EconoFact Chats: The Role of Nuclear Power in Our Energy Future

Gilbert Metcalf, Tufts University

Published on 29th May 2022

Michael Klein:

I'm Michael Klein, Executive editor of EconoFact, a nonpartisan web-based publication of the Fletcher School at Tufts University. At EconoFact, we bring key facts and incisive analysis to the national debate on economic and social policies, publishing work from leading economists across the country. You can learn more about us and see our work at www.econofact.org.

Michael Klein:

45 years ago on May 1st, 1977, over 2,000 members of the Clamshell Alliance, an anti-nuclear organization founded the previous year occupied the Seabrook nuclear power plant construction site in New Hampshire. Over 1,400 of the protesters were arrested, including my guest today, Gilbert Metcalf. Gib is now an internationally recognized expert on energy and the environment. He has frequently testified before Congress, served on expert panels for the National Academy of Sciences and the U.S. Environmental Protection Agency, and he also served as a Deputy Assistant Secretary for [inaudible] the Environment and Energy at the US Department of Treasury in 2011 and 2012. I'm also very pleased to say that he's my colleague at Tufts University. Gib's most recent book, published in 2019 is Paying for Pollution: Why a Carbon Tax is Good for America.

Michael Klein:

Gib, welcome once more to EconoFact Chats.

Gilbert Metcalf:

Thanks, Michael.

Michael Klein:

Gib, what was the Clamshell Alliance for those of our listeners who might not be as old as you or me? And why was it protesting at the Seabrook New Hampshire construction site?

Gilbert Metcalf:

So, Michael, as you noted, the Clamshell Alliance was set up to protest the construction of a nuclear power plant at Seabrook, New Hampshire. Just to step back for a moment, this was part of a broader anti-nuclear movement that was nationwide and grew out of a mistrust of nuclear power that stemmed in part from the Ban the Bomb movement from the 50s and 60s, as well as a post-Vietnam distrust of government and big institutions; and safety issues were at the forefront. But Seabrook in particular, and why Clamshell came about, there were real concerns with this plant. First off, it was a twin reactor plant on the New Hampshire coastline where major tourist destinations would be difficult to evacuate in an emergency. And it was being built by Public Service of New Hampshire, a small underfunded private utility that really could not justify the proposed load edition to their portfolio. And whether it could handle the financial risk was a real question.

Michael Klein:

Gib, this is the first time in any EconoFact Chats episode's when we discussed the guest's time in jail. What happened with the protest and how did it go down?

Gilbert Metcalf:

Well, at the time it was one of the largest mass arrests in US history. The number of people arrested was something on the order of three times what the New Hampshire jail system could handle and so the state distributed the 1,400 or so protestors who'd been arrested into national guard armories around the state. I was in one in Manchester. I think that was the largest armory that held people.

Gilbert Metcalf:

And we were asked to post bail and the protestors refused to do that for the most part. Finally, after a couple of weeks, the state relented, because it was costing them tens of thousands of dollars to house and feed us and pay the national guard to keep us in the armories. So it was really an incredibly effective protest in terms of the national and international attention that it got.

Michael Klein:

Gib I feel like this is a little bit like the song Alice's Restaurant, where they talk at the beginning about jail, but then at one point, Arlo Guthrie says, "That's not what I'm here to talk to you about today" and what we're here to talk about today is nuclear power. Is nuclear energy production today different from the way it was produced in the 1970s. And if so, what kinds of advances have been made?

Gilbert Metcalf:

The technology itself has really not changed much since the 1970s. It is still a fission technology that requires large amounts of cooling water to keep the control rods from overheating. The control rods are what control the speed of the reaction that creates the heat to spin the turbine blades to create electricity. And that's why nuclear power plants are always built either near large waterways, like big rivers, like the Connecticut River in Western Massachusetts, or on coastlines like coastal New Hampshire.

Michael Klein:

How much of US energy production currently comes from nuclear energy?

Gilbert Metcalf:

The US gets about one-fifth, 20% of our electricity from nuclear power. And that is a remarkably stable percentage that has not changed in decades.

Michael Klein:

But other countries like France, they're more dependent on nuclear energy. Aren't they?

Gilbert Metcalf:

France is especially reliant. They made a big bet on nukes in the 50s and 60s, and today they get 70% of their electricity from nuclear power. They're the world leaders in terms of that nuclear share.

Michael Klein:

In terms of world leaders, is it the case that Russia is at the forefront of nuclear energy technology?

Gilbert Metcalf:

Well, I wouldn't say they're at the forefront of technology. Russia, along with China and Korea and a little bit, to some extent, France, they are certainly at the forefront of the sales of new reactors internationally, but their technology is not especially novel or new.

Gilbert Metcalf:

They are leaders, however, in fuel conversion and enrichment technologies. Because you dig uranium out of the ground, you have to convert it to an enriched form that has enough nuclear capacity to actually create the reaction in a nuclear power plant. And that's something Russia has really been a leader in.

Michael Klein:

A particularly important issue is the safety of nuclear energy and the issues related to the disposal of nuclear waste. I remember back in the 1970s and the 1980s, the Smiling Sun posters that said "Nuclear energy, no thanks" or, in the original Danish, "Atomkraft? Nej tak." The safety factor and the disposal of nuclear waste were two of the animating issues for the Clamshell Alliance, right?

Gilbert Metcalf:

That's right. The US made it a strategic decision to forego waste reprocessing, which is something actually the Europeans do. We decided to not do waste reprocessing because that leads to Plutonium production and Plutonium is especially dangerous from both a health perspective and a weapons proliferation perspective. So as a result, we have more waste to dispose of from our nuclear power plants and we have yet to come up with a long-term waste storage facility and plan.

Gilbert Metcalf:

Now that's a political problem rather than a technological problem. No state wants this stuff and the US government has not figured out a way to convince a state to establish a facility in their state. But from a technological point of view, it is straightforward to safely house the waste that we're developing now. The problem is we always talk about the need for a thousand or 2000-year storage solution or a permanent solution, but we really only need to come up with a 200-year plan, the reason being we're in 2022, think about how technology has evolved since 1822. And you can see that all we have to do is store the stuff in a way that we can come back to it and improve storage in the future as technology improves. So that's waste storage.

Gilbert Metcalf:

Now, in terms of the safety of the operating plants, we actually have observed a consolidation of nuclear power plant ownership in the United States. And with that consolidation has come about real learning that has led to considerable improvements in safety and operations. And there's a very nice paper by Lucas Davis and Catherine Wolfram, two energy economists at Berkeley who have documented this improvement.

Gilbert Metcalf:

So we're all familiar with these high-profile nuclear power plant problems; Chernobyl in the Ukraine in 1986 and the Fukushima disaster in Japan in 2011. Do you see these as warning signs or aberrations?

Gilbert Metcalf:

Well, they're both aberrations and warning signs. Chernobyl is a textbook example of what happens when rigid bureaucracies value obedience over safety. Chernobyl used a flawed technology that was well understood, but the Soviet autocratic leadership would not tolerate any dissent from the party line about the quality of Russian nuclear technology. Had they listened to the plant engineers or had proper safety inspections this tragic disaster would never have happened.

Gilbert Metcalf:

Now, Fukushima was also avoidable. And that speaks again to the importance of strong regulation of nuclear power plants. TEPCO, the builder of the plant, did inadequate modeling of tsunami risk. And then they did not carry out the basic steps that could have prevented the disaster, including basic things like moving the generators to higher levels within the plant, the generators to create electricity in emergencies. They didn't have water-tight connections between those emergency generators and the key safety equipment. And they didn't protect their seawater pumps. What's especially tragic is that there had been a flood of a nuclear power plant in 1999 that made clear the importance of waterproofing nuclear power plants. The European nukes did just that, but Japan did not. It's a failure of leadership and regulation.

Gilbert Metcalf:

Another issue, Gib, is the financial viability of nuclear energy. And of course, viability changes as the price of oil and other kinds of energy sources change. And, as I understand it, one of the problems of nuclear energy is plants cannot shut down easily and production of energy continues even if demand is not there. Is that correct?

Gilbert Metcalf:

That's kind of correct. So new plants are extraordinarily expensive to build. And so it's difficult to justify, given recent prices of natural gas. Now, maybe that will change with the invasion of Ukraine, but this is why we haven't seen the construction of new plants in the United States beyond a couple that are currently being built [inaudible] under construction for quite a while.

Gilbert Metcalf:

Now for existing plants that have paid off their capital costs, and that's pretty much the rest, all of them, the operating costs are very low. So it's actually desirable to run them as much as possible. And you're right. It's not easy to turn them on or off, and that's why they serve as what's called baseload generating capacity. Now it would be even more attractive to have these, these baseload plants that just run all the time if we can bring down the cost of storing electricity, whether that's through conventional batteries, or underground compressed air, or hydro pump storage, but that's pretty expensive right now.

Michael Klein:

The issue of the storage of energy of batteries is also an issue for solar, wind, and other kinds of renewable energy as well. Isn't it?

Gilbert Metcalf:

Well, that's why in fact, nuclear power could be a really nice natural complement solar and wind and other intermittent technologies is that you could use excess energy from nuclear power plant, if it was storable, to make up for those times when the wind's not blowing or the sun is not shining,

Michael Klein:

I guess any discussion of the financial costs and the risks of nuclear energy have to be put into context and weigh the very real and very present dangers of climate change.

Gilbert Metcalf:

Well, nuclear power is very capital intensive in part because of the need to ensure they operate safely. Now, there are new technologies being explored, things like modular reactors, and they look very promising, but they aren't ready for prime time yet, meaning that it's just too expensive. Having said that, nuclear power is a carbon-free electricity source. And as we move to electrify the transportation and building sector, something we're working on and these of course are two big sources of greenhouse gases, we're going to need as much carbon-free electricity as we can get.

Michael Klein:

So Gib, given all of this, what role do you see for nuclear energy for a sustainable carbon free future? Is it important or is it just sort of a transition to other sources of energy? Or do you think it'll be part of a long-term strategy?

Gilbert Metcalf:

So that's a good question. And I am a cautious skeptic. We need to continue exploring ways to bring down the costs of nuclear power, and we need to solve the waste storage problem. If we can do that, then great. Nuclear power could then be part of a long-term zero-carbon strategy. But I'm not convinced yet that we'll be able to do that. However, I'd much rather see R & D money spent on solving the nuclear problem than spent on things like geo-engineering. Now, geo-engineering is something that really frightens me, but that's probably for another episode of your podcast.

Michael Klein:

Just briefly can you explain what geo-engineering is? Is it throwing stuff in the atmosphere to keep the sun from shining on us?

Gilbert Metcalf:

That's exactly right.

Michael Klein:

And so that we have no idea what the consequences of something like that would be.

Gilbert Metcalf:

It's completely unheralded kind of technology. We have no idea whether there could be unintended consequences and moreover, there are all kinds of political issues involved if certain countries decide to do it and other countries disagree with that decision to do it.

Michael Klein:

Well Gib, thank you once again, for joining me on EconoFact [Chats] and addressing this really important issue, that is interesting the way your thoughts have evolved on it over the 50 years and in conjunction with that, the way that nuclear energy production has evolved over the last 50 years.

Gilbert Metcalf:

You're very welcome. It's been a pleasure talking with you.

Michael Klein:

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