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One of the reasons why small modular reactors are being promoted so much is because there has been such a huge investment in the reactor business, which is dying. The whole nuclear industry is dying, but because of the nuclear waste you can't just walk away from it. You have to have expertise to look after the decommissioning and waste management problems which are going to last for at least 100 years after the last reactor is shut down. So, in a way the nuclear industry has a stranglehold on those governments, which have invested already in nuclear, to continue to invest just to maintain the expertise. That's one of the motivations.

Another motivation I believe, at least in Canada, is that the premiers — that is the prime ministers of the provinces, three or four of them that have expressed enthusiasm for small modular reactors — are actually not enthusiastic about reining in climate change, they are not enthusiastic about reducing greenhouse gas emissions now. They have expressed opposition to a carbon tax for example. Investing in small nuclear reactors is a way of kicking the can down the road, saying 'well we can say that we're dealing with climate change because we are pouring money into these small nuclear reactors' – when in fact, if the same money were poured into energy efficiency and renewables you would get much faster, cheaper, cleaner returns with a lot more jobs created. So, the logic advanced by those governments is completely at odds with the logic of common sense.

I think we have a problem of rhetoric here. The fact that the industry keeps calling them small modular reactors, and we keep using the industry's language, is a problem. I think we should call them not SMRs but DDDs, short for Dirty Dangerous Distractions. These are dirty and dangerous distractions from dealing with climate change now. You can elaborate as to why they're dirty, why they're dangerous, and why they're a distraction. And that, I think, gives us an opening to reach people at a very fundamental level where they don't have to feel that they need to be experts in energy policy, or nuclear power, or know a lot about radioactive waste.

It's very revealing that the SMR terminology, the SMR acronym, leaves out the "N" for nuclear. It's a small modular ***nuclear*** reactor. They leave out precisely the one word that makes it different and particularly dangerous. Nuclear is not only having to do with the nuclear waste, but it is, by the way, the only industry on earth that actually mass produces hundreds of new toxic elements. There is no other industry that produces brand new toxic elements and these elements in themselves are really indestructible in the sense that we don't know how to neutralize them or render them harmless. We can only move them from one place to another and repackage them, so we have a radioactive liability which has been growing, and that liability continues to grow.

Part of the distraction with small modular reactors is to dazzle the governments and the population into turning their eyes away from the nuclear waste and the nuclear weapons problems, both of which really do threaten the future, and hold out this false hope that if you just keep pouring money into the nuclear industry to produce more nuclear reactors, somehow

all these problems will magically disappear. Just like the Coronavirus will magically disappear if you follow Trump's advice.

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As I understand it, there are really two uses for the word modular. SMNRs can be considered modular in the sense that you can stack multiple units at one site, so that you can build up a large capacity in one spot by simply putting several small modular reactors together. For example, the NuScale plant in Idaho that is designed to build 12 identical small modular reactors to make a kind of a network of interacting nuclear reactors.

This has implications in terms of risk, because the risk of a meltdown is effectively multiplied by 12 simply by having those 12 reactors. That might well make the probability of a meltdown or a serious nuclear accident actually quite a bit greater, significantly greater, than it would be for one single large reactor.

As far as containment goes, containment is often massive, it uses up a lot of space. Because the SMNR vendors are looking to build smaller installations, they try to minimize the containment, and to justify this by the technology that they are using. What they are really saying is that we cannot have releases because we are using an inherently safe technology, so we can dispense with the thick concrete walls.

But the reason why nuclear reactors are unsafe is not because they are machines for generating electricity, but because they are also warehouses of radioactive poisons. Anything that destroys that warehouse – whether it's an attack by bombing from above during warfare, or sabotage on the ground, or just some kind of unforeseen accident like an aircraft crash – can release an enormous amount of radioactive material which will then be in the environment and working its way through the food chain for many, many, centuries to come. So, why call them safe? You can't imagine an accident with say windmills or solar collectors that would be anywhere close to catastrophic compared with the detonation or explosion of one of these small modular reactors. Obviously, they cannot afford to have the same degree of integrity in terms of containment as the larger reactors because otherwise they couldn't be small.

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I can say something about thorium. It's a very important question. The point is there is only one material in nature, only one naturally occurring material, which can be used to make atomic bombs or run a reactor, and that's uranium 235. That's it. That's all there is. Now, there are a couple of man-made materials which can also be used for both purposes, to make bombs or to fuel nuclear reactors. One of them is plutonium, which is produced as a by-product from uranium inside the reactor, so it's a derivative of uranium, you could say. The other is an isotope of uranium that does not occur in nature called uranium 233, and that's a derivative of naturally-occurring thorium if it is bombarded by the neutrons from an operating reactor.

The problems of nuclear weapons proliferation are associated with using uranium reactors to produce plutonium, and that plutonium can be extracted from the irradiated fuel and used to make bombs galore. But those same problems are paralleled when we talk about thorium reactors. Thorium reactors do not produce plutonium, but yes, they do produce uranium 233,

which is an extremely powerful nuclear explosive, and which is produced at 100% enrichment, something we cannot possibly achieve with uranium 235.

So the promoters of thorium reactors are simply trying to confuse people into thinking that because such reactors don't produce plutonium they are not a proliferation risk. They are.

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It's also important to realize that there are a great many competing models of SMNRs. We're talking about well over 100 different models. And a great many small entrepreneurial companies are just looking for an opportunity to build their own particular version of a small nuclear reactor. It's almost like a latter-day gold rush. I'm reminded of those thousands of prospectors heading off to the Yukon, all hoping to get rich quick. Anybody can go and pan for gold, just like anybody can propose a small modular reactor design, but how many are going to be able to corner enough of the market to justify the expense of building an manufacturing plant? If you don't have a market for hundreds or thousands of customers, it's simply not worth building an assembly-line plant. But if these reactors are built just one at a time, before there is enough rationale to build a mass production plant, they are going to be extremely expensive.