

Wind farms and solar farms will not fix the world's worsening pollution and climate-change problems. NUCLEAR REACTORS are our only hope.

Rudy Stefenel, 2/17/2018

A magazine article got me going. The September 2004 issue of *National Geographic* magazine was dedicated to global warming, and it alarmed me. I purchased about 30 of that issue, and I gave them to lots of friends and relatives. After that, I read most anything related that I found in the news. At first, I was convinced that massive wind farms and massive solar farms were the answer. I even wrote a proposal to test a lot of ideas to keep wind farms from killing bats and birds. Then I stumbled on a lecture at San Jose State University, and the guy told us that a very different kind of nuclear reactor called a molten salt reactor was a great solution to climate-change and pollution. A few years later, I was at a lecture at by Dr. Alex Cannara, and he pointed out that wind and solar won't do. He confirmed nuclear reactors were the only way that could solve the pollution and climate-change disasters in progress. I was convinced almost immediately. Very few people, world-wide, understand this, and we have to change that for the longevity of most everything living in this world.

Not only is climate-change a disaster in progress, the accompanying pollution alone is bad enough all by itself. The ways to reduce pollution and climate-change are virtually the same. Internet searches for world-wide deaths per year from pollution reveal numbers in the range of around 3 million to 13 million. Surely a lot more people have health issues from pollution. The [International Health Agency estimates 6.5 million deaths per year from pollution.](https://TinyURL.com/IHApollutionY) <https://TinyURL.com/IHApollutionY>

Here is a climate-change review: <http://TinyURL.com/cChangeIntro>

Worldwide cooperation is needed to slow down both pollution and climate-change, and turn these increasing trends around. Not only that, they both have so much momentum that we must get ready for consequences that we are stuck with in the mean time.

Global Dimming caused by dust and pollution urgently needs attention too. It reduces some effects of climate-change. If we were to reduce global dimming alone, then climate-change will get even worse. Global dimming causes less sunlight to reach the earth because of air pollution from coal plants and other sources. Water condensing on particles from dust and pollution creates small water droplets to form in addition to the water droplets already there.

Clouds become more reflective, and more sunlight is reflected back into space so less reaches the oceans and land. The rain clouds tend to rain at other places than they would without the abundance of extra water droplets. An example is the loss of rain in Ethiopia, which caused famines. So, we must reduce both climate-change and global dimming carefully together or we can make things worse.

<https://TinyURL.com/GlobeDimRain>

The ocean acidification caused by high levels of CO2 is terrible too.

If pollution, climate-change and global dimming are not bad enough, we now have this too. About forty percent of all the CO2 made from burning fossil fuels, and anything else that burns, dissolves into the oceans. This causes carbonic acid to form, which eats away at anything with a shell. We are about half-way to the point where anything with a shell in the oceans will eventually become extinct. This is especially hard on plankton, which is the bottom of the food chain. We get about 20 percent of our protein from the oceans. By the way, the ocean's plankton produces a significant amount of the oxygen in our atmosphere.

<http://TinyURL.com/CO2SeaAcid>

Fear of nuclear power is in the way of real progress. Nuclear power has killed fewer people per kilowatt-hour than any other type of major electric power source. BUT, LOTS OF PEOPLE ARE TERRIFIED OF NUCLEAR REACTOR ACCIDENTS. Consider the situation at Fukushima Daiichi in Japan after the earthquake and tsunami in March 2011. The sea wall was not high enough, and the diesel generators were in a basement where they got flooded. If the diesel generators had kept running, we would not have had the nuclear reactor accident at Fukushima Daiichi. Electricity was lost for the cooling water pumps used to keep the reactor core from overheating.

A common misconception in Japan was that most people died from radiation related to the nuclear accident instead of the earthquake and flooding from the tsunami. Large crowds demonstrated against nuclear power there. The Japanese government had all the nuclear reactors shut down. To add insult to injury, none of the other forty nuclear reactors in Japan failed due to the earthquake and the tsunami. After that, there was no choice in Japan other than to burn more fossil fuels, which resulted in an enormous increase of pollution and CO2 there.

Following the nuclear accident in Japan, there were many anti-nuclear protests in Germany. On 29 May 2011, Chancellor Merkel's government announced that it would close all of its nuclear power plants by 2022. Following the Fukushima nuclear disaster, eight of the 17 nuclear reactors in Germany were shut down.

The conversion from nuclear to "renewables" in Germany is backfiring. In 2013, Germany got only 4.5 percent from solar and not 50 percent as some claim. About 8 percent came from wind. Forty-six percent of Germany's electric generation came from coal, and about half of that is lignite, which is the dirtiest, most polluting kind. There are more greenhouse gases and pollution in Germany instead of less. <http://TinyURL.com/GerSolarLie>

We have terribly been misled about low levels of radiation because there is a low-level range that is good for us. This, and much more, is spelled out in the book: [Unintended Consequences: The Lie that killed millions and accelerated Climate Change](http://www.unintended-consequences.org/) by best-selling author George Erickson. <http://www.unintended-consequences.org/>

This book reveals that minor increases in background radiation lowers the incidence of cancers when compared to residents of areas with very low background levels. Also, George Erickson exposes the lie that created our extreme radiation safety standards and the damage those regulations have caused. Unintended Consequences:... urges close-minded organizations like the Sierra Club, Friends of the Earth and Greenpeace, etc. to remove their blinders and examine the science that persuaded real environmentalists like Mark Lynas, Patrick Moore, Stephen Tindale, James Lovelock, Stewart Brand and others to promote nuclear power, the cleanest, safest, most efficient way to produce the 24/7 electricity that can combat pollution and climate change.

The best policy is to have as many nuclear reactors running as we can to give time to get the new Generation-IV variety on-line. That means completing those planned and being built to get them up and running.

By the way, the rest of this is related to mainly nuclear power, and it will be very technical. If you don't understand it all, at least you will become familiar with the related terms.

Research related to Generation-IV nuclear reactors is happening so fast that what I wrote about it here may be out-of-date by the time you read this. That is progress. So you may need to do some Internet searches to get the latest.

Lots of people mistakenly think that "renewables" will solve our pollution and climate-change problems and still give us adequate electrical power. There are reasons why this won't work. Nowadays, most kinds of renewables being installed are massive wind farms and massive solar farms.

They are of little help. Massive wind and solar produce electricity much less than half the time so we are running on their backup most of the time. That backup has been and will be mostly from fossil fuels. It is that simple.

Some say that we can solve the problem by using energy storage with massive wind and solar. This won't work for several reasons. One reason is that most of their electric power would be going into energy storage forcing us to increase wind and solar by a huge factor. The amount of land needed to do this is beyond reason. Also, wind and solar are our most expensive electricity sources, and they only last two or three decades. The maintenance costs are extreme. Most Nuclear reactors could last at least 60 years if well maintained.

Publications implying that we can solve the problem with massive wind and massive solar are bunk. An example of one is [**100% clean and renewable wind, water, and sunlight \(WWS\) all-sector energy road-maps for the 50 United States by Mark Jacobson**](#), a Stanford Professor.

<https://TinyURL.com/WWSbunk>

Tim Maloney, PhD, checked out WWS in detail. He wrote a report that points out some glaring errors using math, and he provides you plenty of references.

<http://TinyURL.com/TimMaloneyWorks>

You may be amazed at Tim's skill and perseverance as he went about this, step by step, and he included all his calculations in his report. It seems that he leaves out nothing. It is an education by itself.

There have been other analyses of this showing that Mark Jacobson is dead wrong. One example is the blog by Scott Luft called: *WWS (Wind Water and Sunlight): Jacobson's sorcery*. Scott Luft uses lots of data and spreadsheets to show that WWS is unrealistic. WWS does not consider the extreme variability of wind and solar. It only considers a yearly total of energy needs and does not consider the hourly needs. Scott Luft's study lists some other studies that conclude the WWS conclusions are bunk too.

<http://TinyURL.com/gtncvbp>

One of the most promising varieties of Generation-IV nuclear reactors are MSR's (molten salt reactors). Besides more efficiently providing more economical electric power, they can be designed as various kinds of MSFR's (Molten Salt Fast Reactors) to consume some waste from our current nuclear reactors LWR's (Light Water Reactors). I will get into more details of this shortly.

Even though nuclear reactors have killed fewer people than any other major power source, MSR's are even safer. MSR's can't blow up because they run at or nearly at atmospheric pressure and do not use water at extremely high pressure and temperature. In contrast, light water reactors run super-heated water at around 330 degrees centigrade and around 160 atmospheres of pressure. Get a leak, and there will be an explosion. Also, MSR's don't create explosive hydrogen if overheated. They can't melt down either. It is likely that MSR's will be the world's safest kind of nuclear reactors. Also, the basic concept was proven. A MSRE (Molten Salt Reactor Experiment) operated for four years at Oak Ridge National Labs in the 1960s. <https://tinyurl.com/OakRidgeMSRE>

In fact, Kirk Sorensen, a former NASA aerospace engineer and formerly a chief nuclear technologist at Teledyne Brown Engineering, used a government grant to go to Oak Ridge National Labs and digitally photograph what documents he could get his hands on related to this work. www.EnergyFromThorium.com/ This is available to anyone with Internet service all over the world. Also, this a great website to learn about molten salt reactors and what is going on with them.

Our nuclear waste is mostly uranium 238, which is really unused nuclear fuel. Also, about five percent of the used fuel from present LWR (Light Water Reactors) plants is short-lived fission products from splitting uranium 235 (the fuel that was fissioned) and one-percent of that is new, plutonium, etc. (bred from uranium 238). This plutonium can be fuel for other types of Generation-IV nuclear reactors, like IFRs (Integrated Fast Reactors), LMFBR (Liquid Metal Fast Breeder Reactors), MSFR (Molten Salt Fast Reactors), and other kinds of fast reactors. Also, they can 'breed' new plutonium fuel from uranium 238.

When MSR's run on thorium, they are often called LFTRs (Liquid Fluoride Thorium Reactors). Thorium is a metal similar to lead, and tin. It is concentrated in monazite sand available at many beaches around the world. Brazil has lots of sand with monazite in it. <http://TinyURL.com/Th90Sand>

There is some thorium in the most of the dirt all over the world. Thorium is more plentiful and less hazardous than any other nuclear fuel. There is about four times as much thorium in the earth's crust as the total of both kinds of uranium (uranium 235 & uranium 238).

If we compare it only to the uranium 235 that we use in our nuclear reactors, discounting the uranium 238, the world has about 400 times as much. Again, a proof of concept molten salt reactor ran at Oak Ridge National Labs in the 1960s. To learn more, check these websites.

www.ThoriumEnergyAlliance.com <http://TinyURL.com/ThCheaper>
<http://TinyURL.com/EnergyReality> <http://www.egeneration.org/>
<http://www.cgnp.org/>

Here are some molten salt reactors in the works. These are the ones that I was able to dig up, but there could be more.

USA: Idaho National Labs: <https://TinyURL.com/INLgovMSRs>

USA: Thorcon: <http://thorconpower.com/>

USA: Transatomic: <http://www.transatomicpower.com/>

Canada: Moltex: <http://www.moltexenergy.com/>

Canada: Terrestrial Energy: <http://terrestrialenergy.com/>

USA and China: <https://TinyURL.com/USChinaNuc>

<https://TinyURL.com/CiniaNewNuc>

India: <https://TinyURL.com/India1stADS>

Russia: <https://tinyurl.com/AboutRuMSRs>

Here are some similar advanced nuclear reactors in the works.

USA: Lightbridge: <https://TinyURL.com/LBseedTH>

USA: Kairos Power: <https://kairospower.com/>

MSRs and thorium are soon to become household words. They are not often covered by our major news networks yet, but if you do a web search, you will find thousands of articles written about them. The major news networks and our politicians can't stay ignorant about them much longer. There are organizations all over the world promoting molten salt reactors, each with lots of members who write and that amounts of thousands of letters notifying our politicians and news writers about them. Surely MSR and thorium will be a big topic in the news when the first one goes on-line.

Lots of science journals and foreign sources have been writing about recently. As an example, thorium-based nuclear reactors were discussed on enVandaag - [Dutch Public Television](http://TinyURL.com/DutchMSRnews) in 2015. <http://TinyURL.com/DutchMSRnews> The Thorium Energy Alliance website is a wonderful source of information about molten salt reactors and covers eight conferences about them. <http://www.ThoriumEnergyAlliance.com> Try searching the Internet for MSR, LFTR, and thorium, and you will end up with lots of hits.

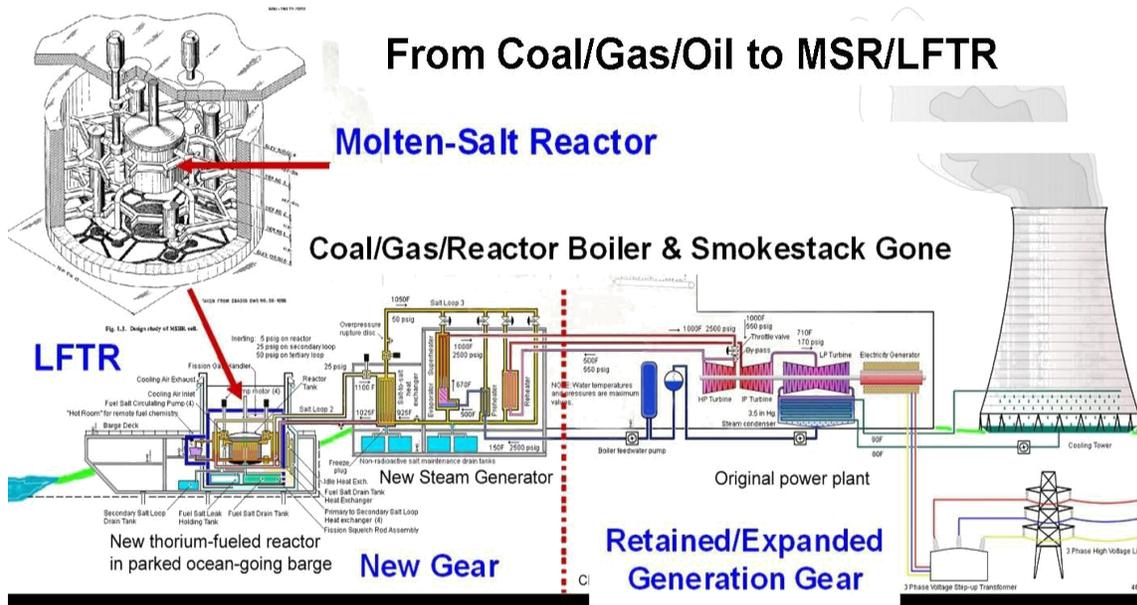
Good news!: Oct. 19, 2016—[The Tennessee Valley Authority's \(TVA\) new Watts Bar 2 nuclear reactor today officially began producing electricity for more than 650,000 homes and businesses.](http://TinyURL.com/NNP100USA)
<http://TinyURL.com/NNP100USA>

It is very significant that the nuclear energy facilities in 30 states generate 19 percent of America's total electricity, and that amounts to nearly 63 percent of its carbon-free electricity. Think of all the land and expense we could save if we stopped building wind farms and solar farms and go all nuclear.

Converting existing power plants to molten salt reactors

Over the years, there have been lots of proposals to convert existing natural gas plants, coal plants and existing nuclear reactors to molten salt reactors.

A high priority would be to convert coal plants to nuclear because burning coal is our worst source of greenhouse gasses and pollution. Here is an illustration of converting a coal plant to an MSR provided by Alex Cannara of [ThoriumEnergyAlliance.com](http://www.ThoriumEnergyAlliance.com) & Thorium Energy Silicon Valley.



Solutions for ocean acidification, a terrible problem getting worse One idea that has been around for years is to put lime into the ocean to neutralize carbonic acid. Human activity has been putting significant amounts of CO₂ into the atmosphere since the beginning of the industrial revolution. It's about 1.8 trillion tons of CO₂ now. About forty percent of all this CO₂ has already dissolved into the oceans and continually forms more carbonic acid.

<http://www.cquestrate.com/the-idea>

<http://TinyURL.com/LessCO2withLime>

<http://TinyURL.com/FixCO2withLime>

Alex Cannara of the *Thorium Energy Alliance* and of the *Thorium Energy Silicon Valley* organizations talked about this at the TEAC7 (Thorium Energy Conference number 7) event in Palo Alto in June 2015, and in a local TV interview.

<http://TinyURL.com/2015TEAC7>

<http://TinyURL.com/KellerOceanAcid>

Alex points out that the natural carbon sequestration process going on is related to plankton and other organisms with carbonate shells/skeletons. This has been going on for millions of years.

Nothing else comes close to how effective this life-driven process has been. Plankton (forams and coccolithophores) are microscopic creatures at the bottom of the food chain. <http://TinyURL.com/EchinodermsCO2sink>

They are food for many other kinds of sea life. They absorb calcium, magnesium and carbonate ions in seawater to make calcium carbonate shells and skeletons. When they die, they drop to the ocean floor and sequester the carbon in these materials as carbonate minerals similar to limestone.

The oceans are getting less alkaline, which is threatening shelled and other calcifying organisms and all sea life is dependent on them for food up through whales. The added CO₂ causes carbonic acid to form, which lowers alkalinity and thus the ocean's pH. If the pH is too low (below 8.0), then shelled animals can't get enough carbonate ions from seawater to make shells. Also, the near-acid eats away at their shells. This happens in freshwater aquariums, where pH is near 7.0. A seashell added to an aquarium like this for decoration gradually dissolves. Only certain shelled animals can survive in fresh water.

Warming ocean water is also making the problem worse, because it makes the chemistry used by the animals harder, or impossible. Alex suggests that we correct the pH by making lime from limestone (which came from sea animals in the first place) and dissolve it back into oceans, under marine biologists' supervision.

There is a lot more to his suggestion because we make CO₂ as we make lime (as happens with cement plants). Many people are looking into sequestering CO₂ by mixing the CO₂ with water and pumping it into underground into abundant, porous layers of basalt. The CO₂-water mixture would chemically react with the basalt to make carbonate again, essentially replenishing the CO₂ that had been baked out of the basalt by the volcanoes it had passed through long ago. We'd need about 10 billion tons of lime each year, just to stay even with present emissions that dissolve in seas. It takes about 400 kilowatt-hours of energy to make one ton of lime in a cement plant.

Alex says that we would need over 450 one-gigawatt electric nuclear reactors just to make enough lime to offset the CO₂ we now emit that dissolves in seas each year. If we want to do more than that, we need more nuclear reactors.

Alex estimated that our past emissions put us about 1800 years behind the natural CO₂ sequestration system on the planet, which puts about 1 billion tons into seafloor sediment and limestone each year (AAAS Science, Canfield & Kump, vol 339, p533, 2/1/2013). If we increase our use of nuclear energy to replace fossil fuels, our emissions will decrease, meaning that the reactors making energy for lime production will start catching up to our 1800-year deficit, year by year. But that only happens if we deploy a few thousand extra reactors to replace fossil-fuel combustion.

See this YouTube video: <http://TinyURL.com/TEAC7AlexC>

Also check: <http://TinyURL.com/StoreCO2Basalt>

BSCSP ([Blue Sky Carbon Sequester Project](http://TinyURL.com/BigSkyCO2Storage)) has the same idea for sequestering CO₂. <http://TinyURL.com/BigSkyCO2Storage>

Basalts are a very common part of the geologic remains from lava flows thousands to millions of years ago. There are many sites like this in North America and throughout the world. They can provide permanent underground storage of CO₂. BSCSP is conducting their small-scale field project near Wallula, Washington.

The project's main objectives include:

- Conduct geological site characterization activities to ensure that the site is a safe location to inject CO₂.

- Participate in public outreach activities to engage local stakeholders in the process.

- Address and comply with all local, state, and federal permitting procedures.

- Inject 1,000 tons of CO₂ into the underground basalt formation.

- The injection phase will test the behavior and the chemical reactions that take place between the injected and the surrounding basalt environment.

This study will be the first field demonstration of its kind in the United States. The results will provide scientists with crucial information on the potential for basalt formations to provide long-term storage of emissions.

BSCSP is not the only effort to sequester CO2 this way. CarbFix is located in Iceland. These folks have the same idea as BSCSP. They are concentrating their effort with basaltic rocks in Icelandic geothermal fields.

<https://www.or.is/en/projects/carbfix>

Right now, some members of the Thorium Energy Alliance are looking into simply adding basalt to the oceans after it is ground up. This may be a lot simpler than sequestering the CO2 made by making lime, but it requires far more material to be processed. First, we need to be sure that all the other components of basalt don't harm anything living in the oceans. Hopefully, we will hear about this in the news and/or from the Thorium Energy Alliance eventually. If the feasibility studies work out, it is likely that some organization will try this on a small scale to see if there are problems that are not anticipated.

My fantasy is that all the Nations will work together to switch to mostly nuclear power in a Manhattan like project. We would accelerate the construction of those being built now to get them on-line. Also, all the start-up companies aimed at getting a variety of molten salt reactors online would get priority support in every way possible. Included in my fantasy is that all the existing nuclear safety agencies would unite to form a worldwide cooperation based on real science. We would convert some existing coal electric plants and natural gas electric plants to molten salt reactors too. Some plants eventually could just be shut down as molten salt reactors come on line.

With few exceptions, we would not replace massive wind and massive solar electric plants at the end of their life. Also, we would not rebuild those that get damaged or destroyed by earthquakes, hurricanes, floods and other extreme weather events.

Please share this.

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