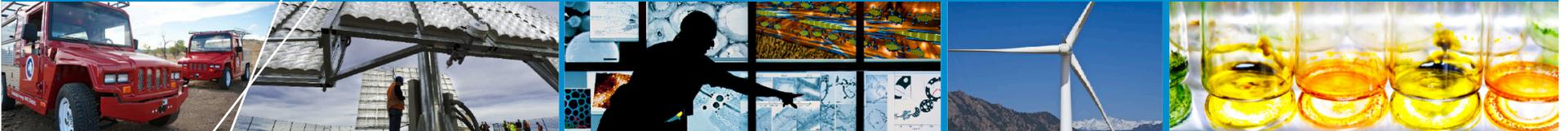


Residential Loans and Shared Solar



Travis Lowder, NREL

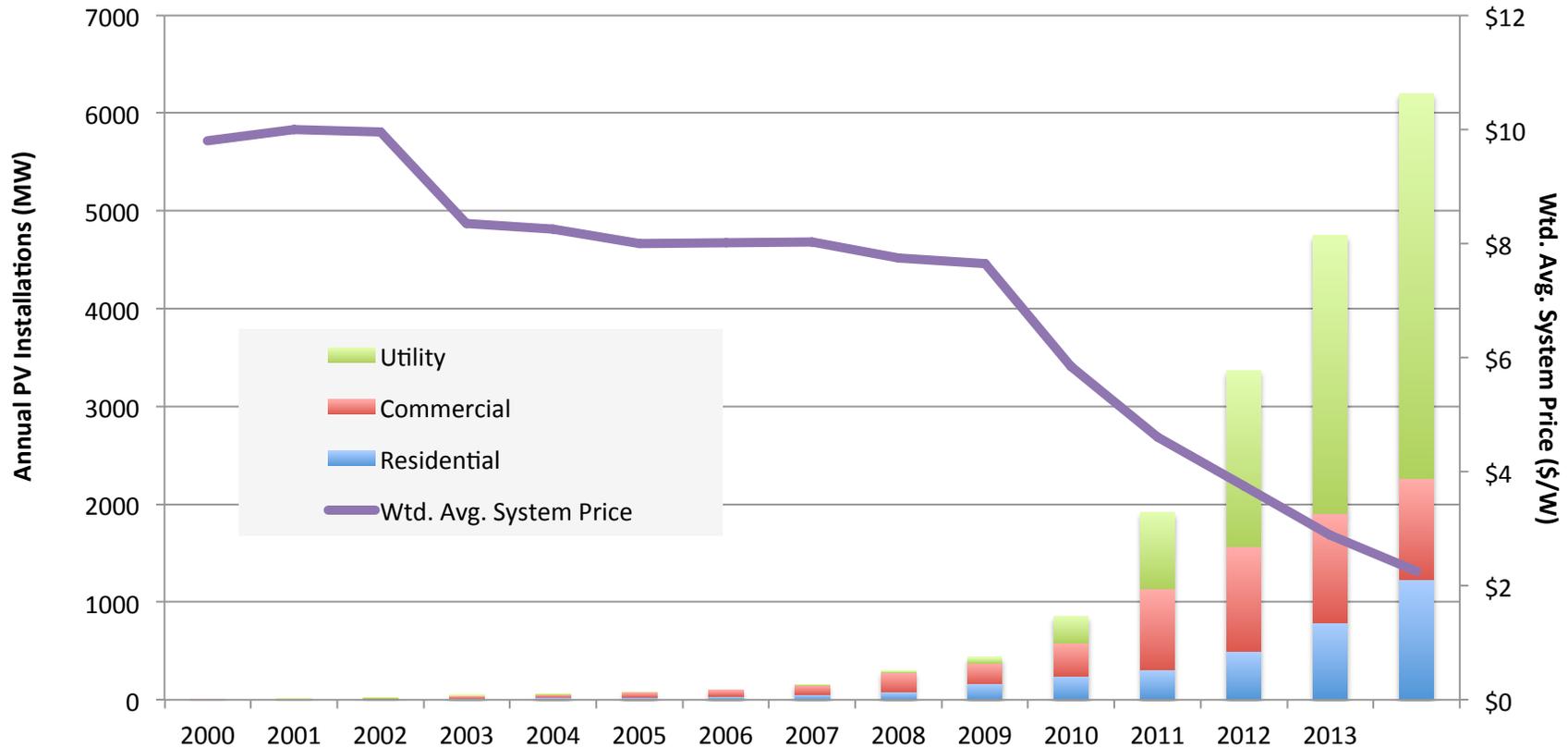
NCRES Speaker Series

Odell Brewing Co.

April 21, 2015

System Costs Continue to Decline

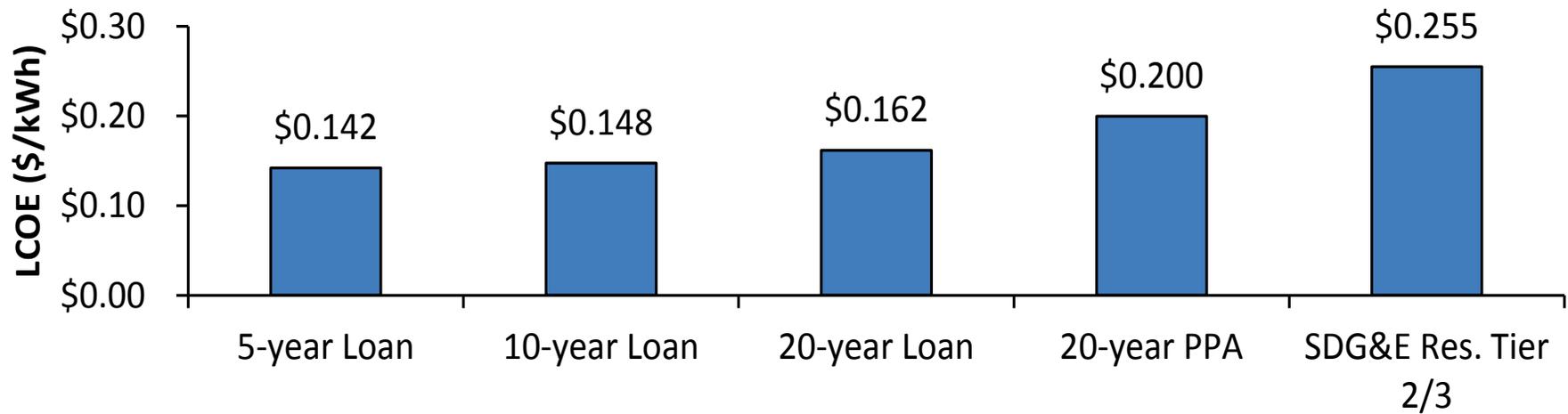
Source: GTM/SEIA 2015



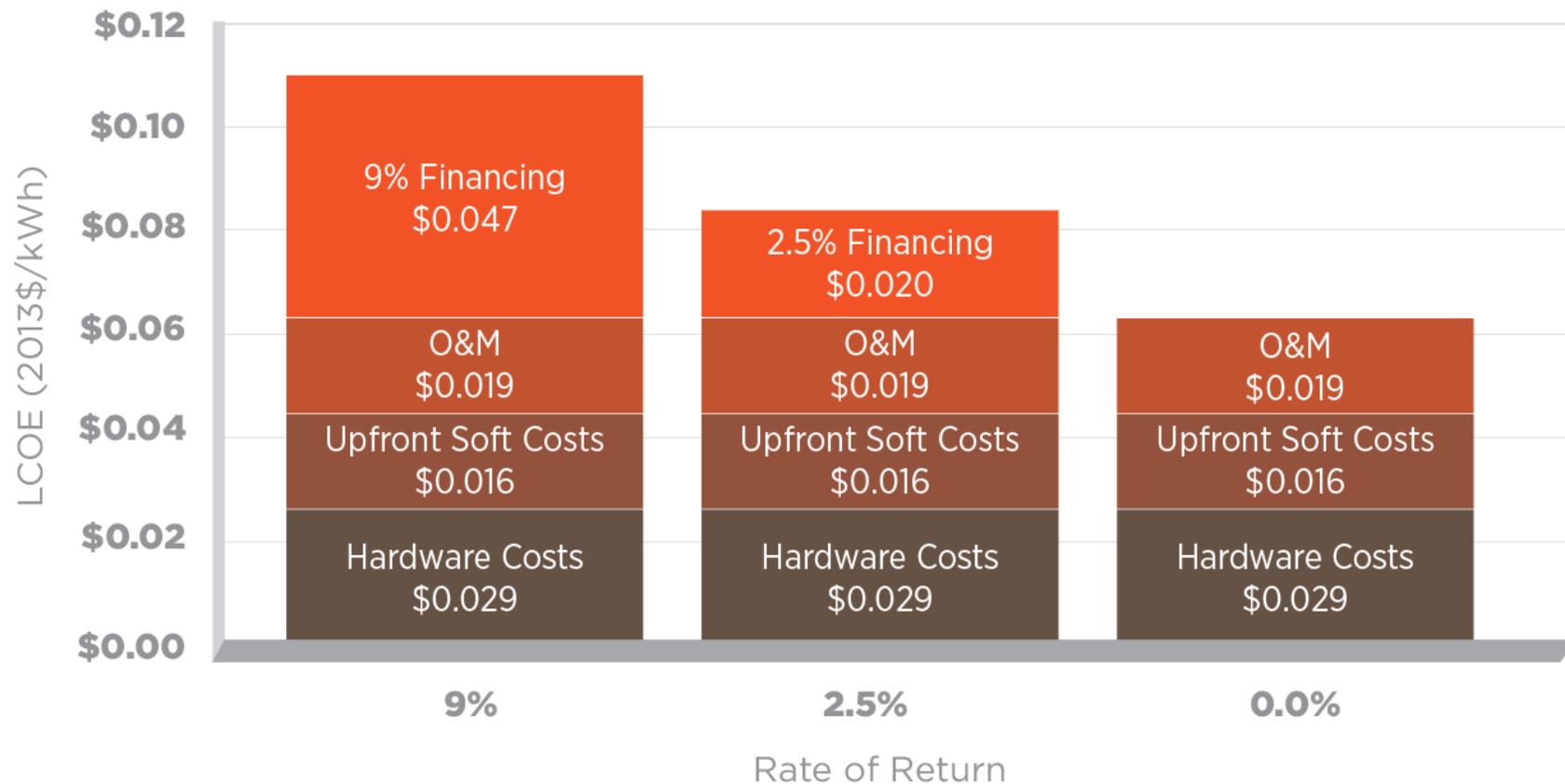
Since 2005, when the investment tax credit was passed by congress, the residential PV market has grown by approximately 53% per year, or about 45X

Still, only 0.5% of households own or lease a PV system (or about 1% of households living in single-family detached households)

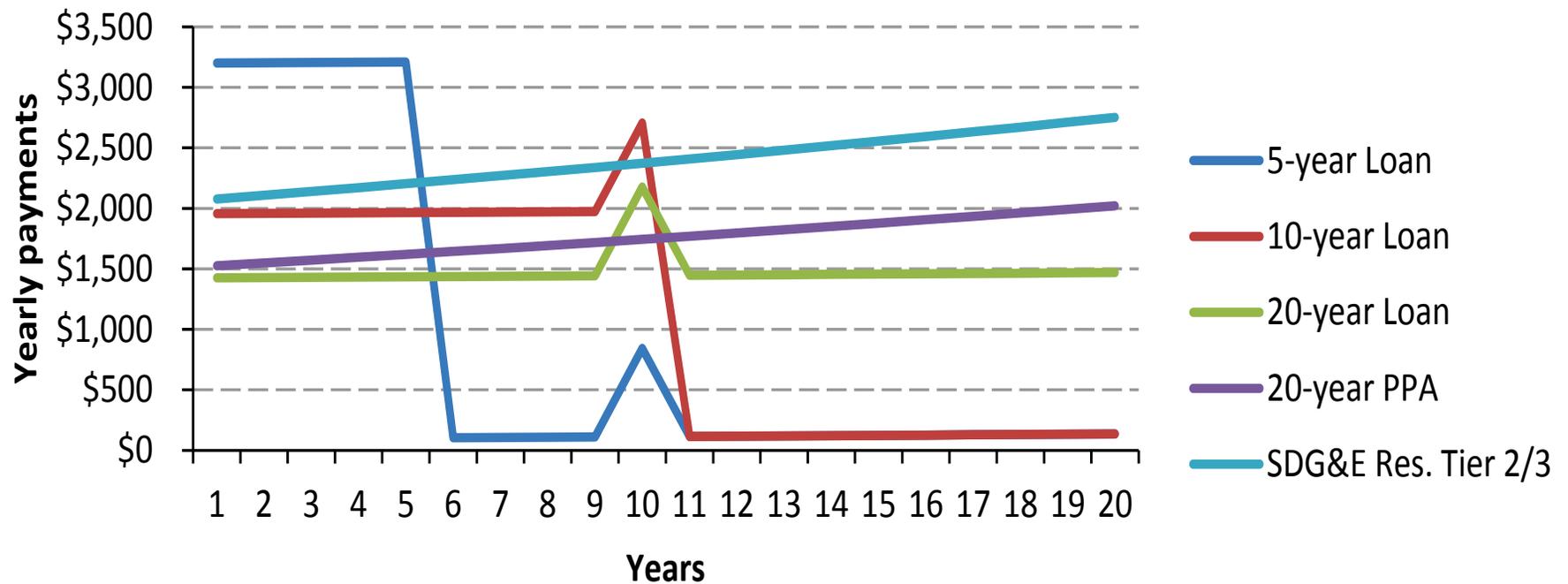
Loans vs. TPO: Cost of Energy



Impact of Financing on Cost of Energy (Utility-Scale)



Loans vs. TPO: Annual Payments



Loans vs. TPO

| | TPO | Loan |
|--|--|---|
| Upfront Cost | <ul style="list-style-type: none"> Typically no upfront costs—can use to eliminate escalator | <ul style="list-style-type: none"> No longer a requirement |
| Incentives | <ul style="list-style-type: none"> Goes to TPO provider | <ul style="list-style-type: none"> Stays with system owner |
| Tax Appetite | <ul style="list-style-type: none"> Typically contracted by TPO provider (tax equity) | <ul style="list-style-type: none"> Must have sufficient tax appetite to use tax credits |
| Maintenance | <ul style="list-style-type: none"> O&M remain the responsibility of the TPO Many companies offer technology to monitor system performance and will report issues to host | <ul style="list-style-type: none"> Host owns the system and can be responsible for O&M and additional costs (i.e. solar inverter) May require outside entity to track system performance |
| Term | <ul style="list-style-type: none"> Typically 20 years, with an annual escalator | <ul style="list-style-type: none"> Typically 10 – 20 years, usually without an escalator |
| Transfer / End of Contract Issues | <ul style="list-style-type: none"> Complications may arise when moving or transferring Transfer options may include <ul style="list-style-type: none"> Contract buy-out Transfer to another property Transfer to another homeowner/tenant Continued payments while technology innovates | <ul style="list-style-type: none"> Can increase the value of the home, bolster marketability May be able to roll system cost into purchase price |
| Savings/ROI | <ul style="list-style-type: none"> Utility savings will depend on contract price, escalation rates, production (in a PPA) and other factors | <ul style="list-style-type: none"> Utility savings determined by amount of electricity produced x retail rate less operating costs Potentially additional revenue through REC/SREC sales, PBI, etc. |
| Pros | <ul style="list-style-type: none"> Low upfront investment, less O&M or repair risks, possible utility savings Allows for depreciation deductions | <ul style="list-style-type: none"> Utility savings, carbon emission reductions, tax credits and other incentives, likely increase property value Potential lifetime savings greater than TPO |
| Cons | <ul style="list-style-type: none"> Leases/PPA may complicate transfer of property May reduce utility savings compared to purchase Potentially higher cost of energy | <ul style="list-style-type: none"> Larger cash outlay and responsibility for O&M costs Loss of depreciation (no residential depreciation) Potentially high P&I payments, esp. for shorter loan |

Other Considerations

- **Local price of power**
- **States where TPO is disallowed by state law/ regulations (or where it is ambiguous)**
- **Mortgage finance?**

Solar Loan Options Today

| | Loan Type | Description | Lender | Term (years) | Interest Rate | Examples | Availability | Security Interest |
|-------------|----------------|---|--|--------------|---------------|---|---|--|
| Residential | Solar-Specific | A loan made to a borrower exclusively for the purchase of a solar system | Bank, CU*, Finco** | 5 – 20 | 2.99% – 8% + | <ul style="list-style-type: none"> EnerBank GreenSky Mosaic Sungage Financial | Can be limited to certain jurisdictions or available nationwide | Solar assets (i.e., the system) or unsecured |
| | Title I (HUD) | 90% government-guaranteed loan secured by second lien on home | Program-approved Lenders (Bank, CU, Finco) | 10 – 20 | 3% – 9% | <ul style="list-style-type: none"> PowerSaver Admirals Bank | Nationwide | Lien on the home (second mortgage) |
| | On-Bill | Loan amortized through electric bill | Bank, CU, Utility, State | ≤15 | 3% + | NYSERDA | Service territories of participating utilities | Utility bill |
| | Home Equity | A loan or line of credit against the value of a home-owner's equity. Also called a 2nd mortgage | Bank, CU, Finco | ≤30 | 4.5% + | N/A | Nationwide | Lien on the home (second mortgage) |
| Both | PACE | A loan made via an increase in property tax assessment and amortized through property tax bill | Bank, Finco, Municipality | ≤20 | 5% – 8% | <ul style="list-style-type: none"> Hero Program Renewable Funding | States with PACE-enabling legislation | Tax lien |
| Commercial | Comm. Loan | A loan made to businesses to finance operations, capital expenditures, etc. | Bank, CU, Finco | 5 - 30 | 3.25% – 6.85% | NA | Nationwide | Borrower's balance sheet |

*CU: Credit union

**FINCO: financial company

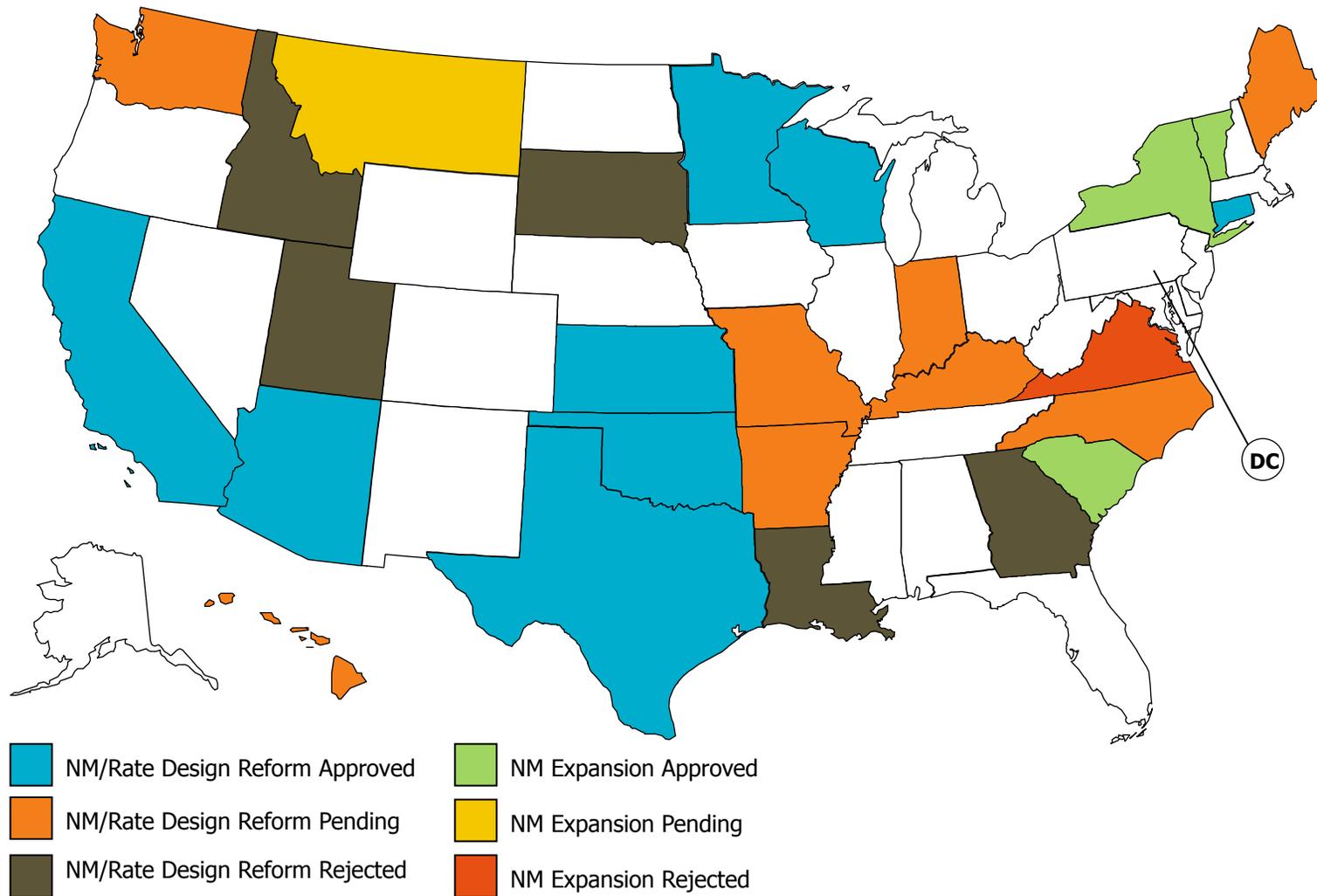
Who is in the Solar-Loan Value Chain

- **Major Banks**
- **Community Banks**
- **Credit Unions**
- **Private Equity**
- **Finance Companies**
- **State and local governments**
- **Utilities**

Challenges

- **Corporate (§48) vs. Personal (§25D) ITC**
- **Federal housing guidelines**
 - Personal property or fixture
 - What happens in a foreclosure?
- **Consumer protection**
 - Dealer discounts
- **Utilities**
 - Net metering
 - Rate structures
 - Getting in the game with their own solar programs

Recent Legislative Action for Net Metering/Rate Design Affecting PV

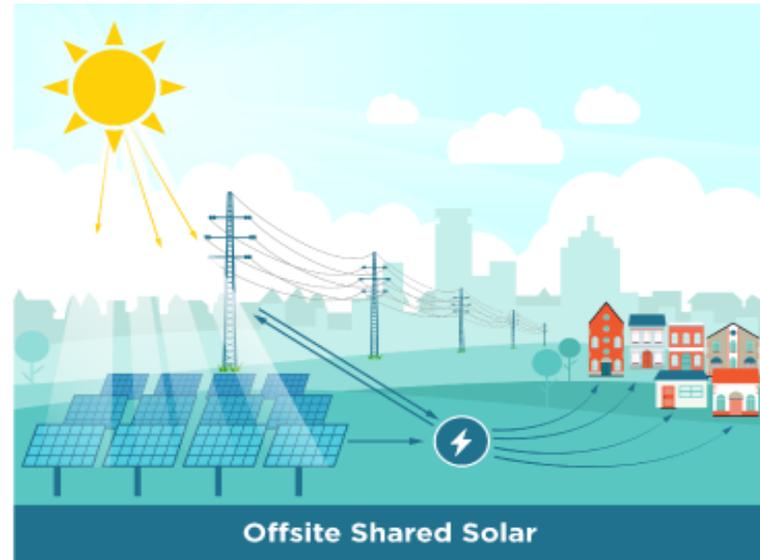


On the Horizon?

- **Solar + Storage**
- **Prosumers and the Connected Home**
- **Distributed Grid**



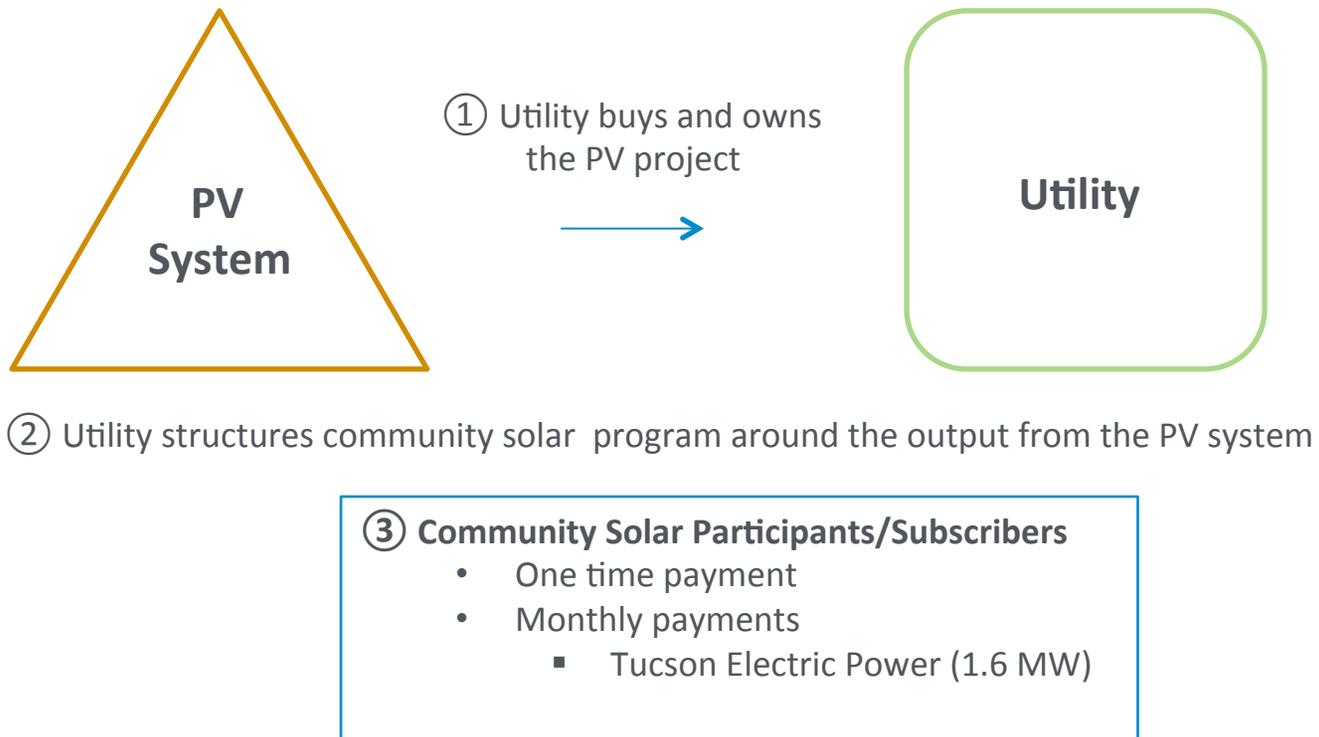
Shared Solar



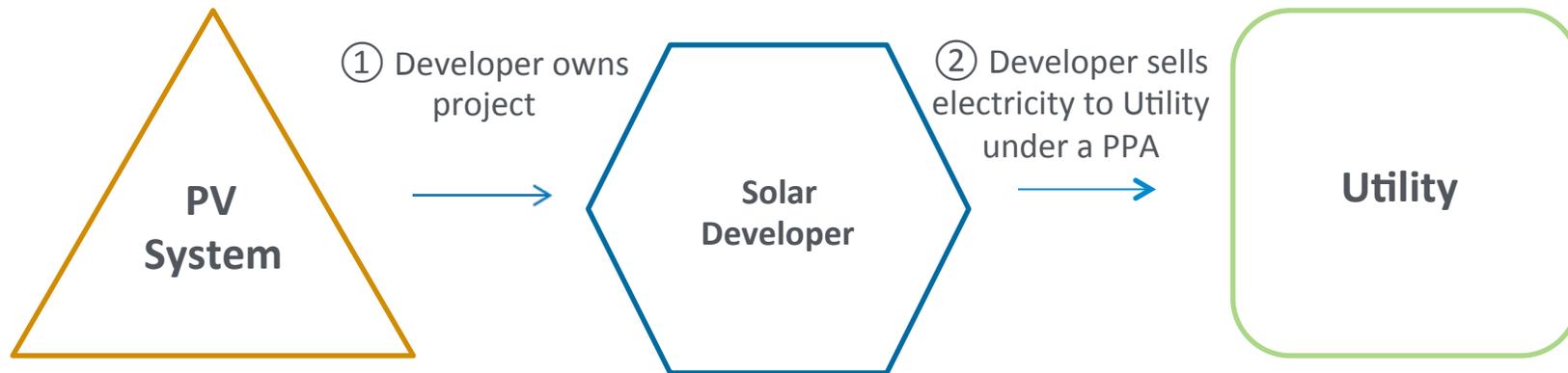
Shared Solar Business Models

| Arrangement | Location | Ownership | Number of Consumers per System | Group Purchasing |
|---|----------------|-------------------------------|---|---|
| Onsite individual net metering | Onsite | Solely owned; TPO | Single | Not necessarily (community group purchasing, e.g., “solarize”) |
| Offsite virtual net metering (VNM) | Offsite | Solely owned; TPO | Single | Not necessarily |
| Onsite shared solar (multi-unit buildings) | Onsite | Jointly owned; TPO | Multiple | Yes |
| Offsite shared solar (solar gardens) | Offsite | Jointly owned; TPO | Multiple | Yes |
| Community driven financial models (crowd-funding) | Offsite | Jointly owned; TPO | Energy not consumed by crowd-funding participants | Yes |
| “Green power” purchasing plans | Offsite | Utility; TPO | Consumption from no distinct system | Yes |

Common Community Solar Project Structures



Common Community Solar Project Structures



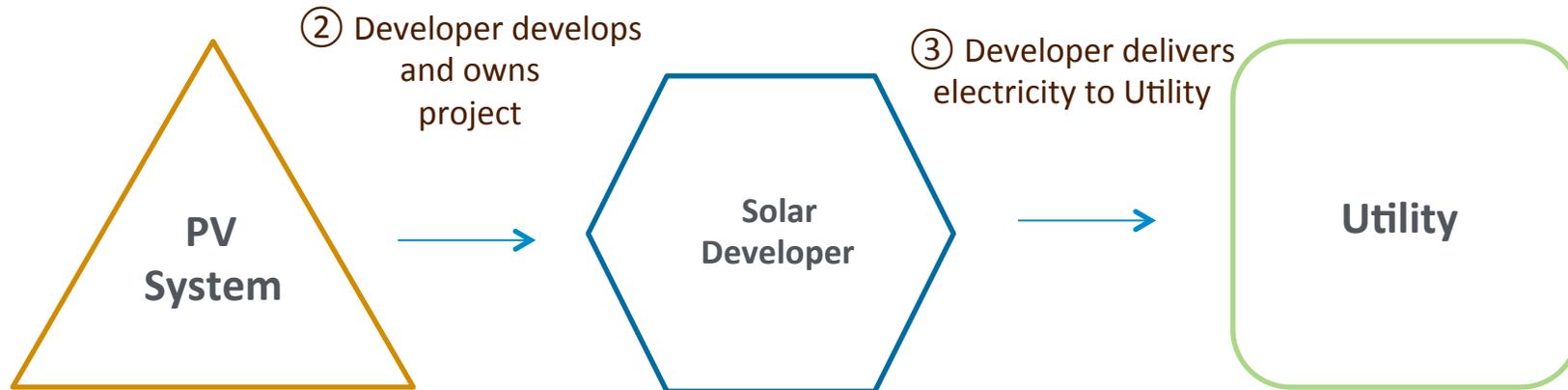
③ Utility structures community solar program around the output from the PV system.

Community Solar Participants/Subscribers

Monthly payments

- SMUD SolarShares (1 MW)

Common Community Solar Project Structures



① Developer collects subscriptions from Community Solar Participants/Subscribers (escrowed until project completion)

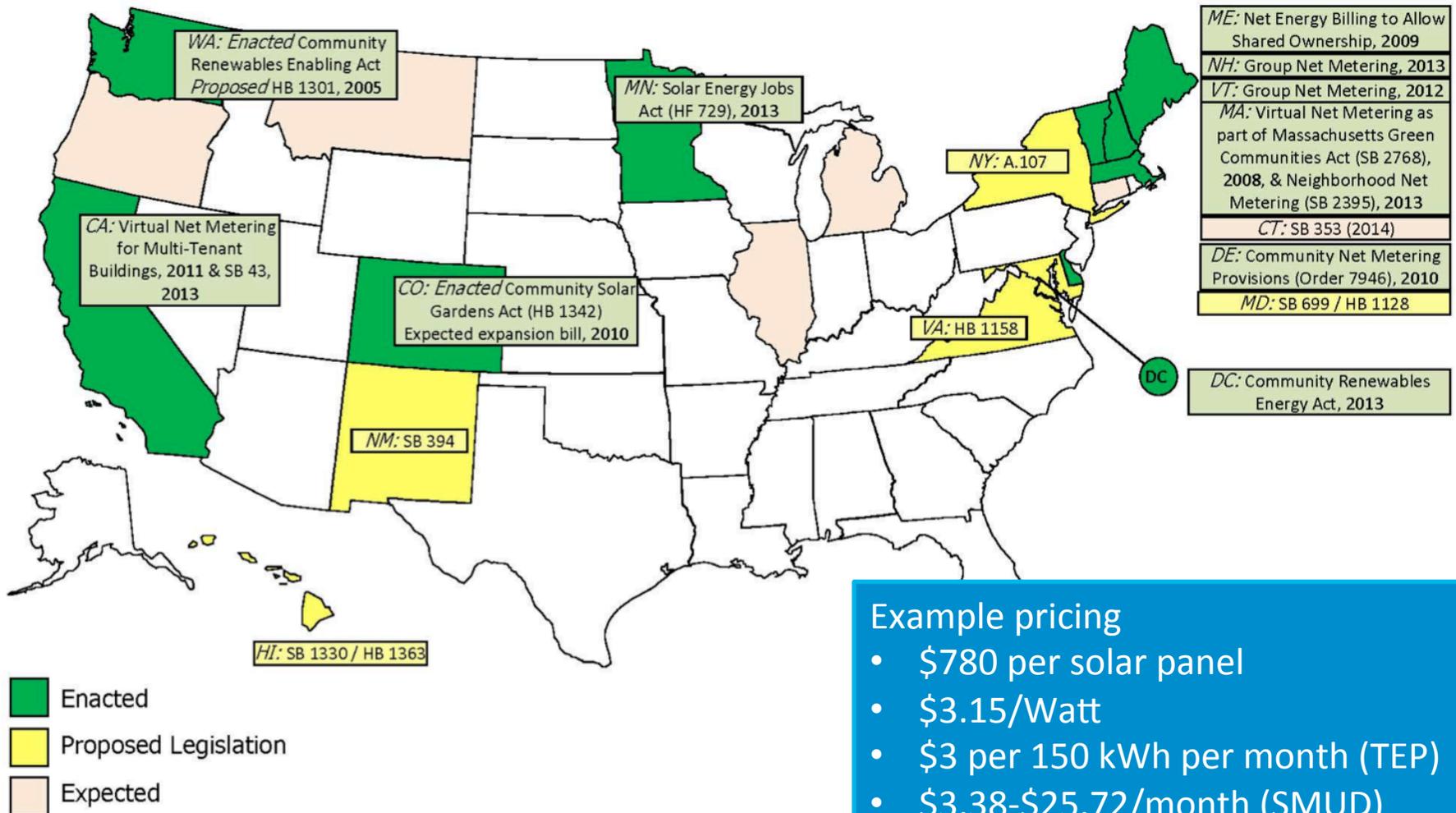
④ Utility credits subscriber accounts (in \$ or kWh)

Various Colorado Projects

- Xcel Energy (6 MW per year)
- San Miguel Coop (1 MW)
- Poudre Coop (116 kW, 500kW**)
- Holy Cross (1.2 MW, 78 kW)
- Colorado Springs Muni (2 MW*)

* Pilot program cap
** under construction

Shared Solar Policies



Example pricing

- \$780 per solar panel
- \$3.15/Watt
- \$3 per 150 kWh per month (TEP)
- \$3.38-\$25.72/month (SMUD)

<http://www.sharedrenewables.org/>

Benefits

- **Economies of scale**
- **Aggregating customer demand**
- **Optimum siting potential**
- **Transferability**

Challenges

- **Standardization**
- **Program and NEM caps**
- **NEM credits (DE off the distribution feeder is a lower credit)**
- **Full credit for SRECs?**
- **SEC? State securities laws?**

Howey Test

| Criteria | CommunitySun Program |
|--|--|
| An investment of money | Yes. Customers purchase condominium interests. |
| In a common enterprise | Yes. Multiple customers are expected to purchase an interest in a single PV asset. |
| Based solely on the efforts of a promoter or a third party | Yes. The program is to be developed, and the project is to be built and operated, by CommunitySun or other businesses they hire. |
| For which there is an expectation of profits | Not necessarily. Solar-condo owners may have many motivations for purchasing a condominium interest. |