INTRODUCTION

Over the last several years, energy markets have dramatically changed, and the solar power industry has significantly matured. The days of one-off projects driven by Innovators and Early Adopters are past. In place of individual opportunistic projects, energy-conscious organizations are implementing comprehensive, long-term roadmaps that strategically utilize solar power in a portfolio of sites to enhance brand equity and achieve clear financial goals.

Now that solar has “crossed the chasm” and moved into the mainstream, the Early Majority is building upon the experiences of the earlier phases. By taking advantage of established business models, organizations are obtaining long-term energy cost stability from clean, reliable on-site generation.

Partnering with experienced, global Energy Solutions Providers (ESPs) is essential to creating successful strategies in this new landscape. Financing, implementing, and managing a portfolio of solar systems across multiple sites—as well as ensuring expected returns are achieved—requires the ability to skillfully align three critical components:

1. Technology
2. Public Policy
3. Finance

Each of these factors is critical to create winning scenarios. When expertly combined, they unlock the maximum value of solar power.

CROSSING THE CHASM
PROVEN SOLAR TECHNOLOGIES DELIVER GREATER VALUE

Raw silicon may be a commodity product, but solar systems are not. Solar systems are carefully engineered power plants that should deliver value for decades and must be rigorously evaluated to accurately forecast long-term value. Those performance forecasts drive calculated returns on investment and other financial metrics. To accurately model performance requires experience, technical expertise, and reliable technology. However, not all solar technologies are created equal. The way solar technology is manufactured and how it performs in real world conditions differ from technology to technology.

To create apples-to-apples comparisons and accurate forecasts, there are three fundamental solar technology factors to evaluate:

- Reliability
- Production
- Efficiency

Assessing Reliability

Poorly built solar cells and solar panels manufactured from cheap materials increase the likelihood of failure. With any product failure, investments suffer. The most common reasons for failures are corrosion and cell or interconnect breaks, which account for more than 85% of solar panel failures.¹

Differences in Materials and Construction

There are fundamentally different approaches to building solar cells, and organizations should look for solar ESPs offering solutions that use quality materials and production processes. Most conventional solar cells utilize screen-printing and soldered copper. These elements of construction allow for cheaper panels, but the cells are more vulnerable to temperature fluctuations, humidity, and other common stresses. When a failure occurs, the impact can cause parts of the cell or whole sections of a panel to stop generating energy.

High quality solar cells avoid the typical failure modes of front-contact, conventional solar cells. The best cells are constructed using a solid copper foundation on the back of the cell that maintains energy production even if the silicon cracks. These cells have multiple points of connection to adjacent cells, which provides strain-relief and double redundancy. This type of construction provides the basis for high performance and reliability. From the cells to the panels to the system as a whole, a quality solar ESP assures long-term productivity.

Understanding Panel Degradation

Research by third-party solar industry experts shows significant variation in solar technology quality. For example, Fraunhofer—Europe’s largest organization for applied research with an annual research budget exceeding $2 billion—conducted rigorous testing (temperature cycling, humidity-freeze cycling, ultra-violet light exposure, etc.) on a select group of solar panels in a 2012 study. The company found that some of the higher quality solar panels degraded at most by only 2.3% in rated power. Other Conventional Panels showed a wider variation in power loss with degradation reaching as much as 92%. Power loss means lower potential energy production, which reduces savings and the overall value of solar. The variability of potential power losses also diminishes system reliability.

Evaluating Production

There’s a common misconception that two different solar panels with the same wattage will produce equal amounts of energy. However, the nameplate wattage assigned through a flash-test at the factory isn’t necessarily an accurate indication of real-world production. Quality solar panels that can maintain high production levels in the field demonstrate:

- Better operation in high temperatures.
- Resistance or immunity to light induced degradation (LID).
- Ability to absorb low-light and convert a broader spectrum of light into electricity.
- Anti-reflective glass allowing for more light to be absorbed.

Be sure to compare similar panels when reviewing efficiency numbers

The Value of Efficiency

Space is always at a premium. This is particularly important because the balance of system (BOS) costs are now the greatest single cost in a solar system. According to a joint report by the National Renewable Energy Laboratory and Lawrence Berkeley National Laboratory, “BOS accounts for the majority of costs across all benchmarks” in the residential, commercial, and utility sectors.

High efficiency solar panels enable the installation of a system of the same capacity compared to lower efficiency solar panels while requiring fewer materials. This can reduce the space needed for a specific capacity size system, or it can generate more energy from the same amount of space. Ultimately, with high-efficiency solar panels, customers get more energy per square foot.

2 As used throughout, “Conventional Panel” refers to a 240W panel, 15% efficient, approx. 1.6 m2.
3 Fraunhofer ISE, “PV Module Durability Initiative Public Report,” Feb 2013. Five out of the top 8 largest silicon solar panel manufacturers were tested.
50 STATES AND 50 MARKETS: THE CHANGING SOLAR POLICY LANDSCAPE

Energy costs for identical facilities will vary widely across North America. Likewise, the economic contribution from solar energy depends on the local climate and utility tariffs as well as policies and incentives at the federal, state, and local levels.

Solar policy covers many issues, but two key elements are financial and structural incentives. Some financial incentives may be direct forms of monetary support such as rebates, tax credits, or feed-in-tariffs (FITs). Structural incentives are forms of policy support that allow for market access and fair competition such as utility rate design, interconnection, and net metering.

While tax incentives and rebates may impact solar savings, utility tariff structures can also be fundamental drivers of solar value. Two identical solar systems—one in Southern California and the other in Arizona—might produce similar amounts of energy, but the utility costs each system avoids will be very different due to the disparity in utility tariff structures and the cost of energy between the two locations. Even within a single utility service territory, the ability to switch between available tariffs may fundamentally affect the value of solar. Ironically, the utility tariff that looks the most unattractive because of high on-peak rates may prove to be the most attractive once the facility has installed solar and receives credits for production at those high rates. (Those rates are known as “solar friendly” tariffs). A thorough understanding of state policy combined with detailed tariff analysis will enable organizations to unlock the lowest cost of energy with solar for a given site.

Building a Formula for Policy Success

Given the variety of state solar policies and constant changes in utility tariffs and other regulatory policies, organizations need to look beyond current market structures. Building a formula for success and effective solar collaboration starts with creating a national roadmap. Existing incentives and policy structures should be built into criteria that establish timing and feasibility for going solar. A knowledgeable solar ESP will facilitate active collaboration with utility providers and influence local solar policies. This, in turn, helps organizations to anticipate and gain first-mover advantage for new programs and incentives as well as manage risk in existing programs. In conjunction with federal, state, and other incentives, utility rate structures must be clearly understood to maximize avoided utility costs and create the greatest possible solar savings.

THE EXPANSION OF SOLAR FINANCING OPPORTUNITIES

Solar projects are significant capital investments that deserve careful financial analysis. A growing variety of financial options offer more opportunity to develop a solar project while also bringing more complexities to evaluate. An experienced solar ESP can help realize financial opportunities and anticipate potential pitfalls to create winning financial outcomes.

Setting Appropriate Goals

Before reviewing financing options, solar goals must be aligned with organizational financial goals. Debt and risk tolerance should be assessed, and it is important to consider the overall scale of the projects and capital commitment. Thinking strategically in terms of large-scale deployment enables organizations to achieve legal, technical, and financing efficiencies while expanding financing options.
Understanding the value solar delivers over the life of a system is essential for making smart decisions. Many Early Adopters evaluated solar investments solely on the basis of upfront costs and the first year of energy production despite the significant differences in quality and system performance over time. With the purchase of a long-term asset, upfront costs can be a consideration, but applying metrics that value the total lifecycle of the system will help create a much clearer and more accurate financial picture. Lifecycle metrics compare the total cost of solar electricity—including system operations and maintenance costs—to the estimated cost of the same amount of electricity purchased from the local utility for the same time period. Using the net present value (NPV) of the savings or comparing levelized costs of energy (LCOE) are two ways to view the big picture of going solar and perform accurate long-term assessments.

**Comparing Financing Options**

Solar investments are generally financed through one of three methods: cash purchase, power purchase agreement (PPA), or lease.

Each financing strategy allocates risk differently, whether it’s operating risk, technology risk, or credit risk. To create the best financing to complement a solar strategy, a solar ESP needs experience, strong connections with the financial and investment communities, and good credit. The right partner reduces risk, provides access to lower cost capital, and helps organizations achieve better financial outcomes.

**Cash Purchase**

One of the most common and best understood methods of going solar is the cash purchase. The ownership model typically enables a greater return on investment by enabling the use of the federal 30% Investment Tax Credit (ITC), depreciation, and other incentives. A cash purchase also avoids third-party financing costs and it allows the customer to retain environmental attributes generated by the system.

**Considerations**

- Organization assumes all risks and benefits associated with owning the system.
- Ownership requires tax appetite to absorb the ITC and other tax benefits.
- ROI must be high enough to justify investment.
- Organization must have enough available capital to pay for purchase.
- Balance sheet impacts include adding a long-term asset and debt, depending on the financing.

**Benefits**

- The cash purchase generally maximizes return.
- A cash purchase typically reduces the total time required for a solar project.

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<tr>
<th>CASH PURCHASE</th>
<th>POWER PURCHASE AGREEMENT (PPA)</th>
<th>LEASE</th>
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<tbody>
<tr>
<td>One-time upfront cost</td>
<td>No upfront cost</td>
<td>Zero or low upfront cost</td>
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<tr>
<td>Own the system hardware</td>
<td>Fixed rate for energy</td>
<td>Fixed payment for hardware</td>
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<tr>
<td>Progress payments during construction</td>
<td>Payment per kWh consumed</td>
<td>Recurring lease payment</td>
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Power Purchase Agreement (PPA)
Under a PPA, an organization “hosts” a system at its facility and pays a pre-determined rate per kilowatt-hour for solar energy used instead of paying a utility. This arrangement can lock-in lower energy costs and protect against future utility rate increases without any upfront investment.

To get the most value from this arrangement, it is vital to have a system that investors trust (i.e., a “bankable” technology) and a PPA that is financeable. Furthermore, there are a limited number of tax equity investors, and their involvement is paramount to creating a deal as well as achieving competitive financing with an attractive long-term energy rate. Consequently, a solar ESP with good investor relationships is crucial.

Considerations
• PPAs are project financing arrangements where the host takes little or no risk but the investor assumes both host credit risk and project performance risk.
• PPAs are off balance sheet, but they appear on financial statements as energy payment expenses.
• PPA terms typically range from 15-25 years.
• At the end of the PPA term, the host has three options:
  – Purchase the system
  – Negotiate another PPA
  – Have the solar system removed

Benefits
• No capital investment for the host.
• Pay only for electricity produced.
• No responsibility for system equipment operations and maintenance (O&M).
• Tax incentives monetized by investor and savings passed on to the host through lower rates.

Lease
A lease allows an organization to benefit from a solar asset in exchange for a fixed, recurring payment. Organizations with long-term procurement strategies will typically see higher savings with a lease than a PPA because of process efficiencies gained from standardized contracts and lower cost capital.

Considerations
• Leases generally offer lower cost of financing due to the assured payment obligation.
• Project operating risk resides with the host-lessee, but it may be mitigated through performance guarantees and O&M contracts.
• Financial statement impact:
  – A capital lease is on balance sheet and will be shown as an increase in liabilities and leverage.
  – An operating lease is off balance sheet and will be reported in financial statements as rent expenses.

Benefits
• Leasing often provides lower cost financing than a PPA.
• Minimal upfront costs reduce capital investment.
• Lessee may be able to take advantage of some incentives directly.
  – Example: The 30% ITC can be passed-thru to the host-lessee.
• Lessor is allocated project tax benefits to reduce lease rental rate.

Choosing a Successful Financing Strategy
PPAs, direct ownership, and leases are tools to help organizations achieve their goals, and each of them may be used in a multi-site solar financing strategy. Clearly-defined evaluation criteria in conjunction with a clear understanding of site-specific solar policy enables effective solar project development.
CONCLUSION
Solar has moved beyond Early Adopters and good intentions to become an integral part of strategic organizational energy planning. According to the Retail Industry Leaders Association’s 2013 Retail Sustainability Report, 75% of top-performers in retail sustainability are expected to make renewable energy generation a standard metric in their sustainability reporting by 2015. For solar specifically, Walmart alone had already installed 65 MW of solar power as of September 2012. Organizations need to keep pace with these industry developments, and solar power has demonstrated its ability to be an essential tool for meeting new sustainability goals.

Maximizing the value of a solar investment requires in-depth knowledge of how to align solar technology, policy, and financing. Closely interrelated, each element influences the others. Policy and incentives influence which financing options are appropriate, and reliable technology can lower financing rates since investors have greater confidence in proven technologies. Combining them appropriately allows organizations to hedge against electricity costs, meet renewable energy goals, and achieve the best long-term value.

References

Fraunhofer ISE. PV Module Durability Initiative Public Report. Fraunhofer ISE, February 2013. Five out of the top 8 largest silicon solar panel manufacturers were tested.


