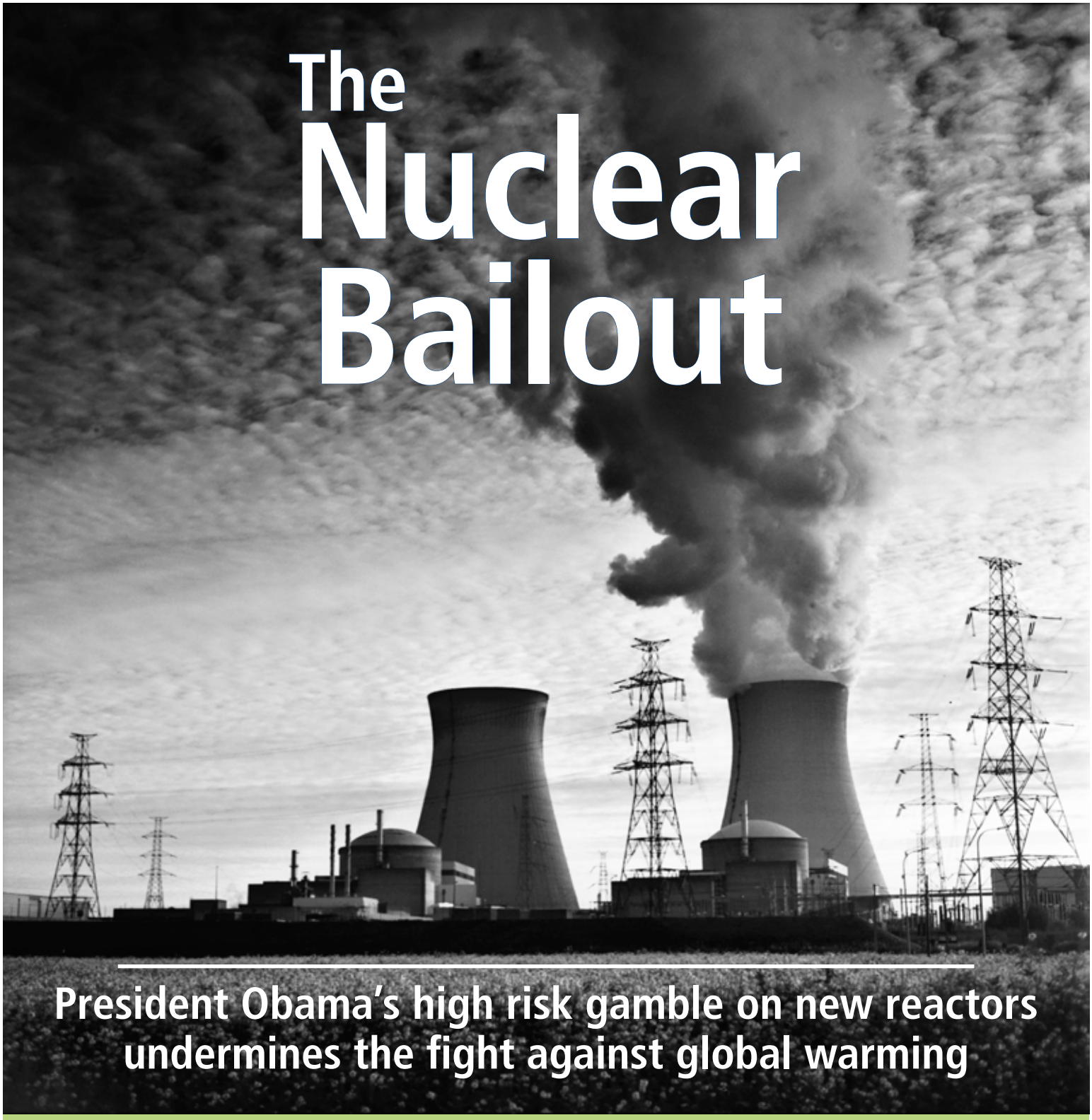

The Nuclear Bailout

President Obama's high risk gamble on new reactors undermines the fight against global warming

ENVIRONMENT AMERICA
RESEARCH & POLICY CENTER

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Written by:
Rob Kerth and Travis Madsen, Frontier Group
Anna Aurilio, Environment America Research & Policy Center

June 2010

Acknowledgments

The authors wish to thank Ellen Vancko at the Union of Concerned Scientists, Tom Clements at Friends of the Earth, Sara Barczak at Southern Alliance for Clean Energy and Michele Boyd at Physicians for Social Responsibility for insightful review and helpful suggestions on drafts of this report. Additional thanks go to Tony Dutzik at Frontier Group and to Carolyn Kramer for editorial support.

Environment America Research & Policy Center is grateful to the Educational Foundation of America and an anonymous donor for making this report possible.

The authors bear responsibility for any factual errors. The recommendations are those of Environment America Research & Policy Center. The views expressed in this report are those of the authors and do not necessarily reflect the views of our funders or those who provided review.

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Layout: To the Point Publications, www.tothepointpublications.com

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Executive Summary

In February 2010, the Obama administration announced that it would help finance two new nuclear reactors at the Vogtle nuclear power station in Georgia, offering an $8.33 billion loan guarantee to Georgia Power (a subsidiary of Southern Company) and two other companies invested in the project. President Obama claimed that the investment was necessary to create clean energy jobs, stimulate our economy to export homegrown technology instead of importing foreign oil, and secure the future of our planet and our civilization by fighting the growing threat of global warming.

However, this loan is an expensive gamble on a technology with a long history of bankrupting utilities and soaking ratepayers. New nuclear reactors are not cheap, not clean, and will set America back in the race against global warming. Most importantly, they are not necessary. Clean energy technologies can begin cutting global warming pollution right away, do so at lower cost and with less risk, and will create more jobs in the process.

There is an extremely high risk that taxpayers will be on the hook if the Vogtle loan guarantee proceeds. The loan guarantee is an up-front bailout that will enable Southern Company to make an uneconomic investment.

- Private lenders decline to finance new reactors because of the substantial risk that the investment will fail. In 2003, the Congressional Budget Office estimated that the chance of a loan for new nuclear reactor construction resulting in default would be "very high – well over 50 percent." In 2008, the Government Accountability Office estimated a default rate of just over 50 percent for all loan guarantees (including other eligible projects in addition to

nuclear power plants). The Obama administration's proposed loan guarantee would transfer this risk onto American taxpayers, who would pay up to $8.33 billion in the event that Southern Company and its partners run into trouble.

- Vogtle perfectly illustrates the risk. The original two reactors at the plant took almost 15 years to build and came in 1,200 percent over budget. Southern Company shareholders had to swallow $1 billion in losses, and Georgia Power electricity customers saw their electricity rates climb 40 percent over several years.
- The design of the new reactor has not been finalized, and is still undergoing review at the U.S. Nuclear Regulatory Commission (NRC). As a result, Southern Company's cost estimates for the two new reactors are speculative. If delays and cost escalation drive up the price tag before or during construction – as was the case with nearly every previous reactor – the company could default on the loan and even fail to complete the reactor, wasting taxpayer dollars.
- Moreover, the electricity demand Southern Company anticipates the reactor to serve may not materialize. And since nuclear power plants are large and inflexible, this possibility poses a serious financial risk. Construction of a nuclear reactor cannot be halted halfway to get half of the power output – it's all or nothing.
- Moreover, in May 2010, a Georgia state judge found that the state Public Service Commission (PSC) failed to adequately explain why building new reactors at Vogtle would be a prudent investment, and remanded the state certification for the reactor back to the PSC.
- Southern Company's decision on whether to accept the offer of the loan guarantee or not is expected in mid-June 2010, after the company requested a 30 day extension.

The Vogtle nuclear loan could cost electricity customers and taxpayers billions of dollars.

- Georgia Power customers will be paying $1.6 billion through higher electricity rates over the next six years to help finance the reactor construction. By 2017, the average Georgia Power customer will be paying an additional $10 per month to support the project.
- If Southern Company defaults before the reactor becomes operational and the government fails to charge an appropriate subsidy cost for the loan guarantee, the taxpayer cost could reach as high as $11 billion (including the loan guarantee amount of $8.3 billion and a possible subsidy cost of $3 billion) – or $95 per American household.

Building new nuclear reactors – at Vogtle or elsewhere – is an expensive way to produce electricity.

- The estimated cost to build a new reactor has more than tripled since 2005. Analysts at Moody's Investor Services call it a "bet the farm" risk.
- Illustrating the risk, the French government-owned nuclear giant Areva is building a new reactor in Finland, and the project is three and a half years behind schedule and 75 percent over budget after a series of construction problems.

- Southern Company and its partners estimate that the new Vogtle reactors and transmission upgrades will cost $14 billion. Over the lifetime of the reactors, that translates to an estimated rate of 13.5¢ to 16.5¢ per kWh for nuclear electricity (including transmission and distribution costs). The benefit of the loan guarantee would only lower the estimated cost of electricity by about 3 cents per kWh. This would still compare unfavorably to the 8.8¢ per kWh average retail price that Georgia households and businesses currently pay.
- Moreover, Southern Company may be underestimating the actual cost of the reactors. For example, in 2009, Florida Power & Light estimated that a similar project to add new reactors of the same design to Turkey Point in Miami would cost $12 to $18 billion. And in May 2010, Progress Energy increased the estimated cost of building a new 2-reactor nuclear facility in Levy County by $5 billion, for a total of $17 to $22.5 billion. Independent estimates of possible reactor costs go even higher.

New nuclear reactors are not safe or clean – nor are they a solution to global warming.

- The new reactors at Vogtle would set America back in the race to reduce global warming pollution. The new reactors would take a decade or more to build and tie up investment dollars, delaying action to reduce emissions. If that money were instead directed to clean energy solutions, such as energy efficiency measures, it could begin reducing emissions immediately.
- The NRC has raised safety concerns about the proposed design of the new reactors at Vogtle, which it has not yet certified. Specifically, the NRC has identified issues that could prevent the reactor's shield building from performing adequately during an earthquake, tornado or hurricane.
- The new reactors at Vogtle would produce 2,500 metric tons of highly radioactive spent fuel over their lifetimes. This waste would remain dangerous for thousands of years, and no nation has developed a permanent solution for safely disposing of it.
- The two reactors at Vogtle already consume as much as 66 million gallons a day from the Savannah River – more water than 500,000 Georgians use daily at their homes. Adding two more reactors would increase water withdrawals to as much as 132 million gallons a day, or 2 percent of the river's normal flow – competing with other downstream water needs. Drought and high temperatures, such as the severe water shortage the state experienced for three years ending in June 2009, could force the reactor to reduce output or shut down even as demand for electricity is highest – a vulnerability that will only be aggravated by global warming.
- Moreover, two additional reactors would double the volume of heated water the reactors discharge back into the river, which kills fish and damages the fragile river ecosystem. Construction of the reactors would likely require dredging up to 100 miles of the river channel as well, disrupting fish spawning.

Guaranteed loans for nuclear reactor construction are not a good way to create jobs.

- After a brief spike in employment during the construction of the plant, the Vogtle reactors will actually become a drag on Georgia's economy.

The high cost of power from the Vogtle reactor (estimated at 10 to 13 cents per kWh including the benefit of the loan guarantee) will raise citizens' energy bills, leading to the loss of 5,000 to 9,000 jobs (full time equivalent).

Clean energy and energy efficiency are more effective tools to stimulate America's economy, create clean energy jobs, increase energy security and fight global warming than new nuclear reactors.

- Clean energy is more cost-effective than new nuclear reactors. Per dollar spent over the lifetime of the technology, energy efficiency and biomass co-firing produce as much as 500 percent more electricity than nuclear power and are five times more effective at preventing carbon dioxide pollution. Combined heat and power (in which a power plant generates both electricity and heat for a building or industrial application) is greater than three times more cost-effective.
- If the $14 billion capital investment required to build two new reactors at Vogtle were instead directed into energy efficiency, Georgia Power could reduce electricity consumption in its service territory by 2 percent annually over 15 years. This investment in energy efficiency would *save* Georgians close to $13 billion on their energy bills at current electricity prices – since energy efficiency measures are cheaper than running an existing power plant. The savings on energy bills would create on the order of 2,800 jobs statewide – an increase in employment on the order of 8,000 to 12,000 jobs when compared to the job losses that would be caused by higher electricity rates from building two reactors at Vogtle.

The United States should focus on improving energy efficiency and generating electricity from clean sources that never run out – such as wind, solar, biomass and geothermal power – rather than wasting taxpayer dollars to offer upfront bailouts to builders of expensive and risky nuclear reactors. State and federal leaders should:

- **Oppose additional subsidies for nuclear power.** Nuclear power has already benefited from more than $140 billion in federal subsidies over the last half-century, from limited liability to loan guarantees. The federal government should not further subsidize new nuclear reactors. Any subsidies for low-carbon energy alternatives must be judged based on their relative short-term and long-term costs and environmental advantages.
- **Shift the nation's strategy for dealing with global warming away from propping up risky technologies like nuclear power, and instead establish a cap on emissions, guided by the latest scientific understanding.** Instead of issuing loans to the nuclear industry, the United States should establish a policy to cap economy-wide emissions of global warming pollution at a level sufficient to prevent the worst impacts of global warming.
- **Focus on energy supply technologies that are cleaner, cheaper and deliver results faster than nuclear power.** The United States should reduce overall electricity use by 15 percent by 2020, strengthen energy efficiency standards and codes for appliances and buildings, and obtain at least 25 percent of its electricity from clean, renewable sources of energy that never run out, such as wind and solar power, by 2025. States should also enact similar policies or expand existing targets.

Introduction

If one were looking for a perfect example of why *not* to invest in nuclear power, the Vogtle nuclear power station in Georgia would be a pretty good candidate.

After all, Vogtle – like many nuclear reactors across the country – was a financial disaster. By the time the second reactor began operating in 1989, the total cost of the project neared $9 billion – *1,200 percent higher* than the originally estimated cost.[1] Southern Company shareholders had to swallow $1 billion in losses, and Georgia Power electricity customers saw their electricity rates climb 40 percent over several years.[2] Additionally, Georgia Power pushed a law through the state legislature guaranteeing the company the ability to charge its customers the full cost of any future construction overruns, as long as the projects were approved by the state beforehand.[3]

Vogtle was also subject to the construction delays common to most nuclear reactors. From blueprints to operation, construction of the reactors at Vogtle took almost 15 years.[4] As originally designed, the site was to have consisted of four reactors. But the project went so badly, Southern Company had to scale back to two reactors.

Today, the Southern Company – majority owner of Plant Vogtle – wants to build two new nuclear reactors on the site. And they have a prospective financial partner: the American taxpayer.

Despite growing evidence from around the country and around the world that none of the fundamental problems with nuclear power – the high cost, the construction delays, the environmental and public safety threats – have been solved over the last three decades, American taxpayers are to be asked to guarantee a $8.33 billion loan to the owners of Vogtle – on top of billions in other federal subsidies now available to the nuclear industry.[5] And that is just a down-payment on tens of billions of dollars in additional subsidies for future reactors elsewhere in the country.

There are many good alternatives to nuclear power – alternatives that reduce fossil fuel consumption and global warming pollution, and do it faster, cheaper,

Photo: Southern Nuclear

If one were looking for a perfect example of why not to invest in nuclear power, the Vogtle nuclear power station in Georgia (pictured here) would be a pretty good candidate.

and with less risk to taxpayers and utility customers. Energy efficiency and renewable energy sources are already contributing to meeting our energy challenges and have the potential to do much more in the coming decades.

The Southeast has tremendous potential to save energy through improved efficiency, especially since Southern Company has consistently resisted efforts embraced by utilities across the country to help their customers improve their energy efficiency. Similarly, the region has enough biomass, wind, and low-impact hydroelectric resources to meet 25 percent of its electricity needs within the next two decades.[6]

There is still time for the nation to avoid repeating the mistakes of the past. Reversing the multi-billion dollar bailout for construction of the proposed Vogtle reactors, and ending future subsidies for nuclear power, are good first steps.

The Vogtle Loan Guarantee Offers High Risk for Little Reward

On February 16, 2010, President Obama himself announced the first offer of a taxpayer-financed conditional federal loan guarantee for new nuclear reactors .[7] The administration, by offering an $8.3 billion loan guarantee for the construction of two new nuclear reactors at the Vogtle facility in Georgia, has unwisely put taxpayers on the hook for a project that offers much in the way of risk, but little in the way of reward.

Southern Company – majority owners of the Vogtle facility – have asked the administration for an additional month to decide whether to accept the loan guarantee offer, with a final decision expected in mid-June 2010.[8] The company is performing additional "due diligence," which could include negotiating the amount of the subsidy fee it would have to pay to the Department of Energy should it accept the loan guarantee.[9]

The two proposed reactors at Vogtle would be the first built since the private sector backed away from the nuclear industry in the 1970s and '80s. Nuclear reactors proved themselves to be too expensive, unreliable, and difficult to construct. Today, there is ample evidence that the nuclear industry remains just as problem-prone as it was then, and there is no good reason to put billions of taxpayer dollars on the line in the hope that the industry will spontaneously and dramatically improve.

Loan Guarantees Are Necessary Because Private Lenders Will Not Finance Nuclear Projects

From the beginning, U.S. taxpayers have been instrumental in financing the deployment of nuclear technology. From 1950 to 1999, the federal government subsidized nuclear power to the tune of $145 billion.[11]

Despite this massive level of historical support, the nuclear industry still requires substantial federal subsidies. In other words, nuclear technology is too uneconomic to compete in the electricity market.

The nuclear industry turned to Congress for life support through the 2005 Energy Policy Act, which contained numerous new subsidies for nuclear reactor construction.[12]

One of the most prominent and valuable subsidies in the legislation authorizes the Department of Energy to issue taxpayer-backed loan guarantees to a nuclear developer, covering up to 80 percent of the cost of a nuclear reactor.[13] The loan guarantees allow companies wishing to build a nuclear reactor to obtain highly favorable financing. A loan guarantee recipient can choose to actually obtain the money from the U.S. Treasury, via the Federal Financing Bank, which coordinates all federal borrowing. The loan guarantee transfers risk away from a private lender and utility shareholders and onto American taxpayers, who would pay back up to the full cost of the loan in the event that the nuclear developer defaults on the loan.

Congress has authorized $18.5 billion for nuclear loan guarantees to date – enough for no more than two projects (3-4 reactors) at currently anticipated costs.[14] However, the Obama administration has proposed to triple the amount of funding in its 2011 budget, to a total of $54 billion.[15] This amount is still far below nuclear industry requests for more than $100 billion in loan guarantees for more than 25 proposed reactors (as of late 2009).[16]

> "Without loan guarantees, we will not build nuclear plants."
>
> – Michael J. Wallace, Executive Vice President of nuclear developer Constellation Energy, quoted in the New York Times on July 31, 2007.[10]

The nuclear industry doesn't want to stop there. The Nuclear Energy Institute (NEI) asked Congress for a "permanent financing mechanism" for new nuclear reactors, suggesting that none would ever get off the ground without taxpayer support.[17] Calling the existing loan guarantee program just a "step in the right direction," NEI announced that building as many reactors as it wants to build "requires a broader financing platform."[18] The U.S. Senate responded with a proposal to create a Clean Energy Deployment Administration in the American Clean Energy Leadership Act of 2009, which would have the authority to issue billions in loan guarantees with limited Congressional oversight.[19] (As of May 2010, Congress has not yet passed the proposal.)

The Vogtle Loan Guarantee

In February 2010, the Obama administration announced the offer of the first loan guarantee to a nuclear developer under the Title XVII Loan Guarantee program authorized by the 2005 Energy

Policy Act. The loan guarantee would offer $8.33 billion in taxpayer-backed financing to Southern Company's subsidiary Georgia Power, and two other partners to build two new nuclear reactors at the existing Vogtle nuclear station near Augusta, Georgia.[32]

The loan guarantee offered by the Obama administration would cover 70 percent of Southern Company's anticipated costs. To cover the remaining 30 percent, the company is seeking loan guarantees from the Japanese government and charging its customers up-front to support reactor construction.[33] The Japanese government has an interest in financing the project because the reactors proposed for Vogtle (a design called AP-1000) are manufactured by Westinghouse, owned by Toshiba, a Japanese company.[34] Many core parts for the reactor are likely to be manufactured in Japan.

In April 2009, Governor Sonny Perdue of Georgia signed a bill that allowed Georgia Power to charge its customers higher electricity rates to finance reactor construction.[35] According to Southern Company, the rate increase will provide

Additional Federal Nuclear Subsidies

In addition to taxpayer-backed loan guarantees, the largest subsidies the federal government offered to nuclear reactor developers in the 2005 Energy Policy Act and subsequent laws include:[20]

- An extension of the Price-Anderson Act, which limits nuclear industry liability in the case of a major accident. By one estimate, reactor operators would be responsible for only 2 percent of the cost of a worst-case accident – with taxpayers covering the remaining 98 percent.[21] This provision is similar to the law that limits the liability of an offshore drilling company for damages to third parties such as fishermen or tour operators from an oil spill to $75 million – a law that could shield Transocean and BP from billions in liability from the catastrophic consequences of their massive May 2010 oil disaster along the Gulf Coast.[22]
- $5.7 billion for a 1.8 cent tax credit for each kilowatt-hour of electricity produced from a new reactor during its first eight years of operation.
- $2 billion to insure companies against any costs caused by delays in licensing the first six new reactors. Covered delays include those that result from action by the Nuclear Regulatory Commission or litigation, even if the delay helps protect public safety.
- $1.3 billion in tax breaks on funds for decommissioning old reactors.
- $2.9 billion for research and development.
- $4 billion for two uranium enrichment ventures.[23]

The value of all the subsidies currently on offer to the nuclear industry is substantial – reaching as high as $13 billion for a single reactor, or 50 to 60 percent of the anticipated cost of power from a reactor over its useful lifetime.[24]

The Deep Pockets of the Nuclear Lobby

In 2010, the Investigative Reporting Workshop at American University reported that "in many ways, the nuclear power industry's efforts to win support are a textbook case of how the influence game is played in Washington."[25] Buoyed by billions in taxpayer and ratepayer support over the decades, the nuclear lobby includes major electricity generators that operate nuclear reactors or are seeking to build new reactors, such as Southern Company and Progress Energy; companies that build reactors or manufacture parts, such as Areva and Hitachi; and related businesses that have an interest in nuclear power, including law firms and engineering firms.[26]

During the first decade of the 2000s, the nuclear lobby spent more than $600 million to lobby Congress for more generous treatment and donated millions to congressional campaigns.[27]

Through major nuclear reactor operator Exelon, the nuclear industry has close ties to President Obama and his Chief of Staff, Rahm Emmanuel.[28] Two high-level managers at Exelon were high-level fundraisers for President Obama, and Emmanuel helped negotiate the corporate merger that created Exelon when he was an investment banker.[29]

In addition to lobbying the White House, Congress and state governments, the Nuclear Energy Institute funds the Clean and Safe Energy Coalition (CASEnergy), a public relations effort promoting nuclear power.[30] Among several high-profile spokespeople for the organization is former New Jersey Governor and former EPA administrator Christie Whitman, and the so-called environmentalist Patrick Moore – actually a paid spokesperson for the nuclear industry and other business interests.[31]

$1.6 billion toward the reactor cost over the next six years.[36] Southern Company claims that the average Georgia Power customer will pay close to $700 to support reactor construction, or an additional $10 per month.[37] The rate increase will happen regardless of whether the utility can bring the project in on time and on budget. Moreover, the utility is not required to return the funds if the reactor never operates.

Private Lenders Refuse to Finance New Nuclear Reactors Because of High Levels of Risk and Uncertainty

Southern Company and its partners are not relying on private lenders to finance their full Vogtle reactor project. Private lenders are likely wary of the substantial risk that the investment could fail, given that no one has any certainty what the proposed reactors will end up costing or how long they will take to build. Moreover, there is a large risk that anticipated electricity demand will not materialize.

The cautionary tale of the original effort to build the nation's existing fleet of nuclear reactors perfectly illustrates what could happen. Of 75 nuclear reactors completed between 1966 and 1986, the average cost more than triple its original construction budget.[38] In fact, the original construction of Vogtle itself came in at 1,200 percent over budget.[39] In 1985, *Forbes* magazine wrote that "the failure

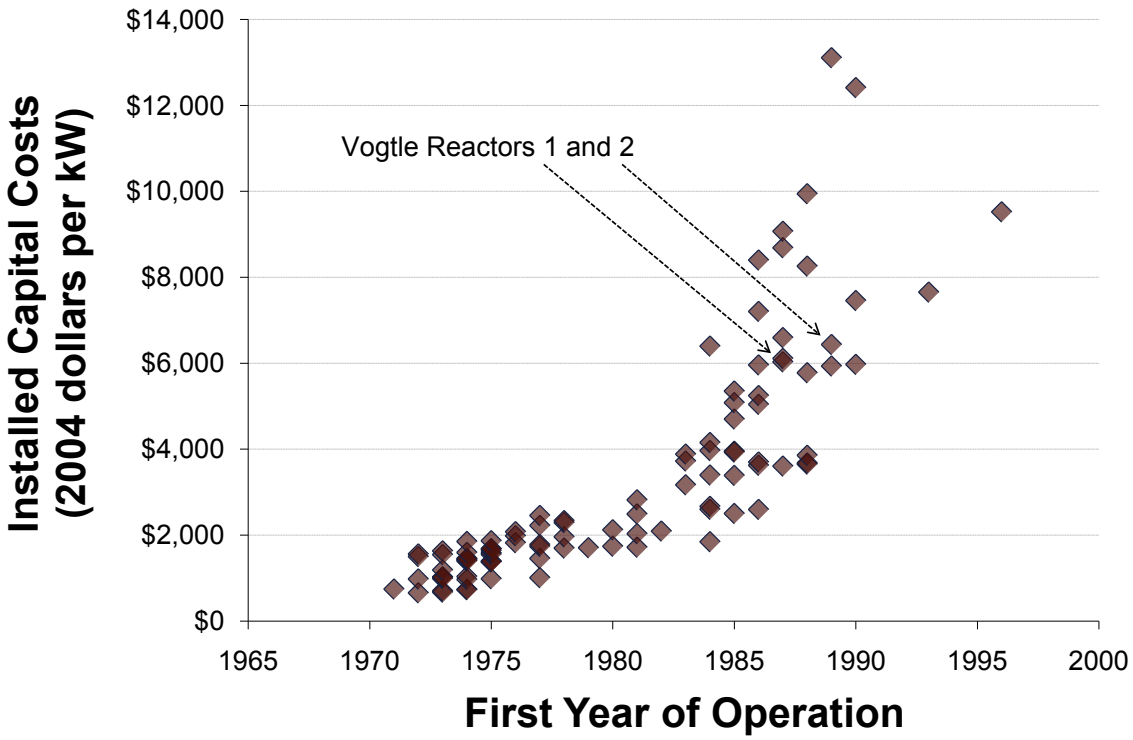
of the U.S. nuclear power program ranks as the largest managerial disaster in business history, a disaster on a monumental scale."[40]

Only one-half of the reactors proposed were ever built, and electricity customers bore much of the cost.[41] The spiraling cost of a nuclear reactor led to the first major utility company bankruptcy since the Great Depression, when the Public Service Company of New Hampshire succumbed to the billions of dollars of unexpected costs it had incurred in building the Seabrook reactor.[42]

Economists commonly expect that new products and technologies become cheaper over time, as companies gain experience and develop economies of scale. However, in the case of the last generation of nuclear power in the United States, the opposite proved to be true. The first nuclear reactors ever built were among the least expensive, while costs spiraled wildly out of control in the final decades of reactor construction. (See Figure 1.) For reactors beginning operation in the late 1970s and onward, inflation-adjusted capital costs escalated from just under $2,000 per kW to more than $10,000 per kW (in 2004 dollars).[43]

In 1973, the beginning of the Arab oil embargo, the United States entered a period of economic turbulence that increased the cost of power plant construction, while simultaneously reducing demand for power.[45] As power companies began to realize that predictions for future electricity demand were greatly overestimated, and as construction costs escalated, executives canceled more than 100 reactor projects, some in the middle of construction.[46]

Figure 1: Actual Capital Costs of Completed U.S. Nuclear Reactors (in 2004 Dollars)[44]



Finally, many reactor projects suffered from quality control problems during construction. Construction times for later-built reactors extended up to 10 to 15 years and beyond, greatly increasing finance costs for reactor owners. [47]

The Nuclear Industry Faces Many of the Same Obstacles to Expansion Today

The uncertainty around cost, timelines, and the need for electricity that plagued the original construction of Vogtle – and other nuclear reactors built in the 1970s and 1980s – continues to persist today. No new reactors are now under construction in the United States. In several other countries where firms have begun construction of new nuclear reactors, delays and cost overruns have resulted. In the case of reactors that are still in the planning phase, projected costs have risen dramatically, leading utilities and municipalities to reconsider their participation.

Delays and Cost Overruns

A reactor now under construction in Finland exemplifies the risk posed by delays and cost overruns. The reactor is now three and a half years behind schedule after a series of construction problems. While the project was initially scheduled for completion in summer 2009 (a four-year construction timeline), its builder, the French government-owned nuclear developer Areva, has scrapped the timeline.[48] There is currently no official schedule. Industry observers project the reactor might not come online until 2013.[49]

The reactor is the first of its kind in the world, incorporating complicated design features. Areva claimed that the design would facilitate rapid completion and keep costs in check.[50] However, that hope has turned out to be overly optimistic. The project has suffered from delays and cost overruns, much like past nuclear reactor projects.

Areva and its contractors have made a variety of costly mistakes during construction. Welds for the reactor's steel liner were flawed, and had to be redone. Water coolant pipes were revealed as unusable. And concrete poured in the foundation was suspect, with too much moisture content to meet safety requirements.[51]

As of September 2009, the project was $3.3 billion over budget.[52] Areva and the Finnish utility TVO are locked in a dispute over who will be responsible for the cost overruns.[53] Meanwhile, a coalition of Finnish industries estimates that the delays will indirectly cost electricity users $4 billion in higher power bills.[54]

The Finnish reactor is not the only nuclear project behind schedule. A second Areva reactor being built in France is at least nine months behind schedule.[55] Project coordinators admitted in late 2008 that the project was 20 percent over budget and two years behind schedule.[56] The last four reactors built in France took an average of 10.5 years to complete.[57]

Skyrocketing Cost Estimates for New Reactors

In 2003, experts at the Massachusetts Institute of Technology and Harvard concluded that "today, nuclear power is not an economically competitive choice."[58] Since then, cost estimates for new nuclear reactors have quadrupled.

In the early 2000s, nuclear industry executives estimated that construction costs for building a new reactor could approach $1,500 per kW of power generating capacity, plus finance costs.[59] They said the lower costs would make nuclear power competitive with coal and natural gas.

However, these early estimates have turned out to be overly optimistic. Recent estimates for the average cost of electricity from a new reactor over its entire life-

Facing Higher Costs And Radioactive Wastes, States And Local Governments Are Growing More Skeptical Of Nuclear Power

While construction has not actually begun on any nuclear reactors in the United States, increasing cost estimates for proposed reactors are proving to be a major hurdle. States and local governments are growing more skeptical about nuclear power as a result.

- When Ameren requested permission to charge customers in Missouri in order to help finance the construction of a new reactor, state lawmakers disapproved. The legislature declined to repeal a 1976 referendum that prevents higher electricity rates during power plant construction.[70] Ameren has since abandoned plans to build another reactor in Missouri.
- When Florida Power & Light asked to charge its customers an additional $1 billion in 2010, the Florida Public Utilities Commission denied 99 percent of the increase.[71] In response, Florida Power & Light suspended any investment in two new reactors it is pursuing at its Turkey Point nuclear station beyond what would be necessary to obtain a construction and operating license from the NRC. [72] The commission similarly denied a rate increase for Progress Energy, which has delayed work on its proposed Levy County reactors.[73]
- The municipal electric utility of San Antonio, Texas, entered into a partnership with NRG Energy and nuclear manufacturer Toshiba to build two new nuclear reactors at the South Texas site. When the estimated cost to build the plant rose by $4 billion (reaching $17 billion in total), San Antonio faced the possibility of a credit rating penalty for the utility or higher taxes for its citizens. The city responded by firing the head of its utility and filing a $32 billion lawsuit against NRG energy and Toshiba, accusing the two of withholding information about the cost increase. In March 2010, the parties settled – but San Antonio reduced its stake in the project to less than 8 percent, leaving NRG in need of new partners to move the project forward.[74]

Skepticism about nuclear power has recently extended to the relicensing of existing reactors, which – with their initial massive capital costs already shifted to utility shareholders through write downs, and to ratepayers through higher electricity bills – often deliver cheap electricity, though sometimes at the expense of public health and safety. In Vermont, for example, the state legislature refused to extend the license of the Vermont Yankee reactor because of repeated safety problems, including the collapse of a cooling tower and leaks of radioactive tritium – a carcinogen – into surrounding groundwater.[75] Additionally, the reactor owner falsely characterized the tritium leak and other issues repeatedly and under oath, eroding the trust of lawmakers.[76]

time are in the range of four times higher than this initial projection that promoters of a "nuclear renaissance" put forward in the early part of the last decade.[60]

Since Areva's misadventure with a fixed-price contract for its reactor project in Finland, no nuclear company has signed a contract guaranteeing a price for a new nuclear reactor. When Canada asked for guaranteed cost bids to build two new reactors, the results blew far past expectations. The only company willing to guarantee its work quoted a price of $26 billion (in Canadian dollars, approximately equal in value to American dollars) to build two new reactors – or $10,800 per kW – more than seven times higher than cost estimates from early in the decade.[61] Areva offered its technology for $23 billion – or $7,400 per kW – but its bid was deemed non-compliant, likely because it would not guarantee the price.[62] Both of these quotes were more than double the threshold for economic competitiveness.[63]

Seen through the lens of history, nuclear industry predictions that new designs and new construction techniques will eventually bring costs down look delusional.[64] New reactors will likely deliver high cost "surprises" and increased financial risk for power companies and their customers.[65]

Due to the large amount of money required to build an individual reactor, the investment ratings firm Moody's calls nuclear construction a "bet the farm risk" for a typical utility.[66] Moreover, Moody's has concluded that loan guarantees will only have a moderate ability to reduce the risk.[67]

Southern Company, and other utilities that attempt to invest in new nuclear reactors, face the possibility that ratings agencies will downgrade their credit rating in response to the huge level of risk the company is taking on.[68] In fact, ratings agencies have already downgraded the credit ratings of companies proposing new nuclear reactor projects, such as Progress Energy.[69]

The Electricity Demand Vogtle is Meant to Serve May Not Materialize

The 2008 meltdown of the U.S. financial system, the ensuing economic crisis, and ongoing national and local investment in energy efficiency are significantly reducing growth in demand for electricity. As a result, the demand a new reactor is meant to serve may not materialize. And since nuclear reactors are large and inflexible, this possibility poses a serious financial risk for Southern Company and its partners in the proposed Vogtle reactors – as well as any other utility considering a new reactor. Construction of a reactor cannot be halted halfway to get half of the power output – it's all or nothing. Michael Morris, the chief executive at American Electric Power, sounded a cautionary note about taking on such large investments. Quoted in the *Wall Street Journal*, he warned, "The message is, be cautious about what you build, because you may not have the demand [to justify the expense]."[77]

In a 2007 brochure explaining the need for two additional reactors at Vogtle, Georgia Power projected that electricity consumption in its service area would increase 30 percent by 2022.[78] Since 2007, however, electricity consumption in Georgia and neighboring states has actually declined – falling 4.3 percent from 2007 to 2009 – and is expected to fall even further in 2010.[79] The Energy Information Administration (EIA) expects demand to return to 2007 levels only by 2014, and at the end of the period in which Georgia Power anticipated 30 percent growth, the EIA expects demand to grow only 10 percent. [80]

Because of this trend, the owners of Vogtle run the risk of building too much

generating capacity, burdening customers and shareholders with unnecessary costs.

Compounding the problem are the high cost estimates for new reactors. Some estimates of the cost of power from a new reactor range as high as 25 to 30 cents per kWh – triple electricity rates in Georgia and most parts of the country.[81] Adding power at even half this price to a service territory would increase the cost that consumers pay for electricity, which would tend to reduce demand for electricity and cause price-sensitive commercial and industrial customers to relocate to areas with cheaper electricity supplies – further dampening the power demand the reactor was built to serve.

This exact situation contributed to the failure of the last wave of nuclear reactor construction in the United States. Dozens of reactors were cancelled, and billions of dollars in unnecessary investment were lost.

Southern Company's Estimates of the Cost of New Vogtle Reactors Are Speculative

Southern Company estimates that the two new Vogtle reactors will cost $14 billion.[82] However, the design of the reactor has not been finalized, and is still undergoing review at the Nuclear Regulatory Commission. The reactors planned for Vogtle would be the first of their kind built in the United States, and among the first of their kind in the world. (Four others are under construction in China as of March 2010.)[83] As a result, the actual cost could diverge widely from the estimates – and a Georgia Power executive conceded as much in testimony before the state's Public Service Commission (PSC) in January 2010.[84]

However, the Georgia Power executive argued for less oversight in the face of uncertain costs, rather than more. The executive felt that annual updates of cost projections were sufficient – not every six months, as recommended by commission staff.[85] Moreover, Georgia Power initially objected to the presence of an independent construction monitor who would report to the PSC at meetings about the new Vogtle reactors – a step the Commission wanted to take to minimize costly mistakes and unexpected surprises.[86] (A pilot project has since begun to test the process.)

If delays and cost escalation drive up the price tag during construction – as was the case with every previous reactor – the company could fail to complete the reactors and default on the loan, wasting billions of taxpayer dollars.

The Loan Guarantee to Expand Vogtle Is a Preemptive Bailout that Could Cost Taxpayers Billions

The Vogtle loan guarantee – and similar guarantees for other nuclear projects – are likely to leave taxpayers on the hook for much of the cost of failure. Since no nuclear reactors have been ordered in the United States in more than 30 years, new construction efforts are likely to encounter unpredictable difficulties.

Frank Bowman, president of the lobbying arm of the nuclear industry, the Nuclear Energy Institute, has defended the loan guarantee program, saying: "Loan guarantees will not involve the expenditure of any federal tax dollars when the clean energy projects are successfully completed."[88]

However, the risk that nuclear reactors will not be successfully completed is substantial. For example, when evaluating the Energy Policy Act of 2003, which proposed guaranteeing half the financing for new nuclear reactors, the Congressional Budget Office (CBO)

wrote: "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."[89] Given how much anticipated costs have increased – and how much anticipated new demand for electricity has decreased – since 2003, CBOs analysis almost certainly underestimates the seriousness of the risk of default today (2010). In 2008, the Government Accountability Office published a similar estimate, projecting a default rate of just over 50 percent for all loan guarantees, including nuclear reactors and other eligible projects.[90]

The ultimate measure of the risk of default may be the transfer of "stranded costs" from nuclear utilities to customers in the 1990s during the restructuring of electricity markets. Moody's estimated that the value of the customer rescue was "between $50 billion and $300 billion" and shielded several companies from bankruptcy.[91]

In the event of a default, the General Accountability Office (GAO)estimated that it would be able to recoup half of the amount it had put up to guarantee a loan through the bankruptcy process.[92] At this level, a default at Vogtle could cost $35 per American household.[93] Since the terms of the loan guarantees for Vogtle will not guarantee that the government is paid back before other creditors, cost recovery could be even lower than estimated.[94] In the worst case, if the government was unable to recover any funds, a default could directly cost each and every American household up to $70. And in addition to direct costs of the loan guarantee, taxpayers could take on an additional subsidy cost.

> Electricity customers "spent tens of billions of dollars saving nuclear power plant owners from large losses, even bankruptcy" during the 1990s. "The loan guarantees [offered under the 2005 Energy Policy Act] arrange the next multibillion-dollar rescue before the fact and charge it to taxpayers instead of customers."
>
> – Peter Bradford, former Nuclear Regulatory Commissioner, quoted in the Washington Post, 18 December 2007.[87]

Loan Guarantees Have Additional Subsidy Costs

Even if Southern Company does not default, there are important costs that the federal government will take on by offering a loan guarantee. The government typically charges a risk premium to the recipient of a loan guarantee, called a "credit subsidy cost." Like any form of insurance, loan guarantees can be assigned a price based on the risk of failure and the amount the government would have to pay if a loan defaulted. The cost is determined by the Office of Management and Budget and the Department of Energy for each loan guarantee recipient.

The nuclear industry has argued that this price should be small – in the range of 1 percent of the size of the loan guarantee.[95] Independent analysts have been far more skeptical. For example:

- The ratings agency Standard & Poor's roughly estimated subsidy costs in the range of 4-6 percent, or approximately between $332 and $498 million for the Vogtle loans.[96]

- The non-partisan Congressional Budget Office estimates the cost of a loan guarantee at 30 percent of the guaranteed loan – which, in the case of Vogtle, would place the subsidy cost at just under $2.5 billion.[97] In March, this office noted that "it would be difficult to set the fee so as to entirely cover the estimated cost to the government."[98]
- The Center for American Progress suggested that subsidy costs should be at least 10 percent on the low end – and up to 37 percent at the high end of the most likely scenarios – assuming that the risk of default is spread evenly over 30 years and that the Department of Energy has the first right of recovery in the event of bankruptcy.[99] (Both of these assumptions lead to lower subsidy costs – in actuality, default rate is likely higher during construction, before the plant can generate revenue.) Under these conditions, the subsidy cost would fall between $830 million and $3 billion.

According to the Government Accountability Office, "To the extent that [the Department of Energy] underestimates subsidy costs and does not collect enough fees from borrowers, taxpayers will ultimately make up the difference."[100] For example, if the government charges a subsidy cost of 1 percent of the loan value, when it actually should be 37 percent, taxpayers would be subsidizing the two Vogtle reactors to the tune of an additional $3 billion on top of the loan guarantee amount of $8.3 billion. In the worst case scenario of a highly underestimated subsidy cost charge and a default on the full loan amount, the cost to the American taxpayer could be as much as $95 for every American household.[101]

The charge that the government levies on Southern Company for the loan guarantee is a critical factor in whether the project will proceed or not. Utility executives have expressed doubt that the industry would be able to build reactors while paying the full subsidy cost if it was in the range of 10 percent of the amount of the loan.[102]

The Vogtle Loan Guarantee Would Be an Expensive Way to Generate Electricity

Southern Company estimates that Vogtle reactors will cost $14 billion to build.[103] At that price, based on a comparison with published estimates of the levelized cost of power from new reactors, the cost of electricity from the reactors could fall in the range of 10.5 to 13.5 cents per kWh.[104] Add an additional three cents per kWh for transmitting and distributing the electricity to end customers – yielding a retail cost in the range of 13.5 to 16.5 cents per kWh.[105]

According to an estimate of the value of the loan guarantee by Constellation Energy for its proposed reactor at Calvert Cliffs, Maryland, the loan guarantee will reduce the cost of power from the reactor in the range of 3 cents per kWh.[106] This would still compare unfavorably to Georgia's current average electricity rate of 8.8 cents per kWh.[107]

Moreover, Southern Company may be underestimating the actual cost of the reactors. For example, in 2009, Florida Power & Light estimated that a similar project to add new reactors of the same design to Turkey Point in Miami would cost $12 to $18 billion.[108] And in May 2010, Progress Energy increased the estimated cost of building a new 2-reactor nuclear facility in Levy County by $5 billion, for a total of $17 to $22.5 billion.[109]

Independent estimates of possible reactor costs go even higher. Recent

estimates for the average cost of electricity from a new reactor over its entire lifetime range from a low of 8 cents to a high of 30 cents per kilowatt-hour (kWh), with the bulk of estimates falling between 12 and 20 cents per kWh.[110] (For many of these estimates, add another 3 cents per kWh to transmit and distribute the electricity from the nuclear plant to the customer.[111])

As discussed in detail on page 26, America has many other options to deliver low- or zero-emission electricity for far less cost.

The Vogtle Loan Guarantee is a Poor Source of Clean Energy Jobs

According to Southern Company, the Vogtle project will create several thousand jobs during its construction, and 800 long-term jobs.[112] With more than $8 billion in government loans supporting the project, the federal government will underwrite $10 million per permanent job directly created at the site.

However, because the electricity produced by the plant will be so expensive (estimated at 10 to 13 cents per kWh including the benefit of the loan guarantee, based on Southern Company's capital cost estimate), the net impact of the new reactors on Georgia's economic situation will likely be negative. The increased cost of energy caused by the plant will raise citizens' energy bills, leading to an estimated loss of 5,000 to 9,000 jobs (full time equivalent).[113]

While large electricity users – which include major employers – are exempt from construction work in progress charges in Georgia, they are not immune to the impact of higher energy costs, including job losses.

Additionally, a significant fraction of the spending on manufacturing reactor components will go overseas, benefiting the economies of other countries and limiting their job creation potential here.[114]

The Vogtle Nuclear Reactors Are Not Safe or Clean – Nor Are They a Solution to Global Warming

Supporters of new reactor construction have presented nuclear power as a clean energy solution that can provide reliable, safe power, and help the United States cut pollution and fossil fuel dependence. In fact, nuclear power poses safety risks, is unreliable, and cannot be deployed rapidly enough to help America reduce its emissions of global warming pollution fast enough to make a difference.

The New Reactors at Vogtle Are Not a Solution to Global Warming

The new reactors at Vogtle would be built too slowly to reduce global warming pollution in the near term, and would actually increase the scale of action required in the future.

To avoid the most catastrophic impacts of global warming, America must cut power plant emissions roughly in half over the next 10 years. Leading experts have called for developed countries to reduce their emissions 25 to 40 percent by 2020 to avoid the worst effects of global warming.[115] Since power plants are one of the easiest places to obtain rapid progress, the electric power industry will need to account for a larger fraction of the overall progress needed.

The new reactors at Vogtle cannot be built quickly enough to contribute appreciably to cutting emissions on that timescale. If historical patterns hold, it could take 9 years or more for a newly licensed nuclear project to begin producing elec-

tricity.[116] While the reactors are under construction, Georgia would continue to rely heavily on electricity from polluting coal-fired power plants. As a result, it is quite possible that the new reactors at Vogtle could deliver no progress in the critical next decade, despite the billions spent on reactor construction.[117]

Moreover, nuclear power is expensive and will divert resources from more cost-effective energy strategies that can deliver much more global warming solution per dollar – including energy efficiency, biomass co-firing, combined heat and power, and sources of energy such as wind, solar, and geothermal power.

The Reactor Design for Vogtle Has Not Been Certified as Safe

As of March 2010, the Nuclear Regulatory Commission (NRC) has not certified the reactor design proposed for Plant Vogtle as safe. In Fall 2009, the NRC announced that it had serious concerns with the construction of the reactor's shield building.[118] The shield building is responsible for protecting and containing the reactor core in the event of an earthquake, impact, explosion, or severe weather, but the NRC is concerned that, as currently planned, the structure might be insufficient to that task. The NRC noted that the design did not yet meet "fundamental engineering standards."[119] The British Health and Safety Executive (HSE) has echoed these concerns.[120]

New Reactors Require Uranium Mining and Produce Radioactive Waste

The impacts of uranium mining and the production of radioactive waste are two difficult and persistent problems associated with nuclear power. Because of these impacts, nuclear power cannot truly be considered "clean."

For example, uranium milling has left a radioactive and toxic legacy in Colorado. Operations have polluted the state's air and water, devastated communities and public health, killed wildlife, and ruined public lands. In March 2009, Cotter Corporation announced plans to reopen a uranium mill in Canon City, even though it's still an E.P.A. Superfund toxic waste site and has other outstanding violations.[121] Another company, Energy Fuels, plans to open the first new uranium mill in the U.S. in 25 years in Western Colorado to mill ore pulled from the public lands in Colorado's red rock canyon country surrounding the wild Dolores River.[122] In Colorado alone, taxpayers have spent more than 1 billion dollars cleaning up past uranium milling operations according to U.S. Department of Energy and U.S. EPA documents.[123]

Nuclear reactors also produce dangerous high-level radioactive waste. Radioactive waste from nuclear reactors is one of the most dangerous substances ever created by humans, remaining hazardous for a million years.[124] No country in the world has developed an effective, safe and permanent way to dispose of this waste.

The new reactors at Vogtle would produce about 2,500 tons of highly radioactive spent fuel during their operational lifetime.[125]

Until recently, the United States has been exploring the idea of burying spent fuel in Yucca Mountain, Nevada. However, the Obama administration declared the idea dead, and instead formed a Blue Ribbon Commission on America's Nuclear Future to make recommendations on managing radioactive waste.[126]

In the absence of a safe, long-term storage solution for radioactive waste, spent fuel is stored on-site at most nuclear plants, including Vogtle.[127] Highly radioactive spent fuel rods are placed in

reactor cooling ponds that were never designed for the long-term storage of nuclear waste.[128]

Reprocessing this waste to separate out plutonium to use as reactor fuel would be extremely expensive and polluting, as well as increase the risk of nuclear weapons proliferation. All reactors produce plutonium, but it must be separated from highly radioactive spent fuel before it can be used in weapons. This separation process is known as "reprocessing."

Currently, reprocessing only happens in two countries: England and France.[129] Were the technology to spread, it would increase the availability of plutonium.

Accounting for all of the plutonium produced by a reprocessing plant is extremely difficult for plant managers or weapons inspectors. For example, at a reprocessing plant in England, a leak that diverted 160 kg of plutonium into a cement chamber went undetected for eight months.[130] Expanding reprocessing capability would increase the opportunities for states or terrorist organizations to acquire weapons-grade nuclear material.

In summary, expanding America's fleet of nuclear reactors poses significant risks to the environment and public safety, and the technology cannot be considered clean.

Photo: Jeri Fry, Colorado Citizens Against Toxic Waste

In Colorado alone, taxpayers have spent more than 1 billion dollars cleaning up contamination from past uranium milling operations, such as the Cotter uranium mill in Canon City (pictured here).

New reactors at Vogtle Would Increase Water Consumption

Vogtle is already a heavy consumer of water from the Savannah River; the existing reactors withdraw 55 to 88 million gallons a day, with 50 to 75 percent consumed as steam rather than returned to the river.[131] Already, the reactors consume as much water as half a million Georgians use at their homes every day.[132] Constructing two new reactors would increase the consumptive water use of Vogtle to as much as 130 million gallons a day – enough to serve the domestic needs of one million Georgians. This amount of water is about 2 percent of the river's average flow – and as much as 10 percent during times of drought.[133] This water consumption would compete with the water needs of downstream communities.

Georgia is no stranger to water shortages—a three-year drought ending in June 2009 forced the state to adopt sharp restrictions on consumption.[134] That same drought forced three nuclear reactors in Alabama to reduce their power output to avoid damaging the Tennessee River.[135]

High summer temperatures and drought have resulted in nuclear reactors reducing electricity production precisely at the times when electricity demand is the highest.[136] Global warming will only aggravate this dynamic in the future, driving increases in temperature and increasing the likelihood of drought.[137]

Moreover, two new reactors would double the volume of heated water the reactors discharge back into the river, which kills fish and damages the fragile river ecosystem. The Savannah River is a hotspot for freshwater fish, with 118 different species of fish – including the endangered shortnose sturgeon and rare robust redhorse – and 24 species of mussels.[138] Vogtle discharges water at 90 degrees Fahrenheit, which is enough to kill the eggs and larvae of the American Shad and the federally endangered shortnose sturgeon.[139]

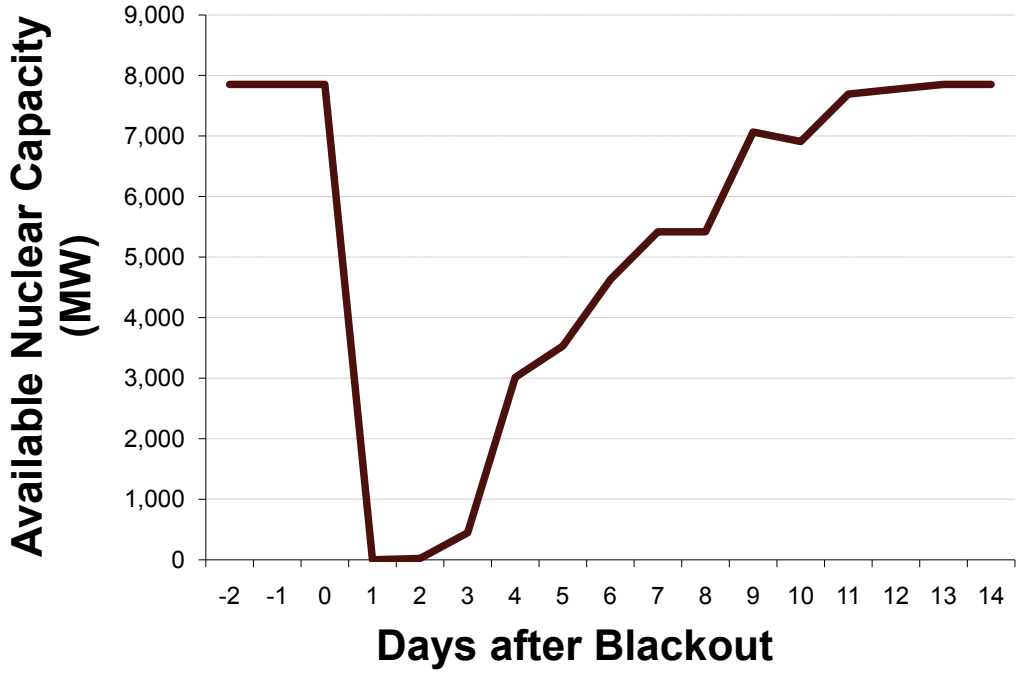
Installing the reactors would also require dredging of up to 100 miles of the Savannah River channel to make room for ships carrying heavy steel parts in to Vogtle from the port of Savannah – something that hasn't been done since 1979.[140] Dredging is likely to disrupt the river ecosystem and interfere with fish spawning.[141]

Additional Reactors at Vogtle Are Not Necessary for Reliable Electricity Service

Nuclear reactors produce electricity in huge blocks of power, and are incapable of reacting nimbly to changes in electricity demand. From a reliability viewpoint, this aspect of nuclear power is actually a disadvantage. In fact, when power is supplied in huge blocks by large central station power plants, the failure of any individual power plant or power line carries a great risk of widespread electricity supply disruption.

Nuclear reactors have a history of unanticipated failures, which sometimes lead to sustained outages. Of the 132 nuclear reactors ever built in the United States, 28 shut down prematurely because of cost or reliability problems, or in the case of Three Mile Island Unit 2, a near-meltdown.[142] Problems at another 35

Figure 2: Available Capacity of Nine Affected Nuclear Power Plants after the Northeast Electric Blackout in August 2003[152]



reactors resulted in one or more outages lasting at least one year – bringing the share of US nuclear reactors to suffer early shutdowns or service interruptions to 47 percent.[143]

Over time, nuclear operators have learned to operate existing reactors with greater reliability. But when a nuclear reactor does shut down – even if such an event happens relatively infrequently – it can wreak havoc on the electric grid. For example, when two reactors at Turkey Point in southern Florida shut down in February 2008 because of a power line failure, the resulting power outage cut off electricity to more than 3 million customers in the Miami area for up to five hours – causing traffic jams, stranding people in elevators, and widely disrupting business.[144]

In addition, it can take days or weeks for a nuclear reactor to return to full output after an emergency shutdown. For example, nine reactors shut down automatically during the wide-ranging Northeast electric blackout that occurred on August 14, 2003. Nearly two weeks elapsed before these reactors regained full generating capacity.[145] (See Figure 2.) Prolonged deactivation of nuclear reactors in Canada threatened to cause another blackout in the days after the event. Government officials asked Ontario citizens to cut their electricity consumption in half to keep the system online.[146] A large amount of backup generation capacity had to be mobilized at high prices to restore electric service in the absence of the output from nuclear reactors.

Vogtle has not been immune to these types of problems. For example after a refueling outage in April 2007, Unit 2 shut down unexpectedly as it was being restarted. Returning the reactor to operational status took longer than a week.[147] In 1990, a Georgia Power truck hit a utility pole at the Vogtle site, causing a local power outage that cut power to the plant's cooling and control systems, causing the core of a reactor undergoing refueling to begin overheating, and shutting down the other reactor, taking the reactor entirely off the grid.[148] Key backup systems were undergoing maintenance. The plant declared a "site area emergency" – the second-highest of four NRC emergency levels.[149] After a little more than a half an hour, workers were able to start an emergency backup diesel generator, which managed to get the reactor core temperature back under control.[150] The NRC responded with a "high-level review" of the incident, the fifth such action in the agency's history at the time.[151]

An electricity system made up of millions of small clean energy measures would yield a more flexible and reliable electricity system compared to a new fleet of nuclear reactors. In contrast to a single large power generating station, it is unlikely that all of the pieces of a diverse portfolio of clean energy resources will fail at the same time. The transient removal of any single small, clean generation unit or even group of units has little to no effect on the overall system. This will be especially true in a "smart grid," where the electricity system operator will have the ability to manage electricity demand at the same time as supply.

Moreover, distributed clean energy technologies – such as energy efficiency, rooftop solar panels and combined heat and power (CHP) systems – are located near where the energy will be used, reducing the need for power to travel over transmission lines. These resources insulate individual customers from wider electricity disruptions. And since nearly all power failures originate in the transmission system, energy resources that bypass power lines can reduce the opportunity for grid failures in the first place.[153]

Energy Efficiency and Renewable Energy Sources Offer More Benefits for Less Cost than Building New Reactors at Vogtle

Energy efficiency and clean energy sources that never run out – such as wind, solar and geothermal power – are more effective tools to stimulate America's economy, create clean energy jobs, increase energy security and fight global warming than building new reactors at Vogtle, or elsewhere. On every measure, clean energy solutions outperform nuclear power as a solution to America's energy problems.

If both nuclear power and clean energy technologies such as wind, solar and energy efficiency can deliver low-emission power and reduce global warming pollution, why can't we just pursue both paths – reducing emissions now through clean energy and in the future with nuclear?

In a world of unlimited resources, such a path would be conceivable. But in the real world of public policy, governments must make choices about how to allocate limited resources. Issuing loan guarantees to Georgia Power and its partners or other nuclear utilities has an opportunity cost – reducing the amount of taxpayer funds available to invest in cleaner solutions that can deliver more results for the money.

An investment in energy efficiency instead of new reactors at Vogtle would deliver vastly superior results. Investing in energy efficiency actually *pays customers back* with ongoing savings on electricity bills. Efficiency measures are cheaper even than operating existing power plants. For example, analysts at the consulting firm McKinsey & Company estimate that investing $520 billion in energy efficiency measures would eliminate $1.2 trillion in waste from the U.S. economy, saving citizens and businesses nearly $700 billion (in net present value terms).[154] In other words, energy efficiency could provide the same level of impact as building 160 nuclear reactors in the next 10 years – at net savings.[155]

An investment in renewable sources of power can deliver carbon-free electricity for much less cost than new nuclear reactors. Many types of renewable energy have the advantage of zero fuel costs, since wind and sunlight and the earth's heat are free. Other types of clean energy, such as solar photovoltaic panels, have the advantage of being located near where the energy will be used, minimizing the cost of transmitting and distributing electricity. And these technologies require no special waste handling or decommissioning and pose little if any risk to public health and safety.

Clean Energy is More Cost Effective than New Nuclear Reactors

Vast amounts of clean energy are available – now – for far less cost than new nuclear power.[156]

- Energy from a new nuclear reactor would be two to six times more expensive than saving electricity through efficiency – including utility and consumer investment. Across the country, the average utility cost of saved energy is 2.5 cents per kWh, three to four times cheaper than building any kind of new power plant.[157] Including consumer contributions to efficiency measures, the average total resource cost of efficiency is around 4.6 cents per kWh.[158] Moreover, as the scale and scope of energy efficiency programs increase, they tend to become even more cost effective.[159]
- Altogether, experts at the National Academy of Sciences and the American Council for an Energy-Efficient Economy estimate that the United States could cost-effectively reduce its overall energy consumption by 25 to 30 percent or more over the next 20 to 25 years – ensuring that America uses less energy several decades from now than we do today, even as our economy grows.[160] Reducing electricity consumption by 25 percent below forecast levels by 2030 would save more than 1.2 trillion kilowatt-hours of electricity in that year – equivalent to the output of more than 150 new nuclear reactors.[161]
- Combined heat and power technologies are also extremely cost-effective sources of electricity. Combined cycle industrial heat and power installations can generally produce power for 4.5 to 5.5 cents per kWh, including credit for the value of useful heat that the generators also produce.[162] And smaller, building-scale CHP technology can deliver electricity for less than 6 cents per kWh, again counting the value of the useful heat also produced by the generator.[163]
- Energy efficiency, distributed solar power, and combined heat and power have the added advantage of saving or generating energy near where it will be used, avoiding transmission and distribution costs. In addition, saving or generating energy locally minimizes electricity losses that can occur while transporting electricity from a distant power plant.

Large potential supplies of clean energy from wind, solar, biomass and geothermal sources are also available – now – at costs well below estimates for new nuclear power. For example:

- America's entire electricity needs could be met by the wind blowing across the Great Plains or the

sunlight falling on a 100 mile square patch of the desert Southwest, or a tiny fraction of the natural heat just beneath the surface of the earth anywhere across the country.[164] Diverse, locally-based resources are available in every state.

- According to the Southern Alliance for Clean Energy, southeastern states, including Georgia, have enough biomass, wind, and low-impact hydroelectric resources to meet 25 percent of regional electricity needs within the next two decades.[165]
- Nationally, the U.S. Department of Energy (DOE) estimates that wind energy resources across the U.S. as a whole could produce more than 1.5 million gigawatt-hours of electricity per year for between 6 and 10 cents per kWh (2006 dollars).[166] (This price includes estimated transmission costs, assuming that the existing grid has 10 percent spare capacity that could be used for wind, and that appropriate planning will allow new lines to be constructed as needed.) This amount of wind would be the energy equivalent of 190 nuclear reactors.[167] DOE estimates that generating 20 percent of America's electricity supply with wind by 2030 would cost the average household just 50 cents per month more compared to sticking with coal- and gas-fired power – and excluding the benefits of cleaner air and conserved water.[168]

Developing U.S. renewable energy and energy efficiency resources could save Americans more than $200 billion on energy bills by 2020.[169]

Per Dollar Spent, Clean Energy Is More Effective at Preventing Pollution than New Nuclear Reactors

Since nuclear reactors can take a decade or more to construct, new nuclear power cannot be obtained today in the United States at any price. However, many other energy technologies are available now that can deliver cost-effective reductions in pollution. In a 2009 analysis, the Center for Climate Strategies found that more than 20 available options could prevent global warming pollution at costs far less than building new nuclear reactors.[170]

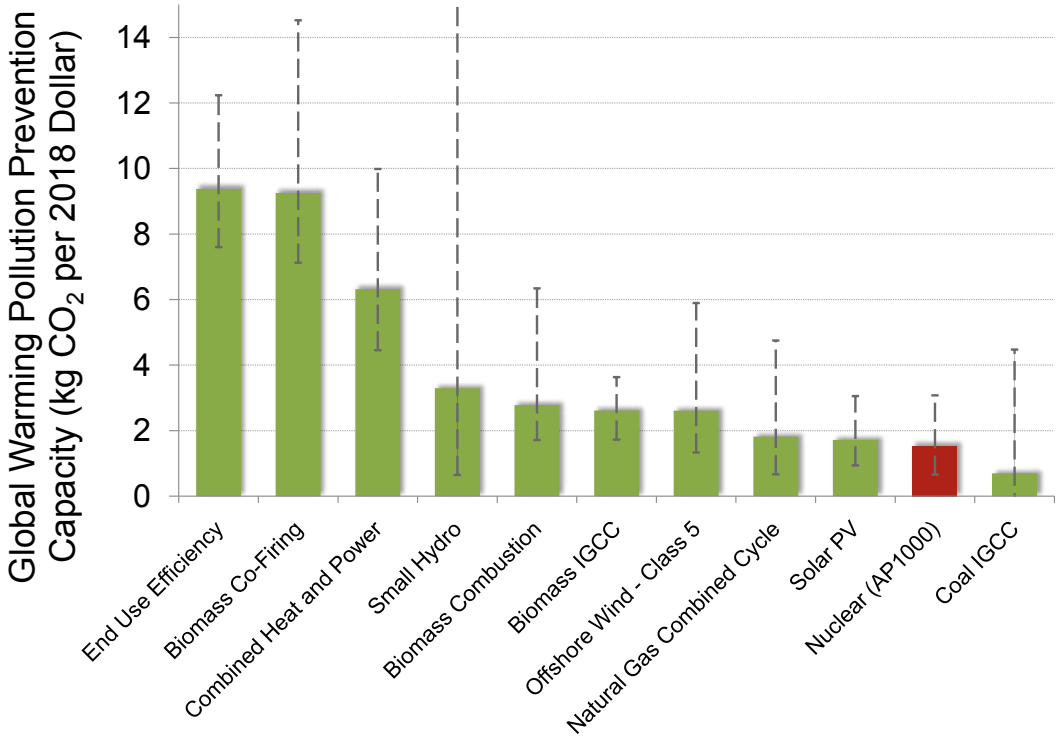
Recent estimates for the cost of a new nuclear power plant place it well above many alternatives, including energy efficiency, combined heat and power, biomass, landfill gas, offshore wind, and natural gas combined cycle power – whether financed by a public utility, an investor-owned utility, or a merchant generator.[171]

Because these technologies can produce low- or zero-emission electricity for much less cost than nuclear power, they deliver more global warming solution per dollar of investment. (See Figure 3, which compares the estimated costs of different generation technologies with an in-service date of 2018, a reasonable estimate as to when the first nuclear reactors might come online.) In addition, possible intermediate solutions, such as replacing coal-fired power with greater utilization of existing natural gas-fired power plants, are also likely to be more cost-effective ways to prevent carbon emissions than building new nuclear plants. In fact, this trend is already underway. Global warming emissions in 2009 were nearly 10 percent below levels in 2007 as electricity demand fell and natural gas prices declined from historical highs – reducing coal consumption.[172]

Under investor-owned utility financing, per dollar spent (over the lifetime of the technology), energy efficiency would be on the order of five times more effective at preventing global warming pollution than expanding Vogtle or other nuclear plants. Combined heat and power (in which a power plant generates both electricity and heat for a building or industrial application) would be greater than three times more effective. Even without the benefit of the production tax credit in 2018, biomass will be more than twice as effective and offshore wind will be on the order of 40 percent more effective.

Since sunlight is available in every state in America, solar power has large potential as a tool to reduce global warming pollution. By 2018, solar photovoltaic power should be at least comparable to a new nuclear reactor in terms of its per-

Figure 3: Comparative Ability of Electricity Technologies to Prevent Global Warming Pollution, per 2018 Dollar Spent over Technology Lifetime– Online in 2018, Merchant Financing Terms [173]



By 2018, an estimate for the first date the first new reactor in the United States could be online, new nuclear reactors will be among the least cost-effective options for reducing global warming pollution. Per dollar spent, nuclear power would be less effective than other low- or zero-emission energy solutions. (For simplicity, this figure assumes that power from these new sources at scale would displace an average unit of electricity from the existing U.S. electricity grid. Error bars represent a possible range of values for each technology, given the range of resource quality and location, and uncertainty around cost estimates.)

dollar ability to prevent global warming pollution. However, solar power is falling in price far faster than any other generation technology; a stark contrast to new nuclear reactors that have seen costs soar. Solar prices have fallen by more than 80 percent since 1980.[174] Between 1998 and 2008, the installed cost of photovoltaic systems declined by 31 percent, excluding the impacts of tax incentives and subsidies.[175] During 2009, prices declined even further, with the cost of PV modules falling by more than 40 percent.[176] Nationally, the U.S. Department of Energy experts forecast that solar will equal other sources of electricity in terms of cost per kWh by 2015.[177]

In fact, recent analysis by the investment firm Lazard implies that thin-film solar photovoltaic and solar thermal power technologies, with existing incentives, are already competitive with and even ahead of nuclear power.[178] Lazard also highlights biomass co-firing – in which an existing coal-fired power plant replaces up to 15 percent of its typical fuel with plant matter – and landfill gas as additional cost-effective options.[179]

Clean Energy Is Better at Creating Jobs than New Nuclear Power

Spending the same $14 billion that it would cost to expand Vogtle on energy efficiency would produce dramatically different results. If the $14 billion capital

Southern Company Subsidiary Georgia Power Has a History of Resisting Energy Efficiency

Georgia Power has historically been resistant to efficiency efforts. Between 1998 and 2004, the utility actually had no efficiency program at all, and it has resisted efforts to implement efficiency programs, claiming at one point that none of the 500 other programs from other utilities nationwide that it had examined was cost effective.[180] In 2007, the Southern Company forecast that energy consumption on the Georgia Power system would increase by 30 percent over the next 15 years.[181]

The Southeast Energy Efficiency Alliance notes that per-capita energy usage in the Southeast is much higher than the national average, and the area has among the lowest levels in the nation for Energy Star® market penetration. Energy-efficiency spending per capita is just one-fifth of the national average.[182] In 2007, Georgia spent only 50 cents per person on ratepayer-funded energy efficiency programs.[183]

A study of Georgia Power's service territory concluded that the utility had the economic potential to cut electricity consumption by one-quarter by the year 2018.[184] Across the entire state of Georgia, the Southface Energy Institute calculates that residential energy efficiency could yield 15 million MWh in electricity savings per year – nearly equivalent to the output of an expanded Vogtle, but available at about one-third the cost.[185] Adding in efforts in the commercial and industrial sectors would greatly increase potential savings. For every 1 percent the state reduces its electricity consumption, homeowners and businesses would collectively save more than $75 million per year.[186]

investment required to build two new reactors at Vogtle were instead directed into energy efficiency, Georgia Power could reduce electricity consumption in its service territory on the order of 2 percent a year for the next 16 years (based on a study for Georgia Power of energy efficiency potential achievable with aggressive incentives on the order of $850 million a year).[187]

In addition to putting put tens of thousands of people to work manufacturing and installing energy-efficient equipment, this investment in energy efficiency would *save* Georgians close to $13 billion (net) on their energy bills at current electricity prices – since energy efficiency measures are cheaper than even running an existing power plant.[188] These savings would create on the order of 2,800 jobs in the Georgia economy – an increase in employment on the order of 8,000 to 12,000 jobs more than the job losses that would be caused by the higher electricity prices driven by building new reactors at Vogtle.[189]

Clean Energy Can Reduce Global Warming Pollution Now

Clean energy solutions have a significant advantage over nuclear reactors when it comes to reducing global warming pollution. Individual clean energy measures are small – as simple as installing a new light bulb in a home or erecting a single wind turbine. Small means fast. Millions of individual workers could participate in a clean energy transition at the same time. And many individual clean energy measures can add up to a rapid, large-scale cut in emissions.

Energy efficiency programs are already reducing electricity consumption by 1-2 percent below forecast levels annually in leading states.[190] Reducing electricity consumption by 1.2 percent per year across America as a whole, starting in 2010, could deliver the same amount of energy as building more than 30 nuclear reactors by 2016 – the earliest possible date the U.S. could have even three new reactors up and running.[191]

The U.S. wind industry is already building the equivalent of three nuclear reactors per year in wind farms, and growing rapidly.[192] Wind energy experts predict that wind will become the dominant source of new electric generating capacity through 2012, with 36,000 to 40,000 MW installed (the energy equivalent of 10-12 new nuclear reactors).[193]

Clean Energy Increases the Reliability of Electricity Service

Small-scale clean energy solutions can actually enhance the reliability of electricity service. Many clean power sources – including energy efficiency improvements, combined heat-and-power technologies and renewable energy sources such as biomass, geothermal energy and solar thermal power with heat storage – are available at any time, just like nuclear power.[194] Others, including wind and solar photovoltaic power, are predictable with about 80-90 percent accuracy a day in advance.[195] With proper planning and investments in a "smart grid" to facilitate wise use of resources, clean energy solutions could supply the vast bulk of America's electricity needs.[196]

Policy Recommendations

Offering loan guarantees to Georgia Power and its partners to build two new reactors at Vogtle – or to support the financing of other nuclear reactors – is poor public policy. While the nuclear industry misleadingly portrays itself as a driver of America's economy, a tool to reduce our dependence on fossil fuels, and a key to solving the challenge of global warming, the fact is that nuclear technology is uneconomic, slow, and not necessary. America has better alternatives, immediately available, to solve our energy problems. To the extent the nation is distracted with complicated and time-consuming efforts to invest in new nuclear reactors, that money and effort will not be available for better solutions.

As a matter of public policy, America should focus on improving energy efficiency and generating electricity from clean sources that never run out – such as wind, solar, biomass and geothermal power. These clean energy solutions can deliver more emission reductions for our money – faster – than nuclear power. Integrated in a "smart grid," clean energy resources can ensure a reliable, safe, secure and affordable supply of electricity, while rapidly and substantially cutting global warming pollution.

Accordingly, state and federal leaders should:

Refrain from directing new subsidies to the nuclear industry.

- Nuclear power is already the most heavily supported form of electric power in America. From 1950 to 1999, the federal government subsidized nuclear power to the tune of $145 billion.[197] However, the nuclear industry has asked for more than $120 billion in loan guarantees for proposed new reactors, far

in excess of the $18.5 billion that Congress has thus far appropriated, and far beyond the additional $9 billion that Congress is considering in the supplemental appropriations bill as of May 2010.[198] Physicians for Social Responsibility calculates that 34 reactors would require between $170 billion and $320 billion in loan guarantees.[199] In addition to expanded loan guarantees, the nuclear industry wish list includes a variety of tax incentives and regulatory rollbacks designed to keep the public and industry regulators in the dark about potential problems at new reactors.[200]

- The federal government should not further subsidize new nuclear reactors. Any subsidies for low-carbon energy alternatives must be judged based on their relative short-term and long-term costs and environmental advantages.[201]
- In the event that a loan guarantee for two reactors at Vogtle or other proposed new nuclear reactors goes forward, the Office of Management and Budget should set the charge for the subsidy cost of the loan at a level high enough to protect taxpayers – and not an artificially low rate as a gift to nuclear developers.

Shift the nation's strategy for dealing with global warming away from propping up risky technologies like nuclear power, and instead establish a cap on emissions, guided by the latest scientific understanding.

- Instead of issuing loan guarantees to the nuclear industry, the United States should establish a policy to cap economy-wide emissions of global warming pollution at a level sufficient to prevent the worst impacts of global warming.

Photo: Eric Delmar

- The latest science indicates that cumulative world emissions of carbon dioxide, or equivalent, must not exceed 1 trillion metric tons from 2000 to 2050. At this level, the world has a 75 percent chance of limiting global warming to 3.6° F above the pre-industrial era – a target the international community has set to limit the severity of global warming impacts.[202]
- To do its part, the United States should commit to reducing emissions by at least 35 percent below 2005 levels by 2020. The nation should then aim to reduce emissions by 80 percent or more by 2050.

Focus on energy supply technologies that are cleaner, cheaper and deliver results faster than nuclear power.

- States with renewable electricity standards (RES) are leading the nation in taking advantage of America's ample clean energy potential.[203] The United States should set a national renewable electricity standard that requires that at least 25 percent of America's electricity come from new renewable energy

Photo: LL28 Photography

sources by 2025. Achieving that target would put the nation well on its way to dramatic cuts in emissions of global warming pollution. Individual states should be empowered to go further.

Reduce the need for nuclear power and other risky energy sources by requiring America to develop its massive potential for energy efficiency.

- America has vast potential to use energy more efficiently. To take advantage of that potential, the nation should adopt an energy efficiency resource standard (EERS) similar to those adopted by leading states across the country. Such a standard would set a concrete goal for improved energy efficiency and unleash the resources needed to achieve that goal. A federal EERS should seek to reduce electricity demand by 15 percent by 2020 and natural gas demand by 10 percent, with more ambitious goals in later years.
- America should ensure that all buildings and appliances use energy efficiently. New codes should aim to reduce energy consumption in new buildings by 50 percent by 2020 and ensure that all new buildings use zero net energy by 2030. Individual states should go further.
- Combining energy efficiency and renewable energy with a national effort to limit emissions of global warming pollution enhances the benefit of these policies to America's economy. For example, the Union of Concerned Scientists has found that combining an EERS and RES with a cap on global warming pollution would deliver $1.6 trillion in consumer savings through 2030 compared to continuing on our current path.[204]

Methodology

To calculate the job impacts of spending on nuclear power and energy efficiency, we used the American Council for an Energy Efficient Economy's (ACEEE) stimulus jobs calculator, which utilizes data from the proprietary IMPLAN economic database.[205] The calculator estimates jobs directly created by spending, jobs created or eliminated due to changes in utility revenue, and jobs created or eliminated by changes in energy prices in the rest of the economy.

For the Vogtle reactors, Southern Company has already stated that operating the reactors will create 800 jobs; the relevant figure, then, is the impact of energy prices on the rest of Georgia's economy. At 10 cents to 13 cents per kWh, delivered (and including the benefit of the loan guarantee), power generated by a 2,200 MW reactor operating at 90 percent capacity (17,344 GWh every year) would cost ratepayers $170 to $690 million per year more than if the cost of electricity matched the state average of 8.8 cents per kWh.

According to the ACEEE jobs calculator, an energy cost increase on this level would result in the loss of 5,000 to 9,000 jobs after 5-10 years.

For the efficiency alternative (see page 30), long-term job projections were also calculated using the ACEEE calculator. Depending on what assumptions are made regarding financing, the number of jobs created varies; our calculation assumes 50 percent direct local expenditure and 50 percent local financing. In addition to jobs created by spending utility bill savings in other parts of the economy, the ACEEE model incorporates the impacts of declining utility revenues leading to lower employment in the utility industry.

The calculator is set up to evaluate spending changes across the U.S. economy as a whole – so to the extent that the impact of energy spending in Georgia affects spending in other parts of the nation, some of the reported job losses or gains might not be in Georgia.

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159. Doug Hurley et al., Synapse Energy Economics for Northeast Energy Efficiency Council, *Costs and Benefits of Electric Utility Energy Efficiency in Massachusetts*, August 2008.

160. National Academy of Sciences, *Real Prospects for Energy Efficiency in the United States*, The National Academies Press, Washington D.C., 2009. Karen Ehrhardt-Martinez and

John A. "Skip" Laitner, American Council for an Energy-Efficient Economy, *The Size of the U.S. Energy Efficiency Market: Generating a More Complete Picture*, Report Number E083, May 2008; See also: Steven Nadel, Anna Shipley, and R. Neal Elliot, American Council for an Energy-Efficient Economy, *The Technical, Economic, and Achievable Potential for Energy Efficiency in the U.S.–A Meta-Analysis of Recent Studies*, From the Proceedings of the 2004 ACEEE Summer Study on Energy Efficiency in Buildings, 2004.

161. 1.2 trillion: calculated based on the reference forecast in: U.S. Department of Energy, Energy Information Administration, *An Updated Annual Energy Outlook 2009 Reference Case Reflecting Provisions of the American Recovery and Reinvestment Act and Recent Changes in the Economic Outlook*, Table 8, SR/OIAF/2009-03, April 2009; 150 reactors: compared to nuclear output on an energy-equivalent basis, using assumptions about reactor size and performance as follows: The average nuclear reactor has a capacity of 1 GW and has an annual capacity factor of 90 percent (per Catherine Morris et al., The Keystone Center, *Nuclear Power Joint Fact-Finding*, June 2007; available at www.keystone.org.)

162. For example, see: Maggie Eldridge et al., American Council for an Energy-Efficient Economy, *Energy Efficiency: The First Fuel for a Clean Energy Future*, Report E082, February 2008; Amory Lovins, Rocky Mountain Institute, *Nuclear Power: Economics and Climate-Protection Potential*, RMI Publication Number E05-14, 6 January 2006; and note 153, "The Nuclear Illusion."

163. See note 153, "The Nuclear Illusion."

164. Wind: U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, *20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply*, DOE/GO-102008-2567, July 2008; Sun: Bernadette del Chiaro, Tony Dutzik and Sarah Payne, Environment America Research & Policy Center, *On the Rise: Solar Thermal Power and the Fight Against Global Warming*, Spring 2008. Geothermal: Jefferson W. Tester et al., Massachusetts Institute of Technology for the U.S. Department of Energy, *The Future of Geothermal Energy: Impact of Enhanced Geothermal Systems (EGS) on the United States in the 21st Century*, 2006.

165. See note 6.

166. With an average levelized cost of 8.6 cents per kWh (2006 dollars). See note 164, *20% Wind Energy by 2030*.

167. Compared to nuclear output on an energy-equivalent basis, assuming a reactor size of 1 GW and an annual capacity factor of 90 percent (per Catherine Morris et al., The Keystone Center, *Nuclear Power Joint Fact-Finding*, June 2007; available at www.keystone.org.).

168. See note 164, *20% Wind Energy by 2030*, 163.

169. The Union of Concerned Scientists (UCS) estimates that a national renewable electricity standard of 25 percent by 2025 would reduce electricity prices by more than 4 percent annually, and natural gas prices by more than 2 percent annually, saving consumers more than $95 billion: Union of Concerned Scientists, *Clean Power, Green Jobs: A National Renewable Electricity Standard Will Boost the Economy and Protect the Environment*, March 2009; and similarly, experts at the American Council for an Energy-Efficient Economy estimate that a national energy efficiency resource standard would save Americans close to $170 billion on their energy bills by 2020: Laura Furrey, Steven Nadel and John "Skip" Laitner, *American Council for an Energy-Efficient Economy, Laying the Foundation for Implementing A Federal Energy Efficiency Resource Standard*, March 2009.

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172. U.S. Department of Energy, Energy Information Administration, *Monthly Energy Review*, *Table 12.1 Carbon Dioxide Emissions From Energy Consumption by Source*, April 2010.

173. The estimates are partially specific to western states, and include the effects of some tax and incentive policies now authorized through that year (but not the renewable energy production tax credit, which is currently set to expire by 2013). These factors aside, the research gives a general idea of how generation technologies compare. Sources: End Use Efficiency, based on estimates by the American Council for an Energy Efficient Economy of 4.6 cents per kWh total resource cost, inflated to 2018 dollars assuming a 3 percent per year inflation rate, and with a 25 percent plus or minus uncertainty factor applied, per note 160, Katherine Friedrich et al., American Council for an Energy-Efficient Economy. Combined heat and power (CHP), derived from estimates for recovered heat industrial CHP, combined cycle industrial CHP, and building-scale CHP by the Rocky Mountain Institute, with a 3 percent per year inflator applied to approximate 2018 cost, per note 153, "The Nuclear Illusion." Biomass co-firing cost estimates from the investment firm Lazard, with a 3 percent per year inflator applied to approximate 2018 cost, per (Lazard, *Levelized Cost of Energy Analysis 2.0*, Presentation at NARUC, June 2008). All other values: levelized cost estimates for an in-service date of 2018, using merchant financing, per note 171, *Comparative Costs of California Central Station Electricity Generation Technologies*.

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182. Southeast Energy Efficiency Alliance, *Energy Efficiency – Why Energy Efficiency in the Southeast?*, downloaded from www.seealliance.org/energy/energySE.php on 25 March 2010.

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186. See note 183.

187. See note 184.

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194. See note 160, for example.

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