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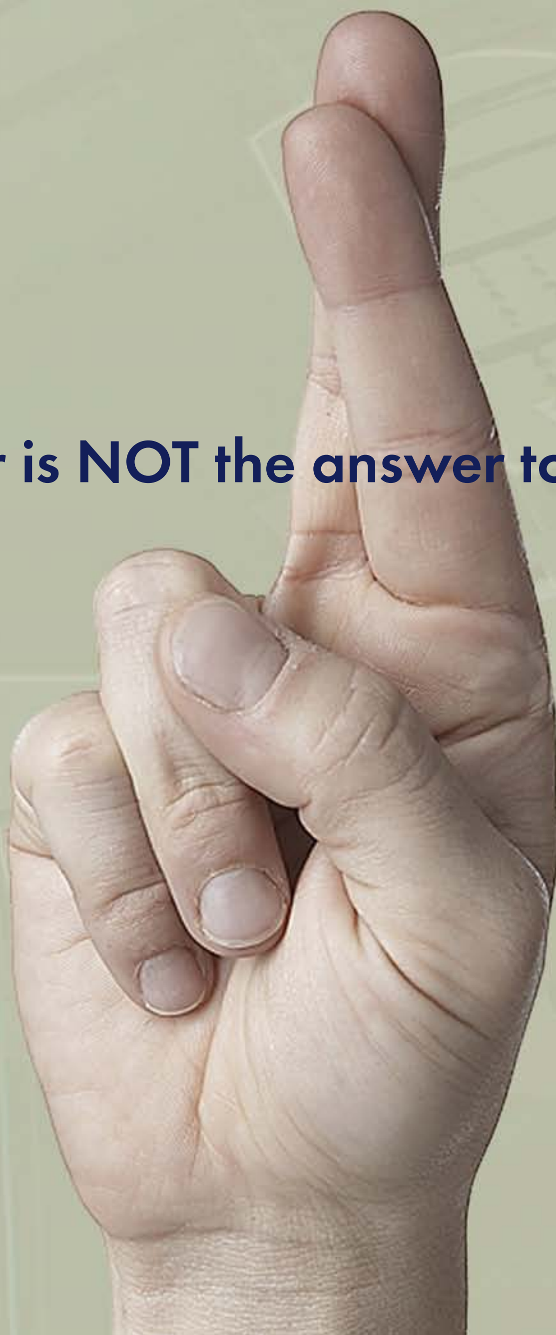
October 2006

FALSE PROMISES:
Debunking Nuclear Industry Propaganda

Nuclear power is NOT the answer to climate change



GRACE
energy initiative

FALSE PROMISES:

DEBUNKING NUCLEAR INDUSTRY PROPAGANDA

NUCLEAR POWER IS NOT THE ANSWER TO CLIMATE CHANGE

GRACE Energy Initiative
October 2006

FORWARD by Robert Alvarez
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FOREWORD BY ROBERT ALVAREZ

Senior Policy Advisor to the U.S. Secretary of Energy 1993-1999

President George W. Bush, a former oil industry executive from Texas, has declared "America is addicted to oil." This bold statement is undeniable: With about 5.5 percent of the world's population, the United States consumes more oil than any nation -- about 20.6 million barrels per day, or a quarter of the world's total production.

"To keep our economy growing," Bush said, "we also need reliable supplies of affordable, environmentally responsible energy... including safe, clean nuclear energy."
Unfortunately, nuclear energy isn't safe or clean and it's too costly for the nation.
Bush's nuclear medicine prescription means addicting the country to, perhaps, an even more expensive and dangerous alternative. Unlike oil, this vice is not based on the thrill of driving gas-guzzling sport-utility vehicles, but rather on unfettered access to the U.S. Treasury. Since the first commercial nuclear power reactor went on-line in 1959, this form of making electricity has depended on regular infusions of taxpayer subsidies. Even today, nearly three decades after the last new U.S. reactor was ordered, subsidies remain necessary for the industry's survival.

Since 1948, about $80 billion was spent by the U.S. government on nuclear energy research and development. Spending for this year by the U.S. Energy Department will be in excess of $800 million - nearly twice the money the government is investing in truly clean, renewable energy sources like conservation, solar and wind power.

This is on top of the enormous "balloon mortgage" payments of tens of billions of dollars to clean up the environmental mess at dozens of Energy Department and other nuclear sites across the country, which developed nuclear power with test reactors as well as uranium mining and processing sites.

As for cost, in some instances the price tag for nuclear reactors has run 10 times higher than originally promised. Despite the recent spate of congressional subsidies, Wall Street is still maintaining its almost 30-year moratorium on the financing of new nuclear power plants. At nuclear reactors, smart investors know, unlike at coal or gas plants, all it takes is a "minor" mistake, like a poorly welded pipe, to cause a multibillion-dollar loss.

In terms of safety, numerous "near-misses" at reactors do not inspire much confidence. In 2002, workers inadvertently discovered that boric acid ate through 6 inches of the solid steel reactor top at the Davis Bessie plant in Ohio. The problem went unattended for years -- leaving a fraction of an inch to prevent the superheated reactor core from a potential meltdown.

Unfortunately, the prospect of solving the nuclear waste problem is getting dimmer. Recognizing that nuclear power spent fuel is among of the most dangerous material on the planet, Congress enacted legislation in 1982 requiring it be disposed so as to protect humans for at least hundreds of millennia. Twenty-four years later, the government's nuclear waste disposal program is plagued by scandal, legal setbacks and congressional funding cuts. As a result, the schedule for the proposed Yucca Mountain disposal site in Nevada has slipped for at least a decade or two. By the time the Yucca Mountain site can take the existing wastes, the Energy department estimates nuclear power plants will have accumulated about the same amount we have today. Right now, the waste continues to sit in densely compacted polls which the National Academy of Sciences warned are vulnerable to terrorism and might lead to a catastrophic radiological fire.

Finally, in terms of proliferation, as beneficiaries of the "Atoms for Peace" program, Iran appears poised to make uranium for nuclear weapons, and North Korea now has them. Undeterred, we have plans to make the problem even worse by reprocessing this waste and allowing weapons-usable plutonium to enter into global commerce. The United States wisely decided against doing this in 1975, because, it would lead, as stated succinctly by Albert Wohlstetter (a mentor of the Bush national security team) to "live in a nuclear-armed crowd." Therefore, it appears that the proposed cure for our dangerous dependence on foreign oil may prove worse than the disease.

Robert Alvarez, served as Senior Policy Advisor to the U.S. Secretary of Energy from 1993 to 1999 and is currently a Senior Scholar at the Institute for Policy Studies in Washington D.C.

EXECUTIVE SUMMARY

The urgent need to curb greenhouse gas (GHG) emissions to avoid severe climate consequences has provided the nuclear industry with an ostensible opportunity to stage a comeback. Through an aggressive public relations campaign the nuclear industry is attempting to portray nuclear power as safe, clean and necessary.

Regardless of the millions spent to win the hearts and minds of the American public, perceptions cannot undo long-standing realities. Nuclear power is an expensive, high-risk technology that poses unprecedented dangers.

Now as before, nuclear power remains a bad option and one that would divert precious resources from available solutions that are cheaper and can be deployed faster. This report debunks the misleading claims being made about nuclear power and shows why it is not part of the solution to our energy crisis. For instance:

- Nuclear power is not the solution to climate change
- Nuclear power is vulnerable to severe climate conditions, which prevent reliable operation
- Nuclear power is not the alternative to coal
- Nuclear power is not clean
- Nuclear power is not safe
- Nuclear facilities pose serious terrorism risks
- Nuclear power is expensive
- Nuclear waste is a unsolved problem
- Nuclear power fosters weapons proliferation
- Nuclear power is not the solution to energy independence
- Nuclear power has negative health effects
- Nuclear power is not supported by the public at large

INTRODUCTION

For the last 20 years, forecasts of an imminent revival of nuclear power plant orders have rivaled - in frequency[1] and in accuracy – to forecasts of the second coming of the Messiah.[2] According to the Nuclear Energy Institute, the lobbying group for nuclear power interests, “we really do believe ... it's going to be a renaissance of nuclear power."[3] In fact, the Nuclear Regulatory Commission has recently proclaimed that there are 27 potential new reactors under various stages of consideration.[4]

However, not a single new nuclear power plant has actually been ordered and the last plants to come on-line had costs several times higher than the original estimates. In fact, the Shoreham nuclear plant in New York State was originally estimated at $350 million and ultimately cost roughly 15 times higher when it was completed ($5.4 billion).

So why this renewed push for nuclear power?

According to one prominent nuclear spokesman, “nuclear energy may just be the energy source that can save our planet from another possible disaster: catastrophic climate change.”[5] Even a cursory analysis of the industry advertising, statements and promotional materials make it apparent that the nuclear industry appears to rest its “revival” almost entirely on the proposition that nuclear power is essential to combating climate change. Instead of head-to-head economic competition, nuclear proponents are seeking to persuade us that their technology is the best option for averting climate change. To date, this strategy has had some success in Washington, with the Energy Policy Act of 2005 providing large subsidies for the construction of a limited number of new nuclear units.

It is indisputable that the world needs dramatic changes to our energy production and consumption framework. However, the focus should be on clean, fast, safe and renewable solutions, and the proliferation and security risks alone should disqualify nuclear power from consideration. Most importantly, the cost of nuclear power per unit of carbon emissions reduced would actually impair our ability to abate climate change and public money should be buying more carbon-free energy per dollar spent. Wind power and other renewable energy technologies, coupled with energy efficiency, conservation and cogeneration are much more cost effective and can be deployed much faster.

A Dialogue Clouded with Misinformation and Misrepresentation:

The public discourse surrounding nuclear power has been misinformed and in-accurate, for which advocates on both sides bear some responsibility. However, current arguments advanced by nuclear proponents are largely going unchallenged in the mainstream media and purported experts are advancing dubious arguments that are irresponsible at best.

In fact, the nuclear industry has sought to position one former environmental activist as representative of broad support for nuclear energy within the environmental movement.[6] However, this could not be further from the truth, and in response to these misrepresentations 313 national and regional environmental organizations have signed onto a position statement that strongly opposes nuclear energy.[7] More recently, on October 6, 2006, more than 150 businesses, environmental organizations and other groups released the "Sustainable Energy Blueprint," a series of policy recommendations for reducing GHGs while phasing out nuclear power.[8]

Thus, the ongoing public discussion of nuclear power desperately needs more balance and the goal of this report is to provide history, context and a critical analysis of these arguments.

BRIEF HISTORY OF NUCLEAR POWER AND FALSE PROMISES

The origins of nuclear power stem from the development of the first nuclear weapons and the subsequent nuclear arms race between the United States and the Soviet Union. In December 1953, President Eisenhower announced the creation of the "Atoms for Peace" program before the United Nations. According to the Bulletin of Atomic Scientists, it "was supposed to distract other countries from pursuing nuclear weapons by sharing peaceful nuclear technology with them…..Today, there are about 35 countries operating or building nuclear power plants worldwide. Eight have nuclear arsenals. At least two additional nations (North Korea and Iran) are believed to be pursuing nuclear weapons."[9]

In the initial aftermath of the Atoms for Peace announcement and through the `1970's, the United States government and corporations benefiting from federal largesse launched a widespread national public relations campaign. The Walt Disney company published a children's book, "Uranium and other Miracle Metals, " in which nuclear-powered cars, planes, and space shuttles would transport Americans on the highways, in the air and outer space. Nuclear home furnaces would not only heat houses, but also melt the snow on sidewalks. Nuclear desalination plants would create vast supplies of fresh water; while nuclear explosions would excavate canals rivaling that in Panama, create harbors and create underground storage reservoirs for oil and natural gas. A nuclear-powered dirigible would fly from city to city. Artificial hearts would tick thanks to plutonium.

None of these came to pass. But, the legacy of these efforts remain at numerous federal sites around the country in the form of large contaminated areas and structures. The legacy of this nuclear heyday is contaminated workers, nuclear accidents, large releases of radioactivity into the open air, all which are costing the taxpayers tens of billions of dollars to clean up.

In the early 1970s, when the U.S. had a dozen nuclear power plants, the Atomic Energy Commission forecast that the American landscape would be dotted with 1000 reactors by the year 2000, which would have required a reactor construction permit and operating license to be issued once a week for 30 years.[10] In 1972, the U.S. Atomic Energy Commission (AEC) also projected that the world would run out of uranium to fuel nuclear power plants. To address this problem the AEC declared that the United States would need a new generation of reactors that would use plutonium as fuel made in existing reactors. At that time it was widely believed that the disposal of high level nuclear waste, as put by an AEC chair of that era to be "the biggest contemporary non-problem"[11] would be under way no later than 1985.

Since then, the U.S. has 103 nuclear plants in operation. The world supply of uranium remains abundant. There are no breeder reactors, no reprocessing plants and no permanent solution for high-level nuclear wastes. However, over the past 50 years, nuclear energy subsidies have totaled close to $145 billion in the United States while government subsidies for wind and solar energy for the same period totaled only $5.49 billion.[12] In Fiscal Year 2006, nuclear power commanded $800 million -- nearly half of all research and develop subsidies in the U.S. Department of Energy.

WHAT IS THE INDUSTRY CLAIMING AND WHY IS IT MISLEADING

Industry Claim # 1:

Nuclear Power is Necessary to Combat Climate Change

There is now international consensus within the scientific community that the world is getting warmer and that most of the warming is due to human activities, primarily associated with the combustion of fossil fuels.[13] Thus, there is scant debate that climate change is one of the most pressing threats of our time, and it is imperative that we take swift and decisive action to avert its most severe impacts. However, the attempt by the nuclear industry to anoint nuclear power as the solution to climate change is dangerous and threatens to squander the resources necessary to implement meaningful climate change mitigation policies.

According to a former U.S. Nuclear Regulatory Commissioner, "nuclear power's asserted comeback rests not on a newfound competitiveness in power plant construction, but on an old formula: subsidy, tax breaks, licensing shortcuts, guaranteed purchases with risks borne by customers, political muscle, ballyhoo and pointing to other countries (once the Soviet Union, now China) to indicate that the U.S. is "falling behind." Climate change has replaced oil dependence as the bogeyman from which only nuclear power can save us."[14]

The pro-nuclear rhetoric has been coming from all levels, including U.S. Vice President Dick Cheney who has publicly stated as fact that nuclear power is carbon-free.[15] A leading industry group has even asserted that nuclear energy can produce electricity "*without polluting the environment*."[16] However, these claims are misleading because nuclear power is neither pollution nor emission free.

Deployment Time:

Nuclear power is the slowest and costliest way to reduce CO_2 emissions when compared to efficiency, distributed generation and some renewable sources.

Currently, around 440 nuclear power stations provide approximately 5% of the global primary energy mix. Even if the number of reactors was doubled, nuclear energy's contribution to the primary energy mix would not have a large enough impact to warrant the associated expense.

A recent study by the Massachusetts Institute of Technology on the future of nuclear power determined that approximately 1500 new nuclear reactors would have to be constructed worldwide by mid-century for nuclear power to have even a modest impact on the reduction of GHG's.[17] A similar study concluded that a GHG emission reduction of 20% could be accomplished by 2100 if all projected coal power were displaced by 4900 GW of nuclear energy.[18] Likewise, the Institute for Energy and Environmental Research estimates that it would be necessary to build some 2,000 nuclear power plants of 1,000 MW each in the next few decades for nuclear power to make a substantial reduction in CO_2 emissions.[19]

THE FUNDAMENTAL FLAW IN THE ARGUMENT THAT NUCLEAR POWER CAN MITIGATE GLOBAL CLIMATE CHANGE IS THAT THE TECHNOLOGY SIMPLY TAKES TOO LONG TO DEPLOY

In the U.K., the government's advisory panel, the Sustainable Development Commission, found that if the country's existing nuclear capacity were doubled, it would only yield an 8% cut in CO2 emissions by 2035, and none before 2010. Indeed, the Commission concluded that the risks associated with nuclear power greatly outweigh its minimal contribution to reducing CO_2 emissions.[20]

Therefore, the expert analyses all agree that nuclear power would require an infeasible schedule, as new reactors would have to come online every few weeks for the next fifty years to have even a modest impact on GHG emissions - new nuclear reactors cannot be built fast enough to address climate change. Thus, the fundamental flaw in the argument that nuclear power can mitigate global climate change is that the technology simply takes too long to deploy. Moreover, in an age of terrorism, the large number of reactors necessary for nuclear power to meaningfully address climate change would only exacerbate proliferation risks and the perils of a nuclear accident or attack.

Opportunity Costs:

Financing nuclear power would divert scarce resources from investments in faster, more easily deployed solutions.

According to NASA's Head Climate Scientist, we have no time to waste in mitigating global climate change and "business as usual" will result in a dramatically different planet.[21] Therefore, aggressively tackling this issue will require the fastest, cheapest and safest solutions, and nuclear power is none of these. The vast amount of money needed to build the number of reactors necessary to meaningfully address global emissions would divert government subsidies and private investment from more effective solutions.

EACH DOLLAR INVESTED IN ELECTRIC EFFICIENCY IN THE U.S. DISPLACES NEARLY SEVEN TIMES AS MUCH CARBON DIOXIDE AS A DOLLAR INVESTED IN NUCLEAR POWER

Analysis by the Rocky Mountain Institute has shown that the enormous costs of nuclear power per unit of carbon emissions reduced would worsen our ability to mitigate climate change, as such an amount would be buying less carbon-free energy per dollar spent on nuclear power compared to the emissions we would save by investing those dollars in solar, wind or energy efficiency.[22] In fact, each dollar invested in electric efficiency in the U.S. displaces nearly seven times as much carbon dioxide as a dollar invested in nuclear power, and nuclear power saves as little as half as much carbon per dollar as wind power and cogeneration.[23]

Limited role in reducing GHGs emissions:

Transportation is responsible for a large part of global emissions, for which nuclear power cannot act as an offset.

The nuclear industry claims that nuclear power is the only energy source that can effectively replace fossil fuels. But, building new nuclear facilities does nothing to address the transportation sector, which is responsible for a large part of GHG emissions. For example, electricity generation in the U.S. is responsible for only 40% of the country's total CO_2 emissions.[24] Likewise, transportation is the primary sector responsible for global oil consumption (corresponding to more than half of the oil consumed worldwide everyday), comprising a full 40% of global CO2 emissions. As oil accounts for only 7% of worldwide electricity generation, the transportation sector is a major source of GHGs and would not be affected by any changes in nuclear power generating capacity.[25]

Nuclear power is not emissions free:

The fuel cycle of nuclear power generation is fossil fuel intensive and produces large amounts of GHG emissions.

While atomic reactions do not emit CO_2 or other GHGs, the full fuel cycle of nuclear power generation is fossil fuel intensive and emits large amounts of these gases. The mining, milling, processing and transportation of uranium fuel for reactors are all carbon-intensive industries and must be included in fuel-cycle accounting. In fact, the total emissions of the nuclear fuel cycle are not typically assessed when it is compared with other energy alternatives, leading to this common misconception.

Indeed, a complete life-cycle analysis shows that generating electricity from nuclear power emits as much as 20-40% of the carbon dioxide per kilowatt hour (kWh) of a gas-fired system when the whole system is taken into account.[26] These estimates only hold true when high grade uranium ores are available. As uranium resources become increasingly scarce, recovery of uranium from lower grade ores would result in greater emissions. It has been shown that a nuclear life-cycle starting with low quality ores (less than 0.02% of U3O8 per ton of ore) produces equal amounts of CO_2 as are produced by an equivalent gas-fired power station.[27] Therefore, if nuclear electricity generation if further deployed, the likely consequence will be that lower grade ores will be required which will result in increased CO_2 emissions.

An analysis by the Oko Institute in Germany, based on the database of the GEMIS (Global Emission Model for Integrated Systems) indicates that a standard size nuclear power plant (1250 MW) will emit some 1.3 million tons of CO_2 per year. This emission level makes nuclear power a more polluting alternative, when compared to electricity saving, cogeneration or renewable energies.[28] Other studies have calculated the amount of emissions from the nuclear cycle to be in the range of 30-60 grams of CO2 equivalent per kWh.[29]

Moreover, uranium enrichment is a highly polluting process and data provided by the Department of Energy (DOE) shows that in 2001 the U.S. enrichment plants alone produced 405.5 metric tons of CFC-114, the equivalent of 5 grams of CO_2 per kWh.[30] (CFCs are not only a potent GHG, but also a potent destroyer of the ozone layer.) The only operating enrichment facility in the U.S., the Paducah enrichment facility in Kentucky, for example, consumes the power output of two 1,000 megawatt coal plants, contributing heavily to the emission of carbon dioxide and other pollutants.[31] Although Paducah is an old and inefficient plant, new alternatives have yet to prove themselves and could still be years away.

Global Warming is already affecting nuclear power plants:

Heat waves, severe storms and droughts expose the vulnerabilities of nuclear power.

Nuclear power stations are particularly affected to level changes in lakes and rivers due to drought, flooding or extreme heat waves because they are dependent on surface water for reactor cooling systems. Heat waves during the summer of 2006 in the U.S. and Europe forced utilities to shut down some reactors and reduce output at others. In France, extreme heat and resultant plant shutdowns lead the country to import some 2000 megawatts of power per day from neighboring states to compensate for shortages in production. Additionally, several European countries were forced to override their own environmental standards for maximum temperature of water drained from the plants' cooling systems, creating a situation with harmful consequences for marine flora and fauna.[32]

In the U.S., nuclear operators were forced to reduced power output at several reactors due to high water temperatures including Xcel Energy Prairie Island 1 and 2, and Monticello units in Minnesota, Exelon's Dresden 2 unit in Illinois, and Exelon’s plant in Quad Cities, Illinois.[33] As atmospheric and surface water temperatures continue to increase with extremes becoming more frequent, these fluctuations in power output from reactors will be of increasing importance in the electricity generation mix.

Industry Claim # 2:

Unlike some other energy sources, nuclear energy is a base load provider and it is not subject to unreliable weather or climate conditions

Electricity is largely provided by central plants that deliver power into a transmission grid that is comprised of a patchwork network controlled by regional entities. It is a system that is increasingly strained. Large base load power additions increase this strain, where energy efficiency and some forms of distributed generation diminish it. Furthermore, nuclear power plants have a unique set of reliability issues tied to climate variations and maintenance imperatives.

Our present system is extremely inefficient, and by the time electricity reaches the customer nearly two-thirds of the energy has been wasted through generation and transmission.[34] Moreover, analysis of the effects of power outages found that the U.S. economy is estimated to be losing between $104 and $164 billion annually because of power outages.[35] Another $15 to $24 billion is lost because of power quality related losses (voltage sags, surges, etc.).[36]

Therefore, the wisdom of a large centralized system should be questioned and in the near term, a combination of DG and central station generation would be a more prudent solution that could save transmission costs and grid strain. However, putting aside the debate about the wisdom of the "central generation paradigm," nuclear power is often cited as the only technology that can provide large amounts of base load power that is carbon free. This argument is based on a common misconception that renewable energy sources are unreliable due to uneven geographical distribution, weather variations, or changes in the season, also known as variability and intermittency.

ACCORDING TO THE INTERNATIONAL ENERGY AGENCY INTERMITTENCY
IS NOT A TECHNICAL BARRIER TO RENEWABLE ENERGY

However, there are a number of strategies that can compensate for days when the sun doesn't shine or the wind doesn't blow. A recent International Energy Agency (IEA) report concluded that intermittency is not a technical barrier to renewable energy.[37] One way to minimize intermittency is to integrate, or "mix," sustainable energy sources by both type and location so that they are mutually supportive. The IEA report noted that interconnection of renewable energy sources over a wide area was an important way of dealing with intermittency issues.[38] Wind farms, for example, can provide steadier and more reliable power when they are networked in areas with high average wind speeds.[39] In addition to centralized electricity generation, solar photovoltaics (PVs) can also produce electricity on-site, making it "harder to disrupt, more stable, and less brittle than full reliance on centrally generated power."[40] Furthermore, geothermal energy is unaffected by weather patterns and tidal patterns can be predicted centuries into the future.

Nuclear power reliability issues

Nuclear power is debilitated by a host of unique and potentially costly and dangerous variability issues. All nuclear power reactors in the U.S. depend on on-site and off-site power to run backup safety systems in the case of an emergency. These power systems are vulnerable to climate conditions such as flooding, hurricanes, tornados and severe storms.

In the aftermath of hurricane Katrina, the Waterford reactor, located outside New Orleans, was forced to operate on diesel generators for four days because of instability in the off-site electrical grid.[41] Similarly, the Cooper nuclear power station in Nebraska was forced to shut down one of its reactors in the 1993 flood, when rising waters collapsed the dikes and levees around the site.[42] The Davis-Besse nuclear plant in Ohio was hit by a tornado in 1998, which caused the loss of off-site power used for the cooling system for the irradiated fuel storage pool.[43] Therefore, nuclear power is in fact seriously affected by climate conditions, and this vulnerability is exacerbated by the increasing effects of global warming, heightening the inherent safety risks of nuclear reactors.

The shortcomings of nuclear power reliability were also evident this summer when, in Sweden, backup generators malfunctioned during a power outage, forcing a shutdown of one the reactors at Forsmark. In this incident, two of the facility's four backup generators malfunctioned when the plant experienced a major power outage in July 2006. Plant workers reported to Swedish media that it had come close to a meltdown. Following the incident, Swedish officials shut down half of Sweden's ten nuclear power plants, triggering record price increases.[44]

The nuclear industry is currently planning to increase power output at some plants by up to 20%, a move which would run already brittle plants over capacity to increase profits. While the industry claims that there are no sacrifices in safety provisions associated with power up-rates, an 18 % increase at the Quad Cities plant in Illinois resulted in serious structural damage and radiation leaks.[45] Therefore, the reliability of the existing reactors operating under license extensions well beyond their intended life-spans is far from certain.

The frequency and duration of shutdowns for maintenance increase during the start-up and wear-down phases in nuclear plant lifecycle. Elevated risk of component failure and unforeseeable accident during the start-up phase of reactors are attributable to limited experience with new designs, manufacturing defects and economic disincentives to fully test equipment before commencing operations.[46] Therefore, the prospect of bolstering reliability of electricity supply through new nuclear facilities is not realistic.

Industry Claim # 3:

Only Nuclear Power Is A Practical and Proven Alternative to Coal

The argument that we need nuclear power because it is the only environmentally viable alternative to coal is fallacious – alternatives do exist and they are available right now. As noted elsewhere, “switching from coal plants to nuclear power is like giving up smoking cigarettes and taking up crack.”[47]

A 2005 study by Synapse Energy Economics showed that the U.S. can substantially reduce global warming pollution through efficiency improvements in power generation. In fact, the report concludes that modest investments in efficiency and renewable energy would reduce global warming pollutants from the electricity sector by 47% by 2025.[48] Similar analysis by the Institute for Energy and Environmental Research set forward a proposal to eliminate U.S. dependence on nuclear power over the next 50 years and reduce CO_2 emissions by 50% through efficiency programs and the replacement of aging coal-fired plants with far more efficient natural gas plants and cost-competitive renewable energy sources.[49]

MODEST INVESTMENTS IN EFFICIENCY AND RENEWABLES CAN REDUCE
GLOBAL WARMING POLLUTANTS FROM THE ELECTRICITY SECTOR BY ALMOST HALF

There are numerous renewable energy technologies available which could be expanded and many more that have great potential and should be pursued and funded more aggressively. The following represents some brief examples:

Solar Power

Every thirty minutes, enough of the sun’s energy reaches the earth’s surface to meet global energy demand for an entire year.[50] The Worldwatch Institute reports that already, “rooftop solar collectors provide hot water to nearly 40 million households worldwide.”[51] Grid-connected solar PV has been cited as the world’s fastest-growing energy technology.[52]

THE SOLAR ENERGY AVAILABLE IN A 100-SQUARE-MILE AREA OF NEVADA COULD SUPPLY
THE UNITED STATES WITH ALL ITS ELECTRICITY NEEDS

Solar PV is especially attractive for developing countries because it can be used in remote locations and power equipment as small as an individual laptop. Applications are also large, such as the 500-megawatt (MW)[53] generator currently under construction in California’s

Mojave Desert that will generate enough electricity to power 40,000 average American homes.[54]

It has been estimated that the solar energy available in a 100-square-mile area of Nevada could supply the United States with all its electricity needs.[55] In addition to large-scale, centralized projects like the one in Mojave, solar energy can be widely distributed and decentralized as well. Fitting the rooftops of America's homes and businesses with solar PV modules could accommodate as much as 710,000 MW of power, nearly 75% of current generating capacity.[56]

Wind Power

It has been estimated that wind energy has the potential to satisfy the world's electricity needs 40 times over, and could meet all global energy demand five times over.[57] One study concluded that, "good wind areas, which cover 6% of the contiguous U.S. land area, have the potential to supply more than one and a half times the current electricity consumption of the United States."[58]

WIND ENERGY CAN SATISFY THE WORLD'S ELECTRICITY NEEDS 40 TIMES OVER AND CAN MEET ALL GLOBAL ENERGY DEMAND FIVE TIMES OVER

It is no wonder, then, that wind is one of the world's fastest growing energy sources. In 2005, wind energy in the United States grew by almost 2,500 MW of installed capacity – a 35% increase in just one year.[59] Total wind-generating capacity in the United States now stands at over 9,000 MW, enough to power more than 2.3 million average American homes.[60]

Globally, the wind energy market grew a staggering 40.5% in 2005.[61] In Europe, wind installed capacity has already exceeded the European Commission's goals of 40 GW by the end of the decade.[62] Germany is the European leader, with more than 18 GW of installed wind capacity.[63] In Navarra, Spain, half of the electricity consumption is met by wind power, and in Denmark wind represents 20% of electricity production.[64] Wind energy is also developing rapidly elsewhere in the world. India is now the world's fourth-largest producer of wind energy,[65] and in China, wind energy grew at a 60% rate in 2005 and the Chinese government plans to reach 30 GW of wind energy capacity by 2020.[66]

GLOBALLY, THE WIND ENERGY MARKET GREW A STAGGERING 40% IN 2005 AND WIND POWER'S GENERATING CAPACITY IN EUROPE HAS ALREADY EXCEEDED THE EUROPEAN COMMISSION'S GOALS FOR 2010

Interest in developing offshore wind energy resources in the U.S. is also growing. Europe has already deployed more than 600 MW of offshore wind energy and the technology is readily available and advancing with larger machines planned. Offshore wind could hold particularly great promise in the U.S. In fact, the U.S. DOE has estimated that there is more than "900,000 MW of potential wind energy off the coasts of the United States, in many cases, relatively near major population centers"…which would "approach the total current installed U.S. electrical capacity."[67]

Geothermal Power

Even in regions without heavy geothermal activity, the regular heating of the ground by the sun can be harnessed to heat and cool homes. Geothermal heat pumps (GHP's) operate by transferring heat from the ground into buildings during the fall and winter, and reversing the process to keep buildings cool during spring and summer.

GHP's can operate more efficiently than the most energy-efficient conventional furnaces on the market today.[68] The potential energy yield from this simple technology is enormous. It has been estimated that the geothermal energy stored in the top six miles of the Earth's crust contains an estimated 50,000 times the energy of the world's known oil and gas resources.[69] It has also been estimated that geothermal energy can meet 100% of all electricity needs in 39 developing countries and could serve the needs of 865 million people around the world.[70]

Moreover, in many areas in the developing world, small geothermal projects have great potential to satisfy electricity demands of rural populations.[71] Perhaps the most dramatic example of geothermal power's potential is found in Iceland, which was largely dependent on imported fossil fuels only a few decades ago. Today, Iceland obtains more than 70% of its energy from domestic, renewable sources and geothermal accounts for more than half of its primary energy consumption.[72] Geothermal energy is also widely used in the western United States and Hawaii, where enough geothermal electricity was produced in 2003 to power two million average American homes.[73] This represents but a fraction of America's potential geothermal generating capacity, which could grow tenfold over the year 2000 levels using existing technology.[74]

THE GEOTHERMAL ENERGY STORED IN THE TOP SIX MILES OF THE EARTH'S CRUST CONTAINS AN ESTIMATED 50,000 TIMES THE ENERGY OF THE WORLD'S KNOWN OIL AND GAS RESOURCES

There are approximately 500,000 GHP's currently in use in the United States, and they are becoming increasingly popular in countries like Germany, where purchases increased by 35% in 2005.[75]

Tidal Energy and Smaller-Scale Hydropower

Both tidal, wave and smaller-scale hydroelectric projects represent a significant improvement over traditional, ‘big dam’ hydroelectric power. The use of rivers to generate electricity is already a proven technology, and accounts for 10% of America’s electricity generation.[76] However, large-scale hydropower is constrained because most of the world’s large rivers have already been exploited, leaving little room for sustainable growth.

Wave power, however, has vast potential. The Carbon Trust, an organization set up by the British government to monitor the county’s emissions, estimates that 20% of Britain’s electricity could be supplied by wave and tidal energy.[77] The U.S. DOE’s National Renewable Energy Laboratory estimates the potential of global wave power to be 2 to 3 million MW, with wave energy density averages of 65 MW per mile of coastline in favorable areas.[78] And the technology to harness the power of the waves is making headway – a new type of wave-power generator allows for high efficiency rates in extracting energy from the sea.[79]

In fact, the world’s first commercial wave farm is expected to come on-line this summer in Portugal. The project, the Aguçadoura Wave Farm, will generate 24 MW of electricity and will provide power to 15,000 households.[80] Preliminary tidal stream projects are also underway in the United States, Russia, and China. In New York City, just four sites in the East River have the potential capacity of nearly 40 MW, and a tidal turbine project being tested in Roosevelt Island is expected to generate 10 MW.[81]

Storing Renewable Energy

The ability to store surplus energy for later use is a crucial step towards making sustainable energy widely available. One potential solution to intermittency is the use of hydrogen as a storage mechanism. Hydrogen, the most abundant element on earth, contains a tremendous store of energy that can be used to produce electricity. In order to tap into this potential, pure hydrogen must first be separated out from other materials, notably water. By passing electricity through water containing a catalyst in a process known as electrolysis, hydrogen can be produced from water at up to an 80% efficiency rates.[82]

Hydrogen fuel cells also have the potential to produce electricity to power homes, buildings, cars, and trucks and are attractive because their only emissions would be pure water vapor. While there are still some technical and economic barriers to the widespread application of hydrogen, the potential benefits make it worth pursuing. Meanwhile, there are more conventional storage technologies that are readily available to store renewable energy until more efficient storage mechanisms are available. Compressed air storage can store electricity by powering a motor/generator that drives compressors to force air into an underground storage reservoir. According to the DOE this technology is already being used to help generate electricity at an 11-year-old plant in McIntosh, Alabama, and a 23-year-old plant in Germany.[83] Furthermore, pumped hydro facilities are being used to store electricity by pumping water from a lower reservoir into one at a higher elevation and then passing the water through hydraulic turbines to generate electricity. According to the DOE, this technology is suitable for times of peak demand by providing low cost power and reserve capability.[84] Furthermore, pumped hydro can be used to smooth out the demand for base load generation making it well suited for application with certain renewable technologies.

Energy Efficiency, Decentralized Generation and Cogeneration

Each dollar invested in electric efficiency in the U.S. displaces nearly seven times as much carbon dioxide as a dollar invested in nuclear power and nuclear power saves as little as half as much carbon per dollar as wind power and cogeneration.[85]

EACH DOLLAR INVESTED IN ELECTRIC EFFICIENCY IN THE U.S. DISPLACES NEARLY SEVEN TIMES AS MUCH CARBON DIOXIDE AS A DOLLAR INVESTED IN NUCLEAR POWER

For many utilities, energy efficiency can lower energy costs and supply more energy than conventional supply strategies. Aggressive, coordinated and comprehensive energy efficiency programs are desirable and attainable. According to Amory Lovins "a cost-effective *combination* of efficient use with decentralized (or even just decentralized renewable) supply is ample to achieve climate-stabilization and global development goals, even using technologies quite inferior to today's. For all these reasons, a portfolio of least-cost investments in efficient use and in decentralized generation will beat nuclear power in cost *and* speed *and* size by a large and rising margin. This isn't hypothetical; it's what today's market is proving decisively."[86]

Likewise, the British Department of Trade and Industry acknowledged that energy efficiency is likely to be the cheapest and safest way of addressing fundamental energy challenges: GHG emissions reduction, maintenance of a reliable energy supply, promotion of competitive markets, and assuring affordable power.[87]

Cogeneration, or the combined generation of heat and power (CHP), is also significantly more efficient than producing electric and thermal energy separately. Cogeneration refers to any system that simultaneously or sequentially generates electric energy and utilizes the thermal energy that is normally wasted for space heating, hot water, steam, air conditioning, water cooling, product drying, or for nearly any other thermal energy need.

Byproduct heat at moderate temperatures can also be used for the production of cold in refrigerators and water cooling mechanisms. A plant producing electricity, heat and cold is sometimes called trigeneration.

Cogeneration already produces almost 9% of the power consumed in the U.S. at a total efficiency nearly twice that of the rest of the country's power grid.[88] A report commissioned by the Western Governor's Association concluded that cogeneration has the potential to exceed the stated goal of adding 30 MW of new, clean and efficient capacity in the Western states by 2015.[89]

Sustainable Energy: A Good Choice for the Economy

Consumers, politicians, workers, and business leaders are increasingly appreciating that the decision between economic growth and environmental sustainability is truly a false choice. In fact, dollar for dollar, the economic rewards from sustainable energy investments continue to outpace those from conventional energy sources.

A recent study by the University of California confirmed that sustainable energy sources provide more jobs "per MW of power installed, per unit of energy produced, and per dollar investment than the fossil fuel-based energy sector."[90] At the same time, sustainable energy is becoming more affordable to end-users and is attracting the attention of financial institutions and investors who are incorporating sustainable energy projects into their portfolios.

Across the board, the sustainable energy sector is experiencing virtually unprecedented financial success. Currently a $2.5 billion industry, solar PV is projected to grow an average of almost 20% a year through 2020.[91] Wind energy is also booming, with a record-setting $3 billion worth of new equipment installed in the U.S. alone last year.[92] Some forecasts anticipate that solar and wind energy will each constitute a $40 billion to $50 billion industry by 2014.[93] Already a $1.5 billion industry in its own right, geothermal energy may grow by up to 15% annually in some sectors, and the DOE predicts that foreign governments will spend as much as $40 billion from 2003 to 2023 to build geothermal energy plants.[94]

> DOLLAR FOR DOLLAR, THE ECONOMIC REWARDS FROM SUSTAINABLE ENERGY INVESTMENTS OUTPACE THOSE FROM CONVENTIONAL ENERGY SOURCES

The sustainable energy sector promises to boost the American and international job market just as many manufacturers and conventional energy providers are outsourcing or downsizing their workforces. The Union of Concerned Scientists estimates that 355,000 new jobs in American manufacturing, construction, operation, maintenance, and other industries can be created if the U.S. obtained 20% of its energy from sustainable sources by 2020.[95]

Solar power alone is expected to provide more than 150,000 U.S. jobs by 2020[96] and Germany already employs 170,000 people in its sustainable energy sector, and substantial future growth is anticipated.[97] In fact, on a global scale, over 1.7 million people are already directly employed in sustainable energy manufacturing, technology, and maintenance, with indirect employment believed to be several times higher.[98]

Industry Claim # 4:

Nuclear Power is Clean & Environmentally Benign

The nuclear power industry has invested a lot of money in marketing campaigns promoting nuclear power as "clean energy." In 1998, the Nuclear Energy Institute (NEI) ran advertisements claiming that nuclear power helps "protect the environment." [99] In response, 15 environmental, consumer, public policy, and business organizations won an important judgment from the National Advertising Division of the Council of Better Business Bureaus (NAD). NAD ruled that the 1998 NEI ads were "misleading" and advised that they should be "discontinued."[100]

However, the NEI chose to ignore the warnings and continued with a new round of barely modified advertising messages, and the case was referred to the Federal Trade Commission (FTC). In December 1999, the FTC ruled that "because the discharge of hot water from cooling systems is known to harm the environment, and given the unresolved issues surrounding disposal of radioactive waste, we think that NEI has failed to substantiate its general environmental benefit claim."[101] The FTC also agreed with the NAD's decision "that NEI has not substantiated its statement that the production of nuclear power does not pollute the water."[102] The FTC warned the NEI that its advertising campaign, touting nuclear power as environmentally clean, was without substantiation and recommended that the NEI "take to heart the evaluation of its advertising that has been rendered by its peers."[103]

Impacts on marine ecosystems

Noted scientists and oceanic experts agree that the health of the world's oceans is in jeopardy. Yet, the nuclear industry is still permitted to destroy significant areas of marine habitat through the daily operations of its once-through coolant reactors. In general, the commercial fishing industry is highly regulated as to the manner of catch, quantity, and frequency. Conversely, the nuclear power industry is required to take very few precautions to avoid impacts on fish stocks and the larvae of numerous near-shore species. Indeed, two very different regulatory regimes control the environmental impacts of commercial fisheries and the nuclear power industry, while both industries have significant impacts on the marine environment.

Reactors that operate with once-through cooling systems typically use more than one billion gallons of water a day (500,000 gallons a minute). This enormous water use can have large impacts on the environment – trapping fish and other marine animals in their intakes and changing the temperature of local waterways through the discharge of heated water.[104]

In fact, fish, fish larvae, and fish eggs are harmed and destroyed upon entering the flow of reactor cooling water where they are sucked into and impinged on the water intake screens. Smaller fish, fish larvae, spawn, and a large numbers of other marine organisms are actually drawn into the reactor coolant system where up to 95 percent are scalded, killed and discharged as sediment. This indiscriminant killing can result in extensive depletion of the affected species and cause the community of species around a reactor to lose their capacity to sustain themselves.

The once through cooling system also discharges water that is much hotter than when it is withdrawn. The hot discharge water damages and destroys fish and other marine life and dramatically alters the immediate marine environment. Warmer waters have been found to cause a fatal disease, known as "withering syndrome," in black and red abalone, which have been virtually eliminated around the Diablo Canyon reactor in California.

Kelp, unable to photosynthesize efficiently due to the shadowing effect of reactor discharge sediment, is also weakened by higher water temperatures. In the immediate discharge areas, the ocean floor is scoured clean of sediment by the force of the thermal discharge, resulting in bare rock and creating a virtual marine desert.

NOT A SINGLE STATE HAS PUT LIMITS ON THE NUMBER OF FISH THAT POWER PLANTS ARE ALLOWED TO KILL

In theory, nuclear power plants are required to use water intake systems that "reflect the best technology available for minimizing adverse environmental impacts," according to the Clean Water Act (CWA). However, the site specific examples of environmental impacts are quite startling when examined. For example, the State of New York estimates that the Indian Point reactors cause the mortality of more than one billion fish a year, and that closed-cycle cooling would lead to at least a 98% reduction in fish mortality.[105] In the case of the Oyster Creek reactor in Tom's River New Jersey, the State Department of Environmental Protection estimates that the cooling system kills millions of small fish, shrimp and other aquatic creatures each year and that dead marine life expelled from cooling systems back into the source stream create a "shadow effect," blocking sunlight to underwater organisms and limiting oxygen uptake.[106]

THE REACTORS AT THE INDIAN POINT POWER PLANT, NORTH OF NEW YORK CITY, ARE ESTIMATED TO CAUSE THE MORTALITY OF MORE THAN ONE BILLION FISH A YEAR

Impacts on Endangered Species

Four species of endangered and one threatened species of sea turtle present in U.S. coastal waters are harmed and killed by nuclear power station operations. Loggerhead, green, and Kemp's Ridley sea turtles are the most common victims at nuclear reactors and are often entrained into the large-diameter coolant intake pipes used by coastal reactors.

A 1990 National Academy of Sciences study, "Decline of Sea Turtles, Causes and Prevention," examined the impacts on worldwide sea turtle populations and recommended protective measures to prevent their extinction.[107] The academy, in its investigation of power plant impacts, found that death and injury can occur in transit through a reactor's once-through intake pipes. Sea turtles are also impinged by the force of the intake water and become lodged on intake structures, barrier nets or against the power station's metal grate trash racks.

Thus, the marine impacts of nuclear power demonstrate that the nuclear industry and regulators value profit over reduction of harm to the marine ecosystem. In fact, there are numerous examples of take limits for endangered species being raised and adjusted in accordance with plant operating imperatives rather than species population maintenance.

The installation of cooling towers to once-through systems (which account for over half of the nations 103) would reduce water intake by 96% and greatly reduce the potential for marine species damage.[108] The towers would also function to cool waste waters before discharge, thereby reducing temperature induced ecosystem disruptions significantly. However, despite this proven and affordable mitigation measure, utilities, which claim to act as stewards of our natural heritage, continue to exact a devastating toll that in many cases may have no chance for reversal.

Industry Claim # 5:

Reactors Are Safe and an American Chernobyl Could Never Occur

The fact that there has not been a Chernobyl-scale accident at a nuclear facility in the United States does not mean that plants here are accident-proof or even have strong safety records. In actuality, the NRC has documented nearly 200 "near misses" to serious reactor accidents in the U.S. since 1986, eight of which involved a risk of a core meltdown that was greater than one in 1,000.[109] Most alarmingly, only one of those eight reactors was on the NRC's regulatory radar prior to the problems occurring.

While dominant reactor designs in the U.S. use water to cool and slow the nuclear chain in the reactor core rather than the graphite absorption model of the infamous reactor at Chernobyl, many operating U.S. reactors have serious design flaws that would not be licensed today. The leading example is the G.E. MARK I reactor which has an elevated spent fuel pool and a primary containment design that has widely been considered to be flawed. In the words of a former Director of the NRC office of Nuclear Reactor Regulation, "I don't have the same warm feeling about GE containment that I do about the larger dry containments." Indeed, the regulator expressed concern that there was something like a 90% probability of that containment failing."[110] However, despite these significant safety issues, the NRC is poised to extend operating licenses and approve power output increases under hasty and superficial technical review.

NRC and Industry Safety Culture

The NRC has in recent years fallen back into the mindset described in the post-Three Mile Island reports to the President as being a major contributor to the accident. As the Commission described, "We find that the NRC is so preoccupied with the licensing of plants that it has not given primary consideration to overall safety issues… With its present organization, staff and attitudes, the NRC is unable to fulfill its responsibility for providing an acceptable level of safety for nuclear power plants."[111]

Moreover, the NRC's regulation of the nuclear industry is inconsistent with the federal governments sweeping homeland security policies. Persistent threats in the wake of September 11th have brought a heightened attention to safety, yet the NRC has attempted to minimize the dangers of terrorism and has not taken these considerations seriously. A prime example of this posture resulted in a June 2006 decision in the Ninth Circuit where the court ruled that the NRC erred in its determination that the National Environmental Policy Act (NEPA) does not mandate formal consideration of the potential impacts of a terrorist attacks at nuclear facilities.[112] This decision is currently being appealed to the US Supreme Court, but utilities and investors should take heed that if it holds as a matter of law, there could be far reaching, even disabling, consequences for existing as well as proposed reactors.[113]

> "THE NRC IS SO PREOCCUPIED WITH THE LICENSING OF PLANTS THAT IT HAS NOT GIVEN PRIMARY CONSIDERATION TO OVERALL SAFETY ISSUES… THE NRC IS UNABLE TO FULFILL ITS RESPONSIBILITY FOR PROVIDING AN ACCEPTABLE LEVEL OF SAFETY FOR NUCLEAR POWER PLANTS."

Furthermore, a recent Government Accountability Office report stated that despite industry assurances, oversight of safety procedures at the nation's 103 operating nuclear plants warrants aggressive attention from federal regulators, and described the NRC as "slow to react" to the deteriorating conditions of some plants.[114] Therefore, the evidence suggests that safety and security efforts by the NRC and the industry should be the subject of serious Congressional oversight.

Reactors Operating Beyond Licensed Lifetime and Capacity Pose a Compounded Risk

This aforementioned poor safety regime is compounded by the technical subtleties of aging nuclear plants with finite operating lives. One nuclear expert, David Lochbaum, of the Union of Concerned Scientists, has described the phases in the operational lifespan of reactors and corresponding safety indicators as adhering to a bathtub curve, with the "break-in" and "wear-out" phases having highest incidence of technical malfunction and potential for catastrophic accident.[115] With the majority of reactors in the U.S. within or approaching the "wear-out" phase, the nation faces an unprecedented danger of accident.

In fact, the recent near-accident at the Davis-Besse reactor demonstrated the eroded safety culture at reactors when both the plant owner and the NRC shunted aside warnings and opportunities to catch the advanced corrosion in the vessel-head that could have caused a major accident.[116] As a matter of practice, the NRC and nuclear utilities do not have measures in place to learn from past accidents, nor do they maintain an effective and rigorous inspection regime. A recent report by the Union of Concerned Scientists has shown that of the 103 nuclear power reactors in the United States, severe problems have caused 41 to shut down for a year or longer, with some registering multiple shut-downs.[117] Such extended shutdowns reveal the degree to which cumulative decay and unattended maintenance issues allow safety margins to deteriorate to levels so low that reactor operations must cease altogether. Thus, industry proposals to extend the operating licenses and increase power output represent serious and unacceptable safety hazards.

Reactor vulnerabilities

The NEI continues to aggressively target policy makers in Washington and the general public alike with high-budget ad campaigns declaring nuclear facility security. In 2002, NEI sponsored a series of ads in Washington, D.C. which featured security officers standing guard outside of a nuclear facility with automatic weapons in hand. Titles of these ads included "Serious Business," "Tough Enough? You Bet" and "Vigilant." All six of these ads promoted the readiness of nuclear facilities in preventing terrorism.[118] However, according to the Project on Government Oversight, guards at twenty-four reactors nationwide say that morale is very low and that they are under-equipped, under-manned, and underpaid.[119] Moreover, the report concludes that neither utilities nor the NRC are making appropriate security modifications at reactors since 9/11.

The claim is often made that reactors are the best defended industrial facilities in the nation's civilian infrastructure. However, when the NRC conducted mock terrorist attacks at nuclear plants to detect vulnerabilities they found “a significant weakness” in defense procedures 46% of the time and that mock attackers were able to infiltrate the plants sufficiently to incur damages to the core and probable radioactive releases.[120]

Furthermore, according to interviews conducted in 2002 with 20 guards at 24 reactors, guards at only a quarter of the plants believed they were adequately prepared to defend against a terrorist attack.[121] Even more troubling than poor performance in the past, after the attacks of September 11 the NRC suspended force-on-force tests until October 2004, and has declined to make results public under claims of national security protection.[122]

Many plants also remain vulnerable from the water, primarily through cooling water intake structures. Available technologies, such as inflated cylinders of a rubber-coated textile, linked together or to a mooring buoy to form a security barrier around an exclusion zone, could be used to thwart small-boat terrorist attacks and are being deployed at several Naval bases, but have not been mandated for installation at vulnerable nuclear plants. Therefore, despite claims of security improvements, the high degree to which nuclear plants are vulnerable to terrorist attack is apparent.

While every attack and malfunction scenario cannot be envisioned or accounted for, there are simple measures that could be taken to better secure our nation’s reactors and their waste. Hence, claims that nuclear facilities are optimally defended are disingenuous at best.

Dangers of Terrorism and Spent Nuclear Fuel

FBI director Robert S. Mueller testified before the Select Committee on Intelligence in the U.S. Senate in February 2005 stating, “Another area we consider vulnerable and target rich is the energy sector, particularly nuclear power plants. Al-Qa'ida planner Khalid Sheikh Mohammed had nuclear power plants as part of his target set and we have no reason to believe that al-Qa'ida has reconsidered."[123] Moreover, in October 2001, the Federal Aviation Administration temporarily restricted all private aircraft from flying over 86 nuclear facilities due to threats of terrorist attacks.[124]

Despite industry claims that concrete containment domes could withstand the impact of low-flying aircrafts, the Swiss nuclear regulatory authority has stated that "nuclear power plants (worldwide) are not protected against the effects of warlike acts or terrorist attacks from the air […] one cannot rule out the possibility that fuel elements in the fuel pool or the primary cooling system would be damaged and this would result in a release of radioactive substances.[125] German researchers have also used computer simulation for various jetliner crash scenarios indicating potential for considerable chaos and radiation release. [126]

Many irradiated-fuel pools are located above ground level or above empty cavities and could be drained if their bottoms or sides were punctured. Such an incident could result in a fire which could not be extinguished and could contaminate up to 188 square miles.[127] Moreover, according to a recent study by the National Academy of Sciences, a terrorist attack on a spent fuel pool could lead to the release of large quantities of radioactive materials to the environment.[128] Therefore, the issue is a serious one that should be a national security priority, but the majority of spent fuel has not been placed in hardened on-site storage (HOSS) and is not any safer than on September 11th 2001 (see more detailed discussion within Industry Claim #7). Moreover, the U.S. is no closer to a solution for this waste, and present proposals from Congress and the DOE raise more questions than answers.

Emergency Preparedness and Evacuation Plans Are Inadequate and Outdated

In accordance with NRC regulations, reactor owners are supposed to develop feasible evacuation plans in the event of a serious reactor accident. However, as concerns over reactor safety have escalated since the attacks of September 11, evacuation plans and emergency preparedness have increasingly come under scrutiny.

In an in-depth consideration of likely impacts of an attack on a nuclear facility in the U.S., Physicians for Social Responsibility (PSR) concluded that quick and effective evacuation would be the greatest challenge in casualty reduction.[129] The report made specific note that the U.S. currently has no mechanism in place to respond to specific weather patterns that would dictate the spread of radiation in the event of an accident, thereby making comprehensive evacuation impossible.

A report for the State of New York, by James Lee Witt and Associates, analyzed the emergency preparedness plan for the reactors at Indian Point and concluded that evacuation plans were woefully inadequate.[130] The report concluded that plans reflected a focus on complying with generic regulations rather than effective public health provision. While the report was specific to two nuclear facilities, it's appraisal of the federal regulatory framework as inadequate, out-dated and ineffectual can be generalized across the industry. Moreover, a 2001 report from the Government Accountability Office found that significant weaknesses in the emergency preparedness at Indian Point went uncorrected for over a year after being identified.[131]

Many reactors are built near large population centers, especially along the eastern U.S. which is more densely populated now than when plants were constructed. For example, Oyster Creek nuclear reactor in New Jersey has seen local population triple in size since the plant was built, making safe and timely evacuation a non-reality for today's surrounding residents.[132] Moreover, existing plans are limited in that they only require utilities to plan for evacuation of residents in the 10 mile radius zone surrounding the reactor. This regulation again undershoots the mark of public protection, as the American Thyroid Association recommends that provisions be made for people with a 50 mile radius.[133]

Therefore, in the wake of the debacle surrounding Hurricane Katrina, the issue of whether evacuation planning has been effective has received heightened attention and the scope of these issues require renewed scrutiny nationwide.

New Nuclear Plant Designs Are Not Inherently Safer of Cheaper

A key component of the proposed "nuclear renaissance" involves the drive for what is being called "Generation IV reactor designs," which are purported to be inherently safer, less expensive to build and more fuel efficient. However, it is important to note that these designs are unproven, making promised delivery time and cost unfounded.

In the case of one Generation IV design, promised cost advantages would be achieved by replacing the steel-lined, reinforced-concrete containment structures currently employed at most U.S. reactors with a far less robust enclosure structure in spite of warnings from the NRC's own Advisory Committee on Reactor Safeguards, which described this cost-advantage as a "major safety trade-off."[134]

THE NRC'S OWN ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
DESCRIBED COST-CUTTING MEASURES IN PROPOSED REACTOR DESIGN
AS A "MAJOR SAFETY TRADE-OFF"

Furthermore, proposed fast breeder reactors have a history of monumental safety lapses, accidental releases of radiation, extended shut-downs and exorbitant costs which have lead ultimately to the majority of them to be forced into early closure. Most concerning, these reactors also come with the increased possibility of "prompt criticality" accidents.[135]

According to the U.S. DOE, actual construction costs for reactors built between 1966 and 1977 were generally three times higher than projected.[136] Industry plans for nuclear power expansion are staked on uncertain technologies, from fuel fabrication processes to reactor facilities and waste disposition. There is no techno-fix for nuclear power, and promises of future developments are not a sound basis for investment. The unavoidable truth is that nuclear technology is inherently dangerous. A sober look at the course of nuclear technology reveals a history wrought with uncertainty, compound risk factors, unpredictable accidents and ample opportunities for disaster.

Billions have been invested in researching new, better, safer technologies, and yet we have made scant progress toward accident risk abatement, waste disposal and public health provision. No other energy source has such extreme and prevalent safety risks and there are a wealth of renewable energy sources and efficiency innovations available without these attendant dangers.

Industry Claim # 6:

Nuclear Power is Cost-effective

While the nuclear industry likes to point out that nuclear power is cheaper than other forms of electricity generation, it counts only the price of operating the plants, not the full costs of building them. Operating costs of nuclear power plants are in fact low, but to argue these are the true costs of nuclear power is disingenuous, and like arguing that its cheap to drive a Rolls Royce, counting only gasoline price and leaving out the purchase price.

In fact, the cost of nuclear power is extremely high at the beginning and end of the operational cycle of a nuclear power plant: construction costs for reactors built since the mid-1980's have ranged from $2-$6 billion, averaging more than $3,000 per kilowatt of electric generating capacity (in 1997 dollars).[137] Historically, nuclear power has been anything but cost effective. The capital cost for construction of a reactor is very high, and cost overruns are highly probable for new reactors. The estimated cost of $1,500-$2,000 per KW of electric generating capacity for the new generation of nuclear plants is extremely optimistic and unlikely to be achieved. The prices of recently built nuclear power plants in Japan were much higher, ranging between $1,796 and $2,827 per KW, in 2003 dollars.[138]

The Congressional Research Service indicates that average construction costs have totaled more than $3,000 per KW, and that the nuclear industry's claims that new plant designs could be built for less than that amount (if a number of identical plants were built) have not yet been demonstrated.[139] Indeed, nuclear construction cost estimates in the U.S. have been notoriously inaccurate. The estimated costs of some existing nuclear units were wrong by factors of two or more, and the total estimated cost of 75 of today's existing nuclear units was $45 billion (in 1990 dollars).[140] The actual costs turned out to be $145 billion (also in 1990 dollars).

RECENTLY BUILT NUCLEAR PLANTS IN JAPAN COST AS MUCH
AS $2,827 PER KW, IN 2003 DOLLARS

The most striking example of costs overruns was the Shoreham nuclear plant in New York. With an initial estimated cost of $350 million, the plant ended up costing $5.4 billion when it was completed 20 years later, about 15 times the original cost. The plant never produced a single kilowatt of commercial power, and the cost overruns of the project contributed to saddling Long Island with some of the nation's highest electricity rates.

Europe's most recent nuclear project, the European Pressurized Water Reactor in Finland, is running over budget and causing financial losses for French builder Areva. The company's operating income for the first-half of 2006 was severely affected by the construction delays, and the company's Reactors and Services Division had a loss of 266 million euros (US$338 million). The loss is due to a "significant" provision the group made to account for past and expected future costs of the delay at Olkiluoto and the Finnish utility is now projecting commercial operations of the reactor to start by the second quarter of 2010, a year behind the original schedule. [141]

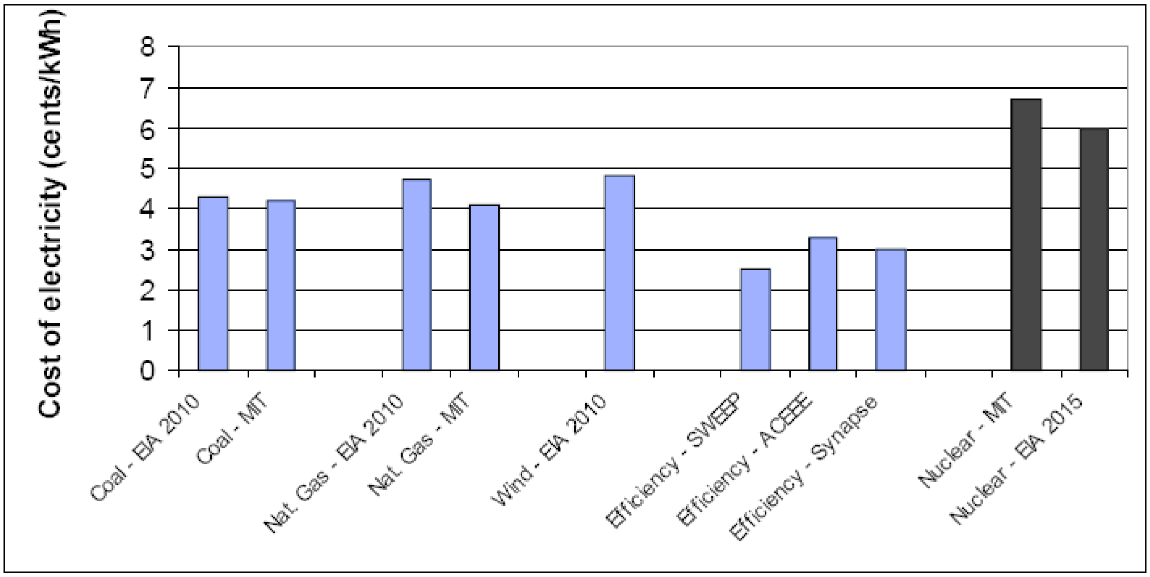
Cost effective compared to what?

A 2003 study by MIT forecasted that the base case real levelized cost of electricity from new nuclear reactors with an estimated 85 percent capacity would be $.067 per kWh over a projected forty year operating life - more expensive than from pulverized coal or natural gas. The study points out that "The bottom line is that with current expectations about nuclear power construction costs, operating costs and regulatory uncertainties, it is extremely unlikely that nuclear power will be the technology of choice for merchant plant investors in regions where suppliers have access to natural gas or coal resources. It is just too expensive."[142] Additional studies have also concluded that overnight capital costs, lead construction times and interest rate premiums are likely to place the cost of electricity from any future nuclear power plants within the range of $.06 to $.07 per kilowatt hour.[143] In fact, even in France, the country with the highest percentage of nuclear power in its electricity supply mix, officials have admitted that natural gas combined cycle plants are more economical than nuclear plants.[144]

ELECTRICITY FROM NEW LIGHT WATER REACTORS WILL COST TWICE AS MUCH AS FROM NEW WIND FARMS, AND FIVE TO TEN TIMES AS MUCH AS FROM DISTRIBUTED GAS-FIRED COGENERATION OR TRIGENERATION IN BUILDINGS AND FACTORIES

Several cost comparisons with wind and efficiency clearly demonstrate the economic disadvantages of nuclear power, including the Rocky Mountain Institute's analysis, which found that "in round numbers, electricity from new light water reactors will cost twice as much as from new wind farms, five to ten times as much as from distributed gas-fired cogeneration or trigeneration in buildings and factories (net of the credit for their recovered heat) and three to thirty times as much energy efficiency that can save most of the electricity now used. Any of these three abundant and widely available competitors could knock nuclear power out of the market, and there are three, with more on the way (ultimately including cheap fuel cells)."[145] Thus, because of the cost, nuclear power cannot compete with these cheaper decentralized alternatives.[146]

Cost of Electricity from Various Technologies[147]



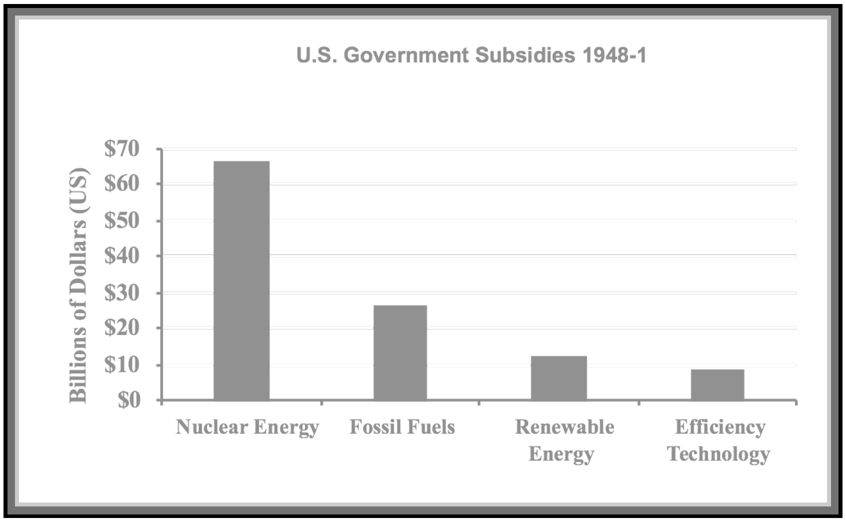
Meanwhile, deployment costs and electricity prices for renewable energies continue to go down. The International Energy Agency predicts a cost reduction up to 25% for wind power and 50% for solar PV from 2001 to 2020.[148] And for part of 2005, utility costumers in Texas and Colorado already paid less for wind-generated electricity than for conventionally-produced power.[149]

Subsidies: The nuclear industry is not able to compete in the market without huge government subsidies

According to Entergy's CEO, "whatever the government needs to spend, it's a small price to pay for weaning America off its addiction to foreign oil, reducing greenhouse gases and protecting our economy."[150] This statement mirrors five decades of nuclear industry demands for subsidies and, unfortunately, again and again, the government has come through for the industry.

Federal subsidies cover 60-90% of the generation cost for new nuclear plants, without which they would not be viable.[151] Market distortions - such as subsidies and the failure to account for the true societal cost of conventional energy - have unjustly benefited the nuclear and fossil fuel industries for decades. Worldwide, conventional energy sources (nuclear and fossil fuels) have received approximately $250 billion in 2003 in government subsidies,[152] while combined U.S. and European government support for renewable energy sources totaled just $10 billion the following year.[153] Thus, the discussion of cost effectiveness cannot be divorced from that of the subsidies and incentives provided. Indeed, these handouts are the economic lifeblood of the nuclear industry. Nuclear power receives 61% of the European Union's energy-related research and development funding, even though it contributes only

13% of the region's energy.[154] The U.S. government spent more than $110 billion on energy research and development between 1948 and 1998. The nuclear industry got the biggest share of this money, some $66 billion or 60%. Fossil fuels were allocated 23% of the R&D, while renewable energies got only 10% and efficiency technologies received a mere 7%.[155]



Energy subsidies are justified as incentives for the advancement of nascent technologies in their early stages of development. Yet, nuclear power is now a 50-year old industry and has even been classified by the International Energy Agency as "proven and mature."[156] However, in the Energy Policy Act (EPACT) of 2005, Congress provided the industry with a package of incentives worth some $13 billion, including:[157]

$2.9 billion in research and development subsidies, including financing for the Nuclear Power 2010 program to build new plants and the Generation IV program to develop new reactor designs $3.25 billion in construction subsidies, including unlimited loan guarantees for the construction of new plants, half of the costs of obtaining the necessary site permits and reactor licenses, and payments to the industry in case of delays in construction and operation licensing $5.7 billion in operating costs, including production tax credits of 1.8 cents per kWh

Moreover, EPACT 2005 reauthorized the Price Anderson Act for another 20 years, freeing existing and proposed reactors from prohibitively high insurance costs. Enacted in 1957, Price Anderson was originally intended to be a temporary incentive to the then nascent nuclear industry to address the difficulties of private investors in obtaining insurance to cover the risks associated with nuclear power. However, at this point, the extension of this incentive amounts to an enormous uncalculated subsidy to the nuclear industry. In fact, the law caps the liability of nuclear operators in case of an accident and passes the costs of damage compensations above $10 billion on to the taxpayers.

THE UNACCEPTABLY HIGH COST OF INSURANCE, WASTE REMOVAL AND STORAGE, AND DECOMMISSIONING WOULD MAKE NUCLEAR ENERGY COMPLETELY UNTENABLE IN A TRULY EQUALIZED MARKETPLACE

It is indisputable that the unacceptably high cost of insurance, waste removal and storage, and decommissioning would make nuclear energy completely untenable in a truly equalized marketplace. Thus, despite the large incentives and subsidies to the nuclear industry, investors remain skeptical of putting their financial resources in new nuclear power plants. In fact, nuclear power is likely to be met with some skepticism on Wall Street and Standard & Poor's found that "an electric utility with a nuclear exposure has weaker credit than one without and can expect to pay more on the margin for credit. Federal support of construction costs will do little to change that reality. Therefore, were a utility to embark on a new or expanded nuclear endeavor, Standard & Poor's would likely revisit its rating on the utility."[158]

Unaccounted Costs: Externalities

In addition to the assistance they receive through subsidies, the cost of nuclear power does not account for the toll it takes on human health and the environment. These costs are paid by society at large and include, but are not limited to, environmental costs, air pollution, climate change as well as health care costs. Because these costs are not taken into account in the calculations of the price of energy, economists call them "externalities."

It is true that the calculation of external costs is not a simple task because of the uncertainties and assumptions involved, but as has been noted "…not to incorporate externalities in prices is to implicitly assign a value of zero, a number that is demonstrably wrong."[159] Nuclear power has been estimated to produce up to $2.7 billion a year in external costs in the EU-15 countries alone.[160]

This is an important distinction because consumers often pay higher prices for sustainable energy because the ecological benefits it provides are unaccounted for. In fact, the IEA considers these "unrewarded environmental characteristics" to be the principal barrier to increasing the market share for sustainable energy.[161] Therefore, despite the difficulty of calculating the costs, understanding the life cycle costs of our energy sources that are borne by society, is an essential part of the case for transition away from reliance on those sources.

Industry Claim #7:

Nuclear Waste Can Be Handled Safely and Effectively

Radioactive waste remains highly toxic for millions of years, presenting an enormous challenge to health and environment provisions for future generations. No country in the world has successfully developed a method for the safe disposition of radioactive waste. Moreover, the waste is extremely costly to safeguard and in 1996 the National Academy of Sciences calculated the cost of programs for radioactive waste disposal would "likely be no less than $50 billion and easily could be over $100."[162]

The nuclear energy cycle produces a complex array of radioactive wastes at every stage. While the majority of the volume is composed of so-called low level wastes, the complete fuel cycle includes uranium mining and milling tailings and depleted uranium from enrichment facilities, which have all resulted in contaminated water supplies and endangered the heath of surrounding populations. Furthermore, the largest concern for public health and security actually rests in the disposal of high-level wastes, which are characterized by very long half-lives of radionuclides (for example, cesium-135 has a half-life of 2.3 million years and iodine-129, 15.7 million years).

As of 2005, the U.S. reactors had generated more than 53,000 metric tons of spent nuclear fuel, all of which is being precariously stored at 76 reactor sites across the U.S.[163] Despite the absence of a long term storage strategy, the industry is re-licensing existing reactors as they approach assigned closure dates.

U.S. REACTORS HAVE SO FAR GENERATED MORE THAN 53,000 METRIC TONS OF SPENT NUCLEAR FUEL, FOR WHICH THERE IS NO LONG TERM STORAGE SOLUTION

In the absence of a long-term storage solution this policy is effectively turning reactor sites, many located in populous areas, into de facto long term storage facilities. Furthermore, the assumption that the planned repository at Yucca Mountain will actually open is no longer a reasonable one. Even if Yucca Mountain ever opens, its storage capacity will be reached with existing waste production by 2010.[164]

"Interim Storage" Proposal Troubling

In response to perpetual uncertainty, in the FY 2007 Energy & Water Appropriations bill Congress is considering what is being termed "interim storage." This hastily considered plan would rush the transport of commercial irradiated nuclear fuel onto roads, rails, and waterways in order to store these highly radioactive wastes at "interim" surface storage sites.

Among the most troubling provisions of this plan is that it would give the U.S. Department of Energy (DOE) authority to site a waste dump within a state over the objections of the state and local governments. Thus, in the absence of a viable plan for moving the waste somewhere else, "interim" storage sites would become long-term "overflow parking" for high-level radioactive wastes with nowhere else to go.

Historically, as well presently, the nuclear industry and the federal government consistently promote waste storage options which unnecessarily compromise public health and security. In fact, the most widely supported method for radioactive waste management is hardened on-site storage that has security and accountability measures built into the design.[165] However, rather than address these complex safety and security issues, the nuclear industry continues to masquerade as if the waste problem were a non-issue, with a silver-bullet solution waiting around the next-turn.

YUCCA MOUNTAIN, THE PROPOSED LONG TERM REPOSITORY FOR U.S. RADIOACTIVE WASTE, SITS ATOP 33 FAULT LINES

Prospects for Long-Term Storage at Yucca Mountain Dubious

The designation of Yucca Mountain as the proposed site for a long-term waste repository is a clear example of political pressures overwhelming scientific realities. Despite being the only option under consideration by the U.S. government, Yucca Mountain, located on Western Shoshone tribal land just 80 miles outside of Las Vegas, NV, is not a scientifically sound solution for long-term waste disposal. In fact, due to the geology, hydrology and seismic activity specific to the site, Yucca Mountain would not be able to isolate waste for the requisite hundreds of thousands of years.[166]

The myriad site deficiencies have pushed the projected opening date back many times over, with the most recent DOE estimation at 2017. Despite the fact that the original Environmental Impact Assessment for the site was deemed illegal by the EPA,[167] industry and the DOE alike continue to press for a speedy opening.

Yucca Mountain actually sits atop 33 fault lines and the State of Nevada ranks third in the nation for current seismic activity[168] and a large fresh-water aquifer lies below the site. Scientists agree that radioactivity will inevitably reach the aquifer and independent review has shown that water can percolate through the mountain at a rate much faster than previously thought, and that water has welled up in the region in the not so far geologic past.[169]

Dangers Associated With "Successful" Opening of Yucca Mountain

Transportation routes to Yucca Mountain will run through 44 states on highways, rails and waterways, with routes passing through highly populated areas and, inevitably waste transportation accidents will happen:

- There are 60,000 tractor-trailer wrecks on interstates each year, 3,300 of which involve full rollovers. This statistic, when applied to the estimated 22,000 shipments over the next 38 years[170] to deliver waste to Yucca, makes this scenario an unacceptable threat to public health.[171]

- Three quarters of the nation's first responders and fire fighters are volunteers and it is extremely unlikely that they will have received sufficient radiation training.[172]

"Advanced Fuel-Cycle Technology" – Reprocessing – Cannot Solve the Waste Issue and is Inherently Dangerous

The claim is often made that radioactive waste still contains 95% of its useable content and can be "recycled" as fuel for new, proliferation-proof reactors. This reality would, by extension, nullify a need for long-term storage and the associated quagmire of the Yucca Mountain site. However, these claims are being made outside the bounds of historical experience with reprocessing or the attendant economic considerations, technical barriers and geo-political realities.

This notion of reprocessing spent nuclear fuel is not a new one. The separation of plutonium and uranium from spent fuel was launched in the 1970's as part of a plan to make breeder reactors the dominant technology by 2000. However, this plan never materialized due to exorbitant costs, unmanageable pollution and the proliferation of weapons useable nuclear materials as well as the unfulfilled promise of waste eradication.

Falling far short of the promised boom, only a handful of reprocessing facilities were ever built and even fewer have been able to remain operational. The only private commercial reprocessing facility to operate in the U.S, West Valley, was such an environmental and fiscal disaster that it was successful in reprocessing only one year's worth of fuel in six years of operation, and the estimated environmental clean up is estimated to eventually cost at least $5.2 billion.[173] Furthermore, the three federal reprocessing facilities which were used to separate plutonium for the U.S. weapons program, the Hanford Reservation in Washington State, Idaho National Laboratories and the Savannah River Site in South Carolina, are often characterized as among the most toxic locales on the planet.

Just as no country has been able to engineer a solution for radioactive waste, no country has been able to safely or economically reprocess waste and achieve a closed-loop fuel cycle. In fact, Japan's Rokkasho reprocessing plant took twelve years to build and cost three times more than estimated to build.[174] A study commissioned by the French government found that reprocessing is indubitably uneconomical, having cost around $25 billion in excess of a typical once-through cycle, and cannot make a even a meager contribution to the reduction of long-lived radionuclides in waste.[175]

THE THREE FACILITIES THAT WERE USED TO REPROCESS SPENT NUCLEAR FUEL IN THE U.S. ARE AMONG THE MOST TOXIC SITES ON THE PLANET

Despite these problems, nuclear proponents still describe reprocessing as "recycling," creating the false impression that 100% of wastes will be turned into reusable fuel, thereby eliminating the storage problem. Similarly, they have claimed that reprocessing will reduce the volume and radioactivity of resultant waste to such a degree as to render the legal capacity proposed for disposal at Yucca Mountain sufficient to solve the waste emergency currently facing the U.S. In actuality, waste storage capacity is determined by heat radiated rather than by volume, rendering this claim totally insubstantial.[176]

However, despite this propaganda, the multiple waste streams involved in closed-loop fuel systems results in total waste volume, including vitrified and intermediate level wastes, in considerably larger amounts than that of the original spent fuel, and still requires long term storage.[177]

Reprocessing and Proliferation

After India's 1974 test of a nuclear weapon derived from commercial reprocessing technology, the U.S. declared a moratorium on commercial reprocessing, citing unjustifiable proliferation risks from the generation of separated plutonium in such quantities. While there has been negligible modification to the fuel separation process, referred to as PUREX, since the Cold War, industry proponents are declaring that new technologies will be proliferation-resistant.

Once plutonium is separated from spent reactor fuel, it loses what experts have termed its "self-protecting" quality, meaning that the significantly lower temperature and radiation dose of separated plutonium allows for it to be safely carried on ones person in an airtight container.[178] Due to the high volume of fuel being handled at reprocessing facilities, it is virtually impossible to account for total plutonium output to within even tens or hundreds of kilograms, making it feasible for stolen plutonium to go undetected for years.[179] This is of concern because a simple nuclear device only requires six kilograms of plutonium, making this uncertainty in stockpile accounting of utmost concern. According to figures released from the International Atomic Energy Agency (IAEA), seizures of illicit radioactive material have doubled over the past four years, with more than 300 incidents worldwide of smugglers being intercepted in that time period.[180]

Recommencing reprocessing in the United States would send a dangerous message to the rest of the world, negating any legitimacy in attempts to bar other countries from operating or obtaining this very technology in the name of non-proliferation.

Industry Claim #8:

Rigid Controls Are in Place and Commercial Reactors Pose Little Risk of Proliferation

The risks of civilian nuclear programs being used for the development of nuclear weapons have been noted since the dawn of the nuclear era. As early as 1946, Robert Oppenheimer speaking about the possibility of the U.S. signing a treaty to abolish nuclear weapons proclaimed that "we know very well what we would do if we signed such a convention: we would not make atomic weapons, at least not to start with, but we would build enormous plants, and we would call them power plants – maybe they would produce power."[181]

There is an inextricable link between nuclear power and nuclear weapons. The technology for producing nuclear fuel is the same technology used to produce nuclear weapons materials. Different levels of proliferation-resistant technologies provide some barriers to proliferation, but there is no proliferation-free nuclear technology and the simple truth is that reprocessing and enrichment activities cannot be safeguarded and international treaty obligations are clearly not enforceable.

NUCLEAR PROLIFERATION HAS BEEN IDENTIFIED BY A UNITED NATIONS HIGH LEVEL PANEL AS THE NUMBER ONE THREAT TO THE INTERNATIONAL COMMUNITY

The associated dangers cannot be overstated. In fact, a high level panel of international experts convened by the United Nations Secretary-General, identified nuclear proliferation as the number one threat to the international community, warning of "a real danger that we could see a cascade of nuclear proliferation in the near future."[182] The panel recommended the implementation of firm and urgent measures to reduce the risk of a nuclear attack, whether by State or non-State actors, and recommended States to "forego the development of domestic uranium enrichment and reprocessing facilities."[183]

Likewise, former Vice-President Al Gore has also expressed his concerns regarding proliferation risks associated with civilian programs: "For eight years in the White House, every weapons-proliferation problem we dealt with was connected to a civilian reactor program. And if we ever got to the point where we wanted to use nuclear reactors to back out a lot of coal -- which is the real issue: coal -- then we'd have to put them in so many places we'd run that proliferation risk right off the reasonability scale."[184]

The cornerstone of the international non-proliferation regime, the Nuclear Non-Proliferation Treaty (NPT), leaves non-nuclear weapons states free to use and develop sensitive technology such as uranium enrichment and spent fuel reprocessing.[185] Article IV of the NPT allows signatories to develop nuclear technology for "peaceful purposes", calling it an "inalienable right." The NPT constitutes a Faustian bargain by which non-nuclear weapons states agree not to develop or acquire nuclear weapons in return for access to nuclear technology. However, the NPT established the right of States parties to withdraw from the Treaty, providing only a 3-month advance notification to the Security Council. Therefore, this regime allows non-nuclear weapons States to benefit from the transfer of sensitive nuclear technology while parties to the Treaty and then withdraw in possession of such technology. North Korea, which withdrew from the Treaty in 2003, is a case in point.

THE NUCLEAR NON-PROLIFERATION TREATY ALLOWS NON-NUCLEAR WEAPONS STATES TO BENEFIT FROM THE TRANSFER OF SENSITIVE NUCLEAR TECHNOLOGY WHILE PARTIES TO THE TREATY, AND THEN WITHDRAW WHEN IN POSSESSION OF SUCH TECHNOLOGY

Nuclear weapons use either enriched uranium or plutonium to create an explosion of huge magnitude, equivalent to thousands of tons of TNT.

Natural uranium must be enriched to increase the concentration of uranium-235 (the isotope essential for nuclear weapons), either in low concentrations to produce low enriched uranium, the fuel for power reactors, or in higher concentrations to produce high enriched uranium that can be used for weapons. The enrichment process constitutes the main barrier to producing weapons grade uranium and as the technology spreads around the world, so does the risk of state and non-state actors to overcome the technical barriers to producing uranium suitable for use in nuclear weapons. Indeed, the A. Q. Khan global proliferation network transferred sensitive nuclear technology to Iran, Libya, and other countries, demonstrating the proliferation risks associated with civilian nuclear programs.

Plutonium exists only in trace amounts in nature and it is generated as a by-product of nuclear reactor operations as part of the spent fuel mix. Under normal operating conditions, reactors produce low concentrations of plutonium-239, the isotope most useful for nuclear weapons. However, even if reactor-grade plutonium is not the most convenient isotope to effectively build a nuclear bomb, it can nevertheless be used to make weapons. According to the DOE, "Virtually any combination of plutonium isotopes…can be used to make a nuclear weapon. […] In short, reactor-grade plutonium is weapons-usable, whether by unsophisticated proliferators or by advanced nuclear weapon states."[186]

Plutonium can be separated from the rest of the reactor spent fuel by a chemical process called reprocessing. This separated plutonium is then mixed with other transuranic waste in a combination called mixed-oxide fuel or MOX. This mix can then be used again in a reactor.

But plutonium is also the preferred material to build a nuclear weapons and thus separating it from the rest of the spent fuel increases the risks of proliferation. While plutonium reprocessing technology is simpler than uranium enrichment (because it involves separating different elements rather than different isotopes of the same element), this process requires highly advanced technology as remote-handling equipment because of the high radioactivity of the spent fuel. In contrast, separated plutonium is not highly radioactive and is an easy target for theft. As noted by the MIT report, "Radiation exposure from spent fuel that is not reprocessed is a strong, but not certain, barrier to theft and misuse."[187]

Some 8 kilograms of reactor grade plutonium are needed to make a bomb, while with weapons-grade plutonium that amount is reduced to 5 kilograms. The International Panel on Fissile Materials, a group of independent nuclear experts from 15 countries, estimates that there are roughly 1,700 tons of highly enriched uranium (HEU) and 500 tons of separated plutonium in the world, enough for more than 100,000 nuclear weapons.[188] Most of the HEU and about half of the plutonium is a legacy of the Cold War nuclear arms race; the other half of the plutonium has been separated from spent nuclear power-reactor fuel - mostly in the U.K., France and Russia. Two other countries, Japan and India, also have commercial reprocessing facilities. The IPFM acknowledges that one of the critical obstacles to reduce these stocks is precisely the uncertainty regarding the amounts of these weapons-grade materials held by various countries.

THERE IS NOW ENOUGH ENRICHED URANIUM AND SEPARATED PLUTONIUM
IN THE WORLD TO MAKE SOME 100,000 NUCLEAR WEAPONS

The planned "nuclear renaissance" raises serious proliferation concerns in an age of terrorism. If 2,000 new nuclear power plants were built over the next several decades, the stockpiles of commercial plutonium would increase to some 20,000 metric tons by 2050, presenting uncalculated proliferation risks.[189] Moreover, the Bush Administration plans to start developing a major international nuclear initiative, the Global Nuclear Energy Partnership (GNEP), which involves the reprocessing of the spent fuel from nuclear reactors and thus the separation of plutonium from other nuclear waste contained in the spent fuel mix. These plans should be regarded with extreme skepticism as they fly in the face of the conventional wisdom, as stated by the British Royal Society, that "the chance that the stocks of [civil] plutonium might, at some stage, be accessed for illicit weapons production is of extreme concern."[190] Likewise, the IPFM, in its recently released report, acknowledged that the growing global stockpile of civilian plutonium separated from power reactor spent fuel is a worsening problem because of the Bush Administration's endorsement of reprocessing as part of the GNEP program, ending 30 years of U.S. opposition to reprocessing because of proliferation concerns.[191]

There are two main proliferation concerns regarding reprocessing and the separation of plutonium. In one hand, reprocessing increases the risk of plutonium being stolen by non-State agents and used for terrorism. On the other hand, States with access to reprocessing technology can use the separated plutonium to develop nuclear weapons in very short time periods.

The recent atomic test by North Korea brought to 9 the number of countries in the nuclear weapons club (U.S., Russia, U.K., China and France are the five recognized nuclear weapons states, and are also the permanent members of the Security Council; India, Pakistan and Israel also possess nuclear weapons and are the only states which were never parties to the NPT). But, as the IAEA' Director's General has restated just recently, it is believed that as many as 40 countries have the capability to produce nuclear weapons.[192]

So how far has the technology spread? Nobody knows for sure, but the British counter intelligence agency identified over 360 private companies, university departments and government organizations in eight countries as having procured goods or technology for use in weapons programs. The MI5 report, entitled "Companies and Organisations of Proliferation Concern", was compiled in an attempt to prevent British companies inadvertently exporting sensitive goods or expertise to organizations covertly involved in weapons of mass destruction programs and identified connections with Iran, Pakistan, India, Israel, Syria and Egypt and the United Arab Emirates.[193]

Dr. ElBaradei, Director General of the International Atomic Energy Agency (IAEA), acknowledged the proliferation risks associated with civilian nuclear technology:

"[C]ontrolling access to nuclear-weapons technology has grown increasingly difficult. The technical barriers to designing weapons and to mastering the processing steps have eroded with time. […]While high-enriched uranium is easier to use in nuclear weapons, most advanced nuclear arsenals favour plutonium, which can be tailored for use in smaller, lighter weapons more suited for missile warheads.

Plutonium is a by-product of nuclear-reactor operation, and separation technology ("reprocessing"), also not proscribed under the NPT, can be applied to extract the plutonium from spent fuel for re-use in electricity production. Under the current regime, therefore, there is nothing illicit in a non-nuclear-weapon state having enrichment or reprocessing technology, or possessing weapon-grade nuclear material. And certain types of bomb-making expertise, unfortunately, are readily available in the open literature.

Should a state with a fully developed fuel-cycle capability decide, for whatever reason, to break away from its non-proliferation commitments, most experts believe it could produce a nuclear weapon within a matter of months. […] Now, with 35-40 countries in the know by some estimates, the margin of security under the current non-proliferation regime is becoming too slim for comfort."

"Towards a Safer World." The Economist. October 16, 2003.

Available at: http://www.iaea.org/NewsCenter/Statements/2003/ebTE20031016.html

Industry Claim #9:

Nuclear Power Contributes to U.S. Energy Independence

Increasing the share of nuclear power in the U.S. energy mix would do nothing to reduce our nation's dependency on foreign sources of oil. The U.S is importing more oil each year – most of it from the world's most unstable regions - increasing the country's economical and political vulnerability and making oil dependency among the largest threats to our economy and national security.

In 2005, the U.S. spent some $250 billion in oil imports, which is about $20 billion per month or $25 million per hour.[194] The U.S. imports almost 60% of the 20 million barrels of oil it consumes daily, and these numbers are projected to go up to 70% by 2025.[195] Moreover, with only 5% of the world's population, and 2% of the world's oil reserves, the U.S. consumes about 25% of global oil production.[196]

As staggering as these numbers may be, they would not be affected by an expanded reliance on nuclear power because only some 3% of the electricity produced in the U.S. is from petroleum.[197] As noted by Former NRC Commissioner Peter Bradford, "Nuclear power's only substantial contribution to oil displacement in the U.S. comes in regions in which natural gas displaced by nuclear power can penetrate further into oil's share of the markets, such as space heating in New England."[198] Indeed, transportation is the sector that accounts for most of U.S. oil consumption - about two-thirds of the country's oil consumption is used by vehicles, which corresponds to roughly 13 millions barrels a day.[199] Thus, possible nuclear power development would not have any influence over these statistics.

Moreover, the nuclear industry portrays nuclear power as a domestic energy source. While most of the uranium originally used in U.S. nuclear plants came from domestic sources, by 2004 over 80 % of the uranium used in domestic reactors came from foreign countries, with 51.8 million pounds being imported.[200] Exporters of uranium to the U.S. include Australia, Canada, Russia, Kazakhstan, Uzbekistan, South Africa and Namibia.

Industry Claim #10:

There Are No Significant Health Impacts From Nuclear Power

The assertion that levels of radiation emitted during normal reactor operations are not a public health threat is essential to industry viability. For years, concerns from the scientific community regarding the carcinogenic qualities and deleterious effects on chromosomes inherent in radiation routinely released from nuclear facilities have been pushed aside and relevant studies downplayed as anecdotal.

However, the body of evidence has mounted to a point which is irrefutable. There is strong evidence published in medical Journals showing elevated cancer clusters around reactors, particularly among children who are most vulnerable to the detrimental effects of radiation on cellular development.[201] In fact, the risk from radiation exposure is now understood to have been initially underestimated by as much as ten to one hundred times.[202]

The U.S. National Academy of Sciences, charged to investigate the dangers of low-energy, has, after years of study, concluded there is no "safe dose" of ionizing low-level radiation, radiation in any amount will have serious cumulative effects of cells.[203] Furthermore, the US Environmental Protection Agency in 2003 officially acknowledged that accepted risk models which used "average humans" (adult males) functioned to diminish the severity of exposure to children under the age of 16, who are three to ten times more vulnerable to than adults to cellular damage from radiation.[204]

The nuclear establishment purports that the science correlating cancer with radiation from nuclear facilities is inconclusive and consistently dismisses statistically significant appearances. However, over the past few decades there have been numerous studies which have enhanced our understanding of the carcinogenic properties of radiation, namely that children and fetuses are exponentially more susceptible to its harmful effects and that low doses can cause serious cumulative effects. In 1990, the National Cancer Institute conducted the only government sponsored study of cancer in areas surrounding nuclear power stations, in which they revealed a significant increase in childhood leukemia in counties closest to reactors in the years after operations began.[205] However, despite these findings, the claim is repeatedly made that the health risks from small amounts of radiation, if any, are low in relative to other health risks.

Nuclear Reactors Release Significant Radiation As a Part of Normal Operation

Even under optimal operating circumstances nuclear plants release radiation into the environment. The NRC acknowledged that 12 people are expected to die as a direct result of routine releases during normal operation from each commercial nuclear reactor that is granted a license extension of 20 years.[206] Thus, just because levels of radiation exposure are permissible under federal regulations does not mean that they are safe. The risk from exposure to radiation allowed at the regulatory limit can induce approximately one cancer in 100 members of the public exposed over a 70 year lifetime. According to the *Federal Register* notice, each re-licensing is expected to be responsible for the release of 14,800 person-rem of radiation during its 20-year life extension.[207] The NRC calculates that this level of radiation release spread over the population will cause 12 cancer deaths per reactor. The Oyster Creek nuclear station consistently ranks among the top ten reactors for airborne emissions of radioactive isotopes (see graphic), but, as far as the NRC is concerned, it is still a strong candidate for a twenty year license extension without remediation measures.

Oyster Creek, New Jersey, Nuclear Reactor
Airborne Emissions of Four Selected Radio-Isotopes (2003)

Isotope	Microcuries	National Rank
Strontium-90	62.3	1st
Strontium-89	6,233	2nd
Barium-140	8,672	2nd
Iodine-131	10,770	9th

Source: U.S. Nuclear Regulatory Commission, Radiation Exposure Information and Reporting System. Available at: http://reirs.com/effluent/EDB_main.asp

Re-Writing History: Industry Denial of the Health Impacts From Three Mile Island and Chernobyl

The nuclear accidents at Chernobyl in 1986 and Three Mile Island in 1979 are the two most significant radiation releases from nuclear reactors. However, as these events recede from public memory, the industry is attempting to rewrite the tragedies into success stories. Using compromised scientific methodology, it is now being claimed that the biological, social and economic impacts were minimal, and that the most significant health impacts from these major releases of radioactivity has been mental stress and paranoia.

A favored tag-line of nuclear proponents in the United States is that no adverse health affects resulted from the accident at Three Mile Island due to sound technology and oversight. However, the only independent analysis correlating specific cancer rates with radiation doses from the radiation plume concluded not only that the accident indeed increased cancer incidence among local population, but also that government reported doses were grossly underestimated.[208] Furthermore, it was shown that people living within the 10 mile radius around the plant experience an increase of 64% in new cancer rates during the years 1981-1985 as compared to pre-accident rates from 1975-1979.[209] However, this particular study team concluded that there was “no-link” between the radiation exposure and cancer, suggesting instead that stress and diagnostic practices could account for such a rise.

FIFTY PERCENT OF UKRAINIAN MEN AGES 13-29 HAVE COMPROMISED FERTILITY
– THE HIGHEST RATE IN THE WORLD -
AND BIRTH DEFECTS IN BELARUS HAVE DOUBLED SINCE 1986

In the explosion of the nuclear reactor at Chernobyl, at least 100 times as much radiation was released as by the two atomic bombs dropped on Hiroshima and Nagasaki combined.[210] Twenty years later, the IAEA released a report outlining the “true scale” of the disaster,[211] in which the agency, an international booster for nuclear power revival, grossly understated impacts to health and the environment in the region, eliciting an outpouring of criticism from the scientific establishment and public health community alike. Among the most contentious conclusions of the report were that total casualties to date were only 50, and that 4000 more people were eventually expected to die as a result from the accident.[212] Moreover, in a supreme statement of condescension and detachment, the report declared that the greatest health impacts were mental, induced by displacement, poverty and “paralyzing fatalism.”[213]

However, in a parallel effort to uncover the health impacts of Chernobyl after twenty years, an independent paper authored by 52 respected scientists in the field and region projected nearly a quarter of a million added cancer cases, with fatalities topping 100,000.[214] Some “true” consequences of Chernobyl include: fifty percent of Ukrainian men ages 13-29 have compromised fertility (the highest rate in the world) and doubled rate of birth defects in Belarus since 1986. [215]

Thus, the transparency of the nuclear establishment is called into question when the international agency responsible for ensuring nuclear technology and management deliberately misrepresents relevant science. Not only is this defense an affront to the memory of many who lost their lives and many more whose suffering continues, but it is made in contradiction to the larger body of scientific study and survivor testimony. Indeed, U.N. Secretary-General Kofi Annan has said that "Chernobyl is a word we would all like to erase from our memory.” But, "more than 7 million of our fellow human beings do not have the luxury of forgetting. They are still suffering, everyday, as a result of what happened." He also stated that the exact number of victims may never be known, but that 3 million children require treatment and "many will die prematurely."[216]

Tritium: A Case Study in Contamination From Nuclear Facilities

As of August 2006, tritium leaks into groundwater have been detected at 19 reactors around the U.S., and experts contend that this is only the tip of the iceberg.[217] In the face of concerned communities and expert testimony to the contrary,[218] the nuclear industry and NRC hold that these unchecked radioactive releases pose no threat to human health or environmental protection. However, many of these leaks were identified after years of drainage and in one case the public was not made aware of a leak of millions of gallons of tritium loaded water which seeped into groundwater, drinking wells and waterways.[219]

A recent report from the NRC revealed that tritium can reach the environment and drinking water supplies undetected through equipment that is not subject to regular inspection and maintenance.[220] In fact, the authors uncovered multiple reasons, from nonexistent regulatory oversight to sub-standard, underground reactor hardware, explaining the recent flood of leak detection.

However, in response to these incendiary findings, the NRC has proposed only voluntary guidelines, claiming that a voluntary initiative spearheaded by the industry lobbying group, NEI, will be sufficient to correct shortcomings and provide for public safety. Because there is no economically feasible way to filter tritium out of aqueous releases from reactors, the NRC has therefore not required any abatement practices or technology from the industry. While the Commission and industry alike maintain that there are no impacts from these unplanned and unmonitored releases, these assertions do not reflect the current body of scientific evidence on the subject or an institutional priority to protect public health from potential dangers. Nuclear utilities repeatedly state that tritium is of the “least harmful” of radioactive particulates present in nuclear fuel and that NRC permissible limits for drinking water are not exceeded, thereby ensuring no potential for harm to the public.[221]

However, tritium has the same chemical behavior as hydrogen, meaning that it readily bonds with oxygen to form radioactive, or tritiated, water, which when ingested is readily absorbed into disparate organs and tissues, spreading radiation throughout the body quickly and effectively. Tritium is unique in that it can cross the placental barrier, exposing fetuses to dangerously high internal doses of radiation[222] and laboratory study has demonstrated significant cellular damage at extremely low doses to be more severe than previously thought.[223]

PROPAGANDA MACHINE:

Misleading polls and pseudo experts

In the last few years, much of the public discourse about nuclear energy has been marked by stepped-up, bold claims by the industry. We hear that nuclear energy is clean, safe and a vital component in the battle against climate change. However, much of this misinformation has gone largely unchallenged in the media and the resulting public discourse has suffered from a lack of intellectual honesty. The U.S. is the world's largest consumer of energy and we need drastic change, but this cannot happen until the issues are discussed and resolved honestly and objectively. Towards that end, this section is an analysis of some of the nuclear proponents and reasons why they should be more carefully questioned and scrutinized.

Clean and Safe Energy Coalition (CASE) and spokesperson

The image of nuclear power understandably suffered from expense, cost over-runs, accidents, the vulnerability to terrorism as well as the unsolved waste problem. One of the industry responses to these serious problems has been to launch public relations campaigns aimed at greening their image and obfuscating the facts.

"To that end the Nuclear Energy Institute, with the help of Hill & Knowlton, formed something called the Clean and Safe Energy Coalition. To co-chair it the institute hired a pair of environmental consultants, a duet to sing pro-nuclear songs. Christine Todd Whitman, of Whitman Strategy Group (which "can help businesses to successfully interact with government to further their goals," according to its Web site), and Patrick Moore, of Greenspirit Strategies, were hired for their résumés: Whitman, a former New Jersey governor, is known as the outdoorsy and moderate Republican who ran the Environmental Protection Agency for two years under George W. Bush; Moore was a cofounder of Greenpeace in the 1970s. Part of the thinking, surely, was that the press would peg them as dedicated environmentalists who have turned into pro-nuke cheerleaders, rather than as paid spokespeople."[224]

IT IS MADDENING THAT HILL & KNOWLTON, WHICH HAS AN $8 MILLION ACCOUNT WITH THE NUCLEAR INDUSTRY, SHOULD HAVE SUCH AN EASY TIME WORKING THE PRESS

The effort had been successful. "*The Washington Post* quite properly noted in the bio box of an op-ed by Moore on April 16 — going nuclear; a green makes the case — that he and Whitman co-chair a nuclear-industry-funded effort. But in a May 25 article the Post simply referred to Moore as an "environmentalist" and a cofounder of Greenpeace — without mentioning any industry ties. *The Boston Globe* ran a Whitman/Moore op-ed on May 15, identifying them as "co-chairs of the Clean and Safe Industry Coalition" without giving readers a clue to what that coalition is. And in some stories, columns, and editorials, the *San Francisco Chronicle*, the *Boston Herald*, the *Baltimore Sun*, the *Richmond Times-Dispatch*, the *Rocky Mountain News*, *The New York Times*, and CBS News all referred to Moore as either a Greenpeace founder or an environmentalist, without mentioning that he is also a paid spokesman for the nuclear industry."[225]

According to the Columbia Journalism Review it is "maddening that Hill & Knowlton, which has an $8 million account with the nuclear industry, should have such an easy time working the press."[226] Therefore, given the obvious industry hand in this propaganda, it is clear that the issue of who is speaking and what they are saying in this discourse deserves greater scrutiny.

Patrick Moore was on board the inaugural Greenpeace voyage, and he went on to serve as president of Greenpeace from 1977 to 1979 and as a member of the international board for seven years after that. This environmental background has enabled the nuclear industry to position Mr. Moore as a symbol of wide environmentalist support for nuclear energy.

The media has been led to refer to Patrick Moore as the Greenpeace co-founder turned pro-nuclear advocate, crediting him as an environmentalist representing an independent perspective. But Mr. Moore left Greenpeace more than 20 years ago and has since apparently undergone a radical transformation of thought:

In 1976: "Nuclear power plants are, next to nuclear warheads themselves, the most dangerous devices that man has ever created. Their construction and proliferation is the most irresponsible, in fact the most criminal, act ever to have taken place on the planet."[227]

Now: "Nuclear energy is actually, if you look at the statistics, one of the safest industries in this world, and it also is one of the cleanest industries in this world, in that it does not release greenhouse gases."[228]

Such a radical change in thought deserves some analysis of a speaker's motivation. Thus, it is important to look at what Moore has been saying and doing. Since leaving Greenpeace in 1986, Mr. Moore has been the front man for several public relations campaigns under the mantle of dedicated environmentalism. In 1991, Mr. Moore was hired as a full-time paid director and spokesperson for the British Columbia Forest Alliance.[229] However, the Alliance was set up as a front group for timber companies as part of a pro-logging media strategy, and Moore admitted that most of the Alliance's budget, some $2 million annually, came from the forest industry.[230]

In 1991, Mr. Moore created Greenspirit Strategies, a consultancy firm "focusing on environmental policy and communications in natural resources, biodiversity, energy and climate change."[231] While Moore admits he is very well paid for his speaking and consulting services, he declines to disclose any specific amounts.[232] Thus, Moore should not be simply presented as a Greenpeace co-founder and environmentalist without any reference to his paid post with the nuclear industry. In a world of ever more sophisticated spin strategies, responsible media should do better.

Public Opinion Polling

Public opinion polls proffered by the nuclear industry show strong support for nuclear power. One recent poll suggests that a large majority of Americans agree that nuclear power will play an important role in meeting future electricity demand and agree with the construction of new reactors (86% and 73%, respectively, in the 2006 poll).[233]

However, these findings come from Bisconi Research, Inc. (BRi), which is run by a previous vice president of the Nuclear Energy Institute for 13 years, who is also a member of the Board of Directors of the American Nuclear Society.[234] Therefore, at a minimum, these affiliations should be noted by responsible media when referring to this polling.

Indeed, some of the surveys commissioned by media organizations and independent research centers reveal support for nuclear power, but with less expressive or extreme figures than the ones reached by BRi. A poll by Bloomberg/Los Angeles Times concluded that 61% of Americans support nuclear power as a source of energy in order to prevent global warming,[235] and a survey by Opinion Dynamics/Fox News showed that 47% of respondents favor building more nuclear power plants, while 43% oppose it.

Meanwhile, the greater body of public opinion polls show strong opposition to nuclear power:

- Recent polling conducted by Yale University found that 86% of Americans support greater funding for renewable energy research and development and only 36% favor constructing new nuclear power plants.[236]
- A poll conducted by ABC News/Washington Post in June 2005 shows that 64% of Americans oppose the building of more nuclear power plants.[237]
- A survey by the Los Angeles Times/Bloomberg from August 2006 shows that 52% of Americans believe that alternative energy sources are a better option when it comes to reducing American dependence on foreign fossil fuels - only 6% preferred nuclear power.[238]
- A 1999 poll on the benefits of science and technology concluded that nuclear weapons and nuclear power are the only scientific advances the American public does not embrace.[239]

- In 2005, most Americans (53%) opposed the government promoting the increased use of nuclear power.[240] And, in February 2006, nuclear energy remained a relatively unpopular option (only 44% of support) with a large majority of respondents favoring improved fuel efficiency for cars and trucks (86%), increased federal funding for research on wind, solar and hydrogen technology (82%), and tax cuts to energy companies conducting research on these alternative energy sources (78%).[241]

- Even an IAEA report commissioned in 2005 shows that 49% of Americans are against the building of new nuclear plants compared to 40% who are in favor. The percentage of people against new nuclear power plants rises to 59% when analyzing the cumulative data from the 18 different countries involved in the survey.[242]

CONCLUSION

Our energy crisis is real, and we need a paradigm shift with an aggressive and rapid transition to sustainable energy. The barriers to this transition are largely political, not technological, and can be overcome. Indeed, failure to make the transformation to clean, safe, renewable energy sources would leave an inexcusable legacy for future generations.

Therefore, misleading nuclear industry propaganda, coupled with aggressive lobbying, is resulting in an enormous disservice to the public good because it impedes our nation's (and the world's) ability to address global warming. Quite simply, the proposed "nuclear renaissance" would divert precious resources from cheaper, faster solutions into a technology that has proliferation, terrorism, public safety and environmental concerns *of unparalleled consequence*.

Notes

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GRACE Energy Initiative promotes renewable energy, distributed generation, conservation and efficiency programs and the reforms necessary for effective solutions to our energy crisis. To accomplish real energy independence for the United States we advocate freedom from nuclear and fossil fuels and healthy, responsible, community based solutions to energy demand.

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