Solar Powering Your Community

Addressing Soft Costs and Barriers

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U.S. Department of Energy

About the SunShot Solar Outreach Partnership

The SunShot Solar Outreach Partnership (SolarOPs) is a U.S. Department of Energy (DOE) program designed to increase the use and integration of solar energy in communities across the US.

About the SunShot Solar Outreach Partnership

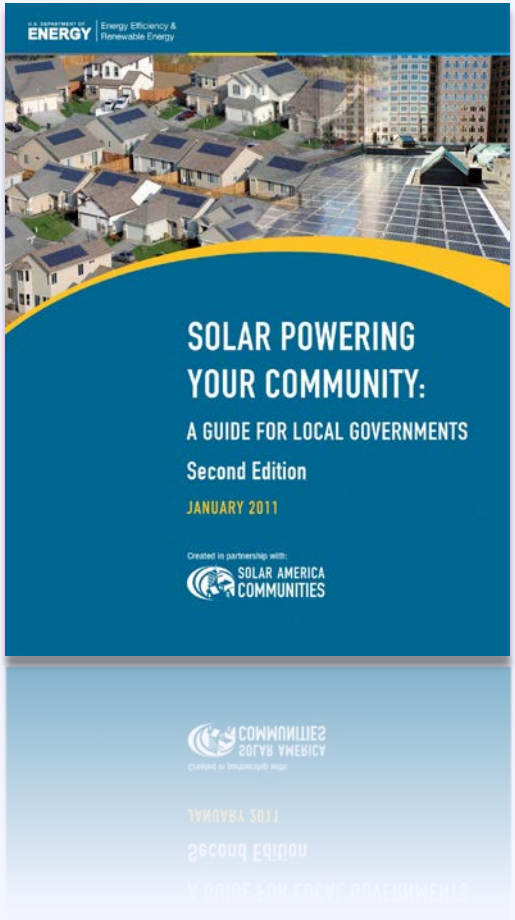
- Increase installed capacity of solar electricity in U.S. communities
- Streamline and standardize permitting and interconnection processes
- Improve planning and zoning codes/regulations for solar electric technologies
- Increase access to solar financing options

About the SunShot Solar Outreach Partnership

Resource **Solar Powering Your Community Guide**

A comprehensive resource to assist local governments and stakeholders in building local solar markets.

www.energy.gov



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About the SunShot Solar Outreach Partnership

Resource Sunshot Resource Center

- Case Studies
- Fact Sheets
- How-To Guides
- Model Ordinances
- Technical Reports
- Sample Government Docs

www4.eere.energy.gov/solar/sunshot/resource_center

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Agenda

08:40 – 09:00	Solar 101
09:00 – 09:50	Creating a Regulatory Landscape for Solar
09:50 – 10:00	*Break*
10:00 – 10:20	Benefits and Barriers Activity
10:20 – 10:50	Understanding Utility Regulations
10:50 – 11:20	Understanding Solar Financing
11:20 – 11:30	*Break*
11:30 – 12:00	Installing Solar on Municipal Facilities
12:00 – 12:30	Next Steps for Solar in Region

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Poll

Who's in the room?

Poll

What is your experience with solar?

Solar Technologies

Solar Photovoltaic (PV)

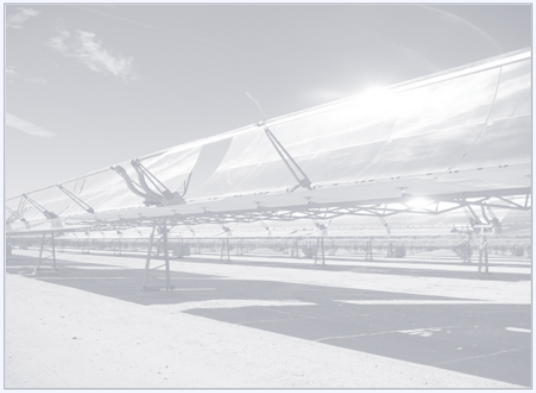
Solar Hot Water

Concentrated Solar Power

Solar Technologies

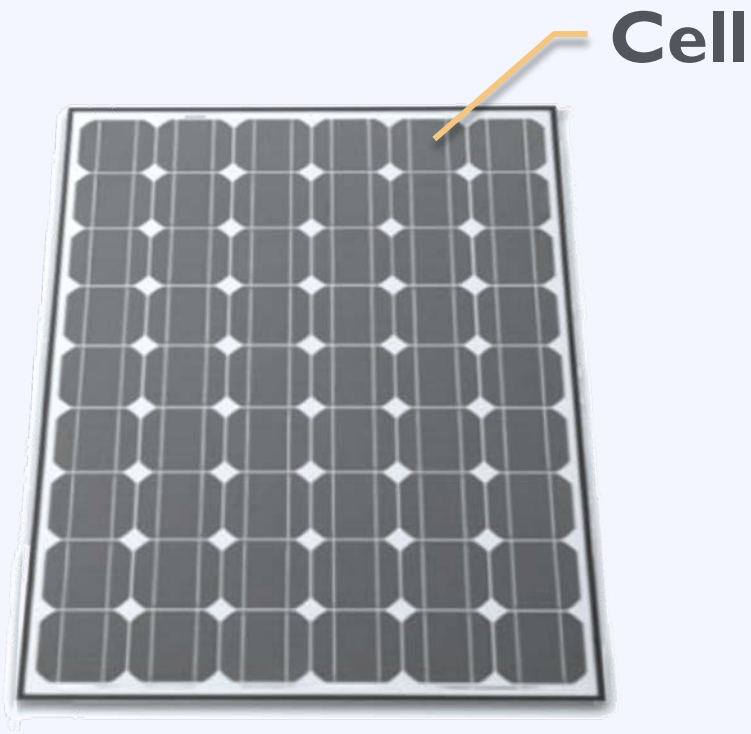
Solar Photovoltaic (PV)

Solar Hot Water



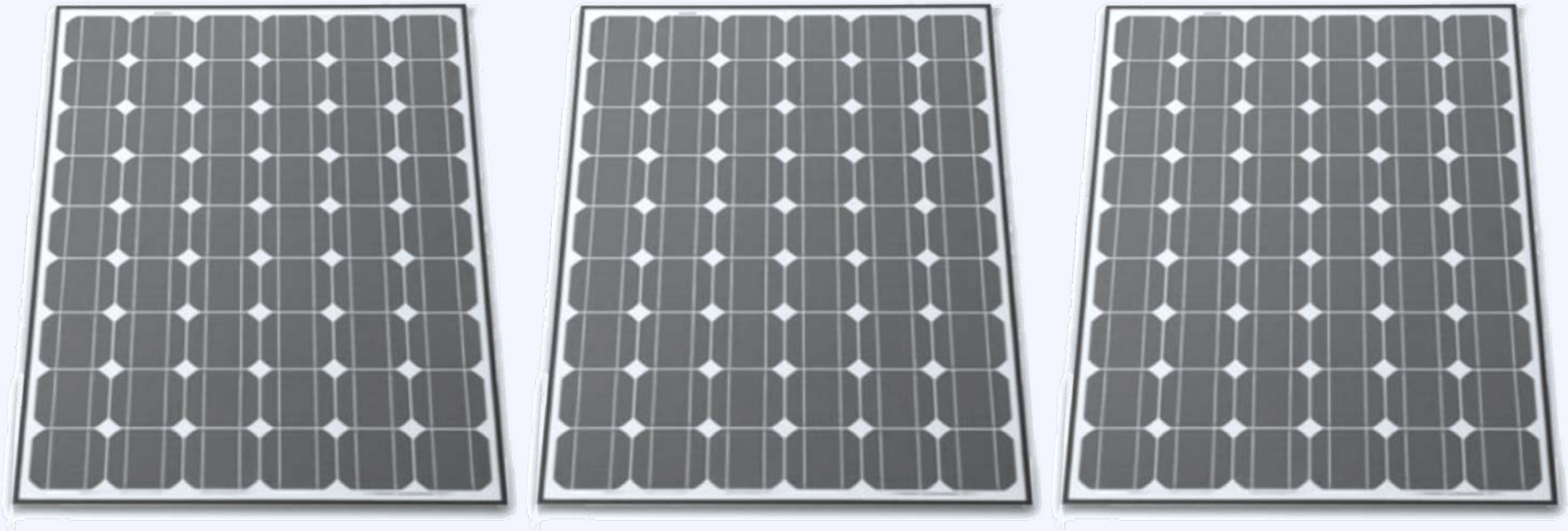
Concentrated Solar Power

Some Basic Terminology



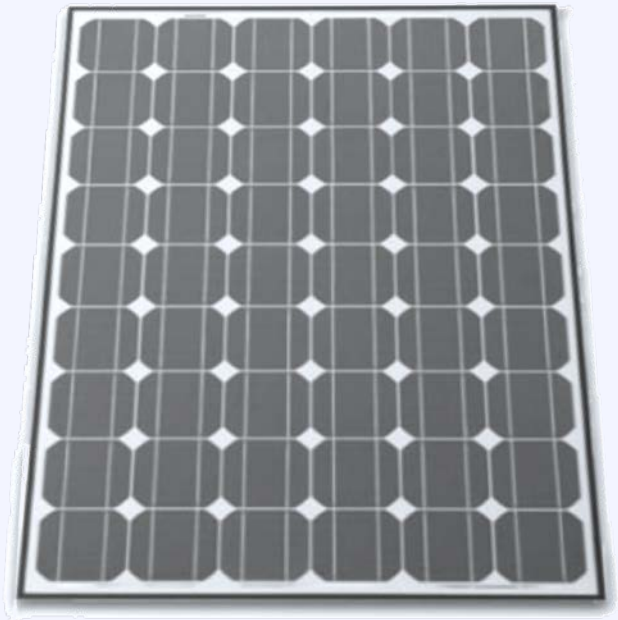
Panel / Module

Some Basic Terminology



Array

Some Basic Terminology



Capacity / Power

kilowatt (kW)

Production

Kilowatt-hour (kWh)

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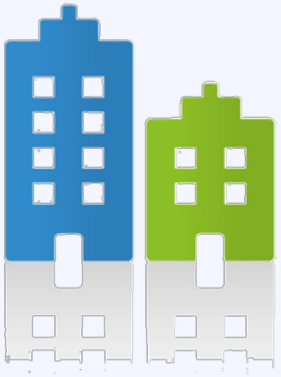
Some Basic Terminology

Residence
5 kW

Factory
1 MW+



Office
50 – 500 kW

Utility
2 MW+

Workshop Goal

Enable local governments to replicate successful solar practices and expand local adoption of solar energy

Explore benefits

and

Overcome barriers

Activity: Identifying Benefits

What is the greatest benefit solar can bring to your community? [Blue Card]

Right Now	During Session	After Break
		
Write answer on card	Compile results	Group discussion

Activity: Addressing Barriers

What is the greatest barrier to solar adoption in your community? [Green Card]

Right Now	During Session	After Break
		
Write answer on card	Compile results	Group discussion

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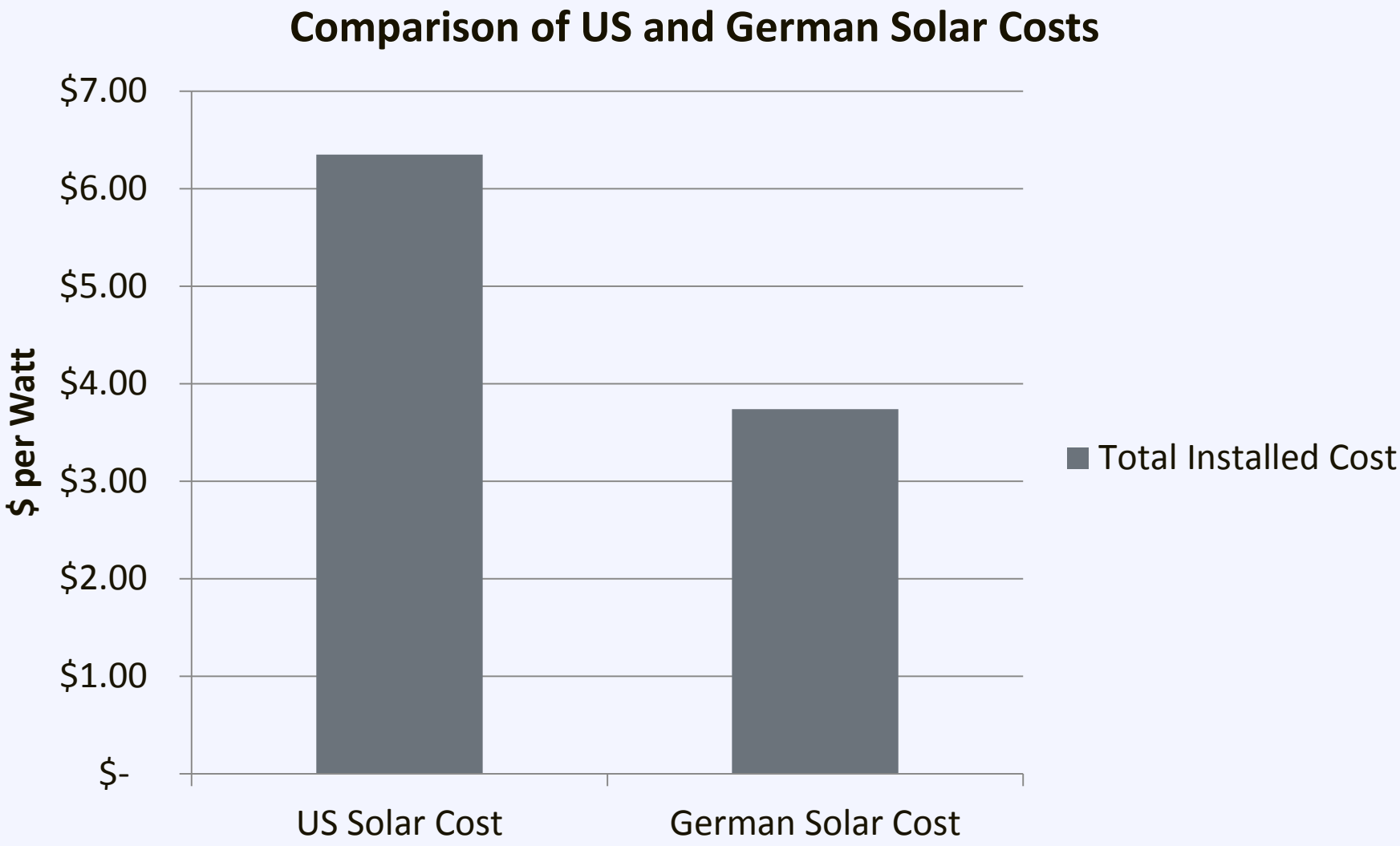
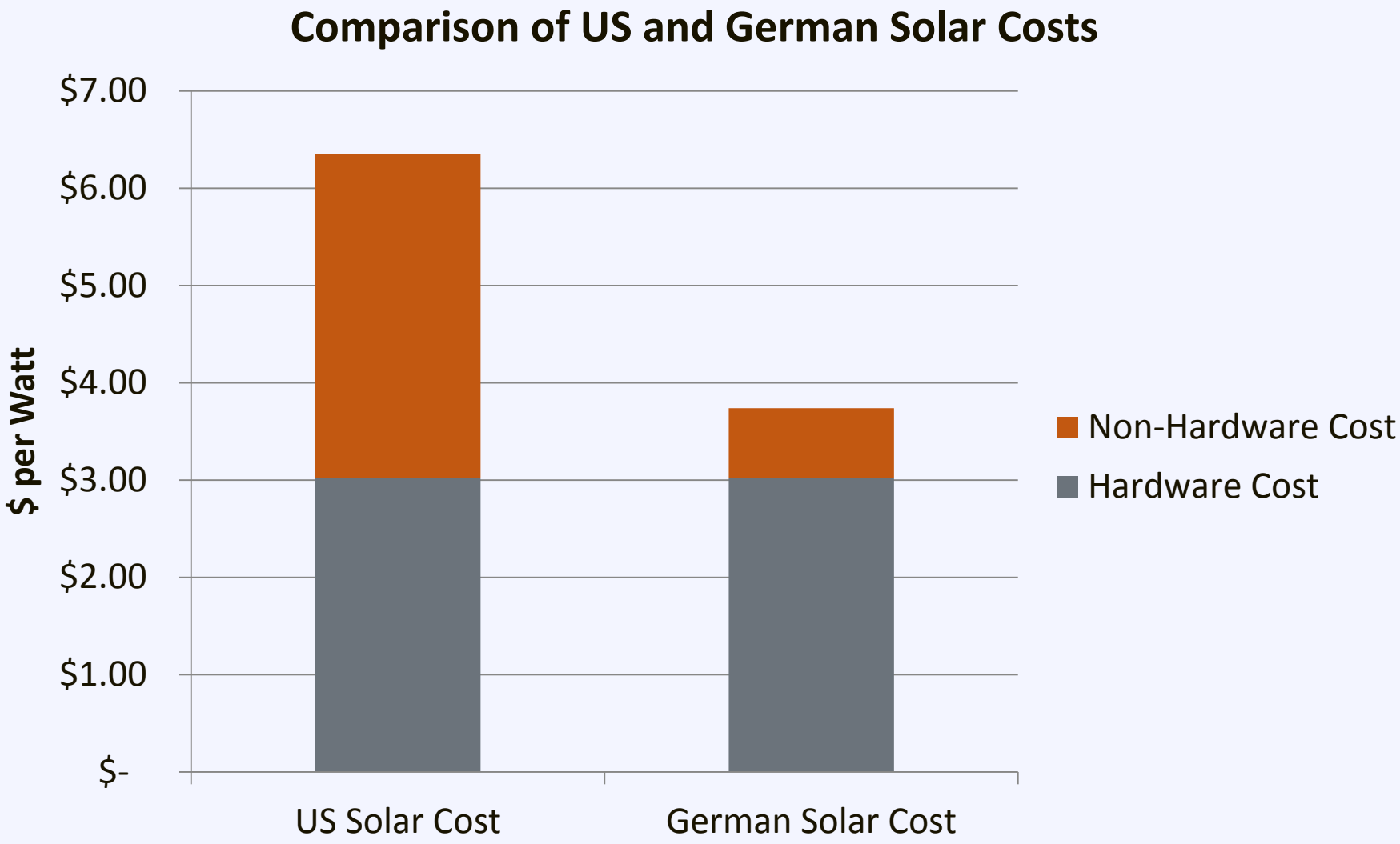
The Cost of Solar in the US



Source: NREL (http://ases.conference-services.net/resources/252/2859/pdf/SOLAR2012_0599_full%20paper.pdf) (http://www.nrel.gov/docs/fy12osti/53347.pdf) (http://www.nrel.gov/docs/fy12osti/54689.pdf)

The Cost of Solar in the US



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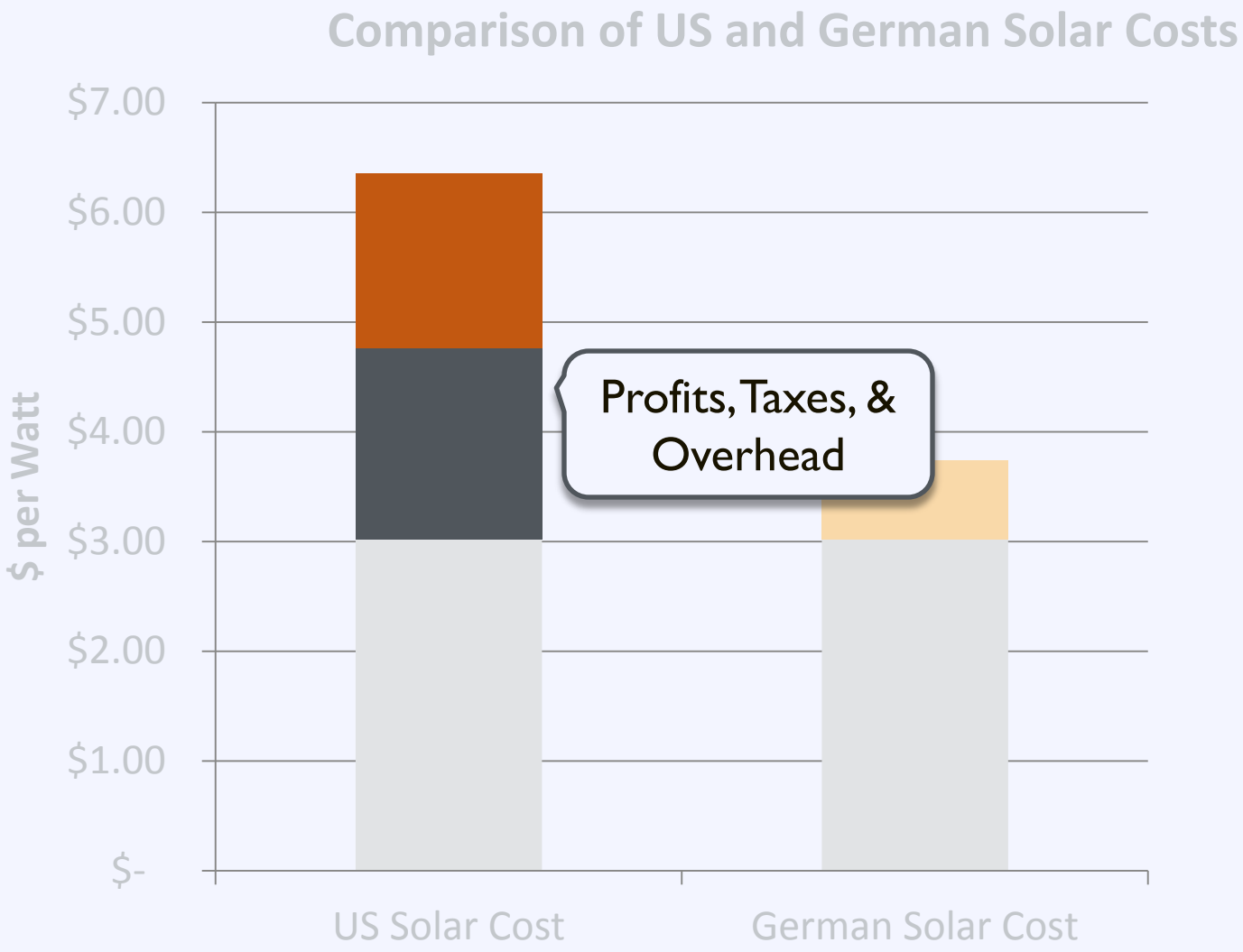

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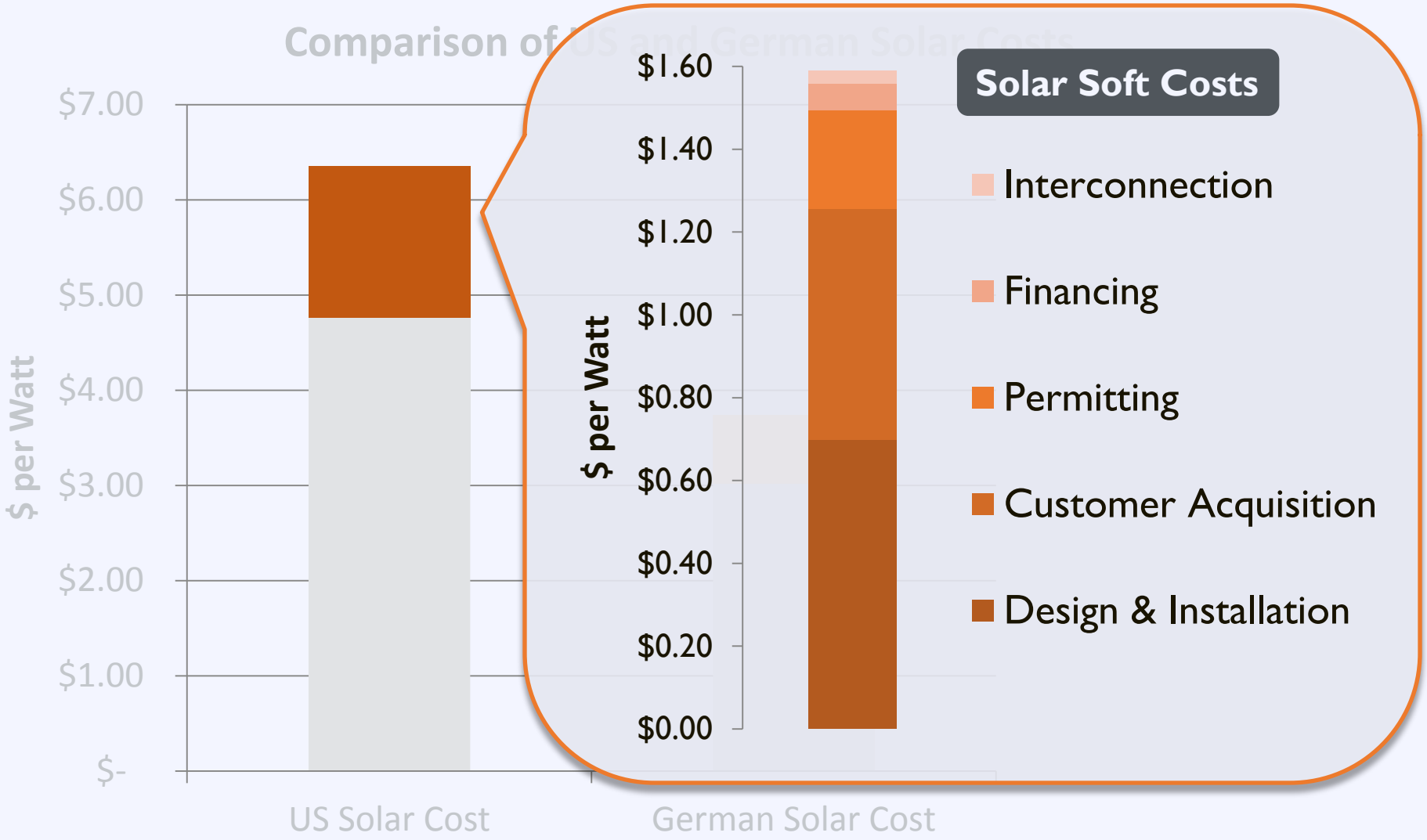

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Time to Installation

New York City's Goal

100 days

from inception to completion

Germany Today

8 days

from inception to completion

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Photon Magazine

Installed Capacity

Total installed solar capacity in the US

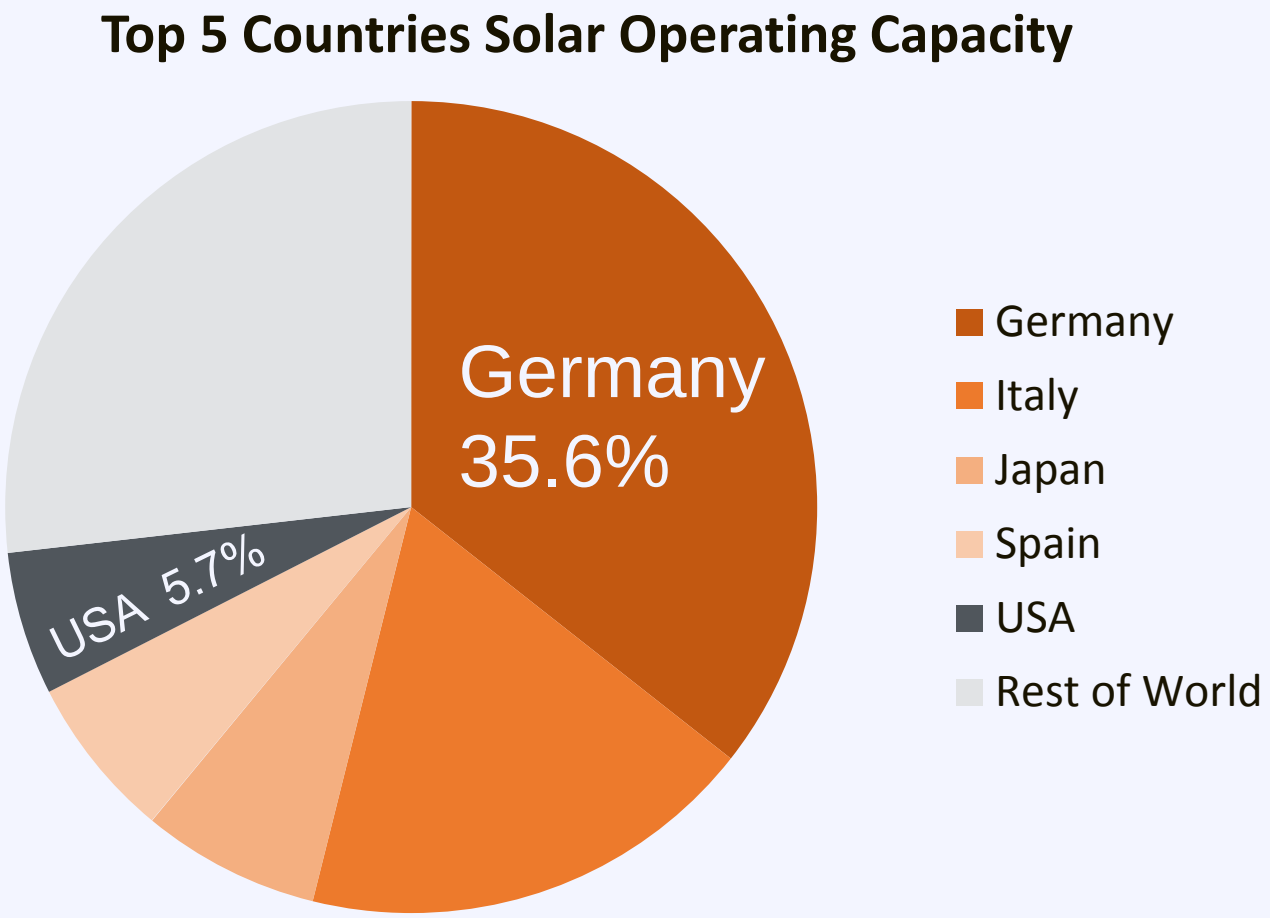
4 GW

Capacity installed in Germany in Dec 2011

4 GW

http://www.map.ren21.net/GSR/GSR2012.pdf

Installed Capacity



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http://www.map.ren21.net/GSR/GSR2012.pdf

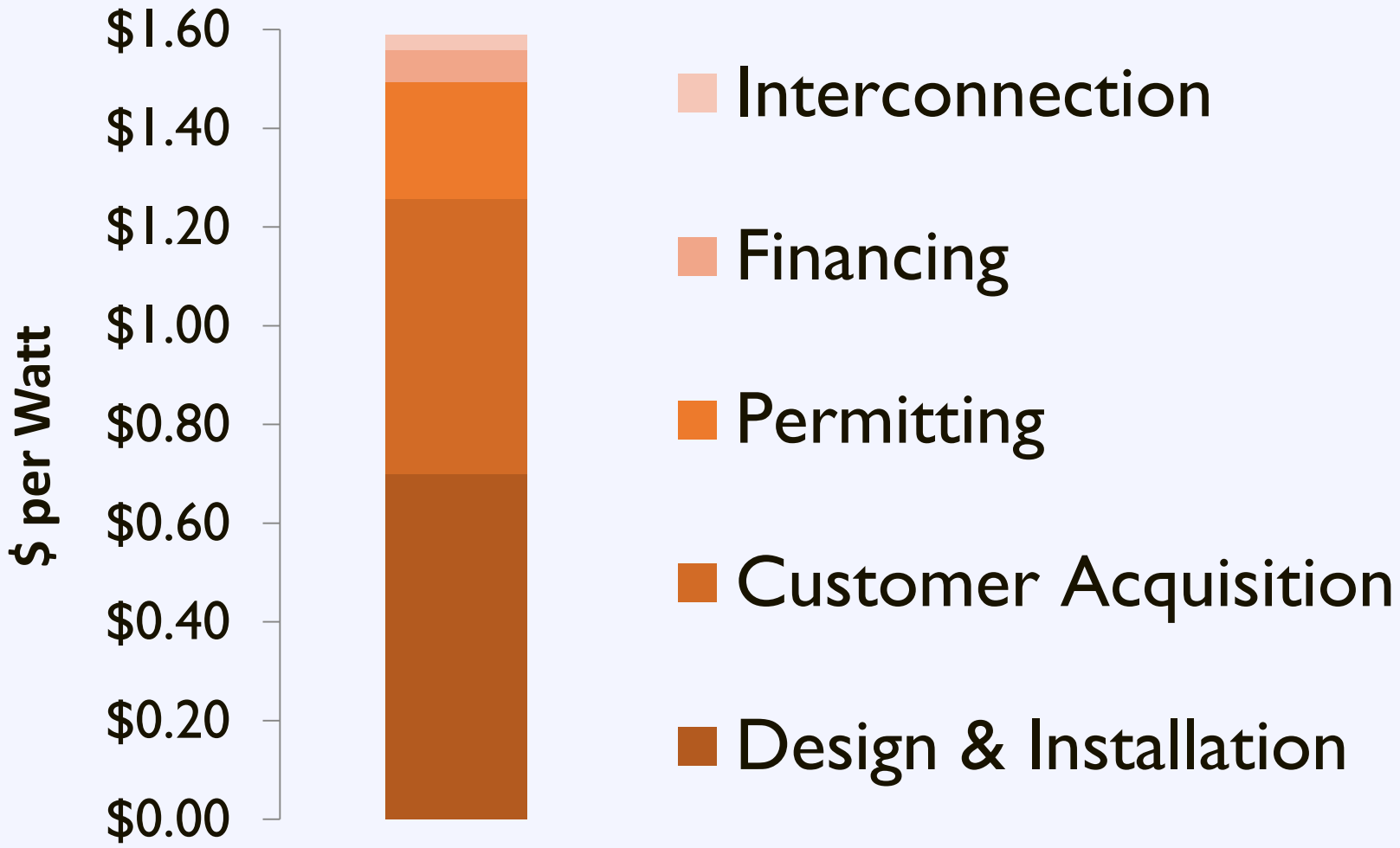
Germany's Success

Consistency and Transparency

through

Standardized Processes

Mitigate Soft Costs



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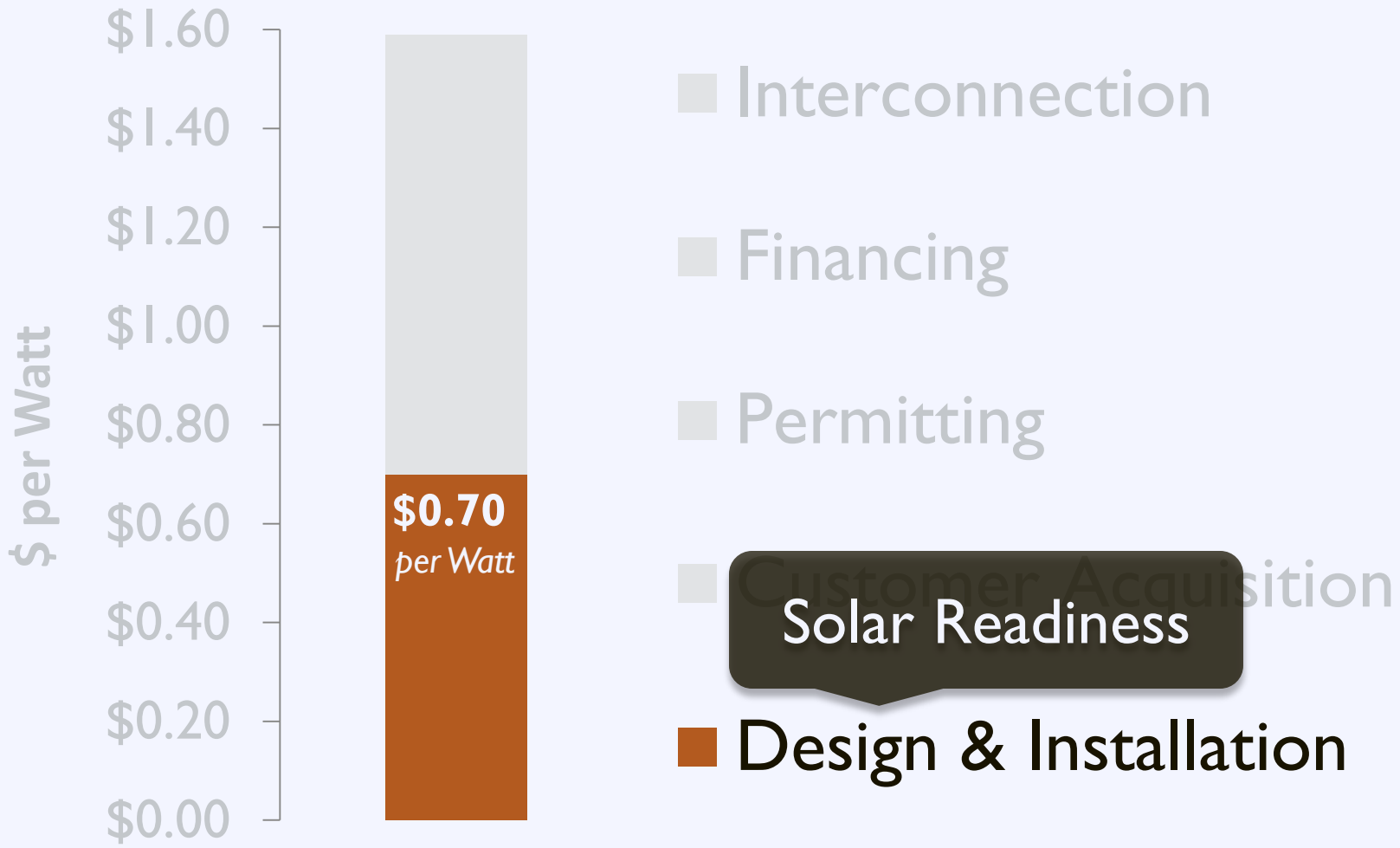
Source: NREL (http://www.nrel.gov/docs/fy12osti/54689.pdf)

Mitigate Soft Costs



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Source: NREL (http://www.nrel.gov/docs/fy12osti/54689.pdf)

Solar Readiness

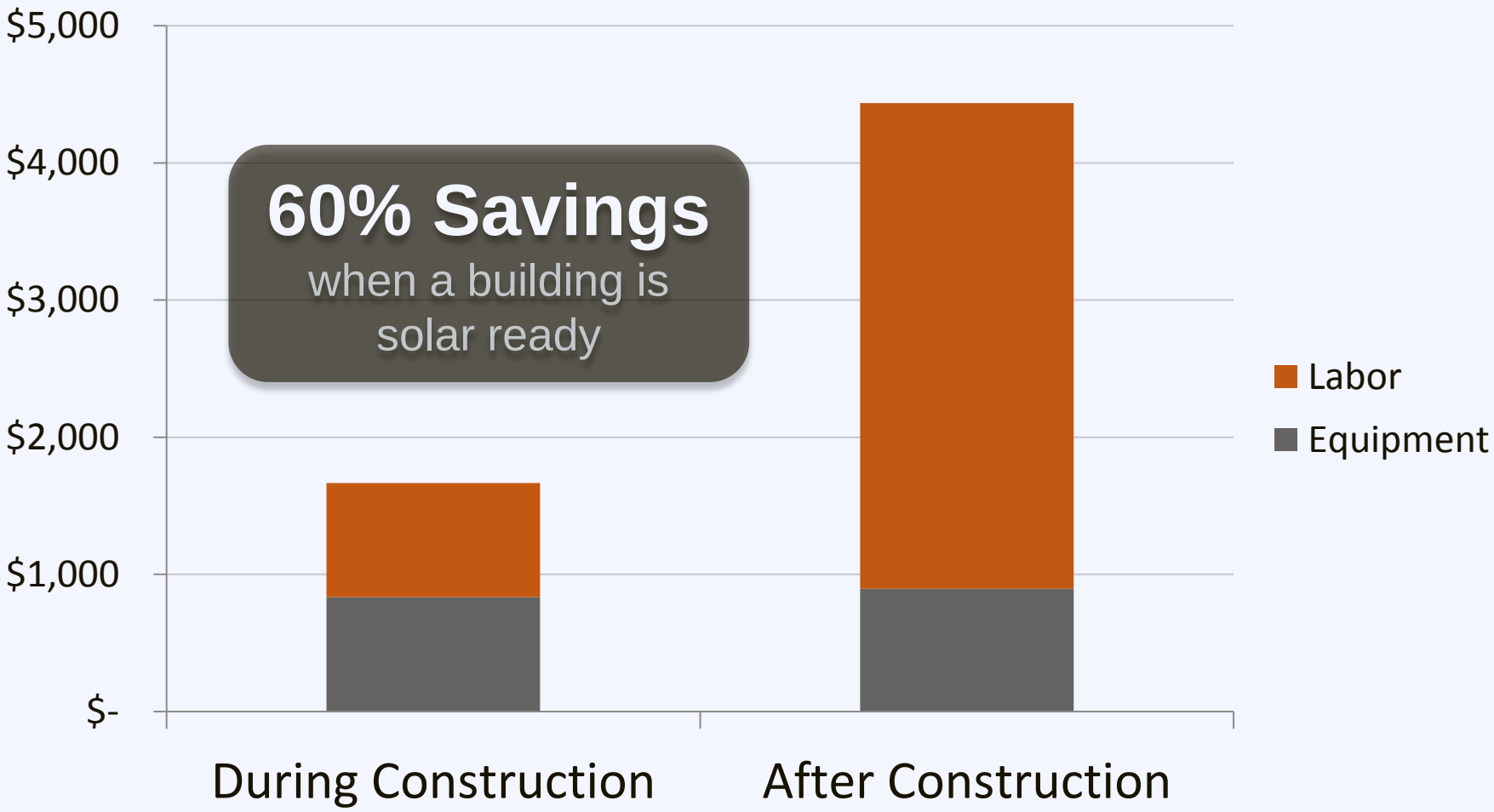
Creating solar-ready guidelines and promoting energy efficiency at the outset can help make future solar installations easier and more cost effective.

Solar Readiness

Require builders to:

- ✓ Minimize rooftop equipment
- ✓ Plan for structure orientation to avoid shading
- ✓ Install a roof that will support the load of a solar array
- ✓ Record roof specifications on drawings
- ✓ Plan for wiring and inverter placement

Solar Readiness



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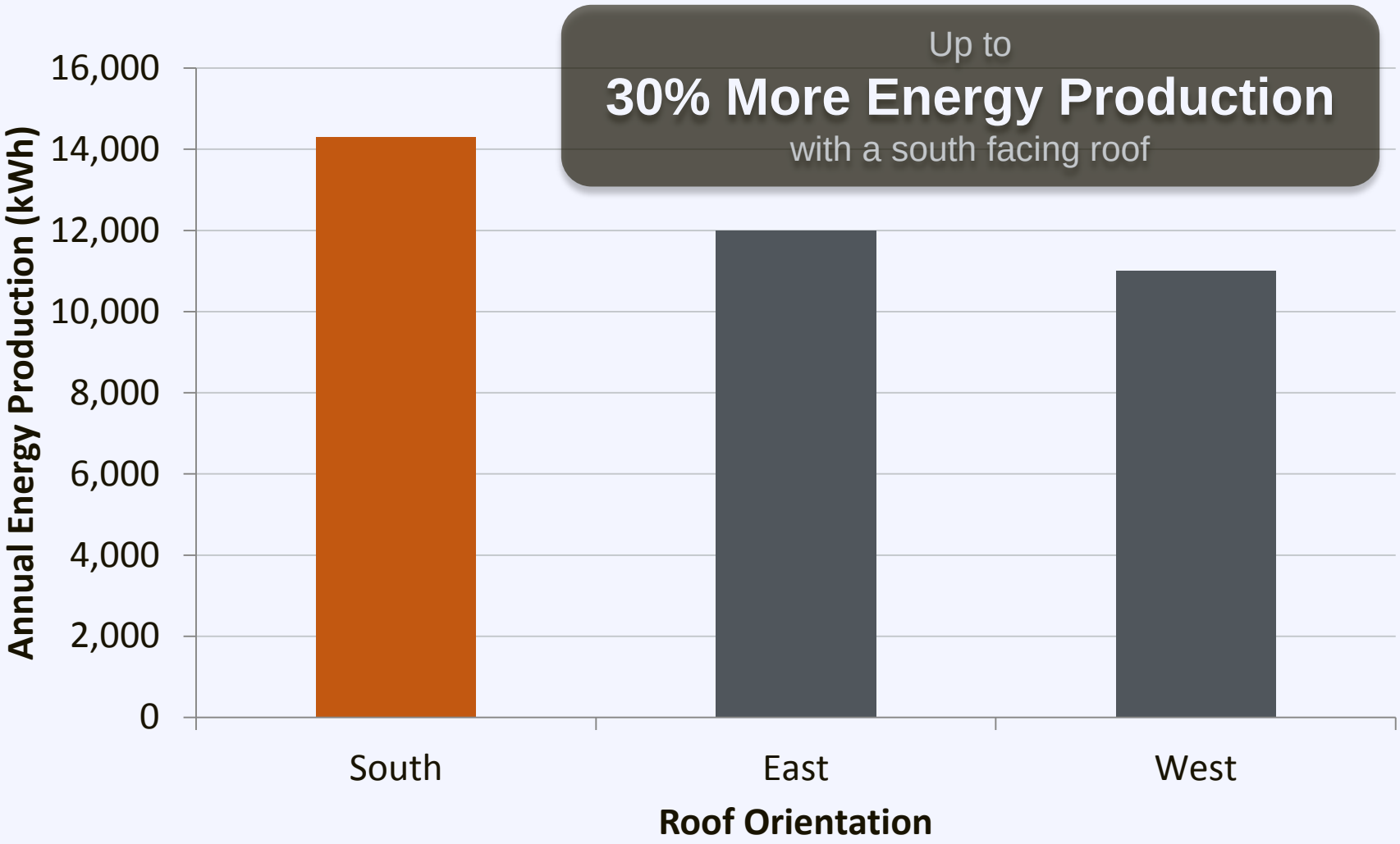
Source: Solar Ready: An Overview of Implementation Practices [Draft]. NREL, Feb. 18, 2011.

Solar Readiness



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Source: Solar Ready: An Overview of Implementation Practices [Draft]. NREL, Feb. 18, 2011.

Solar Readiness: Case Study

Oro Valley, Arizona

Population: 40,195

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U.S. Department of Energy

Source: Wikipedia

Solar Readiness: Case Study

Oro Valley Requirements:

- Installation of conduit or sleeve for wiring
- Site plan must indicate the best roof space for PV panels and provide a roof structure to support additional weight
- A space near the service equipment to mount additional PV equipment (meter, inverter, disconnect switches)
- Installation of a circuit breaker that can accommodate a PV system

Source: http://cms3.tucsonaz.gov/files/dsd/PV_Prep.pdf

Solar Readiness

Resource **NREL**

Creating a solar ready guide for buildings:

- Legislation
- Certification programs
- Stakeholder Education

www.nrel.gov

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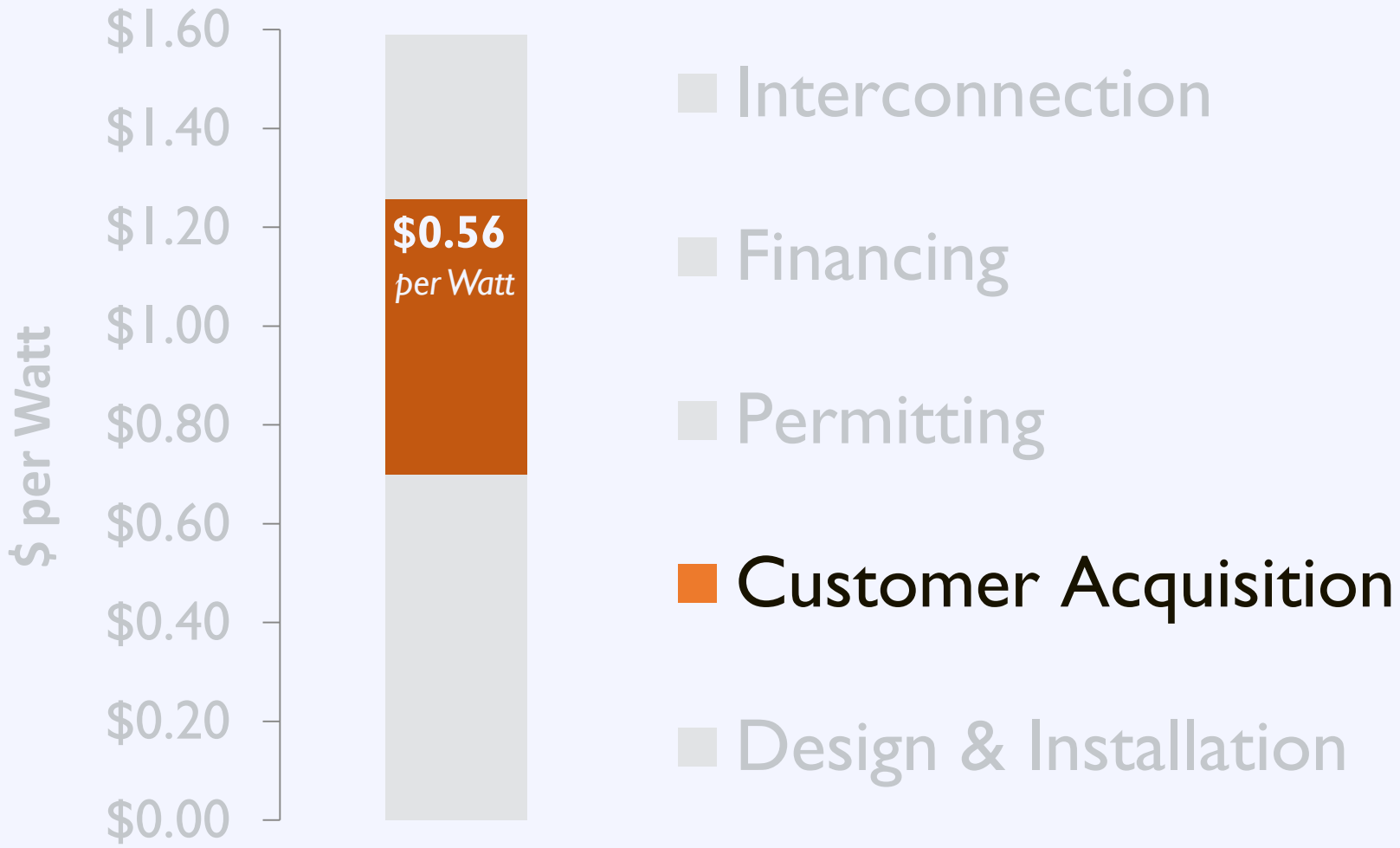
Source: NREL

Mitigate Soft Costs



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Source: NREL (http://www.nrel.gov/docs/fy12osti/54689.pdf)

Customer Acquisition

Solarize

Group Purchasing

Solarize: Advantages

Barriers		Solutions
High upfront cost	→	Group purchase
Complexity	→	Community outreach
Customer inertia	→	Limited-time offer

Solarize: Advantages

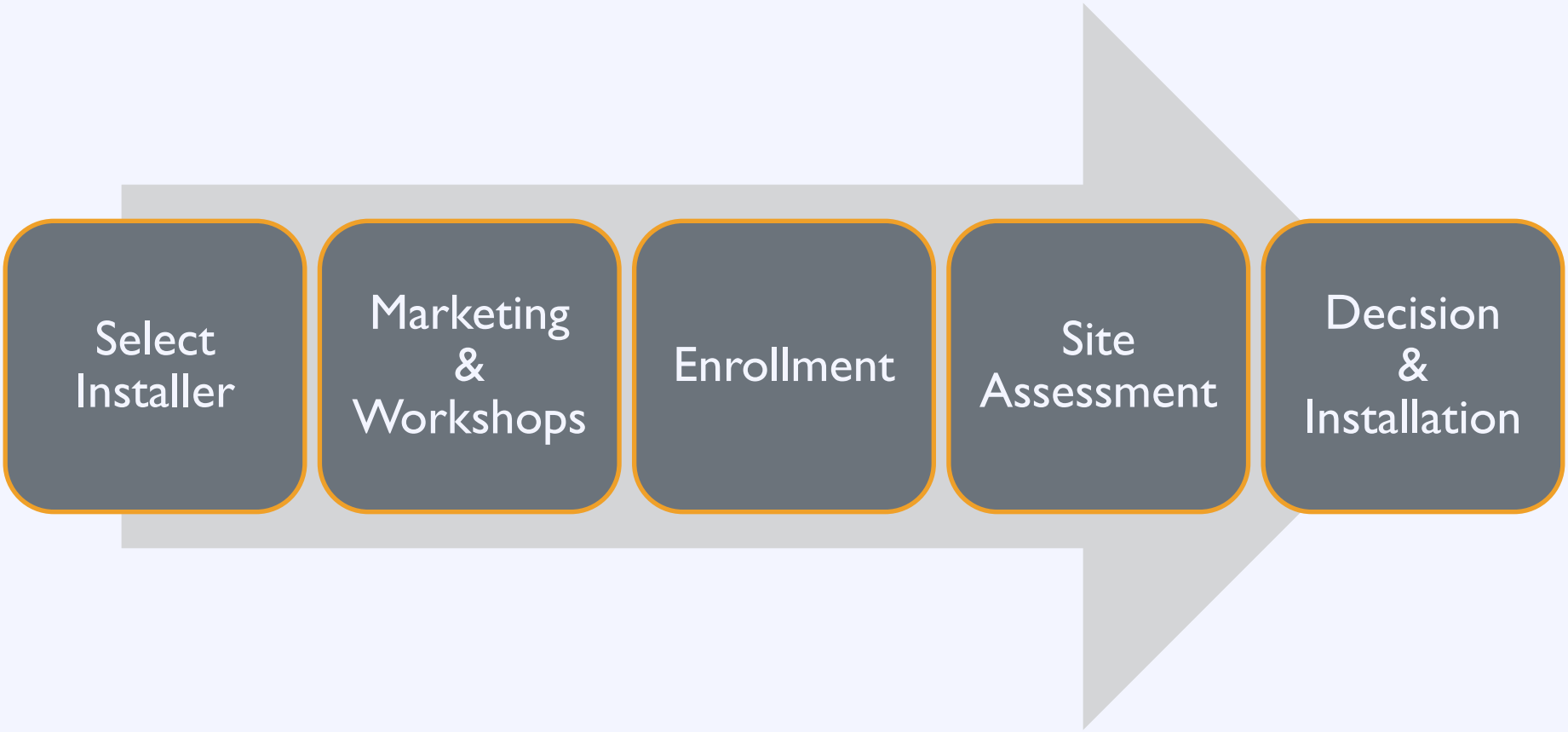
Benefits to Local Government:

Low implementation cost: $5,000 - $10,000

Quick turn-around: 9 Months

Long-term impact: Sustainable ecosystem

Solarize: Process



Solarize: Case Study

Harvard, Massachusetts

Population: 6,520

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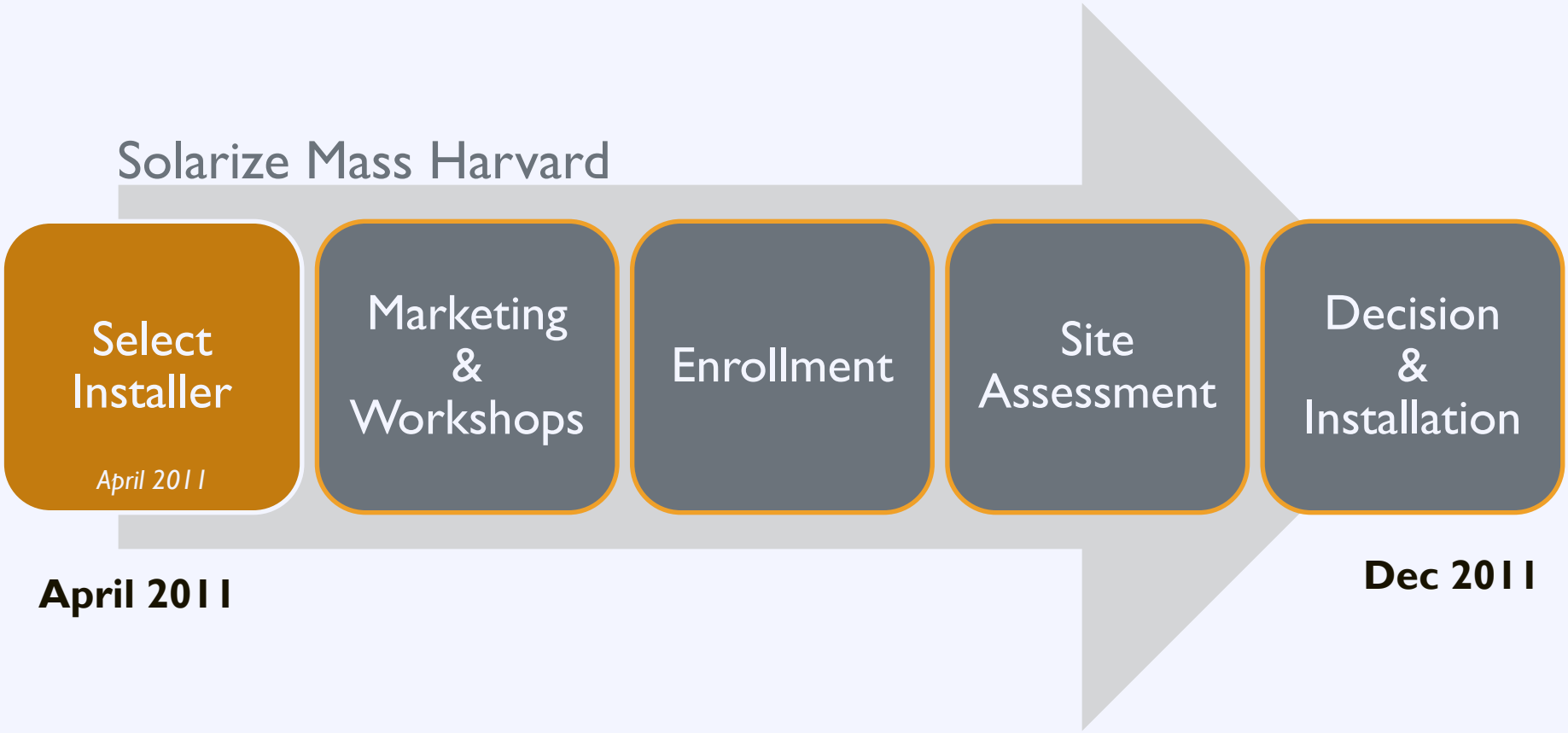
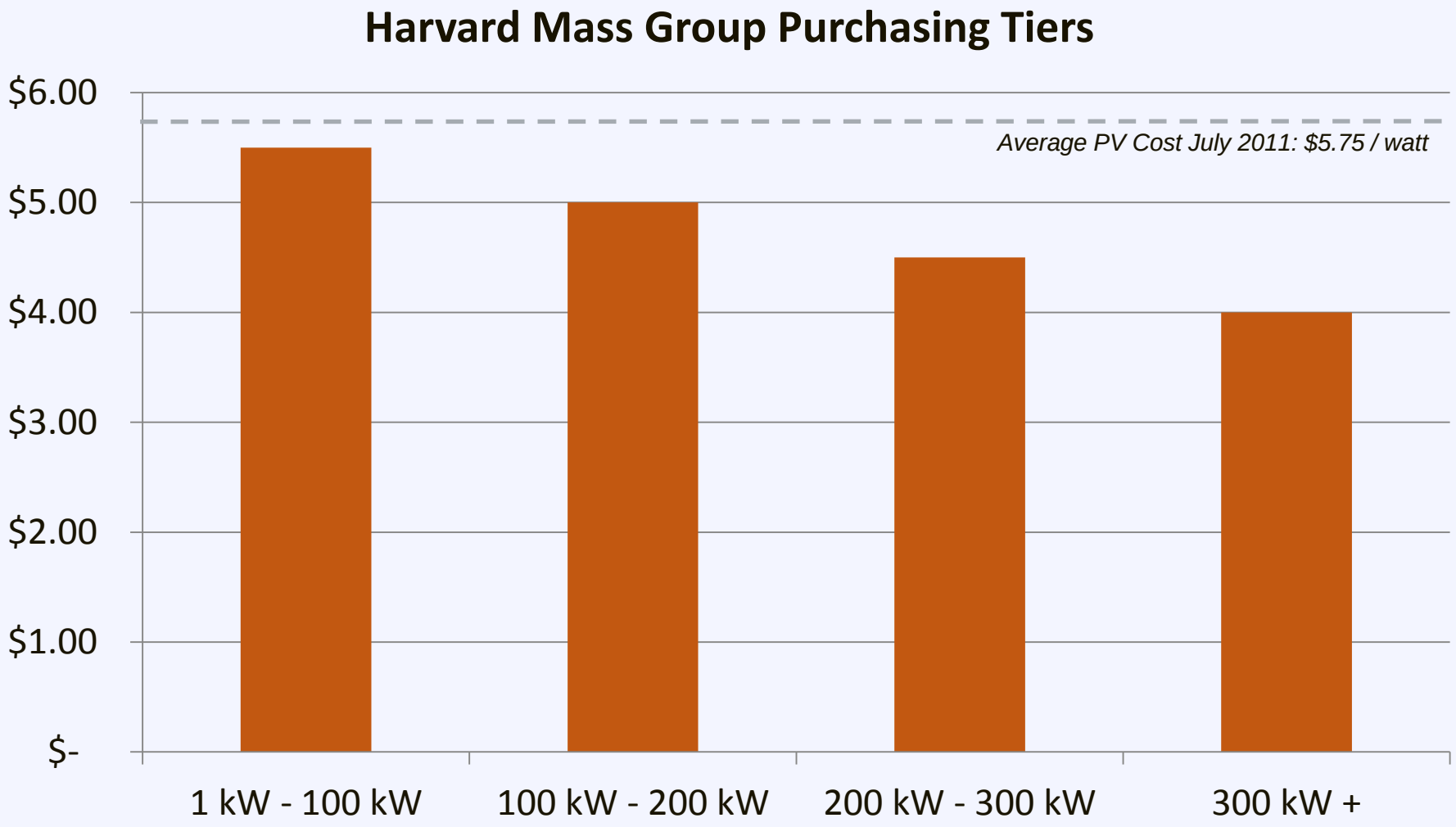
U.S. Department of Energy

Source: Wikipedia

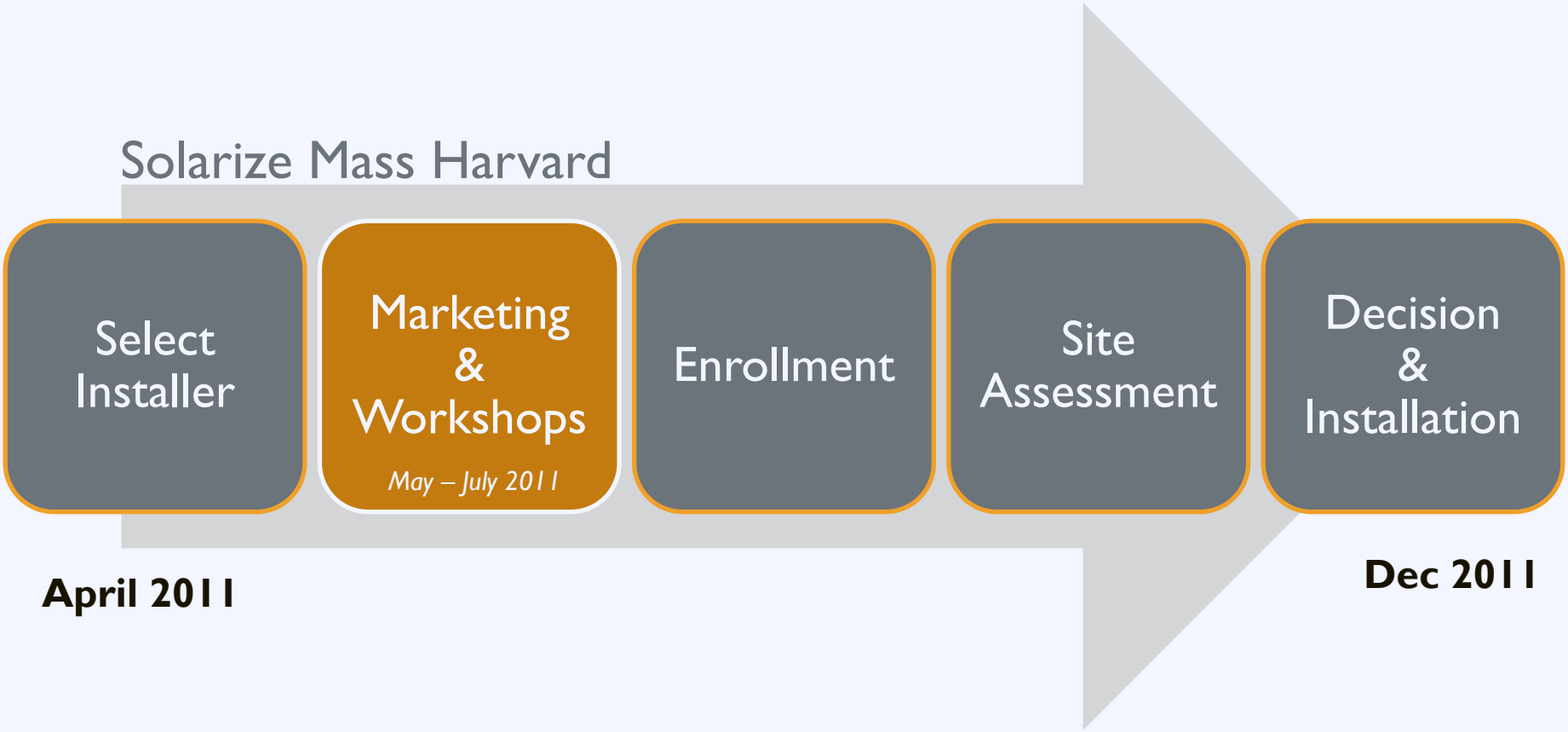
Solarize: Case Study



Group Purchasing



Solarize: Case Study



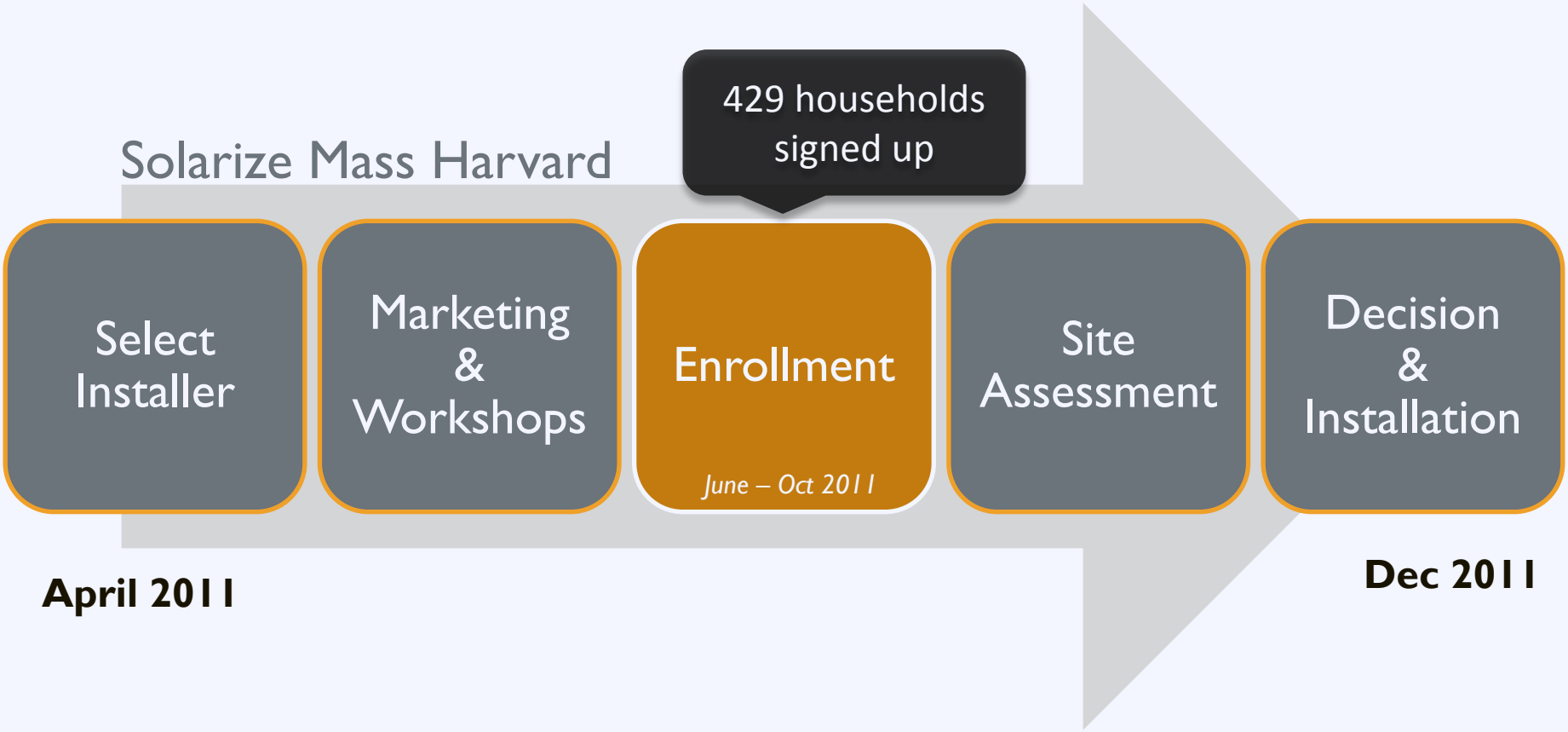
Solarize: Case Study

Marketing Strategy:

- Electronic survey of 1,100 households
- Email newsletters and direct mailings
- Float in July 4 parade
- Articles and advertisements in local newspaper
- Facebook page and online discussion board

Source: Vote Solar

Solarize: Case Study



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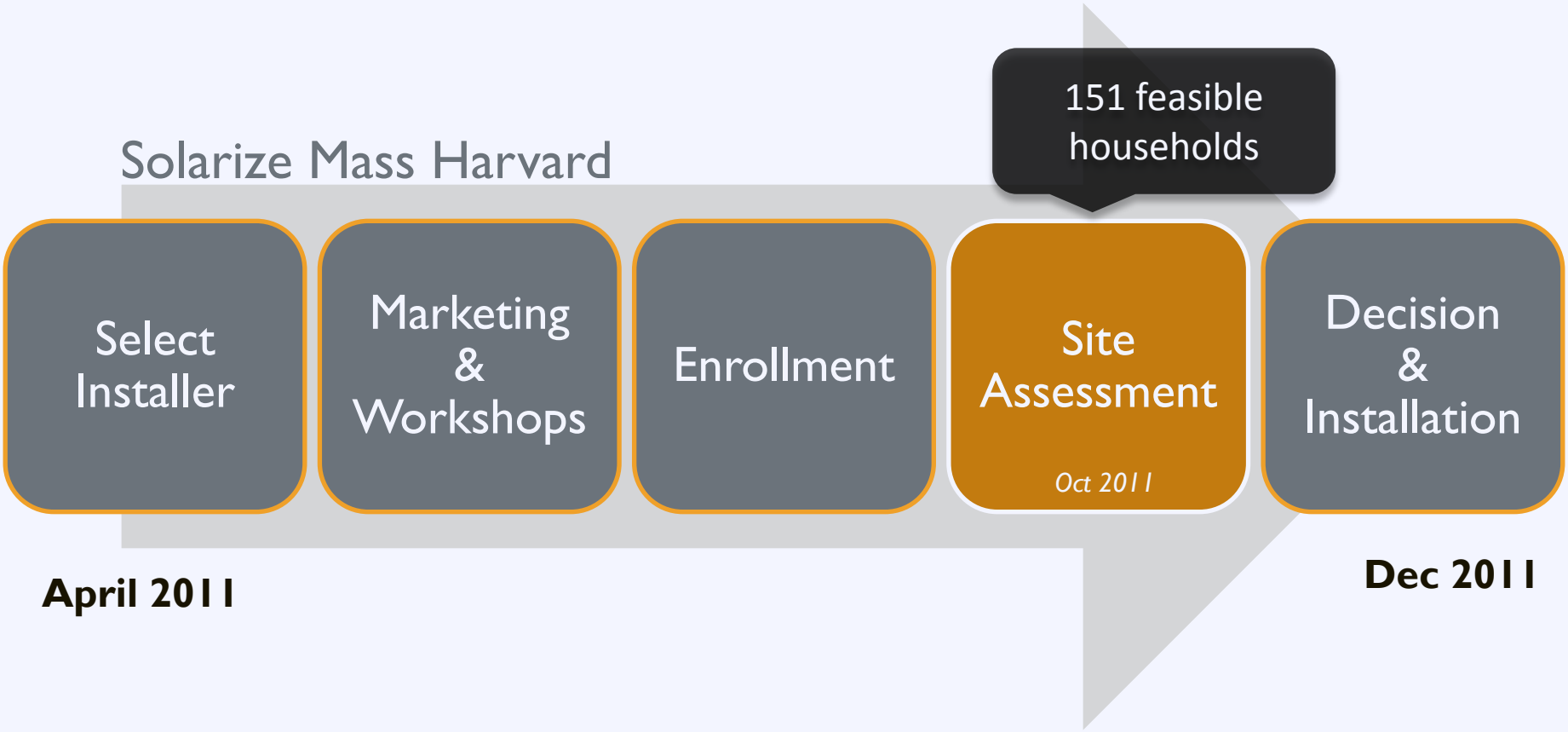
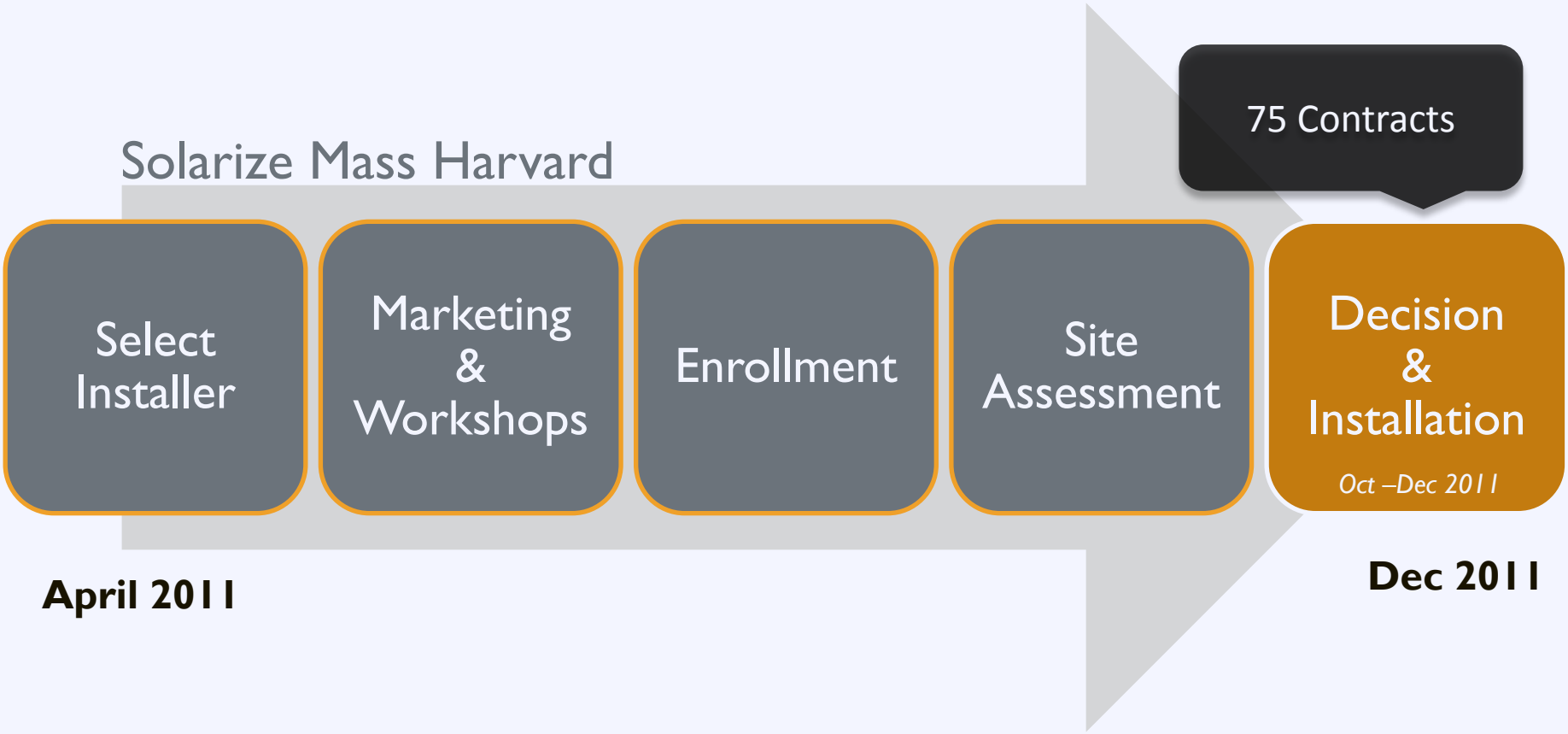
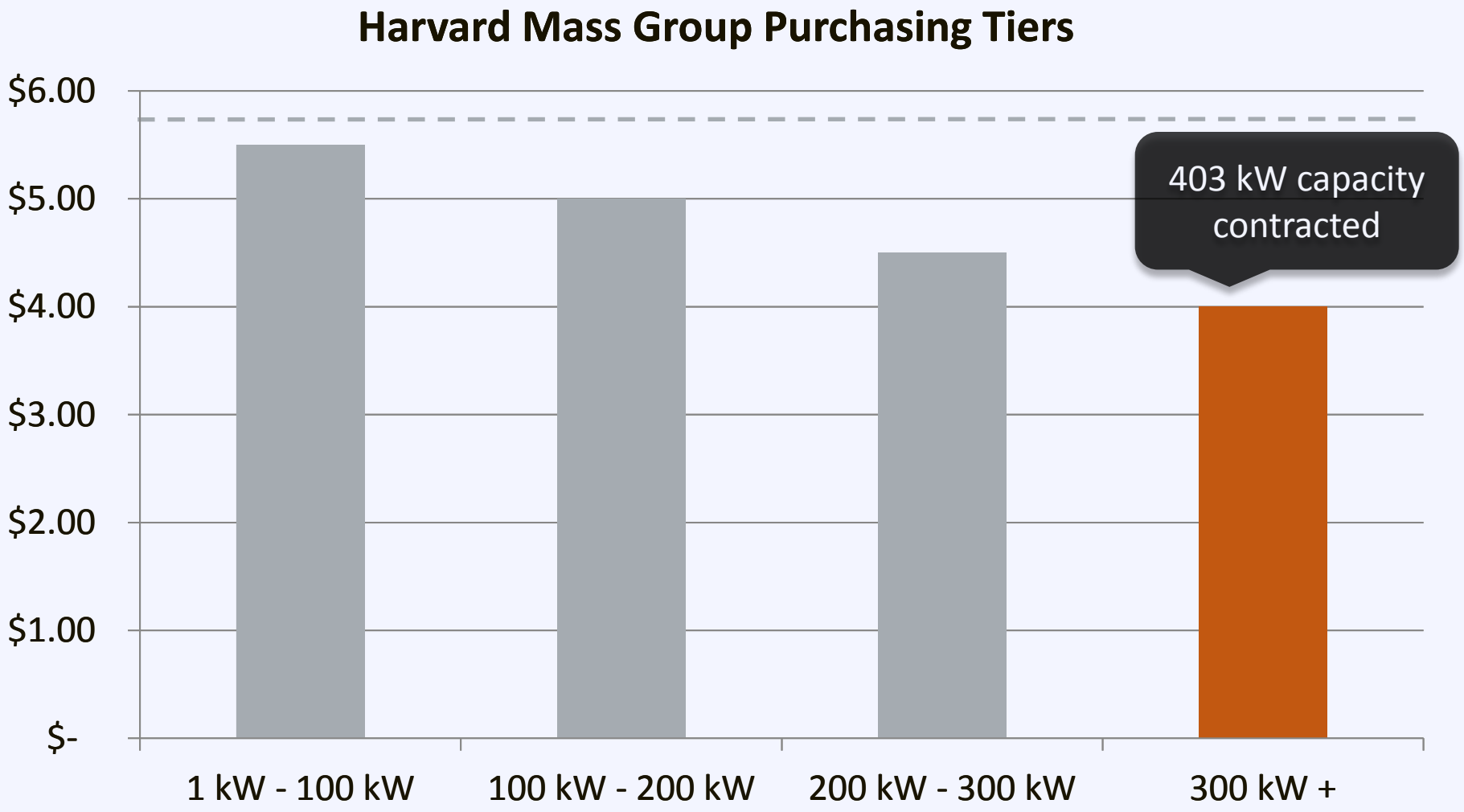


Solarize: Case Study



Group Purchasing



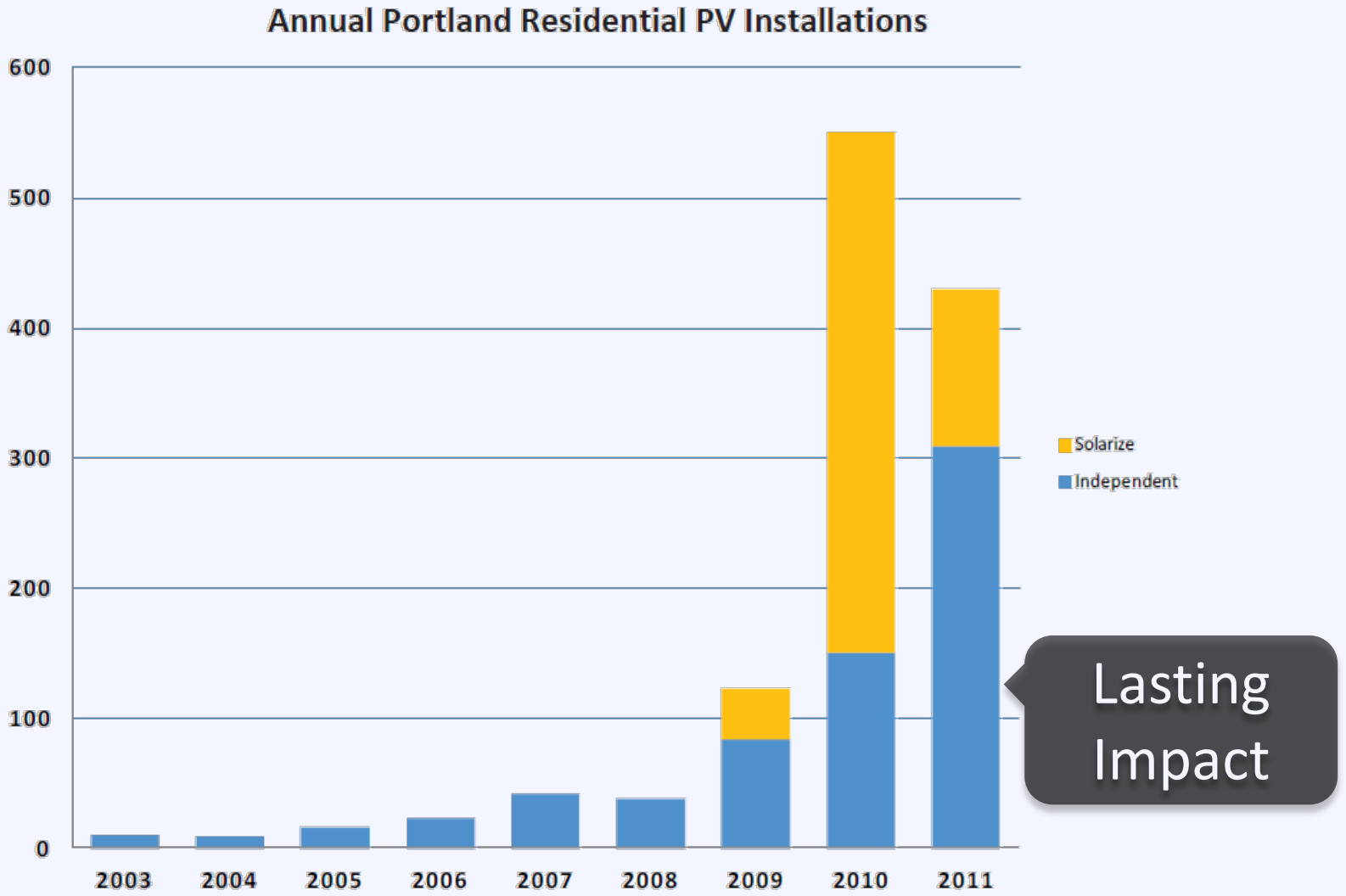
Solarize: Case Study

75 new installations totaling 403 kW

30% reduction in installation costs

575% increase in residential installations

Solarize: Lasting Impact



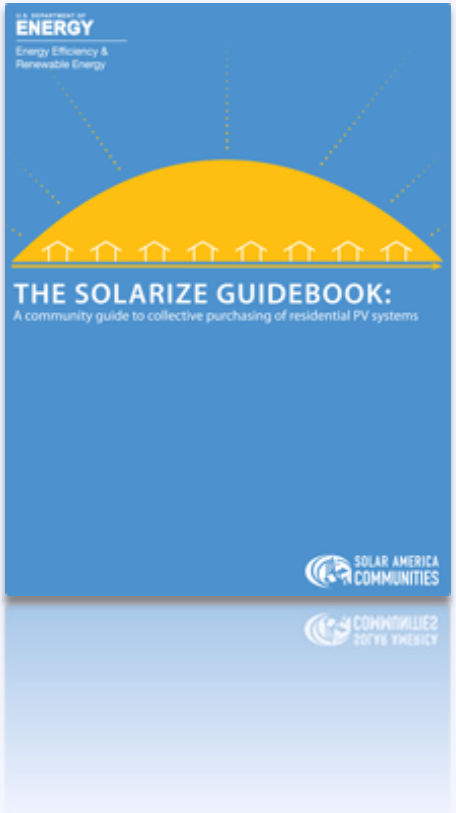
Source: NREL

Solarize: Resources

Resource **The Solarize Guidebook**

A roadmap for project planners and solar advocates who want to create their own successful Solarize campaigns.

www.nrel.gov



Mitigate Soft Costs

- Interconnection
- Financing
- Codes and standards
- Access rights
- Applying and processing
- Permitting
- Customer Acquisition
- Design & Installation

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Source: NREL (http://www.nrel.gov/docs/fy12osti/54689.pdf)

Zoning Code: As-of-Right

With "as-of-right" siting, development may proceed without the need for a special permit, variance, amendment, waiver, or other discretionary approval

Zoning Codes

Update zoning codes to:

- ✓ Remove barriers for solar installers
- ✓ Drive growth in your local solar market
- ✓ Ensure public safety
- ✓ Mitigate potential nuisances from solar equipment
- ✓ Increase clarity and lower costs for local officials

Source: Vote Solar

Zoning Codes: Regulations

Section	Topics to Address
Permitted Uses	Primary vs. accessory
Dimensional Standards	• Height • Lot coverage • Setbacks
Development Standards	• Screening • Placement • Site Planning
Definitions	Types of solar systems

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Source: American Planning Association

Zoning Codes: Small Scale Solar

Typical Requirements:

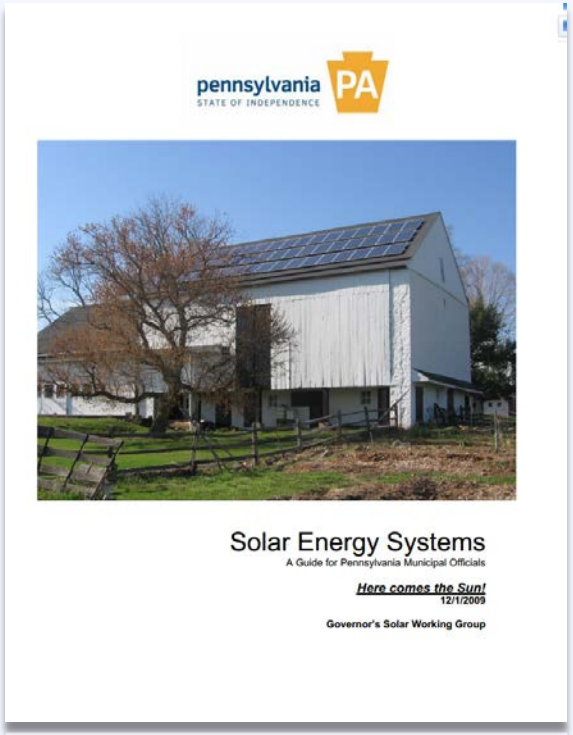
- Permitted as accessory use
- Minimize visibility if possible
- Requirements:
  - District height
  - Lot coverage
  - Setback

Zoning Code: Small Scale Solar

Resource **Pennsylvania Model Ordinance**

Prepared to assist local governments in establishing reasonable standards to facilitate the development of small-scale solar

state.pa.us



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Zoning Codes: Large Scale Solar

Typical Requirements:

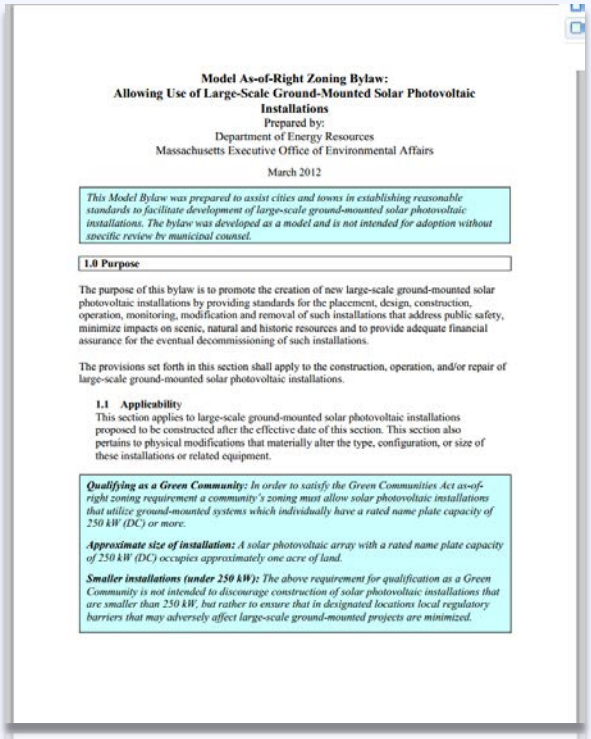
- Allowed for primary use in limited locations
- Requirements:
  - Height limits
  - Lot coverage
  - Setback
  - Fencing and Enclosure

Zoning Code: Large Scale Solar

Resource **Massachusetts Model Ordinance**

Prepared to assist local governments in establishing reasonable standards to facilitate the development of large-scale solar installations

www.mass.gov



Model As-of-Right Zoning Bylaw:
Allowing Use of Large-Scale Ground-Mounted Solar Photovoltaic Installations
Prepared by:
Department of Energy Resources
Massachusetts Executive Office of Environmental Affairs

March 2012

This Model Bylaw was prepared to assist cities and towns in establishing reasonable standards to facilitate development of large-scale ground-mounted solar photovoltaic installations. The bylaw was developed as a model and is not intended for adoption without specific review by municipal counsel.

1.0 Purpose

The purpose of this bylaw is to promote the creation of new large-scale ground-mounted solar photovoltaic installations by providing standards for the placement, design, construction, operation, monitoring, modification and removal of such installations that address public safety, minimize impacts on scenic, natural and historic resources and to provide adequate financial assurance for the eventual decommissioning of such installations.

The provisions set forth in this section shall apply to the construction, operation, and/or repair of large-scale ground-mounted solar photovoltaic installations.

1.1 Applicability
This section applies to large-scale ground-mounted solar photovoltaic installations proposed to be constructed after the effective date of this section. This section also pertains to physical modifications that materially alter the type, configuration, or size of these installations or related equipment.

Qualifying as a Green Community: *In order to satisfy the Green Communities Act as-of-right zoning requirement a community's zoning must allow solar photovoltaic installations that utilize ground-mounted systems which individually have a rated name plate capacity of 250 kW (DC) or more.*

Approximate size of installation: *A solar photovoltaic array with a rated name plate capacity of 250 kW (DC) occupies approximately one acre of land.*

Smaller installations (under 250 kW): *The above requirement for qualification as a Green Community is not intended to discourage construction of solar photovoltaic installations that are smaller than 250 kW, but rather to ensure that in designated locations local regulatory barriers that may adversely affect large-scale ground-mounted projects are minimized.*

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Solar Access

Purpose of Solar Access Laws:

1. To increase the likelihood that properties will receive sunlight

2. To protect the rights of property owners to install solar

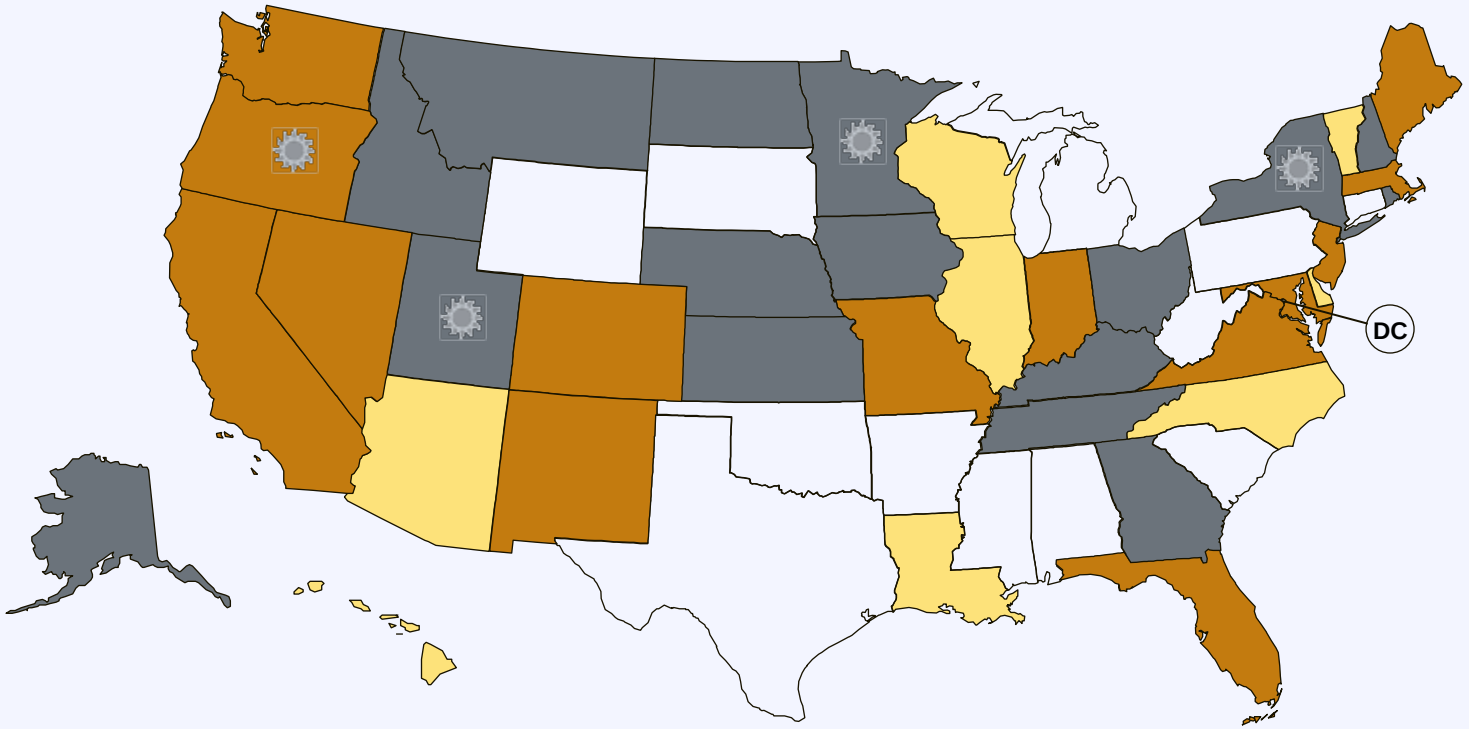
3. To reduce the risk that systems will be shaded after installation

Fontainebleau V. Eden Roc (1959)

A landowner does not have any legal right to the free flow of light and air across the adjoining land of his neighbor

Source: Google Earth

Solar Access



Solar Easements Provision

Solar Rights Provision

Solar Easements and Solar Rights Provisions

U.S. Virgin Islands

Local option to create solar rights provision

Powered by SunShot
U.S. Department of Energy

Source: DSIRE

Solar Access

What can you do?

- ✓ Revise local ordinances that pose unintended obstacles
- ✓ Consider a solar access permit scheme
- ✓ Require written solar easement agreements
- ✓ Dedicate solar easements for newly constructed buildings

Solar Access

Solar access ordinances best practices:

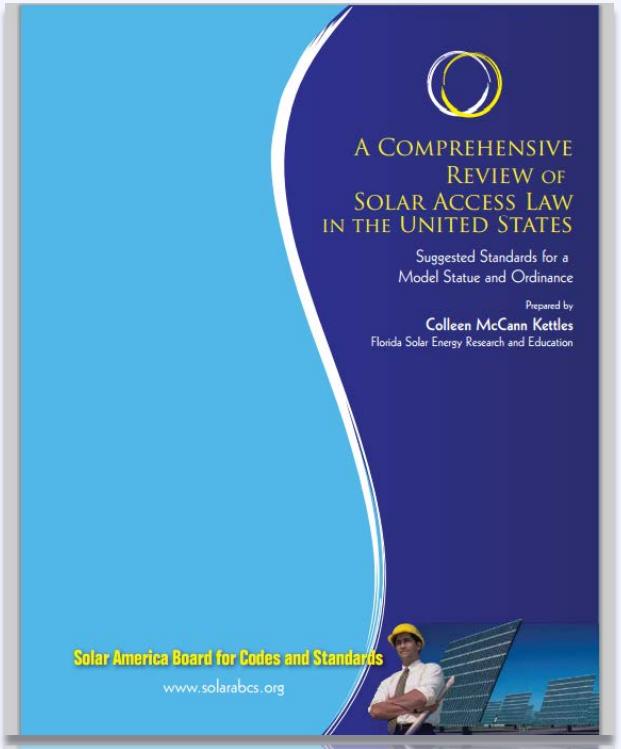
- Define the solar energy equipment protected
- Define the types of structures covered by the law
- Quantify what constitutes unreasonable restrictions
- Award costs to prevailing parties in civil action with HOA
- Don't restrict solar installations because of aesthetics

Solar Access

Resource **Solar ABCs**

A comprehensive review of solar access law in the US – Suggested standards for a model ordinance

www.solarabcs.org



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The Permitting Process: Challenges

18,000+ local jurisdictions

with unique permitting requirements

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U.S. Department of Energy

Source: http://www.nrel.gov/docs/fy12osti/54689.pdf

The Permitting Process: Challenges

Local permitting processes add on average

$2,516

to the installation cost of residential PV

Powered by SunShot U.S. Department of Energy

Source: SunRun

The Permitting Process: Challenges

Source: Forbes

Expedited Permitting

Solar Permitting Best Practices:

- ✓ Fair flat fees
- ✓ Electronic or over-the-counter issuance
- ✓ Standardized permit requirements
- ✓ Electronic materials

Powered by SunShot
U.S. Department of Energy

Source: Vote Solar

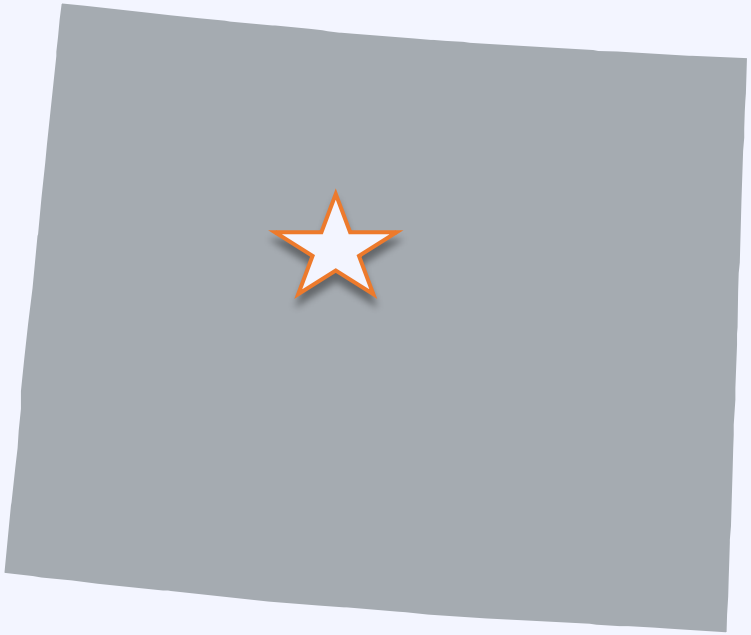
Expedited Permitting

Solar Permitting Best Practices:

- ✓ Training for permitting staff in solar
- ✓ Removal of excessive reviews
- ✓ Reduction of inspection appointment windows
- ✓ Utilization of standard certifications

Source: Vote Solar

Expedited Permitting: Case Study



Breckenridge, Colorado

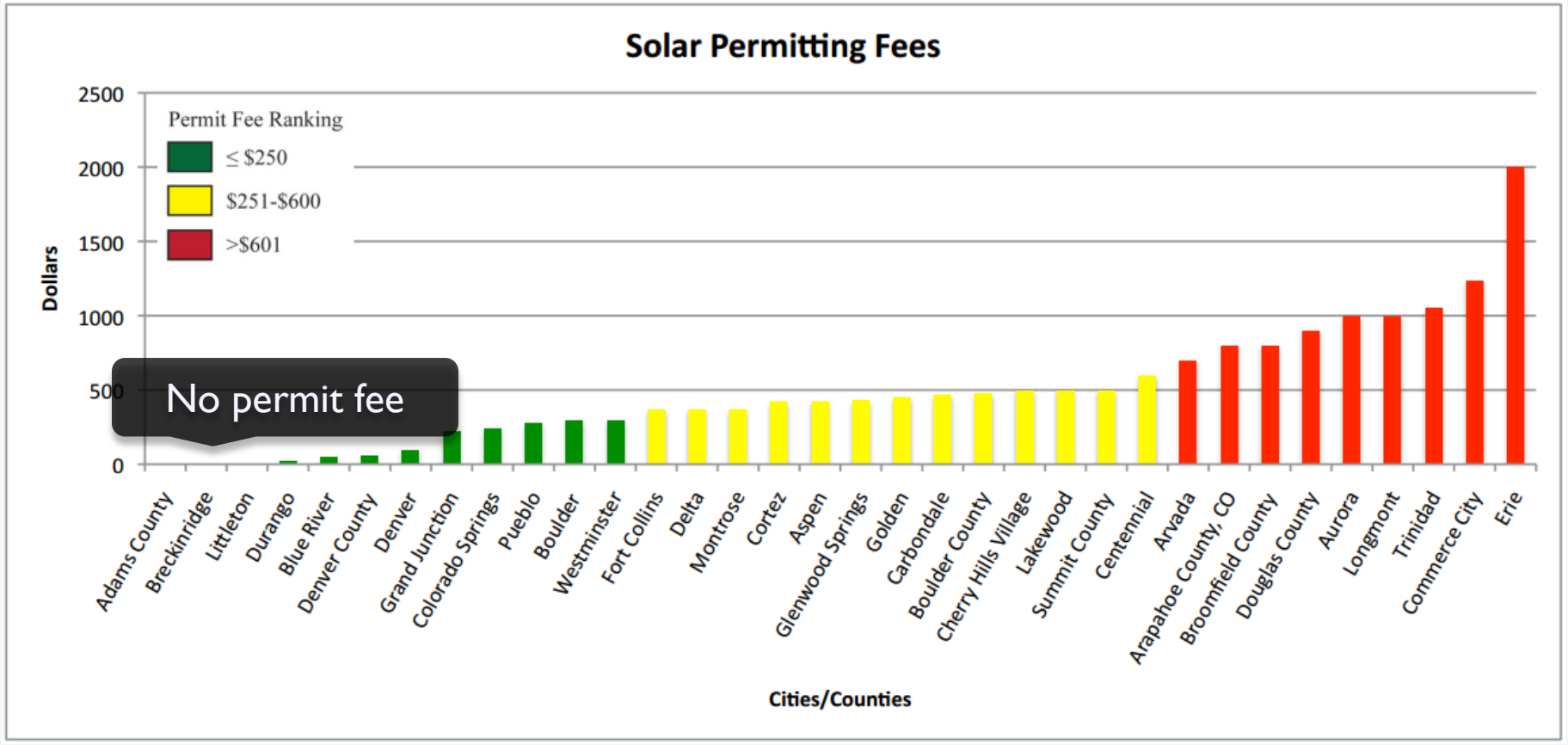
Population: 4,540

Powered by SunShot
U.S. Department of Energy

Source: Wikipedia

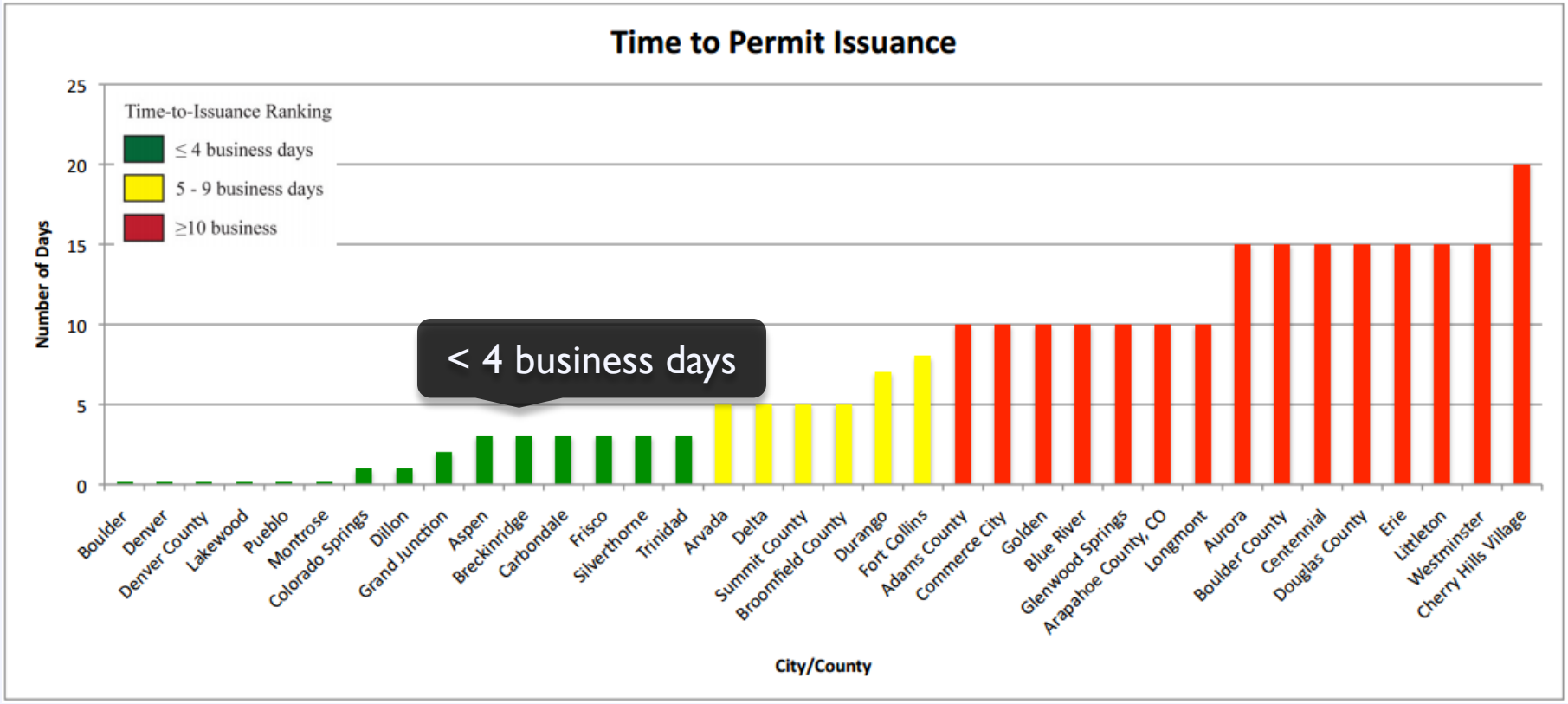
Expedited Permitting: Case Study

Breckenridge charges no fees to file for a solar permit



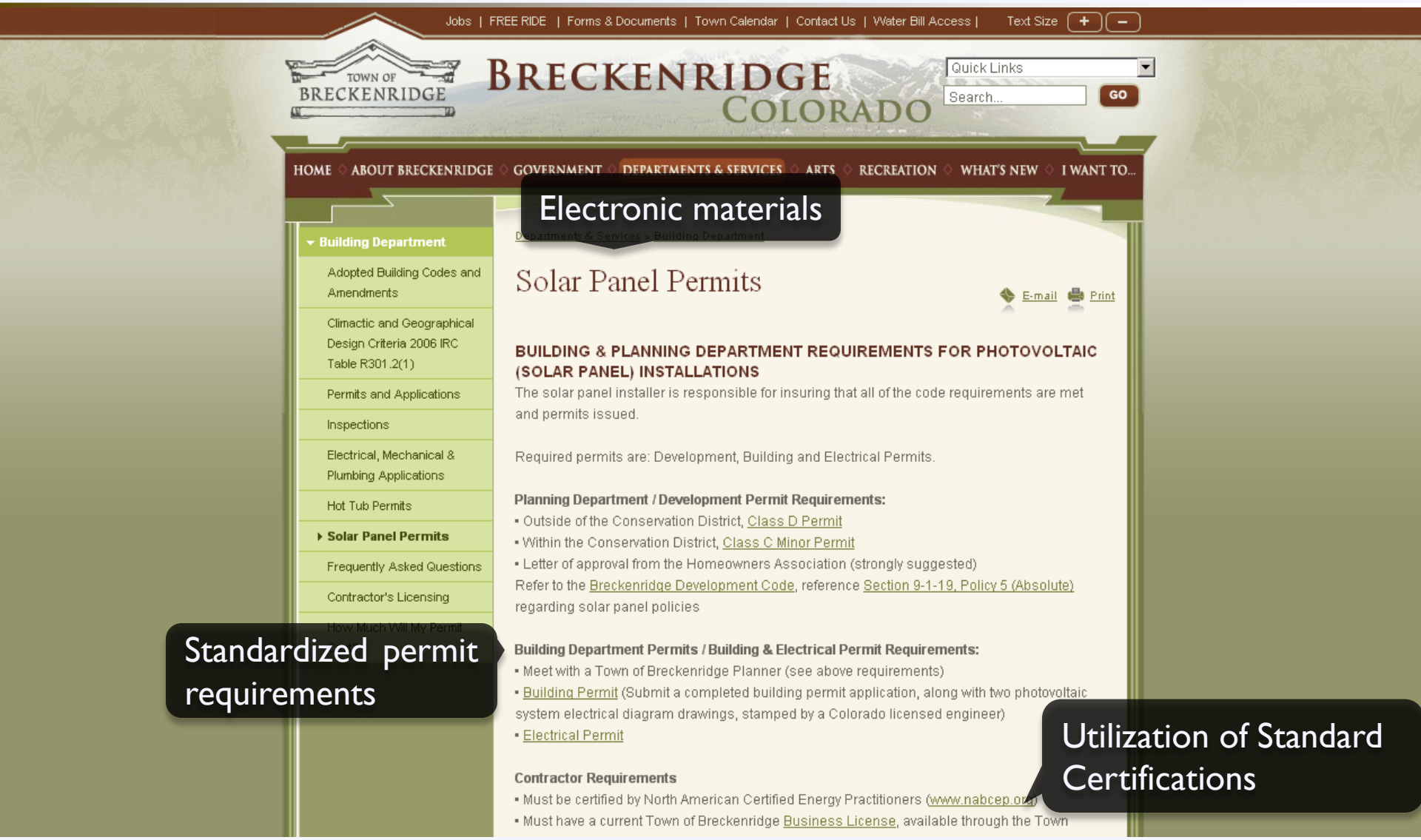
Expedited Permitting: Case Study

Breckenridge offers a short turn around time for solar permits



Source:Vote Solar (http://votesolar.org/wp-content/uploads/2011/03/COPermitReport.pdf)

Expedited Permitting: Case Study



Powered by SunShot U.S. Department of Energy

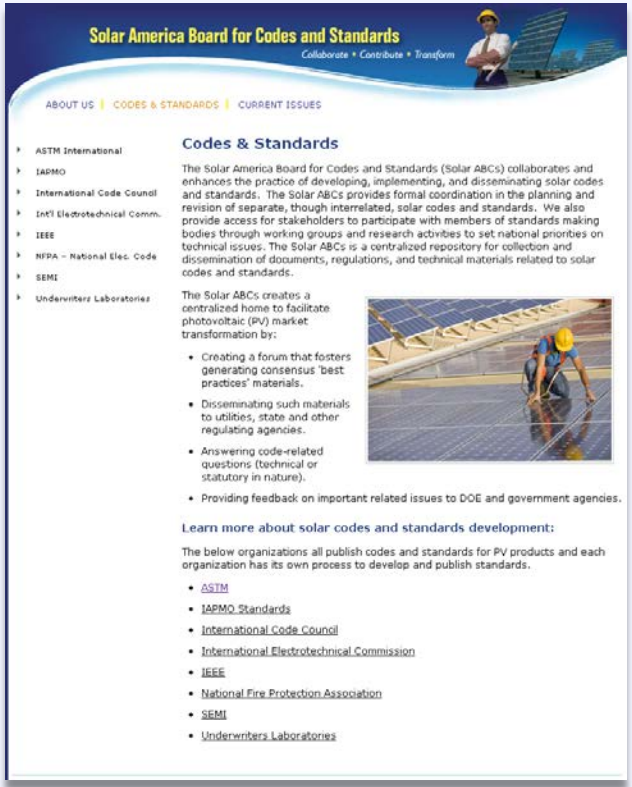
Source: Breckenridge, CO (http://www.townofbreckenridge.com/index.aspx?page=694)

Expedited Permitting: Best Practices

Resource **Solar ABCs**

Expedited Permitting:

- Simplifies requirements for PV applications
- Facilitates efficient review of content
- Minimize need for detailed studies and unnecessary delays



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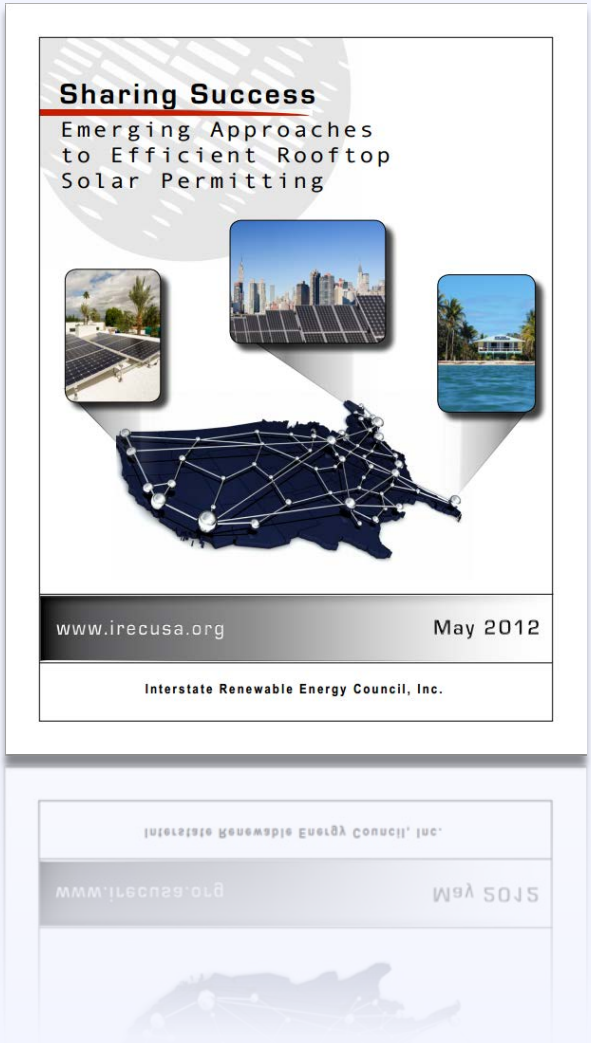
U.S. Department of Energy

Expedited Permitting: Best Practices

Resource **Interstate Renewable Energy Council**

Outlines emerging approaches to efficient rooftop solar permitting

www.irecusa.org



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U.S. Department of Energy

Expedited Permitting: Application

SOLAR PV SYSTEM INSTALLATIONS WITH AN ELECTRICAL PERMIT ONLY

If the Licensed Electrical Contractor can commit to meeting the following installation conditions, limitations and requirements in the installation of the solar PV system, the Department will waive the requirement for a separate building permit and allow the electrical permit to apply to the full installation.

A separate building permit application with construction plans must be obtained if the following conditions and requirements cannot be met or the Electrical Contractor performing the electrical installation is not willing to accept responsibility for the structural installation of the system.

Conditions:

- Installation must be on the roof of a one- or two-family dwelling.
- Installation may not occur on roof systems comprised of engineered trusses. These systems will require building permits
- Property is not designated historical by the Philadelphia Historical Commission.
- Electrical Contractor must agree to accept responsibility for the structural installation of the roof-top equipment.
- If the contractor finds the installation cannot meet these requirements, a separate building permit must be obtained.

Installation Limitations and Requirements

- Equipment weighs less than 5 pounds per square foot (psf).
- Equipment imposes less than 45 psf point load in any location.
- The height of the system is less than 18 inches above the adjacent roof.
- A three (3) foot clearance must be provided around all equipment.
- Installation includes a pre-engineered ballasted or mounting structure with attachments both designed for a wind load of 90 mph.
- The equipment must be installed as per manufacturer's instructions.

Powered by SunShot
U.S. Department of Energy

Source: City of Philadelphia, Department of Licenses and Inspections
(http://www.phila.gov/green/PDFs/Streamlined%20Solar%20Standards.pdf)

Expedited Permitting: Application

Electrical Permit Limitations and Requirements

Specifically, the system must be 10kW or less, be composed of four or less series strings, and have a total inverter capacity of less then 13.44kW, with all materials, devices and equipment labeled and listed by a certified testing agency.

Solar PV system electrical permit applications must include the following information:

- Detailed riser diagrams
- Conduit and wiring details
- Grounding detail
- Electrical service information
- Module information
- Inverter information

Electrical Permits

Systems that meet the electrical limitations detailed above may be eligible for a streamlined permit review. For more specific information on the electrical permit requirements above, please see our *"Permit Checklist for Solar PV Systems."*

Zoning Requirements

Solar PV systems installed on the roof of a one- or two- family dwelling do not require a zoning permit.

Application Process

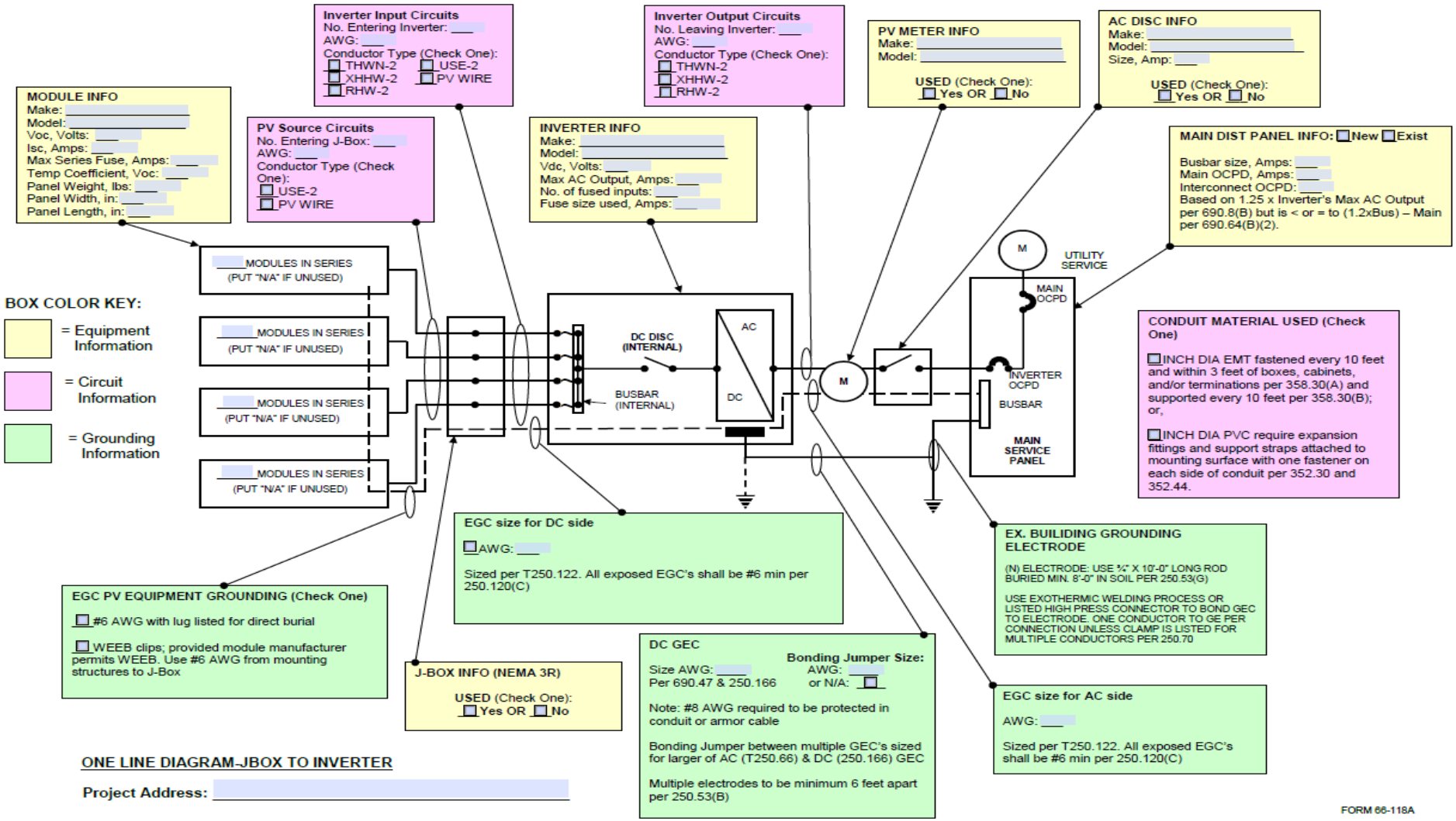
When Licensed Electrical Contractors apply for a permit related to the electrical work required to properly install a solar PV system on one or two family dwellings, they may agree to meet the conditions, limitations and requirements of the Building Code established in this **Solar PV Installation Standard**.

This agreement to meet the limitations and requirements above must be noted in the "Brief Description of Work" field on a standard electrical permit application and the application signed by the Electrical Contractor.

Powered by SunShot
U.S. Department of Energy

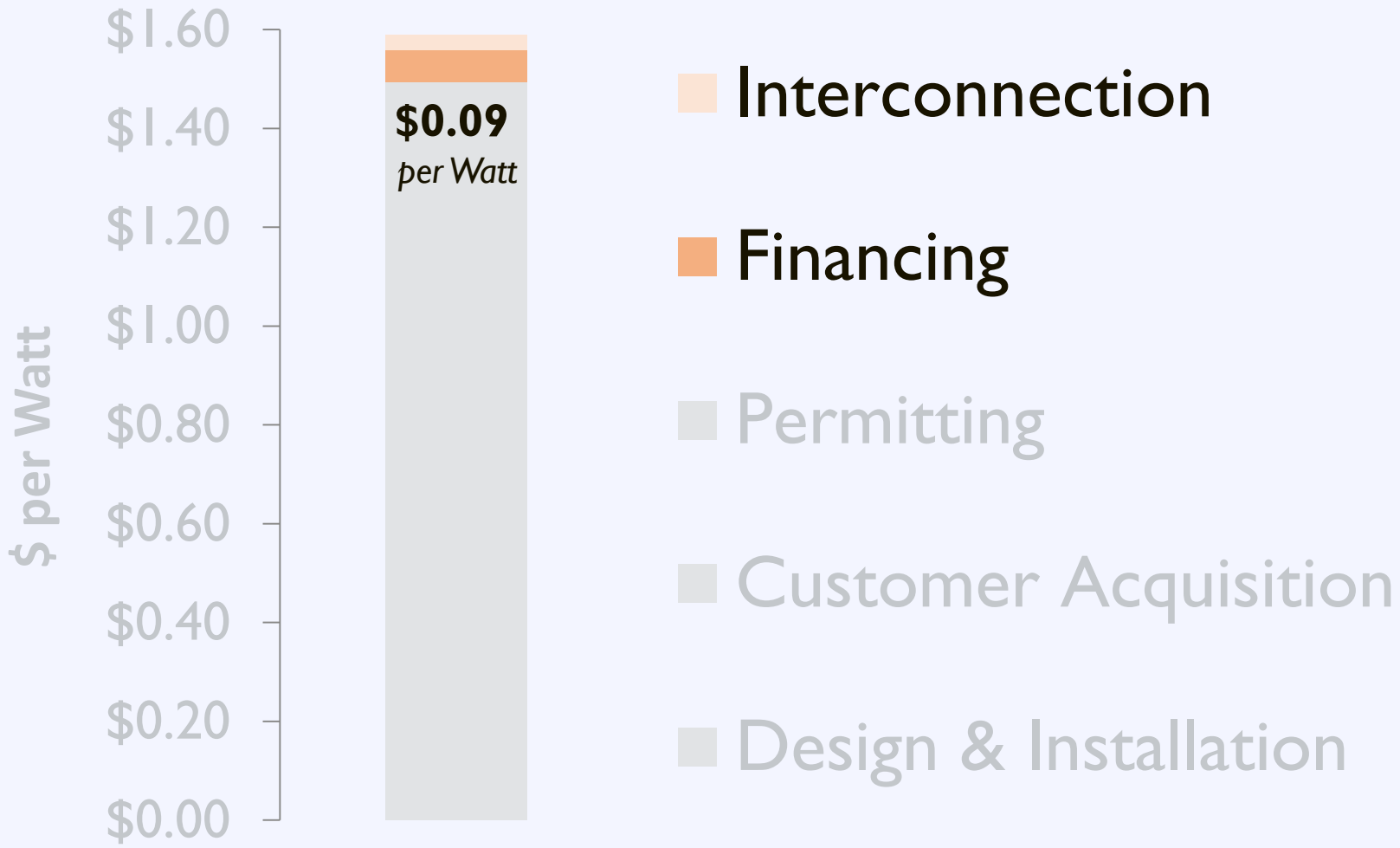
Source: City of Philadelphia, Department of Licenses and Inspections (http://www.phila.gov/green/PDFs/Streamlined%20Solar%20Standards.pdf)

Expedited Permitting: Application



Source: City of Irvine, Department of Community Development (http://www.cityofirvine.org/cityhall/cd/buildingsafety/permit_processing_center/residential_photovoltaic_systems/default.asp)

Mitigate Soft Costs



Source: NREL (http://www.nrel.gov/docs/fy12osti/54689.pdf)

Agenda

08:40 – 09:00	Solar 101
09:00 – 09:50	Creating a Regulatory Landscape for Solar
09:50 – 10:00	*Break*
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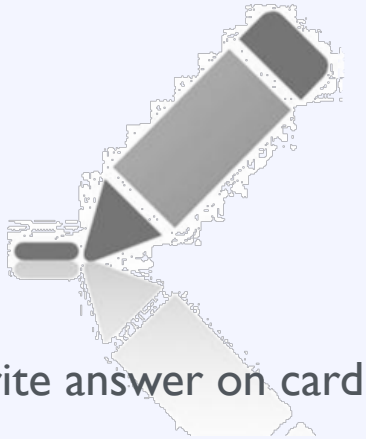
Activity: Identifying Benefits

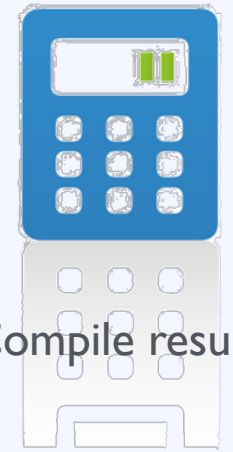
What is the greatest benefit solar can bring to your community? [Blue Card]

Right Now



Write answer on card

During Session



Compile results

After Break

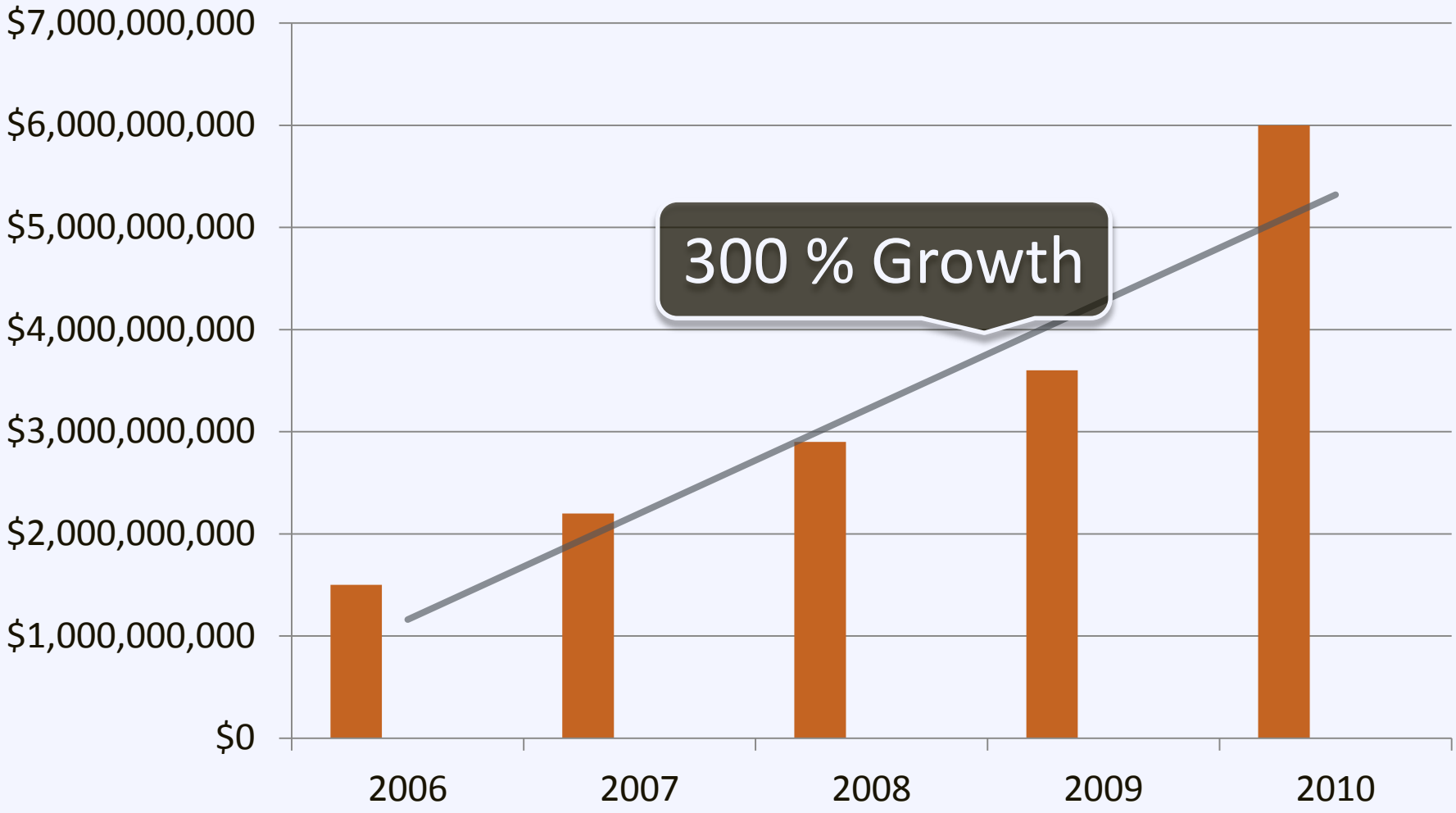
Group discussion

[Results from Survey]

Benefits of Solar Energy

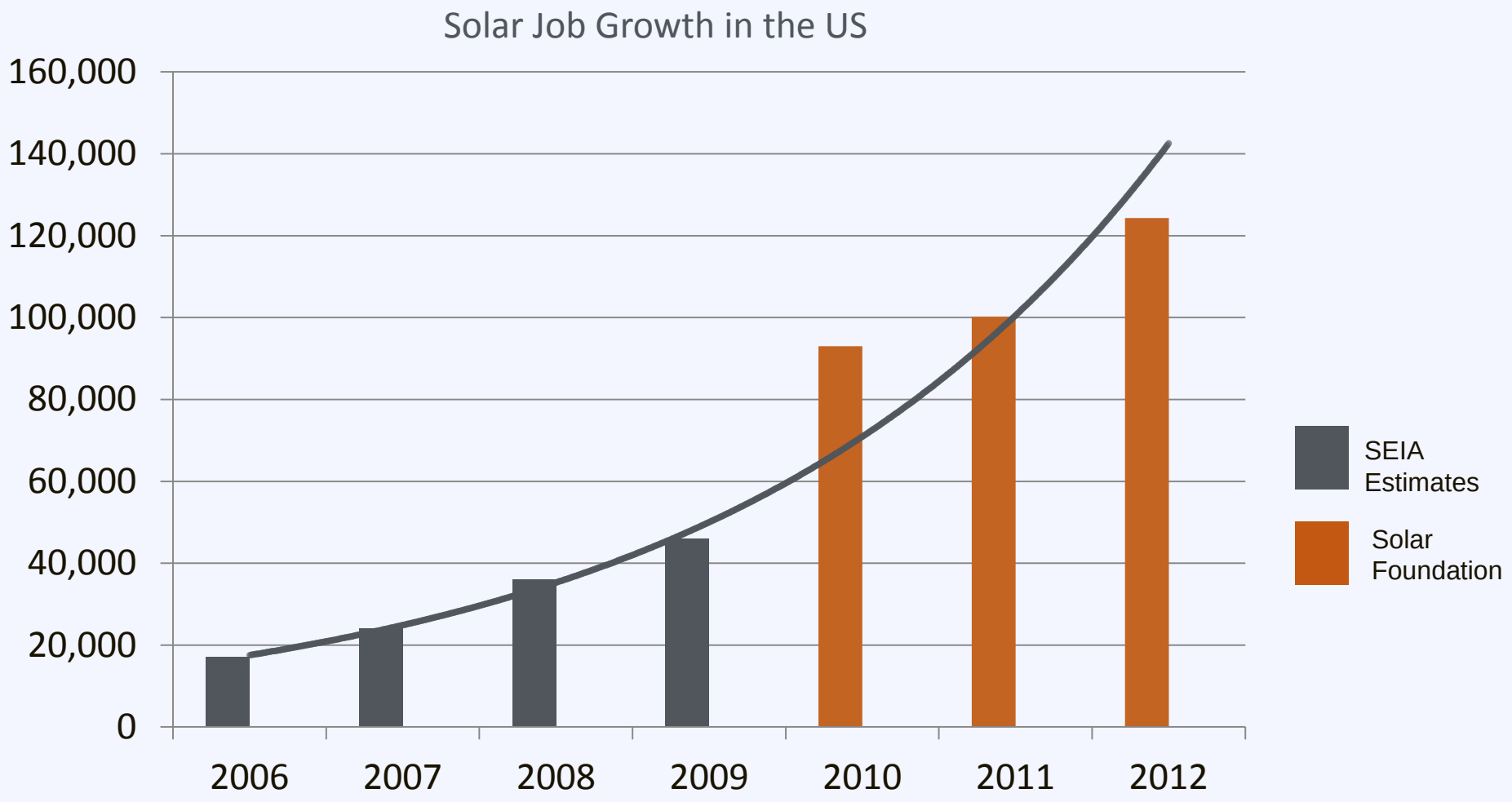
- Local economy growth
- Local jobs
- Energy independence
- Stabilizes price volatility
- Valuable to utilities
- Smart investment

Benefit: Economic Growth



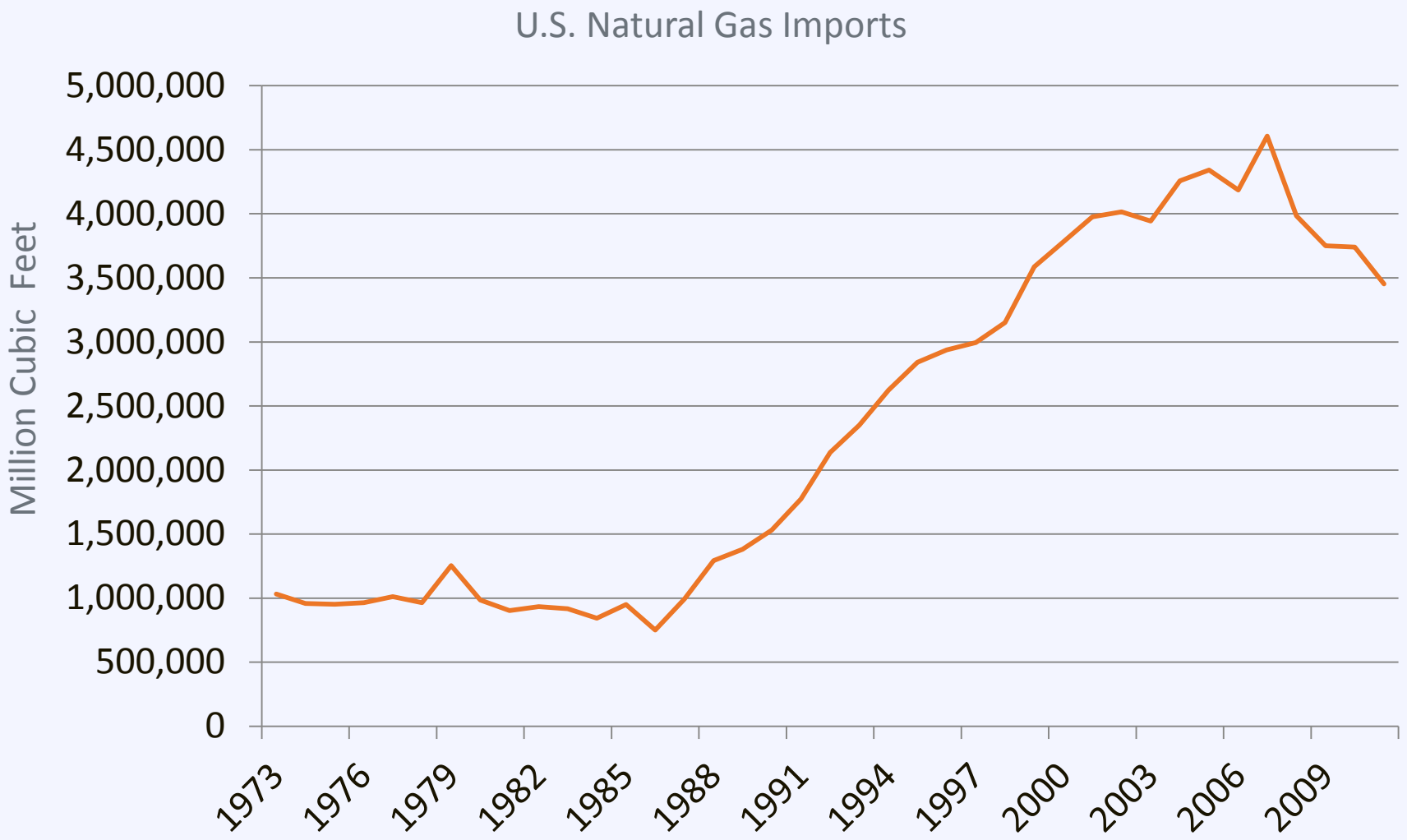
Source: SEIA/GTM Research - 2010 Year in Review Report http://www.seia.org/galleries/pdf/SMI-YIR-2010-ES.pdf SEIA/GTM Research- 2009 year in Review Supplemental Charts

Benefit: Job Growth



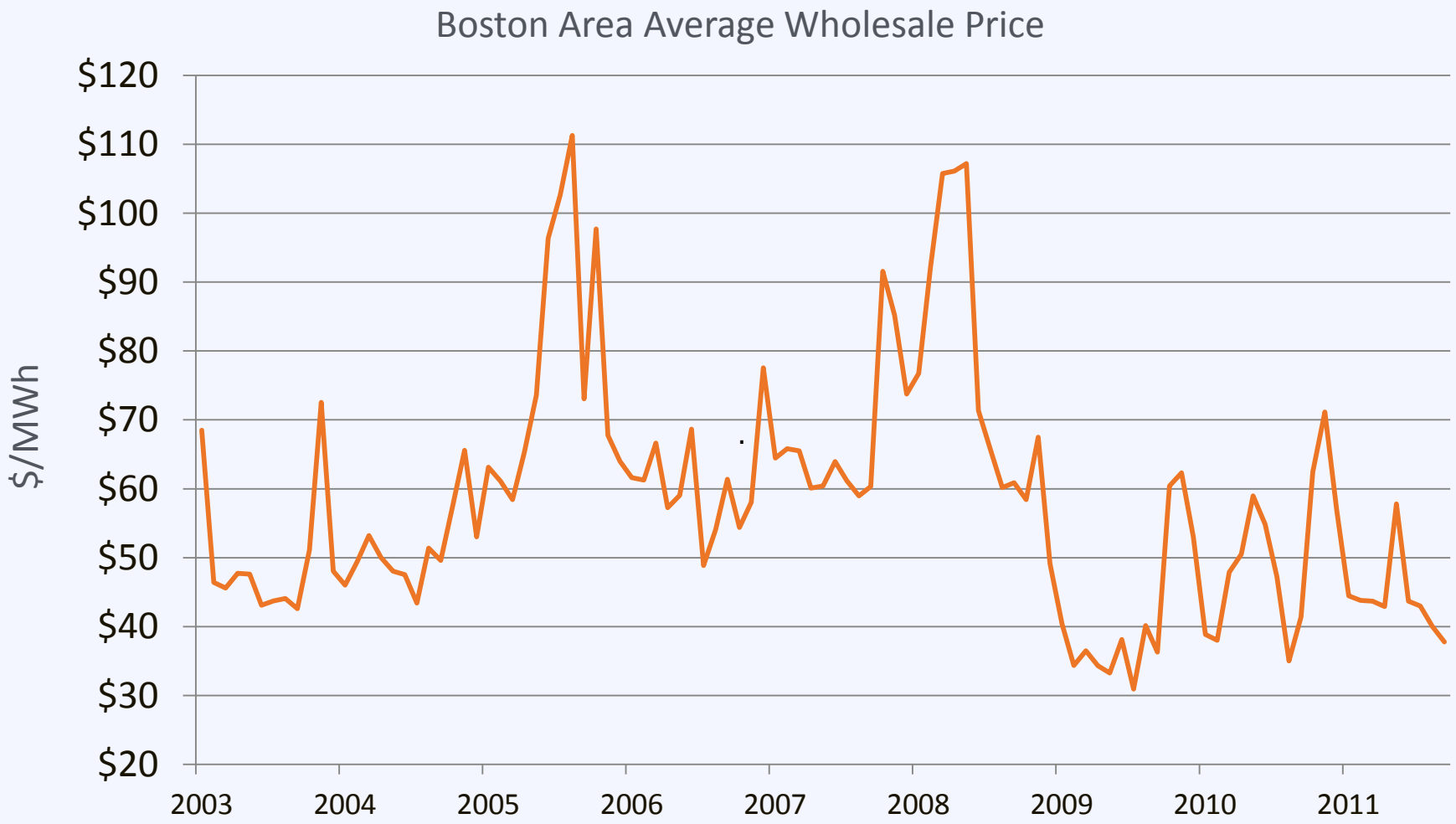
Source: SEIA Estimates (2006-2009), The Solar Foundation's National Solar Jobs Census 2010 (2010), The Solar Foundation's National Solar Jobs Census 2011 (2011-2012).

Benefit: Energy Independence



Source: EIA http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mttimus2&f=a

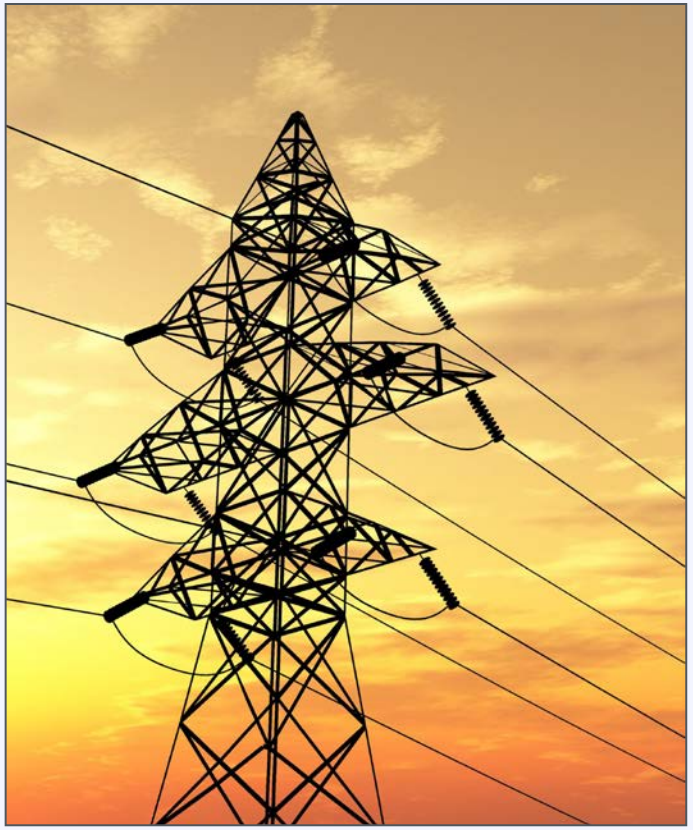
Benefit: Stabilize Energy Prices



Source: NEPOOL

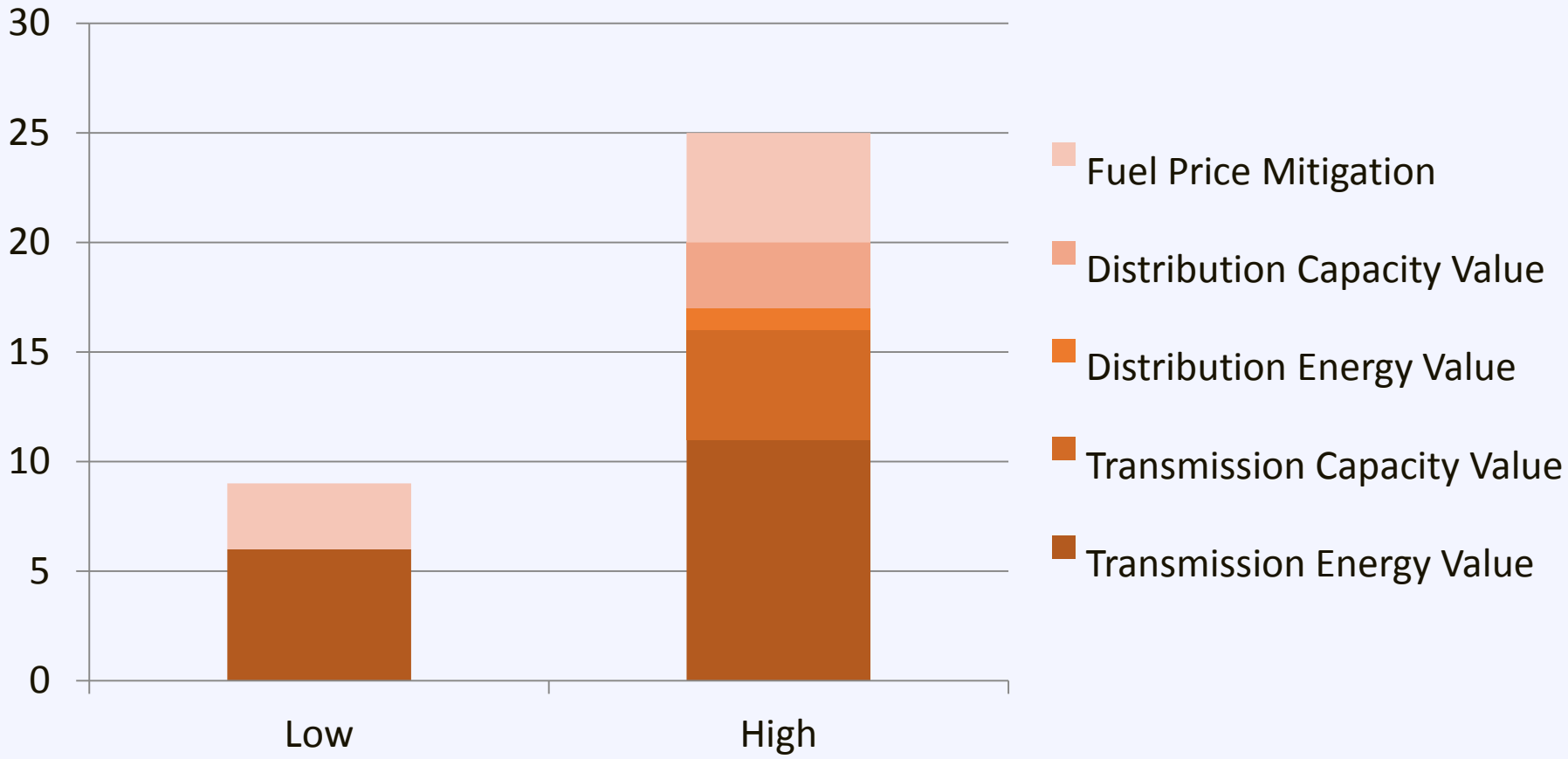
Benefits: Valuable to Utilities

- Avoided Energy Purchases
- Avoided T&D Line Losses
- Avoided Capacity Purchases
- Avoided T&D Investments
- Fossil Fuel Price Impacts
- Backup Power



Benefits: Valuable to Utilities

Value to the utility is **10 to 25 cents** beyond the value of the electricity



Powered by SunShot U.S. Department of Energy

Source: http://www.asrc.cestm.albany.edu/perez/2011/solval.pdf

Benefit: Smart Investment for Homes

From NREL:

Solar homes sold

20% faster

and for

17% more

than the equivalent non-solar homes

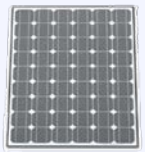
in surveyed California subdivisions

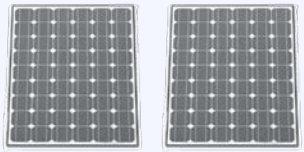
Powered by SunShot U.S. Department of Energy

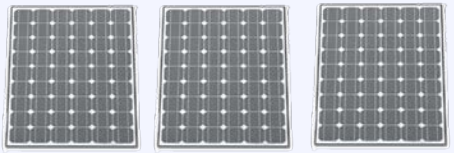
Source: http://www.nrel.gov/docs/fy07osti/38304-01.pdf

Benefit: Smart Investment for Homes

From SunRun:

3 kW  = **$ 16,500** *added sale premium*

6 kW  = **$ 33,000** *added sale premium*

9 kW  = **$ 49,500** *added sale premium*

Source: Tracking the Sun IV, SunRun

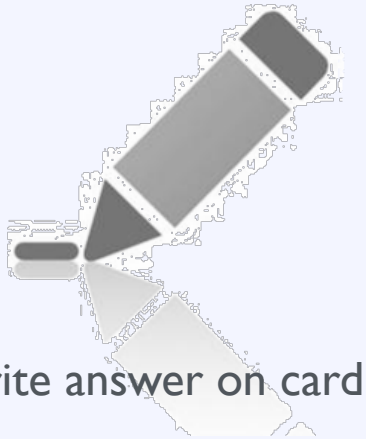
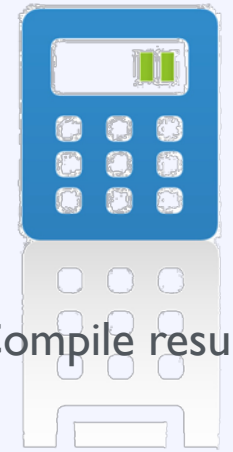
Benefit: Smart Investment for Business

Benefit: Smart Investment for Government

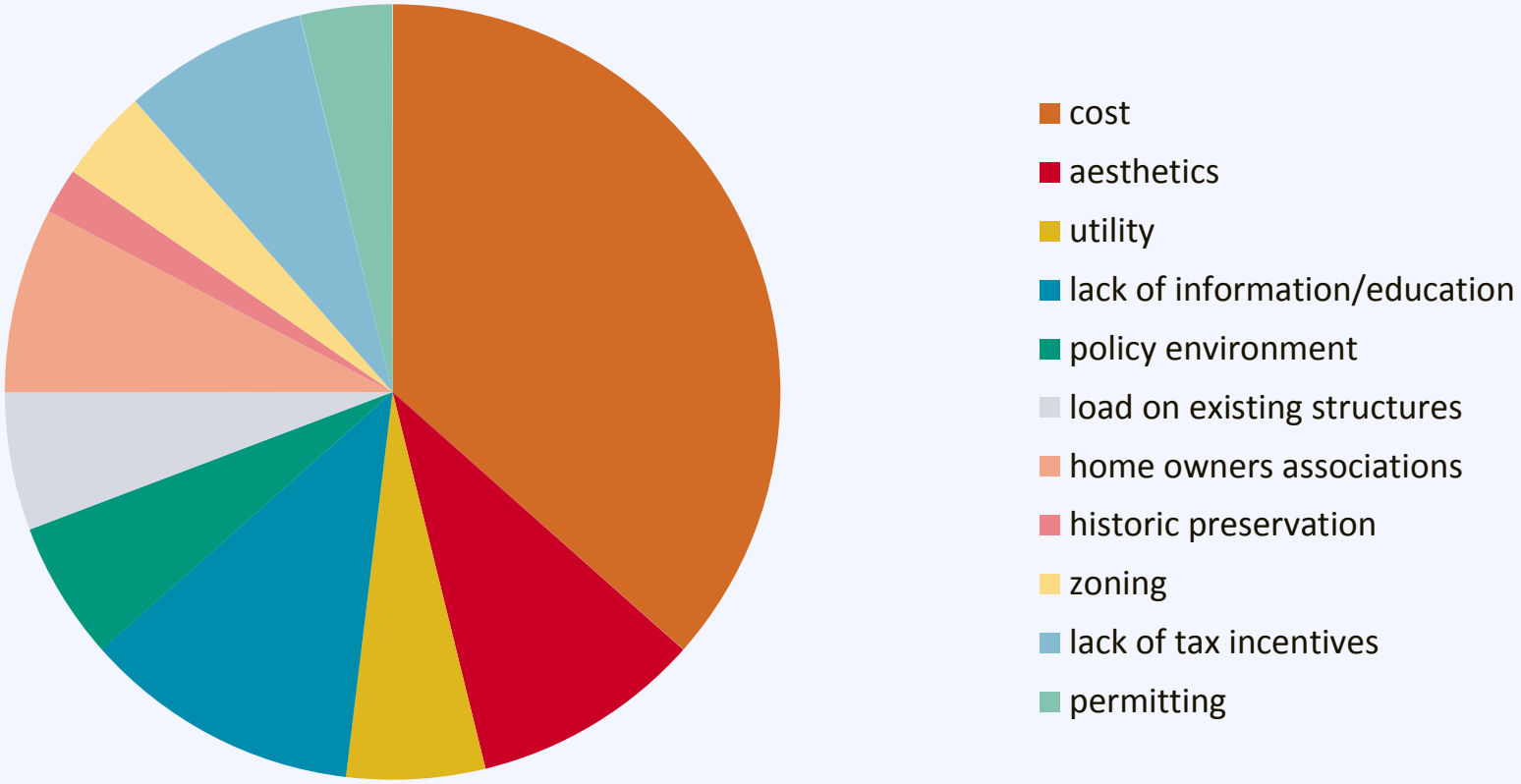
Source: Borrego Solar

Activity: Addressing Barriers

What is the greatest barrier to solar adoption in your community? [Green Card]

Right Now	During Session	After Break
		
Write answer on card	Compile results	Group discussion

[Results from Survey]



Some things you may hear…

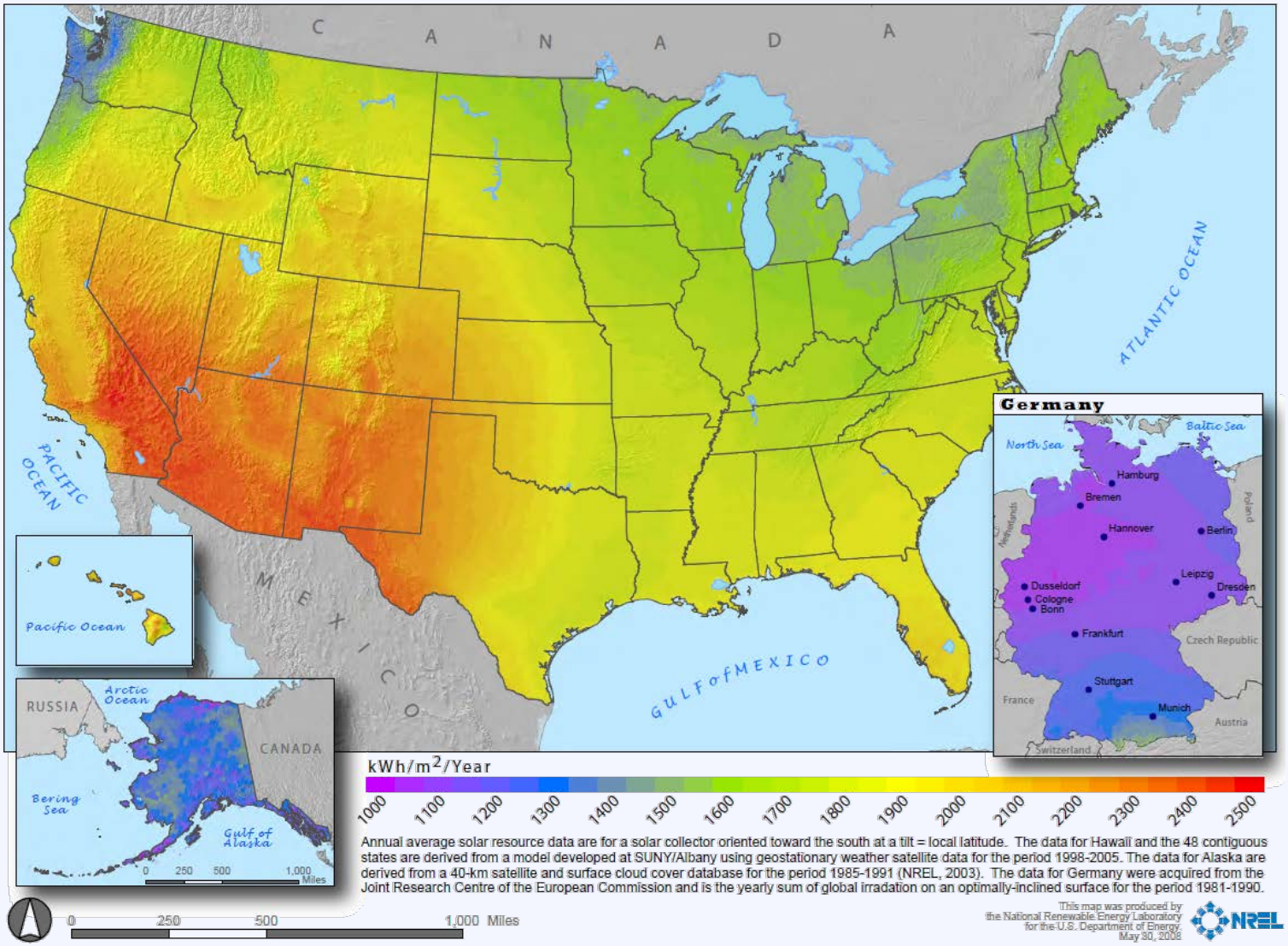
My area isn't sunny enough for solar

Going solar is too expensive

Solar is not ready to compete as a serious energy source

The government should not "pick winners and losers"

Fact: Solar works across the US

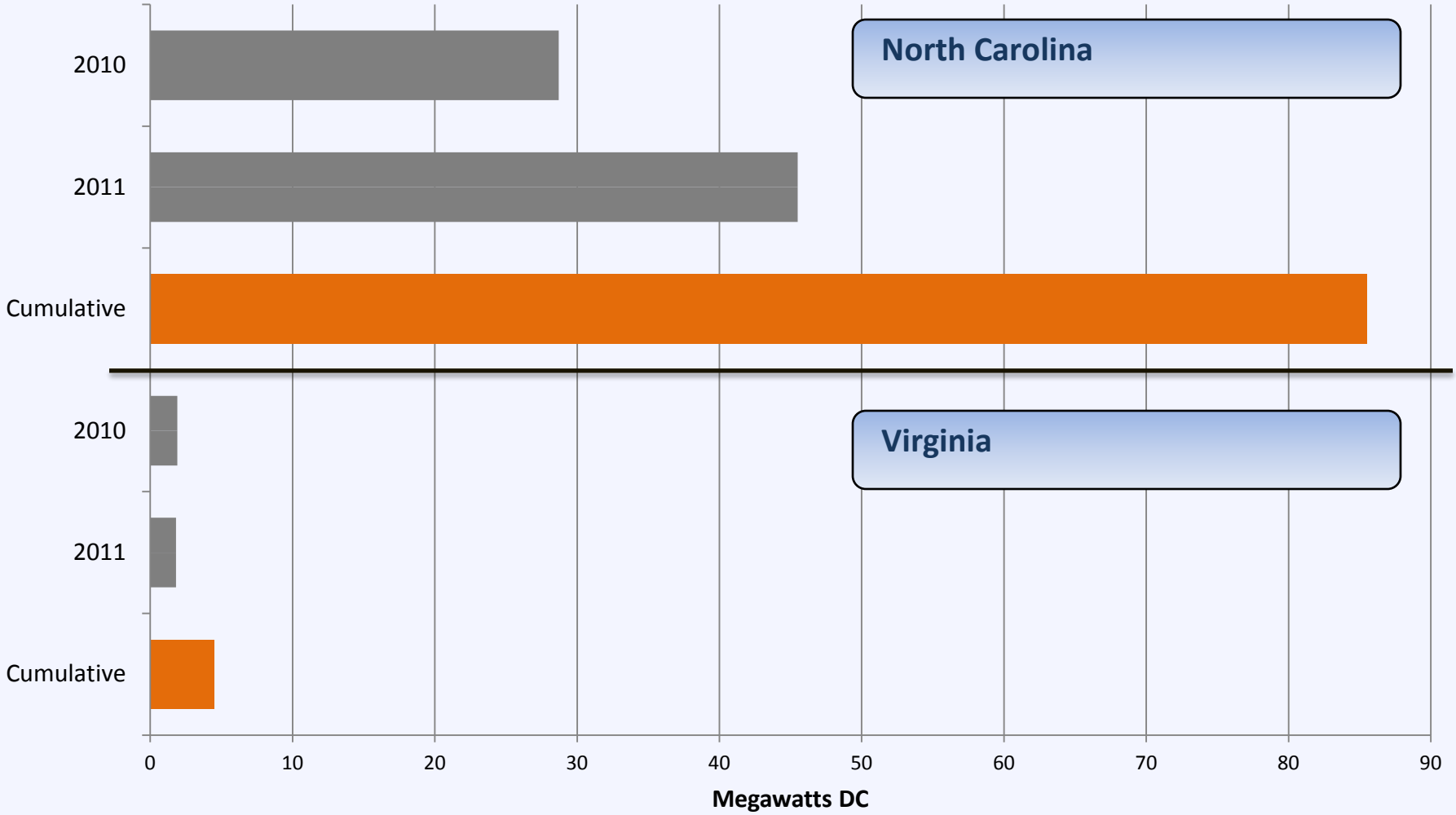


Annual average solar resource data are for a solar collector oriented toward the south at a tilt = local latitude. The data for Hawaii and the 48 contiguous states are derived from a model developed at SUNY/Albany using geostationary weather satellite data for the period 1998-2005. The data for Alaska are derived from a 40-km satellite and surface cloud cover database for the period 1985-1991 (NREL, 2003). The data for Germany were acquired from the Joint Research Centre of the European Commission and is the yearly sum of global irradiation on an optimally-inclined surface for the period 1981-1990.

Powered by SunShot U.S. Department of Energy

Source: National Renewable Energy Laboratory

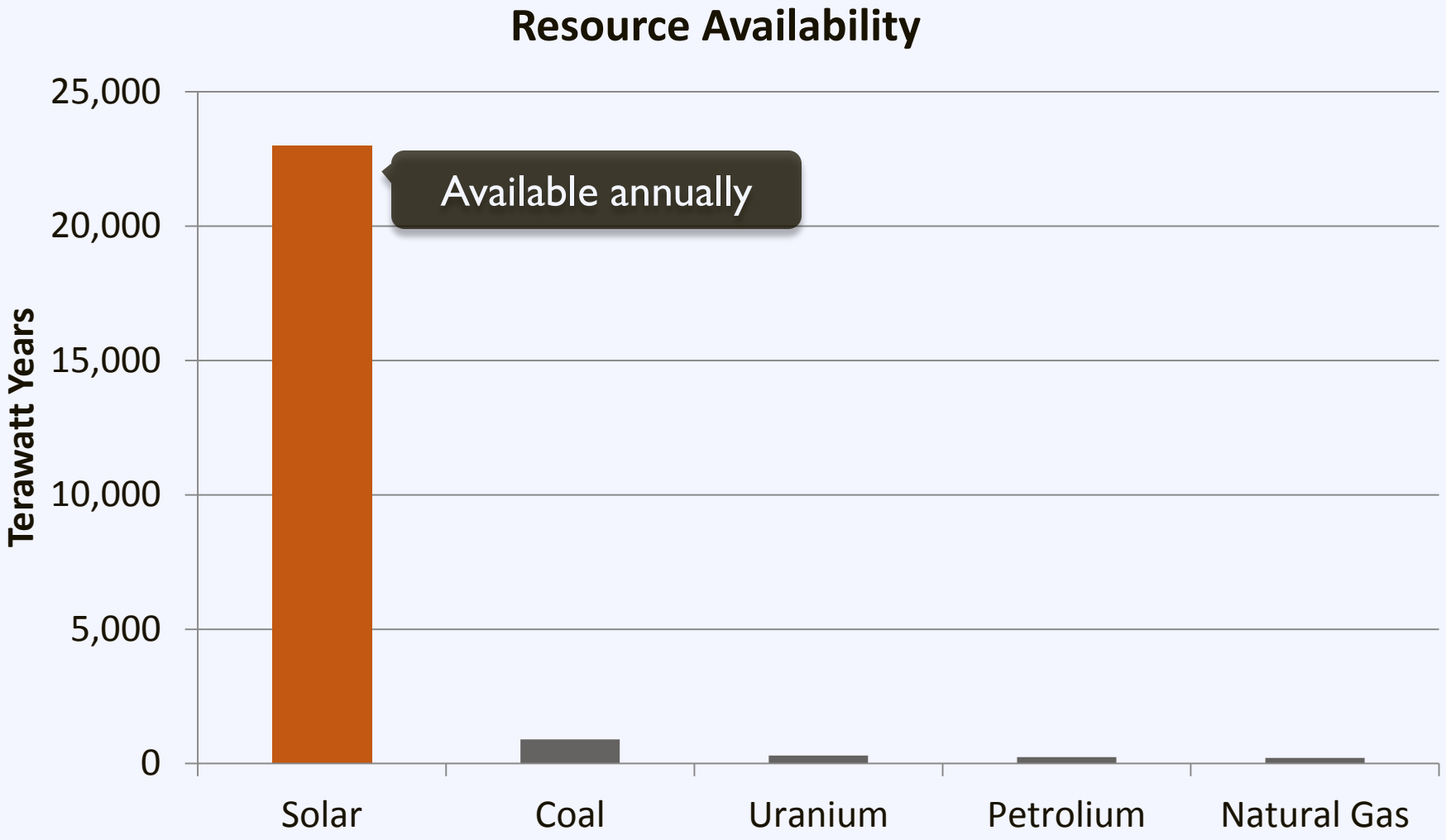
Installed Capacity of Grid Connected Solar PV



Powered by SunShot U.S. Department of Energy

Source: IREC

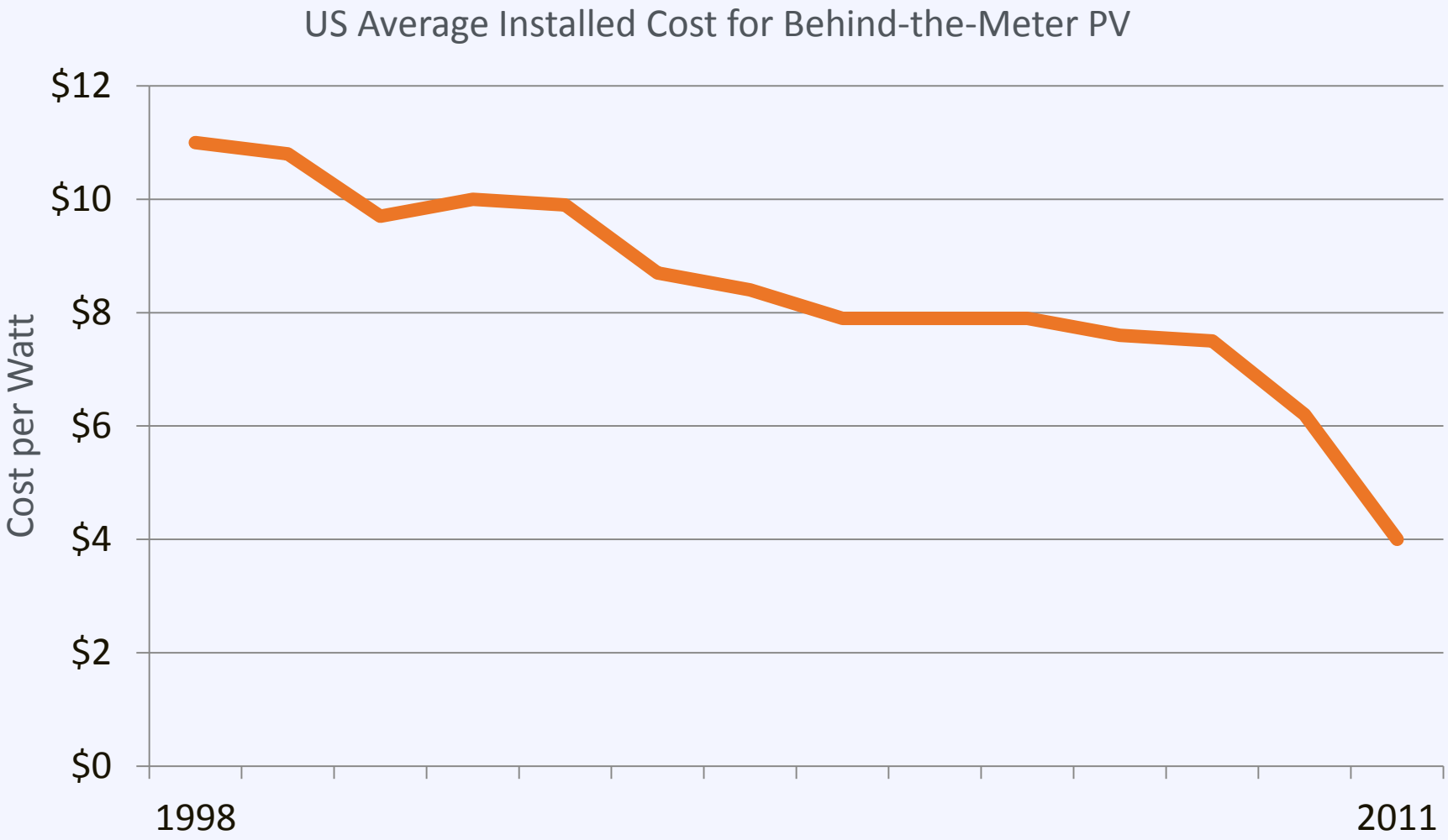
Fact: Solar is a ubiquitous resource



Powered by SunShot U.S. Department of Energy

Source: Perez & Perez. 2009. *A fundamental look at energy reserves for the planet.*

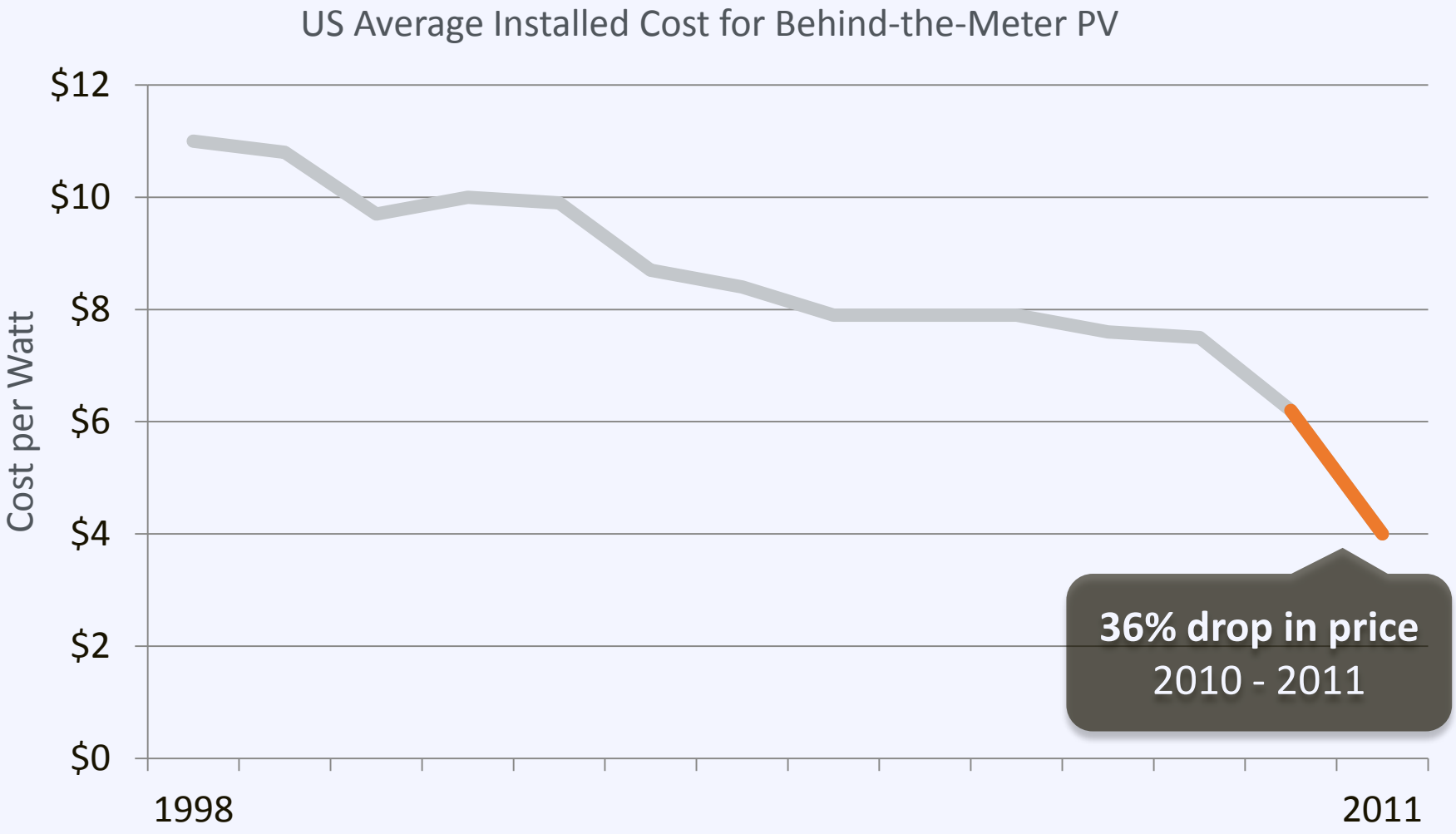
Fact: Solar is cost competitive



Tracking the Sun IV: The Installed Cost of Photovoltaics in the US from 1998-2010 (LBNL), SEIA/GTM Research. 2012. *Solar Market Insight 2011 Year-in-Review.*

Powered by SunShot U.S. Department of Energy

Fact: Solar is cost competitive



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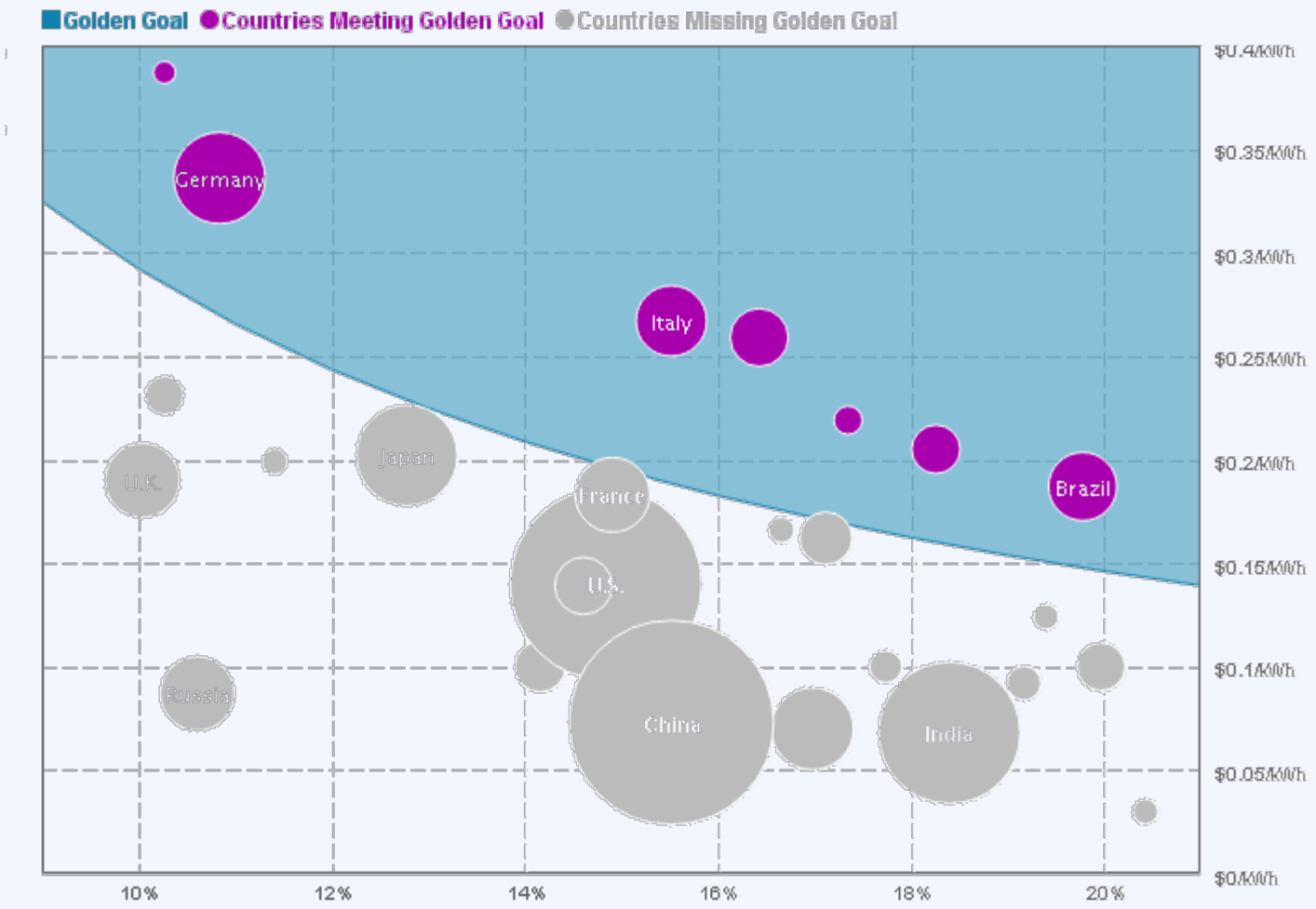
Powered by SunShot U.S. Department of Energy

Fact: Solar is cost competitive

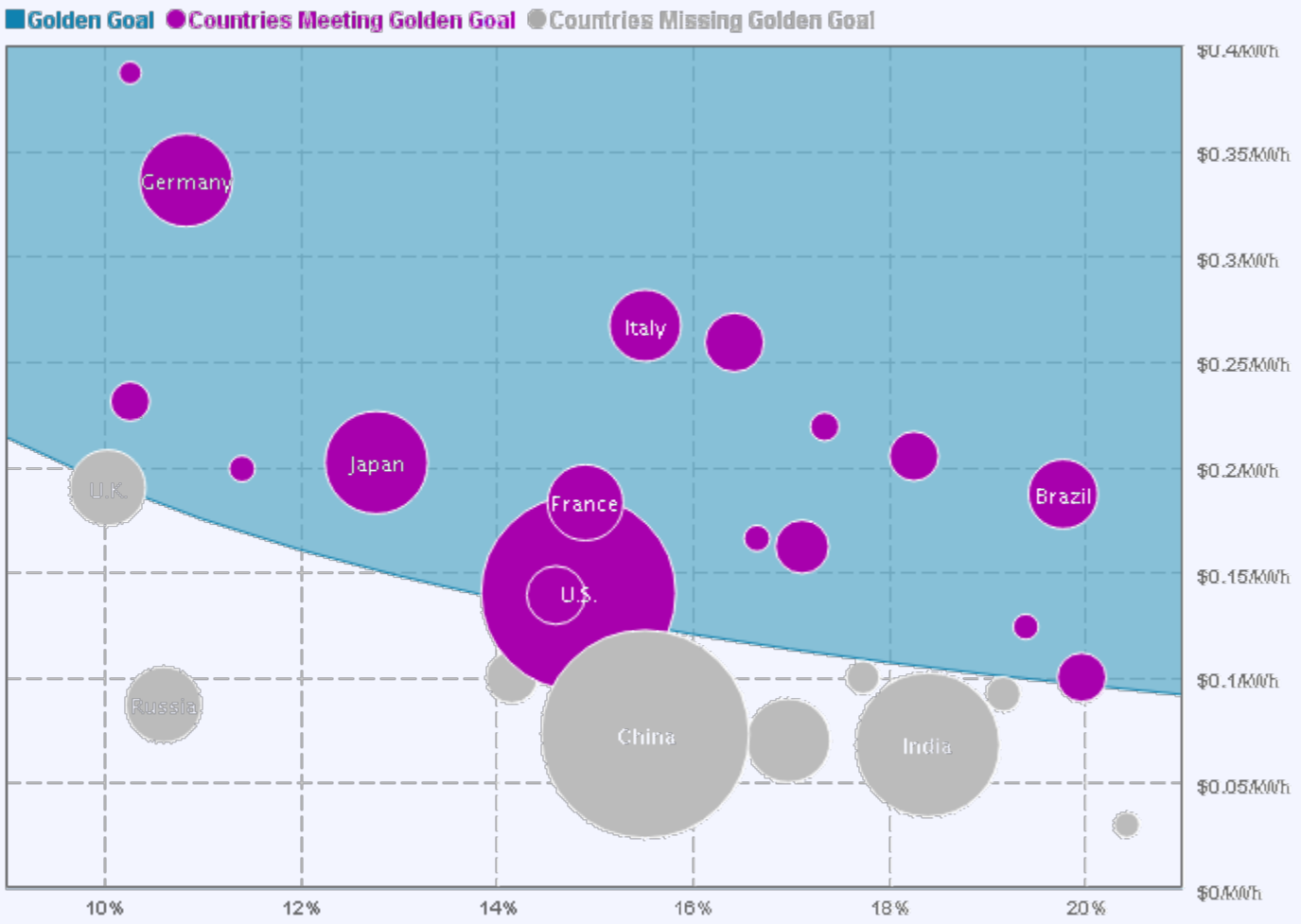
2012



Source: Bloomberg

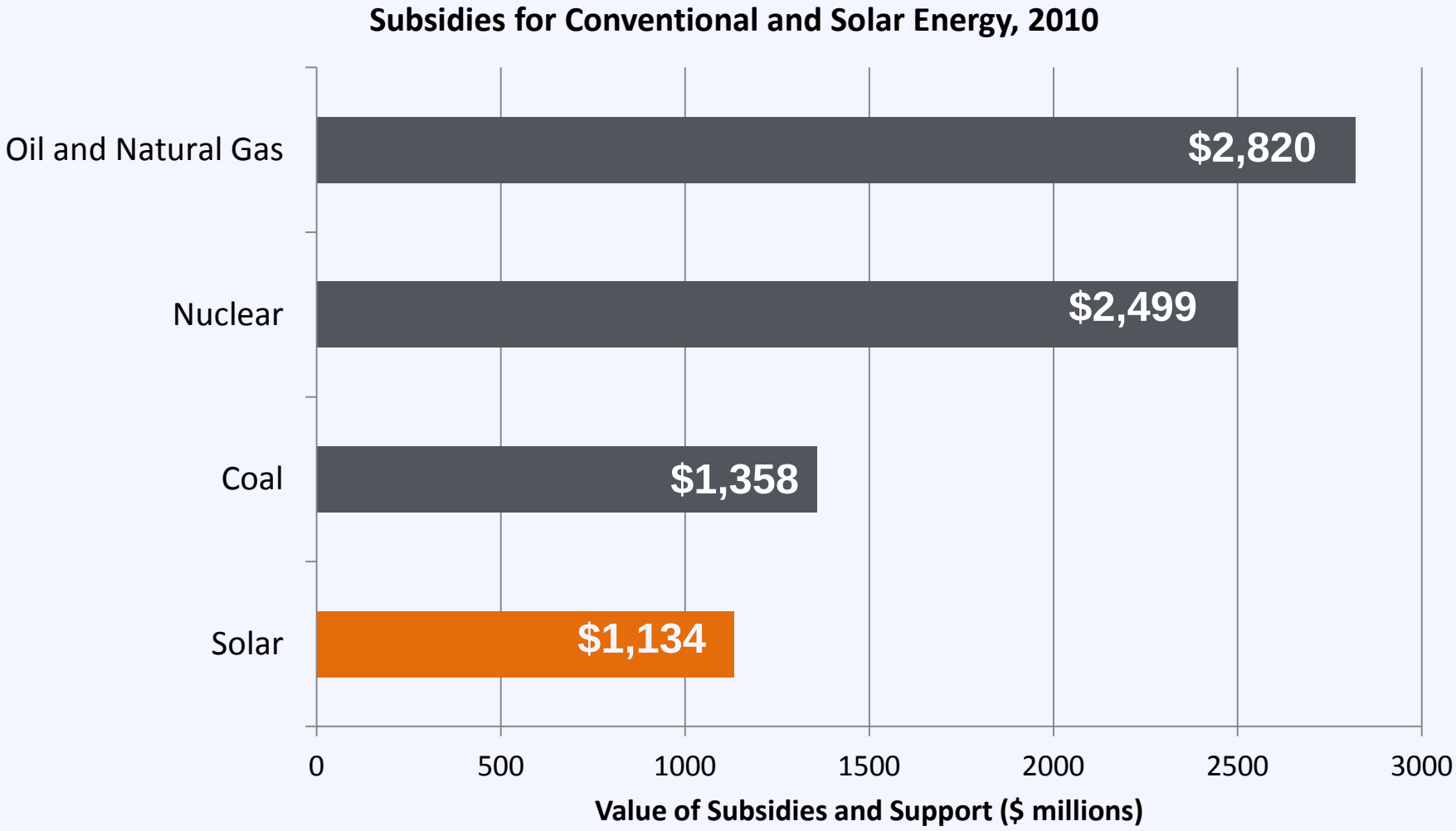
Fact: Solar is cost competitive

2020



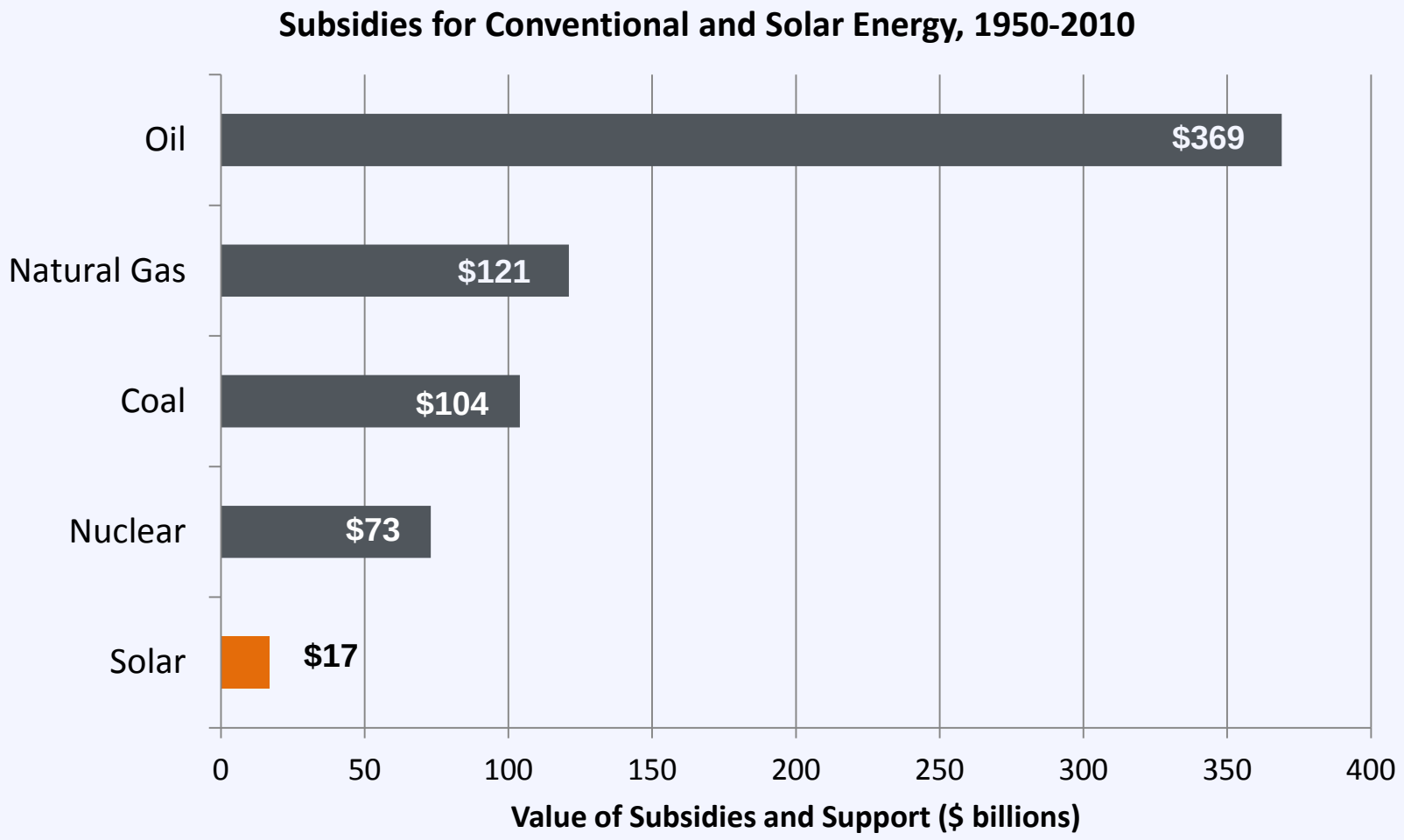
Source: Bloomberg

Fact: All energy is subsidized



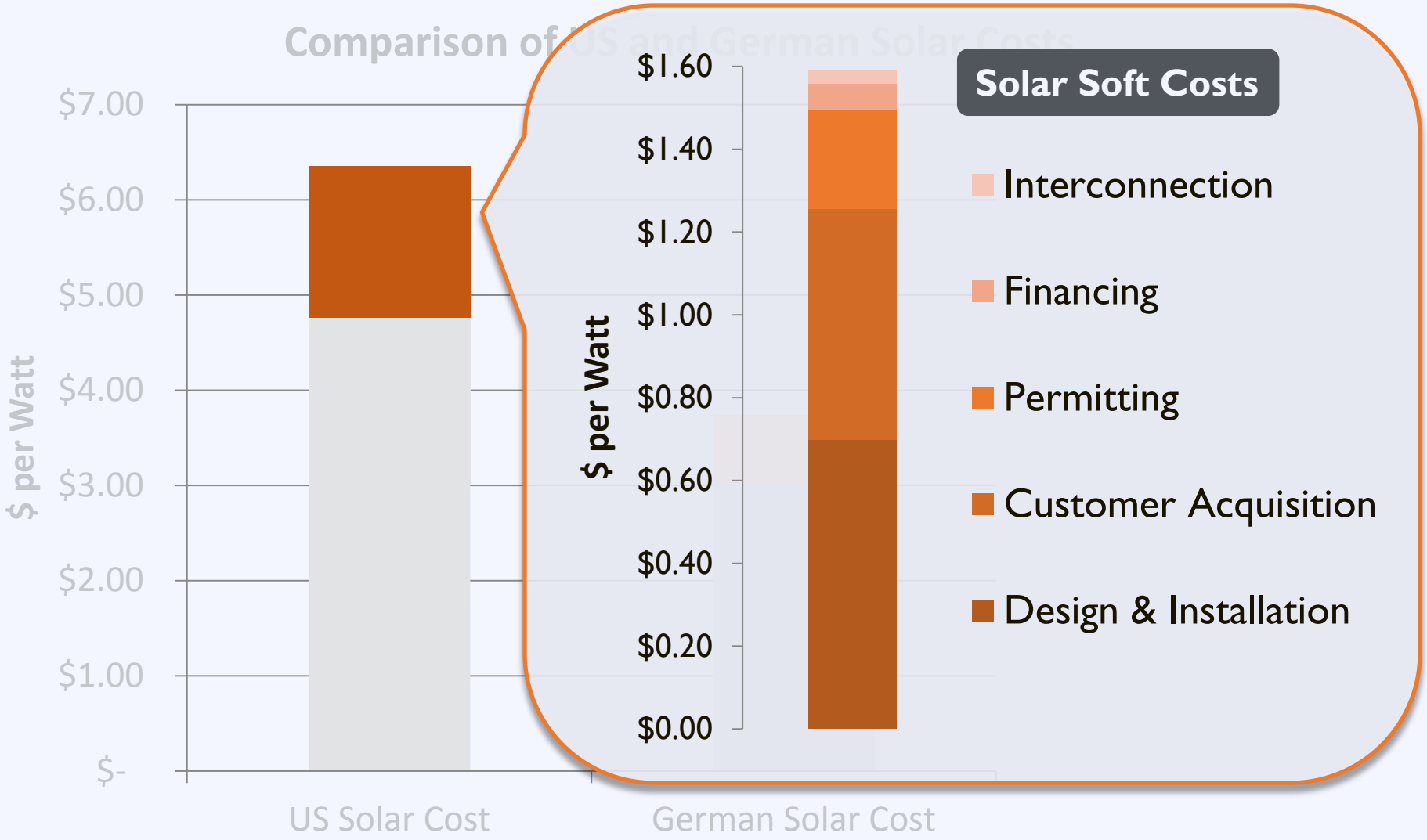
Source: U.S. Energy Information Administration. July 2011. *Direct Federal Interventions and Subsidies in Energy in Fiscal Year 2010*

Fact: All energy is subsidized



Source: Management Information Services, Inc. October 2011. *60 Years of Energy Incentives: Analysis of Federal Expenditures for Energy Development*; SEIA, May 1, 2012. *Federal Energy Incentives Report.*

Barriers Still Exist



Powered by SunShot U.S. Department of Energy

Source: NREL (http://ases.conference-services.net/resources/252/2859/pdf/SOLAR2012_0599_full%20paper.pdf) (http://www.nrel.gov/docs/fy12osti/53347.pdf) (http://www.nrel.gov/docs/fy12osti/54689.pdf)

Q & A

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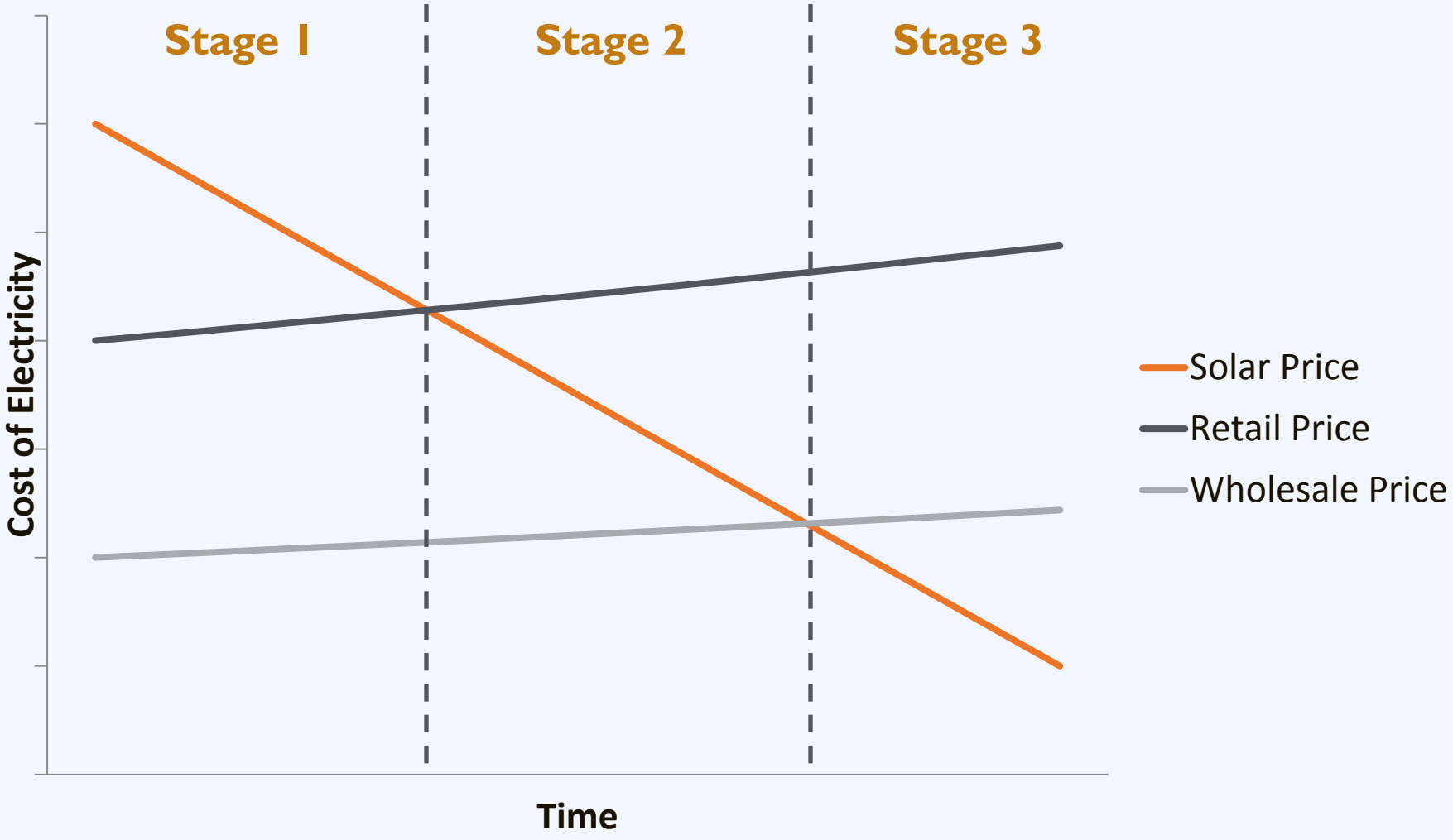
Utility Market Stages



Source: Solar Electric Power Association

Electric Market Status (2010)

Retail Sales	Investor-Owned	Municipal	Rural Co-ops	TOTAL
Virginia	84.1%	4.4%	11.5%	113M MWh
North Carolina	74.3%	12.1%	13.5%	136 M MWh

# Customers	Investor-Owned	Municipal	Rural Co-ops	TOTAL
Virginia	80.1%	4.2%	15.7%	3,684,290
North Carolina	67.1%	12.1%	20.8%	4,828,539

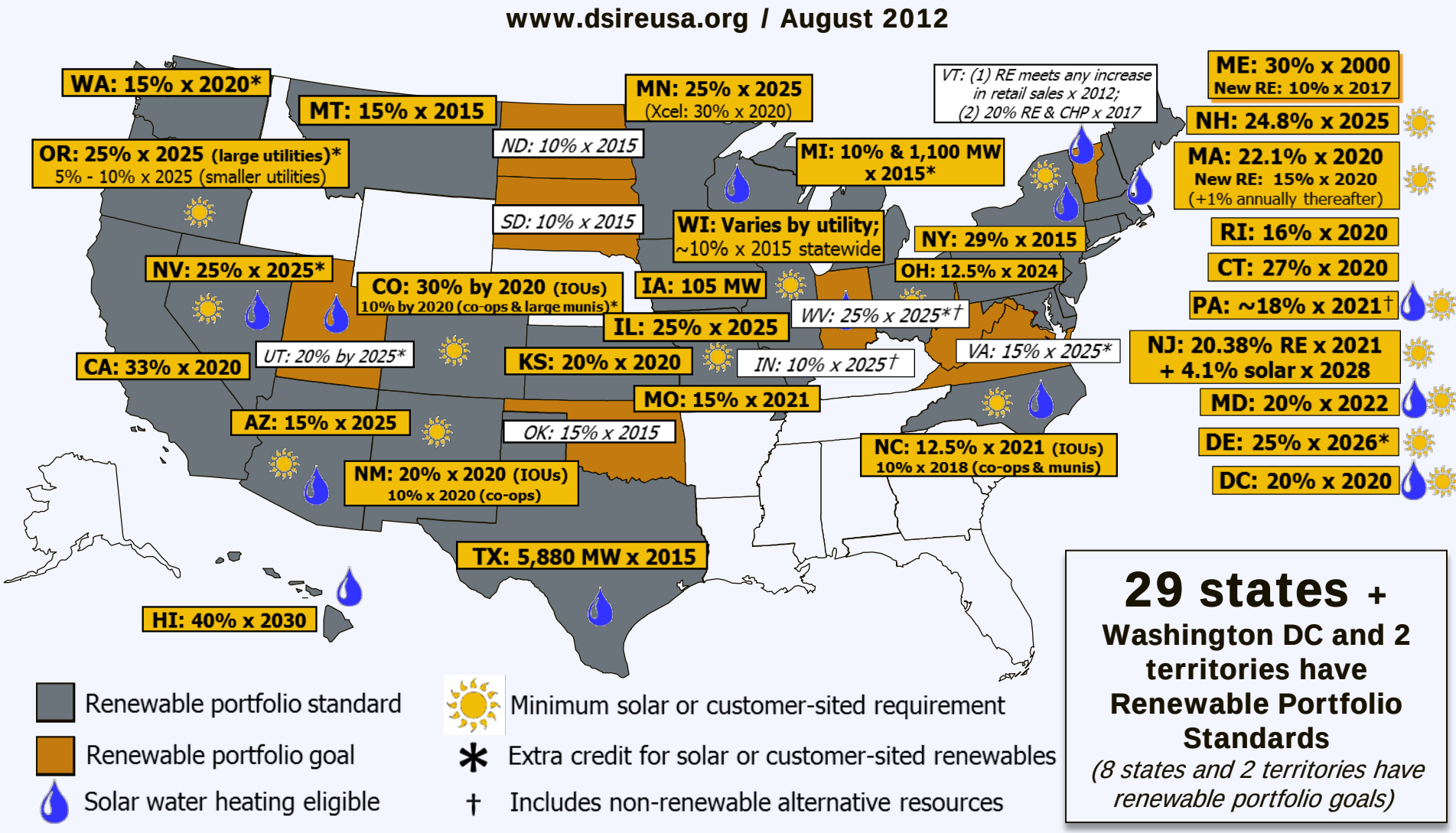
Prices	Investor-Owned	Municipal	Rural Co-ops	Average
Virginia	8.41¢/kWh	8.73¢/kWh	10.98¢/kWh	9.58¢/kWh
North Carolina	8.11¢/kWh	11.23¢/kWh	11.01¢/kWh	11.05¢/kWh

Average U.S. Retail Electric Rate: 9.83 ¢/kWh

Powered by SunShot U.S. Department of Energy

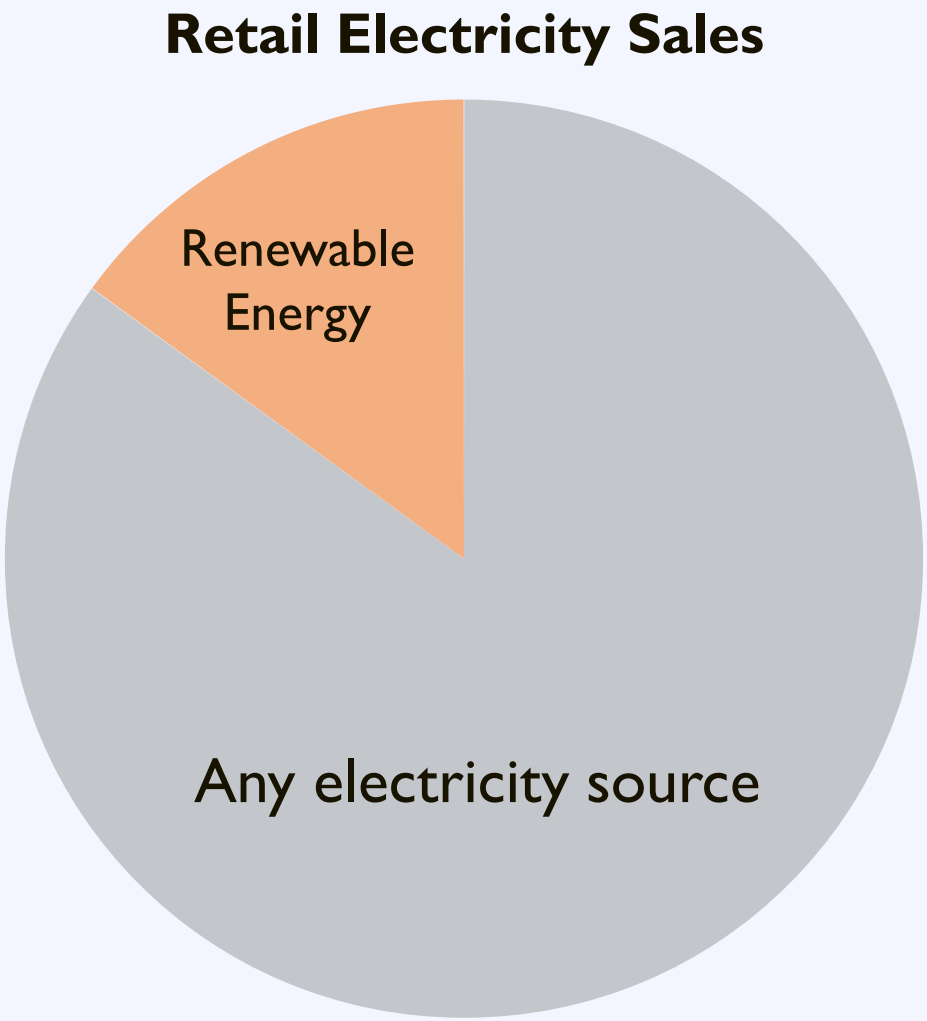
Source: US Energy Information Administration

Renewable Portfolio Standard



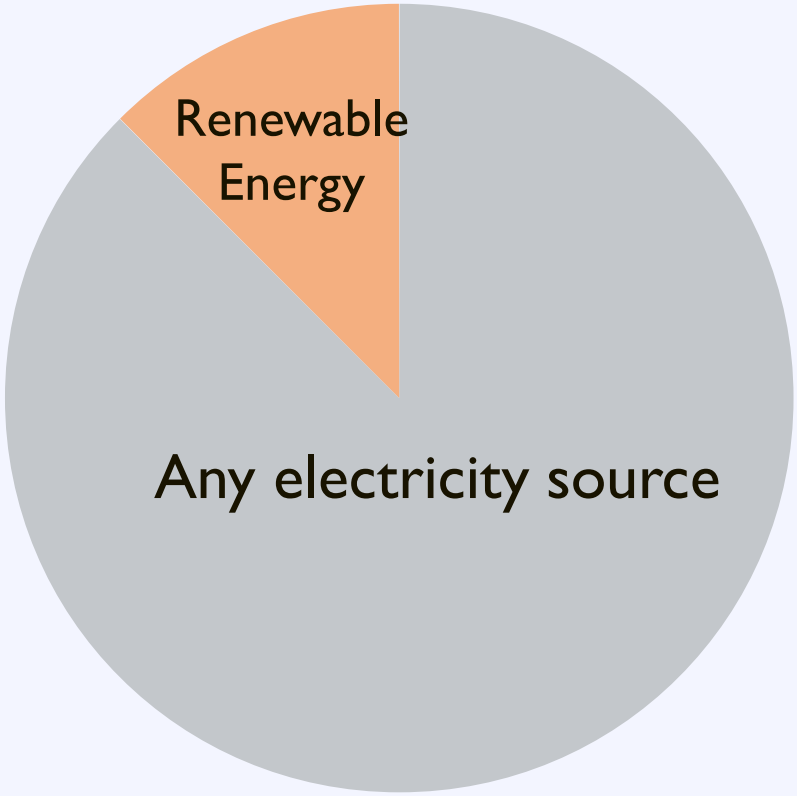
Powered by SunShot
U.S. Department of Energy

Virginia Renewable Portfolio Goal

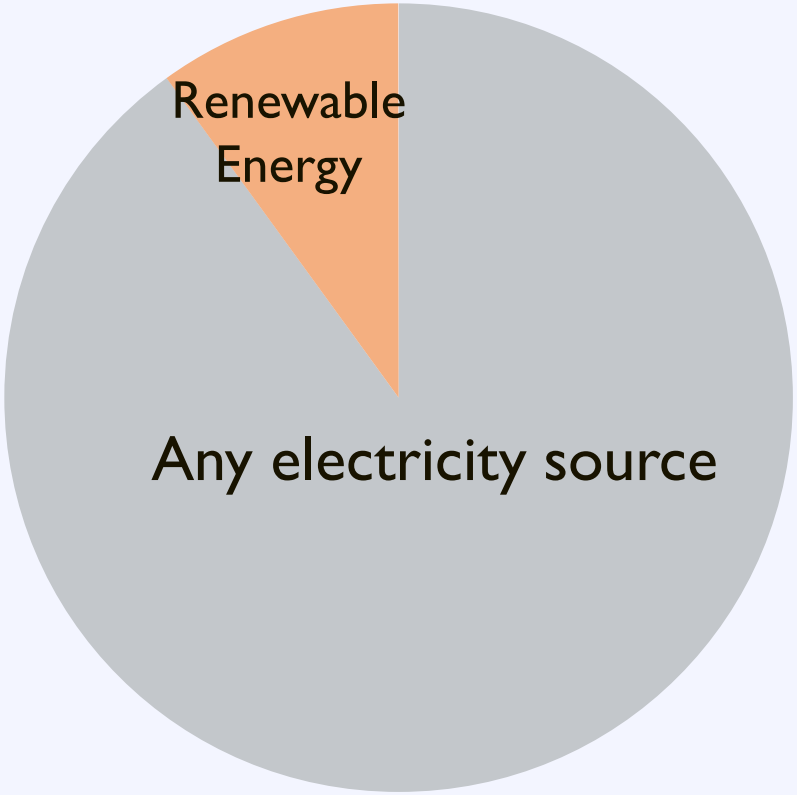


North Carolina: Renewable Portfolio Standard

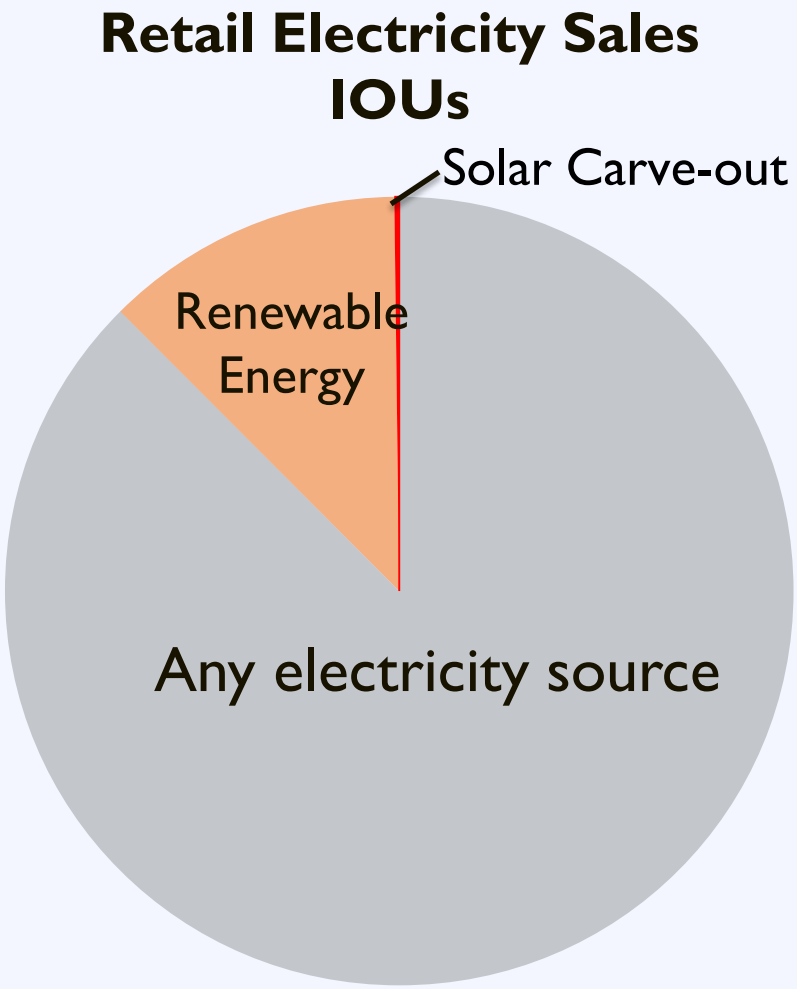
Retail Electricity Sales
IOUs

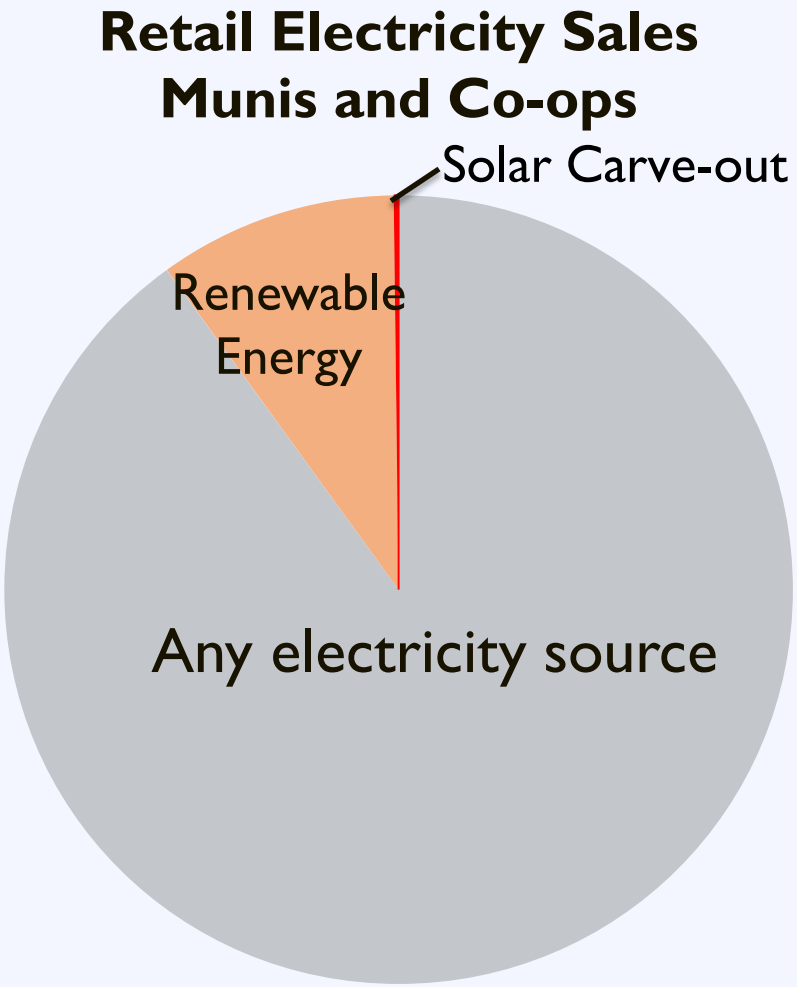


Retail Electricity Sales
Munis and Co-ops

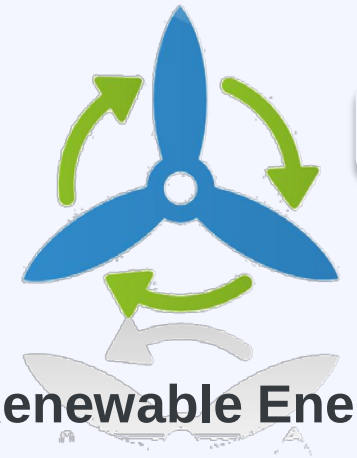


North Carolina: Renewable Portfolio Standard





Renewable Portfolio Standard



Two revenue streams

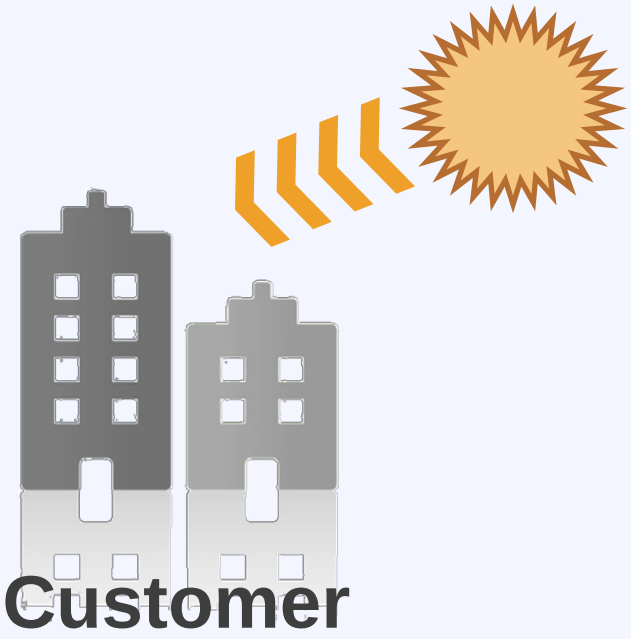
e- REC

Net Metering

Net metering allows customers to export power to the grid during times of excess generation, and receive credits that can be applied to later electricity usage

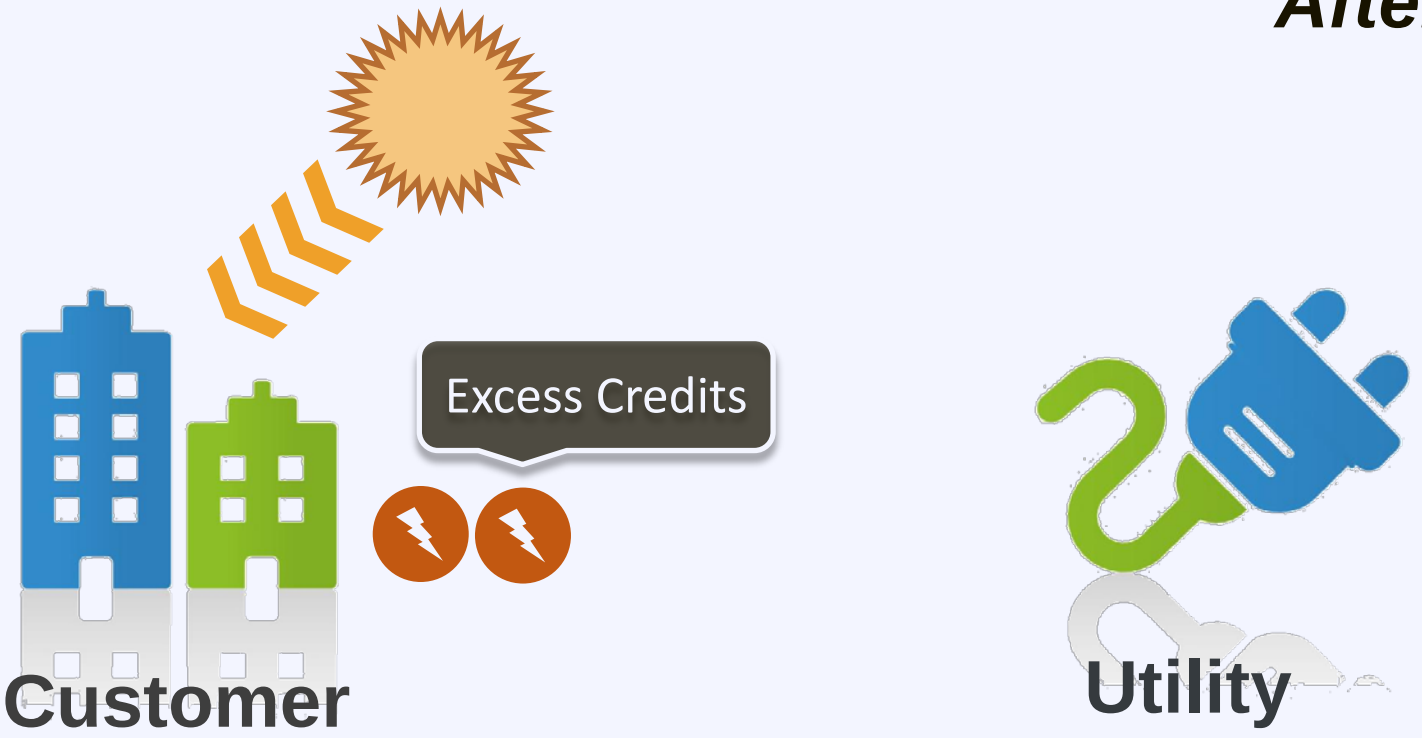
Net Metering: Overview

Morning



Net Metering: Overview

Afternoon



Net Metering: Overview

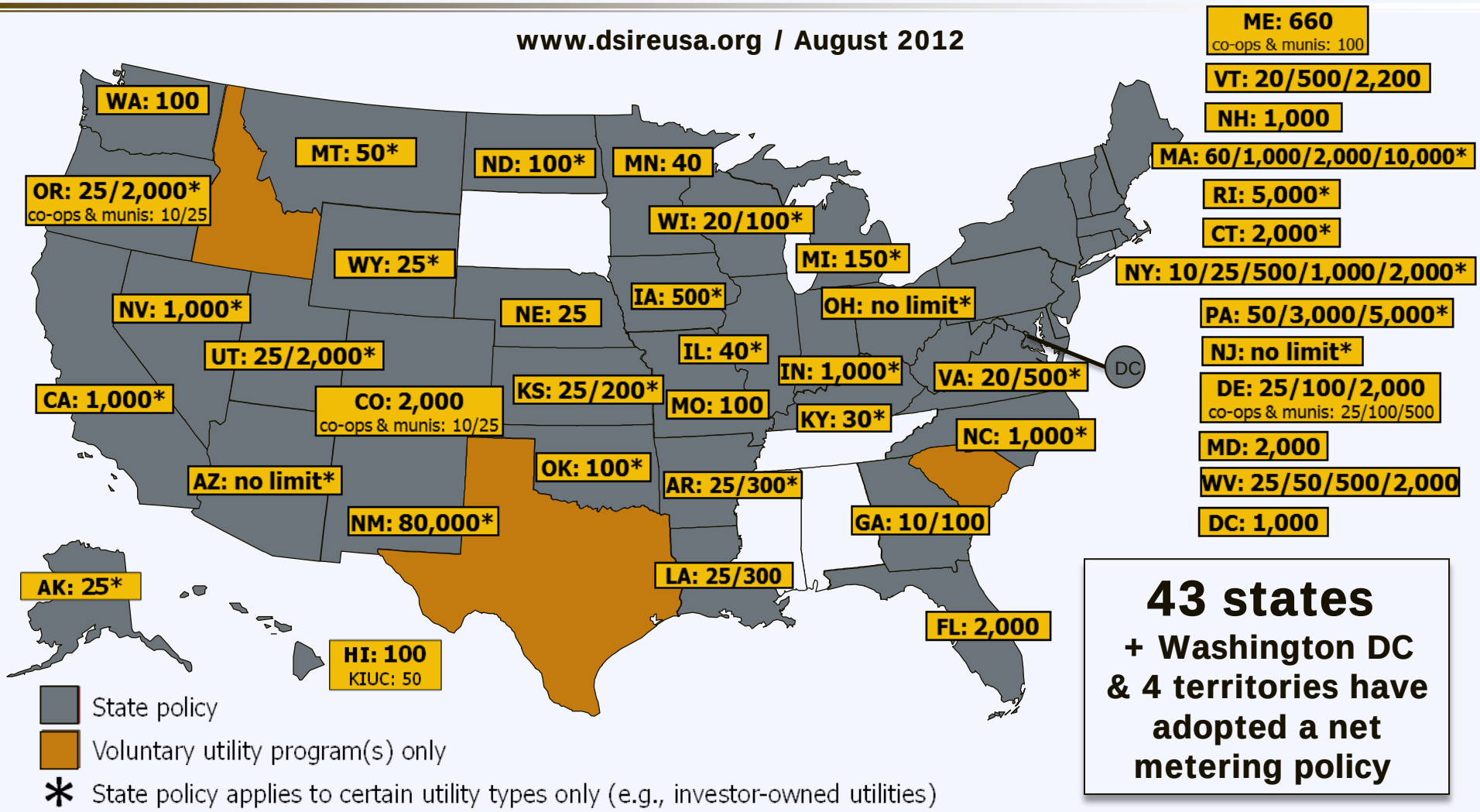
Night

Customer

Utility

Solar covers 100% of the customer's load, even at night!

Net Metering: State Policies



43 states
+ Washington DC & 4 territories have adopted a net metering policy

Note: Numbers indicate individual system capacity limit in kilowatts. Some limits vary by customer type, technology and/or application. Other limits might also apply. This map generally does not address statutory changes until administrative rules have been adopted to implement such changes.

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U.S. Department of Energy

Net Metering: Market Share

More than **93%** of distributed PV Installations are net-metered

Powered by SunShot U.S. Department of Energy

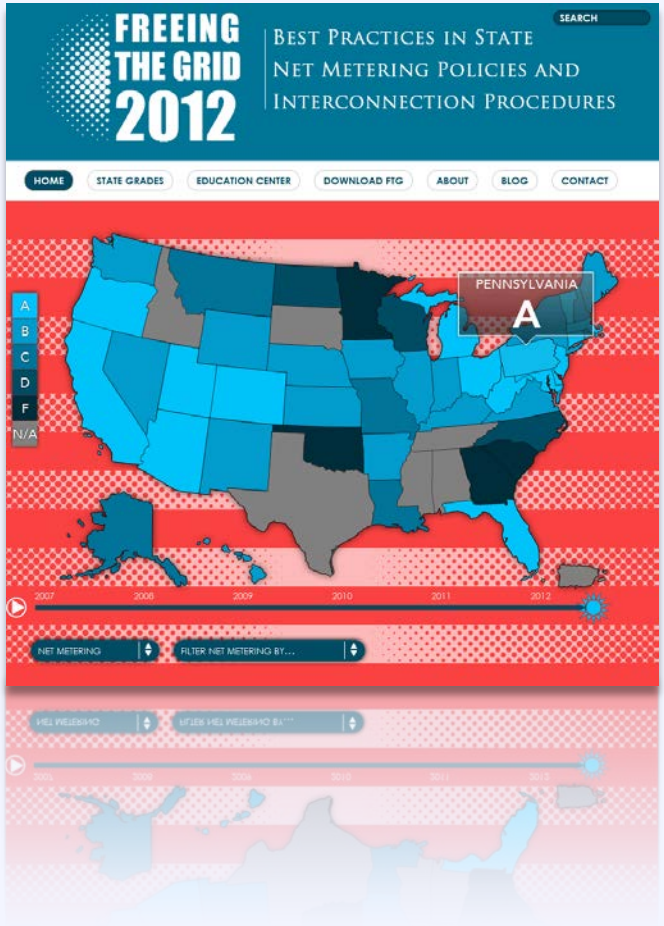
Source: IREC (http://www.irecusa.org/wp-content/uploads/IRECSolarMarketTrends-2012-web.pdf)

Net Metering: Resources

Resource **Freeing the Grid**

Provides a "report card" for state policy on net metering and interconnection

http://freeingthegrid.org/



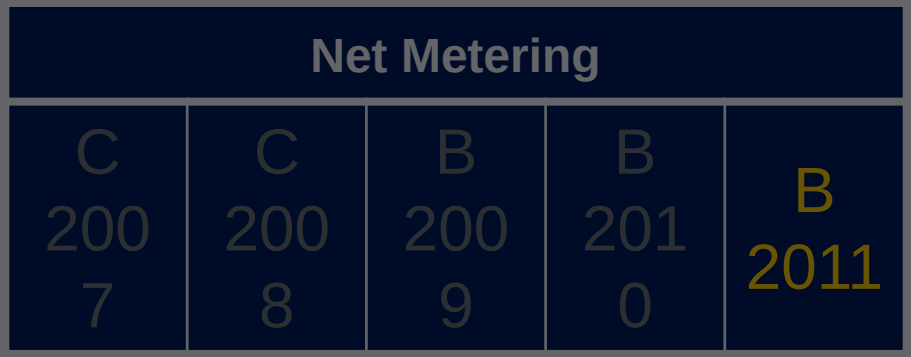
Net Metering: Virginia

Net Metering				
C 2007	C 2008	B 2009	B 2010	B 2011

Eligible Renewable/Other Technologies:	Solar Thermal Electric, Photovoltaics, Wind, Biomass, Hydroelectric, Geothermal Electric, Municipal Solid Waste, Small Hydroelectric, Tidal Energy, Wave Energy
Applicable Sectors:	Commercial, Residential, Nonprofit, Schools, Local Government, State Government, Institutional
Applicable Utilities:	Investor-owned utilities, electric co-ops
System Capacity Limit:	500 kW for non-residential (may be higher if a utility chooses); and 10 kW (20 kW with standby charges) for residential
Aggregate Capacity Limit:	1% of utility's adjusted Virginia peak-load forecast for the previous year
Net Excess Generation:	Credited to customer's next bill at retail rate. After 12-month cycle, customer may opt to roll over credit indefinitely or to receive payment at avoided-cost rate
REC Ownership:	Customer owns RECs
Meter Aggregation:	Not addressed

Source: Freeing the Grid

Net Metering: Virginia



Eligible Renewable/Other Technologies:	Solar Thermal Electric, Photovoltaics, Wind, Biomass, Hydroelectric, Geothermal Electric, Municipal Solid Waste, Small Hydroelectric, Tidal Energy, Wave Energy
Applicable Sectors:	Commercial, Residential, Nonprofit, Schools, Local Government, State Government, Institutional
Applicable Utilities:	Investor-owned utilities, electric co-ops
System Capacity Limit:	**500 kW for non-residential (may be higher if a utility chooses); and 10 kW (20 kW with standby charges) for residential**
Aggregate Capacity Limit:	1% of utility's adjusted Virginia peak-load forecast for the previous year
Net Excess Generation:	Credited to customer's next bill at retail rate. After 12-month cycle, customer may opt to roll over credit indefinitely or to receive payment at avoided-cost rate
REC Ownership:	Customer owns RECs
Meter Aggregation:	**Not addressed**

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Source: Freeing the Grid

Net Metering: Virtual

No direct connection necessary

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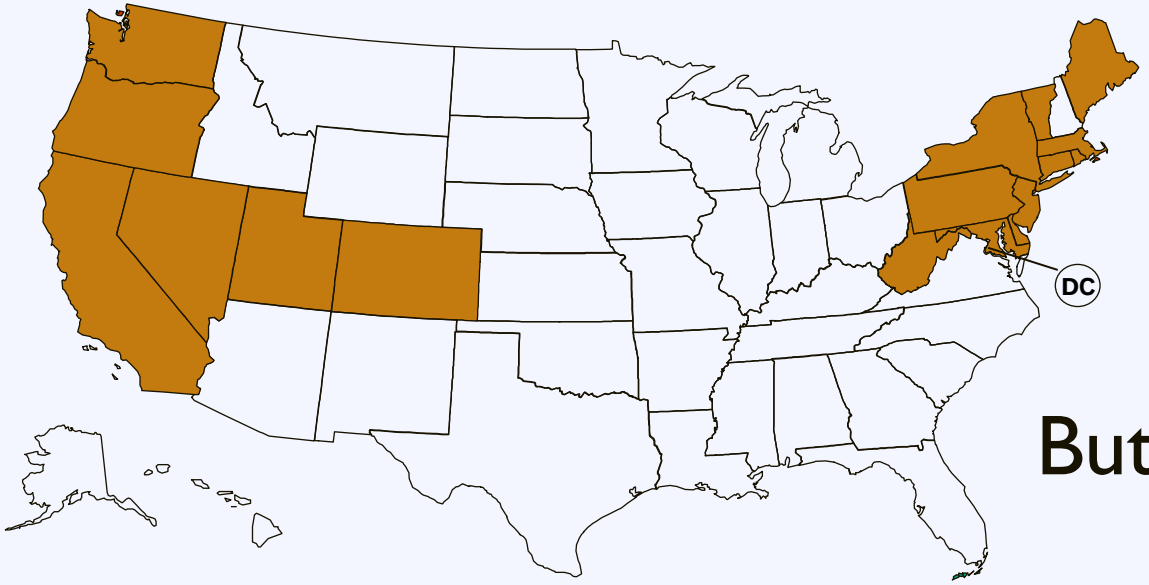
U.S. Department of Energy

Net Metering: Meter Aggregation



But…It's complicated

- Ownership requirements
- Contiguous vs. non-contiguous properties
- Multiple customers
- Multiple generators
- Modified system/aggregate system size limits
- Rollover rates
- Distance limitations
- Number of accounts
- How to address accounts on different tariffs

Net Metering: Virginia

Net Metering				
C 2007	C 2008	B 2009	B 2010	B 2011

RECOMMENDATIONS:

- Remove system size limitations to allow customers to meet all on-site energy needs
- Increase limit on overall enrollment to at least 5% of utility's peak capacity

Eligible Renewable/Other Technologies:	Solar Thermal Electric, Photovoltaics, Wind, Biomass, Hydroelectric, Geothermal Electric, Municipal Solid Waste, Small Hydroelectric, Tidal Energy, Wave Energy
Applicable Sectors:	Commercial, Residential, Nonprofit, Schools, Local Government, State Government, Institutional
Applicable Utilities:	Investor-owned utilities, electric co-ops
System Capacity Limit:	500 kW for non-residential (may be higher if a utility chooses); and 10 kW (20 kW with standby charges) for residential
Aggregate Capacity Limit:	1% of utility's adjusted Virginia peak-load forecast for the previous year
Net Excess Generation:	Credited to customer's next bill at retail rate. After 12-month cycle, customer may opt to roll over credit indefinitely or to receive payment at avoided-cost rate
REC Ownership:	Customer owns RECs
Meter Aggregation:	Not addressed

Source: Freeing the Grid

Net Metering: North Carolina

Net Metering				
F 2007	F 2008	D 2009	D 2010	D 2011

Eligible Renewable/Other Technologies:	Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, CHP/Cogeneration, Hydrogen, Anaerobic Digestion, Small Hydroelectric, Tidal Energy, Wave Energy, Fuel Cells using Renewable Fuels
Applicable Sectors:	Commercial, Industrial, Residential, Nonprofit, Schools, Local Government, State Government, Tribal Government, Fed. Government, Agricultural, Institutional
Applicable Utilities:	Investor-owned utilities
System Capacity Limit:	1 MW
Aggregate Capacity Limit:	No limit specified
Net Excess Generation:	Credited to customer's next bill at retail rate; granted to utility at beginning of summer billing season
REC Ownership:	Utility owns RECs (unless customer chooses to net meter under a time-of-use tariff)
Meter Aggregation:	Not addressed

Source: Freeing the Grid

Net Metering: North Carolina

Net Metering				
F 2007	F 2008	D 2009	D 2010	D 2011

Eligible Renewable/Other Technologies:	Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, CHP/Cogeneration, Hydrogen, Anaerobic Digestion, Small Hydroelectric, Tidal Energy, Wave Energy, Fuel Cells using Renewable Fuels
Applicable Sectors:	Commercial, Industrial, Residential, Nonprofit, Schools, Local Government, State Government, Tribal Government, Fed. Government, Agricultural, Institutional
Applicable Utilities:	**Investor-owned utilities**
System Capacity Limit:	**1 MW**
Aggregate Capacity Limit:	No limit specified
Net Excess Generation:	Credited to customer's next bill at retail rate; granted to utility at beginning of summer billing season
REC Ownership:	**Utility owns RECs (unless customer chooses to net meter under a time-of-use tariff)**
Meter Aggregation:	**Not addressed**

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Source: Freeing the Grid

Net Metering: North Carolina

Net Metering				
F 2007	F 2008	D 2009	D 2010	D 2011

RECOMMENDATIONS:

- Remove system size limitations to allow customers to meet all on-site energy needs
- Adopt safe harbor language to protect customer-sited generators from extra and/or unanticipated fees
- Extend net metering requirements to all utilities (i.e., munis and co-ops)
- Remove limitations on REC ownership

Eligible Renewable/Other Technologies:	Photovoltaics, Landfill Gas, Wind, Biomass, Hydroelectric, CHP/Cogeneration, Hydrogen, Anaerobic Digestion, Small Hydroelectric, Tidal Energy, Wave Energy, Fuel Cells using Renewable Fuels
Applicable Sectors:	Commercial, Industrial, Residential, Nonprofit, Schools, Local Government, State Government, Tribal Government, Fed. Government, Agricultural, Institutional
Applicable Utilities:	Investor-owned utilities
System Capacity Limit:	1 MW
Aggregate Capacity Limit:	No limit specified
Net Excess Generation:	Credited to customer's next bill at retail rate; granted to utility at beginning of summer billing season
REC Ownership:	Utility owns RECs (unless customer chooses to net meter under a time-of-use tariff)
Meter Aggregation:	Not addressed

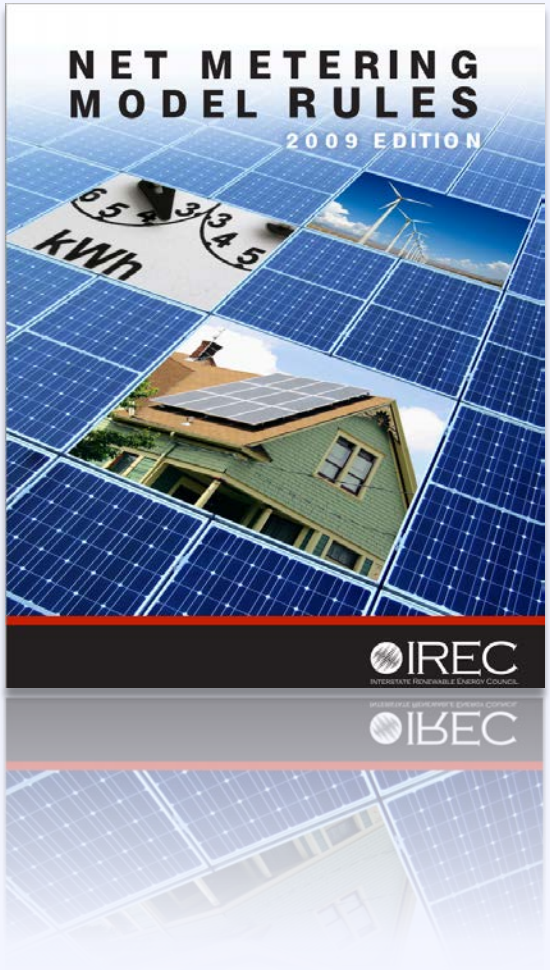
Source: Freeing the Grid

Net Metering: Resources

Resource **Interstate Renewable Energy Council**

IREC developed its model rules in an effort to capture best practices in state net metering policies.

www.irecusa.org



Interconnection

5,000+ utilities

with unique interconnection procedures

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U.S. Department of Energy

Source: NREL (http://www.nrel.gov/docs/fy12osti/54689.pdf

Interconnection: Background

2000: NREL finds that interconnection is a significant barrier to customer sited DG

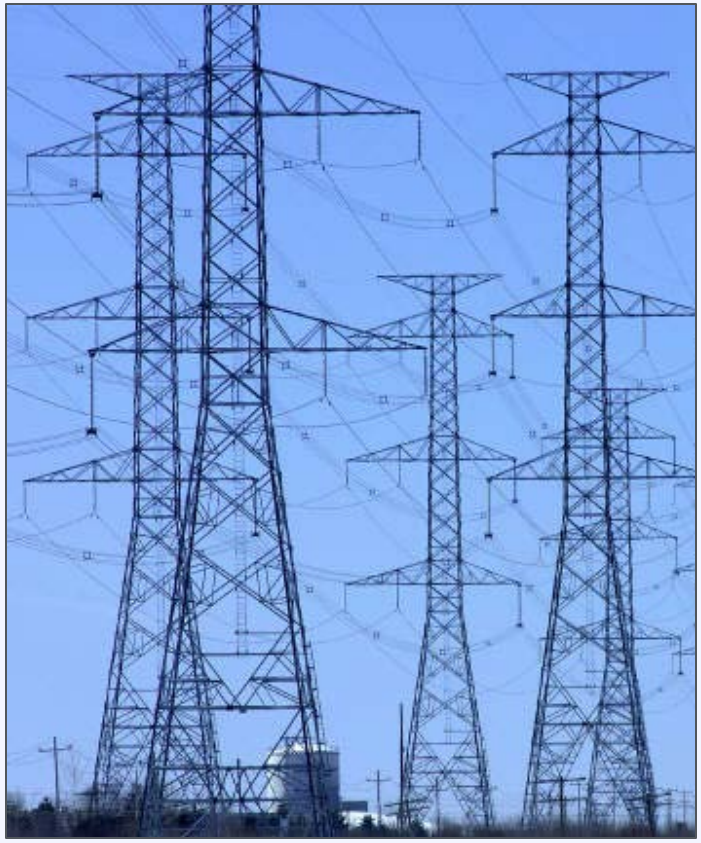
2005: Congress requires state regulator authorities to consider an interconnection standard (IEEE 1547)

2012: 43 States & DC have adopted interconnection standards

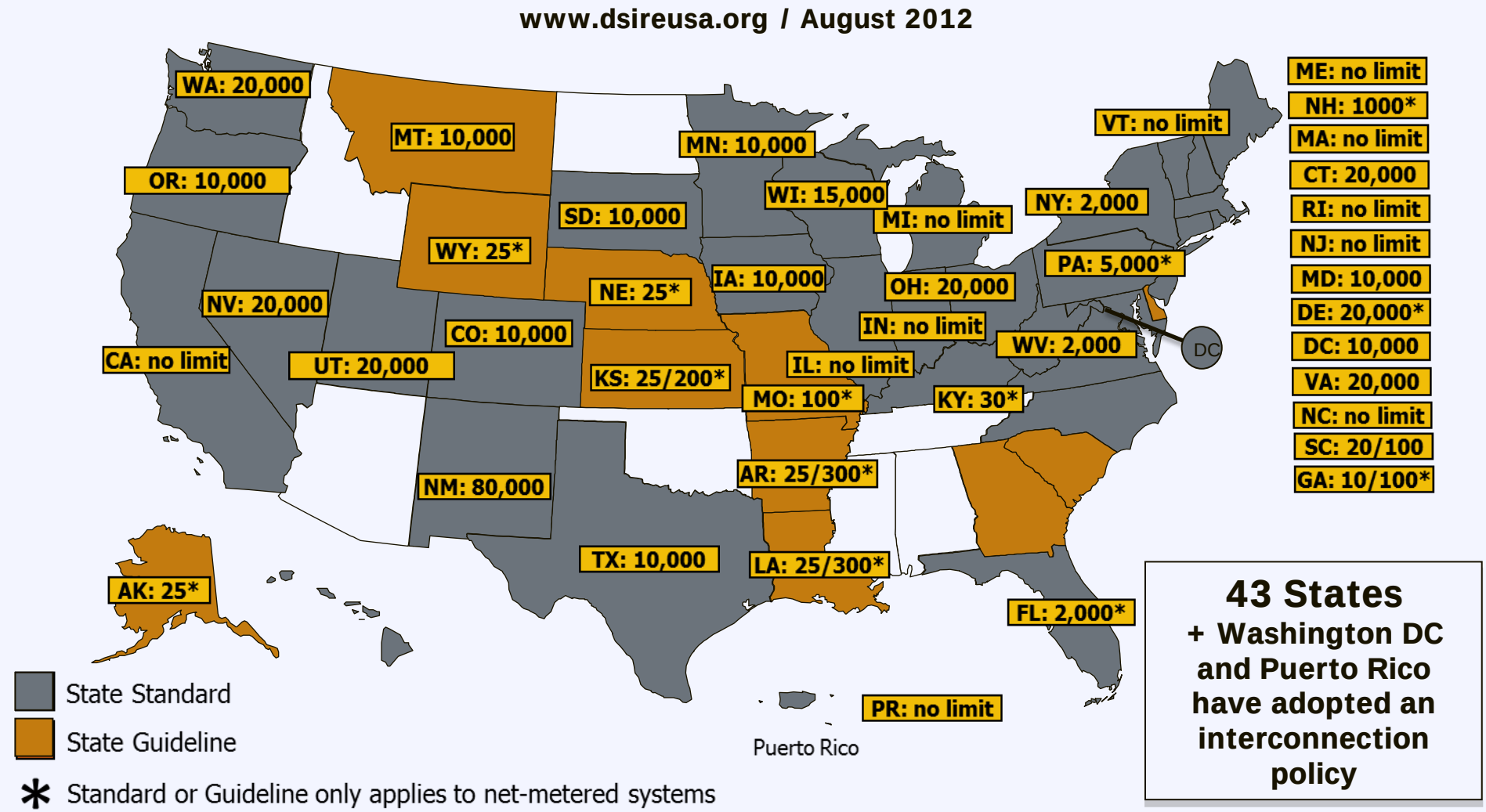
- CA Rule 21
- FERC SGIP
- MADRI Procedures
- IREC Procedures

Interconnection: Best Practices

1. Use standard forms and agreements
2. Implement expedited process
3. Implement simplified procedure for small solar arrays



Interconnection: State Policies



Notes: Numbers indicate system capacity limit in kW. Some state limits vary by customer type (e.g., residential versus non-residential). "No limit" means that there is no stated maximum size for individual systems. Other limits may apply. Generally, state interconnection standards apply only to investor-owned utilities.

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U.S. Department of Energy

Interconnection: Virginia

Interconnection				
D 2007	F 2008	A 2009	A 2010	A 2011

Recommendations:

- Prohibit requirements for redundant external disconnect switch
- Prohibit requirements for additional insurance

Eligible Renewable/Other Technologies:	Solar Thermal Electric, Photovoltaics, Wind, Biomass, Hydroelectric, Geothermal Electric, Municipal Solid Waste, Tidal Energy, Wave Energy
Applicable Sectors:	Commercial, Industrial, Residential, Nonprofit, Schools, Local Government, State Government, Fed. Government
Applicable Utilities:	All utilities
System Capacity Limit:	20 MW
Standard Agreement:	Varies by system size
Insurance Requirements:	Vary by system size and/or type; levels established by commission
External Disconnect Switch:	Utility's discretion
Net Metering Required:	No, separate interconnection procedures exist for net-metered

Interconnection: North Carolina

Interconnection				
F 2007	B 2008	B 2009	B 2010	B 2011

Recommendations:

- Prohibit requirements for redundant external disconnect switch
- Prohibit requirements for additional insurance
- Extend interconnection procedures to all utilities (i.e., munis and co-ops)

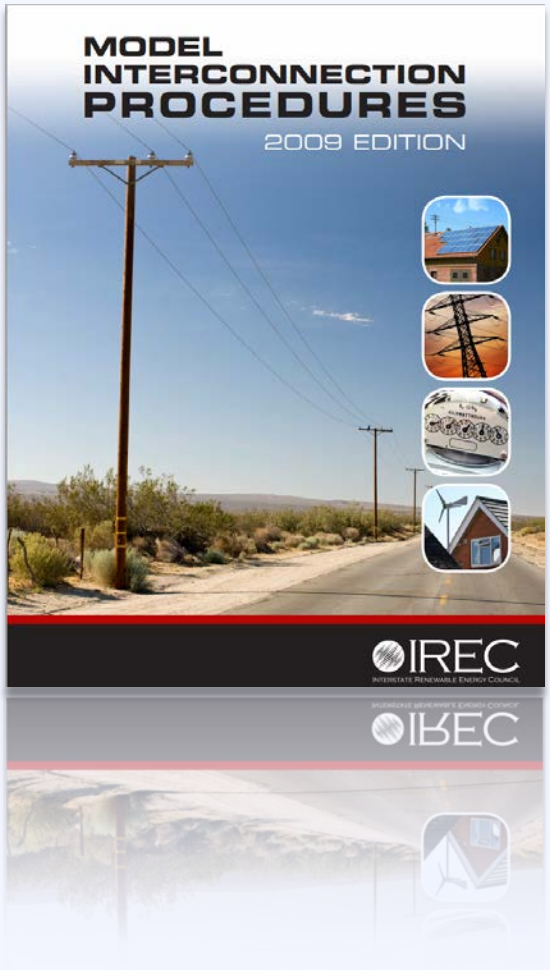
Eligible Renewable/Other Technologies:	Solar Thermal Electric, Photovoltaics, Landfill Gas, Wind, Biomass, Fuel Cells, Municipal Solid Waste, CHP/Cogeneration, Anaerobic Digestion, Small Hydroelectric, Microturbines, Other Distributed Generation Technologies
Applicable Sectors:	Commercial, Industrial, Residential, Nonprofit, Schools, Local Government, State Government, Fed. Government, Agricultural, Institutional
Applicable Utilities:	Investor-owned utilities
System Capacity Limit:	No limit specified
Standard Agreement:	Yes
Insurance Requirements:	Vary by system size and/or type; levels established by commission
External Disconnect Switch:	Not required for inverter-based systems up to 10 kW (unless the utility pays for it); utility's discretion for all other systems
Net Metering Required:	No

Interconnection: Resources

Resource **Interstate Renewable Energy Council**

IREC developed model interconnection procedures in an effort to capture emerging best practices in this vital area.

www.irecusa.org



Utility Spotlight: Dominion Energy

- Proposed Programs:
  - Community Solar Power Program*
    - Two phase program that would seek to install up to 30 MWs of utility-owned solar within the utility's service territory (at 30-50 sites).
    - Projects will be sited at a minimum of four community settings: such as local government buildings, schools, community associations, neighborhood associations or nonprofit organizations.
  - Customer Solar Power Rate
    - The utility is seeking permission to purchase solar-generated electricity from up to 3 MWs of residential and small commercial customer projects at 15 ¢/kWh for a five-year demonstration period.

https://www.dom.com/about/stations/renewable/solar/index.jsp

*Program is not a community solar as traditionally defined. There is no customer participation component.

Agenda

08:40 – 09:00	Solar 101
09:00 – 09:50	Creating a Regulatory Landscape for Solar
09:50 – 10:00	*Break*
10:00 – 10:20	Benefits and Barriers Activity
10:20 – 10:50	Understanding Utility Regulations
10:50 – 11:20	Understanding Solar Financing
11:20 – 11:30	*Break*
11:30 – 12:00	Installing Solar on Municipal Facilities
12:00 – 12:30	Next Steps for Solar in Region

Understanding Solar Financing

Direct Cash Incentives	RPS/SRECs	Rebates	PBIs/FITs
Financing	3rd Party Ownership	Bulk Purchasing	PACE
Other Incentives	Loans	Community Shared Solar	Property & Sales Taxes

Understanding Solar Financing

Direct Cash Incentives	RPS/SRECs	Rebates	PBIs/FITs
Financing	3rd Party Ownership	Bulk Purchasing	PACE
Other Incentives	Loans	Community Shared Solar	Property & Sales Taxes

RPS: Virginia Overview

- *Voluntary* Renewable Energy Portfolio *Goal*
- 15% of 2007 sales by 2025
- No solar carve-out

- Virginia State Corporation Commission (SCC) allows participating utilities to recover program costs and offers a performance incentive (in the form of an increased rate of return) for each goal attained.

Source: DSIRE Solar
(http://www.dsireusa.org/solar/incentives/incentive.cfm?Incentive_Code=VA10R&re=1&ee=1)

Solar Renewable Energy Credits (SRECs)

Three Requirements:

RPS solar carve out

Unbundled, tradeable credits

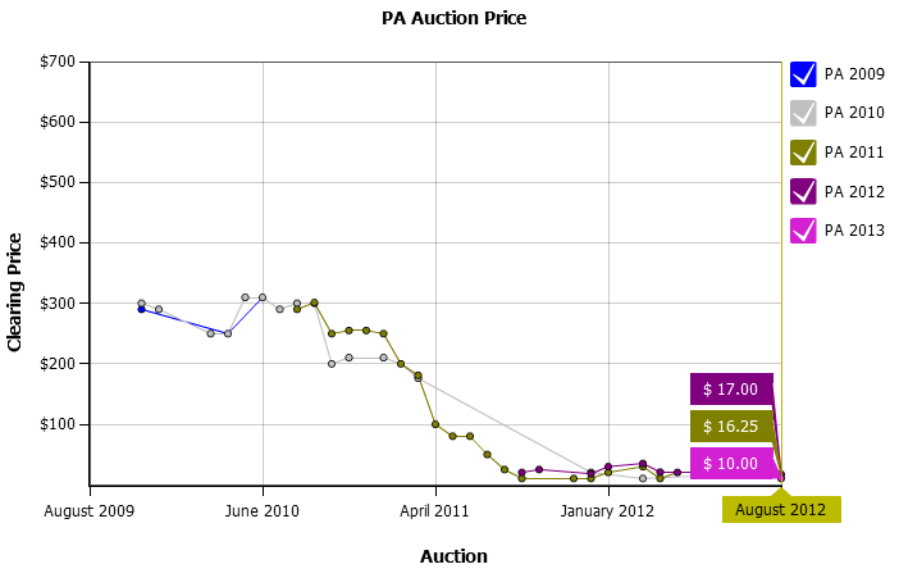
Penalty for non-compliance

– solar alternative compliance payment (SACP)

SRECs in Virginia

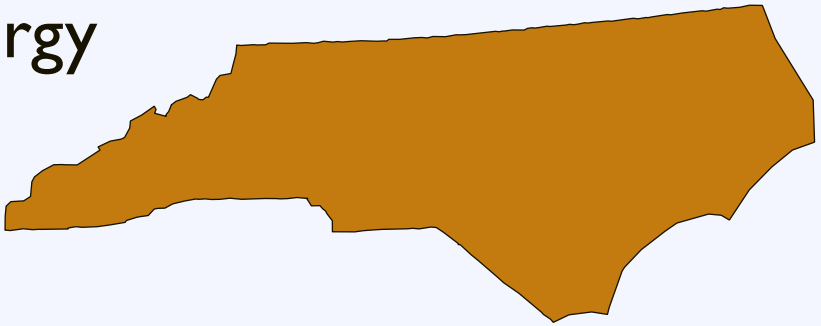
As there is no solar carve-out, Virginia lacks a viable SREC market.

However, system owners may be eligible to participate in the PA SREC market.



RPS: North Carolina Overview

- Renewable Energy and Energy Efficiency Portfolio Standard (REPS)



- IOUs: 12.5% of 2020 retail electricity sales from "eligible energy resources" in 2021
- Solar carve-out: 0.2% by 2018
- Munis/Coops: 10% of 2017 sales by 2018
  - Can use Demand Side Management, Energy Efficiency, and Large Hydropower

Source: DSIRE Solar
(http://www.dsireusa.org/solar/incentives/incentive.cfm?Incentive_Code=VA10R&re=1&ee=1)

SRECs in North Carolina

While an SREC program exists on paper, this market has been slow to develop.

Lack of an SACP

Shortage of Buyers

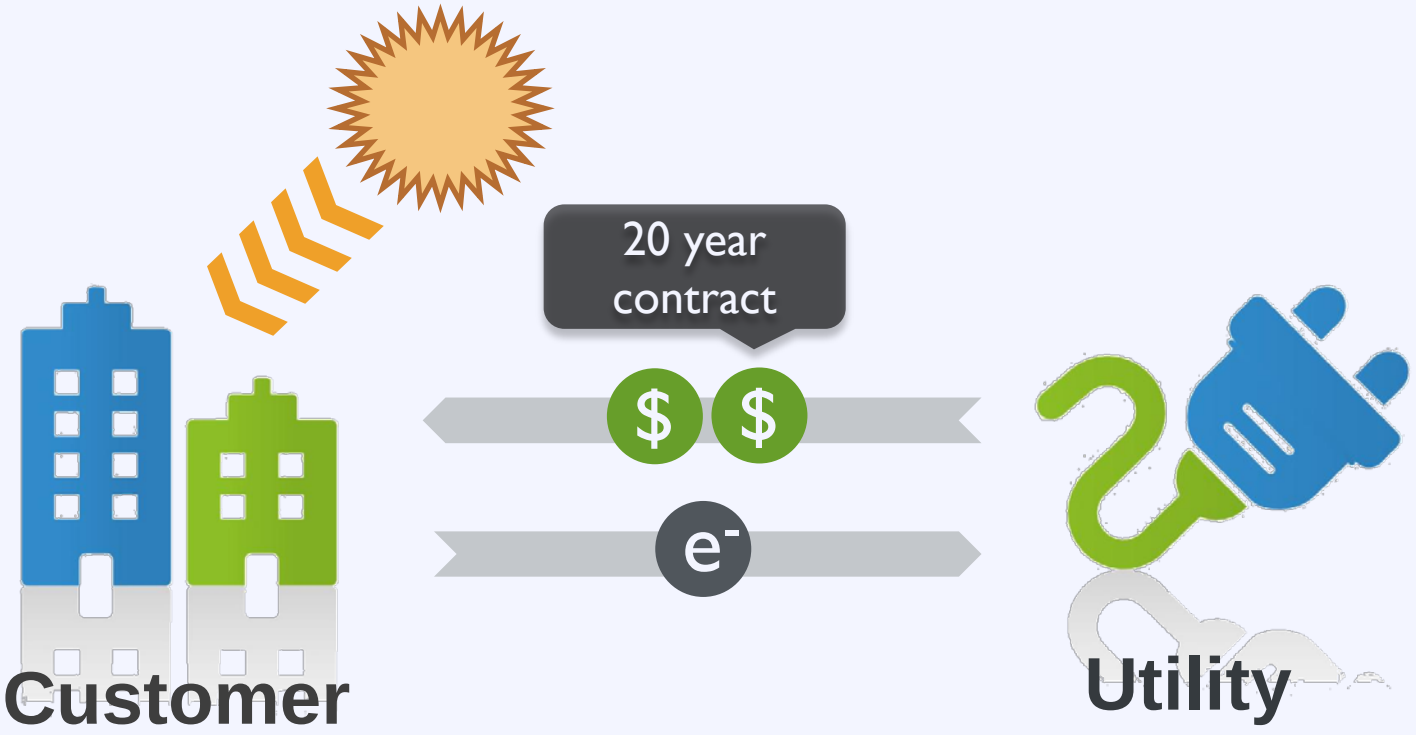
Out-of-State Participation

State PV Financial Incentives

Virginia		
-	State Rebates	-
-	State Grants	-
✓	State Loans	Several programs available through the Virginia Resources Authority
-	PACE Financing	-
✓	Prod. Incentives	Utilities (TVA)
-	Corp. Tax Credits	-
-	Pers. Tax Credits	-
✓	Prop. Tax Incentives	Local Option; Commercial, Industrial, Residential

North Carolina		
-	State Rebates	-
-	State Grants	-
✓	State Loans	Local Option for revolving loan programs
-	PACE Financing	-
✓	Prod. Incentives	Statewide (NC Green Power) and Utility (Duke, Progress, TVA)
✓	Corp. Tax Credits	35% of system cost; max. $10,500 for solar PV, $1,400 for SWH
✓	Pers. Tax Credits	35% of system cost; max. $10,500 for solar PV, $1,400 for SWH
✓	Prop. Tax Incentives	For both PV and SWH

What is a Feed in Tariff?



Components of a Feed in Tariff

- Fixed price payment
- Long term contract
- Guaranteed power purchase
- Price based on generation cost

TVA Performance Based Incentives

Generation Partners Program	
Eligible Technologies	Photovoltaics, Landfill Gas, Wind, Biomass, Small Hydroelectric
Applicable Sectors	Commercial, Residential, Nonprofit, Local Government, State Government, Federal Government
Amount	$1,000 enrollment incentive + $0.12/kWh on top of retail electricity rate (for qualifying PV systems)
Term	10 years*
Eligible System Sizes	0.5 kW – 50 kW

* TVA is in the process of transitioning the Generation Partners Program to the "Green Power Providers" program, which will retain many of the essential features of the current program. Notable changes in the new program include the exclusion of landfill gas as an eligible technology and extension of the contract term to 20 years (with the generation premium in effect for only the first 10 years of the contract). The new program is expected to be finalized in October 2012.

Source: DSIRE Solar (http://www.dsireusa.org/solar/incentives/incentive.cfm?Incentive_Code=VA05F&re=0&ee=0); TVA (http://www.tva.com/greenpowerswitch/partners/pdf/green_power_providers_fact_sheet.pdf)

TVA Performance Based Incentives

Mid-Sized Renewable Standard Offer Program

Eligible Technologies	Photovoltaics, Landfill Gas, Wind, Biomass, Other Clean Technologies, Anaerobic Digestion, Biodiesel
Applicable Sectors	Commercial, Nonprofit, Schools, Local Government, Construction, State Government, Tribal Government, Federal Government, Agricultural, Institutional, Retail Supplier, Systems Integrator
Amount	Varies according to seasonal and time-of-use (TOU) pricing set when contracts are executed. Prices ranges between $0.035 - $0.16/kWh, with an average price of $0.055/kWh
Term	Up to 20 years, with 3% annual base rate escalator
Eligible System Sizes	50 kW – 20MW

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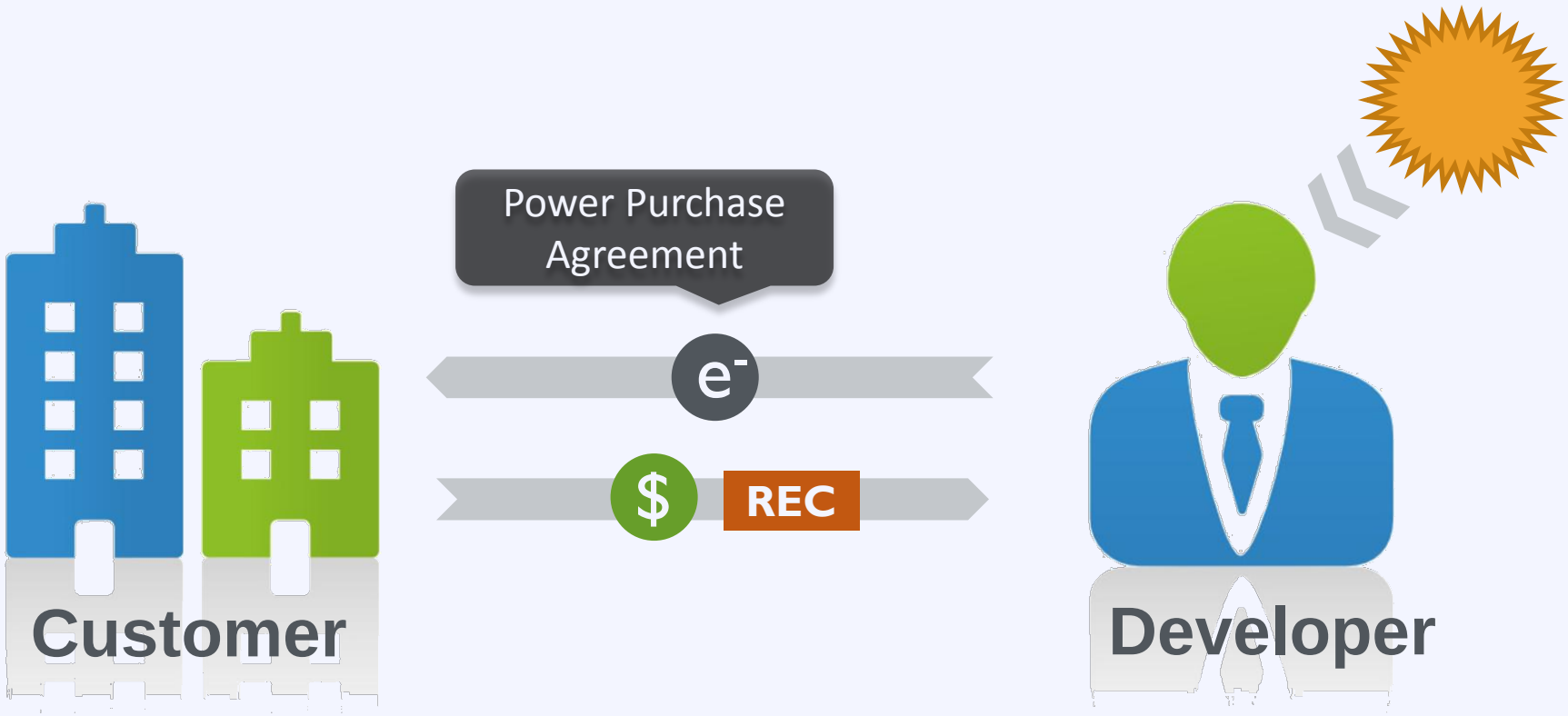
U.S. Department of Energy

Source: DSIRE Solar
(http://www.dsireusa.org/solar/incentives/incentive.cfm?Incentive_Code=VA41F&re=0&ee=0)

Understanding Solar Financing

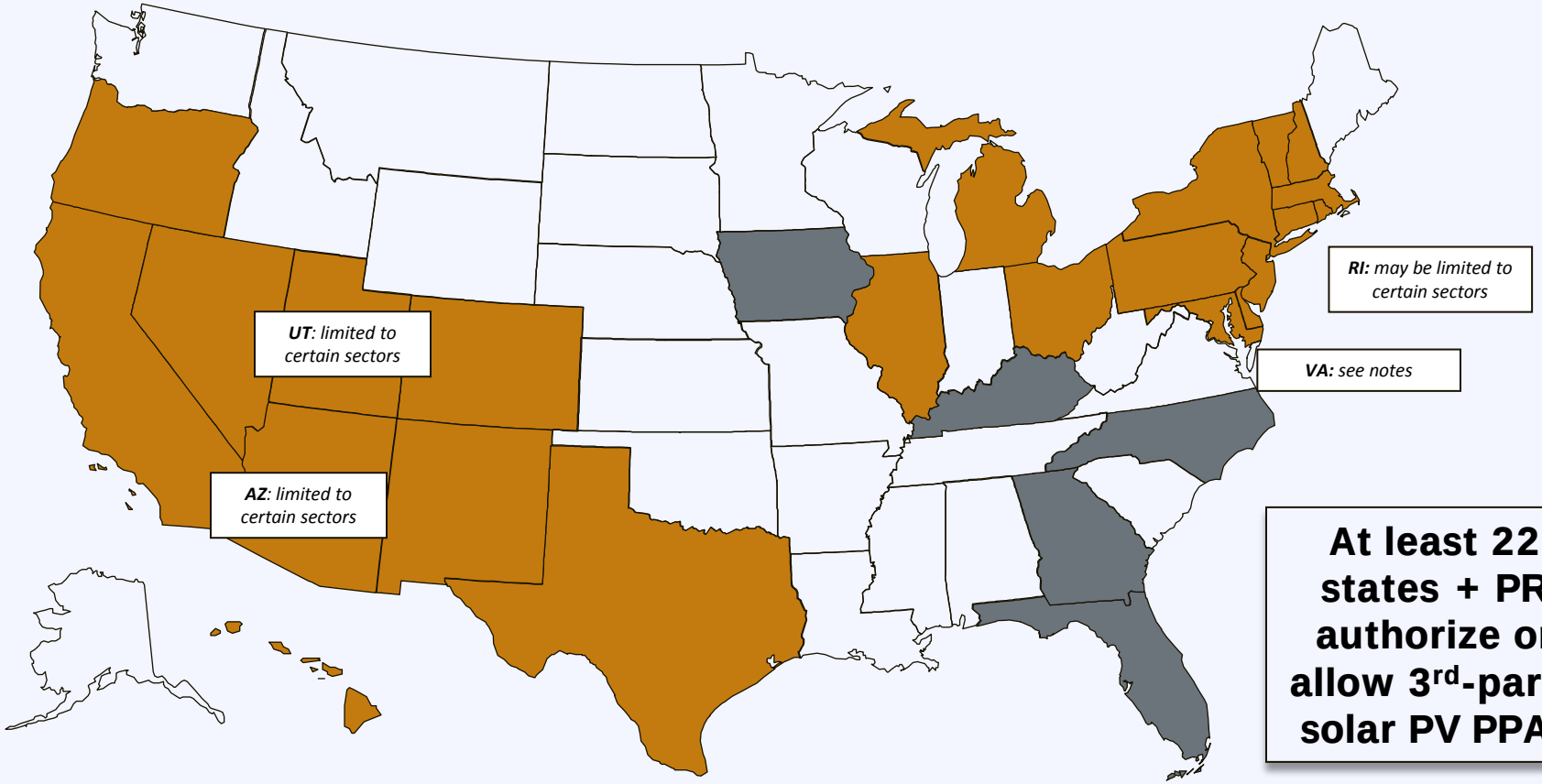
Direct Cash Incentives	RPS/SRECs	Rebates	PBIs/FITs
Financing	3rd Party Ownership	Bulk Purchasing	PACE
Other Incentives	Loans	Community Shared Solar	Property & Sales Taxes

Third Party Ownership



3rd-Party Solar PV Power Purchase Agreements (PPAs)

www.dsireusa.org / August 2012



Note: This map is intended to serve as an unofficial guide; it does not constitute legal advice. Seek qualified legal expertise before making binding financial decisions related to a 3rd-party PPA. See following slides for additional important information and authority references.

Group Purchasing

- Many people come together to purchase solar equipment and installation services in bulk
- Economies of scale = lower price per watt

SunShares
Go Solar with Group Buying Power

georgetownenergy.com
HELPING WASHINGTON DC GO SOLAR

solarize portland

Property Assessed Clean Energy

City creates type of land-secured financing district or similar legal mechanism (a special assessment district)

Property owners voluntarily sign-up for financing and make energy improvements

Proceeds from revenue bond or other financing provided to property owner to pay for energy project

Property owner pays assessment through property tax bill (up to 20 years)

Understanding Solar Financing

Direct Cash Incentives	RPS/SRECs	Rebates	PBIs/FITs
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Other Incentives	Loans	Community Shared Solar	Property & Sales Taxes

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U.S. Department of Energy

Financing: Attractive Loan Options

- Local governments and utilities can develop loan programs:
  - direct loans (e.g., revolving loan fund)
  - loans through private lenders (e.g., credit enhancement)
- Options in Virginia
  - Virginia Resources Authority offers several programs to finance local government energy projects
- Options in North Carolina
  - Allows local governments to establish and make loans from a revolving loan fund, with interest rates capped at 8% and terms of up to 20 years
- The goal is to increase ***access*** to financing or induce ***additional*** improvements

Community Shared Solar

Powered by SunShot
U.S. Department of Energy

Seattle City Light's Jefferson Park Project

Property & Sales Tax Exemptions

- Property tax exemptions in North Carolina
  - Active Solar Heating and Cooling
    - May not be assessed at a higher value than conventional systems
  - Solar Electric Systems
    - Exempts 80% of appraised value from property tax
- Local option for property tax in Virginia
- 4.00% state sales tax in Virginia, plus local (1-1.5%)
- 6.75% state sales in North Carolina, plus local (2-3%)

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Process

Decide on Ownership Structure

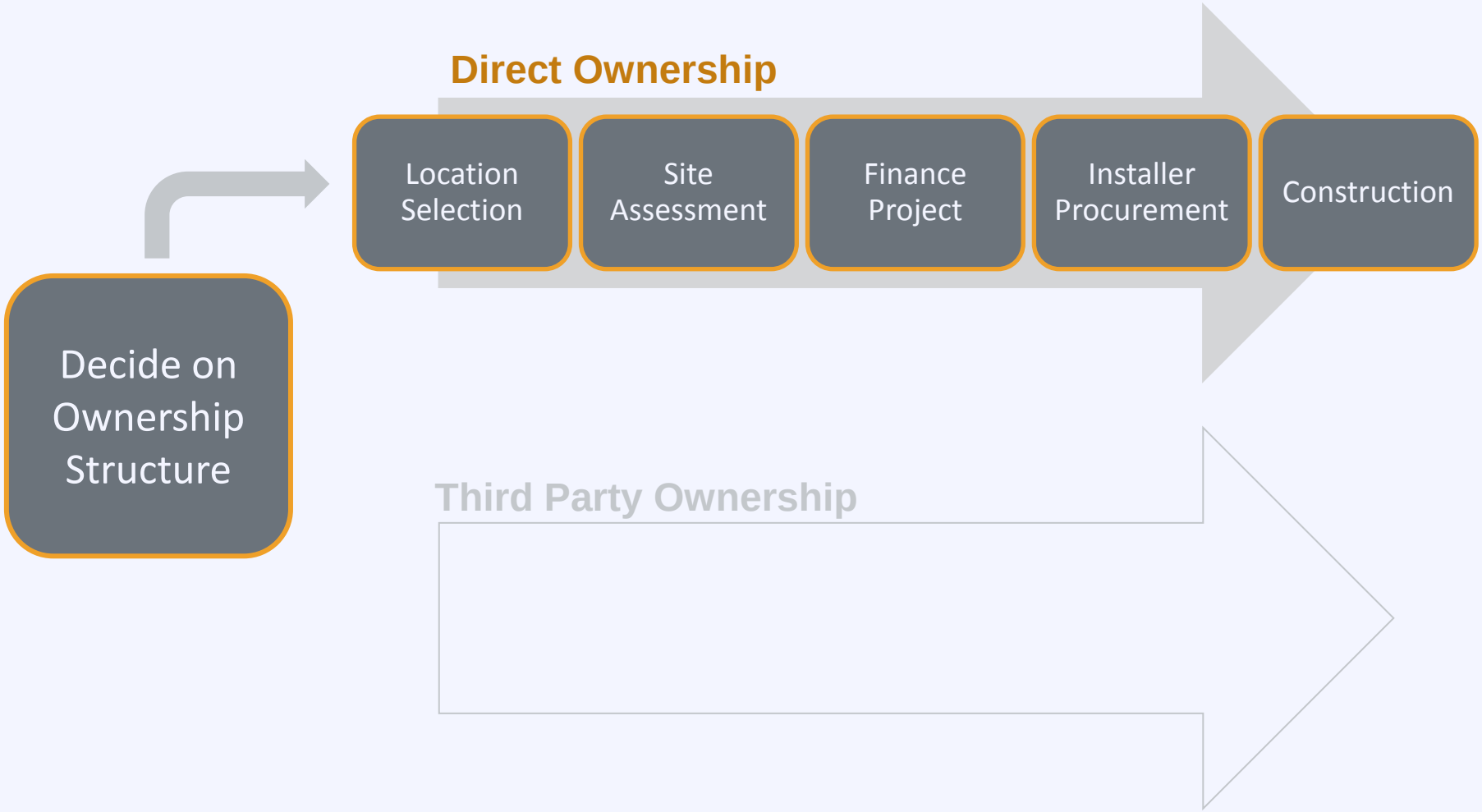
Option 1: Direct Ownership

Option 2: Third Party Ownership

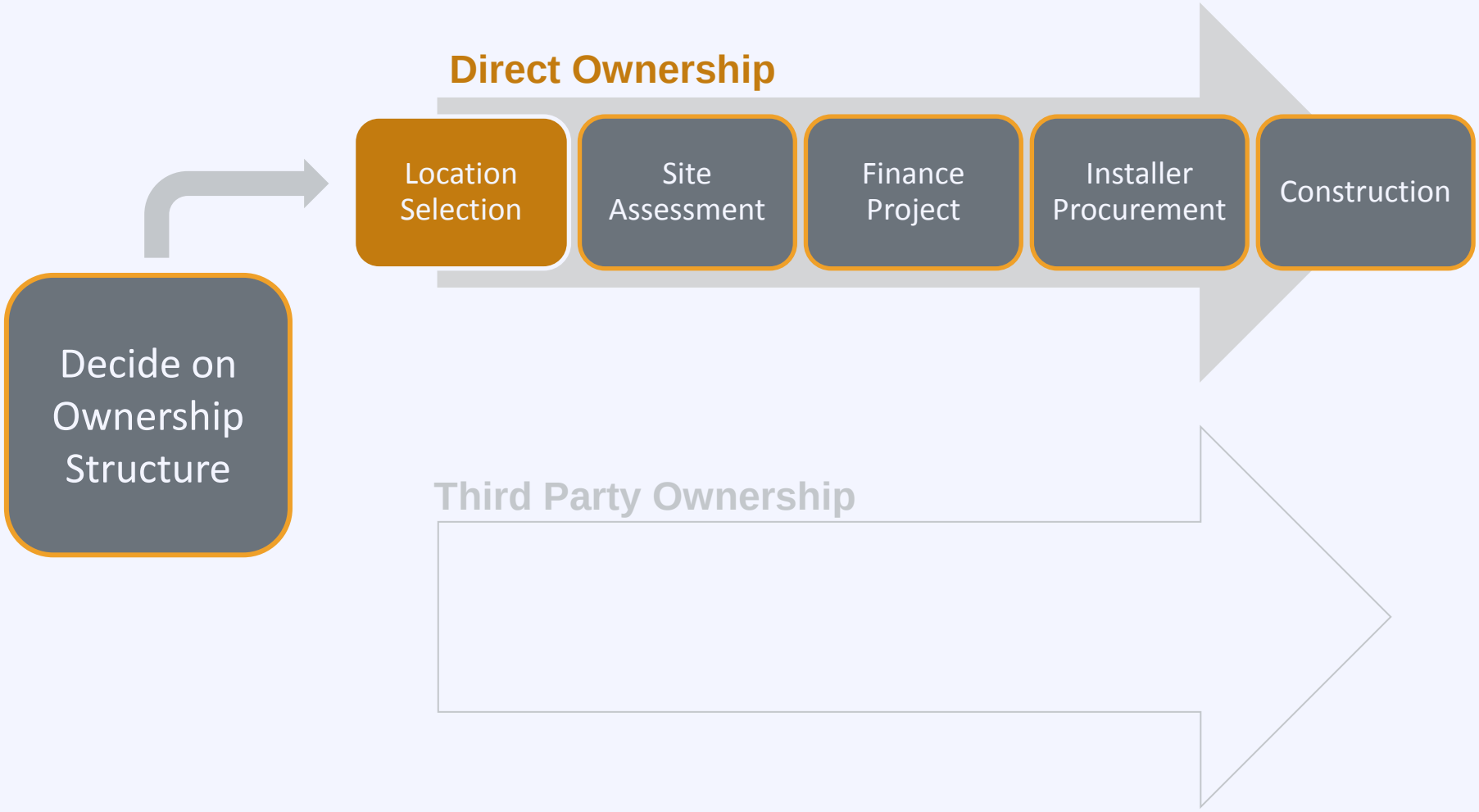
Ownership Structure Decision

- Are you a taxpaying entity?
- Do you have access to financing or available cash?
- How does this compare to other opportunities?
- Can you enter into long-term contracts?
- Do you want to own the system?
- Do you have a municipal utility?
- Do you need the RECs for compliance?

Process


Direct Ownership
Location Selection
Site Assessment
Finance Project
Installer Procurement
Construction
Decide on Ownership Structure
Third Party Ownership

Process


Direct Ownership
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Step 1: Location Selection

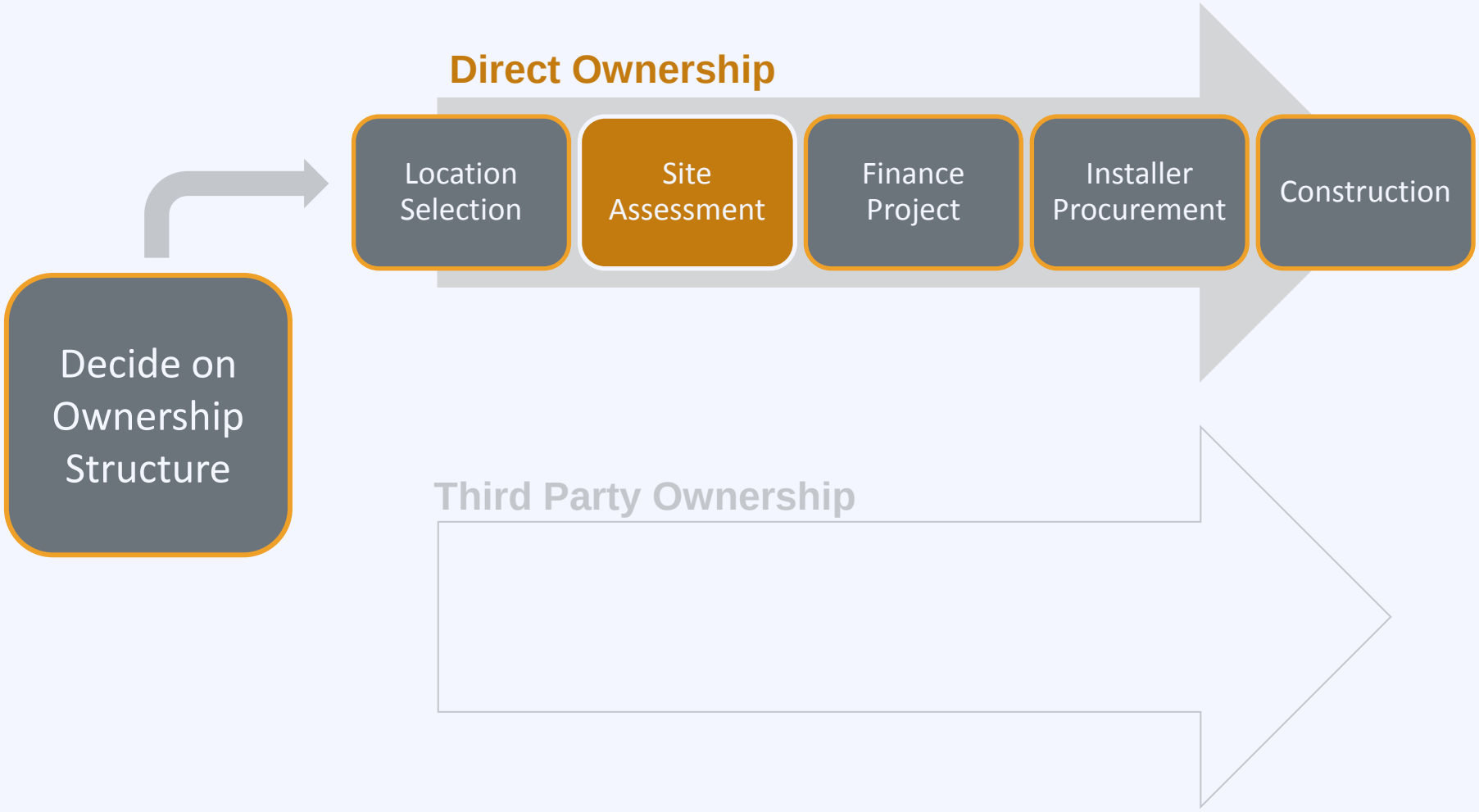
- Who is using the energy?
- Where is the energy being used?
- What is the user's energy load?
- What is the user's energy cost?

Step 1: Location Selection

Rooftop

Ground

Process


Direct Ownership
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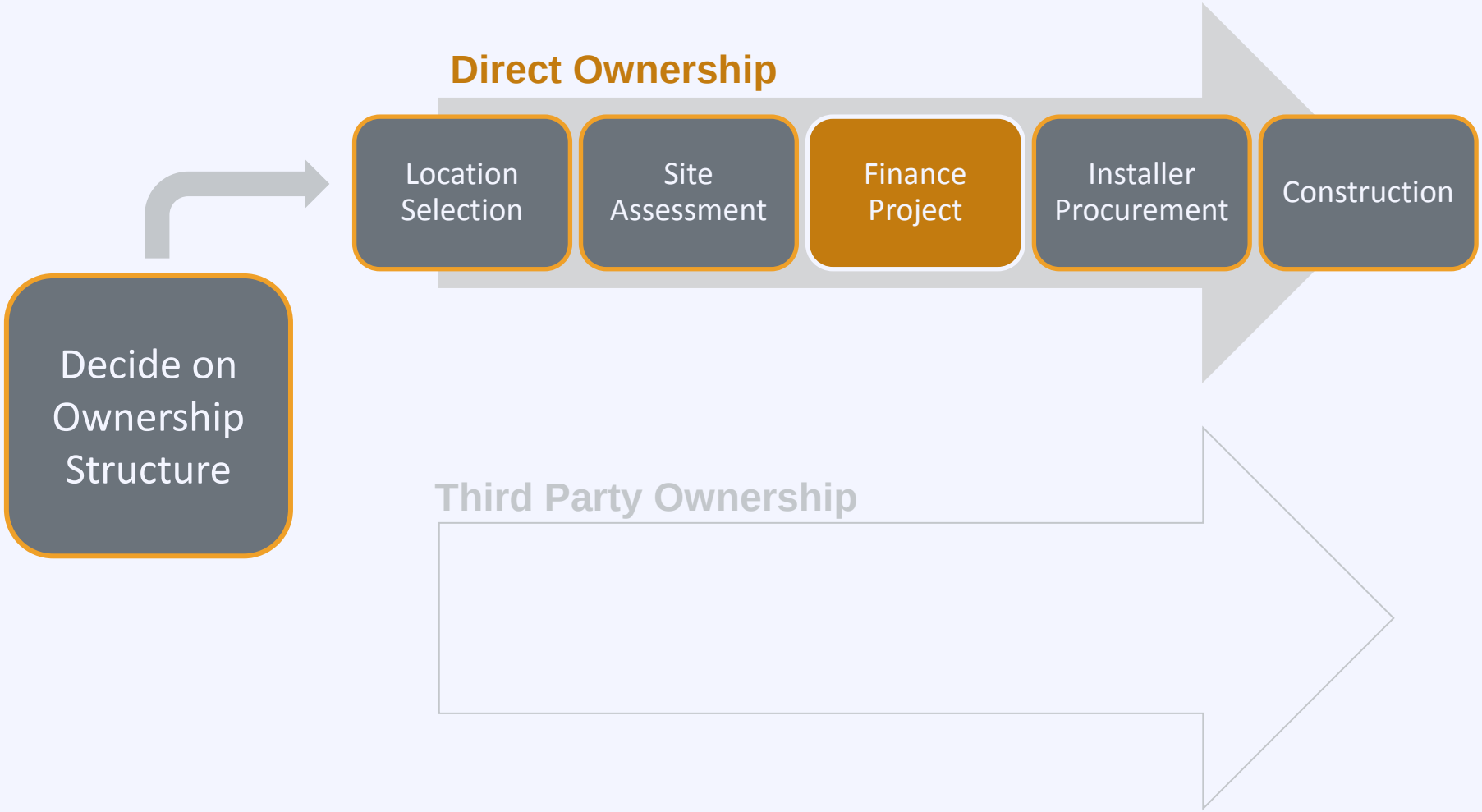
Step 2: Site Assessment

- Solar Access Rights
- Interconnection
- Wind loading
- Roof age, type, & warranty
- Electrical configuration
- Slope, Shading and orientation

Step 2: Site Assessment

- Usable acreage
- Slope
- Distance to transmission lines
- Distance to graded roads
- Conservation areas

Process


Direct Ownership
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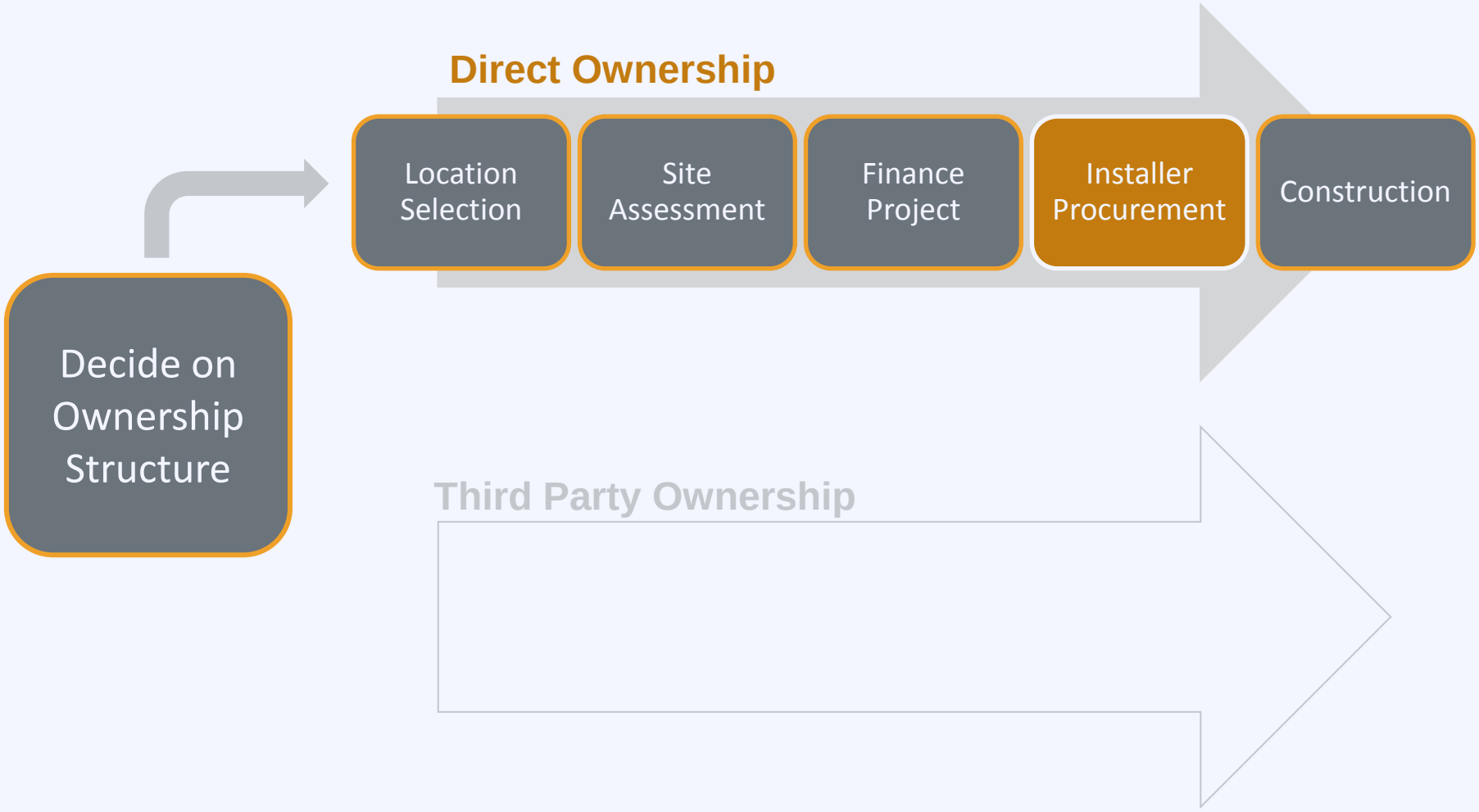
Step 3: Finance Project

- Direct purchase
- Grant financed
- ESCO/performance contracting
- Loans
- Bonds

Process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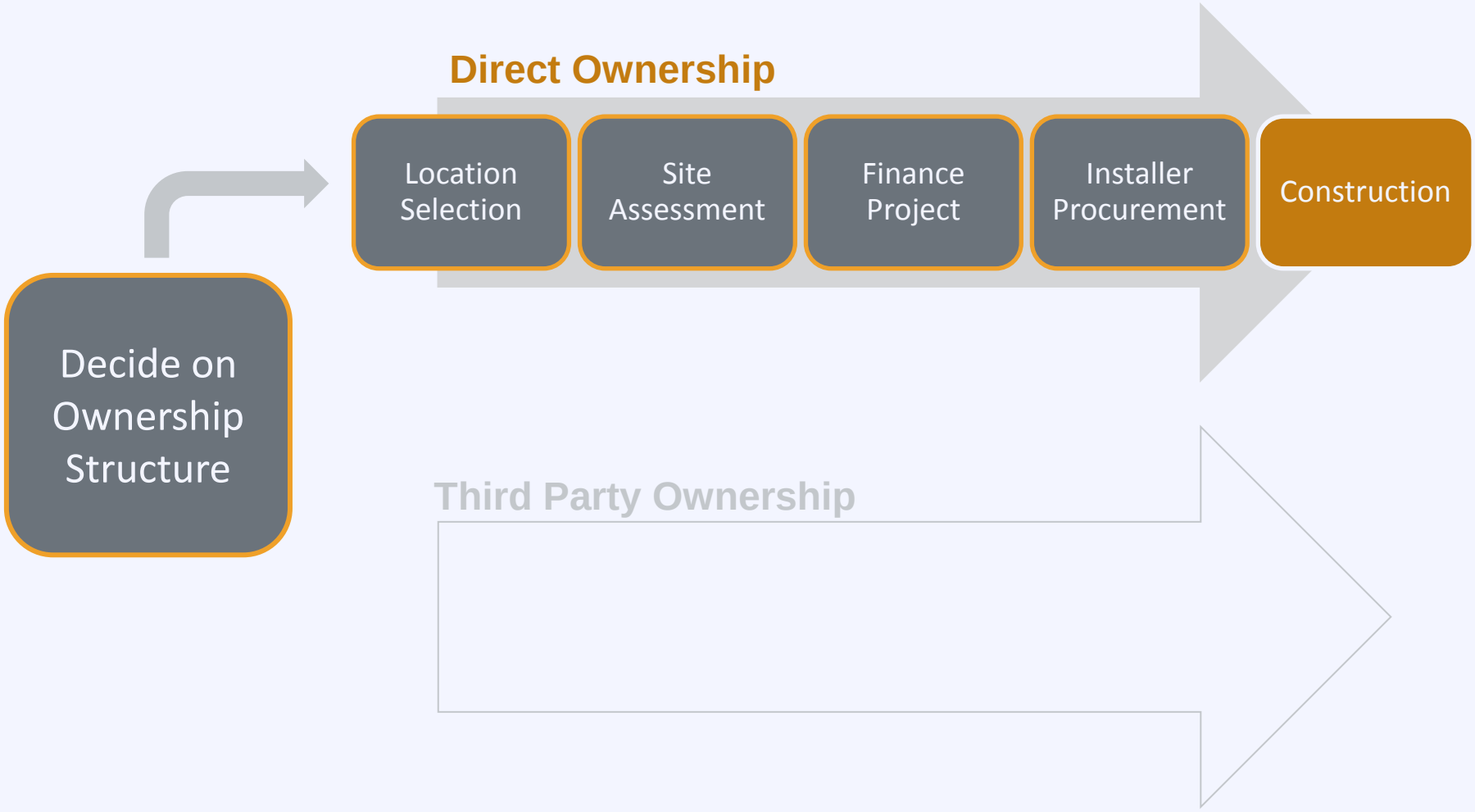
Step 4: Installer Procurement

EPC = Engineer, Procure, Construct

- Designs the project
- Completes necessary permitting requirements
- Works with the utility to file for interconnection
- Assists in procuring components
- Applies for incentives
- Manages project construction

Process


Direct Ownership
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Decide on Ownership Structure
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Direct Ownership

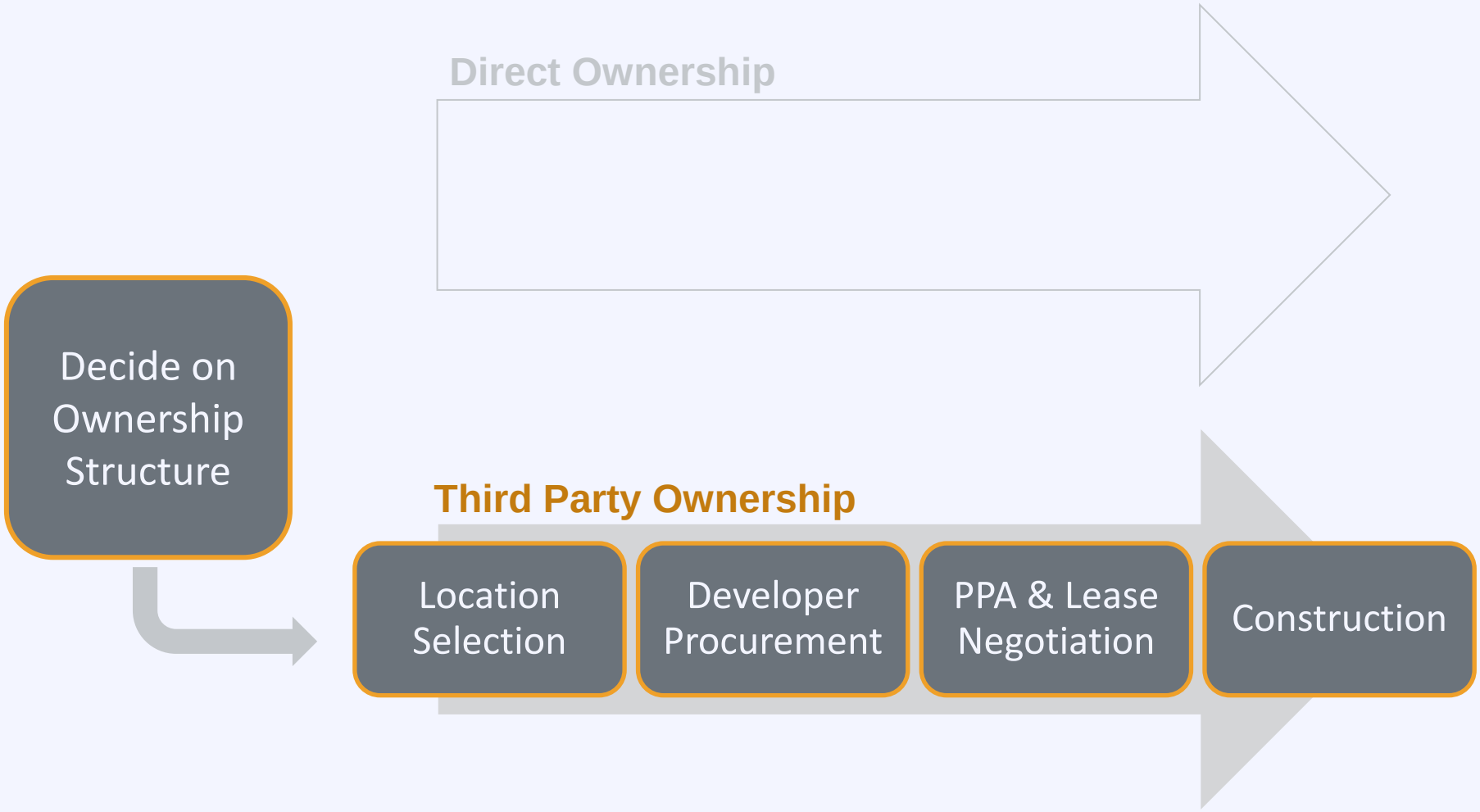
Pros

- Low – cost electricity
- REC revenue
- Maximize underutilized spaces

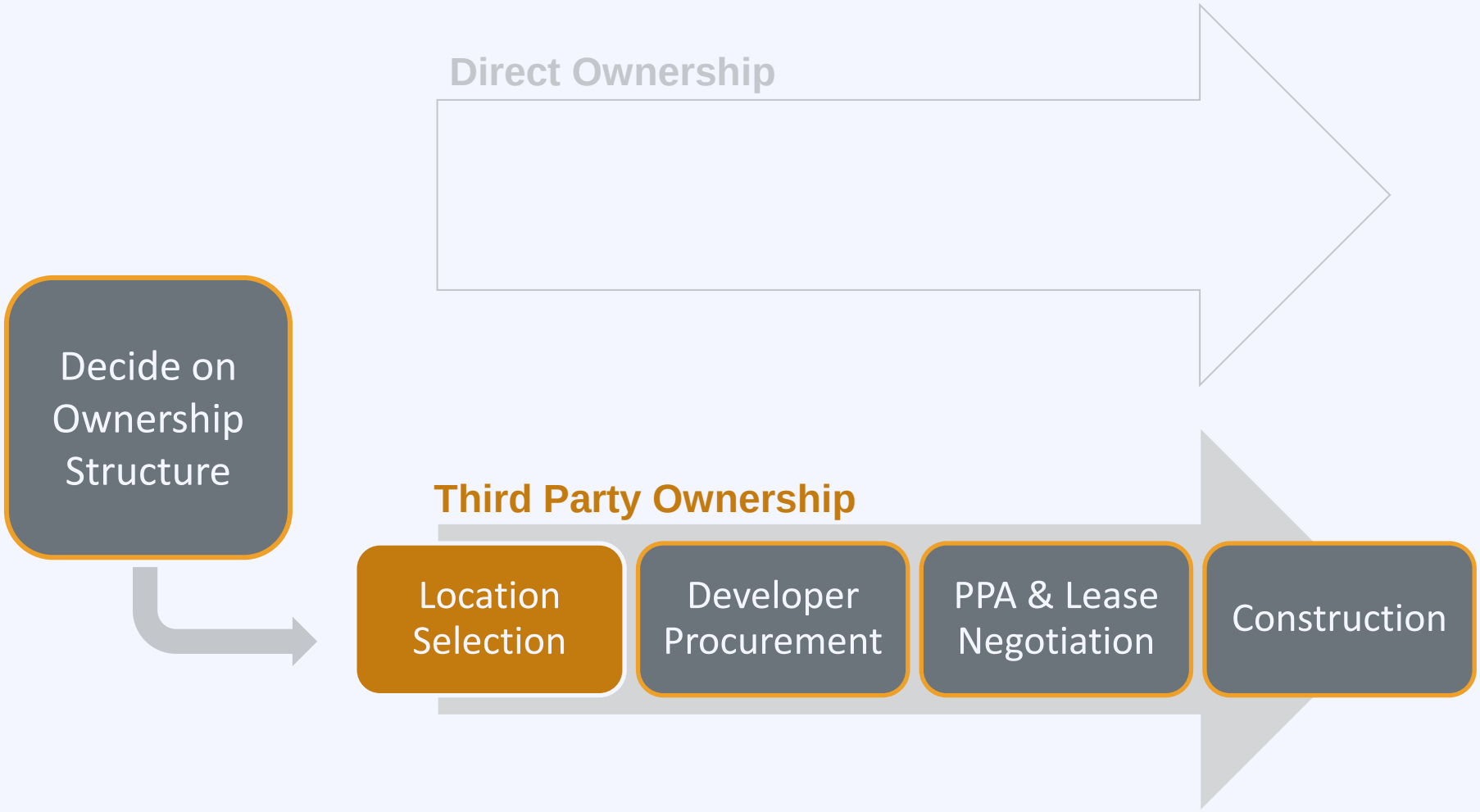
Cons

- Large upfront cost
- Long term management
- Can't take all incentives
- Development risk
- Performance risk

Process


Direct Ownership
Decide on Ownership Structure
Third Party Ownership
Location Selection
Developer Procurement
PPA & Lease Negotiation
Construction

Process


Direct Ownership
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Location Selection
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Process


Direct Ownership
Decide on Ownership Structure
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PPA & Lease Negotiation
Construction
RFP vs RFQ

Step 2: Developer Procurement

Avoid Five Common Pitfalls:

- RFP/RFQ specifications are too restrictive or too unstructured
- Competing measures of system efficiency
- Finding sufficient number of qualified bidders
- Lack of effective O&M program
- Lack of strong monitoring program

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Source: NREL Webinar "Procuring and Implementing Solar Projects on Public Buildings: How to Avoid Common Pitfalls" December 8, 2010

Step 2: Developer Procurement

In Santa Clara County, CA, nine municipalities collaboratively bid out 47 sites. Benefits include:

50% savings in administrative costs

10-15% reduction in energy cost

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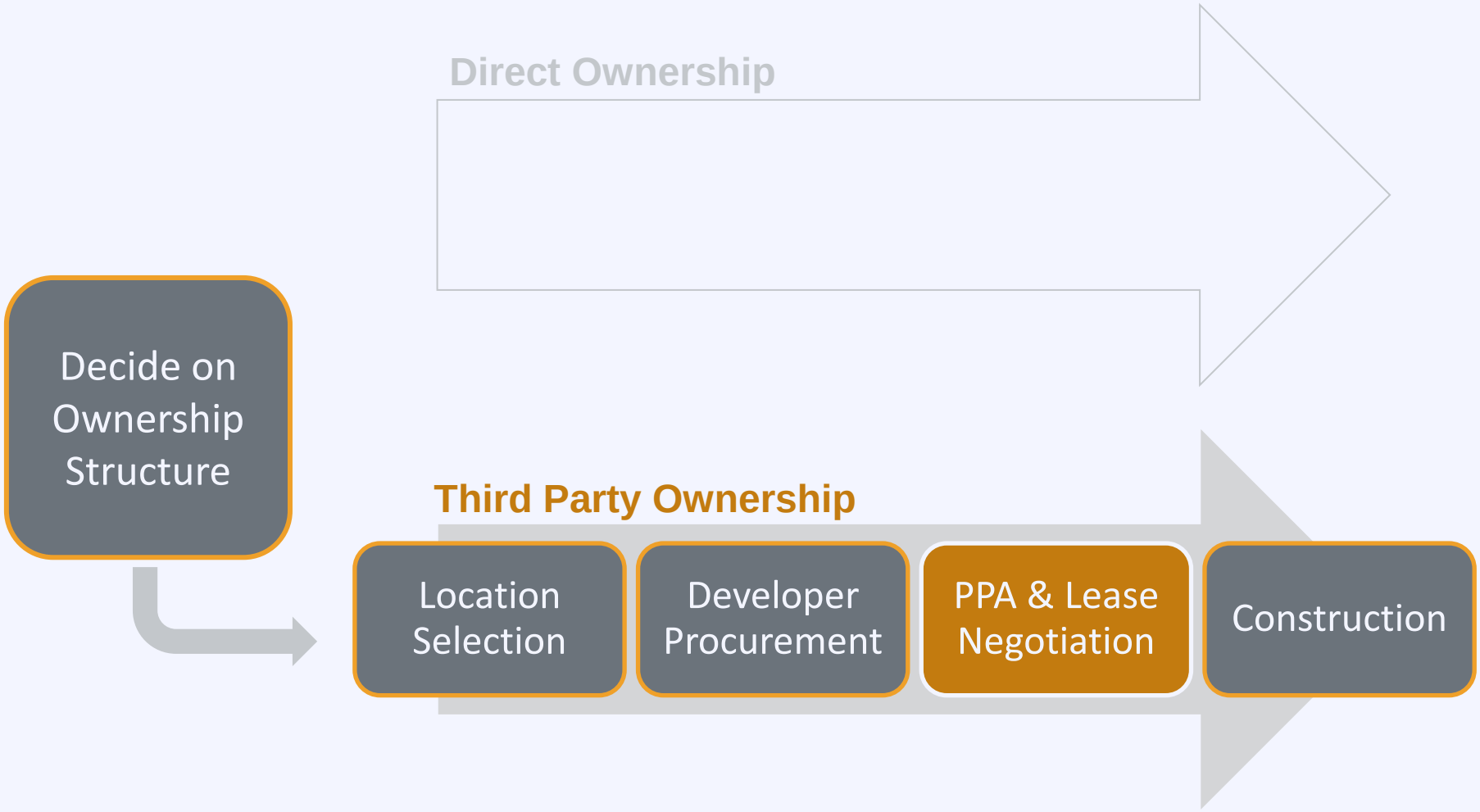
Source: NREL Webinar "Procuring and Implementing Solar Projects on Public Buildings: How to Avoid Common Pitfalls" December 8, 2010

Process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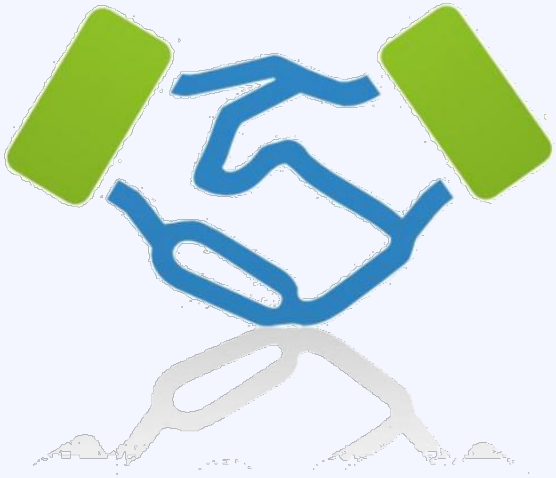
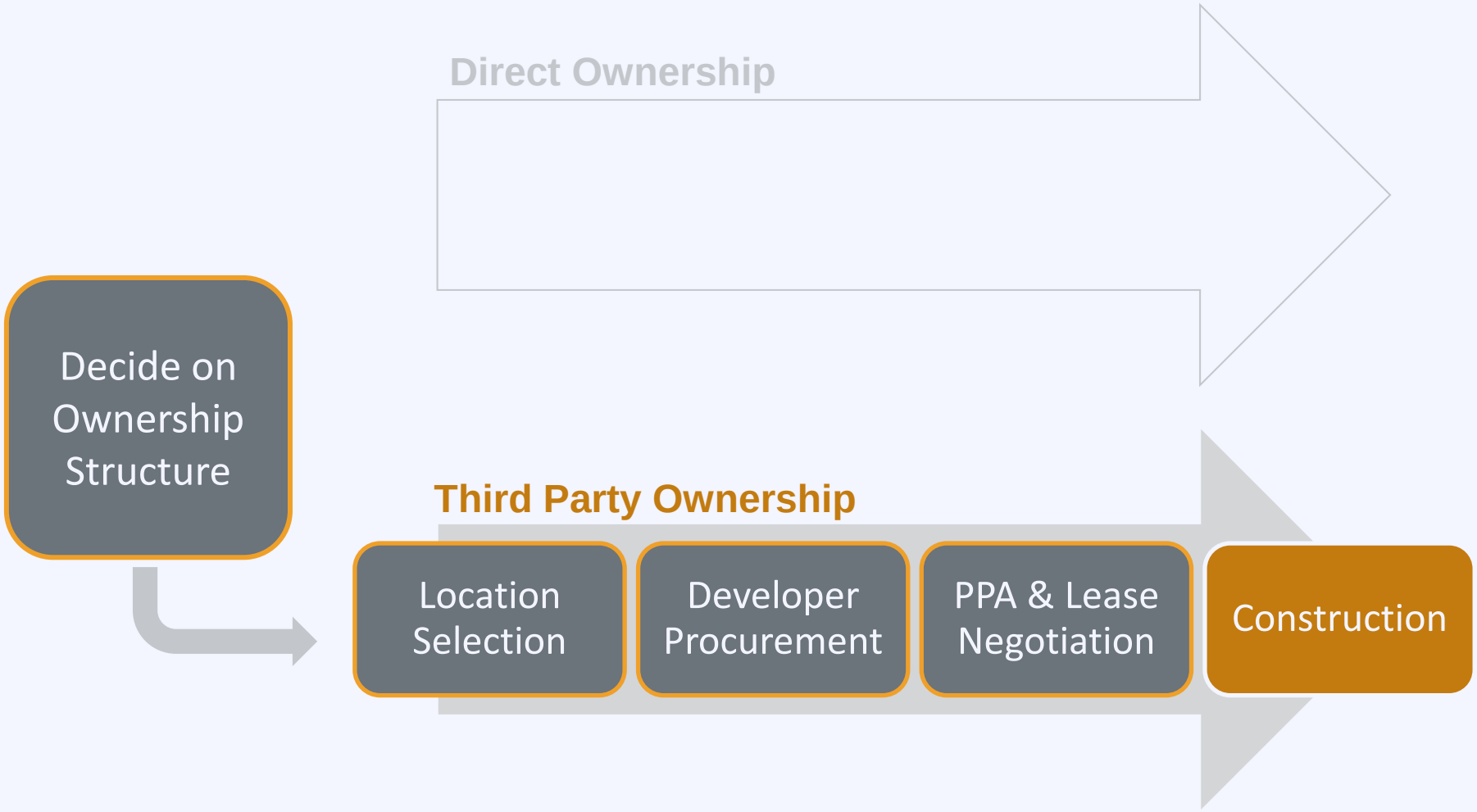
Step 3: Contract Negotiation

Negotiation points:

- Fixed or floating electricity price
- Price escalator
- Contract term length
- Property taxes
- Liability
- Performance guarantee
- Regulatory risk



Process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Third Party Ownership

Pros

- No upfront cost
- No O&M costs
- Low risk
- Predictable payments

Cons

- Market electricity price risk
- Limited opportunity in VA
- Don't keep RECs

Factors PPA Providers Look For

- States that allow PPA providers to operate without being regulated as utility
- State financial incentives – tax credit or rebate
- SREC market
- Good net metering and interconnection
- PPA providers allowed to net meter

Property Leases

- Site owner leases site to third party solar developer
- Typical lease runs 20 years or longer
- Leasing company owns the equipment and energy produced, but pays site owner for use of the site (roof, land)
- Las Cruces, NM leased 240 acres to SunEdison = $2.3 million for the city

14th Street Parking Deck
Type of Site: Public
Location: Richmond, VA

Size of PV system: 188.44 kW
http://live.deckmonitoring.com/?id=14th_street
Photo credit: Urban Grid

Children's Museum of Richmond
Type of Site: Public
Location: Richmond, VA

Size of PV system: 14.4 kW
Photo credit: Urban Grid

Agenda

08:40 – 09:00	Solar 101
09:00 – 09:50	Creating a Regulatory Landscape for Solar
09:50 – 10:00	*Break*
10:00 – 10:20	Benefits and Barriers Activity
10:20 – 10:50	Understanding Utility Regulations
10:50 – 11:20	Understanding Solar Financing
11:20 – 11:30	*Break*
11:30 – 12:00	Installing Solar on Municipal Facilities
12:00 – 12:30	Next Steps for Solar in Region

Discussion

What are some tools from this workshop that you can take back to your community?

Activity: Next Steps

What do you pledge to do when you leave today's workshop? [Orange Card]

Q & A

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