FRANKLIN SERVAN-SCHREIBER

Co-Founder and CEO of Transmutex

Thank you for being here. I am Franklin Servan-Schreiber, I am the co-founder and President of Transmutex, a Swiss-based company that is a spin-off from CERN. I am here to discuss the important role of nuclear energy and then to give you a brief idea of what we do.

Today, where we are is fossil against renewable and it would be better to say carbon versus carbon free, but the gap is enormous, and it has not really changed. I looked at the statistics for 1979 to today and basically gas replaced coal but renewables are almost nowhere to be seen apart from hydroelectric power. I just want to mention that today in Switzerland nuclear is producing more energy than hydroelectric in winter and for all the talk about wind, nuclear is producing more electricity than wind in Germany today, in winter not every day. If we want to understand the power of scalability for nuclear, you have a beautiful experiment in France versus Germany. For a 10-year period over the seventies and eighties, France invested around the same amount as Germany has invested in renewables over the last 10 years. The same amount of money and the same amount of time, and the end result is two times more carbon-free energy for France, which will last 60 to 80 years, when you have to reinstall solar panels of wind turbines every 25 years; this is the power of nuclear. This is a very favorable figure because I did not do it this year, which would have been very unfavorable for Germany. On the summer solstice of last year when you had as much sun in France and Germany, with all the renewables installed in Germany over the last 10 years, there was six times more CO2 per kilowatt hour in Germany than in France.

What do we want? Of course, energy security but also reduction in CO2. It is very clear that for energy security nuclear is more scalable and it is also more scalable for CO2 reduction; there is no contest. Just to make it very clear, we went from Mediaeval times to industrial times with a 2x gain in energy density from wood to coal. Wind and solar are 10 times less energy dense than coal and nuclear is 3 million times more energy dense than coal. I would like to go back to Frank. Let us stop talking about 2050, which is whatever goal it is. What is important is the future of our civilization and nuclear is the last frontier. It is the California of energy, and we have to make it work. Let us not be afraid, let us be engaged. We want to have a future for generation upon generation, not just until 2050.

One of the things you may not understand is that the energy transition is about heat, it is not about electricity, which is the least important part of the consumption of energy. Here in the United Arab Emirates, it is about air conditioning and that is pretty good because electricity can make air conditioning but even with all the sun, they have two nuclear plants and two more nuclear reactors started. If the United Arab Emirates needs nuclear, then we should ask what Germany should do because they do not have anywhere near the same levels of sun.

You may notice that there is transport here, and this is where I believe hydrogen is going to be so important. Hydrogen for me is the most promising vector of energy that is going to be tradeable. The problem with electricity is that it needs to be hard-wired, you cannot trade electricity except for very specific cases of interconnected grids. Hydrogen is like oil, you can transport, transform, and do lots of things with it. Nuclear is the best way to make low-cost hydrogen because nuclear works all the time and if you buy a USD 10 million electrolyzers, you want it to work all the time, not just 20% or 30% of the time with wind.

In 10 minutes, I have convinced you that nuclear is great but of course, we have safety and waste, and we should not sweep that under the carpet. This is the problem, and we have to face it. For me, waste is the major problem because in the end, when you look at safety there have been some spectacular accidents but very few deaths. In fact, the worse technology in terms of deaths per kilowatt-hour is hydroelectricity because a dam in Bangladesh broke and killed 200 000 people. The default solution for waste is to bury it, which means trying to build 5-metre diameter tunnels 500m below the surface, which is a major engineering feat. It is also going to be finite because you are not going to make 30 of them, you will make one because it will probably be incredibly expensive. In fact, this year, the UK doubled its estimate of the costs for burying waste in England. Just for the numbers, England had 20 nuclear reactors, so it is going to be USD 60 billion to bury the waste and that is money lost. You bury the waste, and it is going to be there for 300 000 years, and it might threaten the water supply of future generations. In fact, nuclear waste is woefully underfunded. Switzerland is probably the best case for funding with the money already in the bank for its five reactors. By contrast, America has 93 reactors, actually 100 but some are closed, so 20 times as many reactors as Switzerland, but only twice the amount of money, which is just a line on the general budget rather than in the bank. In my mind, the nuclear industry is already bankrupt from the get-go if we do not deal with the waste. The liability for the waste in America could be USD 500 billion, it is probably going to be USD 90 billion in France, but the French Cour des comptes has said they have no idea how much it is going to cost. Therefore, if we do not deal with the waste we will miss out on the opportunity for our civilization to harness the best clean energy the universe provides us with. In addition, in a 2018 report the UN states that if we want to reach net-zero by 2050, we basically need five times more nuclear.

How are we going to do five times more nuclear if we do not know how to deal with the waste and it is already too expensive? This is the question I had, and it led me to meet some amazing scientists at CERN in Switzerland. Working completely outside the nuclear industry, they have a completely different approach to how we should run a nuclear reactor, which combines a particle accelerator together with a reactor and thorium, which is a very common fuel. I am not going to explain in detail, but the principle is that if you stop the accelerator then the reactor stops in two mini-seconds and reduces the amount of nuclear waste by 99%. This is not a paper; it has actually been demonstrated. I am not saying it is easy or that it has been totally solved, but it has been demonstrated, scientifically evaluated and credible. We also have the worldwide partnerships to do it because if climate change is going to be solved, it is going to be solved together; let us not do it as just one company. We are reaching out to everybody to collaborate with us, and we have some of the most prestigious laboratories in the world and we are reaching out now to more industries to make this effort.

I would like to leave you with a beautiful quote from the Nobel laureate, Gérard Mourou, in France, who never gives quotes but allowed me to state this. 'This is scientifically proven, credible and led by an exceptional team.' Thank you very much for your attention.

John Andrews, Contributing Editor to *The Economist* and *Project Syndicate*

Thank you very much. Just a couple of quick questions, Franklin. In Britain at the moment there is a big dispute at the moment about whether windfarms should be onshore or kept offshore. However, from what you are saying wind turbines are basically a false promise, it is not going to work.

Franklin Servan-Schreiber

It is a useful technology, but it is really a transition technology in my mind. There is a study in Germany that wind turbines are much more efficient offshore than onshore, 30% compared to 10%. In my mind, it is quite useless to build onshore, you should build offshore.

John Andrews

Second question, this looks very attractive, I guess you would call it a thorium reactor. What is your timescale, the same question I asked Frank?

Franklin Servan-Schreiber

If we were at war, which I think we are in many ways, it would be five years but right now it looks like 2032.