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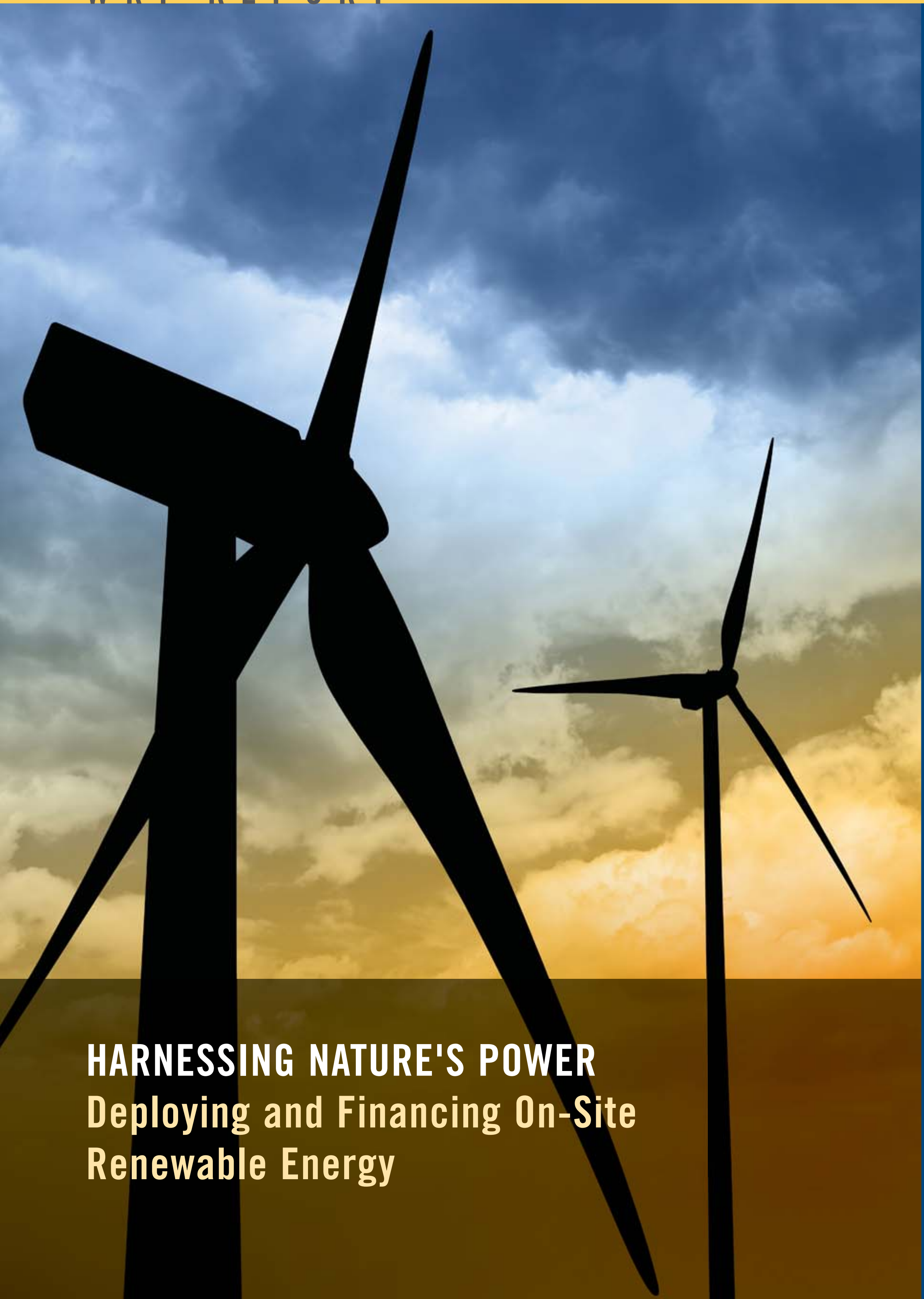
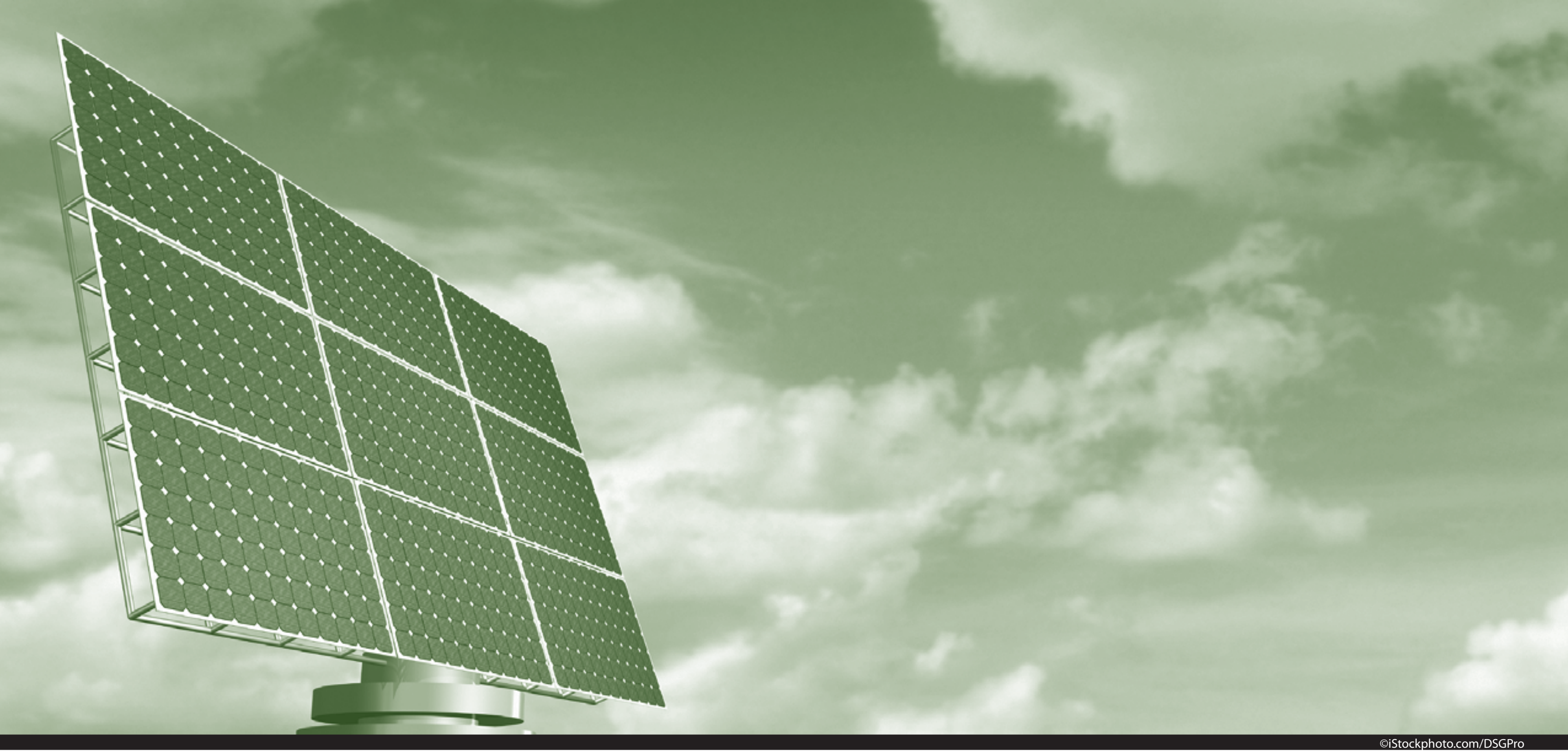


HARNESSING NATURE'S POWER
Deploying and Financing On-Site Renewable Energy

TIMOTHY C. HASSETT

WITH

KARIN L. BORGERSON



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Deploying and Financing On-Site Renewable Energy

BY

TIMOTHY C. HASSETT

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GENERAL DISCLAIMER

This publication has been prepared to acquaint its reader with the various features and benefits of renewable energy as well as financing options and incentives available for deploying renewable energy on-site. It is not intended as a definitive planning guide for undertaking a renewable energy project. Information contained herein was believed to be correct at the time of its publication, but neither the author, WRI, nor any of its staff, partners, or collaborators assumes any legal responsibility for accuracy, completeness, or usefulness of information contained herein and no reference to any commercial product or service implies an endorsement.

Prior to undertaking any renewable energy project, competent professional expertise is required to (1) assess the renewable resource and design an appropriate renewable energy system, (2) understand the complex legal, regulatory, accounting, and tax implications involved, and (3) ascertain whether any federal, state, or local incentives are applicable.

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Foreword

For decades businesses and consumers purchased and consumed energy with little regard to the environmental profile or impact of that consumption. Today, against the backdrop of a warming climate and increasing energy security concerns, that outlook is changing.

Businesses of every size and type are aware that our energy system must be modernized and diversified so that we can end our dependence on high-carbon energy sources. Around the country, the legacy of passive energy consumption is being replaced with smarter, proactive energy management that focuses both on cost and performance. The very definition of performance is now becoming multifaceted—reliability, security, and environmental performance are emerging as issues for energy, environmental, and financial managers alike.

The policies adopted and investments made by the U.S. Congress and Administration over the next several years will shape the country's infrastructure for decades to come. New markets for renewable energy, emerging under state leadership, are already available, and energy prices are expected soon to incorporate the costs of emitting greenhouse gases. Forward-thinking business managers are taking advantage of these opportunities to bring clean technologies to scale and take a lead in renewable energy deployment.

This report is based on a decade of experience that the World Resources Institute (WRI) has gained by working with major U.S. energy consumers as they explore strategies and opportunities to diversify their energy portfolios to achieve sustainable competitive advantage. It offers strategies and approaches that can be valuable to a wide range of firms looking at potential investments, contracts, and facility operational decisions regarding use of renewable energy. It provides guidance on how to consider the choice to finance or purchase renewable technologies for use on corporate facilities and advice on where to go for further information.

WRI's Green Power Market Development Group was founded with a ten-year goal of helping some of the largest energy consumers in the U.S. purchase and support 1,000 megawatts of clean, renewable energy—enough power to displace a large coal-fired power plant. The Group sought to bring new products and purchasing approaches into the market in order to support energy and environmental stewardship efforts. We are very pleased to report that the Green Power Market Development Group companies and WRI have met that goal, and these companies' learning and leadership has been replicated by many other firms.

We hope this report will inspire and assist you to craft and implement strategies to support renewable energy at your facilities, and that you will share your lessons and stories with us. Transforming our energy system is a journey that will require continued new learning and policy innovation. We thank you for joining us in this journey.

Jonathan Lash
President
World Resources Institute

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Executive Summary

In recent years, many U.S. corporations have deployed renewable energy systems at their headquarters, industrial facilities, and retail stores. These include large corporations—such as Google, Johnson & Johnson, Macy's, Staples, and Wal-Mart—and smaller firms, such as dairy farms, hotels, restaurants, wineries, and a ski resort.

Many companies, however, have yet to take advantage of the incentives available for investing in on-site renewable energy and the opportunities such investment brings. The purpose of this report is to provide a detailed introduction for such businesses on deployment and financing options for renewable energy systems, as well as on the risks and benefits involved. In so doing, our aim is to promote the scaling up of renewable energies as part of a transition by the United States to a low-carbon, high-energy-efficiency economy.

Key messages from the report are summarized in the following pages.

DEPLOYING RENEWABLE ENERGY: THE BENEFITS

Certain renewable energy technologies—such as large-scale wind power, solar thermal water heating, and geothermal heat pumps—are already economically competitive with traditional sources of energy, such as fossil fuels. Even when the cost of power produced by renewables is more than average utility rates, many companies can still save money by using renewables to institute "peak shaving." In peak shaving, companies produce renewable energy during periods of peak power use, when utilities often charge higher rates. In addition, government incentives can significantly reduce the actual cost of renewable systems. These incentives include federal, state, and local tax credits; tax deductions; accelerated depreciation; loans; production incentives; rebates; and grants.

Specific benefits for companies deploying renewable energy on-site can include:

- Reducing energy costs or creating a hedge against possible future energy price increases.

- Improving energy reliability at a company's location (depending on system configuration).
- Helping companies to be environmentally responsible and enhance their reputation through a reduction in greenhouse gas (GHG) emissions or a visible commitment to renewable energy.

AT A GLANCE: DEPLOYMENT AND FINANCING OPTIONS

When considering on-site renewable energy deployment, it is important to measure the quality of a specific site's renewable energy resource (such as wind or sun). If a site is acceptable, there are numerous options for deploying and financing a renewable energy system (compared below). In many of these options, a company will own the generation assets deployed at its site, but a company can still benefit even if it does not own the assets.

One fairly standard option is the Direct Ownership of Power (Use of Power). In this scenario, a company purchases or leases a renewable energy asset for on-site deployment and uses the power itself and, in many cases, sells some excess power to the grid.

A far less common option is Direct Ownership of Power (No Power Use). In this scenario, a company does not use most of the power generated by the system installed at its site, but rather uses the system primarily to sell power to the grid. This scenario is not yet common due to a number of factors, including disincentives created by government regulation (such as limitations on the size of systems that qualify for a billing practice called "net metering"). This deployment model could grow, however, if governments adopt "feed-in tariffs," which establish a guaranteed minimum electricity tariff.

Companies seeking to limit their initial capital commitment, or earn a return on a previously under-utilized asset (such as a rooftop), can consider Third-Party Ownership of Power. In this scenario, a third party deploys renewable energy assets at a company (the site host) and:

a. sells the power to the site host under a long-term power purchase agreement (Use of Power), or
b. leases the space and sells the power to the grid (No Power Use).

IDENTIFYING AND DEPLOYING A RENEWABLE ENERGY OPTION

To assist companies in making informed decisions, we have defined objectives and risks commonly associated with on-site renewable energy deployment and developed a schematic of the basic stages involved in deployment.

In order to choose the best deployment and financing option, a company must define its objectives and understand risk trade-offs. Objectives might include:

- **Reducing Energy Costs:** Either reducing energy costs or creating a hedge against possible future price increases.
- **Improving Energy Reliability:** Although most renewable technologies cannot provide sole back-up

TABLE 1. ON-SITE RENEWABLE ENERGY DEPLOYMENT AND FINANCING OPTIONS

	DIRECT OWNERSHIP OF POWER	THIRD-PARTY OWNERSHIP OF POWER
Use of Power	Company invests in an on-site renewable energy project and consumes the power	Investor installs renewable assets at a company's site and company purchases power under long-term contract
Financing Options	General corporate financing or dedicated financing: Secured lending Leasing[1] Vendor financing ESCO[2] with Energy Savings Performance Contract	Solar Power Purchase Agreement (PPA) ESCO with Power Purchase Agreement
No Power Use	Company invests in an on-site renewable energy project and sells all or most of the power	Investor installs renewable assets at a company's site in exchange for lease payments or other consideration and sells the power to another entity
Financing Options	Similar to Direct Ownership (Use of Power)	Hosting arrangement in exchange for lease payments or other consideration

Notes

1. Note that under leasing arrangements ownership of the renewable asset may remain with the lessor, but the power generated by the asset typically belongs to the lessee. When reviewing leasing alternatives, it is important to understand which party is able to benefit from the various federal and state incentives available for renewable energy deployment.
2. An ESCO is an Energy Services Company. See Section V for more information.

power for mission critical needs, an on-site deployment can improve energy reliability if it includes energy storage (such as a battery).

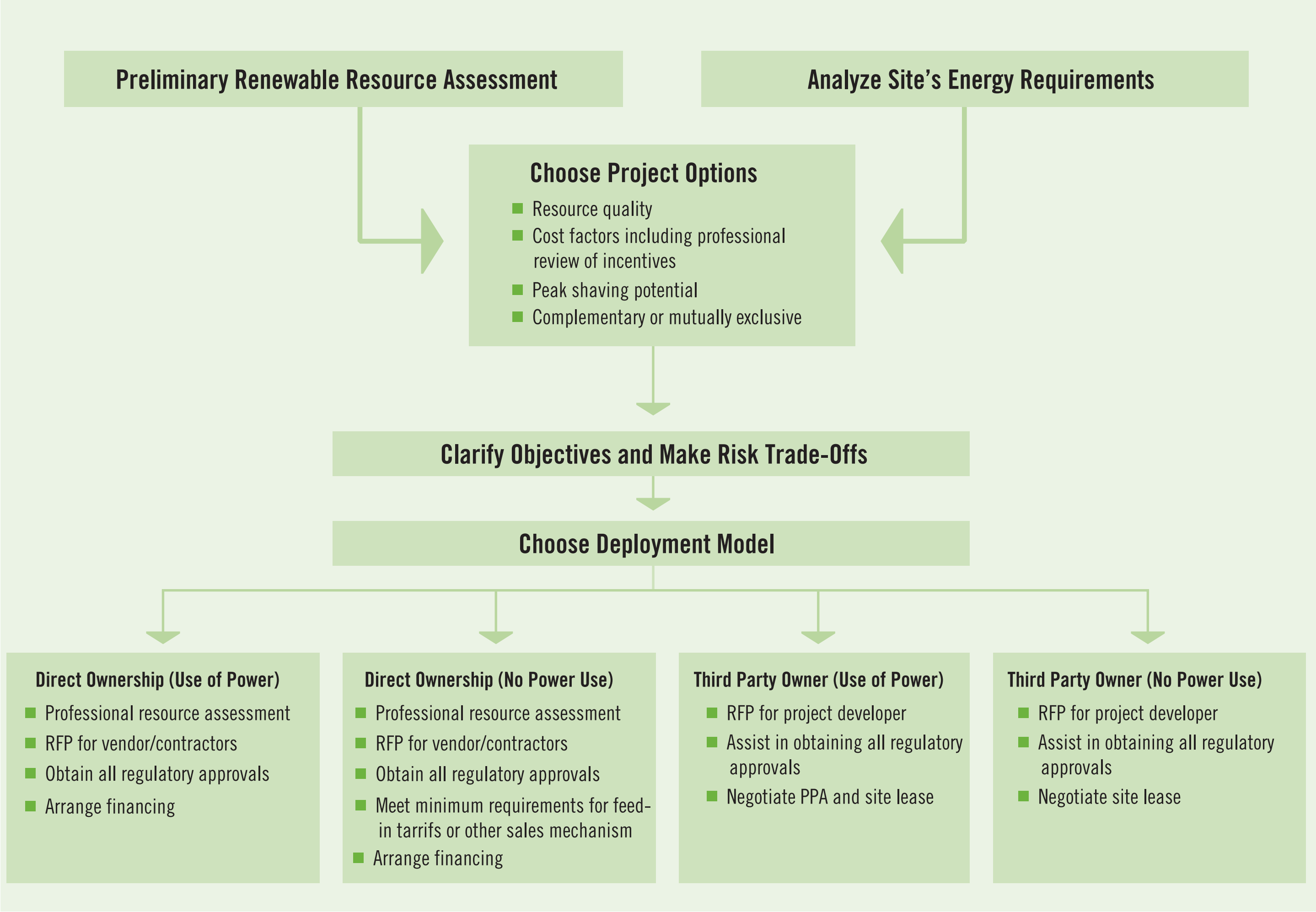
- **Enhancing Brand/Reputation:** Through a visible commitment to renewable energy and/or a reduction in greenhouse gas emissions.
- **Using Tax Appetite:** If a company has sufficient taxable income, it can benefit by taking advantage of tax-based incentives for deploying renewable energy.

Risks associated with deploying on-site renewable energy can include:

- **Dispatch Risk:** Power is not generated by an on-site deployment for any reason.
- **Operational Risk:** The system does not perform as anticipated. This risk is typically assumed by the entity responsible for operating and maintaining the system.
- **Technology Risk**: Technological improvement creates an opportunity cost for someone that has already invested in the older technology.
- **Transfer Risk:** Renewable energy assets may have to be redeployed when a company moves or changes business locations.
- **Credit Metrics:** A renewable energy investment may affect the financial ratios that analysts use to assess a company.

Successfully defining objectives and understanding risks can help a company make the best decisions about deploying renewable energy systems. The basic stages in considering an on-site renewable energy deployment are shown schematically in Figure 1.

FIGURE 1. DEPLOYING ON-SITE RENEWABLE ENERGY



SECTION I

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Introduction

Many companies in the United States are already experiencing the benefits of deploying renewable energy technologies at their business sites. These include large corporations—such as Google, Johnson & Johnson, Macy's, Staples, and Wal-Mart—and smaller firms, such as dairy farms, hotels, restaurants, wineries, and a ski resort. Corporations have even deployed renewable energy at "brownfield" sites.[1]

These investments have helped companies reduce energy costs or create a hedge against possible future price increases. They have also helped companies generate a return on an underutilized asset, such as a rooftop, and enhance their reputation with customers. In the future, investing in renewable energy could also help companies adapt to a "carbon-constrained economy," in which new government regulations on greenhouse gas emissions could increase power prices.

A range of concerns, however, may be preventing companies from deploying renewable technologies. Managers may be concerned about issues such as the initial capital cost or a low perceived rate of return. They may have difficulty determining the optimal financing solution, lack familiarity with renewable energy options, or be concerned about having sufficient in-house expertise to maintain and manage a renewable energy system.

While such concerns are understandable, it is important to know that numerous incentives and deployment options have evolved to address these issues. Federal and state governments offer a myriad of incentives that can reduce capital commitments or boost financial returns. Third-party ownership or hosting models allow a company without an appetite for tax credits or deductions to indirectly benefit from tax-based incentives offered by governments. These models can also allow companies to reap many of the benefits of renewable energy without making a capital commitment. If a company prefers direct ownership of its renewable energy assets, diverse financing options are available.

This publication is designed to help companies explore the various options for deploying and financing renewable energy technologies. In particular, it considers deployment strategies for solar photovoltaic, solar thermal, wind, and geothermal heat pump technologies and provides examples of successful deployments. It provides a unique approach to considering each option, along with information about their relative features and benefits. In addition, it identifies and analyzes numerous risks, so that companies can make informed decisions.

Notes

1. U.S. Congress 2002. Public Law 107–118 (H.R. 2869), "Small Business Liability Relief and Brownfields Revitalization Act," defines brownfields as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant."

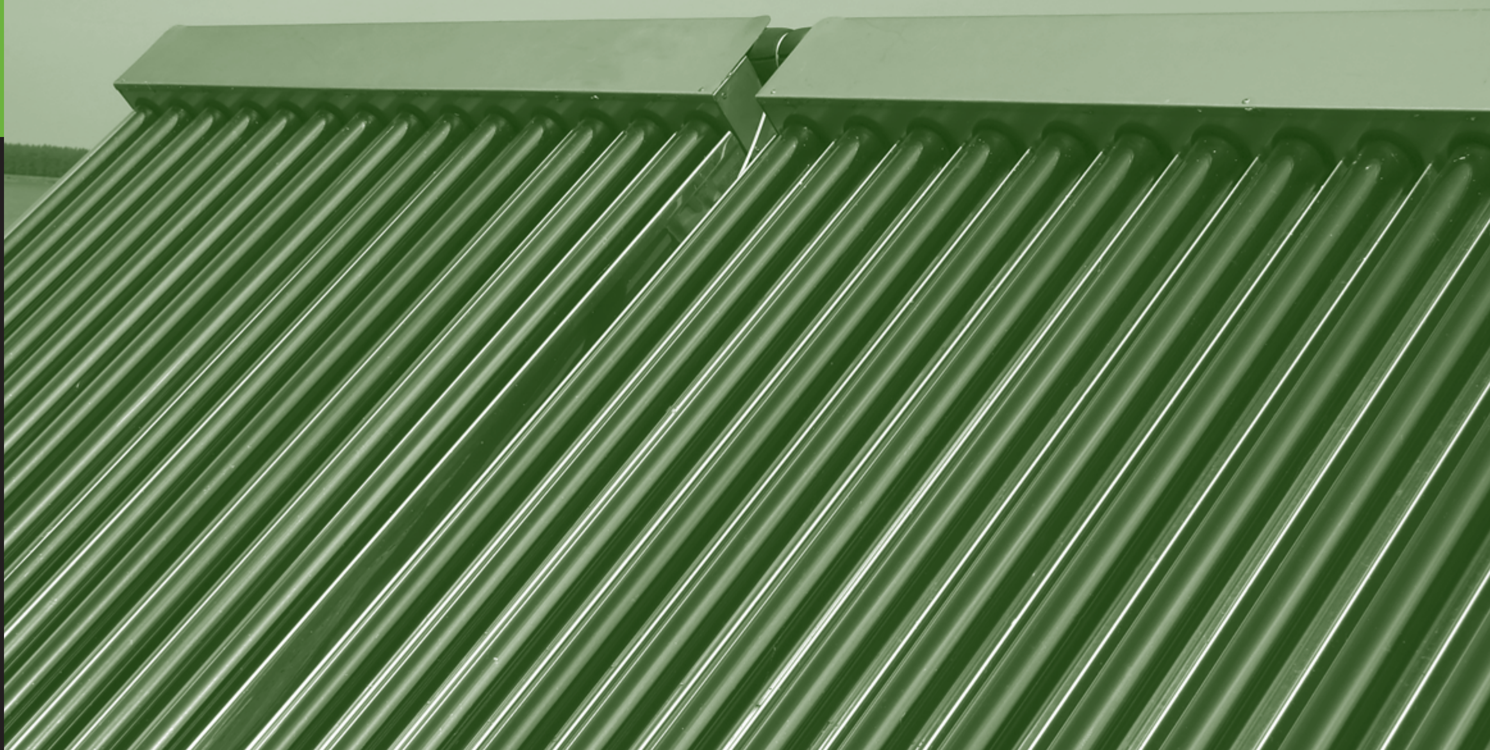
BOX 1. WRI'S RENEWABLE ENERGY AND CLIMATE POLICY WORK

The World Resources Institute has been engaging the private sector on climate policy and low-carbon technology deployment for several years. So far, we have designed our projects to achieve two primary goals: (1) accelerate corporate deployment of renewable energy, and (2) build a business constituency that is more informed on climate and energy policy. Our business network is comprised of over 70 large corporations that we engage through the Green Power Market Development Group (GPMDG), along with its California and European affiliates, and the U.S. Climate Business Group, with regional workgroups in the Northeast, Midwest, and Southeast. Our current projects have generated significant outcomes over the past 8 years, including:

- GPMDG partners have procured over 850 MW of new, cost-competitive renewable energy.
- GPMDG partnerships have helped create new financing structures, develop pricing programs, and encourage policy incentives to promote the use of renewable energy and energy efficiency in the United States and Europe.
- GPMDG partners have become leaders in supporting new technologies. General Motors is one of the nation's biggest corporate users of waste gas from landfills, Google has made important investments in geothermal and other renewable power technologies, and several GPMDG members make the list of top corporate users of solar photovoltaics.
- 10 Climate Midwest partners are actively participating in state and regional climate change policy initiatives.
- U.S. Climate Action Partnership, which WRI helped found, has released *A Blueprint for Legislative Action* with cap-and-trade design recommendations. (See http://us-cap.org for more information.)

Source: World Resources Institute.

SECTION II



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The Benefits of Renewable Energy

Many companies have already discovered the benefits of deploying renewable energy at their business locations. These benefits can include:

- **Reducing Energy Cost:** Certain renewable energy technologies are already competitive with traditional sources of power and can offer immediate cost savings. Most renewable energy technologies provide a hedge against possible future price increases or volatility.
- **Improving Energy Reliability:** In certain cases, on-site renewable technologies may help provide back-up power when there are problems with getting power from the electricity grid. In order for on-site renewables to provide back-up power, the system must include a way to store electricity, such as batteries.
- **Greenhouse Gas Reductions:** Deploying renewable energy on-site can reduce a company's greenhouse gas emissions. This helps provide a hedge against possible increased costs arising from measures to reduce greenhouse gas emissions.
- **Brand Enhancement:** Investing in renewable energy can be an important factor in appealing to a consumer market that is becoming increasingly environmentally conscious.

Before discussing how to deploy renewable energy technologies, we will consider each of these benefits in detail.

ENERGY COST

There is currently a wide disparity in the economic cost of renewable energy technologies. Direct comparison of these costs is difficult due to the nature of renewable energy generation. (See Box 2: Understanding the Cost of Renewable Energy.) With this caveat in mind, Figure 2 compares the economic cost of electricity produced by the renewable technologies most commonly deployed on-site to the average retail price paid by commercial users in 2008 (10.31 cents/kWh through September 2008).[1] The

BOX 2. UNDERSTANDING THE COST OF RENEWABLE ENERGY

The cost of renewable energy generation can be considered in two ways: (1) economic cost, and (2) financial cost.

Economic Cost

Economic cost is the cost of generating power from the underlying renewable energy asset and is a function of the:

- **Quality of the available renewable energy resource:** For a given renewable energy asset, such as a wind turbine or photovoltaic cell, more power will be generated with a better quality renewable resource. However, better quality does not necessarily just mean stronger. For example, at very high wind speeds, many wind turbines are designed to cut out so as to avoid excessive wear.
- **Procurement price:** The cost of the renewable energy system has a direct impact on the cost of generating renewable power. For a given renewable energy system and renewable resource, lower procurement prices lead to lower power generation costs.
- **Operating and maintenance expenses:** These are the ongoing costs of operating and maintaining the renewable energy system.

Financial Cost

Financial cost is the actual cost to the company of its renewable energy and is the economic cost adjusted for the impact of:

- **Interest expense:** Although renewable energy systems generally do not require fuel, they can be capital-intensive. As such, the capital charges needed to finance the asset can be a large component of power generation costs.
- **Federal, state, and local incentives:** Such financial incentives can reduce the cost of acquiring, financing, or operating a renewable energy system.

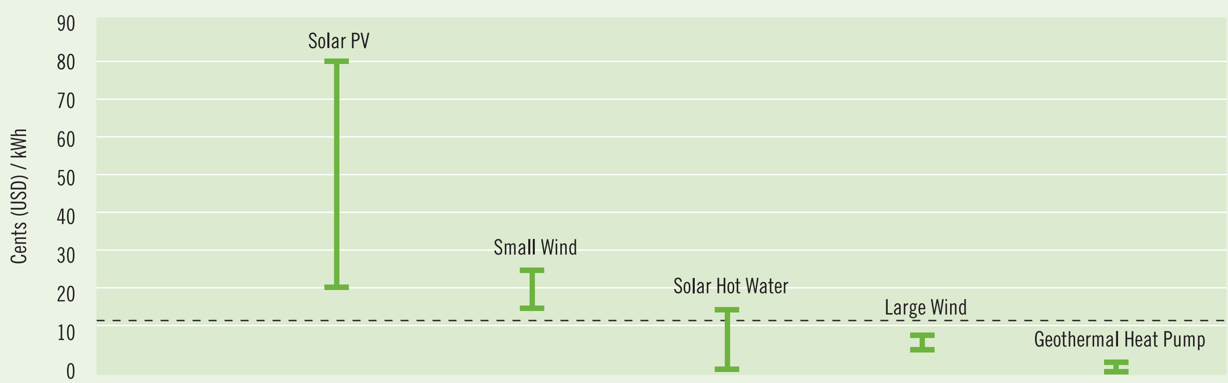
comparison shows that several renewable applications compare favorably, including solar hot water, large wind, and geothermal heat pump.

This analysis, however, may understate the economic advantages of deploying on-site renewable energy. That is because it uses the average retail price for electricity paid by commercial users. This is problematic for two reasons: (1) there are significant differences in commercial electricity rates between states, and (2) many utilities charge commercial users more for power during peak use periods. As a result, renewable energy applications that provide a good peak-shaving profile (meaning they can generate electricity when "time of use" prices are at their highest) may offer significant savings. Solar photovoltaic installations are a good example of a system that has peak-shaving potential, since the sun typically shines brightly on hot days, when demand for power peaks due to air conditioning needs.

When evaluating renewable energy applications, the financial cost—not the economic cost—should drive investment decisions. In part, this is because the financial cost accounts for government incentives at the federal, state, and local levels that can reduce the cost of renewable energy investments. Such incentives can have a significant impact on the financial return of a renewable energy project.

In California, for example, a qualifying solar photovoltaic system would benefit from both a 30% federal investment tax credit and the incentives offered under the California Solar Initiative.[2] The California incentive initially provided a lump sum payment of up to $2.50 per kilowatt for systems of less than 50 kW.[3] Section

FIGURE 2. COMPARISON OF RENEWABLE ENERGY COSTS AND THE 2008 AVERAGE U.S. COMMERCIAL ELECTRICITY PRICE

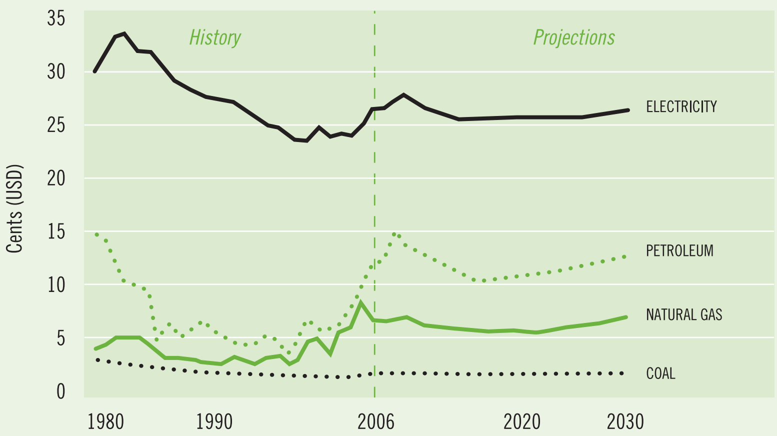


	Solar PV	Small Wind	Solar Hot Water	Large Wind	Geothermal Heat Pump
System size	2–5 kW	3–100 kW	0.5–2 MWth	1–3 MW	1–10 MW
Cost (cents/kWh)	20–80	15–25	1–15	5–8	0.5–2

Sources: Derived from REN21 2008; EIA 2008a (for 2008 average price).

- - - - 2008 U.S. National Average Commercial Electricity Price (10.31 cents/kWh through September 2008)

FIGURE 3. EIA ENERGY PRICES, 1980–2030 ($ 2006 PER MILLION BTU)



Source: EIA 2008b.

BOX 3. GOOGLE USES SUNSHINE TO CUT COSTS AND PILOTS A SHADOW PRICE FOR CARBON

Google recently installed 1.6 MW of solar photovoltaic capacity at its Mountain View corporate campus. The installation meets 30% of the facility's peak energy needs and has an estimated payback period of just 7.5 years.

In addition, Google has indicated that it will incorporate a "shadow price" for carbon into its power cost estimates when evaluating sites for new data centers. According to a company statement, "Pricing carbon is an important tool to reducing the financial risk that our energy investments face. Moreover, when evaluating power options, using a shadow price for carbon puts renewable energy on a more level playing field."

Source: Google 2008.

IV provides a general overview of a broad array of such incentive programs.

Even when there is no immediate cost advantage to deploying renewable energy, most renewable projects may act as a hedge against possible future increases in energy prices. Renewable applications such as wind power, solar photovoltaic, solar thermal water heat, and geothermal heat pumps use no fuel. Consequently, they serve as a natural hedge against potential rising fossil fuel costs.

Predicting future prices for any commodity is difficult and energy is no exception. Figure 3 charts recent historical and projected energy prices from the Energy Information Administration (EIA). It clearly highlights the increase in the real dollar cost of energy that began in the early part of this decade.

While the EIA is projecting relatively constant real dollar energy costs through 2030, there are two important points to consider:

- **Inflation:** The prices shown in Figure 3 are in constant 2006 dollars. They do not include the potential impact of inflation, which could increase costs. Deployment of many renewable energy technologies, such as wind and solar, provides a hedge against inflationary increases in fuel costs since they do not require any fuel use.
- **Carbon Costs:** The EIA projections do not incorporate the impact of future government policies that would constrain emissions of greenhouse gases and probably increase energy prices. For instance, the EIA estimates that electricity prices could have risen 10% to 64% under S. 2191, the Lieberman Warner Climate Security Act of 2007 (increasing from a constant 2006 dollar reference price of 8.85 cents/kWh in 2030 to between 9.75 and 14.52 cents/kWh in 2030). The size of the increase would have depended on the cost and availability of electricity generated by low-emission technologies and access to international offsets.[4] These estimates are national averages; actual price changes would vary by region.

ENERGY RELIABILITY

Distributed energy systems can provide valuable back-up power in case of interruptions in electricity supplied by the transmission grid. Some businesses—including data centers, resort hotels, food processors, and process manufacturers—can experience significant losses due to blackouts. To prevent such losses, these businesses have for years maintained conventional back-up generators (powered by fossil fuels).

To improve energy resiliency, these companies could also incorporate certain types of on-site renewable energy systems. These systems must include energy storage (i.e., batteries or other storage devices), as well as appropriate auxiliary equipment, in order to provide uninterrupted power in the event of a blackout.[5] Many forms of renewable energy are intermittent, meaning they are only available when the sun is shining or the wind is blowing. When paired with an energy storage system such as batteries, these systems can provide a more consistent back-up power on a scale that matches the size of the generation system and batteries. Any firm planning to use its on-site renewable system for backup power should consider the scale of its emergency power needs to see if the system provides sufficient backup or if additional emergency power supply may be needed. However, most renewable energy applications should not be used as the sole backup for mission-critical needs since a grid interruption can occur at any time and last for hours or days, possibly exceeding the generation and storage capacity of the on-site system. This risk would be most acute if the grid interruption coincided with temporarily poor renewable resource conditions at a site.

GREENHOUSE GAS REDUCTIONS

Deploying renewable energy on-site allows a company to reduce its greenhouse gas emissions from either its direct (Scope 1) or indirect (Scope 2) emissions[6], under accounting and reporting standards established by the international Greenhouse Gas Protocol Initiative (co-convened by WRI and the World Business Council for Sustainable Development):

- **Scope 1:** Direct GHG emissions include emissions that "occur from sources that are owned or controlled by the company, for example, emissions from combustion in owned or controlled boilers, furnaces, vehicles, etc."[7]
- **Scope 2:** Electricity indirect GHG emissions account for "GHG emissions from the generation of purchased electricity consumed by the company. Purchased electricity is defined as electricity that is purchased or otherwise brought into the company."[8]

Solar water heating and geothermal heat pump applications, for instance, can reduce emissions from energy required for heating water or facilities. This serves to reduce either Scope 1 or Scope 2 emissions depending on the energy (direct combustion or purchased electricity) that would have been used to meet these needs. On-site solar photovoltaic and wind electric generation can also reduce indirect (Scope 2) emissions by reducing the amount of power purchased from the grid.

BRAND ENHANCEMENT

By deploying on-site renewable energy, a company can enhance its image with customers, investors, and other stakeholders in several ways. First, the company can reduce its contribution to climate change, an increasingly widespread concern. Second, it can make a highly visible commitment to producing green energy by investing in "high-profile" technologies such as wind turbines.

Managing a company's greenhouse gas emissions is critical since a variety of stakeholders—from consumers and investors to policymakers and regulators—are becoming increasingly concerned about climate change. At the same time, companies have increasingly turned to "green marketing" in response to growing public concern about environmental sustainability. In the future, such marketing may become more important in reaching consumers, and deploying renewable energy on-site is one way a company can demonstrate its commitment to a sustainable future.

BOX 4. TO MAKE CLAIMS ABOUT USING GREEN POWER, DO NOT SELL THE RENEWABLE ENERGY CERTIFICATES (RECS)

Renewable energy certificates (RECs) are tradable instruments that indicate the generation of one megawatt hour of electricity from a renewable source. According to a recent WRI fact sheet, "Companies that install and own on-site renewable power systems can claim the use of green power from their projects. However, companies that choose to sell the RECs from their system to improve project economics give up the right to claim they are buying the green power from the system, even though it is located at their facility."[1,2]

Note

1. Aga and Lau 2008.
2. The FTC is currently reviewing the "Guides for Use of Renewable Marketing Claims," or Green Guides, and has sponsored a series of workshops, one of which (January 8, 2008) focused on carbon offsets and renewable energy certificates.

Deploying renewable energy can also have a positive impact on corporate image if the system is highly visible. Wind towers or solar photovoltaic systems, for instance, are more visible to the public than geothermal heat pumps. Companies seeking to maximize the visibility of their renewable energy investments may want to consider which system would best fit their needs. For example, the visibility of a renewable installation might be more important for commercial locations with significant retail traffic or for manufacturing plants and distribution centers near main transportation thoroughfares.

Deploying on-site renewable energy offers many potential benefits, and as Innovest's recent study shows, carbon can make a difference. (See Box 5.)

BOX 5. INNOVEST'S CARBON BETA™ SHOWS THAT CARBON MATTERS

A 2007 study by Innovest Strategic Value Advisers compared investment returns of top "carbon performers" and "carbon laggards." Innovest rated a company's carbon performance based on its Carbon Beta™, which analyzes four factors:

- "Companies' overall carbon footprint or *potential* risk exposure, adjusted to reflect differing regulatory circumstances in different countries and regions
- Their ability to *manage* and reduce that risk exposure
- Their ability to recognize and seize climate-driven opportunities on the *upside*
- Their rate of improvement or regression"[1]

Overall, companies rated as top carbon performers had annualized rates of return that were 3.06% higher than companies rated as below average (from June 2004 to June 2007).

Note

1. Innovest Strategic Value Investors 2007.

Notes

1. EIA 2008a.
2. CPUC 2008a.
3. For systems larger than 50kW the California Solar Initiative provides performance based incentives over a 5-year period of up to $0.39/kWh for residential and commercial customers and $0.50/kWh for non-taxable entities. Please note that all incentive amounts (per kW and kWh) reduce as a function of the quantity of solar energy installed. Please refer to the appropriate CPUC Program Administrators for current information on incentive levels.
4. EIA 2008b.
5. Solar Ray n.d. Virtually all grid-connected renewable energy systems that do not have battery backup are required to automatically shut down in the event of a blackout. This is to protect utility workers. If a site installs a grid-connected renewable energy system that does not include batteries, the system will not provide backup power during a blackout.
6. The Protocol also covers a Scope 3 category of emissions (other indirect GHG emissions). These are defined as "a consequence of the activity of the company, but occur from sources not owned or controlled by the company". As such, an on-site renewable energy deployment would not have an impact on a company's Scope 3 greenhouse gas footprint.
7. WRI and WBCSD 2004.
8. Ibid.

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SECTION III

Assessing a Site's Renewable Energy Resource Potential

While on-site renewable energy projects may provide numerous benefits, not all technologies are appropriate in all circumstances. This section provides a brief introduction to assessing a site's potential for four basic renewable energy technologies: geothermal heat pump, wind, solar photovoltaic, and solar thermal water heat. Before embarking on any renewable energy project, however, companies should seek competent professional advice.

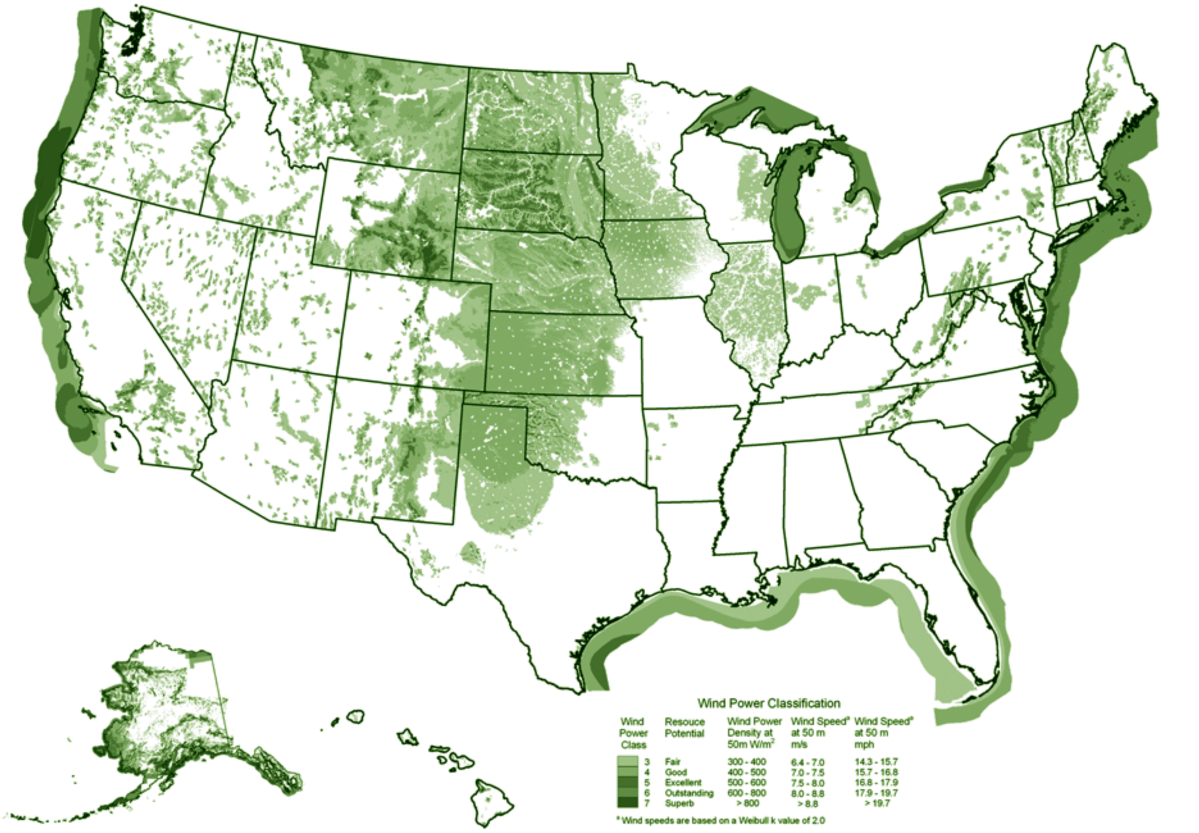
GEOTHERMAL ENERGY

Geothermal energy systems take advantage of temperatures beneath the earth's surface to provide energy. There are several different ways that companies use geothermal energy:

- **Electricity Generation:** Using geothermal heat reservoirs to generate electricity through turbines.
- **Direct Geothermal Use:** Using lower-temperature geothermal resources for district-level heating and in greenhouses or aquaculture. "Low-temperature geothermal resources exist throughout the western U.S., and there is tremendous potential for new direct-use applications. A recent survey of 10 western states identified more than 9000 thermal wells and springs, more than 900 low- to moderate-temperature geothermal resource areas, and hundreds of direct-use sites."[1]
- **Geothermal Heat Pumps (GHPs):** Using temperatures just some six feet below ground surface that remain relatively constant throughout the year to assist with heating in winter and cooling in summer. Although they require electricity to operate, GHPs "use 25%–50% less electricity than conventional heating or cooling systems."[2]

GHPs are fairly easy to deploy. Since "shallow ground temperatures are relatively constant throughout the United States, geothermal heat pumps (GHPs) can be effectively used almost anywhere."[3] Only a competent professional, however, can determine the type and design of the GHP best suited to a particular location.

FIGURE 4. UNITED STATES WIND RESOURCE MAP



Note: This map shows the annual average wind power estimates at 50 meters above the surface of the United States. It is a combination of high resolution and low resolution datasets produced by NREL and other organizations. The data was screened to eliminate areas unlikely to be developed onshore due to land use or environmental issues. In many states, the wind resources on this map is visually enhanced to better show the distribution on ridge crests and other features.

Source: The original map was developed by the National Renewable Energy Laboratory for the U.S. Department of Energy but modified by World Resources Institute for this publication.

WIND

Wind energy systems generate electricity by using turbines to capture the wind's energy. Many locations in the United States have good wind resources (see Figure 4). Evaluating the quality of the wind resource at a specific site is critical to determining if it is suitable. Before making any investment decision, companies should commission a professional wind study, which evaluates the quality and consistency of a site's wind resource potential. This information also allows a company to evaluate whether the wind will be blowing when power is needed most.

In addition to obtaining a wind study, investors must research a number of other issues, including:

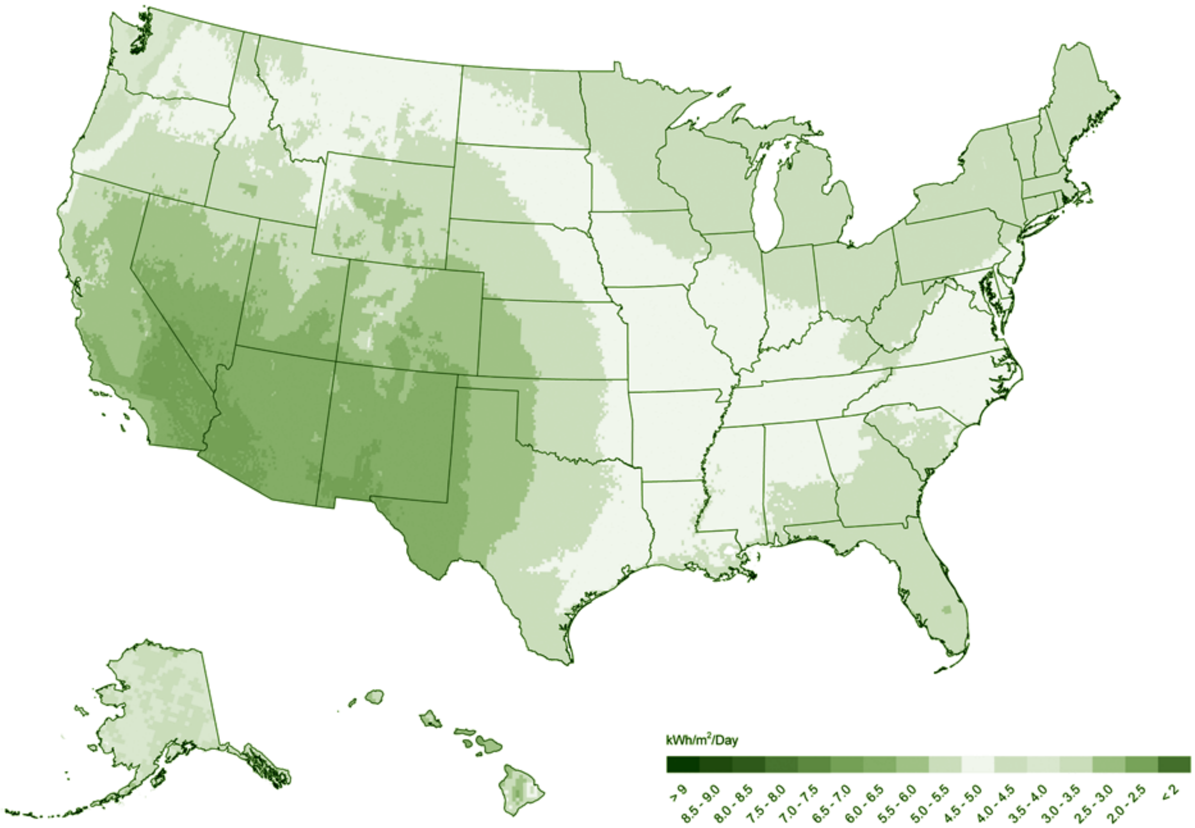
- Zoning restrictions and permitting requirements
- Environmental impacts
- Grid interconnection requirements
- Net metering regulations
- Existence of and qualifying criteria for incentives

BOX 6. SKI RESORT MAKES SNOW WHEN THE WIND BLOWS

Jiminy Peak Mountain Resort, in Massachusetts, installed a 1.5 MW wind turbine on its property in response to concerns about increasing energy costs. One of the key attractions to using wind power is that the resort's wind resource is best during winter months, when Jiminy's energy requirements are highest due to snowmaking and ski lift operations. The resort used a grant and a 10-year bank loan to finance the project, which has an estimated payback period of 8 years.

Source: EOS Ventures 2008.

FIGURE 5. UNITED STATES SOLAR RADIATION MAP



Note: Annual average solar resource data is shown for a til = latitude collector. The data for Hawaii and the 48 contiguous states is a 10 km, satellite modeled dataset (SUNY/NREL, 2007) representing data from 1998–2005. The data for Alaska is a 40 km dataset produced by the Climatological Solar Radiation Model (NREL, 2003).

Source: The original map was developed by the National Renewable Energy Laboratory for the U.S. Department of Energy but modified by World Resources Institute for this publication.

SOLAR PHOTOVOLTAIC

Solar photovoltaic systems generate electricity using technologies that capture the energy in sunlight. Many parts of the United States—especially the Southwest—have abundant solar resources (see Figure 5, which shows estimates of the average daily total radiation for flat plate solar collectors). Before investing, however, firms should commission a thorough professional study of a specific site's solar resources. Even if it reveals lower or moderate resources, solar power could still be financially attractive, depending on financial incentives and regulatory context.

As with wind projects, other issues to consider when planning a solar project include zoning and permitting requirements, environmental impacts, grid interconnection and net metering regulations, and the existence of and eligibility criteria for any incentives.

BOX 7. BP TRANSFORMS BROWNFIELD INTO "BRIGHTFIELD"

In 2002 BP completed the installation of one of the largest solar power facilities on the East Coast, used exclusively for remediation purposes. It has some 276 kW in capacity. It is on a gypsum landfill adjacent to BP's 130-acre Paulsboro site, which had served as a distribution and storage facility for petroleum and specialty chemicals. BP is remediating the Paulsboro site to return it to productive use. The solar installation is providing approximately 20-25% of the power needed for the groundwater treatment plant and soil vapor extraction system used in the remediation effort.

Source: BP Solar n.d.

SOLAR WATER HEATING

Solar thermal water heating systems do not generate electricity. Instead, they use the sun's heat to provide hot water for residential and commercial applications. Solar water heating is not restricted to warm, sunny climates. In fact, "solar water heating systems can be used effectively throughout the Unites States at residences and facilities that have an appropriate near-south facing roof or nearby unshaded grounds for installation of a collector."[4]

There are several types of solar water heating systems:[5]

- **Active or Passive:** Refers to whether electricity is required to power pumps (active) or whether natural convection circulates water (passive).
- **Direct or Indirect:** Refers to whether water is heated directly by the sun or whether it is heated indirectly by a heat transfer fluid.

In addition to having an appropriate installation surface, the most cost-effective sites for this technology typically have generally constant demand for hot water and relatively high energy prices.[6]

Determining whether a solar water heating system can generate cost savings for a business requires assessing:

- whether there is an appropriate physical installation site
- the pattern of hot water consumption
- the current cost of water heating
- zoning restrictions or permitting requirements
- whether any incentives are available

BOX 8. CANADIAN HOTEL SAVES MONEY WITH YEAR-ROUND SOLAR HOT WATER

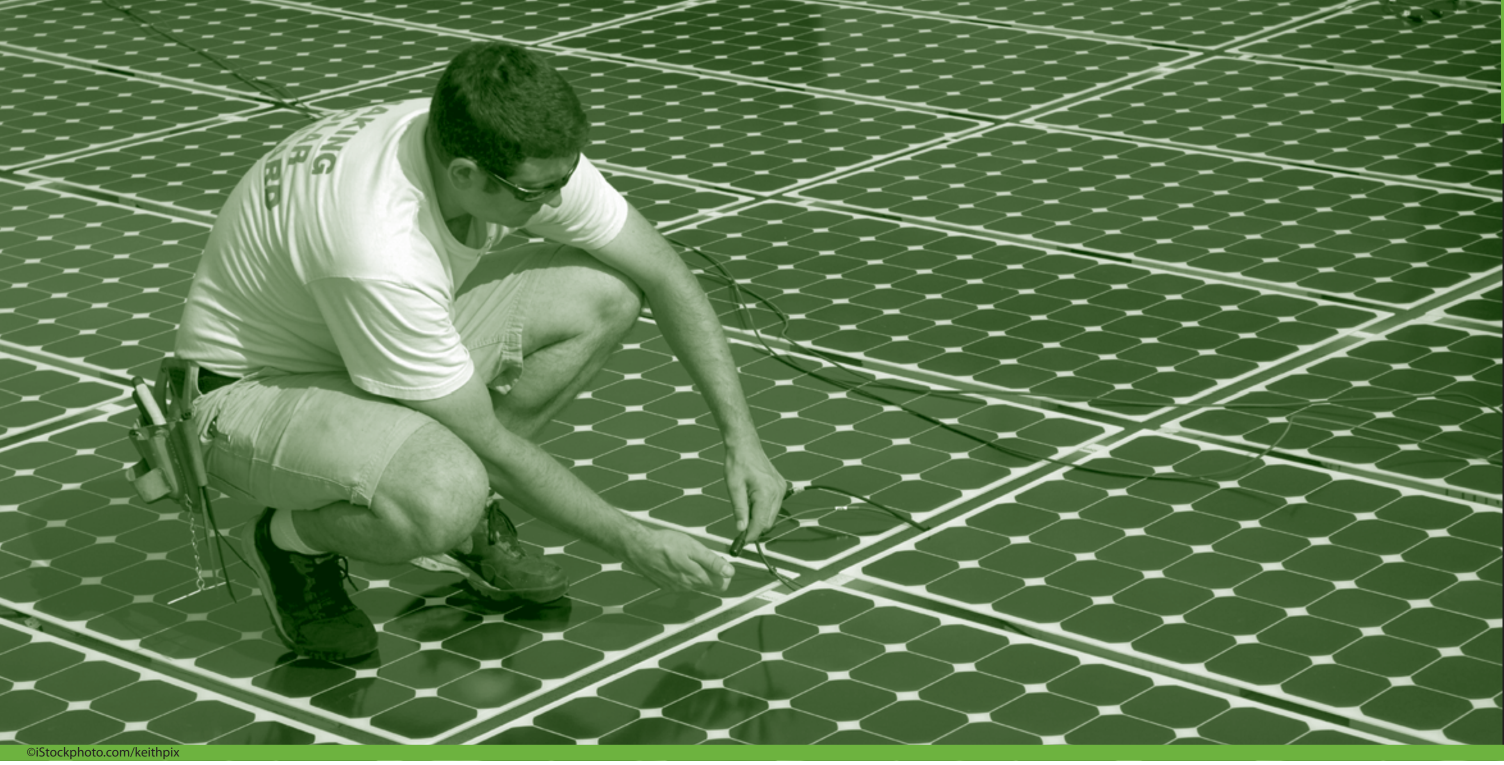
Solar thermal systems can be advantageous for any industry that requires a significant amount of hot water on a regular basis, including hotels, restaurants, agriculture, and food processors. For instance, the Confederation Place Hotel in Kingston Waterfront, Canada, benefits from two solar water heating modules. They provide year-round hot water to guest rooms, laundry facilities and the hotel kitchen. The delivered cost is equivalent to 3.5 cents per kWh and the system has an expected payback of 4 years based on first year operating results. Freeze protection allows for year-round operation.

Source: EnerWorks 2007.

If a solar heating system appears to make sense, companies should engage a competent professional to make a site assessment and suggest a system configuration that is appropriate to their needs and geographic region.

Notes

1. U.S. DOE 2008c.
2. U.S. DOE 2008a.
3. U.S. DOE 2008b.
4. Walker 2008.
5. Ibid.
6. Ibid.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SECTION IV

Incentives Supporting Renewable Energy Deployment

Disclaimer: WRI is not a tax specialist and does not provide tax advice. The information presented in this section is designed to acquaint the reader with various forms of incentives but should not be construed as a definitive source for tax-related information. Prior to making any investment decision, companies should seek competent tax advice.

Federal, state, and local governments offer a significant array of incentives for deploying renewable energy systems. This section does not exhaustively detail these incentives. Rather, it illustrates various types and presents pertinent examples. One of the easiest ways to research incentives in specific locations is to visit the Database of State Incentives for Renewables and Efficiency, known as DSIRE, (http://www.dsireusa.org/), which is maintained by North Carolina Solar Center and the Interstate Renewable Energy Council. The database includes federal and state incentives as well as local and utility-specific programs. It was used in preparing the following information.

FEDERAL INCENTIVES

The federal government offers numerous incentives to help business deploy renewable energy. For illustrative purposes these incentives can be grouped as described in Table 2.[1]

TABLE 2. FEDERAL INCENTIVES FOR RENEWABLE ENERGY (Partial Listing)

Corporate Deduction	Energy Efficient Commercial Buildings Tax Deduction
Corporate Depreciation	Modified Accelerated Cost Recovery System
Corporate Exemption	Residential Energy Conservation Subsidy Exclusion
Corporate Tax Credits	Business Energy Tax Credit Renewable Energy Production Tax Credit
Federal Grant Program	Tribal Energy Program Grant USDA Rural Energy for America Program (REAP)
Federal Loan Program	Clean Renewable Energy Bonds USDA Rural Energy for America Program (REAP)
Production Incentives	Renewable Energy Production Incentive (REPI)

Source: DSIRE 2007a.

Some of the most important federal incentives are based on tax credits and tax deductions. A tax credit is an actual reduction of tax liability; a tax deduction reduces taxable income. The difference can be seen in Table 3, which compares a $5 million credit to a $5 million deduction.

TABLE 3. COMPARISON OF TAX CREDIT AND TAX DEDUCTION

	TAX CREDIT	TAX DEDUCTION
Taxable income	$50,000,000	$50,000,000
– Tax deduction of $5,000,000		-5,000,000
Taxable income after deduction	50,000,000	45,000,000
Tax liability at 35%	17,500,000	15,750,000
– Tax credit of $5,000,000	-5,000,000	
Tax paid	$12,500,000	$15,750,000

Federal Tax Credits

The federal government offers two types of tax credits:

- Investment Tax Credit (Business Energy Tax Credit); and
- Production Tax Credit (Renewable Energy Production Tax Credit).

In general, a renewable technology qualifies for either the investment or the production credit, and no project is eligible for both. It should be noted that the Energy Improvement and Extension Act of 2008 expanded the number of qualifying technologies for both programs However, since these and other incentive details are beyond the scope of this paper, it is important to engage competent tax and legal advisers to understand the specific requirements for each program.

The Investment Tax Credit (ITC) is based on the capital cost of the equipment and taken in the year in which the capital equipment is operational.[2] It is set at 30% for commercial investment in certain renewable energy applications such as solar technologies, fuel cells, and small commercial wind. A 10% ITC is available for technologies such as geothermal heat pumps, combined heat and power, and microturbines.[3]

The Production Tax Credit (PTC) is based on the actual output of the project, is earned on a kilowatt-hour basis and is available beginning in the year in which the facility is placed in service. The PTC generally applies to the first 10 years of operation and is currently worth 2.0¢ per kWh for wind, geothermal electric, and closed loop biomass.[4] Other qualifying technologies including small hydroelectric and open-loop biomass receive half the PTC rate.

Modified Accelerated Cost Recovery System (MACRS)

The key tax deduction offered by the federal government is the Modified Accelerated Cost Recovery System (MACRS), which provides for a five-year recovery or depreciation classification for many renewable energy assets. In addition, in 2008 there was bonus depreciation, which under certain circumstances allowed for 50% of a qualified renewable assets tax basis to be depreciated in 2008[5]. However, there are numerous restrictions. For example, if the asset qualifies under the Business Energy Tax Credit discussed above, the tax basis must be reduced by 50% of the credit.[6]

STATE INCENTIVES

There are several types of state incentives including:

- State Corporate Tax Incentives
- Sales Tax Exemptions
- Property Tax Exemptions
- Rebates and Grants
- Loans
- Production Incentives

These incentives are considered below, but this is not an exhaustive survey. Note that each program is subject to change and has numerous restrictions and specific elements that are too detailed to cover in this guide.

State Corporate Tax Incentives

Similar to federal tax incentives, state tax incentives may include credits and deductions. For example:

- Florida offers a renewable energy production tax credit of $.01 per kWh for certain renewable energy technologies for additional electricity produced between July 1, 2007 and June 30, 2010. Total credits are limited to $5 million per fiscal year with credits pro-rated among program participants if the limit is attained.[7]
- Texas provides a solar and wind energy device franchise tax deduction allowing two options for a corporation investing in solar and wind devices for commercial or industrial applications. A corporate franchise taxpayer can either deduct the cost from its taxable capital base or deduct 10% of the cost from its taxable income.[8]

Sales Tax Exemptions

Sales tax exemptions allow companies to purchase certain renewable energy equipment without paying sales tax. Examples include:

- Washington State offers a sales and use tax exemption for many renewable energy applications including solar water heat, solar photovoltaic, and wind, providing for an exemption from sales tax for the equipment and installation costs of systems of at least 200 kW. The exemption is scheduled to expire on June 30, 2009.[9]
- Minnesota offers a sales tax exemption for certain solar technologies including solar water heat and solar photovoltaic as well as wind energy conversion systems.[10]

Property Tax Exemptions

According to DSIRE, "the majority of property tax incentives provide that the added value of a renewable energy system is excluded from the valuation of the property for taxation purposes."[11] These exemptions often, but not always, apply to the commercial, industrial, and residential sectors. For example:

- New York State has a solar, wind, and biomass energy systems exemption offering a 15-year property tax exemption for many renewable energy applications. The exemption will expire on December 31, 2010. Certain local taxing authorities can disallow the exemption.[12]
- Illinois has a special property tax assessment for solar energy systems. In Illinois "solar energy equipment is valued at no more than a conventional energy system."[13]

Grants and Rebates

Grants and rebates provide cash payments to defray a portion of the initial cost of a renewable energy deployment. Grant programs may require applying for funds prior to the purchase of equipment. Examples of such state programs include:

- Ohio disburses funds under the Advanced Energy Program Grants for distributed energy and renewable energy projects. Grants cover many forms of renewable energy with awards of up to $200,000 for photovoltaic systems under third-party ownership. Grants are based on system size as measured by energy potential and can never exceed 50% of project cost.[14]
- The California Solar Initiative initially offered rebates of up to $2.50 per watt for commercial photovoltaic systems of less than 50 kW[15] based on the expected performance of the system (Expected Performance Based Buydown or EPBB). The incentive reduces in 10 steps as a function of the total level of solar photovoltaic power installed under the program.[16] Please see Table 4 for more information.

TABLE 4. CALIFORNIA SOLAR INITIATIVE EPBB AND PBI AMOUNTS PER STEP

		EBPP PAYMENTS (PER WATT)			PBI PAYMENTS (PER kWh)		
MW STEP	STATEWIDE MW IN STEP	RESIDENTIAL	COMMERCIAL	GOV'T/NONPROFIT	RESIDENTIAL	COMMERCIAL	GOV'T/NONPROFIT
1	50[1]	N/A	N/A	N/A	N/A	N/A	N/A
2	70	$2.50	$2.50	$3.25	$0.39	$0.39	$0.50
3	100	$2.20	$2.20	$2.95	$0.34	$0.34	$0.46
4	130	$1.90	$1.90	$2.65	$0.26	$0.26	$0.37
5	160	$1.55	$1.55	$2.30	$0.22	$0.22	$0.32
6	190	$1.10	$1.10	$1.85	$0.15	$0.15	$0.26
7	215	$0.65	$0.65	$1.40	$0.09	$0.09	$0.19
8	250	$0.35	$0.35	$1.10	$0.05	$0.05	$0.15
9	285	$0.25	$0.25	$0.90	$0.03	$0.03	$0.12
10	350	$0.20	$0.20	$0.70	$0.03	$0.03	$0.10

Source: CPUC 2008a.

Note

1. The first 50 MW are allocated under the 2006 Self-Generation Incentive Program (SGIP) and are not pro-rated by customer class or service territory. In 2006, most residential systems participated in the Energy Commission's Emerging Renewables Program (ERP).

BOX 9. NEW JERSEY UTILITY OFFERS INNOVATIVE LOAN PROGRAM BASED ON SOLAR RECS (SRECS)

Public Service Electric and Gas (PSE&G) is committing approximately $105 million to a 30 MW solar loan program with 12 MW reserved for commercial and industrial customers. Over the next two years, PSE&G will lend between 40-60% of the system cost on a first lien basis to approved commercial and industrial customers. PSE&G's loans can be repaid through SRECs generated by the installation or in cash. PSE&G will value the SRECs at the higher of $475 or market price. The loan amount is based on the estimated output of the system and the $475 floor price over 15 years. If the loan is amortized faster than planned, due to higher SREC prices or greater system output, PSE&G retains a call on the SRECS at 75% of market price through year 15. There has been significant interest in the program from commercial and industrial customers with some 10 MW of the total 12 MW program already committed.[1] PSE&G notes that it is prepared, if the program is successful, to expand beyond the original 30 MW pilot.[2]

Notes

1. Public Service Enterprise Group 2009.
2. Public Service Electricity and Gas, Frederick A. Lynk, Manager, Market Strategy and Planning, personal communication, July 2, 2008.

Loans

Some states provide loans to promote deployment of renewable energy. Rates and tenors vary by program. In certain cases, states provide a below-market interest rate. For example:

- North Carolina has the Energy Improvement Loan Program that provides loans for certain types of renewable energy. Loan amounts may be up to $500,000 for a maximum 10-year term. The interest rate can be as low as 1% depending on the renewable technology, but a corporate borrower has to secure the loan with a bank letter of credit.[17]
- Iowa offers the Alternate Energy Revolving Loan Program, which provides 50% (maximum $1,000,000) of the total loan required for certain renewable energy investments at a 0% interest rate. The matching financing requirement must be borrowed from a bank on market terms. The combined loan, with only half at market interest rates, offers a low-cost source of funding for deployment of certain renewable energy applications.[18]

State Production Incentives

Production incentives are a type of rebate where the amount paid is based on the actual performance of the project in terms of energy output over a pre-determined period of time. (Other rebates are simply based on the capital cost or the capacity of a project.) There are several interesting examples of such incentives:

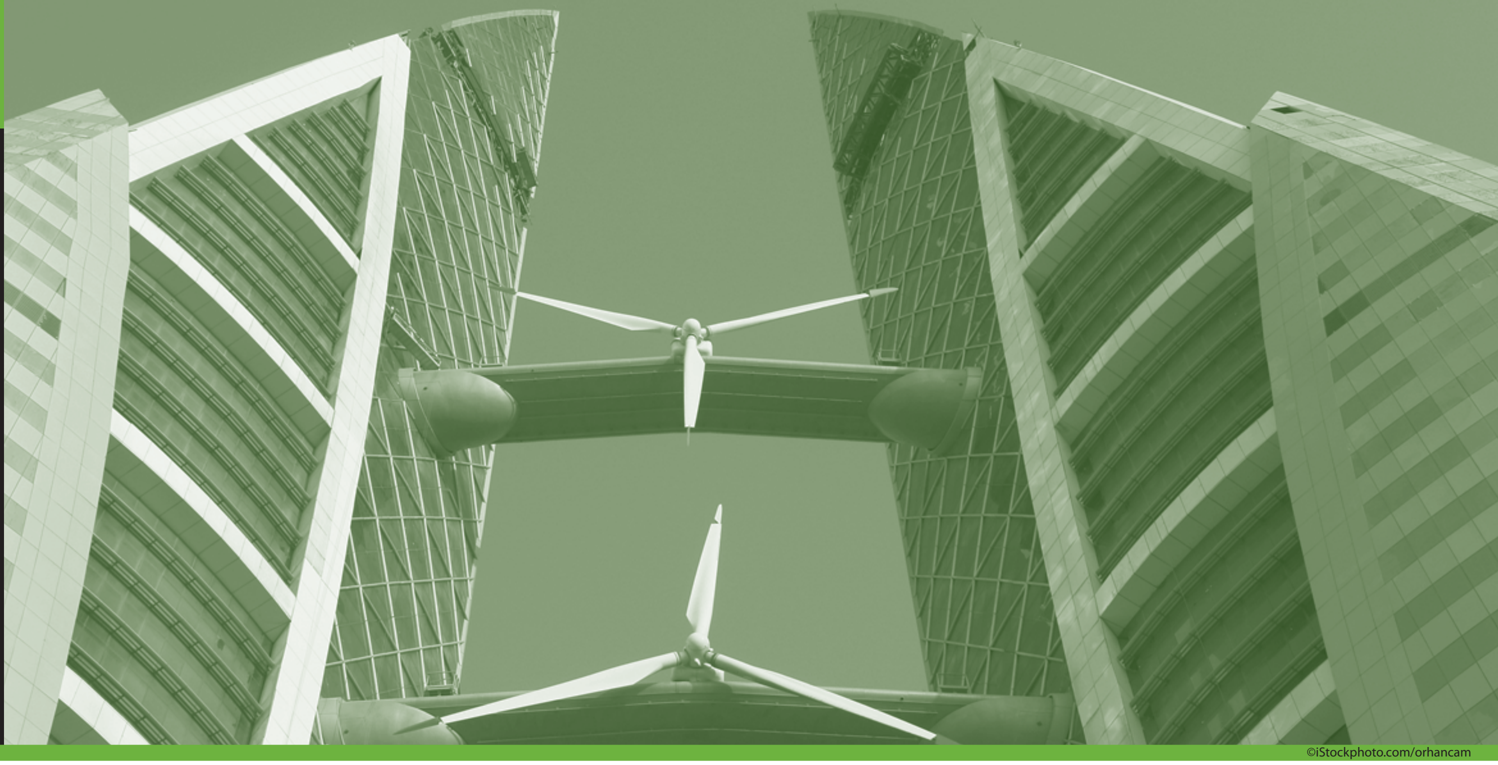
- The California Solar Initiative, described above, offers a production-based incentive (PBI) for photovoltaic systems of 50 kW[19] or larger. The incentive is paid per kilowatt hour for the first five years of production and began at $0.39/kWh for tax paying entities. The incentive reduces in 10 steps as a function of the total amount of solar photovoltaic power installed under the program.[20] See Table 4 for details and Note 16 in this section for information on current incentive levels.
- New Jersey has created a set-aside under its renewable portfolio standards program requiring that, by 2021, 2.12% of all electricity sold in the state must be solar-generated. Under the program, the state issues Solar Renewable Energy Certificates (SRECs) representing the generation of one MWh of solar electricity. SRECs are issued to registered solar energy producers. SREC prices are essentially capped by the Solar Alternative Compliance Payments (SACP) charged to utilities that fail to meet their solar generating requirement for a given year. The price for New Jersey SRECs in the first half of 2008 was approximately $230 when the SACP was $300. However, beginning in June 2008 the New Jersey Board of Public Utilities changed the way the SACP is established and moved to a rolling eight year schedule. The first schedule begins with an SACP of $711 reducing to $594 by 2016.[21]
- In Massachusetts, Connecticut, and Rhode Island the Energy Consumers Alliance of New England offers a three-year contract to purchase RECs from solar photovoltaic and wind projects at a price of $30/MWh.[22]

Notes

1. Please note that this is **not** an exhaustive list of federal incentives.
2. The amount of the credit is subject to reduction if subsidized or tax exempt energy financing is used (see http://www.desireusa.org/).
3. Please refer to (http://www.dsireusa.org/) for more information on eligible system sizes and maximum incentive amounts.
4. Production Tax Credit amounts are indexed for inflation and the amounts above are for the 2007 tax year.
5. Bonus depreciation was not extended past 2008.
6. DSIRE 2009a.
7. DSIRE 2008c.
8. DSIRE 2008m. In Texas the corporate franchise tax is similar to a state corporate tax and covers taxable capital as well as company income.
9. DSIRE 2008n.
10. DSIRE 2008g; DSIRE 2008h.
11. DSIRE 2007b.
12. DSIRE 2008j.
13. DSIRE 2008d.
14. DSIRE 2008l.

15. Reduces to 30 kW in 2010. See California Solar Initiative Handbook (CPUC 2008a).
16. DSIRE 2008a. For current incentive levels, please refer to the Statewide Trigger Point Tracker (http://www.csi-trigger.com/). However, please note the final incentive rate will be determined by the CSI Program Administrator.
17. DSIRE 2008k.
18. DSIRE 2008e.
19. Reduces to 30 kW in 2010. See California Solar Initiative Handbook (CPUC 2008a).
20. DSIRE 2008a.
21. DSIRE 2008i.
22. DSIRE 2008f.

SECTION V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Options for Deploying On-Site Renewable Energy

There are many options for deploying renewable energy at business locations. Some entail direct ownership, wherein a company owns the power produced at its site. Others are based on third-party ownership, wherein the site host does not own the power produced on-site. In many cases, a company will use the energy produced at its site, even under third-party ownership models, by purchasing the energy under a power purchase agreement. In other cases, a company is not interested in using the energy produced on-site, but it is willing to rent space to a third party who generates and sells the power.

Table 5 shows the general options available for deploying renewable technologies:

TABLE 5. OPTIONS FOR DEPLOYING ON-SITE RENEWABLE ENERGY

	DIRECT OWNERSHIP OF POWER	THIRD-PARTY OWNERSHIP OF POWER
Use of Power	Company invests in an on-site renewable energy project and consumes the power.	Investor installs renewable assets at a company's site and company purchases power under long-term contract.
No Power Use	Company invests in an on-site renewable energy project and sells all or most of the power.	Investor installs renewable assets at a company's site in exchange for lease payments or other consideration and sells the power to another entity.

DIRECT OWNERSHIP (USE OF POWER)

This deployment model is a classic capital expenditure. A company invests in on-site renewable energy equipment and uses the power in its own operations. The investment decision is part of a company's capital budgeting process. For those unfamiliar with capital budgeting, the basic elements are outlined in Box 10.

Estimating the cash flows of an investment project is the key building block in the capital budgeting process. While estimating cash flows for a renewable energy investment

BOX 10. BASIC ELEMENTS OF THE CAPITAL BUDGETING PROCESS

- Estimating all of the cash flows associated with a project over its full life including costs (negative cash flow) and revenue or cost savings (positive cash flow). This information is sufficient to determine the simple cash payback, which measures how long it takes for the project to cover its initial costs.
- Identifying the firm's weighted average cost of capital or other hurdle rate since many firms consider the time value of money in the capital budgeting process and do not rely only on the simple payback.
- Determining either (1) the net present value (NPV) of the project cash flows based on the firm's hurdle rate or the weighted average cost of capital, which may be adjusted for the relative risk of the project, or (2) the internal rate of return (IRR) of the cash flows.
- Analyzing the results where (1) a positive NPV, or (2) an IRR greater than the hurdle rate indicate an acceptable investment based on the estimated cash flow profile.[1]

Note

1. In theory all projects with positive NPV or IRR outcomes should be accepted, but since capital is constrained, many firms undertake a forced ranking of projects.

BOX 11. THE CARBON VALUE ANALYSIS TOOL (CVAT)

The Carbon Value Analysis Tool (CVAT) is a screening tool to help companies integrate the value of carbon dioxide emissions reductions into energy-related investment decisions. The tool has two main purposes:

- To test the sensitivity of a project's internal rate of return (IRR) to "carbon value" (the value of GHG emissions reductions). CVAT integrates this value into traditional financial analysis by ascribing a market price, either actual or projected, to carbon emissions reductions.
- To facilitate the development of emissions reduction strategies by developing a Marginal Abatement Cost Curve (MACC) across a portfolio of projects. CVAT ranks projects so managers can prioritize them according to their implicit cost per tonne of carbon emission reduction.

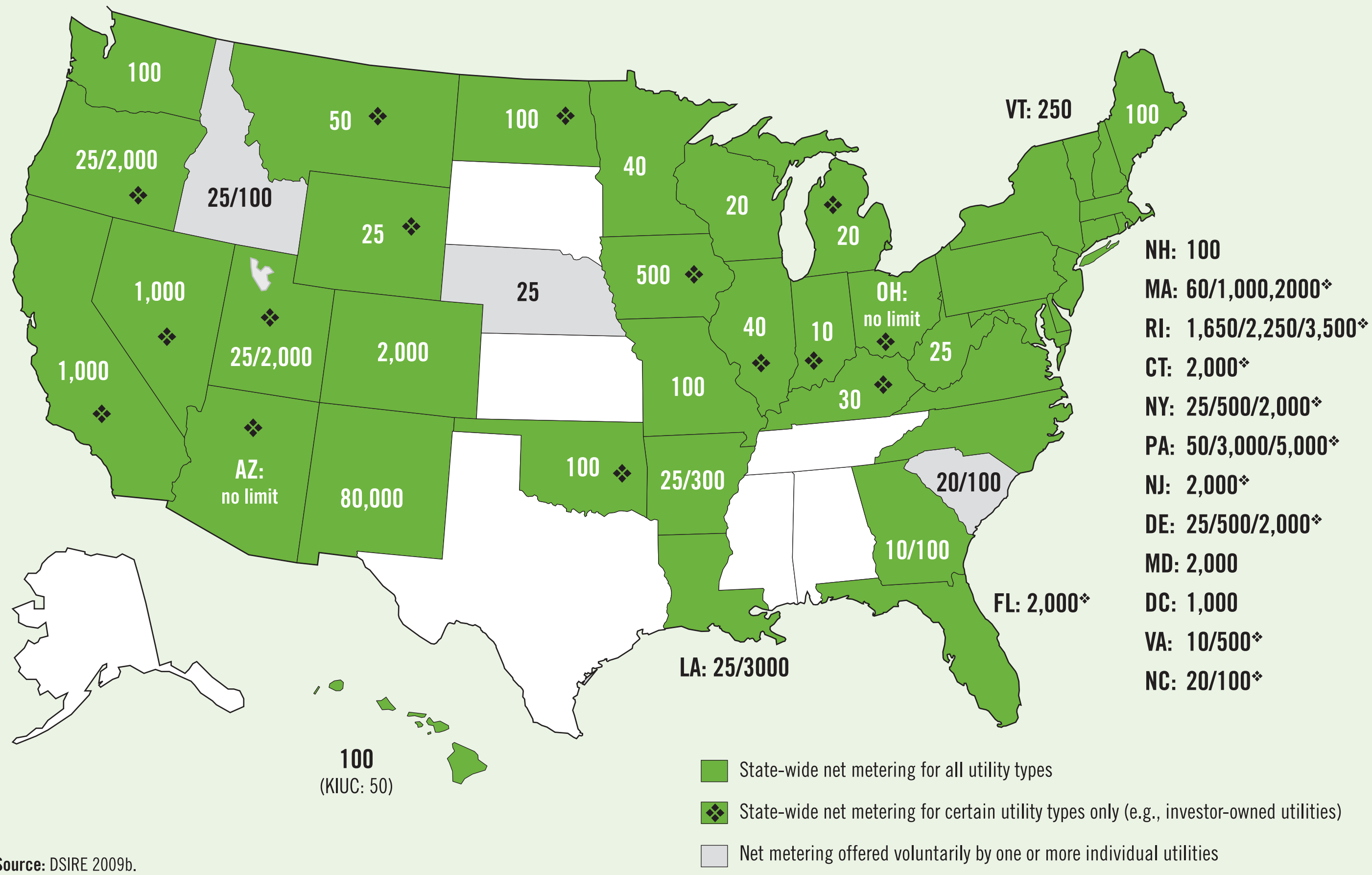
CVAT estimates direct and indirect emissions reductions using standards developed by the GHG Protocol Initiative. CVAT can also run a Monte Carlo analysis for key project variables such as carbon value, providing insights into the possible range of a project's IRR.

Source: World Resources Institute.

is similar to any other capital expenditure project, there are several unique elements. These include accounting for federal and state incentives and considering avoided cost, carbon value, dispatch profile, and net metering:

- **Avoided Cost:** If a firm uses 100% of the energy from its on-site renewable deployment, there is no incremental revenue from the project. Instead, cash flow is increased by the avoided cost of purchased energy. Therefore, it is critical to estimate the future avoided cost of energy correctly when considering on-site renewable energy investments.
- **Carbon Value:** One of the factors that may have a significant impact on future energy costs is the cost of carbon dioxide emissions in a carbon-constrained economy. WRI has developed an analytical tool to allow modeling of assumed carbon costs when estimating project cash flows for energy efficiency and renewable energy investments. The Carbon Value Analysis Tool (CVAT) is available on WRI's website at http://docs.wri.org/CVAT_v1.3.xls.
- **Dispatch Profile:** Understanding the dispatch profile (the timing of electricity generation) of a renewable energy application relative to a company's electricity demand profile is critical to estimating project cash flow. The Jiminy Peak Mountain Resort (see Box 6) has benefited from the fact that its on-site wind resource is strongest during the winter, when its demand for energy is at its highest.[1] As noted, projects that offer a good peak shaving profile can reduce demand for purchased electricity when it is at its highest price. However, many on-site renewable deployments for electricity generation (wind and solar photovoltaic) have generation profiles that do not perfectly complement the site's requirements. For example, the site may generate more electricity than it needs in certain seasons or during certain parts of the day. At other times, the site may require more electricity than is available from the renewable energy source and need to purchase grid-supplied electricity. When sites generate excess electricity, it is critical to understand the net metering regulations applicable to the project (see below).
- **Net Metering:** This entails measuring the two-way flow of electricity from a grid-connected site with distributed generating capacity. When the site generates more electricity than it needs, the excess is fed into the grid and the electric meter runs backward, thereby offsetting energy purchases during other periods. This effectively allows the net-metered site to offset future grid purchases at retail prices. Through net metering, excess electricity generated on-site is "stored" on the grid for use at a later date. As shown in Figure 6, 43 states plus the District of Columbia had net metering programs as of January 2009. However, individual states have different restrictions in terms of eligible renewable technologies and system size. Regulations also vary in terms of overall enrollment limits and the disposition of excess electricity supplied at the end of a 12-month

FIGURE 6. STATES EMPLOYING NET METERING REGULATIONS



Source: DSIRE 2009b.
Note: Numbers indicate individual system size limit in kilowatts (kW).

period. In addition, numerous states only provide net metering for certain utility types. To correctly estimate project cash flows from renewable energy projects, it is important to understand whether, and on what terms, net metering is available in a given location.

Once a company has made the decision to pursue a renewable energy project as a direct owner, the next question is how to finance the project. Numerous options are available ranging from internally-generated cash flow to energy savings performance contracts. A brief discussion of five financing alternatives follows:

- Internally generated cash or general corporate financing
- Secured lending
- Vendor financing
- Leasing
- Energy Services Company with Energy Savings Performance Contract

Internally Generated Cash or General Corporate Financing

When direct ownership of an on-site renewable energy project is preferred, most large, investment-grade corporations would normally finance it using either internally generated cash flow or cash made available through general corporate capital market activities. Internally generated cash is what a corporation retains from its operations and is defined as net income plus depreciation and amortization. It is available for making debt service payments, paying dividends, meeting working capital needs, making capital expenditures, and covering contingencies. General corporate capital market activities entail issuing bonds or sourcing bank debt for general corporate purposes. Researchers estimate that in the United States, 70–90% of long-term financing comes from internally generated cash flow.[2]

There are situations, however, where renewable energy projects encounter difficulty in the capital budgeting process. Management may be uncomfortable with renewable energy technology or may not see such projects as strategic investments. Alternatively, projects may suffer from perceptions of low returns if the managers evaluating them do not use a shadow price for carbon or integrate the value of incentives into their calculations.

BOX 12. JOHNSON & JOHNSON'S CAPITAL IDEA

Johnson & Johnson has committed to reduce its GHG emissions to 7% below 1990 levels by 2010. Since GHG reduction efforts such as energy efficiency and renewable energy projects had encountered difficulty competing for funds in the company's capital budgeting process, the company established a dedicated capital expenditure program. Johnson & Johnson will allocate up to $40 million annually for GHG reduction projects, and will evaluate them based on criteria specific to the fund, including the level of expected GHG reductions.

Source: Climate Northeast 2008.

Secured Lending

Smaller or non-investment-grade companies may not have sufficient internally generated cash flow or the debt capacity to borrow easily for general corporate purposes. Such companies often turn to banks and borrow on a secured basis. They secure loans by offering collateral such as inventory and receivables or property, plant, and equipment. Pledging collateral may help such companies obtain bank loans when they would not normally qualify for unsecured loans.

The collateral is used to reduce a bank's loss in the event of a default on the loan. When making a secured loan, banks evaluate both the quality of the borrower and the collateral. Quality of collateral is judged by (1) the value of the asset being pledged and the consistency of that value over time, as well as (2) the ease with which it can be liquidated including the cost to reposition the asset and general market demand for the asset category. Once banks complete collateral valuation, they apply the advance rates they are willing to lend against pledged assets. Advance rates generally range from 50 to 80% depending on the asset class taken as security.

Given the relative newness of renewable energy products, no clear trend has emerged for treating the collateral value of assets such as wind turbines or solar photovoltaic cells. In addition, it should be noted that banks generally apply advance rates to hard costs such as equipment as opposed to soft costs, which include project planning and installation.

Vendor Financing

In order to support their marketing efforts, many general equipment manufacturers have established either captive or third-party vendor financing relationships. Vendor financing helps the manufacturer sell its product by facilitating financing of a customer's purchase. If vendor financing is done by a third party, that party has typically done the work necessary to become comfortable with the technical aspects of the product as well as its collateral value. For companies requiring dedicated financing for an on-site renewable energy project, the availability and terms of vendor financing can be one criterion used for evaluating proposals made by different vendors.

Leasing

Another financing technique that may be available for renewable energy deployment is leasing. Under leasing arrangements, the investor or lessor usually retains legal ownership of the equipment, which is made available to the lessee for a stream of rental payments. From the lessee's standpoint, there are essentially two main types of leases:

- **Capital Lease:** Under a capital lease a lessee is required to show the leased equipment as an asset and the present value of lease payments as debt on its balance sheet. The accounting standards for lease transactions (FAS 13) require any lease meeting at least one or more of the following criteria to be classified as a capital lease:[3]

  "(a) the lessor transfers ownership to the lessee at the end of the lease term;

  (b) the lease contains an option to purchase the asset at a bargain price;

  (c) the lease term is equal to 75 percent or more of the estimated economic life of the property (exceptions for used property leased toward the end of its useful life) or

  (d) the present value of minimum lease rental payments is equal to 90 percent or more of the fair market value of the leased asset."[4]

- **Operating Lease:** Operating leases are not capitalized on a company's balance sheet and lease payments are treated as an expense for accounting purposes. Any lease that does not meet at least one of the criteria outlined above (i.e., is not a capital lease) is classified as an operating lease.

Please note that the accounting rules regarding lease transactions (FAS 13) are currently under review.[5] Prior to entering into a lease transaction, be sure to check with an accounting professional for the latest information on lease

TABLE 6. PARTIAL RESULTS FROM *THE FUTURE OF FINANCING ALTERNATIVE ENERGY EQUIPMENT*

Is your company actively engaged in alternative energy?	39%: Yes	61%: No		
If currently not invested in alternative energy, do you plan to begin?	27%: Yes	73%: No		
If currently invested in alternative energy, do you plan to continue?	71%: Yes	29%: No		
What is the size of your investment in alternative energy?	80%: < $10 million	0%: $10 to 49.9 million	12%: $50 to 199.9 million	8%: > $200 million
What is the size of your alternative energy transactions?	40%: < $1 million	30%: $1 to $25 million	30%: > $25 million	
Which technologies are you involved with?	20%: Wind	20%: Solar	22%: Biofuels	39%: Other[1]

Note

1. Other includes electricity generation from bio/agricultural waste (20%), hydroelectric (7%), or geothermal (12%).

Source: Derived from Alta Group and Metcalf 2007.

accounting and to determine the appropriate accounting treatment for the transaction under consideration.

The Equipment Leasing and Finance Foundation's (ELFF) 2007 study, *The Future of Financing Alternative Energy Equipment*, indicates "that lessors and equipment financing companies are actively engaged in pursuing opportunities in the alternative energy sector."[6] The study included a survey with responses from 33 firms involved in the equipment leasing and finance industry. Table 6 was derived from ELFF's report. It provides some interesting insights into current activities and potential future trends.

Energy Services Company with Energy Savings Performance Contract

Energy Service Companies (ESCOs) have existed for some 25 years, with the birth of the industry dating to the spike in energy prices experienced in the late 1970s and early 1980s.[7] The National Association of Energy Services Companies defines an ESCO as "a business that develops, installs, and arranges financing for projects designed to improve the energy efficiency and maintenance costs for facilities over a seven to twenty year time period."[8] Such projects can include energy efficiency equipment as well as renewable energy installations. When renewable energy is deployed as part of a larger energy efficiency package, it is typically included in the energy savings performance contract (ESPC, see below). However, when the renewable energy equipment is the main component of the ESCO project, it is often deployed under a power purchase agreement (PPA, reviewed under Third-Party Ownership with Use of Power, below).

While ESCOs design and manage installation of projects, they usually do not own the installed equipment. The equipment is generally owned by the site host or, in certain cases, by a third party who leases it to the site host. An ESCO deployment can be financed in many ways, including cash generated internally by the site host, secured lending, or leasing.

In the United States, when renewable energy is only part of a larger energy efficiency project, ESCOs typically utilize ESPCs. Under an ESPC, ESCOs guarantee a certain level of energy cost savings from the project installation. Financing for an ESCO project is also typically linked to energy savings so that the customer services the debt with the energy cost savings generated by the project.[9]

When renewable energy equipment is deployed under an ESPC, the site host benefits from (1) any initial cost savings that may exist, and (2) a hedge against possible future energy cost increases. Dispatch risk is generally assumed by the ESCO under the ESPC in terms of system availability and efficiency. From the site host's standpoint, the hedge value of an ESPC is maximized if dispatch performance shortfalls are guaranteed for value based on kWh of electricity at prevailing electricity tariffs. (See Section VI for more information on dispatch risk.)

According to a recently completed industry survey, ESCOs generate most (nearly 75%) of their revenue from energy efficiency, but on-site generation is a growing segment of the business and accounted for 16% of industry revenues in 2006.[10] The survey also indicates that ESCOs are heavily weighted to the public sector, but that the private sector represented some 18% of total 2006 ESCO revenue. One of the factors driving ESCO work with federal government facilities is Executive Order 13123, *Greening the Government Through Efficient Energy Management* (1999), which, among other goals, requires each agency to (1) achieve a 30% reduction (from 1990 levels) in greenhouse gas emissions from facility energy use by 2010, (2) reduce energy consumption by 35% (from 1985 levels) by 2010, and (3) strive to expand the use of renewable energy at federal facilities.[11]

While the public sector has been the biggest user of this model to date, there is no reason that the private sector

BOX 13. WIND TURBINE BOOSTS ENERGY SAVINGS

Victorville Prison benefited from the first wind turbine installed under an energy savings performance contract. The 750 kW wind turbine was installed at the prison as part of an energy efficiency project. The project was expected to generate $420,000 in annual energy savings.

Source: Belyeu 2004.

could not deploy renewable energy technology under ESPCs more frequently. As concerns about energy costs and the potential impact of a carbon-constrained economy grow, the ESPC model is an option for companies to achieve not only energy efficiency savings, but renewable energy deployment as well.

THIRD-PARTY OWNERSHIP (USE OF POWER)

There are many reasons why a company may not want to invest its capital in a renewable energy project but would like to benefit from the use of renewable energy investments on-site. The market has responded with two interesting options. The first is the Solar Power Purchase Agreement model and the second is the Energy Services Company model.

Solar Power Purchase Agreements (Solar PPA)

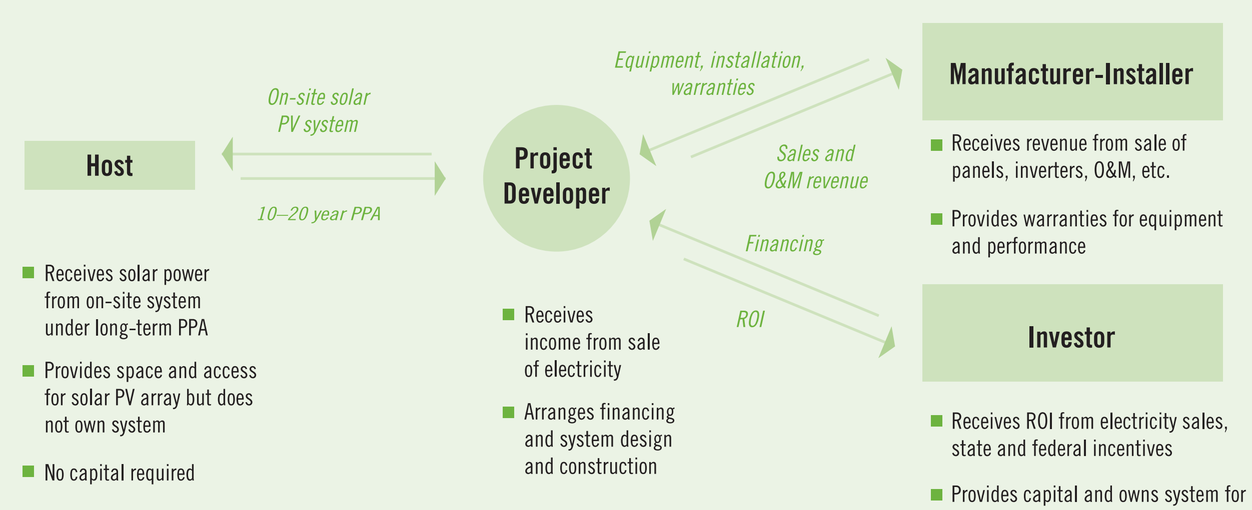
The Solar PPA deployment option allows companies to use their rooftops or other sites to host solar photovoltaic systems and to benefit from the power they generate with little to no capital commitment. Under this model, a third party owns the solar photvoltaic system and the site host enters into a long-term power purchase agreement with the third-party owner. The contract is usually for a minimum of 10 years and typically at a price that is equal to or slightly lower than the utility retail price.[12] A third-party project developer typically handles all aspects of the project development including site assessment, system configuration, procurement, installation, and financing. The project developer is also typically responsible for system operations and maintenance (O&M).

Investors provide the financing needed for the installation and benefit from applicable federal and state incentives as well as the revenue received under the power purchase agreement. However, it should be noted that "to make the third-party, solar PV ownership model work, specific solar provisions such as federal tax credits, solar investment subsidies, and solar-specific tiers in RPS requirements have proven to be important."[13] To make the electric power commercially competitive, investors in these projects are effectively sharing some of the federal and state incentives with the host. In this way, a company that does not have an appetite for tax incentives can still benefit from them indirectly.

A Solar PPA deployment generally entails two contracts: (1) a site license or lease, and (2) a power purchase agreement. The site lease grants the solar services provider access to the site for installation and maintenance. The power purchase agreement typically establishes (1) the rate at which power is purchased, (2) the term of the agreement and any purchase options or termination provisions, (3) performance standards and default remedies, and (4) the ownership of RECs generated by the installation.

Terms vary significantly between contracts, but are likely to include the following key provisions:

FIGURE 7. SOLAR POWER PURCHASE AGREEMENTS



Source: Adapted from GPMDG n.d.

- **Power Tariff:** There are many permutations for setting the power tariff including (1) a fixed rate portion, (2) a fixed rate with an annual escalator set on a percentage or per kWh basis, or (3) a tariff indexed to public utility rates. Note that even when an indexed tariff is set at a discount to public utility rates, it does not offer a hedge against possible future energy price increases since the tariff is indexed to such increases. However, contracting for long-term rates indexed at a discount to public utility rates should allow for cost savings relative to grid-supplied electricity.
- **Tenor and Renewal:** PPA tenors are normally for 10 to 20 years[14] with the length of the contract being a function of (1) the site owner's objective in terms of energy hedging, (2) PPA tariffs, and (3) the tenor of the site beneficiary's leasehold if it does not own the site outright. PPA contracts may contain renewal options allowing the site owner to extend the contract terms for additional period(s) or allow for a purchase of the system by the site owner at fair market value. Site owners should seek competent accounting advice when negotiating renewal and purchase options as these contract terms may affect the accounting treatment of the underlying agreement.
- **Ownership of RECs:** If the site host wants to control the RECs from the installation, it will typically need to purchase them from the project owner. In this way the site owner purchases the energy and the claim of renewable energy generation under a PPA. The site host will need to evaluate the incremental cost for the RECs relative to current market conditions as well as its expectations for future REC prices.

To date, the Solar PPA model in the United States has essentially been limited to solar photovoltaic systems. However, here are two examples of a similar approach used with other renewable technologies.

- The municipal utility in Lakeland, FL has installed solar water heaters for some 60 residential customers on a "pay for energy" basis. Lakeland Electric owns and maintains the solar water heaters and bills customers only for the electricity equivalent of hot water used. When the units were installed approximately 10 years ago, customers benefited by getting a fixed solar energy rate. This solar energy rate is now significantly below the current electricity rate.[15] Lakeland Electric is now working on ways to significantly expand the program, including offering installations to commercial entities.
- Nike benefits from a 9 MW wind farm at its Laakdal, Belgium customer service center. The installation is owned and operated by a third party who leases from Nike the land on which the turbines are located. The lease payments serve to offset Nike's cost of purchasing green power from wind source at the location.[16]

Energy Services Company Model with Power Purchase Agreement

As noted, when an ESCO deploys renewable energy as the main component of a project, it is often done using a PPA. The above comments on Solar PPAs generally apply to ESCO PPAs as well. One of the key differences between an ESCO and a Solar PPA company is that an ESCO does not have a pre-determined technology solution and will often explore several possibilities, including energy efficiency measures, before generating a project recommendation.

DIRECT OWNERSHIP (NO POWER USE)

Another approach to deploying renewable energy on-site is to own the asset but to sell the power to generate revenue. Under this deployment model, the objective is not simply to reduce or hedge the cost of energy, but rather to generate a return by monetizing on-site generation resources for sale to third parties. However, companies not already in the energy business have made few, if any, investments to date under this model.

Lack of Investment in Direct Ownership (No Power Use)

There are numerous reasons for the lack of activity in on-site generation for third-party sale including high on-site demand, poor site quality, exclusion from certain incentives, net metering regulations, and general lack of management comfort with this model.

- **On-Site Demand:** Many business locations have significant power needs and deploy renewable energy to help meet a portion of those needs. For such companies, excess generation capacity does not exist.
- **Site Quality:** Most business locations have been chosen for reasons other than the quality of renewable energy resources. As such, the best locations for a merchant renewable energy installation may not be where a company's manufacturing plant, distribution center, or retail outlet is located.
- **Qualification for Incentives:** Some incentive programs have capacity limitations or exclude systems primarily intended for selling power to others. For example, "California Solar Initiative (CSI) payments are only available if energy is used to offset part or all of on-site needs."[17]

TABLE 7. TREATMENT OF NET EXCESS ELECTRICITY GENERATION FOR SELECTED STATES

STATE[1]	TREATMENT OF NET EXCESS GENERATION (NEG)
California Georgia Illinois Michigan	Credited to customer's next bill Granted to utility at end of 12-month billing cycle
Florida New Jersey[2] New York[3]	Credited to customer's next bill Purchased by utility at avoided-cost rate at end of 12-month billing cycle
Ohio	Credited at utility's unbundled generation rate to customer's next bill Customer may request refund of NEG credits accumulated over a 12-month period
Pennsylvania	Credited to customer's next bill at utility's retail rate PUC to address treatment of NEG remaining at end of 12-month period
Texas	Purchased by utility for a given billing period at avoided-cost rate

Notes

1. Please note that each net metering program indicated may have numerous specificities including limitations on overall enrollment and system size as well as which utilities are involved.
2. Customer generators actually have several options for compensation of NEG in New Jersey.
3. Annual NEG for non-residential systems needs to be addressed by the utilities and DPS.

Source: Derived from DSIRE (various pages).

- **Net Metering Regulations:** Many net metering regulations provide disincentives for excess generation by either (1) granting net excess generation to a utility after a 12-month billing cycle, or (2) compensating net excess at lower rates such as avoided cost. Table 7 provides information on the treatment of net excess generation for selected states.
- **Lack of Familiarity and Comfort:** Companies may be unfamiliar with renewable energy alternatives and believe that they lack the management and technical capacity to operate a renewable energy system as a revenue-producing asset.

Feed-in Tariffs May Promote Direct Ownership (No Power Use)

Feed-in tariffs (FIT) and renewable portfolio standards (RPS) are both policy options that promote deployment of renewable energy. RPS regulations require a certain percentage of energy come from renewable sources and allow the market to set the price. In contrast, FIT mechanisms establish a price for renewable electricity and allow the market to determine the quantity offered.[18] FITs generally provide a known electricity price during a set contract term for all qualifying renewable energy projects. They "have been implemented in over 40 countries worldwide and have resulted in major market successes for renewables in both Germany and Spain."[19]

In 2008, California provided for feed-in tariffs for all customer-generators of Pacific Gas and Electric and Southern California Edison for up to 228 MW of renewable generating capacity. [20] To qualify for the feed-in tariff, the facility must be powered by an eligible renewable energy resource (including wind and solar) and have electric generating capacity of no greater than 1.5 MW. Such facilities can choose contracts of 10, 15 or 20 years and are paid based on the "market-price referent," which is adjusted for time of use factors so that peak pricing should be higher than at other times. Customer-generators can sell all of their output under the "full buy/sell" option or choose to use a portion of the electricity for their needs and sell the remainder under the "excess sale" option.

Since the incentive is designed to help public utilities meet their RPS requirements, RECs are transferred to the utility for the amount of electricity sold under the feed-in tariff. Customer-generators retain the RECs corresponding to electricity used on-site. The feed-in tariff program is only available to facilities that are not participating in net metering and have not benefited from certain other incentives, such as the California Solar Initiative.

By offering standard contract terms including guaranteed pricing mechanisms, it will be easier for small customer-generators to sell excess generating capacity developed on-site. In addition to providing transparency in terms of electricity pricing, standard contract terms reduce transaction costs.[21]

To date, only California has enacted FIT legislation on a state-wide basis, but there appears to be increasing interest in this policy alternative. In mid-2008, for instance, one study found that "six states have introduced feed-in tariff bills, and another eight states have considered, or are considering, similar legislation."[22] It is important to understand, however, that while the California FIT is based on time of delivery, several other states are considering legislation more closely resembling the German approach.[23] "Under the German feed-in-tariff legislation, renewable energy technologies are guaranteed interconnection with the electricity grid, and are paid a premium rate that is designed to generate a reasonable profit for investors over a 20-year term. The rates are differentiated by technology such that each renewable resource type (e.g. solar, wind, biomass, etc.) can profitably be developed."[24]

In addition, federal lawmakers introduced legislation in 2008 (Renewable Energy Jobs and Security Act, HR 6401) that would have established a national feed-in tariff mechanism. Under the proposal, new renewable energy generators would have been able to enter into 20-year power sale agreements. "Uniform national Renewable Energy Payment (REP) rates would be set by FERC ... at levels that would provide a 10% internal rate of return for renewable energy facilities installed under good resource conditions (defined as the top 30% percentile)."[25] This bill will likely be re-introduced (in a slightly revised form) in 2009.

Financing Options for Direct Ownership (No Power Use)

If companies become interested in owning on-site renewable energy in order to generate revenue, either because of a growth in feed-in tariffs or some other reason, then the financing mechanisms discussed for Direct Ownership (Use of Power) will generally apply. If the avoided cost of power is no longer the rationale for the investment, however, firms should consider several points:

- The capital budgeting process will be based on the expected sales price of the power and not the avoided cost of purchased power.
- Lenders will focus on (1) the strength of the contractual relationship underlying the feed-in tariff or other power sale agreement, and (2) the credit quality of the purchaser under any such power sale agreement, among other issues.

THIRD-PARTY OWNERSHIP (NO POWER USE)

The final deployment model consists of leasing on-site space for a third party to generate power that is typically sold through the grid. This enables a company to make an unused or under-used asset economically productive, and generates a return for the site owner. This model has been used to develop wind projects on agricultural properties. For farm owners, wind can be an unused asset and by leasing sites to a wind project developer, the asset generates a return to the farmer without disrupting farming.

Other businesses can also use this model to generate incremental revenue on under-utilized assets. The best candidates typically have a good renewable resource (wind or solar) and are located near transmission lines. Since it is often the case that on-site consumption is the best use of on-site generation, the most desirable sites for Third-Party Ownership (No Power Use) are those where the available energy resource significantly exceeds on-site energy demand. This is the case with many farms, but can also be true for warehouses and distribution centers. Such facilities typically have large flat roofs and, in certain geographic regions, can support solar photovoltaic systems that exceed their own energy needs. In addition, brownfield sites may also be located in areas with strong renewable resources and often already have good grid connections near load centers.

TABLE 1. ON-SITE RENEWABLE ENERGY DEPLOYMENT AND FINANCING OPTIONS

	DIRECT OWNERSHIP OF POWER	THIRD-PARTY OWNERSHIP OF POWER
Use of Power	Company invests in an on-site renewable energy project and consumes the power	Investor installs renewable assets at a company's site and company purchases power under long-term contract
Financing Options	General corporate financing or dedicated financing: Secured lending Leasing[1] Vendor financing ESCO[2] with Energy Savings Performance Contract	Solar Power Purchase Agreement (PPA) ESCO with Power Purchase Agreement
No Power Use	Company invests in an on-site renewable energy project and sells all or most of the power	Investor installs renewable assets at a company's site in exchange for lease payments or other consideration and sells the power to another entity
Financing Options	Similar to Direct Ownership (Use of Power)	Hosting arrangement in exchange for lease payments or other consideration

Notes

1. Note that under leasing arrangements ownership of the renewable asset may remain with the lessor, but the power generated by the asset typically belongs to the lessee. When reviewing leasing alternatives, it is important to understand which party is able to benefit from the various federal and state incentives available for renewable energy deployment.
2. An ESCO is an Energy Services Company. See Section V for more information.

Examples of this deployment model, using wind and solar energy, include:

- **Southern California Edison (SCE):** SCE announced in March 2008 that it was embarking on a program to install 250 MW of solar photovoltaic generation systems on commercial rooftops in California. The systems will generate sufficient power for some 162,000 homes and convert approximately two square miles of unused commercial rooftop space to productive use. SCE will benefit from a peak-generating renewable energy source that does not require building extensive transmission infrastructure. Since the commercial rooftops are located in urban areas, the solar installations can be connected to nearby neighborhood circuits.[26]
- **Steel Winds:** 20 MW of wind power have been developed on a brownfield that was formerly a Bethlehem Steel Mill on the shores of Lake Erie. The wind farm will produce sufficient electricity to power 6,000 homes and did not require the construction of new roads or transmission lines since it could use those left over from the steel mill.[27] Because of the good wind profile, the developers had an excellent site on which to construct a wind farm. In addition, the wind farm provides a lease payment to the site owner.[28]

Before deciding on a deployment option, it is important to understand that each alternative has different features and benefits and entails different trade-offs in terms of risks. To make the best deployment decision, a company must define its objectives and examine the features and benefits inherent in each deployment option.

Notes

1. EOS Ventures 2008.
2. Ross, Westerfield, and Jaffe 2006, p 376.
3. Financial Accounting Standards Board 1976.
4. Equipment Leasing and Finance Association 2008.
5. Financial Accounting Standards Board 2006.
6. Alta Group and Metcalf 2007.
7. National Association of Energy Service Companies 2008.
8. Ibid.
9. Ibid.
10. Hopper et al. 2007. The survey shows 10% of industry revenue from renewable energy but specifies that some respondents included "greening" buildings in the renewable category so activity in renewable generation may be somewhat less than 10%.
11. President 1999. Energy consumption measured based on consumption per square foot. Different standards apply for federal industrial and laboratory facilities.
12. Cory et al. 2008.
13. Ibid.
14. Merry 2008.
15. DSIRE 2008b.
16. GPMDG-EU 2007.
17. Fox 2008.
18. REN21 2007.
19. Ibid.
20. CPUC 2008b. Renewable generation from water and wastewater treatment facilities is covered under a separate limit.
21. Fox 2008.
22. Rickerson, Bennhold, and Bradbury 2008.
23. Ibid.
24. Ibid.
25. Gipe 2008.
26. Edison International 2008.
27. BQ Energy 2006.
28. Krouse 2007.

SECTION VI

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Objectives and Risks in On-Site Renewable Energy Deployment

This section looks at how to define objectives and assess risks associated with an on-site renewable energy deployment. It considers ten factors, including:

- Objectives
  - Energy Costs
  - Energy Cost Hedge
  - Energy Reliability
  - Brand Enhancement
  - Using Tax Appetite
- Risks
  - Dispatch Risk
  - Operational Risk
  - Technology Risk
  - Transfer Risk
  - Credit Metrics

OBJECTIVES FOR AN ON-SITE RENEWABLE ENERGY DEPLOYMENT

For many companies, the reasons to consider on-site renewables include achieving the benefits described earlier in this paper as well as realizing tax benefits. This section revisits the benefits of renewable energy and shows that there are trade-offs to be made when choosing a renewable technology and deployment model.

Energy Costs and Energy Cost Hedge

One potential benefit of a renewable deployment is either reducing current energy costs or providing a hedge against potential future energy cost increases.

It is not necessary to own the renewable installation to achieve an energy cost benefit, but it is necessary to control the power. Either Direct Ownership (Use of Power) or Third-Party Ownership (Use of Power) can provide energy cost benefits. If energy cost is a concern, a deployment under a No Power Use option would not be appropriate, since the deployment would not affect energy costs.

There are important distinctions, however, between direct ownership and third-party ownership even when the site owner is using the power generated by a project. Under direct ownership, the site owner controls the power for the entire economic life of the installation, which may be up to 30 years or more for certain technologies. Under Third-Party Ownership (Use of Power) options, however, the site owner only controls the energy through a power purchase agreement, which differs from direct ownership in that power purchase agreements:

- Typically do not run for the entire economic life of the project, although they may contain a fair market value purchase option at the end of the contract.
- Offer various pricing options such as (1) a fixed rate with an escalator, or (2) a rate indexed to utility rates in some fashion.

This means that a site owner needs to decide whether hedging future energy cost is critical to its business when negotiating the terms of a power purchase agreement. For example, a power rate indexed to utility rates does not offer a hedge against rising energy costs. A fixed rate with an escalation factor may offer a better hedge. A short tenor (10 years) would only provide an energy cost hedge for the duration of the contract, depending on the nature of any renewal provision.

Energy Reliability

Another benefit of an on-site renewable energy deployment can be improved energy reliability. Similar to the discussion regarding energy cost, energy reliability is only enhanced to the extent the site owner is using the energy produced; the benefits do not apply under No Power Use options.[1] There are other issues to understand as well. For instance:

- Wind and solar technologies can improve reliability if energy storage equipment is included in the system, but they are intermittent power sources. The site owner would be limited to the power stored in batteries and generated from intermittent sources until grid power was re-established.
- Geothermal heat pumps actually require electricity to operate and while they can offer cost savings, they do not lead to increased energy reliability.
- Solar water heaters can improve energy reliability depending on the type of solar water heater used. Passive solar water heating systems use no electricity and therefore can improve reliability. On the other hand, active solar water heaters require electricity to function and do not enhance energy resilience.

Brand Enhancement

Not all of the options for deploying renewable energy offer the same potential for brand enhancement. As noted, there are two different ways in which renewable energy deployment can improve a company's image: (1) by reducing the GHG emissions from the business, and (2) by providing a visible physical investment in green energy.

In order for a company to claim the use of renewable energy from an on-site system, it must retain the renewable energy certificates (RECs) associated with the power from the system. As such, under the Direct Ownership (Use of Power) option, the site owner would not be able to sell the RECs generated by the project if it wanted to claim the use of green power. Under the Third-Party Ownership (Use of Power) deployment option, the control of RECs is a negotiated point between the developer, investor, and site host. To claim the use of green power, the site host would have to purchase both power and RECs under a power purchase agreement. Conversely, Direct Ownership (No Power Use) may provide the site owner with the option to retain RECs. Note, however, that under the California feed-in tariff, RECS are transferred to the utility off-taker. When the Third-Party Ownership (No Power Use) model is used, a company cannot claim use of green power.

Even when there is no claim of using green power, on-site deployment means that the company still has the renewable assets at its location. If these assets are clearly visible to stakeholders—including customers, employees and investors—they may generate a positive connotation. The most visible asset is typically a wind turbine, which can be seen from a distance. Solar photovoltaic arrays and even solar thermal water heating units can be visible to those visiting the site. Conversely, it is much more difficult for stakeholders to discern the existence of a geothermal heat pump.

Tax Appetite

To benefit directly from many of the federal and state incentives supporting renewable energy deployment, the site owner must have a "tax appetite." This generally means that it must be a taxable entity, although there are special programs such as CREBS[2] and REPI[3] for certain non-taxable entities. However, even taxable entities must be in a position to use the tax benefits created by the incentives. Tax appetite entails having sufficient taxable income to use the tax deductions (MACRS) or credits (PTC or ITC) created by certain renewable energy investments. Bear in mind that:

- The investment tax credit entails having tax appetite only for the year in which the equipment is placed in service, subject to carry back and carry forward rules.

- The production tax credit entails having tax appetite for each of the first 10 years following eligible deployment, subject to carry back and carry forward rules.
- Other incentives such as MACRS or various state incentives require tax appetite for other specific durations.

Under the direct ownership deployment options, the site owner must have sufficient tax appetite and assumes responsibility for ensuring that the project qualifies for whichever incentives are used. Under third-party deployment options, the site owner does not require any tax appetite since it is generally not eligible for such incentives.

RISKS FOR AN ON-SITE RENEWABLE ENERGY DEPLOYMENT

Dispatch Risk

Although geothermal heat pumps are not an intermittent source of energy, many other forms of renewable energy are intermittent, including wind and solar. Consequently, it is important to understand who bears the risk that energy is not generated during a certain period. There are actually two different types of dispatch risk to consider:

- **Investor Risk:** The risk that the return on an investment is less than anticipated due to lower than planned power dispatch. This could result from either: (1) technical problems with the installation in terms of lower efficiency or availability rates, or (2) reduced renewable resource levels such as lower than expected solar radiation or wind speeds.
- **Power Purchaser Risk:** The risk that power that had been anticipated from a renewable installation, offering either current cost savings or a price hedge, is not produced in the planned quantities. Even when power can normally be purchased from the grid, it may be at a higher price.

Investor risk is generally assumed by the owner of the renewable installation as with the Direct Ownership (Use of Power) or Direct Ownership (No Power Use) models. Third-Party Ownership models with either Use of Power or No Power Use generally entail no investor risk for the site host.

Power purchaser risk is primarily a factor when the site host is using the power from the renewable energy deployment. Consequently, under Direct Ownership (Use of Power), the site host carries both investor and power purchaser risk. Although one of the key benefits of Third-Party Ownership (Use of Power) is that the site host does not assume investor risk, it may be subject to power purchaser risk. The extent to which power purchaser risk is taken by the site host under a third-party ownership model is a function of the contractual terms governing the power purchase agreement. The contract terms may specify a minimum level of availability or power efficiency, which in turn may be linked to manufacturer's guarantees and warranties.

Operational Risk

The entity assuming operational risk is responsible for operating the renewable energy system, performing maintenance, and carrying insurance. Potential costs resulting from poor operating conditions or lack of maintenance include (1) the repair or replacement of damaged equipment, and (2) in certain cases, the cost of replacement power resulting from a system interruption or degradation.

When a company has direct ownership of renewable energy assets, it assumes the operational risk that these assets will perform correctly and becomes responsible for operating and maintaining the system. This risk may be mitigated to some extent through equipment manufacturers' warranties and contracting for operating or maintenance services.

Under a power purchase agreement, the site host typically transfers this operational risk to the project developer who may subcontract certain operating and maintenance responsibilities to an equipment manufacturer or other entity. The responsibilities of the project developer to the site host, including any penalty payments, are detailed in the contracts governing the project (site lease and power purchase agreement).

Technology Risk

This is the risk that future technological improvement renders a given renewable energy investment less attractive. Under direct ownership a company runs the risk that it could have profited by waiting for a "better mousetrap." Third-party ownership models reduce this risk even when there is a long-term power purchase agreement since such agreements are generally for periods shorter than the economic life of the underlying asset.

There is a trade-off to be made between having an energy cost hedge and accepting technology risk. Direct ownership provides the best hedge, but exposes the investor to the greatest technology risk. By the same token, under third-party ownership, longer term power purchase agreements (with fixed tariff mechanisms) generally provide a better energy cost hedge than shorter agreements. However, the longer term agreements expose the site host to more technology risk precisely because it is locked in for a longer tenor.

Transfer Risk

If a company moves away from the site on which renewable assets are deployed, there is a potential transfer risk. Under direct ownership, the company assumes this risk and must either sell the renewable installation with the property or redeploy the assets to a new location if possible.

Under third-party ownership models, this risk remains with the site host for the duration of the PPA contract term. However, it may be possible for the site host to negotiate provisions in the PPA allowing it to assign the remaining contract term to a new site occupant.[4] Such provisions would typically require the new site occupant to be of an acceptable credit quality. Information is not available on the prevalence of such assignment clauses in PPAs; please note that even if no assignment clause is available, the risk is mitigated to some extent since the PPA contract term is generally less than the economic life of the project.

Credit Metrics

A company's choice of how to deploy renewable energy can also have an impact on its credit metrics. These metrics or financial ratios are part of the information used by bank lenders, bond rating agencies, and other financial analysts to determine the credit quality of a borrower and assign risk ratings. A company's credit metrics can have an impact on borrowing costs or even on its ability to raise debt capital.

Although many different ratios are used by the financial community, some of the more common appear in Table 9.

Each of the deployment options for on-site renewable energy has a different impact on credit metrics. For purposes of this analysis, the potential impact on financial ratios is considered for the first year the project is placed in operation:

- **Direct Ownership (Use of Power):** This entails financing the cost of the renewable energy asset on balance sheet and achieving cost savings or realizing the value of an energy cost hedge over the life of the project. If debt is used to finance the project, leverage ratios and coverage ratios may deteriorate.
- **Direct Ownership (No Power Use):** This is similar to the analysis above. In this case an energy project is financed on balance sheet; however, the purpose of the project is primarily sale of electricity to a third party. If debt is used to finance the project, leverage ratios and coverage ratios may deteriorate.

TABLE 9. COMMON FINANCIAL RATIOS

RATIO	DEFINITION
Profitability ratios	
• Net margin	Net income/Total sales
• EBITDA margin	EBITDA[1]/Total sales
Return ratios	
• Return on assets (ROA)	Net income/Total assets
• Return on equity (ROE)	Net income/Total equity
Leverage ratios	
• Debt to equity	Total debt[2]/Total equity
• Debt to EBITDA	Total debt/EBITDA
Coverage ratios	
• Interest coverage	Operating income/Interest expense
• Debt service coverage	Operating income/Debt service[3]

Notes
1. EBITDA is Earnings Before Interest, Taxes, Depreciation, and Amortization.
2. Total debt includes capital leases and sometimes adjusts for operating leases.
3. Debt service is interest expense and principle payment due for the year.

- **Third-Party Ownership (Use of Power):** Since no capital is required for the transaction, there is no impact on leverage ratios.[5] If the power tariff under a power purchase agreement is lower than the commercial rate, profitability, return, and coverage ratios may improve.
- **Third-Party Ownership (No Power Use):** Under this deployment option an unused or under-used asset is brought into productive use by the project host. There is no incremental capital required and the host company's operating income increases by the amount of the lease payment made for hosting the renewable energy assets. As such, most credit metrics (profitability, return, and coverage) may improve and leverage is unchanged.[6]

For large companies with strong balance sheets, it is unlikely that a small renewable energy deployment would have a significant impact on credit metrics. However, for smaller middle market companies, it is possible that financing an on-site renewable deployment could have a material impact. Managers with questions regarding the potential repercussion of a project on credit metrics should contact their finance or treasury department.

TABLE 10. SUMMARY OF BENEFITS FOR ON-SITE RENEWABLE ENERGY DEPLOYMENT OPTIONS				
	DIRECT OWNERSHIP OF POWER		THIRD-PARTY OWNERSHIP OF POWER	
BENEFITS	USE OF POWER	NO USE OF POWER	USE OF POWER	NO USE OF POWER
Energy Cost	Cost savings relative to commercial rates are possible for certain technologies or resulting from (1) federal and state incentives, or (2) applications offering peak shaving profile.	Cost savings are not realized by site owner since power is sold to third parties.	Cost savings may be possible under a power purchase agreement.	Cost savings are not realized by site host since power is sold to third parties by the project developer.
Energy Cost Hedge	Energy cost hedge is created by owning and using power directly.	There is no energy cost hedge unless the site owner retains the right to use power at some point in the future.	Energy cost hedge can be created for duration of PPA depending on the tariff option negotiated.	No energy cost hedge is created since power is controlled by the third-party project developer.
Energy Reliability	Can improve energy reliability under certain circumstances.	Generally no impact on energy reliability.	Can improve energy reliability under certain circumstances.	No impact on energy reliability.
Brand Enhancement	Green power use can only be claimed if RECs are retained. Certain applications provide "curbside" benefit.	Green power use can only be claimed if RECs are retained. Certain applications provide "curbside" benefit.	Green power use can only be claimed if RECs are retained. Certain applications provide "curbside" benefit.	No green power use can be claimed. Certain applications provide "curbside" benefit.
Tax Appetite	Site owner needs to have sufficient tax appetite to benefit from incentives except for certain leasing transactions.	Site owner needs to have sufficient tax appetite to benefit from incentives except for certain leasing transactions.	No tax appetite is necessary for the site host.	No tax appetite is necessary for the site host.

SUMMARY OF ADVANTAGES AND DISADVANTAGES OF RENEWABLE ENERGY DEPLOYMENT OPTIONS

When reviewing the various options that have evolved for deploying on-site renewable energy, it becomes clear that there is no option that is right for every situation. Companies potentially have many reasons for exploring renewable energy deployment. The choice of a deployment option will be a function of each company's circumstances as well as its objectives for the project.

Tables 10 and 11 provide a summary of the objectives and risks for the four major deployment options discussed in this paper.

Notes

1. If a site owner under a Direct Ownership (No Use of Power) deployment was not committed to sell electricity to the grid under a power purchase agreement and had the technical capacity to use the electricity itself, its energy reliability could also be enhanced.
2. CREBS (Clean Renewable Energy Bonds): For qualifying renewable energy projects, certain non-taxable entities can issue bonds at a zero percent interest rate so that the borrower only repays principle. Bondholders receive tax credits, set by the Treasury Department, instead of interest payments. The program has a global cap and the current expiration date is 12/31/09. (See DSIRE website for more information: http://dsireusa.org.)
3. REPI (Renewable Energy Production Incentive): For qualifying renewable energy projects, certain non-taxable entities may receive annual production incentive payments (1.5 cents per kWh in 1993 dollars indexed for inflation) during the first 10 years of operation. Note that this program is subject to availability of annual appropriations. (See DSIRE website for more information: http://dsireusa.org.)
4. GPMDG n. d.
5. Note that if the power tariff is lower than commercial rates, EBITDA will increase thereby improving the ratio of debt/EBITDA.
6. EBITDA would increase by the amount of the lease payments thereby leading to an improvement in the ratio of debt/EBITDA.

TABLE 11. SUMMARY OF RISKS FOR ON-SITE RENEWABLE ENERGY DEPLOYMENT OPTIONS

RISKS	DIRECT OWNERSHIP OF POWER		THIRD-PARTY OWNERSHIP OF POWER	
	USE OF POWER	NO USE OF POWER	USE OF POWER	NO USE OF POWER
Dispatch Risk • **Investor Risk** • **Power Purchase Risk**	Dispatch risk (investor and power purchase) is assumed by the site owner.	Site owner has investor risk. Power purchase risk is a function of the contractual relationship between site owner and power purchaser.	Site host has no investor risk. Power purchase risk is a function of contractual relationship between site host and project.	Site host has no dispatch risk since it is simply leasing a site to the project developer.
Operational Risk	Operational risk is assumed by the site owner .	Operational risk is assumed by the site owner.	Operational risk is assumed by the project developer.	Operational risk is assumed by the project developer.
Technology Risk	Technology risk is assumed by the site owner.	Technology risk is assumed by the site owner.	Technology risk is assumed by the site host for the duration of the power purchase agreement.	Technology risk is assumed by the site host for the duration of the site agreement only to the extent that a better mousetrap could have led to a more profitable hosting arrangement.
Transfer Risk	Site owner retains transfer risk for the life of the asset.	Site owner retains transfer risk for the life of the asset.	Site host retains transfer risk for the duration of the site agreement.	Site host retains transfer risk for the duration of the site agreement.
Credit Metrics	Financial ratios may be weakened by a debt-financed renewable energy project.	Financial ratios may be weakened by a debt-financed renewable energy project.	Financial ratios may improve due to energy cost savings.	Financial ratios may improve as an unused asset is brought into productive use.

SECTION VII

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Conclusion

Although not all renewable energy solutions are appropriate for every business location, it is likely that at least one application is suitable for many business sites. Companies—both large and small—are already realizing the benefits of on-site renewable energy, and as concerns about energy prices and GHGs grow, this trend will likely continue. Recent passage of the Energy Improvement and Extension Act has made on-site deployment easier by expanding qualifying technologies and extending tax credits.

Numerous deployment models and financing options have evolved to meet the needs of companies exploring an on-site renewable energy application. Other models may evolve as the U.S. focuses on the critical issues of climate change and energy security.

Even companies that had previously concluded that an on-site renewable energy project was not right for them may want to revisit the issue. Technology improvements, significant incentives, as well as innovative deployment models and financing options have evolved. These changes make a compelling case for on-site renewable energy deployment.

We suggest the following additional resources for companies considering on-site renewable energy:

- Green Power Market Development Group (GPMDG) U.S. case studies: http://www.thegreenpowergroup.org/casestudies.cfm?loc=us
- GPMDG European case studies: http://www.thegreenpowergroup.org/casestudies.cfm?loc=eu
- Corporate Guide to Green Power Markets: Diversifying Corporate Energy Purchasing With Wind Power: http://www.wri.org/publication/corporate-gpm-guide-9-diversifying-corporate-energy-purchasing-with-wind-power
- The Bottom Line series of climate policy briefs: http://www.wri.org/publication/bottom-line-series

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Glossary

Brownfield Site
Public Law 107-118 (H.R. 2869) - "Small Business Liability Relief and Brownfields Revitalization Act" defines brownfields as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant".[1]

Capital Expenditure
Expenditures made for capital assets including property, plant, and equipment.

Carbon-Constrained Economy
An economy in which a limit, or price, has been placed on the emission of carbon dioxide and other greenhouse gases and where, to reduce the negative impact of such emissions, the limit reduces or price increases over time.

Distributed Energy
According to the U.S. Department of Energy, "Distributed energy consists of a range of smaller-scale and modular devices designed to provide electricity, and sometimes also thermal energy, in locations close to consumers."[2]

EBITDA
Earnings Before Interest Taxes Depreciation and Amortization.

Feed-In Tariffs
"Have become a term of art to refer to the style of incentives adopted (most notably) by Germany to increase the adoption of renewable energy resources. Under the German feed-in tariff legislation, renewable energy technologies are guaranteed interconnection with the electricity grid, and are paid a premium rate that is designed to generate a reasonable profit for investors over a 20-year term. The rates are differentiated by technology such that each renewable resource type (e.g. solar, wind, biomass, etc.) can profitably be developed."[3]

Financial Ratios
Ratios based on financial information including balance sheet, income and cash flow statements. They are used, among other factors, by financial analysts as part of their work to assess the financial strength and credit quality of a company.

Greenhouse Gas
"Naturally occurring and man-made gases that trap infrared radiation as it is reflected from the earth's surface, trapping heat and keeping the earth warm."[4]

Net Metering
According to the Energy Policy Act of 2005 (Section 1251) "'net metering service' means service to an electric consumer under which electric energy generated by that electric consumer from an eligible on-site generating facility and delivered to the local distribution facilities may be used to offset electric energy provided by the electric utility to the electric consumer during the applicable billing period."[5]

Peak Shaving
Generating electricity or reducing energy consumption when demand for grid-supplied electricity peaks during certain parts of the day or due to specific weather conditions.

Renewable Energy
"Energy taken from sources that are inexhaustible, for example, wind, water, solar, geothermal energy and biomass."[6]

Renewable Energy Certificates (RECs)
"A REC is a certificate that indicates the generation of one megawatt hour (MWh) of electricity from an eligible source of renewable power."[7] They can be sold by a renewable energy project owner to enhance the financial return on a project or to secure financing. RECs are purchased to claim green power use or simply to support renewable energy deployment. Certification programs exist, such as Green-e Energy, to ensure the quality of RECs.[8]

Tax Appetite
The ability of an entity to benefit from tax incentives such as tax credits or tax deductions. Entities that are not taxable generally do not have tax appetite. Taxable entities may not have tax appetite if their taxable income is insufficient to benefit from tax incentives.

Tax Deduction
A reduction in taxable income on which income tax liability, is calculated.

Tax Credit
A reduction in tax liability, generally by the amount of the credit.

Notes

1. U.S. Congress 2002.
2. U.S. DOE n.d.
3. Rickerson, Bennhold, and Bradbury 2008.
4. Putt del Pino, Levinson, and Larsen 2006.
5. U.S. Congress 2005.
6. Putt del Pino, Levinson, and Larsen 2006.
7. Aga and Lau 2008.
8. Putt del Pino 2006.

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ABOUT WRI

The World Resources Institute (WRI) is an environmental think tank that goes beyond research to find practical ways to protect the earth and improve people's lives.

Our mission is to move human society to live in ways that protect Earth's environment and its capacity to provide for the needs and aspirations of current and future generations.

Because people are inspired by ideas, empowered by knowledge, and moved to change by greater understanding, WRI provides—and helps other institutions provide—objective information and practical proposals for policy and institutional change that will foster environmentally sound, socially equitable development.

WRI organizes its work around four key goals:

- **People & Ecosystems:** Reverse rapid degradation of ecosystems and assure their capacity to provide humans with needed goods and services.
- **Access:** Guarantee public access to information and decisions regarding natural resources and the environment.
- **Climate Protection:** Protect the global climate system from further harm due to emissions of greenhouse gases and help humanity and the natural world adapt to unavoidable climate change.
- **Markets & Enterprise:** Harness markets and enterprise to expand economic opportunity and protect the environment.

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