APPENDIX

B

Commercial Solar Financing Options

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To view the full Guide, visit https://www.epa.gov/greenpower/guide-purchasing-green-power

DOCUMENT MAP

Introduction

The U.S. solar photovoltaic (PV) market has expanded dramatically in the past decade, with cumulative installed PV capacity in 2016 registering at 140 times greater than in 2006. PV installations across all sectors, including utility, residential, and nonresidential,[1] totaled 104 megawatts (MW) in 2006 and rose to 14,762 MW by the end of 2016, with nearly half of that capacity (7,261 MW) coming online between 2015 and 2016 alone.[2] With the number of PV installations increasing, system costs have continued to decrease. As of 2017, commercial PV systems cost an average of $1.85/Watts dc (Wdc) (a 65 percent decrease since 2010). For comparison, utility-scale fixed-tilt systems averaged $1.03/Wdc in 2017 (a 74 percent reduction since 2010) and residential systems average $2.80/Wdc (a 61 percent reduction over the same period).[3]

As the solar PV market in the United States has evolved, so too have the financing mechanisms associated with it. Third-party ownership (TPO) models, which include power purchase agreements (PPAs) and leases, in addition to loans and cash purchases, are the historical mainstays of the solar financing spectrum. Relatively more recent additions include property-assessed clean energy (PACE) financing and green bonds, among others. This appendix provides a snapshot of the current commercial solar financing arena and an overview of existing financing mechanisms. While there is significant overlap in solar financing options among the residential, government, and commercial sectors, this report focuses on options and considerations for commercial entities only. Performance contracting mechanisms commonly used by federal agencies and also available to the private sector, including energy savings performance contracts (ESPCs) or utility energy service contracts (UESCs), are briefly mentioned in the final section of this appendix but are discussed in more detail in Appendix A, Green Power Considerations for Federal Agencies.

For potential commercial solar energy consumers, the menu of available financing options often depends on whether the PV system is developed on-site or off-site. As corporations, universities, and other potential consumers have begun introducing or expanding renewable energy and carbon reduction goals, many are required to pursue off-site opportunities in order to approach the scale of renewable energy development needed to actually meet those goals. Traditional solar financing models are thus being adapted to encompass these increasingly complex relationships between solar energy consumers and solar development. As new options emerge for financing solar projects, it is important for commercial consumers to consider the role of renewable energy certificates (RECs) in their transactions. The number of RECs associated with a renewable energy project is based on the megawatt-hours of electricity generated and can be sold either together with or separately from the underlying electricity. Commercial consumers that do not keep the RECs associated with a solar energy project—even if they are purchasing electricity from or otherwise own that installation—will not be able to make a claim to the environmental benefits represented by the RECs. In other words, if a consumer does not retain the RECs from a solar project, the consumer will not be able to count that project toward any renewable generation, carbon reduction or other environmental goals.

Initial Considerations

Though not purely financial, determining whether to pursue on-site versus off-site development and evaluating other location-based factors are critical for commercial solar consumers. Incentives and financing structures may apply differently depending on where the electricity is generated versus consumed and whether PV systems are located on- or off-site. Another potential issue for commercial consumers is whether or not they own the property where they wish to site a solar energy system. Institutions leasing their buildings, for example, generally will not have the authority to make decisions regarding rooftop solar installations.

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[1] Nonresidential may include commercial, industrial, and other midscale-market installations.

[2] GTM Research & Solar Energy Industries Association. (2017). *Solar market insight report 2016 year in review.* Retrieved from https://www.greentechmedia.com/research/subscription/u.s.-solar-market-insight

[3] Fu, R., Feldman, D., Margolis, R., Woodhouse, M., and Ardani, K. (2017). U.S. solar photovoltaic system cost benchmark: Q1 2017. National Renewable Energy Laboratory. NREL/TP-6A20-68925. Retrieved from http://www.nrel.gov/docs/fy17osti/68925.pdf.

Additionally, larger consumers (such as governments, commercial property owners and universities) may need to seek off-site PV development in order to meet significant portions of their electricity load with solar. The percentage of a building's annual electricity load that can be offset with rooftop solar PV depends on available roof space, solar resource availability, and annual electricity consumption, as well as local net metering laws and limits. A National Renewable Energy Laboratory (NREL) analysis of representative commercial buildings found that the percentage of annual energy loads that can be reduced with PV systems that fill a building's total available roof area ranges from less than 5 percent (for hospitals) to up to 100 percent (for warehouses).[4] For institutions with less available rooftop or other solar development space, impact at scale will stem from engaging in larger off-site projects.

Institutions have a number of factors to consider when selecting a financing option for their solar purchase. Table B-1 outlines some of these key financing considerations. In addition, organizations will need to evaluate the role of RECs in their solar procurement strategies. While selling RECs to another party can lower the cost of procurement, the procuring institution then cannot legally make a renewable energy claim for that transaction. Organizations could consider a "swap" or "arbitrage" transaction, where they buy renewable energy from a different region or resource type, at lower cost. Renewable claims under a swap transaction will be based on the renewable energy purchased, not the RECs sold. [5]

Table B-1. Commercial-Sector Solar Financing Considerations[6, 7, 8, 9]

Financing Considerations	Details
Desired level of solar PV system ownership	Under loan-financed or cash purchase options, the solar consumer directly owns the PV system(s) and receives all associated tax benefits and incentives. Under TPO arrangements, these benefits still go to the owner of the system, in this case the third-party. Ownership requires a relatively large upfront capital investment, enough taxable income to benefit from tax breaks, and an understanding of potential risks and uncertainties inherent to owning solar PV.
Building ownership and lease terms	Tenant-landlord relationships and building lease terms add layers of complexity to solar financing options. Solar consumers that lease property will likely need to work with the property owner in some capacity to install solar. Discrepancies between building lease timeframes (e.g., 6-8 years) and the lifetime of a solar PV asset (20-plus years) are another challenge that solar consumers will need to consider when obtaining solar financing.

[4] Davidson, C., Gagnon, P., Denholm, P., and Margolis, R. (2015). *Nationwide analysis of U.S. commercial building solar photovoltaic (PV) breakeven conditions (p.7).* National Renewable Energy Laboratory. NREL/TP-6A20-64793. Retrieved from http://www.nrel.gov/docs/fy16osti/64793.pdf

[5] Center for Resource Solutions. (2016). *Solar energy on campus: Part II: solar purchasing options and communicating renewable energy use.* Retrieved from https://resource-solutions.org/wp-content/uploads/2016/09/Solar-Energy-on-Campus-II.pdf

[6] Feldman, D., and Lowder, T. (2014). *Banking on solar: An analysis of banking opportunities in the U.S. distributed photovoltaic market (pp.14).* National Renewable Energy Laboratory. NREL/TP-6A20-62605. Retrieved from http://www.nrel.gov/docs/fy15osti/62605.pdf(p. 14)

[7] Bird, L., Gagnon, P., and Heeter J. (2016). E*xpanding midscale solar: Examining the economic potential, barriers, and opportunities at offices, hotels, warehouses, and universities.* NREL/TP-6A20-65938. Retrieved from http://www.nrel.gov/docs/fy16osti/65938.pdf

[8] The office supply retailer Staples provides a case study in financing and installing solar on leased buildings. See: Feldman, D., and . Margolis, R.. (2014). *To own or lease solar: Understanding commercial retailers' decisions to use alternative financing models.* NREL/TP-6A20-63216. Retrieved from http://www.nrel.gov/docs/fy15osti/63216.pdf

[9] The Database of State Incentives for Renewables & Efficiency (DSIRE) provides information on programs and policies on a state-by-state basis. Solar consumers can refer to the database to determine the applicable policies in their location. DSIRE is available at http://www.dsireusa.org/.

Table B-1. Commercial-Sector Solar Financing Considerations (continued)

Financing Considerations	Details
Liability and maintenance costs associated with solar PV system ownership	Historically, one of the primary selling-points for TPO models is that the third party-owner will cover all operations and maintenance (O&M) functions, including equipment replacement and possibly production guarantees, whereas the solar consumer incurs those costs and liabilities under loan or cash purchase models. However, the introduction of stand-alone O&M and other services packages are expanding the options available to solar consumers who wish to directly own their PV systems but contract out for O&M services.
Credit requirements	Solar consumers with a poor credit rating or no credit history may find it more difficult to secure PPAs or loans and, based on assessed risk, might face higher interest rates. Either cash purchases or PACE financing, which is generally assessed based on property value rather than the borrower's credit score, are potential alternative options.
Tax credits and other incentives	Tax incentives represent the largest public investment in solar energy, but consumers must have the requisite tax appetite to monetize tax credits. Commercial consumers may also benefit from accelerated depreciation benefits (i.e., the Modified Accelerated Cost Recovery System, or MACRS). Tax-exempt entities, including many universities and other not-for-profit organizations, cannot directly use tax incentives. For these consumers, partnering with a third-party owner that can monetize the tax credits is one way to indirectly benefit from these incentives, assuming the third party passes on the associated cost savings via lower PPA or lease prices.
Payback and contract terms	For both loan and TPO configurations, the contract terms can have a significant impact on the total cost of solar financing. Longer contract periods will generally result in lower individual payment installments, but can also increase the overall cost of financing, depending on interest rates. In addition to the contract length, other factors such as down payments or pre-payment can influence financing costs.
State policy and electricity market structures	State policies and electricity market structures also dictate what types of financing mechanisms are available. For example, on-site third-party PPAs, or direct PPAs, are not available in all states. State and local financial incentives and utility rates vary by location, all of which influence the cost and economics of solar projects. These factors may impact the relative attractiveness of different financing mechanisms on a place-by-place basis.

The following pages provide summaries of common solar finance models.

Third-Party Ownership Models

Under TPO arrangements, which include PPAs and leases, a third party owns, installs, and operates a solar PV system and either sells the power output (PPA) or leases the system to a solar consumer. Under a PPA, a third-party owner sells electricity generated from a solar PV system, usually on a per kilowatt-hour (kWh) basis, to a solar consumer over a fixed contract period. PPAs are considered off-balance-sheet transactions, an attractive feature to some entities.[10] PPAs can make solar PV (or electricity more generally) accessible to consumers at a known price that parallels (but is

[10] Feldman, D., and R. Margolis, *To own or lease solar* (p. 24).

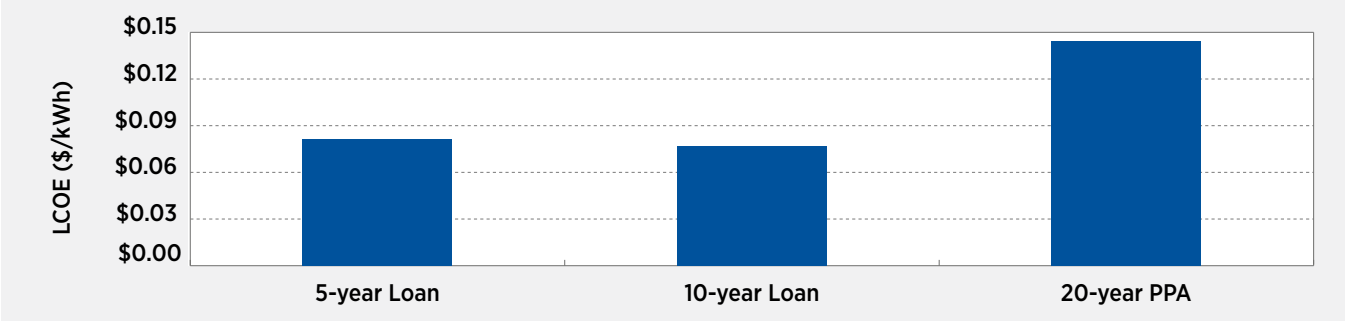
sometimes less than) retail electricity rates, depending on the sector, market and contract terms.[11] There are two varieties of solar PPAs: on-site (or "physical") PPAs, in which the electricity generated from a solar PV facility is directly tied to the consumer's meter, and off-site (or "financial") PPAs, under which a consumer still agrees to pay a fixed price per unit of electricity generated from a solar PV installation, but the arrangement is purely financial rather than a physical transfer of electricity. Both types of PPAs are discussed in more detail in subsequent sections.

Under any of the TPO configurations, the third-party owner, not the commercial solar consumer, is investing the upfront capital to develop the system. TPO models offer an attractive risk-return balance for many consumers. Advantages include:

- **No upfront costs.** There are no upfront costs associated with TPO for the solar consumer.[12]
- **Reduced exposure to risk.** TPO arrangements incorporate services that historically have not been included under direct ownership, allowing consumers to reduce their exposure to risks related to PV underperformance, O&M costs, and delays in receiving incentives or grid-connection approval.[13] However, as the commercial solar market evolves, installers and companies specializing in after-market operations may provide more of these services to solar consumers who elect to directly own their PV system(s).[14]
- **Access to technical and market expertise.** Consumers can access technical and market expertise of third-party PV owners, which can facilitate more rapid PV deployment. Due to the somewhat fragmented nature of current federal, state, and local solar policies, navigating the various tax and incentives programs can be a complex undertaking.
- **Potential cost savings.** For tax-exempt or other entities that cannot directly monetize solar tax incentives, working with a third-party owner can facilitate cost savings if the third party takes the tax incentive and integrates the associated cost savings into the PPA or lease prices.

The benefits of TPO do come with tradeoffs. The financing mechanism selected can have a significant impact on the overall system costs of the solar investment. TPO options may offer several advantages, but do not provide the same long-term cost benefits associated with direct ownership alternatives.[15] As shown in Figure B-1, the modeled levelized cost of energy (LCOE) for commercial PV systems under loan configurations are lower than they would be under a TPO PPA arrangement, due to the higher cost of capital required for sponsors and tax-equity providers under PPAs.[16]

Figure B-1. LCOE of Commercial PV Systems, Financed Under a PPA or Loan[17]



[11] Feldman, D., and Lowder, T., *Banking on solar* (p. 14)

[12] Coughlin,J. and Kandt, A. (2011). *Solar schools assessment and implementation project: Financing options for solar installations on K-12 schools* (p.16). National Renewable Energy Laboratory Retrieved from https://www1.eere.energy.gov/office_eere/pdfs/51815.pdf

[13] Feldman, D., and Margolis, R., *To own or lease solar* (p. 3)

[14] Feldman, D., and Lowder, T., *Banking on solar* (p. 14)

[15] Feldman, D., and Margolis, R., *To own or lease solar* (p. 24)

[16] FFeldman, D., and Lowder, T., *Banking on solar* (p. 28)

[17] Feldman, D., and Lowder, T., *Banking on solar* (pp. 28-29)

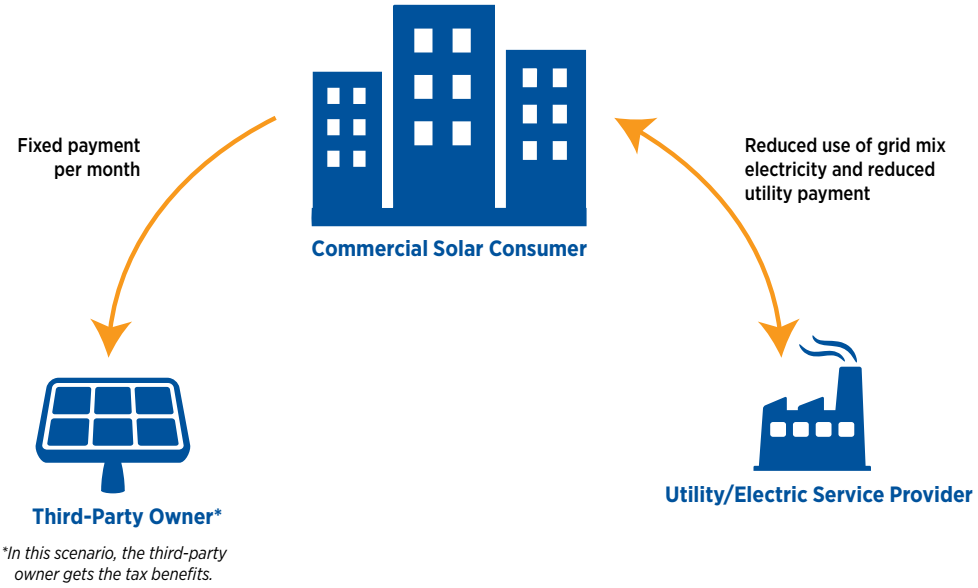
REC ownership is another potential tradeoff for solar consumers under a TPO arrangement. TPOs typically retain ownership of and monetize RECs associated with the solar project. Institutions seeking to claim environmental benefits to meet renewable energy or carbon reduction goals may not be able to do so under a TPO arrangement, depending on the flexibility of the third-party's contract terms.

On-Site Power Purchase Agreement (PPA): Physical PPA

Description

On-site PPAs can be considered "physical" PPAs, because the electricity production is tied to the consumer's meter, directly reducing the amount of electricity purchased from the utility (Figure B-2). Some organizations have also structured off-site "physical" PPAs, where the solar is contractually delivered to the consumer; those structures are far less common and therefore not addressed here.

Figure B-2. Overview of On-Site PPA



Note: Typical term is 15 to 20 years.

Market Insights

In 2015, third-party owned systems made up 65 percent of the nonresidential solar market; GTM Research projects that figure to increase to 74 percent in 2020.[18]

Policy Drivers

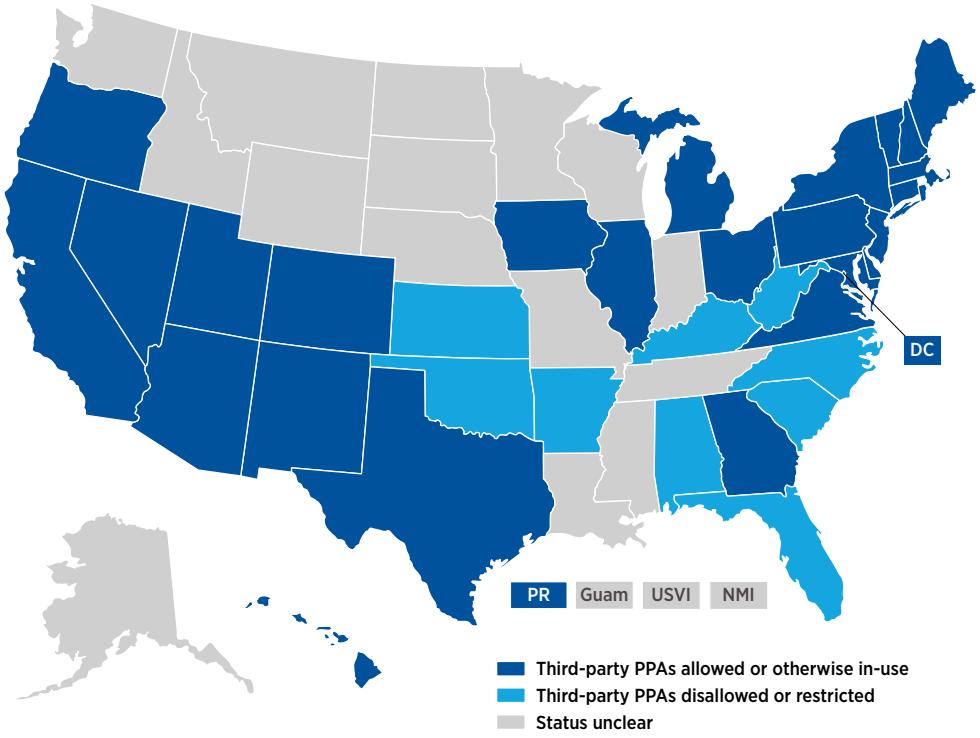
PPAs are a prominent solar financing tool but are not available in all locations. As of April 2017, 26 U.S. states have authorized or otherwise allow third-party PPAs, while at least nine have disallowed them (status is unclear in the remaining 15 states) (Figure B-3).[19] Even in states that have authorized third-party PPAs, specific regulations vary and

[18] GTM Research. (2016). U.S. commercial solar landscape 2016-2020. (2016). Retrieved from https://www.greentechmedia.com/research/report/us-commercial-solar-landscape-2016-2020#gs.QDgdNsQ

[19] DSIRE Database. 3rd Party solar PV power purchase agreement (PPA). Retrieved from http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2017/04/DSIRE_3rd-Party-PPA_April_2017.pdf

may not apply unanimously to all systems. Some policies, for example, only authorize third-party owned systems that are on-site or net metered.

Figure B-3. Status of Third-Party PPA Authorization[20]



Contract Risks

- Solar consumer only pays for production of system, thereby eliminating performance risk
- Solar consumer's exposure to electricity price fluctuations is directly reduced

Target Consumer & Example

- Non-taxpaying organizations (e.g., nonprofit organizations, governments) that cannot directly use tax incentives
- Organizations with good credit ratings
- Organizations not wanting or not able to make a capital investment

Staples worked with SunEdison to deploy solar on its buildings using a PPA model. Staples is a public company with a good credit rating and large balance sheet, but it preferred not to assume the risks associated with solar ownership. Staples has worked with SunEdison to install solar on 37 of its U.S. facilities, totaling 14 MW.[21]

Contract/Cost Implications

- Off-balance sheet
- Typically 15-20 year contracts
- Annual price escalators of around 2 percent

[20] DSIRE Database. 3rd Party Solar PV Power Purchase Agreement (PPA). Retrieved from http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2018/03/DSIRE_3rd-Party-PPA_March_2018.pdf.

[21] Feldman, D. and Margolis, R., *To own or lease solar* (p.6)

RECs

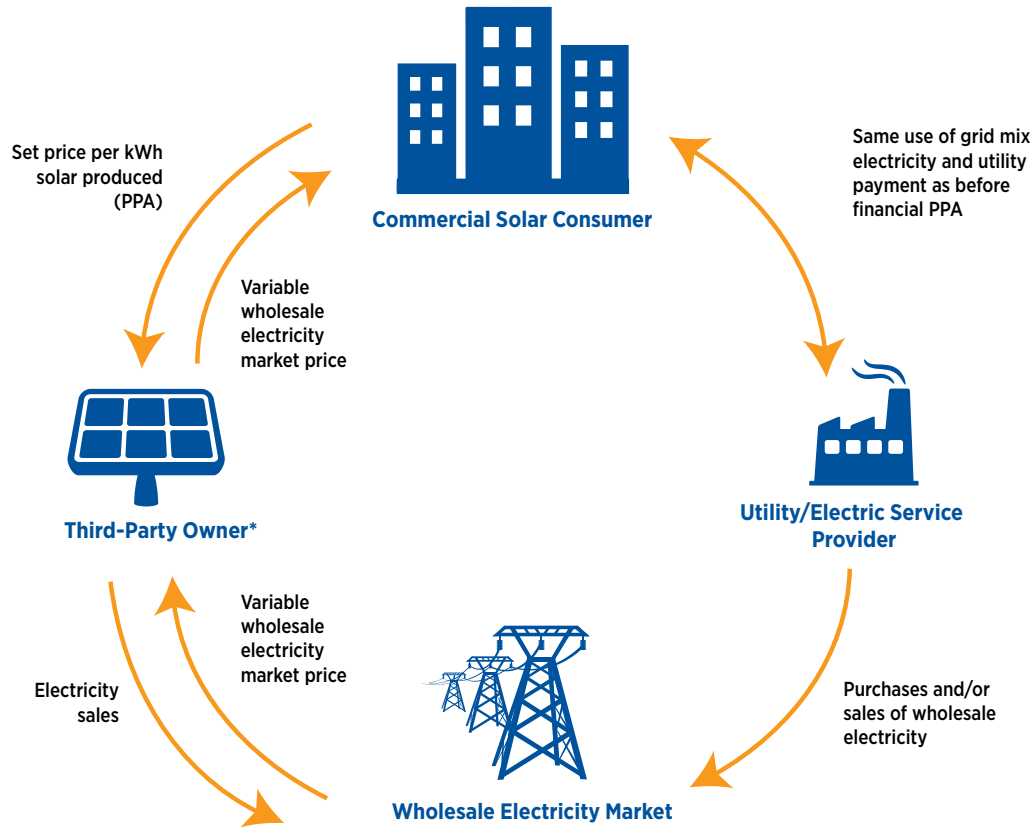
RECs should be defined in the PPA and ownership should be assigned to one party. In higher-priced REC markets and in territories where utilities are offering incentives for RECs, commercial consumers typically sell the RECs to the utility or project developer in order to lower the cost of the transaction, but in doing so they relinquish environmental claims.

Off-Site Power Purchase Agreement (PPA): Financial PPA

Description

Under financial PPAs, which are a common arrangement for an off-site generation PPA, the consumer does not take delivery of the electricity. Rather, the consumer agrees to pay a fixed price per unit of electricity generated from the solar facility, and the electricity producer sells the power to the electric grid and is compensated at the market rate. If the market rate the electricity producer receives is different than the negotiated PPA settlement price per unit of electricity, the difference is paid for via a stipulation in the PPA contract referred to as a contract for differences. If the market power rate exceeds the fixed PPA price, then the electricity producer pays the consumer the difference; if the market power rate is less than the PPA price, the consumer pays the electricity producer the difference. This transaction typically occurs monthly. The consumer's on-site electricity consumption is not affected. See Figure B-4.

Figure B-4. Overview of Off-Site PPA



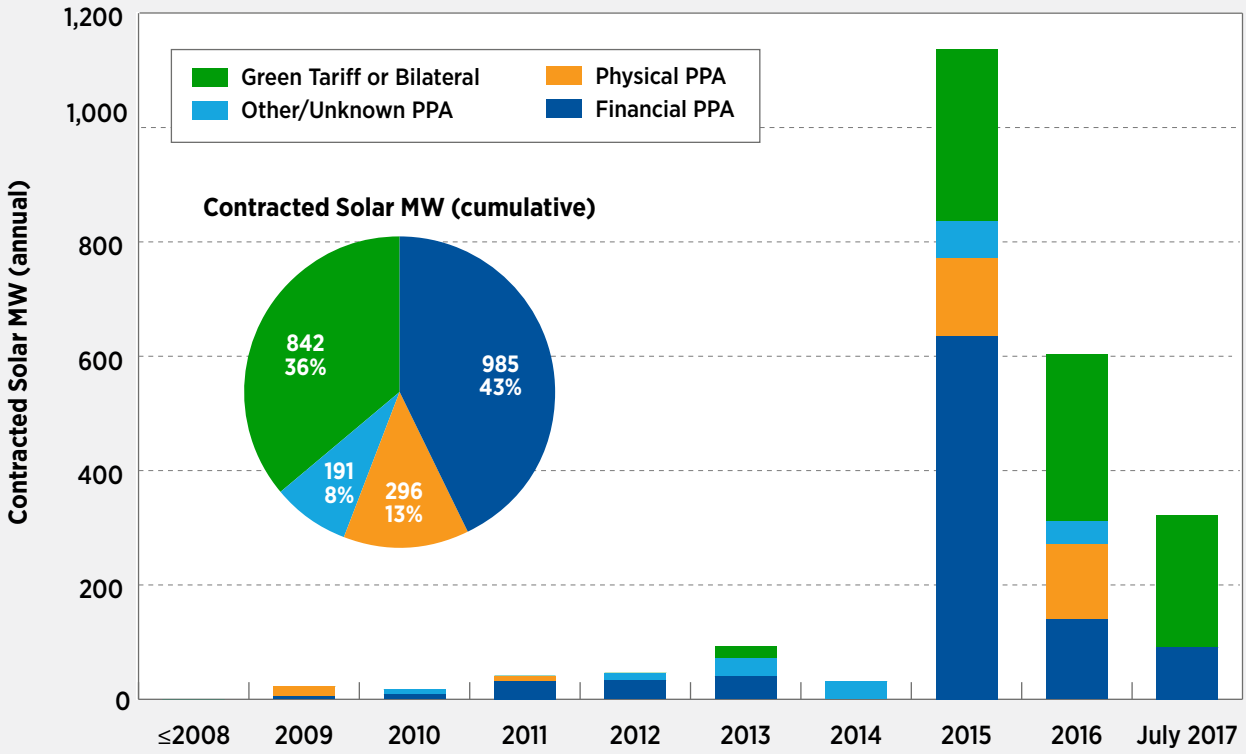
**In this scenario, the third-party owner gets the tax benefits.*

Note: Typical term is 15 to 20 years.

Market Insights

Through July 2017, financial PPAs represented 43 percent of the total off-site contracts (in terms of cumulative MW of renewable energy contracted) signed by corporate consumers (Figure B-5).[22] Procurement in 2015 was likely higher than 2014 and 2016 because of uncertainty around the production tax credit and investment tax credit extensions.

Figure B-5. Contracted Solar MW[23]



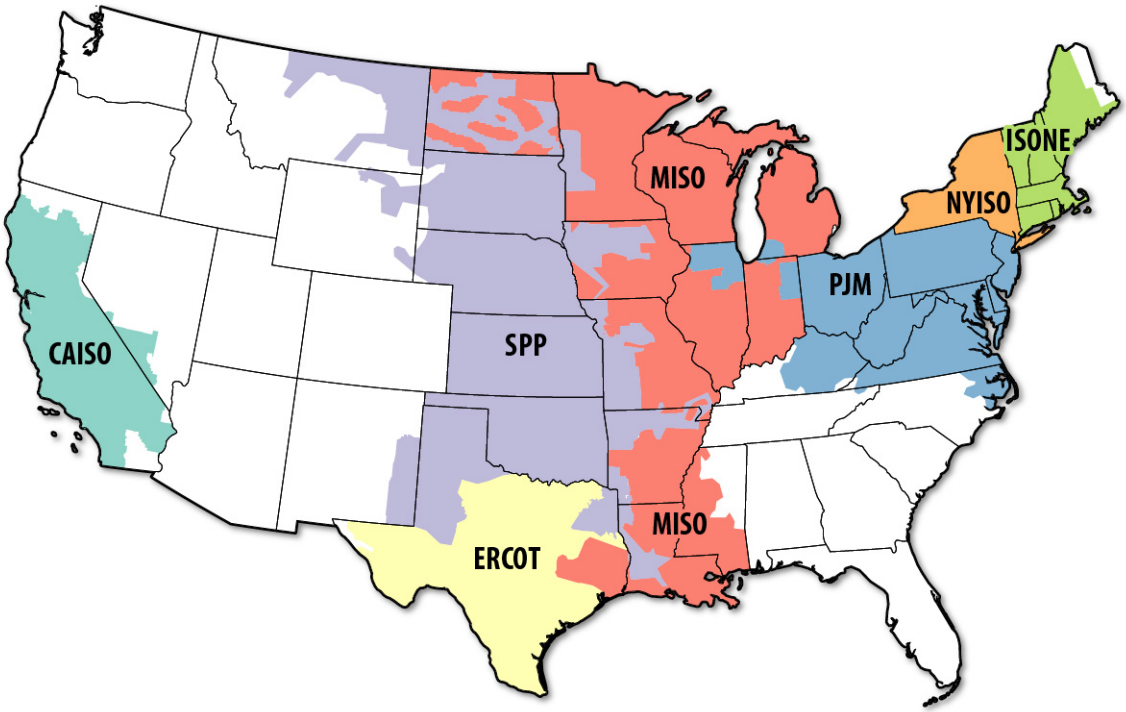
Policy Drivers

With financial PPAs, the generator must be able to sell into a wholesale spot market (Figure B-6). The generator and the consumer are typically located in the same power market in order to ensure the best hedge against rising electricity prices. This is because the consumer would want the wholesale price the generator is receiving to track the retail price the consumer is paying its existing utility as closely as possible, so that if retail rates increased, the consumer would also receive a higher payment from the renewable generator selling into the wholesale market. With solar projects built in areas not served by a regional transmission organization or organized wholesale market, developers and consumers may find it difficult to agree upon a market price index, since there is less market transparency.

[22] Green tariff or bilateral contracts are those in which the commercial consumer is contracting with the utility for renewable generation; the utility then signs a separate contract with the renewable generator. For more on green tariffs, see: Heeter, J., Cook, J., and Bird, L. (2017). *Charting the emergence of corporate procurement of utility-scale PV.* NREL/TP-6A20-69080. Retrieved from https://www.nrel.gov/docs/fy17osti/69080.pdf

[23] Heeter, J., Cook, J., and Bird, L., (2017). *Charting the Emergence of Corporate Procurement of Utility-Scale PV. National Renewable Energy Laboratory.* https://www.nrel.gov/docs/fy17osti/69080.pdf.

Figure B-6. Map of Regional Transmission Organizations and Independent System Operators



Contract Risks[24]

- The consumer will assume locational basis risk if the project is being settled at the busbar (point of interconnection) rather than the hub (the average of multiple busbars).[25]
- Setting a price at the busbar may offer greater opportunity for the consumer to earn greater returns than setting a price at the hub because of the minimized transmission congestion costs, but it comes with more risk.

Target Consumer & Example

- Organizations with finance and legal expertise, or interest in working with partners to understand complex transactions
- Organizations with limited space available for on-site generation
- Organizations with large electrical loads
- Organizations with good credit ratings
- Organizations not wanting or not able to make a capital investment

[24] For more discussion of financial PPA risks, see Schwabe, P., Lowder, T., Feldman, D., Fields, J., and Edward Settle. (2017). *Wind energy finance in the United States: Current practice and opportunities*. National Renewable Energy Laboratory. NREL/TP-6A20-68227. Retrieved from https://www.nrel.gov/docs/fy17osti/68227.pdf; and Renewable Choice Energy. (2017). *Proactively managing risks to accomplish your long-term energy goals using renewable PPAs*. Retrieved from http://www.renewablechoice.com/wp-content/uploads/2017/01/White-Paper-Risk-Mitigation-2017.pdf.

[25] Locational basis risk is the difference between where the renewable generator sells power and the location at which the contract price is set, as defined in the financial PPA.

Massachusetts Institute of Technology, Boston Medical Center, and Post Office Square Redevelopment Corporation executed a financial PPA for 60 MW of solar from a facility to be built in North Carolina. This transaction represented one of the largest solar financial PPAs ever, as most financial PPAs executed as of 2017 have been for wind. Although the price hedging opportunity may not be perfect since the project is located in a different region than the consumers, the project partners cited other benefits, including that North Carolina had larger stretches of contiguous available land for solar development than the Boston area, and that the project would contribute to reducing greenhouse gas emissions in North Carolina, which has a higher grid carbon intensity than New England.[26]

Contract/Cost Implications

- Off-balance sheet
- Typically 10-15 year contracts
- May have annual escalator payment to electricity producer
- The Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank)[27] may have recordkeeping, reporting and other implications for financial PPAs.
- The financial PPA structure will determine if Dodd-Frank compliance is required and can be configured so that reporting and recordkeeping responsibilities are assigned to the seller; responsibilities will vary depending on the PPA structure.

RECs

RECs should be defined in the financial PPA and ownership should be assigned to one party. In many cases, financial PPAs are being signed where the commercial solar consumer is keeping the RECs to make a renewable energy claim, however, there are cases where the consumer sells the RECs or engages in a REC swap.

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[26] Massachusetts Institute of Technology. (2016). MIT to neutralize 17 percent of carbon emissions through purchase of solar energy. Retrieved from http://news.mit.edu/2016/mit-neutralize-17-percent-carbon-emissions-through-purchase-solar-energy-1019.

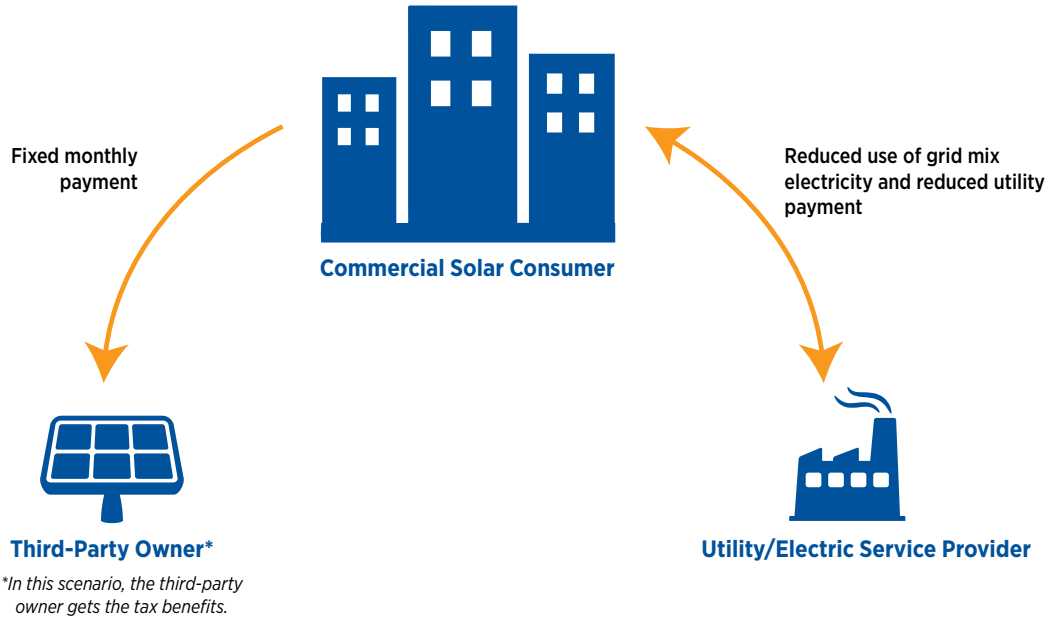
[27] Dodd-Frank Wall Street Reform and Consumer Protection Act. (2010). Pub. L. 111-203. 124 Stat. 1376. 21. Retrieved from https://www.sec.gov/about/laws/wallstreetreform-cpa.pdf.

Lease

Description

Solar leases also fall under the TPO model and mirror other common lease arrangements, such as an automobile lease. Generally, a solar consumer leases a solar PV system from a third party for a monthly rate over a pre-determined contract period (typically 10-20 years) (Figure B-7). The defining characteristic of a solar lease that distinguishes it from a PPA is the fixed monthly payment—consumers are making fixed payments every month rather than paying for the power generated. Because monthly costs are fixed, leases typically include production guarantees. Lease terms and prices vary depending on a number of factors, including physical location, PV system size, roof specifications (for rooftop installations), and the consumer's credit score, among others. Depending on how the lease is structured, consumers may also have the option of pre-paying a portion of the lease to reduce monthly payments.

Figure B-7. Overview of Lease



Note: Typical term is 15 to 20 years.

Market Insights

In 2015, third-party owned systems, including commercial leases, made up 65 percent of the nonresidential solar market; GTM Research projects TPO market share to increase to 74% in 2020.[28]

Policy Drivers

The TPO model of solar leases allows tax-exempt organizations to partner with other entities to monetize tax benefits but is currently not available in all states.

Contract Risks

The solar lessee assumes performance risk, which is typically mitigated by including a performance guarantee.

[28] GTM Research. U.S. commercial solar landscape 2016-2020.

Target Consumer & Example

- Non-taxpaying organizations (e.g., nonprofit organizations, governments) that cannot directly take advantage of tax incentives
- Organizations already using equipment leases
- Organizations with good credit ratings
- Organizations not wanting or not able to make a capital investment or that take a long time to make capital budgeting decisions

Luther College installed a 280-kilowatt (kW) solar PV array in 2012 under a lease agreement with Decorah Solar Field, LLC. The leasing company was able to take advantage of accelerated depreciation and federal grants under the 1603 Treasury Program to reduce project costs.[29]

Contract/Cost Implications

- Typically includes an annual escalator
- In order for a solar lease to qualify for the federal investment tax credit (ITC), both parties (e.g., the third-party owner and the lessee) must be taxpaying entities. Non-taxpaying entities may also enter into solar leases with a third-party owner but risk losing the ITC in that scenario. Taxpaying entities can use operating and capital leases to monetize tax credits directly.
  - An operating lease ("tax lease") is an off-balance sheet transaction which, for accounting purposes, closely resembles a traditional lease or rental. Under an operating lease, the lessor remains the owner of the asset and takes the tax credit. Operating leases are more common and are structured assuming the lessee will not necessarily assume direct ownership of the system in the future.
  - Conversely, a capital lease is an on-balance-sheet transaction that shares many characteristics of a rent-to-own or direct ownership arrangement and assumes the lessee will eventually own the system outright; the lessee is the owner for tax purposes.[30]

RECs

RECs should be defined, in the lease and ownership should be assigned to one party. In higher-priced REC markets and in territories where utilities are offering incentives for RECs, commercial consumers typically sell the RECs to the utility or project developer in order to lower the cost of the transaction, but in doing so they relinquish environmental claims.

Loan

Description

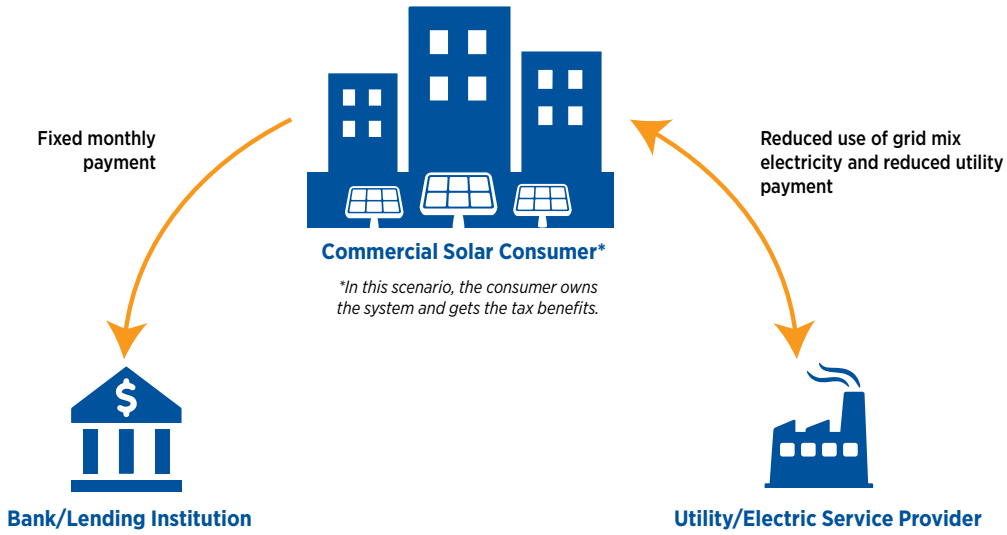
Solar-specific loans provide a pathway to direct ownership, which offers the benefit of free or low-cost electricity after the loan is paid off, and spreads the system cost out over a number of years (usually 5-15, depending on the loan terms), reducing upfront costs (Figure B-8). Solar loans are an ownership model—the consumer is paying for the PV

[29] Aznar, A., Mathur, S., Kim, A., Schramm, J.M. (2016). Non-power purchase agreement (PPA) options to financing solar deployment at universities. National Renewable Energy Lab. Retrieved from https://www.nrel.gov/technical-assistance/assets/pdfs/nonppa-universities-webinar-2016-oct4.pdf.

[30] Bolinger, M. (2009). Financing nonresidential photovoltaic projects: Options and implications. Lawrence Berkeley National Laboratory. LBNL-1410E. Retrieved from https://eta.lbl.gov/sites/all/files/publications/report-lbnl-1410e.pdf.

panels, not for the electricity production, thus the risk of poor performance falls to the commercial solar consumer. Solar loans are typically structured in two parts to allow consumers to take advantage of the 30 percent federal ITC. For example, the loan can be split into a 12- to 18-month zero-interest (also known as "same as cash") bridge loan for 30 percent of the project, and then a second longer-term, fully amortizing loan for the remaining 70 percent. Under this scenario, the solar consumer would pay the full amount of the ITC bridge loan upon receiving the tax benefit. The longer-term loan would be paid back with interest over the loan period. As these loan packages have evolved, some now also include service packages, often covering the same O&M coverage historically associated with TPO models.

Figure B-8. Overview of Loan



Note: Typical term is 15 to 20 years.

Market Insights

Owned systems (including those where a consumer took out a loan to finance the system) made up 35 percent of the nonresidential solar market in 2015; GTM Research projects this will decrease to 26 percent in 2020 as TPO market share increases.[31]

Solar-specific loan offerings—for which the underwriting loan terms, lender security, interest, and other programmatic aspects are designed for financing solar installations exclusively—started emerging as a prominent financing tool in late 2013, partially supplanting the use of more standardized home or commercial loans to finance solar.[32]

Policy Drivers

Loans are a way for solar consumers to finance and directly own a PV system. Loans are used in states that have not authorized third-party ownership or where the status of third-party ownership is unclear.

Contract Risks

- Purchaser assumes performance risk, including risk of delayed interconnection

[31] GTM Research. U.S. commercial solar landscape 2016-2020.

[32] Feldman, D., and Lowder, T., *Banking on solar* (p. 11)

Target Consumer & Example

- Smaller organizations, which PPA providers may not serve or require an interest rate of the organization that is unfeasible, may be able to get a loan through their banks or credit unions.
- Organizations not wanting or not able to make a capital investment
- Organizations able to take on operations and maintenance responsibilities or to contract for those services

Solar loans are used by small commercial consumers; the products are similar to those used by residential households installing solar. Many large solar developers offer solar loan products in addition to PPA or lease options.

Contract/Cost Implications

- Interest rates vary depending on factors like the borrower's credit score, length of the loan, and the loan provider, but generally fall in the 2.99 to 8 percent range.[33]
- On-balance sheet; may limit organization's borrowing potential

RECs

Banks and financial institutions may examine potential revenue from selling RECs; commercial solar consumers may monetize their RECs to make the loan terms more favorable, but they relinquish environmental claims if they do so.

Cash Purchase

Financing Option Description

Cash purchases are the most straightforward solar financing option: the solar consumer directly purchases, owns and is responsible for maintaining the solar installation (Figure B-9). Although PV system costs have fallen in recent years, purchasing a solar PV system outright requires significant upfront capital outlay, making this option unrealistic for many consumers, but appealing to others. Cash purchases also represent the most direct procurement type when selling or transferring an asset because it is already paid off. Owners typically assume all O&M costs and related expenses, but also maintain control over a long-term, high-quality asset.[34] Because cash purchase is a direct sale, there are fewer entities involved in the transaction than there are with loan or TPO options and the solar consumer does not incur financing costs (e.g., interest on a loan or the cost of capital).[35] This generally results in a higher rate of return over the lifetime of the PV system, although consumers typically will not see immediate economic benefits under a cash purchase—depending on the configuration, commercial solar consumers may see a negative cash flow for the first 5-11 years of system ownership.[36]

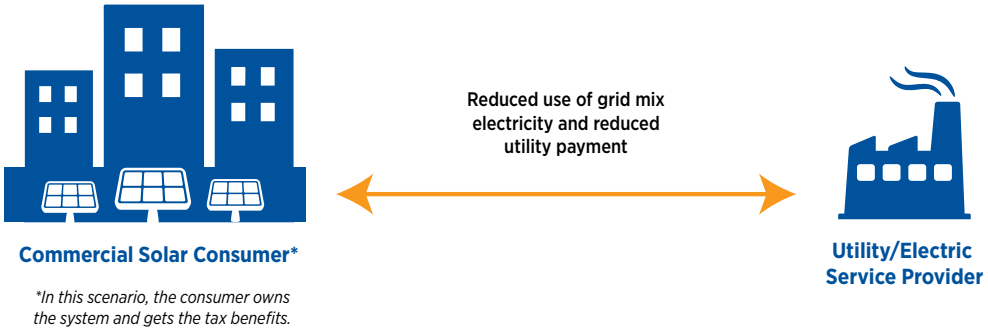
[33] Feldman, D., and Bolinger, M. (2016). *On the path to SunShot: Emerging opportunities and challenges in financing solar* (p. 40). National Renewable Energy Laboratory. NREL/TP-6A20-65638. Retrieved from http://www.nrel.gov/docs/fy16osti/65638.pdf

[34] Feldman, D., and Margolis, R., *To own or lease solar* (p. 2)

[35] Feldman, D., and Margolis, R., *To own or lease solar* (p. 2)

[36] GTM Research. U.S. commercial solar landscape 2016-2020

Figure B-9. Overview of Cash Purchase



Market Insights

Consumer-owned systems accounted for 35 percent of the commercial solar market in 2015; GTM research projects that this figure will decrease to 26 percent by 2020.[37]

Policy Drivers

Some institutions (universities, for example) may be able to utilize internal funding, bond financing, grants and incentives, including rebates or donor funding, as potential revenue streams for cash purchases. However, tax-exempt entities may not be able to take advantage of tax benefit incentives if opting for direct financing, which could impact the economic viability of solar projects.

Contract Risks

Purchaser assumes performance risk, including risk of delayed interconnection

Target Consumer & Example

- Organizations with available capital
- Organizations with access to grants, bond financing or donor funding (e.g., universities, nonprofit organizations)
- Organizations with tax liability

IKEA, a home furnishing retailer, decided to purchase solar installations outright based on several factors: it believed it would get a better rate of return than it would under a PPA, it was comfortable with a longer payback period, and it had the capacity to finance the PV system through the company's available balance sheet. IKEA did initially work with outside partners (including an engineering, procurement and construction contractor) while focusing on building internal, institutional knowledge about managing solar PV systems and learning to navigate the solar policy, financing and risk landscape.

Contract/Cost Implications

- On-balance sheet

[37] Feldman, D., and Margolis, R., *To own or lease solar* (p. 9)

RECs

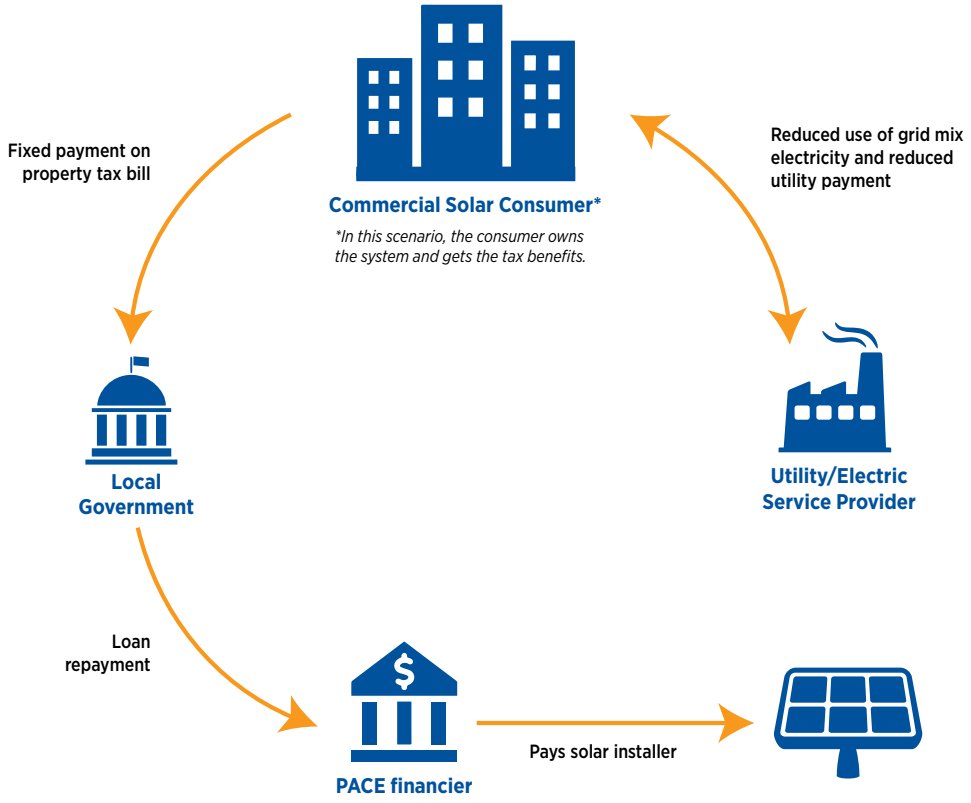
Organizations may examine potential revenue from selling RECs; they may monetize their RECs to ensure shorter payback periods, but they relinquish environmental claims if they do so.

Property-Assessed Clean Energy (PACE)

Financing Option Description

PACE financing, which was first introduced in California in 2008, is a financing option for renewable energy, energy efficiency and water conservation upgrades in certain locations where the state has authorized and local governments have implemented PACE programs. Under PACE financing, a third party finances (but does not own) PACE-eligible projects on behalf of a property owner and, after the project is completed, an assessment for the project costs (plus administrative expenses and interest) is attached to the property. Property owners repay the assessment over time as part of their property taxes (Figure B-10).

Figure B-10. Overview of PACE



Note: Typical term: <= 20years

PACE financing is unique in being property-based—PACE liens are typically evaluated against the underlying property value rather than the borrower's credit score—and transferable, meaning that if a property owner decides to sell, the PACE lien stays with the property and any subsequent owner. PACE can also be used to pay for solar leases and PPAs, in which cases the potential tax benefits associated with TPO arrangements may be combined with the proper-

ty-based advantages of PACE financing, though this option is not as widely used as a PACE-only product.[38] Because the PACE assessment is typically senior to the mortgage loan attached to a property, PACE programs typically require commercial PACE (C-PACE) projects to obtain consent from the mortgage lender.

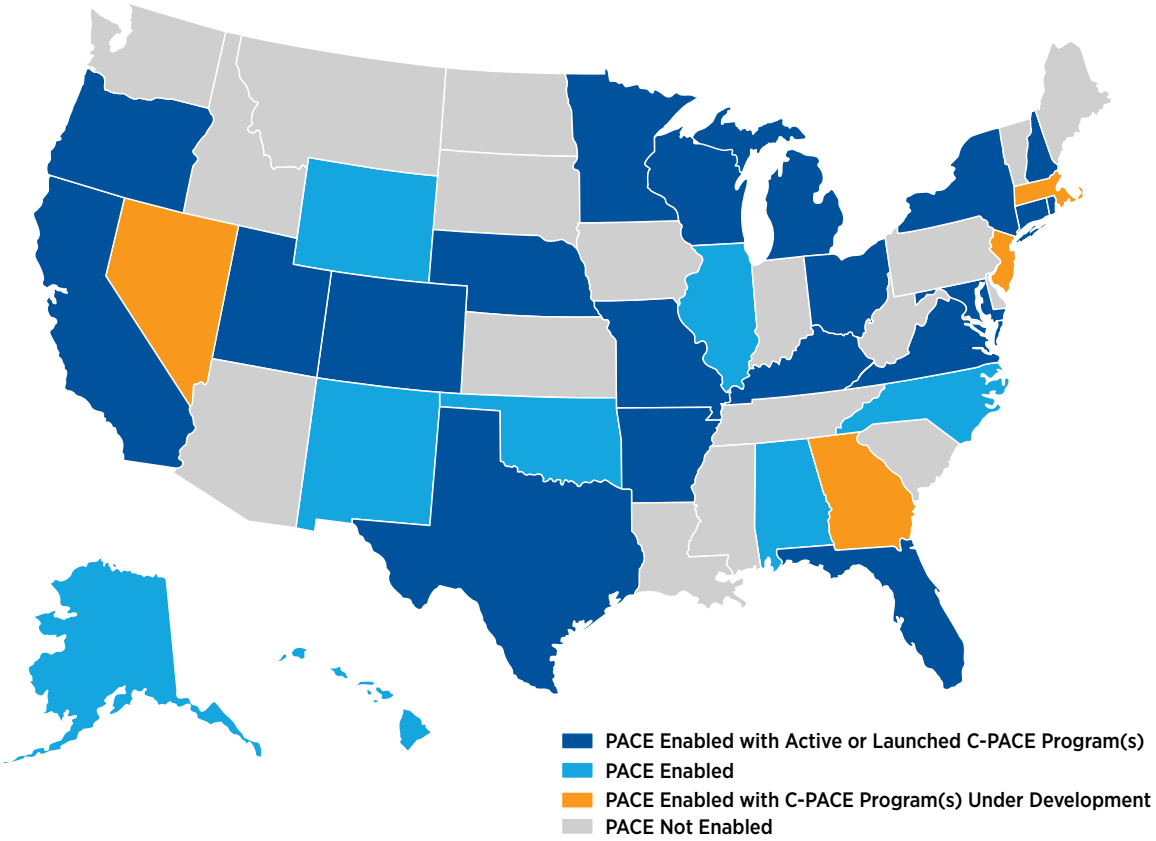
Market Insights

As of May 2017, 1,030 properties had used C-PACE, totaling $400 million in investment; 34 percent of the funding went to renewable energy projects, 51 percent to energy efficiency projects and 15 percent to mixed projects.[39]

Policy Drivers

PACE financing is currently enabled in 33 states and Washington, D.C.; of those, 20 states and Washington D.C. have an active PACE program (Figure B-11).

Figure B-11. Status of Commercial PACE Programs[40]



Contract Risks

- Consumer assumes performance risk, including risk of delayed interconnection

[38] The Connecticut Green Bank, for example, is offering a PACE PPA product. See http://pacenation.us/pace-talk-pace-power-purchase-agreements-ppa-is-a-game-changer-for-connecticut-and-beyond.

[39] PACENation. (2017). PACE market data. Retrieved from http://pacenation.us/pace-market-data/.

[40] PACENation. (2018). Commercial PACE Near You. Retrieved from http://pacenation.us/pace-programs/commercial.

Target Consumer & Example

- Organizations with poor credit or no credit history
- Organizations that may be moving before the end of the expected life of a solar system
- Building owners who lease their space, or organizations that own and use their building but expect to leave in less than 10 years (e.g., office buildings, hotels)[41]

A wholesale distribution facility operator in Chico, California, utilized C-PACE financing to install a 77.74-kW rooftop solar PV system. The building had ample roof space and did not require additional energy efficiency modifications. The annual PACE assessment is $265,458, with an interest rate of 7.99% over 20 years. In this case, the availability of tax incentives and rebates for solar PV systems also factored into the project economics.[42]

Contract/Cost Implications

- May be considered off-balance sheet, depending on accounting practices[43]
- Repayment is tied to the property; does not affect the organization's creditworthiness

RECs

Banks and financial institutions may examine potential revenue from selling RECs; commercial solar consumers may monetize their RECs to make the loan terms more favorable, but they relinquish environmental claims if they do so.

Other Financing and Solar Purchasing Options

There are several additional solar financing or purchasing options that may be available in certain markets, some of which can be used in conjunction with the mechanisms presented in the previous section.

Bond financing. Public institutions, governments and corporations have the option of issuing bonds to raise revenue to finance solar purchases.[44] Green bonds are an emerging subset of bonds specifically dedicated to financing environment-related projects, such as energy efficiency, renewable energy, water conservation and similar measures.[45]

Direct investments. In limited cases, direct investments such as grants, donor funding, endowments or internal capital funds may be available to facilitate solar cash purchases, particularly for larger institutions. Dedicated sustainability or renewable energy funds, such as those collected through student fees at some universities, represent another potential funding stream.

Energy performance contracting. Energy performance contracting mechanisms are structured to allow government agencies and commercial institutions to pay for renewable energy upgrades over time using money saved on energy bills resulting from energy-saving measures. Energy performance contracting structures are used extensively by federal agencies and are also open to the private sector. They include ESPCs and UESCs. Under both types of agreements, the company providing the energy efficiency or renewable energy service upgrades—an energy service

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[41] For more on the implications of leased spaces on solar procurement, see Bird, L., Gagnon, P., and Heeter, J. (2016). *Expanding midscale solar: Examining the economic potential, barriers, and opportunities at offices, hotels, warehouses, and universities*. NREL/TP-6A20-65938. Retrieved from http://www.nrel.gov/docs/fy16osti/65938.pdf.

[42] PACENation. Wholesale distributor. Retrieved from http://pacenation.us/projects/wholesale-distributor/.

[43] Bird, L., Gagnon, P., and Heeter, J. (2016). *Expanding midscale solar: examining the economic potential, barriers, and opportunities at offices, hotels, warehouses, and universities.* NREL/TP-6A20-65938. http://www.nrel.gov/docs/fy16osti/65938.pdf.

[44] For more information on bonds, see Cory, K., Coughlin, J., Coggeshall, J. (2008). *Solar photovoltaic financing: Deployment on public property by state and local governments.* NREL/TP-670-43115. Retrieved from http://www.nrel.gov/docs/fy08osti/43115.pdf.

[45] For more information on federal clean renewable energy bonds see https://energy.gov/savings/clean-renewable-energy-bonds-crebs.

company (ESCO) under ESPCs or the utility in the case of UESCs—guarantees reduced energy expenditures resulting from energy-saving projects. The ESCO or utility typically conducts a building energy audit, identifying specific energy conservation measures. Once the ESCO or utility and the building owner agree on the course of action, the ESCO or utility arranges project financing and makes the upgrades. The building owner then repays the ESCO or utility using its normal operating budget and the freed-up money from reduced energy costs stemming from the energy conservation measures. ESPCs and UESCs are discussed further in Appendix A, Green Power Considerations for Federal Agencies.[46]

Green tariffs. Green tariff programs are an emerging product among utilities that allow consumers (usually larger commercial and industrial entities) to purchase renewable power directly from the utility, typically under a long-term contract. Consumers opting into these programs may purchase electricity at the green tariff rate, which typically replaces the standard electricity rate and may result in cost savings to the consumer over the contract term. Typically, the utility's green tariff will specify key terms and conditions, then consumers will sign an individual contract with the utility specifying the costs. As of April 2017, five utilities had a subscribed green tariff, with 900 MW of renewable capacity committed.[47]

Conclusion

The solar PV financing landscape continues to evolve and expand, with new products and configurations affording solar consumers a variety of potential options. Specific financing mechanisms offer different combinations of advantages and challenges. A consumer's tax profile, location, and access to upfront capital, among other factors, will impact the viability and relative attractiveness of the different approaches. Individual solar consumers will need to carefully consider solar financing options within their specific contexts. Table B-2 summarizes the overarching advantages and challenges associated with the different financing mechanisms and identifies the types of end users that may benefit most from the respective financing options.

[46] For more information on the basics of ESPC, see the DOE Office of Energy Efficiency and Renewable Energy's overview at https://energy.gov/eere/slsc/energy-savings-performance-contracting.

[47] World Resources Institute. (2017). Grid transformation: Green tariff deals. Retrieved from http://www.wri.org/resources/charts-graphs/grid-transformation-green-tariff-deals; for more on green tariffs, see Heeter, J., Cook, J., and Bird, L. (2017). *Charting the emergence of corporate procurement of utility-scale PV*. NREL/TP-6A20-69080. Retrieved from https://www.nrel.gov/docs/fy17osti/69080.pdf.

Table B-2. Summary of Solar Financing Mechanisms

Financing Mechanism	Advantages	Challenges	Which end users benefit most?
On-site, Physical PPAs	• Little or no upfront capital investment • Tax-exempt consumers can take advantage of tax benefits, including MACRS • Consumer only pays for production • Reduces consumer exposure to electricity price fluctuations • O&M responsibilities covered by TPO • Utility bills reduced by amount the PPA covers • Off-balance sheet	• Not available in all states • Requires long-term contract for power • Consumer must have good credit • Potential transfer issues at property sale • RECs must be assigned to one party; selling RECs may lower transaction costs, but consumer then cannot claim environmental benefits	• Consumers with little or no tax appetite • Consumers with limited access or interest in spending upfront capital • Organizations with good credit
Off-site, Financial PPAs	• Same advantages as on-site PPAs, plus: • Option for consumers where physical PPAs are not allowed • Often issued for shorter contract terms (10 years) than on-site PPAs	• Complex financial arrangement; consumers may experience steep learning curve in executing contracts • Consumer continues to pay existing electricity bill; may not provide perfect hedge against rising utility rates • Electricity producer must be located in restructured markets • Consumer must have good credit • Dodd-Frank Wall Street Reform and Consumer Protection Act may have recordkeeping, reporting and other implications • RECs must be assigned to one party; selling RECs may lower transaction costs, but consumer then cannot claim environmental benefits	• Consumers in restructured electricity markets • Consumers with distributed loads • Consumers with interest and ability to learn about new financial products • Large electricity users • Consumers with limited space available for on-site solar development • Consumers in restructured electricity markets • Consumers with distributed loads • Consumers with interest and ability to learn about new financial products • Large electricity users • Consumers with limited space available for on-site solar development • Organizations with good credit rating • Consumers with little or no tax appetite • Consumers with limited access to or interest in spending upfront capital

Table B-2. Summary of Solar Financing Mechanisms (continued)

Financing Mechanism	Advantages	Challenges	Which end users benefit most?
Lease	• Little or no upfront capital investment • Can work with existing equipment lease financial partners • Fixed payments monthly	• Lease may impact balance sheet, depending on the structure • Consumer assumes performance risk • RECs must be assigned to one party; selling RECs may lower transaction costs, but the consumer then cannot claim environmental benefit	• Non-taxpaying organizations (e.g. nonprofit organizations, governments) • Organizations already using equipment leases • Organizations with good credit ratings • Large corporations with aversion to debt • Organizations not wanting or not able to make a capital investment or that take a long time to make capital budgeting decisions
Solar Loan	• Reduced upfront costs • Consumer enjoys benefits of ownership after loan is paid off • Typically lower cost to consumer than TPO models	• Consumer must have good credit • Consumer assumes risk of nonproduction • On-balance sheet	• Consumers in states that disallow third-party PPAs • Organizations not wanting or not able to make a capital investment • Organizations able to take on operations and maintenance responsibilities, or contract for those services
Cash Purchase	• Owner avoids financing charges and interest payments • May expedite the solar installation process • May expedite property sale or transfer	• Competing uses for organizations' funds • No accelerated depreciation benefits (residential consumers) • Tax-exempt entities may not be able to monetize tax benefits • Owner responsible for O&M (or contract out for those services)	• Consumers with available upfront capital • Organizations with access to grants, bond financing, or donor funding (e.g., universities, nonprofit organizations) • Organizations with tax liability
PACE	• Little or no upfront capital investment • Transferable to subsequent property owners • Financing is primarily property-based rather than credit-based	• Limited availability • PACE requires clear communication with underlying mortgage lender	• Building owners who lease their space, or organizations that own and use their building but expect to leave in less than 10 years • Public-sector consumers • Organizations with poor or no credit history

Resources

PPAs

National Renewable Energy Laboratory. (2016). U*sing power purchase agreements for solar deployment at universities.* National Renewable Energy Laboratory. NREL/BR-6A20-6556777. Retrieved from http://www.nrel.gov/docs/gen/fy16/65567.pdf.

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Feldman, D., Friedman, B., and Margolis, R. (2013). *Financing, overhead, and profit: An in-depth discussion of costs associated with third-party financing of residential and commercial photovoltaic systems.* National Renewable Energy Laboratory. NREL/TP-6A20-60401. Retrieved from http://www.nrel.gov/docs/fy14osti/60401.pdf.

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PACE Financing

U.S. Department of Energy. (2014). Chapter 12: Commercial property-assessed clean energy (PACE) financing *U.S. Department of Energy Clean Energy Finance Guide.* Retrieved from https://energy.gov/sites/prod/files/2014/06/f16/ch12_commercial_pace_all.pdf

U.S. Department of Energy. (2017). *Property-assessed clean energy programs.* Retrieved from https://energy.gov/eere/slsc/property-assessed-clean-energy-programs.

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Cory, K., Coughlin, J., and Coggeshall. J. (2008). Solar photovoltaic financing: Deployment on public property by state and local governments. NREL/TP-670-43115. Retrieved from http://www.nrel.gov/docs/fy08osti/43115.pdf.

Renewable Energy Claims

Solar Energy on Campus Past I-IV

https://resource-solutions.org/wp-content/uploads/2016/08/Solar-Energy-on-Campus-I.pdf

https://resource-solutions.org/wp-content/uploads/2016/09/Solar-Energy-on-Campus-II.pdf

https://resource-solutions.org/wp-content/uploads/2016/12/Solar-Energy-on-Campus-III.pdf

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