



Solar 101

Presented by:
Massachusetts Clean Energy Center

January 29, 2014



Outline

- **Introduction**
- Solar PV Basics
- Overview of Solarize Mass
- Solar PV Incentives and Economics
- Getting Started

MassCEC Statutory Mandate



Advance Clean Energy Technology



Create Jobs



Develop a Trained Workforce



Accelerate Deployment of Clean Energy

Outline

- Introduction
- **Solar PV Basics**
- Overview of Solarize Mass
- Solar PV Incentives and Economics
- Getting Started

Solar Photovoltaic (PV) Basics



World energy use 16 TW-yr per year

~ 475 exajoules
~ 460 Quads

16

TIDES ¹
0.3 per year

0.3 – 2 per year
Geothermal^{1,7}

3 – 4 per year
HYDRO ^{1,6}

2 – 6 per year
Biomass ^{1,5}

3 – 11 per year
OTEC^{1,4}

25-70 per year
WIND^{1,2}
Waves^{1,3}

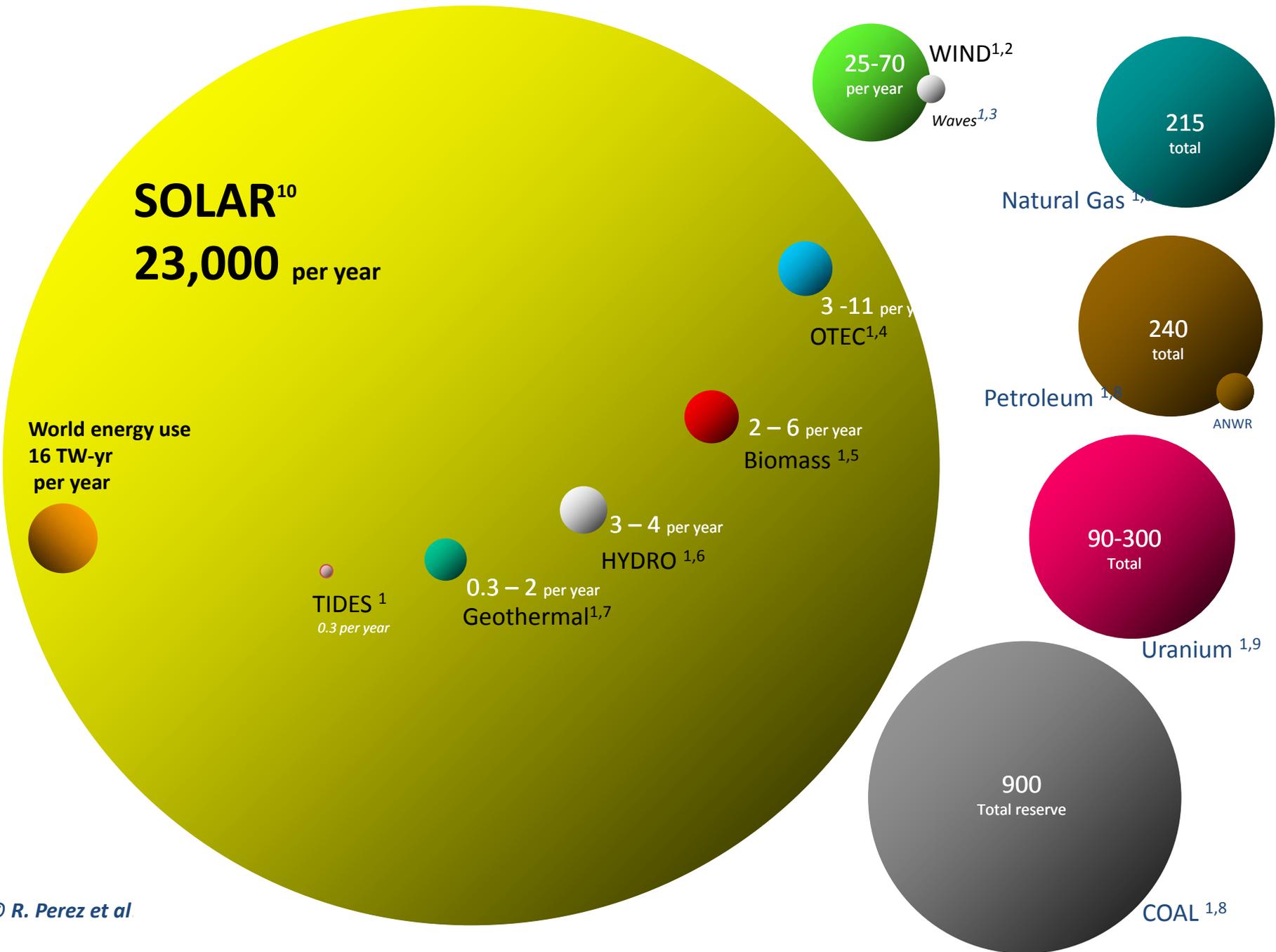
215 total
Natural Gas ^{1,4}

240 total
Petroleum ^{1,4}
ANWR

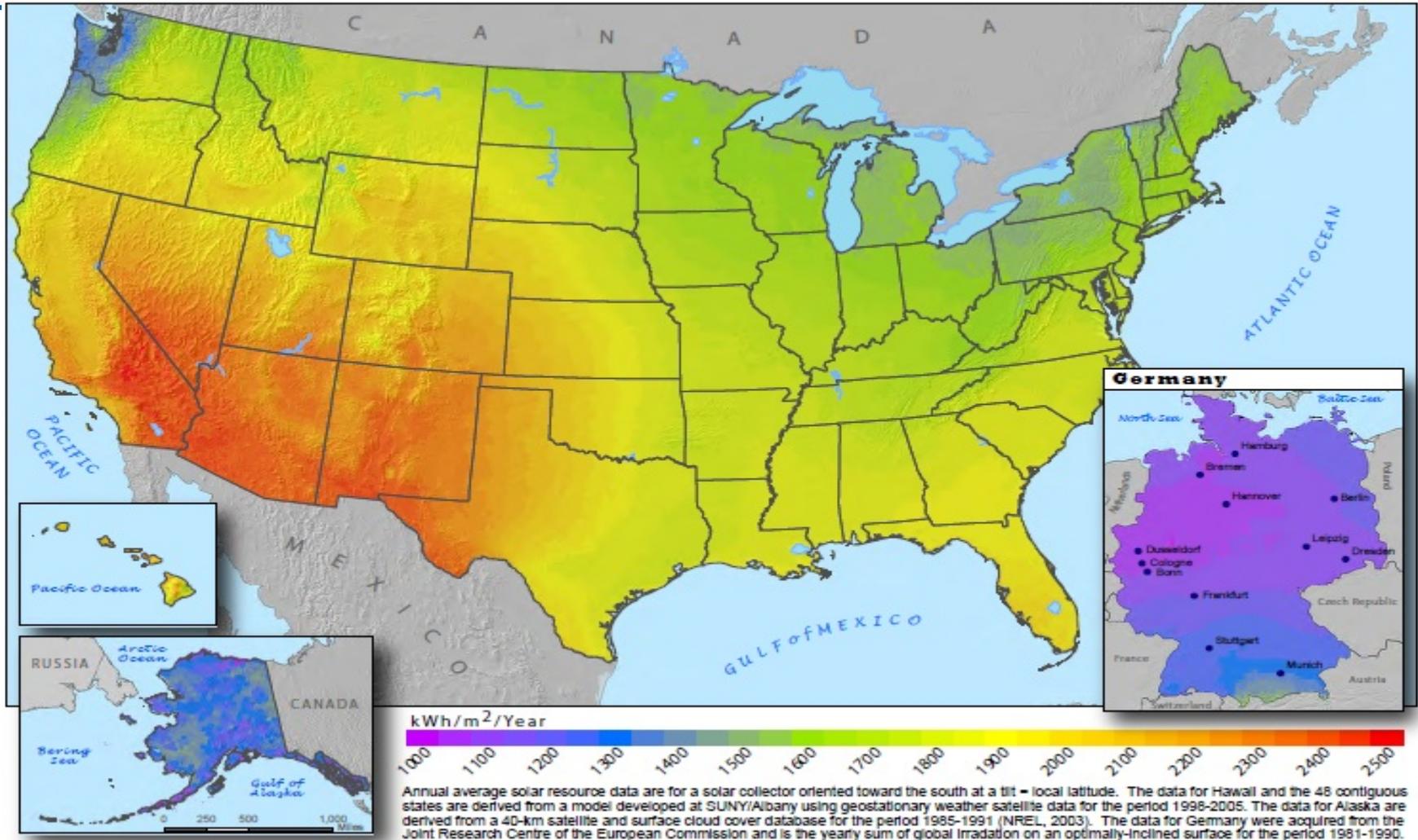
90-300 Total
Uranium ^{1,9}

900 Total reserve
COAL ^{1,8}

FINITE ENERGY RESERVES

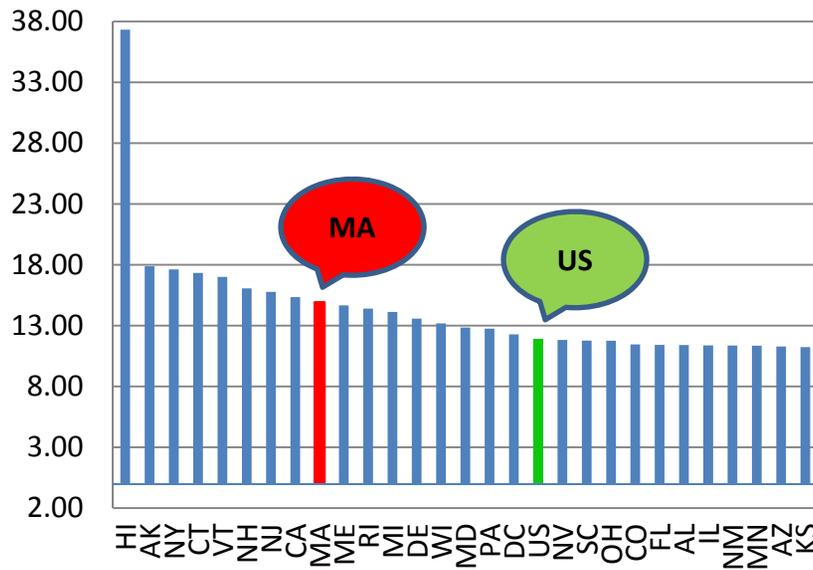


Is There Enough Sun In MA?



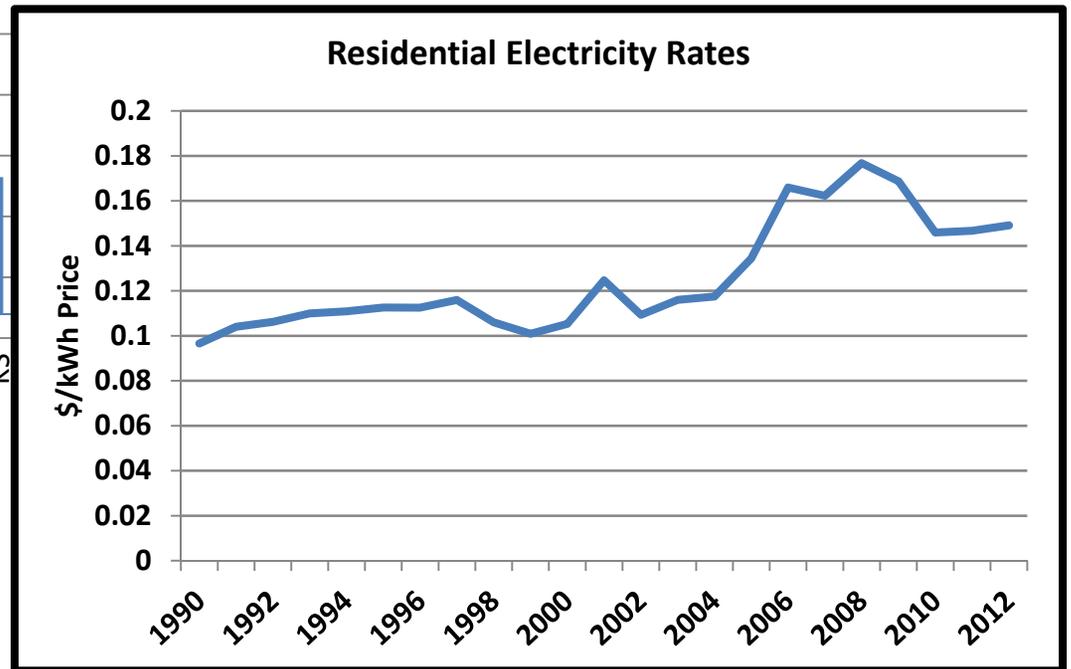
Massachusetts Residential Electricity Prices

2012 Avg Residential Electricity Prices
(cents per kWh)

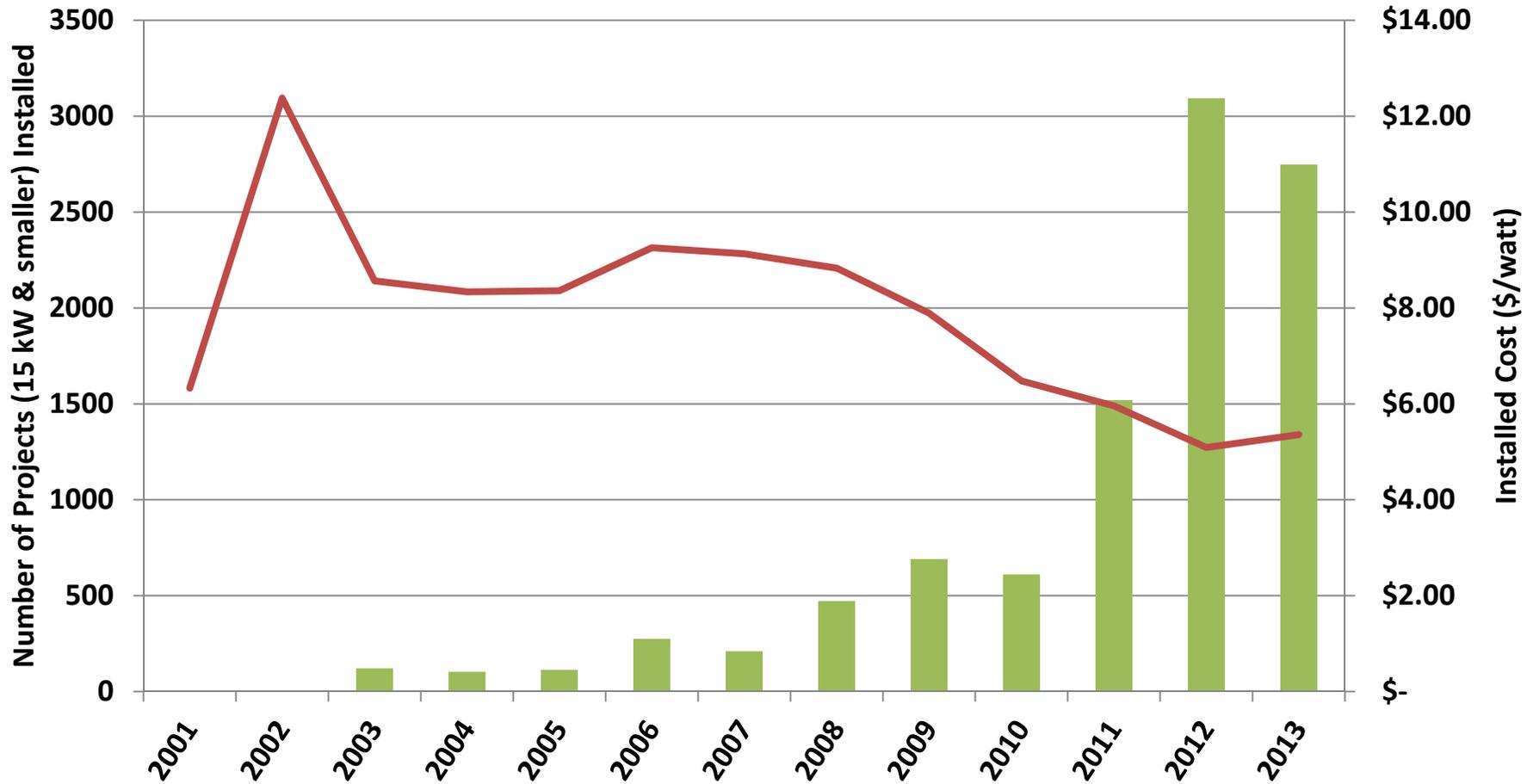


MA homeowners had the 9th highest average electricity prices in 2012.

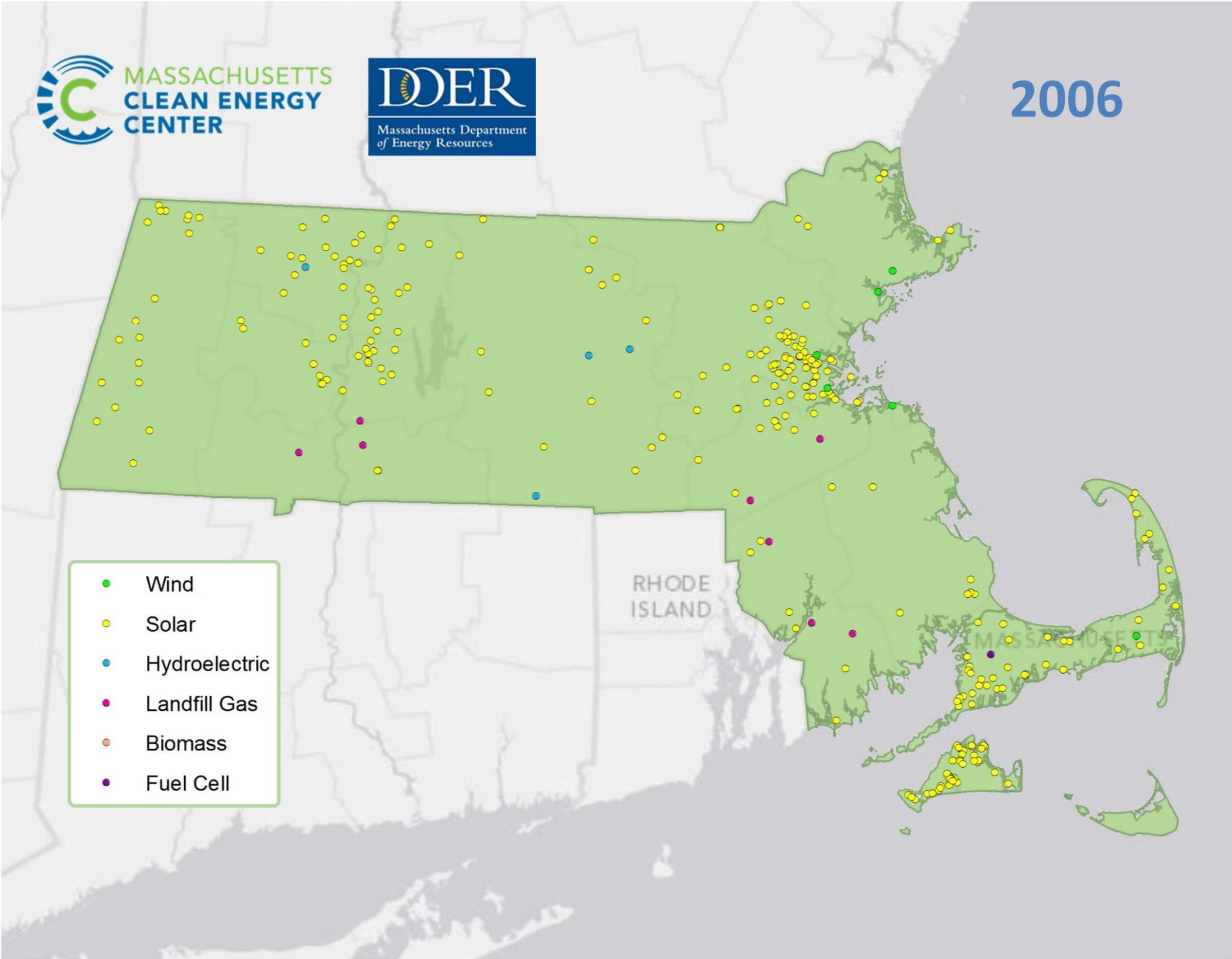
Sources: EIA 2012 Data



Residential Project Trends



-  Wind
-  Solar
-  Hydroelectric
-  Landfill Gas
-  Biomass
-  Fuel Cell

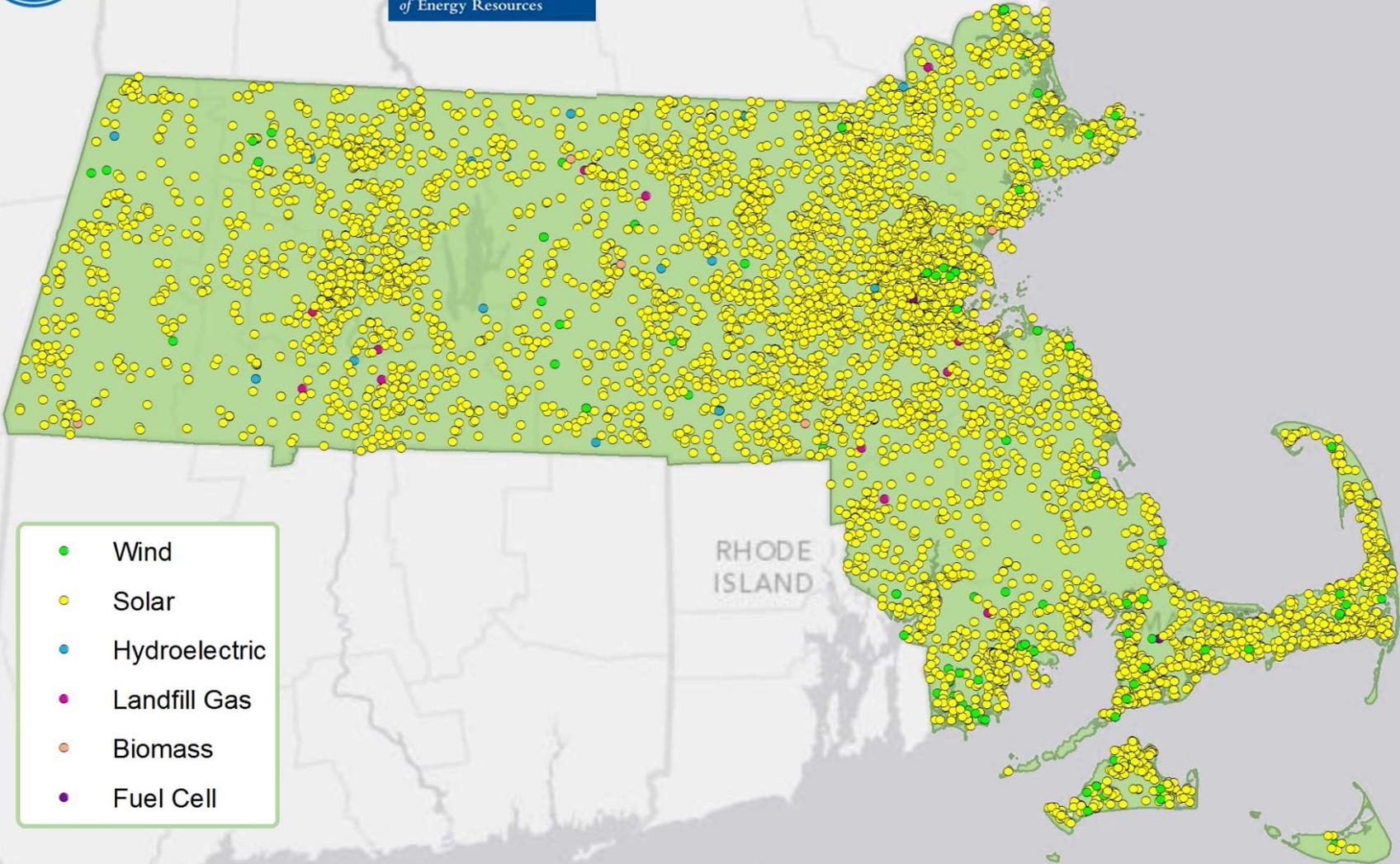




MASSACHUSETTS
CLEAN ENERGY
CENTER

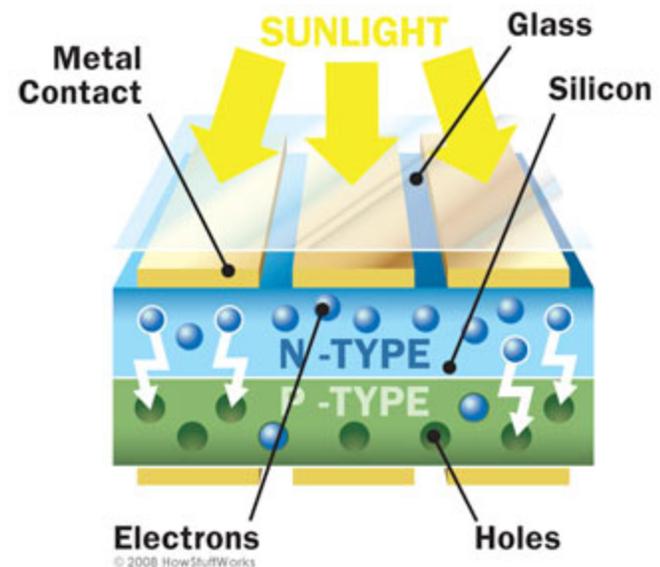


2013

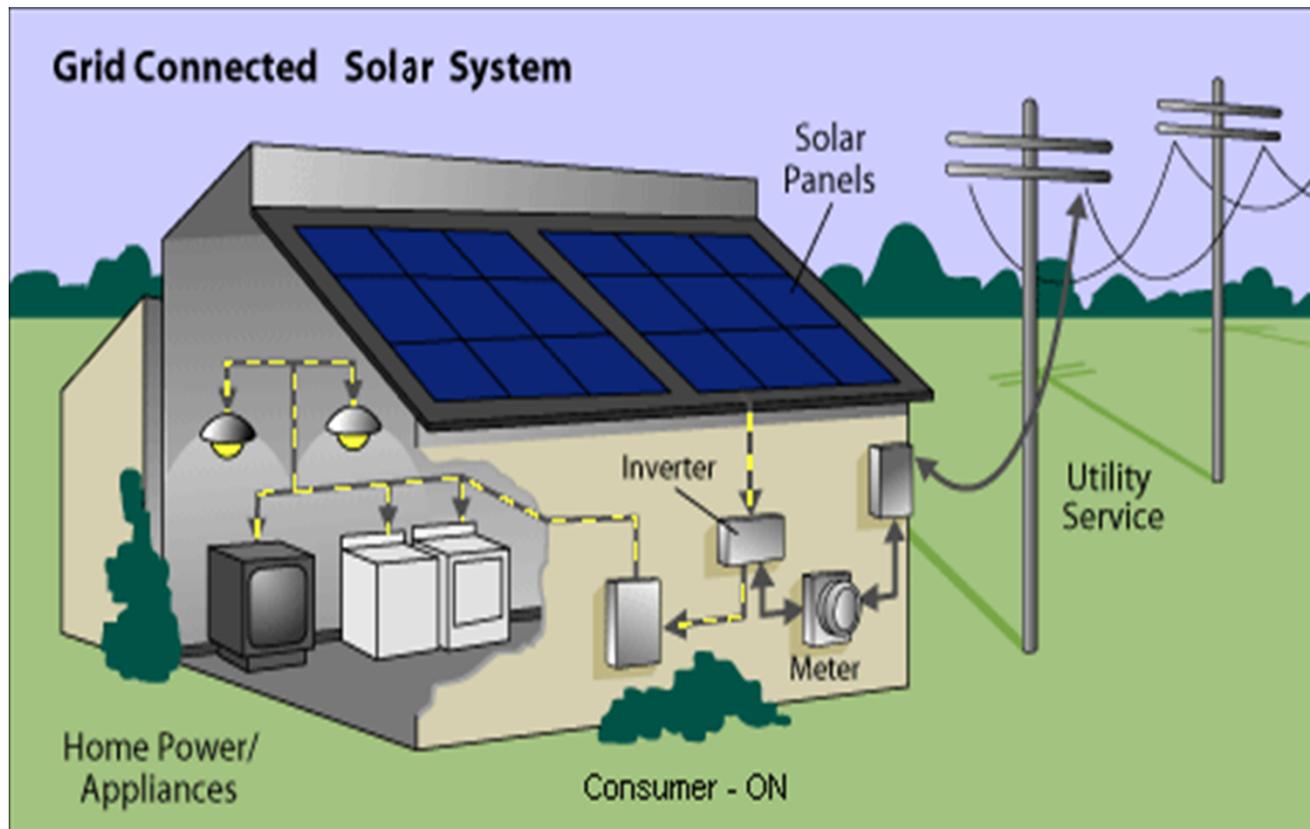


How do solar PV panels work?

- NEED DIRECT SUNLIGHT!
- Sunlight dislodges electrons in a layer of silicon
- Electrons flow to layer that needs electrons

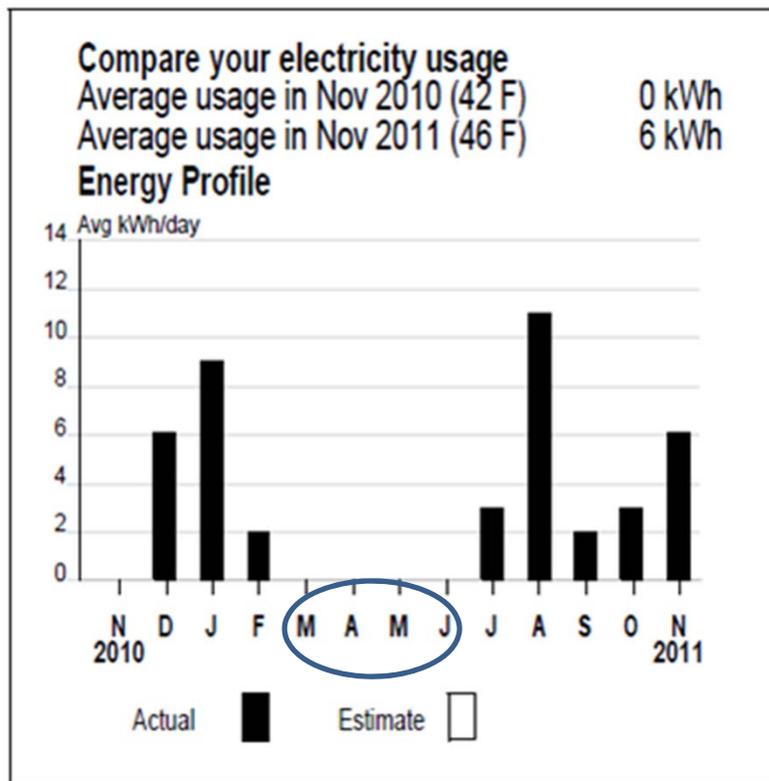


How Does Solar a PV System Work?



- Grid-connected projects can apply for Net Metering (utility meter spins backwards)
- **Power outage: Inverter shuts down, unless a battery-back up system is installed**

Estimate Electricity Load

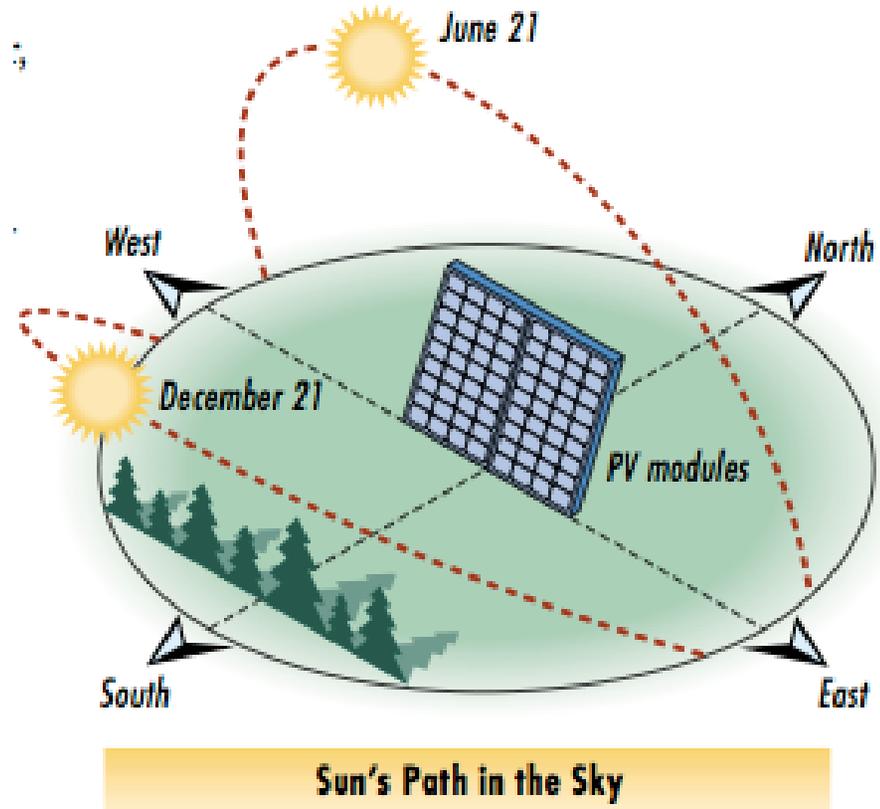


- **Average MA Home uses 7,600 kWh/year** (EIA, 2011 state data)
- Average solar PV system in MA is about 5,000 watts or 5 kW
- Electricity bill will have summary of prior year's consumption
- Assist in sizing solar PV system

Back of the Envelope Calculation: 1 kW = approximately 1,200 kWh/year

What makes a good site?

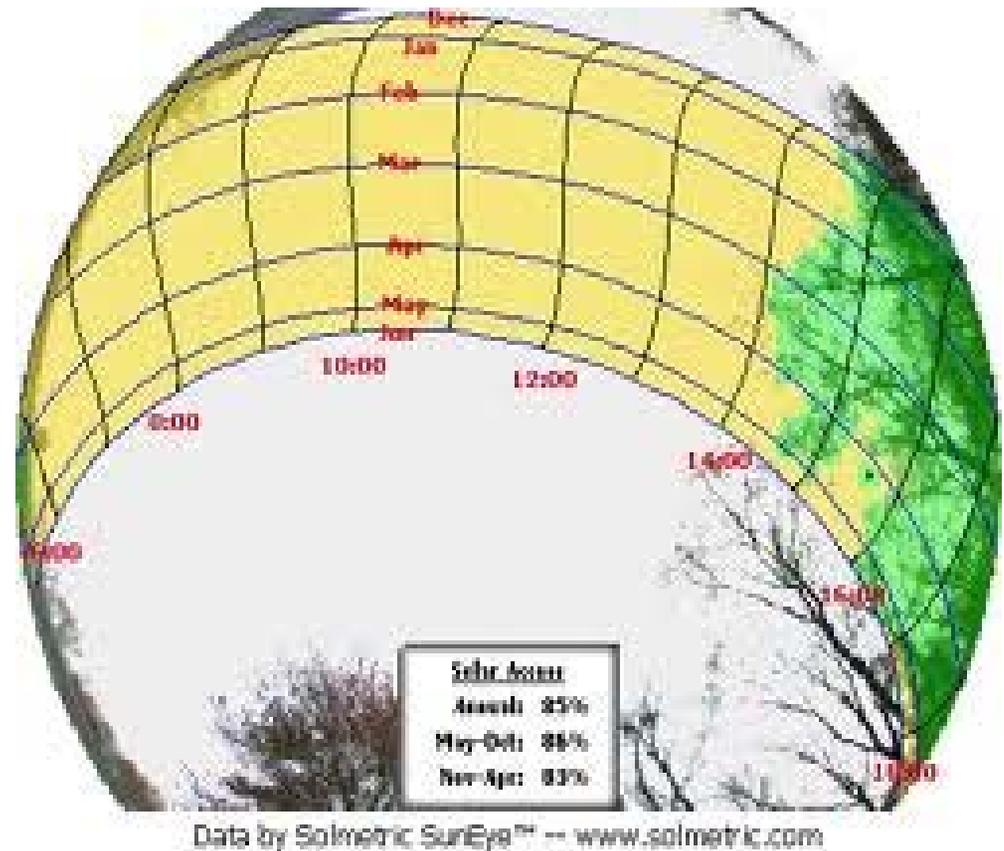
- Southern exposure
- PV panels angled 30° – 45°
- At least 4-6 hours of direct sunlight
- Open roof area of ~100 sq ft per 1 kW
- Open space for a ground or pole mounted system



<http://energy.ltgovernors.com/solar-energy-pv-systems-self-generation-make-your-own-power.html>

Shading of Solar PV Systems

- Initial site feasibility can be determined online through aerial images
- A shading analysis should be performed for each feasible project site
 - Solmetric SunEye
 - Solar Pathfinder



Aerial photos

1.



2.



3.



4.



5.



What to do with a Non-Feasible Site

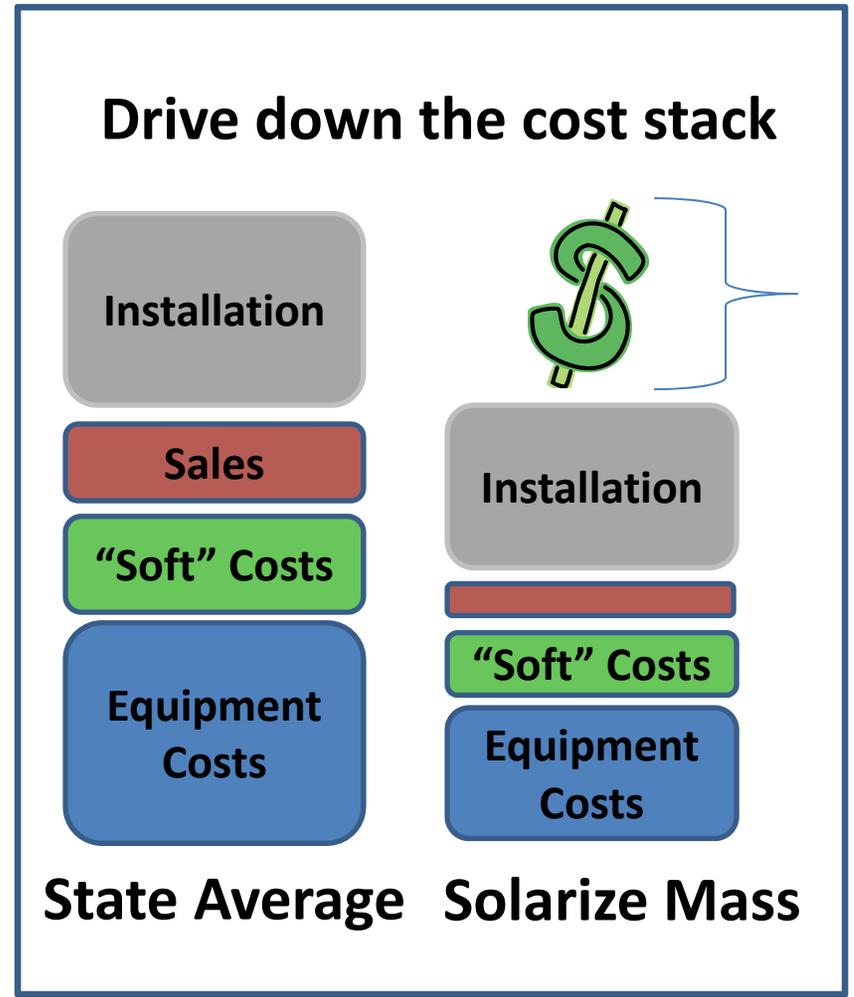
- Consider energy efficiency
 - www.MassSave.com
- Other renewable energy technologies
 - Solar Hot Water
(www.masscec.com/solarhotwater)
- Community Solar Projects
- Help spread the word about Solarize Mass!

Outline

- Introduction
- Solar PV Basics
- **Overview of Solarize Mass**
- Solar PV Incentives and Economics
- Getting Started

Goals of Solarize Mass

- Increase education through community outreach
- Introduce model to simplify process
- Reduce time to contract
- Reduce installation costs



MassCEC/DOER

Town and Installer RFPs
Engage tech. consultants
Marketing/Education
System Rebates/SRECs

Installer

Free Site Assessments
Tiered Pricing and
Ownership Options
Contracting
Rebate Application
Installation

Community

Installer Selection
Solar Coach
Volunteers
Outreach



Homeowner

Sign up for a site
assessment
Talk to neighbors!

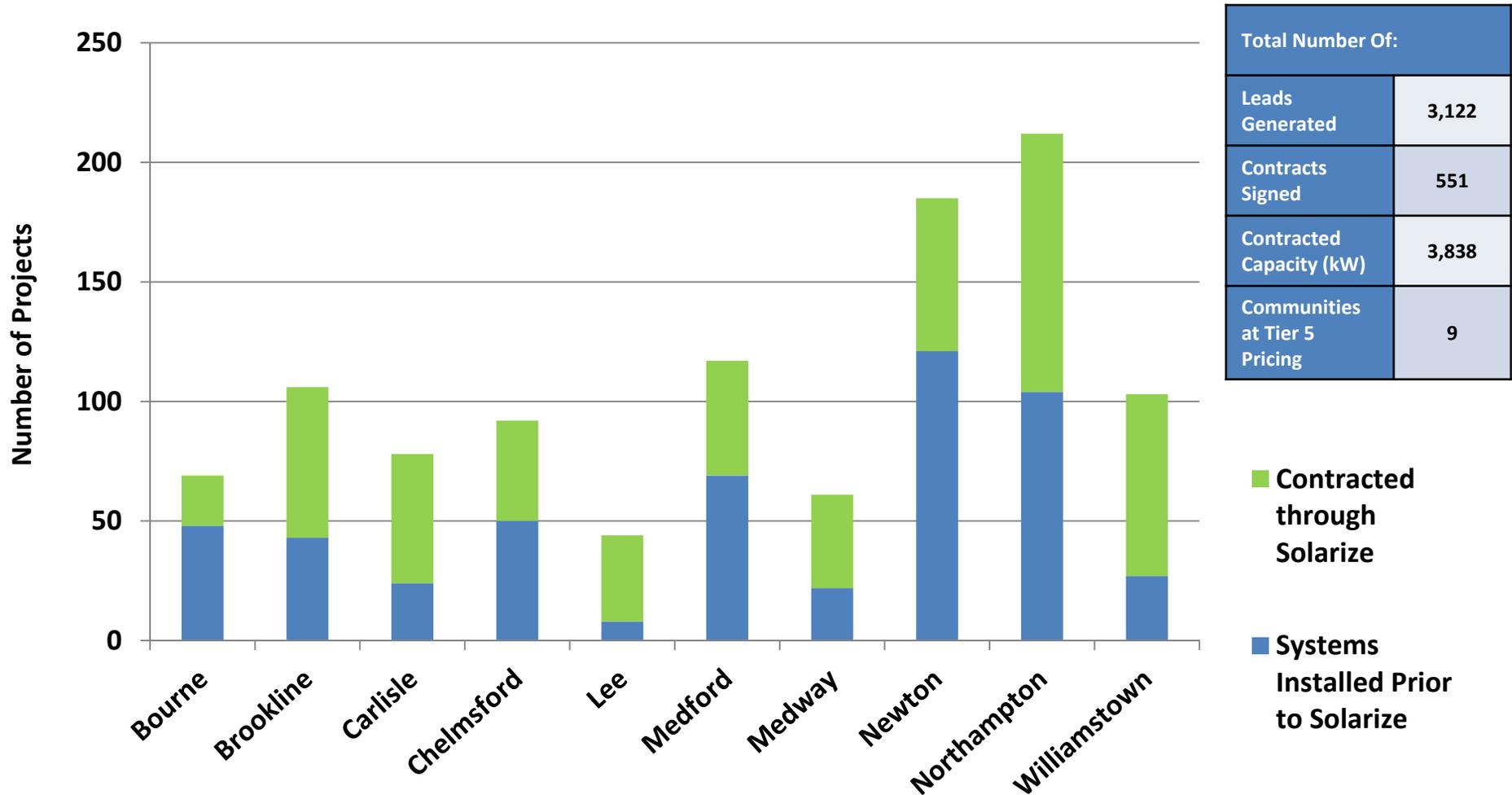
2014 Solarize Mass Basics

- 15 Communities in Round 2
- Competitive Installer selection
- Tier Pricing (based on contracted capacity)

Tier	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
kW	1 -25	>25 -50	>50 -100	>100 -200	200 +

- Limited time program – contract by **June 30, 2014**

Solarize Mass Adoption in 2013 Round 1



Total Number Of:	
Leads Generated	3,122
Contracts Signed	551
Contracted Capacity (kW)	3,838
Communities at Tier 5 Pricing	9

■ Contracted through Solarize
■ Systems Installed Prior to Solarize

Outline

- Introduction
- Solar PV Basics
- Overview of Solarize Mass
- **Solar PV Incentives and Economics**
- Getting Started

Solar Incentives in Massachusetts

**High electricity prices + Reduced Solar PV Costs +
Numerous Incentives = Economical solar projects**

Incentives
Tax Incentives: Federal (30%) State (15% up to \$1,000)
Rebates from MassCEC
Net Metering
SREC Sales
Low/No money down options



www.house-power.com/blog/wp-content/uploads/2009/12/iStock_000009001180XSmall.jpg

Commonwealth Solar II Rebate Program

- Quarterly funding blocks
- \$1.5 million available
- Residential, commercial, non-profit & public solar PV systems ≤ 15 kW
- Rebate capped at 5 kW
- Rebate ranges from \$2,000 to \$4,250 for 5kW system
- Rebate covers ~7% of Installed Cost

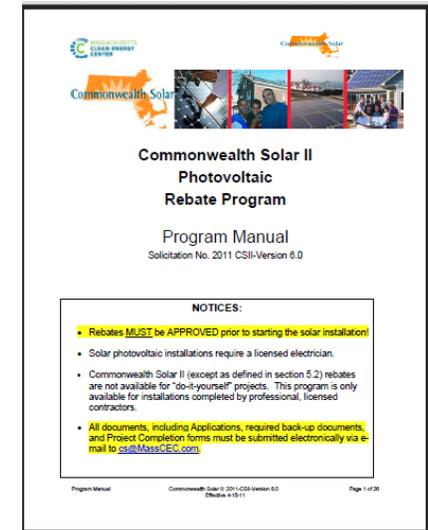
Block 17 Rebate Levels (\$ per watt (DC @ STC))

Base Incentive	\$0.40
PLUS:	
Massachusetts Company Component Adder	\$0.05
Moderate Home Value Adder OR Moderate Income Adder $\leq 120\%$ of MA median income (only residential projects eligible)	\$0.40
Natural Disaster Relief Adder	\$1.00

Go to www.MassCEC.com/solar to learn more.

MassCEC Rebate Program (cont.)

- Experienced Installer
- Minimum Technical Requirements
 - Equipment must meet certain standards
 - Required warranties
 - Panels have 20 year production warranty
 - Inverters have 10 year warranties
 - 5 year workmanship warranty
 - 80% of optimal system production



Solar Renewable Energy Certificates (SRECs)

Electricity Pathway

- Electrons from all generation sources are physically the same
- Cannot be tracked independently on the grid

Electricity and SRECs can be, and often are, sold separately



SRECs Pathway

- SRECs represent the “green” attributes of the renewable generation source
- Utilities are required to purchase SRECs every year
- 1 SREC = 1,000 kWh
- Verified SRECs ensure that only one buyer can claim each SREC

SRECs (cont.)

- Will be able to sell SRECs for 10 years
- Likely sell from \$285 - \$199 per SREC
- Work with aggregator or broker to help with the sale
- Monthly production reported to MassCEC's Production Tracking System (PTS)
- DOER is currently engaged in a rulemaking process for the SREC II Program

Ownership Models

- Outright purchase
- Power Purchase Agreement
- Lease



Assumptions: Simple Solar Ownership Model

Assumptions*	
Size:	5 kW (5,000 watts)
Capacity Factor:	13%
Panel Degradation:	1% Annually
Electricity Price:	\$0.14/kWh
Electricity Price Escalator:	3% Annually
Life of System:	20 years
SREC Value:	\$285.00 and declining per DOER schedule
Timeline for SREC Sales:	10 years
Income Tax Rate:	28%
Discount Rate:	7.5%

* Model assumes that the project qualifies under the SREC II Program, is receiving the base rebate incentive, and is eligible for federal and state tax incentives.

Disclaimer: This financial analysis is only an estimate. Actual installed costs, savings, and revenues are subject to change and will be specific to individual projects.

Simple Solar Ownership Model

	State Average Price	Example Tier Price
Dollar Per Watt Cost	\$ 5.11	\$ 4.00
Total Installation Cost	\$ 25,550.00	\$ 20,000.00
CSII Rebate (base of \$0.40/watt)	<u>-\$ 2,000.00</u>	<u>-\$ 2,000.00</u>
Total Upfront Cost	\$ 23,550.00	\$ 18,000.00
Federal Tax Credit (30% of cost)	-\$ 7,065.00	-\$ 5,400.00
MA Tax Credit	<u>-\$ 1,000.00</u>	<u>-\$ 1,000.00</u>
Total After Tax Credits	\$ 15,485.00	\$ 11,600.00
NPV SREC Income (over 10 yrs)	- \$6,927.47	- \$6,927.47
NPV Electricity Savings (over 20 yrs)	<u>-\$ 9,402.17</u>	<u>-\$ 9,402.17</u>
Net Project Cost	\$ (844.64)	\$ (4,729.64)
Payback after rebate & tax credits	~8 years	~6 years

Disclaimer: This financial analysis is only an estimate. Actual installed costs, savings, and revenues are subject to change and will be specific to individual projects.

Outline

- Overview of Solarize Mass
- Solar PV Basics
- Solar PV Incentives and Economics
- **Getting Started**

Next Steps

- Sign up for a free site assessment (sign-up sheet)
- Installer will contact you shortly after selection
- **Nothing is binding** at this point
- Consider other options if solar PV is not feasible
- **Tell your friends and neighbors!**

Thank You!

www.SolarizeMass.com

(617) 315-9306

MassCEC: solarize@MassCEC.com

Or

Lexington Solar Coach: solarizelexington@gmail.com

Bedford Coach: solarizebedford@gmail.com

MassCEC Rebate Program (cont.)

Moderate Home Value Adder Criteria

County	Property Value
Berkshire, Franklin, Hampden, and Hampshire	≤ \$300,000
Bristol, Suffolk, Worcester	≤ \$350,000
Barnstable, Duke, Essex, Middlesex, Nantucket, Norfolk, and Plymouth	≤ \$400,000

Moderate Income Adder Criteria

Income Category	Income Levels
Individual Income	≤ \$75,810*
Domestic Unit Income	≤ \$95,420*

* 120% of median household income as determined by the US Census Bureau