Bulletin of the Atomic Scientists

COLUMNISTS (/FEATURE-TYPE/COLUMNISTS)

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Thorium: the wonder fuel that wasn't

Robert Alvarez

"Thorium-Fueled Automobile Engine Needs Refueling Once a Century (http://www.industrytap.com/thorium-fueled-automobile-engine-needs-refueling-once-a-century/15649)," reads the headline of an October 2013 story in an online trade publication. This fantastic promise is just one part of a modern boomlet in enthusiasm about the energy potential of thorium, a radioactive element that is far more abundant than uranium. Thorium promoters (http://energyfromthorium.com/thorium/) consistently extol its supposed advantages over uranium. News outlets periodically foresee the possibility of "a cheaper, more efficient, and safer form of nuclear power (http://www.csmonitor.com/Environment/Energy-Voices/2014/0328/Thorium-a-safer-nuclear-power) that produces less nuclear waste than today's uranium-based technology."

(/bio/robert-alvarez)

ROBERT ALVAREZ (/BIO/ROBERT-ALVAREZ)

A senior scholar at the Institute for Policy Studies, Robert Alvarez served as senior policy adviser to the Energy Department's secretary and deputy assistant secretary for national security and...

More (/bio/robert-alvarez)

Actually, though, the United States has tried to develop thorium as an energy source for some 50 years and is still struggling to deal with the legacy of those attempts. In addition to the billions of dollars it spent, mostly fruitlessly, to develop thorium fuels, the US government will have to spend billions more, at numerous federal nuclear sites, to deal with the wastes produced by those efforts. And America's energy-from-thorium quest now faces an ignominious conclusion: The US Energy Department appears to have lost track of 96 kilograms of uranium 233, a fissile material made from thorium that can be fashioned into a bomb, and is battling the state of Nevada over the proposed dumping of nearly a ton of left-over fissile materials in a government landfill, in apparent violation of international standards.

Early thorium optimism. The energy potential of the element thorium was discovered in 1940 at the University of California at Berkeley, during the very early days of the US nuclear weapons program. Although thorium atoms do not split, researchers found that they will absorb neutrons when irradiated. After that a small fraction of the thorium then transmutes into a fissionable material—uranium 233—that does undergo fission and can therefore be used in a reactor or bomb.

By the early 1960's, the US Atomic Energy Commission (AEC) had established a major thorium fuel research and development program, spurring utilities to build thorium-fueled reactors. Back then, the AEC was projecting that some 1,000 nuclear power reactors would dot the American landscape by the end of the 20th century, with a similar nuclear capacity abroad. As a result, the official reasoning held, world uranium

supplies would be rapidly exhausted, and reactors that ran on the more-plentiful thorium would be needed.

With the strong endorsement of a congressionally created body, the Joint Committee on Atomic Energy, the United States began a major effort in the early 1960s to fund a two-track research and development effort for a new generation of reactors that would make any uranium shortage irrelevant by producing more fissile material fuel than they consumed.

The first track was development of plutonium-fueled "breeder" reactors, which held the promise of producing electricity and 30 percent more fuel than they consumed. This effort collapsed in the United States in the early 1980's because of cost and proliferation concerns and technological problems. (The plutonium "fast" reactor program (http://energy.gov/sites/prod/files/2014/04/f14/Volume%203.pdf) has been able to stay alive and still receives hefty sums as part of the Energy Department's nuclear research and development portfolio.)

The second track—now largely forgotten—was based on thorium-fueled reactors. This option was attractive because thorium is far more abundant than uranium and holds the potential for producing an even larger amount of uranium 233 in reactors designed specifically for that purpose. In pursuing this track, the government produced a large amount of uranium 233, mainly at weapons production reactors. Approximately two tons of uranium 233 was produced (http://www.beyondnuclear.org/storage/reactors/thorium/Alvarez%20SGS%20U-233%20-1.pdf), at an estimated total cost of $5.5 to $11 billion (2012 dollars), including associated cleanup costs.

The federal government established research and development projects to demonstrate the viability of uranium 233 breeder reactors in Minnesota, Tennessee, and Pennsylvania. By 1977, however, the government abandoned pursuit of the thorium fuel cycle in favor of plutonium-fueled breeders, leading to dissent in the ranks of the AEC. Alvin Weinberg, the long-time director of the Oak Ridge National Laboratory, was, in large part, fired because of his support of thorium over plutonium fuel (http://www.oakridger.com/article/20131217/NEWS/131219922?template=printart).

By the late 1980's, after several failed attempts to use it commercially, the US nuclear power industry also walked away from thorium. The first commercial nuclear plant to use thorium was Indian Point Unit I, a pressurized water reactor near New York City that began operation in 1962. Attempts to recover uranium 233 from its irradiated thorium fuel were described, however, as a "financial disaster." (http://www.osti.gov/scitech/servlets/purl/5080081) The last serious attempt to use thorium in a commercial reactor was at the Fort St. Vrain plant in Colorado, which closed in 1989 after 10 years and hundreds of equipment failures, leaks, and fuel failures. There were four failed commercial thorium ventures (http://www.beyondnuclear.org/storage/reactors/thorium/Alvarez%20SGS%20U-233%20-1.pdf); prior agreement makes the US government responsible for their wastes.

Where is the missing uranium 233? As it turned out, of course, the Atomic Energy Commission's prediction of future nuclear capacity was off by an order of magnitude—the US nuclear fleet topped out at about 100, rather than 1,000 reactors—and the predicted uranium shortage never occurred. America's experience with

thorium fuels faded from public memory until 1996. Then, an Energy Department safety investigation found a national repository for uranium 233 in a building constructed in 1943 at the Oak Ridge National Laboratory. The repository was in dreadful condition; investigators reported an environmental release from a large fraction of the 1,100 containers "could be expected to occur within the next five years in that some of the packages are approaching 30 years of age and have not been regularly inspected." The Energy Department later concluded (http://www.beyondnuclear.org/storage/reactors/thorium/Alvarez%20SGS%20U-233%20-1.pdf) that the building had "deteriorated beyond cost-effective repair. Significant annual costs would be incurred to satisfy current DOE storage standards, and to provide continued protection against potential nuclear criticality accidents or theft of the material."

The neglect extended beyond the repository and storage containers; the government had also failed to keep proper track of its stores of uranium 233, officially classified as a Category I strategic special nuclear material (https://www.directives.doe.gov/directives-documents/5632.1-DManual-c-1c1) that requires stringent security measures to prevent "an unauthorized opportunity to initiate or credibly threaten to initiate a nuclear dispersal or detonation."

A 1996 audit by the Energy Department's inspector general reported that the Oak Ridge National Laboratory, the Rocky Flats nuclear weapons facility, and the Idaho National Laboratory "had not performed all required physical inventories ... the longer complete physical inventories are delayed, the greater the risk that unauthorized movement of special nuclear materials could occur and go undetected." The amounts of uranium 233 that the Oak Ridge and Idaho national labs have reported in their inventories has significantly varied. Based on a review of Energy Department data, there appears to be an inventory discrepancy; 96 kilograms or 6 percent of the U-233 produced is not accounted for (http://www.beyondnuclear.org/storage/reactors/thorium/Alvarez%20SGS%20U-233%20-1.pdf). The Energy Department has yet to address this discrepancy, which difference is enough to fuel at least a dozen nuclear weapons.

Uranium 233 compares favorably to plutonium in terms of weaponization; a critical mass of that isotope of uranium—about 6 kilograms, in its metal form—is about the same weight as a plutonium critical mass. Unlike plutonium, however, uranium 233 does not need implosion engineering to be used in a bomb. In fact, the US government produced uranium 233 in small quantities for weapons, and weapons designers conducted several nuclear weapons tests between 1955 and 1968 using uranium 233. Interest was renewed in the mid-1960s, but uranium 233 never gained wide use as a weapons material in the US military because of its high cost, associated with the radiation protection required to protect personnel from uranium 232, a highly radioactive contaminant co-produced with uranium 233.

For a terrorist, however, uranium 233 is a tempting theft target; it does not require advanced shaping and implosion technology to be fashioned into a workable nuclear device. The Energy Department recognizes this characteristic and requires any amount of more than two kilograms of uranium 233 to be maintained under its most stringent safeguards, to prevent "onsite assembly of an improvised nuclear device." As for the claim that radiation levels from uranium 232 make uranium 233 proliferation resistant, Oak Ridge researchers note that "if a diverter was motivated by foreign nationalistic purposes, personnel exposure would be of no concern since exposure ... would not result in immediate death."

The end of an unfortunate era. After its 1996 safety investigation at the Oak Ridge National Laboratory, the Energy Department spent millions to repackage about 450 kilograms of uranium 233 that is mixed with uranium 235 and sitting in the lab's Building 3019, and to dispose of diluted uranium 233 fuel stored at the Idaho National Lab. The Energy Department's nuclear weapons program managed to shift responsibility for the stockpile in Building 3019 from Oak Ridge to the Office of Nuclear Energy, which envisioned using the uranium 233 to make medical isotopes.

This plan fell apart, and in 2005 Congress ordered the Energy Department to dispose of the uranium 233 stockpile as waste.

Since then, the Energy Department's Office of Environmental Management has considered uranium 233 disposal to be an unfunded mandate, disconnected from other, higher-priority environmental cleanup compliance agreements. After several fits and starts, including a turnover of four project managers in less than two years, the Energy Department's disposition project "had encountered a number of design delays, may exceed original cost estimates, and will likely not meet completion milestones," the department's inspector general reported in 2010. The cost of the project increased from $384 million to $473 million—or more than $1 million per kilogram for the disposal of uranium 233 (http://energy.gov/sites/prod/files/igprod/documents/IG-0834.pdf).

In an effort to reduce costs, the Energy Department developed a plan to ship nearly 75 percent of the fissile materials in Building 3019, *as is,* to a landfill at the Nevada Nuclear Security Site (http://www.oakridge.doe.gov/em/ssab/Minutes/FY2012/7-April.htm) by the end of 2014. Because such disposal would violate the agency's formal safeguards and radioactive waste disposal requirements, the Energy Department changed those rules, which it can do without public notification or comment. Never before has the agency or its predecessors taken steps to deliberately dump a large amount of highly concentrated fissile material in a landfill, an action that violates international standards and norms.

In June 2013, Nevada Gov. Brian Sandoval and members of the state's congressional delegation announced their opposition to the landfill disposition plan (http://www.reviewjournal.com/news/nevada-and-west/nevada-nuclear-waste-challenge-doe-officials-thought-they-had-deal). Energy Secretary Ernest Moniz visited with Sandoval (http://www.lasvegassun.com/news/2013/jul/18/sandoval-energy-secretary-agree-disagree-continue-/) but did not back down from the landfill plan. Even though the Oak Ridge material in its current form meets the legal definition for radioactive waste requiring geologic disposal, the Energy Department has taken the position that the sweeping authority granted to it under the Atomic Energy Act allows the department to dispose of the fissile material however it pleases, regardless of the state's objection.

The United States has spent nearly $10 billion to discourage practices like landfill dumping of fissile materials in the former Soviet Union, only to have the Energy Department try it at home. (http://www.fas.org/sgp/crs/nuke/RL31957.pdf) Heedless of the discrepancy between overseas and domestic disposal policies, the department's agenda—which focuses on saving money on guards who would be needed to secure the uranium 233—is placing the United States in an impossible position when it comes to criticizing the nuclear materials security of other countries. So ends America's official experience with thorium, the wonder fuel.

Dr. John Miller • 18 hours ago

Might I suggest, Bob, that you add citations to evidence into your columns. It's clear reading this one that you have access to many documents I've

never seen. But without your explicitly listing them, I'll probably never find them.

1 • Reply • Share ›

WhatTheFlux • 3 days ago

There is absolutely no one -- at all -- in the Thorium Energy Alliance or the international "thorium community" (the people who advocate for thorium-fueled molten salt reactors) who buy into the nonsense of a Thorium-fueled car. Like, no one.

The idea is being promoted by crackpots who don't know bupkis about nuclear physics and engineering, and are riding on the coattails of a renewed interest in Thorium as an alternative reactor fuel.

7 • Reply • Share ›

Dr. A. Cannara ➦ WhatTheFlux • 3 days ago

It's also "buttkiss".
;]

• Reply • Share ›

SA Kiteman ➦ Dr. A. Cannara • 2 days ago

Alex, Couldn't find that spelling in any dictionary. (Didn't look too hard! ;)) But the bupkis is from Yiddish meaning "beans" (something of small value). As in "you don't know beans about that".

• Reply • Share ›

Dr. A. Cannara ➦ SA Kiteman • a day ago

Buttkiss is actually an urban dictionary term that you might want to stay away from. ;]

• Reply • Share ›

WilliamAshbless • 4 days ago

The USA only spent a few cents on thorium back then but gave up before it really trying because the AEC were certain the uranium fast reactor would work.

Is the USA struggling to cope with legacy of the thorium experiments? The sacked thorium researchers told management how to clean up the Oak Ridge reactor for less than $100k. Someone else 'knew better' and ignored them.

What became of the 'uranium fast reactor' - the IFR? After years in the wilderness between 1964-'83, it finally worked when scientists regained control over research. Nearly ready by 1994, just in time for Al Gore and John Kerry to close all nuclear power research, and spike the IFR as a proliferation threat. The Democrats wrote off billions of US research.

Note 1: The U-233 used at Oak Ridge for the thorium programme was made elsewhere.
Note 2: "Between 1993 and 1999, Mr. Alvarez served as a Senior Policy Advisor to the Secretary and Deputy Assistant Secretary for National Security and the Environment." So that would've been Robert Alvarez advising Al Gore to close down all nuclear reactor research back in 1994?

4 • Reply • Share ›

Buzzy123 • 4 days ago

This article really doesn't shed any light on whether a thorium reactor could be built safely and economically today-merely that there are storage problems with some really old reactor design byproducts.
So what? is hunting for hydrocarbons by fracking or damming up every what supply or putting up 1 million windmills, or the lithium batteries needed to store sporadic solar power less destructive then building many inexpensive

thorium reactors? I don't know and this article casts no light on that subject-it just tries to shut the debate down.
Meantime the Chinese according to numerous press reports reportedly are spending billions on developing a new generation thorium reactor design. I would far prefer hearing about their progress or lack thereof rather than a rehash of issues on dumping old fuel-which are being exacerbated by NIMBY types who steadfastly refuse to allow permanent storage of the old fissile materials--and then use that politically inspired failure to store the material as a reason not to build needed power reactors.

8 • Reply • Share ›

rlhailssrpe • 4 days ago

Take this article with a grain of salt, except for one reality. The great crimes in nuclear power are centered in the federal bureaucracies, not the private sector. After engineering a score of civilian nukes, my notion is that a misspelled word in the lunch menu will raise eye brows of a enforcement regulator, but dumping tons of bomb fuel rad waste in a ditch is just another days work for the DOE. The history is reflective of the closed government culture; whatever we decide is good, whatever they decide is bad. And our work is secret.

The original bomb/power plant agency, AEC, was split into virgin nuns, the NRC, and two fisted heroes, the DOE. The end result, after two generations, is that nothing the DOE does, means NRC standards of safety. And oceans of money have been spent (or wasted depending on your technical bias) with absolutely no results. Example: Yucca Mountain Spent Fuel grave.

The management of US atomic energy has been non existent since the Manhattan Project. There are retired, or dead, federal bosses with enormous personal net worth, who should have ended their career in a penitentiary.

see more

7 • Reply • Share ›

Garry Morgan • 4 days ago

96 kg of missing fissile material is a problem, serious problem. So is the propaganda associated with the "nuclear Cadillac." After reading the comments below I can only hope that some of the commenters are not involved with nuclear materials or their management. Nuclear security is always an issue, personnel and human factors reliability goes along with any program of nuclear security/surety.

1 • Reply • Share ›

dean in michigan • 4 days ago

The author states that the original estimate was that the US would have 1,000 nuclear reactors by the year 2000 vs the 100 we actually have (and similarly high numbers of reactors around the world). It would be interesting to calculate what today's CO2 levels would be had the original estimate came to pass. Perhaps we wouldn't need to worry about sea levels flooding major cities.

3 • Reply • Share ›

BV ➦ dean in michigan • 4 days ago

I'm sorry, you mentioned sea levels flooding major cities. Which major city is now underwater? Miami? Houston? New Orleans? New York City?

The industrial age has been going on for over a century now, and, still no flooded cities (as described by the AGW doom and gloom crowd).

I don't know why climate science is exempt from the requirements of the scientific methods. Models must correspond to reality; models (and the theory they implement) are judged by real world

experiments. The two must agree. So far, this agreement has not been found in the field of AGW, and for some reason the scientific community, as a whole, doesn't care. Strange.

• Reply • Share ›

Dr. A. Cannara → BV • 3 days ago

Tell you what, BV, we'll get you a nice comfy tent & bedroll, and you can stay in the lower Manhattan subway of your choice for all of this year's hurricane season. We'll spring for all your take-out orders too.
;]
You've just displayed 2 things...
a) ignorance of science & engineering facts, and ,
b) lack of gumption to use a real name.
--
Dr. A. Cannara
650 400 3071 (call if confused)
;]

1 • Reply • Share ›

Rob Lewis → BV • 4 days ago

It's a real shame that when future events prove you dead wrong, we'll all have to suffer.

Maybe we could convince all the denialists to move to Miami.

2 • Reply • Share ›

BV → Rob Lewis • 3 days ago

Speaking of "future events," let's review several. Al Gore said that the arctic will be ice free by 2013. It's 2014 and arctic ice is still present with us. Damn.

The IPCC presented several models predicting an increase in the temperature of the lower earth atmosphere as more CO2 is introduced into the atmosphere. The curves failed to predict the trend in warming for the past 15 years. Damn.

All of those predictions about the Himalayan glaciers? Damn.

http://www.theregister.co.uk/2...

We've been waiting since the 70s for this climate catastrophe to take place. Since the AGW crowd is so good at predicting the future, please let me know when these "future events" are to occur. Or should I look to guys like Harold Camping for predictions for the future? He's been as accurate at you guys at predicting "future events."

• Reply • Share ›

William Barnett-Lewis → BV • 4 days ago

tt isn't. Just because you refuse to see the truth does not make it false.

1 • Reply • Share ›

BV → William Barnett-Lewis • 3 days ago

boring. in "science," facts judge theories, not me. nor any other scientist. facts judge theories, and, as we've seen with the models lauded by the IPCC, they're ability to predict future warming trends in the earth's lower atmosphere is terrible.

but whatever, keep your faith in your ideology. in the 21st century, facts are meaningless.

• Reply • Share ›

Dr. A. Cannara → BV • 3 days ago

It's always fun to see the denier';s head for suckle at the IPCC's teats of models of Earth's flimsiest fluids.

Funny how these fact-avoiders take great care to hide things like isotopic fingerprints of CO2 in air & water; the heat content of not-flimsy ocean waters. pH drops in ocean waters from isotopically fossil carbon in dissolved CO2. And so on and so on.

I like it when fact avoiders like BV stick their pitiful verbiage out, because it gives us a chance to get real info out to those listening in.

Here's one example of bad effects directly tied to Industrial-Age carbon combustion (avert your eyes BV)... http://tinyurl.com/n2qnos6

Keep it up BV. Remember, what you think is of no concern. Getting facts to others is.
;]

1 • Reply • Share ›

Patrick K • 4 days ago

The whole discussion is being hijacked by the missing uranium 233. What does the missing uranium 233 have to do with the possibilities that thorium offers ?

11 • Reply • Share ›

WilliamAshbless → Patrick K • 4 days ago

A thorium reactor would, ideally, run on U-233 because it has the best profile of all fissile materials. By preventing the disposal of this material, anti-nuclear activists such as Alvarez have, paradoxically, made thorium reactors more likely. There's a good chance some or all of the U-233 will go to China to help their thorium reactor research.

2 • Reply • Share ›

Patrick K → WilliamAshbless • 4 days ago

Thank you for the explanation WilliamAshbless ! Your comment caused me to read more about the Thorium vs Uranium nuclear reactor discussion. It made me ask critical questions like; "Is Thorium a safe alternative to Uranium at all ?"

I also found this article by A. CANON BRYAN; < http://ensec.org/index.php?opt... >. I quote from the article about the waste produced by Thorium reactors; "The waste products are, respectively, 233U, which cannot be used for bomb production, and 239Pu, which is the best possible bomb material."

If this is true and 239Pu is created in enough quantity, it destroys the whole proliferation benefit that Thorium reactors supposedly gives. I don't know at this point ...

• Reply • Share ›

Andy Maier → Patrick K • 4 days ago
both completely inaccurate - try again - in the sense that neither are made in enough quantity to matter
• Reply • Share ›

Patrick K → Andy Maier • 3 days ago
Andy, don't hold back. If you have accurate information, please share it. :)
• Reply • Share ›

RemyC • 4 days ago
Fission: 40 years of electrical generation, 60 years of decommissioning. Cost? 4 trillion dollars in North America! What a boondoggle. The folks who came up with that scam got rich, scrammed like rats, leaving the next generation with another fine mess Olie! Thorium might lend some future solution, but it doesn't solve the problems the nuclear industry faces today, total collapse.
1 • Reply • Share ›

Mike Carey → RemyC • 4 days ago
Here is a visual way to compare the total cost of electricity generation, including decommissioning. Unfortunately, the chart does NOT include the cost of "decommissioning" the mega tons of coal ash waste that is continually threatening the water supplies of coal burning states.
Cheers ...
1 • Reply • Share ›

DrGeneNelson → Mike Carey • 15 hours ago
Hello, Mike: I'm interested in the source of your graphic of the total cost of energy production per kWh. Thanks in advance!
• Reply • Share ›

Mike Carey → DrGeneNelson • 12 hours ago
Hi there -
My copy has been passed around from hand to hand, but a Google image search turns up multiple links under the full title:
Total Cost of Electricity Production per kWh. I would include the link but Disqus highlights it in red which means they will block comments with links. The web site is intellectualtakeout dot org/library/chart-graph/total-cost-electricity-production-kwh.

Other useful charts show up using these titles:
Real Cost of Power Sources Affected by Capacity Factor (2006),
and
Total System Cost of Electricity from Different Sources.
Cheers.
• Reply • Share ›

WilliamAshbless → Mike Carey • 4 days ago
Why is there no figure for the decommissioning of solar? These solar panels are decentralized, thereby making disposal a nightmare compared to the problem of decommissioning centralized nuclear. Heavy metals contained in solar panels

last forever.

1 • Reply • Share ›

WhatTheFlux ➦ WilliamAshbless • 2 days ago

Naw, solar panels are made from 100% biodegradable granola hydrates, and glued together with recycled hemp oil. Sheesh...!

• Reply • Share ›

GoresChakra ➦ WilliamAshbless • 4 days ago

There are three chemicals, hexafluoroethane (C2F6), nitrogen trifluoride (NF3), and sulfur hexafluoride (SF6), used to produce solar panels that are green house gases that are more than tens of thousands times more potent than CO2. Also, they are very stable compounds that have from several hundred to thousands of years lifespans. The cure from solar panels is worse than the bite.

3 • Reply • Share ›

Dr. A. Cannara ➦ GoresChakra • 4 days ago

Thanks for the info. Having been in the semiconductor biz in Silicon Valley, I'm never surprised about the chemistry and its dangers. We still have plenty in our groundwater.

The joke among AMD chip workers was that a new guy might wonder what sokmething smelled like and take a sniff. For a Silane sniff, the sniffer might say: "Oh, that smells so goo..." as his/he last words.
;]

• Reply • Share ›

Mike Carey ➦ WilliamAshbless • 4 days ago

Good point. Like the coal ash, there probably is no legislative requirement to recover and dispose of the toxic material. Of course we do have disposal fees for other retail products like motor oil, tires, glass/plastic bottles, etc. And outsourcing our electronic waste disposal to Asia is immoral.
Cheers.

• Reply • Share ›

Matthew Baker • 4 days ago

The supposed "loss" of this material has absolutely nothing to do with the viability of a thorium fuel cycle. That's a straw man argument if I've ever seen one, and nearly half the article has nothing to do with Thorium. Not to mention that you basically defeat your entire "Thorium is bad because it produces 'unrecoverable' U233" argument in this one statement:

"Attempts to recover uranium 233 from its irradiated thorium fuel were described, however, as a “financial disaster.”"

If it's not economically feasible to recover the fissle material from this reaction chain for reprocessing (ease of detecting its gamma emissions not withstanding) then it's not actually a problem in reality. The paper you reference is also from 1978. Manufacturing/process automation, and materials science technologies have come a very long way since then. If anything we should be pushing for a full scale reinvestigation of the same problems to assess modern technological feasibility, not relying on analysis that is nearly 40 years old.

14 • Reply • Share ›

Buzzy123 ➦ Matthew Baker • 4 days ago
I agree. This was an article written with an agenda--NO MORE NUKES!!! not a reasoned discussion of thorium as a power source at all.
5 • Reply • Share ›

Adam Jorgensen • 4 days ago
This article says little in a fair amount of space. More astroturfing, plz!
12 • Reply • Share ›

madskills • 5 days ago
This guy is a supporter of both fossil fuel and uranium based power generation. It's like he forgot in the 1960s we all ready had a thorium reactor and it was in the running but lost because of making bombs was more important. Thorium reactors are safer and easier to control and there is 5 times the amount over uranium available in the world. And he didn't discuss what India and Europe are doing because they have huge supplies of thorium. They are going for it. This isn't 25 years down the road, but 3-5 years.
12 • Reply • Share ›

RemyC ➦ madskills • 4 days ago
Actually "this guy" Robert Alvarez is a supporter of neither the fossil fuel or uranium based power generation. Like most environmentalists or anti-nuclear activists, he advocates clean energy alternatives like wind, solar, geothermal, conservation. The pro-nuclear logic and argument is that these "soft" energy paths could NEVER replace nuclear, the measly 10% of electricity it produces in the US, when every day, inch by inch, it's doing just that.
2 • Reply • Share ›

madskills ➦ RemyC • 4 days ago
RemyC,
He seems to advocate that way, at least in this writing. I read his bio and he does seem to indicate leanings about safety at nuclear plants. I was trained as a geologist and therefore have a personal spin. Certain areas of the country and certain types of activities require huge amounts of energy. We do need a source of intense energy production. All the passive systems seem to not have the capability to provide it. I advocate thorium because of the minimal radioactivity, safety features, and availability. It is certainly better then uranium and fossil fuel generation in my estimation.
3 • Reply • Share ›

WilliamAshbless ➦ madskills • 4 days ago
@madskills
Have you bothered to read the article or check any of Alvarez's so-called facts?
• Reply • Share ›

madskills ➦ WilliamAshbless • 4 days ago
I was responding to RemC's comments. You obviously didn't see my comments were directed at him. If it's not that, I really don't know what you are talking about. I will say Alvarez's article seems to be all over the place and incoherent.
2 • Reply • Share ›

drkennethnoisewater ➦ RemyC • 4 days ago

Good luck convincing the world of that. Only safe, clean, efficient, cheap and ubiquitous nukes can provide the world with the standard of living that the west currently enjoys on the back of cheap hydrocarbons without wrecking the planet. If you want to deny them such a quality of life, you're a racist.
2 • Reply • Share ›

Guest → drkennethnoisewater • 4 days ago
Wow, I'm a racist because I support the green economy? What planet are you on? You're the one waving a handgun!
• Reply • Share ›

WilliamAshbless → Guest • 4 days ago
I think everyone who supports the US nuclear bomb but denies the expansion of nuclear power on proliferation grounds is racist.
• Reply • Share ›

drkennethnoisewater → Guest • 4 days ago
Cheap, abundant energy correlates with poverty reduction and thus improved life expectancies, quality of life, health, happiness, basically everything that's good. Wanting to keep that from those who don't have it because it's not "good for them" is condescending and racist. They are entitled to their aspirations, and the question is how best to provide for large and continuing increases in energy with the least environmental and military impact. Standing in their way and consigning them to continued poverty to feel better about yourself is amazingly arrogant, condescending and presumptuous, and in the end, is racist too.

And when I hear folks speak of a population problem, how the world should reduce human population, I have only 2 words: "You first."
3 • Reply • Share ›

SA Kiteman → madskills • 5 days ago
Madskills,
I appreciate your support for thorium fueled reactors, but please be careful how you state the reason why they were dropped. The part about not good for bombs was back in the '40s, not the '60s. And that DID play a part in that the widely known fuel cycle was the U/Pu, not the Th/U.

But LFTRs lost out because Nixon (blast his beady little eyes) decided to "save money" by supporting only those breeder technologies that were primarily based in California. Since LFTRs were ~100% Tennessee...

The rest of your statement is good.
8 • Reply • Share ›

madskills → SA Kiteman • 4 days ago
SA,
I checked my source at it stated the reactor ran from 1965-69. I also again state use of material produced from the uranium reactors was important for making bombs. I suggest you check Wikipedia as that is where I got the material but did see it before also from another source. Thanks for the comment

it before also from another source. Thanks for the comment, want it right. Dean

• Reply • Share ›

Dr. A. Cannara → madskills • 4 days ago

Just supporting SA K here. MSRE started with U235 and at some point U233 was used as the fissile. before Dec 1969 shutdown.
http://tinyurl.com/7o6cm3u

Making bombs using U235 needs no reactor. making POu bombs needs special reactors, like Savannah River, Chernobyl's RBMK, Windscale, etc., because the U238 mustn't sit long in reactor, or too much Pu240 will be made and it has the unfriendly penchant for spontaneous fission, ruining the bomb-maker's day.
;]

• Reply • Share ›

WilliamAshbless → madskills • 4 days ago

@madskills: "use of material produced from the uranium reactors was important for making bombs"

No, not really. The US used special reactors for making bomb grade plutonium-239 - not commercial reactors. Commercial reactors change fuel every 18 to 24 months. When breeding Pu-239 from U-238 for bombs, you really ought to stop after just 3 months to avoid production of higher actinides (Pu-240, Pu-241, etc). You want to keep Pu-239 as pure as possible for bomb-making.

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SA Kiteman → madskills • 4 days ago

The MSRE did run between those dates, and was shut down by the program because it had taught them all it could. The MSBR work was shut down by Nixon's administration.
Yes, but the reactors supported by Nixon, while they used the same basic technology as reactors used to make bomb-grade fissiles, were not intended to make bombs. They were intended to breed quickly to support the then extant 7+% electrical growth rate at a time when uranium was thought to be in short supply.
Again, thanks for your support!

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Charles Borner • 5 days ago

http://youtu.be/P9M__yYbsZ4

For those of you who want the real story on Thorium. Take a look at this video.

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Mike Miller • 5 days ago

As someone who apparently makes his living in this field, you should do much better, Mr. Alvarez. Citing your own papers is not the sort of thing that lends credibility to your arguments as far as I am concerned. Furthermore, despite the title, this whole piece isn't even really about thorium, being little more than fear mongering about nuclear "waste". I use the term advisedly as what we currently treat as waste is mostly fuel that we have made a political, rather than scientific decision to not use. Thorium-based reactors were never given anything like the priority and funding devoted to light water reactors, and despite this, Dr. Weinberg and his staff did an admirable job of running a test reactor for years, until, again, a political, rather than scientific decision forced them to close it down.

I don't know why I bother replying, since I won't change your closed mind anyway, but you and your supporters are effectively supporting the filthy, climate-catastrophe-inducing worst possible outcomes of continued indefinite use of burning fossil fuels for energy. Until the last coal-fired plant shuts down, I believe it is utterly irresponsible for someone supposedly learned in the field to advocate for an end to nuclear power. You are indeed worse than the fossil fuel industry shills themselves who make no bones about their motivations. Despicable.

Only my own sense of decorum prevents me using stronger language.

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