

Subsidies to Nuclear Power in the United States: The Case of Calvert Cliffs Unit III

Costing Nuclear Power's Future

Nonproliferation Policy Education Center and the Carnegie
Endowment for International Peace


February 11, 2009

Washington, DC

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Dreaming of a Better Tomorrow

BY MEN WHO PLAN BEYOND TOMORROW




Deserts Will Bloom Through Atomic Power

NEW "BREAD BASKETS" of the world can grow where only sand and scrub had been. Harnessed atomic energy will transform deserts into rich fruit and grain country... provide power to tap subterranean water for irrigation, power to run machines, to operate utilities. Already Atomic scientists are adapting the world's newest wonder to this peacetime use.

AMONG the good things of life, Americans by the millions rate high the wholly unique Canadian whisky they order by name—Seagram's V.O. This lightest of all Canadian whiskies, this clean-tasting imported blend is Canadian whisky at its glorious best.

This Whisky Is Six Years Old—86.6 Proof. Seagram-Distillers Corporation, N.Y.



Seagram's V.O. Canadian
CANADIAN WHISKY—A BLEND... OF RARE SELECTED WHISKIES

- What timeframe?
- What options foregone?
- What measures of success?
- New problems created?
- **Whose money?**

Nuclear Has Been Heavily Subsidized for More than Half a Century



AS GENERAL ELECTRIC SEES IT . . .

The atom will produce power for homes in 5 to 10 years

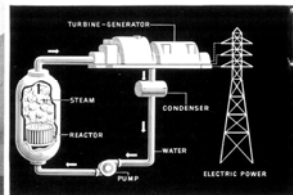
Full-sized plants will generate electricity from atomic energy without government subsidy.

Biggest question in producing electricity with atomic energy has not been: Can it be done?—but: How can it be done economically on a full-scale basis so that many areas and many people can benefit? America is now very close to a practical answer.

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 five years — certainly within ten — 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.

Developing the right fuel element is still a problem, but the Atomic Energy Commission, General Electric scientists and other experts are all working on a solution. And real progress is being made.

Protective plastic suit enables technician to work safely. 12,000 General Electric employees are assigned to atomic projects.



Atomic power plant of type developed by the A. E. G. Argonne National Laboratory. Fissionable material serves as fuel to produce steam which powers turbine. For more information from G. E.'s Atomic Power Study, write Department K, 2419, Schenectady, N. Y.

Progress Is Our Most Important Product
GENERAL ELECTRIC

“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 five 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.”

-General Electric Advertisement, 1954

Historic Subsidies to Nuclear: Subsidy Dependency an Old Problem

Subsidizing Plant Construction and Operation (2007\$)

Period of Analysis	Federal Subsidy, \$Billions		Subsidy, cents/kWh		Avg Subsidy as % of Industrial Price	Analysis	Notes
	Low	High	Low	High			
2008	-	-	5.7	8.3	129-189%	Koplow/Earth Track calculations	Share of national average wholesale rates, 2002-06
1947-99	178.0	-	1.5	-	NA	Goldberg/Renewable Energy Portfolio 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.

Nuclear Subsidies to Capital Investment and Market Price Support

	Relevance 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)

	Relevance to Calvert Cliffs III	Anticipated Subsidy Magnitude
Subsidies to Operating Costs		
Fuel and Enrichment		
P-A cap on liability: 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.

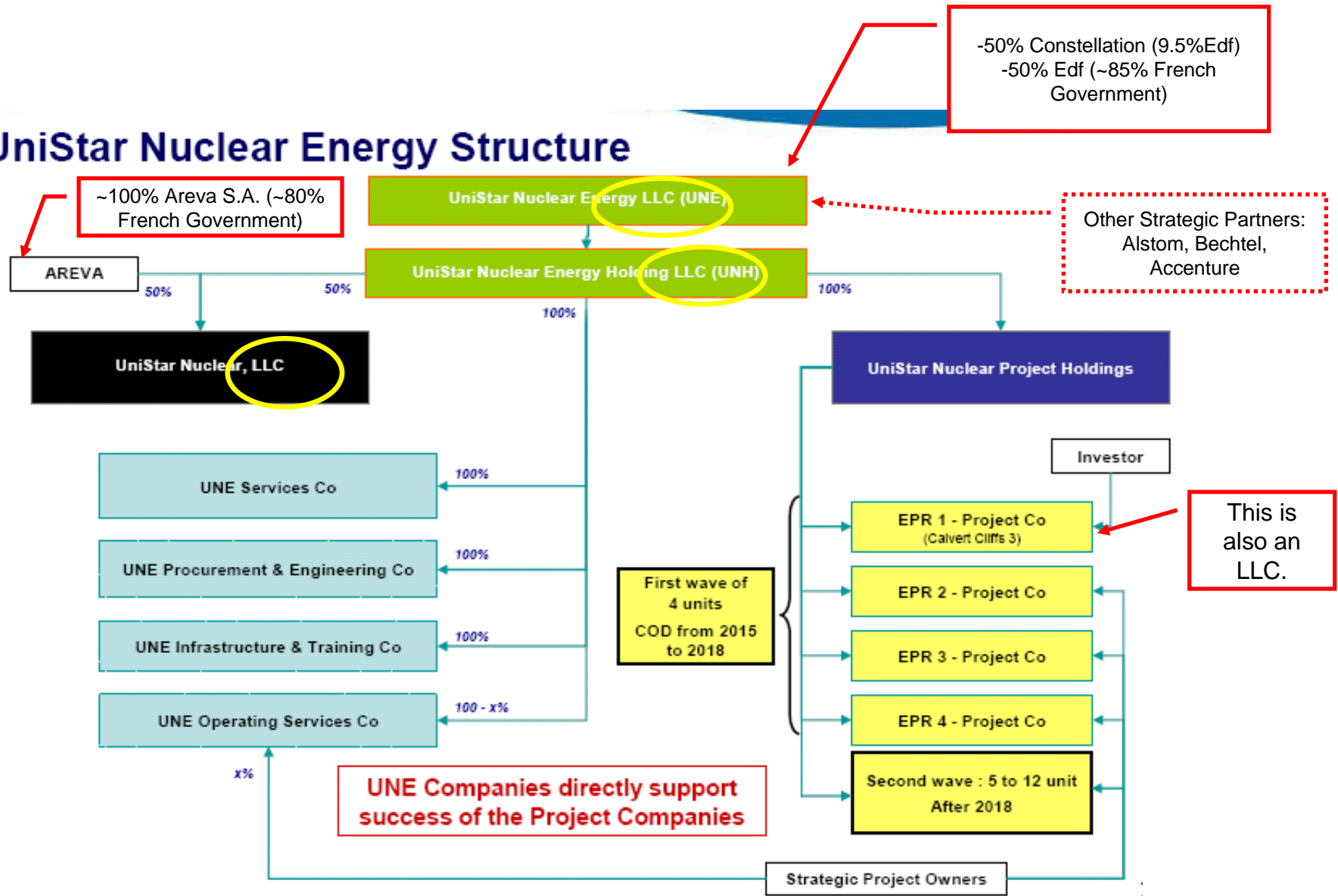
Nuclear Subsidies to Operating Costs (2) and Closure/Post Closure

	Relevance to Calvert Cliffs III	Anticipated Subsidy Magnitude
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

Socialization of Nuclear Power Is Counterproductive and Inefficient

- Energy market transformation requires market transparency, thousands of small actions.
- Subsidies to nuclear new-build:
 - Likely exceed private capital put at risk.
 - Represent highly concentrated political bets.
- Cost of GHG reductions via nuclear pathway greatly exceed other options.

UniStar Nuclear Energy Structure



Sources: Turnage/Constellation (2008); Mariotte (2008); Edf (2009); Gil/Reuters (2009).

Calvert Cliffs III: UniStar Nuclear Objectives

- Economies of Scale
 - Single design, large firms, multiple sites.
- Reliable supply chain
 - Small number of established, well connected partners.
- Predictable construction and maintenance
 - Standardization; manage, eliminate outside challenge to licensing, development.
- Streamlined, efficient operations
 - IT platform, high capacity factor targets.
- Reduced costs
 - EPR experience in Finland, France not reassuring.

Loan Guarantees: The Fog of Pork

- “[A] subsidy is when the federal government makes a payment to a private party. The energy loan guarantee program works the other way around. The private parties make payments to the federal government in order to receive the loan guarantees. That’s not a subsidy.” (Richard Myers, NEI, 25 Oct 07).
 - If there is no subsidy, why are they fighting so hard to keep it?
 - Paying *something* for a good or service says nothing about whether the price paid was reasonable or not.
- “We can’t speak for the other nine technologies eligible for loan guarantees, but in the case of new nuclear plants the probability of default is pretty close to zero.” (Richard Myers, NEI, 25 Oct 07).
 - “CBO considers the risk of default on such a loan guarantee to be very high—well above 50 percent. The key factor accounting for this risk is that we expect that the plant would be uneconomic to operate because of its high construction costs, relative to other electricity generation sources.” (CBO, 7 May 2003).

Venture Strategy: Subsidies are Integral

- **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).

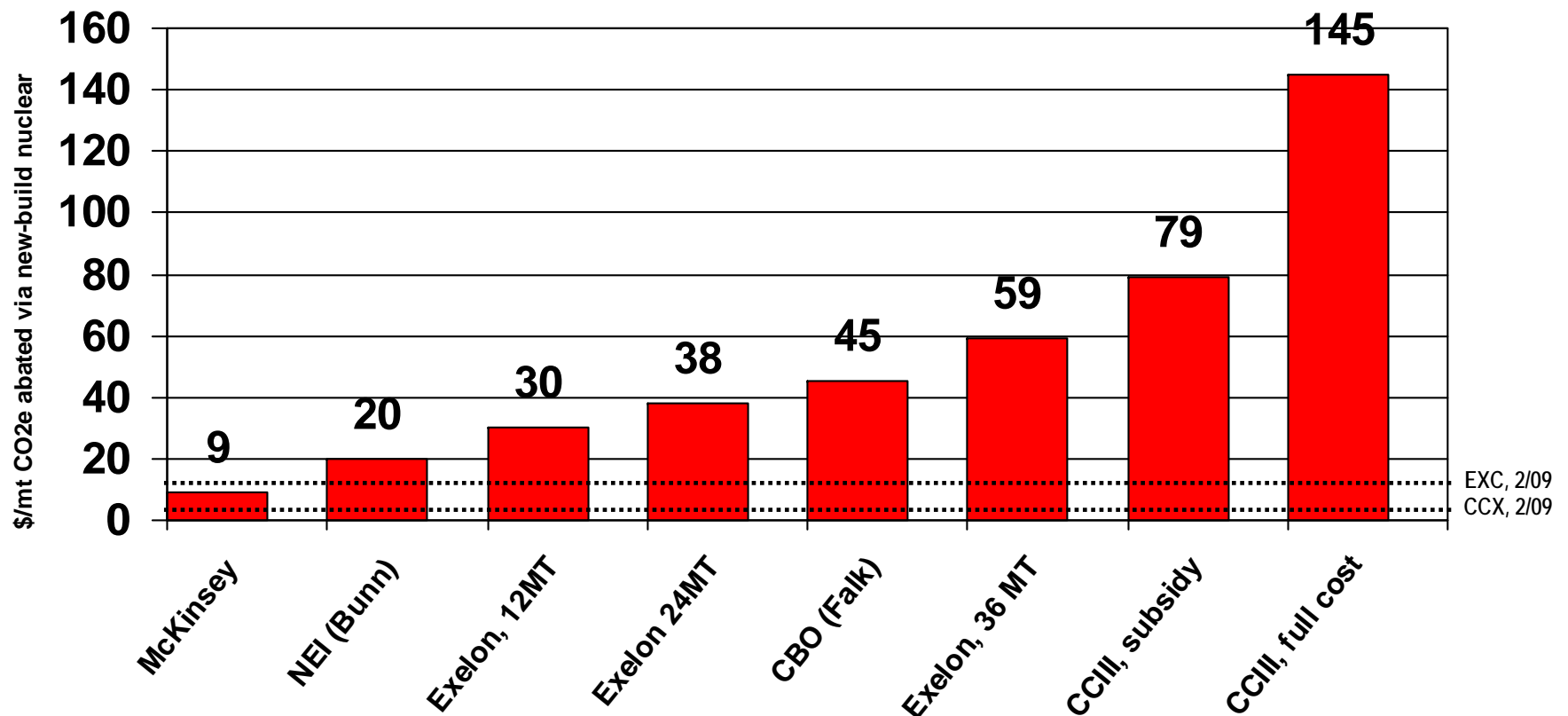
Full Cost of Nuclear: Subsidies Exceed Private Investment

	Low	High	
	Cents per kWh		
I. Private investment in Calvert Cliffs III			
Base case of Calvert Cliffs	5.7	5.7	Constellation estimate, Oct. 2008
II. Public investment in Calvert Cliffs III			
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
<i>Industry total estimated cost</i>	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); 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).
<i>Add-in missing subsidies</i>	1.5	4.1	
III. Total cost of nuclear power			
Public subsidy	5.7	8.3	
Public/private share	99%	145%	
Subsidy/avg. wholesale rates, 2002-06	129%	189%	
Full cost of power	11.4	14.0	

Insights from Evolution of Calvert Cliffs III Costing Scenarios

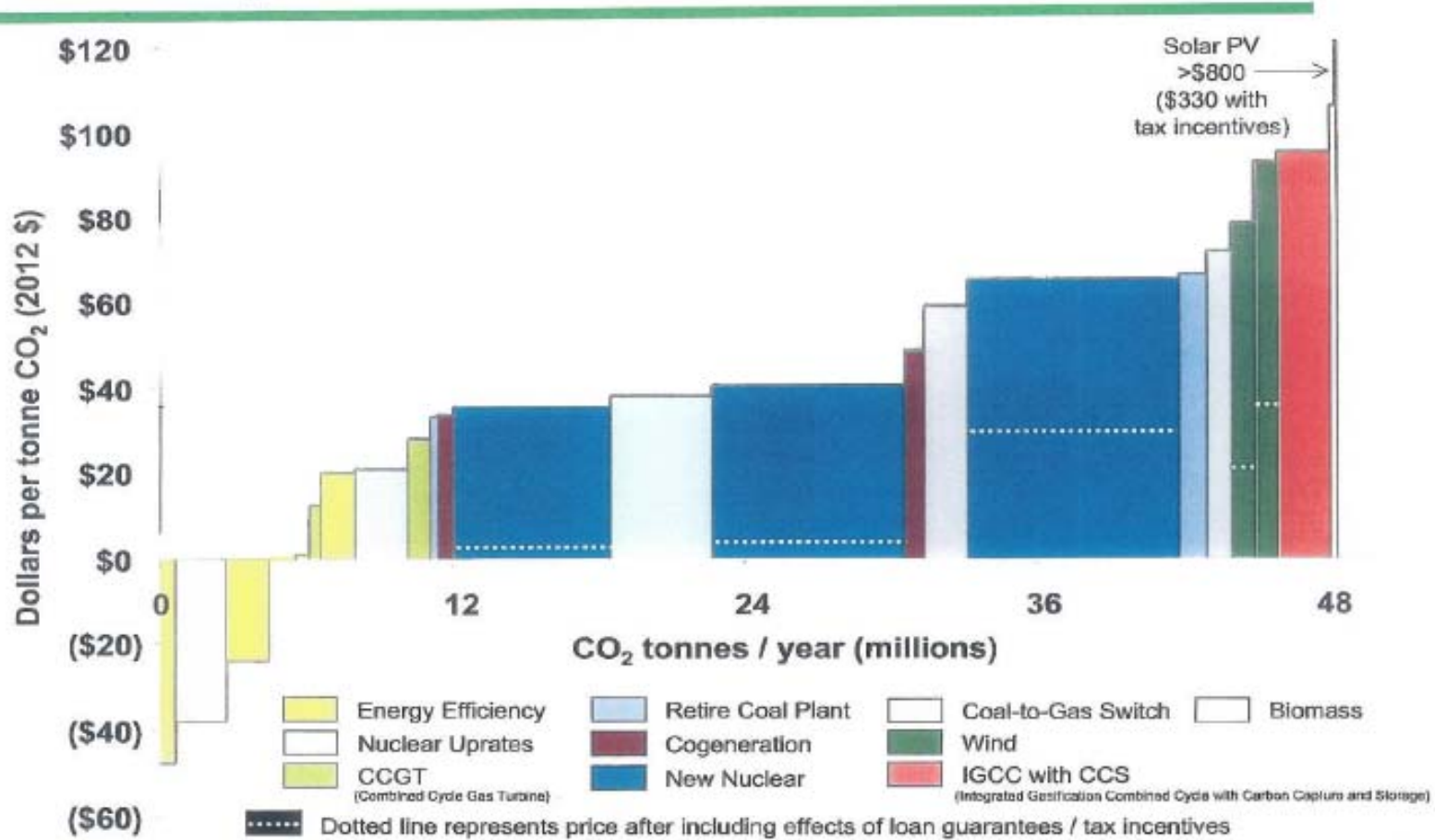
	Then	Now	Alt Value	Notes/Comments
Cost				
Overnight cost (\$/kWe)	\$1,600-2,000	\$3,500-4,750	\$5,746	2005-08; alt value is CCIII from CRS (2008)
Levelized cost (\$/MWh), base case	37	57		Mar. 2007 to Oct. 2008
Assumed ROE	18%	15%		Mar. 2007 to Oct. 2008
Subsidies				
Access to Production Tax Credit	100%	50%		Mar. 2007 to Oct. 2008
Loan Guarantee (LG) value (\$/MWh)	32	37		
LG value per EPR-year	\$575m			Turnage (3/07); nominal value over life of LG: \$13b/reactor.
LG value/CCIII base case	86%	65%		
Assumed LG payment (admin. + default risk)	1.50%	3.50%	25.40%	Alt value from GAO; 50.85% default, with 50% recovery.
Capital Structure				
Debt/Equity shares, LG	80/20	80/20		
Debt/Equity shares, no LG	50/50	50/50		Seems optimistic
LG reduction in debt costs, bps	700	700		
Debt cost, no LG	12%	12%		Also optimistic?

Nuclear: High Cost Approach to Pull GHGs from the Economy -- Even Displacing Coal



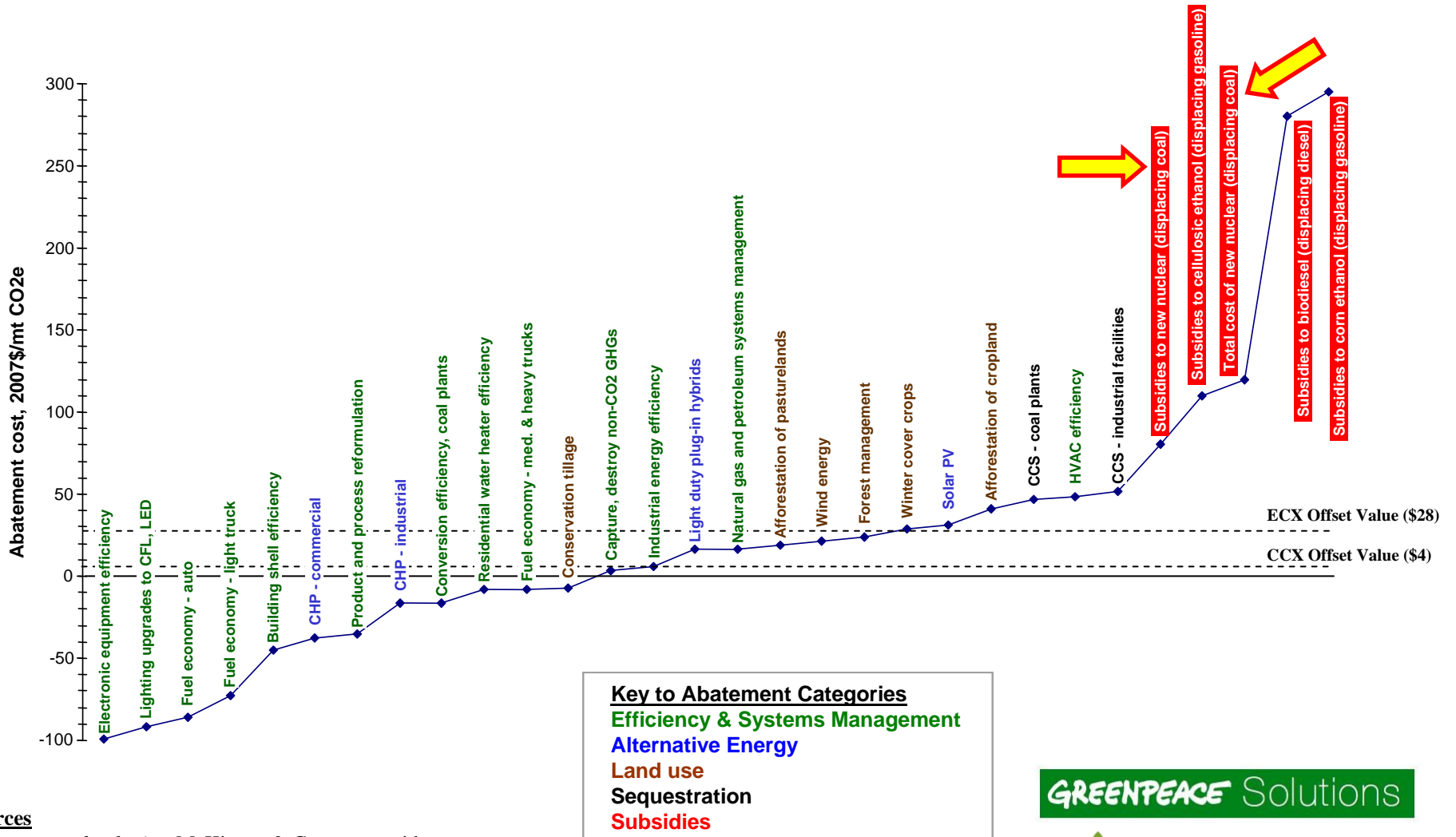
Exelon: PTC and LGs cut costs by >50%

Exelon CO₂ Abatement Curve



Source: Extracted from Turnage, 8 Oct 2008.

Subsidies are An Expensive way to Remove Greenhouse Gases from the Economy



Sources

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

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

Subsidy data: Earth Track, Inc.

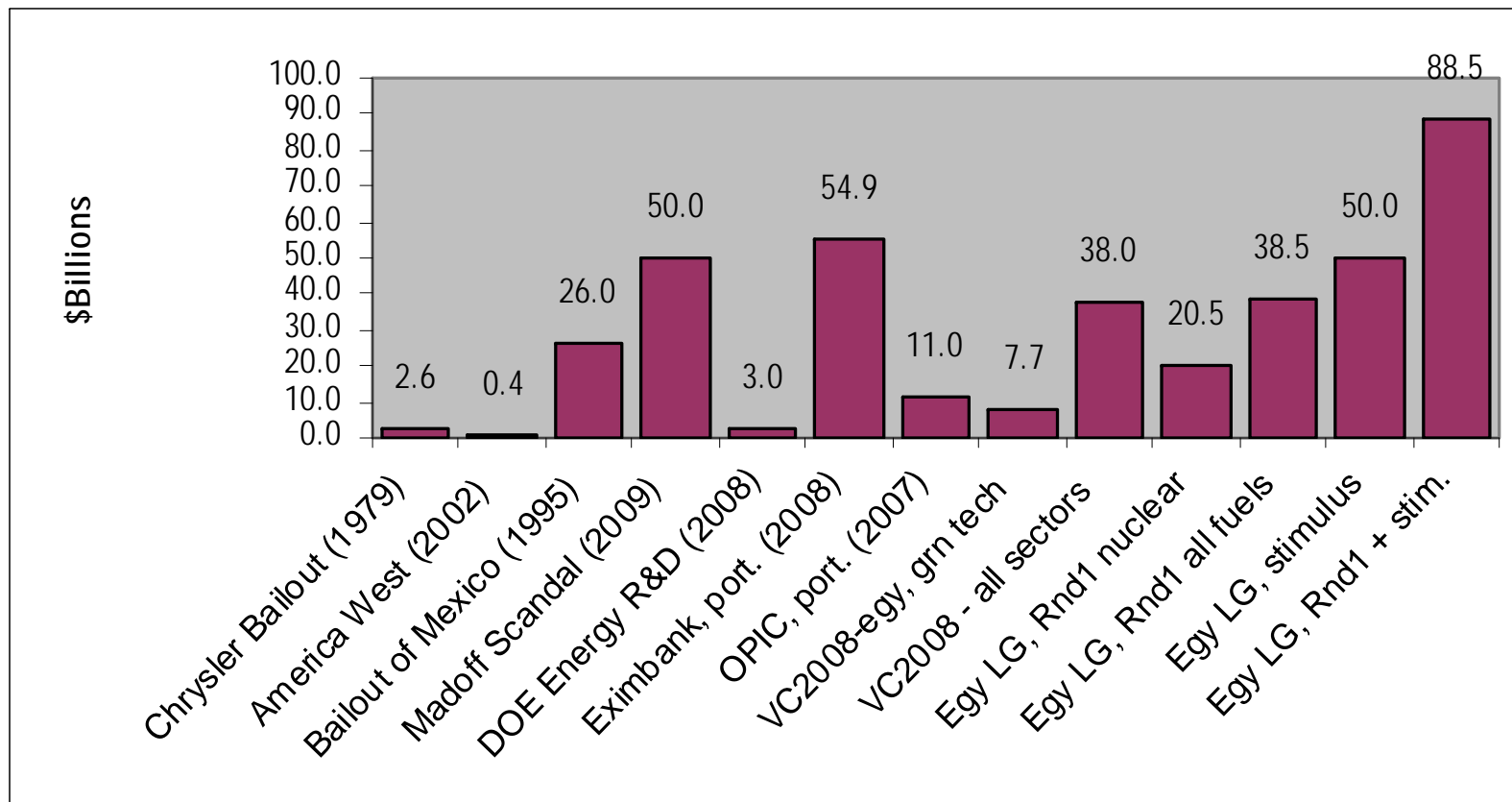
GREENPEACE Solutions

earth track
 www.earthtrack.net

Subsidy Mechanics: Loan Guarantees

- Industry focus tends to be on default rates; guarantees provide large subsidies even if no default.
- Benefits come through dramatic reductions in the cost of capital.
 - **More debt.** Allows much higher use of debt (up to 80% rather than 20-25% with no guarantees); debt is much less expensive.
 - **Risk-free rate.** Allows lenders to base interest rates on the credit worthiness of the guarantor (in this case the default “risk-free” rate of the federal government), rather than the high risk project.
 - **Lower risk of loss of equity.** By reducing cost of debt service and risk of non-payment on the debt, the bankruptcy risk to equity investors may be reduced, driving down equity costs as well.
- **Long-term availability of cheap credit.**
 - Guarantees can be extended for up to 30 years.
 - This enables the company to pay back their more expensive financing costs first.

Scale of Energy Loan Guarantees too Often Overlooked



Summary

- **Subsidies hide important cost and performance variation in energy resources.**
 - Subsidies result in more expensive energy and impediments to cheaper, quicker alternatives.
 - GHG mitigation via nuclear can be orders of magnitude more expensive than alternatives.
- **Capital markets price risk into projects for a reason.**
 - Longer gestation, larger investments, and greater volatility all provide bigger opportunities to waste societal wealth.
 - Sub-prime mortgage meltdown should be a reminder that guaranteeing high risk ventures is not costless.
- **Policy should focus on highlighting the cost differences associated with different energy attributes, not trying to subsidize them away.**
 - Fuel type, time and location of delivery, load factor, use of constrained T&D infrastructure, investment risk/capital cost, and environmental profile.
 - Structure should be neutral between demand and supply side actions.