PURE RISK: FEDERAL CLEAN ENERGY LOAN GUARANTEES

Henry Sokolski Editor
Pure Risk:
Federal Clean Energy Loan Guarantees

Henry Sokolski
Editor

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Acknowledgements

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Henry Sokolski
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In Washington, where immense power and stupendous budgets comingle, it is tempting to think any financial proposal formally approved is money in the bank. This, however, is misguided: Any investment, even one made by Congress, poses risks and has costs. Some, as the recent controversy surrounding the Solyndra project demonstrates, can clearly lose money.

This volume spotlights the costs and risks associated with federal clean energy loan guarantees. To be sure, these costs are difficult to calculate to the last penny. Critics of loan guarantees emphasize the risks that guaranteeing loans to large renewable projects, clean coal plants and nuclear entities can run. They point to the half billion dollars Solyndra has already cost U.S. taxpayers.

Proponents, however, insist that Solyndra was an anomaly, that there will be no more defaults and that, henceforth, the cost of clean energy loan guarantees to the taxpayer will be zero. This, of course, is rebuttable. After all, if the clean energy projects applying for federal loan guarantees are certain to make money, why are there no private investors willing to back them?

Still what makes granting such guarantees difficult to resist is that the initial cost of awarding such loans is negligible. Also, such loan guarantees are almost entirely off-budget. Certainly, whatever the final costs might be are most likely to be incurred well after the loans have been granted. These costs, though, do have to be paid and when
they are incurred, there can be substantial political fallout. Again, the Solyndra Corporation’s default makes this painfully clear.

Beyond having to pay for actual defaults, though, there are two other significant risks associated with these loans. The first is the moral costs of government officials backing commercial projects that turn out to be significant money losers. Such misjudgments are rarely conceded until very late in the game (e.g., synfuels in the 1970s, the Clinch River Breeder Reactor in the 1980s, and corn ethanol in the 1990s). Worse, in some cases, the government must cover its tracks by mandating that the public buy the product produced (e.g., ethanol) even thought it clearly is not cost effective against less expensive alternatives. The net effect of such fiscal cynicism is the diversion of financing – public and private – from more worthy energy innovations to projects that otherwise would fail financially. More important, public faith and credit in the federal government suffers with each transaction.

Yet another set of concerns, which has drawn my center’s attention, is the corrosive effect these subsidies can have in the case of nuclear projects on U.S. and allied nuclear nonproliferation policy.

As the last four decades of nuclear weapons proliferation have demonstrated, countries’ “peaceful” nuclear programs (e.g., in India, Iran, Iraq, North Korea) can and have been used to develop nuclear weapons programs. None of these “civilian” programs ever made much commercial sense. Historically, this is an important point that the U.S. and other like-minded governments have spotlighted to challenge these programs. Yet, the more heavily the U.S. and its allies have subsidized their own commercial nuclear programs, the less authority they have had to spotlight how uneconomical other states’ nuclear plans might be.

We have already seen how costly this can be in the case of Iran. Before the Bush Administration established multi-billion-dollar commercial nuclear loan guarantees under the Energy Policy Act of 2005, both the Bush and Clinton administrations publicly criticized Tehran for subsidizing an uneconomical nuclear power program when it was flaring millions of cubic feet of relatively clean natural gas. This criticism was one Tehran had difficulty deflecting.
After 2005, though, the U.S. stopped making this case and instead conceded that Iran had a right to develop nuclear power no matter how uneconomical it might be. Although passage of the 2005 act did not cause the change in U.S. policy, it came just before this policy shift was announced and made any attempt to return to the previous sounder nuclear economic critique of Iran far more awkward.

Yet another dimension of this problem is the U.S. Department of Energy’s recent granting of conditional nuclear loan guarantees to French government-owned nuclear firms to build nuclear plants in the U.S. Granting these loan guarantees has unintentionally rewarded a foreign nuclear supplier that has been undermining U.S. nonproliferation standards overseas.

In specific, the French have undercut the new U.S. Gold Standard for nuclear nonproliferation created under the conditions of the 2009 U.S.-United Arab Emirates (UAE) nuclear cooperative agreement. This agreement required the UAE to forswear making nuclear fuel and to ratify an intrusive International Atomic Energy Agency inspections agreement known as the Additional Protocol. The U.S. asked the French to uphold this standard but the French instead have consciously decided not to do so.

This has caused Congress to question how serious the Executive Branch is about pushing the standard. When the U.S. Department of Energy awarded conditional loan guarantees to French firms to build nuclear plants in 2010, Congress, nonproliferation experts, and the press took note. They noted that whatever else the U.S. government should be doing to promote nuclear energy, it ought not to be using the U.S. Treasury to help foreign nuclear firms expand their business in the U.S. if they are simultaneously undermining U.S. nonproliferation standards overseas.

This, of course, is a distance from the political and economic controversies surrounding such headline grabbers as Solyndra or, more recently, the United States Enrichment Corporation’s political difficulties in securing a $2 billion federal loan guarantee for a new, commercial enrichment project. Still, it highlights the unintended, negative knock-on effects of such politicized loan making.
Washington insiders’ cynical rejoinder to such arguments is that for most Americans these worries are simply too complicated to be comprehended, have no political visibility, and, therefore, can be ignored.

This small monograph, however, assumes that after Solyndra, just the opposite is possible. Its aim is to clarify what otherwise might seem complicated. Although none of the authors of the essays it contains necessarily agree with one another on the importance of promoting nuclear power or any other specific form of electrical generation, each presents a clear set of evidence on why Congress and the Executive should stop increasing the amount of federal dollars available for making such loans. Some of this analysis is detailed. Some comes in brief op-ed length pieces. None are obscure. The hope is that each in its own way is persuasive regarding the bottom line: Continuing to pile on more clean energy loan guarantees constitutes nothing less than pure risk, i.e., creating a situation where there is a chance of running loss but no chance of gain.
Federal Clean Energy Loan Guarantees: Their Moral Hazards

Pamir Wang

If you ask any American if they support a program that guarantees energy security, job creation, innovation, and carbon abatement at little to no cost, he or she will surely respond positively. Clean energy loan guarantee proponents tout these benefits and more to justify further loan guarantees for commercial nuclear plants and other commercial clean energy projects.¹

But as the recent $535 million loss that the Solyndra solar project incurred demonstrates, the costs and political risks of clean energy loan guarantees can be significant. Clean energy loan guarantees, moreover, are likely to inhibit innovation and increase the overall cost of borrowing for these purposes. At a minimum, they distort crucial market signals that determine where capital should be invested, causing unmerited lower interest rates and a reduction of capital in the market for more worthy projects. Public loan guarantees for new nuclear plant construction are particularly risky because of these project’s high construction costs.

The nuclear industry downplays these risks, yet they have hedged their bets. Nuclear utilities have painstakingly limited the financial exposure to their own reactor projects by taking out loans under separate corporate entities. This assures that the U.S. government can’t reach into their pockets if the nuclear project bellies up.²

The default rate of new reactors is in dispute; some argue that it is as high as 50 percent; others argue that is much lower. What is clear,
however, is the credit ratings of nuclear utility companies. Two of the five nuclear loan guarantee finalists had the lowest ratings of all the applicants, and a third was on the brink of being rated a junk bond. Standard and Poor’s latest 2010 study on past corporate bond defaults found that corporations with junk bond ratings are significantly more likely to default than those with investment grade bonds (see Figure 3).

All of this suggests that it would be best if federal clean energy loan guarantees were eliminated. If this is impractical, at the very least, they should not be expanded: Six years after Congress created clean energy loan guarantees, $10 billion still remains up for grabs for new nuclear power facility projects alone. Creating more federal energy loan guarantee authority will only increase what are already substantial risks in the government’s portfolio.

The Case for More Clean Energy Loan Guarantees, Including for Nuclear

Supporters of federal loan guarantees for clean energy projects contend that this subsidy promotes innovation, energy security, and carbon abatement. President Obama has also lent support for such guarantees by arguing that increased nuclear electricity generation is critical to reducing U.S. dependence on fossil fuels. Loan guarantee proponents also maintain that difficulty in securing financing is the main roadblock preventing private industry from constructing new low emission electrical generating plants. They argue that subsidized financing levels the playing field with fossil fueled generators because renewable and nuclear energy sources are still more expensive. Even though the commercial nuclear industry is mature, the industry also insists that loan guarantees are necessary and appropriate to offset the regulatory processes that continue to hamper nuclear power’s expansion as compared to renewables and fossil fuels. In this regard, their concerns have been heightened recently by the U.S. NRC safety regulatory board, which has called for increased scrutiny of new reactor safety after the Fukushima disaster.

Government loan guarantees reduce capital costs through lower borrowing interest rates. This results in greater use of debt (80 percent) in proportion to equity (20 percent) to finance the project and up to $15
billion dollars saved over the life of the loan.\textsuperscript{7} Privately funded power generating projects typically require 40-50 percent equity.\textsuperscript{8}

When it comes to loan guarantees for new nuclear plant construction, nuclear power supporters make several additional arguments. Compared to other renewables, new reactors require a massive capital investment upfront to cover the immediate construction costs.\textsuperscript{9} Upon completion, however, the cost of maintaining a reactor is low. This initial capital burden often makes loan guarantees a necessary component of new nuclear projects.

Finally, loan guarantees for commercial energy projects are popular with Congress and the Executive. Congress can approve billions of dollars in loan guarantees with little or no immediate impact to federal appropriations because they are almost entirely off budget. Additionally, since the costs of these guaranteed loans are unlikely to surface for many years – i.e., only when and if the project actually fails – political officials can low-ball the costs when they grant the guarantees and are generally able to skirt political blame years later when or if the project defaults.

**How DoE Clean Energy Loan Guarantees Work**

Under the Energy Policy Act of 2005 (EPACT 2005), the Department of Energy (DoE) provides loan guarantees to “support innovative clean energy technologies that are typically unable to obtain conventional private financing due to high technology risks.”\textsuperscript{10} Under Section 1703 of EPACT 2005, the federal government can guarantee 80 percent of the project’s total cost, so the remaining 20 percent must be funded by private equity.\textsuperscript{11} DoE approves loan guarantees, and for large exposures such as new reactor projects, the Federal Financing Bank (FFB), an arm of the U.S. Treasury Department, disburses the loan. The loan guarantee ceiling for new reactor construction is currently set at $18.5 billion, although legislation to increase it up to $54 billion has been proposed both in Congress, and as a part of President Obama’s FY 2011 budget.\textsuperscript{12}

Although there have been 14 nuclear loan guarantee applications submitted since 2005, only one $8.33 billion loan guarantee of the $18.5 billion for new reactor construction has been approved.\textsuperscript{13} An
additional $4 billion has been set aside for uranium enrichment facilities, $2 billion of which has been conditionally awarded to AREVA for an enrichment plant that it hopes to build in Idaho.

If a recipient company defaults on their loan, the FFB pays the remainder of the debt and repossesses all of the assets from the unfinished project. The company’s other assets may be seized as well, but the limited liability companies that are legally responsible for new reactors typically do not have much collateral. The Office of Management and Budget (OMB) has estimated that only 55 percent of the loan can be recouped from the sale of project assets (raw materials, etc. that were already purchased).

An additional barrier to reckless corporate behavior is the credit subsidy fee, mandated under section 504(b) of the Federal Credit Reform Act of 1990 (FCRA). It stipulates that an applicant with a fully federally backed loan guarantee must pay a credit subsidy fee, “meant to protect taxpayers from the risk of federal credit programs.” The cost of the fee is determined by DoE with guidance from the OMB based on the “current value of risk of default.”

When nuclear loan guarantee supporters want to downplay the public’s fears that these loan guarantees are risky; they argue that the credit subsidy fees are high enough to cover the risk default. Arguably, the Calvert Cliffs 3 project’s 11 percent credit subsidy fee is a good example of this, but Constellation Energy, the utility company in charge of it protested the 11 percent as too high. The industry complains that the fees are much too high when they want to secure specific loans, and argue that the program is impractical unless the credit subsidy fees are set at 1-1.5 percent of the loan.

If determined realistically, the credit subsidy can hedge against the risk of default. When the credit subsidy cost is too low, however, “taxpayers are at risk because if the borrower defaults and the credit subsidy fee is not sufficient to cover the losses, the shortfall must be covered with higher future taxes, lower future government benefits, or cuts in other spending.” DoE chooses not to disclose the credit subsidy fees for nuclear loan guarantees, but Energy Secretary Chu has publicly stated his expectation for credit subsidy fees to be between the industry supported 0.5-1.5 percent of the loan guarantee.
To understand how high or low the credit subsidy fee should be, it is critical to identify whether the state utility is a regulated or a merchant system. In a merchant system, the utility company is required to sell their electricity at market price, which is lower than the state regulated utility rate. In a regulated state utility, private utility companies have the option of asking the state utility board for permission to set rates above market price to compensate for fluctuations in demand, as well as charge ratepayers in advance for construction. For example, on top of the $8.33 billion loan guarantee Georgia Power Co./Southern Co. received for their two new Vogtle reactors, ratepayers in their jurisdiction will pay the additional $6.1 billion needed through pre and post- construction rate hikes. Investors consider utilities in regulated state systems to be a safer investment, because revenues are mandated through rate controls. Although the merchant system encourages competition, the fluctuation of market energy prices is riskier for investors. For this reason, the credit subsidy fee is higher in merchant utility states than in regulated utility states.

The Case against Federal Commercial Energy Loan Guarantees, Especially for Nuclear

There are four reasons not to increase federal clean energy loan guarantees. First, the risk of default for new energy projects is generally higher than admitted by project advocates, and nuclear’s risk of default is significantly higher than most. Second, contrary to those who argue that loan guarantees pump more capital into the market, such mandated financing reduces the amount of money available for more promising projects. Private investors flock to government backed projects, irrespective of the project’s inherent merits, siphoning capital away from unsubsidized projects that are potentially more viable and could succeed if it were not for the government’s distortion of market signals. This also reduces the overall rate of energy technology innovation. Third, with the most capital intensive of commercial energy projects – e.g., clean coal and nuclear – the political costs of admitting they might be failing discourages government officials from taking timely action to terminate the projects even when the signs that they are failing are clear. A modern day example is federal support for money losing corn ethanol production, where the federal government has simply mandated increased production and consumption by law and, more recently, the
Solyndra project.

Finally, there is a unique cost for increasing loan guarantees to new nuclear power projects, which relates to nuclear weapons proliferation. Before passage of the Energy Policy Act of 2005, U.S. officials insisted that oil and gas-rich Iran’s investment in nuclear power had no economic justification. This argument made sense and put Iran on the diplomatic defensive. Shortly after the passage of the Act, which substantially increased federal subsidies for new nuclear power plants, though, the U.S. backed off this point. Now, it no longer is an argument the U.S. can make without appearing hypocritical.

Loan Defaults

Of all the arguments against making more loan guarantees, the most powerful one turns on just how many more Solyndras — i.e. defaults — are likely. When you examine what those most informed about the nuclear industry say, specialists such as credit raters and government auditing entities, they all project a high likelihood of default. The Congressional Budget Office (CBO) has warned that federal loan guarantees for new nuclear plants are particularly risky because of the significant frontloaded capital costs associated with their construction, which translates into billions of dollars lost if a reactor defaults. These risks might be tolerable if the estimated rates of default for new nuclear projects were low; unfortunately, the reverse is the case. First, in 2003 the CBO determined that default rates could be as high as 50 percent. They have since replaced this estimate with a list of variables affecting default that evades making any specific estimate of the likelihood of new reactor defaults. The 2011 CBO report does state that higher equity financing lessens the default risk, but at 20 percent equity, new reactors do not have very much collateral equity. Given the historical reactor construction default record, the 50 percent default rate is not hard to believe. During the 1970s nuclear boom, half of the 200 reactors ordered were never completed. For the reactors that were actually completed, their actual cost was two to three times more than their projected cost. The construction time period for building these reactors also ended up being much longer than anticipated. This pattern of frequent defaults and significant time and cost overruns is likely to continue (see Figure 1).
Second, nuclear utilities seem worried enough about the prospect of defaulting that they’ve organized themselves to limit the possible financial fallout they might suffer. As the CBO noted in its August 2011 study, “utilities that invest in nuclear power may be able to limit the liability to their shareholders—and thereby increase the risk to the government—by structuring their nuclear facilities as legally separate entities.” Most nuclear loan guarantee applications were submitted through a limited liability company (LLC), a legally separate subsidiary of a larger parent company. The key reason to organize themselves this way is to reduce risks. As one legal counsel notes, the parent company of an LLC bears, “little risk...of being found liable for the negligence or wrong-doing of the subsidiary,” and, “Courts are not likely to permit a litigant to “pierce the corporate veil” of a corporation and reach the assets of its parent shareholder.”

While limiting liabilities this way is commonplace among private corporations, providing federal loan guarantees to such operations is risky to the U.S. taxpayer. This may protect the major stockholders of nuclear utility stock, but it’s dicey for the U.S. Treasury to back such operations. After all, the taxpayer must pay for debts incurred from default, but
can’t access the assets of the parent company. Under current law, when a project defaults private investors who funded 20 percent of the loan get paid back with the sale of assets before the U.S. taxpayer, who holds 80 percent of the project investment. The CBO has estimated that as much as 50 percent of the loan might be recouped by seizing assets, so after 20 percent of the project’s total cost is paid to private investors, what’s left on average would be no more than 30 percent of the DoE loan for the federal government. Based on these projections, the Treasury would have to pay an average of 70 percent of each defaulted multi-billion federal dollar loan guarantee.

Yet another way nuclear investors have revealed their fear of possible defaults is their unwillingness to pay the full costs of default insurance. Consider the Calvert Cliffs 3 debacle from late 2010. The Calvert Cliffs 3 application, submitted by Unistar Nuclear (an LLC under joint ownership by Areva and Constellation Energy), was selected as one of the four loan guarantee recipients. The project’s prospects for default in the merchant utility state of Maryland were higher than if it was proposed in a regulated utility market where utility companies can charge ratepayers for the construction costs before and after the plant is built. As such, the Department of Energy was forced to impose a significant credit subsidy fee for the loan.

In Calvert Cliffs 3’s case, the DoE set the fee at 11.6% of the $7.6 billion dollar loan guarantee. Even as nuclear critics complained that the fee was too low, Unistar objected that it was too high. In 2010 alone, Constellation increased campaign contributions to $4 million for various Congressmen and executive agencies in effort to lower their credit subsidy fee. Ultimately, rational minds prevailed, DoE balked at any reduction, and Constellation Energy pulled out of the project, citing an “unreasonably burdensome” credit subsidy fee. What this history suggests is that when the credit subsidy fee is set at a reasonable level, applicants see no advantage to seeking the guaranteed loan, and are not as interested in building nuclear plants.

This is referred to as adverse selection, and happens when “the likelihood that borrowers who have reason to think their project is
riskier than the guarantor believes it to be will accept the guarantee fee offered, whereas borrowers who believe their project is relatively safe will be more likely to decline the offer of a guarantee they view as overpriced.”33 Although companies with sounder projects may still opt for federal loan guarantees, companies with risky projects are most likely to pursue a federal loan guarantee because their only other option is to cancel the project.34

The result is a heavy concentration of risky projects in the federal government’s portfolio.

This assessment is hardly speculative. Bond rating companies, like Moody’s, Standard & Poor’s, and Fitch Ratings, who examine the creditworthiness, or financial health, of electric utility companies on a regular basis, routinely confirm the risk in backing many of these companies with their corporate bond ratings.35 Based on S&P’s rating system, AAA is the highest rating, and D is the lowest rating. Each letter indicates a different degree of the obligor’s ability to meet their financial commitments. The lower the rating, meaning the further down the alphabet and the fewer total letters, the less likely a company is expected to repay their debts. Bonds rated below BBB- are considered non-investment grade, or “junk” bonds.36 Corporate bond ratings indicate a company’s creditworthiness and also impact borrowing interest rates because the lower the bond rating, the higher premium a company is charged for borrowing money.37

The bond ratings of the final five parent companies that recently received federal energy loan guarantees were CCC, BB-, BBB-, BBB+, and A.38 Non-recipient applicants who completed both parts of the loan guarantee process had credit ratings ranging from A- to BBB-. Alarmingly, two of the five companies approved for loan guarantees were rated junk status, and a third was on the cusp.39 The two companies with the lowest credit ratings of the entire group were selected to the last round. Some of the companies with the best ratings didn’t even apply for a loan guarantee. Whatever the method of distributing loan guarantees, it is obvious that the recipients selected include the applicants most likely to default. This illustrates adverse selection because the least creditworthy companies have the most to gain from a federal loan guarantee.
The Logic of Overriding Market Signals and Creating New Capital: A Myth

Corporate bond ratings are important for determining the cost of capital, which drives where money is invested. Government intervention through subsidies distorts these market signals, which is one reason why market respondents, such as venture capitalists, make more economical decisions than the federal government. When the government subsidizes one portion of the market, what they subsidize becomes the safest investment, regardless of the actual merits of the project. A venture capitalist’s sole purpose is to earn a return, so when there are

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fewer distortions, they more likely to invest in what is most likely to succeed. The government’s purposes span a range of interests, often conflicting with bottom line profits. It is sometimes argued, though, that the federal government must intervene in the market because some projects are so capital intensive, they would not be built without federal support. However, the high initial capital requirement is no excuse for government intervention because recent history suggests otherwise. The Alaska pipeline project was privately financed at $7 billion ($35 billion in 2007 dollars).

It also is argued that since the Federal Reserve can print and distribute money, so too, can the federal government easily create and allocate net new capital. If true, this would provide financing for risky projects without impeding the resources available to finance sound projects.

Unfortunately, loan guarantees do not increase the overall capital available in the market; they do the reverse. There is only a finite amount of capital in the market, so loan guarantees hog capital that might have been available for privately viable projects. By the law of supply and demand, limiting the supply of capital increases the cost of borrowing for others in the market.

Investors will always put their money behind government supported projects before private ones. As the Government Accountability Office
has noted, “guarantees would make projects it (the federal government) assists financially more attractive to private capital than conservation projects not backed by federal guarantees. Thus both its loans and its guarantees will siphon private capital away...”

Investors prefer government supported projects because they will get their money back even if the project defaults. If not for government interference in market signals of risk, these venture capitalists may have chosen to invest in more viable, innovative technological startups.

Why, then, do federal loan guarantee programs enjoy so much support? Besides the factors already detailed, lobbying is also a major consideration. Although corporations claim they don’t dictate political agendas, they try by spending billions of dollars to secure favorable federal support. To use Constellation Energy’s Calvert Cliffs 3 loan guarantee again as an example, Constellation Energy contributed $3.97 million in 2010 when the conditions of their loan guarantee were being finalized. $3.97 million is a $1.47 million increase from 2009, and $2.3 million more than 2011 contributions. H.R. 2454, described in Constellation Energy’s lobbyists’ reports as, “Issues related to nuclear loan guarantees, foreign investment and global climate change,” was the second most cited legislation in 2010 lobbying reports.

A Word on Carbon

Some environmentalists and industry officials argue that the economic case against nuclear energy loan guarantees ignore the value of nuclear’s zero emissions because no price (tax) has yet been set for reducing carbon. This, however, ignores the analysis and conclusions industry itself have

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**Figure 4**
The past price and futures price (from the NYMEX) of natural gas, per million BTU

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![Price of Natural Gas Past and Futures](chart.png)
made, John Rowe, the president of Exelon, the largest merchant nuclear utility in the U.S., recently noted that his firm’s ability to close and swap dirty coal plants with cleaning burning natural gas-fired plants made building new nuclear reactors uneconomical for the next decade or two. This is especially true in light of the declining electricity consumption and the price of natural gas (see Figures 4 and 5). Of the most economical methods of carbon abatement, McKinsey and others have determined that new natural gas plants, energy efficiencies, and even nuclear upgrades are the best. New nuclear reactors are one of the most expensive methods of carbon abatement, and take much longer to build than natural gas plants (5 years for nuclear, 18 months for natural gas).

Conclusion

Loan Guarantees: Less Please

Mr. Rowe has also argued against expanding the federal energy loan guarantee program. He says expanding the program is unnecessary, and he has a good point. $18.5 billion in loan guarantees has already been set aside for new nuclear construction, and yet only one loan guarantee has been disbursed in the six years since the passage of EPACT 2005. With $10 billion remaining, the expansion of loan guarantee funds will add unnecessary risk to the federal government’s portfolio. As already noted, the companies now slated to receive loan guarantees are also some of the likeliest to default. Keeping the current
loan guarantee ceiling, then, risks little. Certainly, the longer the further expansion of federal energy loan guarantees is put on hold by Congress, the stronger the facts against loan guarantees will resonate.

**Endnotes**

1. Loan guarantees are only one of more than twenty-three different government subsidies to the commercial nuclear industry.


9. Other renewable sources have the cost spread out over the life of the project, making the cost of failure much lower. Cap investment in renewables is also front-loaded.

10. U.S. Department of Energy, DOE Title 1703 Loan Programs, lpo.energy.gov/?page_id=39. Private investors are unwilling to fund risky endeavors because of the likelihood of failure will result in a large financial loss. The benefit of dumping this risk onto taxpayer funded Federal Financing Bank is not clear.

11. Utility companies with sizeable foreign state investors will turn to foreign export credits to finance much of the remaining 20% of the loan. In effect, the new reactors are financed solely on debt, limiting the company’s liabilities by reducing the assets DOE is able to seize. See B.J. Csik, “The Challenge of Financing Nuclear Power Plants,” International Atomic Energy Agency, IAEA-SM-353/9, p. 80, www.iaea.org/iniis/collection/NCLCollectionStore/_Public/31/007/31007028.pdf. Some nuclear utilities are joint holding companies between domestic and foreign entities, so the remaining 20% of the projects can be financed by foreign debt. Even though the US gov. guarantees 80% of the project, the federal gov. guarantees 100% of the loan (companies take multiple paths of financing, including loans not exceeding 80 percent of the total project that is covered by the US gov. and foreign export credits/selling corporate bonds/equity/private capital investment for the remaining 20 percent).

13. The loan guarantee was approved for two additional reactors at Georgia’s Vogtle plant. Commercial nuclear energy is a mature industry; although the industry claims regulatory uncertainty, their commercial representatives boast of the simpler design and enhanced safety features of third generation reactors. Since regulatory hurdles are frequently safety related, the enhanced safety features should withstand scrutiny from the Nuclear Regulatory Commission. The commercial nuclear industry’s $18 billion in nuclear loan guarantees should be adequate to process through new regulatory uncertainties.

14. The government then has the option of selling off the assets if the project is not operable, or taking over operation if the project has been completed. Since the loans for large commercial projects are often large, a company can still default on its loan if their completed project is more expensive to operate than their combined revenue.


17. Ibid.


19. The public will have a hard time determining exactly how adequate of a hedge the credit subsidy fees are, because they are kept private unless a company chooses to disclose the amount.


21. See “Unlimited Taxpayer Liability,” Union of Concerned Scientists. The credit subsidy cost is a crucial aspect of the loan guarantee because it is taken into serious consideration by companies competing for loan guarantees. Of the two nuclear loan guarantee applications approved, one company rejected the loan guarantee because of the credit subsidy fee, and the other credit subsidy fee remains undisclosed. Note that the subsidy fee that was rejected was along the lines of what Congress assumed for renewable projects (likely lower risk than nuclear) in the ARRA funding.


23. Constellation Energy’s Calvert Cliffs 3 project is an example of a credit subsidy fee which was set higher than they anticipated at 11.6%, resulting in their defection from the loan guarantee program. They cited the costliness of the credit subsidy fee as the reason for their decision.


32. Ibid. $4 million in lobbying was significantly more than the years prior and contributions in 2011.


34. This is especially true for companies in merchant utility states.


36. Ibid.

37. This process is most valuable because of its efficiency in evaluating and allocating capital across the risk spectrum to ensure balance of maximum innovation and success.

38. Junk bond status is defined as lower than BB. CCC- is defined as in default with little prospect for recovery.


40. Data from Vazza et al., “2010 Annual Global Corporate Default Study.”


43. Ibid., 154.


Let’s Reset Our Energy Policy
Starting with Loan Guarantees

Mike King and W. David Montgomery

It’s fashionable today in the name of reducing the federal deficit to suggest budget cuts. What’s too often overlooked is eliminating off-budget funding of questionable or, even worse, money-losing commercial ventures. A prime example of such is the Department of Energy’s clean energy federal loan guarantee program.

If Congress and the White House were serious about cutting unnecessary financial commitments, they could start by eliminating this program that has a dubious policy rationale and checkered past. And there is no need to stop with loan guarantees. Even more radical elimination of subsidies for favored forms of energy investment could save hundreds of billions over the next decade and improve the performance of the economy. The idea behind all these reforms is to level the playing field for all forms of energy, so that they would compete based on their ability to meet environmental and energy goals rather than on their ability to deal in favors for particular interests.

The starting point for this more ambitious agenda might be where the public spotlight is brightest and where the tilt in the playing field is least connected to systematic energy or environmental policy objectives. After the Solyndra controversy, the spotlight is clearly on federal clean energy loan guarantees, but not always for the right reasons. The waste of taxpayers’ money on Solyndra has attracted attention, but the problems of loan guarantees are more fundamental than one, or even several, failed projects.
From a first principles point of view, loan guarantees are a solution seeking a problem. No one has identified a valid set of problems that they are intended to address. Rather, one hears a litany of excuses, usually a unique market failure that prevents some particular kind of project or technology from moving forward.

Unlike the broad externalities that justify environmental policy in general, such as the public goods nature of clean air and energy security, there is an ad hoc flavor to the excuses given for loan guarantees. A frequently encountered excuse is lack of access to capital for early stage (e.g. unproven) technologies. But it is far from clear that providing low-cost debt financing is the right solution. There are plenty of private sector funds that invest in early stage technologies, and they presumably have capabilities to manage the flow of funds, development of companies and technologies, and track record necessary to do so. What competency does the government have to provide this support, especially when it is denied by those more expert firms? In fact, it is more likely that the incredible bureaucracy associated with dealing with the LGPO, Treasury, and OMB stifles the development of the company and its technology. What is necessary for success in the marketplace: entrepreneurship or the ability to navigate (and manipulate) the government? The Solyndra affair does suggest the answer to this question.

A bigger issue is the complete lack of competence in the government to judge the prospects for a company or technology – and the strong pressures to make the award based on political connections and Congressional interest in local pork. Private industry has built the infrastructure to assess and manage risk: It is called the financial services industry. It takes time, effort, and resources to build the institutions, human and intellectual capital and processes to look at an opportunity, assess its risk, and price capital. And that expertise and experience can’t be built overnight, or even in a year or two in the government. Further, those financial institutions, who are expert at identifying, managing, and pricing risk, take into account the likelihood that some elements of the portfolio will fail. Hence, the cost of the capital reflects a margin adequate to cover the risk of default. Some of the projects in the clean energy loan guarantee program are generation projects backed by power purchase agreements with
credit-worthy counterparties. Since there is much less risk in those projects than in entrepreneurial ventures to prove a new technology, the case for providing subsidized capital is hard to find. For the plants that manufacture clean energy equipment there is the merchant risk that they may not be able to survive while pricing their product competitively and lots of it. So why is it a good idea to extend debt at a below market rate when the risk of repayment is so uncertain? The private market is available to these folks; it just allocates the capital appropriately (e.g. venture capital for an equity stake at a high price to reflect risk versus debt at the federal T bill rate plus 220 basis points).

Some of the abuses that became quite apparent when energy loan guarantees appeared in the 1970s have been addressed, so that it is no longer quite so easy to use loan guarantees to hand out subsidies without any accountability in the budgetary and appropriation process. Nevertheless, that loan guarantees are contingent commitments to future payments makes their numbers easy to manipulate in budget and deficit games.

Some programs, including the clean energy loan guarantee program, are subject to rules intended to prevent them from being a pure giveaway to companies that do not need financial support. These rules require that it be commercially infeasible to obtain financing from normal sources and that the project and technology have a high probability of success. With capital markets that are either efficient or excessively prone to risk-taking these conditions will only exist when a company’s balance sheet or management are judged to be so poor that they cannot be trusted to complete even a potentially economic project. Thus adverse selection is built into the rules.

Adverse selection implies that even if the Department of Energy is required to charge an actuarially fair fee, the resulting collections are not likely to cover actual defaults. This is because financially sound companies that are confident they have a profitable prospect will forego the loans, and unsound companies or those with technologies on which they do not want to risk their own money will take the loan guarantees up. As Solyndra has proved, a bit of an interest rate subsidy will not be enough to cover a fundamentally flawed business plan that anticipated further government action to make the ongoing business profitable.
Thus the loan guarantee program has become an exercise in organized hypocrisy that perverts incentives of economic “experts” as well as promoters and politicians. It becomes necessary for promoters to plead poverty, because if a project is “bankable” through ordinary financial intermediaries it cannot receive a loan guarantee. The loan guarantee program, in short, is designed to skew the playing field in favor of badly run companies with poor credit and against successful, well managed ones.

Critics of loan guarantees who observe this bias often point out that loan guarantees would be unnecessary if the technology in question were as good as its promoters claimed. The need to address this criticism in turn creates demand for analysts who can describe the “market failures” that keep good projects with good management from being able to raise capital by normal means. The resulting controversy then forces legislators to evaluate arcane arguments about “principal-agent” problems and the “economics of information” — or leaves them free to pursue pure rent-seeking with assurance that their cover is so arcane that in no specific case can it be refuted with any clarity. And it is always possible to hope that the government will get its money back. All this makes the consequences of loan guarantees easy to conceal from voters and a highly attractive means of distributing the technology pork barrel.

Loan guarantees, then, by their very nature lead to a misallocation of government support for new technologies. They shift priorities for government funding into support for commercial enterprises intended to produce energy or equipment, when a valid application of reasoning about market failures in R&D leads to the clear conclusion that most government funding should go to early stage R&D and not to commercial deployment of uneconomic technologies. Indeed, the rent seekers and their political allies are quite happy to starve research and development for funds in order to move as much as possible into large scale commercial enterprises where money can be made and votes claimed.

It is not just loan guarantees for doomed ventures and technologies that are draining the budget. The Department of Energy administers a wide variety of direct loans and grants that have the same effect of distorting the playing field in favor of energy sources and equipment
producers with political clout. There are massive tax expenditures for producing favored forms of energy and for household and business purchases of particular kinds of energy efficient equipment. There are also hidden costs, which drain consumers’ pocketbooks and divert investment away from productive purposes. These costs are imposed by the regulations and mandates that order car manufacturers, fuel producers, electric utilities and ordinary people to bear higher costs in order to benefit specific energy interests, from small oil producers to manufacturers of more costly light bulbs. Eliminating these mandates and regulations would not only relieve businesses and consumers of those burdens, but also produce additional tax revenue as the economy is free to grow more rapidly.

Based on data in the 2013 Budget of the United States, eliminating loans and loan guarantees would eliminate about $5.5 billion of federally sponsored borrowing and $46 billion in direct loans that would be outstanding in 2013. Eliminating all programs in the Department of Energy beyond basic research that are designed to support favored energy activities – loan guarantees, commercialization programs, grants and support for national laboratories — would reduce spending by $22 billion in 2013 and about $100 billion from 2013 to 2022. Repealing regulatory authorities would produce small but useful reductions (perhaps $100 million) in spending on the actual regulator’s salaries and expenses, and more importantly would free up income and capital for more productive uses throughout the economy. Eliminating special tax treatment for selected types of energy production and efficiency investments could increase revenue in 2013 by about $11 billion. In total, savings for 2013 alone could total $33 billion in lower spending and increased tax revenue and a reduction of over $50 billion in additional indebtedness.

The industries enriched by these programs, the members of Congress who use them to be re-elected, and the self-appointed gurus of energy efficiency will all complain that these actions will leave the United States without an energy policy. That is the whole point of a reset: To move from a dysfunctional and prejudiced system to a set of neutral incentives that would let markets help make the selections necessary to update and optimize America’s energy mix for energy security and carbon abatement.
There are, in fact, two ways to restart energy policy that can deal with both the legitimate policy goals of energy security and environmental protection. They are an oil import fee and a carbon tax. An oil import fee in the range of $10 per barrel would increase incentives for domestic oil exploration and development, for less driving and for production of more efficient automobiles. A carbon tax of $10 per ton on all fuels burned in the United States would provide a uniform incentive across the economy to conserve energy in proportion to its carbon content, substitute lower carbon fuels and processes, and develop low carbon technologies for the future. These policies would address the true issues of energy security and environmental protection and end the hypocrisy of pork barrel programs masquerading as solutions for energy and environmental policy.

Taking advantage of these revenue sources would also provide $1 trillion in truly additional revenues over the next 10 years. Substituting economic incentives for regulation of energy use would reduce the deadweight loss of energy policy by over 80%. And, if backed by a commitment to veto any attempt to replicate existing pork-barrel programs by means of exemptions and special provisions of the two taxes, the reset would break the hold of re-election seeking politicians and the lobbyists that support them over energy technology choices.

Of course, even without carbon taxes and oil import fees, getting rid of loan guarantees could produce substantial savings without weakening energy security or environmental achievements. But once one gets started by clearing the deck of loan guarantees, it would be sensible to go further.
The Energy Innovation Environmental Case against Loan Guarantees

Ben Schreiber

Catastrophic climate change is perhaps the biggest environmental crisis that humanity has ever faced. It will take real political commitment to mobilize the resources necessary to avoid the worst impacts of climate change. Like the Apollo Project of the 1960s, which turned a national vision into reality within ten years, the federal government will need to play a central role in making the transition to clean energy.

Renewable energy and energy efficiency technologies, and especially distributed renewables, must be scaled up dramatically to replace fossil fuels. There is no silver bullet for doing this; it will take a suite of policies including regulating greenhouse gases, putting a price on carbon (preferably with a carbon tax), and economic incentives like a feed-in tariff to ensure a stable market for distributed renewable energy. Government action is necessary to regulate emissions and impose a price on carbon, and there is also an important role for the government in financing renewable energy and efficiency.

But given the urgency of the climate crisis, we do not have time to waste, or money to spare, on the wrong technologies, and we certainly cannot continue to subsidize dirty and dangerous forms of energy. The Department of Energy’s Title XVII Loan Guarantee Program is guilty of both these transgressions. That is why we need to eliminate Title XVII and replace it with policies like regulations on greenhouse gases, a carbon tax and a feed-in tariff that will effectively lead to deployment of renewable energy and efficiency technologies at a significant scale.
The Title XVII loan guarantee program

Title XVII was created in the Energy Policy Act of 2005.¹ Billed as a way to get a small number of innovative, low-emission technologies off the ground, in reality the program has always been little more than a taxpayer handout for mature and environmentally harmful technologies that cannot compete on the open market. In 2005, many in the environmental community, including Friends of the Earth, as well as members of Congress on both sides of the aisle, strongly opposed the creation of Title XVII.

The program grew out of an unsuccessful attempt by the nuclear industry, which had problems raising private capital for new reactors, to get a nuclear-specific financing program as part of the Energy Policy Act of 2003. This industry-specific program did not gain political traction, so the nuclear industry’s champions in Congress broadened the scope of the program in the 2005 bill. While new technologies were included, the program’s structure remains designed to meet the needs of the nuclear industry.

In 2011, Congress stripped away any pretense that the program benefits clean technology by eliminating $17.3 billion in financing authority for renewable energy and energy efficiency, while leaving all the authority for nuclear and coal intact.² Today $32.5 billion of the $33.68 billion of loan guarantee authority in DOE’s permanent program has been earmarked for the coal and nuclear industries — a far cry from the program’s purported objective of spurring new, innovative, and clean energy.

Title XVII has become best none fora temporary (and now expired) program for renewable energy projects that the 2009 stimulus bill tacked onto the existing Title XVII framework. While the stimulus program funded some good projects, as well as some well-publicized failures, it did nothing to address the fundamental flaws of Title XVII. As a result, taxpayers have lost hundreds of millions of dollars on three stimulus program guarantees, and the solar technologies that are desperately need to fight climate change have taken a public relations beating. Many in Congress used the Title XVII Solyndra scandal as a broadside attack on renewable energy, but few members of Congress have worked to fix the structural flaws of the loan guarantee program.
Investigations into the program have made it clear that members of Congress in both parties view the loan guarantee program as a means of bringing pork home to their district, with no regard to the merits of the projects they push.

Not the program we need for renewables

Because of its structure, Title XVII is more advantageous to dirty and dangerous technologies like nuclear reactors and coal than it is for renewable energy or energy efficiency. Even if the program were dedicated entirely to renewable energy, it is poorly suited to develop the small distributed generation that is key to avoiding climate change. Key reasons include:

• Many renewable projects do not qualify: Onshore wind technologies, for example, do not qualify for loans under Title XVII because they do not meet the definition of innovative. While many renewables projects do not qualify, mature technologies such as liquid coal and nuclear reactors, which have been around since the 1940s and 1950s respectively, are defined as “innovative” under Title XVII.

• The program advantages large projects: Under DOE’s rules for Title XVII, a technology is eligible to receive loan guarantees until three projects of the same design have been in commercial operation in the United States for 5 years. For projects such as nuclear reactors, that will take a decade or more to construct, this means that many projects of the same design can receive government loan guarantees. Renewable and efficiency projects can be brought online in two years or less, so a relatively small number of those projects would be eligible for loan guarantees. It is especially perverse that the program benefits projects with long construction times, because the cumulative nature of carbon emissions means that reductions achieved today are more valuable than those achieved a decade from now.

• The size of renewables projects means less generating capacity is created: An individual nuclear reactor or coal facility has a much larger generating capacity than an individual renewable or efficiency project. If the same number of projects of each technology received loan guarantees, the effect would be to increase megawatts of nuclear and coal-generated energy relative to those generated by renewables.
Exacerbating this situation, funding for all renewable energy technologies is lumped with transmission into a single category, while dirty technologies like nuclear reactors and coal each have an individual category, or even categories, for funding.

Furthermore, in order for the government to perform the due diligence necessary to protect taxpayers on such risky investments, loan guarantees have a high administrative cost for both the company and the government. That means that loan guarantees are more suited to mega-projects, and DOE has an incentive to provide guarantees for a small number of expensive projects. Even if the program were funding only renewable energy projects, it would be predisposed to invest in large utility-scale projects and not in smaller distributed generation.

**Structured as a money loser**

The fiscal problems that have arisen out of the stimulus loan guarantees were obvious to anyone who was willing to look at the program with a critical eye. There should be a role for government financing of projects, but public finance should only be used for safe and environmentally beneficial technologies. Title XVII supports a myriad of dirty projects and its structure makes it a giant risk to taxpayers because it:

- **Backs intrinsically risky projects:** Loan guarantees by their nature back projects that cannot obtain affordable financing on the private market. This means that Title XVII is designed to take on a portfolio of uncreditworthy projects, and its bias towards nuclear power heightens this risk. Nuclear reactors have been projected to suffer a default rate of over 50 percent, and are not commercially viable without a large and persistent suite of subsidies designed to reduce costs and liabilities.³

- **Is biased towards underestimating project subsidy costs:** Title XVII is designed to be largely self-financed by requiring companies to pay a fee, called the project subsidy cost, to the U.S. Treasury before receiving their guarantee. The project subsidy cost is difficult to calculate, so DOE likely overestimates the project subsidy cost for some applicants, and underestimates it for others. According to the Congressional Budget Office, borrowers “may turn down a guarantee if they believe DOE’s fee is too high but go forward if they consider [it] too low. This also makes it
more likely that DOE’s loan guarantee portfolio will have more projects where the subsidy fee has been underestimated than overestimated.\textsuperscript{4} As a result, DOE will likely not charge enough fees to cover the costs of defaults for the entire portfolio.

- \textit{Is mandated to approve projects:} According to CBO, if a company receiving a loan guarantee were truly paying the full project subsidy cost up front, then the company would be able to get the same terms on the private market and there would be no need for the program. However, by design, DOE provides loan guarantees to projects that cannot get private financing, thus shifting risk from Wall Street onto taxpayers. Since DOE’s mandate is to get projects out the door, and because the program often comes under political pressure to approve certain deals, there is a built-in programmatic incentive to underestimate the project subsidy cost.\textsuperscript{5}

**Implemented to increase risk**

As designed by Congress, Title XVII is risky for taxpayers because it puts tens of billions of dollars at jeopardy. Yet the technologies that DOE is backing are so financially unsound that the meager taxpayer protections contained in the bill made it impossible for many loan guarantees to be approved. To get around this DOE has implemented Title XVII in ways that shift additional risk to taxpayers including:

- \textit{Skirting guidance designed to protect taxpayers:} The final rule for implementing Title XVII ignores OMB safeguards that are intended to protect taxpayers. In EPACT 2005, Congress limited the amount the government can guarantee to a maximum of 80 percent of a project’s cost. This ensures that any company building a project has a financial stake in it.\textsuperscript{6} The Office of Management and Budget guidance also recommends that “private lenders who extend credit that is guaranteed by the Government should bear at least 20 percent of the loss from a default” to subject them to risk and provide an incentive to perform due diligence before lending.\textsuperscript{7} In other words, no more than 80% of any loan (not the project cost) should be guaranteed. However, DOE’s final rule for Title XVII allows for loan guarantees to cover 100 percent of a loan (not the project cost). This eliminates the incentive for private lenders to perform due diligence — an important taxpayer safeguard.
• **Allowing the build-up of technical risk in the portfolio:** DOE’s rule further increases risk to the U.S. Treasury by allowing multiple projects to go forward using the same untested and potentially flawed design. This concentrates risk within the portfolio, and means that taxpayers could end up on the hook for a multitude of the same failed projects.

• **Eliminating taxpayers’ preferred creditor status:** The language of EPACT 2005 explicitly says that taxpayers’ rights “shall be superior to the rights of any other person with respect to the property.” A plain English reading of this provision would be that in the case of default, the U.S. Treasury has the right to recover their losses before other creditors. However, in interpreting this rule, DOE has weakened this safeguard by voluntarily giving up the right of first lien and sharing any money recovered “pari passu,” or in proportion, with the holders of the non-guaranteed portion of the loan. This is the same flawed logic that DOE applied in administering the synthetic fuels loan guarantee program of the late 1970s and early 1980s, the last time it issued loan guarantees. The synthetic fuels corporation ended up costing taxpayers billions of dollars.

The federal government has an important role to play if we are to have any chance of avoiding the worst effects of climate change. Unfortunately, Title XVII takes the wrong approach to energy finance so it should be eliminated. The program is subject to pork barrel politics, risks taxpayer money and creates incentives for dirty and dangerous energy projects like nuclear reactors and coal plants. It is also ill-suited to creating a system of small distributed renewable energy or increasing energy efficiency. We simply cannot afford to make missteps like this if we are going to have any chance of effectively fighting climate change.

Today, the biggest impact of the loan guarantee program is not any progress in solving the climate crisis but rather the damage it has done to the reputation of renewable energy. The harm caused by the Solyndra scandal is significant and it has made success in the fight against climate change more difficult. If we do not end the program, however, the damage to the environment could be much worse. DOE is moving forward with issuing loan guarantees for the Vogtle nuclear reactor in Georgia, the Kemper coal gasification project in
Mississippi and the Medicine-Bow liquid coal plant and associated coal mine in Wyoming. These projects would take us backwards in our fight against climate change and diminish our chances of success. This flawed program should be ended immediately and replaced with proven policies including regulations on greenhouse gases, a carbon tax and a feed-in tariff that will lead to real emissions reductions now.

**Endnotes**

5. “Having a federal loan guarantee would lower the cost of capital and improve a project’s viability if the credit risk is shifted to the federal government. However, requiring the borrower to pay the subsidy fee shifts most of that risk and cost back to the project, leaving its creditworthiness largely unchanged. Because such projects are either uneconomic or marginally so without the guarantee, there is a practical limit to how large the subsidy fee can be without jeopardizing the project’s financial prospects. In addition, prospective borrowers will have imperfect information about the risk associated with their proposals and may turn down a guarantee if they believe DOE’s fee is too high but go forward if they consider to low. This also makes it more likely that DOE’s loan guarantee portfolio will have more projects where the subsidy fee has been underestimated than overestimated.” Ibid.
10 Ibid.
I would like to thank Chairman Kucinich and Ranking Member Jordan along with other Members of the Subcommittee for allowing me to testify before you today on whether creating additional federal loan guarantees for new civilian nuclear energy plants is advisable. My short answer to your committee is that it’s a bad idea.

My own nonprofit organization, the Nonproliferation Policy Education Center (NPEC), just completed a two-year assessment of the economics of building new civilian nuclear energy plants. This project, Weighing the Costs and Risks of Nuclear Power’s Global Expansion, was funded by four national foundations with very different political outlooks — from very conservative to very liberal — and commissioned over 20 of the world’s leading energy economists to assess the economic costs and risks of new reactor construction and operations. These experts’ general conclusion was that the best way to promote the optimal mix of energy types was to rely more on market mechanisms and to back off piling on more government financial incentives to promote the commercial deployment of nuclear power or any other specific energy type.

Their findings turned primarily on nuclear power’s key disadvantages — its relatively high capital construction costs. If nuclear power
is to have any viable economic future against its alternatives, its construction costs must come down and it must build a strong enough record of success to attract substantial private investment. In this regard, reducing market pressures on industry to compete for financial resources by extending federal loan guarantees is only likely to make matters worse.

This, then, brings me to your committee’s four questions:

1. **Are cost overruns in the construction of nuclear power plants a thing of the past?**

If we understand what is happening in Finland, France, Canada, the U.S., and China, the short answer is no. In Finland the French government owned nuclear vendor AREVA is trying to complete its most modern reactor for a turnkey price. This project was supposed to prove that nuclear power reactors could be built on time and on budget. So far, the project is more than three years behind schedule and roughly 80 percent over budget. In France, the state owned utility company Électricité de France (EDF) is struggling to keep construction of a similar reactor, Flamanville 3, on schedule. French nuclear regulators have raised questions regarding one quarter of the welds in the reactor’s secondary containment shell and found cracks in the reactor’s concrete base. At one point, French regulators actually suspended the pouring of concrete at the site. The project is now reported to be running more than 20 percent over budget and at least 2 years late. In Canada, last summer, the government of Ontario put its nuclear plans to build two large power plants on hold after receiving a $26 billion bid that was nearly four times higher than the $7 billion the government originally set aside for the project only two years before. In the U.S. actual construction of new nuclear reactor designs has not yet gotten underway. However, projects at an advanced stage of planning have seen their cost projections soar. In the U.S., the estimated cost of two reactors that Toshiba is planning to build for NRG Energy and the city of San Antonio recently jumped from $14 billion to $17 billion. As a result, the city board sued NRG. High-end estimates of the full costs to bring a new nuclear plant on line reflect this pattern of cost escalation, as San Antonio’s experience has been replicated in many other places. As a result, estimated construction costs (exclusive of financing) for an installed kilowatt have jumped from a little over $1,000 in 2002 to well over $7,000
in 2009. China, meanwhile, has over 20 reactors under construction including both French and U.S.-designed plants. The Chinese state published overnight construction cost projections for these plants are seductively low – between $2 billion and $3 billion for a single Westinghouse AP 1000. However, there are two reasons to question how relevant these projections might be for possible construction in the U.S.. First, the Chinese nuclear industry has experienced substantial corruption. Just last summer, Kang Rixin, the president of China National Nuclear Corporation, which is building AP 1000 plants, was arrested for his involvement in a $250 million bid-rigging scheme. Second, the AP 1000 plants China is now building are not ones that our own Nuclear Regulatory Commission would permit in the U.S.. In fact none of them meet the post-9/11 U.S. safety regulations. These require that new reactors be able to sustain direct hits by large airliners. What will these reactor designs look like and cost? We don’t know: Westinghouse submitted its design modifications to the NRC to meet the post-911 safety requirements last year but the NRC rejected them as being inadequate.

2. Why won’t Wall Street invest in nuclear power plants, and why does Moody’s call them a “bet-the-farm” investment?

For three reasons:

A. Projections of new nuclear plant construction costs are far higher today than several nonnuclear alternatives while the long-term requirements for ever larger numbers of base load generators – nuclear or nonnuclear – could easily decline as a result of energy technology innovation. The nuclear industry likes to say that future nuclear power plants are projected by selected analysts to be “competitive”. What’s competitive, however, is in the eye of the beholder and Wall Street is not buying the nuclear industry’s arguments. The bottom line reason why is nuclear power’s high costs compared with its alternatives. Domestic dirty coal is substantially cheaper than projected new nuclear. Meanwhile, domestic conventional and unconventional natural gas, which emits roughly half the carbon as coal, has become so plentiful and cheap domestically and internationally that it is almost certain in the near and mid-term to cost less than nuclear. Unlike nuclear, it will be able to service both peak and base-load demand. Here, it is worth noting that new natural gas projects have been able to secure private
financing, whereas new nuclear projects have not. As for renewables, their costs are still comparatively high but unlike nuclear – which has seen its projected overnight costs increase by roughly 400 percent in the last six years – the costs of renewables are coming down. Given that no new nuclear plants are likely to come on line domestically much before 2020 and these plants are designed to operate for 60 years, the danger of nuclear investments being devalued by new technical developments is real. Beyond the alternative generators and fuel types (gas, carbon sequestered coal, wind, solar, etc.) that are or could turn out to be cheaper than nuclear, systemic changes that could make nuclear and all large base load generators far less salient — electric storage systems, fuel cells, distributed electrical systems, etc. – might well emerge in the next ten to fifteen years. Betting that nuclear will break even financially or even make money through 2080 when nuclear power plants clearly cost far more to build now and take far longer to construct than cheaper alternatives is too large a gamble for private investors. Like U.S. public spending on canals in the early 1800s, which was undercut by the invention of the steam locomotive, the risk of investing in expensive long-lived nuclear plants is that energy innovations could easily wipe out the value of whatever commercial nuclear investments are made.

B. History has been unkind to nuclear power projects, with over half of all plants ever to receive construction permits in the U.S. being canceled. Most senior bank investment analysts are old enough to remember the financial disasters that followed the mismanagement of the construction of nuclear plants for the Washington Public Power Supply System (WPPSS). Here, project costs kept rising until they exceeded original estimates by more than 300 to 400 percent. The utility was forced to default on $2.25 billion in bonds. From the late 1960s on, over half of the nuclear plant orders in the U.S. were cancelled and almost ninety percent of the projected plants globally were never built. This trend and the prospect of a significant portion of new nuclear projects defaulting on their loans again have soured Wall Street’s enthusiasm for such projects. Certainly, the financial risks of construction and management errors and delays are enough to destroy billions of dollars of investment. That’s why the nuclear industry has pushed to secure massive new federal loan guarantees or sought to get
their rate payers to pay for the capital construction costs in advance. It also helps explain why some at the U.S. Department of Energy (DoE) are willing to ask industry for a mere one to two percent loan subsidy fee to cover what they believe the risks of default on these projects might be, but private financiers clearly do not. If, as some official assessments suggest, the DoE is wrong on the likely default rate for these nuclear projects and the loan fee is set too low, it costs DoE nothing. However, if private investors put their money down, their reading of the risks of default is such that without massive loan guarantees, they will lose most or all of what they invest.

C. The value of federal loan guarantees is so uncertain and the ability of the utilities to cover their risks with their own capital so low that even with loan guarantees, private investors are leery of putting their own money at risk. One of the worries Moody’s report, New Nuclear Generation: Ratings Pressure Increasing,” raised when it was released last June is that the loan guarantees that the federal government is offering to the nuclear industry are too conditional. Will loan guarantees apply to plants that the NRC has stopped construction for safety reasons? Will the loan guarantees only be paid after a utility project goes bankrupt or some time before? In the case of default, who has first call on the remaining assets – the U.S. Treasury or other creditors (those that cover the required remaining 20 percent of the project’s capital costs)? What will the DoE assess the loan subsidy fee to be to cover the costs of such defaults? Will they assess this fee to be one or two percent of the loan, which the nuclear industry says it can tolerate or will the fees be higher? How much might the fees vary from project to project? Will the DoE continue to argue that this information is proprietary and must be kept from the public? Without clear answers to these and other questions, private investors (including the firms that might consume the electricity produced and are being asked to pay higher rates to help cover the unguaranteed portion of the financing) are unlikely to find proposed federal loan guarantees entirely comforting. A simple fix on this would be to have Congress demand that DoE supply Congress with the answers before authorizes such guarantees.
3. Do increased loan guarantees for nuclear power plants misdirect resources that could be better used for energy efficiency and renewable power projects? Yes.

One of the repeated findings of the analysts from institutions as disparate as the American Enterprise Institute, The Heritage Foundation, The Cato Institute, Greenpeace, and the Union of Concerned Scientists is that if we are serious about promoting clean energy experimentation, our government should stay out of picking commercial winners and losers by granting federal loan guarantees. One of the concerns repeatedly raised by these analysts is how much government investments in energy commercialization projects distorts and represses the kind of innovation we need. Historically, when the U.S. government has lent its financial support to specific commercial energy projects, the results have been abysmal. Among our government’s most prominent initiatives are such losers as synthetic fuels, breeder reactors, and corn ethanol. Mistakes, of course, can always happen but with the federal government, such errors dominate while admission to them comes late and at great expense. Indeed, generally, government energy commercialization projects continue to receive federal support well after it is clear they are white elephants. What’s worse, the government all too frequently tries to cover its mismanagement tracks by demanding that the public pay out of their own pockets to buy the costly commercial production of such schemes (e.g., corn ethanol mandates, which cost private U.S. consumers roughly $10 billion last year). Unlike small businesses, who pay for their cockups, the bill is passed on to the public. This is not to argue that there is not an important role for the federal government in promoting clean energy technologies and fuel. There is but it isn’t in spending on or off budget on commercialization efforts. Instead, what is needed is to have Washington work to promote increased energy market competition through regulatory reforms that state governments should undertake. These reforms would, among other things, (1) set standard rules for selling electricity through the grid; (2) remove conflicts of interest for existing grid or pipeline operations to block new entrants; (3) ensure regulated utilities have similar incentives to invest in efficiency as they do in expanding generation plants and energy supplies; (4) encourage key market constraints, be they carbon limits or liability coverage, through the market pricing
system rather than through government subsidies; and (5) increase pricing visibility for power to final customers. Finally, as long as state utilities commissions do not allow utilities to profit fully from introducing fuel efficiencies, there will continue to be a role for the federal government to encourage and fund energy research and development directly.

4. Do increased loan guarantees for nuclear power plants misdirect United States financial resources for the benefit of other countries?
In a word, yes. AREVA and EDF, who design and build the Evolutionary Power Reactors (EPR) planned for the U.S., are key beneficiaries along with Hitachi and Toshiba, the Japanese firms who have teamed up with Westinghouse and General Electric (which these Japanese firms now have controlling or major ownership of). URENCO, a European consortium that enriches uranium fuel and is building an enrichment plant in New Mexico also stands to benefit as does AREVA again, which is building an enrichment plant in Idaho. Since the U.S. does not make nuclear reactors, almost all of the manufacturing jobs associated with reactor construction will either be done abroad or in plants owned by these foreign firms. All of these firms have applied for federal loan guarantees either alone or in concert with American partners. Also, when it comes to the nuclear divisions of General Electric and Westinghouse, it is arguable that they are any longer entirely or truly American. Toshiba owns roughly 70 percent of Westinghouse’s nuclear division. Hitachi controls 40 percent of General Electric’s nuclear business. As for AREVA and EDF, they are not even private firms: Over 80 percent of AREVA and EDF are owned by the government of France. Finally, roughly 80 percent of the fuel for our commercial nuclear reactors currently is imported from Russia and Europe. This will change when AREVA and URENCO complete enrichment plants in the U.S. When they do, though, the key parts of the plants built in the U.S. will be almost entirely manufactured overseas by these foreign firms. AREVA also hopes to secure federal loan guarantees for its U.S. enrichment project as well.
Conclusion: What Should Guide Investments in Commercial Nuclear Power?

Last September, Chris Crane, president of Exelon, America’s largest owner and operator of nuclear power plants, and the World Nuclear Association’s Vice Chairman, publicly cautioned other utility executives against investing in new nuclear generating capacity until both natural gas prices rose and stayed above $8 dollars per 1,000 cubic feet (mcf) and carbon prices or taxes rose and stayed above 25 dollars a ton. Looking at available price data over the last decade, as my center did as a part of its economic assessment of nuclear power, suggests why neither condition, much less both, are likely to be met any time soon (see Figure 1 below):

Recent developments suggest why continued skepticism is warranted. After the latest international conference to control carbon emissions held in Copenhagen, carbon prices in the European carbon market hit a near all-time low. There is little reason to believe that prices will increase either in or outside of the EU any time soon. Domestic natural gas prices, meanwhile, driven by reduced demand, massive increases in supplies and newly discovered reserves, have dropped precipitously and have stayed low even through a very harsh winter. For a variety of

![Figure 1](image-url)

**Natural Gas and Carbon Prices — Hardly Steady or High Enough to Underwrite Private Nuclear Investments**

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<table>
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<tr>
<th>European Climate Exchange Carbon Prices In Constant 2009 dollars</th>
<th>US Natural Gas Prices in Constant 2009 Dollars</th>
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<td>![Graph of European Climate Exchange Carbon Prices]</td>
<td>![Graph of US Natural Gas Prices]</td>
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Bottom line: If the prices for renewables, natural gas and carbon were all rising, consensus about carbon emissions and global warming was solid, and private industry was still only investing in dirty coal, the case for government intervention in promoting commercial nuclear power, although still wrong both in principle and in practice, would be much stronger. Yet, none of these conditions prevail. If anything, just the opposite seems to be the case. That ought to inform us about the advisability of saddling the U.S. public with massive nuclear federal loan guarantees. It’s bad business and pure risk: Losses are quite possible; gains are not.
After weeks of outrage over an ill-fated $535 million federal loan guarantee to Solyndra — a bankrupt, politically backed solar-energy company — you’d think Washington would back away from such boondoggles. Yet, there’s a good chance lawmakers will do it again, this time awarding a $2 billion loan guarantee to an Ohio nuclear-fuel project that, like Solyndra, is almost certain to fail. But rather than being a liberal project to promote “green” energy and enrich Democratic donors along the way, this loan guarantee is an attempt of Ohio politicians — of both parties — to bring the bacon home to their swing state.

Rejected for a loan guarantee back in 2009, the troubled United States Enrichment Corporation (USEC), based in Maryland, has lobbied hard to get the Department of Energy (DOE) to reconsider their case. On October 21, USEC’s insistent pleading paid off: DOE announced it would spend up to $300 million to help USEC reduce the technical problems that forced DOE to reject USEC’s original application.

Never mind that Moody’s just gave USEC a junk-bond credit rating. Ohio’s Sen. Rob Portman (Republican and member of the Senate Energy Committee), Sen. Sherrod Brown (Democrat), and Rep. John Boehner (Republican and speaker of the House) all insist USEC deserves federal support and have urged the president to live up to his own pledge to back a loan guarantee for the project. That promise was made — you guessed it — during President Obama’s 2008 presidential bid to drum up Ohio votes.
That the massive uranium-enrichment machines that USEC is trying to deploy are still failing in demonstration tests doesn’t really seem to matter. Four months ago, the Nuclear Regulatory Commission reported that six of these machines, which are based on an exotic U.S. Department of Energy design, “crashed” in what was supposed to be a validation run. USEC has already spent nearly nine years and $2 billion to develop these machines but still needs $3 billion to complete the project.

It also doesn’t help that USEC has few, if any, firm contracts for the uranium-enrichment services the machines are supposed to afford. Like Solyndra, USEC has a customer problem. That, along with the technical riskiness of the centrifuge design, is a key reason why USEC wants federal taxpayers to guarantee the project. A quick review of USEC’s competition shows why the company will have a hard time penetrating the market.

First, there’s Louisiana Energy Services, which operates a large European-designed plant in New Mexico. It secured enough fuel contracts that it didn’t have to ask for a federal loan guarantee. It also has sufficient cash flow to finance the plant’s expansion if needed. Its enrichment technology is proven and much less expensive than USEC’s.

Then there is Areva SA, a French-government-owned firm that secured a $2 billion federal loan guarantee to build a large uranium-enrichment plant in Idaho. It needed the guarantee because, like USEC, it lacks enough firm contracts to cover its construction and operation costs. However, unlike USEC, Areva SA’s plant is based on proven enrichment technology (the very same technology that is operating in New Mexico). Even so, AREVA, which has financial troubles of its own, recently announced that it was putting this project on hold until it was clear that investing in it would produce profits.

Finally, there is the GE-Hitachi enrichment venture now underway in Wilmington, N.C. This project could blow all of the competition away, since it uses a new technology known as SILEX, which promises to produce enriched uranium for one-third to one-half the cost of any deployed enrichment system.

Given all these other options, why would anyone back USEC? The project’s supporters contend that supporting USEC will guarantee
400 long-term jobs and ensure an entirely American source of enriched uranium. This, of course, assumes that USEC won’t go under before its machines start working. Also, if USEC finally fails and federal taxpayers become responsible for the loan, as is likely, those 400 jobs will come at a pretty high price — up to $5 million apiece.

As for the national-security argument, it’s a head scratcher. Why do we need a purely American source of enriched uranium — that is, why would the URENCO or the French bug out of operating in the U.S.? If there are legal barriers to using this supply for national security emergencies, we could simply change the law. As for our military, it has enough enriched uranium stockpiled to replenish our arsenal and naval reactors for nearly 100 years.

All of this brings us back to the Beltway take on helping USEC: The Ohio project, Washington insiders whisper, is hardly any worse than Solyndra. Even shakier energy projects, both nuclear and nonnuclear, are sure to get federal energy loan guarantees, so why shouldn’t USEC? After all, they argue, the USEC guarantee, if approved, is unlikely to prompt much public blowback but it’s sure to make interest groups in Ohio happy.

Perhaps, but this ought to be reason for pause.

Before USEC goes the way of Solyndra and even more bankrupt energy projects get federal backing, it certainly would be smarter to consider the alternative of just saying no. This, of course, would require government officials to do more than merely express moral outrage about energy projects that have gone wrong. They’d actually have to show some self-restraint at a time when money is scarce.

*This is a version of an earlier piece titled “Another Solyndra” published by National Review Online on October 28, 2011.
Summary and Introduction

Among the goals often posited for federal energy policy are to enhance energy security by diminishing the nation’s reliance on foreign oil, to meet a growing demand for electricity, and to reduce greenhouse gas emissions by encouraging investment in clean energy production and technologies. To help further such objectives, the Energy Policy Act of 2005 (Public Law 109-58) established incentives to encourage private investment in innovative technologies, including advanced nuclear energy facilities. Much of the support for such investment is provided under title XVII of that legislation, which offers federal loan guarantees for the construction of nuclear power plants and other types of “alternative” energy facilities.

Administered by the Department of Energy (DOE), the loan guarantee program encourages private investment in nuclear energy by lowering the cost of borrowing and possibly increasing the availability of credit for project sponsors—usually an individual utility, a consortium of utilities, or a merchant power producer. In exchange for providing a loan guarantee, DOE is authorized to charge sponsors a fee that is meant to recover the guarantee’s estimated budgetary cost.

However, budgetary cost estimates—which are calculated as required under the Federal Credit Reform Act of 1990 (FCRA)—are not a comprehensive measure of the cost to taxpayers of those guarantee commitments. Specifically, FCRA estimates do not recognize that
the government’s assumption of financial risk has costs for taxpayers that exceed the average amount of losses that would be expected from defaults; those additional costs arise because a borrower is most likely to default on a loan and fail to make the promised payments of principal and interest during times of economic stress, when the losses are especially painful for taxpayers. Consequently, the estimated budgetary cost of a guarantee is generally lower than its estimated “fair-value” cost, which approximates the market price that a private guarantor would charge for an obligation with similar risk and expected returns.

Because budgetary cost estimates are not a comprehensive measure of the taxpayer resources committed, and because of concerns about the accuracy of the methods and assumptions that DOE uses to forecast default rates and recovery values, some commentators have suggested that federal loan guarantees for the construction of nuclear power plants are being systematically underpriced, whereas others believe they are being overpriced.3

For this study, the Congressional Budget Office (CBO) reviewed the many factors that can influence the cost to the government of guaranteeing loans for the construction of advanced nuclear facilities; developed a model to estimate guarantee costs for a representative loan using both FCRA-based and fair-value methodologies; performed a sensitivity analysis of those estimated costs to changes in assumptions about key drivers of cost; and explored the challenges inherent in attempting to charge borrowers the full cost of a loan guarantee. CBO’s findings are as follows:

- **The expected cost to the federal government of guaranteeing a nuclear construction loan will vary greatly depending on a project’s characteristics and on the economic and regulatory environment in which the project will operate.** Important considerations include capital structure (the mix of debt and equity used to finance the project); ownership structure (whether it is a stand-alone project or part of a diversified company); whether construction costs may be passed on to utility ratepayers or local taxpayers; the regulatory environment; the degree of uncertainty about construction costs; the cost of competing generation technologies; and the
demand for electricity. Although a serious nuclear accident could entail extremely large costs to investors and society, that risk has a small effect on the direct cost to the government of providing a guarantee because liability under the guarantee is limited to the amount of the debt, and the probability that such an accident will occur is low.

- **Default rates and recovery rates are likely to vary considerably, both across projects and over the lifetime of a given project.** CBO does not have enough information to independently estimate an average recovery rate for nuclear construction loans. However, assigning a similar expected recovery rate as a starting point for all projects—which is DOE’s current practice—does not appear to make full use of the information available to DOE through its detailed project assessment process. For example, when sponsors of stand-alone projects cannot pass on construction costs to ratepayers, very low recoveries may result if bankruptcy occurs during the construction phase. By contrast, recovery rates may be considerably higher once projects become operational.

Using a single recovery rate tends to increase the variability of estimated guarantee costs relative to their true values, which increases the government’s exposure to a phenomenon known as adverse selection. Adverse selection occurs when borrowers are better able than the government to assess the value of a guarantee offer and take advantage of their superior information at the government’s expense. For nuclear construction loans, borrowers will tend to turn down a guarantee if they believe the fee set by DOE is too high but go forward if they consider it fair or underpriced, which increases the likelihood that DOE’s portfolio will include more projects for which the subsidy fee has been underestimated than overestimated.

- **When credit ratings are used to assess default probabilities, cost estimates will vary widely with the assigned ratings category, the assumed recovery rate, and whether Treasury interest rates or estimated market interest rates are used**
for discounting (see Figure 1). CBO relied on the information in historical credit ratings to impute default probabilities (as does DOE) and considered a range of recovery rates that might apply to different projects depending on their characteristics. As required under FCRA, budgetary estimates use Treasury interest rates for discounting future cash flows; fair-value estimates rely on estimates of the applicable market interest rates for discounting.

• **Budgetary estimates of guarantee costs are significantly lower than the corresponding fair-value estimates, which provide a more comprehensive measure of the cost to taxpayers.** CBO used the credit rating associated with a project to derive the discount rate the market would most likely assign to the loan cash flows. For example, if the risks associated with a guaranteed loan are in the range of those posed by bonds rated A (less risky) and bonds rated BB (riskier), and if 55 percent of the amount owed is expected to be recovered in the event of a default, the budgetary cost, measured on a FCRA basis, ranges from 1 percent to 6 percent of the principal loaned. In contrast, the fair value of the guarantee ranges from 9 percent to 21 percent of the principal loaned. (Compare the first and second panels of Figure 1.)

• **Because of the high degree of uncertainty involved, it may not be possible to charge borrowers the full cost of a loan guarantee.** When adverse selection is severe, attempts to offset expected losses with an increase in fees can backfire because the higher fees drive away creditworthy borrowers, making it impossible to provide a loan guarantee that does not involve a subsidy.

CBO relied on a credit-ratings-based approach to evaluate the probability of default rather than on the historical experience of the nuclear industry, for which not enough data exist to draw quantitative inferences. However, historical experience suggests that investing in nuclear generating capacity engenders considerable risk. One study found that of the 117 privately owned plants in the United States that were started in the 1960s and 1970s and for which data were available,
48 were canceled, and almost all of them experienced significant cost overruns. As a consequence, most of the utilities that undertook nuclear projects suffered ratings downgrades—sometimes several downgrades—during the construction phase.

However, bondholders experienced losses from defaults in only a few instances. Losses for the most part were borne by the projects’ equity holders, the regions’ electricity ratepayers, and the government. Supporters of nuclear power argue that newer plant designs and changes in the regulatory environment make nuclear investments less risky now, but recent experience abroad suggests that cost overruns and delays are still common phenomena, and concerns remain about an environment and changes in demand for electricity. (See Appendix A for a more detailed historical review of the industry’s performance.)
Finally, although the federal budget is intended to account for the costs of federal activities, it does not account for the benefits of such activities. As is the case with other types of federal spending, loan guarantees for the construction of nuclear plants might increase well-being by supporting activities that are valuable to society but that are unlikely to be economically viable without governmental support. In assessing the value of the program, such benefits must be weighed against the costs of those activities. However, an analysis of the benefits of loan guarantees for nuclear construction is beyond the scope of this study.

Overview of DOE’s Loan Guarantee Program

Under title XVII of the Energy Policy Act of 2005, the Secretary of Energy, in conjunction with the Secretary of the Treasury, is authorized to provide loan guarantees for qualifying energy projects that use certain innovative technologies. To qualify, projects must “avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases” and “employ new or significantly improved technologies as compared to technologies in service in the United States at the time the guarantee is issued.” Among the types of projects meeting those criteria are advanced, or third-generation, nuclear reactors. Third-generation reactors are designed to be safer to operate and less expensive to build and maintain than the first- and second-generation reactors used in existing nuclear power plants.

Borrowers who qualify for a federal guarantee can obtain low-cost debt financing from private financial institutions or from an arm of the Treasury known as the Federal Financing Bank. Under the title XVII program, sponsors of a qualifying nuclear power project can finance up to 80 percent of the project’s total construction costs. For example, a project estimated to cost $3 billion to build could qualify for a guarantee on as much as $2.4 billion of debt. Guarantees may assure the lender of receiving full repayment of principal and any interest owed on the guaranteed amount (in which case the borrowers can obtain the loan from the Federal Financing Bank) or they may protect the lender against only a portion of potential losses. In exchange for a guarantee, DOE is authorized to charge sponsors a fee that covers the guarantee’s estimated budgetary cost.
In 2008, the Congress authorized $18.5 billion to cover the cost of guaranteeing loans for the construction of advanced nuclear power facilities and $2 billion to cover the cost of guaranteeing loans for the construction of facilities for front-end fuel processing.7 The President’s budget proposal for fiscal year 2012 includes a request for an additional $36 billion of guarantee authority for advanced nuclear facilities. As of April 2011, DOE had received a total of 19 applications for credit assistance from 17 different companies for the construction of 14 nuclear power plants.8 The requested loan guarantees amounted to $188 billion.9 Of those applications, only one—an $8.33 billion guarantee for the addition of two new reactors at Southern Company’s Plant Vogtle in Georgia—has been reported to be close to completion.10 A guarantee offer was also extended to Constellation Energy last October to build a plant in Maryland, but the company declined to take it, citing the high cost of the guarantee fee.11 Observers pointed to lower projections of energy demand in the region as another possible factor. In general, the subsidy provided by a loan guarantee may be insufficient to make a project economically viable. (For additional information on the applications that have been made to DOE for loan guarantees, see Appendix B.)

To apply for a guarantee, a project sponsor must pay a fee and complete a two-part application process that DOE uses to determine the project’s eligibility and pricing of the guarantee.12 The application asks for general information, a description of the project, technical information, a business plan, a financing plan, and regulatory and other certifications.

The project evaluation process is intended to determine the likelihood that a project will generate revenues that are sufficient to cover the required payments on the guaranteed loan. The process involves extensive conversations with the applicant as well as input from independent consultants and outside legal counsel. In addition, DOE obtains an independent credit rating from a rating agency. DOE also conducts a financial and technical review that evaluates project and loan characteristics—such as the creditworthiness of the borrower, construction factors, legal and regulatory issues, the technical relevance and merit of the project, the proposed technical approach and work plans, and environmental and energy security benefits.
On the basis of the information obtained during the evaluation process, DOE assigns its own credit rating to a project, following the scale that Standard & Poor’s (S&P’s) Rating Services uses for industrial firms. It then relies on several rating agencies’ (including S&P’s) tabulations of the historical default experience for corporate bonds with a similar credit rating and on an assumed recovery rate to determine the guarantee fee and other terms offered to the borrower.

Projects that pass DOE’s internal review process must then go through a credit approval process, starting with a review by the agency’s Loan Guarantee Program Office, continuing with an assessment by the Treasury and the Office of Management and Budget, and concluding with an evaluation by DOE’s Credit Review Board (CRB).

The CRB, which is chaired by the Deputy Secretary of the Department of Energy, establishes the overall policies of the loan guarantee program and coordinates credit management and debt collection. If approval from the CRB is obtained, the applicant receives a “term sheet,” which lists the conditions required to enter into a loan guarantee agreement with the DOE. If after further negotiations an agreement is reached between the CRB and the applicant, the final term sheet becomes a conditional agreement with the DOE. Final approval of a loan guarantee agreement must then be obtained from the Secretary of Energy.

**Estimating Loan Guarantees’ Cash Flows and Riskiness**

Many of the key drivers of the risk that a sponsor will default on a loan for the construction of a nuclear power plant are common to most capital investments. They include the project’s capital structure (the mix of debt and equity used to finance the project); whether it is a standalone project or backed by the sponsor’s other assets; and uncertainty about construction costs, costs of operation, and product demand. Certain risk factors, however, are more specific to the nuclear industry: the regulatory environment, the high proportion of fixed relative to variable costs (which causes any savings from temporarily suspending electricity production to be small), and the extent to which costs can be passed on to utility ratepayers or taxpayers.
To estimate expected cash flows for loan guarantees, analysts generally reduce the many drivers of cost and risk to two factors: the probability that a default will occur in each year and the expected severity of defaults. The loss severity rate is measured as the present value of lifetime principal and interest losses in the event of default as a percentage of the principal balance. Severity is inversely related to the recovery rate, which measures the fraction of the present value of outstanding principal and interest that the lender receives in the event of a default. The probability of a default and its expected severity can differ significantly depending on project-specific characteristics and over time. A potentially important source of variation is that defaults may be more likely, and losses more severe, during the construction phase of a project than after a project becomes operational.

Evaluating the prospects for success of a nuclear investment project, and translating that evaluation into estimates of the probability and severity of default, requires significant technical expertise and necessarily involves judgment; even the best-informed estimate of the cost of a loan guarantee has considerable uncertainty associated with it. CBO did not attempt to assess DOE’s technical evaluation process or the means by which DOE translates those evaluations into credit ratings to assess default probabilities, nor did it consider the details of any specific application for a guarantee. However, to illustrate the sensitivity of projected guarantee costs to alternative assumptions about a project’s credit rating and recovery rate, CBO adopted the following methodology: It relied on historical default rates derived from credit ratings and considered a range of recovery rates that were intended to capture variations in recovery amounts caused by factors such as whether or not construction costs could be immediately passed on to ratepayers.

**Key Drivers of Risk**

Nuclear power entails the risk that a serious accident or other incident could occur that would result in catastrophic losses—the costs of which would be borne by the plant’s owners, the government, and the public. However, only a small fraction of such costs would be absorbed by bondholders or guarantors. The reason for the small effect is twofold: The maximum loss to bondholders and the maximum liability arising
from a loan guarantee are limited to the principal value of the debt (which represents a small fraction of the total potential cost to society); and most experts believe that the probability of a catastrophic event is very small, particularly for new reactor designs.\textsuperscript{15} Even so, recent events in Japan have heightened concern about the potential for similar incidents in the United States, and such concern could increase the risk of default by causing costly construction delays or the imposition of new safety measures.\textsuperscript{16}

In comparison to conventional approaches to generating electricity, the risk of investing in nuclear power is heightened by the relatively high proportion of costs that are fixed rather than variable. Compared with facilities that use coal or natural gas to produce electricity, nuclear plants have high fixed costs (for construction and decommissioning) but low variable costs (for fuel). Total operating costs are similar to those for coal-fired plants, but operating costs for nuclear power plants have a larger fixed component because they require relatively large and fixed expenditures on safety systems. Fixed costs increase the risk of investing in nuclear power because if demand turns out to be low, cutting back on a plant’s output does not save much money. The relatively high cost of nuclear power also is a source of risk: Widespread use of nuclear power is unlikely to become economically viable in the absence of subsidies unless a sufficiently high price is levied on the emission of greenhouse gases or the price of fossil fuels escalates more rapidly than most forecasters predict. Hence, even with subsidies, the economic viability of nuclear power may be marginal in today’s economic and regulatory environment.\textsuperscript{17}

The risk associated with providing loan guarantees is increased by the phenomenon known as adverse selection—the likelihood that borrowers who have reason to think their project is riskier than the guarantor believes it to be will accept the guarantee fee offered, whereas borrowers who believe their project is relatively safe will be more likely to decline the offer of a guarantee they view as overpriced. DOE’s methodology may elevate the risk of adverse selection by categorizing nuclear construction projects into fairly broad credit-rating groupings and treating projects, regardless of how they are structured, as having similar recovery rates.
The cost to the government of guaranteeing a loan depends critically on the likelihood that the borrower will default and on the expected recovery rate, which in turn depend on a variety of factors. Those include the project’s capital structure, its ownership structure, the structure of debt payments, allowable charges to ratepayers, the potential need for additional financing, and other considerations.

**Capital Structure.** Even a very risky project can support a small amount of safe debt because debt holders’ claim to any recoveries from the sale of assets takes priority over that of equity holders. Conversely, the debt of a relatively safe project can prove to be risky if the project is backed by only a small amount of equity. In general, equity financing makes a project’s debt safer because the equity serves as a cushion to absorb unanticipated losses. Title XVII limits federally guaranteed loans to 80 percent of construction costs, and the law requires that the guaranteed amount not be subordinate to other financing, so that the insured debt holders have the first claim on any recoveries in the event of a default. Nevertheless, the composition of the other 20 percent of the financing can affect expected losses; risk is lower if equity rather than other debt comprises the balance of funding because firms with higher total debt levels are more likely to default. DOE can reduce the government’s risk and lower the fee offered on a guarantee by requiring a higher proportion of equity financing.

**Ownership Structure.** Another aspect of capital structure that affects the government’s exposure to risk is whether a proposed nuclear power plant is legally organized as a stand-alone project—a financially independent, single-purpose entity that relies on “project finance”—or whether it is part of a larger corporation. Project finance involves the creation of a legally and economically independent project company financed with equity from one or more sponsors and with nonrecourse debt that can be repaid only from project cash flows. By contrast, corporate debt is a general obligation of the issuing corporation; it does not rely on the success of any particular investment for repayment.

Which structure poses greater risk depends on several factors. All else being equal, a stand-alone project tends to be riskier because no other revenue streams are available to provide diversification. For example, defaults that occur during the construction phase of a stand-alone project that is 80 percent debt-financed and with no
recourse to ratepayers or taxpayers could have negligible recoveries. However, historical data for nonnuclear projects shows that, on average, recovery rates on debt issued by entities using project finance have been higher than those on corporate issues, despite the latter having recourse to multiple revenue streams. Risk can be higher for a diversified firm if the possibility of adverse shocks to other parts of its business more than offset the benefit of diversification, and there can be organizational advantages to a project finance structure as well.

For nuclear construction projects, sponsors that are merchant producers are more likely to depend on project finance than are utilities. However, utilities that invest in nuclear power may be able to limit the liability to their shareholders—and thereby increase the risk to the government—by structuring their nuclear facilities as legally separate entities.

Structure of Debt Payments. How payments on guaranteed debt are structured can affect the likelihood of a default. Spreading payments out over a longer period, or delaying the start of the repayment period, may reduce risk by making it more likely that the sponsor will have sufficient earnings from operations to cover the debt payments. However, prolonging or delaying the repayment period also could increase the risk and severity of defaults. Accumulated interest payments increase total indebtedness and the size of required payments, and the longer the debt is outstanding the more exposed it is to the possibility of an adverse event.

Allowable Charges to Ratepayers. For projects sponsored by public or investor-owned utilities, the risk to the government from a loan guarantee is affected by two important considerations: how quickly the utility is allowed by regulators to include construction costs in the rate base and the extent to which cost overruns can be passed on to ratepayers. (Merchant producers cannot pass on construction costs to ratepayers except perhaps indirectly through the price of the energy that they eventually sell.) In localities where utilities can include a charge for construction work in progress, much of the risk during the construction phase is absorbed by ratepayers rather than by bondholders. Even in such cases, however, bondholders face the risk that regulators or the courts will determine that certain costs cannot be passed on to ratepayers and hence accentuate the risk of a default on the bonds.
The Potential Need for Additional Financing. Although DOE guarantees may cover up to 80 percent of the estimated cost of construction, construction costs are difficult to predict accurately. Historically, construction costs for nuclear plants were often many times higher than the amounts initially predicted. Similar overruns in the future would pose the risk that project sponsors might require additional funding to complete construction and that the government might be the only available source of those funds. Thus, some may believe that the government is providing an implicit guarantee on a larger amount of debt than the amount formally contracted and paid for under the guarantee program.

Other Considerations. Many uncertainties about costs and revenues affect the ultimate profitability of a nuclear power plant, which in turn affects the risk of losses related to default: construction and operating costs (including the possibility of cost increases caused by delays); the costs of competing types of electricity generation over time that will affect the price path of electricity; and future demand for electricity. Those risks are exacerbated by regulatory uncertainty. Regulatory changes governing the design, construction, operational security, or decommissioning of nuclear plants could adversely affect (or, on the contrary, improve) profitability. Furthermore, the title XVII program is designed to support new technologies, which may be riskier than established designs. The prospect that policies will be adopted that require electric utilities to reduce their emissions of carbon dioxide is a potential, but also uncertain, mitigating factor.

Probability and Severity of Default

Rating agencies define default as the first occurrence of a missed payment on any financial obligation, bankruptcy, or a distressed exchange (wherein the debt holders are forced to accept substitute instruments that may have less favorable financial terms, such as a lower coupon, lower seniority, or longer maturity). The probability of default varies with the risk factors just discussed, but it is difficult to directly translate those factors into default probabilities. Defaults on bonds are fairly rare, and there is not enough historical data to draw reliable statistical inferences, particularly for an individual industrial sector. However, extensive data are available
from ratings agencies about the historical default experience of corporate bonds with a particular credit rating. Therefore, a common approach is to distill an analysis of a project into a ratings category and then use the historical default experience of firms with that rating to infer the probability of default for the project under consideration (see Box 1). DOE follows that approach and assigns ratings to loan guarantee applications that correspond to ratings for corporate bonds.

The severity of defaults varies widely and is also difficult to predict. In some cases, missed payments are rescheduled and bondholders are able to fully recover their money. In other cases, bondholders may recover little of what they are owed, if anything. The severity of

<table>
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<td><strong>Average Recovery Rates, by Type of Security</strong></td>
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<td><strong>Standard Deviation of Recovery Rate</strong></td>
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<tr>
<td><strong>Investment-Grade Securities</strong></td>
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<tr>
<td><strong>BANK LOANS</strong></td>
</tr>
<tr>
<td>First lien</td>
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<tr>
<td>Second lien</td>
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<td>Senior unsecured</td>
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<td><strong>BONDS</strong></td>
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<tr>
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<tr>
<td>Senior unsecured</td>
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<td>Senior subordinated</td>
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<tr>
<td>Subordinated</td>
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<tr>
<td>Junior subordinated</td>
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<tr>
<td><strong>ALL PROJECT FINANCE DEBT</strong></td>
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n.a. = not available.


Notes: The standard deviation of the recovery rate measures the variation from the average recovery rate. A low standard deviation indicates that most values are closely distributed around the average recovery rate, whereas a high standard deviation indicates that recovery rates are spread out among a wide range of values.

The type of bank loan indicates whether the borrower has pledged specific assets as collateral for the loan and the seniority of the debt over other types of obligations in bankruptcy proceedings. First and second lien loans are backed by collateral; senior unsecured loans are not collateralized. First lien loans will receive payment before second lien loans, and second lien loans will receive payment before senior unsecured loans.

The type of bond indicates whether the borrower has pledged specific assets as collateral for the loan and the seniority of the debt over other types of obligations in bankruptcy proceedings. Senior secured bonds are backed by specific collateral; senior unsecured bonds and all levels of subordinated bonds are not collateralized. In the event of bankruptcy, bondholders receive payment in the following order: senior secured, senior unsecured, senior subordinated, subordinated, junior subordinated.

Project finance debt is issued on the basis of the expected cash flows from a particular project, rather than those of the sponsor. In the event of bankruptcy, a lender can recover losses only from the project-specific assets and not from the general assets of the borrower.

default is influenced by most of the same drivers as the probability of default. For instance, projects with a higher proportion of equity financing are less likely to experience large losses because the amount owed represents a smaller fraction of assets. For stand-alone nuclear projects, the severity of loss is likely to be greater before the plant becomes operational because cash on hand is likely to be low and any assets may have very limited salvage value.

The data available to predict recovery rates are extremely limited, but some patterns have been documented on the basis of bond characteristics. (Recovered amounts are generally measured as the present value of payments received by bondholders as of the default date; that value is often measured by the price of defaulted bonds at the time of default.) Debt that is owed to banks or that has a higher priority for repayment tends to have higher recovery rates, as do project finance bonds (see Table 1).

One natural point of reference for nuclear construction loans is senior unsecured bonds, which are medium- to long-term general obligations of corporations.21 Those bonds have an average historical recovery
Box 1. Credit Ratings as Predictors of Default

Distribution of Credit Ratings Among U.S. Utilities, 2006 to 2010

Source: Congressional Budget Office based on data from Standard & Poor’s CreditPro®—Corporate Ratings, accessed April 6, 2011.

Notes: Standard & Poor’s classifies electric, gas, and water utilities, and companies that operate as independent producers or distributors of power, as “utilities.” Standard & Poor’s uses letter designations to identify a company’s credit quality rating. For example, AAA and AA (high credit quality) and A and BBB (medium credit quality) are considered investment grade. Credit ratings for bonds below those designations (BB, B, CCC, etc.) are considered noninvestment grade.

Rating agencies such as Standard & Poor’s (S&P), Moody’s Investors Service, and Fitch Ratings assign credit ratings to issuers of corporate bonds (and to specific bond issues) to provide investors a metric for judging the relative creditworthiness of corporate obligations. The top credit ratings indicate that the obligations are believed to be of the highest quality and pose minimal risk of loss; lower ratings imply a higher expected likelihood of loss. Ratings reflect analysts’ judgments about the future and thus may vary over time as economic conditions and a firm’s situation change.

For nuclear construction projects sponsored by utilities that probably will be able to pass on most costs to ratepayers, a relevant reference point is the rating of the sponsoring utility. The distribution of credit ratings for electric power utilities is concentrated in a range from A- to BBB-, with BBB as the most frequent rating. In recent years, the average credit quality of utilities has declined (see figure above). The current rating of a utility, however, is not necessarily indicative of what the utility’s rating would be if it were to undertake a nuclear construction project. For example, Moody’s recently reported that it was considering taking a more negative view of bond issuers who were seeking to finance the construction of new nuclear power plants. A primary concern cited by Moody’s was whether the proposed plants were economically viable, especially given uncertainties about the effects of energy-efficiency programs and national clean electricity standards on the demand for new nuclear generating capacity, the availability of capital for such projects, and the effect of such investment on the sponsoring utilities’ balance sheets.

The same rating for different broad categories of debt obligations—for instance, corporate bonds, sovereign debt, asset-backed securities, municipal bonds, and project finance—may not mean the
same thing. For instance, project-finance bonds with an A rating have historically experienced higher recovery rates than corporate bonds with the same rating. Some observers contend that bonds issued to finance nuclear projects that use project finance are therefore safer investments than might be assumed on the basis of data associated with corporate bonds. However, it is uncertain whether bonds backed by nuclear projects are as safe as the typical project-finance investment because of differences in the characteristics of the projects.\textsuperscript{3} For nuclear projects, project financing may be more likely to be used for riskier merchant plants that cannot pass on cost overruns to ratepayers. (Merchant power producers are private companies that build independent generating capacity that is sold to utilities or to other customers that are not contractually obligated in advance to buy the power.)

The linking of credit ratings with expected default rates relies on historical data collected by rating agencies. The rating agencies conduct annual corporate default studies using “static” (or fixed) pools of bonds issued by corporate entities—including industrial firms, financial institutions, utilities, and insurance companies—grouped by initial ratings category. This method allows default rates to be calculated over long horizons while also accounting for changes in ratings over time. Average default rates vary significantly across ratings categories, and the default rate varies significantly over time within each category. (See the accompanying table for the cumulative default rates over 15 years by ratings category, as reported by S&P, and for a measure of the uncertainty associated with those rates.)\textsuperscript{4}

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|}
\hline
\textbf{Ratings Category} & \textbf{Average 15-Year Cumulative Default Rate (Percent)} & \textbf{Standard Deviation of Default Rate} \\
\hline
AAA & 1.1 & 1.0 \\
AA+ & 0.3 & 2.1 \\
AA & 0.9 & 0.5 \\
AA- & 1.4 & 2.1 \\
A+ & 2.8 & 1.4 \\
A & 3.0 & 0.8 \\
A- & 3.2 & 2.3 \\
BBB+ & 5.9 & 2.2 \\
BBB & 7.1 & 1.5 \\
BBB- & 13.2 & 3.5 \\
BB+ & 14.8 & 7.0 \\
BB & 19.7 & 3.7 \\
BB- & 27.1 & 8.1 \\
B+ & 33.6 & 5.3 \\
B & 36.6 & 5.0 \\
B- & 40.1 & 14.1 \\
\hline
\end{tabular}
\caption{Historical Frequency of Defaults on Corporate Bonds}
\end{table}


\textbf{Note:} The standard deviation of the default rate measures the variation from the average default rate. A low standard deviation indicates that most values are closely distributed around the average default rate, whereas a high standard deviation indicates that default rates are spread out among a wide range of values.
Endnotes

1. Although the probability of default is clearly linked to credit ratings, the extent to which ratings predict recovery rates is less certain. The major rating agencies differ in whether or not the likely severity of a default is a factor in determining the credit rating. However, evidence suggests that default and recovery rates are to some extent negatively correlated. For a discussion of that relation, see Edward I. Altman and others, “The Link Between Default and Recovery Rates: Theory, Empirical Evidence, and Implications,” Journal of Business, vol. 78, no. 6 (November 2005), pp. 2203–2228.


3. Project finance is used for a variety of types of projects that include construction and commercial real estate development, equipment finance, industrial and manufacturing projects, oil and gas facilities, petrochemical projects, power transmission and distribution projects, telecommunications projects, and transportation infrastructure.

4. The slightly higher rate of defaults experienced by AAA bonds relative to AA bonds is probably attributable to a combination of two factors: there are a very small number of AAA corporate bonds; and, because the likelihood of default is so low, one or two events can have a large effect on the sample average. The reversal does not affect CBO’s analysis because a nuclear construction project would not get a rating of AAA.

rate of about 37 percent. However, some have suggested that federally guaranteed debt for nuclear construction would behave more similarly to project finance, which has an average recovery rate of 72 percent.22 Individual recovery rates vary considerably within each of those categories, and the recovery rate expected for a particular project could lie well outside of the range implied by those averages.23 DOE assumes a base recovery rate of 55 percent for both nuclear and nonnuclear projects (although it sometimes adjusts expected recoveries somewhat to take into account project-specific factors). That estimate falls between the historical average rates of recovery for senior unsecured corporate bonds and for project finance. CBO does not have enough information to independently evaluate whether the choice of 55 percent is the best estimate of the average recovery rate on nuclear construction loans.24 However, in CBO’s view, finding the best estimate of the recovery rate for a given project would require an assessment based on the specific risk factors discussed earlier. The practice of assigning a similar expected recovery rate as a starting point to all projects does not appear to make full use of the information available to DOE through its detailed project-assessment process. Moreover, using a single recovery rate rather than a project-specific one tends to increase the variability of estimated guarantee costs relative to their true worth. Because project sponsors have the option to accept the guarantee offer or decline it, that variability makes it
more likely that the guarantees accepted will be those that were priced below their true budgetary cost, whereas those turned down may be those that were priced above it.

Comparing Budgetary and Fair-Value Costs

Under current policy, DOE requires borrowers to pay the initial estimate of the cost of a loan guarantee. The estimation approach used to calculate that amount is also used to determine the initial budgetary cost of a loan guarantee. Hence, the Office of Management and Budget records a zero cost in the budget when nuclear construction loan guarantees are made.\textsuperscript{25}

The Federal Credit Reform Act of 1990 specifies the procedures that are used to estimate the budgetary impact of most of the federal government’s loan and loan guarantee programs. Under FCRA, the budgetary cost of a loan guarantee (or a direct loan) is calculated as the net present value of expected cash flows over the life of the obligation. The net present value is calculated by discounting cash flows to the time of loan disbursement using rates on Treasury securities of comparable maturity. (For example, the cash flows a year after disbursement are discounted using a one-year rate, cash flows five years out are discounted using a five-year rate, and so on.)

The budgetary cost of a loan guarantee is not intended to be a comprehensive measure of economic cost, and in practice it is generally less than its fair-value cost—the amount that a private financial institution would charge for the guarantee in a well-functioning market. The main difference between the cost that appears in the federal budget and the fair-value cost of a guarantee is that investors require compensation for bearing market risk, which is not treated as a budgetary cost.

Market risk is the component of risk that investors cannot protect themselves against by diversifying their portfolios. Investors require compensation for market risk because investments exposed to such risk are more likely to have low returns when the economy as a whole is weak and resources are more highly valued. In general, loan guarantees have significant exposure to market risk because private enterprises default on their debt obligations more frequently and with greater severity (meaning that recoveries from the borrowers
A common view is that the government has a lower cost of capital than private financial institutions because it can borrow at Treasury rates. Treasury rates are low, however, because holders of Treasury bonds are protected against losses by taxpayers, who absorb the risk of the government’s activities. Specifically, when the government provides a loan guarantee, taxpayers are at risk because if the borrower defaults and guarantee fees are not sufficient to cover the losses, the shortfall must be covered with higher future taxes, lower future government benefits, or cuts in other spending. Therefore, when the government provides such a guarantee, it is effectively shifting financial risk to taxpayers who, like investors in a financial institution, are averse to bearing that risk. From that perspective, market risk is a cost to taxpayers that is not included in budget estimates.
To provide a more comprehensive measure of the cost of the subsidy associated with nuclear construction loan guarantees, CBO evaluated guarantee costs on a fair-value basis as well as on a budgetary basis. In recent years, CBO has provided supplementary information to the Congress on the fair-value cost of several major federal credit and insurance programs. For a liability such as a loan guarantee, the fair value is the price that would have to be paid to induce a market participant to assume the liability. Fair values are often based on market prices when those are available. However, the fair value of an obligation may diverge from its market value, for instance, during a financial crisis when the few transactions that occur are likely to be at distressed prices or when comparable obligations are not publicly traded. In such cases, fair value can be estimated using standard financial modeling and extrapolation. A private market for nuclear construction loan guarantees does not exist. However, the cost that investors would assign to the risk of such guarantees can be estimated from the prices of debt securities that have similar risk characteristics as evaluated through credit ratings, and CBO took that approach in this study.

The federal budget is intended to account for program costs but not their benefits. Credit guarantees, like other federal spending, might increase public well-being by supporting activities that are valuable to society but that are unlikely to be economically viable without government support. In evaluating a program, those benefits must be weighed against the costs to taxpayers of those activities, but such an analysis for nuclear construction loan guarantees is beyond the scope of this study.

**The Impact of Adverse Selection on Estimated Budgetary Cost**

In practice, it may not be possible to charge borrowers the full budgetary cost of a loan guarantee, either on a FCRA or fair-value basis. When projects involve a high degree of uncertainty and adverse selection is severe, increasing fees would only serve to drive away more-creditworthy borrowers. Under such circumstances, private lenders may refuse to offer credit at any price (a situation known as credit rationing). Indeed, fully private financing does not appear to be
available for nuclear power plant construction. For investments that provide significant social benefits, avoiding credit rationing in the private marketplace is a rationale for offering federal credit assistance. However, such assistance is likely to involve a cost to taxpayers, regardless of the fees that the government charges.

In CBO's view, adverse selection is likely to be a significant factor for nuclear construction loan guarantees, and it is probably not possible for DOE to set fees that would entirely cover the estimated budgetary cost of the program. To account for that difficulty, and to avoid a downward bias in its official cost estimates, CBO adds 1 percentage point to its FCRA estimates for the cost of title XVII guarantees.

**Selecting Discount Rates for Fair-Value Estimates**

When estimating the cost of nuclear construction loan guarantees, the difference between budgetary (or FCRA) estimating practices and a fair-value approach is in the choice of discount rates. Whereas FCRA calls for Treasury rates to be used to discount expected future cash flows, a fair-value methodology employs discount rates that reflect the market risk inherent in the specific credit obligation, which gives rise to investors’ requiring a risk premium.

As noted above, the frequency and severity of defaults on credit obligations varies considerably over time and with the state of the economy. Still, expected recovery rates on such obligations depend more on “idiosyncratic,” or project-specific, risk than on market risk. For example, expected recovery rates during the construction of a nuclear plant may be low because the unfinished plant has little value when it comes to alternative uses, whether the aggregate economy is performing well or poorly. Conversely, an operating plant could default because revenues from electricity sales during a recession are too low to support the promised debt payments, but expected recovery rates in that case may be high because the operating plant remains a valuable asset.28

To determine the appropriate risk premium for estimating the fair value of loan guarantees for nuclear construction, CBO relied on information in yield spreads—the difference between what investors expected to earn on bonds of a particular credit rating and Treasury rates. The key advantages of that approach are that extensive historical
data are available on credit spreads and that the discount rates are consistent with the translation of project risk into a ratings category.

The yield spread on a risky bond can be decomposed into four components: a market risk premium, an expected default loss rate, a liquidity premium (which is compensation to investors for the higher costs of buying and selling non-Treasury debt), and a tax adjustment (to account for differences in tax treatment). For the purposes of discounting expected loan guarantee cash flows, CBO used only the estimated market risk premium to adjust Treasury discount rates. The expected default loss rate was incorporated in the projections of cash flows; including it in the discount rate would cause expected losses to be counted twice. CBO chose not to include an estimated liquidity premium or tax adjustment in the discount rate for its fair-value calculations; although a broader interpretation of fair value would also include those effects, CBO chose to focus only on the risk that most directly affects taxpayers. Finally, CBO selected the size of the risk premium for each ratings category on the basis of the findings of academic studies.\textsuperscript{29} Those studies show, as expected, that the market risk premium increases with the riskiness of the debt as measured by its credit rating (see Table 2).

CBO’s estimates of guarantee costs rely on the fact that the cash flows associated with a loan guarantee are identical to the combined cash flows from directly making a risky loan and, at the same time, borrowing the promised cash flows risk-free. (To value a partial guarantee, both the risky loan and the corresponding amount borrowed risk-free are reduced proportionally.) The value of the guarantee is then calculated as the difference between the value of the risk-free loan and the risky loan. Using that approach follows standard industry practice, and it produces the same results as using FCRA methodology when the risk premium is set to zero.\textsuperscript{30} (Appendix C explains CBO’s procedure for calculating the fair value of a guarantee in more detail.)

**Illustrative Guarantee Costs and Sensitivity Analysis**

The estimated cost of a nuclear construction loan guarantee varies widely with the assumptions made about a project’s credit rating, recovery rate, and whether the cost of market risk is taken into account. Therefore, CBO estimated the guarantee cost for a hypothetical
nuclear construction loan under a variety of assumptions about those key parameters and the loan contract itself.

The ratings-based approach that CBO used reflects the assumption that it is appropriate to evaluate the cost of loan guarantees for nuclear construction by summarizing the proposed project’s risk characteristics with a credit rating and then using the typical default rates and risk premiums for those ratings categories to infer the cost of the guarantees. That approach is frequently used in the private sector for investments that are difficult to evaluate, such as those considered here. An alternative approach would be to model the cash flows and the uncertainty associated with them for each individual project. For example, a simulation model that incorporated assumptions about the capital structure and other features specific to a project could be used to predict the probability and severity of defaults. Such an approach might produce more-accurate estimates than the more generic ratings-based approach used here. However, it would require a significant investment in modeling for each project, and the results would still have a great deal of uncertainty associated with them.

The reference loan that CBO considered has features that are fairly typical for loans that might be guaranteed by DOE under the federal guarantee program. The loan has a maturity of 30 years. Principal

<table>
<thead>
<tr>
<th>Ratings Category</th>
<th>Bond Yield Over U.S. Treasuries</th>
<th>Risk Premium</th>
</tr>
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<tbody>
<tr>
<td>AAA</td>
<td>83</td>
<td>38</td>
</tr>
<tr>
<td>AA</td>
<td>90</td>
<td>43</td>
</tr>
<tr>
<td>A</td>
<td>120</td>
<td>69</td>
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<td>BBB</td>
<td>186</td>
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<tr>
<td>BB</td>
<td>347</td>
<td>160</td>
</tr>
<tr>
<td>B</td>
<td>585</td>
<td>200</td>
</tr>
</tbody>
</table>


Note: The risk premium is the additional rate of return that investors require to bear market risk—the risk that losses will be greatest during times of economic stress.
is paid in equal increments semiannually, starting at the end of an assumed 6-year construction period. Interest on the outstanding balance is paid semiannually over the life of the loan. The interest rate charged equals the 10-year Treasury rate plus a small spread; CBO assumed that the rate charged is 3.4 percent.

Sensitivity to Credit Ratings, Recovery Rates, and the Inclusion of a Risk Charge

Estimated guarantee costs vary widely with changes in the assumed credit rating, recovery rate, and discount rate on risky loans (see Figure 1 on page 3). The choice of credit rating is a key determinant of estimated costs for both FCRA-based and fair-value estimates. In particular, estimated costs increase significantly for ratings that are below BBB, which is the lower cutoff for bonds that are considered “investment grade.” That variation reflects the much higher default rates historically for bonds in lower ratings categories. Most utilities have ratings that fall within the range of A- to BBB-, and initiating a new nuclear construction project could cause a utility’s rating to be revised slightly downward by the rating agencies. For stand-alone projects or weaker utilities, lower ratings for potential nuclear projects are a possibility. However, such projects may not be economically viable even with the subsidies provided by a loan guarantee, and DOE might be reluctant to approve those applications.

The assumed recovery rate also has a significant effect on the estimated cost of a loan guarantee, particularly for projects with a rating below investment grade. Therefore, for projects with low ratings, assigning a project-specific recovery rate could significantly change the estimated cost. The relative insensitivity to the recovery rate for investment-grade projects is explained by the low probability of default on highly rated bonds, which reduces the importance of recovery.

The fair-value estimates, which include a risk premium, are significantly higher than budgetary estimates for guarantees with the same credit ratings and recovery rates. The pattern of higher costs for projects with lower ratings and lower recovery rates remains the same; however, including a risk charge has a larger effect on lower-rated bonds because riskier bonds have greater exposure to market risk and
therefore have a higher associated risk premium. For example, for a project that has an A rating and the 55 percent recovery rate often assumed by DOE, market risk increases the guarantee cost rate from 1 percent to 9 percent of the loan principal; but for a project with a B rating and the same recovery rate, market risk increases the cost from 11 percent to 27 percent. As is the case with the FCRA-based estimates, the effect on fair-value estimates of changing the recovery rate on highly rated bonds is muted because the underlying default probability is low, so expected losses are small regardless of the recovery rate. However, investors still require a risk premium because when the rare default occurs, it is most likely to be during a severe economic downturn.

**Sensitivity to the Timing of Defaults and Recoveries**

Assuming a fixed recovery rate at all stages of a project’s life may neglect significant variation over time in expected recoveries. For example, it may be that expected recoveries for a project that is limited in its ability to pass on costs to ratepayers are lower during the construction phase than when that project is producing revenue from power sales. Lowering the recovery rate in the early years tends to increase the estimated cost of a loan guarantee because more principal is outstanding and because the recovered payments are discounted less.

To illustrate the potential size of the effect of recovery rates that vary over time and in particular the possibility that recovery rates are much lower during the construction phase, CBO compared the estimated guarantee costs across an assumed recovery rate during construction that varied from 0 percent to 40 percent, while assuming a fixed recovery rate of 55 percent after the construction period (see Figure 3). CBO estimated that the effect on the estimated cost of a loan guarantee for nuclear construction is less than 2 percentage points for ratings of BBB and higher, but much larger for lower-rated projects. For a project rated BB, for example, the effect of recovering only 20 percent early on increases the lifetime cost by 3.6 percentage points relative to the assumption of a flat 55 percent recovery rate.

Similarly, default rates may be higher during the construction phase, which would shift the pattern of defaults forward relative to a typical bond with the same rating. Shifting defaults forward in time increases
the estimated cost of a loan guarantee because more principal is outstanding and losses are discounted less. CBO examined the effect of increasing the baseline default rate for a given credit rating during the construction phase by either 10 percent or 20 percent and then decreasing the probability afterward so that the lifetime default rate remained unchanged. The recovery rate was again assumed to be 55 percent over the project’s lifetime. Shifting forward the timing of defaults has the expected effect of increasing the estimated guarantee cost, but the size of that effect is less than half a percentage point for projects rated BB and higher. The combined effect of assuming higher default rates and lower recovery rates during construction would be to increase the estimated cost of low-rated projects significantly.

**Sensitivity to the Terms of the Loan Contract**

The terms of the loan contract can have a significant impact on the guarantee cost. For example, in the case of a direct loan, the guarantee cost is affected by the interest rate charged to the borrower; higher interest paid to the government reduces the subsidy cost required to be paid up front by the borrower.

In some cases, the guaranteed loan may be structured so that payments are deferred for some number of years to better match the pattern of project revenues. For instance, DOE may allow stand-alone merchant projects that do not have the resources of a utility available to them to defer the payment of principal and interest during the construction phase, whereas only principal repayment may be deferred for rate-based projects. Such deferrals can affect guarantee cost. For instance, if interest payments are deferred until after the construction phase (and the deferred amounts are added to the principal balance owed), then the estimated cost of a loan guarantee for a project receiving a BBB rating and with a flat 55 percent recovery rate is 2.4 percent on a budgetary basis (16.5 percent on a fair-value basis). In contrast, without any interest deferral, the estimated cost is 2.1 percent on a budgetary basis (14.6 percent on a fair-value basis). All else being equal, the cost of the guarantee increases with the length of deferral because, on average, a smaller portion of the loan is repaid before a default occurs.
The 30-year maturity of nuclear construction loan guarantees amplifies the effect of including a charge for market risk compared with the effect on the cost of shorter-term guarantees. Over a 30-year period, the present-value cost of even a small amount of market risk each year becomes significant.

**Uncertainty in Default Rates Within a Single Credit Rating**

A further source of uncertainty in estimating the cost of loan guarantees is that, within a given ratings category, there is considerable variation in the expected default rate. Standard & Poor's
represents those uncertainties in terms of standard deviations. The standard deviation of the recovery rate measures the variation from the average recovery rate; realized values should fall within a range of one standard deviation below the average to one standard deviation above the average about 68 percent of the time. (See Figure 4 for an illustration of how uncertainty about default rates translates into uncertainty about guarantee costs for different ratings.) For instance, a one-standard-deviation increase in the assumed default probability for bonds rated BB would increase the estimated guarantee cost on a budgetary basis by about 1.5 percentage points. That variation

![Figure 4: Sensitivity of Estimated Loan Guarantee Costs to the Probability of Default](image)

Source: Congressional Budget Office.

Notes: The change in the guarantee cost is calculated relative to the base case and is expressed as a percentage of the loan amount.

Cost estimates under the Federal Credit Reform Act of 1990 use Treasury rates for discounting projected cash flows. Fair-value estimates approximate what a private guarantor would charge for the guarantee; they are based on the same projected cash flows, but the discount rates are adjusted to include a market risk premium.

In determining the percentage point change in the cost of a loan guarantee, CBO assumed that the probability of default would vary plus or minus one standard deviation. The standard deviation of the default rate measures the variation from the average default rate. A low standard deviation indicates that most values are closely distributed around the average default rate, while a high standard deviation indicates that default rates are spread out among a wide range of values.
underscores the significant uncertainty associated with estimates of subsidy costs that are based on credit ratings. Estimating such costs using alternative methodologies, however, would also involve considerable uncertainty.

Endnotes

1. Merchant producers are private companies that build independent generating capacity that is sold to utilities or to other customers that are not contractually obligated in advance to buy the power.

2. Under FCRA, the budget records the lifetime cost of a loan guarantee, which is estimated by projecting the associated cash flows (amounts paid out to cover expected losses from defaults net of expected fees received) and discounting those cash flows to the present at Treasury interest rates.


6. P.L. 109-58, §1703(a); 119 Stat. 1120; 42 U.S.C. § 16513(a)

7. Front-end fuel processing comprises the various steps necessary to turn raw uranium ore into fuel that can be used in a nuclear reactor.

8. A plant (which can have one or more reactors) may have multiple sponsors, and a sponsor may participate in building more than one plant.


10. The amount of the up-front guarantee fee has not been publicly disclosed, but press reports suggest it ranged from 0.5 percent to 1.5 percent of the loan principal. That would translate to a fee ranging from $41.65 million to $125 million for the investors. See Regina Griffin, “Constellation Unmoved by New Offer on Loan Guarantee,” Electric Power Daily (October 12, 2010), available at www.plattsenergyweektv.com/story.aspx?storyid=115313&catid=293.

11. Ibid.

12. The sponsor pays an application fee of $200,000 for the first stage of the evaluation and $600,000 for the second phase. DOE issues an initial project ranking on the basis of its initial review. Upon receiving that feedback, an applicant can decide whether or not to proceed so as to avoid the full cost of the application if the project gets a negative first-stage review. A more detailed description of the program requirements, process, and evaluation procedures for a Nuclear Power Facility Loan Guarantee Application is available online from the

13. “Present value” is a single number that expresses a flow of current and future income (or payments) in terms of an equivalent lump sum received (or paid) today. The present value depends on the rate of interest (known as the discount rate) that is used to translate future cash flows into current dollars.

14. CBO independently developed its model for translating default rates and recovery rates into expected cash flows, using standard formulas. Although both CBO and DOE employ a ratings-based methodology to estimate cash flows, CBO’s model differs in some respects from DOE’s model in implementation.

15. In its analyses, the Nuclear Regulatory Commission assumes a probability of one severe nuclear event in a million reactor years for reactors currently in operation. See Nuclear Regulatory Commission, State-of-the-Art Reactor Consequence Analysis (SOARCA) (November 2010). The International Nuclear Safety Advisory Group produces risk assessments for two types of nuclear events: core damage frequency (for which it assumes a chance of 1 in 10,000 for existing plants and 1 in 1,000,000 for new plants); and a large release of radioactive material (for which it assumes a chance of 1 in 100,000 for existing plants and 1 in 1,000,000 for new plants).


18. Project finance is used for various types of projects, including construction and commercial real estate development, equipment finance, industrial and manufacturing projects, oil and gas facilities, petrochemical projects, power transmission and distribution projects, telecommunications projects, and transportation infrastructure.

19. To minimize its exposure to loan losses attributable to a project’s potential cost overruns, DOE has the authority to require that engineering, procurement, and construction contracts have built-in provisions for cost overruns.

20. Minor violations of covenants (legal restrictions on the firm contained in debt contracts) generally are not treated as defaults.

21. In the United States, senior unsecured corporate bonds generally are not explicitly backed by specific collateral but have a claim on all of a corporation’s assets that have not been otherwise pledged.

22. For example, see Nuclear Energy Institute, Credit Subsidy Costs for New Nuclear Power Projects Receiving Department of Energy (DOE) Loan Guarantees.

23. For an analysis of the performance of project finance loans relative to corporate loans, see Chris Beale and others, “Credit Attributes of Project Finance,” Journal of Structured and Project Finance (Fall 2002), pp. 5–9.
24. Technically, DOE’s model begins with the assumption that pre- and postconstruction recovery rates are equal to 55 percent.

25. DOE’s authority to guarantee loans under the title XVII program is subject to annual appropriation action. The Office of Management and Budget periodically reestimates the cost of federal loan guarantees to capture changes in expected and realized losses. Under FCRA, the costs of those reestimates are covered by an unlimited appropriation (and not by the borrower).

26. CBO’s analysis considered direct losses to the government from defaults but excluded certain indirect effects. For instance, no cost was included to account for the fact that the offer of a guarantee increases the likelihood that a plant will be constructed, which in turn increases the probability of future damages that could be costly to the government.

26. See, for example, Congressional Budget Office, The Budgetary Impact and Subsidy Costs of the Federal Reserve’s Actions During the Financial Crisis (May 2010); letter to the Honorable Judd Gregg about the budgetary impact of the President’s proposal to alter federal student loan programs (March 15, 2010); Costs and Policy Options for Federal Student Loan Programs (March 2010); and Federal Financial Guarantees Under the Small Business Administration’s 7(a) Program (October 2007).


30. Alternatively, practitioners sometimes use an options-pricing approach to value loan guarantees.

31. An investment-grade rating indicates that a bond or other credit obligation has a relatively low risk of default. Bond-rating firms, such as Standard & Poor’s, often use letter designations to identify a bond’s credit quality rating. For example, AAA and AA (high credit quality) and A and BBB (medium credit quality) are considered investment grade. Credit ratings for bonds below those designations (BB, B, CCC, etc.) are considered low credit quality.

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Pure Risk

“Continuing to pile on more clean energy loan guarantees constitutes nothing less than pure risk, i.e., creating a situation where there is a chance of running loss but no chance of gain.”

– Foreword

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