TOP 10 REASONS NUKES WON'T SAVE CLIMATE

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Despite the nuclear industry's lavishly-funded propaganda, which claims that nuclear power is at least a partial solution to the climate crisis, there are plenty of reasons why nuclear power cannot, should not and ultimately will not be part of a climate change solution.

For all its other shortcomings, at least the House-passed Waxman-Markey ACES climate bill recognized this, and offered little for nuclear power other than the benefits a price on carbon provides to any low-carbon electricity source. But as the Senate prepares to take on its climate bill, there is substantial industry pressure for still more taxpayer giveaways to the nuclear power industry, ostensibly as a means to bring some more conservative Senators over to vote for a final bill.

Leaving aside the politics for a moment—and those Senators who most want more nuclear subsidies aren't going to vote for a climate bill anyway—anyone seriously concerned about climate needs to understand that not only would nuclear power not be helpful at addressing the climate crisis, it would be counterproductive.

Back in 1989, I wrote in the *Multinational Monitor*, "To the nuclear industry, the greenhouse effect is a godsend....the industry is counting on concern over the greenhouse effect for its resurrection."

I'm not saying that now because I was so smart back then, but because if I could figure it out, so could the nuclear industry. And it took them a while—which is understandable since all nuclear utilities are also coal-burning utilities that would prefer to ignore the reality of climate change—but they've finally caught on. But for the utilities and industry backers, climate is an *excuse* to build nuclear, not a meaningful effort to address climate. They know it's not a solution, not that they've ever cared so much about a solution anyway. The reality is, nuclear power is not going to solve the climate crisis, nor even play a role in solving the climate crisis.

Cutting to the chase, here are the top 10 reasons nuclear power can't and won't save the climate:

10. Takes Too Many

9. Too Little Infrastructure

8. Too Little Safety

7. Too Much Waste

6. Too Much Carbon

5. Too Much Emissions
4. Not Suited For Warming Climates
3. Too Slow
2. Renewables and Efficiency are Faster, Cheaper, Safer and Cleaner
1. Too Expensive

OK, this is a long diary, and I apologize, but there's a lot to cover. For those with shorter attention spans, here's a powerpoint that covers many of these issues.

10. Takes Too Many.
50 million Elvis fans couldn't be wrong, nor can the unanimous conclusions of studies by entities like MIT and the Commission on Energy Policy, which agree that it would take 1500-2,000 new nuclear reactors or more by mid-century, 300-400 in the U.S. alone, to make any kind of meaningful reduction in carbon emissions—by meaningful, I mean even a 20% reduction.

Globally, that's about one new reactor per week from now til mid-century. For the U.S. alone, that would be nearly a reactor a month from now til 2050. Can't be done.

First, let's look at the U.S. There are no reactors currently under construction, and no reactors have even received a construction license from the NRC. At best (for the industry), some utility might get a license by 2012. Then add another 6-8-10 years for construction. So we're already that far behind schedule, which means a reactor would have to be built every 2-3 weeks in the U.S. from about 2018-2020 until mid-century. Not likely.

Even then, the first 100 or so reactors would only replace the existing 104 reactors which will be retiring between 2020 and 2050, and which will virtually all be retired by then. Net carbon reductions=0.

The same holds true internationally. There is no chance 1500 or more new reactors will or can be built by mid-century, and the first 440 would only go to replacing the power from the existing 440. Why can't they be built so fast? Because right now, there is little global infrastructure to support building new reactors.

9. Too Little Infrastructure.
In fact, the current global capability is 8 reactors per year—which is far more than are actually being built, by the way. Only Japan Steel Works can forge the enormous reactor pressure vessels nuclear power requires. Yes, Russia has a facility and China is building one and may even have it online now, but really, few outside Russia want to buy Russian nukes, and China—if it keeps to its own construction plans, which is itself unlikely—wouldn't be able to export any reactors anyway.

So, let's see, 8 reactors per year times 40 years equals 320 reactors. We'll even add in a few Russian and a couple dozen Chinese reactors. Not even close to a meaningful reduction in carbon emissions.

Sure, more large-scale forging facilities could be built over the coming decades, but who's going to put up that kind of money—these factories aren't cheap after all, nearly as expensive as a reactor itself—without firm commitments for purchases for more than a handful of reactors? So far, those firm commitments don't exist.

At most, nuclear might be able to replace itself, but right now the infrastructure doesn't even exist to do that.

The infrastructure that is lacking extends far beyond the ability to forge reactor pressure vessels. There is also a shortage—not surprising since there hasn't been a new reactor built in the U.S. in 30 years, and only a handful have been built worldwide—of skilled operators, welders, machinists and others necessary to actually build and run a reactor.

8. Too Little Safety.
The reactors being proposed for the U.S. right now, as well as for the rest of the world, are merely slight modifications to the same type of nuclear reactors that operate now across the world. In other words, they're roughly the difference between a 1979 Ford LTD and a 2009 Ford Fusion. Yeah, the newer cars are better and probably safer, but people still die every day on the highways.

You've heard about "inherently safe" or "Generation IV" reactor designs? Probably so. But not a single reactor being seriously proposed anywhere in the world even claims to be an "inherently safe" design—not that any such thing exists anyway. Nor are "Generation IV" designs even within a decade of commercial deployment.

The reality is that reactor design—at least for those planned by nuclear utilities—has progressed remarkably little since the 1960s. The basic concept—Pressurized Water Reactor or Boiling Water Reactor—is the same, and so is the same reliance on too many valves, pumps, and other types of plumbing that can break. But unlike in your home, where you may lose a sink or toilet, when the plumbing in a nuclear reactor breaks, you can lose your entire state.

7. Too Much Waste.
No country in the world yet has a permanent solution for radioactive waste (and no, you pro-nukers, Sweden only has a proposal, which is being fought by environmentalists who think—rightly—that it is just plain stupid to dump waste where it can leak into the North Sea).

President Obama has essentially ended the proposed Yucca Mountain radioactive waste dump in Nevada, which has been pilloried by environmentalists because it would basically be a sieve allowing radiation to escape for millions of years. Indeed, by the end of the Yucca Mountain project, even Bush's Department of Energy had to admit that the steel casks that would hold the waste would provide 99+% of the protection to the public—Yucca Mountain itself would provide virtually no protection. Well, if that were the case, we could just pile up the steel casks on the White House lawn, no problem. That didn't seem like a good idea to President Bush, and doesn't to President Obama either. But at least Obama has had the strength to move on.....

Not only do we not have a place for the high-level waste from reactors, we don't even have a place for the lethal Class B and C "low-level" radioactive waste. That's why contentions to this effect have been accepted for hearing by NRC licensing boards in about 10 new reactor licensing cases. No nuclear utility has figured out what to do with this waste.

Meanwhile, if we actually embarked on the kind of nuclear construction program needed to address climate change—3-400 new reactors in the U.S., 1500-2000 worldwide, we'd need to come up with a new Yucca Mountain every five years or so. Since we can't find even one, odds are we won't come up with one every five years.

The nuclear industry's apparent answer to the waste problem is reprocessing, an expensive, dirty and dangerous technology that failed miserably in the U.S. in the 1960s, at West Valley, NY. The bill to clean up the mess from that experiment 40 years ago is now estimated at $10 billion. France's reprocessing facility on the Normandy coast releases so much radiation into the Atlantic that most neighboring countries have asked France to end its reprocessing program. About 10 years ago, the Normandy beaches were closed during the summer season because of high radiation levels along the coast—Greenpeace measured levels in the water at some 17 million times above background. It's worth noting that France's reprocessing program hasn't solved the country's waste problem—the nation is still seeking a permanent waste dump, but has encountered substantial citizen opposition at every site it has examined.

6. Too Much Carbon.

The nuclear industry loves to tell you that nuclear power is carbon-free. Well, except when it's not. And it isn't.

It's true that nuclear reactors themselves emit only small amounts of carbon (although the carbon they do emit is radioactive). But the nuclear fuel chain necessary to supply the reactors with fuel is not nearly so carbon-friendly. In fact, the mining, milling, processing, enrichment and fuel fabrication of uranium, not to mention the construction of enormous reactors made of concrete, steel, and the millions of gallons of gasoline involved, leaves a fairly significant carbon footprint.

Exactly how large that footprint is remains a matter of debate. Probably the best study done on the issue comes from a Virginia Tech professor, Benjamin Sovacool, who concludes that while nuclear power is indeed a low-carbon energy source, its carbon footprint is about three times the size of alternatives like wind power, and much higher than the low-hanging fruit of energy efficiency.

5. Too Much Emissions.
The nuclear industry likes to talk about "emissions-free" nuclear power. Wrong! Ding! Not Even Close! In fact, every nuclear reactor—and every nuclear facility of any kind—emits radioactive elements into our air and water on a daily basis, even when everything goes right.

When things go wrong, the emissions go up, as they have with radioactive tritium leaks at numerous reactors over the last several years, or as they did, for example, at the Pilgrim reactor in the 1970s, which the Massachusetts Department of Public Health concluded caused cancers among the local population.

For the past several decades, the National Academy of Sciences has done studies trying to determine exactly how dangerous exposure to radiation is. Every time they have done a new study, the "safe" level has gone down. Finally, in 2006, the NAS concluded that there is no such thing as a safe level of radiation exposure.

4. Not Suited for Warming Climates.
Reactors require large amounts of water for cooling. Reactors situated on rivers or lakes may not be able to obtain sufficient cold water to allow adequate cooling. This is not a hypothetical point. During the European heat wave of 2005, which killed thousands of people, most French reactors—those using rivers as their water source—were forced to close at the exact time their electricity was most needed to power air conditioning and electric fans.

Nor has the U.S. been exempt from such reactor shutdowns. As far back as 1988, the Byron reactors in Illinois were forced to close because of high water temperatures. Last year, Browns Ferry-1 in Alabama had to close for similar reasons.

As climate change heats our water, nuclear power stations will close more and more frequently. In addition, more water fights among jurisdictions can be expected in coming years. The two largest users of water in the U.S. are agriculture and electricity production, and nuclear uses more water per megawatt of power produced than any other electricity source. Scarce water supplies will result in added pressure to produce electricity with the least possible effect on those water supplies.

Meanwhile, reactors situated on oceans, especially on low-lying areas, may find themselves *under* water, instead of using water, as climate change accelerates sea level rise.

3. Too Slow.
Climate scientists agree that we have a short time—maybe 10 years or so—to turn around our existing situation and take real steps to reduce our carbon emissions. That means taking the most effective, lowest-cost measures as soon as possible.

Yet, as noted above, at most there would be a small handful of new reactors in the U.S. within 10 years, and it's just as likely there will be none. Even the industry's Nuclear

Energy Institute predicts only about 4 new reactors in the US by 2020. Neither scenario does anything for climate.

In contrast, energy efficiency measures can be implemented very quickly; average-sized wind farms take only a year or two to build, compared to 10 years or so for reactors; solar photovoltaics can be installed as fast as the panels can be manufactured.

Nuclear power is merely masquerading as a climate solution; it has no real potential to mitigate our climate problem in the time frame needed.

2. Renewables and Efficiency are Faster, Cheaper, Cleaner and Safer.
Energy efficiency is the low-hanging fruit. The U.S. is half as efficient as the European Union, which is half as efficient as Japan. We have a long ways to go. Fortunately, most energy innovation is on the efficiency side, and it's making an impact.

The lead story in the *Wall Street Journal* on Wednesday (August 12, 2009) reported that electricity demand has fallen 4.4% so far this year in the nation's largest wholesale power market. That's on the heels of a 2.7% drop in 2008 from 2007. There have only been five years since 1950 in which electricity demand has dropped, and never since then has demand dropped two years in a row. Some of the demand drop is, of course, due to the recession. But that doesn't explain the entire drop. On November 21, 2008 the *Journal* puzzled over the drop in demand at that time. It reported, for example, that Excel Energy saw home energy use drop by 3% from August to September 2008. Duke Power saw demand in the Midwest drop 5.9% from third-quarter 2007 to 2008, including a 9% drop among residential users. Other utilities reported similar drops.

Factory drops in electricity use could be expected in a recession. Home energy declines? Not likely absent other factors. And those other factors are federal and state energy efficiency programs, increased energy efficiency of appliances and increased awareness among people that electricity use can be cut down without sacrificing comfort or convenience.

In short, energy efficiency programs are beginning to work. Where I live, in Maryland, the state has a goal of cutting energy use by 15% by 2020. I bet we'll exceed that goal. And what does that mean for a massively-large new reactor proposed for Maryland? It means that, if built, it likely won't have a market for its expensive electricity.

And that's before renewables enter the equation. 20-30 years ago, renewables weren't ready for prime time. They were expensive, intermittent, and reliant on government handouts. Now, they are reliable, cheaper than nuclear power, and being installed in increasing quantities across the globe.

In 2008, for example, according to Clean Edge Research, 27,000 Megawatts of new wind power was installed worldwide, or the equivalent of about 27 large nuclear reactors. Nuclear's new installation in 2008? A big fat Zero. By the way, 8,000 of those wind

Megawatts were installed in the U.S., meaning that the U.S. has now surpassed Germany as the nation with the most wind power.

Meanwhile, the Department of the Interior issued a report earlier this year that said offshore wind potential, just off the mid-and north-Atlantic coast of the U.S., could supply 25% of the entire electricity needs of the U.S. Add that to a Department of Energy report from 20 years ago that said wind power in South Dakota alone could supply 100% of our needs, and you quickly get an idea of the potential of wind power.

How about solar power? David Freeman, former chief of the Tennessee Valley Authority, says in his book, *"Winning Our Energy Independence: An Energy Insider Shows How,"* that we could power the entire U.S. on just 7% of the available above-ground potential of solar photovoltaics. By above-ground, he means rooftops and parking lots. Think of how much space is used in the U.S. by parking lots, and how much of it could have solar panels above it—keeping cars cool and generating electricity (and, by the way, a great source of power for plug-in hybrids and other electric vehicles). The US Navy generates 750KW of electricity from solar photovoltaics on just a portion of a parking lot in San Diego; you can see a photo of it on page 27 of this powerpoint.

But solar power is not limited to photovoltaics; solar thermal power provides "baseload" power for electricity generation. *The Wall Street Journal* reported on August 6, 2009 that entrepreneurs in Spain are building 4300 Megawatts—about 4 large nuclear reactors worth—of solar thermal electricity.

It’s expensive—about $5,200/kw installed. Well, that would be expensive for wind or natural gas. It’s actually about $2,000/kw cheaper than new nuclear.....

Which leads us into the foremost of the top 10 reasons nuclear can’t save climate...

1. Too Expensive.
Nuclear power is now so expensive that if we tried to use it as a climate mitigation strategy, we would blow through our resources and be left with no options whatsoever. And for all the reasons above, nuclear power won’t work.

Even back in early 2007, when banks would give money for a mortgage to anyone who could walk through the door, the large investment banks wrote to the Department of Energy and said they would not be willing to loan money for new nuclear reactors unless the taxpayers guaranteed the loans. In other words, the nation’s largest investment banks thought nuclear power was so risky—riskier than every other kind of derivative-based loan they were making back then---that they simply wouldn’t put up the money unless the taxpayers took the risk.

Congress and the Bush administration, of course, bought into that. In the 2005 Energy Policy Act they had approved the concept of taxpayer loan guarantees for new reactors. And in December 2007, after a fight in which environmentalists succeeded in knocking down the Bush administration's $50 billion loan guarantee request to $18.5 billion, Congress funded the program.

But $18.5 billion doesn't buy what it used to—at least when it comes to nuclear reactors. Waaaay back, all the way back to early 2006, the Nuclear Energy Institute had on its website a paper that declared new nuclear reactors would cost about $2,000/kw initially (about $2 billion for an average large reactor), going down to about $1500/kw over time. That document is, of course, no longer available on their website.

Why? Because nuclear construction cost estimates—now that they're no longer based on industry wishful thinking and utilities have actually been forced to try to calculate them—have skyrocketed and are now running three and four times that NEI estimate of just three years ago.

Consider: in recent testimony before the Maryland Public Service Commission, Constellation Energy chief Mayo Shattuck admitted their proposed Calvert Cliffs-3 reactor from the French firm Areva would cost $10 Billion. Canada recently ended plans to build new reactors upon receiving bids from Areva (which based its bid on Calvert Cliffs-3) of $23 billion for two reactors. The Pennsylvania utility PPL estimates a single new AREVA reactor at $15 billion on its website.

Other reactor designs aren't much cheaper. And some reactor designs, like General Electric's Advanced Simplified Boiling Water Reactor, are so far from prime-time that no utility is even pursuing it anymore. So much for the only U.S. company still in the nuclear manufacturing arena.

In fact, both Moody's and Standard and Poor's place new reactor costs in the realm of $7,000-$7,500/kw, or about $2,000 more per kilowatt than it costs to build new solar thermal plants; two to three times the cost of new wind power, and about seven times the cost of energy efficiency measures.

Here's how to put such enormous costs in context: a recent study by Marc Cooper, Senior Fellow for Economic Analysis at University of Vermont's Law School, found that the U.S. would save $1.9 to $4 *TRILLION* over the lifetime of the plants by using renewables and efficiency over building 100 new reactors. That's serious money.

Pro-nuclear folks sometimes argue that nuclear power is the only low-carbon baseload electricity source and thus, no matter what it costs, we have to use it to deal with climate change.

But there are two basic problems with this argument.

The first is that, as Spain is proving, solar thermal IS baseload power—their plants, which store heat in molten sodium, will run 24/7, which is anyone's idea of baseload power.

More fundamentally, however, the entire concept of "baseload" power needs to be re-examined.

What we need is electricity when we need it—when we flick the light switch, when we turn on the computer, as well as to make sure the fridge keeps running.

How we get that electricity—well, none of our appliances cares in the least.

Those who argue we need "baseload" power are really acknowledging that they don't understand the future of electric power in the U.S. and across the globe. They believe only behemoth power plants, nuclear or coal, can supply our electricity needs. Sorry, but that if that ever was the case—and perhaps it was—it isn't any longer.

The future, and it is moving here faster than many realize, is smaller-scale generation—distributed generation—with smart grids that help regulate electricity use and switch back and forth between solar and wind, depending on which is providing power at any given time (and nearly always either solar or wind is producing power)and a little natural gas for the rare times that both are down. Add to those resources like geothermal in some areas, and further on, electricity produced by more exotic fuels, such as micro algae. Venice, Italy is building such a plant now that will ultimately provide half their region's electrical needs. That is the electricity grid of the future. And that future is closer than many seem to realize.

Take a train through northern Germany, as I did in 2002, and you'll see that just about every small city has about 5-9 windmills outside it, producing power. Combine that power with solar photovoltaics, and these towns are just about self-sufficient in producing electricity. Combine that on a national level, and you quickly realize that the only areas that need extra power are the large cities. That's where larger wind farms and solar thermal power comes in. That's true in Germany, and what is most striking about Germany—which is the most solar-powered nation on Earth—is that if you look at a solar potential map, its potential is the same as that for Alaska. In other words, Germany has among the lowest solar resources on the planet, and yet it receives a greater portion of its electricity from solar than any other country.

The US could do far, far better. Some will argue that solar power in Germany is heavily subsidized, and that has been true. On the other hand, Germany was trying to jumpstart an industry, and has done so successfully, while the nuclear industry already has existed for more than 50 years, and still can't bring its costs down to a manageable level.

And the potential for wind power and solar power, not to mention energy efficiency, in the US is so great, that every dollar we spend on nuclear power is counterproductive at reducing carbon emissions. That's because the emissions reductions are so much greater with renewable and efficiency that the dollar spent on nukes is wasted. It gets us nowhere. Really, for all it accomplishes, it might as well be spent on coal. And we know we don't want to spend any more money on coal.

The choice is not nuclear vs coal. If it were, we'd all be losers. Fortunately, our choices are much better than that. We don't want or need coal and its carbon emissions and mountain top removal. Likewise, we don't need nuclear meltdowns or radioactive waste, or to live in fear of terrorists targeting nuclear power plants. We just need electricity. And that we can provide.

If reducing carbon emissions is our goal—and it should be--then we need to keep nuclear power out of the climate bill. If you agree, then please go here to send a letter to your Senators. Don't be shy, more than 7500 letters already have been sent. By taking action now, you'll be doing your part to bring about the clean, safe, cost-effective energy future we all need and want.

You can also sign a simple statement on nuclear power and climate here. It says: *"We do not support construction of new nuclear reactors as a means of addressing the climate crisis. Available renewable energy and energy efficiency technologies are faster, cheaper, safer and cleaner strategies for reducing greenhouse emissions than nuclear power."*

These are only the top 10 reasons to shun nuclear power; we didn't even get into many other issues like nuclear proliferation, security from terrorist attack, the health effects to miners and environmental destruction caused by uranium mining, and so forth.

But don't just take my word for all this. Here are a few background readings that will be of interest if you've gotten this far:

Carbon-Free, Nuclear-Free: A Roadmap for U.S. Energy Policy(you can download the entire book here, for free).

Energy [r]evolution: A Sustainable USA, a report prepared for Greenpeace International by the German Aerospace Center (German counterpart to NASA).

The Nuclear Illusion, from Rocky Mountain Institute (Amory Lovins and Imran Sheikh)

Review of Solutions to Global Warming, Air Pollution, and Energy Security, by Mark Z. Jacobson, Stanford University

Nuclear Power, Climate Policy and Sustainability, An Assessment by the Austrian Nuclear Advisory Board