Assessing the Value of Loan Guarantees as an Instrument for Supporting the Deployment of New Clean Energy Technology

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Introduction

Renewable energy technologies have the potential to reduce greenhouse gas emissions, enhance energy security, and minimize environmental threats to public health. These technologies remain at a competitive disadvantage compared to mature fossil fuel technologies that enjoy a number of structural advantages which discourage widespread adoption of renewables in the energy market. In order to accelerate the deployment of clean and renewable sources of energy, policymakers have implemented a variety of financial incentives such as tax credits, subsidies, grants, and loan guarantees. Government loan guarantees can encourage private investors to provide capital to projects relying on risky or unproven technologies that may otherwise be unable to secure private funding on their own. However, recent setbacks in the U.S. Department of Energy's Loan Guarantee Program make a review of this policy instrument's role in the energy sector especially timely. This paper traces the historical development of the federal government's use of loan guarantees in general and specifically analyzes the efficacy of this policy tool for promoting the commercialization of new energy technologies. This analysis, based on a literature review and case studies of funded projects, provides a series of recommendations to improve the functionality of existing loan guarantee programs and advance the deployment of clean energy while minimizing financial risks.

This paper concludes that the use of loan guarantees to support new clean energy technologies is a recent expansion that represents a new role for a financial tool that has historically been used to facilitate investment in home ownership and education. The use of loan guarantees to back small numbers of high value clean energy loans exposed to complex and dynamic market conditions stands in distinct contrast to the government's prior experience with comparatively predictable home and education loan guarantee programs that spread risks over large numbers of small loans. While some projects in the loan guarantee program depend on tested, market-ready technologies, other projects require loan guarantees to absorb and manage technological risk for the first time, posing significant management challenges for the DOE's Loan Programs Office. The time pressures associated with temporary funding from the American Recovery and Reinvestment Act compounded these difficulties. Further, managing utility-linked projects and new technology manufacturing projects in the same program management structure with the same expectations and vetting processes does not give enough consideration to the greater technological risk that manufacturing projects face.

Why Support Clean Energy?

In the U.S. policy context, the main drivers for supporting new clean energy technology are reducing emissions from electricity production, concerns about the importation of oil from sometimes unstable and unfriendly nations, and mitigating the risk of fossil fuel price fluctuations. The United States currently produces almost half of its electricity from coal,[1] which not only emits large amounts of carbon per megawatt hour, but also emits other pollutants and particulate matter that contribute to acid rain and health problems. Coal emissions have been linked to respiratory problems and increased morbidity in some populations.[2] The declining popularity of coal[3] and regulatory pressure from states and the EPA have constrained the profitability of future coal plants, causing most utilities to abandon plans to build new ones. This means that most new generation capacity will be fulfilled by natural gas, renewables, and potentially nuclear power.

Utilities have a significant degree of exposure to variations in fossil fuel prices. Retail electricity prices are typically regulated by state Public Utility Commissions (PUC), which are often more concerned with moderating price increases for consumers than keeping prices in synch with fuel costs. The slow adjustments to rates and delayed cost recovery put a squeeze on utilities when fuel costs increase sharply until PUCs allow rates to rise. Renewables such as solar and wind require no purchases of fuel and so therefore do not become more expensive to operate when fossil fuel prices rise. These renewables essentially replace marginal generation costs (fuel purchases) with fixed costs (capital). While fossil fuel price viability likely helped support renewables in the past, developments in shale natural gas extraction have driven down gas prices and removed much of the danger of price fluctuations due to increased production.

While climate change has not played as significant role in the support of renewables in the United States due to widespread skepticism of global warming, it has played a significant role in the policies of foreign countries. Many countries are attempting to decarbonize their energy supply by expanding renewable power, which has created a sizeable global market. The Pew Charitable Trusts

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[1] "Electric Power Monthly," Department of Energy, Energy Information Agency, March 27, 2012. Table 1.1. http://205.254.135.24/electricity/monthly/

[2] Jonathan M Samet, Scott L Zeger, Francesca Dominici, Frank Curriero, Ivan Coursac, Douglas W Dockery, Joel Schwartz, and Antonella Zanobett, "The National Morbidity, Mortality, and Air Pollution Study Part II: Morbidity and Mortality from Air Pollution in the United States" Health Effects Institute, June 2000. http://tesuque.cabq.gov/airquality/pdf/samet2.pdf

[3] Taylor Kuykendall, "Poll: Most Favor Regulating Coal Emissions, Accept Costs," The State Journal, April 18, 2012. http://www.statejournal.com/story/17523940/poll-most-favor-regulating-coal-emissions-accept-cost

estimates that the clean energy economy will be worth $2.3 trillion within the next 10 years. This would be a high-tech, high-value global industry that the United States might not be able to participate in if it does not have a strong domestic producer base. Several U.S. groups concerned with global warming have tried to encourage support for renewables by portraying it as an economic opportunity that the nation must capture a part of rather than use climate change as an argument for increasing deployment.

National security and interruption of fossil fuel supplies is another concern that many people raise about the energy sector. This concern is largely not applicable for the U.S. electric industry since it relies on very few imports for electricity generation. It is a concern for transportation energy, which is partly dependent on imported petroleum; however, the United States has abundant domestic supplies of coal and natural gas, the mainstays of the electricity sector.

Barriers to Clean Energy Deployment

As federal, State, and local governments have supported the deployment of renewable generation as a matter of policy, they have had to make attempts at compensating for the many disadvantages that renewables face when competing with the fossil fuel technologies that dominate the market. Many of these disadvantages stem from the tremendous investment, both from the private sector and government, that fossil fuel technologies have received over past decades that give traditional gas and coal generation a significant advantage. But they also stem from specific characteristics of renewables such as intermittency and reliance on location-dependent sources that are unlikely to completely disappear as the technologies mature.

Worldwide, governments in 2009 spent $46 billion[4] on renewable energy subsidies while in 2008 they spent over ten times that much, $557 billion, supporting a mature fossil fuel industry. From 2002-2008, the U.S. government spent $29 billion on renewables and $72 billion on fossil fuels.[5] Without even considering a decades-long head start in technological development, government subsidies, and support infrastructure, fossil fuels enjoy an advantageous position through current government spending alone. The Department of Energy has invested significant sums in advancing coal gasification technologies and boosting efficiency in natural gas turbines. While these

[4] Editorial, "Fossil Fuel Subsidies Outpace Renewables," RenewableEnergyWorld.com, July 29, 2010. http://www.renewableenergyworld.com/rea/news/article/2010/07/fossil-fuel-subsidies-outpace-renewables

[5] "Estimating U.S. Government Subsidies to Energy Sources: 2002-2008" Environmental Law Institute, September 2009. http://www.elistore.org/Data/products/d19_07.pdf

technologies may result in emissions savings, increased efficiency in gas and coal combustion raises the bar against which renewables must compete.

As renewables improve and become more cost competitive; they still face a utility industry that has relied on fossil fuels for years and is not enthusiastic about embracing technologies that are seen as carrying greater risks. Unpredictable and intermittent generation is one of the largest problems for renewables because power utilities are responsible for guaranteeing that generation exactly matches demand at any given moment to ensure that the grid is functioning properly and reliably. Utilities must keep backup generators running (known as "spinning reserves") for a percentage of the renewable generation that they have online, adding to the cost of operating a renewable facility. The Electric Reliability Council of Texas (ERCOT) only counts 8.7% of nameplate wind generation capacity toward meeting peak demand requirements as it cannot be dispatched like most generators to produce power.[6] As generation peaks, so do wholesale electricity prices, providing high value sales to any generator that is able to supply electricity during peak demand. Renewable generation that reaches maximum output at times of low demand has less earning potential than generation that can be controlled so that it is sold when prices are highest.

The planners of large scale renewable power projects want to achieve the largest sales possible from their capital investment, so they build in locations with high levels of sun and wind. These locations are often far away from population centers, requiring substantial transmission infrastructure to connect generation capacity to demand centers. Intermittency also presents problems for building the right transmission capacity because most of the time, transmission that is built for a facility's name plate capacity will go underutilized. However, if transmission capacity is insufficient and generation must be curtailed, the operator of a facility will lose out on revenues.

On a smaller scale, home owners likewise face barriers when they purchase residential renewable generation (distributed generation). Many states require utilities to pay for electricity that residential customers contribute to the grid, but this competes with the prevailing business model of most utilities that relies on electricity sales for revenue and profits. If sales erode due to distributed generation, revenues will decline too. For this reason, it is not uncommon for utilities to maintain policies that are not advantageous to distributed generation. Since utilities must still maintain electricity transmission and distribution systems despite lower power sales to a household, some

[6] "ERCOT Expects Adequate Power Supplies for Summer," Electric Reliability Council of Texas, June 1, 2011. http://www.ercot.com/news/press_releases/show/381

utilities assess a special connection charge on homes with solar panels to make up for maintenance costs that are normally supported through electricity sales. Since this is only assessed on homes using distributed generation, it acts as a disincentive for homeowners to install renewables on their homes.

Residential solar electricity is still relatively rare, and so it is not well understood by the general population. Home buyers do not understand the value of rooftop panels, and so home installations do not add much to the value of a home. If an owner sells his home before his investment in renewable panels pays itself off, he will lose out on his investment. Home rooftop panels take several years to pay off, so anyone who may want to sell his home within a few years is unlikely to invest in renewables.

Policy Instruments for New Energy Technology

The federal government has historically had and continues to have a significant role in developing new energy technologies, from demonstrating civilian nuclear power to funding the development of hydraulic fracturing.[7] Many renewable technologies either began with government supported research or were greatly improved with government support. Government-funded space programs provided photovoltaic cells with their first real market and drove increases in solar efficiency for decades.[8] The government spends significant sums on research and development, though only a small portion is devoted to energy. The federal government's FY 2012 budget provide s $142 billion for research, and of this, $2 billion supports energy programs.[9] These programs support a broad array of energy projects and only a smaller subset supports the development of renewables. Though it is difficult to separate out exactly how much the government spends on research and development for clean energy, a significant portion of the Advanced Research Projects Agency – Energy's (ARPA-E) and the National Renewable Energy Laboratory's budgets are devoted to renewables, storage, and energy efficiency. ARPA-E's FY 2012 appropriation stands at $275 million[10] (down significantly from the administration's request of $550 million). NREL's funding

7 "Fossil Energy: DOE's Oil/Gas Research Program," Department of Energy, Office of Oil and Natural Gas, http://fossil.energy.gov/programs/oilgas/index.html
8 http://www1.eere.energy.gov/solar/pdfs/solar_timeline.pdf
9 "FY 2012 Congressional Action on R&D by Agency," American Association for the Advancement of Science. January 9, 2012. http://www.aaas.org/spp/rd/fy2012/total12c.pdf
10 House Resolution 2055, Page. 85, 112th Congress.

from FY 2002 through 2006 stood at around $210 million per year, however since 2007 funding has increased steadily to $537 million in FY 2010.[11]

The Federal Government supports R&D mainly by either conducting the research itself or by making grants to outside organizations. Technological risk is highest during the early stages of research and development, so the government bears most of the costs to compensate for the lack of private sector investment at this stage. Further down the development pipeline, where there is less risk, companies take over funding when a technology is closer to becoming a marketable product.

Once new technologies move to the deployment stage, ones that are near market ready but still carry a degree of technological uncertainty or have not reached price parity with other sources of generation on the grid may require additional support to encourage companies to invest. The loan guarantees that are the focus of this paper are meant to facilitate cheaper financing and decrease capital costs. There are two other federal programs that are currently in operation that are aimed at driving down the cost of initial investment for a renewable facility and increasing operating revenues.

The Production Tax Credit (PTC) provides for a 2.2 cent tax credit per kilowatt hour of generation for most forms of renewable electricity, except for solar. This, in theory, allows renewable energy projects to retain more of their revenues so that they can better compete with fossil fuel generation for sales on the electric grid. The Investment Tax Credit (ITC) allows renewable energy projects, including solar but not large scale wind, to deduct 30 percent of the capital and installation costs of the project from their taxes. This attempts to overcome a significant obstacle, the high upfront costs of renewable energy infrastructure, by offsetting a portion of initial costs with tax credits.

These tax credits would boost profits for projects since they would be able to keep more of their revenues, but most renewable energy projects have few tax liabilities against which to apply the credits. Rather than forgo the benefit of the PTC and ITC, renewable projects take on partnerships with large banks with significant tax liabilities. The banks take an equity stake in a project which allows the project sponsors to transfer the tax credits to the bank. The bank then gives a portion of this value back to the project in the form of upfront cash to help defray initial construction costs. This type of investing is referred to as tax equity. The management structures of projects that allow

[11] "NREL Overview." National Renewable Energy Laboratory. http://www.nrel.gov/overview/

these tax credit transfers to take place are complicated and can increase the cost of the project. The value of this tax benefit must also be split with a bank, decreasing the amount that actually goes toward a renewable energy project.

Demand for tax equity investments shrank in response to the financial crisis of 2008 because large banks, who were the major drivers of this style of investment, saw their tax liabilities fall during the downturn. To compensate, the government enacted the 1603 tax grant that paid project sponsors directly with cash in lieu of the investment tax credit. While this was only a short term solution meant to provide renewables with support during the downturn, it provided direct support to the project sponsors and avoided much of the organizational difficulties that accompany tax credits. This program was only temporary and reverted back to the previous tax credit scheme at the end of 2011.

The Production Tax Credit is also coming to an end and will only apply to facilities built through the end of 2012 unless it is extended by Congress. Should the program expire, new renewable facilities will face decreased earnings potential compared to ones that are eligible for the tax credit. The Investment Tax Credit is also narrowly focused toward supporting only a few types of renewables, leaving the loan guarantees as the only broadly focused program that will be available in the future.

As the above discussion illustrates, the government uses a range of policy tools to encourage innovation and bridge the valley of death in the energy sector. These tools address a variety of market imperfections that have hindered the commercialization of new energy technologies over the years—from privatizing R&D costs, to putting a price environmental degradation, to reducing uncertainty and risk for investors. As the deployment challenges have evolved in conjunction with an increased focus on disruptive and transformative technologies, the government has sought new roles for these tools within the innovation framework.

The experimental use of loan guarantees in the synthetic fuels industry during the 1980s exemplified the government's quest for novel approaches to support energy innovation. This application was a significant departure from the traditional use of the loan guarantee tool, which had hitherto been used to incentivize the uptake of low-risk activities such as home ownership and college education. In their new capacity, loan guarantees took on another role—risk subsidization—in addition to their traditional role in facilitating financing. Ultimately, the synthetic fuels programs ended with disappointing results and served as a cautionary tale on the use of traditional policy tools for new functions. Nevertheless, the unique set of challenges facing renewable energy deployment continue to force policymakers to choose from a limited set of tools that are not always a perfect match for the task at hand.

In recent years, loan guarantees have once again gained the favor of policymakers as a form of clean energy assistance. One reason for this development is that loan guarantees have the advantage of leveraging government funds by providing support through mainly off-budget channels. Another factor is that they are one of only a handful of means that can directly facilitate access to low-interest financial capital for risky projects. Given the current socioeconomic environment in the United States, these factors have rendered loan guarantees as the instrument of compromise among the diverse set of actors in the energy system. In the following sections, these topics will be discussed in greater detail through an examination of the history of loan guarantees in the United States and how they have evolved into their current state. First, the paper will turn to a discussion of the theoretical underpinnings of loan guarantees and their implementation.

Loan Guarantees: Process and Rationale

The primary goal of a loan guarantee is to make financing cheaper and thereby help facilitate expenditures on activities that the government has prioritized, such as purchasing a home, paying for education, or building new energy infrastructure. In the instance of a person wishing to purchase a new home, without a loan guarantee, he or she would go to a bank and receive a loan with interest premiums that cover the expected losses associated with the barrower's specific risk profile, the operating costs of providing the loan, and a margin of profit. In the event that the borrower defaults, the lender is at risk of losing the remainder of the unpaid balance of principle and interest. Lenders manage their risk by making several loans and charging an interest rate that includes a risk premium that is high enough for the lender to return a profit even if a projected number of loans go into default. When the government guarantees a loan, it promises to pay the principle and interest for the loan in the event that the borrower fails to repay. This in essence replaces the borrower's risk profile with that of the government, greatly lowering the chance that the loan will not be repaid. The lower cost of covering expected losses allows the bank to offer the borrower loans at decreased interest rates. By guaranteeing the loans, the government reduces the cost of borrowing and encourages private expenditure on the targeted activities.

Because the government bears the responsibility for repayment in the event of default, there is a risk cost associated with each loan that the government guarantees called the Credit Subsidy Cost. Were the government to simply absorb the risk associated with the loan guarantee without any payment from the borrower, the government would be effectively subsidizing the loan in the amount of the Credit Subsidy Cost. For most types of government loan guarantees though, the entire cost of the program is born by the borrower through reimbursement of the full Credit Subsidy Cost and administrative costs to the government. In the event that a borrower defaults, the government pays the outstanding amount from the premiums collected from the borrowers. Because the government collects all of the management costs and expected losses from the borrowers through the Credit Subsidy Cost, these types of loan guarantee programs are designed to be budget neutral. The government has decided that for some classes of borrowers, such as students and veterans, there are social reasons for further lowering the costs of borrowing. In these cases, the government either covers the entire Credit Subsidy Cost or collects less than the necessary amount for covering the costs of the program, and so some of the financial risk of borrower default is borne by the government. According to accounting rules passed by Congress in the Federal Credit Reform Act of 1990 (FCRA), the government must account for the Credit Subsidy Costs of subsidized loan guarantees as if they were real expenditures in the budget and must have an appropriation from Congress to cover them.

It would be reasonable to ask why a company would seek an unsubsidized loan guarantee from the government if it has to pay the full cost of the loan regardless of whether it is guaranteed by the government or arranged directly with a private lender. In both cases, the borrower must pay for the cost of the risk associated with the loan, and so one might assume that the cost of a guaranteed loan would be the same as an unguaranteed loan. There are two reasons why guaranteed loans tend to cost the borrowers less. The first is that if the government maintains a large portfolio of loans, such as Department of Housing and Urban Development's FHA loan guarantee program, it can decrease the overall risk by pooling diverse risk factors together (such as homes in many different parts of the country exposed to diverse economic conditions). The pooled risk allows it to offer a lower Credit Subsidy Cost because it maintains larger home loan portfolios than many private lenders. The second reason government guaranteed loans are cheaper is because of the difference in the cost of capital for private banks and the government. Both the government and private banks base their interest rates off of their own cost for obtaining capital. Because the federal government's cost of capital is one of the lowest in the world (U.S. treasuries carry a lower interest rate than virtually any other sovereign debt), it can obtain money more cheaply than a private bank. This spread in interest rates means that the government's Credit Subsidy Cost will be lower than a risk premium that a private bank uses in a loan. Some members of Congress are opposed to the FCRA accounting method and have proposed in H.R. 3581 that the government account for the Credit Subsidy Cost according to the fair market value of what a private bank would charge, arguing that the discount due to the government's lower cost of capital is itself a subsidy and understates the government's liabilities.[12] Opponents of H.R. 3581 say that the FCRA method represents the actual cost to the government and that using a fair market value method would overstate the cost of making the loan guarantee because it includes costs that the government does not incur, namely the higher interest rates at which private banks can borrow money and private sector risk aversion.[13]

Calculating Credit Subsidy Costs can be a challenge when loan guarantees back small numbers of expensive purchases, such as the clean energy projects that are the focus of this paper. Because there are a smaller number of projects, the risk cannot be pooled as effectively. Large projects that run into the hundreds of millions or even billions present large risk profiles that are too costly to effectively insure against. Further, as many of the projects are in the same type of industry, a large percentage of the loan portfolio may encounter financial troubles simultaneously, resulting in greater exposure to losses from default.

The primary advantage of a loan guarantee program is that there is little cost to the government unless a barrower fails to repay. The government is able to facilitate a larger number of projects without making actual outlays. When the government subsidizes riskier loans, it typically sets aside an amount of funds to cover potential losses. Hypothetically, if the government decides to reserve 10 percent of the total principle amount to cover a loan guarantee program, an appropriation of 10 million can secure 100 million in loans. This allows a relatively small amount of funds to facilitate a much greater amount of financing. Direct loans on the other hand have a direct, upfront budget impact because they require outlays to the borrower. However, since the FCRA, the difference in the budget impact between loans and loan guarantees is minimal since the full present value of the

[12] "Chairman Ryan Applauds Passage of the Budget and Accounting Transparency Act", Press Release, Office of Rep. Paul Ryan, Chairman of the House of Representatives Committee on the Budget, Feb. 7, 2012. http://budget.house.gov/News/DocumentSingle.aspx?DocumentID=278590

[13] James R. Horney, Richard Kogan and Paul N. Van de Water, "House Bill Would Artificially Inflate Cost of Federal Credit Programs", Center on Budget and Policy Priorities, Jan. 24, 2012. http://www.cbpp.org/cms/index.cfm?fa=view&id=3661

expected revenue and outlays over the entire course of the loan guarantee must be accounted for up front.

Another advantage of loan guarantees is that they can encourage greater involvement of private capital. Involving private banks and financiers in clean energy projects may help lending managers to gain a better understanding of the industry and the risks involved, and may facilitate a quicker and smoother transition to private funding once market conditions allow. However, while many government-guaranteed loans are ultimately provided by private banks, the Federal Financing Bank, a government-owned bank, provided many of the 1703 and 1705 program loans rather than private financial institutions.

History of Federal Loan Guarantees

The federal government began to issue loan guarantees during the 1930s in response to the great depression. The majority of these loans were directed toward consumer home loans. Because of the relatively small size of each loan and large number of subscribers, it was possible to develop actuarially sound programs based upon probable default risk.

While primarily aimed at arresting the collapse of the U.S. housing market, the government's entrance into the home credit market drastically altered the rate of home ownership in America. In the 1930s, about 40% of the population owned their own homes; by 2009 this had risen to 67%. Prior to the extension of loan guarantees to the home credit market, loan terms were stringent, loan payment times were short, and interest rates were high and variable. Government-backed mortgage loans were typically amortized over 25 years rather than the 3 or 4 years which were previously common. Later, in 1944 the department of Veterans affairs began offering special housing loan guarantees to former military service members. The original justification was that returning WWII veterans had missed the chance to save money or establish a credit score, thus putting them at a disadvantage relative to their civilian counterparts. The loan guarantees soon became standard and from 1944-2010 the VA guaranteed over $1 Trillion in veterans' home loans.[14]

Loans guarantees have also been used to finance rural development programs. Rural areas were hit particularly hard during the depression. Rural flight was doubly damaging because it dropped the

[14] Foote, Bruce. *VA-Home Loan Guaranty Program: An Overview*. Congressional Research Service. 2011.

volume of economic activity in existing communities, and the refugees strained poverty support programs in the cities to which they fled. The various rural assistance programs that emerged during the depression used a mixture of grants, direct loans, and guaranteed loans. Loan guarantees were used to finance the construction of needed infrastructure, give farmers access to operational credit, and fund the construction of housing. The Rural Electrification Administration (now the Rural Utilities Service) provided loan guarantees to electric cooperatives to extend electricity, and later telephone service, to rural areas.

A number of new financing options including grants and direct loans were introduced in1965 to help college students finance their education.[15] Among these were the Federal Family Education Loans (FFEL) through which private lenders extended credit to college students and the government provided a guarantee. These loan guarantees fit well into the government's pattern of extending credit for social welfare reasons to borrowers arbitrarily deemed as too risky (in this case because of age) by private lenders. In 2010, Congress decided to remove private lenders from government student lending programs altogether. The Congressional Budget Office estimated that the government would save $80 Billion over ten years by converting completely to direct loans. In 2009 there were $471 Billion in outstanding FFEL-backed loans.[16]

The first attempts at using loan guarantees to promote alternative energy were in response to the oil shocks of the 1970s. In 1974 a program was authorized for loan guarantees to be used to finance geothermal demonstration facilities. A 1978 law similarly offered loan guarantees for alternative fuel demonstration facilities. The Energy Security Act of 1980 created the Synthetic Fuels Corporation. The law made it possible to construct a coal gasification plant near Beulah, North Dakota. It was partially financed by a DOE loan guarantee of $2.2 Billion. The sharp decline in energy prices in the 1980s made the project uncompetitive, and it defaulted on its loans in 1985. The plant was sold for $85 Million and remains in operation today.[17]

Two questions arise in the context of this paper when examining the federal government's experience with loan guarantees. Have loan guarantees been used in the past to either accelerate the

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[15] Stoll, Adam. *The Administration of Federal Student Loan Programs: Background and Provisions*. Congressional Research Service. 2005.

[16] Congressional Budget Office. *Cost Estimate for H.R. 3221 Student Aid and Fiscal Responsibility Act of 2009*. 2009.

[17] Brown, Phillip. *Loan Guarantees for Clean Energy Technologies: Goals, Concerns, and Policy Options*. Congressional Research Service. 2012.

diffusion of new technology or to enhance U.S. competiveness in an emerging industry? And do the loan guarantee programs actually resemble the idealized vision of loan guarantees in which private lenders are induced to extend credit because of their faith in the government's backing?

The first question is partly a matter of definition: does one consider home ownership or education to be "technologies" in need of diffusion? Certainly home ownership and college attendance rates have increased as a consequence of government loan guarantees, but these could only qualify as technologies only under a broader conception of the term.[18] Although a portion of USDA's loan guarantees helped to facilitate the adoption of water treatment systems, electricity, and telephony, the bulk of the federal government's loan guarantees have not been aimed at spreading technology per se. Generally, the government has used loan guarantee programs to spread the adoption of *behaviors* that are seen as providing positive spillovers for society and benefiting the country.

The answer to the second question seems to be that the majority of guaranteed loans deviate from the idealized version because governmental or quasi-governmental enterprises such as Sallie Mae and Fanny Mae actually originate, service, and collect the loans. Another entity, the Federal Financing bank provides the funds for some programs, taking commercial lenders entirely out of the picture. Thus many loan guarantees are simply direct loans that use public corporations or government sponsored enterprises as intermediaries.

Recent Federal Loan Guarantee Programs for Clean Energy

Energy Policy Act of 2005: Section 1703

Contemporary federal use of loan guarantees in support of clean energy began with the Energy Policy Act of 2005, signed into law by President Bush on August 8, 2005. Title XVII of the act—Incentives for Innovative Technologies—authorized the Secretary of Energy to issue loan guarantees for up to 80% of the value of projects that reduce greenhouse gas emissions and employ "new or significantly improved technologies" compared to commercial technologies at the time of

[18] See Read Bain, "Technology and State Government," *American Sociological Review* 2, no. 6 (December 1937): 860–874. Bain defines technology as including "all tools, machines, utensils, weapons, instruments, housing, clothing, communicating and transporting devices and the skills by which we produce and use them."

the guarantee.[19] The threshold for eligibility was only that projects offer a "reasonable prospect of repayment" of their respective loans.

The Energy Policy Act stipulated that that loan guarantees would require either payment from borrowers or a federal appropriation for their credit subsidy cost. In the absence of appropriations, DOE has implemented Section 1703 under "self-pay" authority that requires borrowers to pay the credit subsidy cost.[20] To date, DOE has only made two conditional commitments through the program, each to nuclear facilities.[21]

American Recovery and Reinvestment Act: Section 1705

The American Recovery and Reinvestment Act of 2009 expanded the federal government's use of loan guarantees as a method of accelerating clean energy technology deployment, increasing DOE's loan guarantee authority and providing its first appropriations for credit subsidy costs. It amended Title XVII of EPACT 2005 by adding Section 1705—Temporary Program for Rapid Deployment of Renewable Energy and Electric Power Transmission Projects—which authorized the Secretary to make guarantees for renewable energy systems and manufacturers of related components, electric transmission systems, and biofuel projects.[22] The Recovery Act originally appropriated $6 billion for the Section 1705 program to pay for the credit subsidy cost associated with the loan guarantees,[23] although this amount was later reduced to $2.4 billion after rescissions and transfers.[24] A temporary program, the Section 1705 program's loan guarantee authority expired on September 30, 2011.

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[19] *Energy Policy Act of 2005*, 2005, sec. 1703(d), http://www.gpo.gov/fd sys/pkg/PLAW-109publ58/pdf/PLAW-109publ58.pdf

[20] Office of Management and Budget, *The Budget for Fiscal Year 2013*, 2012, 452, http://www.whitehouse.gov/sites/default/files/omb/budget/fy2013/assets/doe.pdf

[21] These include a $2 billion loan guarantee for the AREEVA uranium enrichment facility in Idaho and a $8.33 billion guarantee for two nuclear reactors of the Georgia Power Company, which is the largest commitment in DOE loan guarantee portfolio. U.S. Department of Energy, "The Financing Force Behind America's Clean Energy Economy", https://lpo.energy.gov/?page_id=45

[22] *American Recovery and Reinvestment Act of 2009*, 2009, sec. 406, https://lpo.energy.gov/wp-content/uploads/2010/09/ARRA-2009.pdf

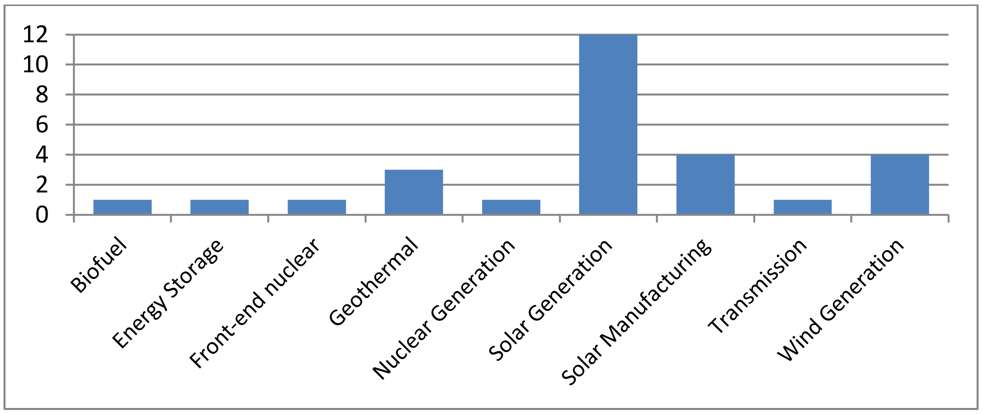
[23] Ibid., sec. 5.

[24] Office of Management and Budget, *The Budget for Fiscal Year 2013*, 452.

Overview of the DOE Clean Energy Technology Loan Guarantee Portfolio

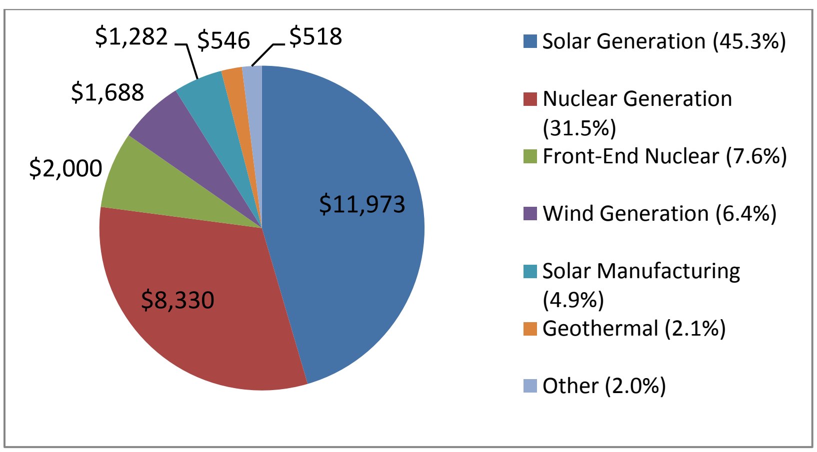
To date, the Section 1703 and 1705 programs together have issued 28 loan guarantees totaling $26.3 billion.[25] The supported projects span a number of categories, but as shown in **Figure 1**, a significantly higher number of solar generation projects have received guarantees than projects in other energy technologies. However, the distribution of loan guarantees in dollar amounts is different, in large part to the Section 1703 program's high level of commitment to a single nuclear power project in Georgia (**Figure 2**).

Figure 1: Loan Guarantee Commitments by Technology (Number of Projects)



Source: U.S. Department of Energy, https://lpo.energy.gov/?page_id=45

Figure 2: Loan Guarantee Commitments by Technology (Millions of Dollars)



Source: U.S. Department of Energy, https://lpo.energy.gov/?page_id=45

[25] U.S. Department of Energy, "The Financing Force Behind America's Clean Energy Economy." The Advanced Technology Vehicle Manufacturing (ATVM) program is a third initiative administered by the DOE Loan Programs Office. Although its purposes include the support of new technologies aimed at enhancing energy efficiency and reducing emissions, it is a direct loan program focused on transportation rather than energy generation and delivery, and thus not within the primary focus of this report.

2008 Farm Bill and USDA Programs

In 2008, after overriding a veto by President Bush, Congress passed the Food, Conservation, and Energy Act of 2008, popularly known as the 2008 Farm Bill. Following the example of 2002 Farm Bill, this version also contained an explicit energy title (something not included in previous Farm Bills). The 2008 Farm Bill utilized a variety of different financial incentives to encourage the use and production of renewable energy including tax credits, grants, procurement, and loan guarantees. A major focus of the legislation was to help make the transition from first generation biofuels to so-called "advanced" biofuels.[26] First generation biofuels, primarily ethanol derived from corn starch and biodiesel made from oilseed crops, directly compete with food production. In addition to driving up the price of agricultural commodities these first generation fuels are relatively inefficient, with low net positive energy balances. Proponents of advanced biofuels argue that because such fuels are made from non-food biomass, such as switchgrass or poplar trees, they will not compete with food crops and can be raised with fewer inputs (improving their energy balance). This strategy is reflected in both the 2008 Farm Bill and the RFS 2 (Renewable Fuel Standard) passed as part of the 2007 Energy Bill. The RFS 2 mandates that the majority of the expansion in U.S. biofuel consumption after 2010 must come from advanced biofuels.

Deploying advanced biofuels suffers from many of the same problems as other renewable energy systems. The first is that such projects are almost inevitably local in scope because of their dependence on specific feedstocks. A plant that makes ethanol out of wood in the southern United States will be of a completely different design than a camelina-based biodiesel plant in northern plains. Second is scalability: many biofuels conversion techniques which have been shown to work in the laboratory have difficulty with production on a large scale. Attracting investment for such plants has been difficult.

Two new programs were created that made use of loan guarantees to finance the deployment of renewable energy technology. These were the Biorefinery Assistance Program (BAP) and the Rural Energy for America Program (REAP). Both programs also employed the use of grants.

[26] Schnepf, Randy. *Renewable Energy Programs and the Farm Bill: Status and Issues*. Congressional Research Service. 2009.

Biorefinery Assistance Program (BAP)

According to the USDA, the BAP is intended to "increase the energy independence of the United States; promote resource conservation, public health, and the environment; diversify markets for agricultural and forestry products and agricultural waste materials; and create jobs and enhance economic development in rural America." While its mandate may seem somewhat expansive, BAP essentially provides help for building new advanced biofuel refinery facilities or retrofitting old refineries. Ethanol plants which use corn starch as a feedstock are explicitly excluded.

The BAP has two primary funding mechanisms. One is grants for the construction of pilot facilities. The other is loan guarantees for commercial scale refineries. The loan guarantee financing terms are listed below:

- 90 percent (maximum) guarantee on loans of $0-125 million (under certain conditions)
- 80 percent (maximum) guarantee on loans, if the loan amount is less than $150 million
- 70 percent (maximum) guarantee on loans, if the loan amount is equal to or more than $150 million but less than $200 million
- 60 percent (maximum) guarantee on loans, if the loan amount is $200 million up to and including $250 million[27]

So far the BAP has seven active projects in its portfolio. Three loans have been closed and four remain in process.[28]

Closed

- **INEOS Bio** received a $75 million loan guarantee for its new eight million gallon/year integrated biorefinery in Vero Beach, Florida.
- **Sapphire Energy** received a $54.4 million loan guarantee from the BAP and a $50 million grant from DOE for the construction of a demonstration scale algae biorefinery in New Mexico.
- **Freemont Community Digester**, an anaerobic digester project in Freemont, Michigan, received a $22 Million dollar loan guarantee in 2011. The plant is intended to convert farm and food waste to biogas for electricity production.

[27] U.S. Department of Agriculture. "Biorefinery Assistance Program." 2012. http://www.rurdev.usda.gov/BCP_Biorefinery.html
[28] Cambell, Todd. *Updates on USDA Programs Supporting the BioEconomy.* USDA Rural Development. 2012. http://www.usbiomassboard.gov/pdfs/campbell_march2012_tac.pdf

In Process

- **Enerkem** received an $80 million conditional loan guarantee for its 10 million gallon/year integrated biorefinery in Mississippi.
- **Coskata** received a $250 million conditional loan guarantee for its 55 million gallon/year integrated biorefinery in Alabama.
- **Zeachem** received a $232.5 million conditional loan for a 25 million gallon per year biorefinery, which will be constructed on an industrial site in Boardman, Oregon.
- **Fiberight** received a $25 million conditional loan to retrofit an existing corn ethanol plant to produce cellulosic ethanol from municipal solid waste.

Rural Energy for America Program (REAP)

While BAP is aimed at assisting large scale plants become operational, REAP focuses on encouraging the adoption of innovative, small scale, renewable energy production and energy conservation technologies. The program itself is limited to small businesses, farmers, and ranchers located in rural areas. Loan sizes range from $5,000 to $25 million. REAP support consists of both loans and grants. Projects that are eligible to be funded by REAP include renewable biomass, anaerobic digesters, geothermal for electric generation, geothermal for direct use, hydroelectric (30 megawatts or less), hydrogen, small and large wind, small and large solar and ocean (including tidal, wave, current, and thermal) and energy efficiency projects.[29]

REAP is intended to be a widely subscribed program and has proved popular. REAP grants and loan guarantees have financed 5,733 projects in all 50 states. These projects have generated or saved enough power to meet the annual needs of 600,000 household. As shown in **Figure 3** the loan guarantee portfolio has been balanced between four major categories: solar, wind, anaerobic digestion, and energy efficiency. Geothermal heating and cooling and biofuel/biodiesel projects have been funded at lower levels.

[29] U.S. Department of Agriculture. *The Impact of the Rural Energy for America Program on Promoting Energy Efficiency and Renewable Energy*. 2012. http://www.rurdev.usda.gov/Reports/rdREAPReportMarch2012.pdf

Figure 3: Distribution of USDA REAP Loan Guarantees by Technology

Technology	Loan Guarantees (2009-11)
Solar	$23,910,430
Wind	$40,551,540
Anaerobic Digester	$46,835,599
Energy Efficiency	$43,168,271
Geothermal Heating and Cooling	$770,375
Biofuel and Biodiesel	$4,826,692

Source: U.S. Department of Agriculture, http://www.rurdev.usda.gov/Reports/rdREAPReportMarch2012.pdf

Evaluating Federal Clean Energy Loan Guarantees: Case Studies and Analysis

As evidenced by the ill-fated experiences with synthetic fuels during the 1980s, the application of loan guarantees to high-tech, capital intensive projects engenders a certain set of risks that the policy tool was not originally intended to accommodate. In this new capacity, the original function of loan guarantees as an insurance mechanism has been expanded to include components such as market assessment and project monitoring—which add complexity and risk to the matter. Indeed, the Section 1705 program has already been beset by two bankruptcies which have illuminated the challenges to the Loan Guarantee Program and exposed some of its major shortcomings. Accordingly, opponents have used these examples to assail the program's implementation as well as the theoretical basis of loan guarantees as an effective policy tool for renewable energy deployment.

This section examines these criticisms by analyzing a number of cases and identifying both the strengths and weaknesses of this policy tool in the energy sector. The observations in this section serve as the basis for a series of recommendations at the end of this report for improving energy loan guarantee programs in order to most effectively deploy new energy technology while minimizing financial risks.

Before individual projects are examined in detail, a brief overview of our findings will be useful to inform the following discussion. We have observed that loan guarantee programs for energy deployment face challenges on two broad fronts. On one hand are management challenges that affect a program's ability to implement its stated goals in a consistent and transparent manner. These issues include time constraints, weak or uneven enforcement of program rules, and poor documentation of various aspects of a program. Not only do these problems lead to a loss in program efficiency, but they also engender public distrust and damage the political legitimacy of a program.

The second type of challenge relates to a program's ability to adequately measure, analyze, and forecast the risks of particular loans in order to mitigate the government's exposure to poorly performing projects. These risk management challenges include issues such as information asymmetry, estimation of subsidy costs, and forecasting market conditions. It should be noted that although the particular market risks vary on a project-by-project basis, the management of these risks is an important aspect of a program that will have significant ramifications on its outcome, especially for programs that involve projects with higher levels of risk. In the following sections, the selected cases will be used to illustrate these problems and identify where the government has been more or less effective at dealing with them.

Solyndra Corporation

The experience with Solyndra showcases many of the issues mentioned above and provides a good starting place for a project-level analysis. Solyndra was a manufacturer of solar photovoltaic systems which, following its establishment in 2005, gained widespread praise and interest due to its promising new technology. Solyndra's photovoltaic systems were revolutionary because they did not employ silicon and were implemented as arrays of thin rods rather than traditional flat panels. The company claimed the new technology had several advantages over traditional panels such as increased efficiency, lighter weight, and a cheaper installation process.

In March 2009, Solyndra became the first company to be awarded a conditional commitment for a loan guarantee in the DOE's Loan Guarantee Program. The deal, which guaranteed a $535 million loan from the Treasury's Federal Financing Bank, allowed the company to construct a state-of-the-art production facility known as "Fab 2." Solyndra needed the facility to ramp up production of its solar systems and benefit from economies of scale. However, over the following years several market factors prevented Solyndra from generating expected revenue, and the company regularly operated with significant losses. By early 2011, Solyndra was in danger of defaulting on its loan, but it successfully petitioned to restructure its debt to provide some financial relief. Unfortunately, the deal provided only a temporary solution and the company continued to struggle. After DOE turned down a second loan restructuring request in August 2011, the company was forced to close its doors and declare bankruptcy.

Throughout the lifecycle of this project, the Loan Programs Office experienced several issues that hindered its ability to operate effectively. A major challenge appears to be the time pressure under which managers were forced to approve or deny the loan guarantee. Although the loan guarantee application process for Solyndra lasted over two years, recently released government information shows a flurry of activity in the two months prior to when the conditional commitment was made and also reveals hesitant views from some DOE employees associated with the project.[30] This time pressure apparently resulted from a political push for a loan guarantee commitment to be made within two months of the Obama Administration's inauguration. By pushing forth the vetting process at an aggressive pace, the program was forced to make difficult decisions without sufficiently evaluating all of the available information. In fact, certain personnel involved in the review process had almost no time to perform their duties prior to the loan's approval. For instance, in an audit report released in April 2012 by the Office of the Inspector General at the Treasury Department, auditors found that Treasury employees only had about one day to complete their review of the terms and conditions of the loan guarantee.[31] The time pressures are further evidenced by internal communications during the review process that have since been made available to the public. In one internal OMB email from March 10, 2009, an employee close to the project warned that "this deal is NOT ready for prime time."[32]

The pressure to make a decision on this loan exacerbated other issues with the program's management as well. In the same Inspector General Audit Report mentioned above, the auditors found that "there was no common understanding/definition of what constituted Treasury's

[30] U.S. House of Representatives Committee on Oversight and Government Reform. "Documents Entered into Record." http://republicans.energycommerce.house.gov/Media/file/Hearings/Oversight/091411/DocumentsEnteredIntoRecord.pdf#page=4

[31] U.S. Department of the Treasury Office of Inspector General. *Consultation on Solyndra Loan Guarantee Was Rushed*. April 3, 2012. http://republicans.energycommerce.house.gov/Media/file/pdfs/040312treasuryoigreport.pdf

[32] Ibid, 30.

consultative role within Treasury or between Treasury and DOE" and "there were no policies and procedures governing Treasury's consultative process." The OMB has a similarly informal consultative role in the loan guarantee approval process, which in the case of Solyndra led to confusion about the roles and responsibilities of the involved parties.

Another issue that arose was the lax implementation of established procedures in the vetting process. This process requires independent reviews of every project's legal, environmental, technical, and market aspects prior to approval. In the case of Solyndra, a final independent marketing report was not submitted prior to the loan's approval, although a rough draft was submitted six days before DOE officials unanimously voted to approve the project. While the severity of this oversight is questionable, it adds to a narrative of an irresponsibly managed and rushed process that detracts from the program's public image and support.

Regardless of the programmatic faults in the handling of the Solyndra loan guarantee case, the ultimate cause of the company's failure was its inability to compete due to the prevailing market conditions. In the period of a few years preceding the bankruptcy, several major market factors converged in the solar photovoltaic industry that impacted Solyndra's ability to operate on a profitable basis. Most importantly, the cost of competing technologies underwent a precipitous decline due to a collapse in the price of silicon. Another major factor was a reduction in European solar subsidies, which Solyndra viewed as a critically important market for its products. These factors, combined with added pressure from low-cost Chinese products and a lack of versatility in Solyndra's business model, ultimately led to the company's failure.

Notwithstanding the volatile economic climate of the period, the inability of DOE to anticipate these market conditions prompts real questions about its ability to accurately assess and budget for the risk in its loan guarantee portfolio. Not only did program evaluators fail to anticipate trends in the market at the outset of the project, but they also continued to provide their support even in the face of increasingly bleak indicators. When Solyndra lobbied to restructure its loan terms in February 2011, DOE approved the restructuring with terms that made the agency vulnerable to future criticism. Rather than hedging against a company that was clearly in dangerous water, DOE increased its exposure to loss in the event of a default by agreeing to allow private investors to recover $75 million of their losses with precedence over the government's investment.[33]

On the whole, the experience with Solyndra epitomizes the many challenges that may occur in this type of loan guarantee program. The conditions surrounding this case are exceptional, but as the other cases will demonstrate, some projects are at a much higher risk than others due to their vulnerability to market risks.

Abound Solar

Abound is also a solar manufacturer that specializes in next-generation photovoltaic systems. In December 2010, the company was awarded a loan guarantee of $400 million in order to expand its factories and ramp up production of its cadmium-telluride thin-film solar panels. As of March 2012, Abound had drawn down about $70 million of its loan guaranteed funds, which were supplied by the Federal Financing Bank, in order to fund its operations and expansion. However, concerns over the company's long-term survivability have recently surfaced after it laid off 280 of its 400-employee workforce in February 2012 in order to expedite the retooling of its factory for added production.[34] In the wake of the Solyndra bankruptcy, the shutdown at Abound has attracted extensive media attention and invited comparisons between the two firms. Indeed, despite some significant differences in technology and business models, the firms have faced the same market conditions, namely plummeting prices for competing polysilicon-based photovoltaic panels, in a competitive solar manufacturing industry—a situation which emphasizes the difficulty DOE has in understanding and forecasting risks in this sector. Nonetheless, despite the shutdown there is no indication that Abound is in immediate danger, and the company continues to receive loan disbursements from the FFB.

Whether or not Abound will ultimately succeed depends on a host of factors that cannot be completely understood by any government market analysis. Abound expects a shutdown of nine to twelve months—a lifetime in the photovoltaic industry—before it returns to its production activities. With fierce competition from other U.S. thin-film producers First Solar and GM, as well

[33] Riddell, Lindsay. "Congressional hearing focuses on Solyndra debt restructuring." *San Francisco Business Times*. October 14, 2011. http://www.bizjournals.com/sanfrancisco/news/2011/10/14/hearing-solyndra-debt-restructuring.html

[34] Sweet, Cassandra and Ryan Tracy. "UPDATE: Loan Recipient Abound Solar To Cut Jobs, Retool Colorado Factory." *The Wall Street Journal.* February 29, 2012. http://online.wsj.com/article/BT-CO-20120229-719672.html

as ever-growing pressure from China's solar manufacturing base, some outside analysts have a pessimistic take on Abound's prospects.[35] In the solar manufacturing industry, uncertainty about a long-term, secure customer base is an inherent problem for accurate risk assessment—a problem which is alleviated in other types of projects that will be discussed next.

Caithness Shepherds Flat

Caithness Shepherds Flat was established in 2009 to "develop, finance, construct, own, and operate the Shepherds Flat Wind Farm" in eastern Oregon.[36] In December 2010, Caithness secured a $1.3 billion partial loan guarantee to construct the project, which has a total price tag of $2 billion. This project is significantly different from the previously discussed projects in that, rather than selling a manufactured product, the company will sell electricity produced from the wind farm. More importantly, the company has secured a long-term buyer—Southern California Edison—for all electricity produced by the wind farm via a power purchase agreement (PPA). In the agreement, which is based on a 'take-or-pay' style contract, SCE is obligated to purchase 100% of the electricity that the wind farm produces over the lifetime of the contract.[37] By utilizing a long-term PPA agreement, Caithness Shepherds Flat effectively reduces the default risk of the project by pre-arranging sales for its output. This type of arrangement is frequently utilized in renewable electricity generation projects, and is an important qualification for acquiring project financing in many cases.

The reduced risk of this project is evident by the willingness of private investors to fund the project using the aid of the loan guarantee. Unlike the manufacturing projects described above which were financed by the Federal Financing Bank, the Caithness project's debt is being funded by 26 institutional investors and commercial banks led by Citi, Bank of Tokyo-Mitsubishi UFJ, RBS Securities and WestLB Securities.[38] Per the agreement, which was made through DOE's Financial Institution Partnership Program (FIPP), DOE offered to reimburse the consortium of lenders up to 80% of the $1.3 billion loan amount should the company default on its loan. Still, however, the

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[35] Jenny Chase, chief solar analyst for Bloomberg New Energy Finance, represented this viewpoint when she opined "The odds appear stacked against a successful return for Abound." http://www.denverpost.com/business/ci_20291837?source=bb

[36] Caithness Energy. "Caithness Development Projects." http://www.caithnessenergy.com/Caithness-Development-Projects.php

[37] "Fitch Rates Caithness Shepherds Flat, LLC Sr Secured Loans and Shepherds Flat Funding Trust I Ctfs." *Business Wire*. June 1, 2011. http://www.businesswire.com/news/home/20110601007638/en/Fitch-Rates-Caithness-Shepherds-Flat-LLC-Sr

[38] "Environmental Finance Awards 2011." *Environmental Finance*. July – August 2011, pg 18. www.environmental-finance.com

willingness of private investors to take on more risk in this project does not suggest that a loan guarantee is unnecessary. It is unlikely that this project would have been undertaken in the private market without federal assistance due to its sheer scale. At 845 megawatts (MW) of generating capacity, the Caithness Shepherds Flat Wind Farm will be the largest onshore wind farm in the world once it begins operating at full capacity.[39]

This project is characteristic of many in DOE's loan guarantee profile that carry reduced risks due to PPA agreements. In essence, the loan guarantee profile consists of two types of projects: those that are linked to utilities through long-term sales contracts; and those that have a variable customer base determined by short-term market conditions and technological factors. In the former case, many of the projects in the DOE profile are similar to Caithness Shepherds Flat in that they are unprecedented in scale and rely on more established technologies. Therefore, estimating the risks associated with these projects is a much easier task for program analysts, making them prime candidates for the loan guarantee instrument.

Beacon Power

In October 2011, Massachusetts-based Beacon Power became the second company to fail after receiving government backing through DOE's Loan Guarantee Program. However, despite the bankruptcy of the firm and its political ramifications, the circumstances of this failure differ significantly from those of Solyndra and may provide some important insights to the effectiveness of loan guarantees in non-utility-linked projects.

An energy storage company which specializes in flywheel technology, Beacon Power was one of the first companies to benefit from the government program when DOE approved a $43 million loan guarantee in August 2010. The company used the money to construct a 20 MW facility in Stephentown, N.Y. which utilizes cylindrical flywheels to store excess power from the grid in the form of rotational kinetic energy, releasing it back to the grid when additional power is required. This type of flywheel system has been promoted for its superior ability over traditional fossil fuel methods to smooth out power supply and improve the reliability and efficiency of the electrical

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[39] Trabish, Herman. "World's Biggest Wind Farm Gets Backing." *Greentechmedia.* December 17, 2010. http://www.greentechmedia.com/articles/read/worlds-biggest-wind-farm-gets-backing/

grid.[40] Despite the completion of the project, Beacon's operations failed to generate sufficient revenue to finance its debt and the company was forced into bankruptcy in October.

Much like the other non-utility-linked cases discussed previously, the DOE program was unable to accurately gauge the market factors that would have damaging effects on the company's competitiveness. In this case, the major factors were the decreasing price of natural gas, which makes using natural gas generators for grid regulation cheaper, and a lack of interest from investors who viewed the project as technically viable, but not especially profitable. Unlike Solyndra, however, this project contained more hedges against potential losses in the event of a default. First, more taxpayer protections were included in this loan guarantee deal than in the Solyndra case, such as cash on reserve requirements for collateral for the loan. Another factor was that the facility was a revenue-generating asset that could continue to operate despite the bankruptcy. In the second quarter of 2011, for instance, the plant generated $525,000 in revenue.[41] Not only would this revenue help pay off the loan principle, but it would also make the facility attractive to buyers. In March 2012, the Beacon Power facility was purchased by Rockland Capital for $30.5 million, which Beacon will use towards repaying its $39.1 million in outstanding debts to the Federal Financing Bank. Additionally, Rockland has said it plans to rehire the majority of the Beacon employees and invest funds towards a second 20 MW flywheel storage facility in Pennsylvania.[42]

This case illustrates a situation with a significant level of risk, but also strong defenses against the loss of taxpayer dollars. A major factor in this case is the role of federal regulations, which made the company profitable after a Federal Energy Regulatory Commission rule was modified that improved the profitability of the facility. Although the rule was not passed in time to save Beacon Power, it increased its value to the eventual buyer and allowed DOE to recover a greater portion of the disbursed funds. Further, while this project may have ended with the failure of a company, it also fulfilled the primary purpose of the DOE loan guarantee program: it demonstrated that a previously unproven technology is viable and market ready. The first installation is proving profitable enough for the successor company to invest in building a second facility. Projects such as

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[40] Mufson, Steven and Julia Eilperin. "Beacon Power declares bankruptcy; second loan guarantee recipient to falter." *The Washington Post.* October 31, 2011. http://www.washingtonpost.com/national/health-science/beacon-power-declares-bankruptcy-second-loan-guarantee-recipient-to-falter/2011/10/31/gIQACNAaaM_story.html

[41] Ibid.

[42] Wang, Ucilia. "DOE-backed Beacon Power to be sold to private equity firm." *GigaOM*. February 6, 2012. http://gigaom.com/cleantech/doe-backed-beacon-power-to-be-sold-to-private-equity-firm/

this, which have significant amounts of available collateral and are attractive acquisitions for other private firms, may be good candidates for loan guarantees even if they do not have long-term sales contracts and an established customer base on which to rely.

Effectiveness of Federal Loan Guarantees in Mobilizing Project Financing

Whether or not federal loan guarantees have enabled additional clean energy projects to obtain financing is an essential step in evaluating this policy instrument's value. If loan guarantees are merely subsidizing projects that would have been built anyway, then they are neither functioning as intended nor serving the public interest. However, if the evidence suggests that guaranteed projects would not have been able to get a loan without government assistance, or only on prohibitively costly terms, then they have most likely had a beneficial effect . According to these criteria, federal clean energy loan guarantees have likely had their desired effect in accelerating the deployment of clean energy.

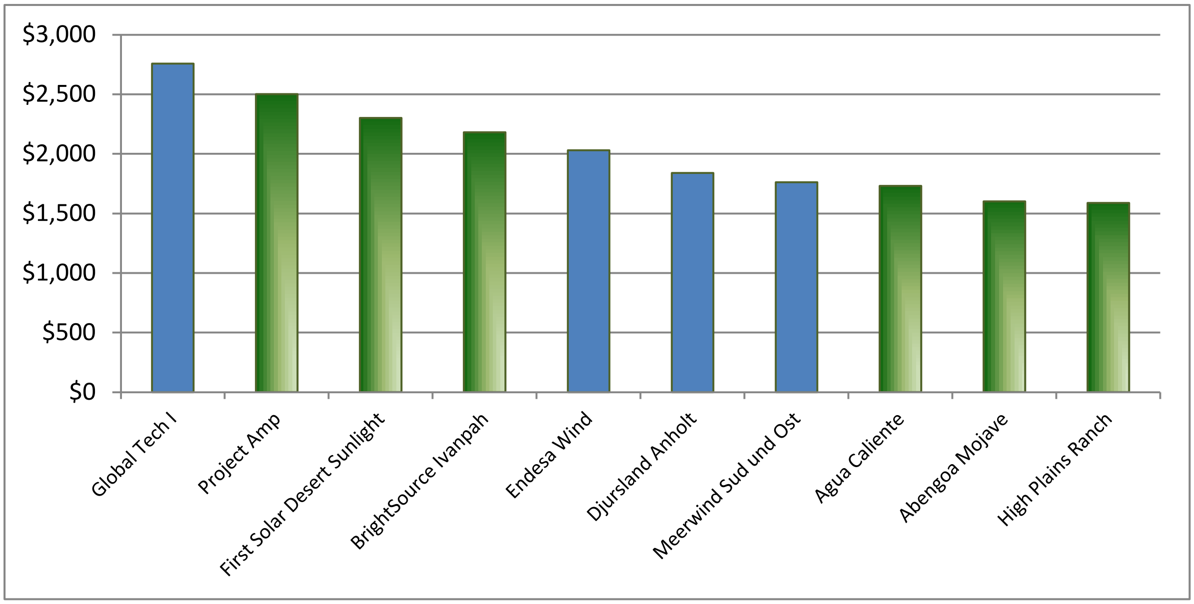
Projects within the DOE portfolio would likely have had a difficult time receiving financing in the absence of government intervention. Commercial investments in clean energy declined significantly during the economic downturn: U.S. investments dropped sharply from $34 billion in 2008 down to $20 billion in 2009, and had yet to recover to pre-recession levels in 2010.[43] As private capital available for renewable energy projects dried up, federal financing has had to make up this shortfall.

Several market indicators demonstrate the significance of the loan guarantee program in this sector. First, the U.S. Federal Financing Bank, which provided many of the guaranteed loans, was the biggest lender to clean energy projects in 2011, providing over $10.1 billion in credit, or nearly 20% of the market total. Second, six of the ten largest clean energy deals in the world in 2011, including three of the top four, were backed by a DOE loan guarantee. These ten largest deals totalled $20.3 billion, of which $11.9 billion—nearly 60%—was guaranteed by the federal

[43] Venture capital investments in the United States also decreased from roughly $3 billion in 2008 to $2 billion in 2009. Bloomberg New Energy Finance, as cited in National Science Board, *Science and Engineering Indicators 2012* (National Science Foundation, 2012), Ch. 6: 61 – 63, http://www.nsf.gov/statistics/seind12/pdf/c06.pdf

government (**Figure 4)**. Third, five out of the six companies with the largest clean energy project portfolios last year were at least in part supported by DOE loan guarantee programs.[44]

Figure 4: Largest Clean Energy Asset Deals of 2011 (Millions of Dollars)



Note: Projects in green received federal loan guarantees. Source: Bloomberg New Energy Finance, http://about.bloomberg.com/pdf/bnef-2011-ye-clean-energy-est-league-tables.pdf

The loan guarantee portfolio contains some of the largest clean energy projects in the world, far larger than those that have obtained financing in years past without federal intervention. As mentioned earlier, the Caithness Shepherds Flat wind farm is the largest such project in the world.[45] The BrightSource Energy and Genesis Solar concentrating solar power (CSP) projects have a combined capacity of 633 MW, and if installed will double the total CSP capacity of the United States.[46] The total planned capacity of guaranteed photovoltaic (PV) solar projects stands at nearly 2,900 MW, almost three-quarters as much as the nation's cumulative installed capacity.[47] Taken

[44] Bloomberg New Energy Finance, *Clean Energy & EST League Tables: YE 2011*, 2012, http://about.bloomberg.com/pdf/bnef-2011-ye-clean-energy-est-league-tables.pdf; Nathaniel Bullard, "U.S. Clean Energy Leadership Is Misleadingly Strong After a Record 2011," *Bloomberg*, January 18, 2012, http://www.bloomberg.com/news/2012-01-18/u-s-clean-energy-leadership-is-misleadingly-strong-after-a-record-2011.html. The five firms are NRG Energy, NextEra Energy, Abengoa, Exelon Corp, and General Electric.

[45] General Electric, "Caithness: Using GE's Advanced Wind Turbine Technology," *Ecomagination*, 2012, http://www.ecomagination.com/progress/innovation/renewables/caithness/

[46] Total CSP capacity in the U.S. was 516 MW at the end of 2011. GTM Research and Solar Energy Industries Association, *U.S. Solar Market Insight Report: 2011 Year-in-Review*, 2012, 3, http://www.slideshare.net/SEIA/us-solar-market-insight-report

[47] Cumulative PV capacity in the U.S. was 3,954 MW at the end of 2011. Ibid.

together, these aspects of the loan guarantee portfolio indicate that rather than simply crowding out private investment, the federal loan guarantee program has helped deploy projects at greater scales and in greater numbers than likely would have been financed otherwise.

Federal loan guarantees have also provided financing for clean energy projects on significantly better terms than private financiers would have otherwise offered, given these investors' lower tolerance for risk in funding new innovative technologies. Recent estimates of the long-term cost to the government of the department's loan guarantees from DOE reports and the independent White House review range from $2.7 billion to $2.9 billion. However, if these loans had been issued using the fair market value (FMV) evaluation practiced in capital markets, private investors acting alone would have demanded $5 billion to $6.8 billion to cover their costs.[48] These higher estimates of risks would have resulted in far more costly loan terms to renewable energy projects in the government's portfolio, likely delaying or prohibiting their construction.

Federal Loan Guarantees as a Vote of Confidence in New Technology

Federal energy loan guarantee programs may also have a positive impact on clean energy deployment by serving as a valuable vote of confidence in clean energy projects writ large, although the evidence for this larger effect is less definitive. Large-scale government commitments to emerging technologies can provide a strong signal of their creditworthiness to otherwise reluctant private financiers, encouraging them to offer capital more often and at lower cost to projects that traditionally did not have access to such resources. This dynamic appears to be in motion with respect to clean energy power facilities, particularly solar. Businessweek reports that Google, Berkshire Hathway, and other high-profile investors are now backing solar projects without government support.[49]

According to Arno Harris, CEO of Sharp's renewable power unit, DOE endorsements of solar and renewable projects have addressed investors' concerns and helped form a larger collection of institutions ready to lend money:

[48] Herbert Allison, *Report of the Independent Consultant's Review with Respect to the Department of Energy Loan and Loan Guarantee Portfolio*, January 31, 2012, 8, http://thehill.com/images/stories/wh-independent-report-doe-loans.pdf
[49] Christopher Martin, "Solar 15% Returns Lure Investments From Google to Buffett," *Bloomberg Businessweek*, March 20, 2012, http://www.businessweek.com/news/2012-03-19/solar-15-percent-returns-lure-investments-from-google-to-buffett

> "Solar is now bankable," Harris said. "When solar was perceived as more risky it required a premium," and now it's "becoming part of a much broader capital market."[50]

Additionally, the CEO of SolarCity—which failed to secure a federal guarantee but nonetheless benefited from a rigorous due diligence process—has interepreted his firm's success in garnering a $350 million loan from Bank of America as a broader sign of lenders gaining confidence in providing major financing for large-scale solar projects.[51] If the presence of traditional institutional lenders in the renewable energy continues to grow in the coming years, this could be a strong indication that government loan guarantees have played their intended role in accelerating technological deployment.

Managing Risk in the Federal Loan Guarantee Portfolio

The DOE loan guarantee program is specifically designed to aid clean energy projects that lack the proven track record necessary to obtain private financing without public support. However, the Solyndra bankruptcy has raised concerns of whether DOE has taken excessive risks in the projects it has selected for loan guarantees. Simply reviewing the status of the DOE loan guarantee program as a whole suggests that is performing quite well, as the commitments to the now-bankrupt Solyndra and Beacon Power make up only about 2% of its portfolio. However, as we have seen, the relative scarcity of such failures to date does not mean that federal energy loan guarantees have not encountered significant challenges in managing risk.

Long before the Solyndra bankruptcy, the Government Accountability Office (GAO) cautioned that the unique characteristics of the program's diverse projects would complicate evaluating the risks of individual projects.[52] The independent White House review calculated that the long-term cost to the government of the loan guarantee program would run nearly $2.7 billion, far below budgeted reserves, but qualified that no methodology could truly predict the eventual losses of the portfolio.[53] Additionally, it estimated that the credit subsidy cost for non-utility-linked projects

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[50] Ibid.
[51] Ronald D. White, "SolarCity Proves There Is Life After Federal Loan Guarantees - Latimes.com," *Los Angeles Times*, December 1, 2011, http://latimesblogs.latimes.com/money_co/2011/12/solarcity-life-after-federal-loan-guarantees.html
[52] U.S. Government Accountability Office, *Department of Energy: New Loan Guarantee Program Should Complete Activities Necessary for Effective and Accountable Program Management*, July 2008, 1, http://www.gao.gov/new.items/d08750.pdf
[53] Allison, *Report of the Independent Consultant's Review with Respect to the Department of Energy Loan and Loan Guarantee Portfolio*, 8.

would be over 40% of the total value of the loans, a significant revision upward from previous DOE estimates. Accurately predicting the funds necessary to cover losses in energy loan guarantee programs is likely to be an ongoing issue for the federal government. Although methods exist for evaluating the risks of innovative clean energy projects, predicting losses from a small number of large energy projects presents special challenges not present when pooling risk across a large number of small home loans.

The Energy Policy Act of 2005 directed the Secretary of Energy only to make guarantees that offered a "reasonable prospect of repayment of the principal and interest on the obligation by the borrower," but the legislation did not provide a definition for what constitutes a reasonable prospect of repayment.[54] Furthermore, DOE does not appear to have specified what constituted a "reasonable prospect" of repayment from borrowers as it set up and administered the loan guarantee program.[55] It is not surprising that this lack of a clear standard for risk-taking has led to some confusion as to what kind of projects should be eligible for loan guarantees, and whether DOE has departed from the original intent of the legislation establishing the program.

Many of these concerns over the program's lack of clarity were articulated during a hearing of the U.S. Senate Committee on Energy & Natural Resources. Herbert Allison, who led the independent review of the DOE loan guarantee program commissioned by the White House, gave the following remarks before the committee:

> …nowhere could we find a definition of reasonable prospect of repayment…How does one define it? I would say that reasonable prospect of repayment would probably mean more than a fifty percent probability, but others might define it as a ninety percent probability, and with that amount of vagueness, there's room for a great deal of controversy and second-guessing about this program.[56]

There is no agreed upon standard for the degree of risk DOE should be taking on in its portfolio; the ambiguity in the legislation allows some lawmakers to believe that the department's selection of guaranteed projects has been appropriate and the default rate is well within acceptable

[54] *Energy Policy Act of 2005*, sec. 1703(d).

[55] DOE's final rule establishing policies for Title XVII of the Energy Policy Act did not further refine eligibility requirements. See "Loan Guarantees for Projects That Employ Innovative Technologies," *Federal Register* 74, no. 232 (December 8, 2009): 63544 – 63560, .

[56] Herbert Allison, testimony before U.S. Senate Committee on Energy & Natural Resources, *Allison Report on DOE Loan Guarantee Program*, 2012, http://www.energy.senate.gov/public/index.cfm/hearings-and-business-meetings?ID=d0867c7a-9cca-4f12-8bb9-57d0fa02ab58

levels, while giving others the opportunity to conclude the exact opposite. A staff report by the House Committee on Oversight and Government Reform was intensely critical of the department for developing a portfolio of investments with an average rating by credit agencies of BB-,[57] which is considered "Junk grade," but such commitments may be entirely appropriate for a government program focused on high-risk projects. The lack of a clearly defined threshold of risk within the DOE loan guarantee program has thus made it difficult to hold the department accountable to a certain performance goal, and also left it more vulnerable to varying expectations and sweeping criticism in the event of relatively minor losses.

Job Creation

In addition to accelerating technology deployment, job creation has emerged as one of the intended benefits of federal clean energy loan guarantees. The DOE has made repeated emphasis on the job creation benefits of the loan guarantee program, despite the fact that such goals are not mentioned in the legislation that established the program. The Loan Programs Office's website displays job creation estimates in its graphics and lists of projects,[58] and DOE's press releases announcing loan guarantee commitments invariably contain mentions and estimates of job creation.[59] News media investigations into the loan guarantee program suggest that DOE employees were under significant pressure from the administration to approve projects at a faster rate to increase jobs spending, and GAO found that the DOE had granted preliminary loan approvals for several projects before officials had completed mandatory evaluations of their risks.[60] The House Committee on Oversight and Government Reform found further instances of job creation pressures

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[57] U.S. House of Representatives Committee on Oversight and Government Reform, *The Department of Energy's Disastrous Management of Loan Guarantee Programs*, March 20, 2012, http://oversight.house.gov/wp-content/uploads/2012/03/FINAL-DOE-Loan-Guarantees-Report.pdf

[58] U.S. Department of Energy, "The Financing Force Behind America's Clean Energy Economy."

[59] For example, "Project expected to fund nearly 400 jobs and produce clean geothermal power." U.S. Department of Energy, "Energy Department Finalizes Loan Guarantee for Ormat Geothermal Project in Nevada", September 23, 2011, https://lpo.energy.gov/?p=5226

[60] Joe Stephens and Carol D. Leonnig, "Solyndra: Politics Infused Obama Energy Programs," *The Washington Post*, December 25, 2011, http://www.washingtonpost.com/solyndra-politics-infused-obama-energy-programs/2011/12/14/gIQA4HllHP_story_4.html; Eric Lipton and John M. Broder, "In Rush to Assist a Solar Company, U.S. Missed Signs," *The New York Times*, September 22, 2011, http://www.nytimes.com/2011/09/23/us/politics/in-rush-to-assist-solyndra-united-states-missed-warning-signs.html?_r=3&pagewanted=1&ref=politics

intruding on the loan guarantee program, suggesting that the review process was systemically compromised, and not just in the Solyndra case.[61]

Like other infrastructure projects, renewable energy generation plants may provide a sizeable number of jobs during their construction, but require relatively few permanent jobs to maintain facility operations thereafter. Estimated permanent jobs created from Section 1703 and Section 1705 projects are far fewer in number than temporary construction jobs. According to DOE's own figures, over $26 billion in loan guarantees in these programs has resulted in almost 19,000 construction jobs created, but only about 3,500 permanent jobs.[62] This comes out to an average of about 650 construction jobs and 120 permanent jobs per project, a number far too low to justify meaningful expectations for job creation from federal clean energy loan guarantees.

Pacing Loan Guarantee Commitments

Federal clean energy loan guarantee programs have also experienced difficulty with regard to the proper pace for issuing guarantees. The balance required to properly vet projects but still make commitments in a timely fashion is likely to be an ongoing concern for federal guarantee programs.

The Recovery Act stipulated that DOE's authority to make guarantees under the Section 1705 program would expire on September 30, 2011, leaving only about two and a half years after the legislation's passage for the department to close its guarantee commitments. One challenge with having an expiration date for loan authority is that it may place undue pressure on agency officials to issue guarantees to projects within the deadline before sufficiently reviewing their applications. In fact, nearly two-thirds of Section 1705's loan guarantees were finalized in the last two months before the statutory deadline, with nearly half of the agreements finalized in the last month alone.[63] Performing adequate due diligence on these energy projects, many of which are on a scale over $1 billion, can be a lengthy process, and rushing that process could result in loan guarantees going towards otherwise too-risky applicants, inappropriately jeopardizing taxpayers' money.

Prominent lawmakers earlier decried DOE's "mad rush" to get loan guarantees out the door, but now the Department is under congressional fire for dragging its heels with approving new loans

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[61] U.S. House of Representatives Committee on Oversight and Government Reform, *The Department of Energy's Disastrous Management of Loan Guarantee Programs*, 35–37.
[62] U.S. Department of Energy, "The Financing Force Behind America's Clean Energy Economy."
[63] U.S. Department of Energy, "The Financing Force Behind America's Clean Energy Economy."

in its remaining program.[64] The Section 1705 program has closed more than two dozen loan guarantees, whereas the Section 1703 program—which does not expire—has not closed a single guarantee. Many Section 1703 applications have been ongoing since 2008 or earlier, and according to GAO, DOE has not "otherwise demonstrated that the program is fully functional."[65]

The Department appears to have overcorrected for its previous errors and is now putting loan guarantee candidates through an unreasonably stringent and lengthy application process. In the eyes of some legislators and loan applicants, DOE has become too risk averse and deliberative to effectively implement its remaining loan programs in the hope of avoiding further political controversy.[66] What is clear is that federal loan guarantees in support of emerging technologies such as clean energy will have to balance the competing demands of venture capitalists and stewards of public funds. Given the poor political optics of gambling taxpayer funds away on the wrong bets, it may be especially difficult to for such programs to continue to make the necessary risks in order to play a meaningful role in accelerating technological deployment.

Lessons from USDA: Flexibility and Administration

The USDA programs have so far escaped a major project failure or scandal related to program administration. The avoidance of major problems has exempted the USDA from the level of inquiry DOE has faced recently. There are two major lessons that can be learned from USDA's relative success.

The first is the importance of coordination with industry and flexibility in the rule making process. The Biorefinery Assistance Program's initial rules were deemed too restrictive by the renewable fuels industry. A major change was the shift from requiring a commercial bank to be the singular holder of a project's loan. Instead banks were allowed to become trustees of bond sales to the broader credit market. This change along with others refinements led to more progress.

Second is the value of having adequate administrative staff. REAP projects were distributed widely over the United States and this was facilitated by the USDA's significant geographic footprint. Even with country level FSA offices available nationwide, states better equipped to assist

[64] John McArdle, "DOE: Senators Press Chu to Speed Loan Approvals," *E&E News*, March 14, 2012, http://eenews.net/public/EEDaily/2012/03/14/2
[65] U.S. Government Accountability Office, *DOE Loan Guarantees: Further Actions Are Needed to Improve Tracking and Review of Applications*, March 2012, 30, http://www.gao.gov/assets/590/589210.pdf
[66] U.S. Senate Committee on Energy & Natural Resources, *Allison Report on DOE Loan Guarantee Program*.

their citizens with the complicated application forms were able to grab a disproportionate share of the funding. Any program designed to facilitate diffusion of small scale renewable energy technologies among the general public must include significant levels of administrative capacity.

Conclusion

The use of loan guarantees for the deployment of clean energy technologies is a highly complex issue that lies at the intersection of the technical, financial, and political domains. After reviewing the issue in this context and examining some current policy implementations, we have found that this policy instrument has both major strengths and weaknesses in its capacity as a clean energy deployment tool. The primary finding of this analysis is that loan guarantees—in their capacity as clean energy deployment tools—are being employed to address a range of issues that carry different risks and expectations. Specifically, two distinct goals have emerged from federal loan guarantee programs. On one hand, they are being used in the more traditional deployment sense to encourage the spread of existing clean energy technologies at a faster rate than the market would dictate. On the other hand, they are being used as a vehicle for venture-capital style activities, allowing the government to support high-risk industries in a politically acceptable manner.

The first goal is typically associated with efforts to expand electricity generation from renewable sources through utility-linked projects. This activity carries minimal risks due to long-term contracts and a focus on more established technologies. The second goal is generally associated with efforts to support high-tech manufacturing of new products, an activity that carries a host of political, financial, and technological risks. In this capacity, loan guarantee programs may encounter risk assessment problems typically associated with industrial policy, as well as fostering political opposition due to "picking winners and losers." The existence of two distinct goals is a situation which engenders confusion about the role of the loan guarantee in the innovation toolkit. As was discussed in an earlier section, programs that lack clearly defined risk thresholds preclude an accurate assessment of the program's performance, leading to a lack of accountability and reduced program legitimacy.

Overall, our analysis finds that loan guarantees are an effective tool for clean energy deployment when used in the first scenario described above. Additionally, they can still be used successfully in the second role discussed if the risks are clearly defined, accepted by all stakeholders, and managed prudently. We conclude by offering a set of recommendations for the structure and management of loan guarantee programs so they can address the issues and challenges discussed throughout this paper, and be most effective in accelerating clean energy deployment without placing the public's tax dollars at undue risk.

Recommendations

1. Improve Oversight and Precautionary Measures for Ongoing Projects

Projects that are subject to market risks need close supervision at all stages to ensure goals and milestones are on track to being met. Program analysts should establish and maintain close ties with industry experts to gain a better understanding of future market conditions and risks that may affect the likelihood of loan repayment. Loan guarantee terms and conditions should be clearly defined and structured to avoid taking on unnecessary risk if debt restructuring negotiations become necessary.

2. Clarify and Codify Roles of all Government Actors Involved

The responsibilities and expectations of all government actors involved with loan a guarantee program should be clearly defined and documented to improve program coherence. Each involved party should be guaranteed a sufficient but not excessive period of time to perform their duties and communicate their results to other members of the program.

3. Appropriate Funds for the Credit Subsidy Cost

Congress should appropriate funds to cover the credit subsidy cost of its loan guarantees, rather than require applicants to pay this amount themselves. The credit subsidy cost may be prohibitively high for some smaller, innovative renewable energy firms, which explains why there has been significantly less interest for renewables in the Section 1703 program, which has not closed a single guarantee to a renewable energy project. Appropriating funds for the credit subsidy cost will ensure that innovative renewable energy projects are not disadvantaged in receiving federal loan guarantees.

4. Use FCRA Methodology to Estimate Project Costs

The budgetary cost of federal loan guarantees should be calculated based on Federal Credit Reform Act (FCRA) accounting, rather than Fair Market Value (FMV) accounting, which would ignore the government's ability to absorb greater risk and borrow at lower cost than private lenders.

Federal loan guarantees should continue to be scored on an FCRA accounting basis to maintain their effectiveness and reflect the government's advantage in supporting higher-risk activities that have a public benefit, such as support of emerging technologies.

5. Place Power Generation and Manufacturing Projects in Separate Programs

The federal government should administer loan guarantees to higher risk manufacturing projects and lower risk utility-linked projects in separate programs, and make this distinction clear to lawmakers and the public. If these two classes of federal energy loan guarantees are created and managed independently, there will be greater opportunity to assess the strengths and weaknesses of each loan guarantee program more accurately and adjust future policies with greater precision.

6. Clearly Define Acceptable Levels of Risk Before Implementation

Federal clean energy loan guarantee programs must have a clear level of acceptable risk established before they begin making commitments. Without a specific target success rate in place, it is difficult to judge whether the DOE loan guarantee program is taking on too little or too much risk. Providing a specific threshold of acceptable risk early on in a loan guarantee program will help manage expectations for failures and establish a benchmark by which to judge the performance of the loan portfolio.

7. Maintain a Diverse Portfolio of Technologies

The government should maintain a diverse portfolio of loan guarantees across a range of technologies. A large majority of DOE commitments have gone towards solar generation and manufacturing, which has concentrated the exposure of taxpayer funds in an especially volatile market. Creating a diverse portfolio of loan guarantees will reduce the program's vulnerability to the specific risks that each technology faces.

8. Do Not Use Loan Guarantees as a Tool for Job Creation

Federal clean energy loan guarantees should not be used as a vehicle for government-supported job creation. Pressures for job creation likely adversely affected the Section 1705 program's management and resulted in unnecessary risk-taking. Loan guarantees may help create short-term construction jobs, but very few permanent jobs. Therefore, job creation should not play a primary role in the promotion, administration, and subsequent evaluation of future energy loan guarantees.

9. Grant Federal Programs Long-Term Loan Guarantee Authority

Congress should provide clean energy loan guarantee programs the authority to make commitments over a long timeframe to ensure that the due diligence process on applicants is given adequate time. Loan guarantee programs should not last indefinitely, nor be used to support already mature technologies, but they should be given sufficient time to examine prospective projects in full detail to reduce the likelihood of taxpayer bailouts of failed projects.

10. Provide Long-Term Funding for Loan Guarantee Programs to Ensure Adequate Staffing and Monitoring

Many of the energy loans guaranteed by the federal government will not mature for decades, so it important that agencies have the necessary funding to maintain staff and monitor their portfolios in the coming years. Although application fees have provided some of the funding for administrative expenses, further appropriations are necessary to ensure that loan programs have the resources to protect taxpayers' interests as market conditions inevitably change and the status of the portfolio evolves over time.