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TO: **Interested Parties**
FROM: **Nuclear Information and Resource Service**
SUBJECT: **Cost of Proposed Nuclear Energy Subsidies: Build Back Better Act and Bipartisan Infrastructure Bill**
DATE: **September 16, 2021**
CC:

Both of the major spending bills before Congress include subsidies to currently operating nuclear power reactors: the Civil Nuclear Credit (CNC) in the $1.2 trillion Bipartisan Infrastructure bill (BIF); and the Zero-Emissions Nuclear Production Credit (Nuclear PTC) in the $3.5 trillion Build Back Better Act (BBBA). The subsidies would be allocated through different mechanisms, but to the same group of nuclear power plants.

It is not entirely clear how the two subsidies will interact, but their total cost could be more than $50 billion over the next ten years: the BIF would authorize $6 billion in direct subsidies over five years; and the BBBA's Nuclear PTC has a total projected cost of more than $57 billion over ten years. If both measures are approved, the costs could be additive, totaling over $60 billion.

Because each bill is based on a finite amount of money to be raised by increasing certain taxes and reappropriating certain funds, the spending proposed for nuclear energy means there will be fewer funds available for other priorities: energy, climate, infrastructure, and social programs. The proposed nuclear subsidies are also exceedingly inequitable, accruing vast sums to just a small number of corporations, with negative impacts on employment, greenhouse gas emissions, and environmental justice.

The sheer amount allocated to nuclear energy through these subsidies is disproportionate to how much energy the eligible power plants actually generate. Nuclear power provides about 8.8% of total primary energy in the United States, compared to ~80% from fossil fuels. More than 80% of the proposed subsidies ($52.5 billion over 10 years) would go to a subset of the industry: merchant reactors that sell electricity in wholesale markets. Those reactors currently provide about 40% of total nuclear power generation in the U.S. (3.5% of total energy). If fossil fuels were subsidized at the rates proposed for these reactors, the subsidies would total $120 billion/year. As detailed in the July 2021 report by economist Mark Cooper, renewable energy is far more cost-effective than subsidies to aging nuclear reactors.

Legislation	**Subsidy Mechanism**	**Eligibility**	**Expense Rate**	**Total Cost**
Build Back Better Act	Nuclear Production Tax Credit	Currently operating reactors, not federally owned	$15 per megawatt-hour (w/revenue-based adjustments)	$57.4 billion over 10 years (2022-2031)

Bipartisan Infrastructure Bill	Civil Nuclear Credit	Merchant reactors which are: ● Unprofitable ● Retiring imminently ● Closure would impact emissions	TBA (DOE to accept applications and allocate available funds)	$6 billion over 5 years (2022-2026)

Subsidy Provisions

The provisions in both bills apply to all nuclear power plants that are not owned and operated by federally-owned utility companies. However, based on the ways the subsidies would be allocated, it is possible that the majority of the funds would accrue to a handful of corporations that own merchant nuclear power plants. Merchant power plants sell their capacity and the electricity they generate on wholesale markets or directly to consumers through power purchase contracts, in contrast to utility-owned power plants that sell electricity to customers in a defined service territory, under rates established by a state agency or commission or, in the case of municipal and cooperative utilities, a customer-elected board of directors.

The BIF authorizes a total of $6 billion over five years (2022-2026) for the CNC. Eligibility is restricted to merchant reactors that are unprofitable and likely to be retired within the next two years without additional revenue; the owner must also show that the plant's retirement will have an impact on greenhouse gas emissions. Nuclear corporations would apply to the Department of Energy (DOE) for the credits, which would award funds to all plants which qualify.

The CNC provisions appear vulnerable to fraud and abuse. Evaluating the finances of power plants and other assets is very complex, especially in diversified energy holding companies which own the vast majority of merchant nuclear reactors. State public utility commissions maintain large staffs of economists, accountants, attorneys, and other technical experts to evaluate utility rate proposals, usually ironed out in adversarial proceedings presided over by administrative law judges, with rulings by state-appointed or elected commissioners. DOE does not appear to have any existing capacity or experience for administering such a program, nor does the bill specify how DOE is to evaluate companies' claims about emissions impacts. Yet the BIF would task DOE with establishing the program and accepting CNC applications within 90 days of enactment. The most expedient solution could be for DOE to delegate this function to the Federal Energy Regulatory Commission (FERC).

The BBBA proposal is adopted from stand-alone bills introduced in 2021 (S.2291/H.R.4024, "The Zero-Emission Nuclear Power Production Credit Act of 2021"). It does not contain a firm cost cap, but we can estimate the total cost. The bill would provide a tax credit to eligible power plants for 10 years, at a base rate of $15 per megawatt-hour. All nuclear power plants could qualify for the tax credits, with the exception of nuclear power plants owned by federal government entities. At this time, the Tennessee Valley Authority is the only federal entity that owns commercial nuclear power plants.

Electricity production tax credits effectively reduce the income taxes corporations owe to the federal government, based on multiplying the annual amount electricity the eligible power plants generate by the tax credit rate. However, the Nuclear PTC proposal would provide an alternative payment option: to receive the credits in an up-front payment each year, effectively turning the tax credit into a direct subsidy. This would enable non-taxpaying entities--including rural electric cooperatives and utilities owned by state and local governments--to claim the credits. The bill includes a provision that would modify the tax credit rate based on the amount of sales revenue the nuclear power plant receives each year (see below).

Calculating the Cost: Merchant Nuclear Reactors

Merchant reactors are most likely to claim the full value of the Nuclear PTC. There are currently 40 merchant reactors operating in the U.S.—about half of the total in the U.S. For various reasons, seven of those reactors likely would not qualify for the credits, despite their merchant status:

- One reactor in Michigan that is slated to close in 2022 (Palisades).
- Two reactors in Wisconsin that have a contract through which to sell their electricity at very high prices until 2033 (Point Beach 1&2).
- Four reactors in New York that are receiving much more lucrative subsidies through a state program, until 2029 (FitzPatrick, Ginna, and Nine Mile Point 1&2).

Of the other 33 merchant reactors, all would likely qualify for the BBBA tax credit. Several of those reactors may also qualify for the CNC (i.e., those that demonstrate they are unprofitable, will be imminently retired, and result in emissions impacts).

The total of 33 reactors includes eight which are already receiving subsidies that are charged to consumers in three states (CT, IL, and NJ).[1] Those states might cancel those subsidies if the federal bill is enacted. The nuclear production tax credit would likely be greater than what the states are providing to those plants, so it would be in the interests of both the nuclear corporations and consumers to take the federal tax credit and end the state subsidies in CT, IL, and NJ.

The 33 reactors likely to be eligible generated 303,824,058 megawatt-hours of electricity in 2020. At the Nuclear PTC rate of $15/MWh, the total cost would be $4.8 billion/year, or $46.5 billion over the 10-year period. The most unprofitable of the reactors may also qualify for the CNC, which would cost $1.2 billion/year, totaling $6 billion over the five years the BIF would cover. At similar rates to the state nuclear subsidies in IL and NJ (~$10/MWh), the CNC could support 12-14 reactors. However, because unspent CNC funds authorized in BIF can be carried over to subsequent years, they could still be claimed by reactors that are unprofitable even with the Nuclear PTC. Therefore, the actual costs could be additive.

Calculating the Cost: Utility-Owned Reactors

In addition, utility-owned nuclear plants would be eligible for the Nuclear PTC and may well claim it. State utility commissions may, in fact, require them to seek the tax credits as a prudent measure to reduce rates for consumers. Under the reduction provision detailed below, utilities may claim the credits at a lower rate that maximizes their total revenue, while satisfying the prudency mandate. In

[1] NOTE: Illinois recently enacted new energy legislation that provides subsidies to six additional reactors over the next five years, totaling $698 million. It is possible these six reactors would still qualify for the full value of the Nuclear PTC. This amount of the subsidy is small relative to other state subsidies, averaging ~$2.50/MWh, compared to ~$10.50/MWh for three reactors subsidized under the 2016 energy law and $10/MWh in NJ, under that state's 2018 energy law.

addition, they may use their nuclear assets to maximize total revenues under the BBBA, by using their nuclear generation to meet the emissions standards of the Clean Energy Performance Program. This would enable utilities to maximize the value of their legacy nuclear assets while minimizing the amount of renewable energy they need to purchase.

A conservative estimate of the cost of the Nuclear PTC claimed by utility reactors would be $3/MWh: setting the ratepayer charges at $40/MWh would make them eligible to claim $3/MWh in Nuclear PTCs. Eligible utility-owned reactors generated 378,263,132 MWh of electricity in 2020. At those rates, the additional cost of the Nuclear PTC would conservatively be $1.1 billion/year, or $10.9 billion over ten years. In total, the Nuclear PTC cost would be $57.4 billion; with the additional cost of the CNC, a total of $63.4 billion in taxpayer subsidies to aging nuclear reactors is on the table.

The Nuclear PTC Reduction Provision

The Nuclear PTC also includes an adjustment to the tax credit based on market prices for electricity. For nuclear power plants that earn market revenues in excess of $25/MWh, the production tax credit would be reduced by 80% of the difference. That means, if a reactor earned $28/MWh on the competitive market in a given year, the difference would be $3/MWh. The production tax credit it receives would be reduced by 80% of $3, or $2.40/MWh. The company would receive Nuclear PTC at a rate of $12.60/MWh--receiving total revenues of $40.60/MWh.

Similarly, if the company earned $40/MWh on the market, the tax credit would be reduced accordingly:

- $40/MWh (market revenue) minus $25/MWh = $15/MWh (difference)
- $15/MWh times 80% = $12/MWh (tax credit adjustment)
- $15 MWh (base tax credit) minus $12 MWh = $3 MWh (adjusted tax credit)

That nuclear power plant would still receive a subsidy of $3/MWh—for total revenues of $43/MWh. Under this provision, the subsidy would ensure that reactors which might be profitable on their own could still receive a taxpayer subsidy that would make them even more profitable to operate.

Projected Impact of the Reduction Provision

The nuclear industry might claim that this adjustment provision would greatly reduce the actual cost of the subsidy to less than $46 billion. In principle, if electricity prices trend significantly upward in the next decade, it is possible that could happen. However, there is no guarantee of that outcome and, to the contrary, there is good reason to assume the opposite, especially for federal budgeting purposes. Market electricity prices have been decreasing for over a decade, and that could well continue as renewable energy grows and natural gas generation declines.

Electricity sources are typically required to bid their power into the market at their “marginal cost of generation”—that is, the amount it costs them to generate the next MWh of electricity versus what their costs would be if they did not generate electricity. The main driver of marginal prices today is the cost of fuel to run power plants: primarily coal, gas, diesel fuel, and biomass. For wind, solar, and hydro, which have no fuel costs and minimal to zero staffing costs, they typically bid $0, which reduces the overall price of power in the markets. In contrast, nuclear power plants buy all of their fuel at once, every 18-24 months. The cost of nuclear fuel is treated more like a capital cost the company will pay off over time, but also with $0 marginal cost, for purposes of market bidding. In

reality, nuclear reactors cannot adjust their output in response to demand and market conditions, so they typically operate at 100% power on a 24/7 basis and are "price takers" in the market--that is, they generate and sell their electricity no matter the market price. When prices are high and volatile, they benefit; when prices are low on a sustained basis, they may operate at a loss.

Fracked gas prices can be quite volatile, depending on weather conditions and peak electricity demand. When demand for gas or electricity is high, the price increases; and when supply is short while demand is high, the prices can get very high. But the average costs of fracked gas have remained quite low for years, even with infrequent, localized spikes. As renewables, storage, efficiency, and demand response expand over the next decade, demand for gas will decrease and the patterns of peak pricing will change as well. It is quite possible that gas prices and average market prices for electricity will trend lower, rather than increase.

There is real-world experience to justify this caution. The current state nuclear subsidy program in New York includes a market price adjustment like the one proposed in the nuclear production tax credit bill. But market prices have remained low in NY, and the state subsidies have maxed out with no price adjustment. By contrast, Illinois's current nuclear subsidy includes a total cost cap, which has reduced the amount ratepayers have been charged for nuclear subsidies. Based on these trends and the experience with the state programs, the cost of the proposed federal nuclear production tax credit should be estimated at the maximum level. Based on the number of reactors that could be eligible, that would be $57.4 billion over 10 years. If both of the nuclear subsidy proposals are enacted, the total cost could top $60 billion.

Following the Money: Corporate Beneficiaries of the Nuclear PTC

The majority of the taxpayer subsidies will accrue to merchant nuclear reactors, with over 80% of the cost projected going to 33 reactors. Because ownership has become highly concentrated in the nuclear industry since the 1990s, so would be the benefits of the proposed nuclear subsidies. The two largest recipients, Exelon and Energy Harbor, would likely receive $24.2 billion and $6.9 billion, respectively--nearly 50% of the total. Both corporations are currently at the center of federal corruption indictments over nuclear subsidy legislation in Illinois and Ohio, which have led to indictments of top lawmakers, corporate executives, and lobbyists.

Nearly one-third of the remaining subsidies would primarily accrue to six large energy corporations. One of those companies, PSEG, has overlapping interests with Exelon, as a co-owner of four merchant reactors. PSEG would receive nearly $5 billion in federal nuclear subsidies.

Figure 1: Merchant Nuclear Reactors Likely Eligible for Proposed Tax Credits (next page)

State	Reactor	Controlling Owner	Capacity (MW)	Annual Gen., 2020 (MWh)	Annual Tax Credit ($)	TOTAL (2022-2031)
CT	Millstone 2	Dominion	853	6,690,501	$100,357,515	$1,003,575,150
CT	Millstone 3	Dominion	1,220	9,024,354	$135,365,310	$1,353,653,100
IL	Braidwood 1	Exelon	1,183	10,604,454	$159,066,810	$1,590,668,100
IL	Braidwood 2	Exelon	1,154	9,767,222	$146,508,330	$1,465,083,300
IL	Byron 1	Exelon	1,164	9,853,735	$147,806,025	$1,478,060,250
IL	Byron 2	Exelon	1,136	9,671,159	$145,067,385	$1,450,673,850
IL	Clinton	Exelon	1,065	9,462,481	$141,937,215	$1,419,372,150
IL	Dresden 2	Exelon	902	7,966,534	$119,498,010	$1,194,980,100
IL	Dresden 3	Exelon	895	7,512,354	$112,685,310	$1,126,853,100
IL	LaSalle 1	Exelon	1,131	9,535,886	$143,038,290	$1,430,382,900
IL	LaSalle 2	Exelon	1,134	10,159,798	$152,396,970	$1,523,969,700
IL	Quad Cities 1	Exelon	908	8,075,967	$121,139,505	$1,211,395,050
IL	Quad Cities 2	Exelon	911	7,636,478	$114,547,170	$1,145,471,700
MD	Calvert Cliffs 1	Exelon	866	7,371,348	$110,570,220	$1,105,702,200
MD	Calvert Cliffs 2	Exelon	842	7,709,209	$115,638,135	$1,156,381,350
NH	Seabrook	NextEra	1,250	9,865,196	$147,977,940	$1,479,779,400
NJ	Hope Creek	PSEG	1,172	10,592,697	$158,890,455	$1,588,904,550
NJ	Salem 1	PSEG	1,153	7,142,172	$107,132,580	$1,071,325,800
NJ	Salem 2	PSEG	1,142	9,003,389	$135,050,835	$1,350,508,350
OH	Davis-Besse	Energy Harbor	894	7,228,063	$108,420,945	$1,084,209,450
OH	Perry	Energy Harbor	1,240	10,990,962	$164,864,430	$1,648,644,300
PA	Beaver Valley 1	Energy Harbor	907	8,047,731	$120,715,965	$1,207,159,650
PA	Beaver Valley 2	Energy Harbor	901	7,345,662	$110,184,930	$1,101,849,300
PA	Limerick 1	Exelon	1,120	9,133,195	$136,997,925	$1,369,979,250
PA	Limerick 2	Exelon	1,122	10,211,569	$153,173,535	$1,531,735,350
PA	Peach Bottom 2	Exelon	1,265	10,211,819	$153,177,285	$1,531,772,850
PA	Peach Bottom 3	Exelon	1,285	11,580,515	$173,707,725	$1,737,077,250
PA	Susquehanna 1	Talen	1,247	9,332,238	$139,983,570	$1,399,835,700
PA	Susquehanna 2	Talen	1,247	10,658,665	$159,879,975	$1,598,799,750
TX	Comanche Peak 1	Luminant	1,205	9,781,846	$146,727,690	$1,467,276,900
TX	Comanche Peak 2	Luminant	1,195	9,698,102	$145,471,530	$1,454,715,300
TX	South Texas Project 1	NRG	1,280	10,409,819	$156,147,285	$1,561,472,850
TX	South Texas Project 2	NRG	1,280	11,548,938	$173,234,070	$1,732,340,700
TOTAL			**36,269**	**303,824,058**	**$4,557,360,870**	**$45,573,608,700**