POWERING AMERICA'S COMMUNITIES

How smart state energy policy can foster economic development and local energy independence through distributed clean energy generation

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Note: The views expressed here are solely those of the authors and do not necessarily represent the positions of Americans for Energy Leadership.

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- Educating the nation's leaders and general public about the benefits of strong advanced energy innovation and competitiveness policy;
- Empowering pragmatic policy entrepreneurs with a platform to develop and advance their proposals at the national scale;

As part of this effort, the 2011 New Energy Leaders Project provided a unique platform for a selective group of young thought leaders to produce impactful research and writing and actively promote their work to a national audience. The project goals included:

- Empower new thought leaders who are capable of analyzing complex energy policy issues, advancing pragmatic ideas at the federal and state level, and rising to future leadership roles;
- Providing commentary and analysis on the development of the next energy policy agenda;
- Provide an online hub for young leaders to discuss energy policy, access resources, and connect with other organizations and career opportunities;
- Build a cohesive national network of young people who support an energy innovation agenda, and who can be called upon to support legislative and electoral education efforts in the future.

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EXECUTIVE SUMMARY

After decades of support for conventional fuels to make them inexpensive and reliable, it is time to invest in new technologies that will meet the challenges of the 21st century. Distributed generation (DG) clean energy — energy produced from clean sources at or near the site of consumption — is a key component of that investment portfolio. It can deliver a host of benefits to not only the communities where the generation is sited, but also the nation as a whole. Such benefits include greater security, economic growth, and zero-pollution energy production.

Today, the levelized generation cost of DG clean energy is more expensive than conventional sources on a kWh basis (not accounting for the negative externalities associated with conventional fuels). But the additional premium is rapidly declining as demand increases and technology progresses. Sufficient and reliable demand will bring economies of scale, innovation, competition, and more flexible financing. DG clean energy – whether it is a residential wind turbine, a biogas facility on a local landfill, or a solar array in the city center – is an investment in a more diversified future that will pay dividends as DG clean energy reaches grid parity and as the costs of fossil fuel use increase.

This report lays out a state-level policy framework that will cost effectively spur the demand needed to push DG clean energy further down the cost curve. This framework is designed to overcome the four key barriers to more widespread deployment of DG clean energy:

1. Insufficient demand for clean DG
2. Lack of proper incentives to stimulate investment in DG technologies
3. Exclusion of key rate payer groups from effectively using DG sources
4. Gaps in financing options for households and businesses looking to install DG systems

The intricacies of each state's regulatory environment forfeits the opportunity for a one size fits all approach, but the core ideas and concepts presented in this paper can be tailored to any state.

The foundation of forwarding-looking policy starts with a well-designed renewable portfolio standard (RPS). A RPS with the following characteristics can rapidly deploy DG at the state level:

- Meaningful goals within a reasonable timeframe
- In-state renewable energy credit (REC) provisions
- DG carve-out with specific D-RECs
- Stable but competitive REC prices and stable yearly budgets
- Interim targets to track progress and compliance

To supplement a strong RPS, incentives are needed to ensure that DG clean energy systems can achieve a reasonable rate of return to make them attractive to potential owners and investors. Incentives must be designed to minimize the financial impact on ratepayers while at the same time providing a strong, consistent market signal. This can be done by providing upfront incentives (UFI) or production-based incentive (PBI) payments tied to utility D-REC purchases for RPS compliance. For small-scale systems installed on-site by a customer-owner, UFIs and PBIs can leverage avoided costs, and for larger systems, PBIs can be provided through competitive bidding mechanisms to contain costs.

Forward-thinking net metering rules and community energy programs open opportunities for investment in DG clean energy projects to all ratepayers. Lastly, financing mechanisms aimed at overcoming the front-loaded cost of some renewable technologies is essential when looking to engage low- and middle-income households as well as nonprofits. All of these near-term policy proposals can also compliment a longer-term strategy to increase federal funding for energy technology innovation.

Together, these policies establish a framework that can be used by state policymakers interested in fostering local economic development and energy independence through distributed clean energy generation. The framework will provide needed state support for DG clean energy and cost-effectively catalyze the widespread deployment of DG clean energy.

SECTION 1

DISTRIBUTED CLEAN ENERGY

Introduction

Since the collapse of comprehensive climate legislation in the summer of 2010, federal policy makers have struggled to find a new approach to securing America's energy future. Over that same period the political landscape has drastically changed. The 2010 midterm election saw Republicans gain a majority in the House, a slimming of the Democratic majority in the Senate, and the Tea Party gain a voice in the national dialogue. On both sides of the aisle the federal deficit has become a central issue in the policy debate, making significant new spending a non-starter. Gridlock in Washington has left many disillusioned with the federal government.

The hyper-partisan federal deficit debate has made the near-term prospects for meaningful energy legislation slim, yet America faces serious energy challenges that threaten our security, economic competitiveness, and ability to combat environmental degradation.

Security

Recent events have reminded us of just how frail our current energy infrastructure is to both natural and man-made terror. The earthquake and resulting tsunami in Japan has left the nation with a 25 percent electricity shortfall, forcing Japan to institute rolling blackouts that have stunted GDP by and estimated .29 percent.[1] At the same time, terrorism and international hacking remain a very real threat. Two years ago sources reported that China, Russia, and other countries had hacked into the U.S. grid, implanting bugs that could shut down power in times of strife.[2] Repeatedly the Department of Defense has issued warnings about the vulnerability of the U.S. energy grid to terrorist attack.

Economic Competitiveness

According to Energy Business Reports, "In 2013, the global electricity market is forecast to have a value of $2,605.8 billion, an increase of 52% since 2008" Compare that to the coveted global mobile handset and smart phone market which is expected to reach $341.4 billion by 2015.[3] Clearly, the market for electricity is large and expanding. The Pew Charitable Trust estimates that with aggressive international policy, clean energy investments could reach $2.3 trillion within the decade, and even under current policies, investments will reach $1.7 trillion.[4]

Undoubtedly, the energy market represents an opportunity for disruptive technology and innovation. Perhaps analogues to the timeworn telephone network before modernization and mobile phones, the worldwide energy market represents an opportunity for advancement. As fossil fuels increase in price due to heavy demand and scarcity, the need for alternatives by consumers will also increase. The wealth generated from revolutionizing this market could determine the next great economic opportunity.

Environmental Degradation

As the countries of the world continue to deal with the environmental and social costs related to negative externalities of fossil fuel consumption, clean forms of energy production will need to be available at a reasonable cost. With the UN projecting over 9 billion people by 2050, the world will have little capacity to absorb the environmental calamities predicted by scientist if we continue on the business as usual path.[5] Parts of the US in particular could be devastated both economically and physically with increased extreme weather and raising seas. If the US starts to address the environmental impacts of its energy production today, it could help to mitigate the severity of future environmental decline and reduce the cost of clean energy adoption down the road.

Why We Need Distributed Clean Energy

Such challenges require immediate and significant policy action. Yet any meaningful approach in the near-term needs to accommodate several realities: it will need to be inexpensive for taxpayers, bypass the Washington gridlock, and achieve widespread deployment, while also driving next-generation technologies. Given these realities, a state-level strategy for the immediate future makes sense. States can function as "laboratories for democracy", as Chief Justice Brandeis once noted, and this is exactly the role they have begun to play in clean energy policy. While the federal government remains stalled, states will have to drive clean energy adoption on a more local level. Yet states face tight budget constraints as well, and therefore policies must be lean and efficient. This report thus outlines a framework for increasing distributed generation clean energy on a state level through a variety of mechanisms. This near-term policy proposal compliments a long-term strategy to increase federal funding for energy technology innovation in order to make clean energy cheaper than fossil fuels.

Distributed clean energy carries two sets of benefits: those resulting from DG generally, and those resulting from distributed generation from clean energy sources in particular. Both of these benefits are especially important for urban areas — cities, towns, and suburbs — that have growing demands for power. States must ensure that these needs are met through their regulatory oversight of utilities. In order to meet power demands without comprising security, increasing pollution, and continuing to be exposed to price increases, clean energy must be used. Furthermore, the use of clean energy both on the utility scale and the DG scale can bring economic revitalization and spur innovation.

Benefits of Distributed Generation

Distributed generation avoids the limitations of utility-scale projects because distributed projects are smaller and can usually be built more quickly and with fewer requirements than utility-scale projects.[6] DG systems are also generally tied directly into the distribution grid. Much of the electricity generated by distributed systems is consumed on-site or very near to the systems, but even if there is excess production, most distribution lines have the capacity to carry it over these lines to other nearby customers.[7]

A study conducted by the U.S. Department of Energy in 2007 evaluated the potential benefits of DG generally (not only of clean energy) and found a number of other significant benefits to utilities, electricity customers, and the general public, in addition to addressing long timelines and transmission bottlenecks that plague utility-scale projects. These include the following:

- **Reduced vulnerability to terrorism and improved infrastructure resilience:** Centralized sources of power are prime targets for terrorist attacks. DG disperses the production of electricity, making the energy infrastructure more resilient to attacks, as well as to weather and other forms of potentially disruptive events.[8]

- **Increased power quality and system reliability:** DG can be used to supplement a distribution system's ability to supply sufficient power during periods of peak demand, and to provide ancillary services such as reactive power and voltage support. Using DG to meet these local system needs can improve the quality of power delivered and enhance overall electric system reliability. However, energy storage devices will have to be utilized if intermittent DG technologies gain significant market penetration in the future.

- **Reduced peak power requirements:** If enough DG is installed to satisfy increases in demand, it can offset the need to build additional utility-scale facilities (which saves ratepayers money), or at least it can reduce utilities' need to purchase power on the spot market to supplement their own production during periods of peak demand. Avoiding market power purchases can save ratepayers money as well.

Benefits of Distributed Clean Energy Generation

The use of clean energy sources for distributed generation is widely acknowledged to deliver additional benefits as well. These include:

- **Creation of long-lasting, high-wage jobs:** Studies have shown that clean energy sources such as biomass, solar PV, and wind provide more jobs per dollar invested than traditional energy sectors in the economy.[9] And within clean energy, DG projects result in more jobs per megawatt installed than utility-scale projects.[10] Many of the jobs created by deploying DG clean energy systems are long-lasting, high-wage local jobs for workers with trade skills.[11] And unlike jobs created through manufacturing clean energy technologies, these jobs cannot be exported because they relate to installation, operation and maintenance – work that is inherently tied to the location of the systems.

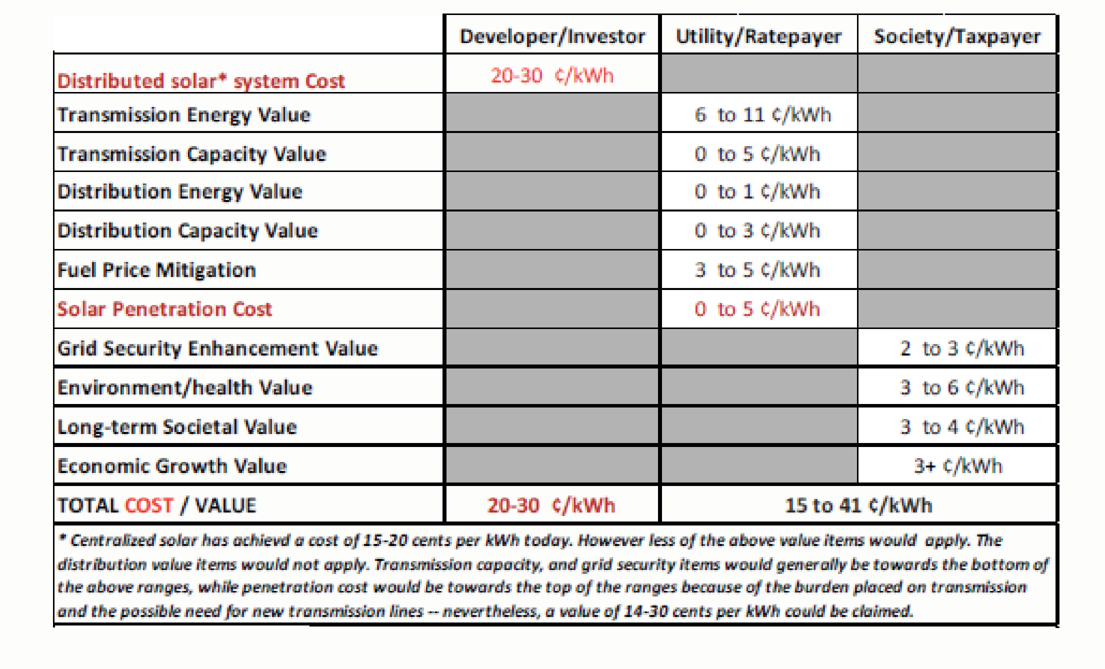
- **Economic benefits from community investment and greater economic productivity through the exploitation of unused urban space:** DG clean energy systems are often owned and/or financed by local residents and businesses. Research suggests that community-owned clean energy projects deliver 2-5 times the economic benefits of projects built by out-of-state investors. This is because when the owners are participants in the local economy, they purchase more materials and labor for construction locally and are more likely than remote corporate owners to spend their money in the community.[12] Local ownership and local financing result in more dollars remaining in the local economy when compared with projects of similar size not locally owned or financed.[13] And, in communities that currently import electricity from outside the area, community-owned DG clean energy can also keep utility dollars in the community, with multiplier benefits for the local economy. In addition, DG clean energy can turn unused urban space such as rooftops and parking lots into productive resources.

- **Greater economic stability and insulation against increasing energy prices and supply shortages:** Much of the prosperity and development experienced in the U.S. during the 20th Century was aided by access to abundant, inexpensive energy. Every part of the U.S. economy depends on electricity to thrive, and that means that every part of the economy would be impacted by rising energy prices or supply shortages. Electricity rates that are tied to the use of fossil fuels have the potential to rise substantially in the future, either as a result of increasing resource scarcity, or because of stricter regulations on greenhouse gas emissions. And electricity production from fossil fuels is also vulnerable to price spikes and market disruptions, whether caused by speculation, natural disasters, or other catastrophic events. DG clean energy helps to insulate communities from rising rates and supply shortages, because clean energy sources are generally less vulnerable to disruption from external sources. Investment in DG clean energy can be seen as a decision to purchase a more certain energy future.[14]

- **Reduced Environmental Impact:** Clean energy DG reduces:
  - C02 Emissions
  - NOx Emissions
  - SO2 Emissions
  - Particulate Emissions
  - Mercury Emissions
  - Coal Ash
  - Water Consumption

- **Distributed** generation solar for example has been shown to be less expensive than previously imagined particularly when implemented aggressively.[15] According to a joint report by the University at Albany, George Washington University, and Clean Power Research – DG solar provides the following tangible benefits:
  - Transmission capacity savings
  - Grid loss savings
  - Reduce the wear and tear on equipment – e.g., transformers - as well as deferred upgrades
  - Hedge against fuel price inflation
  - Grid security enhancement
  - Environment/health
  - Economic growth (job creation, tax revenues, etc.)

The chart below illustrates the benefits of Distributed generation solar in New York:



	Developer/Investor	Utility/Ratepayer	Society/Taxpayer
Distributed solar* system Cost	20-30 ¢/kWh		
Transmission Energy Value		6 to 11 ¢/kWh	
Transmission Capacity Value		0 to 5 ¢/kWh	
Distribution Energy Value		0 to 1 ¢/kWh	
Distribution Capacity Value		0 to 3 ¢/kWh	
Fuel Price Mitigation		3 to 5 ¢/kWh	
Solar Penetration Cost		0 to 5 ¢/kWh	
Grid Security Enhancement Value			2 to 3 ¢/kWh
Environment/health Value			3 to 6 ¢/kWh
Long-term Societal Value			3 to 4 ¢/kWh
Economic Growth Value			3+ ¢/kWh
TOTAL COST / VALUE	**20-30 ¢/kWh**	**15 to 41 ¢/kWh**	

** Centralized solar has achievd a cost of 15-20 cents per kWh today. However less of the above value items would apply. The distribution value items would not apply. Transmission capacity, and grid security items would generally be towards the bottom of the above ranges, while penetration cost would be towards the top of the ranges because of the burden placed on transmission and the possible need for new transmission lines -- nevertheless, a value of 14-30 cents per kWh could be claimed.*

Source: Perez, R., Zweibel K., Hoff, T., 2011. "Solar Power Generation in the US: Too expensive, or a Bargain?"

The clean technology market particularly on the DG scale is growing rapidly. Venture capital, despite the suboptimal economic conditions, has also continued to flow to startups. In fact $3.98 billion of venture capital was invested in clean energy technologies in 2010. Inventions like the Bloom Box and solar PV shingles are regularly making headlines. According to the Brookings Institution's *Sizing the Clean Economy* report, 2.7 million people now work in the green/ low carbon economy nationwide. That is more than the amount of workers in the fossil fuel industry. Additionally, "roughly 26% of all green jobs are in manufacturing, compared to just 9% in the broader economy." This translates into higher pay and more steady job creation.

However, at the same time, other countries are aggressively pursuing domination in clean tech market. China's government, in 2010, spent around $90 billion in support of its clean tech industries, with Germany coming in second at around $41.2 billion, and America coming in third at $34 billion. There is no clear frontrunner in this race and great strides still need to be made, particularly in the area of energy storage, before mass adoption can occur. It is to the advantage of every nation to figure out there comparative advantage in the industry. For the US, it seems that its university system, R&D capabilities, and open, democratic nature may be to its advantage. In particular this report will focus on the US's opportunity to democratize energy markets for the American consumer. It is important to remember that it was not until computers were made available to the mass consumer market that they truly revolutionized the word and created one of America's most vibrant industries. In this way DG represents a similar opportunity for clean tech industries.

The Limits of Utility-Scale Clean Energy Production

For most of the electrical era in the U.S., demand for power has been met by utilities building large-scale power plants far away from centers of demand and sending the power into urban areas over high-voltage transmission lines. As clean energy has become more prevalent, many clean energy projects, especially wind turbine projects, have been built following this "utility-scale" model. There are certainly benefits to this approach. In particular, such projects are relatively cheaper because they can use large tracts of (relatively low-priced) land to build big projects, harnessing economies of scale to reduce the per kilowatt-hour (kWh) costs of equipment, installation, and even project financing.[17]

But building large, remote power-generating facilities, whether using clean or fossil energy sources, has limitations that are becoming more pronounced in the 21st Century. For one, large-scale energy generation projects are complex and it can take years to plan, acquire the necessary permits, and secure financing, before building even begins.[18]

And some generation projects simply cannot get built, even if the projects themselves are strong, because of transmission constraints. Many regions are facing bottlenecks and simply do not have enough transmission capacity to handle the additional power from new production facilities.[19] Developing new transmission lines has proven extremely difficult, especially with regard to identifying appropriate sites, carrying out environmental impact analyses and acquiring needed permits.[20]

A Look at Distributed Clean Energy

While the Federal Government debates the merit of clean energy legislation, policymakers in many states have recognized the benefits of nurturing clean energy development though a supportive suite of policies and investments. State and local governments are setting goals for clean energy production through renewable portfolio standards, and encouraging market development with tax credits, rebates and other incentives.

Over the past decade, as states have begun investing more heavily in clean energy, it has become clear that certain forms of clean energy deliver greater benefits at lower costs than others. Distributed clean energy is one area that has shown especially great promise, and recently a number of state governments have started implementing policies that promote the widespread deployment of distributed clean energy technologies and promote distributed clean energy generation.

What is Distributed Clean Energy?

In general, "distributed generation" (DG) refers to relatively small electricity generation systems located at or near the point of use, and does not refer exclusively to clean energy.[21] Distributed generation has been around for a long time, but it has primarily been used to produce power for on-site or emergency needs, such at hospitals or industrial facilities where back-up power is needed to protect against possible failings of the electrical grid.

In the early years of electricity, DG technologies were largely limited to fossil fuel-powered generators. However, the advent of clean energy technologies gave rise to a host of new DG options. And as clean energy and grid interconnection technologies have improved, using clean energy for DG production has become more practical and economical.

Distribute generation became directly associated with clean energy as a result of the passage of the Public Utilities Regulatory Policies Act (PURPA) in 1978. PURPA created a new class of energy producers, called "qualifying small power production facilities" (QFs), which generate electricity using renewable resources, and required that utilities purchase the power they produced.[22] QFs were unique because they were not owned by utilities but were still designed explicitly to produce electricity for sale to the grid.

Not all QFs are considered distributed clean energy, but some are. DG clean energy is also made up of other, often smaller clean energy systems that are built to offset owners' electricity consumption with locally generated clean energy rather than for exclusive sale to the grid. Definitions of the size cap for distributed generation systems have ranged from less than 20 MW to up to 80 MW.[23] Because the typical nameplate capacity of systems varies widely depending on the technology used, we find it more useful to define DG as electricity-producing systems that are connected to the distribution side of the grid (rather than transmission lines), either in front of or behind customer meters.

In the DG clean energy arena, solar photovoltaic (PV) technology is by far the most prevalent distributed clean energy technology used. However, there are other clean energy sources that can be effectively applied for distributed generation, such as wind, biogas, biomass, and geothermal.

State Support Necessary for Widespread Deployment

Distributed clean energy generation brings many positive benefits to local communities as a whole. But, in many ways, DG clean energy is a public good: the benefits are diffuse, accruing to the population as a whole not just to those who own it. This is in contrast to fossil fuels, which have benefits that are directed to the user (cheap and reliable) with negative impacts that are externalized to everyone else.

This suggests that governments have a role in leveling the playing field. However, due to the patch-work nature of the United States' electricity markets and geographic diversity, it is ultimately up to states to craft policies that fit their regulatory structure, resources and community needs.

Barriers to Distributed Clean Energy Generation

Lack of Demand – Electric utilities have little incentive to invest in distributed clean energy systems or purchase distributed clean energy generation. Regulations of the electric utility industry have developed over the course of a century to protect customers from monopolistic behavior and to ensure that the nation has access to abundant, inexpensive electricity. Until recently, the imperative to provide cheap power has been paramount in utility resource acquisition decisions. Even now, in many states the pressure to contain electricity costs in the short run continues to trump concerns about the consequences of reliance on increasingly scarce and dirty fuels. As long as the levelized costs of clean energy per kWh are higher than energy from conventional fossil sources, regulations that require utilities to acquire the least-cost resources precludes investment in clean energy technologies and erodes market demand for clean energy.

Even in states where policymakers have made official commitments to promoting clean energy, distributed clean energy generation is unlikely to be developed without government involvement. This is because utility regulations have created a profit structure that rewards the building of centralized power-producing facilities and discourages utilities from facilitating the development of a network of distributed generation sites. For example, the more electricity a utility sells the more revenue and profit it receives. If a customer installs a clean energy system then the utility is in effect losing revenue which creates a disincentive to carry out more DG . Decoupling, a policy outside the scope of this report, is a possible answer to overcoming this disincentive.

Numerous interconnection regulations also deter demand for private distributed clean energy systems because they make it difficult for non-utility entities to connect to the grid and get paid for the electricity they produce – either in the form of credit to their own bills or by selling their production to others.

Insufficient Production Incentives – High technology costs and low electricity rates make it difficult to realize returns on investments in distributed clean energy: Clean energy technologies have improved in efficiency and performance over the years, but the levelized costs of many technologies have nonetheless remained too high to compete directly with conventional technologies. In recent years, increasing demand for clean energy has yielded substantial price reductions, especially for wind turbines and solar photovoltaic systems. However, even for these technologies, distributed generation applications face higher capital costs and transaction costs compared to centralized applications, which benefit from economies of scale, and thus distributed clean energy generation trails the levelized costs reductions achieved by recent utility-scale clean energy projects. Federal investments in clean energy innovation will be crucial in lowering these costs, but in the short term other action must be taken.

Because electricity rates for ratepayers in many places are low (a result in part from past and current government investments and subsidies for hydroelectric dams, coal mining and nuclear reactors), it can be very difficult for owners of distributed clean energy systems to achieve cost recovery as a result of offsetting their own electricity consumption within a reasonable timeframe. Achieving cost recovery with a modest rate of return sufficient to cover the opportunity costs of investment is even more difficult.

It is important to note that although distributed clean energy projects have higher capital costs and transaction costs, in the long term these technologies may have equal or lower lifecycle costs than other conventional energy technologies due to lower costs of operation and maintenance, less susceptibility to disruptions, lower costs of transmission and greatly reduced decommissioning expenses. And, if prices of conventional energy sources increase in the future due to diminishing supply or regulation on emissions, distributed clean energy could even rival these on a levelized cost basis.

THE COST OF DISTRIBUTED GENERATION VS. THE BENEFITS - A VIEW FROM THE RATEPAYER

If ratepayers pay an incentive of $0.036 a kWh for 20 years or $1.25 per Watt upfront incentive how does their investment pencil out? Assuming the fix costs the utility needs to recoup from the loss of a customer adds up to $0.06 per kWh and the panel produces 1800 kWh per kW a year (with a .05% yearly decrease in output), ratepayers would be paying $0.096 per kWh.

Ratepayers might expect fuel savings summing to $0.03 per kWh (the market cost of conventional comparable generation less the wholesale rate) with prices increasing around 4% a year. Ratepayers might also realize other savings (O&M, Transmission, and distribution) particularly if enough DG comes online.

If total savings add up to $0.06 per kWh, DG energy will become cheaper around year 21 of the system life with a slight net benefit to ratepayers by year 30. This calculation does not include the indirect social benefits of DG or any environmental savings.

However, under current market conditions, production of distributed clean energy faces unfavorable terms, which deters investment.

- Limited Investor Pool – Many ratepayers are currently left out of the market.
  Despite poor returns due to low electricity prices, many people are still interested in investing in distributed clean energy, either as a hedge against future price increases, or out of conviction that clean energy represents environmental stewardship, energy independence, or economic development. Unfortunately, the opportunities for these individuals to invest are limited, often by restrictions on who can benefit from distributed clean energy generation. In most states, those who do not own property, such as renters or businesses that lease commercial space, or those who do not pay electricity bills at the properties they own cannot reap the benefits of distributed clean energy generation at those sites. Similarly, those who own property that is not suitable for distributed clean energy generation are largely left out of the market. This shrinks the pool of potential investors and makes it even more difficult to achieve widespread deployment of distributed clean energy systems.

- Challenges in Financing – Many potential owners have trouble securing financing.
  Even in states with mandates for utilities to purchase distributed clean energy, and with subsidies available and policies in place to make investment attractive and accessible to all ratepayers, it can be difficult for potential system owners to secure the financing they need. One reason for this is because of the mismatch between the needed loan periods (15-20 years) and typical homeownership timeframes (5-7 years). For homeowners to be willing to borrow to finance a clean energy system, they must be confident that they can transfer the loan, along with the system, to the next property owner or someone

else who will benefit from the system when they move. And, for potential owners who seek debt financing for systems not attached to property or businesses against which they can borrow, securing loans is exceptionally difficult. Again, the limitations on access to capital mean that only a small portion of those who are interested in (and financially capable of) owning distributed clean energy can do so.

State Policies Can Tip the Balance to Overcome Barriers

Many of these barriers can be addressed by states taking proactive measures to promote the deployment of distributed clean energy. The outcomes in places where policy support has been put in place show that states can play a major role in tipping the balance on distributed clean energy, catalyzing investment by local utilities, residents, and the private sector. Even though some states have begun recognizing the value of distributed clean energy, much more is possible. And many states still lack the basic policies and programs required to transform goals for clean energy into generation capacity on the ground.

A State Policy Framework

This report highlights the state policies needed to address the barriers and reap the benefits of widespread deployment of distributed clean energy for job creation, community investment, rate stability, and energy independence. It must be noted that these recommendations are no substitute for strong federal support for energy innovation, commercialization, and deployment.

As mentioned above, solar photovoltaic (PV) technology is the major player in distributed clean energy generation. For this reason, policies that encourage solar PV specifically and those that encourage distributed clean energy generation generally are often discussed together, even interchangeably. However, our intent is to develop a policy framework that supports distributed clean energy generally, including but not exclusive to solar PV. Still, because many distributed generation policies have been designed for solar PV deployment, most research on these policy effects reports their findings in these terms. Therefore, we sometimes make recommendations for policy designs based on solar PV outcomes, but nonetheless intend them to be relevant for distributed clean energy more broadly.

Because the economy and regulatory environment of electricity generation is unique in each state, there are no one-size-fits all solutions. Indeed, these differences in state energy markets are one reason why promoting distributed generation as a strategy for promoting clean energy across the country makes sense. Still, it is important to point out that the policies presented are discussed in broad terms. Any effort to apply the policies discussed here must take into account unique state policy and market factors, and tailor recommendations to these specific conditions.

Goals and Criteria for Strong State Policy

Over the next four sections we will outline the critical state policy elements that comprise a strong package to support distributed clean energy. We believe that a strong state policy framework achieves the following goals:

- Creates demand for distributed clean energy and sends clear, stable, consistent signals to the market
- Incentivizes production in a way that brings large amounts of distributed clean energy online in a cost-effective way
- Expands opportunities for investment in distributed clean energy systems to all ratepayers and Improves the availability or feasibility of financing for distributed clean energy systems

Due to the current political and economic realities the policies to achieve these goals will have to meet the following criteria to be considered viable:

- Cheap for the state government to implement
- Not a burden for ratepayers
- Must incentivize innovation and not entrench market ready technologies

In subsequent sections we provide more detail about each of these goals while checking recommendations against the above criteria.

SECTION 2

CREATING DEMAND THROUGH A RENEWABLE PORTFOLIO STANDARD

An Introduction to Renewable Portfolio Standards

Renewable Portfolio Standards (RPS) are among the most widely used and extensively studied policy mechanisms for supporting clean energy deployment at the state level. Broadly speaking, RPS programs require that utilities or other electricity suppliers acquire a certain amount or proportion of their energy portfolios from clean energy sources.

As of December 2010, 29 states and the District of Columbia have established binding RPS programs. The details of RPS policies vary significantly, due to unique regional and local electricity markets and actors, and the policy goals and interests of decision makers within each state.

Even though RPS program designs are necessarily unique, many programs share common goals, including diversification of the state's energy mix, environmental protection and local economic development. Deployment of DG clean energy, and realization of its associated benefits, is often one of the major goals of policymakers when developing an RPS program.

However, not every RPS program is equally successful in achieving this goal. In order use an RPS program to foster DG clean energy development, it must include explicit provisions that create demand for DG clean energy. This section draws on empirical analyses, program documentation and first-hand experiences to suggest a framework for using RPS programs in this way.

RPS Policies that Create Demand for Distributed Clean Energy

1. **Set RPS targets above business-as-usual forecasts.**

   In order for RPS programs to encourage clean energy, distributed and otherwise, beyond what would be provided by the market without government action, the targets must go beyond business-as-usual predictions. Most, but not all, state RPS programs currently in place have done this. What the exact target should be for any given state depends on the current clean energy capacity and resource availability. At the national level, an analysis by the National Renewable Energy Laboratory shows that a goal of 15% renewable production by 2021 with 4% coming from efficiency is on track with business-as-usual growth in the industry, suggesting that, for most places, a robust target should exceed this.[24]

2. **Require a certain percentage of clean energy to be acquired from within the state.**

   Adopting a Renewable Portfolio Standard does not guarantee a significant increase of in-state generating capacity of clean energy. In some cases, utilities covered by RPS programs have met their obligations largely through the purchase of renewable energy "credits" (RECs) from out-of-state clean energy projects. While the purchase of out-of-state RECs may advance clean energy on a national level, it does not support in-state market development. A robust in-state market helps to spur DG clean energy development by attracting experienced installers, reducing installation costs, and familiarizing local investors and financers with clean energy.

An empirical analysis of the effects of different RPS designs shows that certain design elements have a great effect on the amount of in-state clean energy capacity installed. The analysis suggests that, in states that either prohibit or otherwise discourage the purchase of out-of-state RECs, each 1 percentage point mandated increase in clean energy has, on average, led to slightly more than a 1 percentage point increase in in-state clean energy capacity. In contrast, in states that place no restrictions on out-of-state REC purchases, the presence of an RPS has not contributed in a statistically significant way to increases of in-state capacity.[25]

To ensure that RPS programs achieve the goal of stimulating local economic development and creating jobs, it is vital to design a program that leads to the development of in-state clean energy capacity. Thus, including provisions that utilities meet some portion of their compliance obligation with in-state resources is essential. In states that are especially small or that have limited resource potential of their own, in-state provisions may not be appropriate. In these cases, provisions that prioritize regional clean energy sources can also help investment dollars be put to use to benefit the regional economy, which will likely have a greater local economic impact than purchases of RECs from far away.[26]

Exactly what portion of the total RPS these provisions should cover depends on the local economy, market conditions and in-state resource potentials. It is also important to structure any in-state requirement so it does not violate the U.S. Commerce Clause. Tying the need for in-state resources to the delivery of local grid benefits rather than local economic benefits is strongly recommended.

3. Require a certain percentage of clean energy to be acquired from distributed generation.

Initially, RPS programs were designed to be project size and technology neutral, so as to encourage competition among technologies and contain costs for utilities and ratepayers. However, research on the effects of programs designed in this way suggested that RPS requirements alone are not sufficient to catalyze investment in distributed generation of clean energy, given its relatively higher capital costs and resulting difficulty competing head-to-head with less costly utility-scale clean energy projects.[27] And the technology-neutral structure of early RPS programs did little to encourage development of multiple clean energy technology types. In fact, an estimated 94% of all RPS-driven renewable energy capacity additions in the U.S. from 1998-2009 have come from utility-scale wind power projects.[28]

Recognizing this shortcoming of a project-size and technology-neutral approach, some RPS programs have gone further to incentivize distributed clean energy projects, adopting specific targets for distributed generation (often for distributed solar PV specifically) within the larger RPS goal, and using policy mechanisms such as carve-outs or multipliers.

13 states and Washington, DC now have carve-outs for solar and 4 states have carve-outs for DG clean energy generally, while 6 states use multipliers to support distributed generation generally or solar specifically. For a detailed list of these policies, see Appendix A at the end of the report.

Most of these carve-outs and multipliers are relatively new, and compliance deadlines are either too recent to have been rigorously analyzed or have not yet arrived, so no complete review of their effects is available. But an early evaluation by the Lawrence Berkeley National Laboratory (LBNL) indicates that solar and DG carve-outs have played a central role in driving growth of solar electric capacity in recent years. This evaluation showed that 65-81% of total grid-connected PV capacity additions in the U.S. between 2005 and 2009, outside of California, occurred in states with active or impending solar/DG carve-outs.[29]

Few solar multiplier policies have been in place long enough to pass compliance deadlines or to provide sufficient time for data collection and analysis on a representative sample, but the LBNL evaluation suggests that, in contrast to carve-outs, multipliers have so far not resulted in a significant increase in solar/DG.

Creating robust demand requires explicit RPS provisions for utility acquisition, and carve-outs appear to be the most effective mechanism for this. Again, what percentage of the total RPS should be carved out for DG clean energy depends on the resource potentials, local market conditions and the goals of policymakers in each state.

4. Issue separate renewable energy credits (RECs) for distributed clean energy.

Most states with RPS programs have chosen to use RECs to verify, quantify, and monetize the generation of qualifying clean energy. RECs are generally issued by a state's RPS program administrative body to clean energy producers for each MWh produced. Utilities then acquire RECs and use them to prove their compliance with RPS obligations.

Issuing separate RECs for DG clean energy is a complementary and logical extension of establishing carve-outs within the RPS requirements and can help make the implementation of these requirements more efficient. These "DRECS" (distributed renewable energy credits) would serve the same functions of quantifying, verifying and monetizing the value of the clean energy they represent.

This approach is already used in seven states with policies specifically targeting solar deployment, where the credits are referred to as SRECs. Like solar carve-outs generally, it is too soon for a robust analysis of most carve-out programs with SRECs, but a survey by Peregrine Energy Group of program managers in states with SREC systems suggests that states believe they are helping achieve DG goals.[30]

5. **Establish a separate market for DREC trading and include requirements or incentives for utilities to sign long-term contracts for acquisition of DRECs.**

   Under most RPS programs, utilities can receive RECs for generation from clean energy sources they own, or they can purchase RECs from residential, commercial, or utility-scale providers to meet their compliance obligations. In some states, utilities must acquire RECs from clean energy producers by entering into long-term (10-20 year) contracts to purchase clean energy at set rates. These long-term contracts create financial certainty for developers, tie RPS compliance directly to the purchase of electricity, and are a proven way to provide robust support for clean energy deployment. Many production-based incentive programs use this approach to stimulate investment in distributed clean energy generation. These policies are discussed in greater detail in Section 3.

   However, some states decouple the purchase of electricity generated by clean sources with the purchase of the environmental attributes associated with that clean energy generation, allowing RECs to be bought and sold independently of the electrons they are associated with.

   Free trade of RECs exerts market forces on REC prices and thus on the cost of compliance with the RPS. These market forces can be positive — they create transparency for both buyers and sellers, reduce transaction costs, and eliminate dead-weight losses from inefficient exchange — but they can also be counterproductive for achieving many of the goals policymakers have for clean energy development. For example, as utilities seek out the lowest priced RECs to minimize the costs of compliance, the most mature and least expensive forms of clean energy gain advantage, while clean energy with higher development costs, especially distributed generation, is harmed. Race to the bottom market forces (through unaccounted for harms and benefits) are, after all, what has hindered clean energy from being more widely adopted in the first place. For this reason, trade of DRECs, if allowed at all, should be separated from other RECs.

   Additionally, utilities should be required or encouraged to meet their DG clean energy targets by purchasing DRECs through long-term contracts, which provide greater stability and certainty to system owners, making investment more attractive.

6. **Use fixed annual investment budgets, rather than periodic compliance percentages, to smooth demand for clean energy across years.**

   When utility purchases of RECs are tied to periodic compliance targets, REC prices can experience boom and bust cycles, driving up the costs of compliance and increasing the uncertainty of returns on clean energy investments. For example, if the DG market booms, allowing the utility to reach its compliance targets ahead of time, the following years will experience a drop in funding because the utility has met its goals and no longer needs to invest in DG clean energy. The resulting anemic market can drive companies out of business and diminish a state's capacity to install low cost DG in the future. Utility-scale projects do not face this issue because the utility, in an orderly and measured way, is the entity soliciting the projects, not the general public, as is the case for DG clean energy.

One approach to smoothing the fluctuations in demand for clean energy that result when utilities face periodic compliance percentages is to require utilities to invest a certain amount annually — either a percentage of revenue or a set amount estimated as necessary to meet an incremental compliance goal — into clean energy acquisition.

Fixed annual investment budgets aid businesses, who can better forecast annual incentive budgets, and thus make long term investments in their business. This builds economic efficiencies and helps lowers costs. Fixed budgets also discourage utilities from pursuing only the lowest-cost clean energy resources. In return, utilities should not be penalized for not meeting incremental targets as long as they are making sufficient investments in clean energy acquisition.

Fixed annual budgets may help the RPS act as a floor, rather than a ceiling, on clean energy development. As prices for clean energy resources drop in coming years, utilities may be able to acquire larger amounts of MWs than compliance targets require.

An alternative to fixed annual budgets can come in the form of an energy based floor. Rather than a stable budget, a market could have MWh floor to provide market predictability

7. **Set a minimum price for DRECs to assure investors of "worst case" revenue projections.**

Whether DRECs are acquired through long-term contracts or through an open market, developers face a risk that REC prices may drop precipitously if a significant amount of capacity is added at once.

THE CASE FOR FIXED BUDGETS

If a utility needs 10 MW of DG a year and has $20 million in ratepayer funds, it could provide a $2.40 UFI for 830 6-kW PV systems and an $80,000 UFI to 100 50-kW commercial systems. If during the course of the year panel prices decline or new federal incentives are introduced which lowers the cost of solar, the incentives would trigger lower. Suddenly that $20 million could fund 200 more 6 kW systems and 25 more commercial systems if incentive dropped 20%, adding 2.5 MW more than anticipated.

The following year, the utility would need only 7.5 MW instead of 10 MW for compliance and as long as there was not another dramatic price decline in the industry, the market would in essence be cut by 25%.

Like fixed annual investment budgets, establishing minimum prices for DRECs helps to temper the volatility of compliance-driven clean energy investments. By limiting the price dips possible in the REC market, minimum prices provide assurance to potential investors and can help to drive more investment dollars into clean energy projects.[31] This can be done for the REC market overall or can be confined to DRECs/SRECs, which comprise projects that typically have smaller margins and have greater difficulty securing investment.

Tying REC sales to production-based incentives is another way to improve the financing available for distributed clean energy generation projects by creating certainty and increasing returns to investments. Effective production-based incentive structures are discussed in greater detail in Section 3.

8. **Set interim targets with so that policymakers can track progress and compliance.**

RPS programs should also aim to create demand in the short term by setting interim targets. In its policy brief, "Helping America Win the Clean Energy Race, " the Center for American Progress notes the importance of interim targets:

"Short-term goals in the next 5 to 10 years will promptly create a market and certainty for investors, generating immediate investments and creating jobs when we need them most."[32]

Interim targets also give policymakers an opportunity to evaluate how well utilities are making progress toward longer-term goals.

BENEFITS & HURDLES OF AN RPS

Benefits	Hurdles
• Diversifies state energy mix • Creates mechanism for fund collection for incentives • Encourages the development of various technologies	• Only applies to utilities regulated by the entity requiring the RPS • Can be complex to set up • Does not put a price on negative externalities of conventional energy

To be effective at creating demand for DG clean energy, RPS programs must also carry a mechanism for enforcement, such as a noncompliance penalty. Penalties for not meeting DG clean energy goals should be set significantly higher than overall program penalties, to incentivize utilities to invest in DG clean energy rather than simply pay the fines.[33]

9. **Ensure private ownership of DG assets.**

Allowing individuals and the private sector to own and install DG assets is key to driving innovation and competition induced cost declines. Utility ownership also has advantages and should not be wholly excluded. However, allowing a competitive market for DG technologies will leverage a more full set of market forces to help mature the related clean technology industries and aid in developing the best products, financing arrangements, and business models.

SECTION 3

INCENTIVIZING PRODUCTION TO MEET RPS PROGRAM GOALS

An Overview of Options for Incentives to Support Distributed Clean Energy

When structured properly, Renewable Portfolio Standards (RPS) with carve-out requirements for DG clean energy create demand for these systems. However, because DG tends to require high upfront capital outlays, it is out of reach financially for a large segment of the population. Moreover, in order for businesses to invest, the rate of return has to match or exceed the rate of return available through other investment options. These factors limit the investment in DG and the amount of clean energy that is produced.

PBI VS UFI

With a UFI, the payment is upfront and typically for 15-20 years' worth of RECs. Because of this long-term horizon, up-front incentives can be a better deal for ratepayers then a PBI from a cost per kWh perspective.

For a 6 kW PV system producing an average of 1650 kWh per KW a year and receiving a $1.50 per Watt incentive, the price per kWh is 6.6 cents. This yields a 10.8% rate of return for the owner. To get the equivalent return one would need a 12 cent PBI for 15 years. The UFI would cost $9,000 and the PBI would end up costing $17,700. However, if one applies a 3.5% time value of money discount rate, the PBI would be only $1,000 more.

Properly designed incentives can address this problem in one of two ways: either they can be used to make distributed clean energy systems less costly to build though an upfront payment, or they can be used to increase the amount system owners receive for producing electricity on a dollar per kWh basis.

Policymakers at the state level have experimented with various incentive structures on both sides of the equation. For example, California has the popular California Solar Initiative (CSI) which pays an incentive to homeowners up-front based on projected performance. The amount of the up-front incentives (UFI) decline on a well-publicized schedule dependent on the amount of solar installed.

The risk of programs that provide rebates or other upfront incentives is that they may pay for systems that do not end up delivering as much clean energy as anticipated, leading either to undersupply or to higher program costs to achieve clean energy targets. Protecting against this risk requires sophisticated contracts with claw-back provisions and continuous monitoring over the period of expected production, which add costs to program administration. Upfront incentives also require more dollars up front and, depending on who is financing the program, this can be challenging. For states with limited budgets, tax credits can be issued in lieu of cash payments, but unless the tax credits are fully refundable, they end up excluding a portion of potential system investors who do not have the tax liability required to take advantage of the credits.[34] This has been a major problem with federal incentives, and is why the 2009 American Recovery and Reinvestment Act established a U.S. Treasury Grant program that could be used more easily by system owners than the federal Business Energy Incentive Tax Credit (ITC) or the Production Tax Credit (PTC).

For commercial scale DG, production-based incentives (PBIs) have been shown to be another successful approach to meeting RPS goals by paying only for the actual generation of distributed clean energy RECs, while creating a mechanism for incentive payments that are available to all interested investors.[35] PBIs are paid by utilities and can be funded through the same mechanism that pays for acquisition of all clean energy for RPS compliance. Because they are paid over a period of time, PBI avoid the "sticker shock" of up-front incentives. The downside to PBIs is that they require more funds than an upfront incentive (nominally) and they do not help with the upfront cost of a DG installation.

Using Variations of Production-Based Incentives to Meet RPS Program Goals

Many RPS programs create the opportunity for offering PBIs through the purchase of RECs. As mentioned in Section 2, RECs are sometimes decoupled from the actual electricity produced and are purchased by utilities either under separate long-term contracts or through a spot market. This approach provides utilities flexibility and can be easier to regulate, but it has two shortcomings that are especially relevant for DG clean energy credits ("DRECS").

First, DREC prices set through the spot market or via negotiated long-term contracts do not necessarily meet the needed financial returns of developers, meaning that DREC prices can either be too low and thus fail to motivate sufficient investment in these systems (as is typically the case) or too high because of limited supply and DREC scarcity, resulting in windfall profits to DREC sellers and burdensome costs to ratepayers.

Second, unbundling DREC sales from electricity sales adds a level of complexity to DG clean energy projects that can deter investment. Investors must understand how to forecast expected returns from both revenue streams and assess the potential value of a project. The sophistication required to do this can restrict the pool of potential investors, leaving out many of the entities that are well suited for DG clean energy system ownership.

Therefore, tying RECs to actual production is a more simple way to ensure widespread implementation of DG resources. If competition is introduced into the procurement process, the market forces captured in unbundled sales can be mimicked.

PBI are especially attractive on the commercial scale >75 kW because the upfront cost of the UFI would be too steep from most ratepayer funded programs. Although PBIs can be used on the residential scale, PBIs fit comfortably onsite, directly offsetting commercial load in a net metered arrangement.

This is in contrast to a "in front of the meter" feed-in tariff where producers of DG clean energy are able to sell their total electricity output to utilities for a premium sufficient to cover the needed financial return of developers and owners. By leveraging the avoided cost of the facility through a PBI, rate payers are saved from having to pay a higher premium for the electricity produced.

Moreover, many potential owners of distributed generation systems want to invest in clean energy to produce electricity for their own consumption. Investing in distributed clean energy can be a hedge against the possibility of higher energy prices in the future, and has the benefit of turning a variable cost into a fixed cost. Net metering arrangements offer benefits to potential system owners that can result in lower costs for the program overall.[36]

This approach is best suited for small-scale DG clean energy systems with owners who pay for electricity usage, such as homeowners or commercial customers that own their own commercial spaces. If virtual net metering is available (as we recommend in Section 5), then it is not necessary that the system owner's electricity usage is on the same site as the DG clean energy system, but merely that the owner receives an electricity bill from the same utility as the one its system connects to.

Under these circumstances, the total PBI value set for whatever tranche the system is in can be provided in two parts. For the electricity produced by a DG system that offsets the owner's usage, the value of that "avoided cost" of electricity is considered part of the incentive package. The difference between the value of the avoided cost and the PBI for that tranche is paid as a premium to the system owner in exchange for the RECs associated with the production amount. For example, if the PBI for the tranche is $0.30/kWh and the retail rate of electricity is $0.10/kWh, a system owner who offsets 1,000 kWh of usage with production from their system will receive $200.00 as a PBI in exchange for 1 REC (if RECs are issued on a MWh basis). But the system owner will realize a total value of $300.00 for that production because they are saving $100.00 in energy costs. In fact, the total value of the production will likely be greater than $300.00 because savings in energy costs are not taxed, whereas Feed-in tariff payments paid directly to system owners are considered taxable income.

For electricity produced in excess of what the system owner consumes, the utility should apply to the following period at retail rates until a proper payout date is reached at the optimal time of year. At that date the excess should be paid to the owner a wholesale or avoided cost rates.

This PBI arrangement is less costly for utilities and ratepayers than a feed-in tariff because part of the incentive is paid via avoided cost and bill credit, lowering the amount of fixed payments per kWh. Reducing demand can itself lead to savings for utilities, either from reduced costs related lower peak demands or averted load growth that would require new base load capacity, or from reduced transmission and distribution costs. The value of avoided costs related to demand reduction depend on many factors unique to each electricity market and utility, but in most cases cost savings from net metering can accrue both to DG clean energy system owners and to utilities and ratepayers.[37]

Germany, whose Feed-in tariff program has long been heralded as the most successful in the world at stimulating installations of solar PV, implemented this PBI approach in 2009 as an option for systems smaller than 30 kW.[38] Without advanced net metering rules however, a feed-in tariff is needed. Yet if the net metering rules presented in the next section get adopted, it lessens the argument as to why ratepayers should be paying producers a set premium for electricity as if it were wholesale electricity. Instead, "behind the meter" programs buttressed with PBI payments use clean electricity to offset onsite usage (tax free) and provide a hedge against inflation – all at less of a direct cost to ratepayers.

1. **Create a program large enough to achieve ambitious RPS goals for distributed generation.**

   RPS goals for DG clean energy should guide PBI program parameters. This helps to ensure that the investments made by utilities and system owners are aligned with state policy goals for distributed clean energy generation. Importantly, the overall size of a program will determine how many new systems are installed, how much power is generated, how many jobs are created and how much investment is attracted to the state.

2. **Target programs toward the project types most in need of support for RPS compliance.**

   PBI programs are best used to support clean energy in areas where the RPS has carved out specific targets that face special market barriers, distributed generation, rate classes with high demand charges, and system with local content or storage capabilities. Within these categories, of course, there are differences among projects and the barriers they face, and the PBI should be designed to provide varying levels of support to account for these differences.

3. **Differentiate between technology type and project size.**

   To achieve the greatest precision and efficiency, PBI programs should create tranches that provide different incentive rates for each technology used for DG clean energy. Different tranches should also cluster incentives by project size, as the levelized cost of energy (LCOE) and market barriers are significantly different for small projects and large projects.

4. **Decrease incentive levels as technology matures and prices drop.**

   A major goal of RPS programs is to catalyze reductions in the LCOE of clean energy by supporting market development and advances in technology and manufacturing. Consequently, it is reasonable to assume that PBI levels can be decreased at regular intervals based on forecasted price drops for DG clean energy systems. This will encourage innovation and accelerate the pace of deployment among those eager to lock in higher rates, while still providing sufficient support to projects installed in future years. The administrator of rate payer money could solicit system bids every month and competitively grant systems that met certain cost metrics a PBI.

5. **Employ competitive bidding for larger wholesale DG projects.**

   A wide range of possible projects fit within the realm of DG clean energy, and there is no "one size fits all" incentive structure. Indeed, attempts to cast a wide net with PBI programs can lead to expensive and inefficient PBI programs. One mistake that has been made by PBI programs in the past has been offering similar structures and incentive amounts to small DG clean energy systems, which are often developed and owned by homeowners or small businesses not experienced with clean energy project development, and to large projects, which are typically developed by clean energy professionals.

   A decade ago, when DG clean energy technologies of any size were extremely expensive, this may have been necessary for stimulating market development. But today, many larger projects (typically 1-20 MW) benefit from lower technology costs, market maturation, and economies of scale. These projects still face many of the same market barriers as all DG projects, and still require additional support to allow investors to realize reasonable returns, but they no longer require the same level of support.

   Many industry professionals now recommend using a competitive bidding process to set PBI levels for larger DG projects, which encourages project developers to be efficient and innovative while still providing the support needed to cover needed return of investors.[39] The bidding mechanism, also sometimes referred to as a reverse auction, gives priority to projects with lower LCOE levels, and accepts projects into the program with incrementally higher LCOEs until the annual program cap for that tranche is met. This approach maximizes program value for ratepayers by capturing the benefits of decreasing costs while still providing the additional support and certainty required to sustain investment and growth in the in the larger-scale DG market segment.[40]

6. **Select the best projects through a competitive application process.**

   Even for smaller-scale DG clean energy projects, an element of competition can improve overall program impacts. Rather than allocating PBIs on a first-come, first-served basis, programs should have open application periods on a quarterly or annual basis, and then select from among applications received within that period projects that best meet the program's criteria, such as the most efficient, quickest deployment potential, or greatest economic impact. A small, refundable application fee should be charged to deter speculative applications and inure the program against weaker proposals.

7. **Keep the application process simple.**

   While charging a modest refundable fee can benefit the program by encouraging only serious applications, the application process itself should simple. Overall, efforts should be made to minimize the transaction costs, so as not to deter participation from non-professional applicants who do not have access to the financial and technical resources required to navigate complex application processes.[41]

8. **Provide long-term, guaranteed PBI commitments and electricity purchase contracts.**

   In addition to providing additional support for DG clean energy not currently provided by the market price of electricity, PBI programs reduce financing costs by giving project investors confidence that they will be able to realize a return on their investment. To be successful in enticing investors to finance DG clean energy, PBI programs need to offer long-term contracts (10+ years) for electricity sales and premium payments that match the lifespan of equipment.

For projects that require financing, whether through debt or equity investment, the assurance provided by long-term contracts is essential for securing the financing needed to get up and running. Because the guaranteed payments reduce revenue risk, they also reduce the risk premiums required by equity investors, thereby lowering overall project costs and ultimately lowering the costs incurred by PBI programs.

9. **Provide guaranteed grid access and standard interconnection agreements.**

   As previously noted, the transaction costs and sophistication required to negotiate interconnection agreements with utilities are often far beyond what non-professional developers can bear, and thus frequently serve as an insurmountable barrier to installing additional distributed clean energy systems. PBI programs can eliminate this barrier by guaranteeing all PBI recipients access to the grid and providing standard contracts for grid Interconnection.[42]

10. **Investigate PBI/UFI hybrid models.**

    By including performance linked incentive payments encourages system owners and installers to put in place reliable high performing systems. Additionally, buttressing the PBI with an upfront payment helps with financing and reduces the long-term legacy costs of a large PBI program.

11. **Explore a PBI "Trust Fund."**

    Utilities sometime engage in prepaid "power purchase agreements" (PPA) with large scale developers. The same concept can be applied to small scale PBIs. If the PBI program is prepaid into an interest bearing account and paid out over the traditional term of the PBI (10-20 years), rate payers would largely have the initial investment intact at the end of the term, assuming 4%-6% rate of return on the account. In essence, the yearly interest on the initial investment is used to pay the PBI commitments each year.

BENEFITS & HURDLES OF THE PBI

Benefits	Hurdles
• Leverages nontaxable avoided cost savings • Pays for output, which optimizes the production of DG clean energy and encourages quality and regular maintenance • Lower upfront cost to ratepayers	• Does not help with upfront costs • Does not aid renters or owners with a poor site for DG • Nominally more expensive than a UFI

SECTION 4

EXPANDING OPPORTUNITIES FOR PRIVATE INVESTMENT: DEMOCRATIZING CLEAN ENERGY

An Overview of Virtual Net Metering and Community Energy Programs

Strong production-based incentive programs can entice those who might not otherwise invest in clean energy to do so, and expanding the pool of DG clean energy investors means funneling more investment dollars into the state, with positive local economic benefits. But in many states, large portions of the market are unable to invest, even when attractive incentives are in place.

Without explicit programs designed to include them, residential renters, businesses leasing commercial space, and homeowners or commercial building owners with poor on-site resources are often left out of programs supporting clean energy investment because they cannot install DG clean energy systems on their own property. For others, whether property owners or not, the costs of entire systems are simply too steep, and they cannot afford to invest at the levels required for whole system ownership. Because these ratepayers still bear the costs of achieving RPS goals, fair clean energy programs make investment opportunities available to all who pay to fund them.

Production-based incentives can go partway to addressing these barriers by allowing owners of DG clean energy systems to receive payments for electricity generated by systems they own, regardless of whether those systems are installed on-site or not. However, to maximize the benefits of PBIs while minimizing the costs, states must have virtual net metering (VNM) programs in place.

VNM programs function similarly to standard net metering arrangements, in which distributed clean energy systems located behind the meter of a utility customer offset electricity consumed on-site. But under VNM, electricity produced by the system that exceeds the use of the customer on the site of the system can be credited to other customers within the same utility area. VNM programs allow groups of people to band together to share the costs and benefits of DG clean energy systems. This means that distributed clean energy projects can take advantage of economies of scale, installing the optimal system size for the location, and the costs of the system can be spread across multiple owners, as long as they are customers of the same utility. All ratepayers, then, become potential project owners, because they are able to reap the benefits of DG clean energy just as if they were installing systems on their own property.

VNM programs can also make investments in DG clean energy more attractive than direct payment incentive programs, at least for customers with electricity loads that can be offset. This is because VNM avoids tax liability issues, while direct production incentive payments are generally viewed as taxable income and the tax associated can eat up any surplus acquired through PBIs.

VNM programs can enable what is being call "community energy" or "energy gardens." Community energy can effectively harness local investment to open DG to all ratepayers — including renters, customers who move frequently, lower-income customers and others with limited investment abilities.

Community energy programs, which go beyond narrow VNM programs by explicitly carving out opportunities for small-scale investments in clean energy projects, can be used to broaden the pool of DG clean energy investors to maximize local economic benefits. Community energy programs also do not require distributed generation systems to offset any on-site load, broadening the possible land locations where they can be placed.

A small number of states have put VNM or community energy programs in place. The following section draws on the examples of leading programs in Massachusetts and Colorado to suggest crucial elements for expanding opportunities for ownership and investment in DG clean energy.

VNM and Community Energy Policies that Expand Opportunities for Investment

1. Incorporate best practices from standard net metering programs.

Virtual Net Metering/Community Energy programs should draw on the comprehensive research about best practices in standard net metering programs. In December 2010, the Network for New Energy Choices released a report titled, "Freeing the Grid," which spells out common pitfalls and articulates best practices for state net metering programs.[43]

Among the critical program elements described in that report, these five are equally important for VNM:

- Allow net metering system size limits to cover a range of distributed clean energy system sizes, including systems built to offset larger commercial and industrial customers loads.
- Allow all distributed clean energy technologies to net meter.
- Allow all customer classes to net meter.
- Protect net-metered customer-owners of distributed clean energy systems from unnecessary and burdensome red tape and special fees.

Apply net metering standards to all utilities in the state, so customers and installers fully understand the policy, regardless of service territory

2. **Allow multiple system owners and apply credits via virtual net metering.**

   All ratepayers should be able to invest in DG clean energy systems, and all system owners should be able to benefit equally through virtual net metering. Credits for surplus production, including any production-based incentives, should be applied to owners according to their proportional ownership.

3. **Allocate excess credits on cost basis rather than kWh basis, using cost of electricity in place for the customer, not for where the system is located.**

   As noted in IREC's "Community Renewables Model Program Rules" document, allocating credit on a cost basis allows community owners to benefit from the "hedge" of their DG clean energy investment as energy prices rise.[44]

4. **Encourage multiple community ownership structures of distributed clean energy systems.**

   Community energy programs can encourage multiple approaches to clean energy investment. The most common ownership types are utility ownership, direct joint ownership, and third-party ownership via a contract with a community energy subscriber organization. Other publications have provided in-depth case studies of each of these community ownership models, so this report will not go into depth on the elements, benefits, or constraints of each.[45,46] Instead, we note simply that, given the range of opportunities for DG clean energy and the ambitious goals to be achieved, all avenues of community ownership should be explored.

5. **Allow larger project sizes, but require high levels of community ownership.**

   As mentioned before, larger clean energy projects can benefit from economies of scale, and although distributed generation is not usually built on a massive scale, DG clean energy projects in certain suitable locations (such as in parking lots or on roofs of large commercial buildings) can nonetheless take advantage of it, and with numerous small investors, community projects can be well suited to raise the capital required for these larger projects. Program rules should support this by not restricting the size of community-owned projects that can benefit from the various programs in place to support DG clean energy. However, to ensure that all the financial benefits of these investments keep circulating in the local community, projects should be required to have a high number and/or percent of ownership from the local community.[47]

6. **Protect community owners from legal and regulatory burdens.**

   Community ownership of DG clean energy systems raises novel issues for existing rules and regulations. One major challenge for community projects to date has been uncertainty about the impacts of securities rules for such investment and ownership structures. Community energy legislation, such as the "Community Solar Garden Act" passed in Colorado can provide clarity and transparency about the consequences of the various types of community ownership of DG clean energy.

7. **Explore “Aggregated Net Metering.”**

Aggregated net metering allows the electricity generated on one meter to be applied to other meters owned by the same host. This can be beneficial to several groups such as municipalities that have minimal energy usage on their rural land but have high energy demand in tight urban settings that lack enough open space to install DG technologies. Aggregated net metering would enable certain entities and individuals the freedom to install DG energy where it is convenient and cost effective while offsetting their high load centers.

8. **Set low minimum investment requirements and allow financing for community owners.**

In order for community ownership to overcome the cost barriers for many community members, low-cost investment opportunities must be available. One way to create this is to keep investment minimums within reach of ordinary household investors. Low-cost community ownership opportunities can also be created by allowing utilities or third-party owners to provide financing for community investors.[48]

BENEFITS & HURDLES OF COMMUNITY ENERGY

Benefits	Hurdles
• Opportunity for local investment	• Can be complex to finance and divide up shares
• Allows greater accessibility to DG clean energy investment for all ratepayers	• Without changes to existing laws, can be subject to securities regulation
• Utilizes economies of scale	• Requires utility coordination and accounting

SECTION 5

IMPROVING FINANCING OPTIONS FOR OWNERS OF ON-SITE SYSTEMS

Past Efforts to Improve Financing for Homeowners and Small Commercial Owners

Virtual net metering and community energy programs make it possible for ratepayers who do not have the ability or interest to install on-site DG clean energy systems, and these programs can make it more affordable to invest in clean energy. But for homeowners and small businesses that do have suitable property and want to own their own systems, the upfront costs can still be a barrier. This drives down incentives for innovation on the supply side because the bulk of demand for clean energy products remains at the utility level, limiting the applicability of technologies. With diversified demand would come diversified suppliers, fueling the competition that drives innovation.

Perhaps the best and worst feature of a DG clean energy systems is that it compresses 30 or more years' worth of electricity into a single upfront payment to purchase and install the system and connect it to the distribution grid. This effectively fixes the system owner's electricity bill for the portion covered by their system, acting as a hedge against rising energy prices, and if the incentives are right, locking in savings for decades. Unfortunately, the upfront investment required for direct ownership involves a large capital expense. This can put clean energy systems out of reach for many Americans. Some clean energy developers have come up with novel ways to overcome this hurdle, such as through lease agreements and other third party ownership structures. However, much like in the automobile market, there is a segment of the population that prefers to own their systems.

Like any major purchase, investing in clean energy can be accessible to more homeowners and small businesses if long-term financing is available. In fact, most homeowners and small businesses have access to home equity or business-backed credit lines that can be used to finance clean energy purchases and some systems have been paid for this way. But many potential system owners are reluctant to take on additional financial liability, especially when they anticipate moving before having reaped all the benefits of their systems.[49] DG clean energy systems are generally custom-designed for the site where they are installed, making them impractical to move if the owners relocate. Given that the average length of home ownership is 5-7 years, while clean energy systems can generate electricity for 30 years or more, this is understandably a common concern.[50]

In an effort to provide financing for DG clean energy systems in a way that is linked to the system itself rather than the system owner, the City of Berkeley developed a program called Berkeley FIRST (Financing Initiative for Renewable and Solar Technology), which was subsequently adopted by other local and regional governments under the moniker of Property Assessed Clean Energy (PACE). PACE programs utilize public bonding to provide low interest loans to commercial and residential property owners to finance small DG clean energy systems and energy efficiency measures. The loan recipients then repay the balance over a certain term, typically 10-20 years, via an annual assessment on their property tax bill. If the original owner sells the property, the new owner becomes responsible for the payments.

Unfortunately, the PACE approach has run into opposition from mortgage lenders and mortgage securities investors, who raised concerns that PACE loans have automatic first lien priority over previously recorded mortgages. Key players in the mortgage arena opposed PACE just as it was starting to be introduced to dozens of states. For the time being, (until federal legislation comes to the rescue), PACE is effectively on hold and the country is looking for new financing mechanisms for homeowners and small businesses. One approach that holds promise is on-bill financing.

New Opportunities in On-Bill Financing

On-bill financing programs allow utilities to offer or assist in coordinating financing for customers seeking to purchase a DG clean energy system. (These programs can also be used to financing energy efficiency upgrades and, in fact, is how such programs are most commonly used. However, because our interest is in distributed clean energy generation, we only discuss using these programs for clean energy systems.) As the Department of Energy states, under on-bill financing programs, “the utility or some other entity (such as a third party financial institution) incurs the cost of the upgrade, and the customer repays the investment through a charge on their monthly utility bill.”[51]

By offing a solution that deals with upfront costs, more and more customers are able to obtain capital-intensive distributed clean energy systems. According to *Open Energy Information,* an energy-related information hub sponsored by the U.S. Department of Energy, there are over 150 active utility loan programs in the United States.

On-bill financing programs can be structured in a variety of ways. To begin with, there are two divergent types of on-bill programs — on-bill tariffs and on-bill loans.[52] On-bill tariffs are tied to the meter, not the individual customer — even if the original customer moves. This can allow for low long-term payment plans that ensure energy savings exceed monthly payments. In contrast, on-bill loans typically follow the customer and require repayment if the customer moves. On-bill tariffs require significant administrative changes on the utility’s end to keep track of the balance on the meter and monthly charge on the bill. Conversely, on-bill loans can be entirely administered by a third party lending institution.

In certain markets with high electricity costs and/or lots of sun or wind, on-bill financing can deliver renewable energy without the need for upfront or performance-based incentives. If interest charges are kept low or near zero, on-bill financing can make it possible for customers with little or no capital for investment, such as lower-income customers, to obtain the benefits of DG clean energy systems.

ON-BILL EXAMPLE

Take a hypothetical PV system in Arizona for example:

If a $28,500 6 kW system with a net cost of 18,950 (after the 30% ITC and a $1000 state tax credit) could receive a 20 year loan, how would it pencil out?

Assuming a 1% rate, the homeowner would be cash flow neutral from day one. Their loan payments would be around $88 a month while their bill savings would be about the same. Plus the owner would be shielded from bill increases for the life of the system.

Moreover, ratepayers would see income streams coming back into the incentive bucket every year until the loan was paid off.

On-bill financing is attractive to rate payers because their investment is partially recouped until it is fully paid off at the end of the loan term. Other incentive programs do not offer that type of fund replenishment. The downside is that the upfront outlay is much higher than PBIs and even UFIs unless outside financial institutions step in to help supplement ratepayer funds. This reduces the number of systems that can be installed or risks increasing costs for ratepayers.

Third Party Ownership

A solar service agreement (SSA) or operating lease is an arrangement in which a 'third-party developer owns, operates, and maintains the energy system, and a host customer agrees to site the system on its property and purchase the system's electric output from the provider for a predetermined period.[53] Unless the customer chooses to engage in a prepaid PPA or a down payment lease, there is little or no upfront capital required from the customer. In addition, the parties involved can monetize the tax credits and depreciation for the customer, in turn, reducing the system cost and possibly allowing the customer to be cash positive on day one.[54] It is important to note that under some PPAs or leases, the price the customer pays can be fixed or have a yearly escalation rate attached. Regardless, third party ownership can help those without tax liability obtain clean energy without significant upfront capital.

1. Stay on the lookout for PACE

If a comprise is reached or a legislative fix passes, PACE could be back as a viable financing mechanism for the residential and small commercial market. The inexpensive interest rate, transferability, and long-term repayment, make it very attractive for those without the up-front capital.

2. Enable on-bill financing

If a homeowner or business wants to own a DG system an on-bill tariff program would help raise the needed capital. Moreover, by linking the program to the meter, on-bill tariffs will aid in addressing owner–tenant issues because the surcharge on the bill would be passed to the next tenant or owner.

3. Allow for third party financing

Allowing third party ownership can deliver DG clean energy to hosts at no upfront cost. By leveraging federal and state tax credits, third party developers can serve schools, churches, and other nonprofit that normally could afford DG systems. Furthermore ratepayers would not have to pay an elevated amount for incentives aimed at the market segments without tax liability.

4. Explore state-backed loan programs

Setting up loan programs in partnership with third party financing entities can serve as a valuable tool in helping lower/middle income households afford renewable energy. A utility, municipality or state would provide funds for a loan loss reserve which would protect the guarantor from having to fund losses. This in-turn would lower the rate of borrowing and lower the credit requirements to participate in the program.

BENEFITS & HURDLES OF ON-BILL FINANCING

Benefits	Hurdles
• No upfront capital cost • Recipient may not be required to own building • Potential increase in property value after system is paid off • Ratepayers' investment is paid back over time	• Repayment issues if property becomes vacant • Administrative issues associated with the utility's billing system • Higher upfront cost for ratepayers to setup program

SECTION 6

SUMMARY – A STATE POLICY FRAMEWORK FOR DG CLEAN ENERGY

This report attempted to not only showcase the best practices of state energy policy but also introduce new ideas that have to the potential to help promote DG clean energy without burdening ratepayers or taxpayers. Four central policy topics were explored that, if implemented, can put a state on the path toward greater clean energy adoption, local economic development, and greater energy security.

At the heart of state energy policy there must be a mechanism that creates demand for distributed clean energy and sends clear, stable, consistent signals to the market. This comes in the form of a RPS. As we detailed above, the RPS must be aggressive, have a DG carve-out, and proper accountability and REC price structures.

To ensure that sufficient DG clean energy is supplied to meet ambitious RPS goals, states need to design incentive programs that are straight forward, competitive, and cost effective. For residential DG this might come in the form of a UFI, for commercial a PBI, and for wholesale DG a reverse auction mechanism.

Next, forward thinking net metering rules and community energy programs expand opportunities for investment in DG clean energy to all ratepayers and bring economies of scale to installations. These programs open up an investment model that can build local economic development and supply clean energy to high-density buildings and urban centers.

Last, improving financing options for DG clean energy systems in the wake of PACE's setback is key to democratizing DG clean energy. Allowing on-bill financing and third party ownership models can help get DG clean energy to low- and middle-income households, nonprofits, and other potential system owners currently frustrated by the limited financing options.

Together, these policies establish a framework that can be used by state policymakers interested in fostering local economic development and energy independence through distributed clean energy generation. The framework will provide needed state support for DG clean energy and cost-effectively catalyze the widespread deployment of DG clean energy.

APPENDIX A:

State RPS Carve-Outs and Multipliers for Distributed Clean Energy*

Table 3. Technology and Application Eligibility for Solar and DG Set-Asides

State	PV	CSP	SHC	Non Solar DG	Eligible Applications	Geographic Restrictions
AZ	√	√	√	√	Customer-sited; 90% Retail DG (Installed behind customer-meter); ½ residential; SHC must displace electricity	Effectively in-state(a)
CO	√	√		√	≤ 30 MWdc per project, ½ retail DG	In-state required for retail DG; in-state multiplier for all other RPS resources, including wholesale DG
DC	√	√	√		All	Out-of District solar accepted only if insufficient in-District(b)
DE	√	√	√		SHC must displace electricity	Delivery required to region
IL	√				All	Preference for in-stat (IOUs only)
MA	√				Customer-sited and ≤ 6 MWdc	In-state
MD	√	√			All	Out-of-state accepted until 2012 only if insufficient in-state
MO	√	√			All	In-state multiplier for all RPS, resources, including solar, delivery requirements under development
NC	√	√	√		All	Unbundled RECs allowed with limits; otherwise delivered to state
NH	√	√			All	Delivery required to region
NJ	√	√			All	Effectively in-state(c)
NM	√	√		√	DG set-aside: Customer-sited Solar set-aside: All	DG set-aside: Effective in-state(d) Solar set-aside: Delivery required to state and preference for resources located in-state
NV	√	√	√		All	Delivery required to state
NY	√		√	√	Retail DG; SHC must displace electricity	In-state
OH	√	√			All	Delivery required to state; ½ of all RPS resources must be in-state
OR	√				500 kW to 5 MW per project	In-state
PA	√				All	In-region

(a) Arizona's RPS rules require that distributed solar energy resources are sited at a customer facility and serve on-site customer load or provide wholesale capacity and energy to the local utility distribution company.

(b) Washington DC's RPS rules require that solar resources are connected to the distribution system serving the District, unless insufficient in-District solar is available.

(c) New Jersey's RPS rules require that solar resources are connected to the in-state distribution system.

(d) New Mexico's RPS rules require that DG resources serve on-site customer load or serve customers in contiguous distribution substation areas.

**Chart from Wiser, R. and G. Barbose. 2010. "Supporting Solar Power in Renewables Portfolio Standards: Experience from the United States." Lawrence Berkeley National Laboratory.*

APPENDIX B:

On Bill Financing Example

ON BILL FINANCING

Interest Rate	Monthly Savings	Yearly Savings	Loan Payments
1.00%	$ 0.35	$ 4.20	$ 87.15
Loan Term	$ 1.65	$ 19.84	$ 87.15
20	$ 2.98	$ 35.72	$ 87.15
% Fin	$ 4.32	$ 51.84	$ 87.15
100%	$ 5.68	$ 68.19	$ 87.15
Tax Deductible	$ 7.07	$ 84.79	$ 87.15
No	$ 8.47	$ 101.64	$ 87.15
	$ 9.89	$ 118.73	$ 87.15
Final Loan Amount	$ 11.34	$ 136.09	$ 87.15
$ 18,950.00	$ 12.81	$ 153.70	$ 87.15
Total Payment	$ 14.30	$ 171.57	$ 87.15
$ 20,915.84	$ 15.81	$ 189.71	$ 87.15
Total interest	$ 17.34	$ 208.12	$ 87.15
$ 1,965.84	$ 18.90	$ 226.80	$ 87.15
Monthly Payment	$ 20.48	$ 245.76	$ 87.15
$ 87.15	$ 22.08	$ (2,735.00)	$ 87.15
Yearly Payment	$ 23.71	$ 284.54	$ 87.15
$ 1,045.80	$ 25.36	$ 304.36	$ 87.15
	$ 27.04	$ 324.48	$ 87.15
	$ 28.74	$ 344.89	$ 87.15
	Assumptions		
Size: Watts	**Energy Inflation**	**Tax Rate**	
6,000.00	2.0%	25%	
System Cost	**Yearly Degradation**	**KWH Yr. 1**	
Per Watt Cost	0.5%	10,500.00	
$ 4.75			
$ 28,500	**Future Inverter Cost**	**Avoided Cost**	
Final Cost	$ 3,000.00	$ 0.10	
$ 20,000			

PV SYSTEM ASSUMPTION FOR UFI VS PBI
Size: Wats
6,000
System Cost
Per Watt Cost $4.80 $28,800 **Final Cost:** $19,160
Energy Inflation
0.2%
Yearly Degradation
0.5%
Future Inverter Cost
$3,000.00
Tax Rate
25%
KWH Yr 1
10,500.00
Avoided Cost
$0.10

ASSUMPTIONS FOR FIXED BUDGET ANALYSIS

			Needed Kw	**Average System Size**	**Number of Systems**	**Cost**
10 MW Total	Residential	5 mw	5,000,000	6,000	833	$12,000,000
Incentive level	Commercial	5 mw	5,000,000	50,000	100	$8,000,000
$2.40 6 kW Average	Cost	$14,400				**Total Funds**
$1.60 50 kW Average	Cost	$80,000				$20,000,000
Price decline of 20%						
New Incentive Level						
$1.92 Cost		$11,520	$5,000,000	$6,000	833	$9,600,000
$1.28 Cost		$64,000	$5,000,000	$50,000	100	6,400,000
						Total Funds
						$16,000,000
						Total Additional
					$2,400,000	208
					$1,600,000	25
						1,042
						125

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