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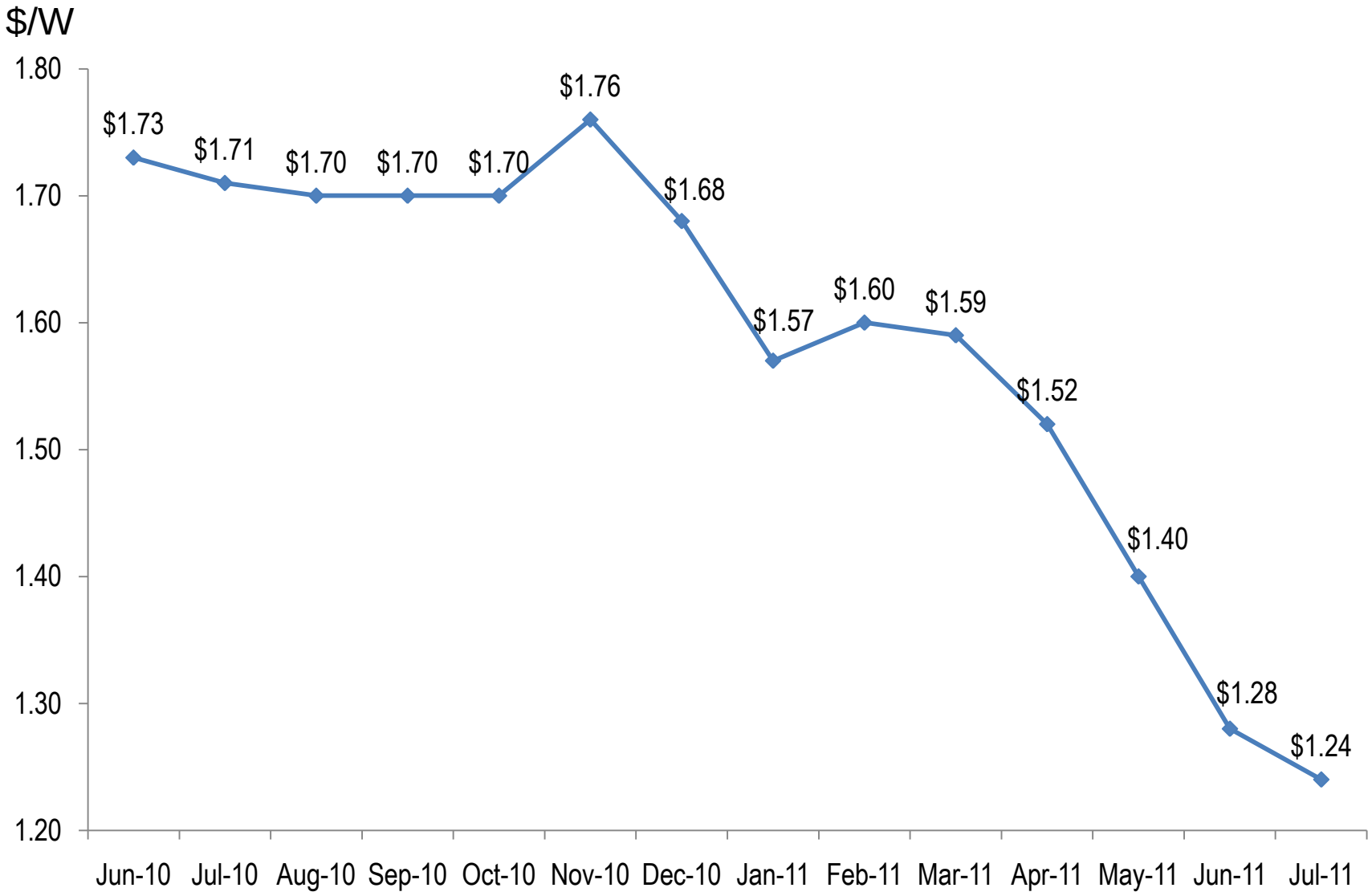
Solar Economics for Government Projects Today

Karen Butterfield SunPower 2011

Agenda

- **Market Dynamics**
  - The Cost of Solar Today
  - The Effect of Falling Prices
- **Inputs that Affect Solar Economics**
  - Rates
  - Rebates
  - Radiation
- **Case Studies**
  - Bean Center Roof
  - USAFA Ground
  - VA Carport
- **Conclusions**

Global Crystalline PV Module Spot Price Trends



Source: PVInsights, July 2011

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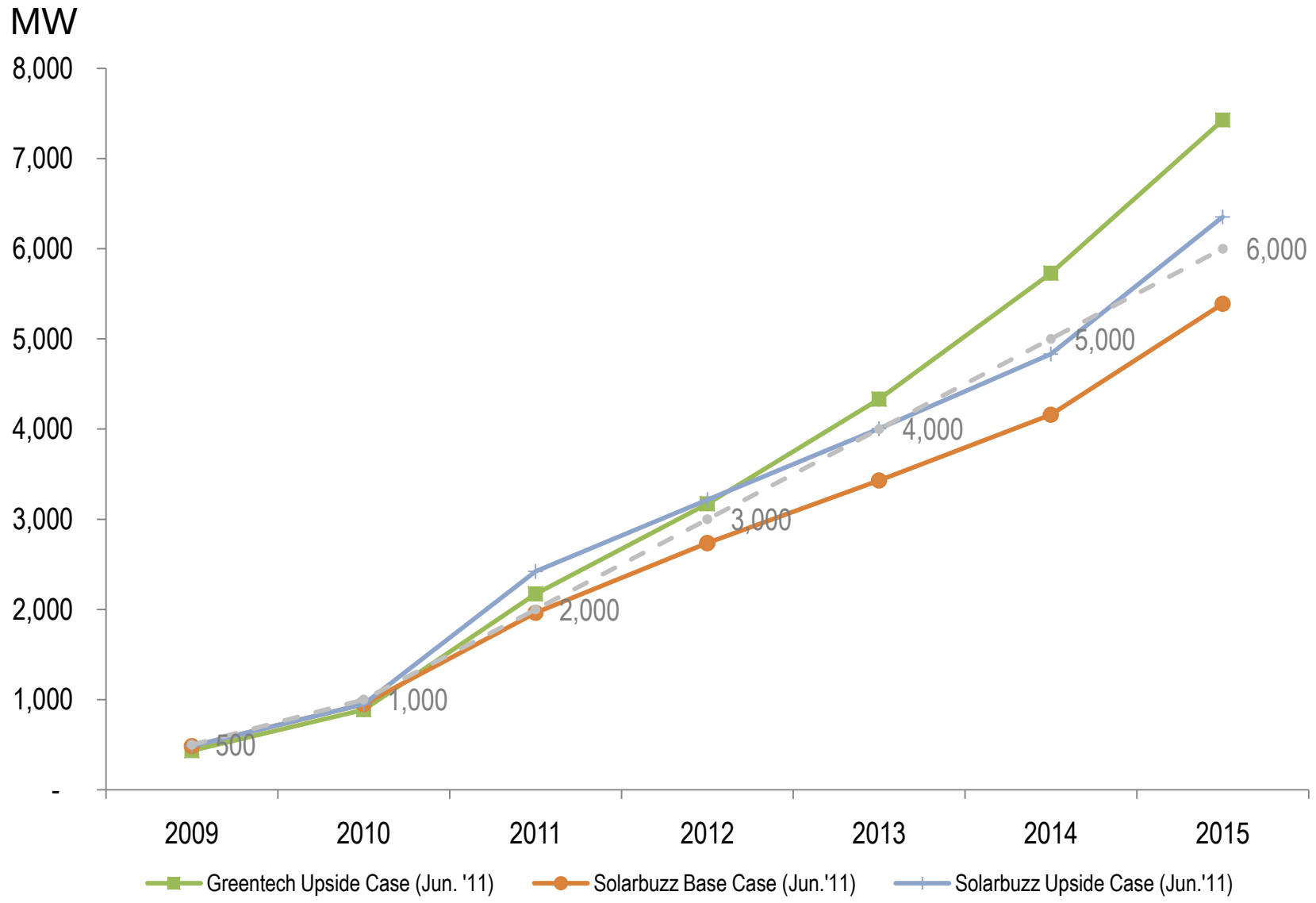
US Solar PV Market Forecasts



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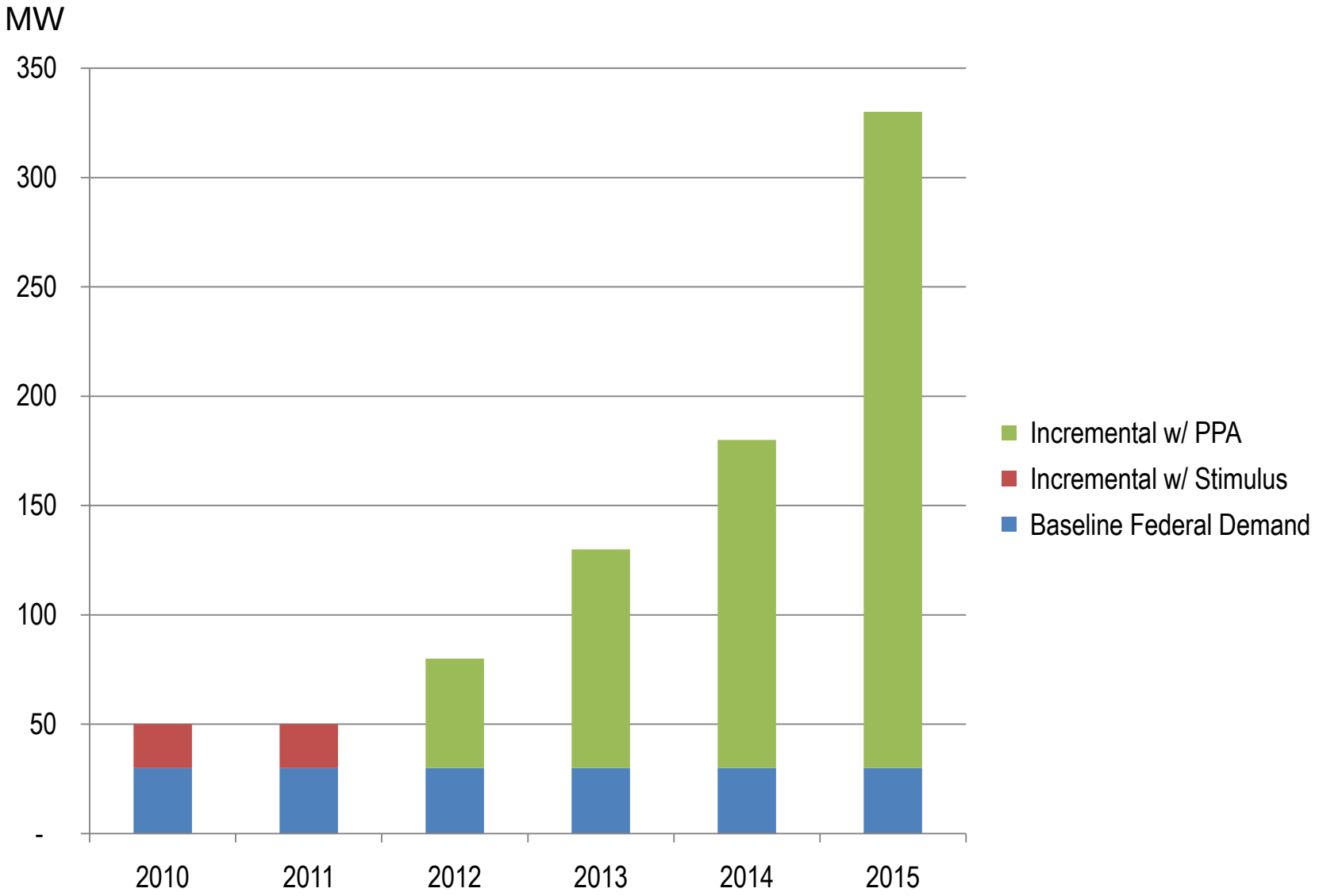
Sources: As noted. Note: Steady growth line (dotted) shown for reference.

US Government Solar Contracted or Completed



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Rates and Other Cost Inputs

	Better	Worse
Rates		
Utility Rates	> $0.12 kWh	< $0.08 kWh
Demand Charges	Low/None	High
Rate Structure	Time of Use	Fixed
Load Profile	Afternoon Peak	Nighttime Peak
Standby / Departing Load Charges	None	Significant
Other Cost Inputs		
Interconnection Limits	> 5 MW	< 1 MW
Net Metering Limits	> 5 MW	< 1 MW
Land Cost	Low/None	High Valuation
O&M Cost	< $18,000/MW/yr	No O&M contract
Economies of Scale	Large/Multi-Site	Small/Single Site

Rebates – All Incentives

	Better	Worse
Rebates		
Capacity Based Incentive (CBI)	> $1.00/W	kW Size Cap
Performance Based Incentive (PBI)	> $0.10/kWh (5yr)	< $0.02/kWh (5yr)
Renewable Energy Credits (RECs)	Compliance Market	Voluntary Market
Feed In Tariff (FiT)	Long-Term Program	Start Stop Program
Tax Incentives		
Investment Tax Credit (ITC)	Treasury Grant	Forfeited
Depreciation (MACRS)	Bonus Depreciation	Forfeited
State Tax Credits	Refundable	Forfeited
Sales Tax Exemptions	Applicable	No Exemption

Radiation and Design Inputs

	Better	Worse
Solar Generation		
Solar Radiation	High >1,200	Low <1,200
Orientation/Azimuth	South/SW	North/NE
Climate	Dry & Cold	Wet & Hot
Altitude	High	Low
Shade Objects	None	Numerous
Soiling	None	Particulates
Wind Zone	<= 90 mph	> 90 mph
Ground Only		
Topography	Flat	Sloped
Boundary Shape	East/West Axis	North/South Axis
Roof Only		
Building height	<35 ft	>45 ft
Roof Age/Pitch	New /Flat	Old/Steep
Structural Capacity	>5 lbs/ft2	<2.5lbs/ft2

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Understanding Levelized Cost of Energy

$$LCOE = \frac{\text{Total Life Cycle Cost}}{\text{NPV Energy Output}}$$

LCOE is determined by 5 critical variables:

1. System Cost ($/Wp) net of financial incentives (rebates, tax incentives, etc)
2. System Output (Watts/unit area) & module yield (kWh/kWp)
3. Cost of ownership (O&M)
4. Avoided Cost of Energy
5. Cost of land or roof space

Key Takeaways:

Comparing price per watt alone does not compare true system cost.

The cost of a solar system must be considered in terms of total cost to install & own and total energy produced over the system's lifetime.

Case Studies Roof, Ground, Carport

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Rooftop Mounted Solar Projects
Case Study Bean Center

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General Emmett J. Bean Center (GSA)

Location: Indianapolis, IN
System Size: 1.9MW
Facility Energy Offset: 20%
Contract: Roof Construction

Rates: ~ $0.076 / kWh avoided cost

Rebates/Incentives:
Recs: **$0 /**Owned by GSA
Funding Source: ARRA

Radiation/Design
Yield: 1,308 kWh/kWp
First Year Output: 2.5M kWh
Technology: SunPower® T5 Solar Tile rooftop system

Photo Courtesy Shiel Sexton

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Ground Mounted Solar Projects
Case Study USAFA

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US Air Force Academy (USAFA) Project

Location: Colorado Springs, CO
System Size: 6 MW
USAFA Energy Offset: > 11%
Contract Mechanism: Pre-paid PPA with local utility

Rates

PPA Rate: ~ $0.06/kWh

Rebates/Incentives

RECs: Split Developer/USAFA
Tax: ITC and Depreciation

Radiation/Design

Technology: SunPower® T0 Tracker
Yield: 1,942 kWh / kWp
First Year Output: 11.6M kWh

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US Air Force Academy

Parking Canopy Projects
Case Study

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Department of Veterans Affairs

Locations: Sepulveda, CA
System Size: 8.2 MW
Funding Source: VA Appropriations
Contract Mechanism: Purchase through GSA Schedule

Rates: ~ $0.12 / kWh avoided cost

Rebates/Incentives
LADWP Local Utility Rebate
RECs owned by VA

Radiation/Design
Technologies: Carports, Rooftops & Ground Tracker
Yield: 1,845 kWh / kWp
First Year Output: 7.3M kWh

Artist Renderings

Viera, FL Carports

Sepulveda, CA Tracker

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How to Drive Costs Down

- Feasibility Studies
- Pre-perform NEPA
- Avoid pre-performing Design
- Provide Drawings, Environmental Reports and Technical Specifications
- Aggregate Sites – Leverage the Scale of the Government
- Use a PPA

Conclusions

- The Cost of Solar has fallen by 50 percent since 2005
- Rebate Incentives are declining commensurately
- Tax Incentives are equal to or better than they have ever been
- Proper site evaluation for solar feasibility is critical and can be complex
- A PPA lowers costs because the tax benefits are monetized

Q&A