Government Subsidies to Nuclear Power: A Case Study of UniStar's Calvert Cliffs III Reactor

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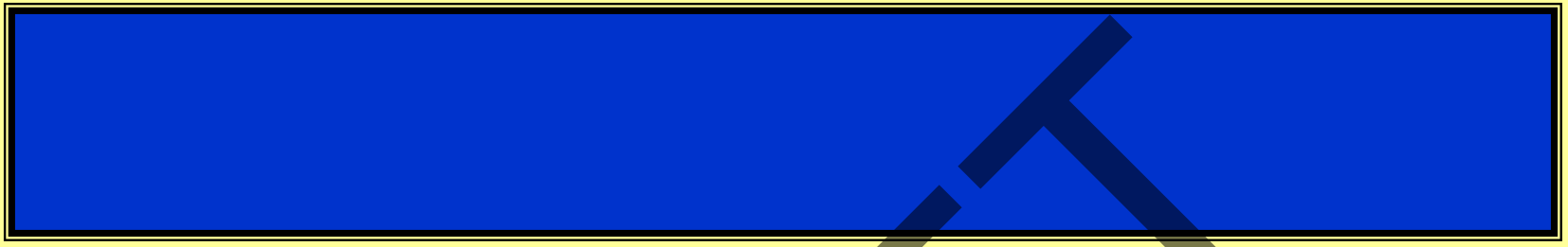

Historic Subsidies to Nuclear: Subsidy Dependency an Old Problem

Subsidizing Plant Construction and Operation (2004$)

Period of Analysis	Federal Subsidy, $Billions		Subsidy, cents/kWh		Avg Subsidy as % of Industrial Price	Analysis	Notes
	Low	*High*	*Low*	*High*			
1947-99	160.87	-	1.33	-	NA	Goldberg/Renewable Energy Porfolio Project (2000)	P-A not estimated.
1968-90	110.52	-	2.06	-	32.8%	Komanoff/Greenpeace (1992)	P-A not estimated.
1950-90	128.69	-	2.35	-	NA	Komanoff/Greenpeace (1992)	
1989	6.89	14.61	1.31	2.76	31.2%	Koplow/Alliance to Save Energy (1993)	
1985	24.23	-	6.31	-	81.8%	Heede, Morgan, Ridley/Center for Renewable Resources (1985)	P-A not estimated.
1981	-	-	5.29	11.16	104.0%	Chapman et al./US EPA (1981)	Tax expenditures only.
1950-79	-	-	3.71	5.46	NA	Bowring/Energy Information Administration (1980)	Tax and credit subsidies not estimated.

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Venture Overview: UniStar Nuclear, LLC and Its Partners

- **Cutting edge technology?** Calvert Cliffs will use an Areva 1600 MW "Evolutionary Power Reactor".
- **Main players.** Joint venture formed July 2007 between Constellation Energy and Electricite de France (EDF).
  - Absorbed earlier partnership between Constellation and Areva NP.
  - EDF committed $350m immediate investment; $275m additional if benchmarks met. Can buy up to 9.9% of Constellation.
- **Current roles.**
  - **Constellation and EDF**: own and operate Calvert Cliffs III (Lusby, MD) and at least three other reactors.
  - **Areva NP**: Reactor technology and marketing.
    - Plants will all use Areva's European Pressurized Reactor (EPR). Called "Evolutionary Power Reactor" in US; Areva spent $200m to adapt reactor to US market.
    - Areva comprised of old Framatome and 1/3 ownership by Siemens. Both French and German governments have significant ownership.
  - **Bechtel**: Architect, engineer, and constructor of new plants.
  - **Additional partners** for license preparation; and forgings and machining.

Venture Strategy: Market Side

- **First mover advantage**, to secure access to key subsidies and scarce parts.
  - First firm to submit COL paperwork (albeit partial).
  - Early standardization of reactor design.
- **Economies of scale** through multiple installations, single partners, standardization.
- **Minimize public opposition** by using existing reactor sites.

Venture Strategy: Political Side

- **Subsidies integral to build decisions.**
  - **Michael Wallace**, Co-CEO, Constellation.
    - "Without loan guarantees we will not build nuclear power plants." (NYT, July 2007).
  - **Joe Turnage**, Sr. VP, Constellation Generation Group
    - *Associate Member Geesman*: "And just to revisit the cap 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." (CEC Workshop Transcript, 29 June 2007: 302).
  - **Foreign subsidies** also important.
    - "COFACE, the French Ex-Im Bank equivalent, and JBIC, the Japanese equivalent, absolutely [sic] prepared to loan into these projects at attractive rates. They are not going to do it unless we fix the pari passu problem." (Turnage, CEC, 295).
- **Changing the political environment**
  - **Lobbying.** "Constellation spent $100,000 in the first half of this year to lobby the federal government on the issue [of loan guarantees], disclosure forms show." (*Baltimore Sun*, 6 September 2007).
  - **Reduce public oversight.** Redefine "construction" to exclude oversight for all non-reactor site work.

Constellation's Ever-Changing Cost Estimates

- Overnight costs – internal estimates:
  - 2005: $1,600-$2,000/kWe (UniStar EPR, 2005).
  - March 2007: $1,935/kWe (Turnage, 12 March 2007).
  - June 2007: $2,400/kWe (Turnage, CEC: 288).
- "All-in" costs:
  - Industry, June 2007: $5,000-$6,000/kWe (Quillian, NEI, CEC: 260).
  - Constellation, June 2007: $3,125/kWe (Turnage, CEC: 281).
  - Industry, October 2007: $5,000-$6,000/kWe (Moody's, 10/07).
- Which metric?
  - "From a credit perspective, Moody's is indifferent to what the 'overnight' cost of the actual nuclear generating plant might be – as overnight costs exclude owner's costs and price escalation." (Moody's, 10/07).

Nuclear Subsidies to Capital Investment and Market Price Support

	Revelance to Calvert Cliffs III	Anticipated Subsidy Magnitude
Subsidies to Capital Costs		
Cost of Funds		
Federal loan guarantees	Eligible	Very large
Advantaged credit, foreign banks	Eligible	Large
Ratebasing of WIP/AFUDC	Merchant plant; not relevant.	N/A
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	Nuclear eligible in some federal amendments; not currently in MD standard.	Potentially Large

Nuclear Subsidies to Operating Costs (1)

	Revelance to Calvert Cliffs III	Anticipated Subsidy Magnitude
Subsidies to Operating Costs		
Fuel and Enrichment		
P-A cap on liabliity: fuel cycle, transport, contractors.	Pro-rata beneficiary	Moderate
Uranium % depletion	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		
P-A cap on liability	Automatic	Large
Regulatory oversight		
Incomplete recovery of NRC oversight costs.	Pro-rata beneficiary	Low; most costs now covered.

Nuclear Subsidies to Operating Costs (2) and Closure/Post Closure

Subsidies to Operating Costs, continued		
Taxes		
MD property tax abatement	Specific to plant	Relatively small
Depreciated value rather than assessed value as MD tax base	Automatic	Relatively small
Plant security		
Low design basis threat	Plant designed for higher than standard	N/A
Emissions and waste management		
Windfall CO2 credits from grandfathering based on energy output.	Depends on CO2 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.	N/A
Subsidies to Closure/Post-Closure		
Decommissioning trusts: preferential tax rates, special transfers; underaccrual.	Only preferential tax rates would be relevant for a new reactor.	Relatively small

Valuing the Subsidies: UniStar's Estimate

- No PTCs or loan guarantees: $80/MWh.
- Loan guarantees, no PTCs: $48/MWh.
- Loan guarantees and PTCs: $37/MWh
  - Constellation's Turnage tags the difference as "potential rate payer value," though they are a merchant supplier.
  - Turnage: "More fundamentally, at $80/MWh, these plants would not likely be built."
- They value the subsidies at **$575 million per US Evolutionary Power Reactor per year**. (Turnage, 12 March 2007:48).
  - 1600 MW at 95.3% capacity factor (their assumption) results in a subsidy of 4.3 c/kWh.
  - EPACT allows guarantees to run 30 years; nominal value over this time would be nearly $13 billion *for a single reactor.*

Optimistic Underlying Assumptions Understate Subsidies

- **Cost of funds too low.** Underestimates merchant cost of capital.
  - Assumes 50% debt (@12%); 50% equity (@18%).
  - Too optimistic? Constellation current ROE is 18.93%; clearly new build nuclear deserves more.
  - Constellation's 5-year Debt/Cap ratio is 51.8% *for existing facilities.* (Moody's 10/07).
  - Absent subsidies, equity ratios would need to be substantially higher – 65-70% even for non-nuclear merchant plants. (Keystone, 6/07).
- **Capacity factor too high.**
  - Constellation assumes 95.3% capacity factor; this is aggressive.
  - Highest US industry-wide capacity factor was 90.3% (2002). Keystone high value is only 90% as well; Harding views 75-85% as reasonable for new build.
  - While 34 plants exceeded UniStar target in 2006, lifetime performance at this level, with a new reactor design, will be much more difficult.
- **Plant costs too low.** Base case assumes overnight costs of $1,935 kWe.
  - Company estimates already higher; and may be higher still at point construction starts.

UniStar Calculations Also Ignore "Baseline" Subsidies

	Low	High	
	Cents per kWh		
Private investment in Calvert Cliffs III			
Base case of Calvert Cliffs	3.7	3.7	Constellation estimate, Mar. 07
Public investment in Calvert Cliffs III			
Selected EPACT subsidies			
Production tax credits	1.1	1.1	Constellation estimate assuming full access.
Loan Guarantees, 100% of debt	3.2	3.2	Actual value probably higher due to higher merchant cost of capital.
Industry total estimated cost	8.0	8.0	
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); needs updating.
Calvert Co. property tax abatement	0.0	0.0	$20m/year.
Cost of capital value of delay insurance, first two reactors	0.7	0.8	Based on Bradford (2007).
Public subsidy	**5.8**	**8.4**	
Public/private share	**155%**	**226%**	
Full cost of power	**9.5**	**12.1**	

Price Anderson at Calvert Cliffs

- New reactors *would not* have been covered without the extension in 2005.
- Proximity to population centers, expensive RE, should result in higher than average premiums under a real insurance program.
- Calvert Cliffs located 50 miles from Washington, DC; 75 miles from Baltimore.
  - Nearly 8 million people live in the Baltimore-Washington,DC-consolidated metropolitan area.
  - Among the most expensive real estate markets in the country.

Price-Anderson: Adequacy of Coverage

Insurance Coverage if Accident At Calvert Cliffs III

	Nominal	Present Value
Total payments from Calvert III to offsite parties		
Primary insurance, $mils	$ 300.0	$ 300.0
Retrospective premiums, $mils	$ 95.8	$ 64.4
Total liability for Calvert III	$ 395.8	$ 364.4
Additional resources from other reactors		
Retrospective premiums, $mils	$ 9,963.2	$ 6,696.2
Total available to offsite parties	$ 10,754.8	$ 7,424.9

Adequacy of Coverage

Balt/WDC MSA 2000 Population, millions	7.6
Total insurance available, $/person	$ 977
Calvert III coverage, $/person	$ 48
Reactor::latte ratio	17

Price-Anderson: Protecting Yourself Versus Protecting Others

		Coverage $Millions
Calvert III Insurance for property and business operations		
Property Insurance		
Nuclear property	$	500.0
Blanket excess	$	2,250.0
Terror attacks under conventional property	$	1,000.0
Accidental outage coverage	$	490.0
Total available to business	$	4,240.0
Calvert III self-coverage/offsite coverage		11.6

Source: Constellation Energy Group Form 10-K, December 31, 2006.

Title XVII Loan Guarantees

- NGOs late to the game; not a single one submitted comments on the final rule.
- LGs provide large subsidy even if no default.
- Allows facilities to borrow at roughly Treasury bond rate, rather than junk bond debt levels.
- Allows facilities to use 80% debt for 30 years, rather than at least 65-70% equity.
- GAO, CBO, OMB all concerned DOE will underestimate risk premiums in up-front collections.
- Magnitudes of funding can crowd out smaller scale, less powerful competitors.

Summary

- The public is taking on a large share of the risk for the nuclear build out.
- The most important subsidies to nuclear are via shifting risks away from private investors, not from direct cash payments.
  - These are difficult to find, value, and challenge.
  - Federal loan guarantees pose the most immediate fiscal risks and potential to distort energy markets in damaging ways.
  - State and county policies are becoming more important not just in MD, but in TX and rate-base states as well (e.g., FL, SC have special rules for cost recovery).
- Price-Anderson liability caps need to be more fully analyzed.
  - One of the most important subsidies to nuclear; never comprehensively evaluated.
  - Caps are well below what utilities are buying for their own plant and operations.