



# ***Lexington Solar Task Force***

## ***Public Information Session***

September 25, 2013

# Session Outcomes

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- 5 min overview of the Lexington Solar Initiative
- Solar 101 - Introduce you to the technology and market
- The Benefits – economic / environmental
- The process – next steps
- Q and A – Answer as many as we can here and now



# Sustainable Lexington & Solar Task Force



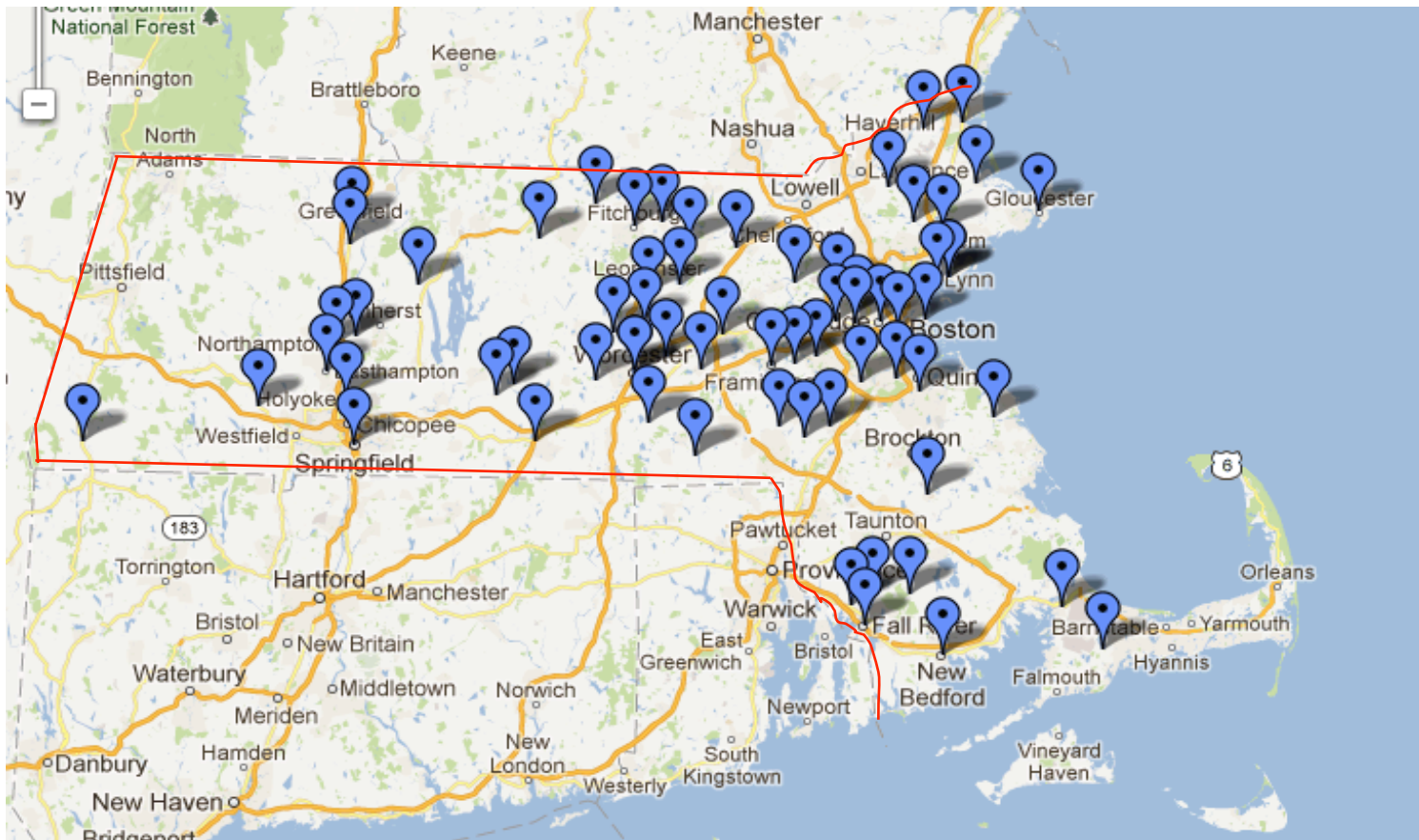
- We develop programs to enhance Lexington's sustainability and resilience in response to environmental, resource and energy challenges.
  - Stretch energy code
  - Home efficiency initiative
  - Climate action plan
- Taskforce formed in August of 2012
- The Taskforce founding members:
  - Department of Public Facilities
  - Appropriation Committee
  - Capital Expenditures Committee
  - Energy Conservation Committee
  - Sustainable Lexington Committee

 **Objective: Determine Lexington's Solar Potential.....We can save money (\$1.7mm power bill in 2012) and reduce CO2!**



# Peer Review – What have other towns done?

- Over 50 towns in MA have solarized Municipal or School buildings.



 **Solar technology and contracts, are established and tested.**



# Solar Potential – Lessons Learned

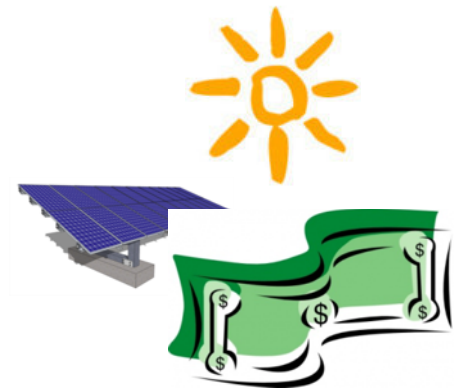
- Standard practice has been for communities to partner with a Solar Developer.
- The developer pays for the equipment, construction, maintenance and insurance.
- The town benefits from buying low cost solar electricity – 20yr agreements are typical.



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**With no capital investment, Lexington is cash flow positive on each kWh the system produces in Year 1.**

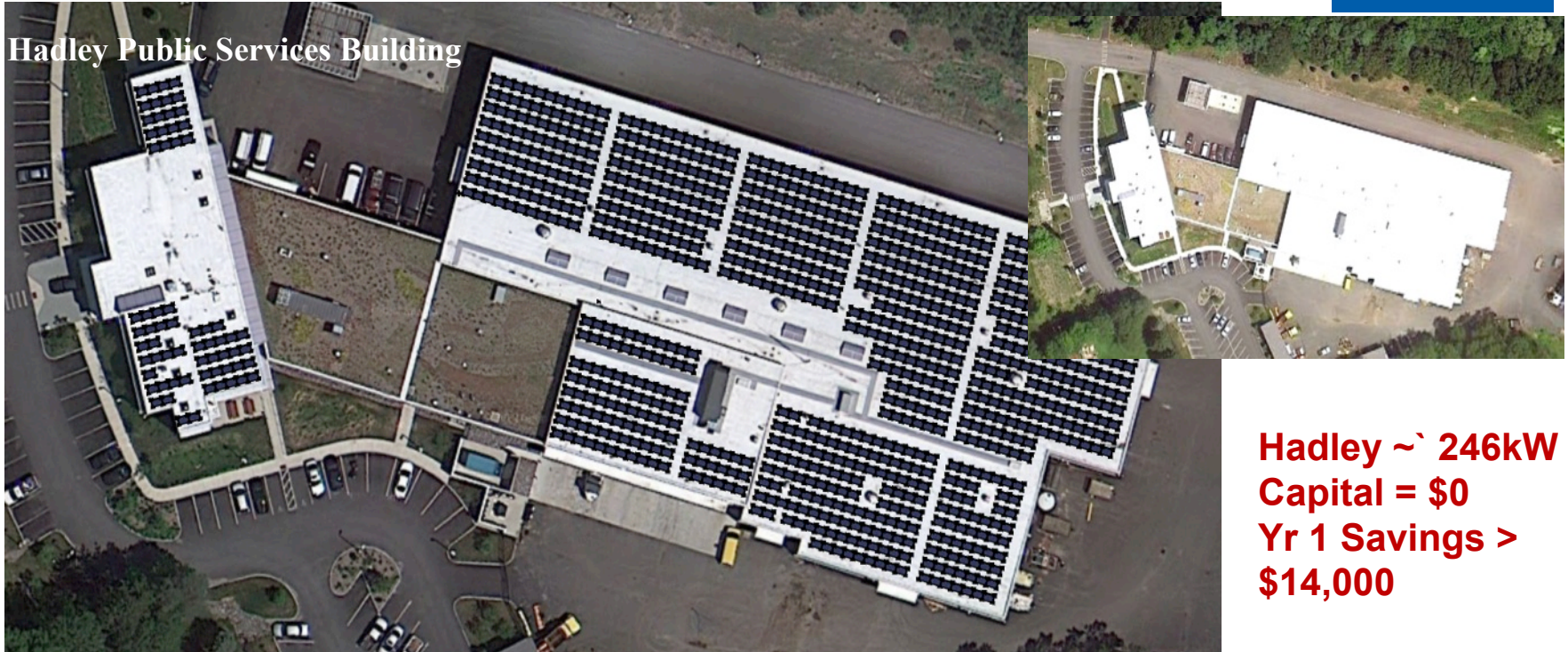




# Solar Potential - Analysis

- Partnering with DPF, we have worked with a 3<sup>rd</sup> party owners agent to validate our technical and economic analysis.

CADMUS



**Hadley ~` 246kW  
Capital = \$0  
Yr 1 Savings >  
\$14,000**

**Extending across Town Property, Solar Potential ~ 2.6MW – 5.6MW**



**\$2 - \$14million in 20yr savings.....\$0 Capital**

**CO<sub>2</sub> reduced by 114 million lbs. or 404 cars off the road.**



# Our Current Status

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- ✓ Completed preliminary technical and commercial due diligence.
  
  - ✓ Proposed an adjustment to Town By – Laws to enable purchase of Solar Electricity should the Town so choose.
    - Won the support of Selectmen key municipal committees and departments.
    - Won the support of Town Meeting - Warrant Article #29 was unanimously supported.
  
  - ✓ With Selectmen support and in concert with DPS we have developed a draft RFP – under final review.
    - RFP is an information gathering tool.
    - The RFP does not bind or commit the Town to any action.
- ➔ Today! An information session to inform and collect feedback.



# Agenda

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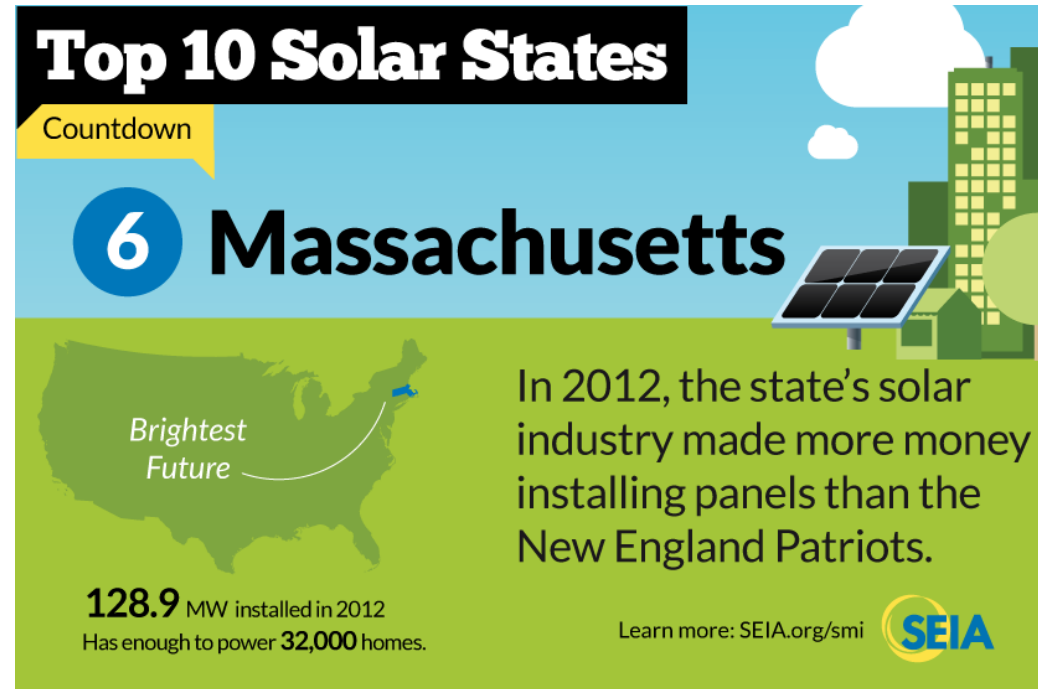
- 5 min overview of the Lexington Solar Initiative
- **Solar 101 - Introduce you to the technology and market**
- The Benefits – economic / environmental
- **The process – next steps**
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# Solar Industry Overview

- Rapid growth
- Lower costs
- Higher efficiency
- Higher reliability
- Longer life
- Finance options

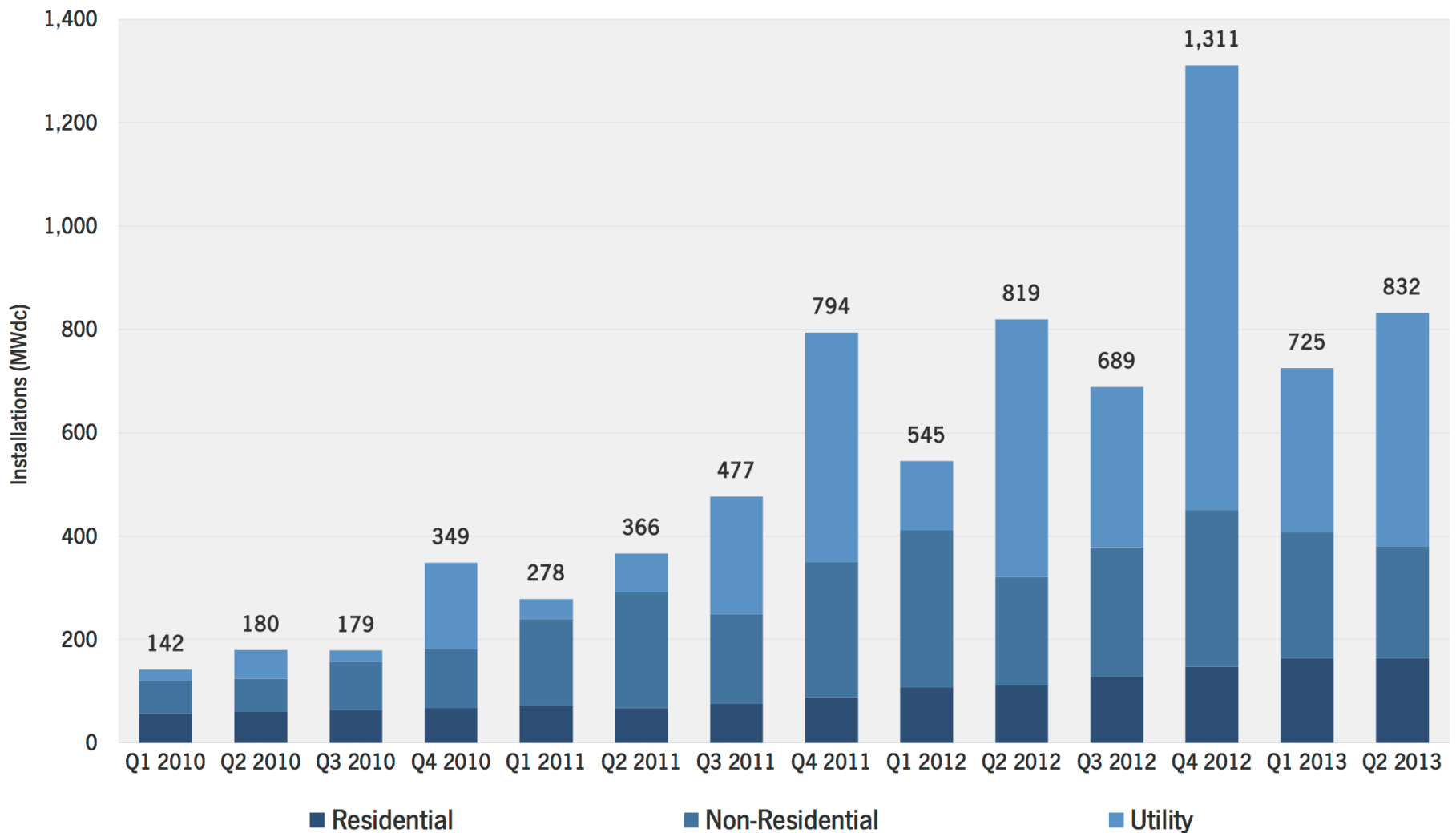


- 3.3 GW US Solar PV installations in 2012  
– 1.75 times 2011's record pace

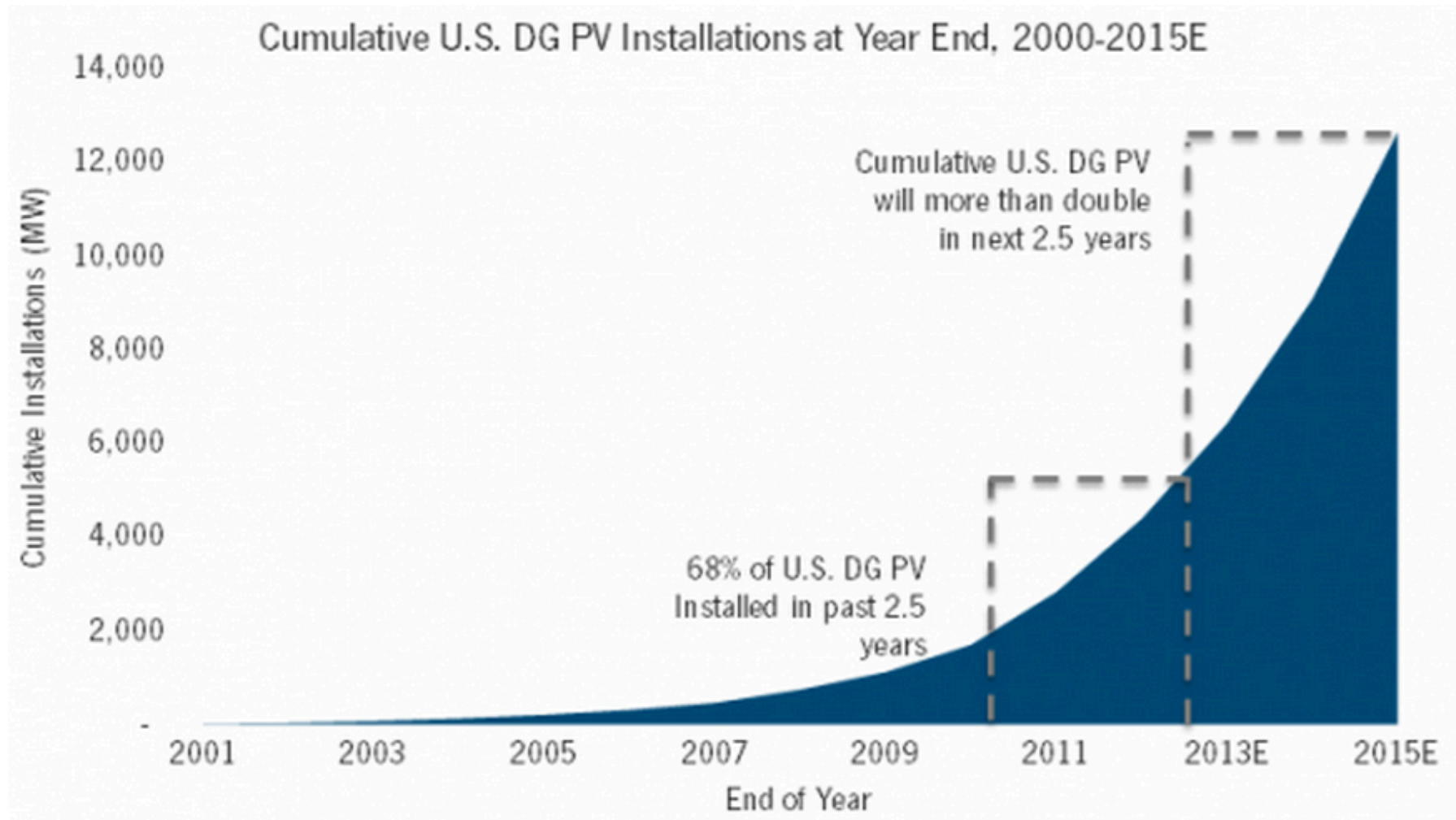


# Solar Industry Overview

Figure 2.1 U.S. PV Installations by Market Segment, Q1 2010-Q2 2013

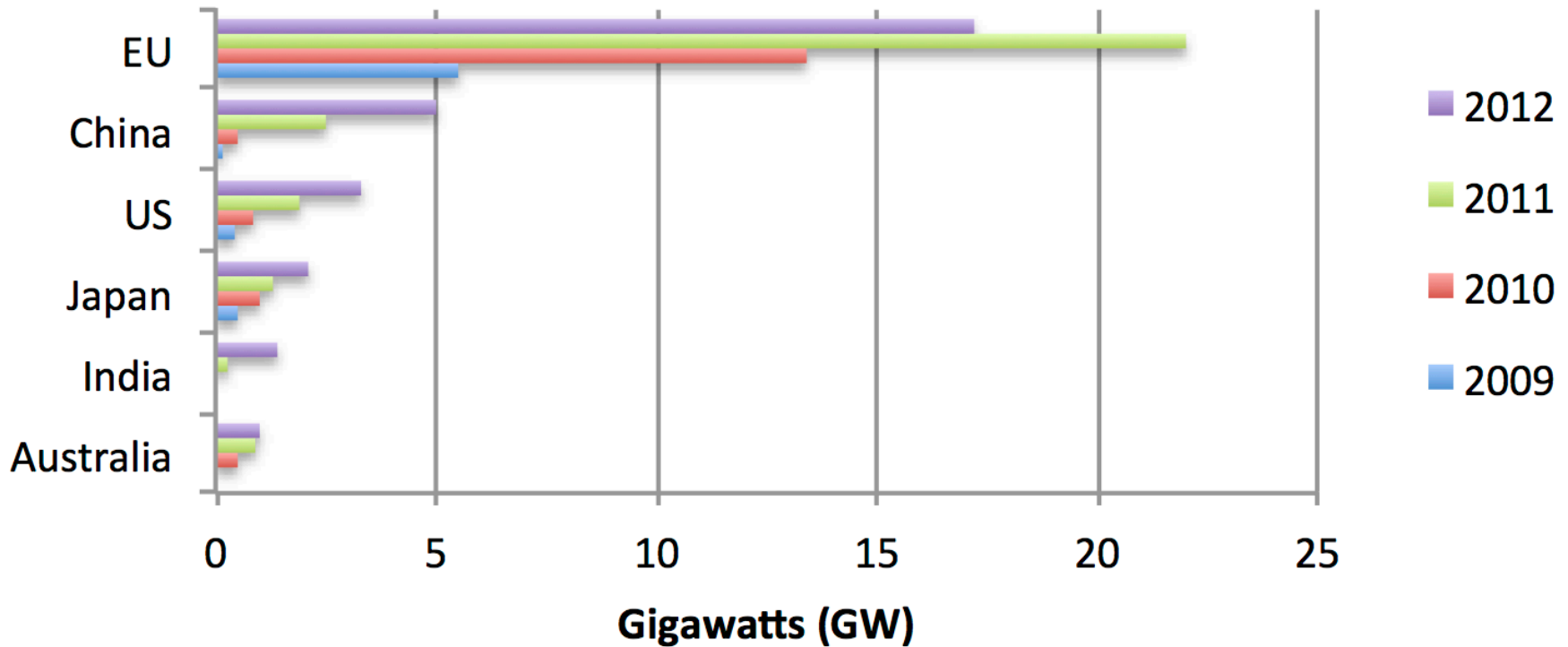


# Cumulative Growth Rate



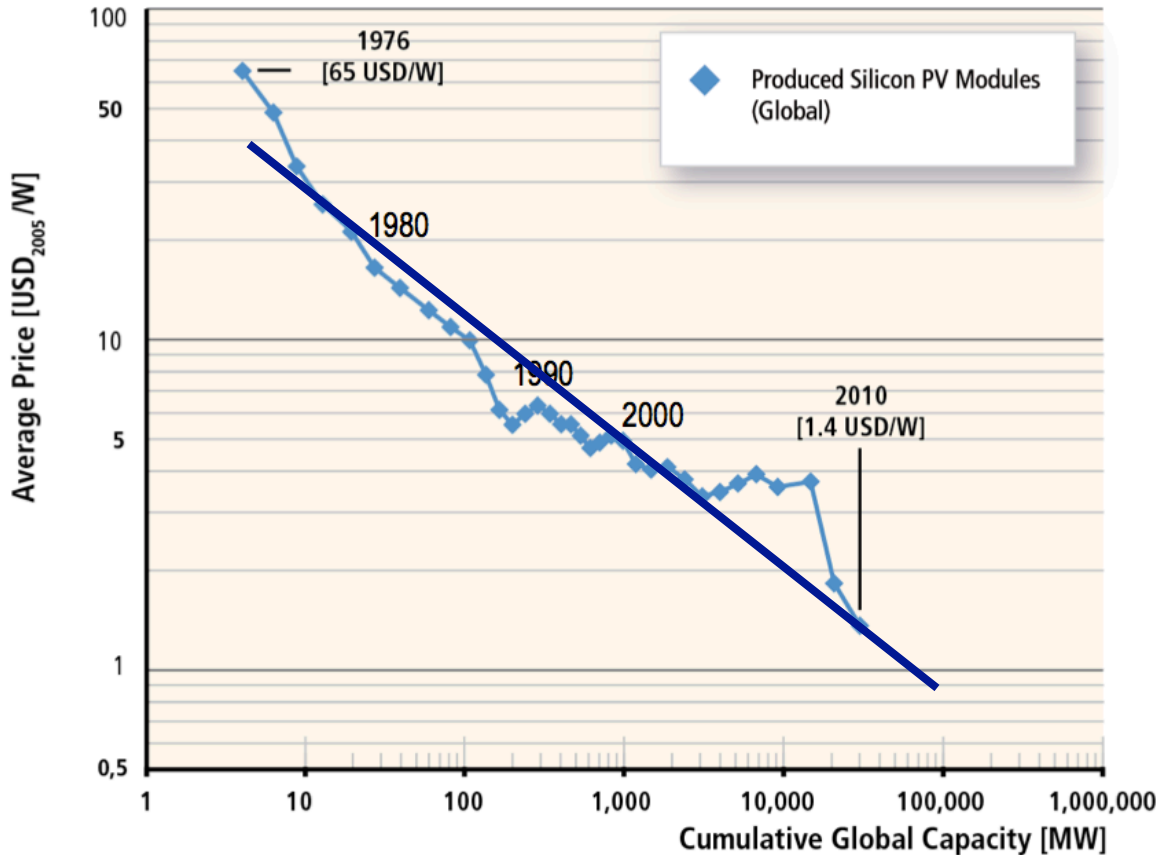
# Global Growth in Solar

## Solar PV New Capacity Additions



# Solar Panel Cost Trends

## Global Installed Solar Capacity



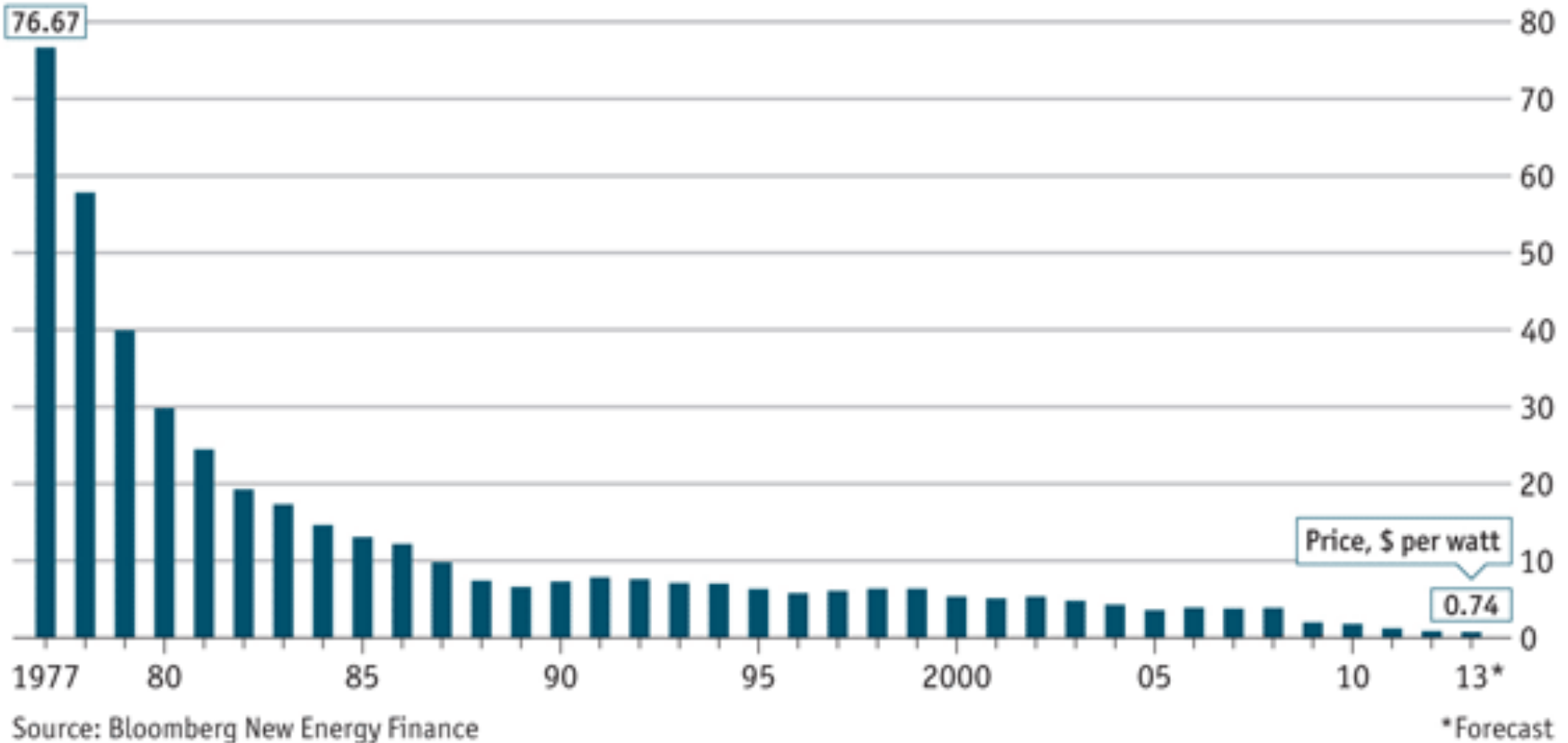
- 40 year trend
- Learning curve
  - Solar costs decline with higher volume production





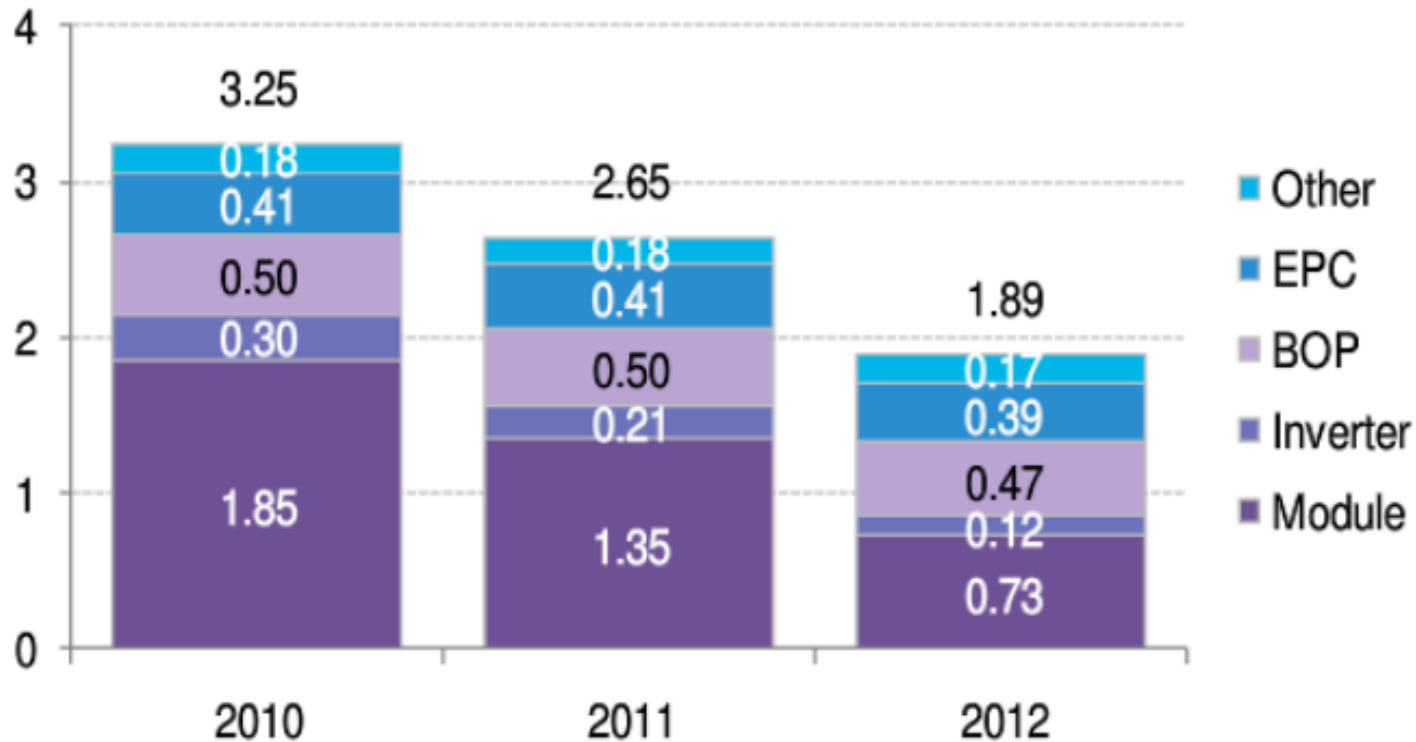
# PV Module - Cost Trends

Price of crystalline silicon photovoltaic cells, \$ per watt



# PV System Cost Trends

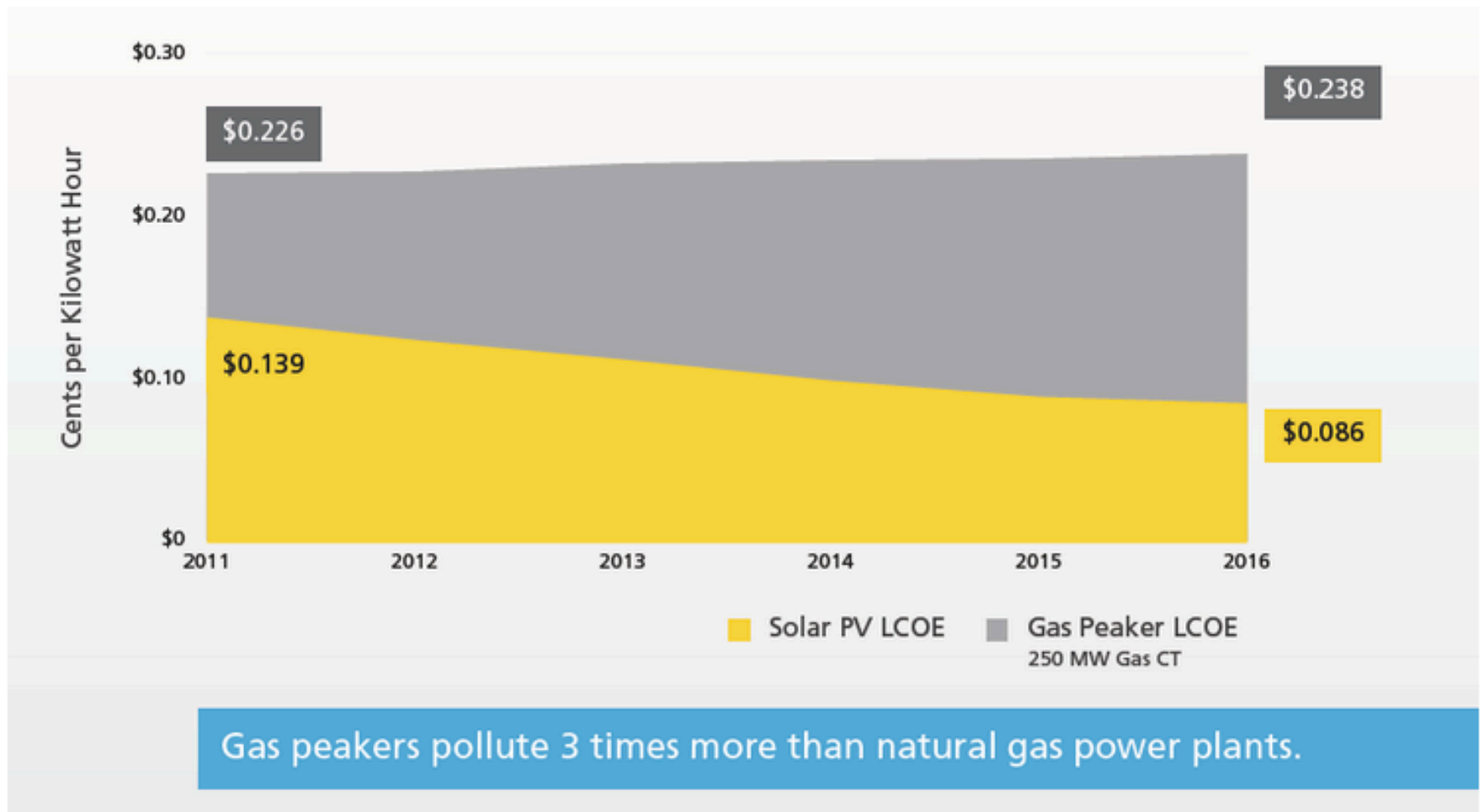
CAPEX – BEST-IN-CLASS COST OF GLOBAL UTILITY-SCALE PV, 2010-12, (\$/W)



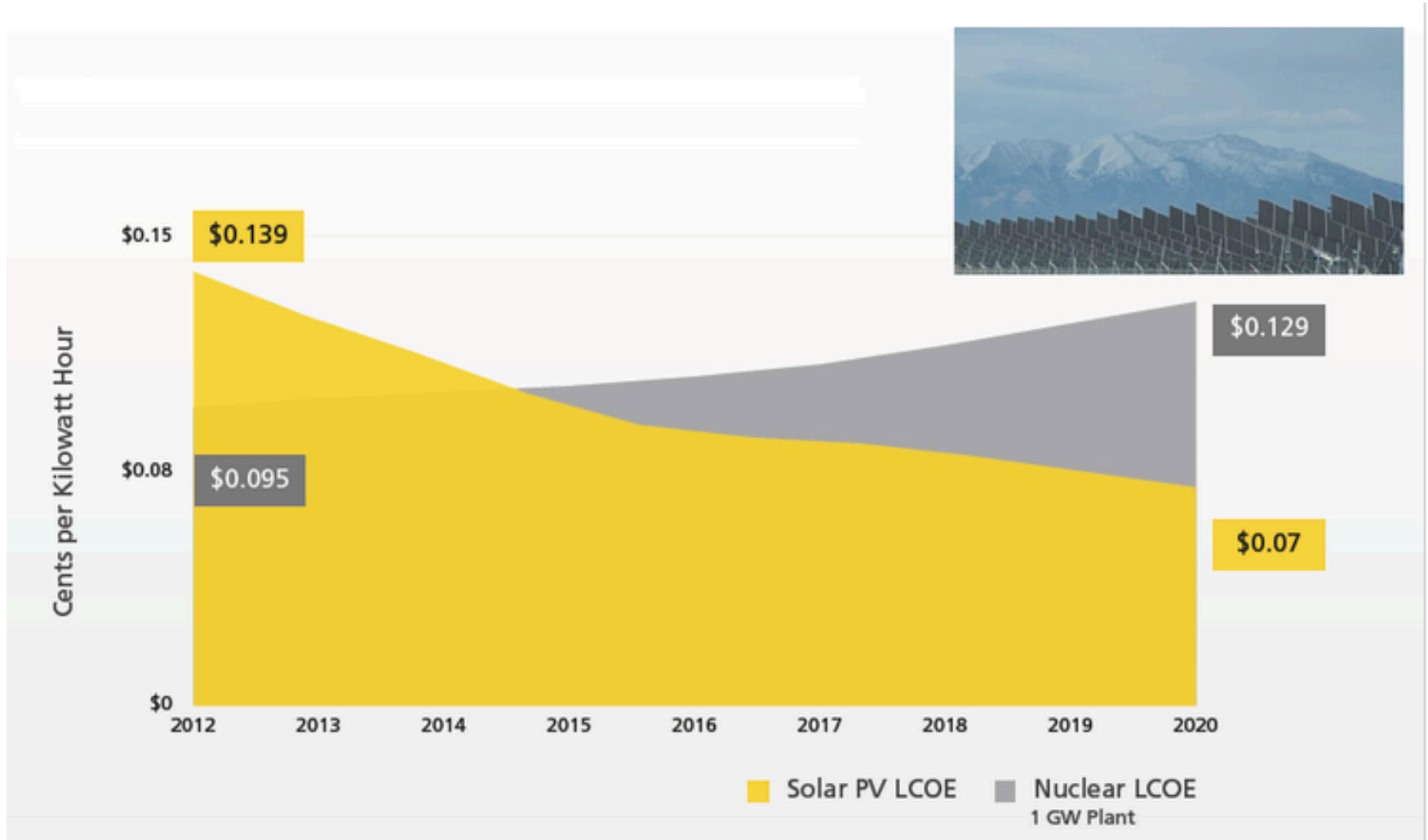
Source: Bloomberg New Energy Finance



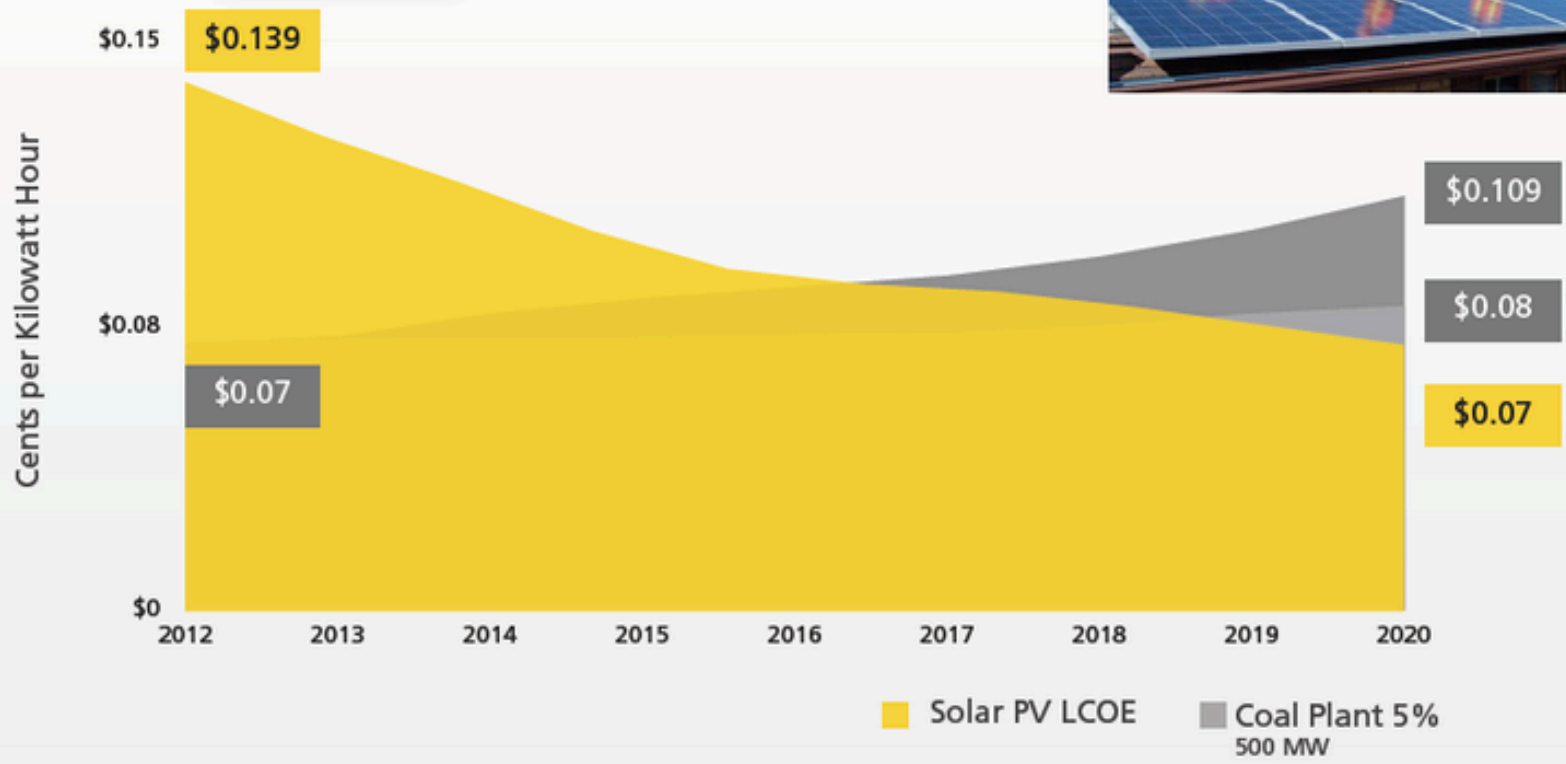
# Solar costs lower than Gas Peakers



# Solar Costs and New Nuclear

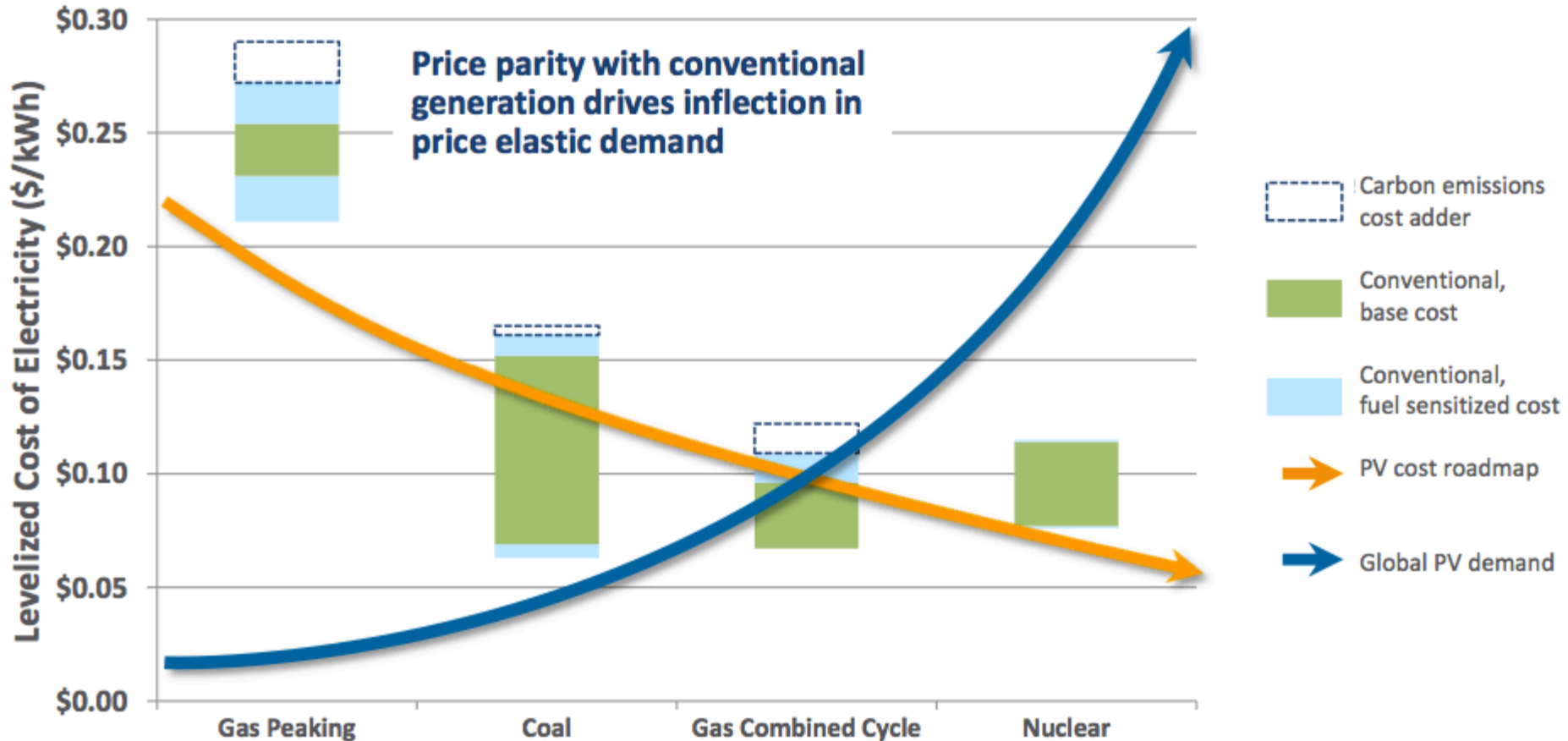


# Solar Costs vs. New Coal

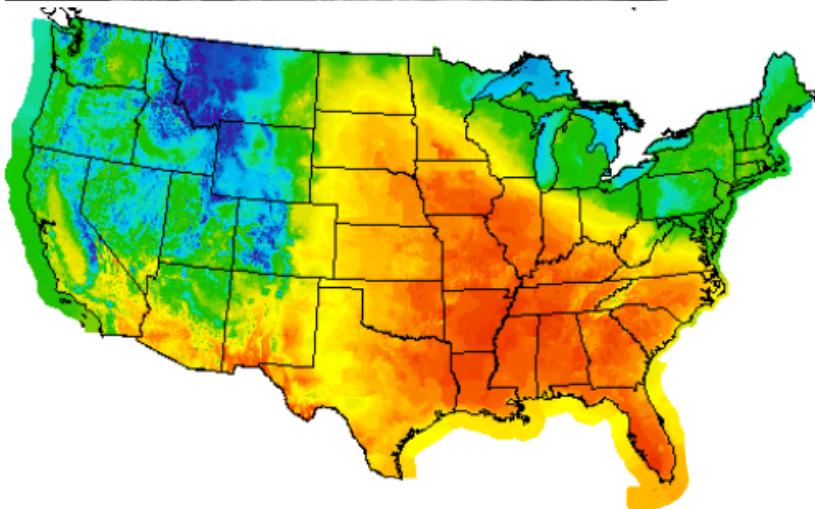
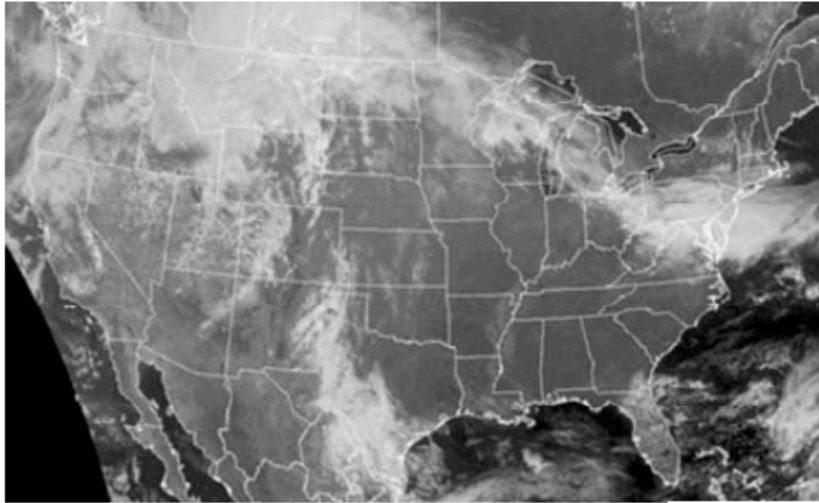




# Solar Inflection Points

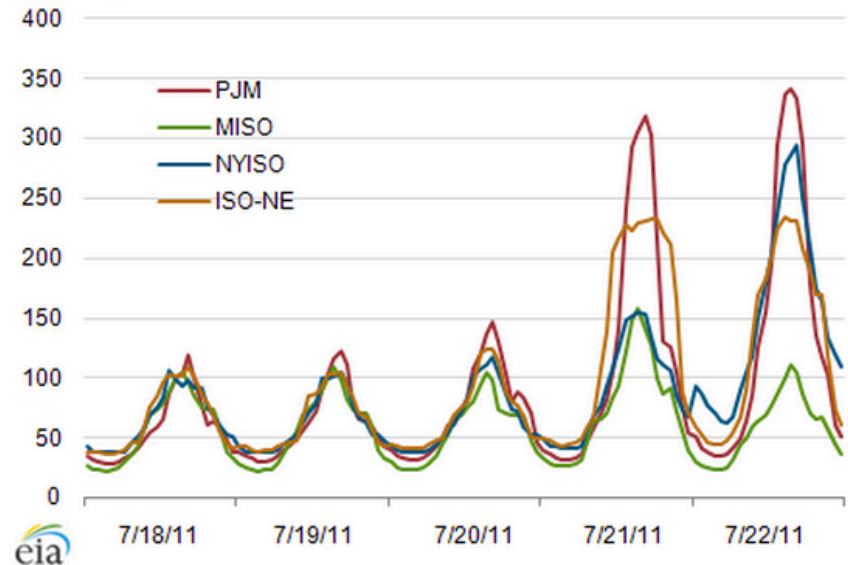


# Solar and Heat Waves



## Solar Power when it is needed most

Hourly day-ahead power price  
\$ per megawatt hour



eia



# Solar Power Peak Demand

## Actual production



■ Solar: max. 22.4 GW; 1.1 TWh (Fr 25 May, 12:45)

■ Wind: max. 9.1 GW; 0.65 TWh

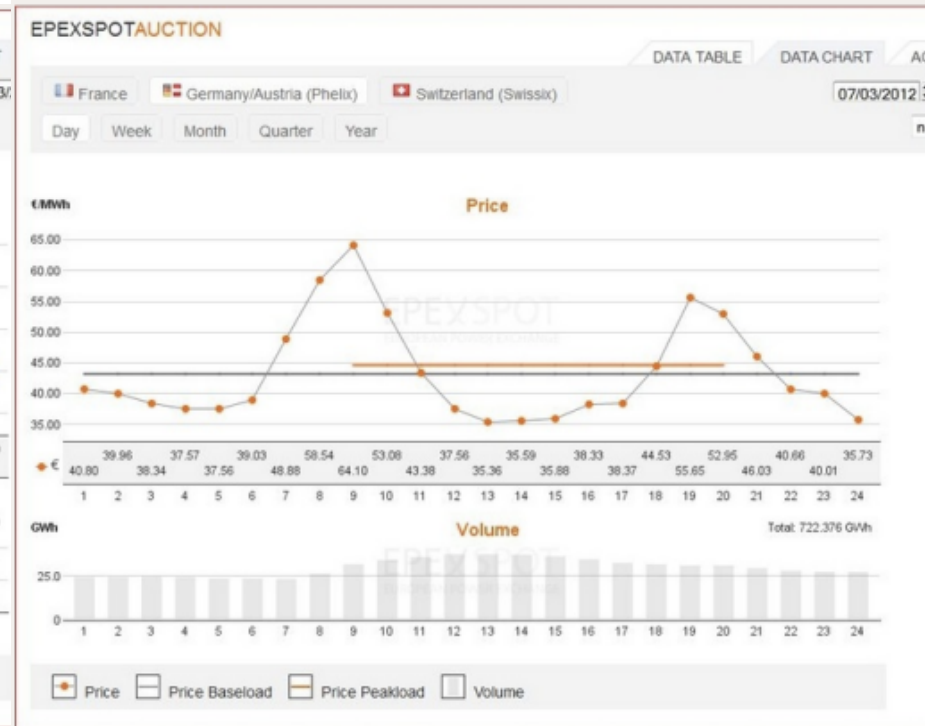
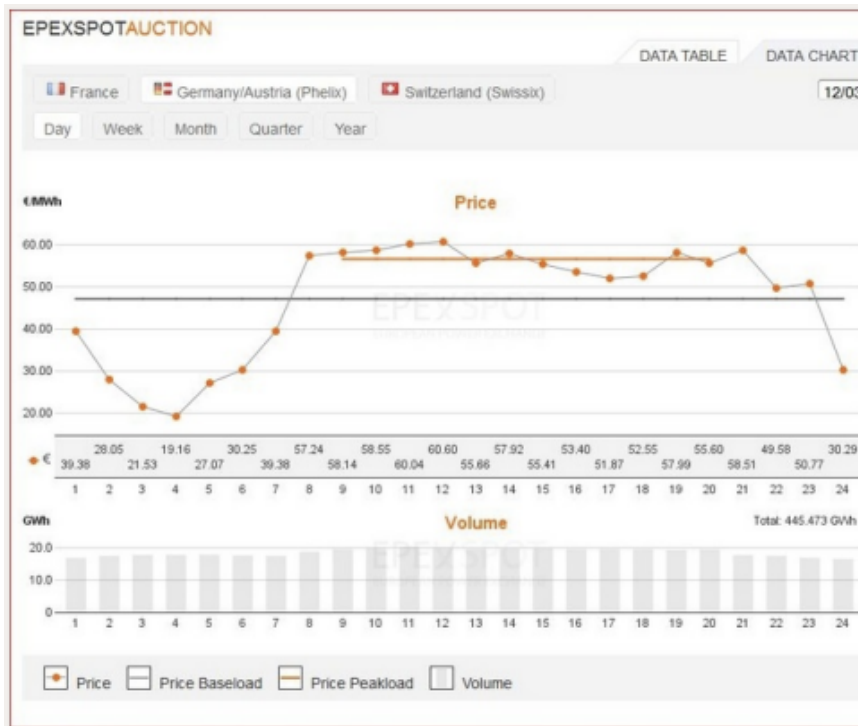
■ Conventional: max. 47.0 GW; 6.0 TWh

Graph: Bruno Burger, Fraunhofer ISE; Data: EEX, <http://www.transparency.eex.com/de/>



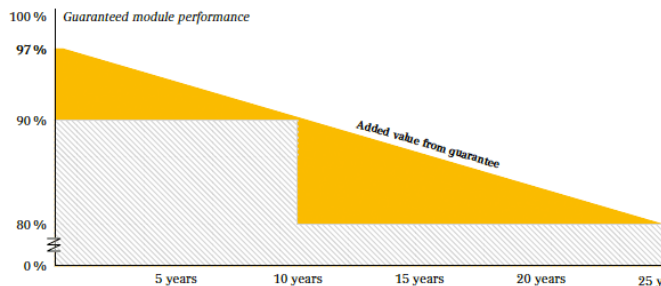
# Solar Lowers Peak Power Prices

- German peak power prices dropped 22% between March 2008 & March 2012 after installing 20 GW



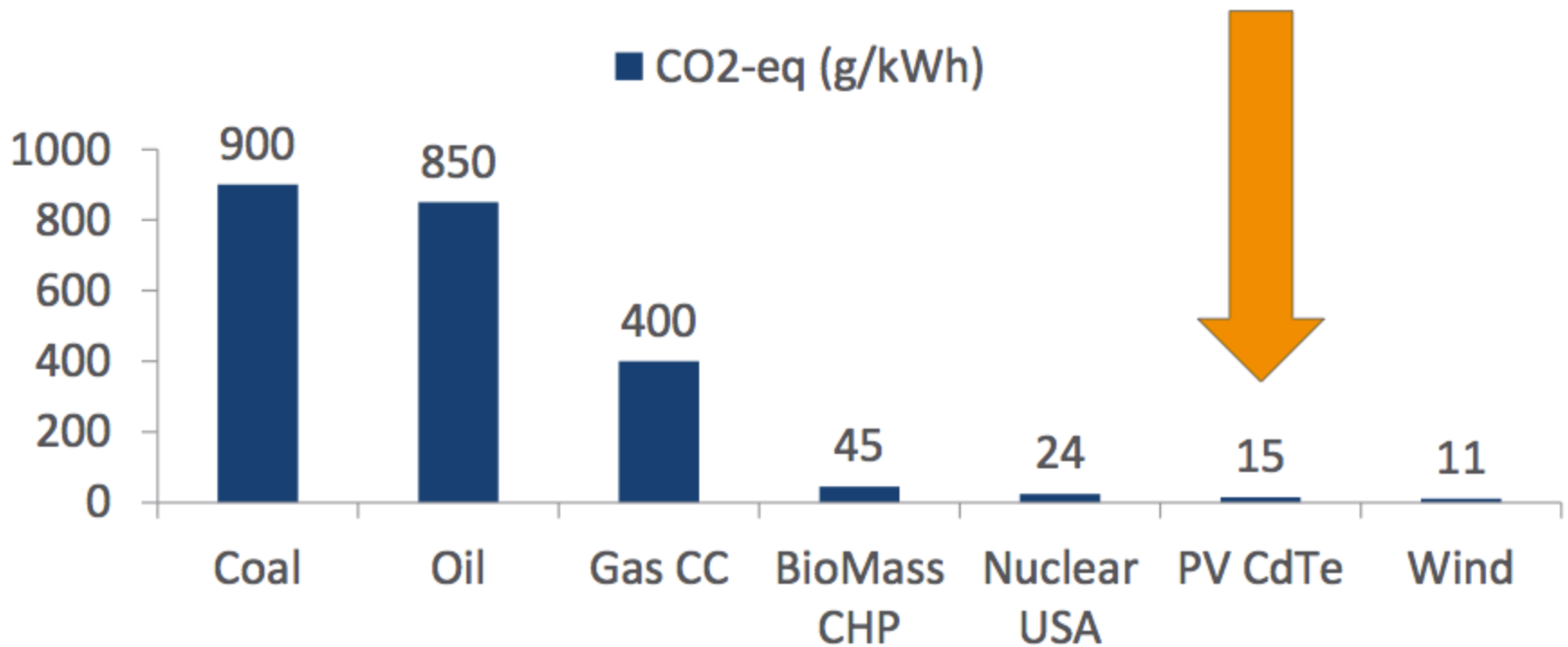
# PV Solar Reliability

- 30+ year expected lifespan for PV modules
  - 25 year 80% performance warranty
  - 0.3% actual annual power decline
- Inverter reliability and costs improving
  - 10 year warranty now standard
  - \$0.22 / watt moving toward \$0.14 / watt in 2016
- Operations & Maintenance costs declining
  - Annual cost of \$20 / kW (10% reduction in last year)



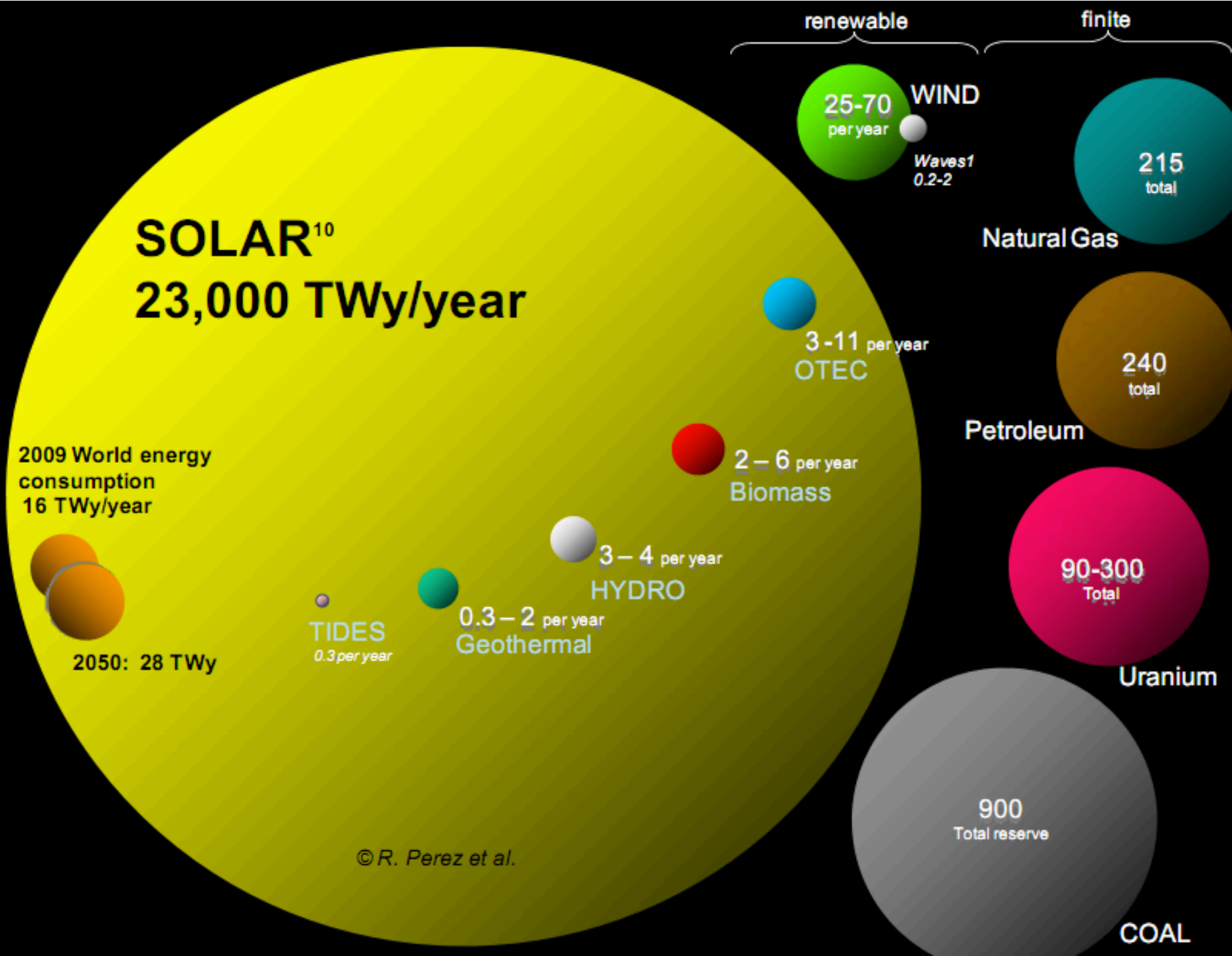


# Environmental Footprint

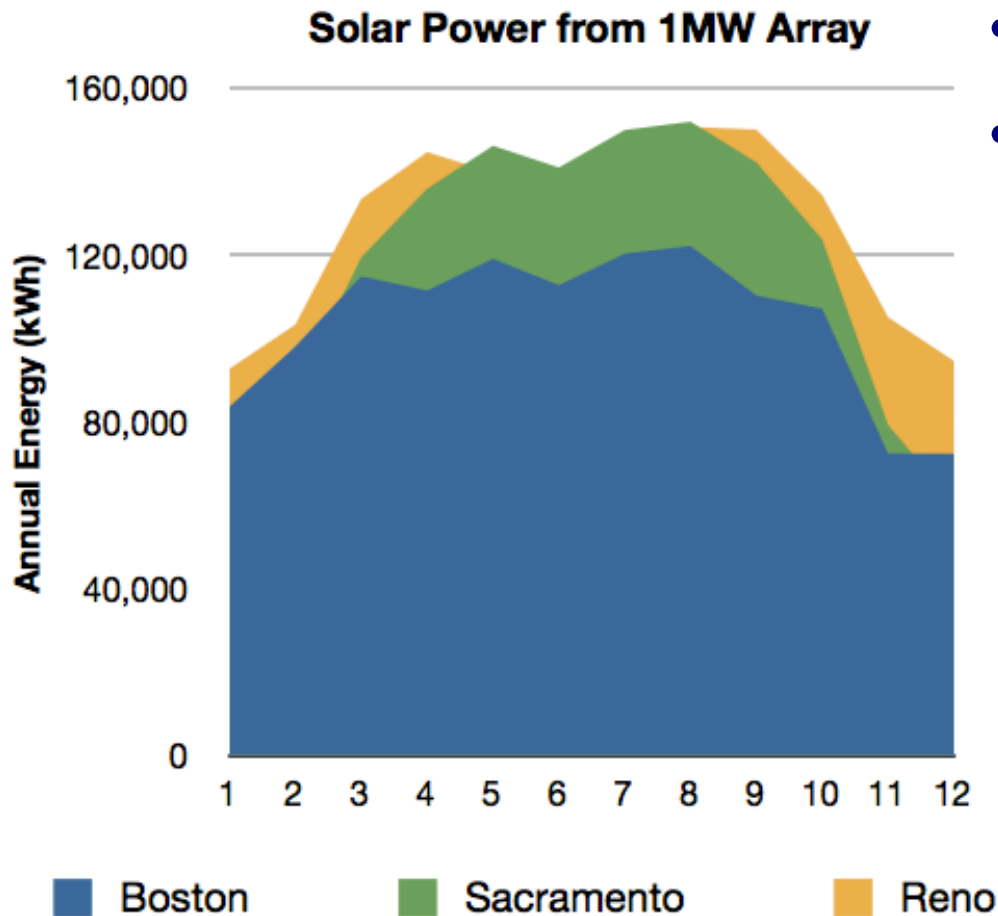


Source: ExternE project, 2003; Kim and Dale, 2005; Fthenakis and Kim, 2006; Fthenakis and Alsema, 2006; Fthenakis and Kim, in press. de Wild-Scholten & Schottler, 2009.





# Solar Energy Potential



- Location, Location...
- Lexington has excellent solar potential
  - 1.5x more than Germany
  - 11% less than Sacramento and
  - 19% less than Reno
  - 1,243 MWh / Year



# *Solar Energy Performance*

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- Flat roof mounted system
  - 7 kW system size / 1,000 square feet\*
  - Generates 8,200 kWh / year
- Ground mount system
  - 250 kW system size / acre
  - 1 MW system generates 1,171,000 kWh / year
  - 180° solar azimuth, 15° fixed tilt angle
- Residential rooftop system
  - 13 kW system size / 1,000 square feet\*
  - Generates 16,200 kWh / year

\*Usable area – no shading



# ***Federal Solar Incentives***

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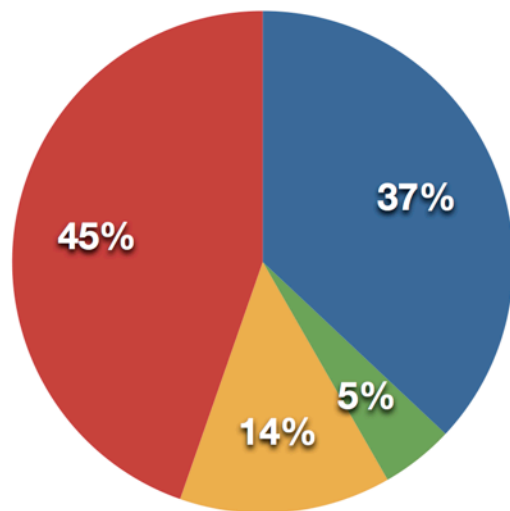
- Federal Investment Tax Credit
  - 30% of total system cost
- MACRS Depreciation
  - 5 Year Accelerated Depreciation
- Bonus Depreciation
  - 50% total system cost in first year
- Solar developer captures tax incentives
  - Passes savings on to Town



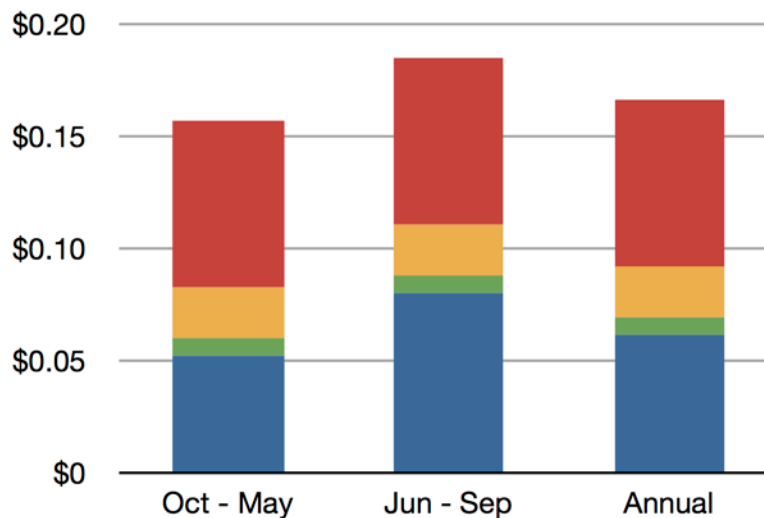
# Net Metering Credits

- Green Communities Act incentive program to encourage distributed generation
  - Municipalities are compensated for solar electricity they generate at close to retail rates (~ 16.6 cents / kWh)

Net Metering Credit



Net Metering Credit

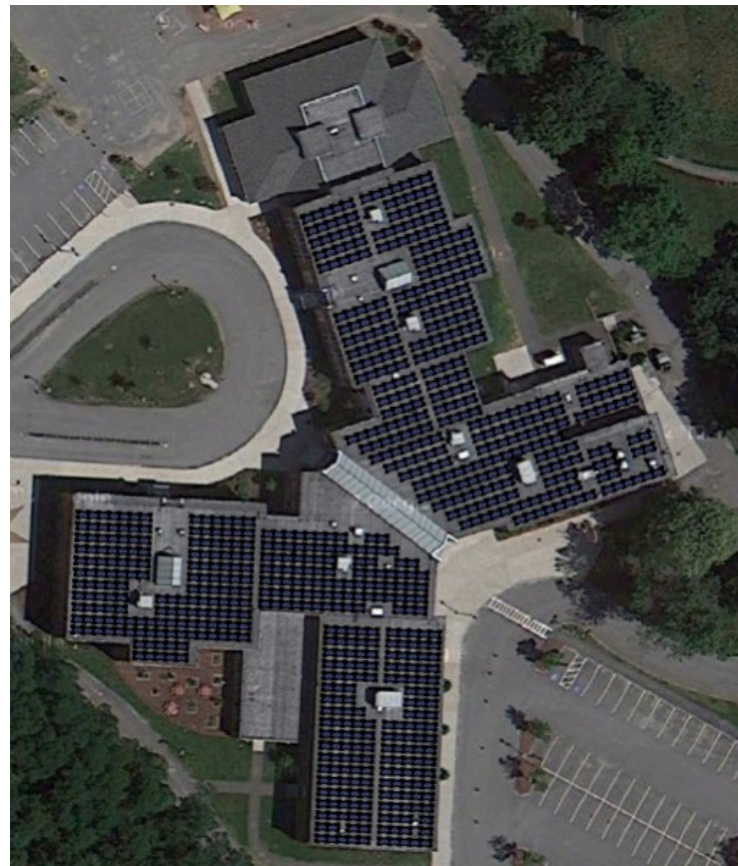


● Distribution   ● Transition   ● Transmission   ● Generation



# Net Metering Example

- Fiske Solar PV System generates 225,000 kWh / Yr
- Net Meter credit @ \$0.166 /kWh
- Town is credited \$37,350
- Town buys solar electricity for \$0.08 - \$0.11 / kWh
- Net Economic Benefit \$12,600 - \$19,350 / Year



Fiske School – 192 kW

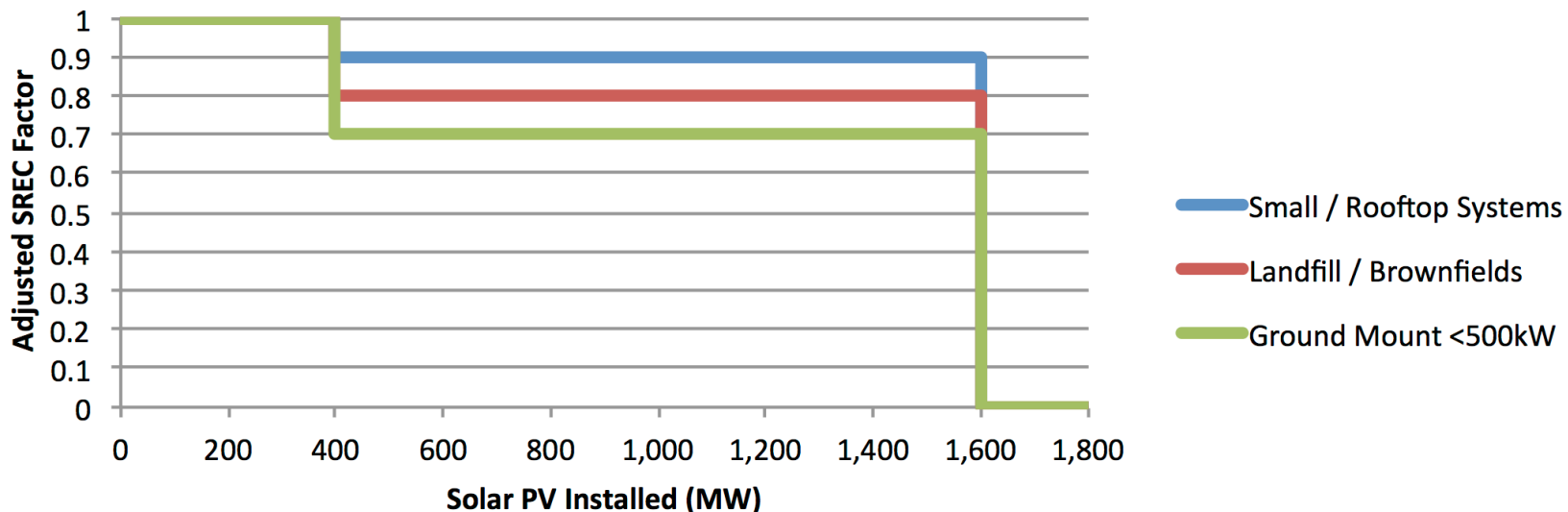




# Mass Solar Incentives

- Solar Renewable Energy Certificates (SRECs)
  - 10 year, market-based, production incentive
  - Utilities purchase SRECs from system owners
- SREC 1 Program (400 MW Cap - Closed)
  - 1 SREC for each MWh produced (recent price \$241 / MWh)
- SREC 2 Program (1,200 MW Cap)
  - <1 SREC for each MWh produced

## Adjusted SREC Factor



# ***This is Optimal Time for Solar***

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- Installed PV prices have dropped substantially – but we expect a slower rate in future.
- And incentives will not always be available
  - Federal Tax Credit (30%) (expires 2016)
  - SREC I (400 MW cap) (closed June 2013)
  - SREC II (1,600 MW cap) (est. through 2016)
  - Net Metering (3% cap) (est. through 2015)
  - Bonus Depreciation (uncertain – must be renewed annually)



# ***Town Electricity Usage***

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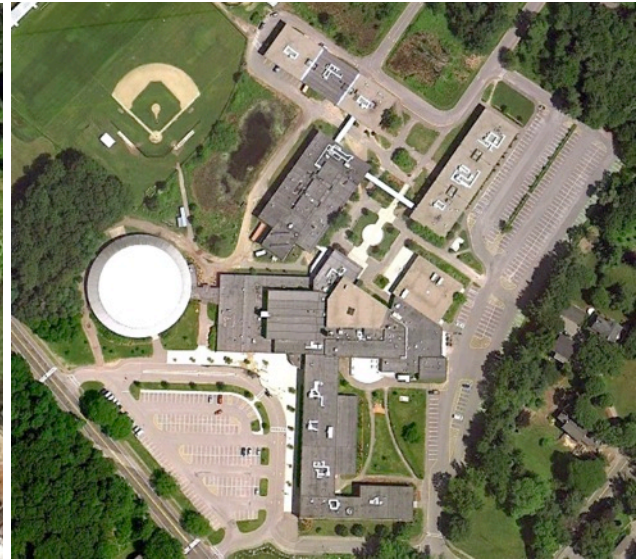
- **Municipal Buildings**
  - 2,500,000 kWh per year
  - \$480,000 budgeted for 2012
  
- **School Buildings**
  - 6,700,000 kWh per year
  - \$1,280,000 budgeted for 2012



# *Potential Solar Sites*

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- DPW Hadley Building & Garage
- Hartwell Avenue Landfill Site
- School Buildings



# Lexington Solar Potential

Facility Name	Estimated System Size (kW)	Solar Energy Production (kWh)
Lexington High School	792	916,243
Diamond Middle School	306	355,368
Bridge Elementary School	302	351,845
Bowman Elementary School	294	341,115
Clark Middle School	252	290,505
Public Services Building	246	286,587
Harrington Elementary School	193	225,992
Fiske Elementary School	193	224,723
Hastings Elementary School	66	75,493
<b>Rooftop Total</b>	<b>2,642</b>	<b>3,067,871</b>
Hartwell Ave Landfill	3,000	3,520,932
<b>Grand Total</b>	<b>5,642</b>	<b>6,588,803</b>



# ***Hadley Building – Solar Potential***

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- Hadley is an outstanding solar site
  - Large white roof (56,000 ft<sup>2</sup> usable space)
  - 164° & 195° azimuth
  - 246 kW array
  - 287,000 kWh / yr
- Electricity demand
  - 403,000 kWh / yr





# Hartwell Avenue Site

Excellent Solar Site

12 Solar Acres  
NSTAR Substation

3 MW Installation  
3.5M kWh / Year

Positive Cash Flow\*  
\$4,000,000 -  
\$6,000,000

\*20 Years





# *Why Solar?*

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- **Enhance our quality of life**
- **Sustainability**
  - Cleaner air and water
  - Significant reductions in CO<sub>2</sub> emissions
- **Resilience**
  - Directly increases our energy security
  - Directly saves (conserves) money



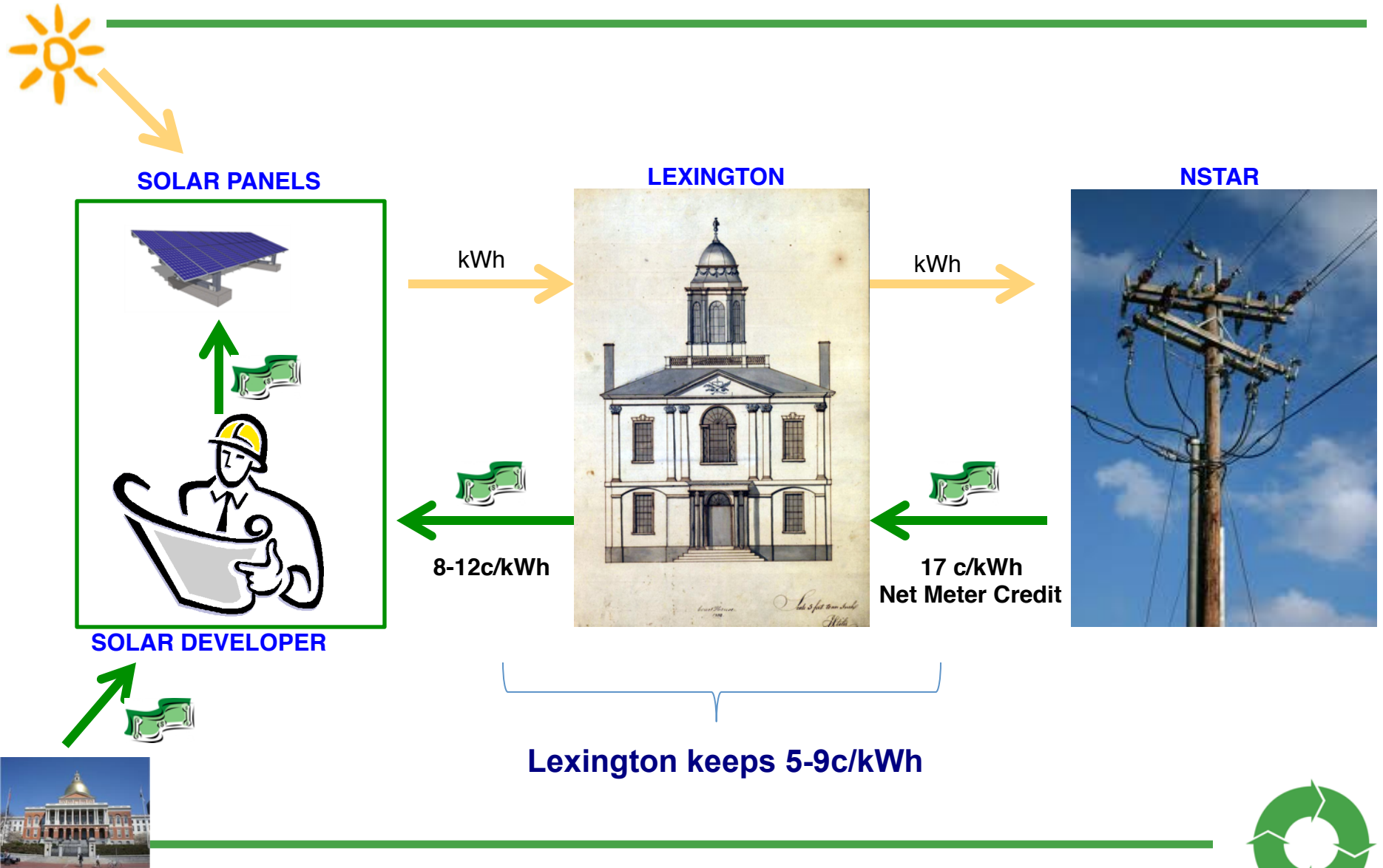
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# Economic Model



# Economic Scenarios

- Potential Savings \$2M - \$14M

Lexington Municipal & School Projections (100% Net Metered)						
NET METERING RATE						\$0.1660
ASSUMED NET METERING RATE ESCALATION						0.0%
ASSUMED PPA RATE ESCALATION						1.5%
DEGRADATION RATE						0.5%
SYSTEM SIZE (kW)						2,642
ESTIMATED FIRST YEAR OUTPUT (kWh)						3,067,871
ESTIMATED CARBON EMISSIONS OFFSET IN THE FIRST YEAR (lbs.)						2,776,423
						\$0.1660
						2.0%
						0.0%
						0.5%
						5,642
						6,588,803
						5,962,867
Potential Savings (\$/year) at Various PPA Rates (\$/kWh)						
	\$0.090	\$0.095	\$0.100	\$0.105	\$0.110	
0	\$233,158	\$217,819	\$202,479	\$187,140	\$171,801	
<b>20 YEAR Total:</b>	<b>\$3,764,827</b>	<b>\$3,408,627</b>	<b>\$3,052,427</b>	<b>\$2,696,226</b>	<b>\$2,340,026</b>	
						\$0.1660
						2.0%
						0.0%
						0.5%
						5,642
						6,588,803
						5,962,867
Potential Savings (\$/year) at Various PPA Rates (\$/kWh)						
	\$0.090	\$0.095	\$0.100	\$0.105	\$0.110	
0	\$500,749	\$467,805	\$434,861	\$401,917	\$368,973	
<b>20 YEAR Total:</b>	<b>\$14,887,156</b>	<b>\$14,228,852</b>	<b>\$13,570,547</b>	<b>\$12,912,243</b>	<b>\$12,253,939</b>	





# Environmental Benefits

Over the next 20 years a 5.6 MW solar energy system will generate 125,700,551 kWh of clean electricity.



Your Town's PV system will  
save a total of  
**5,687,950 lbs.**  
of CO<sub>2</sub> emissions each year



This is the equivalent of  
eliminating  
**4,855,567 miles**  
of driving each year



This is the equivalent of  
preserving  
**11,012 acres**  
of eastern mountain forests.



# Social Benefits of Solar

Year	Massachusetts CO <sub>2</sub> per kWh (kilograms)	Social Cost of Carbon (\$/ metric ton)	Solar Production (kWh)	Social Cost of Carbon (\$)	Social Cost of Carbon (\$ / kWh)	CO <sub>2</sub> Reduction (metric tons)
2014	0.410	\$56.61	6,588,803	\$ 153,082	\$0.02	2,704
2015	0.406	\$58.00	6,555,859	\$ 154,502	\$0.02	2,664
2016	0.402	\$59.39	6,523,080	\$ 155,828	\$0.02	2,624
2017	0.398	\$60.82	6,490,464	\$ 157,150	\$0.02	2,584
2018	0.394	\$62.28	6,458,012	\$ 158,467	\$0.02	2,545
2019	0.390	\$63.77	6,425,722	\$ 159,777	\$0.02	2,505
2020	0.386	\$65.00	6,393,593	\$ 160,334	\$0.03	2,467
2021	0.382	\$66.11	6,361,625	\$ 160,519	\$0.03	2,428
2022	0.378	\$67.23	6,329,817	\$ 160,685	\$0.03	2,390
2023	0.373	\$68.37	6,298,168	\$ 160,832	\$0.03	2,352
2024	0.369	\$69.53	6,266,677	\$ 160,960	\$0.03	2,315
2025	0.365	\$70.00	6,235,344	\$ 159,437	\$0.03	2,278
2026	0.361	\$71.05	6,204,167	\$ 159,210	\$0.03	2,241
2027	0.357	\$72.12	6,173,146	\$ 158,963	\$0.03	2,204
2028	0.353	\$73.20	6,142,281	\$ 158,695	\$0.03	2,168
2029	0.349	\$74.30	6,111,569	\$ 158,407	\$0.03	2,132
2030	0.345	\$76.00	6,081,011	\$ 159,334	\$0.03	2,097
2031	0.341	\$76.99	6,050,606	\$ 158,687	\$0.03	2,061
2032	0.337	\$77.99	6,020,353	\$ 158,019	\$0.03	2,026
2033	0.332	\$79.00	5,990,252	\$ 157,330	\$0.03	1,991
2034	0.328	\$80.03	5,960,300	\$ 156,621	\$0.03	1,957
2035	0.324	\$81.00	5,930,499	\$ 155,755	\$0.03	1,923
<b>Total</b>				<b>\$ 3,482,592</b>		<b>50,656</b>

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# Process / Next Steps

Step	Status	Timing
Form Taskforce	Complete	Q3 2012
Feasibility Analysis	Complete	Q4 2012
Hadley Case Study	Complete	Q4 2012
Committee / Selectmen Review	Complete	Q1 2013
Town Meeting - Amend By-Law #32	Complete	Q2 2013
Draft RFP	Complete	Q3 2013
Community Information Meeting	Pending	Today
Selectman Review RFP	Open	Q4 2013
Town Manager Issues RFP	Open	Q4 2013
Review Responses	Open	Q4 – Q1 2014
Recommendation to Town	Open	Q1 2014
Economic Decision	Open	Q1 2014
Construction	Open	Q2/Q3 2014



# Conclusion

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1. The Solar Taskforce supports the ongoing development of a Solar business case for consideration by Town management.
  - Clear Economic Case with potentially \$2-\$10 million in 20yr savings
2. The RFP process will provide information critical to making decisions on the economics of solar for our rooftops and decisions on the highest and best use of our land resources.
3. With continued diligence, rooftop Solar Generation could be operational for Lexington by Q3 of 2014

 **The Solar Taskforce asks for the continued support of our community as we complete the study of Lexington's Solar Potential!**



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# Q&A

