CHAPTER 8

A CASE STUDY OF SUBSIDIES TO CALVERT CLIFFS

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OVERVIEW

Sharply rising energy prices in 2007 and the first part of 2008, growing concerns over climate change, and geopolitical instability in major fossil fuel producing regions of the world have focused increasing attention on energy security and supply diversification. The nuclear industry was well-positioned to enter this fray. Capacity factors at existing reactors have been slowly climbing. A series of massive capital write-downs at these reactors over the past 2 decades meant that much of the cost to build the facilities had already been dumped onto taxpayers and ratepayers. Industry boosters have highlighted low operating costs only, as if capital costs do not exist. Finally, nuclear's role as a baseload generating source with relatively low carbon emissions has been transformed by well-funded and well-staffed industry trade associations into claims that their resource was the only viable "carbon-free" resource available to meet our growing energy demand.

Many countries, including the United States, have bought these arguments virtually whole cloth. Despite cost projections running into the hundreds of billions of dollars for the nuclear solution, the hope of a clean, domestic, low carbon nuclear future has been subjected to little critical review. This is unfortunate. While we do face very real energy security and climate change challenges, transforming our economy will require thousands of small actions and a heightened level of market transparency and accountability.

The economics of nuclear power are far from transparent. The technology is riddled with complex public subsidies to new reactors that are both opaque and quite difficult to value. Industry sound bites mask key information so that public subsidies for the sector will likely exceed the private capital put at risk, hardly a formula for sound financial decisionmaking. These taxpayer "investments" are really highly concentrated, politically-targeted bets on a narrow set of technologies and management teams.

Choosing who to subsidize with billions in public largesse does not encourage the rational, technical evaluations needed to maximize success rates. Instead, the recipients of this support are at least as likely to be determined based on their political connections and the sophistication of their lobbying as they are on the large scale market viability of their approach.

A case study of the proposed new reactor at Calvert Cliffs in Lusby, Maryland, provides a useful window into the dynamics and implications of federal nuclear policy today. The analysis demonstrates not only that the taxpayer ends up as the largest de facto investor in this project, but also that, while we bear most of the downside risk, we share little of the upside benefits should the plant ultimately be successful. The data also highlight that despite nuclear's relatively low carbon footprint, the cost per unit of greenhouse gas avoided is far more expensive than many other alternatives.

This chapter begins with some historical context on the role of government subsidies for nuclear power in the United States. It then shifts to the specific case of Calvert Cliffs, including the venture structure, projected costs, and acknowledged or embedded subsidies. The final sections of the chapter evaluate the cost-efficiency of a nuclear power option to address energy security and global warming concerns.

NUCLEAR VIABILITY: RELIANT ON SUBSIDIES FOR MORE THAN A HALF-CENTURY

Despite industry efforts to frame nuclear energy as the cheapest option, the reality is that nuclear power's very survival has required large and continuous government support. The industry routinely argues that subsidies are transitional, needed only for a short time to gain operational experience with new reactor designs. After these "first of a kind" costs have been amortized, the argument goes, the industry will be self-reliant.

All sorts of industries are challenged by the need to invest in continuous technical improvements to remain competitive. Unlike most industries that rely on private capital for this need, the nuclear power sector has been making the transitional support argument since the earliest civilian reactors. A 1954 advertisement from the General Electric civilian reactor program notes this clearly:

> We already know the kinds of plants which will be feasible, how they will operate, and we can estimate what their expenses will be. In 5 years—certainly within 10—a number of them will be operating at about the same cost as those using coal. They will be privately financed, built without government subsidy.[1]

Clearly, 5 or 10 years were not enough. If fact, more than 50 years later, almost identical claims are still being made by the industry. Yet, in the intervening half-century of "transitional" support, the federal government has provided a growing array of subsidies to bolster nearly every step in the nuclear fuel cycle. Some of these programs have fed the industry for virtually its entire existence.

Of greatest importance to nuclear viability have been the subsidies that effectively socialize the most intractable risks of nuclear energy: damages from accidents (capped via the Price-Anderson Act first passed in 1957) and management of extremely long-lived radioactive wastes (where the federal government has guaranteed ultimate responsibility for management in return for a small variable surcharge per unit of power sold).

Uranium enrichment services are another example, because the complexity and scale of operations early in the industry's evolution would have made them cost-prohibitive. In the United States, these facilities were historically government-owned and remain so in a number of other countries. U.S. enrichment operations were privatized in 1998, though not before providing decades of large subsidies to civilian reactor customers. The U.S. Enrichment Corporation (USEC), as the privatized organization is known, inherited key assets of its public predecessor, while leaving the cleanup of contaminated sites a taxpayer liability.

Not every energy technology has these types of impairments. As a result, the more the federal government does to shift the costs and risks of dealing with these issues away from investors, the more harm is done to the competitive position of alternative energy resources.

Subsidies for capital formation have also been extremely important to nuclear energy, because the resource is perhaps the most sensitive of all energy technologies to the cost of capital. Large, complex plants that take many years to build carry inherent risks of significant shifts in market conditions before the plants come on line. Their technical rigidity precludes mid-course corrections (other than delay or abandonment), yet their scale requires high capacity utilization for them to be efficient. Invested funds can be tied up for years, accruing substantial financing costs as well. Finally, the need to pre-sell power via advance power contracts, while mitigating the market risk upon completion, also opens the facility to large financial obligations to meet these contracts via power purchases if the start of operations of the nuclear plant is delayed.

A common theme in government support for the sector has been to bring down capital and financing costs, either through direct subsidies (accelerated depreciation and various tax credits) or by shifting risks to rate payers (such as by including project and interest costs in a regulated utility rate base during the period of construction). These interventions are sold as being low- or no-cost to the government. The idea that providing large amounts of credits and guarantees is somehow costless to the provider is pure fantasy, as the recent financial meltdown so clearly illustrates.

Other subsidies involved support for uranium mining and stockpiling; a half-century of government-financed research and development into reactor technologies, waste management and cleanup, and enrichment technologies; and special tax breaks for plant decommissioning.

Although there is no comprehensive record of historical subsidies for nuclear power since inception, a review of a number of studies that have been done over the years demonstrates government's central role in the sector's market viability. Table 8-1 illustrates that subsidies were generally equal to one-third or more of the value of the power produced. While such levels of support may not be surprising for very new industries with little installed base, to see subsidy levels so high over the course of 5 decades is quite striking.

Period of Analysis	Federal Subsidy, $Billions		Subsidy, cents/ kWh		Avg Subsidy as % of Industrial Price	Analysis	Notes
	Low	High	Low	High			
2008	-	-	5.0	8.3	113-189%	Koplow/Earth Track calculations - subsidies to a new reactor	Share of national average wholesale rates, 2002-06
1947-99	178.0	-	1.5	-	NA	Goldberg/Renewable Energy Porfolio Project (2000)	P-A not estimated.
1968-90	122.3	-	2.3	-	33%	Komanoff/ Greenpeace (1992)	P-A not estimated.
1950-90	142.4	-	2.6	-	NA	Komanoff/ Greenpeace (1992)	
1989	7.6	16.2	1.4	3.1	32%	Koplow/Alliance to Save Energy (1993)	
1985	26.8	-	7.0	-	83%	Heede, Morgan, Ridley/Center for Renewable Resources (1985)	P-A not estimated.
1981	-	-	5.9	12.3	105%	Chapman et al./ US EPA (1981)	Tax expenditures only.
1950-79	-	-	4.1	6.0	NA	Bowring/Energy Information Administration (1980)	Tax and credit subsidies not estimated.

Source: Koplow (2009).

Table 8-1. Subsidizing Plant Construction and Operation (In 2007 Dollars).

VENTURE OVERVIEW OF CALVERT CLIFFS 3

Calvert Cliffs, located in Lusby, MD, already serves as host to two existing nuclear reactors with a total capacity of 1,700 megawatts (MW). These units came online in 1975 and 1977.[2] The reactors are owned by Constellation Energy Group (CEG), a holding company formed in 1999 from the holdings of the Baltimore Gas and Electric Company.

No new nuclear reactors have been built in the United States for decades. Although the industry likes to blame regulatory bureaucracy for the problem, others point out that the majority of reactors were cancelled after license approval on economic grounds.[3] It is clear, however, that constructing a new reactor is a far more complicated financial undertaking than buying and operating an existing one.

The corporate structure set up to build new reactors at Calvert Cliffs provides important insights into political and economic strategies Constellation is using to manage risk and boost returns to shareholders. These are important complementary strategies for obtaining very large government subsidies. Constellation and other nuclear firms face successive challenges. After fighting a vigorous political battle to create a new wave of large subsidies that shift risk of new construction away from investors, the firms must now manage the deployment of those subsidies to ensure they support their specific projects. With many of the most lucrative subsidies time- or capacity-limited, Constellation must work to extend expiring policies, and to capture available subsidies instead of having them flow to rivals.

CORPORATE STRUCTURE

The new reactors (Constellation discusses just Calvert Cliffs 3 at the site, but it is clear their plans include a number of additional reactors around the country) are to be developed and built by a new corporate joint venture. Though complicated, getting a picture of the corporate structure is important for providing context to the new reactor plan. Three significant findings are evident. First, the firm has adopted a joint venture approach to building new reactors in order to spread risks. This is a logical structure, one that has been adopted by all of the new-build nuclear projects underway. Second, the corporate structure remains in flux, having already been through a series of important modifications despite the young age of the venture. These shifts are likely to continue in response to significant changes in market conditions or public policy circumstances. Third, the growing role of foreign governments in the U.S. nuclear rennaissance can be seen clearly through the evolution in Constellation's deal structure. This involvement certainly weakens claims that nuclear power boosts domestic energy security.

Also of note is the highly compartmentalized corporate structure adopted for this venture. This compartmentalization may give Constellation greater flexibility to modify parts of their venture as conditions change. A more important goal, however, is probably to control financial and operating risks by isolating the parent firms from the liabilities associated with the new nuclear venture as much as possible. Though this insulation may be good for Constellation shareholders, it may be very bad from the perspective of the taxpayer or surrounding community—the groups who will suffer if the venture does not go as planned.

The last wave of U.S. reactor construction resulted in massive capital write-offs. Similarly, poor incentive structures within the mortgage and commercial debt were significant factors in the growing losses, and resultant taxpayer bailouts, of financial firms. These examples should underscore how important proper risk management and incentive alignment is with these new-build scenarios. Unfortunately, public policy seems to be moving in the opposite direction with more subsidy programs with complex and opaque rules. Lost in the press to move ahead with new reactors is the fact that proper review and challenge of these programs is most critical at their inception, before taxpayers become contractually obligated to back tens of billions of dollars in new reactor investments.

NUCLEAR KEY PARTNERS

UniStar.

The first formulation of Constellation's joint venture was UniStar Nuclear LLC, launched in 2005. This entity was a partnership between Constellation and Areva. Constellation is the largest seller of wholesale and retail electricity, "[l]arger than maybe the next three competitors combined," according to Joe Turnage, a Senior Vice President in Constellation's Generating Group.[4] The involvement of Areva brought in both the French and German governments. Areva NP, the division of Areva slated to produce the Evolutionary Power Reactor (EPR) to be used at Calvert Cliffs was formed in 2001 by the combination of Siemens (roughly 30 percent owned by the German government) and Framatome (owned by the French government). The role of the German government is diminishing as that of France increases. Siemens announced in January 2009 that it would divest its interest in Areva NP, selling its interest to the Areva parent company, Areva S.A.[5] Areva S.A. is approximately 80 percent owned by the French government.[6]

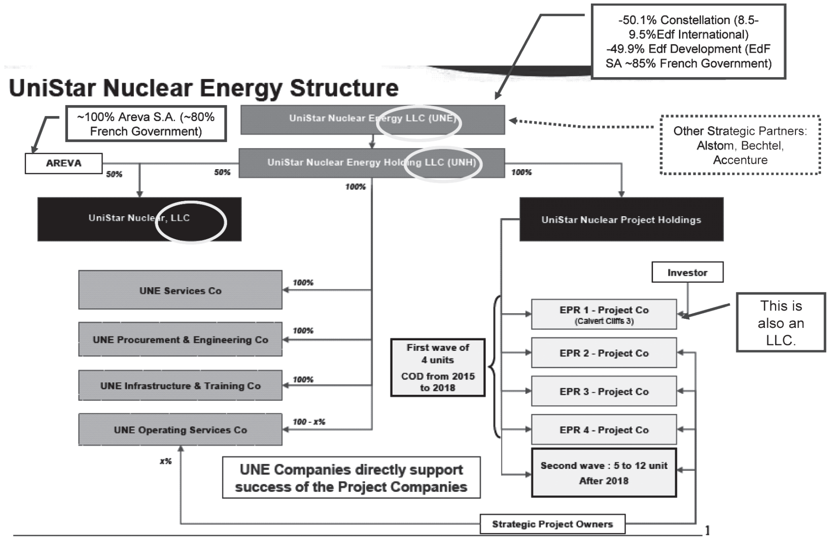
July 2007 brought significant changes to UniStar Nuclear with the formation of a similarly-named new partnership, UniStar Nuclear Energy LLC (UNE). UNE is owned by Constellation Energy and Electricite de France (EdF), and absorbed the earlier partnership. While the French government was already involved with Calvert Cliffs 3 through Areva S.A., EdF is also 85 percent owned by the French government.[7] This investment also gave EdF roughly 9.5 percent of Constellation Energy, UNE's parent. In December of 2008, EdF significantly upped its ownership of Constellation's nuclear venture, with an additional investment of $4.5 billion.[8]

Foreign ownership brings with it some interesting challenges. Calvert Cliffs will be owned and operated by a firm that has substantial involvement by the French government. The provider of critical heavy forgings will also be non-U.S.—either French or Japanese. Enrichment services, as well, are increasingly being supplied by non-U.S. firms—though USEC remains a U.S. competitor.

One obvious challenge with this situation is its legality. Section 103(d) of the Atomic Energy Act states that "No license may be issued to an alien or any corporation or other entity if the Commission knows or has reason to believe it is owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government."[9] An earlier *New York Times* article noted that the purpose of this clause was related to nuclear security, but that relative to U.S. firms "EdF's expertise in power plant construction is far more current."[10] FERC's decision to accept the EdF purchase demonstrates their belief that Section 103(d) does not apply in this circumstance, though subsequent challenge seems likely.[11]

Precedent also matters here. Would the involvement of countries such as China or Russia be subjected to greater constraints and review under Section 103(d) than that given to French involvement? Will the rapid acceptance of French government involvement in Calvert Cliffs 3 make it more difficult to argue national security concerns about foreign ownership in other circumstances?

Another important part of the venture structure has been the use of contractual relationships with key suppliers outside of joint venture partners. These include Bechtel (architect, engineer, and builder for the new plants), Accenture (plant-related information technology systems), and Alstom (nuclear turbine generators). Accenture's contractual involvement with the plant is interesting, as the firm recently conducted a global survey of public attitudes to nuclear power that "found that, overall, sentiment has swung in favor of nuclear energy."[12] Poll takers normally do not have a financial stake in the outcome of the polls. (See Figure 8-1.)



Sources: Basic chart developed by Turnage/Constellation, 2008. Additional material is from Mariotte, 2008; EdF, 2009; Gil/Reuters, 2009; and FERC, 2009.

Figure 8-1. Unistar Nuclear Energy Structure.

Venture Strategy.

UniStar's venture strategy can be discerned in part from corporate statements and publications, and in part from looking at the decisions they have made thus far. The discussion below addresses both their market strategy and a closely related political strategy.

Market Strategy.

The French model of nuclear plant deployment seems to provide the core framework in UniStar's strategy: market standardization, close integration with the political system, and achievement of economies of scale. Of particular import is:

- First Mover Advantage. UNE has worked to move early as a new U.S. reactor builder in order to secure critical inputs. Constrained material inputs, such as heavy forgings, are central to this effort, because delivery delays can ripple forward to delay a plant opening and can be extremely costly. However, the first mover advantage is perhaps even more important with respect to securing access to key government subsidies such as loan guarantees, construction delay insurance, and production tax credits that are (at least for now) limited to the first handful of reactors. UNE was the first firm to submit combined operating license (COL) paperwork and to establish contracts on key heavy forgings. They also moved quickly with early standardization of their reactor design, based on a model already being deployed in Europe. This strategy seems to be working: Calvert Cliffs 3 has made the Department of Energy's (DoE) short-list of five projects to receive highly lucrative loan guarantees. Two or three of these projects will be funded under current budget authority.[13]
- Economies of Scale. Reactor standardization is an oft-listed success factor in the French nuclear power program, and is being replicated in the UniStar venture. Other elements of achieving economies of scale include:
  - Adopting a single design and licensing process to roll out at multiple sites, including provision of contract licensing for other firms using the same Areva reactor.

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– Working with large partner firms with deep pockets and staying power in the market.
– Establishing long-term, stable relationships with a small handful of well connected partner organizations (specifically Alstom, Bechtel, Accenture, and Areva). This allows learning to spread through their broader supply chain. Partner firms are also more willing to incur high initial fixed costs if they are confident they will not be cut out of future developments.

UniStar notes a few related marketplace goals as well. These include achieving a predictable construction and maintenance schedule, streamlined and efficient operations at a high capacity factor, and reduced costs. All of these goals are logical objectives, though it is hard to guess whether they can be met once construction begins. Despite a highly favorable regulatory environment, two current projects for similar Areva reactors in Olkiluoto, Finland, and Flamanville, France, are both way over budget. These delays are indicative of the challenges UNE will likely face in the United States even once they are over licensing hurdles.

Political Strategy.

Nuclear power has always relied heavily on political support to make it viable. The new reactors will be no different. Some of UNE's market strategies have ancillary benefits in the political arena. These are supplemented by a variety of direct political initiatives to reshape the political terrain for Calvert Cliffs 3 to one more favorable to the firm.

- Powerful Partners. Members of the UNE venture, as well as the core set of subcontractors, are all large, politically savvy firms with long experience in working with governments to achieve their market goals. Both Areva S.A. and EdF are heavily government owned. The French government also owned more than 26 percent of Alstom through June of 2006, when its stake was sold to Bouygues SA, a firm with close connections with French President Nicholas Sarkozy.[14] Nuclear energy is viewed as a strategic industry of France, so aligning the French government with a new reactor at Calvert Cliffs is likely to have significant financial and political dividends for the project sponsor. The firm hopes the French government will provide a project guarantee for 30 percent of the project cost, with an additional 50 percent guarantee from the U.S. Government. Bechtel is a major player in large U.S. construction projects, well versed in the politics these projects often entail. Finally, reactor partner Areva-NP has used Japan Steel Works to produce heavy forgings for similar reactors it is building in France and Finland,[15] and it will benefit from Japanese government support should a similar supply arrangement be used in the United States.
- Suppressing Political Challenge. Past U.S. reactor construction was often heavily contested in the courts and the government. Delays of any

sort on a large project can be expensive. They are particularly troublesome if substantial investments have already been made on which interest is accruing, or if the delays boost the risk of missing power supply guarantees. Delays can also increase the overall market risks of the projects, since much can change in the demand pattern and pricing for electricity over a span of a couple of years. UniStar has deployed a number of strategies to minimize the likelihood of their business decisions being challenged:

— Collocating new reactors with old ones. Locating new reactors on the same site as old reactors reduces siting battles as well as allowing the new reactor to share some preexisting ancillary infrastructure investment.
— Lobbying. Constellation spent $100,000 in the first half of 2007 "to lobby the federal government on the issue [of loan guarantees], disclosure forms show."[16] Constellation's total spending on lobbying increased six-fold between 2006 and 2008, to nearly $3 million.[17]
— Reduce public oversight of environmental impacts. James Curtiss, a director of Constellation and head of the law firm Winston & Strawn's energy practice, worked with the NRC to change the definition of construction such that, according to an NRC official Andrew Kugler, it would exclude from NRC oversight "probably 90 percent of the true environmental impacts of construction."[18]
— Reduce or eliminate public input to licensing. Intervenors must be granted standing to

have their opinions heard in a licensing case. Historically, proximity to a reactor was sufficient since such parties would be harmed in the case of an accident. UniStar has advocated in NRC filings to replace this with a probabilistic assessment of risk based on modeling of the core damage frequency.[19] Intervenors argue that the new standard would rely on modeling by the applicant, and, if upheld, "no intervention—and thus no meaningful public involvement in the NRC's reactor licensing process—would be possible for any reactor design that could claim similar low risks."[20]

- Balance Promotion of Reactor as Both "New and Innovative" and "Tested and Low Risk." UniStar faces a challenge in its reactor designs due to conflicting pressures. To be eligible for the most lucrative federal subsidies, the reactor design must be new and innovative. Yet, investors rationally worry that very new technologies have much greater risks of poor performance and cost over-runs. As a result of trying to meet both of these objectives, UniStar's promotional materials tend to be somewhat schizophrenic, describing the reactor as "advanced" and "state of the art" as well as "evolutionary" and employing "technologies that have been licensed in the United States for more than 40 years."[21]
- Publicize Jobs Creation. All big industrial projects use local job creation as a selling point to garner community support of their project. Calvert Cliffs 3 is no exception. Constellation notes that the project will provide approximately

4,000 jobs during peak construction, and boost permanent jobs within Calvert County by about 360.[22] While some new jobs will be created, the exact numbers are always tough to benchmark. As of August 2006, Constellation was the fourth largest employer in the Tri-county area of Southern Maryland, with 1,143 jobs.[23] Employment levels in 2004 were flagged at a similar 1,140.[24] The County's "Brief Economic Facts, 2006-2007" notes only 800 jobs for Constellation at the Calvert Cliffs Site.[25] The cause of the discrepancy could be measurement error, job shifts, or reduced need for labor—the source does not say. However, it is useful to note that the difference between the two values is almost exactly the number of new permanent jobs the firm says will be created by Calvert Cliffs 3.[26]

SUBSIDIES ARE CENTRAL TO VIABILITY OF CALVERT CLIFFS 3

Public subsidies have always been a central plank of UniStar's new reactor development program, something the firm has been quite up-front about. Questioning before the California Energy Commission in June of 2007 is a good example:

> Associate Member Geesman: "And just to revisit the cap[ital] question again. Your business model is premised on receiving the federal loan guarantee for each of your four projects. Is that correct?"
>
> Dr. Turnage: "That is correct."[27]

Around the same time, Constellation's Co-CEO noted to the *New York Times* that "Without loan guarantees we will not build nuclear reactors."[28] UniStar's President George Vanderheyden notes that "Everywhere else in the world where entities are pursuing advanced new nuclear plants, it is all governments. Only here in the U.S. do we try to make private companies build these plants."[29]

Nuclear power benefits from more than 20 subsidies, most of which are applicable to the Calvert Cliffs 3 project. These programs, listed in Table 8-2, support all key cost elements in the nuclear fuel cycle, from research and development to plant construction and operations, through closure and post-closure issues. The structure and value of some of these subsidies on plant economics are discussed in the subsequent sections. Many of these subsidy values shown are based on UniStar's own estimates.

	Revelance to Calvert Cliffs 3	Anticipated Subsidy Magnitude
Subsidies to Capital Costs **Cost of Funds**		
Federal loan guarantees/Clean Energy Bank	Eligible	Very large
Advantaged credit, foreign banks	Eligible	Large
Ratebasing of work-in-process	Merchant plant; not relevant.	Very large for eligible facilities
Regulatory risk delay insurance	Eligible	Medium
Cost of Capital Goods		
Accelerated depreciation	Automatic	Large
Research and development	Pro-rata beneficiary	Low to Medium
Output based subsidies		
Production tax credit	Eligible	Large
Market Price support		
Renewable portfolio standard	Included in OH; under consider-ation elsewhere, but not yet in MD.	Potentially large for eligible facilities
Subsidies to Operating Costs **Fuel and Enrichment**		
Cap on liability: fuel cycle, transport, contractors.	Pro-rata beneficiary	Moderate
Excess of percentage over cost deple-tion for uranium	Pro-rata beneficiary	Low
HEU dilution programs	Pro-rata beneficiary	Unknown
Enrichment D&D: LT funding shortfall	Pro-rata beneficiary	Low
Virtually free patenting of federal hardrock mining claims (including uranium)	Pro-rata beneficiary	Low
No royalty payments on uranium extracted from federal lands	Pro-rata beneficiary	Low
Inadequate bonding for uranium mine sites	Pro-rata beneficiary	Low
Insurance		
Cap on liability: reactor accidents	Automatic	Large
Regulatory oversight		
Incomplete recovery of NRC oversight costs.	Pro-rata beneficiary	Low; most costs now covered.

Table 8-2. A Compendium of Government Subsidies for Nuclear Power.

	Revelance to Calvert Cliffs 3	Anticipated Subsidy Magnitude
Taxes		
Calvert County, MD property tax abatement	Specific to plant	Relatively small
Depreciated value rather than assessed value as MD tax base	Automatic	Relatively small
Security		
Low design basis threat for reactors	Plant designed for higher than standard	Unknown
Ancillary costs to prevent proliferation	Pro-rata beneficiary	Unknown
Emissions and waste management		
Windfall CO_2 credits from grandfathering based on energy output.	Depends on CO_2 control regime.	Potentially Large
Inadequacy of waste disposal fee - spent fuel	Pro-rata beneficiary	Low-Moderate
Payments for late delivery of disposal services	Not relevant since new reactor not covered by old agreement.	Litigation likely to result in vey high federal payments.
Subsidies to Closure/Post-Closure		
Decommissioning trusts: preferential tax rates, special transfers; under accrual.	Only preferential tax rates would be relevant for a new reactor.	Relatively small

Table 8-2. A Compendium of Government Subsidies for Nuclear Power. (cont.)

FEDERAL LOAN GUARANTEES

Capital markets provide funds to finance new investments. The most common forms of capital are equity and debt. With equity, an investor owns a slice of the firm, and the value of that ownership interest varies with the fortunes of the company. Debt is a contract in which the lender provides cash to a borrower in return for a set of pre-defined payments of the amount lent, plus interest. Because the return to investors through equity (via dividends or a growing value for the shares owned) is not contractually guaranteed, investors normally require a higher return on equity than on debt. For both classes of instruments, the higher the perceived risk of the venture, the higher the rate of return investors will demand.

An important distinction must be made between the risk level of the firm versus the risk level of the project. Firm-level information on the cost of capital is often used as a benchmark for the financing assumptions for a new nuclear power plant. Large coal projects may be used as proxies as well. In both cases, costs are tweaked upward slightly to allow for the greater uncertainty of nuclear. This approach tends to understate the appropriate return targets for the nuclear project because nuclear power is considered a much higher financial risk than either the firm or alternative large power plant proxies.

The perception of greater risk is well placed, derived in large part from the actual historical performance of the industry. Historical cost overruns for the construction of the existing fleet of reactors topped $300 billion (in 2006 dollars); and sunk costs in reactor projects that were abandoned prior to completion added another $40 to $50 billion.[30] Another roughly $100 billion (in 2007 dollars) was deemed uneconomic at the time the electric industry was deregulated and was shifted to ratepayers as "stranded costs."[31]

The historical performance of these investments was, in large part, driven by market characteristics and risks that remain concerns today. The very large scale of reactors, their high fixed costs, and their long construction period create significant investment risks associated with misestimating what the market will look like when the plant construction finally enters production. The financial penalties from being wrong are quite large, as even with good market conditions, the economics of reactors require that they operate at a high capacity utilization to be profitable.

Absent federal intervention, the risk profile of new plants suggests that debt providers would require a high share of equity in the plant. They would also require returns on both debt and equity that would be too high for the energy produced to compete in the marketplace. While the industry views this as a negative outcome, it is actually a core function of capital markets, and quite a useful role for society. By requiring higher returns on higher risk ventures, capital markets provide strong incentives to find smaller scale or more rapidly deployable solutions that pose lower financial and market risks, yet still address the problem (e.g., creating more electricity) in comparable ways.

In this case, however, the federal government has on offer large loan guarantees. For eligible nuclear reactors or enrichment facilities, the high risk of default is shifted from their investors to taxpayers. The sums are significant: $20.5 billion has thus far been authorized for the nuclear sector, all but $2.0 billion earmarked for reactors. The industry is pushing for much higher levels, approaching $100 billion. Much of the debate has focused on the high default risk of the federal guarantees. These are real: both the Congressional Budget Office and the Government Accountability Office expect 50 percent of the loans to default.[32]

Often overlooked is the fact that the guarantees have tremendous value regardless of the default. There are two main reasons for this. First, they allow the plants to use a much higher share of debt (which is lower cost) than would otherwise be possible. The guarantees under present law will cover a project structure up to 80 percent debt. Second, the guarantees bring down the cost of that debt dramatically, since investors care only about the federal government's risk of default (close to zero) rather than the chance that the nuclear reactor will go bust.

Together these factors greatly reduce the cost of financing a new nuclear plant. UniStar estimates the program will save them 3.7 cents per kilowatt hour (kWh) on a levelized cost basis, a cost reduction of nearly 40 percent.[33] As shown in Table 8-3, this translates to nearly $500 million per year in savings per reactor. The authorizing statute allows the guarantees to stay out for a maximum of 30 years—which a rational owner will do since the cost of funds is so low. This translates to a public investment of nearly $13 billion for a single nuclear reactor, an astonishing amount of public support for a single private facility.

Value of Energy Subsidies to a UniStar EPR Nuclear Reactor			
		Value	Source/Notes
1) Constellation Energy Core Inputs (embedded in levelized cost estimates in Turnage, 2008b)			
	Reactor size (MW)	1,600	(1)
	Overnight cost (2007$/kW)	3,500	
	Reactor delivery date	2,016	
	Capacity Factor (avg).	0.953	
	ROE	0.15	
	D/E with guarantees	80/20	
	D/E no guarantees	50/50	(1)
	Duration of debt	30	
2) UniStar estimated savings from LG/MWhr (2007$/MWhr)			
	Base case break-even	57	(1)
	Break-even, no loan guarantees	94	(2)
	Incremental savings from LG	37	
3) Convert MWhr values to annual savings			
	MWh/year	13,357,248	(3)
	LG savings/year ($millions)	494	
	Duration of loan guarantee	30	
	PV of savings from LG ($millions)	14,827	(4)
Sources and Notes			
(1)	Joe Turnage, "New Nuclear Development: Part of the Strategy for a Lower Carbon Energy Future," International Trade Administration, Nuclear Energy Summit, October 8, 2008, pp. 24, 25.		
(2)	Note that this still includes other subsidies		
(3)	Hours per year x capacity factor		
(4)	Because the cost scenarios represent levelized costs, converting to a PV does not require discounting, as doing so would simply be reinflating the values already in their cost model over the operating life, then discounting them back to 2007 dollars with the same discount rate.		

Table 8-3. Value of Energy Subsidies to a UniStar EPR Nuclear Reactor.

These savings are not "free" money, as the industry likes to portray them. Quite the contrary: the savings to a specific industrial facility arise because their business risk is being moved from the investors who will profit from the new reactor to generally taxpayers. It is clearly a good deal for the nuclear industry; far less clear is how the taxpayer is benefiting.

PRODUCTION TAX CREDITS

The Energy Policy Act of 2005 introduced a 1.8 cent/kWh production tax credit for new nuclear power plants. The nuclear production tax credit (PTC) is limited in two ways. First, no single plant can claim more than $125 million per year in credits; or claim the credit for more than 8 years. Second, current statutes stipulate that a maximum of 6,000 megawatts (MW) of capacity will be able to claim the credit.

Although the Department of Energy has discretion in how the eligible capacity to receive the PTC is allocated across projects, it is reasonable to assume that each plant will get a smaller share of the total available subsidy the larger the number of new reactors that get built. UniStar's early cost estimates assumed they would get full access to the PTC; newer cost estimates assume they will get half of what they are eligible for. Politically, however, the energy-related PTCs are frequently tinkered with. Thus, it is plausible that if many plants are queued up to be built, Congress would simply increase the allowable number of credits. Senator Lisa Murkowski (R-Alaska), for example, has proposed doubling the cap to 12,000 MW.[34] EIA projections assume 8,000 MW of capacity will ultimately tap into the credit,[35] indicative of this possibility.

ADDITIONAL SUBSIDIES ASSUMED PART OF UNISTAR'S BASELINE COSTS

While UniStar's cost models do explicitly include the federal loan guarantees and production tax credits, the $57/MWH levelized cost base case scenario also includes many other subsidies that help keep costs down. Were these subsidies to be removed, the delivered cost of power would rise even further. Due to the large number of subsidies for the nuclear fuel cycle (see Table 8-2), the following discussion only addresses a handful that are considered to be significant.

Accelerated Depreciation.

Normal accounting rules allow capital investments to be deducted from taxable income over the service life of the investment. When deductions are accelerated, corporations receive higher than normal deductions in the early years of the investment. Funds that would have otherwise gone to the taxing authority are retained as additional cash within the firm, and can be used for other purposes. The provision acts as an interest-free loan. Towards the end of the asset life, the allowed deductions actually go below the baseline (since total deductions are capped at 100 percent of the investment), accelerated depreciation still provides net subsidies on a present-value basis.

The larger the investment, and the more rapid the write-off relative to actual service life, the larger the subsidy will be. Nuclear reactors, which can last 40-60 years, can be written off from taxes entirely in only 15 years. This generates a reduction in levelized power costs of roughly 0.3 to 0.6 cents per kWh. Price escalation in plant costs suggest the actual levelized value of accelerated depreciation may end up higher than this figure.

Accident Liability.

Most industrial enterprises face accident risks. What makes nuclear energy different is the potential for much larger scale damage through the release and dispersal of high-level, long-lived, radioactivity. Thankfully, the probability of a major accident at a U.S. reactor is very low. However, the potential damages should one occur would be extremely high.

The Price-Anderson Act (P-A), first passed in 1957 and renewed multiple times since then, caps the liability of a reactor owner for damages they cause to people and property outside their plant walls in the case of an accident. Under P-A in its current form, a primary tier of insurance (presently $300 million per reactor) must be purchased by the firms. A secondary level of insurance has been created through retrospective pooling of payments from all reactors should an accident at any single reactor exceed the available primary coverage. This second tier coverage provides, in aggregate, more than $10 billion nationwide.

As shown in Table 8-4, while the size of the total pool seems large, it is not. Payment of retrospective premiums is capped at $15 million per reactor per year, resulting in a delay of more than 6 years from the accident until final payment. Converting the P-A pool to a present value is appropriate given the long payment period, and the fact that most of the damage is caused immediately upon the accident. On a present value basis, the pool coverage is about 30 percent lower—roughly $7.7 billion. This level of damages is exceeded on a routine basis in storm events such as hurricanes.

	Nominal	Present Value	Notes
Total payments from Calvert 3 to offsite parties			
Primary Insurance, $mils	$300.0	$300.0	(1)
Retrospective premiums, $mils	$100.6	$66.5	(2), (3)
Total liability for Calvert 3	$400.6	$366.5	
Additional resources from other reactors			
Retrospective premiums, $mils	$10,462.4	$6,920.7	
Total available to offsite parties	$10,863.0	$7,653.8	
Adequacy of Coverage			
Balt/WDC MSA 2000 Population, millions		7.6	(4)
Total insurance available, $/person		$1,007	(5)
Calvert 3 coverage, $/person		$48	(5)

Notes and Sources:

(1) P-A coverage requirements were last revised in the Energy Policy Act of 2005.

(2) Retrospective premiums are capped at $15 million/year, so each reactor will need more than 6 years of payments to fully pay in their amount due. Calculations assume 105 reactors, 104 currently in operation plus Calvert Cliffs 3. Statutory retrospective premia of $95.8m per reactor can have a 5 percent surcharge levied, upping the total to $100.6m/reactor. Multiyear payments have been discounted at 12 percent real.

(3) This reflects UniStar financing assumptions of 50 percent debt at 12 percent and 50 percent equity at 18 percent, less 3 percent assumed inflation rate.

(4) "Ranking Tables for Metropolitan Areas: 1990 and 2000," U.S. Bureau of the Census, April 2, 2001, available from *www.census.gov/population/www/cen2000/briefs/phc-t3/tables/tab03.txt*.

(5) Aggregate coverage available per person before P-A cap reached; and Calvert Cliffs 3 portion of that coverage per person in the surrounding region.

Table 8-4. Insurance Coverage for an Accident at Calvert Cliffs 3.

In addition, the pool of coverage has grown much more slowly than the population density surrounding the plants, the value of real estate and infrastructure in the potentially affected areas, or court recognition (via jury awards) of ancillary damages in accidents, such as environmental damages and lost wages for injured workers. In the case of Calvert Cliffs 3, total coverage in the related Baltimore/Washington combined statistical area barely tops $1,000 per person before the private coverage maxes out. This small amount would need to cover loss of property as well as morbidity or mortality from an accident. The portion paid by Calvert Cliffs 3 directly to cover the off-site accident risk from its own operations (Tier 1 coverage plus its share of Tier 2) would be less than $50 per person affected.

While the original plan on P-A was for it to last roughly 10 years—at which point private insurance would be available, primary coverage levels have increased little on a real basis. Industry continues to claim that accident coverage remains highly constrained, and that increased requirements for them to internalize the accident risks from their operations would be unworkable. Surprisingly, however, there seem to be fewer constraints on the policies the utilities want to protect themselves from risk rather than third parties.

For example, Calvert Cliff 3's Tier 1 and 2 responsibilities under P-A force them to cover damages only up to $370 million present value. In contrast, based on a review of financial filings with the Security and Exchange Commission, Constellation Energy's insurance coverage at existing locations indicate that they would carry more than ten times as much insurance cover ($4.2 billion) for damage to their own property and interruption of service.

Any time there are statutory caps on liability below reasonably expected damages, a subsidy is conferred on the recipient industry. Quantitatively, this subsidy is equal to the premiums that would be required to purchase full coverage, less the premiums actually paid for the partial coverage under P-A. Valuing this amount is not easy, since it requires some data on the probability distribution of both accidents and damages. The subsidy estimates shown in Table 8-5 are based on work by Heyes.[36] They should be viewed as indicative rather than precise, as even he believes additional work is needed to develop more accurate values.[37]

	Low	High	Notes
	Cents per kWh		
I. Private investment in Calvert Cliffs 3			
Base case of Calvert Cliffs	5.7	5.7	Constellation estimate, Oct. 2008
	-	-	
II. Public investment in Calvert Cliffs 3			
A. Selected EPACT subsidies			
Production tax credits	0.5	0.5	Constellation estimate assuming 50% access to PTCs
Loan Guarantees, 100% of debt	3.7	3.7	Constellation estimate, Oct. 2008
Industry total estimated cost	9.9	9.9	
B. Additional subsidies ignored in Constellation models			
Accelerated depreciation	0.3	0.6	15 yr 150% DB vs. service life.
Price-Anderson cap on reactors	0.5	2.5	Based on Heyes (2002); values uncertain.
Waste fund short-fall	-	0.2	Based on Rothwell (2005).
Calvert Co. property tax abatement	0.0	0.0	$20m/year, but not visible on a per kWh basis.
Reduced cost of capital from de-lay insurance, first two reactors	-	0.8	High estimate based on Bradford (2007).
Add-in missing subsidies	0.8	4.1	
III. Total cost of nuclear power			
Public subsidy	5.0	8.3	
Public/private share	87%	145%	
Subsidy/avg. wholesale rates, 2002-06	113%	189%	
Full cost of power	10.7	14.0	

Table 8-5. Public Subsidies to Calvert Cliffs 3 Approach Private Capital at Risk and Exceed Value of Power Produced.

More recent estimates contained within a CBO report estimate the subsidy value of P-A caps at less than $600,000 per reactor year. This estimate is not considered realistic, and therefore not included.[38] As there is not much resolution on the origin of this value, it is difficult to pinpoint the drivers behind such a low number. However, politically it would be highly unlikely for the industry to fight so fiercely for more than half a century to retain this subsidy if the value to them really was so insignificant.

One common issue with these lower estimates is that they estimate subsidy costs for a handful of scenarios, rather than for a much bigger universe of accident scenarios. For example, the probability of an accident with damages in excess of $12 billion may be low, but if one sums the probability of an accident for the entire range of $300 million through tens of billions, the numbers turn out larger. It is not clear whether this specific limitation applied to the CBO work or not.

Management of Long-Lived Nuclear Waste.

High level radioactive waste must be isolated and managed for thousands of years. At any point during this period, accident or theft can happen, bringing with it potential liabilities to the waste generator and site manager, should they still be in operation. A suitable waste repository is quite difficult to site and build, and faces severe risks for cost escalation.

The combination of technical complexity and difficult, though long-lived, risk exposure is not one that investors or owners like very much. These factors could well have made civilian nuclear power uninvestible. Even if the waste management concerns did not block investment entirely, it is clear that they would have further worsened the already challenging economics of nuclear power.

Federal subsidies have solved this problem for the industry. First, the government stepped in and agreed to take on full ownership of the waste from the plant owners, eliminating uncertain and very long-term liabilities. Given the technical risks and political concerns related to a high level repository, the government's contractual obligations were very poorly structured, containing no risk sharing on delays. Second, the fact that the government agreed to take on this liability in return for a small fee per kWh that is passed through to consumers is also quite important. In so doing, a very large and uncertain fixed cost has been shifted to a very small and predictable variable cost. Both of these factors generate subsidies: the former through reduced sector risk, bringing down cost of capital; and in the latter, if the federal collections underestimate the funds that will ultimately be needed.

This structure has turned out quite badly for the taxpayer. The federal government has been unable to meet its promised deadlines, and therefore has been subjected to breach of contract litigation by the industry and has lost. Payments are already going to utilities to cover on-site storage, and are expected to escalate sharply over time. The tax liabilities have a present value according to the U.S. Department of Energy of at least $7 billion,[39] and ranging as high as $80 billion.[40] For a new reactor, economist Geoffrey Rothwell estimates per kWh surcharges would need to be at least 0.2 c/kWh higher to cover waste disposal costs taken on by the government.[41]

Calvert County Property Tax Abatement.

In an effort to increase the chances of getting a new reactor at Calvert Cliffs, the Calvert County Board of Commissioners approved a 50 percent reduction in property taxes over the first 15 years of plant operations. This is expected to save the company $20 million per year. The company currently pays $15.5 million in annual property taxes.[42] While too small to even register on a per kWh basis, this is a very sizeable subsidy for a county-level government to offer. The property tax abatement to the new reactor is equivalent to roughly 7 percent of the County's 2009 budget of $296 million, and larger than their entire annual debt service.[43]

INTEGRATING UNISTAR COST ESTIMATES AND ADDITIONAL SUBSIDY DATA

In an effort to sell the idea of a new reactor at Calvert Cliffs and to educate people about what such an effort would entail, Constellation staff have provided many briefings over the past 4 years on the venture. Most of them have been conducted by Joe Turnage, a Senior Vice President in the Constellation's Generation Group. His presentations provide a valuable resource for understanding the economics of the new reactors based on an industry view of the market and their cost of capital. One can also see how core assumptions have changed over time as market realities demonstrated problems with original assumptions. This section reviews specific information on the value of subsidies to Calvert Cliffs, then provides some additional contextual information on the subsidy value of federal loan guarantees.

Value of Government Subsidies Clear From Constellation Cost Models.

Running through the results from Constellation's own cost models (the models themselves are not public) clearly illustrates why the firm has focused so heavily on government support. The models calculate the levelized cost per MWh of delivered energy from a new reactor, based on the firm's internal assumptions regarding financing, cost of capital and equipment, and operating parameters. Levelized costs represent the average price they expect to be able to deliver electricity to the wholesale market during the life of the plant and pay back their full investment, including financing costs.

As of October 2008, Turnage projected the break-even price for their firm at $57/MWH.[44] In an earlier presentation, he noted that "at $80/MWH, these plants would not likely be built."[45] Higher delivered costs increase the risk that when the plant finally comes on line, its cost structure will be too high to enable UniStar to recoup its investment and earn a profit.

Interestingly, without the government subsidies, UniStar's own models illustrate there is no way they would be competitive. Without loan guarantees for all of the project debt (assumed at 80 percent of the project cost), the levelized cost from Calvert Cliffs 3 would spike from $57/MWH up to $94/MWH. This scenario appears still to assume that the plant would receive lucrative production tax credits worth roughly $5/MWH; the price of power without either of these two programs would be almost $100/MWH.[46]

As a frame of reference, U.S. average wholesale power prices in 2007—a time of surging energy prices—were roughly $57/MWH.[47] UniStar's new reactor would just about have broken even, assuming everything on construction and operation went according to plan. The average wholesale electricity price for the U.S. during the 2001-2007 period was only $47/MWH.

Table 8-5 provides a more detailed summary of the public and private costs associated with the Calvert Cliffs 3 reactor. Some key conclusions:

- Full Levilized Cost of Power Is Not Competitive Based on Unistar's Own Data. The largest cost elements (net of subsidies levelized cost of new EPR reactor, production tax credits, and loan guarantees) take Turnage's own inputs as given. These factors alone, which put the levelized cost of nuclear power at $99/MWH, render the resource uncompetitive.
- Public Sector Investment Nearly Equal To, or Larger Than, Private Capital Put at Risk. Under the high cost estimate, the public sector investment in Calvert Cliffs 3 is nearly 150% that put in by the plant owners themselves. Should the investment pay off, the public sector would have no direct stake in the venture's profits.
- Subsidies Are Worth More Than the Power. The concept of "value added" measures how much more a product is worth than the sum cost of its inputs. Striking in Table 8-5 is the fact that Calvert Cliffs appears to be a value subtracting enterprise, where input costs are actually worth more than the power one gets out at the other end. Subsidies are 113 to nearly 190 percent of the wholesale value of power, even assuming in the low estimate that there are no subsidies to waste management or from delay insurance. A 5- year average was used to prevent single-year

price fluctuations from skewing the results. Value-subtracting businesses do not normally survive in market economies because investors bleed cash. With nuclear power, public subsidies drive this anomaly.

As discussed below, however, some of Turnage's assumptions are not realistic; and their "net-of-subsidies" values still include some important subsidies to nuclear power. Correcting these assumptions can be expected to further worsen the economics of the proposed Calvert Cliffs reactor.

- Levelized Cost of Reactor Likely too Low. Turnage assumes an overnight capital cost of a new reactor at $3,500/kW of capacity. The overnight value estimates the cost if the plant could be built in one day; "all-in" costs reflect the need to finance the plant, as well as incur costs to integrate it with the grid.
  - The value used in the Turnage cost models is well below the $5,746/kW overnight cost for this same reactor estimated by the Congressional Research Service.[48] This shift alone would bring the levelized cost well above $72/kW, even with loan guarantees and the PTC.
  - Turnage's estimate assumes equity providers would want a return on equity of 15 percent (down from 18 percent in earlier iterations). As noted above, however, investment hurdle rates are driven by the riskiness of the project, not the firm. A new-build nuclear reactor is viewed as quite high risk, and would therefore require a higher-than normal return on equity in order for investments to

proceed. It is useful to note that the return on equity for Exelon Corporation, a large U.S. utility with many nuclear reactors for which it did not bear the construction risks, has averaged more than 20 percent over the trailing 5 years.[49] It is hard to imagine investors accepting a lower return for a higher risk project in the case of UniStar. Thus, without federal guarantees on the debt, the cost of equity should be expected to rise well above Turnage's 15 percent target. There is much higher to go: risks commensurate with early stage venture capital can have hurdle rates of 30 percent or higher.

- "Stress" Cases also understate likely reactor costs. To evaluate how well the venture would succeed if certain conditions were worse than expected, Turnage estimated levelized costs assuming no federal guarantees were available; and that the lifetime capacity factor dropped from 95.3 percent to 85 percent.
  - Under a merchant model, Turnage assumes UniStar could still finance 50 percent of the venture with debt, at a 12 percent interest rate. Yet, Constellation's 5-year debt-to-total capital ratio has averaged only slightly above 50 percent for existing facilities for the 5 years prior to October 2007.[50] Higher-risk new projects would be expected to have higher equity requirements than the existing plant fleet in a merchant environment.
  - The non-partisan Keystone study of nuclear economics, issued in June 2007, estimated equity ratios even for non-nuclear merchant

plants would need to be at 65-70 percent.[51] However, the recent collapse of credit markets suggests even higher equity ratios might be needed.

— Jim Harding, a main author of the Keystone report, also views lifetime capacity factors for new plants deploying new technologies at 75-85 percent.[52]

EVALUATING THE SOCIAL BENEFITS OF CALVERT CLIFFS 3

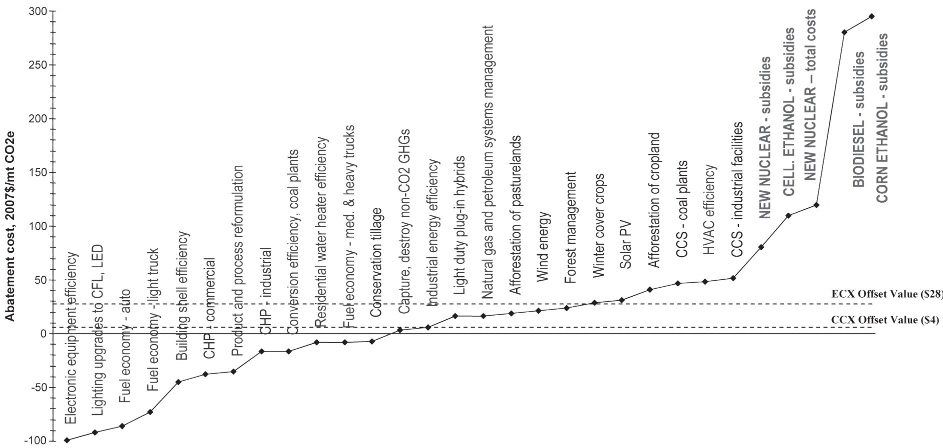
In return for billions of dollars in subsidies for Calvert Cliffs 3, the taxpayer is expected to get two main social benefits: energy security and reduced emissions of greenhouse gases. Both of these claims begin to erode under closer scrutiny.

On the energy security front, proponents argue the nuclear power can reduce or replace our reliance on oil imports from unstable regions. This line of reasoning has a number of weaknesses. First, it will be many years before electricity and oil are substitutes, and electrical power on the grid provided by nuclear power stations would be able to fuel our transport fleet. At present, these two markets are almost unrelated. Even hybrid vehicles, which do rely on some electrical motive energy, get that energy from onboard combustion of fossil fuels, not from the grid. Second, nuclear power is an increasingly international venture, with key components produced abroad. Key plant components such as heavy forgings are a good example, and are not made in the United States. Enrichment services and uranium are also provided by international markets with some U.S. presence, but also with heavy reliance on foreign firms and mines.

Finally, there is the link between reactors and terror risks. This can arise through attacks on plants, or through the linkage between the civilian power sector and weapons proliferation. With respect to the former, the NRC ruled unanimously in January 2007 that nuclear plants don't need to protect themselves against attacks using airplanes.[53] However, Constellation has said their design basis is harder, and could withstand a direct hit from a civilian or military jet aircraft. With regards to proliferation, it is unlikely that a single new reactor at Calvert Cliffs will have a material impact on proliferation risks. However, reactor construction on the order projected to mitigate any sizeable portion of global GHG emissions clearly would.

The climate change picture is even more interesting, as this has been a major push behind public subsidy to new reactors. While it is true that nuclear power does have quite low emissions of greenhouse gases (GHGs) per unit of energy produced, those figures are not zero. In addition, the economic costs for the reactors are quite high once both the public and the private investments are taken into account. As a result, the cost per unit of CO_2 equivalent removed through the nuclear fuel cycle turns out to be significantly higher than many other options with shorter implementation periods and much lower market and financial risks.

Figure 8-2 illustrates this graphically, integrating data on the marginal cost of abatement from evaluative work done by McKinsey with estimates of subsidies to new build nuclear reactors done by Earth Track. As can be seen, the lower cost options tend to be in improved efficiency, systems management, and land use modifications. Subsidies alone to nuclear power exceed the costs of many of these other alternatives and greatly exceed the market value of the off-sets on the carbon market. Many scientists believe we have a limited window to address climate change con-cerns, and it is quite important that our investments into GHG reduction are done efficiently, targeting the lowest cost, lowest risk options first.



Sources:

Abatement technologies: McKinsey & Company (2007), mid-range case.

Offset prices: Average of contract values from CCX (2008-10) and ECX (2008-12).

Subsidy data: Earth Track, Inc. Chart prepared by Earth Track, Inc. for Greenpeace Solutions, 2008.

Figure 8-2. Subsidizing Nuclear Energy Is an Expensive Way to Address Climate Change.

CONCLUSIONS

Calvert Cliffs 3 is one of a number of projects around the world to restart nuclear energy through the construction of many new reactors. A close review of the corporate structure and public support to this initiative indicates that much of the financial and operating risks are being shifted from investors to the taxpayer and the surrounding population. Smaller scale, emerging power sources are also likely to be hurt in two ways. First, subsidies will enable uneconomic reactors to be built. Second, even if the massive capital investments in the reactors are lost entirely due to bankruptcy or restructuring, the reactors would continue to function. Their low operating costs would squeeze the margins of many alternative resources that had not been so heavily subsidized.

Once subsidies are added to private investment costs at the reactors, Calvert Cliffs 3 would not be commercially competitive. Public subsidies alone are likely to exceed the value of the power that the facility produces. Public investment is nearly equal to (low estimate), or greatly exceeds (high estimate), the private investment into the new plant. Nonetheless, the taxpayer will not share in the "upside," should the plant be financially successful.

Even from a greenhouse gas perspective, nuclear power is an expensive solution. Once reductions are normalized to the cost per metric ton of CO_2 equivalent reduced, it is evident that there are a variety of other technologies and options that are far less expensive, as well as having lower financial risks, smaller unit sizes, and more rapid deployment schedules. The availability of these other options can be seen by how much lower the market value of carbon offsets is relative to the cost of abatement via the nuclear fuel cycle.

While the United States faces real energy security and climate change challenges, this does not mean that earmarking tens or hundreds of billions of dollars in subsidies to the nuclear sector is a worthwhile or effective strategy. Any subsidies that are to be deployed to reach these policy end-goals should be competitively tendered, forcing nuclear to compete on an efficiency basis with alternative energy pathways.

The federal government's foray into large scale subsidization of energy credit, both through loan guarantees and more recently, via clean energy "banks" is particularly worrying. There is little evidence that the federal government has the technical skills to manage programs on these scales, or the ability to shelter decisions from being politicized. Oversight structures and the alignment of incentives to increase the chance of project success are both lacking. Once these deals are approved, there will be little that can be done in terms of mid-course corrections to reduce the size of taxpayer losses or the competitive impediments that widescale subsidization of large, baseload nuclear capacity will create for smaller-scale alternatives.

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