Energy Education Series

Book 1

ENERGY EDUCATION SERIES

Solar and Storage Foundations

FOREFRONT POWER

ForeFront Power has more than 15 years of renewable industry experience, serving business, public sector, and residential power customers around the world. Our team has developed over 900 MW of capacity across more than 1,000 projects, targeted on assisting public sector agencies and C&I firms to deliver the most impactful behind-the-meter, community solar, and wholesale solutions.

ForeFront Power is a wholly owned subsidiary of Mitsui & Co., Ltd., a global energy infrastructure and investment leader. Mitsui brings a strong balance sheet and global presence to its partnership with ForeFront Power. The company offers substantial financial liquidity due to its strong profitability and is proud to have a credit rating of A from Standard & Poor's and A3 from Moody's.

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The U.S. Energy Information Administration estimates that over 70% of global electricity will come from renewable energy by 2050.[1]

Introduction

In today's energy landscape/electricity market, "solar" is perhaps the most commonly used buzzword. Buyers are inundated with terms such as "PV panels," "PPA rates," "energy efficiency", "tax credits", "community choice" – all with little significance behind their meaning or guidance around their application. For consumers or business operators that are looking to lower their electricity bills and/or want to become more sustainable, understanding the solar market, and the process of solar procurement, can be extremely daunting. Even the phrase "solar power procurement" sounds complicated and off-putting. For these reasons, we at ForeFront Power have set out to change the way people understand and buy solar energy and energy storage.

Welcome to **ForeFront Power's Energy Education Series**, a collection of detailed guides helping consumers and decision makers navigate the world of solar. The first of five guides in this series, "Renewable Energy Foundations" provides a comprehensive knowledge base for those who are interested in learning about or wanting to brush up on their understanding of solar history, policy, technology, and financing.

Our goal is to empower you with the knowledge and understanding of how the solar market works and the various options so that you can begin to determine whether procuring solar energy is right for you and your organization's needs.

This guide is a curated collection of information that strives to provide an unbiased perspective of solar today. For more detail on any of the data provided, we have included footnotes with direct links to the original sources.

[1]https://www.eia.gov/outlooks/ieo/pdf/ieo2019.pdf

About this Series

This guide is the first of a five-part Energy Education Series by ForeFront Power. Our goal is to put the power of learning about solar energy into your hands so that you are comfortable with the products and services before moving along in your own procurement process.

Here is an overview of the Energy Education Series:

1. **Solar and Storage Foundations:** What is happening in the renewable energy industry? Why are organizations adopting solar and storage, and what are the various products and structures on the market?
2. **Evaluation:** Is solar the right fit for your facilities? What information can you gather internally to understand your unique situation? What factors should you consider?
3. **Case Building:** Ready to move forward in the process, but you don't have internal support? This report gives you the tools and insight to convince those around you that your time spent on renewable energy procurement is the right step.
4. **Sourcing:** It is time to gather quotes and see which provider is the right partner for your organization. Should you release a Request for Proposal? What should you ask for in the proposal process and how should you evaluate the responses?
5. **Promotion:** You have a new solar installation or subscription and you are excited about the impact. How do you share this excitement with fellow employees, partners, and customers? How do you quantify the direct and indirect benefits?

Each guidebook of the Energy Education Series is available for free at forefrontpower.com If you ever have any questions or ideas for improvement, please do not hesitate to contact us on our webpage.

Navigating this Guide

This guide is subdivided into the following sections:

INDUSTRY

This section gives an update of current trends and how renewable energy technologies currently fare against traditional sources, such as natural gas and coal. It also includes details on pricing, capacity, and policy.

SOLUTIONS

Renewable energy solutions are always evolving, and local policies commonly dictate which solutions are available in a certain areas. This section introduces the various renewable energy products and financing mechanisms currently available, while discussing how best to navigate them to find the best fit.

BENEFITS

This section addresses the fundamental question, "Why adopt renewable energy?" There are a myriad of reasons including cost savings and sustainability, but there is much more to it than those high-level motivations. We also introduce our "Motivation Circle" to showcase why different people will adopt.

Key Takeaways

1. **Understand the current market background in the U.S. solar industry.**
2. **Find renewable energy incentives and identify those that apply.**
3. **Navigate the various solar and energy storage solutions available.**
4. **Filter options for your organization based on your priorities.**

INDUSTRY

Section 1: Industry

FOREFRONT POWER

Market Overview

Solar is a rapidly evolving and exciting sector that has transformed from a seemingly obscure technology to a multi-billion-dollar industry in just a few short decades. Over the last thirty years, Solar Photovoltaic (PV) technology has improved to the point where solar is becoming more affordable to everyone from business owners to households, including renters. Policy and regulation have come to dictate how and where solar is available by way of incentives and innovative programs; most of which vary by region.

Given its complex and variable nature, solar can often be confusing and intimidating to those who are just starting to get involved. Whether you're a resident looking to cut down your electric bill or a business owner trying to improve your sustainability practices, it's important to not only understand the technical side of solar, but have some context around how the solar industry is laid out in terms of policy, financing mechanisms, and incentives. This section aims to introduce these elements and provide some context to the incredible growth that the industry has seen over the past decade.

Historical Background

WHERE IT ALL BEGAN

President Jimmy Carter, often referred to as the "solar president", was the first American President to drive solar energy adoption beyond a truly niche market.

Support for the American solar industry began in 1977 with the establishment of the Solar Energy Research Institute (SERI) in Golden, Colorado and a push to install solar across 2.5 million households by 1985.

During a ceremony at the White House in 1979, President Carter famously dedicated a solar thermal system on the roof. He stated:

"As President, I am determined that America will move toward the solar age with effectiveness and determination, with excitement, high spirits, and with confidence. Therefore, I dedicate, this afternoon, this solar heater, harnessing the rays of the Sun to the benefit of those who serve our country at the White House, with the faith that American technology will meet challenges that lie ahead and that we will build a more self-reliant and a more secure nation for the generations to come."[2]

Behind this message, President Carter had a goal to provide 20 percent of America's electricity from the sun by the year 2000. He created a $100 million fund for a newly founded solar energy bank, a 15 percent investment tax credit on solar equipment, and up to $2,000 per home for passive solar designs.[3] Some solar installations from this period are still in operation today.

Unfortunately for President Carter and environmentalists, the support for solar power was short-lived. Ronald Reagan took office following his 1980 election triumph and proceeded to remove the solar thermal system during a re-roofing of the White House in 1986.[4]

[2]http://www.presidency.ucsb.edu/ws/?pid=32500
[3]https://www.washingtonpost.com/archive/politics/1979/06/21/carter-proposes-100-million-solar-energy-bank/7d-7ced0d-56ee-4e30-95c8-4f16e4c038a7/?noredirect=on&utm_term=.1118bdc7bbce
[4]https://www.yaleclimateconnections.org/2008/11/jimmy-carters-solar-panels/

Incentives

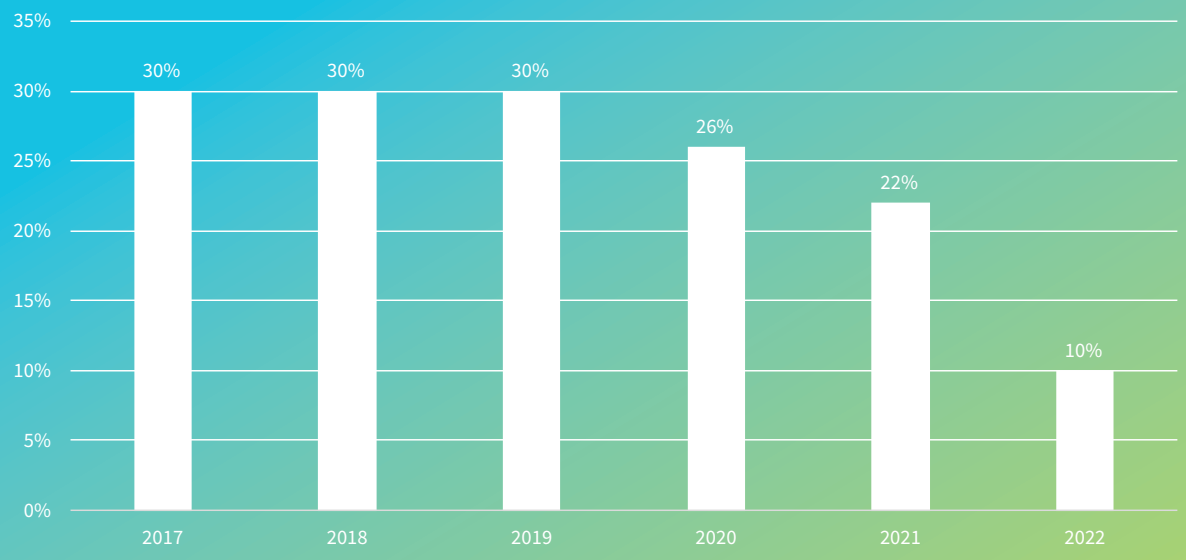
Federal Investment Tax Credit

While the solar industry saw an initial spurt during the Carter Administration in the late 1970s, it was energy policy under President George W. Bush's term that revitalized solar growth.

The Energy Policy Act of 2005 created a 30 percent investment tax credit (ITC) for residential and commercial solar energy systems. After a series of extensions, this is the same tax credit that currently supports the industry. According to the Solar Energy Industries Association (SEIA), the residential and commercial solar ITC has helped annual solar installation grow by over 1,600 percent since the ITC was implemented in 2006 - a compound annual growth rate of 76 percent.[5]

In 2015, the federal ITC received a significant extension through the Omnibus Appropriations Act under the Obama Administration. As costs continue to fall for solar photovoltaic technology, the ITC will gradually decrease to 26 percent in 2020 and 10 percent for commercial and utility projects after 2021.

ITC Stepdown Schedule



American Recovery and Reinvestment Act (ARRA)

In 2009, President Obama signed the American Recovery and Reinvestment Act (ARRA) into law that provided stimulus across the economy following the financial crisis that onset during 2008. Among non-energy incentives, the package included a goal to cut the cost of solar power in half by 2015.

The grant package would spur $13 billion in clean energy investment and support 650 solar power projects across the United States. The package also included goals to increase solar module manufacturing capacity.

1603 PROGRAM

As part of the ARRA incentives, the Obama Administration included an extension for the so-called Section 1603 program that allowed businesses to take a grant in-lieu of the 30 percent federal investment tax credit. According to a Congressional Research Service report, "the Section 1603 grant program was motivated by difficult economic conditions and the perceived lack of tax-equity capacity to support renewable energy projects."[6]

The solar industry had a record year in 2010 as a result of the incentives, resulting in over 800 megawatts of installed capacity.

[5]SEIA. (2019). Solar Investment Tax Credit (ITC) | SEIA. [online] Available at: https://www.seia.org/initiatives/solar-investment-tax-credit-itc [Accessed 28 Aug. 2019].
[6]Congressional Research Service, https://www.everycrsreport.com/files/20111109_R41635_f042092b5c65021d792f0ccb79634694bd9aeea8.pdf

Installations and Capacity

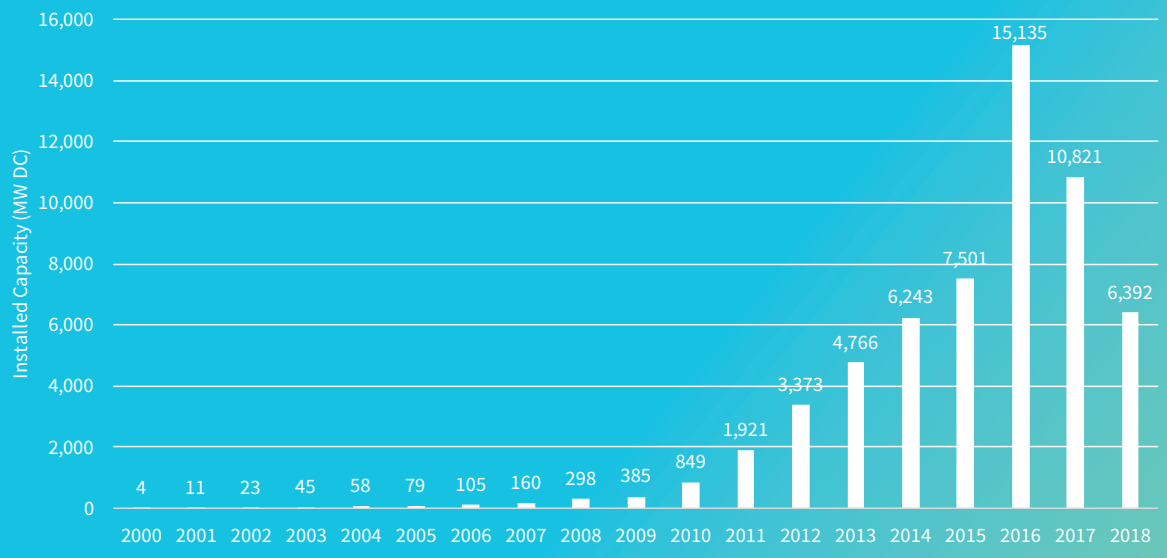
Installed Capacity Growth

The federal programs that launched during the Bush and Obama administrations were the catalysts that helped solar energy emerge into a full-fledged industry across the United States. As a result, the number of new solar energy installations grew exponentially, and the volume capacity (the measure of how much energy is produced) nearly doubled between 2015 and 2016. The graph below highlights this incredible exponential growth.

The year 2016 saw a record number of new solar installations as customers and industry leaders alike feared a looming end to the federal ITC. However, when the ITC was extended in 2015, this growth slowed in the last two years. It's important to note that the growth compound annual growth rate.

[7]GTM Research, U.S. Solar Markets Insight: 2018 Year in Review

Annual U.S. Solar Installed Capacity[7]



Employment

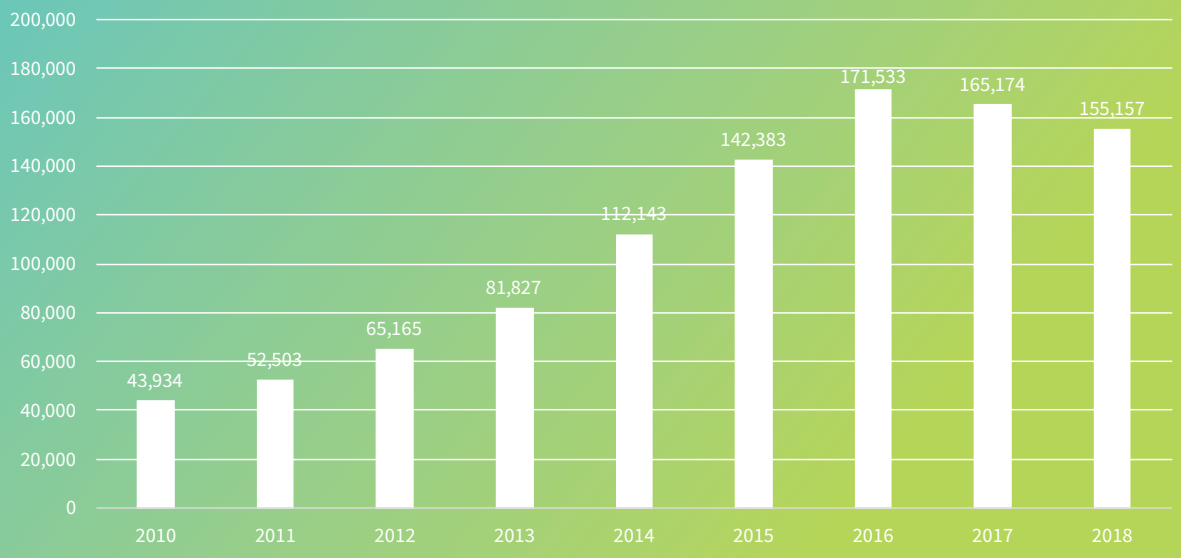
Despite a slight decline in solar industry jobs in 2017, overall employment has increased significantly since 2010 when The Solar Foundation released initial data as part of its annual Solar Jobs Census. This decline, the first since The Solar Foundation started tracking industry jobs, was the result of a slowdown in installations after an accelerated period between 2015 and 2016. This intensity was primarily due to an anticipated expiration of the 30 percent federal investment tax credit that did not occur.

Other reasons for the slight downturn include the uncertainty around the Section 201 trade case and state-level policy and economic challenges, including in California.

The graph below shows this data over time. Installation jobs reflect the majority of solar energy workers, followed by manufacturing and project development, respectively.

[8]The Solar Foundation, Annual Solar Jobs Census

Solar Energy Employment (2010-2018)[8]



Policy

Renewable Portfolio Standards

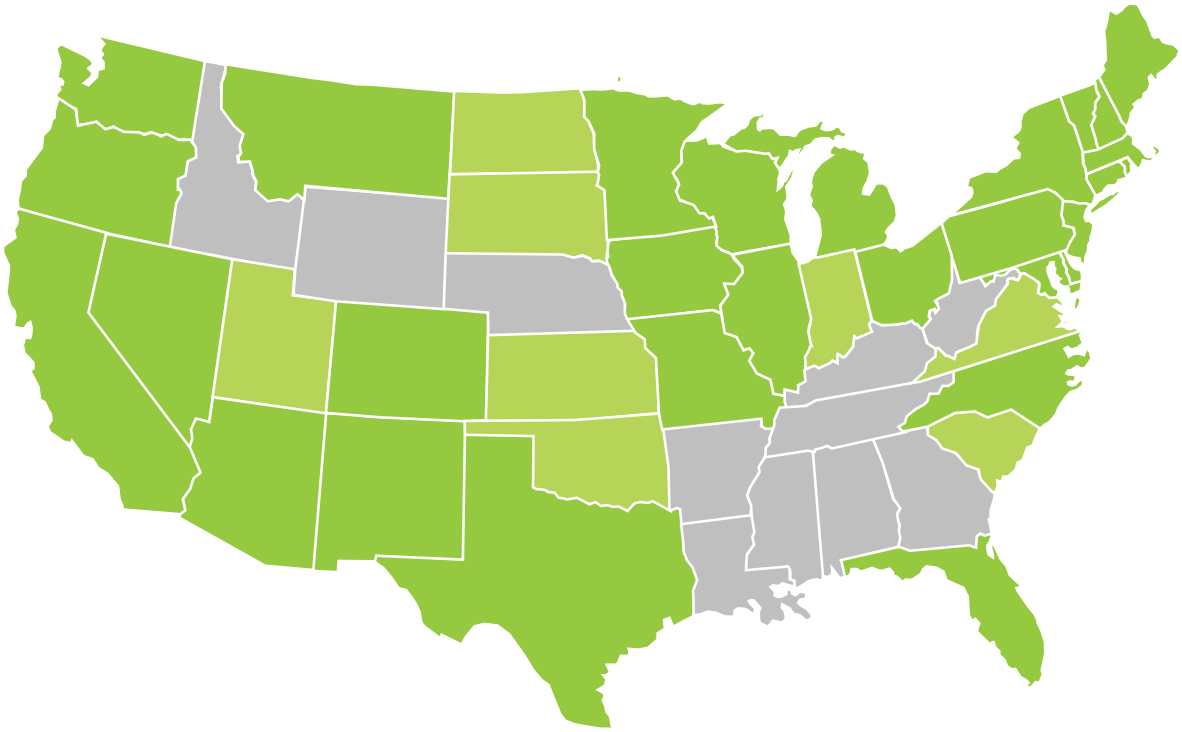
A Renewable Portfolio Standard (RPS), also known as a Renewable Energy Standard (RES), is a state-level policy that is intended to drive further investment and growth in renewable energy technologies and their share of the electricity grid. The RPS includes wind, solar, biomass, geothermal, and sometimes hydroelectric power as part of the policy.

These standards commonly outline a baseline of electricity sales from renewable energy as a portion of the total across the state. For example, Colorado currently has a goal of 30 percent renewable energy for investor-owned utilities by 2020. Within the high-level goal, there are often sub-targets for distributed generation, the deployment of small-scale electricity producing technologies, or specific technologies, including solar.

If utilities do not meet the targets outlined by an RPS, there is usually a fine placed upon the utility at a rate which is higher than it would normally cost to generate renewable energy directly or to purchase Renewable Energy Credits to offset a portion of non-renewablez electricity (see page X for more information on these credits).

While there has never been a federal RPS, these policies at the state level are driving renewable energy adoption. The means by which they operate can differ dramatically, but the goals are often clear and similar. However, some states clearly stand out from the crowd. In September 2018, California Governor Jerry Brown signed a law for the state to reach 100 percent renewable energy by 2045. Across the country in New York, Governor Andrew Cuomo signed the state's own Green New Deal with a similar goal of reaching 100% carbon-free electricity by 2040. With their own policies and incentive structures in place, states like California and New York are two prominent leaders in energy policy, with more states beginning to follow their examples.

State Renewable Portfolio Standards[9]



States with Renewable Portfolio Standards

States with Voluntary Renewable Energy Standards or Targets

States with No Renewable Energy Standard or Target

[9]NCSL.org. (2019). State Renewable Portfolio Standards and Goals. [online] Available at: http://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx [Accessed 28 Aug. 2019].

About half of new renewable capacity since 2000 is associated with state RPS requirements, according to Berkeley Lab.

Renewable Energy Certificates

Renewable Energy Certificate (REC) represents the environmental attributes of a megawatt-hour of renewable energy. RECs provide a measurable way to meet institutional environmental goals. However, the way they contribute to renewable energy adoption and overall cost is confusing and often misunderstood.

A VERY BRIEF HISTORY OF RECS

RECs originated in the late-1990s to create a bundle of environmental attributes associated with a specific megawatt-hour (MWh) of renewable energy that could be tracked and traded in one of two emerging parallel markets: Renewable Portfolio Standards (RPS), and competitive retail electricity supply in California, Pennsylvania and other states.

RECs, initially called Green Tags and Green Tickets, provided a tool for compliance with RPS obligations and a mechanism to allow customers to voluntarily pay for the additional cost of renewable energy. In 2002, the Center for Resource Solutions had developed the Green-e certification protocol for voluntary market RECs. Most RECs are now issued a unique serial number and tracked in an online database, which helps avoid double-counting.

VOLUNTARY AND COMPLIANCE MARKETS

There are two markets for RECs: voluntary and compliance. Voluntary markets involve customers voluntarily purchasing RECs to green their power supply.

Compliance markets involve utilities and electricity suppliers that are obligated to meet state renewable energy standards. Those entities can purchase RECs, in a limited context, to meet their obligations. The eligibility of compliance RECs is determined by state laws and statutes, not by Green-e. For more information visit the Database of State Incentives for Renewables and Efficiency.

Need support? The EPA's Green Power Partnership (GPP) is a national program that encourages organizations to use green power and provides technical and marketing support to participants.

DO YOU NEED TO BE GREEN-E CERTIFIED?

Purchasers of voluntary RECs often wonder if they should limit their purchase options to Green-e certified. Green-e is the nation's leading independent certification and verification program for renewable energy and has earned the trust of buyers and sellers through its time-tested standards and verification protocols.

Green-e is a consumer-protection program that ensures that customers get what they pay for, while setting standards to ensure product quality. While Green-e certified RECs may carry a premium over non-certified, it provides a safe harbor of purchasing standards, ensuring that your supply will be eligible for other programs such as the EPA Green Power Partnership, LEED green building certification, and greenhouse gas accounting protocols.

Green-e can also provide advice on compliance with FTC's Green Guides for marketing claims.

In short, the need to be Green-e certified is up to you and your organization's goals. If you want to create clear impact for official sustainability initiatives or certifications, it's probably a good idea.

REC PRICING

Customers considering a REC purchase face the challenge of deciphering REC prices. REC markets are notoriously opaque when it comes to pricing. There is no over-the-counter transparent market, nor a singular reliable published price. Instead, RECs are largely transacted in hundreds of daily bi-lateral trades between buyers and sellers, often with a broker in between.

Some brokers have been willing to share average or representative trade prices. NREL consolidates those data points and publishes them on their Green Power Network.

Compliance market RECs command a premium over voluntary market RECs. RPS laws are geographically constrained, typically contain a non-compliance penalty and may also contain a solar carve-out, or specific goal for energy generated from solar panels. When RPS supplies are tight or utilities face a non-compliance penalty, they are willing to pay up to the penalty price for a qualifying REC, which in some cases is several hundred dollars per REC.

REC SWAPS

In some cases, solar purchasers may receive a valuable REC that can be arbitraged for a lower priced REC. But what does that mean?

Take the example of a solar facility in Maryland. Compliance market RECs for Maryland are currently selling for about $180 per MWh. A solar customer could sell that REC to a load-serving entity and buy a Green-e eligible voluntary market REC for $0.50. The REC swap allows the solar customer to continue to make green power and carbon avoidance claims, thereby making solar economics more attractive.

THE FUTURE OF RECS

As the price of renewable energy continues to decline, and utility rates continue their inevitable upward creep, the value proposition of solar increases. In areas where solar has reached price parity with the gird, customers may wonder why they would pay any premium for renewable energy.

Some customers will continue to want or need to buy RECs in order to meet corporate environmental goals. With REC prices at a historic low, customers have an opportunity to “green” large volumes of their power at a low premium.

Net Metering

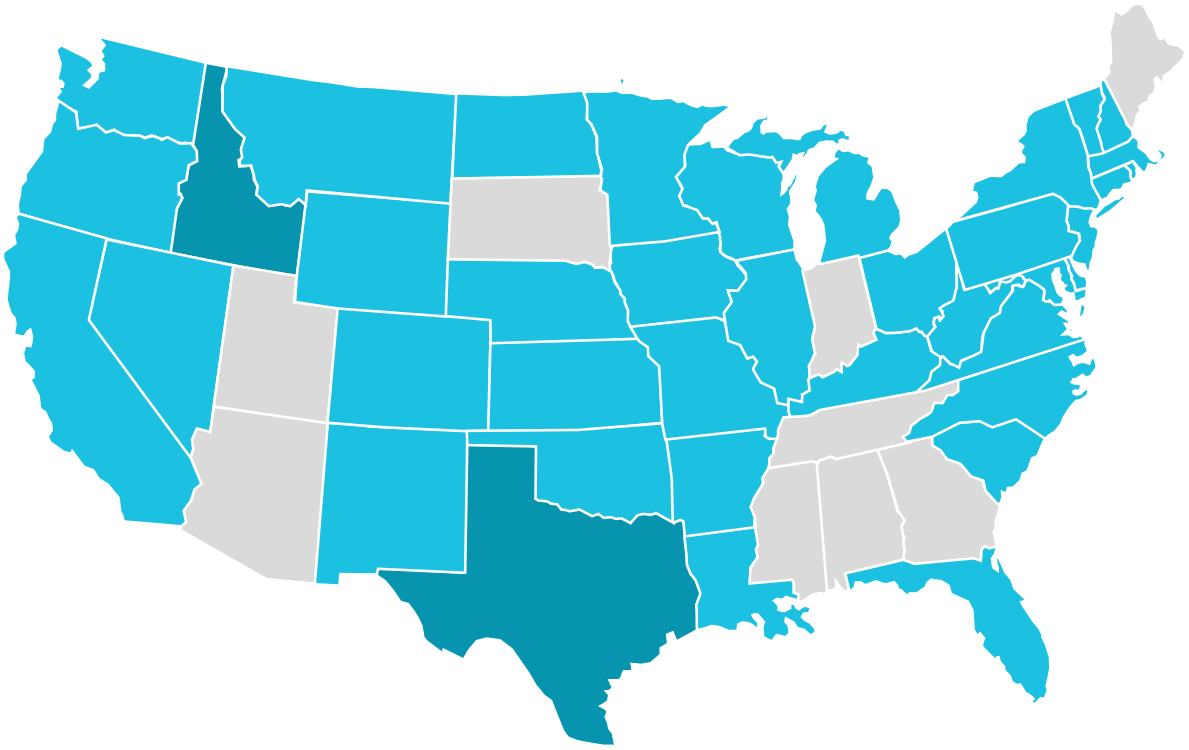
According to the Solar Energy Industries Association (SEIA), net metering is defined as the following:

"Net metering is a billing mechanism that credits solar energy system owners for the electricity they add to the grid. For example, if a residential customer has a PV system on the home's rooftop, it may generate more electricity than the home uses during daylight hours. If the home is net-metered, the electricity meter will run backwards to provide a credit against what electricity is consumed at night or other periods where the home's electricity use exceeds the system's output. Customers are only billed for their "net" energy use. On average, only 20-40% of a solar energy system's output ever goes into the grid. Exported solar electricity serves nearby customers' loads."

In other words, it's basically a billing construct that allows the grid to serve as a storage device for your solar energy production when you aren't using the power on-site. This policy construct has been especially helpful in getting the solar industry off the ground because it allows for overall bill impact even if your energy usage does not match the on-site production of the solar array.

The map on the following page shows where net metering is currently possible across the United States. It is important to note that policies can often change at the utility level rather than just at the state level. Plus, municipal and cooperative utilities will have rules that differ from their investor-owned utility (IOU) counterparts.

Net Metering Availability



Statewide Mandatory Rules for Certain Utilities

No Statewide Mandatory Rules; Some Utilities Allow Net Metering

Statewide Distributed Generation Rules Other than Net Metering

INDUSTRY

City of Fremont's Parking Canopy System at their Police Headquarters in Alameda County, California

Accelerated Depreciation

Another significant policy that influences renewable energy adoption is the Modified Accelerated Cost-Recovery System (MACRS). Adopted in 1986, the MACRS allows business investments to be depreciated over a specified period of time through annual tax deductions.

For solar energy, MACRS is important because it allows for an expedited recovery period of five years versus the useful life of the property (typically 20 years or more). Moreover, "bonus depreciation" has existed for solar energy investments since 2010 to allow for 50 percent depreciation under the first year of service while the remaining 50 percent is depreciated under a normal MACRS period.

To add even more complications (in a beneficial way for solar), the new tax law passed at the end of 2017 allowed for a bonus depreciation of 100 percent, essentially allowing for all depreciable value (calculated at 85 percent of full system cost) to be taken in the first year.

WHAT DOES THIS MEAN?

It means that businesses can further reduce the overall cost of their renewable energy assets by depreciating the equipment faster than they otherwise would. Simply put, it reduces the tax burden for system owners and will reduce overall system cost.

For organizations that choose an off-balance sheet Power Purchase Agreement framework (as most organizations do), the MACRS benefit will be worked directly into the price per kilowatt-hour of electricity charged by the solar energy developer.

Pricing

Cost Comparison

SOLAR COSTS ARE FALLING

The significant decrease in solar installation costs over the last decade has brought grid parity for solar PV in many markets across the United States and the rest of the world. **Grid parity can be summarized as the point when the cost of the alternative energy becomes equal to or less than electricity from conventional energy forms, such as fossil fuels.** As shown in the chart on the following page, the mean levelized cost of energy (LCOE), or average cost for unsubsidized utility scale solar has fallen from $359 per megawatt-hour (MWh) in 2009 to just $50 per MWh in 2017.

This change has been the catalyst behind the growth in the solar industry over the last decade as module costs decline and economies of scale result in savings across the supply chain. The chart shows how utility scale solar PV has dropped below nuclear, coal, and gas in many markets. Plus, the LCOE for subsidized solar energy, including federal and local incentives, is often significantly less than the $50 per MWh shown by the LCOE analysis on the following page.

In summary, the average cost of solar in the United States, and other areas of the world, has become competitive with or even cheaper than other traditional forms of energy.

PRICING ACROSS SOLAR PRODUCTS

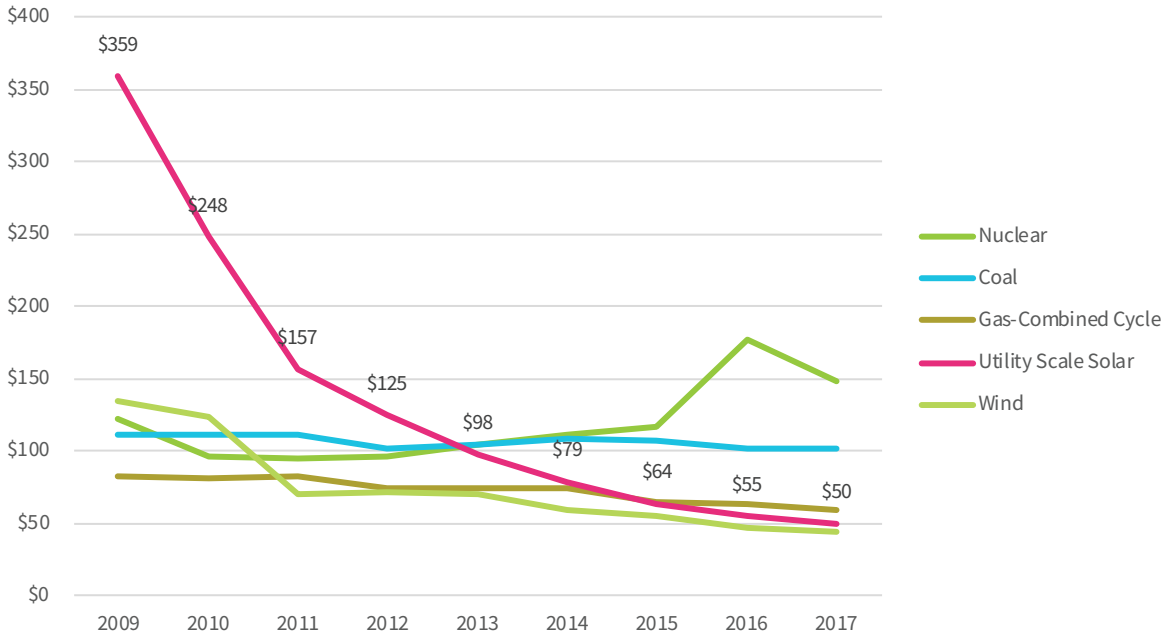
Due to varying installation costs and the direct impact of geography on solar insolation (the amount of sunlight shining down), solar electricity pricing spans a wide range. As shown in the chart to the right, ***unsubsidized*** solar PV generation can range from a low of $43 per megawatt-hour (MWh) for thin film utility scale to $194 per MWh for commercial and industrial rooftop.

Similar to the previous chart, it is important to note that the LCOE analysis includes pricing for unsubsidized solar energy, which does not reflect the federal investment tax credit (ITC), state-level impacts of Renewable Portfolio Standards (RPS), or local tax exemptions.

[10]https://www.lazard.com/perspective/levelized-cost-of-energy-2017/. Reflects Version 11.0, including low and high end means.
[11]https://www.lazard.com/perspective/levelized-cost-of-energy-2017/. Reflects average unsubsidized high and low LCOE range for given version of LCOE study (3.0 to 11.0), primarily for North American alternative energy landscape. Solar LCOE values reflect mean of fixed-tilt (high end) and single-axis tracking (low end) crystalline PV installations.

Selected Historical Mean LCOE Values[10]

Unsubsidized LCOE Comparison[11]



Notes

Exercise:
Understand Your Market

1. Let's start by listing some of the locations that you are considering for solar energy or energy storage. Then, visit **www.dsire.org** to see what incentives or policy frameworks are available to you.

Site Name	Location	Utility	Net Metering	RPS
Levi's Stadium	*Santa Clara, CA*	*Pacific Gas & Electric*	*Yes, up to 100% of annual load.*	*Yes. California has a standard of 60% by the end of 2030.*

2. Do you think that you would want to take ownership of Renewable Energy Credits? Remember, this is important for organizations that want to claim emissions reductions towards an official goal. It's okay if you don't know right now.

SOLUTIONS

Section 2: Solutions

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Solutions Overview

Navigating the myriad of solutions available in the solar industry can be one of the most confusing aspects when considering solar procurement. There are a variety of on-site and off-site product solutions available, as well as a variety of financing and purchasing mechanisms to consider. Plus, the availability and pricing of these products will vary based on local policy, incentives, and solar insolation (access to the sun).

This section introduces the various solar and energy storage solutions in the market while discussing how best to navigate them to find the best fit. We have separated these solutions into two categories: **Product Options and Purchasing Options**. Product options refer to physical solar energy solutions while purchasing options refer to the various financing and procurement options available.

Various Solar and Storage Solutions

Product Options

Rooftop Solar

As a property manager or owner, it is important to minimize roof penetrations and dead load, while also emphasizing quality and cost. Various racking (or panel mounting) solutions are available, including ones that minimize roof penetrations through ballasting. You can choose the best option for your site situation.

CONSIDERATIONS

Dead load: Some roofs are just not prepared to hold extra weight on the roof. Ballasted solar typically adds about 4 or 5 pounds per square foot and pales in comparison to snow load requirements that can reach 30 or 40 pounds per square foot in certain geographies. While solar isn't much added in comparison, some roofs are just too old and would not pass a structural review. Modern roof structures are usually adequate and ready to support the minor added weight.

Penetrations or Lack Thereof: In most geographies, roof-mounted solar on flat roofs can utilize modern ballasts and slip sheets to minimize or even eliminate the need to make any penetrations. However, if hurricane-force winds are an issue or if your roof has over a 10-degree pitch, it may be necessary to connect directly to the roof structure below the membranes or shingles. Rest assured, there are many roof flashing options that can reduce or eliminate the likelihood of leaks.

Available Space: Roof-mounted solar is typically the right fit when you don't have other space available, such as open land or a parking lot. Roof-mounted solar is ideal in urban or suburban areas where land value is at a premium. However, if your organization wants the community to see the installation, it might be a better option to do a ground mount or parking canopy project.

Roof Age: A solar installation's life is typically planned for 20 or 25 years, meaning that it is important to make sure that your roof is ready to last that long prior to the solar installation. Otherwise, it can be a time-consuming process to remove the solar installation, re-roof, and re-install solar during the contract term. Plus, if your roof is new or if you are able to re-roof during the solar installation, it is sometimes possible to roll the installation cost into your solar project for financing or tax benefits.

Parking Canopy Systems

With solar parking canopy systems, you can leverage your existing parking lot to reap the benefits of renewable energy. Parking canopies offer a cooler place to park in the summer, protection from the elements, and clean, renewable electricity for your organization.

CONSIDERATIONS

Available Parking Space: Do you have an open parking lot located next to your building? If so, a solar parking canopy system might be a good fit. In places where there is good sun exposure, parking canopies are often preferred over rooftop installations

Protection from the Elements: Solar parking canopies are very popular in hot climates where shade is highly valued by both customers and employees. Likewise, parking canopy systems are highly valued in places with a lot of rain and snow so that cars and people are protected. Therefore, you might see a lot of solar parking canopy systems installed in places like Arizona, but also in Massachusetts and New York.

LED Lighting and Security: Solar parking canopy systems often come with security lighting to protect people and valuables underneath. These are especially popular for schools and businesses in densely populated areas. Cameras and electric vehicle charging stations can also be integrated to increase the level of service provided.

Paso Robles Joint Unified High School District in Paso Robles, California utilizes solar parking canopy systems to keep buses and staff cool during hot summer days.

Guilderland Central School District's 3 megawatt ground mounted solar farm in Altamont, New York.

Ground Mounted Solar

If you have available land at your facility or nearby, ground mounted systems offer the best value and economies of scale, resulting in the quickest payback period or the lowest cost of electricity from the first day. The systems are customized for your site based on the local environment, orientation, and electrical design.

CONSIDERATIONS

Available Space: Unlike rooftop solar or solar parking canopy systems, ground mounted solar will take unused space near your facility. While it is a great option if you have the space, you should keep in mind that you won't be able to use that space for the next 20 years.

Best Value: Ground mounted solar offers the best value per watt compared to other installation methods. Installation, including materials and labor, is typically cheaper than roof-mounted or parking canopy solutions due to economies of scale and a simplified racking design.

Optimized Electricity Generation: Ground mounted systems are not limited by the slope of your roof or size of your parking lot, allowing customized panel tilt to maximize electricity production. These solutions also offer more flexibility with the site layout and row spacing. Solar trackers, which automatically adjust module tilt throughout the day, may also be good candidates for your site.

Community Solar

For some customers, on-site solar projects simply do not work. Roof conditions, changes in energy consumption over time, and overall available space can all make considering an on-site solar system a challenge. Community solar, procured from off-site installations, helps avoid these challenges and reduces the risks associated with site closings and load changes over time.

If you are in a state or utility service territory with a community solar program, you can purchase a percentage of the output from ground-mounted community solar arrays located on land leased by a local solar energy developer.

The power generated by each community solar site is interconnected into the utility grid, delivering renewable power to your utility provider. Your utility provider will, in turn, credit your bill based on the production associated with your purchase.

CONSIDERATIONS

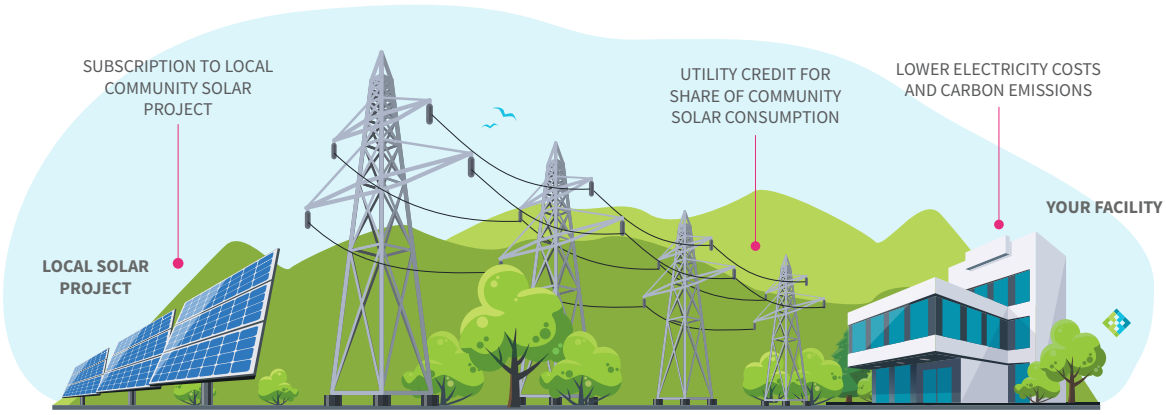
Off-site Location: Community Solar is located at a nearby site in your community, eliminating space constraints and other limitations of on-premises development, all while keeping environmental benefits local. On the other hand, if you want the benefit of a visible project at your location, this would not be the best option for you.

Great value: Ground mounted solar is the best value per watt compared to other installation methods due to economies of scale.

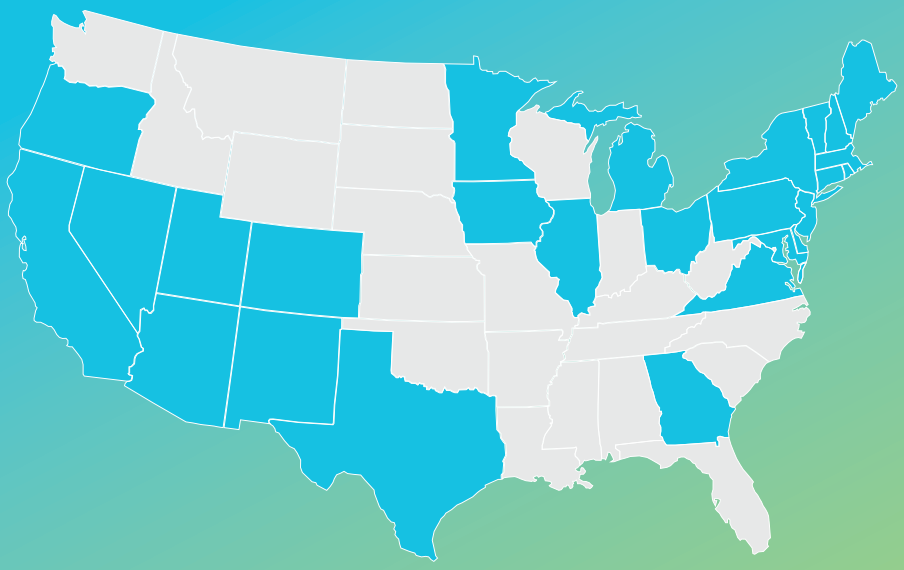
Scalable: Depending on local community solar regulations, you can subscribe to the amount of electricity you need, up to 100 percent of your usage. If you change facilities, you can usually transfer your subscription.

Availability: Community Solar is a relatively new program that is expanding quickly across the United States. The map on the following page shows where these programs are currently available.

How Community Solar Works



Community Solar Availability



States with Community Solar

Wholesale Purchasing

Do you have a big appetite for electricity and are you interested in long-term contracts? If so, wholesale power purchasing might be a good fit for your organization.

Wholesale power purchasing involves choosing an independent electricity provider for the generation component of your bill while transmission and distribution will continue to be provided by the local utility. The catch is that this is only available in deregulated utility markets. In regulated markets, there is no "retail choice" to allow a customer to choose the electricity provider.

CONSIDERATIONS

Avoid On-Site Challenges: Wholesale solar energy procured from off-site installations helps avoid on-site challenges and reduce the risks associated with site closings and load changes over time.

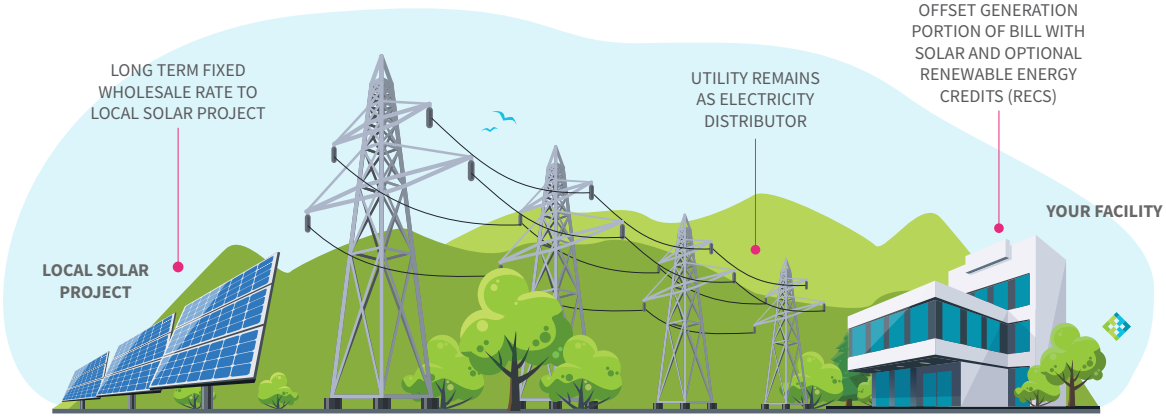
Price Certainty: It's no secret that energy prices can be highly volatile. Technology, global politics, and economics collide in the energy markets resulting in volatility that leaves consumers victim to the unpredictable dynamics. By contrast, wholesale solar procurement allows you to buy power at a stable, predictable rate over the long term.

Scalable: Wholesale solar procurement unlocks significant development scale. In many cases, your company or organization can achieve sustainability goals by reaching 100 percent renewable power generation through wholesale purchasing-- something difficult to accomplish with on-site development alone.

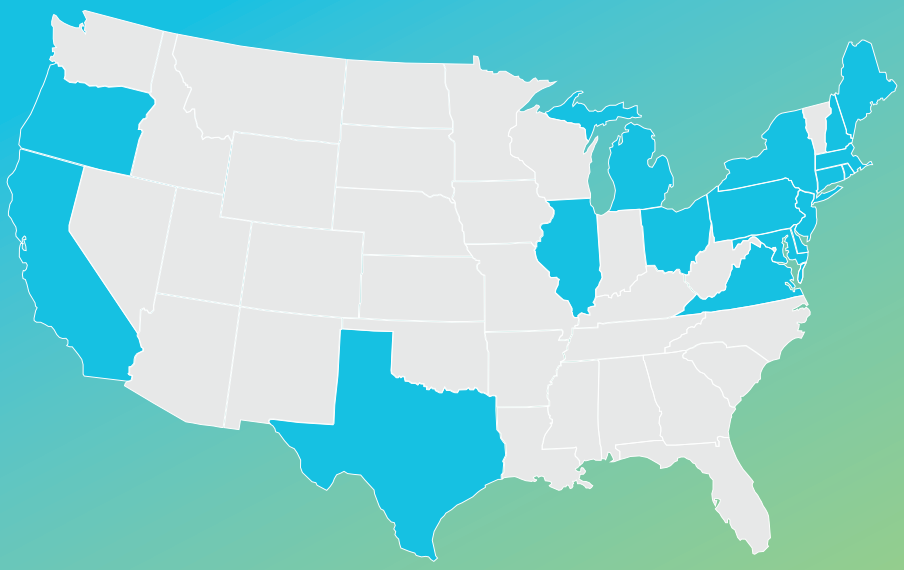
Geographic Limitations: Wholesale power purchasing through a provider other than your local utility company is only available in deregulated electricity markets where consumers are free to select their suppliers. See the map on the following page to know where this is possible.

Wholesale purchasing allows organizations in "deregulated" electricity markets the option to choose their energy provider. You still get your electricity from the same grid, but your wholesale source may differ.

How Wholesale Purchasing Works



Retail Choice Availability



States with Retail Choice

Energy Storage

Energy storage uses innovative lithium-ion battery technology coupled with advanced software to adjust your electricity usage. When costs are low, the system will draw power from the grid and charge the batteries. When costs are high during "on-peak" hours, the storage system will discharge to lower your consumption of electricity from the utility. The result is a smoother load curve, or variation in demand, resulting in lower electricity costs over time. See the charts on the following page.

CONSIDERATIONS

Reduce Peak Demand: High demand charges can account for up to 50% of your electricity bill, based on the most intense 15-minute spike in usage each month. This would be the cost of running your AC in the middle of hottest day or running your heater during the coldest winter night. Energy storage reduces usage spikes and demand charges with no upfront cost to our customers.

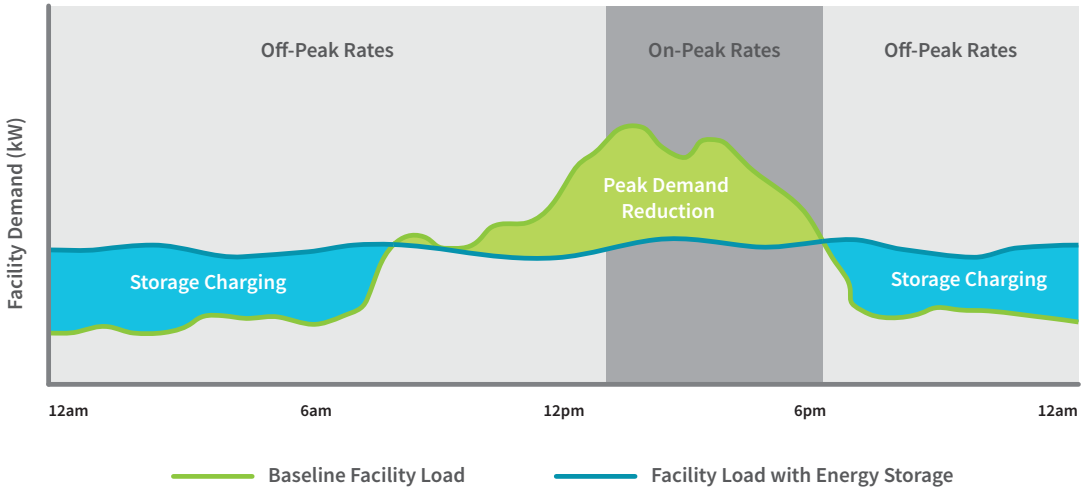
Solar Plus Storage: Energy storage and solar form a symbiotic relationship that can offer even more savings. On-site solar power can add more charging power during the day while also contributing to reduced demand charges. Plus, by combining storage with solar, your storage project costs are currently eligible for a tax credit under the Federal ITC.

Backup Power and Resiliency: Storage systems can provide backup power to your facility. Stored energy is charged by the solar system and can be reserved for emergency operations.

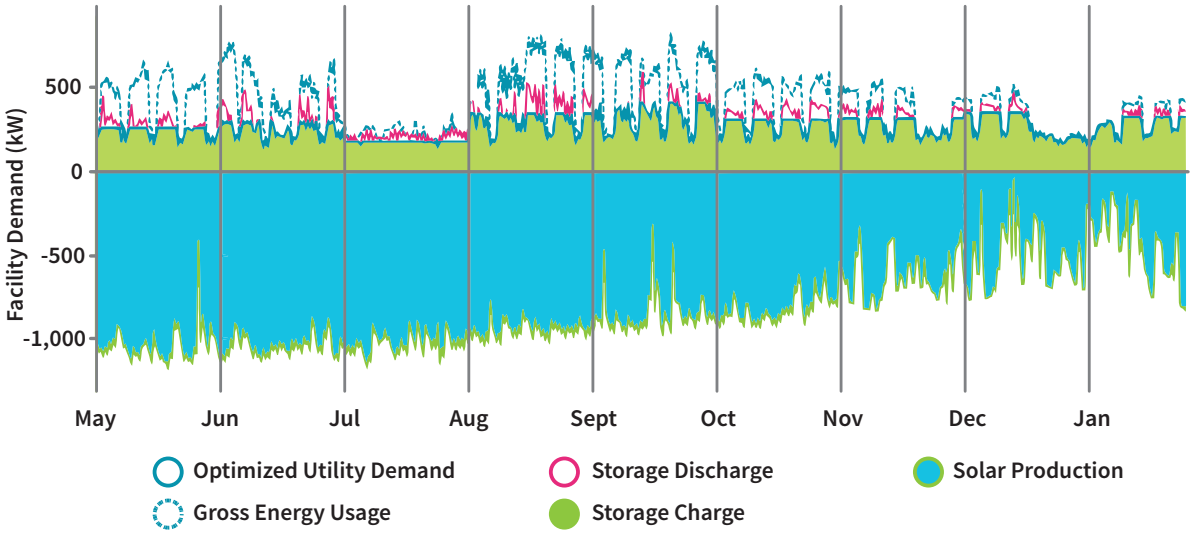
Load Shifting: Electricity is more expensive during peak periods when demand is highest. Energy storage allows you to shift your consumption to off-peak periods when electricity is least expensive. See the figures on the following page to see how solar and storage work together to shift loads and reduce peak demand.

Geography: Because energy storage is an emerging technology in some places, the opportunity to combine energy storage with solar works best in markets where there are large swings between on-peak and off-peak pricing.

Sample Daily Load Profile with Storage



Sample Multi-Month Load Profile with Storage



Product Add-Ons

SYSTEM MONITORING

Once your system is up and running, the most interaction you will have will likely be with the system monitoring package on your computer and smart phone. These web-based asset management applications deliver insight into the performance of your solar project, including a wealth of raw data. It is important to consider what package you will be getting when you make a procurement decision.

PORTFOLIO MANAGEMENT

Do you have multiple facilities that need renewable energy? Some companies are able to offer discounts when you increase the scale across multiple meters or sites.

OPERATIONS & MAINTENANCE

If you purchase the system outright, you might be planning your own O&M or you will need to enter into an O&M contract with a firm to visit your site and make sure everything is running properly.

You can also enter into a Power Purchase Agreement (PPA), whereby you pay only for the power generated by the system. This framework incentivizes the system owner to make sure everything is running optimally over the entire term of the contract. See the next section for more details.

RESIDENTIAL SOLAR PROGRAMS

If you are a big company that is procuring solar at scale, you might want to consider a residential solar program for your customers or employees. This can really make an impact beyond your own sustainability or cost reducing measures. Programs may include rooftop solar or subscriptions as part of a local community solar project.

Sample Performance Monitoring and Management

Having access to a monitoring portal is a key component of system management for both solar power system owners and customers alike. Look for a solution that provides the data and flexibility that you need.

Purchasing Options

Every organization has very specific purchasing requirements. Whether you're focused on optimizing your balance sheet, maximizing tax benefits, or enhancing company sustainability initiatives; you can typically find a customized energy purchase model that can meet your needs. Here are some of the purchase options that can be leveraged today, although it is important to note that availability varies across states, utility service territories, and sometimes local jurisdictions.

CASH PURCHASE

By directly purchasing solar energy at your location, you own the full tax benefits and any additional local incentives for the system. This is comparable to investing in a bond that provides great long-term dividends and earnings through your decreased energy expenses for the full lifespan of the system.

POWER PURCHASE AGREEMENT

Under a Solar Power Purchase Agreement (PPA), customers enter into a financial agreement with a developer who will provide the design, permitting, financing, and installation of either an on-site or off-site solar project at no upfront cost to the customer. Customers benefit from the receipt of clean, renewable energy without capital outlay or the complexity of ownership.

The developer earns income by selling the energy (kWh) generated by the system to the customer at a fixed rate that is typically lower than the local utility's retail rate. The developer uses the revenue from the PPA in addition to any tax credits and other incentives generated by the system to recover the initial costs of development and installation.

PPAs typically last for 20 years and the developer is responsible for the operation and maintenance of the system for the duration of the PPA term. At the end of the PPA contract term, a customer may be able to extend the PPA, have the developer remove the system, or purchase the solar energy project from the developer.

PACE FINANCING

Property Assessed Clean Energy (PACE) is an alternative loan product that helps customers overcome any barriers of high up-front building improvement costs. While PACE financing does not reduce the total cost, it spreads the cost of an energy solution over a twenty-year period. Repayment is managed through your property tax bill.

OPERATING LEASE

Under an operating lease, the customer makes regular payments to the provisioning bank, and can claim the system for tax benefits. The solution is used as collateral and at the end of a typical ten- to fifteen-year lease period, the title for the solar installation transfers to the customer. An operating lease is appealing to organizations that may not have the required credit to secure a Power Purchase Agreement (PPA).

Financing Options At A Glance

Site Name	Cash Purchase	PPA	PACE	Lease
Term	-	10-20 Years	20 Years	5-15 Years
Customer Ownership	Yes	No	Yes	TBD
On Balance Sheet	Yes	No	TBD	TBD
Credit Check	No	Yes	No	Yes
Upfront Cost	Yes	No	No	No
Tax Benefits	Yes (Private Entities)	Yes (via Tax Equity)	Yes (Private Entities)	Yes (via Tax Equity)

Find the Right Fit

On-Site vs. Off-Site

The first question that you might pose when considering the various products available is "should I procure on-site or off-site solar?" Typically, the answer to this question will be determined by a quick analysis of your space available and local policies. Below is a quick overview of items to consider.

WHEN ON-SITE SOLAR MAKES SENSE

Project Marketability: You desire maximum visibility of your commitment to sustainability. You want employees, customers, and partners to see your solar project(s).

Direct Offset: You prefer to consume the energy from your solar project directly rather than have a credit on your bill from procured energy from an offsite location.

Available Space: Your facility has a large rooftop, an expansive parking lot, or land available to host the solar energy project. Moreover, the space that you have available for solar is adequate to make a significant impact on your current electricity load.

Net Metering: If you want to install on-site solar, you would most likely take advantage of local net metering laws. Net metering allows you to get credit for excess solar energy production that you send to the grid so that it still makes a financial impact when your system is not producing power. However, if you have a facility that consumes a lot of electricity and solar would always be consumed on-site rather than sent to the grid, you could consider a "non-export" installation that doesn't need net metering to make financial sense.

Long-Term: You anticipate that you will be in your current facility for at least the next 20 years. This will allow you to maximize savings for an on-site solar project.

WHEN OFF-SITE SOLAR MAKES SENSE

Group Participation: Do you want to take part in a community solar project? If so, you might be able to subscribe to an off-site location along with local residents and organizations. Large electricity consumers may also have an opportunity to become an "anchor" subscriber to be the catalyst to make a project happen.

Flexibility: If you are concerned that your facility location or energy load may change over time, an off-site solution would provide the flexibility to change billing and crediting. Plus, you can size your solar energy procurement to suit your needs.

Limited Space: You might simply not have enough space at your facility to install the solar energy system that provides the production you need. In this case, off-site solutions can provide the scale necessary to make a considerable impact.

Credit Transfer: Would you like to split solar production across multiple meters or facilities? With off-site projects, you can typically choose the amount of production for each individual meter. Plus, you can typically transfer your credits, subscription, or contract to another location if your facility moves (usually within the same utility service territory).

Speed: Sometimes you want to make the decision to adopt solar very quickly. If that is the case, there are sometimes off-site projects that have space available for wholesale contracts or community solar subscriptions. You can simply sign up without waiting for an installation to be completed.

Purchase vs. PPA

WHEN PURCHASING A SYSTEM MAKES SENSE

Cash Available or Bonds: You have a significant amount of money available for an investment and you don't mind waiting for the payback from cheaper electricity.

Tax Liability: Purchasing a system outright can make good sense for a business with the tax liability to reap the benefits of the Federal Investment Tax Credit. Otherwise, you might be missing out on this huge benefit.

O&M Contract: You might have a savvy staff of maintenance professionals that are ready to work on the solar project and keep it humming along. If not, you could enter into a maintenance contract with a solar energy firm that is up for the task.

WHEN A POWER PURCHASE AGREEMENT MAKES SENSE

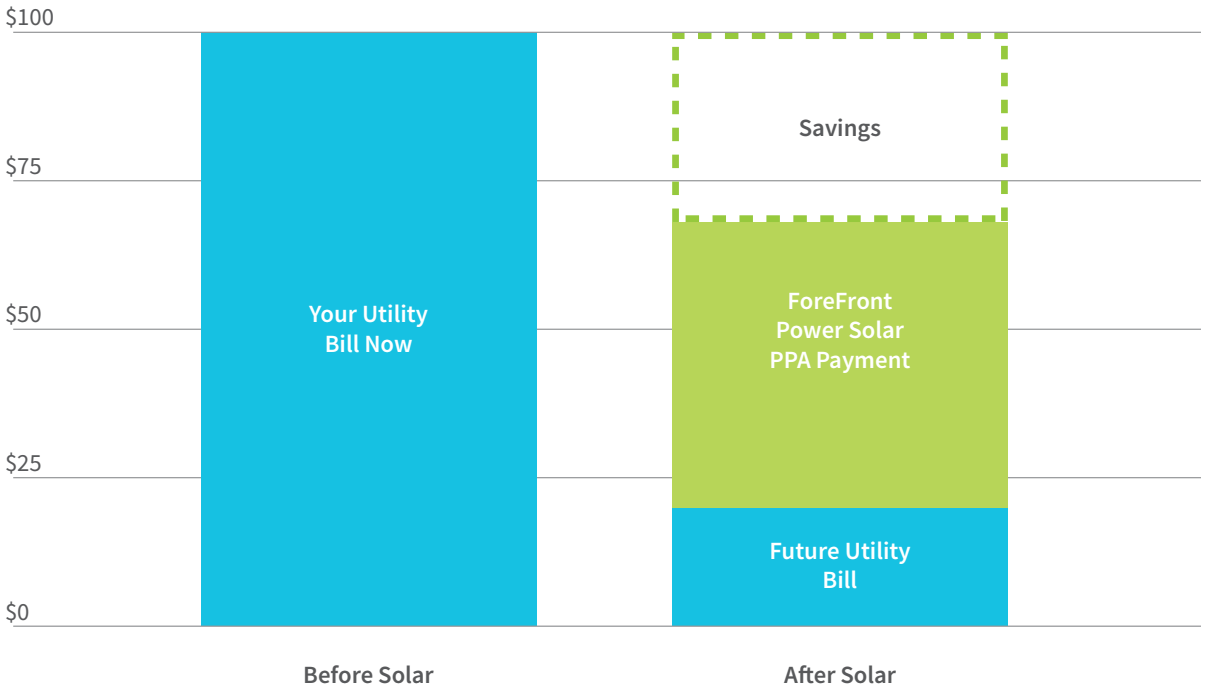
No Upfront Cost: the PPA model allows you to adopt solar energy without any upfront cost. The investment is taken on behalf of the solar energy developer (and their investor partners) to leverage available incentives and translate them into a low kilowatt-hour rate for your organization.

Performance-Based: If you are worried about the system working properly over the long haul, the PPA allows you to pay for the kilowatt-hour electricity generated by the solar facility. This means that interests are fully aligned to produce reliable power for the entirety of the contract term.

Price Certainty: Many PPAs are available today with flat rates that are static over the term of the contract. In some markets, escalators exist to follow inflation during the term. If utility rates rise as they have in the past, your electricity costs are still predictable and serve as a hedge.

Included O&M: A PPA includes asset monitoring throughout the contracted term along with preventative cleanings, maintenance, and coverage for all repairs and warranties. All costs are included in the PPA rate.

How a Power Purchase Agreement Lowers Utility Costs



A Power Purchase Agreement lowers your overall electricity costs by offsetting a portion of your total utility bill with solar energy at a lower rate per kilowatt-hour (kWh) that what you would normally pay the utility.

Notes

Exercise:
Find the Right Fit

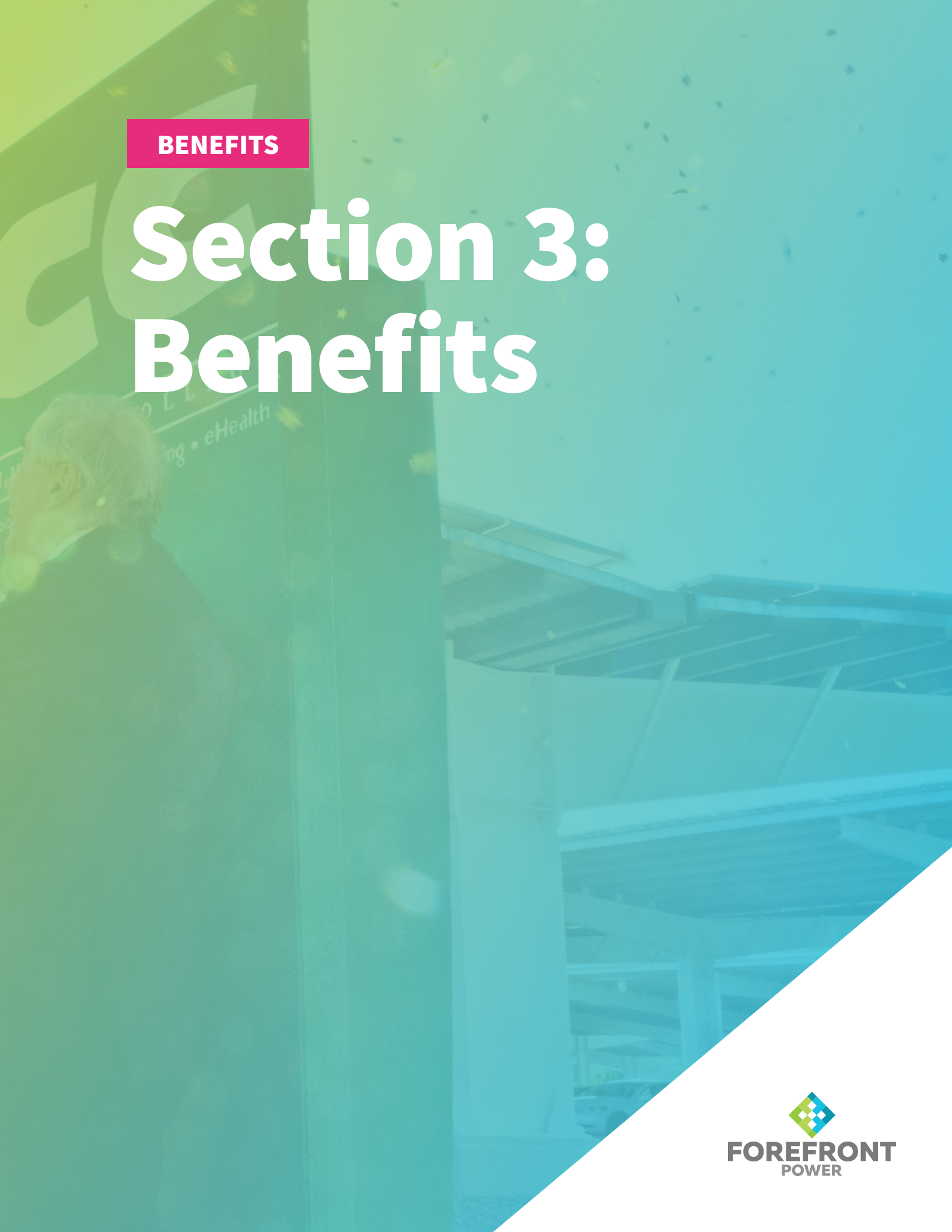
1. What are you hoping to achieve by embarking on renewable energy for your organization? This is important to know in advance to set your goals for the process.

Question	Answer	Notes
Do you have cash available or loan/ bond money to purchase a system?	Yes or No	
Do you have available space? (i.e. rooftop, parking lot, or open land)	Yes or No	
How long will you be in your facility?		
Does your organization pay taxes?	Yes or No	
Do you have access to your facility electricity data?	Yes or No	

2. Do you think that you would want to take ownership of Renewable Energy Credits? Remember, this is important for organizations that want to claim emissions reductions towards an official goal. It's okay if you don't know right now.

BENEFITS

Section 3: Benefits



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Electricity Cost Savings

Most organizations adopt solar energy and energy storage for one simple reason: to save money. As shown in the previous sections, the cost of solar power has fallen to the point where it now undercuts existing utility electricity prices in many markets across the United States.

While savings vary by geography, product type, and site conditions, most organizations achieve rates that range from 5 to 20 percent below their existing rate. Multiply this savings rate across each kilowatt-hour of electricity generated over 20 years and it is easy to see how sizeable the impact can be.

CASE STUDY: FAIRFAX SCHOOL DISTRICT

ForeFront Power started working with Superintendent Michael Coleman at Fairfax School District (SD) in 2015 to create a renewable energy project to meet the needs across two locations, Zephyr Lane Elementary School and Shirley Lane Elementary School.

Given the availability of space at Zephyr Lane and the close proximity to the Shirley Lane campus across South Fairfax Road, our engineers were able to develop a single project solution to serve both locations.

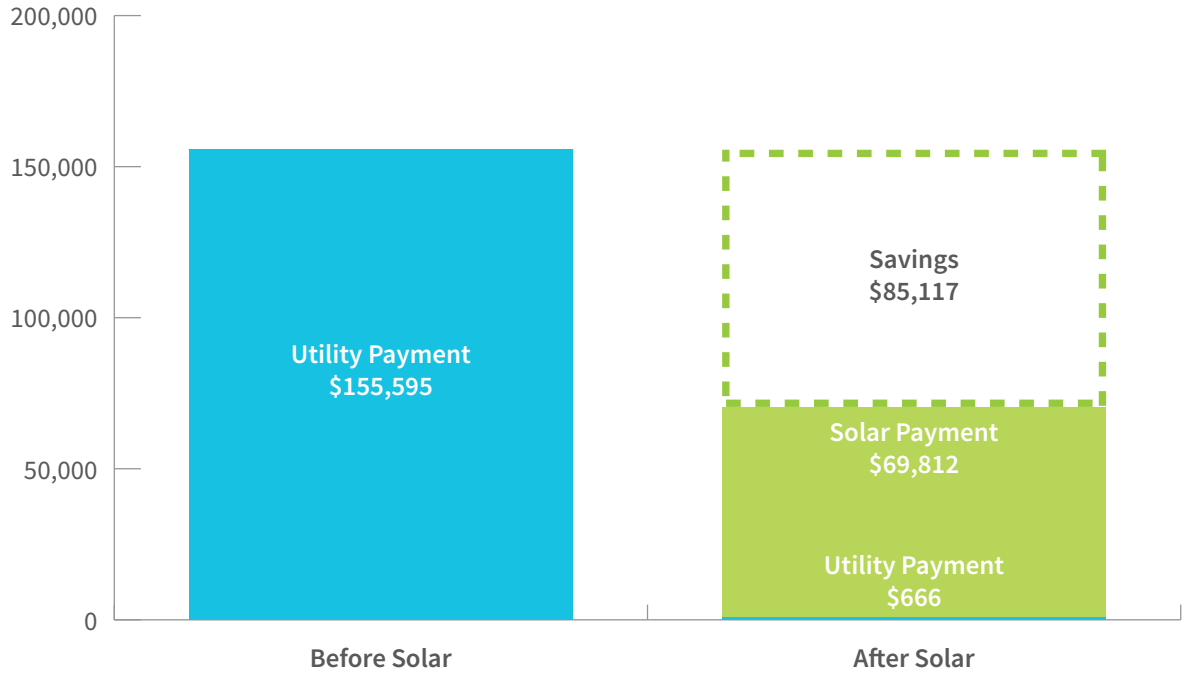
The result was a 375 kilowatt (kW) ground mounted project that produces over 750,000 kilowatt-hours (kWh) of clean energy annually for the District. The system utilizes an innovative tracking mechanism by NEXTracker to follow the sun as it moves across the sky each day.

Fairfax School District utilized an innovative purchasing framework through School Project for Utility Rate Reduction (SPURR) that allows public agencies in California to “piggy-back” a competitive Request for Proposal process for solar energy. SPURR’s program mitigates many challenges of public procurement, like consultant fees and long contract negotiations.

When we revisited Fairfax SD to calculate savings, we estimated that the District has saved over $85,000 on their electricity costs. Prior to solar energy adoption, electricity expenses at the two locations totaled $155,595 annually. This utility payment is now reduced to $666 while a solar Power Purchase Agreement payment of $69,812 is added to total $70,478 of electricity expenses. The chart to the right highlights this information.

The 375 kilowatt (kW) solar array at Fairfax School District saved an estimated $85,117 in electricity costs during the first year of operation.

Savings Analysis for Fairfax School District (CA)



Sustainability Impacts

Does corporate social responsibility (CSR) matter to your organization? Do your employees, customers, or shareholders care if you adopt renewable energy or report on your sustainability metrics?

CSR means financial returns and competitive benefits, especially for businesses. Initiatives such as reducing your emissions with renewable energy, holding volunteer events, developing sustainable products, or enhancing your safety procedures can have the following impacts:[12]

INCREASE YOUR MARKET VALUE

Investors prefer companies with responsible business practices and reward them with higher share price and value. Project ROI estimates that this can increase a company's potential market value by up to 6%.

ADD REVENUE

CSR initiatives make people feel good about your business and have the potential to increase customer satisfaction, foster trust, and generate new revenue. This could translate to as much as 20% more sales revenue, meaning especially big gains for large companies.

ALLOW YOU TO CHARGE A PRICE PREMIUM

CSR's potential for improving brand reputation and marketing means that customers are willing to pay up to 20% more than they would for a comparable product without the same CSR attributes.

INCREASE EMPLOYEE PRODUCTIVITY

People appreciate working for companies that positively impact their communities and engage in social ventures. Companies that adopt CSR practices can enjoy up to 13% higher productivity from their workers than the corporate average, according to a separate study from UCLA. Employees may value a company's CSR initiatives so much that they're willing to accept less pay, or even accept a pay cut up to 5%.

REDUCE TURNOVER

When employees are satisfied with where they work, they don't go looking for alternatives, and companies don't have to hire and train new employees as often. Companies with CSR initiatives can reduce their staff turnover rate by as much as 50%, yielding company savings of 90-200% of an employee's annual salary for each staff member retained.

"Project ROI", a report by the research firm IO Sustainability, shows that sustainability benefits go way beyond the direct impacts for the community, planet, and employees. Check out the graphic to the right to see what it can mean for your organization.

[12]http://www.impactroiglobal.com/project-roi/

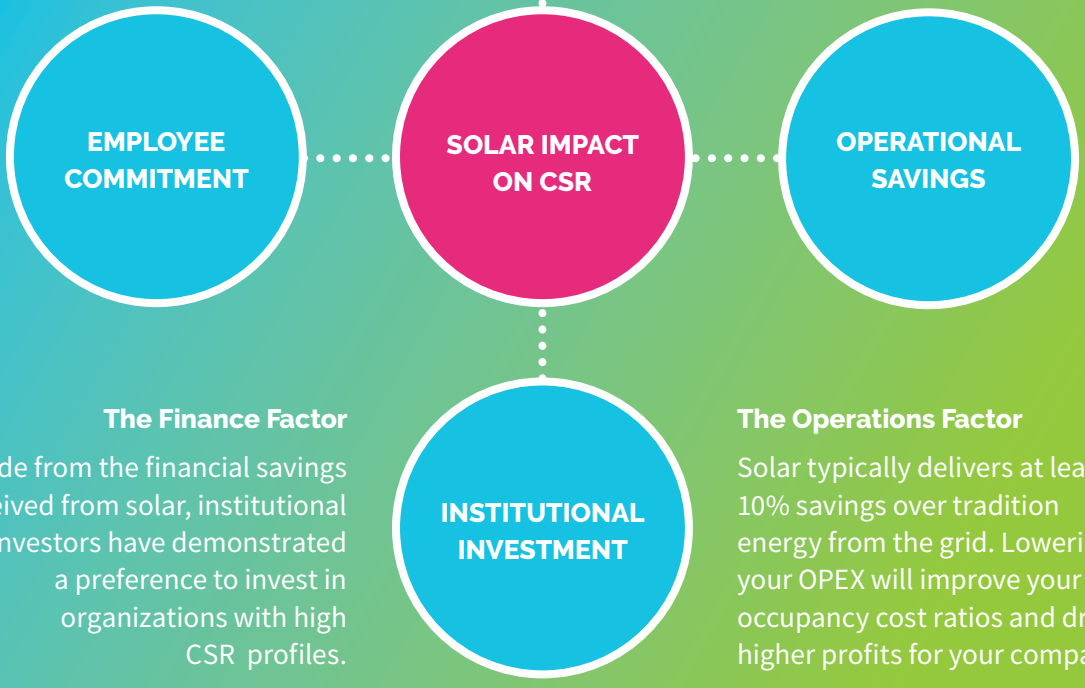
The Strategic Impact of Corporate Social Responsibility[12]

The Human Resources Factor

Promoting your CSR efforts with employees can lead to a 3 to 3.5% improvement in retention while providing new perks and becoming an attractive place to work for new talent.

The Sales & Marketing Factor

Promoting your CSR efforts with solar can lead to new sources of revenue for your organization. This could mean 2.0% to 5.0% for companies willing to engage in the marketing of their efforts.



The Finance Factor

Aside from the financial savings received from solar, institutional investors have demonstrated a preference to invest in organizations with high CSR profiles.

The Operations Factor

Solar typically delivers at least 10% savings over tradition energy from the grid. Lowering your OPEX will improve your occupancy cost ratios and drive higher profits for your company.

Notes

Exercise:
Project Benefits

1. What are you hoping to achieve by embarking on renewable energy for your organization? This is important to know in advance to set your goals for the process.

2. Let's prioritize the benefits available to your organization and think about what you think would make your project successful.

Benefit	Goal
Sample: Lower Utility Costs	*Save 10% or $10,000 annually.*
Lower Utility Costs	
Reduce Emissions	
Expand STEM Learning Opportunities	
Attract More Employees	
Be a More Respected Organization	

Looking Forward

KEY TAKEAWAYS

After reading this guide, you should have a better understanding of solar market policy, the types of solutions, and the various financing options. In summary, here are the key points from this guide:

- ✔ Solar energy has been around for a while and is an established, cost-competitive player in the energy market
- ✔ Tax incentives are available depending on the level of responsibility you want to take on
- ✔ Rooftop isn't the only option – off-site and community solar are just as viable and affordable
- ✔ Energy storage and net metering address the dilemma of when the sun doesn't shine
- ✔ Electricity savings and sustainability benefits impact business' bottom line

NEXT STEPS

With this understanding, you can now move forward in the process of deciding if solar is right for your business.

As you enter the **Evaluation Phase**, our next guide will help you decide which solutions are right for your facilities . In order to do so, we'll look at what information you can gather internally to understand your unique situation and the various factors that should be considered.

Having this knowledge is intended to empower you to be the change advocate and a key player in helping your organization achieve its savings and sustainability goals.

Visit www.forefrontpower.com/resources to download the next guidebook in our Energy Education Series.

FOREFRONT POWER

ForeFront Power has more than a decade of renewable industry experience, serving business, public sector, and wholesale power customers around the world. Our team has developed over 800 MW of capacity across more than 1,000 projects, targeted on assisting public sector agencies and C&I firms to deliver the most impactful behind-the-meter, virtual, and wholesale solutions.

ForeFront Power is a wholly owned subsidiary of Mitsui & Co., Ltd., a global energy infrastructure and investment leader. Mitsui brings a strong balance sheet and global presence to its partnership with ForeFront Power. The company offers substantial financial liquidity due to its strong profitability and is proud to have a credit rating of A from Standard & Poor's and A3 from Moody's.

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