Climate Smart Montana Webinar: Dec 1,2022 Outline

“New Nuclear Power is a Losing Climate Solution” by Don Safer

         New reactors are too expensive and would take too long to build.

         Nuclear power is not clean energy: the underlying reasons nuclear is bad for us and our biosphere.

         Debunking pro-nuclear propaganda.

1. How I got on the anti-nuclear path
2. My utility: TVA
3. The case against new nuclear power, including small modular nuclear reactors and so-called “advanced” reactors centers on five issues: Cost, Timeline, Safety, Waste and Nuclear Weapons Proliferation. https://beyondnuclearinternational.files.wordpress.com/2022/11/bn\_talkingpoints6\_smallmodularreactors\_nov2022-1.pdf
4. Gaslighting is Merriam Webster’s word of the year: “the act or practice of grossly misleading someone especially for one’s own advantage.” We all have been experiencing the US Department of Energy, US Congress, nuclear industry, and nuclear proponents gaslighting us by claiming it is clean energy and a viable climate solution and that there is no logical reason to oppose it.
	1. Following the model of the tobacco and fossil fuels industries among others.
	2. The US Government has suppressed the truth about the harmful effects of radiation since the bombs were dropped on Hiroshima and Nagasaki.
	3. Climate concerns make a lot of people want to believe in nuclear power.
5. Renewables, Energy Efficiency, Conservation and Storage make new nuclear obsolete
	1. Renewables are the better choice: by Arjun Mahkajani https://www.utilitydive.com/news/small-modular-reactor-smr-wind-solar-battery-100-percent-clean-power-electricity/637372/
	2. Renewables expanding rapidly worldwide: https://www.climateandcapitalmedia.com/the-greatest-surge-of-renewable-dealmaking-ever/
	3. If nuclear was ever a “bridge” to the future, we have crossed it. The future is here!
6. High cost projections with almost certain cost overruns and the extended, unpredictable timeline for new nuclear make it a false climate solution. Significant new nuclear cannot be online before 2035 or 2040, if ever. Too little, too late.
	1. Lost opportunity cost: renewables plus storage combined with energy efficiency and conservation will reduce more carbon emissions sooner at a lower cost: Amory Lovins: https://www.utilitydive.com/news/nuclear-energy-should-not-be-part-of-the-global-solution-to-climate-change/620392/
	2. The only reactors currently under construction in the US are the two Westinghouse AP 1000 pressurized water reactors (PWR) being built at Plant Vogtle in Georgia. Construction was started in 2012 and was supposed to be complete by 2017. The current projected start-up is 2023. In 2012 cost was estimated at $14 billion and now is well over $30 billion. Westinghouse promoted the modular aspects of the design and construction as time and cost savers. That has proven to be a false claim.
	3. The last reactor startup in the US was TVA’s Watts Bar Unit 2, an 1150 MWe Westinghouse PWR Ice Condenser Design. Construction started in 1973. The two reactors were supposed to be finished in 1978 and cost a total of $685 million. Unit 1 came online in 1996 at a cost of over $6.4 billion. Unit 2 was not finished until 2015 (over 42 years!) and the cost was $6.3 billion. The total is over 18 times the original estimate.
	4. Many proposed reactors are never built. In 1973 President Nixon predicted 1000 operating reactors in the US by 2000. Only around 230 were proposed to the NRC. By 2012 104 were operating, now there are 93.
	5. In 2002 President G.W. Bush launched the “Nuclear Power 2010” program. It was a joint government/industry cost share that was supposed to re-start construction on new reactors. Over two dozen projects resulted, only 1 is still alive: Plant Vogtle. The only other one that got to the construction phase was V.C. Summer in South Carolina. It was cancelled in 2017 after over ten billion dollars was wasted. Westinghouse declared bankruptcy because of the fiasco. Utility executives have been prosecuted and jailed for defrauding ratepayers.
	6. New nuclear continues to get more costly per unit of generation (kwh or mwh).
7. The NuScale UAMPS reactors, the frontrunning US smnr design and project:
	1. Pressurized water reactors currently planned at 77 MW, with 6 slated to be built at Idaho Falls (462MW total) on Idaho National Lab: https://www.powermag.com/nuclear-field-activities-completed-for-idaho-nuscale-smr-project/
	2. The NuScale small modular nuclear reactors proposed for Idaho by Utah Associated Municipal Power Systems (UAMPS) were first funded by the US DOE in 2002. The Design Certification process on a 50 MW size started in 2008 with a unit supposed to be online by 2018, and 11 more to be completed soon after. Completion of the first unit has been pushed back repeatedly, now to 2029: https://www.nuclearcosts.org/timeline .
	3. The NuScale reactors were supposed to produce electricity for $58 per MWh. That has recently increased to $90 to 100, even when Federal subsidies of up to $30 are figured in. This is before the realities of construction delays and cost increases strike: https://www.nuclearcosts.org/concerns . Institute for Energy Economics and Financial Analysis (IEEFA) Report on NuScale reactors: https://ieefa.org/articles/ieefa-us-small-modular-reactor-too-late-too-expensive-too-risky-and-too-uncertain
	4. Completion of the UAMPS project is far from a certainty: https://www.utilitydive.com/news/nuscale-makes-public-debut-but-requires-a-lot-of-financing-to-launch-smal/624568/
	5. The Utah Taxpayer’s Association says beware the financial risks of the UAMPS project: https://utahtaxpayers.org/uamps-smr/
	6. This just in: NRC staff says the NuScale design application has several significant issues: https://www.utilitydive.com/news/nrc-nuscale-smr-small-modular-application-utah-uamps/637456/?utm\_source=Sailthru&utm\_medium=email&utm\_campaign=Issue:%202022-11-29%20Utility%20Dive%20Newsletter%20%5Bissue:46301%5D&utm\_term=Utility%20Dive
		1. Standard design draft application for the proposed uprate to 77 MWe has missing information
		2. NuScale says no big deal, no delay in timeline. Ed Lyman doubts that is true.
	7. Report from Oregon Physicians for Social Reponsibility: https://www.oregonpsr.org/report-uamps-nuscale-smrs
8. The Natrium liquid sodium cooled fast reactor proposed for Kemmerer, Wyoming: Bill Gates’ clever way of getting on the government dole - $80 million from the DOE. A curious, desperate choice. Reactors of this design have a 70-year history of failure worldwide: US, France, UK, Germany, Japan, Italy, Soviet Union/Russia, US Navy, Soviet Navy: https://www.citizen.org/wp-content/uploads/fastreactors.pdf . Up to $100 billion spent worldwide has failed to bring this technology to commercial deployment.
	1. Fast refers to the speed of the neutrons. Most currently operating reactors slow neutrons with a moderator such as water or graphite.
	2. Liquid sodium is a very problematic coolant: it explodes or burns when it comes into contact with air or water, even the water in concrete. It becomes 30,000 times more radioactive than water and the radiation decays much slower than water, making rapid repairs impossible.
	3. After decades of research, a couple of failed attempts (Phenix and SuperPhenix) and a ton of money spent France gave up on this technology in 2019: https://www.reuters.com/article/us-france-nuclearpower-astrid/france-drops-plans-to-build-sodium-cooled-nuclear-reactor-idUSKCN1VK0MC
	4. Arnie Gundersen’s open letter to Bill Gates: https://www.climateandcapitalmedia.com/bill-gates-dumb-climate-idea/
	5. The Natrium reactor will use HALEU fuel enriched to close to 20% U 235
		1. Not available from US manufacturers, Russia only current source
		2. HALEU fuel is much closer to nuclear weapons grade
		3. The fuel will be metallic rods that sit in the liquid sodium coolant.
	6. Failed US liquid sodium cooled reactors:
		1. Fermi 1 near Detroit suffered a partial fuel meltdown in 1966 three years after it came online. It took 4 years to repair and then was shut down in 1972. Book: We Almost Lost Detroit.
		2. In 1959 Santa Susana Field Lab near Los Angeles became the first reactor in the US to have a meltdown accident. Radioactivity released then is still causing problems now.
		3. US Navy submarine Seawolf’s sodium cooled reactor was replaced with a pressurized water reactor after about a year of operation because of sodium leaks, difficult repairs and high radiation exposure to workers. The replacement took two years starting in 1958.
9. There are several other non-light water reactor designs being proposed. Most have been tried unsuccessfully decades ago in the US and around the world. Ed Lyman of Union of Concerned Scientists has done an analysis of many of the current prospects in the race for Federal dollars: Advanced is not Always Better: https://www.ucsusa.org/resources/advanced-isnt-always-better
	1. The term “advanced” reactor is a meaningless public relations ploy: it was defined by the US Congress as “any light water or non-light-water fission reactor with significant improvements compared to the current generation of operational reactors”. (from page 15 of the report)
10. X-Power Xe-100 Reactor
	1. High Temperature Gas Cooled Reactor: HTGR. With TRISO fuel spheres, pebble bed
	2. Energy Northwest is planning to build the first of these north of Richland, Washington with an unrealistic goal of finishing by 2027.
	3. Received a DOE grant under the Advanced Reactor Demonstration Project
	4. Fort St. Vrain Reactors in Colorado were a failed attempt to make this type work: Looking Back At The Nuclear Power Plant, Fort St. Vrain | Colorado Public Radio (cpr.org)
	5. The Xe-100 is not likely to have robust containment as the designers are claiming that the fuel cannot melt, burn, or crack open.
11. Nuclear power is not “clean” energy. No matter how many times the US DOE and proponents repeat it!
	1. An example of the gaslighting: Chernobyl: proponents only admit to as few as 50 deaths. The reality is more like 825,000 or more according to the book: Chernobyl: Consequences of the Catastrophe (page 322) by Russian scientist, Alexey Yablokov and Belarusian physicist, Vassily Nesterenko.
	2. Manual for Survival: A Chernobyl Guide to the Future by Kate Brown details the effects of the accident and goes into the background of the conflicting histories.
	3. Nuclear Power Is Not Clean or Green! - Public Citizen
	4. It takes a lot of uranium ore to make 1 pound of nuclear fuel it depends on the quality of the ore, but U-235, the fissionable isotope is less than 1% of the uranium, most of it is U-238.
	5. Uranium Mining and Fuel - Nuclear Power Info (fairewinds.org)
	6. Uranium mining leaves a deadly legacy: mine tailings: Environmental Impacts of Uranium Mining | Greentumble
	7. Uranium mining devastates the Navaho Nation: For The Navajo Nation, Uranium Mining's Deadly Legacy Lingers : Shots - Health News : NPR
	8. U-238, depleted uranium, a by-product of nuclear fuel enrichment is used in military armor and projectiles: Depleted Uranium, Devastated Health: Military Operations and Environmental Injustice in the Middle East (harvard.edu)
	9. Full Body Burden: Growing up in the Nuclear Shadow of Rocky Flats by Kristen Iverson documents the abuses of the DOE.
12. The Safety of exposure to radiation caused by nuclear power reactors and other emitting facilities has not been adequately studied. In fact, many opportunities have been missed. There seems to be intentional disregard of the issue.
	1. It’s not just about cancer: those exposed to Chernobyl radiation had many other health issues.
	2. In the US the latest studies that I know of are from the 1980’s. The National Academy of Sciences did a Phase 1 study in 2012: [Analysis of Cancer Risks in Populations Near Nuclear Facilities: Phase I - PubMed (nih.gov)](https://pubmed.ncbi.nlm.nih.gov/24872970/). The NAS declined to proceed with Phase 2.
	3. Radiation affects children and women more adversely than adult males: [Team — Gender + Radiation Impact Project (genderandradiation.org)](https://www.genderandradiation.org/team)
	4. Effects of the Fukushima accident: [Latest UNSCEAR Report on the Fukushima Nuclear Disaster - Dr Ian Fairlie](https://www.ianfairlie.org/news/latest-unscear-report-on-the-fukushima-nuclear-disaster-in-2011/)
	5. Three Mile Island: [Three Mile Island: Health Study Meltdown - Joseph Mangano, 2004 (sagepub.com)](https://journals.sagepub.com/doi/full/10.2968/060005010)
13. The US Nuclear Regulatory Commission (NRC) is a regulatory agency captured by the nuclear industry. It struggles to regulate in the face of Congressional Oversight that is tainted by industry lobbying and campaign contributions.
	1. After the major accidents: Three Mile Island, Chernobyl and Fukushima the NRC has attempted to learn and modify regulations to prevent a repeat. Congress, at the behest of the industry, then threatens to withdraw funding and the NRC is forced to back down.
	2. Read the book: Confessions of a Rogue Nuclear Regulator by Gregory Jazcko, former Chairman of the NRC. He was Chair during the Fukushima meltdowns and explosions.
	3. 10 CFR Part 53, the NRC is developing a new licensing process for new reactors that may greatly weaken safety margins. Ed Lyman of Union of Concerned Scientists is following the process and has great concerns: https://www.commondreams.org/views/2022/11/23/us-nrc-seeks-greatly-reduced-safety-regulations-advanced-nuclear-power-plants and https://www.nrc.gov/docs/ML2219/ML22196A043.pdf
	4. A little informative history: for years the NRC had “confidence” that a solution would be found for highly irradiated used (spent) nuclear fuel in the future. It was called the Waste Confidence Rule. In 2012 the rule was challenged in Federal Court and thrown

out by that court ( https://www.nirs.org/radioactive-waste/waste-confidence/ ) because the confidence was not supported by a credible plan

* 1. Web-site: nrc.gov
	2. NRC Staff is very responsive to citizen inquiries. Every facility or licensing process has contacts that will respond to your questions. They need the public to weigh in to counterbalance industry pressure.
	3. Many of meetings are open to the public, with opportunities for comments and questions. Most can be attended remotely, by phone or online.
1. New Reactors and Waste
	1. Each of the proposed non-light water reactor designs has a different, specific waste stream, information on them is hard to find. They all produce dangerous radioactive waste because they all split uranium and plutonium atoms. Radioactive Waste - Beyond Nuclear
	2. “The technologies and economics of SMRs have been the focus of many studies, but there has been only minimal information published on the amount of nuclear waste different types of SMRs are expected to generate and no reports focused on near-term-deployable designs”. From the DOE Office of Nuclear Energy funded Argonne National Lab report released in Nov 2022. https://fuelcycleoptions.inl.gov/SiteAssets/SitePages/Home/SMR\_Waste\_Attributes\_Report\_Final.pdf
	3. Stanford Study on smnr radioactive waste: https://news.stanford.edu/2022/05/30/small-modular-reactors-produce-high-levels-nuclear-waste/
		1. “Our results show that most small modular reactor designs will actually increase the volume of nuclear waste in need of management and disposal, by factors of 2 to 30 for the reactors in our case study,” said study lead author Lindsay Krall, a former MacArthur Postdoctoral Fellow at Stanford University’s Center for International Security and Cooperation (CISAC). “These findings stand in sharp contrast to the cost and waste reduction benefits that advocates have claimed for advanced nuclear technologies.”
2. Highly Irradiated Fuel Rods from Existing Operating and Shuttered Reactors
	* 1. There is still no functional US plan for long term disposition of highly irradiated used fuel, after over 60 years of nuclear power generation. The industry is far more interested in generating the waste than understanding it and properly dealing with it.
	1. Short graphic pamphlet on nuclear waste disposal in Canada: https://www.ccnr.org/Comic\_Book\_2020\_eng.pdf
	2. US DOE Nuclear Waste Technical Review Board
		1. Advisory Board appointed by the POTUS, advises the DOE. Sometimes is a source of less industry-biased information.
		2. Website: https://nwtrb.gov/
		3. Twice a year meetings
		4. Reports
3. Gaslighting: the mythology of using nuclear waste to power reactors
	1. False claims revolve around burning used fuel in some designs to minimizing waste storage and disposal challenges. All of these involve reprocessing highly irradiated used fuel to separate plutonium. Reprocessing is an environmental and weapons proliferation nightmare: https://thebulletin.org/2022/09/some-fuels-never-learn-us-energy-department-returns-to-costly-and-risky-plutonium-separation-technologies/.
	2. The story of West Valley, New York: the US’s failed reprocessing facility: West Valley Nuclear Waste Site - Information Hub · NIRS
4. Nuclear Weapons Proliferation and the New Reactors
	1. Many proposed reactors plan to use HALEU Fuel: high assay low enriched uranium. Enriched to almost 20 percent U-235.
	2. “DOE Ignores History, Risks Proliferation by Stephanie Cooke: https://www.energyintel.com/0000017e-ff91-df96-a1fe-fffddf990000
	3. Nine countries have nuclear weapons, 32 countries currently have nuclear power. Nuclear power is a pathway to nuclear weapons. Exporting more nuclear reactors to more countries is likely to result in nuclear weapons in more countries and possibly rogue groups and individuals.
5. Private insurers will not cover nuclear power reactors. Only limited liability insurance coverage is available to nuclear power reactors under the Federal Price Anderson Act, originally intended as a temporary fund in 1957. The limit is about $12 billion per disaster. The estimated cost of the Fukushima nuclear disaster is between $250 and $500 billion. Payments above $12 billion would require Congressional approval. The Act expires in 2025 but another Congressional extension has been recommended by the NRC.
6. A very valuable resource: The World Nuclear Industry Status Report- 2022: https://www.worldnuclearreport.org/The-World-Nuclear-Industry-Status-Report-2022-HTML.html
7. Ohio Nuclear Free Network Flyer: “How Nuclear Power Worsens Climate Change”: <https://docs.google.com/document/d/1njU45aOjBGCR56MRhlEgITxZRcy-jjrt/edit>