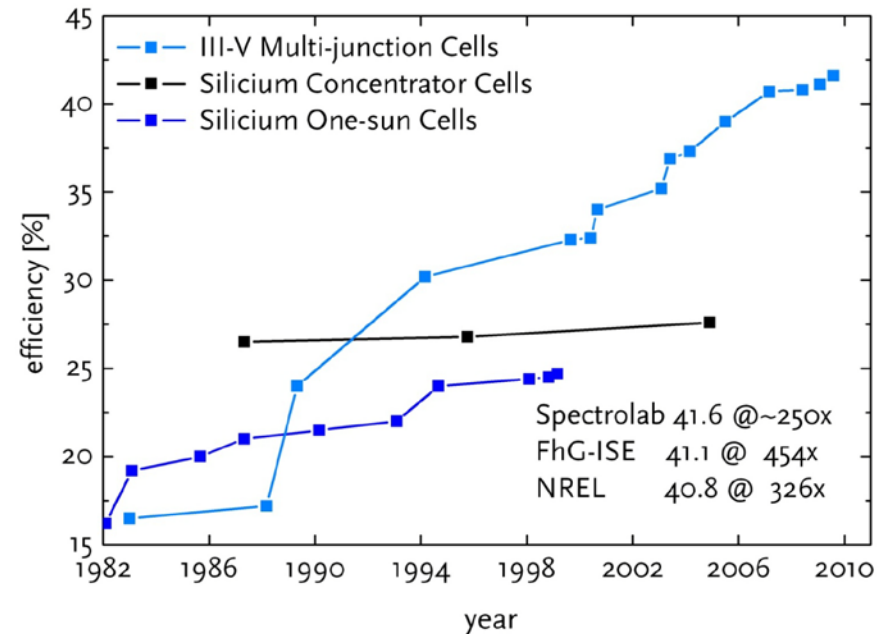
Discussion Topics

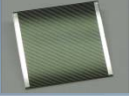


- ▶ Technology Snapshot
- ▶ CPV Value Proposition
- ▶ Challenges for CPV in Going to Scale
- ▶ The State of Commercialization
- ▶ More Case Studies
- ▶ A Rapidly Growing Market

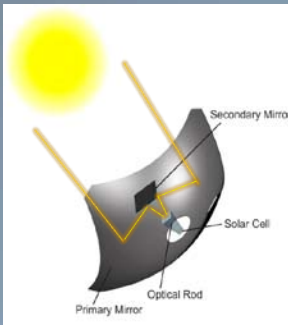
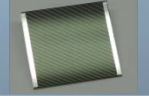
High-Efficiency, III-V Multi-Junction Cells

- ▶ >2X Efficiency of Silicon PV Cells
- ▶ ~39% Efficiency in Production
- ▶ >42% Efficiency in the Lab
- ▶ Steep Trajectory for Efficiency Improvements in Upcoming Years
- ▶ Many New Cell Technologies Under Development



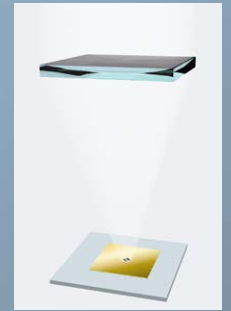


High-Efficiency, III-V Multi-Junction Cells



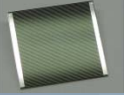
Reflective - Mirror

Concentrating Optical System

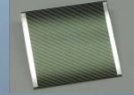


Refractive - Lens

- ▶ Two Basic Approaches: Reflective or Refractive Optical Systems
- ▶ Optics Collect Large Area of Sunlight
- ▶ Focus Sunlight on Small Area of PV Cell
- ▶ High Concentration: ~500-1000+



High-Efficiency, III-V Multi-Junction Cells



Concentrating Optical System

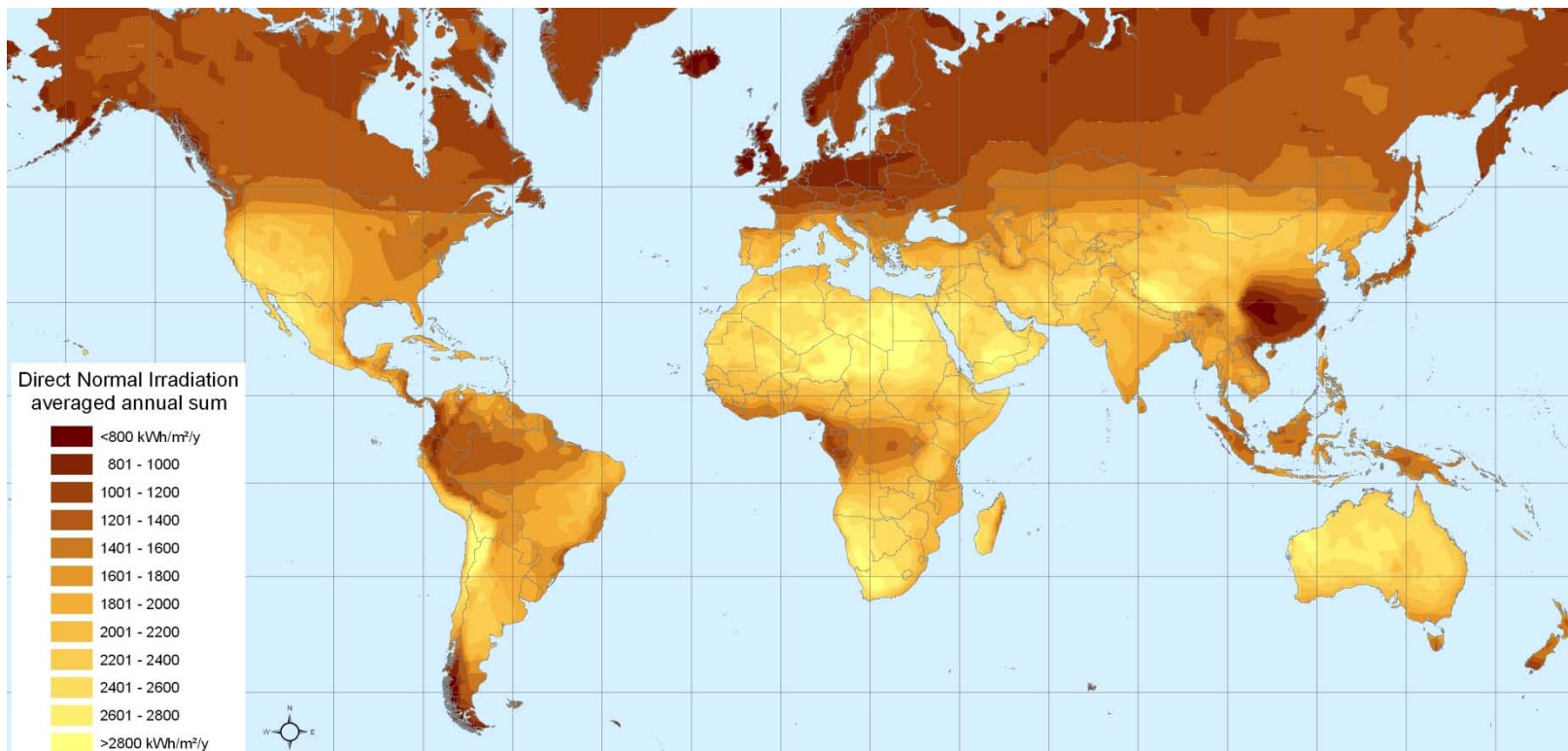
Dual Axis Trackers

- ▶ Incorporate Dual-Axis Tracking Systems
- ▶ Track Sun Sunrise to Sunset
- ▶ Best Match to Peak Demand

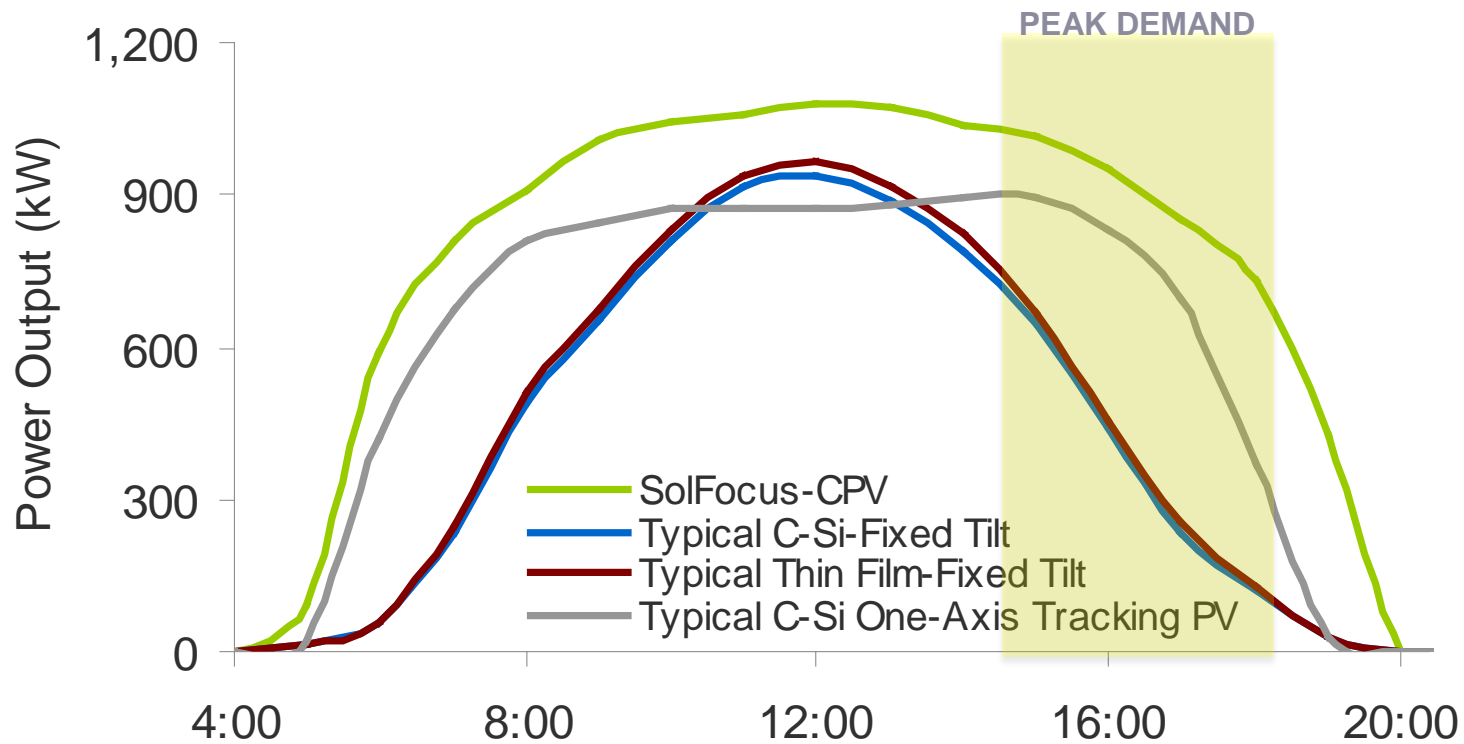


Right Technology for Key Segments

- ▶ Best Technology for Sunny Dry Areas
- ▶ Scalable Deployment Reduces Risk and Speeds Deployment



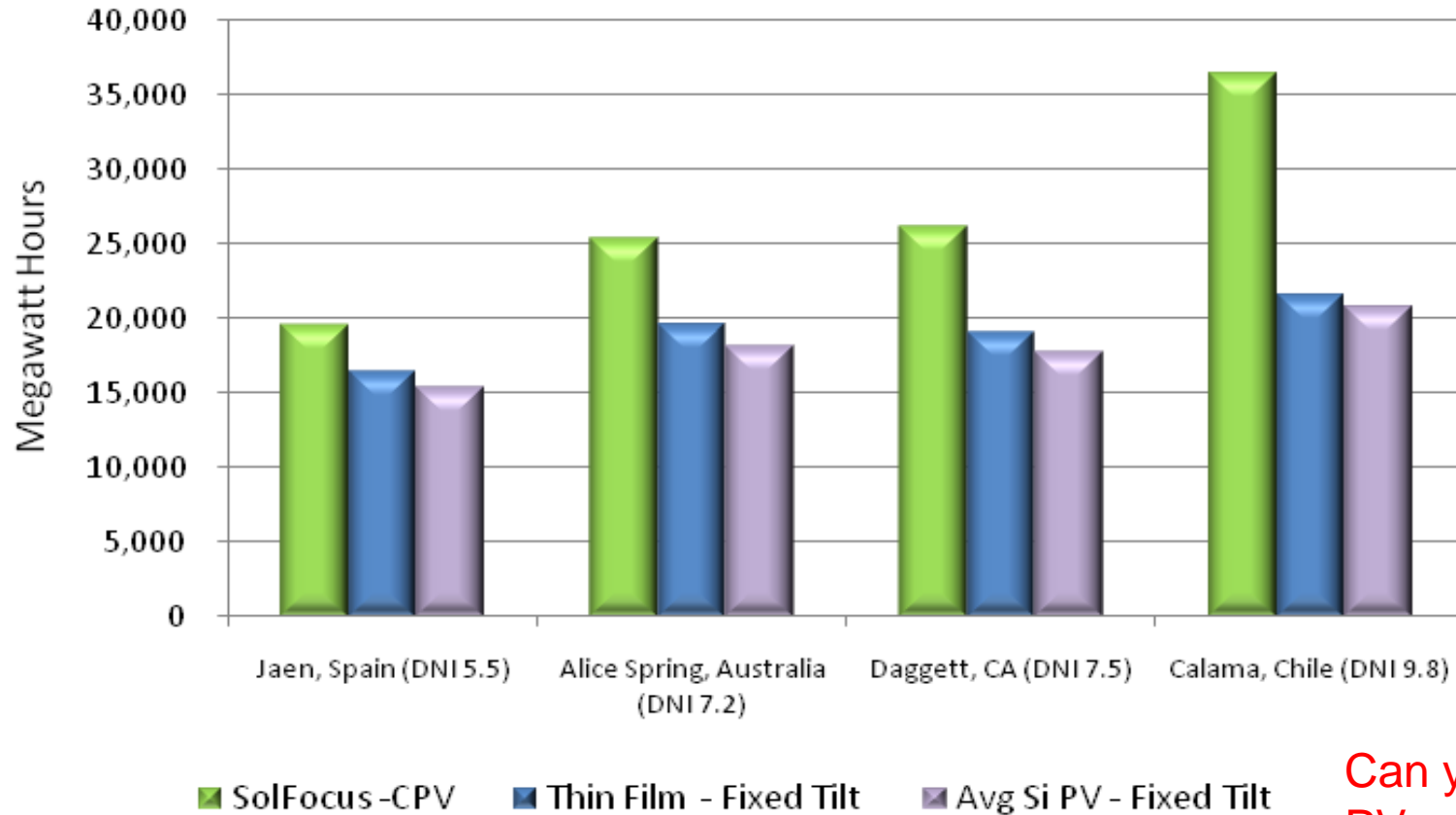
CPV Provides Consistent Energy



More Energy per Megawatt Installed



Energy Output (MWh) by Location and Technology for 10MW-DC Power Plant



Can you add Avg
PV – with tracker

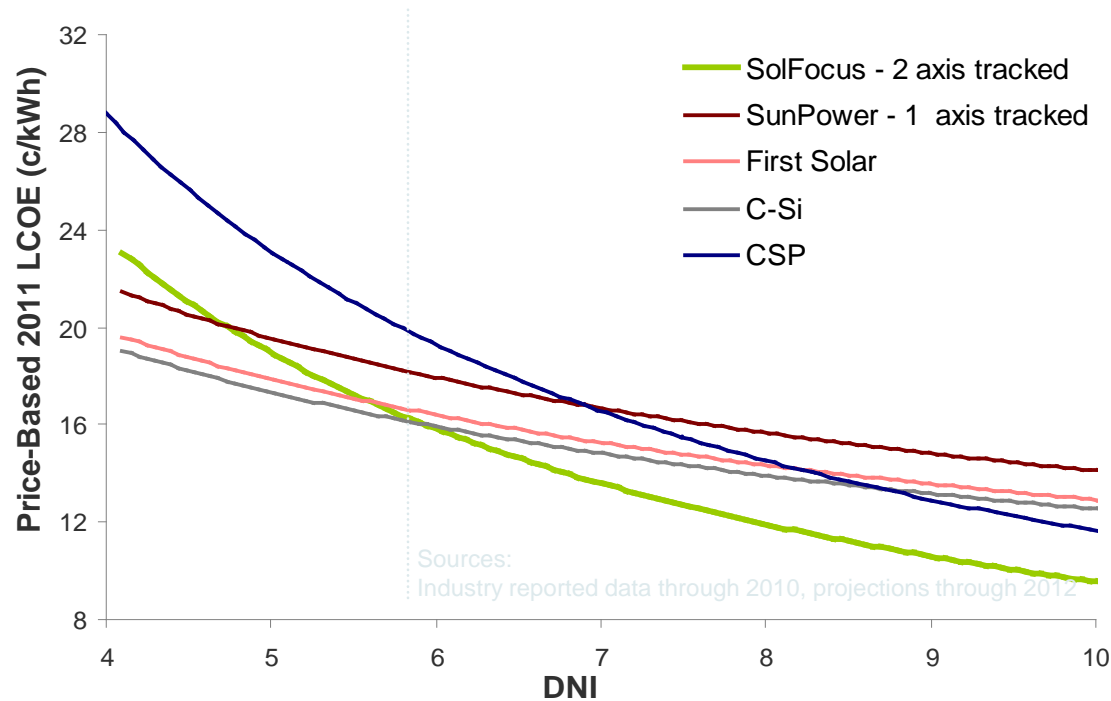


Compelling Cost Advantage



CPV has a competitive LCOE⁽¹⁾ in its target market (>6 DNI)

- Higher consistent energy production
- Increasing system efficiency
- Decreasing manufacturing costs



⁽¹⁾ LCOE: Levelized Cost of Energy (includes all costs over lifetime of the project including initial investment, operations and maintenance, consumables and capital).

Lower LCOE at >6 DNI with Greater Future Potential vs. cSi & Thin Film

Flexible Deployment Options



- ▶ Scalable from 1 MW Commercial/Industrial to 20MW+ Utility Scale Plants
- ▶ Lower Fixed Capital Costs Sized to Demand
- ▶ Technology Expandable with Growing Demand
- ▶ High Energy Yield Distributed Gen near Use Points



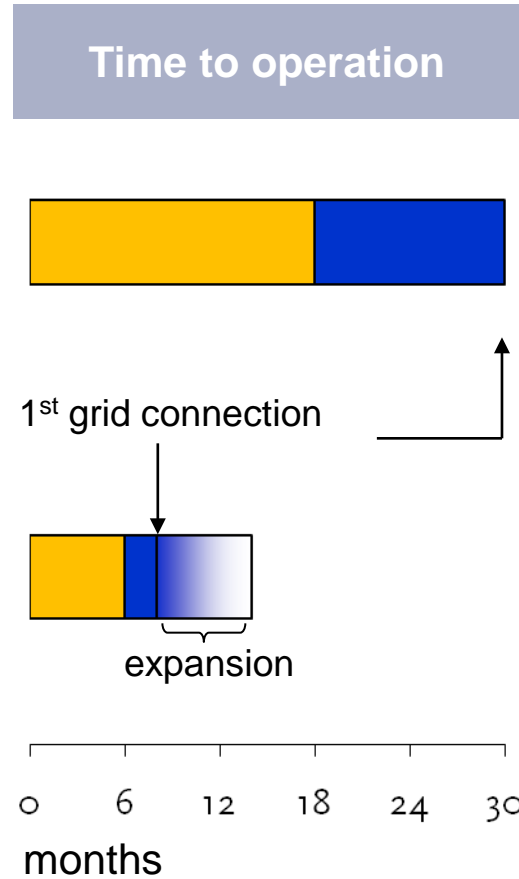
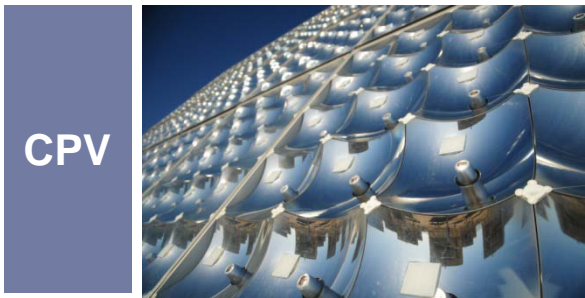
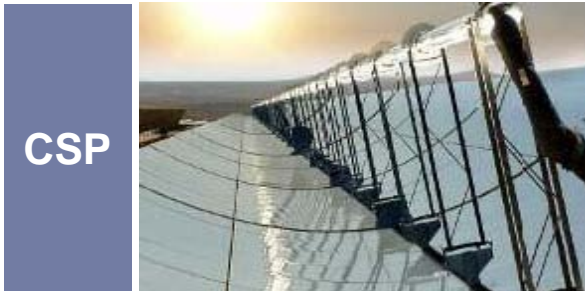
20+MW Utility Plants



1+ MW Industrial/Commercial



Fast and Flexible Deployment



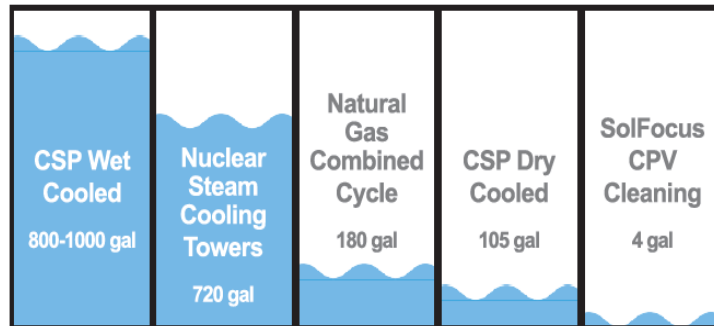
Environmentally Advantaged



- ▶ No Permanent Shadowing
- ▶ Minimal Impact to Land
- ▶ Dual Land Usage
- ▶ Flexible Layout Sites
- ▶ Best Cradle-to-Cradle Footprint
- ▶ No Water Usage for Electricity Generation



Comparison of Water Consumption per MWh



Challenges for CPV in Going to Scale

Understanding CPV Versus PV

▶ Rating Structure Challenges

- ▶ Flat Plate Standard: $1,000 \text{ W/m}^2$ GHI, 25 deg C cell temperature
- ▶ CPV: 850 W/m^2 DNI, 20 deg C *ambient*
- ▶ Different Rating Methods Require Adjustments Across Different Technologies



▶ Modeling Challenges

- ▶ Third Party Modeling Tools not Well Supported for CPV
- ▶ Dependence on “In-house” Models



Bankability of the Technology

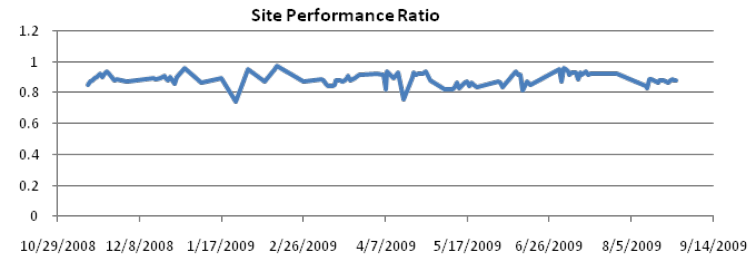
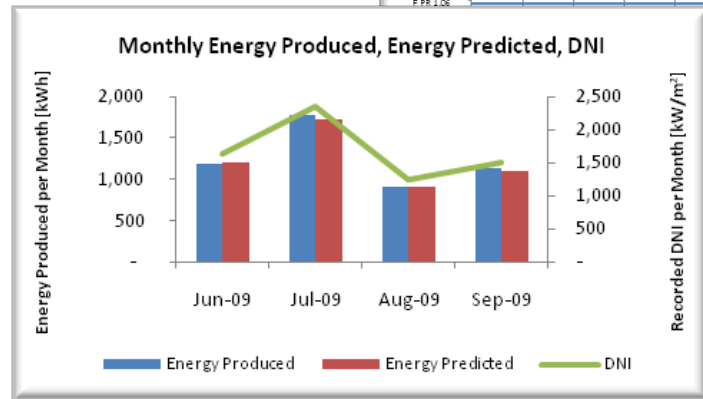
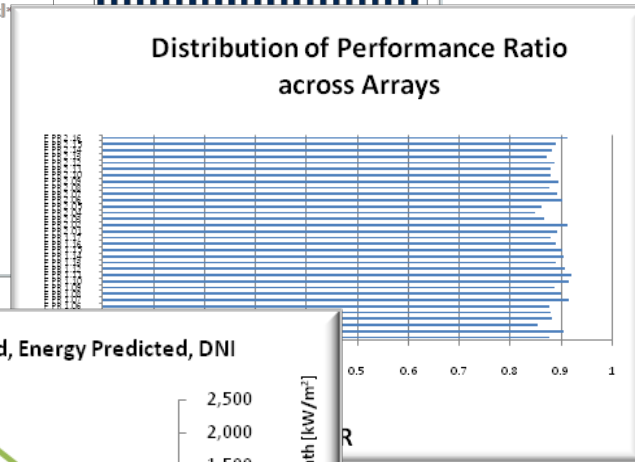
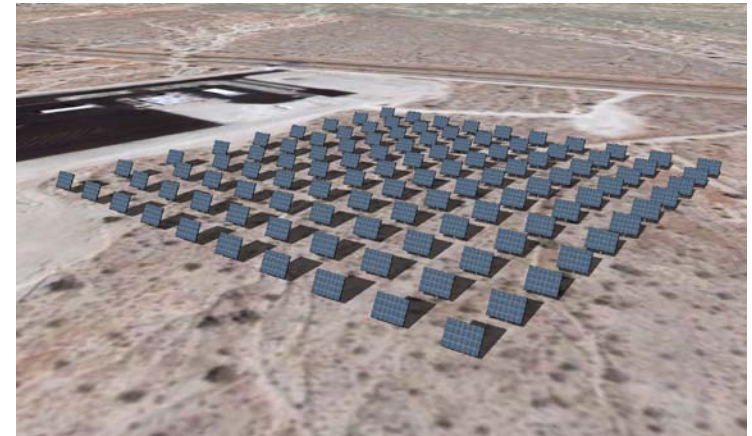
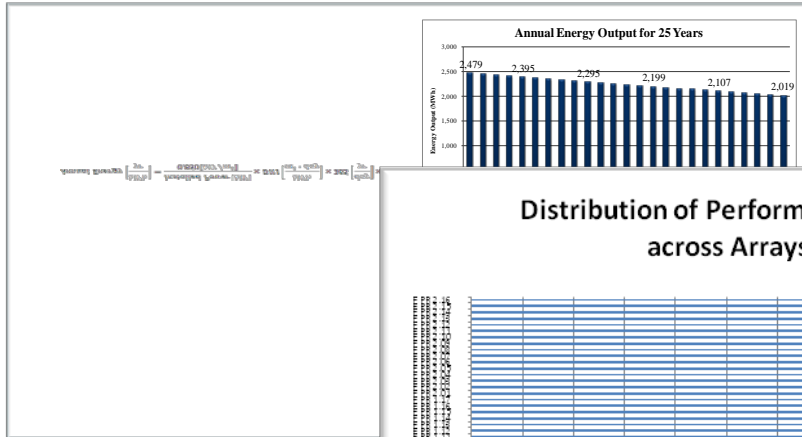


- ▶ EPC Technology Partnerships with Project Wraps
- ▶ Third Party Performance Insurance
- ▶ Proven, Reliable Product
 - ▶ Certification: IEC 62108, CEC-listed
 - ▶ Field performance data
 - ▶ Proven track record of PV cells
- ▶ Third Party Validations
- ▶ Supportive Financing Options: i.e. DOE Loan Guarantees



Key Milestone of Commercialization 1:

Validated Predictable Performance

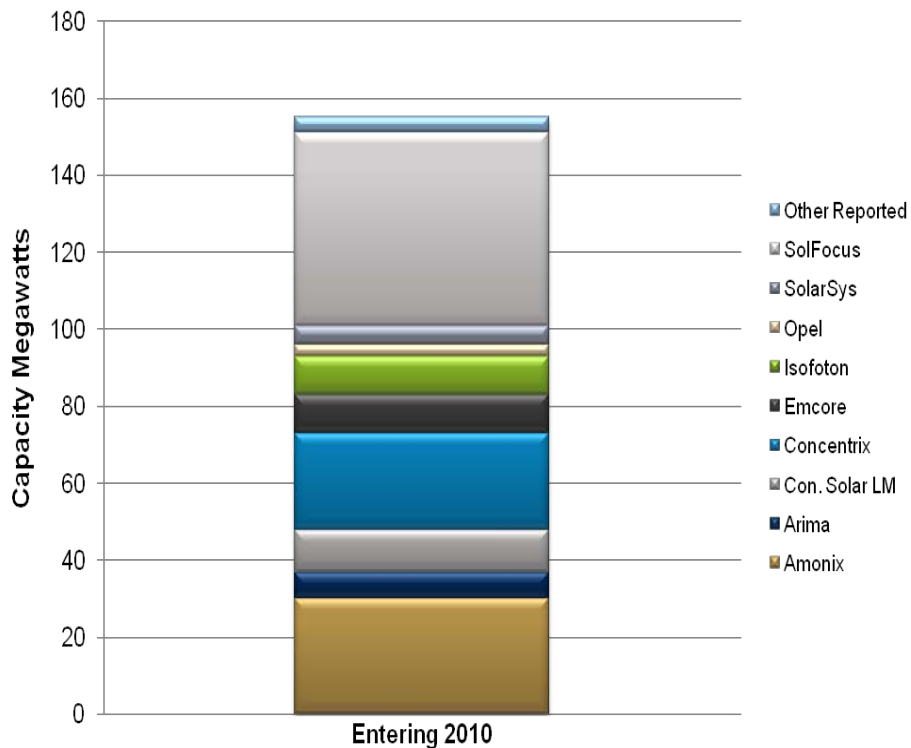


± 2-4% of Actual to Predicted Energy Performance



Key Milestone of Commercialization 2:

Volume Manufacturing & Fieldability



Source: NREL Report 11/09



Key Milestone of Commercialization 3: Validated Reliability, Certifications



CEC Listed

	Model	Technology	Notes
Energy	ATL 120/125W	Photovoltaic Skylight	NA
Amonix Inc	7000 Mega Module	10,300W High Concentration Photovoltaic Module	NA
Concentrix Solar	CX-75-III	75 Watt Concentrator PV Module	NA
Solaria	CMT-190	190W Low-Concentrating Polycrystalline PV Module	NA
Solaria	Solaria 210	210W Low Concentrating Monocrystalline PV Module	NA
Solaria	Solaria 220	220W Low Concentrating Monocrystalline PV Module	NA
Solaria	Solaria 230	230W Low Concentrating Monocrystalline PV Module	NA
SolFocus	SF-1000P	210W Concentrator PV Module	NA
SolFocus	SF-1100P	300W Concentrator PV Module	NA

IEC 62108



Case Studies:

- Evidence of Commercialization
- Validation of Value Proposition

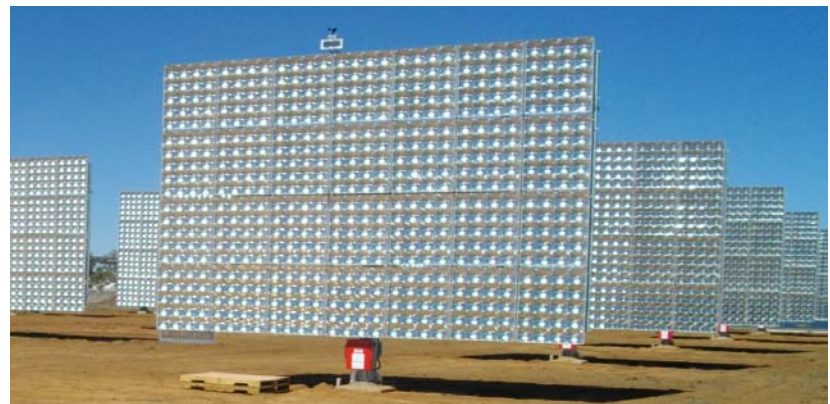
Alice Springs Airport, Australia



- ▶ Alice Springs, Australia: 7.2 DNI
- ▶ Competitive RFP
 - ▶ Beat best-in-class thin film and best in class SiPV
 - ▶ Selected based on “price and iconic technology”
- ▶ 28 Arrays for 235kW
- ▶ 30% of Airports Energy Demand
- ▶ Rapid Deployment
 - ▶ Ground breaking late May 2010
 - ▶ Completion Estimation July 2010



Note: Image of projected deployment.



Chevron Technology Ventures – 1MW



- ▶ Questa, New Mexico: DNI >7
- ▶ Ground Breaking – Imminent
- ▶ Mine Tailings Site Brownfield
- ▶ PPA to Kit Carson Electric Cooperative
- ▶ Technology Showcase and Brownfield Usage



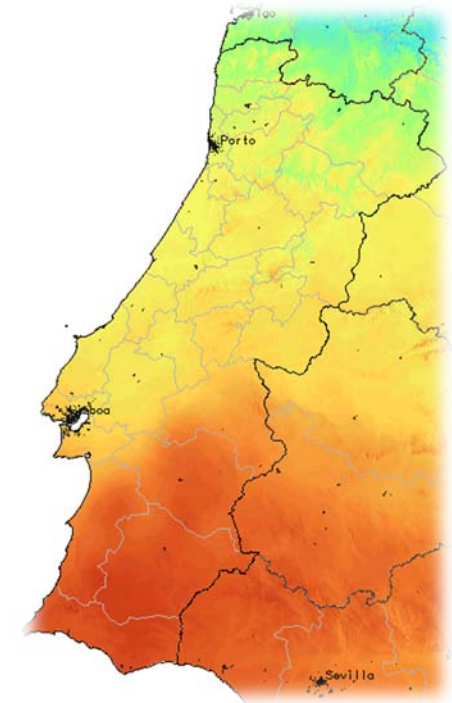
Conceptual of project to be deployed at high desert mine site in Questa, New Mexico.



Portuguese Government Project

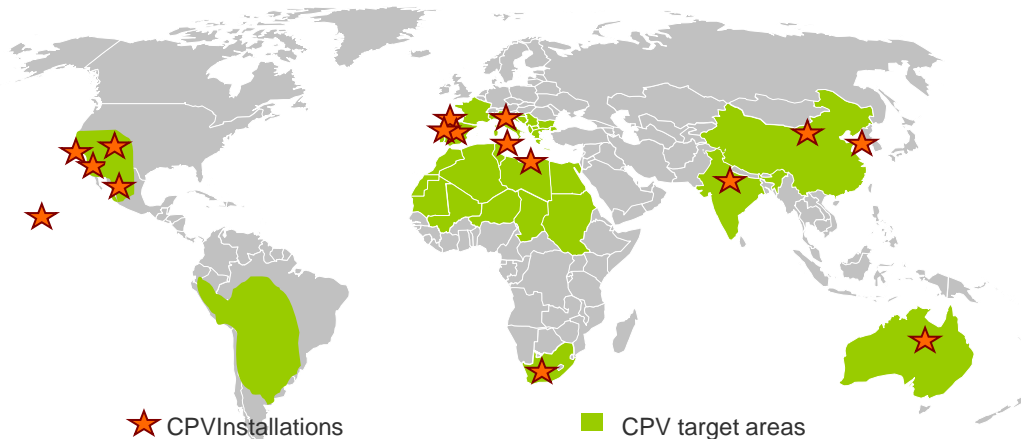


- ▶ 2020 Renewable Portfolio Standards Commitment
- ▶ CPV - Key Part of Strategy to Achieve RPS Standards with High Solar Resource
- ▶ 5MW Awarded in Preliminary Phase Projects to 5 CPV Companies
- ▶ Construction to Begin on Many in Q3 2010



Other Recent Announcements

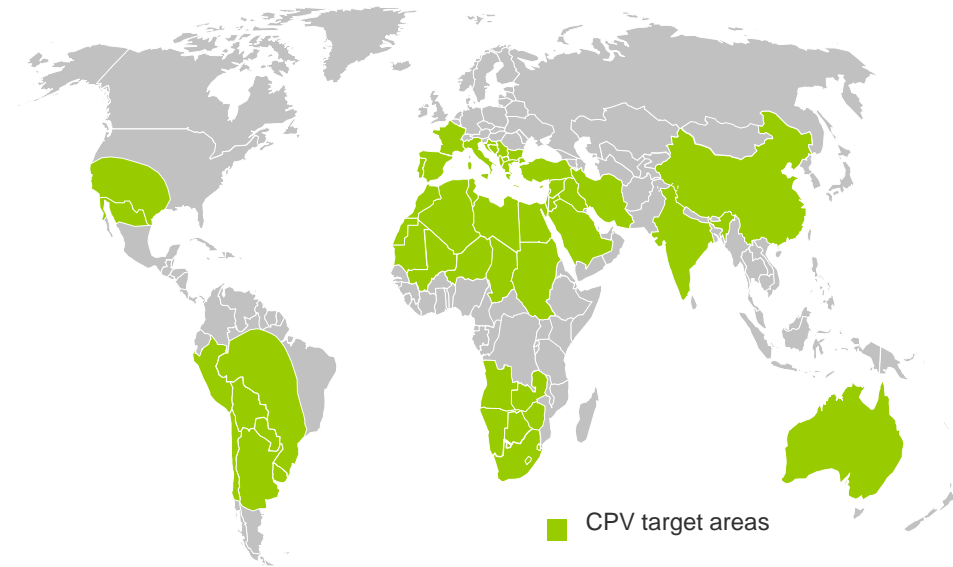
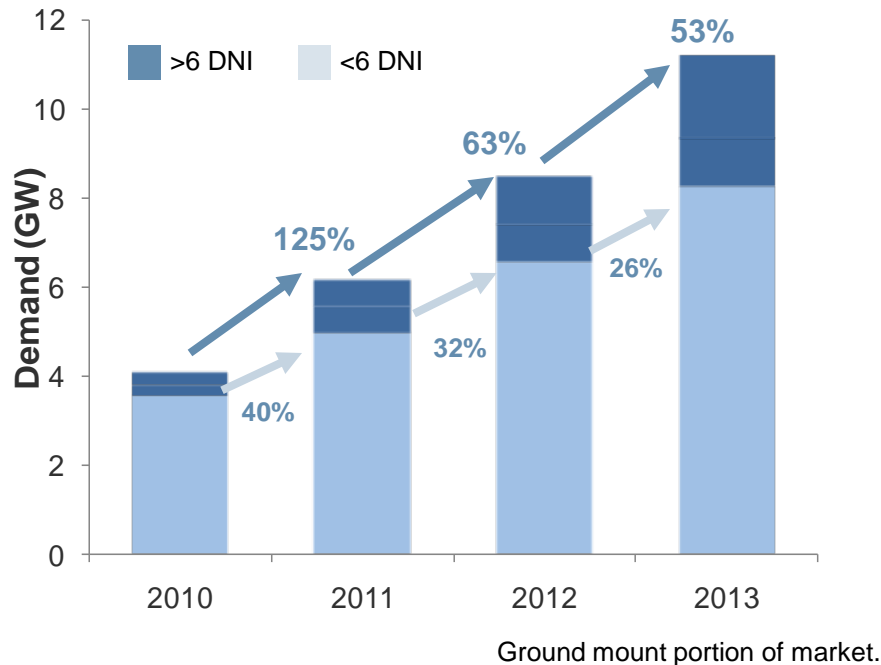
- ▶ Deployments in South Africa (Concentrix and SolFocus)
- ▶ 30MW Cogentrix Project in Alamosa (Amonix)
- ▶ Deployments in Middle East
 - ▶ 800kW ISFOC at Masdar City (Multiple CPV Technologies)
 - ▶ 200kW in Saudi Arabia (SolFocus)
- ▶ Deployments in China (Emcore and Local Suppliers)



Fastest Growth in CPV Target Market

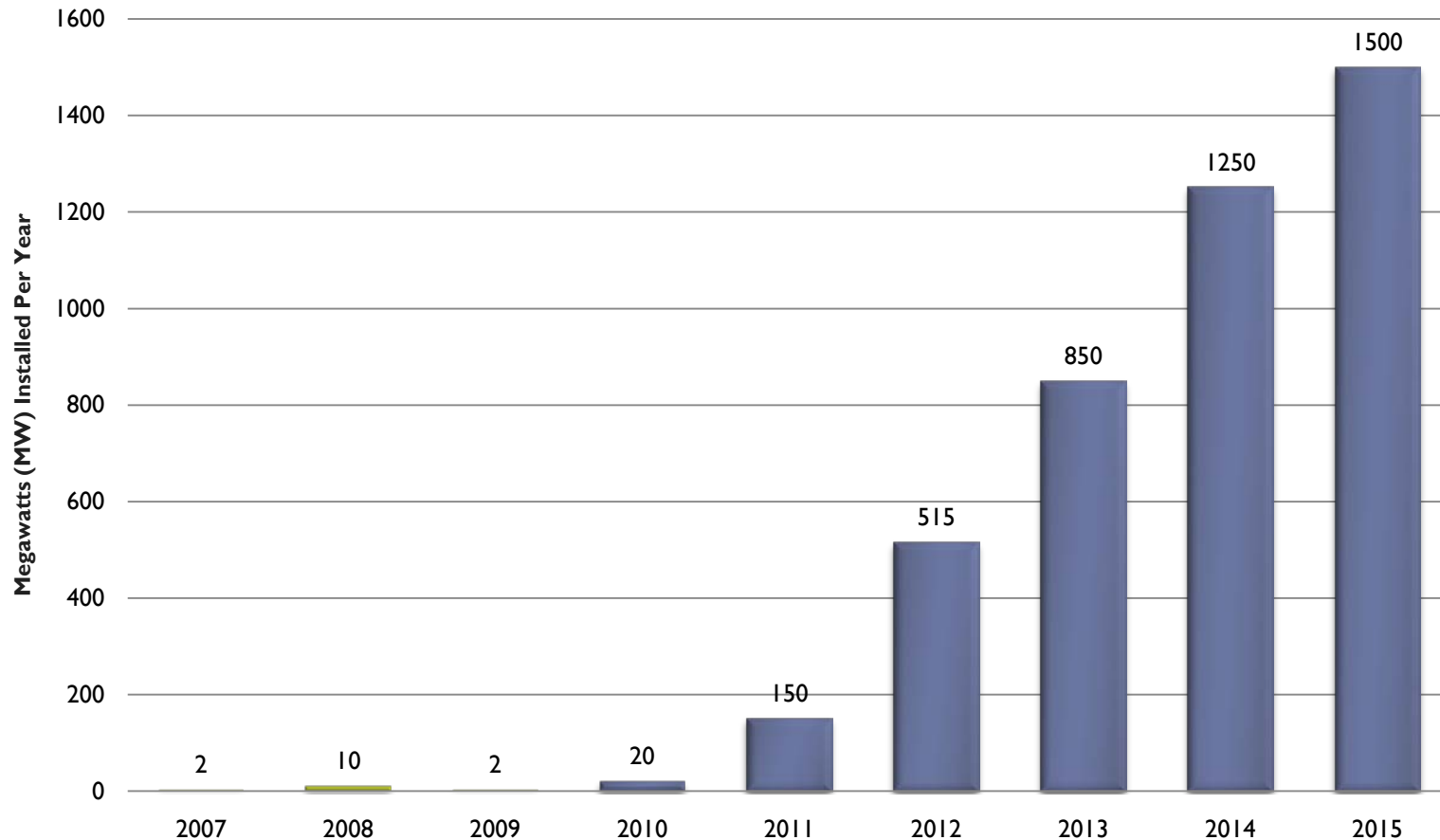


- ▶ CPV Target Areas with >6 DNI ⁽¹⁾
- ▶ Market Growing at 78% CAGR for CPV Target Geographies: 3GW by 2013



⁽¹⁾ DNI: Direct Normal Irradiance, the average amount of solar radiation received per unit area per day (kW/m²/day)

CPV Market Forecast 2010



Sources: 2007-2009 EPRI; 2010-2015 CPV Consortium 2010 Report

Thank You



www.cpvconsortium.org
nancy_hartsoch@solfocus.com

