TAXPAYERS for COMMON SENSE

NUCLEAR REPORT

February 2021

Understanding Nuclear Subsidies:

Why shoveling more handouts won't revive the industry or solve our energy problems

$0 what taxpayers have received in royalties from uranium mined on federal lands under the General Mining Law of 1872. Thousands of uranium mines abandoned on federal lands because of the law's weak protections will also cost taxpayers billions of dollars to clean up.

29 the number of planned reactors that have pulled the plug because of cost overruns, technological hurdles and lack of market and consumer interest since 2008.

$12 billion loan guarantees to a nuclear plant that's more than 5 years behind schedule and $14 billion over-budget

$6 billion latest tax subsidies on the table for any new nuclear projects without a deadline

$120 billion Dept. of Energy spending on nuclear energy technology since FY1948

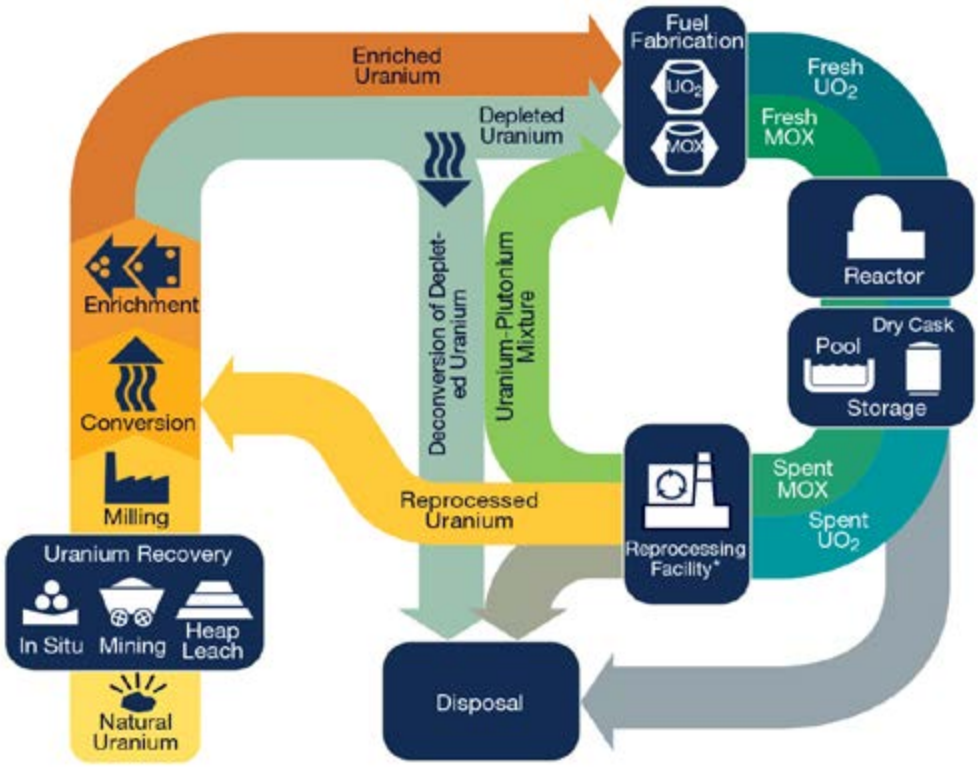
<10 years the rough time frame we have for critical climate action. Increasing or even maintaining subsidies for nuclear power projects that take more than a decade to construct runs the risk of crowding out faster, cheaper sources of low carbon energy as well as saddling taxpayers with long-term risks associated with waste and liability for catastrophic accidents.

In the United States, nuclear energy is harnessed to generate electricity with the help of significant subsidies from federal taxpayers. These subsidies support the use of nuclear fuels from before raw metal leaves the ground to, eventually, the storage of spent fuel as waste materials. Nuclear power plants are similarly enabled from ideas on the drawing board to operable designs, during construction and through actual electricity production and then are protected through federally-backed insurance programs. In addition to receiving federal supports, the nuclear industry benefits from local and state supports and, internationally, other governments have shouldered its costs and liabilities for decades.

This report provides an overview of the current federal subsidies supporting civilian nuclear energy in the U.S. In the form of foregone royalties on uranium from federal lands, discretionary spending on development and demonstration, loan guarantees for new construction, covered liabilities for accidents, access to federal facilities, tax credits for electricity, and many other means, these subsidies have collectively cost taxpayers billions of dollars year after year for nearly a half century.

To limit the extent of the climate crisis and the enormous costs it will impose, policymakers are examining all options to reduce emissions from our current energy mix. Before national policy is steered toward new and expanded nuclear initiatives, the current costs, inefficiencies, and existing suite of subsidies must be fully considered and weighed against other more affordable and lower risk options.

The Nuclear Fuel Cycle



Source: U.S. Nuclear Regulatory Commission

U.S. Nuclear Energy Today

In 2020, there were 56 nuclear power plants operating in 28 states across the country.[1] These plants ran a total of 94 nuclear reactors with net capacity of nearly 100 gigawatts (GW) combined,[a] representing nine percent of the total utility-scale capacity installed in the U.S.[b] The oldest of these reactor units began commercial operations in 1969; the newest started serving consumers in 2016,[2] more than 40 years after construction started.[c] Nuclear sources have consistently provided roughly 20 percent of all U.S. electricity over the last two decades. In comparison, the portion of electricity generated from coal plants has dropped from 51 percent in 2001 to 19 percent in 2020, while the contribution from natural gas plants' has increased from 17 percent to 41 percent.[3]

According to the U.S. Energy Information Administration (EIA), nuclear plants are expected to account for the majority of all generation capacity expected to retire in 2021. In total, five reactors at three plants with combined capacity of 5.1 GW are expected to close this year.[4] The retirements continue a trend of overall decline in nuclear energy production largely due to low natural gas prices, flatter demand, and more competition from renewable sources like wind and solar.[5] The recent closures have highlighted the lack of a permanent solution for the storage of radioactive waste from reactors' spent fuel. According to one government database, roughly 86,000 metric tons of waste was stored at power plants in 2020, including 7,300 metric tons at closed sites.[6] (See map on p. 10.)

Legacy Subsidies

Existing federal subsidies for nuclear energy span the nuclear fuel cycle and many have been on the books for decades. Easy, cheap access to uranium mining on federal land predates the splitting of the atom. Another major legacy subsidy, the Price-Anderson Act, hails from the beginning of the nuclear era and undergirds all civilian nuclear power generation.

[a] 1 gigawatt = 1,000 megawatts = 1 billion watts
[b] Only sources with nameplate capacity of 1 MW or greater are included; this measure excludes significant capacity from solar photovoltaic sources.
[c] Construction on the newest reactor in service, the Tennessee Valley Authority's Watts Barr Unit 2, began in 1973 before being halted in 1985 and re-started in 2012.

Summary of Federal Subsidies and Supports for Nuclear Energy

Subsidy	20-Year Cost (2020 dollars)	Explanation
Department of Energy Nuclear R&D Funding	$9,307,619,000	FY2001-2020 - excludes fusion research
Percentage Depletion Allowance	$2,620,686,884	FY2001-2020 - est. from rounded figures; includes subsidy to coal mines
Exploration & Development Costs Expensing	$1,753,815,482	FY2001-2020 - est. from rounded figures; includes subsidy to coal mines
Special Tax Rate for Decommissioning Reserve Funds	$10,560,181,768	FY2001-2020 - est. from rounded figures
Abandoned hardrock mining cleanup	$5,236,652,068	FY1998-2017 - includes federal spending to reclaim all hardrock mines
Subsidy	**Support Total**	**Explanation**
Standby Support for Nuclear Plant Delays	$2,000,000,000	- total coverage available for first six nuclear plants
DOE Loan Guarantee Program	$12,030,060,422	- current value of loans guaranteed by DOE for nuclear projects
Nuclear Production Tax Credit	$5,692,000,000	- est. of total credits claimed by new nuclear plants in the future
Uranium Enrichment Decontamination & Decommissioning	$7,500,000,000	- est. of utilities' share of remaining cleanup at gaseous diffusion plants
Unquantified Item		
Royalty-free uranium mining on federal lands		
Price-Anderson Act accident liability cap		

The subsidies included here flow to the 'nuclear energy industry,' defined as the range of companies working and profiting at every stage in the nuclear fuel cycle for non-military electricity generation. This includes companies that: mine and mill uranium to purify and concentrate it into 'yellowcake' (U_3O_8); convert yellowcake into uranium hexafluoride (UF_6); enrich UF_6 i.e., increase the proportion of the U-235 isotope; convert and organize enriched uranium into a nuclear fuel assembly; construct the nuclear reactors that harness the energy released when U-235 breaks down into lighter elements; operate those reactors and the associated power plant; provide storage for spent nuclear fuel; and facilitate the complete fuel cycle through applied research and development, transportation, handling, etc.[7]

The profits of these firms, like all companies, depend on the cost of their inputs for production, which in turn depend on others in the fuel cycle. Subsidies for activity at one stage have ripple effects for the entire industry. Subsidizing the cost of acquiring mining rights to certain lands or building the mine, for example, can reduce the price that conversion facilities pay for yellowcake, which in turn reduces the price of inputs to enrichment. Federal subsidies at almost every stage of the fuel cycle produce a compound market distortion and allow the industry to offer competitive rates in a in electricity market dominated by cheaper fuels and production methods.

DOE Research & Development Spending

The entire U.S. nuclear energy establishment rests on a technological foundation built by the federal government. Taxpayer-funded research supported the first civilian application of atomic fission and continues to subsidize the development of nuclear reactors today. When Congress created the modern Department of Energy (DOE) in 1977, the agency inherited a network of national laboratories and a nuclear energy research program from the Atomic Energy Commission dating back to the Manhattan Project.[8] Historical spending on research and development (R&D) by the DOE and its predecessors reflected this legacy; more than 56 percent of R&D funding between FY1948 and FY2000 was devoted to nuclear energy , or a total of roughly $98 billion in 2020 dollars.[9]

Royalty-Free Uranium Mining and Abandoned Mine Lands

Subsidies for the nuclear fuel cycle in the U.S. start at the ground level. Except for one area of Colorado, uranium mining on federal lands is governed by the General Mining Act of 1872.[10] This legislative leftover from the Ulysses S. Grant Administration allows companies to make mining claims on federal land, pay minimal fees, then extract and sell hardrock minerals like gold, silver, and uranium without federal taxpayers receiving any royalty.[11] In comparison, companies drilling for oil and gas or mining coal are required to lease federal lands or waters where they want to operate and then pay 12.5 to 18.75 percent of the sales value of any resources they develop back to the federal government. By not imposing a royalty to mine publicly-owned uranium, the federal government has effectively subsidized the uranium used for nuclear fuel by billions of dollars over decades.

The total amount lost in foregone royalties from the mining of uranium and other hardrock minerals is unknown. The Department of the Interior does not collect data on the type, quantity or value of hardrock minerals removed from federal lands.

The great giveaway of uranium and other hardrock minerals for private profit is compounded by the lasting effects of impotent protections for federal land once mining operations end. The 1872 Mining Law provided only a skeletal structure for federal hardrock mining management and did not include provisions requiring mining operators to clean up of federal land after activities cease. The Department of the Interior (DOI) adopted regulations in 1981 to impose reclamation (clean-up) requirements on mine operators, but they failed to prevent further mine abandonments and DOI has struggled to secure adequate financial assurances to guarantee future reclamation.[12]

For more than a century after the 1872 Mining Law was passed, it was standard practice for mining companies to abandon mine sites on federal lands instead of incurring costs for reclamation that was not required. The extent of these legacy abandoned mines littered throughout public lands is still unknown. Federal agencies have identified 140,000 abandoned hardrock mine features and estimate there could be roughly 390,000 more based on historic maps of mining operations.[13]

Abandoned mine lands can be hazardous and toxic. The DOI, EPA, and other federal agencies reclaim these sites to mitigate threats to human health and safety. In 2011, the Government Accountability Office (GAO) reported that four federal agencies had spent $2.6 billion to identify and reclaim abandoned hardrock mines on federal lands between 1997 and 2008.[14] In 2020, the GAO reported that $2.9 billion had been spent between 2008 and 2017, or $287 million per year on average.[15]

That work addressed only a fraction of sites in need of reclamation. Through these agencies, taxpayers continue to spend hundreds of millions of dollars a year to clean up liabilities created by the hardrock mining industry. Uranium miners are responsible for thousands of the abandoned hardrock mines, including many radioactive sites that pose the most extreme threats to health and safety. Funding for continued cleanup of past operations is an ongoing subsidy for the nuclear fuel industry.

Tax Subsidies

All companies can deduct the cost of everyday operations from their income before taxes are calculated. However, the costs for capital investments, like a machine in a factory, are typically deducted, over time as income from the asset is recognized and the asset value deteriorates with use. Provisions in the tax code allow uranium miners to depart from standard

practice and deduct capital costs for mine exploration and development immediately, with no cap. Mine development expenditures became immediately deductible in 1951,[16] while exploration expenses qualified starting in 1966.[17]

Uranium mining corporations are allowed to recover any other capital costs through "percentage depletion." The percentage depletion allowance is a flat percentage that can be deducted from a company's gross income derived from extracting minerals and other nonrenewable resources. Specifically, thanks to 1954 legislation, corporations can deduct 22 percent of their total revenue from selling uranium, regardless of what they spent to open the mine from which it was extracted.[18] For example, if a company incurred $1 million in costs to open a new mine, but the uranium they extract sells for $10 million, they can deduct $2.2 million from their taxes under the guise of recovering their $1 million in capital costs. Percentage depletion disconnects what companies can deduct from their taxes from what they actually paid to dig and open a mine.

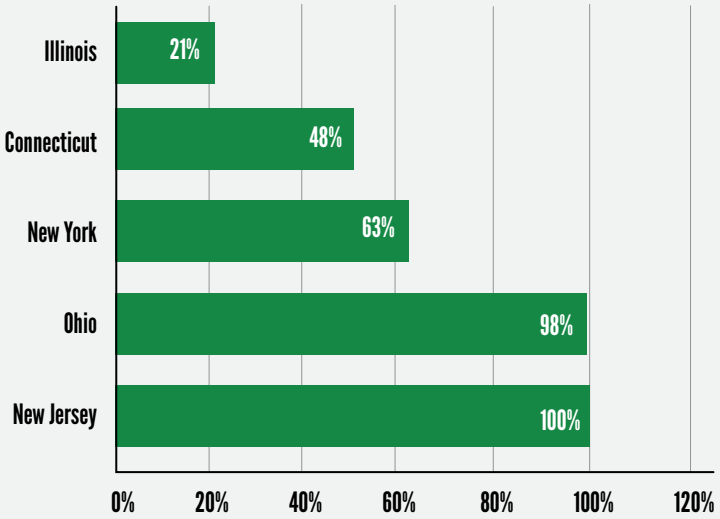
Together, the provisions allowing expedited cost recovery for mining fuel resources including coal and uranium are a subsidy that costs federal taxpayers $1 billion over five years, according to the Joint Committee on Taxation (JCT).[19]

In addition to the extraction-related tax preferences, nuclear plant operators benefit from reduced taxes on earnings from Nuclear Decommissioning Reserve Funds. To ensure there are no lasting threats to the health of the public or environment, operators must carefully shut down reactor and fuel storage sites when operations cease and put aside enough funds in advance to finish the job. Decommissioning a nuclear reactor generally costs between $300 and $400 million.[20]

Plant operators are not taxed on their contributions to a Nuclear Decommissioning Reserve Fund or their withdrawals from one if the funds are used for clean-up as intended. Over the decades a nuclear plant is operating, the plant owner must recognize any interest its Reserve Fund accrues as income. When Congress created the Reserve Funds in 1984, this investment income was taxed at the highest corporate tax rate (then 46%).[21] In the Energy Policy Act of 1992, however, Congress reduced the tax rate on these earnings to 20 percent.[22] Congress also removed certain limits on how much operators could contribute to the Funds in the Energy Policy Act of 2005.[23]

In addition to federal subsidies, several states have implemented policies to support nuclear power plants in recent years. The state policies allow nuclear plants to recover some of their operating costs through surcharges to customers or access to clean energy markets.

Portion of Nuclear Electric Generating Capacity Supported by State Policies



Source: U.S. Energy Information Administration, *Preliminary Monthly Electric Generator Inventory*

The value of the tax break to operators has varied over time. According to JCT estimates, the special tax rate reduced operators' taxes between $200 million and $1.1 billion per year from 2010 to 2017. The 2017 Tax Act reduced the highest corporate tax rate that would otherwise apply to the earnings and thereby lessened the value of the special rate, but it will still cost taxpayers roughly $100 million over the next five years.[24]

Price-Anderson Act

Congress first enacted the Price-Anderson Act in 1957 and has consistently extended it. The Act establishes a liability cap in the event of nuclear accident, regardless of the causes or related costs.

The liability cap was first proposed because private insurance coverage was deemed insufficient to pay claims for death, injuries and property damage in the case of a nuclear accident and "the market for civilian atomic energy would collapse and vendors would withdraw from the field"[25] without government-sponsored insurance underwriting. The Price-Anderson Act now essentially limits the liability of the nuclear industry in the case of a nuclear or radiological accident to approximately $13 billion, with the rest to be shouldered by the taxpayer. In fact, when it was first proposed, the Atomic Energy Commission opposed setting a specific upper limit on the amount because no reliable method existed to estimate the possible damages from a reactor accident. For a sense of scale, one analysis put the cost of one type of nuclear accident – a fire in a spent-fuel pool – at up to 143,000 cancer deaths, and $599 billion in property damage.[26] The most recent revision to the Price-Anderson Act was enacted by the Energy Policy Act of 2005, which extended it through December 31, 2025.

Three Mile Island | Source: Todd MacDonald via Flickr

Spent Reactor Fuel Pool | Source: Nuclear Regulatory Commission via Flickr

The 2005 Energy Bill and the 'Renaissance' that Never Arrived

Nearly all commercial nuclear reactors currently operating in the U.S. were built before 1990.[27] None broke ground after 1978. Building new nuclear plants ceased because construction costs and duration escalated over time rather than diminishing, particularly after the Three Mile Island accident. Almost all plants that began construction in the 1970s had overnight construction costs that were two to five times higher than plants that broke ground in the late 1960s.[28] The high cost risk associated with nuclear plants made them an unattractive option for utilities building new generation capacity.

The early 2000s brought a renewed interest in building new nuclear plants as a response to surging fuel prices, oil markets insecurity in the wake of the Iraq war and other conflicts in the Middle East, and an interest in reducing carbon emissions. The average annual spot price for natural gas, for example, nearly quadrupled between 1999 and 2008.[29] Congress proposed a significant increase in supports for nuclear energy in 2003 but failed to enact them. In 2005, Congress passed the landmark Energy Policy Act establishing a whole suite of new subsidies for nuclear energy broadly and new nuclear plant construction particularly. These subsidies

included authorizing new research, development, and demonstration funding for the Department of Energy, a loan guarantee program to subsidize construction financing, standby support for construction delays, and a generous tax credit for any electricity produced from new nuclear plants.

Together, these developments led to speculation of a "nuclear renaissance." According to one news aggregating service, unique mentions of the phrase spiked from 43 in 2004 to 867 in 2007 and then 1354 in 2008.[30] By then, the Nuclear Regulatory Commission (NRC) was expecting to receive licensing applications for up to 31 new nuclear reactors by the end of 2009.[31] Of those, just two remain as possibilities to become operable today. The nuclear renaissance never materialized for several reasons, but it was not for lack of support from Congress which forced taxpayers to foot the bill for billions of dollars in new subsidies including the following.

Treasury Backed-Loan Guarantees

In Title XVII of the Energy Policy Act of 2005, Congress created the Department of Energy (DOE) Loan Guarantee Program to support financing for projects employing 'innovative' technology that would "avoid, reduce, or sequester," air pollutants of greenhouse gas emissions. By guaranteeing that loans to eligible projects would be repaid by DOE even if the project owners defaulted, the program shifted risk from lenders to taxpayers. Assuming this risk allowed projects meeting the expansive criteria for eligibility, including "advanced nuclear energy facilities," to find financing at discounted rates and reduce their overall costs.

After the DOE program was created, Congress still needed to determine the extent and focus of the loan guarantees it could make. In the continuing resolution for FY2007, Congress authorized DOE to guarantee up to $4 billion in loans without specifying specific recipients.[32] But individual eligible industries wanted funds dedicated solely to their projects. In 2007, the nuclear industry lobbied Congress to make $50 billion in loan guarantees available for nuclear projects in 2008 and 2009.[33] In the Omnibus Appropriations Act of 2008, Congress responded by authorizing DOE to guarantee $34.5 billion in loans, of which $18.5 billion could be for nuclear power facilities and $2 billion could be for facilities at the "front-end" of the nuclear fuel cycle.[34] DOE later allocated an additional $2 billion from the original $4 billion in authority for "front-end" nuclear projects.

The DOE loan guarantee program subsidizes projects in proportion to their risk; the riskier the project, the more financing costs its owners save by getting rates further from what they could otherwise, and the more likely it is that DOE will have to step in to repay lenders. The $22.5 billion in loan guarantee authority for nuclear projects was a more significant subsidy because of the projects' inherent riskiness. In 2003 – four years before Congress passed the FY2008 Omnibus – the Congressional Budget Office (CBO) estimated the cost of a bill that gave DOE similar authority to guarantee loans to new nuclear reactor projects. The report on the bill states: "CBO considers the risk of default on such a loan guarantee to be very high—well above 50 percent." The CBO further noted that a hypothetical recipient "would have significant technical risk because it would be the first of a new generation of nuclear plants..."[35]

Under the Federal Credit Reform Act of 1990, before the government can issue a loan guarantee, the cost of the guarantee to the government needs to be accounted for and paid.[36] This "credit subsidy cost" compensates the government for the inherent cost of assuming project risk. Each project subsidy cost reflects the present value of any expected payments by the government, including those to "cover defaults and delinquencies," reduced by expected payments to the government resulting from the loan guarantee. In its 2003 report, the CBO estimated the credit subsidy cost for a guarantee to build a nuclear reactor would be 30 percent of the loan principal because of its extreme risk.

Congress appropriated funds to cover the credit subsidy cost for loan guarantees to renewable energy projects when it expanded the DOE program in the 2009 American Reinvestment and Recovery Act,[37] and again later when it passed the FY2011 Continuing Resolution.[38] However, under the original 2005 authorization, the cost of loan guarantees to nuclear projects was expected to be paid for by the guarantee recipients.

This could have provided some protection to taxpayers for backing loans to an inherently risky industry. In practice, the CBO's early warning of nuclear projects' risk proved to be prophetic, and DOE failed to protect taxpayers through appropriate credit subsidy cost collection.

In June 2008, the DOE published solicitations for $30.5 billion in loan guarantees,[39] including $18.5 billion for nuclear power facilities,[40] and $2 billion for fuel cycle "front-end" facilities.[41] When the deadline for the first part of applications passed, DOE announced that 17 companies had applied for $122 billion in guarantees to build 21 new nuclear reactors.[42] Two other companies, the United States Enrichment Corporation (USEC) and the France-based AREVA, applied for $4 billion in guarantees to construct front-end facilities.

In May 2010, DOE announced a conditional commitment of a $2 billion loan guarantee to help AREVA construct the Eagle Rock Enrichment Facility near Idaho Falls, Idaho.[43] The Nuclear Regulatory Commission approved a license for AREVA to operate the facility a year later, but the company abandoned the project just two months after the approval.[44] AREVA, after rebranding to Orano USA, LLC and receiving a license transfer from the NRC, requested termination of license for the Eagle Rock Enrichment Facility in 2018. The NRC approved the termination, and the Eagle Rock Enrichment facility was never constructed.[45] As for USEC, the estimated cost of its American Centrifuge Project consistently grew over time, forcing USEC to shutter the project and file for bankruptcy before ever receiving a conditional commitment.

By 2010, many of the applicants for loan guarantees to build nuclear reactors had put their projects on hold or cancelled them altogether.[46] Late in the year, another project died when its owner refused to accept the tentative $880 million credit subsidy cost proposed by the Office of Management and Budget (OMB) for a loan guarantee worth $7.6 billion.[47] Ultimately, the only remaining applicants to the initial solicitation were three owners of the Vogtle Electric Generating Plant in Burke County, Georgia seeking to construct two new nuclear reactors (Units 3&4) to add to the two already operating on site (Units 1&2).

DOE initially offered the Vogtle project partners – Georgia Power Company, Oglethorpe Power Company, and the Municipal Electric Authority of Georgia (MEAG) – a total of $8.33 billion in guarantees in February 2010.[48] However, DOE and the Plant Vogtle owners struggled to reach an agreement on an appropriate credit subsidy cost. In a 2012 report, the CBO suggested a loan guarantee like the one to Georgia Power Co. should have a minimum credit subsidy cost of one percent of the guaranteed loan principal ($35 million).[49] In 2013, the owners announced the project was already over-budget. In the same year, internal documents showed that DOE had estimated the credit subsidy cost at between $17-$52 million for Georgia Power and $70-$132 million for Oglethorpe.[50] When $6.5 billion in loan guarantees to the two owners was finalized in February 2014, however, the Office of Management and Budget calculated the credit subsidy cost at $0. In June 2015, DOE issued the remaining $1.8 billion in loan guarantees to three subsidiaries of MEAG.[51] By that time, the project was already $1.5 billion over budget and 21 months behind schedule.

Since DOE issued the loan guarantees for construction of Plant Vogtle Units 3&4, the riskiness of the project has been on full display (See the 'Recent Developments' section below).

Nuclear Production Tax Credit

In the Energy Policy Act of 2005, Congress also created a nuclear production tax credit (PTC) to incentivize the installation of new nuclear power plants. Originally, the new section 45J of the tax code offered plant owners 1.8 cents in tax credits for every kilowatt hour of electricity produced by any advanced reactor placed in service by 2021 over the first eight years of its operation.

At the time of the PTC's enactment, Congress expected many plants would qualify and limited the total amount of tax credits that could be awarded. The limits included a national cap on qualifying nuclear capacity, and an annual cap per facility:

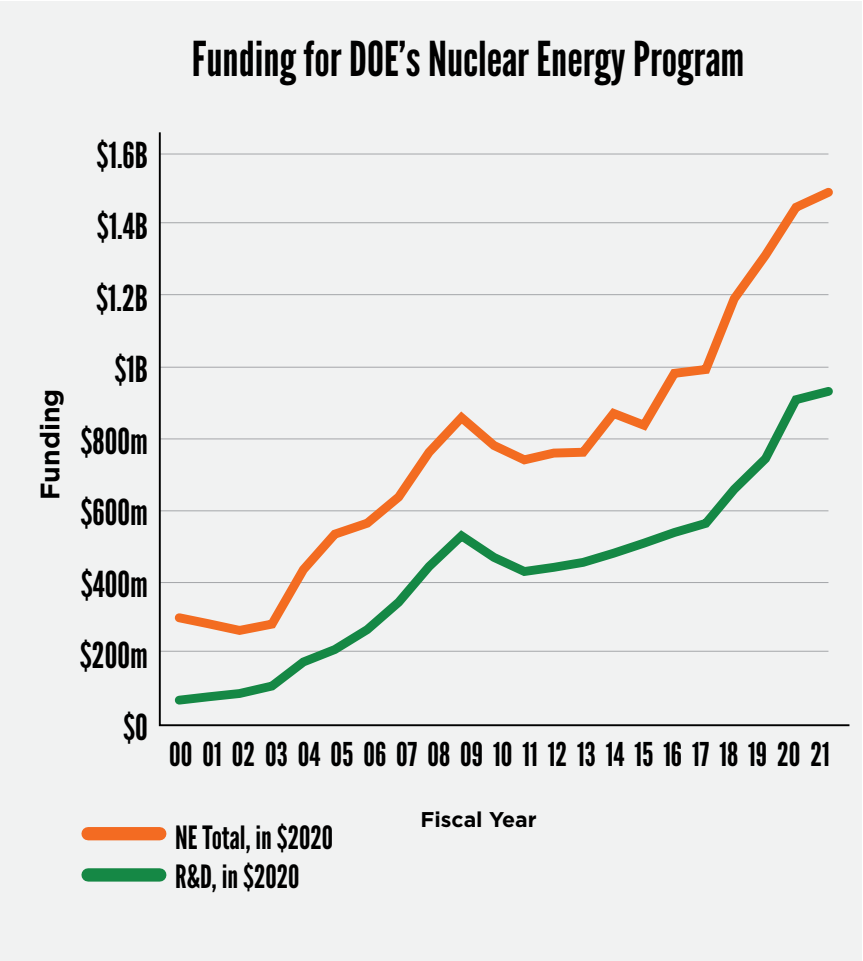
- **National Limitation**
  An advanced nuclear facility could only earn the PTC for the portion of the 6000 MW national capacity limitation it had been allocated. In regulations, the IRS stated that if the nameplate capacity (total energy output

under certain conditions in a certain period of time, typically an hour) of all facilities that applied was less than 6000 MW, then each facility would be allotted the amount equal to its nameplate capacity; and if the total nameplate capacity was over 6000 MW, then each facility would be allotted an amount proportional to its individual nameplate capacity divided by total qualifying nameplate capacity. For example, if the total nameplate capacity of facilities applying for the credit had been 8,000 MW, then a plant with a nameplate capacity of 1,000 would have received 1/8 of the 6,000 MW national capacity, or 750 MW of national capacity.

- **Annual Limitation**
  On an annual basis, each facility can only receive $125 million in tax credits for every 1,000 MW of national capacity allocated to it. For example, if a certain plant had been allocated 1,200 MW of national capacity, it could only accrue $150 million each year.

Through these limitations, Congress effectively capped the total amount of annual tax credits at $750 million. Because qualifying nuclear plants could only earn credits for their first eight years of operations, the annual limitation entailed a $6 billion cap on all credits. More precisely, the Energy Information Administration estimated it would cost the federal government $5.692 billion in lost revenue, taking into consideration that power plants typically produce less than their capacity in the first few years of operations.[52]

Ultimately, concerns about excess demand for the PTC were unwarranted. The original January 1, 2021 deadline passed without any new generation capacity from an advanced nuclear reactor coming online. Several years before the deadline, however, it became clear no power plant would qualify to claim the PTC and the nuclear industry and its allies in Congress began seeking to extend and expand the credit (see 'Subsidy Resupply' section).



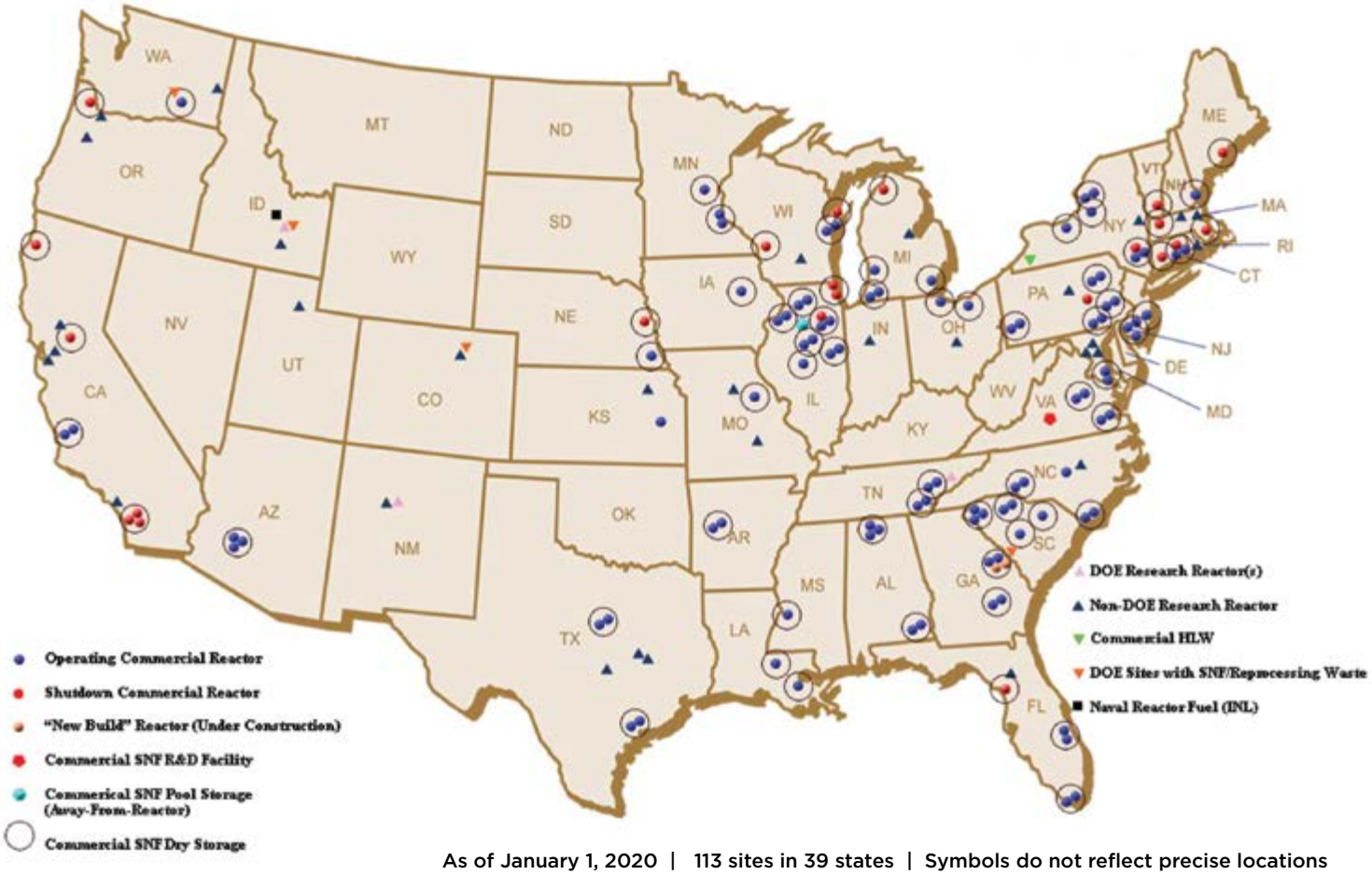
Recent Developments and Subsidy Resupply

Current DOE Research & Development Spending

DOE spending on nuclear energy ballooned over the last two decades, even as its share of DOE's total R&D budget declined. In FY 2000, DOE's budget for nuclear R&D (excluding fusion) stood at $57.5 million, or $86 million in 2020 dollars. In FY 2021, Congress appropriated $945 million for the same activities, a whopping increase of 988%.[53] In total from FY2000 to FY2021, Congress supplied DOE's Office of Nuclear Energy with $18.5 billion in funding, including $10.1 billion devoted to nuclear R&D, in 2020 dollars. The Energy Policy Act of 2005 authorized additional programs that received the bulk of that R&D funding.

In addition to continuing pre-existing programs, like the Nuclear Energy Research Initiative and Nuclear Energy Systems Support Program, the Energy Policy Act of 2005 authorized new programs including the Nuclear Power 2010 Program and the Generation IV Nuclear Energy Systems

Locations of Spent Nuclear Fuel and Reprocessing Waste



As of January 1, 2020 | 113 sites in 39 states | Symbols do not reflect precise locations

Source: U.S. Department of Energy

Initiative. Between FY 2005 and FY2010, Congress appropriated more than $1.2 billion, in nominal dollars, to those two new programs alone. Despite the flood of funding, the goal of the programs was never met, and no new nuclear power plants have come online.

In the last ten years, DOE focused more of its R&D dollars on the development of small modular reactors (SMRs). A budget line item expressly devoted to them, "SMR Licensing Technical Support," first appeared in FY2012, but federal support for reactors producing less than 300 MWe (compared to traditional reactors producing roughly 1,000 MW) can be traced back to the 1950s.[54] The chief beneficiary of the Licensing Technical Support grants, NuScale Power, is the only company to have its SMR design approved by the NRC. In total, DOE has subsidized NuScale's "Power Module" design with grants of more than $400 million. However, the company's reactor still faces an uncertain path to commercialization. The NRC's 2020 approval was only the first step in a comprehensive series of federal approvals, the financial stability of NuScale's parent company, Fluor Corporation, is in question, and multiple utilities have cancelled plans to help build NuScale reactors.[55] In October 2020, DOE announced its intent to grant the utility trying to adopt the Power Module an additional $1.4 billion.[56] If the modules are constructed, the utility would be able to claim millions of dollars more in taxpayer support through the Nuclear PTC.

Nuclear Production Tax Credit Expansion

By the start of 2017, only two nuclear projects were underway with an expected completion date before the PTC's 2021 placed-in-service deadline. One was the Vogtle project, the other was the construction of two reactors at the V.C.

Summer plant in South Carolina. As both projects suffered setbacks and it became increasingly clear no new nuclear facility would qualify for the PTC, some Members of Congress led efforts to expand and extend the credit.

In 2016, Rep. Tom Price (R-SC) introduced H.R. 5879 to that effect. In 2017, companion bills nearly identical to the 2016 bill were introduced in both the House and Senate. The House version, H.R. 1551 passed the chamber in June 2017. During the 2017 tax reform debate, a copy of H.R. 1551 appeared as section 3506 in the House tax proposal. The final 2017 Tax Act omitted the provision, but it resurfaced in the tax extenders package that eventually passed in February 2018 as part of the Bipartisan Budget Act of 2018.[57]

The enacted provision effectively eliminated the placed-in-service deadline and expanded the definition of qualifying facilities to include non-taxable entities, like municipal and cooperative utilities. The Secretary of the Treasury is now authorized to allocate any unused portion of the original 6,000 MW national capacity limitation to any new nuclear facility, regardless of when it comes online. In addition, the expanded PTC allows entities like municipal and cooperative utilities that have no tax liability to claim the credit and transfer it to project partners that do pay tax. Two of the Plant Vogtle owners, Oglethorpe Power and MEAG, fit the expanded criteria for claiming the credit and will be able to transfer any credits they receive to Georgia Power Company. If the Vogtle Units 3&4 are completed, the expansion could mean that Georgia Power receives $1 billion in credits more than it would have under the original PTC.[58] The extension also makes any utility company constructing SMRs like NuScale's Power Module or any future design eligible to claim the PTC.

Vogtle, VC Summer & Westinghouse

In August 2008, Georgia Power Company originally estimated that Plant Vogtle reactors 3&4 would cost $14.3 billion and begin commercial operations in 2016 and 2017 respectively. In 2020, the owners' financial filings put the total project cost at roughly $29 billion and the completion dates for the two reactors in November 2021 and November 2022. According to independent monitors, the completion dates could slip to 2022 and 2023. The Vogtle project is more than $14 billion over budget and five years behind schedule after numerous setbacks.[59]

Construction on Vogtle Reactors 3&4
Source: Bohdan Melekh via Flickr creative commons

In March 2017, Westinghouse Electric Company, LLC, the contractor for the Vogtle and V.C. Summer projects, filed for bankruptcy. South Carolina Electric & Gas (owned by SCANA Corp.) and Santee Cooper, the owners of the V.C. Summer plant, reported that their projected capital costs alone had increased from $11.4 billion to roughly $18 billion. After unsuccessfully seeking a $3 billion grant from the Department of Energy and turning down a counteroffer of an undisclosed amount in loan guarantees, the two companies decided to abandon the project on July 31, 2017.

The bankruptcy court handling Westinghouse's chapter 11 filing approved a service agreement which would make Southern Nuclear (a Southern Co. subsidiary) the main contractor on the Vogtle project on July 20, 2017. The agreement required additional approval from DOE given the department's role in the financing of the project. On September 29, 2017, the DOE offered the Vogtle owners $3.7 billion more in loan guarantees. DOE finalized the loan guarantee agreements in March 2019, bringing the total taxpayer liability for the project to $12 billion.

DOE's Attempted Coal and Nuclear Plant Bailout

In September 2017, then-Department of Energy Secretary Perry asked the Federal Energy Regulatory Commission (FERC) to consider the "Grid Resiliency Pricing Rule" which proposed to

provide full cost recovery for power plants that provide "essential energy and ancillary reliability services and have a 90-day fuel supply on site in the event of supply disruptions caused by emergencies, extreme weather, or natural or man-made disasters." As justification, the Secretary cited the 2014 Polar Vortex as demonstrating the importance of having resilient fuel reserves. The rule would have primarily benefited coal and nuclear power plants, which were better positioned to meet its criteria to qualify for full cost recovery.

The proposal was widely characterized as a massive bailout for the coal and nuclear industries that could have cost taxpayers as much as $11.8 billion.[60] After it was introduced, Secretary Perry failed to demonstrate a need for the rule. DOE's own report found that each region of the United States had excess supply of energy resources needed to meet demand.[61] Plants with on-site fuel supplies are also susceptible to extreme weather events and can fail during the kind of emergencies used to justify the rule. During the 2014 Polar Vortex, some coal plants halted operations when their supplies froze, and certain nuclear power plants had to be taken off-line in preparation for Hurricane Irma.[62]

FERC rejected the proposal in January 2018, on the grounds that there was no evidence showing that the "resilience" coal and nuclear power plants provide is not already priced into the market, and the proposal failed to show how it would be fair to taxpayers.[63]

After the rule's demise, the Trump Administration continued pursuing policies to help struggling coal and nuclear power plants. A draft memo leaked in May 2018 revealed a plan to use emergency authority granted to the President under Section 202 of the Federal Power Act, the Defense Production Act of 1950, and the Fixing America's Surface Transportation (FAST) Act, to buy power from uneconomical coal and nuclear power plants struggling to compete with natural gas and renewable energy, in the name of "promoting national defense and maximizing domestic energy supplies." Neither the White House nor DOE formally acknowledged plan, and it was reportedly halted by the National Security Council and National Economic Council, according to Politico.[64]

Nuclear Energy Innovation and Modernization Act

In 2019, Congress passed the Nuclear Energy Innovation and Modernization Act (NEIMA), which created new processes for advanced nuclear reactor licensing. However, lawmakers still managed to slip in provisions that would benefit the nuclear industry.

The NRC receives all of its funding through Congress, but collects fees from licensees and applicants throughout the year and that money is given to the U.S. Treasury as reimbursement, a process known as cost-recovery.[65] The Omnibus Reconciliation Act of 1990[66] requires the NRC to recover approximately 90 percent of its budget authority through fees charged to NRC licensees and applicants, excluding amounts appropriated for generic homeland security activities, the Nuclear Waste Fund, and Inspector General services for the Defense Nuclear Facilities Safety Board, and other operating programs.[67] On top of these exclusions, NEIMA removes amounts appropriated for R&D and regulations development for advanced nuclear reactor technologies from the amount the NRC must recover through fees, thereby further decreasing the portion of NRC budget to be paid for by the nuclear industry, shifting more costs to taxpayers. This means the rest will come from taxpayers who have already paid for decades of generous subsidies. These exclusions will remain effective till January 1, 2031.

The bill also puts a cap on the annual fee amount that may be charged to an operating nuclear reactor, but NRC could waive this cap if it compromised NRC's safety and security mission.

American Nuclear Infrastructure Act of 2020

In December 2020, the Senate Committee on Environment and Public Works approved S.4897 the American Nuclear Infrastructure Act,[68] another bill that will cost taxpayers billions of dollars to support the nuclear industry.

Here are some provisions that would provide handouts to the nuclear energy industry in the form of awards, grants, credits and cash:

- Sec. 201 establishes prizes for advanced nuclear reactors licensing equal to the amount of fees assessed and collected by the Nuclear Regulatory Commission (NRC). The award is

essentially a fee reimbursement program for the first few certifications of advanced nuclear reactors, giving the nuclear industry money at another step of the production process. The bill did put a cap on the prize amount, which shall not exceed the total amount spent on the project excluding any expenditure made with federal funds.

- Sec. 203 removes costs related to early site permit review/approval from the portion of NRC's budget authority that could be recovered by fee collection, providing federal funding for an early site permit to demonstrate advanced nuclear reactors on a DOE site. It would add to the lengthy list of activities that the nuclear industry doesn't have to pay for, which was expanded by Congress through NEIMA
- Sec. 301 would give 2-year financial credits to nuclear reactors that are at risk of shutting down due to economic factors, eligible for renewal till September 30, 2026. Although the bidding process will take into account the price per megawatt-hour required to continue operations as well as a specific number of megawatt-hours of generation during the 2-year period, this section authorizes appropriations of "such sums as are necessary" to carry out the incentive program from fiscal year 2021 to 2026, essentially giving uncapped cash bailout to the nuclear industry.
- Sec. 503 authorizes $100 million to be spent each fiscal year from 2021 to 2030 to clean up and remediate abandoned mine sites on Tribal land. Uranium mines already don't pay royalties to mine on federal lands, yet somehow taxpayers have to pay for their cleanup.
- Sec. 504 will give grants to assist with economic development and fund community advisory boards in "nuclear closure communities", which are units of local government (counties, cities, towns, school districts, etc.) that are affected by a nuclear power plant shutdown.
- Sec. 505 requires reporting on corporate support that the NRC receives from its fees. The Nuclear Energy Innovation and Modernization Act (P.L. 115-439) capped the amount of NRC's budget that can come from fees paid by the nuclear industry at 28% for 2025 and beyond, meaning the rest has to come from taxpayers' pockets.

Though the bill was not enacted into law, it is likely to be reintroduced in the new Congress.

Conclusion

The nuclear energy industry in the United States has benefited from cradle to grave subsides throughout its history. In recent decades, as policymakers have sought to incentivize or support new, more sustainable technologies that also will reduce carbon emissions, nuclear continues to receive federal support, despite its prohibitive costs and history of long delays. The subsidies, like those for other legacy fuel sources like oil and gas, have allowed nuclear to remain competitive and maintain a strong market position in the face of growing pressure from renewable sources. Perhaps the best example of the market distortion is the preference nuclear power received in the creation of the Title XVII loan guarantee program. When the loan guarantee programs was created, in 2005, well before the financial crisis, credit was readily available – and yet nuclear energy was unable to obtain financing without federal guarantees.

Current scientific consensus suggests that the next decade is critical for reducing carbon emissions to curb climate change. Increasing or even maintaining subsidies for nuclear power runs the risk of crowding out other faster, cheaper sources of low carbon energy as well as saddling taxpayers with long term risks associated with waste and potential liability for catastrophic accidents.

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