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Helping Utilities Make Smart Solar Decisions

Why Utilities are Embracing Community Solar

Tanuj Deora
Chief Strategy Officer, SEPA

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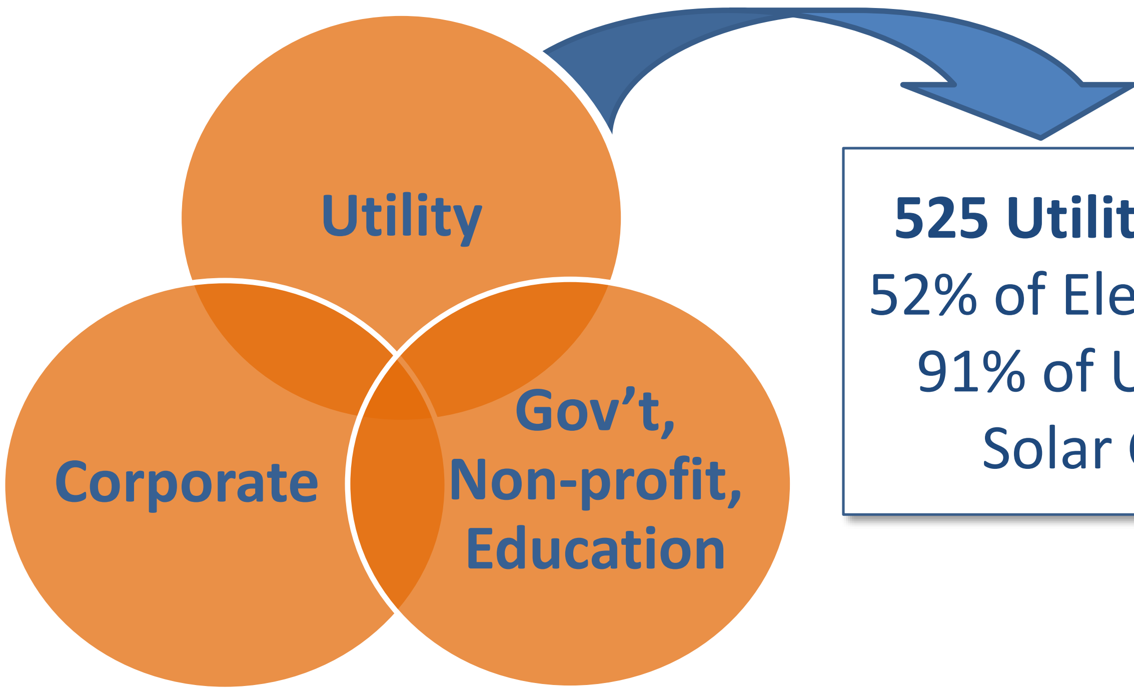
Organization Overview

SEPA is a 501(c)3 research and education organization with over 900 members from across the solar industry with a mission to help utilities integrate solar into their portfolios



525 Utility Members
52% of Electricity Sales
91% of US Installed Solar Capacity

Our Guiding Principles

- **Utilities are a critical part** of the equation for solar energy to live up to its full potential in serving the public good.
- The **regulatory compact must evolve** to support utility business models that encourage expanded deployment of central station and distributed solar resources.
- **Advancements** in **grid design, grid operations, and grid technology** are needed in order for solar energy to reach maximum potential.
- The long-term economic health of utilities, solar companies and their customers will be strengthened through **partnership**.

What We Do

Facilitate Utility Peer Learning

Build Bridges between Utility & Solar Industries

Develop Solutions

Overview

1. **The Changing Landscape for the Modern Utility**
   - Expectations of the Utility are Shifting
   - The Solar Market is Booming
   - The Challenge of Distributed PV is Not Going Away

2. **Utilities are Responding**
   - Reactive – Rate Reform, Grid Integration Strategies, Consumer Education
   - Proactive – Utility Scale Procurement, Rooftop Ownership, Community Solar

3. **Community Solar Offers Particular Promise with Significant Consumer, System, and Utility Benefits**
   - What is it?
   - How Does it Work?

4. **But Community Solar isn't a Panacea, and Utilities Will Need to Adapt Further**

BONUS! - SEPA Can Help! (plus Appendix Slides)

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The Public Expectations of the Utility are Increasing

Legacy Expectations

- **Safe**
- **Reliable**
- **Low Cost**
- Enabling Economic Development
- Stable and Predictable Costs

The Public Expectations of the Utility are Increasing

Legacy Expectations

New Demands

- Safe
- Reliable
- Low Cost
- Enabling Economic Development
- Stable and Predictable Cost
- Resilient
- Support for DSM
- Proactive Environmental Stewardship
- Support for Consumer Choice, including Self Generation
- Support for Transportation Infrastructure

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Often Forgotten

- **Obligation to serve**
- **Existing (& Unquestioned) Cross-Subsidization**
- **Impact on Capital Cost & Availability**
- **Data Availability, Security, & Ownership**

Market Growth

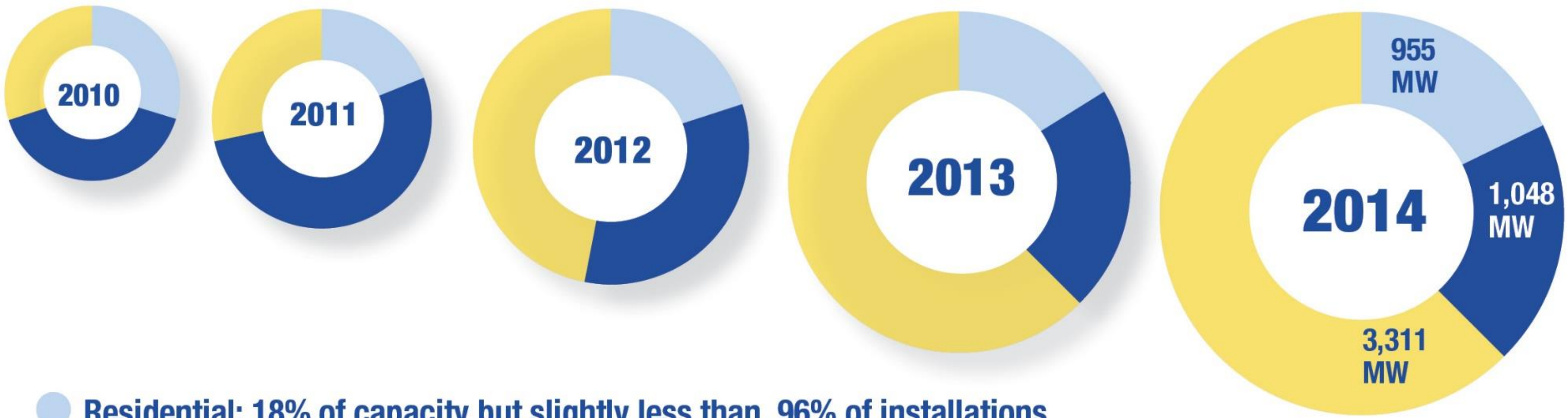
Megawatts

	Annual MW	Cumulative MW
2010	897	2,518
2011	1,577	4,095
2012	2,688	6,783
2013	4,198	10,981
2014	5,314	16,295

Number of installations

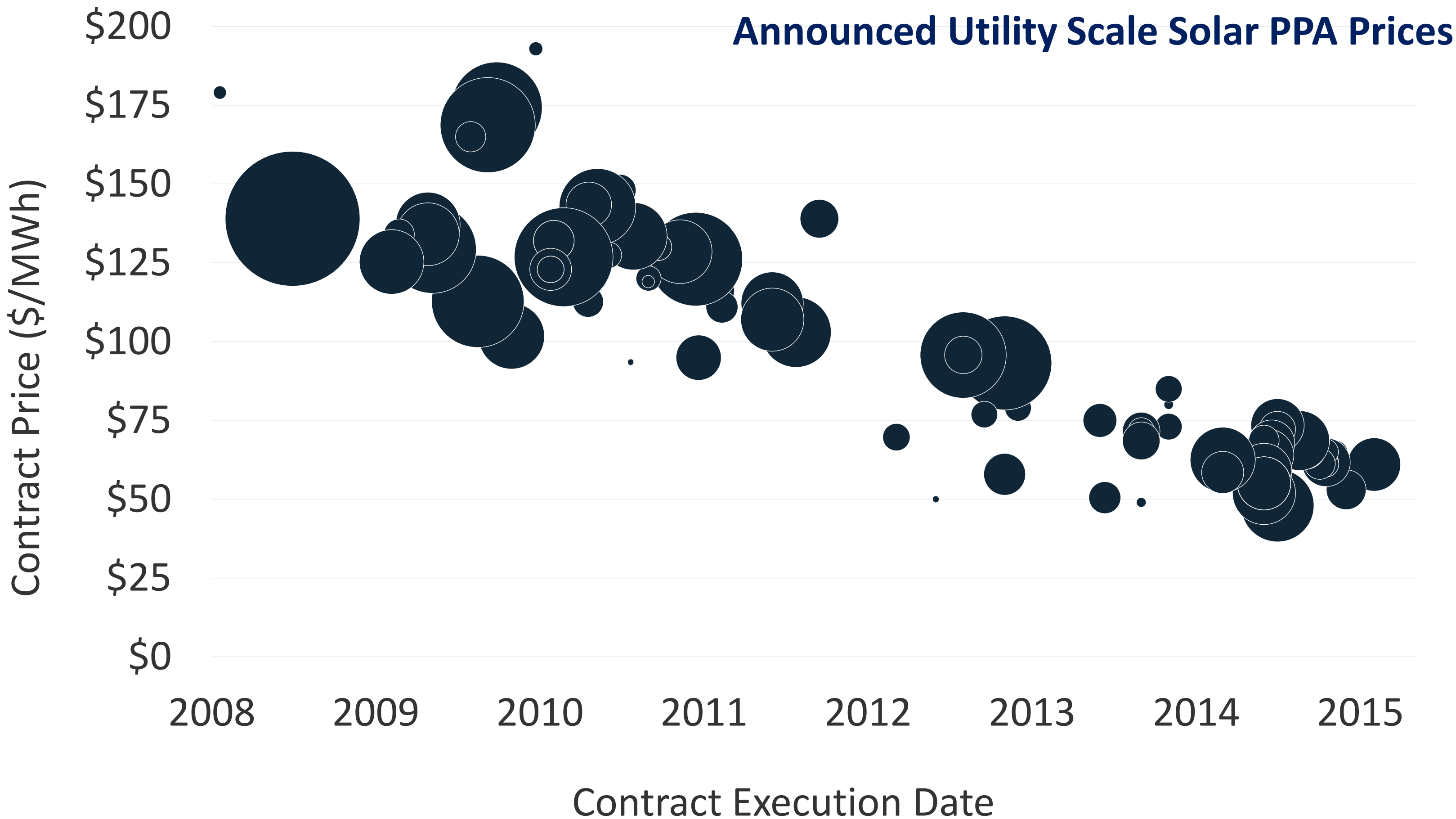
	Annual Systems	Cumulative Systems
2010	68,846	158,705
2011	85,993	244,698
2012	111,515	356,213
2013	137,056	493,269
2014	182,262	675,520

Market Segments



- Residential: 18% of capacity but slightly less than 96% of installations
- Nonresidential: 20% of capacity but 4% of installations
- Utility-scale: 62% of capacity but 0.05% of installations

Utility Scale Solar has Arrived



Source: GTM Research

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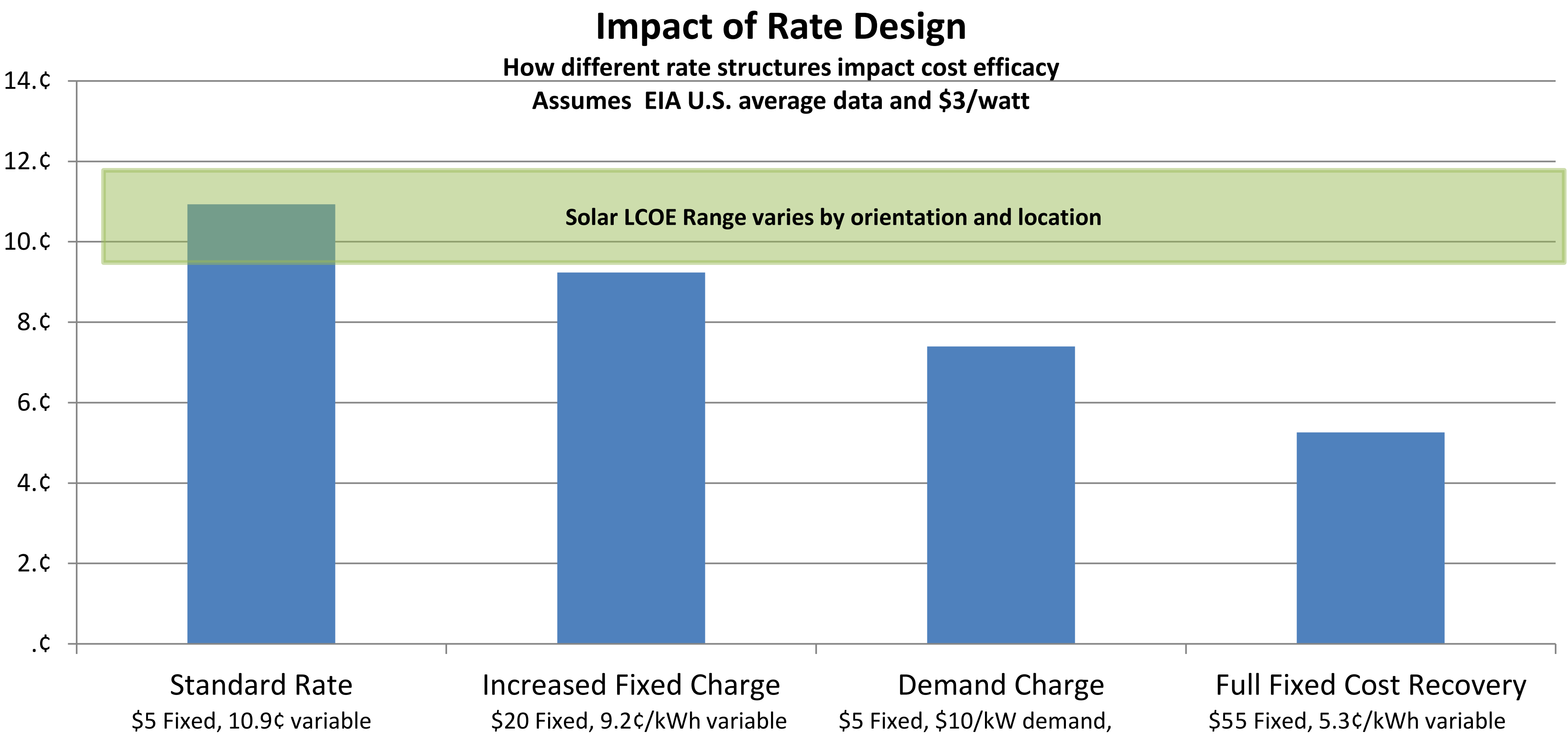
DGPV Competiveness Today



At today's costs, modifying retail rate design can impact solar deployment economics

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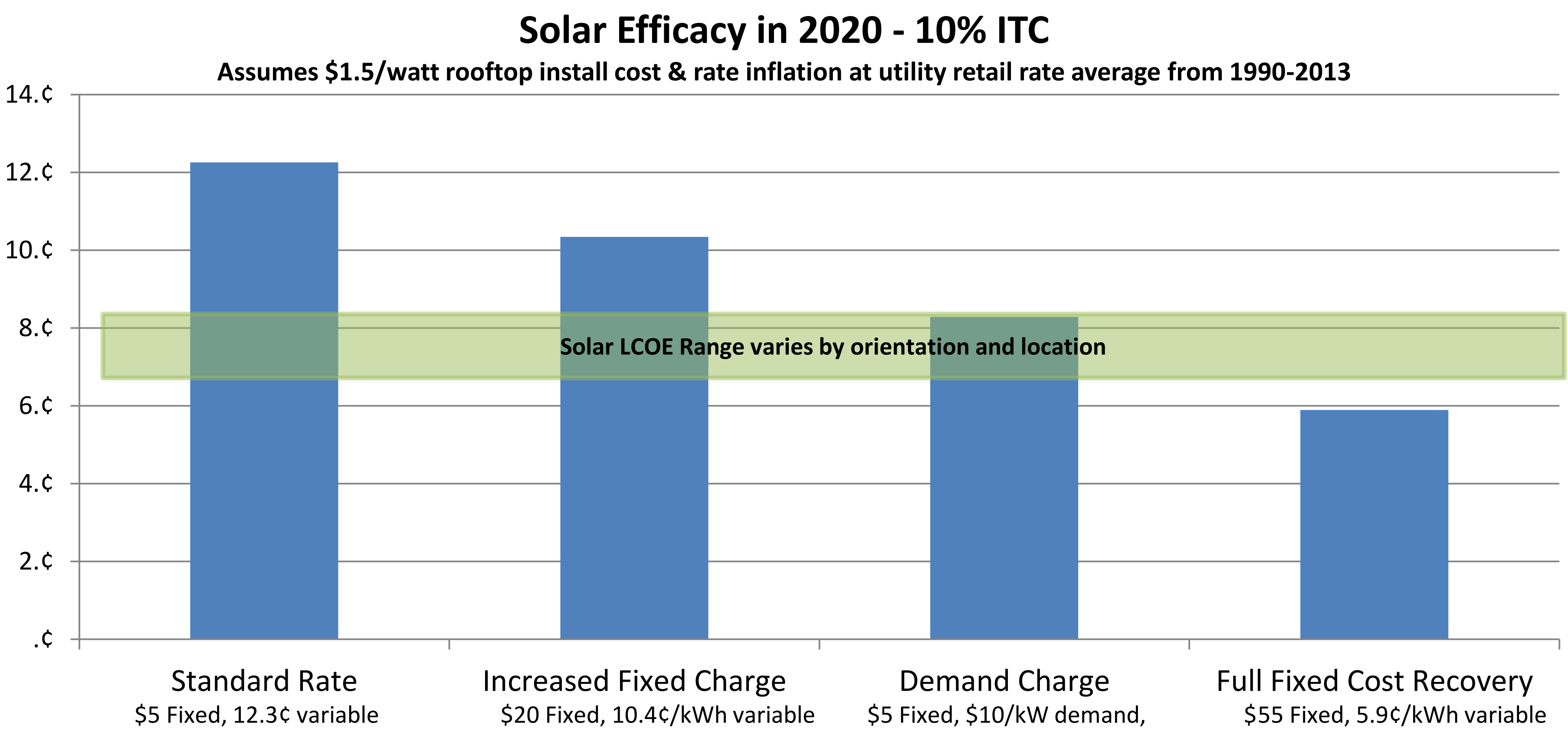
DGPV Competiveness in 2020



Once solar costs level out, with typical utility rate inflation rooftop solar will be economic under virtually all rate designs – even with the ITC stepping down

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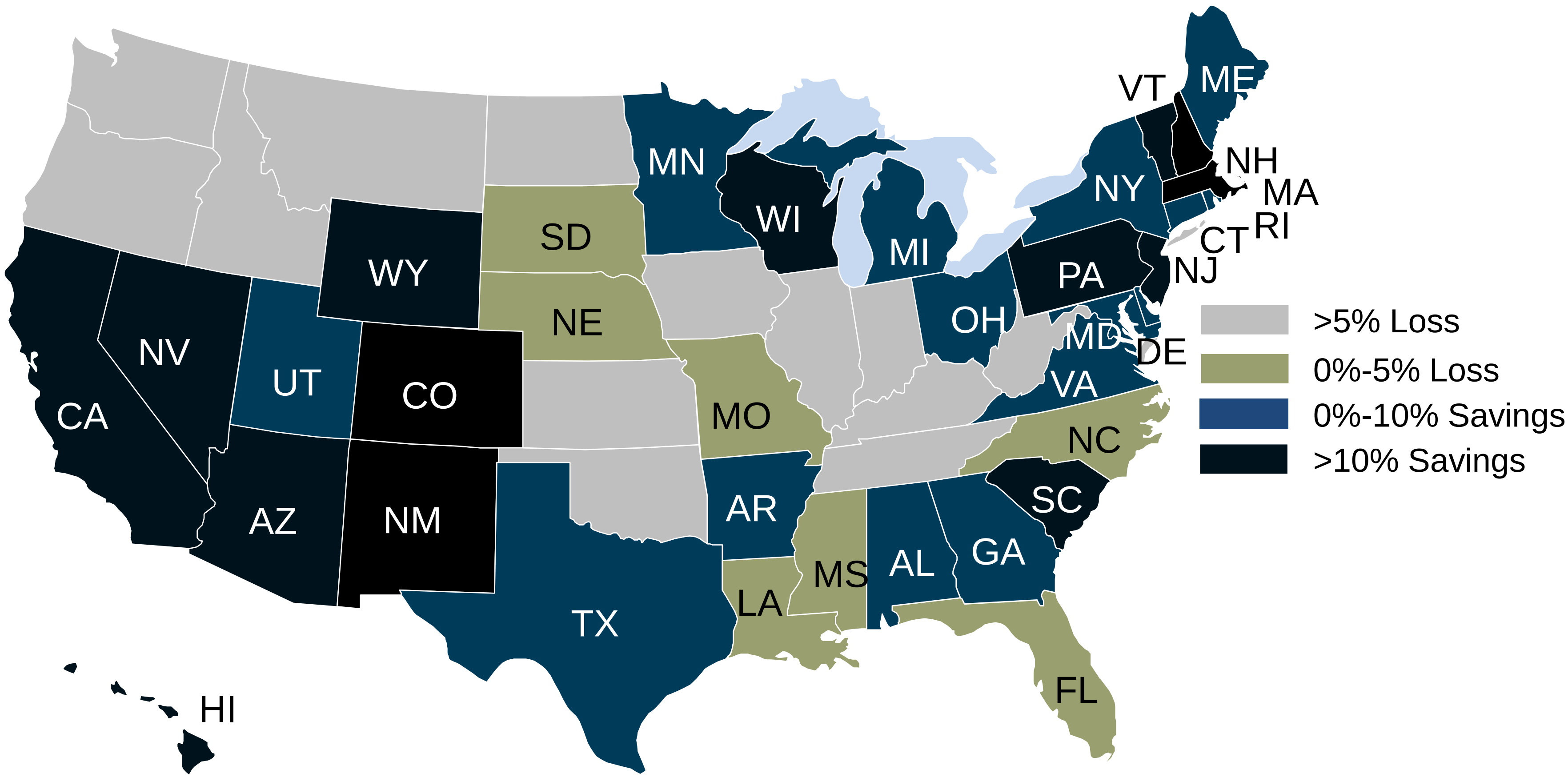
PV Competitiveness Will Soon be Widespread

How the LCOE of Energy from Residential Rooftop PV will Compare to Retail Rates in 2020



Source: GTM Research

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Comparison of Utility-Scale vs Distributed

	Utility-Scale	Distributed Generation
Interconnection Point	Utility System	Behind the Meter
Intermittency	High - Single Site	Mitigated - Many sites
Transaction	Rate Base / Purchased Power	Net Energy Metering
Power Quality Management	Active - Utility Responsibility	Passive - Feeder Impact
Resource Need Decision	Utility	Customer
Penetration Concerns	NA	Yes
Resource Planning Treatment	Capacity Addition	Net Load Impact
Financial	Rate of Return / Pass Through	Revenue Erosion

Source - DOE - Results from the DOE-CPUC High Penetration Solar Forum

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Utilities Responses to New Expectations & Economics

WELL ESTABLISHED

Utility Scale Generation

- PPAs in the $40s - $60s /MWh in CA, TX, NM, CO, NV, AZ

Consumer Education

- General Information
- Program information
- Solar Rooftop Calculators

Standards

- Interconnection
- Inverter

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Utilities Responses to New Expectations & Economics

INNOVATIVE APPROACHES

More information at www.sepatop10.org

Rate Reform

- Fixed Charges
- Value of Solar Tariffs

Grid Integration

- Locational Deployment
- Advanced Inverters
- Solar Production Forecasting
- Storage Integration

Rooftop Ownership

- Underserved Markets
- Integration tie-ins

Community Solar

- Utility Administered & Third Party

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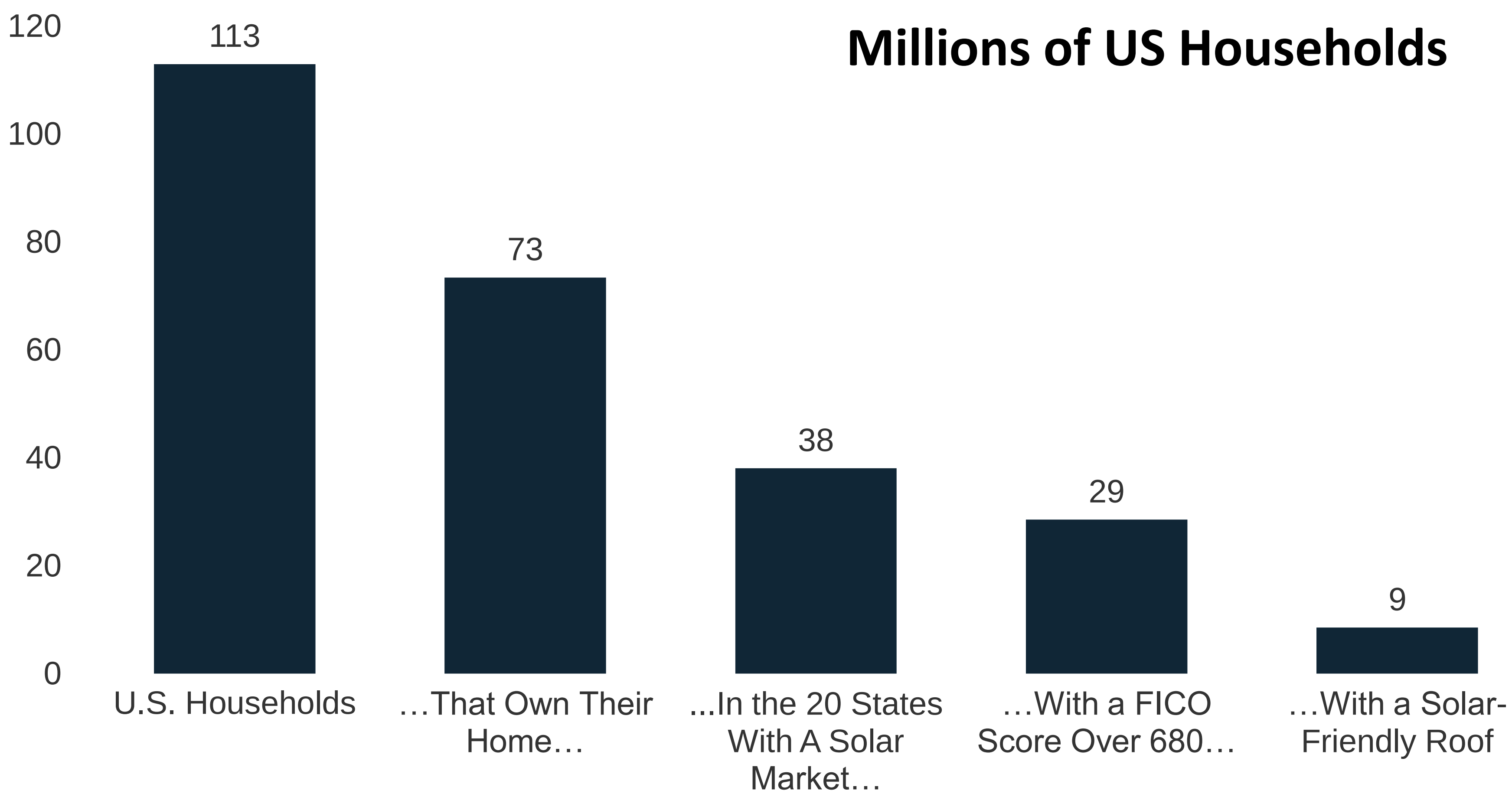
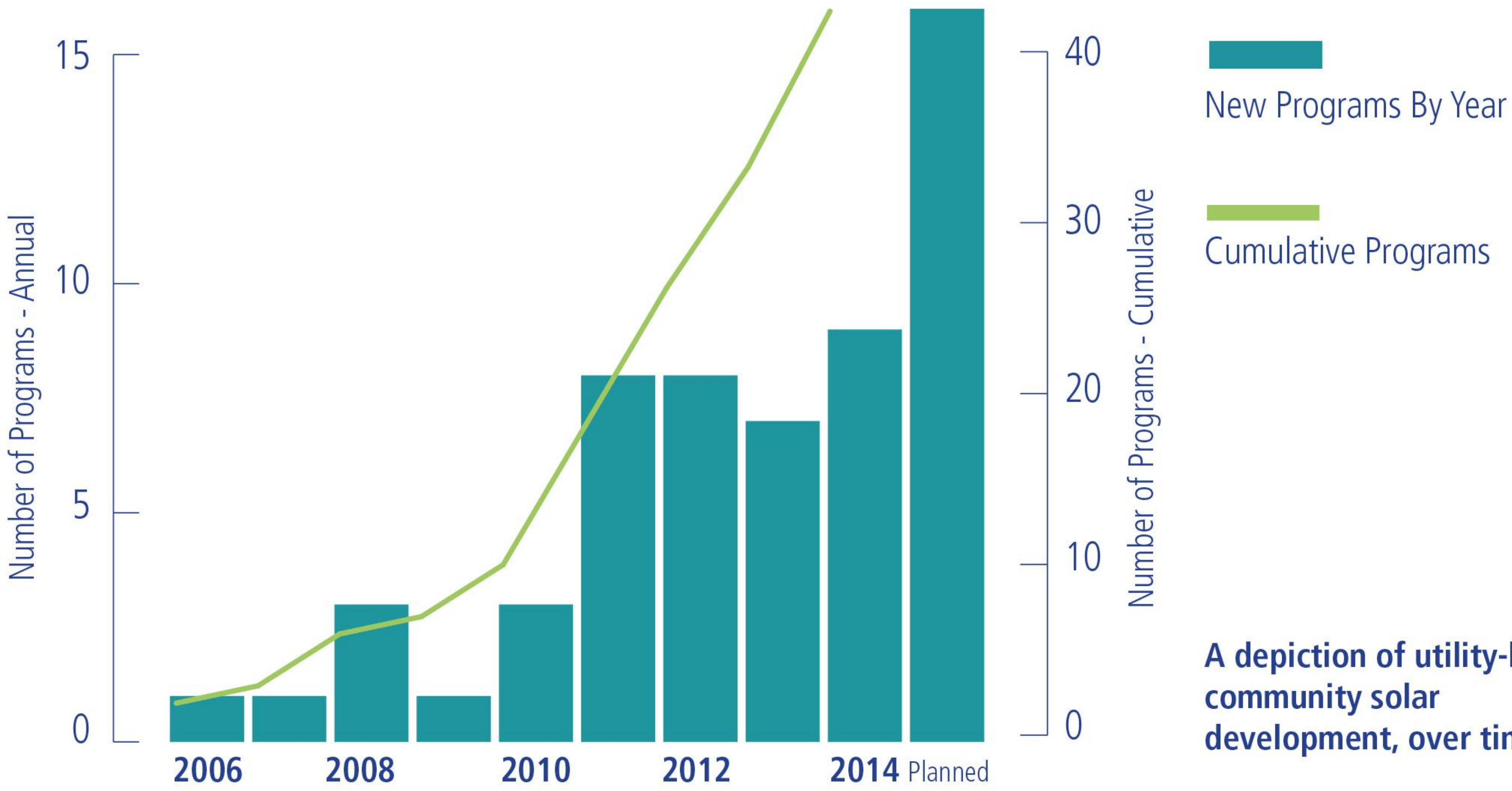
DGPV's Limits Are Opportunity for Community Solar



Source: GTM Research

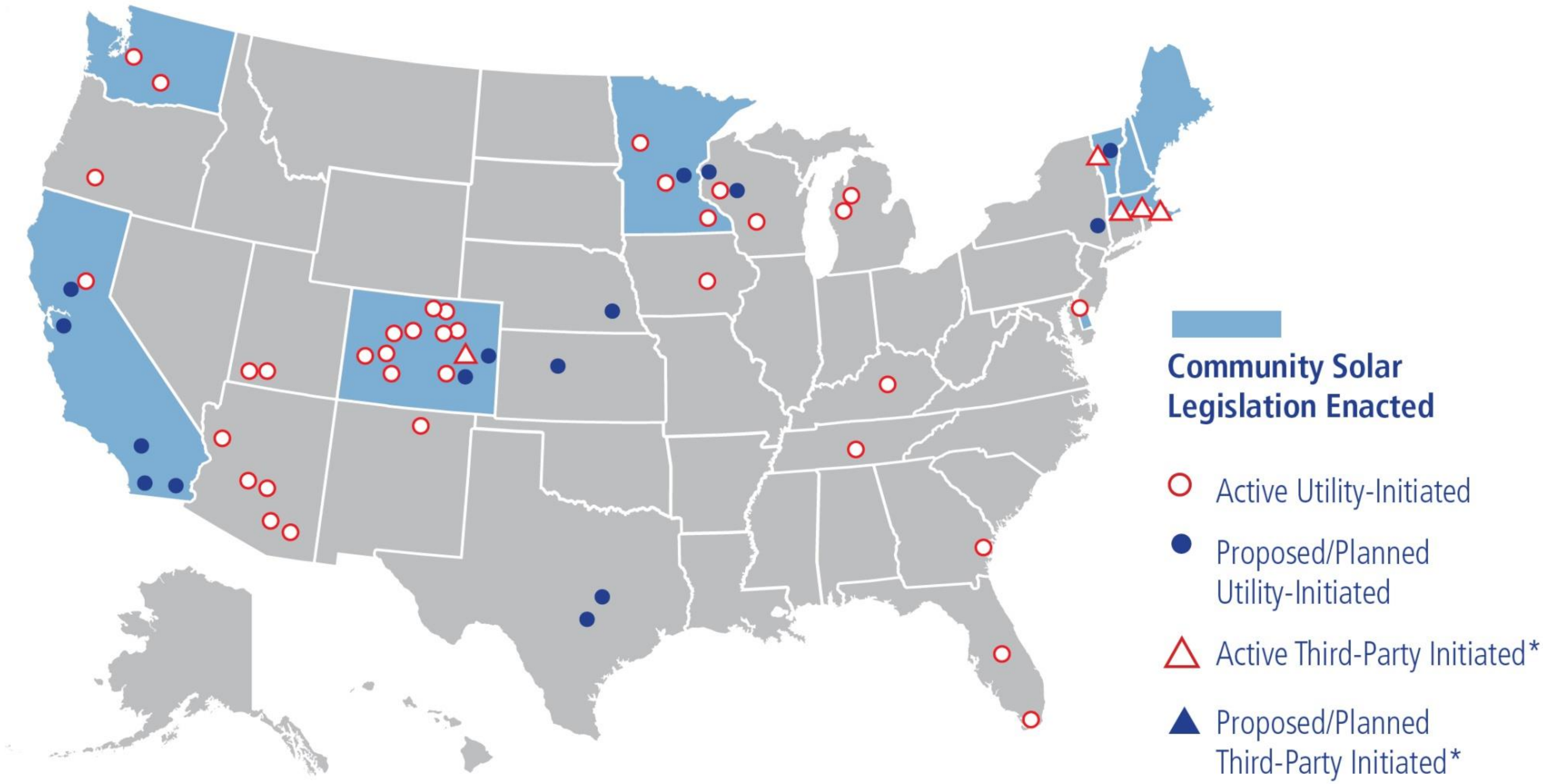
Community Solar Growth



A depiction of utility-led community solar development, over time.

"Expanding Solar Access Through Utility-led Community Solar", SEPA (September 2014)

Where are the Programs?



* Third-party initiated programs indicate that the utility is an active partner, but the program was not proposed or initiated by the utility.

"Expanding Solar Access Through Utility-led Community Solar", SEPA (September 2014)

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What is <u>Utility</u> Community Solar?

What is it…

- Voluntary, rooftop alternative for customers
- Utility controls supply, program design, and benefits decisions
- Supply is most often larger, ground-mounted PV system
- Customer receives immediate or anticipated economic benefit
- Benefits can include kWh offset, immediate or anticipated rate savings, return on investment

What it isn't…

- Bulk purchasing program for customer rooftops
- Green pricing program
- Charity program
- Utility as administrative agent with no supply or benefit decision-making authority
- Other?

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Utility Elevator Pitch

1. Increase customer access to and participation in solar
2. Proactive customer engagement with the utility
3. More cost effective than smaller, distributed projects
4. Increase customer equity from solar projects
5. Support the local PV industry
6. Can be strategically sited
7. Minimal points of interconnection (vs rooftop)
8. Low-risk customer program

Paradox Community Solar Array in Naturita, Colorado (Courtesy of Clean Energy Collective)

Benefits for Customers

Lower prices plus hedge benefits of fuel-free renewable energy

No (or limited) up-front costs and no responsibility for operations and maintenance.

Community Solar is portable within the utility's service territory.

COMMUNITY SOLAR DESIGN CONSIDERATIONS

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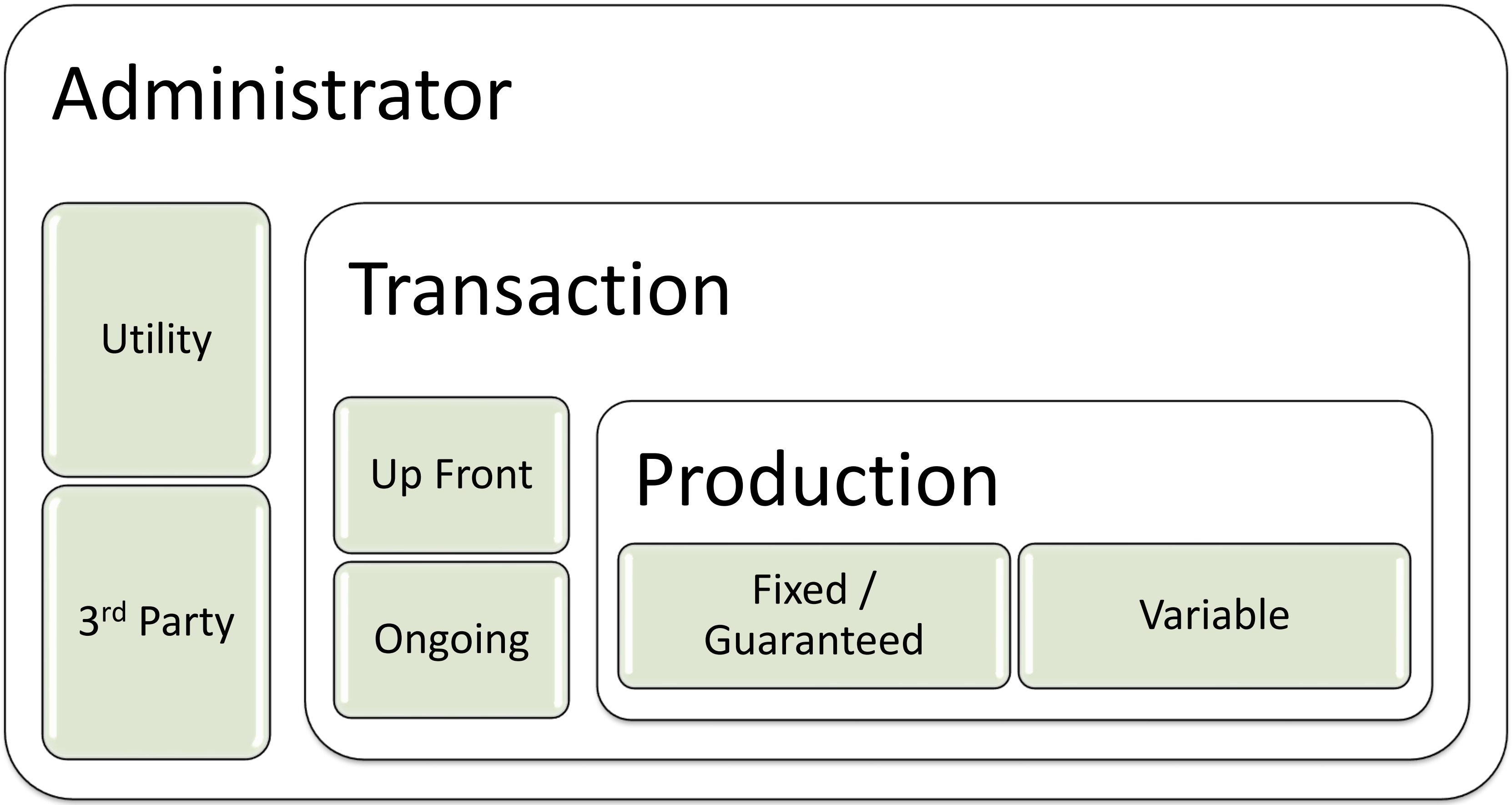
Program Hierarchy

Top tier design considerations consist of three major decisions



Key Questions and Programmatic Attributes

Who runs the program?	• Program Administrator • System Owner/Purchaser
What is the value proposition?	• Offer/Transaction • Production Guarantee • Economic Proposition • Target Customer Classes
What size system is appropriate?	• Siting & Scale • Participation Limit: Residential • Participation Limit: Non-Residential
What are the terms & conditions?	• One-Time Sign-Up Fee • Fee Treatment • Minimum Term • Unsubscribed Energy • Subscription Transferability • Program Length • REC Treatment

Price Setting

What should you charge participants?

Administration + Marketing + Supply + Operation + Maintenance + Integration

= Total Cost ($) over 20 years

kW

kWh

$$\frac{\text{Total Cost}}{\text{\# kW}} = \$ / \text{kW}$$

$$\frac{\text{Total Cost}}{\text{20 Years kWh}} = ¢ / \text{kWh}$$

Final price could include additional incentives, similar to rooftop program.

Value Proposition

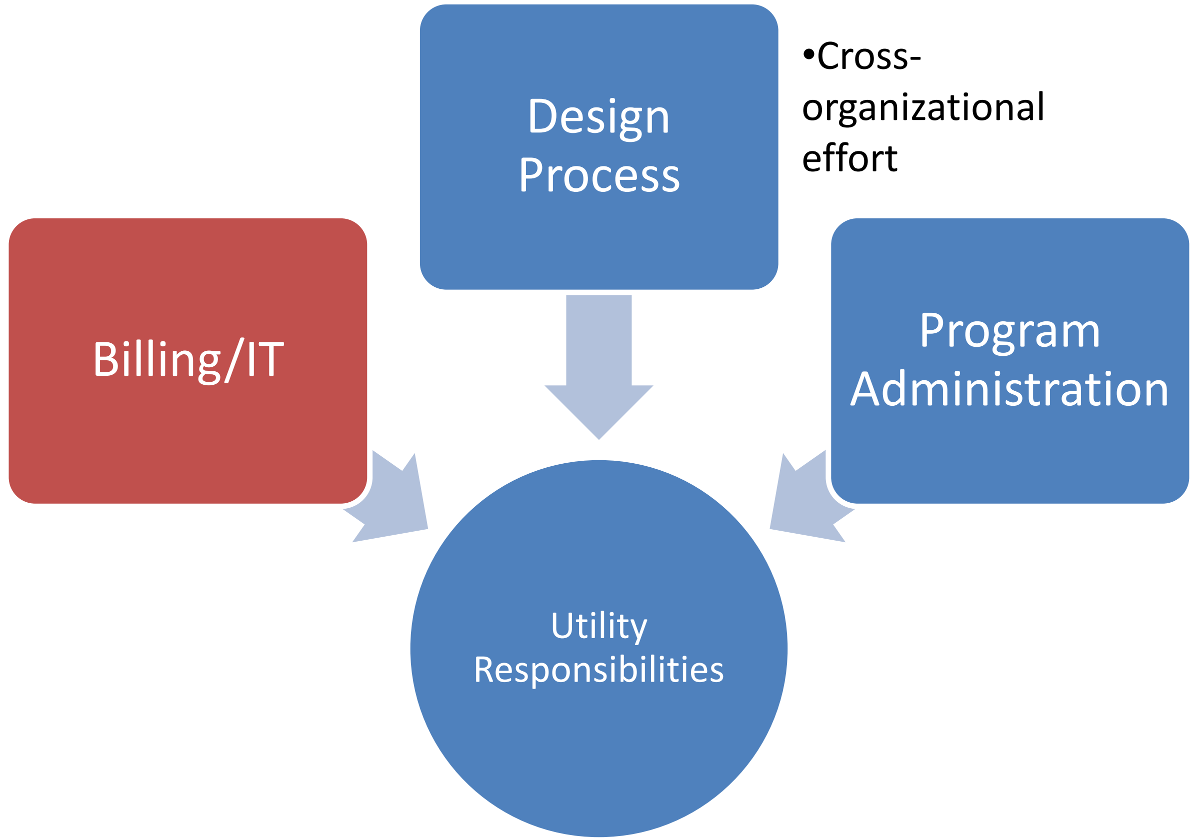
Compare your program offer to **other customer options**:

- Installed costs: $ / kW costs should be competitive today *and* in the near future
- Rates: ¢ / kWh rate should be competitive with retail rates or third-party provider PPAs now *or* in the near future

- Value can be a combination of price, risk management, financing, trust, and under-served parts of the market.
- Participation rates will be commensurate with customer value.

Major Staffing Needs

- Integrate the program into existing systems
- Minimize manual billing



- Cross-organizational effort

- Managed by utility or third-party
- Plan for recordkeeping

Marketing & Communications

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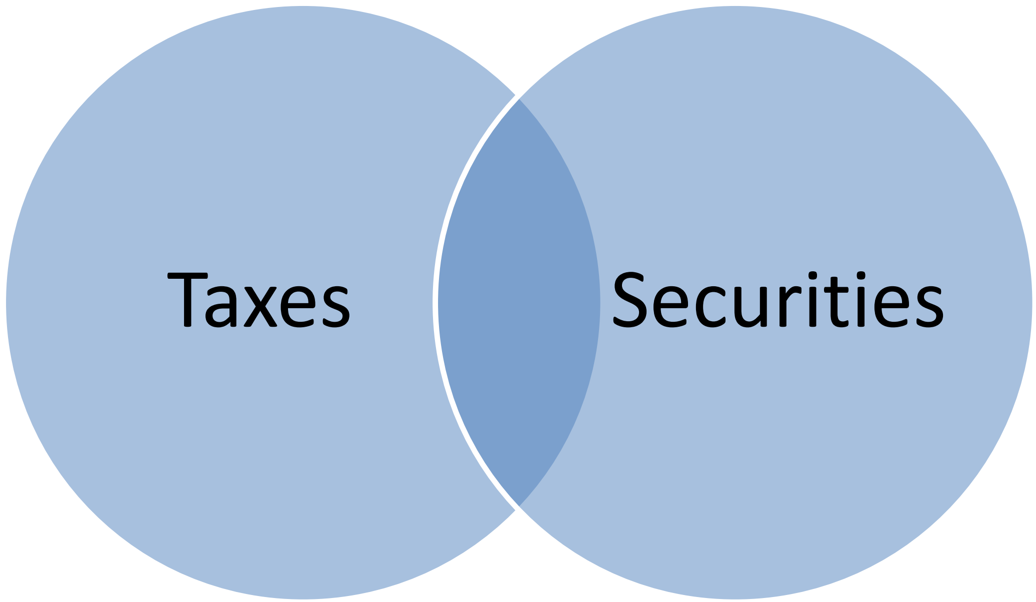
Tax and Securities Issues

- Maximize tax benefits to minimize cost



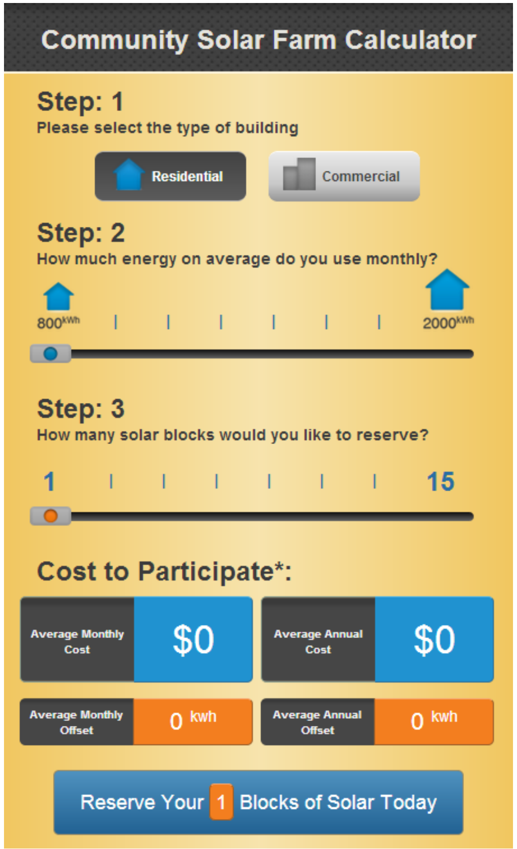
- Is it an investment of money?
- Is there an expectation of profit?
- Are the customers investing in a common enterprise?
- Is the return solely based on the efforts of others?

- Consult legal counsel
- Issues and requirements will vary for each utility

Program Example: Orlando Utilities Commission

Offer

- 1 kW blocks, up to 15 kW at $0.13/kWh fixed based on actual plant generation; net metered
  - $.025/kWh (residential) or $.015/kWh (commercial) more than current rates
- Term: 25 years
- No performance guarantee
- Customers pay a $50 deposit (refundable after 2 years)



Response

- Phase I: 400 KW
- Fully subscribed in 6 days; active waiting list for Phase 2

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SEPA Resources

Public

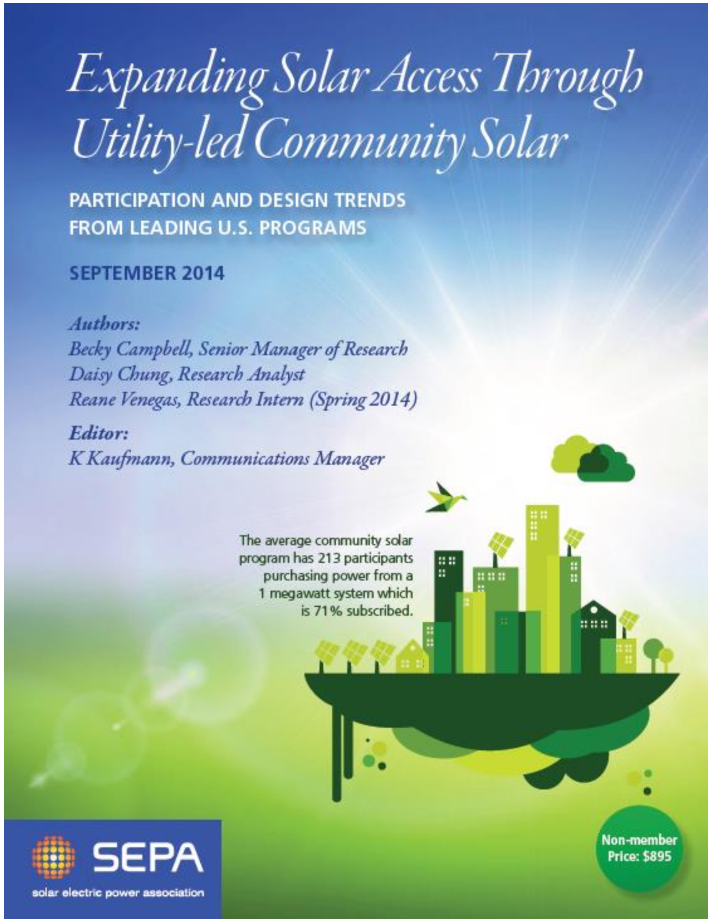
- *SEPA Community Solar Program Catalog*
- Annual Solar Market Snapshot

Members

- *Expanding Solar Access Through Utility-led Community Solar*
- *Utility Community Solar Handbook*
- Utility Solar Database

Fee-for-Service

- Technical Assistance and Advising



http://www.solarelectricpower.org/discover-resources/publications-and-media.aspx

SEPA'S SOLAR MARKET PATHWAYS PROJECT

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Who is Involved?

Funded By

- US Department of Energy

Executed By

- SEPA
- The Shelton Group

Working Group Participants

- CPS Energy
- Duke Energy
- Hawaiian Electric
- Pacific Gas & Electric
- Portland General
- SMUD
- Salt River Project
- Orlando Utilities
- Pedernales Electric
- Clean Energy Collective
- Sunshare
- First Solar
- Vote Solar
- IREC
- Regulatory Ass't Project
- Rocky Mountain Institute
- Clean Power Finance
- Community Power Network
- MA DOER

What are we trying to accomplish?

- Create several standardized community solar models (consumer tested)
- Develop tools/techniques for effective marketing to a variety of consumer groups
- Spur nationwide adoption of our models
- Ultimately, generate streamlined and lower cost adoption of community solar

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Utilities Responses to New Expectations & Economics

LOOKING AHEAD

Distribution Market Reform

- New York's *Reforming the Energy Vision* (REV)
- Minnesota's *e21*
- California
- Hawaii

Integrated Offerings

- NRG and Green Mountain Power
- Fort Collins Utilities
- Arizona Public Service Residential Rooftop Program
- **Tucson Electric Power Residential Solar Program**
- **Steele-Waseca Cooperative Electric's Sunna Project**
- **Grand Valley Power and Grid Alternatives**

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Emerging Ecosystem of Solar Plus

Solar + Storage

- SunEdison / Solar Grid storage
- SolarCity / Tesla Motors
- enphase Energy / ELIIY Power
- SunPower / Sunverge Renewable Made Reliable
- Kyocera / stem
- sunrun / OutBack Power Systems

Solar + EV

- SolarCity / Tesla Motors
- SunEdison / chargepoint
- nrg eVgo / green charge networks powered by the Prosser Group
- Panasonic / Power Tree

Solar + Energy Management/Load Control

- nest → Astrum Solar, enphase Energy, sunrun
- vivint.
- enphase Energy / Nexia Home Intelligence
- SunPower → Tendril, EnerNOC

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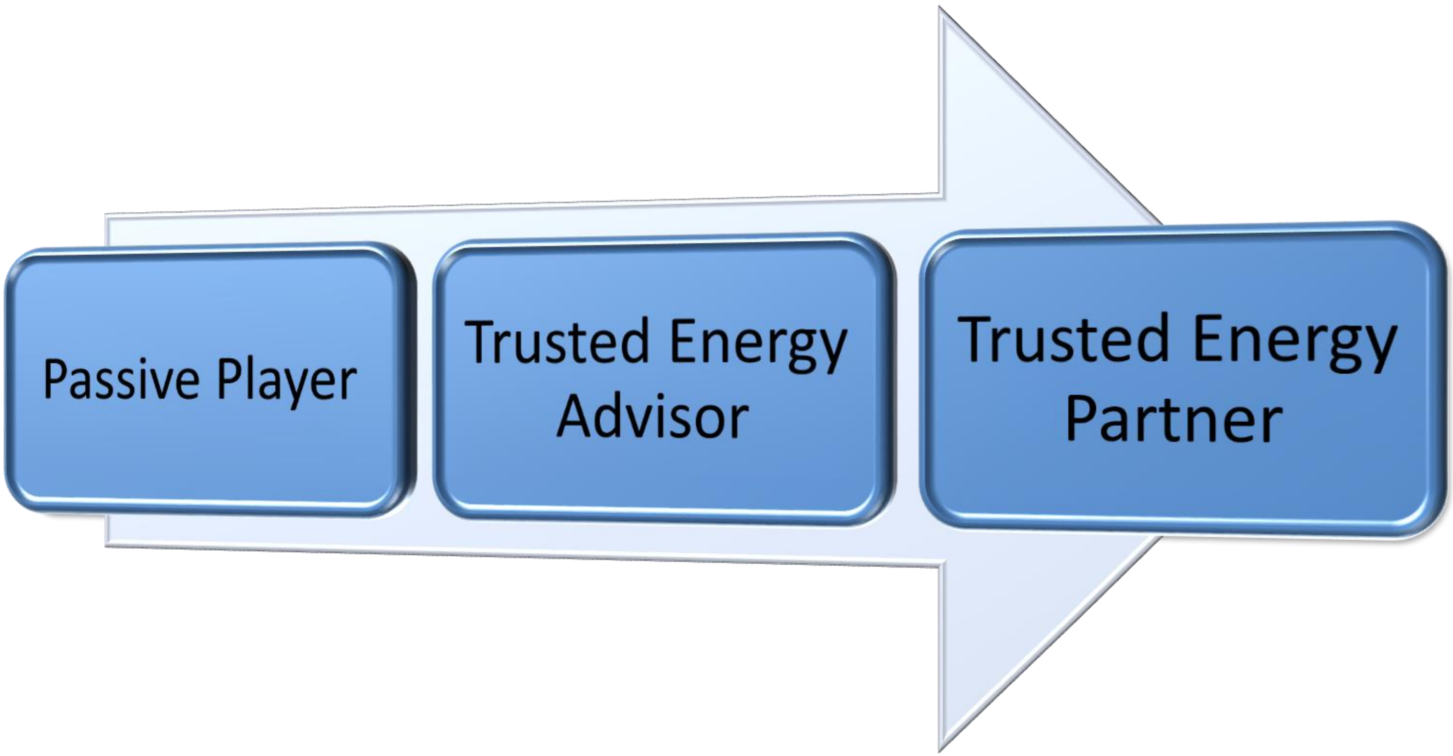
A Proactive Utility Strategy

Transitioning from a passive player …



…to a proactive partner for customers adopting solar and other DER

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Thank You!

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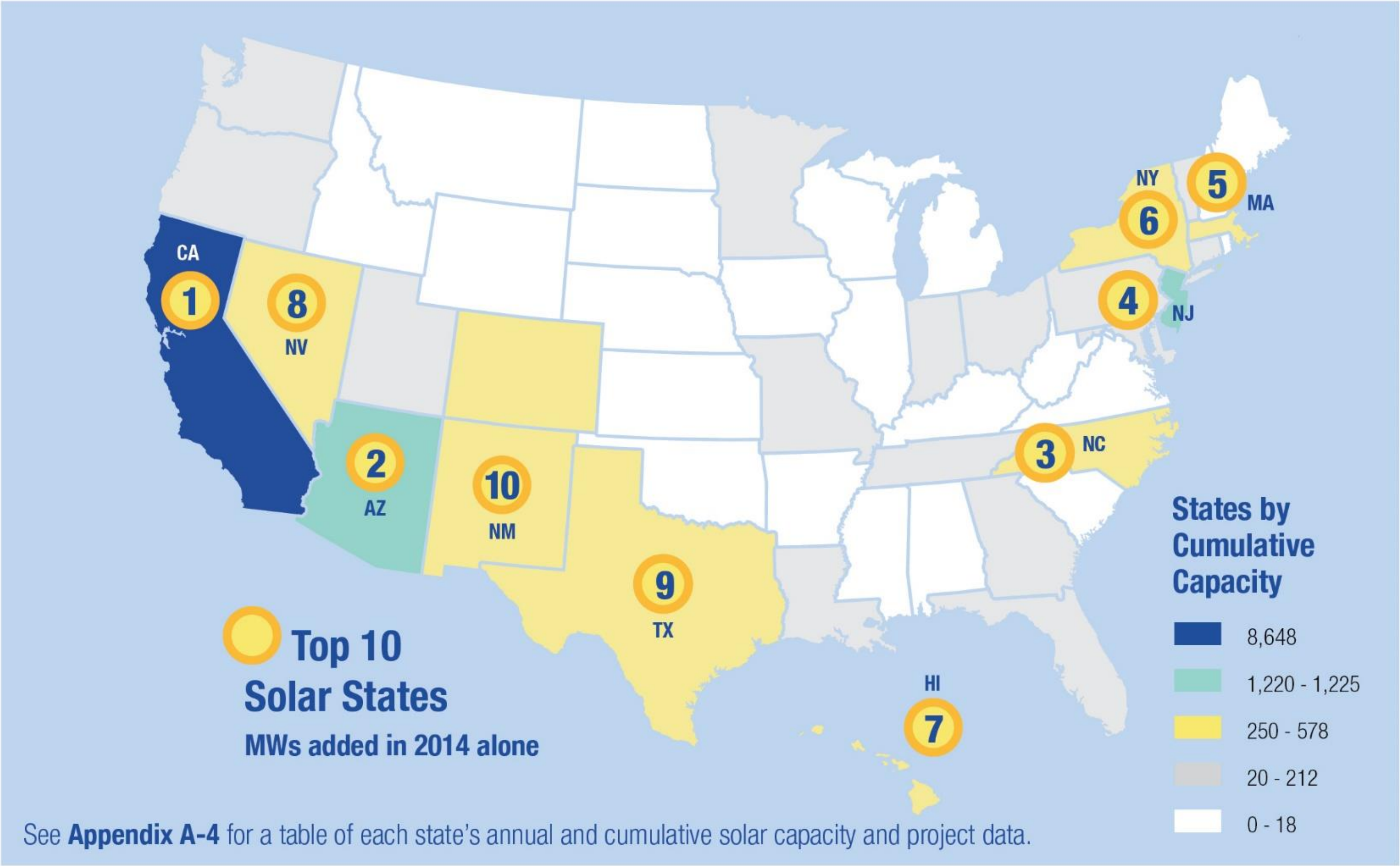
www.sepatop10.org
www.sepa51.org

2014 Top Solar States



2014 UTILITY SOLAR LEADERS

SEPAtop10.org

SEPA TOP 10 UTILITY SOLAR RANKINGS 2014 SEPA

	ANNUAL MW	ANNUAL W/CUSTOMER	ANNUAL INTERCONNECTIONS	ANNUAL % OF NET METERED PROJECTS PER CUSTOMER	
1	**Pacific Gas and Electric Company (CA)** 1,504 MW	**Pickwick Electric Cooperative (TN)** 1,679 W	**Pacific Gas and Electric Company (CA)** 45,265 projects	**Maui Electric Company Ltd (HI)** 3%	1
2	**Southern California Edison (CA)** 1,043 MW	**Farmers Electric Coop (IA)** 1,158 W	**Southern California Edison (CA)** 34,588 projects	**Hawaii Electric Light Company (HI)** 3%	2
3	**San Diego Gas & Electric Company (CA)** 430 W	**City of St. George Energy Services Dept (UT)** 751 W	**San Diego Gas & Electric Company (CA)** 15,750 projects	**Hawaiian Electric Company, Inc. (HI)** 2%	3
4	**Duke Energy Progress (NC, SC)** 161 W	**Kauai Island Utility Cooperative (HI)** 503 W	**Arizona Public Service (AZ)** 7,931 projects	**Kauai Island Utility Cooperative (HI)** 1.5%	4
5	**National Grid (MA)** 123 W	**San Diego Gas & Electric Company (CA)** 307 W	**Hawaiian Electric Company, Inc. (HI)** 6,841 projects	**Electrical District No. 3 (AZ)** 1.3%	5
6	**Arizona Public Service (AZ)** 91 MW	**Pacific Gas and Electric Company (CA)** 281 W	**Xcel CO - Public Service Co. of Colorado (CO)** 6,257 projects	**San Diego Gas & Electric Company (CA)** 1.1%	6
7	**Jersey Central Power & Light (NJ)** 86 MW	**Southern California Edison (CA)** 211 W	**National Grid (MA)** 5,270 projects	**Roseville Electric (CA)** 0.9%	7
8	**Tucson Electric Power Company (AZ)** 73 MW	**Hawaiian Electric Company, Inc. (HI)** 192 W	**Long Island Power Authority (NY)** 4,741 projects	**Pacific Gas and Electric Company (CA)** 0.8%	8
9	**NV Energy (NV)** 71 MW	**Maui Electric Company Ltd (HI)** 191 W	**Salt River Project (AZ)** 4,109 projects	**Trico Electric Cooperative, Inc. (AZ)** 0.7%	9
10	**El Paso Electric Co. (NM, TX)** 63 MW	**Tucson Electric Power Company (AZ)** 178 W	**Los Angeles Department of Water and Power (CA)** 3,280	**Southern California Edison (CA)** 0.7%	10

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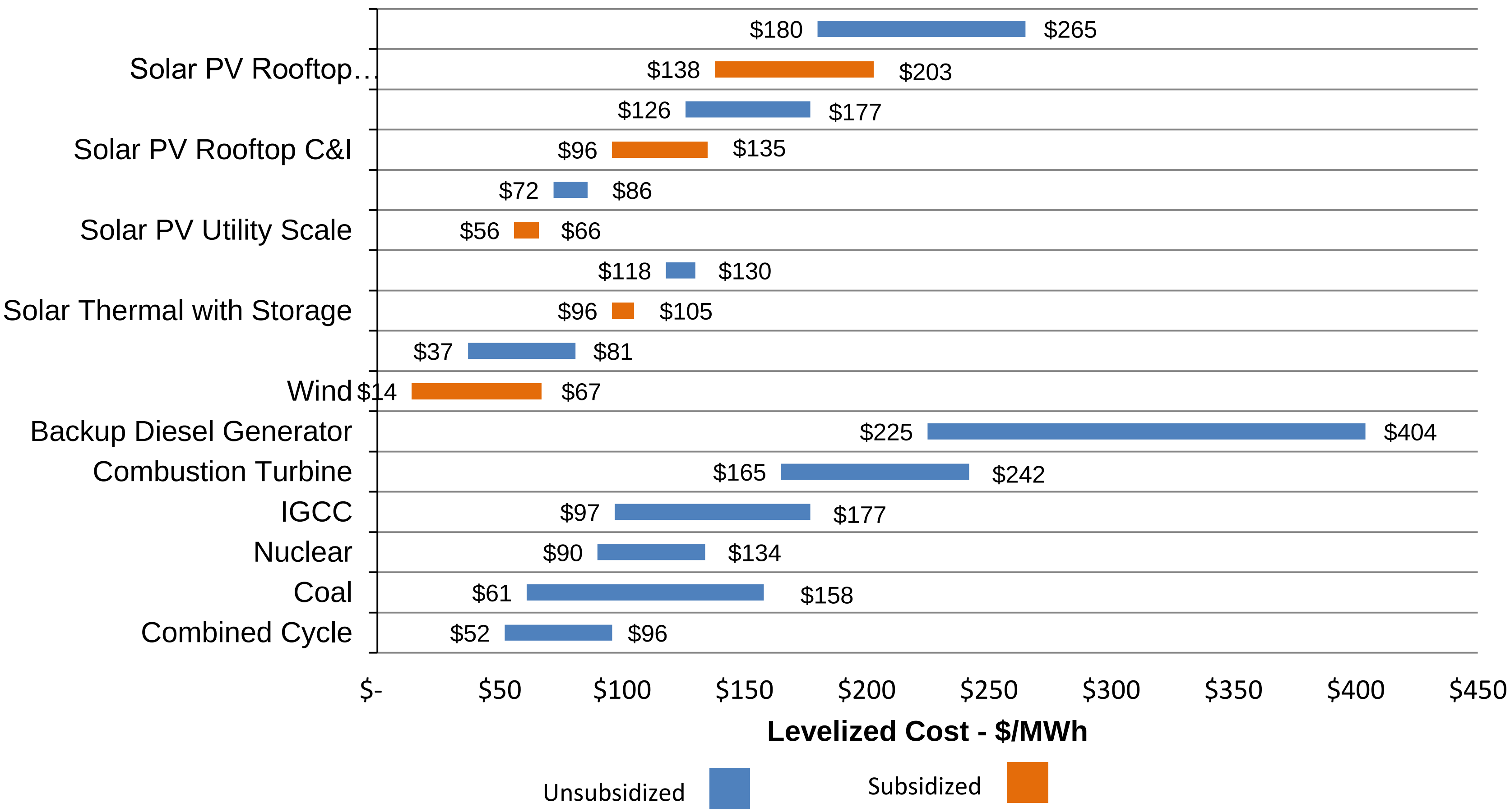
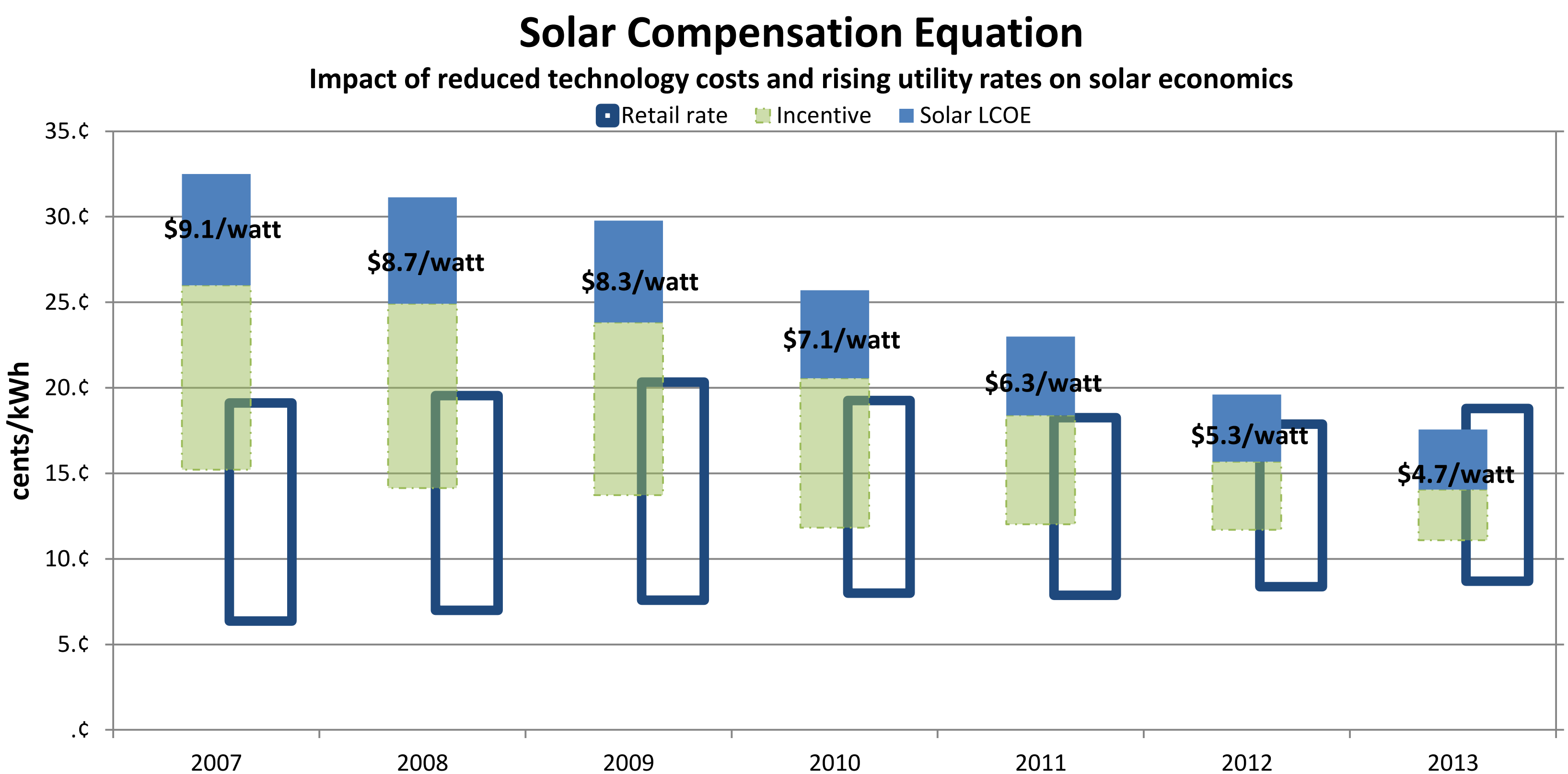
Renewable Technology LCOE



"Lazard's Levelized Cost of Energy Analysis – Version 8.0" (September 2014)

DGPV Has Become Increasingly Competitive

Retail rates alone are causing more and more transactions, even as incentives go away due to falling solar costs



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INNOVATIVE APPROACHES

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Rate Reform	• Fixed Charges • Value of Solar Tariffs
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Rate Reform Strategies

	CAMP 1	CAMP 2				
	Continue NEM	Reforming the Solar Customer Transaction (NEM reform)				
RATE CONSTRUCT	Single Transaction (Rate) Approach				Two or More Transactions (Rates)	
	Apply NEM	Reform Existing Rates (all customers or solar only)			Solar Rate	Reform All Rates
MODEL	Current Rates	Increased Fixed Charge and/or Minimum Bill	Demand Charge	Stand-by or Solar Charge	Independent Energy Sale and Solar Purchase Rates	Value of Services
ATTRIBUTES	• Currently applicable rates result in an acceptable transaction • Solar penetration does not warrant action	• Add or increase basic service charge ($/month) • Raise minimum bill requirements ($/month)	• Add or increase customer fee for demand ($/kW/month)	• Charge for stand-by capacity, based on DG system size ($/kW/month or ($/kW/yr)	• Retain existing rates for services provided from utility to cust. • Establish second rate to purchase from customer	• Design rates to reflect itemized services from utility to cust. and from cust. to utility

Commonly-Discussed "Value of Solar" Elements

Generation Value Streams	System Value Streams	Societal Value Streams
• Avoided energy • Generation capacity deferral • Fixed and variable O&M • Ancillary / grid support services impact	• Transmission system impact • Distribution system impact • System losses	• Environmental • Economic development • Disaster recovery • Security Enhancement impact

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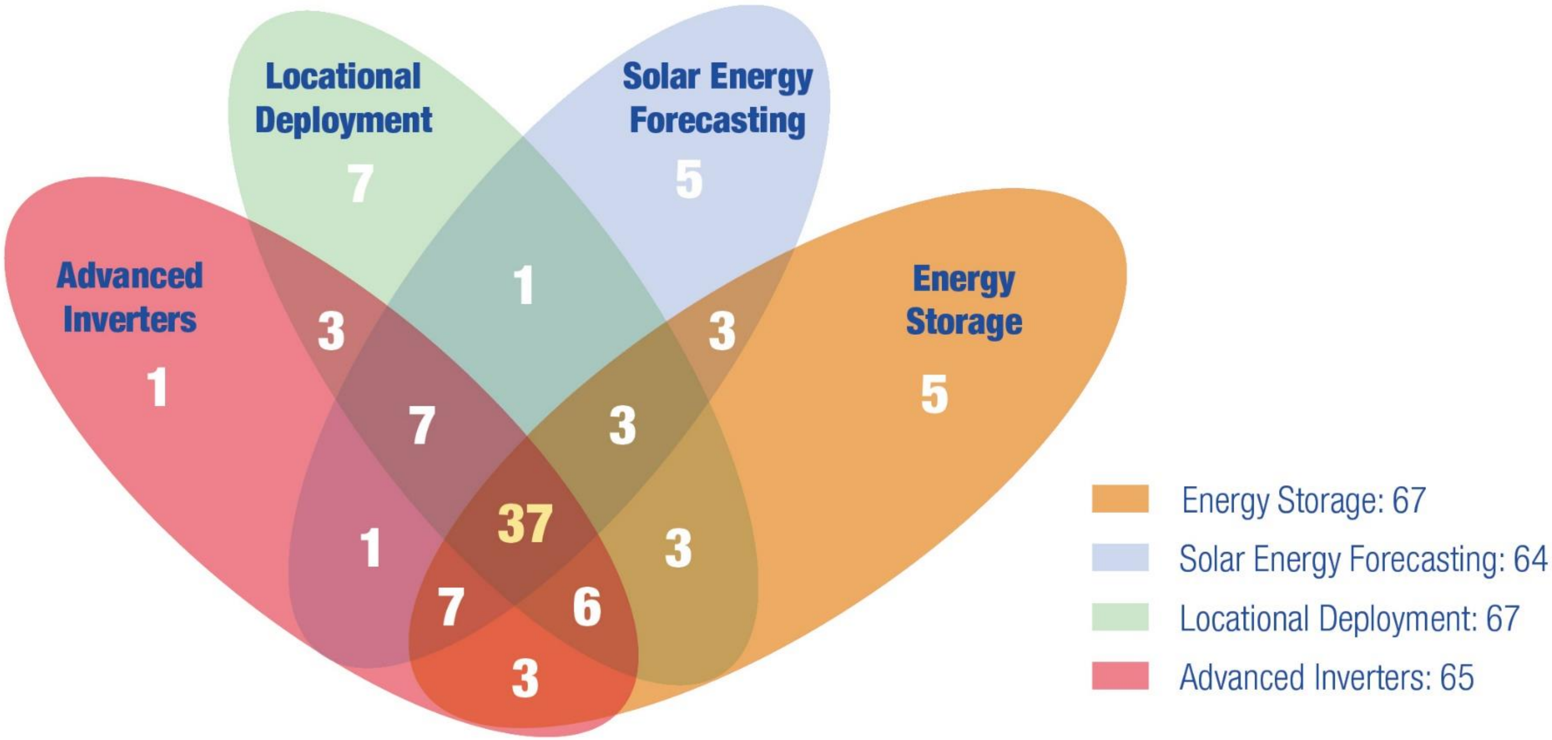
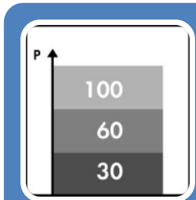
Grid Integration Strategies

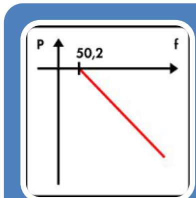


Smart Inverters



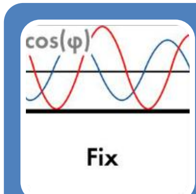
Remote Dispatch

- Ability to control PV generation to a specified % of nominal power



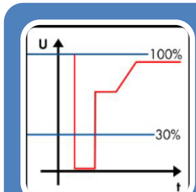
Over Frequency Response

- Ability to automatically reduce active power with frequency deviations



PF Control Mode

- Ability to supply/absorb reactive power during PV operation
- Ability to control Power Factor



Fault Ride-Through

- Ability to supply reactive current during fault ride-through period

- Smart inverter standards are in development
  - California Rule 21
  - IEEE 1547
- Advanced functionality is similar to distribution system assets deployed today
  - Load tap changers, voltage regulators, shunt capacitors, etc.
- Business case can be made that utilities should own smart inverters and provide to customers going solar

German Association of Energy and Water Industries (BDEW) Guidelines

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Grid Storage Services

Types of applications under consideration today

Electric Supply

- Electric Energy Time-shift
- Electric Supply Capacity

Ancillary Services

- Load Following
- Area Regulation
- Electric Supply Reserve Capacity
- Voltage Support

Grid System

- Transmission Support
- Transmission Congestion Relief
- Transmission & Distribution Upgrade Deferral
- Substation On-site Power

End User/Utility Customer

- Time-of-Use Energy Cost Management
- Demand Charge Management
- Electric Service Reliability
- Electric Service Power Quality

Renewables Integration

- Renewables Energy Time-shift
- Renewables Capacity Firming
- Wind Generation Grid Integration

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Utilities Responses to New Expectations & Economics

INNOVATIVE APPROACHES

More information at www.sepatop10.org

Rate Reform	• Fixed Charges • Value of Solar Tariffs
Grid Integration	• Locational Deployment • Advanced Inverters • Solar Production Forecasting • Storage Integration
Rooftop Ownership	• Underserved Markets • Integration tie-ins
Community Solar	• Utility Administered & Third Party

Helping Utilities Make Smart Solar Decisions

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Utility Ownership Strategies

Arizona Public Service

- 20 MW cumulative program size for about 3,000 customers
- Customers get a $30 monthly bill credit for 20 years (lease payment for rooftop real estate)

Tucson Electric Power

- 3.5 MW or about 600 customers
- Customers get a fixed monthly rate for 25 years
- Competitive process using local contractors

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Attributes Defined

Program Attribute	Definition
System Administrator	Designs, markets, acquires customers, and responsible for tracking & managing the program
System Owner/Purchaser	Entity that physically owns the project (directly or thru PPA)
Offer / Transaction	How the customer pays to participate
Production Guarantee	Who wears production risk; does customer receive fixed or variable kWh each month
Economic Proposition	What the customer receives in return for participating
Target Customer Classes	Which customer classes are eligible to sign up for the program
Siting & Scale	Where the project is located, and how large the project can be
Participation Limit: Res.	Maximum subscription for any residential customer, as a % of average annual consumption
Participation Limit: Non-Res	Maximum subscription level aggregated across all non-residential customers
One-Time Sign-Up Fee	Subscription / administration / registration fee, paid once upon signing up for program
Fee Treatment	Whether or not the fee (if imposed) is refundable and if so, under what conditions
Minimum Term	Tied to one-time fee, the minimum amount of time a customer must stay on the program
Unsubscribed Energy	What occurs with the energy and associated costs for under-subscribed projects
Subscription Transferability	Defines how customers can move in and out of the program with their subscription
Program Length	The length of time the administrator guarantees the customer benefit
REC Treatment	How the RECs from the solar system are transferred, sold, or retired

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Program Attribute Matrix
Generic Options to Consider

Program Attribute	Typical Options in Program Design*		
System Administrator	Utility		3rd Party
System Owner/Purchaser	3rd Party Asset	Utility PPA with Developer	Utility Asset
Offer / Transaction	Up Front Payment (Panel Purchase / Lease)		Ongoing Payment (kWh or kW Block)
Production Guarantee	Fixed or Guaranteed Output		Variable Output
Economic Proposition	Partial Bill Credit (kWh)	Full Bill Credit (kWh)	Monetary Credit
Target Customer Classes	Residential	Non-Demand Rate Customers	All Customer Classes
Siting & Scale	Community: Small Scale	Locational: Small to Mid Scale	Remote: Utility Scale
Participation Limit: Res.	50% Avg. Consumption	100% Avg. Consumption	150% Avg. Consumption
Participation Limit: Non-Res	<= 20% of Project	<= 50% of Project	No Limit
One-Time Sign-Up Fee	None	<= $25	<= $100
Fee Treatment	N/A	Non-Refundable	Refundable After Min. Term
Minimum Term	None	2 Years	20 Years
Unsubscribed Energy	Socialized	Remarketed	Below the Line
Subscription Transferability	Portable & Transferrable	Available to Waiting List	Sold at Market Value
Program Length	5 Years	10-20 Years	PPA Length / System Life
REC Treatment	Retired	Transferred to Customer	Held or Sold to Market

*Not meant to be all-inclusive, but representative of approaches that generally cover what has been pursued nationally

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Most Common Structures

Up Front Payment Model

- Customer pays up front to purchase or lease a panel and receives a credit on their bill tied to system production
- Bill credit reflects an allocation of actual system output based on proportionate share of system
  - kWh credit
  - Monetary ($/kWh) credit
- Mimics a rooftop ownership model in that up front capital is required
  - Economics based on a payback period analysis
- SEPA statistics:
  - 84% of programs in operation
  - Avg. system size: 700 kW
  - Avg. # participants: 150

Ongoing Payment Model

- Customer subscribes to program in either kW or kWh blocks and receives a credit on their bill tied to system production
  - kWh blocks: guaranteed output each month at fixed payment per block
  - kW blocks: variable output each month at fixed price per kWh or fixed payment per block
- Customer pays a premium on day one for solar blocks, but that price is fixed for a long term (e.g., 20 years) providing a rate hedge
- Mimics a rooftop lease model
  - Economics based on break-even analysis
- SEPA statistics:
  - 16% of programs in operation
  - Avg. system size: > 6 MW
  - Avg. # participants: 1,200

Buy or build?

- RFP process
  - Evaluating responses
  - Involve stakeholders
- Other considerations
  - Choosing a location
  - Managing risk of underperformance
  - Preparing for over and/or under subscription
  - Delegating maintenance responsibilities