

Rooftop Revenue: Making Underutilized Space Profitable Through Energy Harvesting

August 2010

Marci De Vries, consultant
Soleil Solar



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NAIOP, the Commercial Real Estate Development Association, is the leading organization for developers, owners and related professionals in office, industrial and mixed-use real estate. NAIOP comprises 15,500 members in North America. NAIOP advances responsible commercial real estate development and advocates for effective public policy. For more information, visit www.naiop.org.

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About This Report

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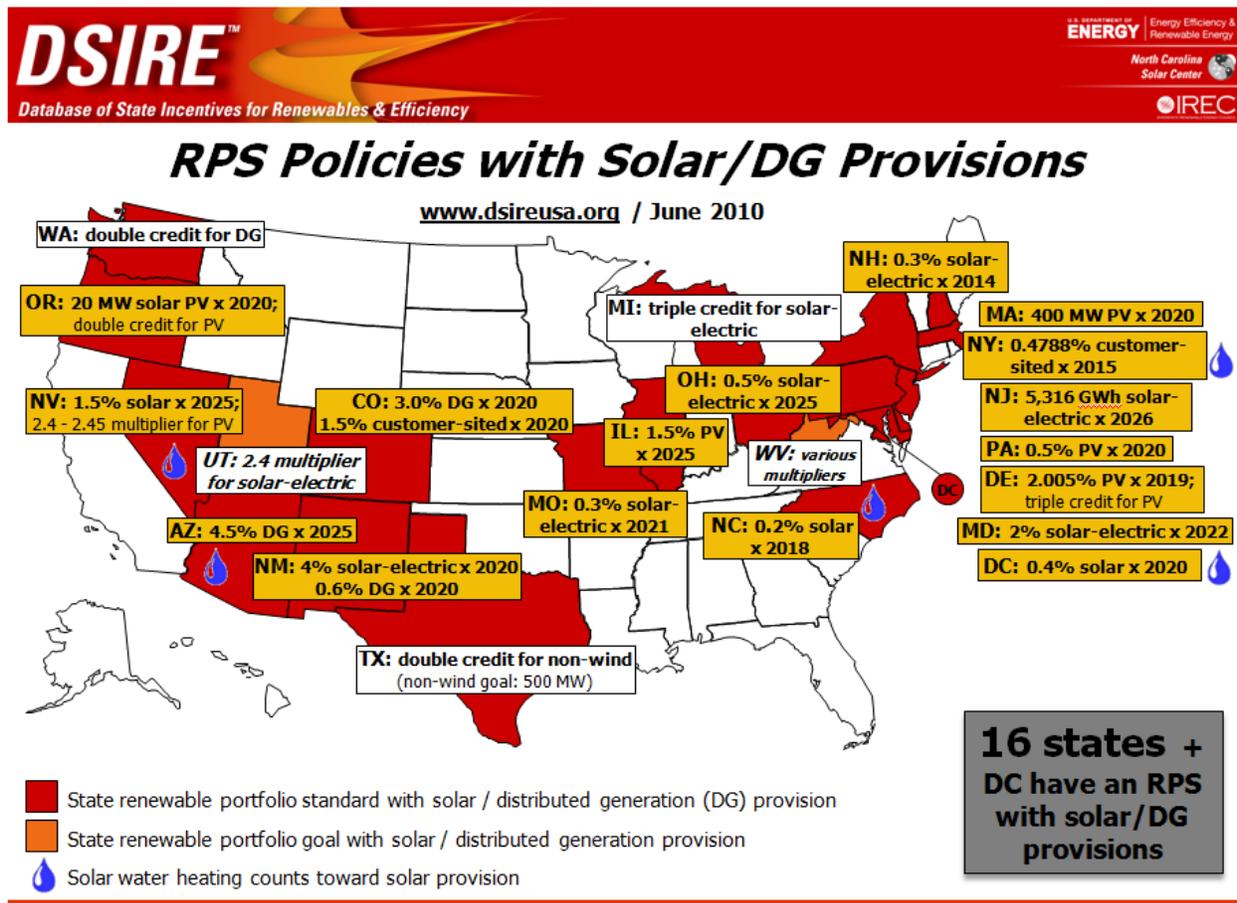
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Executive Summary

Rooftop Revenue, a concept that building owners and developers capitalized on with cellular antenna installations where the cellular companies paid a small lease for rooftop space, now provides a new revenue stream via solar and wind energy device installations.

Solar panels, wind turbines and other energy systems will provide not only tax credits and LEED points, they will also generate electricity that can be used to offset property utility costs. In some cases the energy can be sold by the property owner directly to tenants at retail (utility company) pricing. New financial models include a zero-funds-down option to make energy harvesting more appealing for owners and/or developers.

The impetus for viable rooftop solar opportunities started in California with the CEC (state level energy commission) deciding that solar energy meets RPS (Renewable Portfolio Standard) requirements. Prior to this 2009 decision, solar was not classified as a renewable energy source. The map below from the Database of State Incentives for Renewables & Efficiency (DSIRE) (www.dsireusa.org) indicates 16 states have provisions for solar to meet RPS requirements:



This favorable decision regarding solar as an RPS motivated other states to follow suit.

When this RPS rating was added to the federal tax credit law that now allows utilities to participate with a federal Renewable Energy Grant, utilities began aggressively pursuing solar. This same economic environment also motivated private investors to begin pursuing energy harvesting via PPA arrangements. (see Power Purchase Agreement in the glossary)

Standard leasing of rooftop square footage is also available with a straight “price per square foot” lease that fits with property owner/managers’ core business model. Owners of very large properties can opt for a Power Purchase Agreement (PPA) with a solar integrator or utility.

This paper explores some of these financial models as well as the pros and cons of installations for both wind and solar energy generation. Specifically, it examines:

- ownership models
- installation considerations
- maintenance issues
- reliability of power generation
- expected financial returns

The paper also highlights recent innovations in energy harvesting devices that improve reliability and provide performance accountability in real time. Additionally, the research examines the impact that electric vehicles will have on energy generation, and their implications for property owners/managers.

This is not a moral paper on sustainability; it is an analysis of revenue opportunities and a how-to guide for financing and installation.

The Roof as Revenue: An Introduction to the Issues and Opportunities

Everyone is talking about solar and wind energy in the context of reducing our stress on the environment and the electrical grid. While there is a good political and environmental argument for pursuing the installation of solar and wind generation devices, the property owners and developers bear the consequences (both positive and negative) for these installations. Pursuing alternative energy generation is not a decision to rush into if it means ongoing maintenance cost for buildings, or if the installation itself is prohibitive from a time/money/disruption standpoint.

However, now that the government and large-scale investors have turned their attention to alternative energy, it may be time to take action.

- Unprecedented tax credits are motivating investors to install solar on large scale rooftops at no charge to the building owner, simply to package and sell the tax credits in the financial markets.
- Small-scale building owners can recoup the majority of their solar investment cost in rebates and grants within the first year of ownership, and generate revenue thereafter from selling electricity to tenants.
- Utilities are under pressure to use solar and wind energy in their Renewable Power Source (or Renewable Portfolio Standard -- RPS) offerings. In 29 states they are likely to entertain higher rates for the electricity generated on roof tops.

RPS States in 2010, listed in alphabetical order:

Arizona, California, Connecticut, District of Columbia, Hawaii, Illinois, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nevada, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, Texas, Virginia, Vermont, Washington, Wisconsin, Wyoming.

With up to 20-year locked-in pricing (depending on the kind of installation) on electricity generated by solar or wind, it's hard to ignore this opportunity any longer.

Why Now

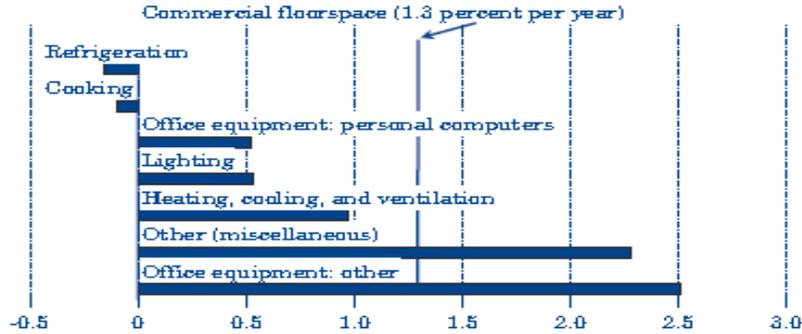
Government Incentives, Deregulated Utilities, the Smart Grid and Electric Cars

The "Perfect Storm" of external influences is gathering around energy usage and distribution. The nation is on the cusp of figuring out how to provide enough energy to power our nation without depleting our natural resources, and political will is driving us to figure it out now.

So what does this have to do with you? The graph below, courtesy of U.S. Energy Information Administration's *Annual Energy Outlook 2010*, illustrates how tenants' office equipment will continue to increase their energy consumption. Even as items such as refrigerators and air conditioning become more energy efficient, the proliferation of office devices (such as multiple smart phones for each employee, computer sound systems, PPT projectors and plasma TVs in individual offices, electric cars parked charging in the parking lots, etc.) will drive energy usage continually upward.

Electricity leads expected growth in commercial energy use

Figure 47. Average annual growth rates for selected electricity end uses in the commercial sector, 2008-2035 (percent per year)

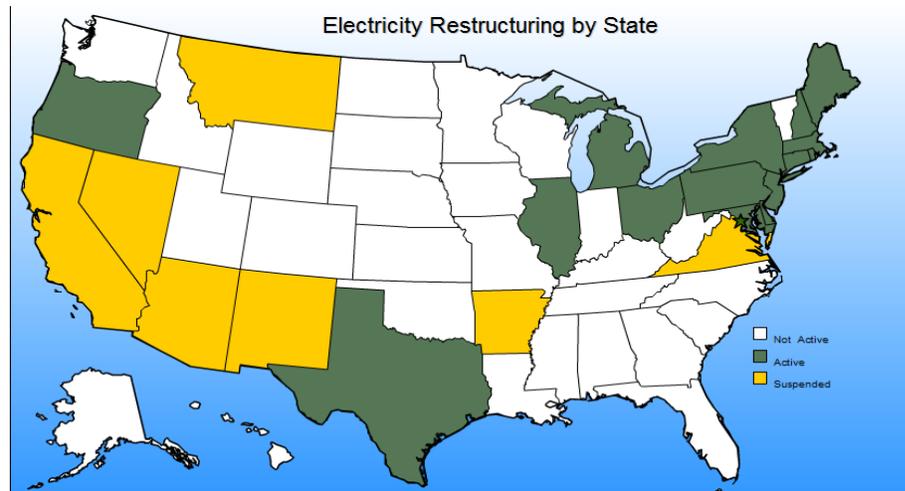


Several other factors are driving tenants to ask about alternative energy sources and causing property owners and developers to pay attention. The major forces include the following:

- **Deregulated utilities** create uncertainty in tenants' revenue forecasts. In states with deregulated utilities, energy costs fluctuate at the discretion of the utility company. Tenants may appreciate fixed pricing for their energy for the next 20 years via wind or solar energy generation on the premises.

For example, in Maryland (a deregulated state) utility rates have fluctuated by as much as 50 percent in a single rate hike. As energy demand increases 40 percent by 2035, more fluctuations in pricing are anticipated.

In the map below, the green states have deregulated/private utilities:



Source: Energy Information Administration

- **Electric Cars** – as electric cars take over the automotive world, your properties will be able to function as “gas stations” to allow tenants’ employees to purchase a “fill up” on electricity right in the parking lot while they work. If the energy used to power the electric cars is generated by a solar/wind power unit, the property enjoys an additional revenue source.
- **The Smart Grid**, an initiative that is underway to install software switches at all electrical outflow points (think: air conditioning units, breaker boxes, structured lighting systems, etc.) to allow energy to flow back and forth along power lines, which will allow the utility company to send electricity to where it’s needed at the time of the need. This software switch solution will allow the utility companies to buy and sell energy on a micro level. For example, they will buy energy from car batteries in the parking lot, and sell it back to you for your air conditioning.

Setting Expectations

This question has been asked more than any during the research of this paper: If solar panels and/or wind turbines are installed on every single office building and on top of every parking lot, will we be able to feed our entire energy grid with the power we generate?

The answer is: No. But that's not why we're talking about this.

Truthfully, you can't save the country's economy or ecology by putting solar panels on your roof, even if you put a lot of them up there. It's simply the wrong question to ask. Here are two scenarios that will help you understand how alternative energy works for small to mid-sized building owners.

Think of it as Subsistence Farming

Subsistence farming was how the majority of food was grown in the 1700-1800s when land owners "grew what they ate." The idea was that they could eat like a king for free, and sell a few cabbages at the market if they had extra. If you think of solar on your properties the same way, you "generate what you use" and if there are a few kilowatts (kWhs) left over, those go into the grid for some small amount of revenue.

According to Gary Skulnik, president of Clean Currents Green Energy Solutions, a company providing PPAs and green energy supply to the Mid-Atlantic region, "Today's solar systems for industrial and office properties offset roughly 10 percent of the total energy needs of the property. However, it is important to note that the peak power production from a solar array (produced between 11 a.m. and 6 p.m.) offsets up to 40 percent of the power burden during the most critical time of day for the overall energy grid. This is where we really start to see the difference solar makes.

Solar power generation on commercial office roofs is more about easing the stress on the power grid than it is about generating megawatt hours of electricity. By easing the grid during peak hours, the energy companies can forego building that extra coal burning plant, and stop replacing miles of wires."

So by reducing the stress on the grid by consuming most of the power generated on site, everyone's energy cost begins to stabilize, as does our impact on the environment.

Think of it like this: If nobody participates in alternative energy generation, everyone's electricity bill will continue to rise because we'll need a bigger and bigger grid (think about replacing all the existing electrical wires with bigger wires). But by using alternative energy generation, properties enjoy guaranteed control over property energy costs, while enabling the stabilization of energy costs overall because we can all continue to use our existing grid.

More Food for Thought

The grid right now contains energy generated by coal, gas, nuclear, and other sources. The state governments are asking the utilities to reduce their Nox (green house gas emissions) by using energy from clean sources such as solar and wind. The utilities need large and/or flat spaces to produce this energy.

By providing rooftop access to the utilities, property owners may, en masse, be able to generate enough electricity to offset the growth of energy demand over the next 20 years. This simple offset of power generation might keep us from building more coal-burning or nuclear plants.

Think about this:

- ✓ An average coal burning plant generates 500-800 megawatts of power.
- ✓ A large-scale solar array on a stadium rooftop generates 10-20 megawatts of power.
- ✓ The Southwest United States and California are the only climates conducive to utility-scale solar power generation.

Rooftop Revenue Strategies and Models for Property Owners/Developers

How it works for large roofs: More often than not, large-scale solar arrays (one megawatt and above) are not purchased by the property owner or long-term tenant. Large scale arrays are installed at no cost to the property owner or long-term tenant by the local utility or a solar integrator. The energy generated is either: 1) sold back into the building at a fixed price for 20 years; or 2) sold directly into the local utility's electrical grid at a fixed price for 20 years.

How it works for small to mid-sized roofs: Small to mid-sized property owners may enter a bulk arrangement with a solar energy provider to install units en masse on the roofs of their properties (20 installation opportunities or more) for small units that will cover common area energy costs. In a bulk deal like this an owner may be able to have the units installed with no capital investment, although the solar integrator may require bank financing, which puts a capital investment requirement back onto the property owner.

For property owners interested in just one or two units, the owner will need to purchase the units and use the tax credits, grants and incentives to recoup costs. The upside of ownership is that roughly 80 percent of the purchase price is refunded via tax credits, grants and incentives within the first year of ownership. Continued tax credits turn the capital expense from year one into a small revenue center for the next four years.

Typical Revenue Models:

Square Footage Lease

Definition: This arrangement is similar to a standard tenant-based square footage lease. An investor or a utility simply rents your roof space in a long-term lease (usually 20 years) and installs/maintains the solar panels themselves. Installation size for these kinds of arrangements is between 200 KW and one megawatt. Industry standard roof leases are 10 cents/square foot; however, this varies by market and can be negotiated until the numbers make sense for the property owner.

Many large property management companies find this to be the most desirable relationship because it aligns with their core business model. They understand the terms and conditions completely, and do not need to train staff or hire outside experts to negotiate unfamiliar areas of the contracts. They also know how to manage the relationship going forward because this is the same relationship they have with all their other clients.

AMB entered into a square footage lease with Southern California Edison (their local utility company) and was about 60 percent complete on its first solar installation at the time of the interview. This installation was one megawatt in size. According to Aaron Binkley, director, sustainability programs, AMB had been looking into alternative energy for more than two years prior to agreeing to their current installation, and finally said yes when Southern California Edison offered a straight property lease for their rooftop.

The idea of a 20-year lease sounded right to AMB because they are involved with property management and they know how to do leases. The roof lease agreement looks like all of their other leases. There is no worry about the performance of the solar panels because the utility company is maintaining the panels themselves. Profitability is described as "a modest income," according to Binkley.

While the typical square foot lease offered by the solar industry is around 10 cents, Binkley said AMB was able to negotiate a lease “several times higher” to make the revenue meaningful to the company.

The electricity generated by this installation is fed directly into the energy grid, not into AMB’s building. This allowed AMB to avoid altering their triple net lease arrangement with their tenants. Direct grid sales arrangements for solar energy can usually only be made between a utility and a building owner. Other solar companies do not have this level of access to the grid.

AMB’s current one megawatt installation is considered by AMB as a test of what it will be like to live with solar panels. “We are dipping our toe in the water,” said Binkley. They call their rooftop lease “the top bunk.”

Roof Lease with Energy Invoicing to Tenants

Definition: Property owners or developers rent the roof to a solar integrator. Upon installation, tenants are required to purchase electricity from the solar integrator as part of their lease arrangement.

Weingarten Realty manages many large retail spaces, where the roof space for their grocery-anchored properties is around 150,000 to 200,000 square feet. The company has worked an interesting contract with their solar integrator, SunEdison.

According to Bill Goeke, senior vice president, property management of Weingarten Realty Investors, Weingarten agreed to place solar on their rooftops after SunEdison agreed to make the capital investment. SunEdison owns the panels on the roof and maintains them for Weingarten. They also lease the roof space from Weingarten at a rate, “Somewhere around 20 cents per square foot.”

SunEdison then sells the solar power to Weingarten at 5 percent below the retail utility rate for their common areas only.

The idea is that SunEdison placed only enough panels on the rooftop to provide common area power. If tenants want to purchase solar power, they would make their own arrangement with SunEdison to place additional panels on the roof (and subsequently pay more rent to Weingarten).

Weingarten is currently not incentivizing tenants to make these agreements with SunEdison.

PPA (Power Purchase Agreement)

Excerpted from Solar Power Partners, Inc.: [Is a Solar PPA Right for You](#)

Definition: The Solar PPA is a long-term agreement to buy power from a company that uses its own source of funds to build a solar energy facility on a customer’s site and maintains/operates the facility for 15 years or longer... At the end of the solar PPA term, the facility can be purchased at fair market value, or the PPA can be renewed...

Basically with a PPA, a solar system is installed at no charge onto your facility by an investor, solar integrator or your local utility, and this entity sells electricity to the building tenants at a fixed price for the duration of the PPA, which can last up to 25 years. Minimum size is between 500 kilowatt and one megawatt.

The main benefit to building owners is locked-in electricity pricing for 25 years. In unregulated utility states, the uncertainty of energy pricing is a growing concern among tenants.

There is also a second, un-quantified benefit for building owners. Several owners interviewed for this paper reported that buildings with a “green” appearance tend to lease faster than non-green buildings. Solar panels are a very visible advertisement that a building is “green” even if the electricity generated by the panels is not a substantial percentage of the building’s power usage.

Why 25 years?

Utilities, investors and solar integrators ask for these long term arrangements because the first year or two of installation is not profitable for them – the energy sold into the building does not offset the cost of the panels until year five, generally. The PPA providers start to generate their ROI after year five. The PPA providers also write off the depreciation of the panels for their own tax purposes. The panels take several years to depreciate.

The PV panels produce reliable energy for up to 25 years, at which time the PV cells start to lose their efficiency. Investors would like to earn as much passive income as they can from the panels, therefore the terms are usually as long as the life of the panel installed.

For utility companies, the ability to achieve their RPS requirements every year has a financial benefit that drives utilities to form long-term agreements for their solar installations.

The property owners and developers interviewed for this paper were generally suspicious of PPA arrangements. The legality of a full PPA is complex and has created a sense of risk among property owners and developers approached with this arrangement.

Developers Diversified Realty (www.DDR.com) has a heavily modified version of a PPA with SunEdison, a solar integrator, where the arrangement looks more like a mass leasing agreement. While a true PPA generally focuses on a single-roof, large scale installation, this hybrid approach allows SunEdison to sell power to tenants across several portfolio properties.

Jacob Stein, new business development manager for DDR, said that the company has eight active arrays totaling more than 143,000 square feet of roof space. The active arrays are all located in New Jersey, based on SunEdison’s assessment that New Jersey is a favorable state for solar credits, rebates and incentives.

DDR had three objectives when deploying solar arrays on their rooftops:

- 1) Portfolio-wide solar installations would eventually become a major revenue stream. The revenue is generated from leasing the roof space to solar energy provider, SunEdison.
- 2) This program supports Developers Diversified’s corporate sustainable energy initiative.
- 3) This innovative program allows Developers Diversified to reduce energy expenditures for the common areas of the shopping center, and the savings are passed along to tenants.

Developers Diversified tenants are naturally supportive of the program. Besides the obvious economic and environmental benefit, the installation itself is quite a simple process. “In many cases,” Stein says, “the tenant and their customers don’t even notice the panels being installed.” Because the installation takes place on the roof, it is fairly non-invasive from a shopping perspective; and because the panels are ballasted, the roof membrane is not penetrated during installation, eliminating maintenance issues down the road.

Stein commented on the marketing value of allowing SunEdison to sell solar power to their tenants. “Our tenants are presented with the opportunity to work directly with SunEdison, allowing tenants to purchase cleaner energy at a discount to local retail utility rates. From our perspective the operation is completely turn-key.”

Direct Ownership

Definition: A property owner or developer purchases (or leases-to-own) solar panels for their buildings. Most of the upfront cost is reimbursed through the sale of tax credits and Federal grant money within the first year. Depending on the relationship between the solar integrator and the property owner/developer, the remaining cost can be turned into a Lease-to-Own arrangement or a financing option that lasts about five years.

Many who opt for direct ownership are either in a market where energy prices are rapidly increasing so the need to control energy costs outweighs the price of installation, or they are able to sell the energy at a retail price to their tenants.

MIE Properties, (a subsidiary of St. John Properties) manages several flex space buildings and has begun installing 10 kW systems on the rooftops of their flex space buildings in Denver. They have 134 installations planned.

MIE purchased solar panels in 2009/2010. The total cost was \$66,127 for each 10 kW system. The rebates from the utility as well as federal grants and REC credits immediately refunded \$55,801 of the purchase price, leaving \$10,326 as a capital expense. This \$10,326 was financed by Howard Electric (a solar integrator), which loaned MIE this money on a five-year payback note.

MIE leases are triple net leases; however, MIE now requires tenants to purchase all of the power generated by the panels from MIE as part of their lease arrangement. When discussing the idea that selling energy was outside the core business of a property owner/manager, Rasmussen laughed and said, “It’s time to get in the business of selling electricity!” After the note is repaid, Rasmussen anticipates generating roughly 30 cents/square foot per year in his buildings. This revenue is calculated by factoring in the retail price of electricity plus the solar energy rebates offered by the local utility, Xcel Energy.

MIE will be able to invoice the energy bill accurately for their tenants by logging into a Web interface that shows the total kW’s generated by the system in real time. The tenant then writes a utility invoice check to MIE in addition to Xcel Energy each month.

MIE has been able to protect themselves from the risk that a property may go vacant or a tenant might neglect to pay their utility bills by opting for a smaller solar array (10 kW) that generates enough electricity for some hot water, common area utilities and HVAC only. If the building is vacant, the energy generated by the panels will offset most, if not all, of the vacant property's energy bill at no cost to MIE. Any excess power is refunded to MIE by Xcel Energy in the form of solar energy credits that can be redeemed when the building is reoccupied. (This credit system will vary by state and utility.)

When planning a solar installation, calculate the array to cover the utility needs of the building when it is vacant; then calculate the common area energy usages first; and then (cautiously) consider expanding to more energy generation based on tenant interest.

Emerging Business Models – Shorter Agreements with Solar Integrators

The James F. Knott Realty Group, headquartered in Timonium, Md., is currently investigating solar on the rooftop of a 140,000-square-foot warehouse. Bob Hamilton, COO, and James F. Knott Jr., SVP, had concerns that many property owners and developers share:

“If I lease the roof, and the roof lease is dependent on selling electricity to a tenant, what happens when the tenant moves out and we have a 2.5 year gap (for example) between tenants?”

Another issue that stands in the way of their embracing the business models listed above is that Knott's longest lease is 10 years. A standard PPA/solar rooftop lease is 20 years, where part of the agreement requires selling energy to the building tenants. This creates up to a 10 year gap between the agreement with a solar integrator and Knott's leasing model. If the building is vacant there is no customer to buy the energy, so the model wouldn't work.

Knott's leases are primarily triple net leases with a duration of two to five years. They were concerned that the value proposition for their tenants (if the tenant was somehow willing to fulfill a 20-year lease) was small if the price of electricity was the same from the solar panels as it is from the grid. However, the idea of stabilizing energy costs for clients did seem interesting in Maryland's deregulated energy environment.

Knott didn't feel like they were in a position to move away from triple net leasing, because their broker network only deals in triple net.

The marketing value of providing green energy for new tenants is interesting, but not a deciding factor. “Solar integrators are currently working on a shorter duration financial model to help accommodate building owners and developers,” said Andrew Maus, president of Soleil Solar, a solar integrator in Baltimore, Md. “Mid-market players like Knott will be critical to helping solar energy offset the grid in a meaningful way during peak hours.”

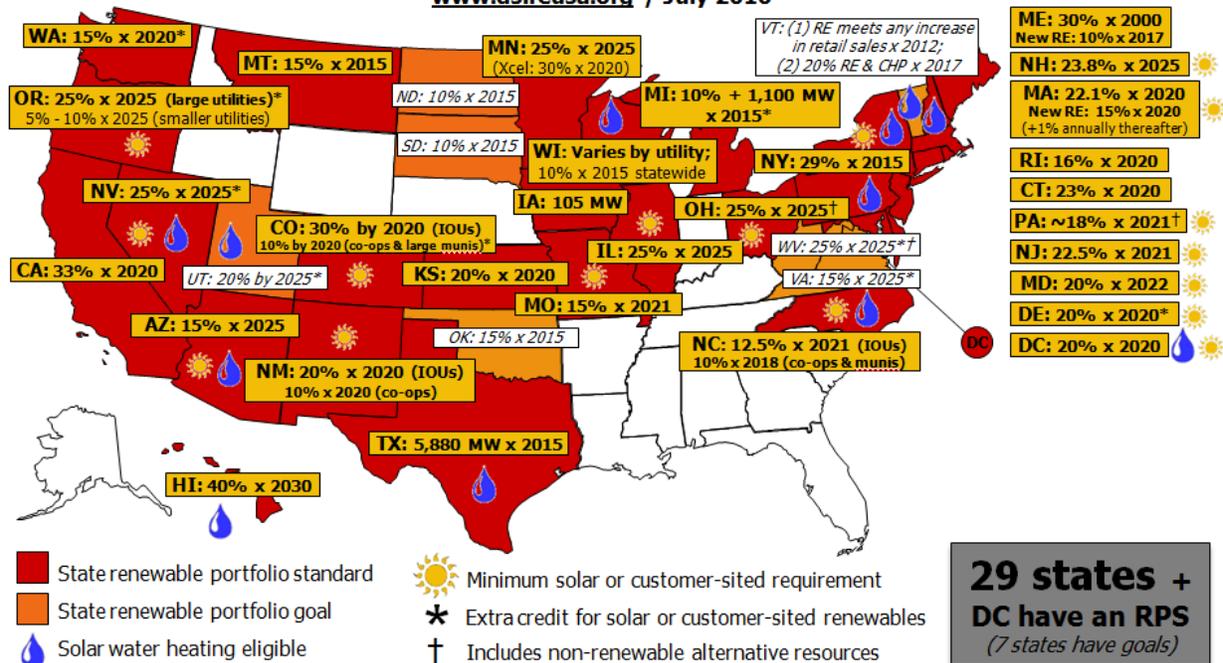
Who wants to rent your roof?

Your local utility company, solar integrators and private investors will be the most interested. Utilities are under pressure from state and federal governments to include both solar and wind power as part of their Renewable Portfolio Standard (RPS) requirements (see RPS in Glossary). As policies change within our government to enforce the use of green energy, local utilities are looking for locations to install solar and wind generation stations. Below is a map of the United States showing the states that currently enforce an RPS standard (indicated in red).



Renewable Portfolio Standards

www.dsireusa.org / July 2010



At the same time the utilities are required to meet an RPS, they are also offered tax incentives that rebate most of the cost of installation. Therefore, they can install solar and wind generation systems without causing their companies financial hardship. (See NOX credits in the Glossary.)

The Department of Energy offers a chart at this Web address that shows a map of states with RPS standards and the percent of renewable energy required in each state.
http://apps1.eere.energy.gov/states/maps/renewable_portfolio_states.cfm

Solar Opportunity Costs, Maintenance and Revenue in Action

Decision making – For AMB, the entire company was aware of the decision, but the actual decision was made at the regional level because that property manager would have to live with this installation for the next 20 years. For smaller real estate/property management companies, the decision is made at either the tenant or CEO level.

Installation – Before installing solar panels or wind turbines, there will be some minor proactive maintenance repair to do on the roof prior to installation. Many solar panel systems are ballasted these days, which means they simply rest on the rooftop instead of penetrating it. The install is faster that way and does not void the roof warranty.

Why AMB and Knott hesitated to jump into renewable energy sources:

- 1) The business models presented required them to change their own business model.
(When this was resolved, AMB moved forward)
- 2) No “stick:” There is no penalty for avoiding solar.
- 3) No “carrot:” There isn’t a huge incentive to engage with solar.

Maintenance and Accountability

Solar panels themselves dictate a lot of this discussion. MIE, for example, opted for Solyndra solar tubes instead of flat PV panels because they were concerned about uplift in a windy scenario. There was no need to penetrate the roof membrane, no ballasting and their vertical orientation mitigates snow load on the panels. In order for the panels to work at an optimum capacity, MIE needed to add a white coating to their roofs.

MIE’s direct ownership model was structured to put the onus for maintenance on the tenant. Each new tenant would assume ownership as the lease transferred, and each tenant is required to buy power from MIE as well as the local utility.

In a PPA or roof lease scenario, all maintenance is the responsibility of the panel owners, so there is no maintenance consideration needed on the part of the property owner for the panels. However, the roof maintenance is the building owner’s responsibility.

All solar panels’ energy production are now able to be monitored on the Web in real time, so if a panel malfunctions or is broken, the owner will be able to view the outage and take appropriate measures whether the panel is owned directly, through a PPA or through a lease arrangement. This monitoring also triggers preventive maintenance alerts, such as panel washing or excessive shading from surrounding trees/buildings.

In a 2009 white paper from the Center for Environmental Innovation in Roofing, some maintenance advice was delivered by commercial roofers:

Roofing system companies feel that the installation of a PV system may create watertight issues via penetrations or load. The PVs also generate added heat and reflected ultra-violet rays that may damage the roof unless countermeasures are implemented.

Design and operating countermeasures that may be necessary to assure long-term roof integrity include the following:

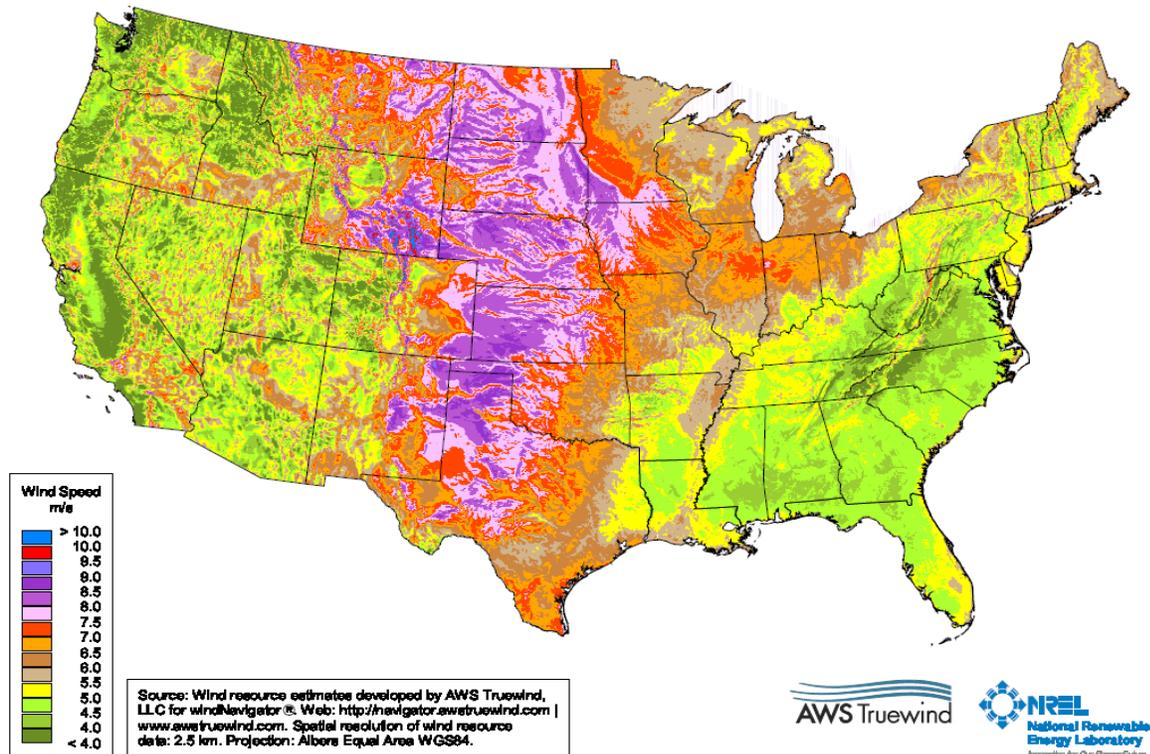
- 1) PV system details should be accepted by the warranty roofing system manufacturer prior to installation.
- 2) In areas of high rain/snowfall, increase flashing heights and roof drainage provisions.
- 3) While PV systems are designed to withstand “normal” weather, they are not rated for hail, hurricanes, tornadoes or wind-blown debris. Repairs for damage sustained to the roof and the panels may require the temporary removal and reassembly of the rooftop PV system.
- 4) PV installations increase the service traffic on the roof. To accommodate these effects, install protective walkways, increase membrane thickness, and add protective cover boards.
- 5) To accommodate the effects of heat build-up and reflected ultra-violet frequently associated with PV systems, install a sacrificial membrane layer beneath the PV system to reduce heat build-up on the primary waterproofing membrane. Additionally, install additional membrane or coating layers at exposed vertical flashings to reduce UV exposure.
- 6) Modern roofing systems, regardless of the amount of robustness built into the system, must be well maintained over time to assure optimal service life is achieved.

Without exception, every developer and office property owner/manager interviewed for this paper was interested in participating in alternative energy generation, and had been investigating the feasibility of doing so for the past few years.

What about Wind

For many rural parts of the country, wind makes a lot of sense. Bryan Conkling, mayor of Union City, Ind., mentioned that Randolph County will have 300 wind turbines in three to five years. Conkling said, “As a rural area, there is an enormous untapped resource for utilities to take advantage of simply by installing more turbines in the Midwest.”

However, the Midwest is a series of microclimates (see the wind map below, courtesy of the U.S. Department of Energy), which indicates some excellent wind generation prospects (red areas) for wind farming. Outside of those red/purple areas indicated on the map, the opportunity for wind is not as substantial.



The SREC and energy grant programs are available for wind just as they are for solar, and will provide the same kind of payback over time as solar.

What is the Noise Factor with Wind?

Wind power simply creates noise. Sometimes it comes from the air whooshing from 100+ foot blades repeatedly passing at high speed in front of their support poles. Smaller turbines create a white noise from the blades spinning in the wind. Newer MagLev models do not generate as much sound; however, any device interfering with wind flow will have some noise issues.

Estimating Wind

Wind speeds are divided into classes, much like whitewater rapids. Wind classes range from 1 (low consistent speed) to 7 (extremely high consistent speed). To know the quality of available wind, a wind measuring instrument is needed or, for estimating purposes, the wind readings from a nearby airport would be a good starting point.

Commercial property owners/developers fall into a category called “Mid-wind” where the available space for wind generation is too small for a utility scale wind farm, but large enough for a unit that generates more power than residential. Mid-wind systems come in sizes ranging from 150 kW to 300 kW. Building owners can assess which model to invest in based on their wind speed and current energy usage.

Deciding on Wind

Binkley from AMB felt that wind technology for building rooftops was unresolved from a performance perspective. He was also concerned that most rooftop wind turbines generate only five kW. In order to generate meaningful electricity, AMB would have had to install up to 50 turbines. This could potentially expose the company to a vibration/noise issue, a zoning issue and a performance issue because there are many moving parts on the turbines.

Brian Kuhn, director of marketing and sales for Aeronautica Windpower LLC, is a proponent of installing wind devices within underutilized spaces of industrial or office campuses such as near the trash areas, or in drainage areas. Kuhn’s comments about rooftop wind devices follow:

“Rooftop wind is a hot topic, but until you actually do the numbers, only small machines that are not cost effective can usually be put on the roofs. If, however, you extend the concept to ‘onsite revenue,’ then wind turbines will really start to shine.”

Mitchell Manoff is a large-scale wind power investor and CEO of Corinthian Partners in New York City. His firm has partnered on two wind farm investments in Canada, totaling 235 megawatts. He has particular conditions under which he will enter a wind investment:

- 1) The project must have a PPA with a per kWh price that makes it worthwhile to participate. His projects in Canada are set at 13 cents per kWh. In Europe, per kWh rates are up to 20-22 cents per kWh.
- 2) The PPA should be backed by an AA rated credit buyer. Manoff’s wind deals sell power to the Canadian government, which has an AA credit rating. Manoff typically walks away from PPAs for private companies, such as a project at a corporate headquarters, because no one knows if any company will be solvent for 20 years to come.
- 3) Manoff is only comfortable working with a developer who has successfully managed a wind project prior to the proposed project.
- 4) Wind projects near airports can begin two years earlier because the wind measurements have already been taken by the airport. If there are no wind measurements, then a wind gauge needs to sit on site for two years prior to beginning the project.

When asked if investors were looking at alternative energy because of the Al Gore-inspired “earth morality,” or if the interest is in the financial return only, Manoff said that if he were handed two deals that had exactly the same return, and one was for a polluting entity and one was for clean energy, he would opt for clean energy. However, “earth morality” would not drive investment all by itself.

He went on to say that most of the investing in solar and wind energy is taking place because of “political will” embodied by the current government incentives ensure that the deals in renewable energy are profitable. Carbon Offsets and Renewable Energy Credits (RECs) in combination with Federal Tax credits for energy efficiency allow an investment opportunity with reasonable returns.

A database of state incentives for renewable and efficiency can be found at www.DSIREUSA.org.

Improving Affordability Through Tax Credits

According to Weingarten Realty, which has property holdings in 23 states, four states are identified as favorable tax and incentives areas for alternative energy generation. The states they are focusing on are: New Mexico, Colorado, Arizona and parts of California. SunEdison is focusing on New Jersey for its installations.

In some states that are favorable to renewable energy, the price per kWh can be as high as 25 cents. On the flip side, in Baltimore, Md., alternative energy is calculated by simply spinning the energy meter backwards, generating no cash value, only savings on an existing energy expense.

In Baltimore:

- If your utility bill per month is \$1,000
- And on one day you generate an excess of energy valued at \$100 (retail price)
- Your bill at the end of the month will be \$900

Alternative Energy Acts and Legislation

Enacted in 2008, the Solar Investment Tax Credit (ITC) is one of the most significant drivers of solar energy installations. According to a press release distributed by the Solar Energy Industry Association (SEIA) on October 3, 2008, the tax credit assisted the solar industry in the following ways:

- Extended the 30-percent tax credit for both residential and commercial solar installations for eight years
- Eliminated the prohibition on utilities from benefiting from the credit
- Allowed Alternative Minimum Tax (AMT) filers, both businesses and individuals, to take the credit
- Authorized \$800 million for clean energy bonds for renewable energy generating facilities, including solar

The solar tax credits were originally enacted in 2005 and have created unprecedented growth in the United States. The amount of solar electric capacity installed in 2007 was double that installed in 2006.

"By passing this bill, Congress has finally given the solar energy industry 'policy certainty' that will attract investment, expand manufacturing and lower the cost of solar energy to consumers," said Roger Efird, SEIA chairman and president of Suntech America, a leading Chinese solar power manufacturing company. "This will allow companies like mine to move forward with expansion plans to serve the growing U.S. market."

What are the three main tax credits/incentives property owners can expect from an alternative energy installation?

- 1) **Federal Grant** – the 30 percent ITC or Grant for wind and solar (information provided by DSIRE)

This is a federal tax credit for corporate use. Commercial entities receive a credit of 30 percent for solar, fuel cells (see Bloom Box information at the end of this white paper) and small wind turbines.

In general, credits are available for eligible systems placed in service on or before December 31, 2016:

Type of Credit	Credit	Eligible Systems	Not Eligible
Solar	30 percent of expenditures, no maximum	Solar used to generate electricity, heat or cool, provide hot water for use in a structure, or to provide solar process heat. Hybrid solar lighting systems, using solar energy to illuminate the inside of a structure using fiber-optic distributed sunlight are eligible.	Passive solar systems and solar pool heating systems.
Fuel Cells	30 percent of expenditures, no maximum but capped at \$1,500 per .05 kW of capacity	Fuel cells with a maximum capacity of 0.5 kW that have an electricity-only generation efficiency of 30 percent or higher.	
Small Wind Turbines	30 percent of expenditures, no maximum	Wind turbines up to 100 kW in capacity. (In general, the maximum credit is \$4,000 for eligible property placed in service after October 3, 2008, and before January 1, 2009. <i>The American Recovery and Reinvestment Act of 2009</i> removed the \$4,000 maximum credit limit for small wind turbines.)	

2) STATE SREC (Solar Renewable Energy Credits) Information provided by Wikipedia (June 2010)

Solar Renewable Energy Certificates (SRECs) or Solar Renewable Energy Credits are a form of **Renewable Energy Certificate** or **Green tag**. SRECs are available in states where a Renewable Portfolio Standard (RPS) exists with a specific allocation for solar energy. SREC programs provide a means for SRECs to be created on behalf of a solar panel owner and sold to state electric suppliers to meet the solar RPS requirement. Electric suppliers are required to use the SREC program to show compliance with this part of the State's Renewable Portfolio Standard.

The SREC is separate from the value of the electricity itself and permits the owner or purchaser to claim the benefits of the clean energy production by effectively subsidizing the cost of the installed system. SRECs are designed to provide individuals and corporations with an economic incentive to investing in solar electric systems which improve the electric distribution grid. They represent the renewable attributes from a solar facility, bundled in minimum denominations of one megawatt hour (MWh) of production. The additional income received from selling the solar certificates increases the economic value of an investment. Instead of up-front subsidies from the state, solar system owners can recover their investment by selling certificates to utilities.

Other corporate tax credits are available on a state-by-state basis, where you can receive a credit up to 10 cents per kWh for solar energy used.

It is important to keep in mind that state credits are allocated based on a lump sum amount, so once the credits fund is exhausted, the credits disappear.

Credits from local utilities – These are not available everywhere. Xcel Energy has a strong program throughout the southwest United States, and more information about their program is available on their Web site.

In general SRECs work like this: in an RPS state, utilities are fined if they do not fulfill their RPS credits. Because the utilities do not typically have enough renewable energy sources in place, they purchase RPS credits from businesses that are generating energy via solar, wind or other approved renewable sources.

SREC pricing corresponds with the dollar amount of the fine imposed on the utility by the state in which it operates. For example, in New Jersey, the fine is \$700 for each unfulfilled RPS. In Maryland, the fine is \$400. This difference in the dollar amount of the fines creates the SREC credit market price, because the utilities will pay any amount that is less than the fine. In New Jersey, the maximum price for an SREC could theoretically be \$699 because the fine amount is \$700. In Maryland, the maximum price could only be \$399 because the fine amount is only \$400.

The actual price for SRECs is driven by supply and demand, and will generally land at a price of about two-thirds the price of the state fine.

More often than not, SRECs are managed by the solar integrator that installs the system. Integrators have SREC buyers on their team that bundle SRECs and sell them together on the open market. Most of the SREC buyers pay a flat fee for several years' worth of SRECs at a rate somewhat lower than what the market will bear.

Here's a sample scenario:

In this sample scenario, a property owner/developer installs a 10 kW system on their roof. This 10 kW system will produce one SREC each month for five years or more, give or take a few for weather/maintenance issues.

There are two options for selling SRECs:

- 1) Sell all the SRECs for five years to an integrator at the time of the installation, netting the equivalent of 60 SREC sales. With an SREC price of \$250 (deflated cost for bulk sale) the building owner would gain \$15,000 on day one from the sale of their SRECs.
- 2) The building owner could sell the SRECs themselves for a slightly higher price. For example, if the company was able to sell SRECs for the 10 kW installation for \$325, their return would be \$19,500 over the course of five years.

To sell SRECs on the open market for the additional \$75 per credit (see the example above), the following steps need to be taken by the building owner:

- 1) Certify the energy system with the State (solar, wind or other)
- 2) Set up an SREC tracking account. Every state or region will use a different system for creating and tracking the SRECs. The Mid-Atlantic states use GATS; North Carolina uses NC-RETS; Massachusetts uses NE-GIS.
- 3) Create an account online with SRECTrade to place offers to sell SRECs. There is generally a four-month delay in payment because of the way SRECs are recorded, auctioned and paid. For example, if your system goes online on January 1, your January generation will be recorded on February 1. Your first SREC(s) will be actually credited to your account on March 1. They would then be sold in the March auction, so your first payment would come in late March. After that, payments will come as SRECs are generated. Also note: some states operate on a quarterly basis, rather than monthly.

Grants - These vary by state. Maryland, for instance awards grants for PV (solar) installations at \$500/kilowatt up to \$50,000. More about their grant program can be found here: <http://energy.maryland.gov/incentives/business/MidSizedSolarGrants.asp>. California's rebates are posted here: www.gosolarcalifornia.org/csi/nonres/index.html. Each state posts their grant program through their energy administrations.

Based on the data tables provided by DSIRE, the following are the most favorable states for commercial renewable energy opportunities based on combinations of tax credits, grants, rebates and credits.

The numbers inside the color coded squares indicate the volume of incentives provided by each entity within that state – federal, state, utility, local and non-profit. California, for example, provides 11 incentives at the state level as well as 40 incentives from the state’s utility companies for renewable energy expenditures and energy generation:

Financial Incentives for Renewable Energy

Federal = State = Utility = Local = Non-Profit =

State	Personal Tax	Corporate Tax	Sales Tax	Property Tax	Rebates	Grants	Loans	Industry Support	Bonds	Performance-Based Incentive
California				1	7 38 3		1 1 3	1		1 2
Colorado			2 1	3	2 9 3	1 1	1 3 1			
Florida		2	2		1 10 1		1 5	1		2
Georgia	1	1	1		1 9		1 1			2
Iowa	1	2	1	3	12	1	2 1			1
Kentucky	1	2	1		1 7	1	1 1 1			1
Minnesota			2	1	5 21	2 2	6 2			1 1
Missouri		1			1 10		1 1			
New York	3	1	1	2 1	6 3	1	3 1	2		
Oregon	1	1		1	7 21	2 1	3 9	1		1 1
Pennsylvania				1	1 1	7 1 2	8 1 5	3		1
Texas		1		1	22 2	2	2	1		2
Utah	1	1	1		1 6			1		
Washington			1		16	1 1	11	1		1 3

New Jersey has also been identified as a favorable region for solar energy in particular, based primarily on the state’s 14 tax and incentive programs. While other states have a larger number of incentives, New Jersey offers the greatest financial amount per incentive, with the clearest path to realizing the incentives.

New Jersey			1	1	6	1	2 1	1		2
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Electric Cars: Revolutionizing Power and Revenue Relationships

How will electric cars change the way you view onsite power generation? It's actually a combination of electric cars launching in the fall of 2010, combined with the creation of a smart grid.

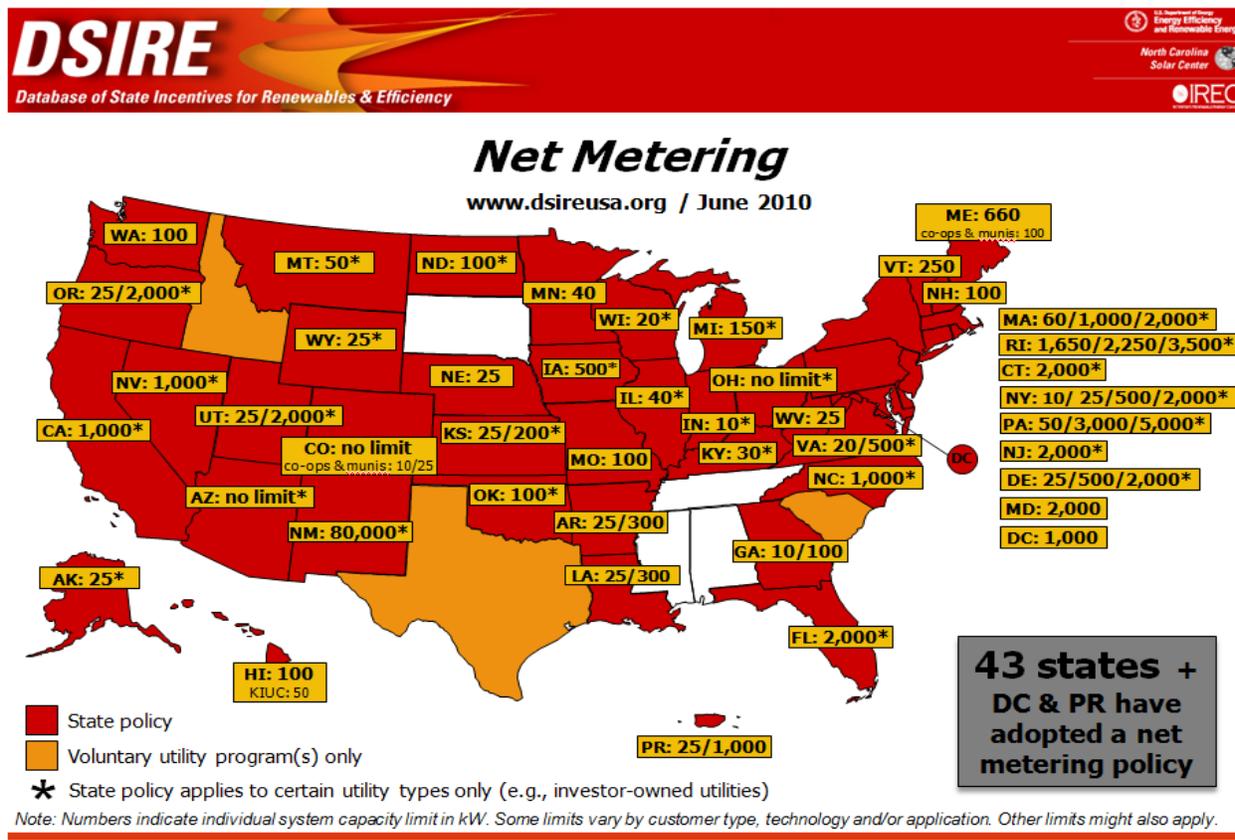
According to Suite 101.com, storing the energy in electric car batteries is the most likely possibility for storing solar energy and reusing it during peak hours or after dark.

It works like this: Tenants' employees drive to work in electric cars and park under solar canopies/solar trees in the parking lot. They then plug their cars into a metered energy panel (attached to a smart grid) and go to work for the day. The property owner generates revenue from the charge.

The solar panels charge employees' cars from 11 a.m. to 6 p.m. For example, during peak hours of 2-4 p.m., the grid reverses the energy flow through the metered panel so that instead of energy flowing *TO* the car batteries, it *EXTRACTS* some for use in the grid to offset peak usage. Then, before the employees finish work for the day, the power is returned to their cars by the solar panels. Because the cars are charging on a metered, intelligent charging system, the charge level of the battery is constantly monitored, which prevents the grid from draining a car battery below a useful level at any time.

While this smart grid concept is still about three to five years away, many property owners including local government and universities have started installing solar canopies.

At press time, 43 states have adopted a net metering policy to allow smart grids to redistribute power. (See the map from DSIRE below)



Note: DC and PR in the illustration above are abbreviations for the District of Columbia and Puerto Rico.

Quick Stats:

- **October 2011** – more than 100 electric car competitors will be fighting for U.S. market share according to John Addison, publisher of the *Clean Fleet Report*. (Article last updated 6/10/2010)
- **1.5 million** electric cars will be purchased by consumers by 2015, according to Accenture.
- **\$4** is the average cost to fully charge an electric car, according to The Auto Channel.com (2008). A fully charged RAV4 electric vehicle goes 125 miles per charge, while the Tesla can reach up to 200 miles per charge.

Envision Solar (www.envisionsolar.com) is a company working heavily in this field, and they have partnered with Coulomb Technologies (www.coulombTech.com) to provide canopies with CleanCharge™ electric car charging within their solar canopies.

An excerpt from Envision Solar's June 3, 2010, press release, written for a hospitality application of the technology, states:

The Envision Solar CleanCharge vehicle charging system provides restaurants with a Solar Grove, – an array of Solar Trees® – equipped with an electric vehicle and hybrid electric vehicle charging station. The Solar Trees provide shade for diners' vehicles, while simultaneously allowing the restaurant to offset some of its energy usage through the grid-connected solar system. The CleanCharge solar-to-electric vehicle charging station also allows customers to recharge plug-in electric and hybrid vehicles while they dine.

Jill Sorensen, the executive director for the Baltimore-Washington Electric Vehicle Initiative (BEVI) (www.B-evi.net), provided a vision of the industrial and office complex future regarding electric vehicles:

Question: How do you envision the presence of electric vehicles impacting the owners/managers of industrial and office properties? Will employees need/demand solar canopies and or charging stations for their cars?

"I envision that electric vehicles will command significant consumer attention by 2015, allowing the United States to achieve the Obama Administration goal of one million electric vehicle or plug-in hybrid electric vehicles in use nationwide by then. The smartest recharging systems will do more than simply draw conventional power from the grid. The smartest systems will be solar powered, as in car ports or photovoltaic panels augmenting electric feed, with the additional capacity of time-shifting recharging to off-peak charge rates, where possible. Industrial properties will enjoy tax credits for providing EV recharging onsite, and additional tax credits if they provide net zero (solar or wind energy supported) recharging. Every little bit of reduced petroleum dependence counts. Stepping toward bigger and better goals will benefit all globally. Also, the pleasure/pain principal is relevant here. If we don't police our energy consumption and carbon footprint, someone else surely will, so better to take the initiative ourselves for the sake of global competition before some international environmental or economic body decides to penalize us for not doing our part."

Question: What (if any) revenue opportunities do you see for industrial and office property owners with metered car charging on their property?

"Employers or office property owners who currently charge for parking will be able to negotiate for carbon credits for investments they make in renewable energy resources. For example, McCormick spice company entered a power-purchase agreement with Constellation Energy to lease some of its land to install photovoltaic panels. The energy collected by those panels offsets McCormick energy needs. McCormick could also provide some of the "American-made electrons," to quote a phrase of Plug-in America's founder, Paul Scott, to recharge electric trucks and transport vehicles for free, or at significantly reduced re-fueling cost compared to petroleum-based vehicles. In addition, any goods transport using electric trucks or other vehicles is zero emission, yielding additional opportunity for negotiable carbon credits.

I favor reducing refueling and parking prices for EV and PHEV users. Early adopters should see market incentives, not penalties. Most will enjoy reduced price for refueling given that the electricity for recharging will cost about one-fourth the price of gas. We will need to work to maintain and sweeten these incentives in order to enjoy market uptake.”

Question: Is BEVI working on any legislation to enforce or encourage the use of electric vehicles?

“BEVI is working actively with coalition members to promote the use of electric vehicles by all measures needed, including legislative. With the help of the Maryland Clean Energy Center and the Maryland Energy Administration, Maryland has passed legislation to provide tax credits for EV purchasers and HOV lane access. Maryland also passed medium speed legislation to advance the use of alternative fuel vehicles not yet highway crash tested. We will continue to promote broad consumer education, outreach and market conditioning to help stage this revolution in clean transportation.”

Device Innovations and Promising New Energy Products

Many critics of solar and wind have been vocal about the efficiency of each. A common discussion among renewable energy critics is that wind produces three times more energy than solar panels per device; however, the wind only blows 40 percent of the time.

Innovations within the devices themselves will improve these efficiencies. Current installations for solar and “mid-to-small wind” (the kind of wind turbines installed on commercial property and residences) are designed as modules, where the core components simply snap off for maintenance or replacement. The racking and support structures are designed to stay in place while the energy generation device itself, such as solar panels or turbines, can be easily removed/replaced.

The idea is that companies install the devices “as is” today, and then simply swap out the energy generation device as new innovations are available. Much of the installation effort for solar and wind involves running the power lines across the roof structure and installing inverter and meter systems, which are not likely to change as much as the energy generation devices will in the next 20 years.

Here are some innovations that are changing the game as we speak. These will be available soon.

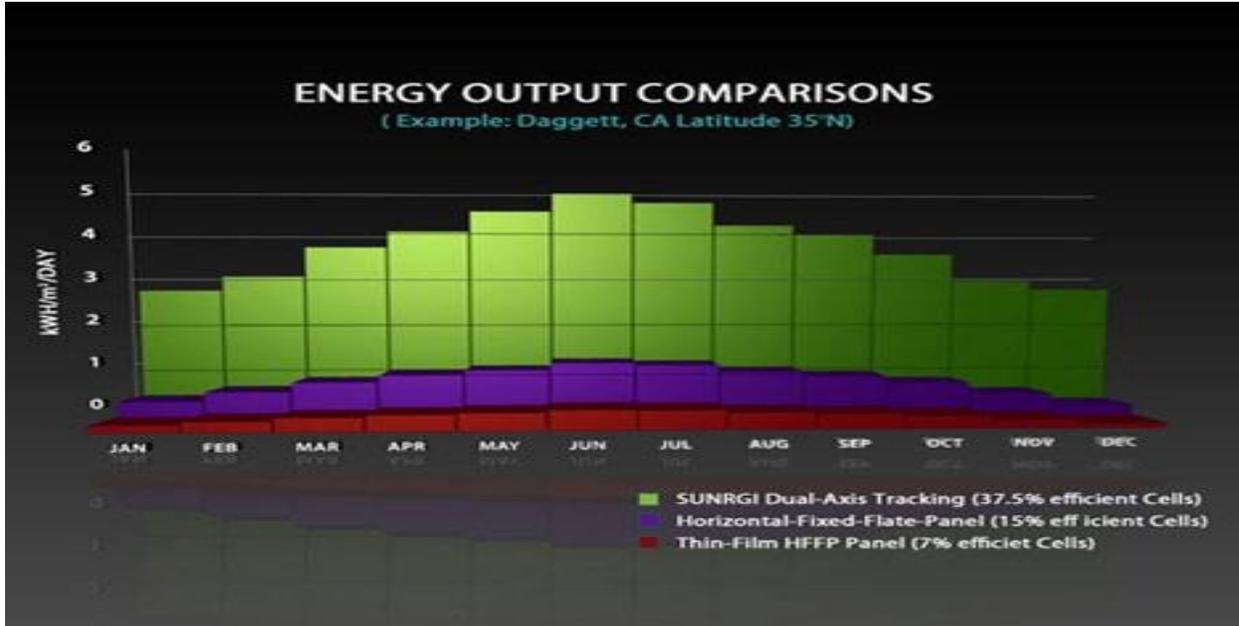
Solar

Sunrgi Xtreme Concentrated Photovoltaics

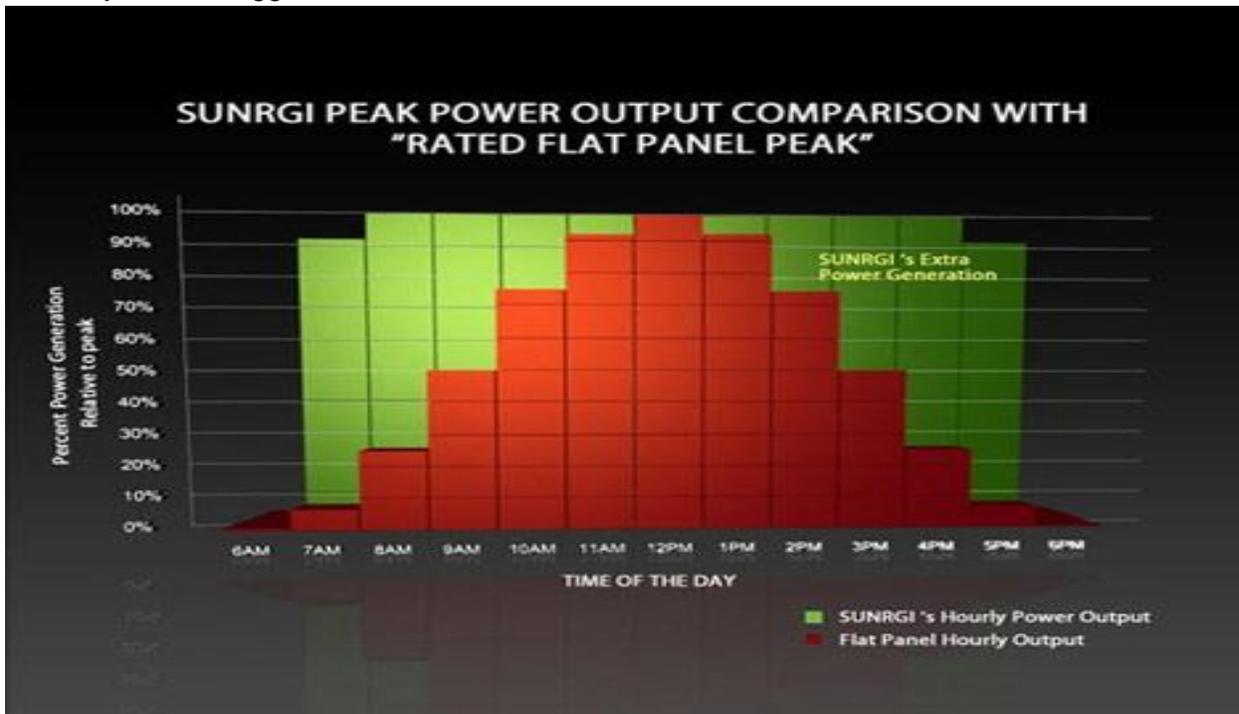
Sunrgi (www.sunrgi.com) recently made an impressive claim at the National Energy Marketers Association’s 11th Annual Global Energy Forum in Washington, D.C.: They say that their system will soon be able to “produce electricity at a wholesale cost of 5 cents per kWh. [A] price competitive with the wholesale cost of producing electricity using fossil fuels and a fraction of the current cost of solar energy.”

They do it with Xtreme Concentrated Photovoltaics (XCPV) by concentrating the sun's light almost 2,000 times into extremely efficient solar photovoltaic cells. Part of Sunrgi's patent-pending technology has to do with the cooling of the solar cells, dual-axis sun tracking and the way the whole system is optimized for mass-production.

Courtesy of Treehugger.com, 2008



Courtesy of Treehugger.com, 2008



Nanosolar (www.nanosolar.com):

Promising to create solar panels without silicone, these low cost PV panels are printed like paper. This company mixes PV nanoparticles into a proprietary ink system. They use equipment from the printing industry to produce solar electric foil at high speeds, bringing the overall price of solar panels down substantially.

Fuel Cells as Alternative Energy Sources

Fuel cells are basically “batteries for your building.” They generate energy through a chemical reaction just like a battery, but without the waste. These fuel cells are designed to last 20 years and release very few chemicals into the air. Fuel cells are an interesting alternative energy source because they do not rely on the weather - they simply run all the time. They are capable of energy generation as well as energy storage.

The fuel cell is installed on a property (not on a roof) and attached to methane or natural gas source. This source fuel kicks off a chemical reaction that produces energy and heat, as well as carbon dioxide and water. The amount of source fuel used is minimal.

Bloom Energy, the manufacturer of the Bloom box, has installations at Google, Ebay and other high-profile technology companies. A Google spokesperson said, “Bloom fuel cells are powering a portion of Google’s energy needs at our headquarters right here in Mountain View. This is another onsite renewable energy source that we’re exploring to help power our facilities. We have a 400 kW installation on Google’s main campus. During the first 18 months the project has had 98 percent availability and delivered 3.8 million kWh of electricity.”

Many are touting fuel cells as the next wave of alternative energy generation equipment. However, these cells need further testing prior to widespread commercial availability. They are also very expensive. Much research is being conducted to help find a way to produce fuel cells at a lower price point.

Conclusion

Alternative energy harvesting is in an historic position, where the political will and public mindset are aligned to such an extent that alternative energy harvesting is not only a popular choice for marketing value to tenants, but it is a revenue source to building owners via rooftop rentals, PPAs, and/or electricity sales arrangements with investors or utility companies.

Should the political landscape for Federal and state tax incentives and grants continue at its current level or increase to an even more favorable level, it will only be 10 or 15 years before every commercial building will have some sort of array on its roof, parking lot, or both.

The time has come to look at alternative energy generation as a possible revenue source. Everyone's thinking about it, and the opportunity is ripe for the picking. The ability to install energy harvesting equipment with no capital investment varies somewhat by state, but it is worth looking into no matter what your tax climate.

Enjoy your new rentable square footage: Rooftop Revenue.

Glossary of Terms

CAIR	Clean Air Interstate Rule (see NOx below)
Carbon Offset	A financial instrument designed to reduce greenhouse emissions. This instrument allows polluters to purchase offset credits from non-polluters, creating an economy of pollution reduction. For every unit of carbon created by a polluter, an equivalent offset credit may be purchased from an entity who has reduced their carbon emissions by using renewable energy (for example) or undertaking a carbon offsetting activity such as powering a factory with methane gas from a landfill.
EV	Electric Vehicle – automobiles that do not use internal combustion as a means to propel the vehicle. EVs run entirely on electricity via rechargeable batteries, eliminating the use of gasoline as the primary fuel for the vehicle.
Inverter	This device is part of a solar or wind array. Its purpose is to convert/invert the Direct Current (DC) energy that is harvested by the arrays and turn it into Alternating Current (AC) for use in buildings. If a building is monitoring energy production online, the data comes from the inverter.
MagLev	This is a technology used in some wind turbines to eliminate gears and friction. The parts of the turbine glide on an air cushion of magnetic polarization/levitation similar to how MagLev trains “ride above the rails” using magnetic polarization.
Megawatt	One megawatt equals one million kilowatts. Megawatt hours is a term used to describe energy generation on a utility scale.

NOx Credits (also called CAIR)	NOx is the generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. Many of the nitrogen oxides are colorless and odorless. However, one common pollutant, nitrogen dioxide (NO ₂) along with particles in the air can often be seen as a reddish-brown layer over many urban areas. The primary sources of NOx are motor vehicles, electric utilities, and other industrial, commercial, and residential sources that burn fuels. Nitrogen-Oxide State Implementation Plans (NOx SIP) compensate entities based how much they have reduced their NOx Production.
PHEV	Plug-In Hybrid Vehicle - a vehicle that has an internal combustion engine, but may also run on electricity via rechargeable batteries. The combustion engine supplements the electric engine in the vehicle.
PPA	Power Purchase Agreement - an arrangement in which investors install solar panels on large roofs (starting with one megawatt installations) and sell the energy to building tenants and the REC (and other) tax credits on the open market.
PV	Photo Voltaic - an abbreviation referring to the energy harvesting cells in solar panels. Solar panels themselves are often referred to as "PVs."
REC	Renewable Energy Credit - the Renewable Energy Credits are incentives set on a state-by-state basis, and are based on a lump sum of money. Once the money has been distributed, the RECs do not have value.
RPS Requirements	Renewable Portfolio Standard (also referred to as Renewable Power Source) - a regulation that requires the increased production of energy from renewable energy sources. In the United Kingdom, it is known as the Renewables Obligation regulation.
Smart Grid	Smart Grid - an initiative to transform the way electricity is distributed throughout the United States. The current electric grid pushes power in only one direction in an electrical circuit. In order to distribute power more effectively, power will need to be able to move in both directions on an electrical circuit. The Smart Grid will include the installation of Meters, which are software switches that will allow the utility to adjust where and how power flows to the grid in an intelligent way from a local or remote location.

Solar Integrators	Companies that are financing and maintenance companies that are enabling properties to engage with solar energy with little or no capital expense. These are not utility companies or panel manufacturers, they are installers and financiers.
Solar Panels	Also called PhotoVoltaics (PVs), these are modular panels that contain photovoltaic cells that harvest energy from the sun.
Thin Film	Thin Film is a roofing material that contains Photo Voltaic cells that harvest energy in a way that is similar to solar panels.

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