The Oregon Conservancy Foundation

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Before the Senate Committee on Energy and Environment

Testimony of Lloyd K. Marbet
Oregon Conservancy Foundation
March 23, 2021

Mr. Chair, members of the Committee, and the public, my name is Lloyd K, Marbet and I am the Executive Director of the Oregon Conservancy Foundation (OCF). I am testifying in opposition to SB 360.

In 2017 we gave testimony in opposition to SB 990, an early version of Senator Boquist's reoccurring legislation. What is striking is how relevant this attached testimony still is four years later. (Attachment 1) I also attach a recent Deutsche Welle article that shows how nuclear power worsens the climate crisis, (Attachment 2) along with an Executive Summary of a RethinkX study showing how inaccurate cost estimates for conventional energy generating facilities, including nuclear, are being turned into overpriced stranded assets by the rapidly decreasing costs of solar, wind and battery storage. (Attachment 3)

In its testimony, NuScale/Fluor, has given all the bells and whistles of its modular reactor design. Yet these reactor modules will produce the same kind of high level radioactive waste temporarily stored outdoors at the Trojan Nuclear Plant site, in Rainier, Oregon, at a storage facility licensed in 1999, and recently given a license extension to March 31, 2059. **When will this waste be taken away, no one knows?**

Nuclear radiation is not restricted to boundaries of cities or counties. Even with the public relations of NuScale/Fluor representatives, the promises of safety and the so called imperviousness to a multitude of disasters – high level nuclear waste will reside at each NuScale reactor facility with the need for transport and permanent disposal. **When and how that waste will be taken away, again no one knows?**

As we testified in 2017:

> *No one can project all the scenarios of radiation exposure and accidents that will occur, from the reactor site to an unknown location for possible reprocessing of the fuel assemblies and/or transport of this high level nuclear waste to a final waste repository...No one knows the problems that will occur with the structural components within each reactor module as they are exposed to the long term degradation of radiation over its life of fissioning and the subsequent embrittlement of surrounding metal. What we are offered are projections of nuclear salesmen and academic reactor designers.*

Now we are told that NuScale reactor design bells and whistles are going to function without failure or error, even in the midst of a climate crisis with its crescendoing catastrophic events; similar to the siren songs sold to us long ago for reactor designs that have historically failed, and for which no electricity produced was "too cheap to meter."

Please examine the exhibits on page three of our 2017 testimony, and consider the wisdom being offered by Amory Lovins: **"When you've got one planet and you've got to keep living there, you don't want to try anything irreversible."**

I thank you for this opportunity to testify. We ask that you reject SB 360.

> ***No degree of prosperity could justify the accumulation of large amounts of highly toxic substances which nobody knows how to make safe and which remain an incalculable danger to the whole of creation for historical or even geological ages. To do such a thing is a transgression against life itself, a transgression infinitely more serious than any crime perpetrated by man. The idea that a civilization could sustain itself on such a transgression is an ethical, spiritual, and metaphysical monstrosity. It means conducting the economical affairs of man as if people did not matter at all.***
>
> ***– E. F. Schumacher "Small is Beautiful"***

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Before the House Energy and Environment Committee

Testimony of Lloyd K. Marbet
Oregon Conservancy Foundation
May 24, 2017

Mr. Chairperson, members of the Committee, and members of the public, my name is Lloyd K. Marbet and I am the Executive Director of the Oregon Conservancy Foundation. I appear before you today in opposition to SB 990.

SB 990 would allow modular nuclear fission reactors, with an electrical output not to exceed 300 megawatts, to be built and operated within Oregon cities, or within an unincorporated area in Oregon counties. This would be done without having to meet the requirements of the law, passed by Oregon voters in 1980, prohibiting the construction of nuclear power plants until "an adequate repository for the disposal of the high-level radioactive waste produced by the plant has been licensed" by the federal government (ORS 469.595); and the proposed nuclear power plant has been approved by statewide vote of the people. (ORS 469.597)

1980 BALLOT MEASURE 7 <u>NEVER INTENDED</u> TO EXEMPT MODULAR NUCLEAR REACTORS FROM THE REQUIREMENTS OF THIS LAW.

NuScale/Fluor, a major proponent of this legislation, has yet to receive a license for its small modular reactor design from the Nuclear Regulatory Commission. (NRC) Even if the design is eventually licensed, these reactors would produce the same kind of high level nuclear waste produced by the Trojan Nuclear Plant, which for 14 years has been stored on plant site, near St. Helens, OR, waiting for the nuclear garbage man to come take it away to a federally licensed permanent waste repository that still doesn't exist. You would think that nuclear proponents would spend their time focused on cleaning up the tremendous backlog of the nations nuclear waste before proposing clever legislation to circumvent the 1980 ban on producing more of it in Oregon.

High level nuclear waste is not restricted to the boundaries of cities or counties. Even with all the public relations of NuScale/Fluor representatives – proposed local elections, the promises of safety and the so called imperviousness to a multitude of disasters – high level nuclear waste will reside inside each spent NuScale reactor module with the ultimate need for transportation and permanent disposal. No one can project all the scenarios of radiation exposure and accidents that will occur from the reactor site to the unknown location for possible reprocessing of the fuel assemblies and/or subsequent transport of this high level nuclear waste to a final waste repository that is yet to be constructed and capable of accepting this waste.. No one also knows the problems that will occur with the structural components within each reactor module as they are exposed to the long term degradation of radiation over its life of fissioning and the subsequent embrittlement of surrounding metal. What we are offered are projections of nuclear salesmen and academic reactor designers with all their shortcomings, as so aptly described by Admiral Hyman Rickover, the father of the American Nuclear Navy, in testimony to Congress over sixty years ago:

> *Unfortunately for those who must make far-reaching decisions without the benefit of an intimate knowledge of reactor technology, and unfortunately for the interested public, it is much easier to get the academic side of an issue than the practical side. For a large part those involved with the academic reactors have more inclination and time to present their ideas in reports and orally to those who will listen. Since they are innocently unaware of the real but hidden difficulties of their plans, they speak with great facility and confidence. Those involved with practical reactors, humbled by their experiences, speak less and worry more. – Admiral Hyman G. Rickover - "Paper Reactors, Real Reactors" (5 June 1953)*

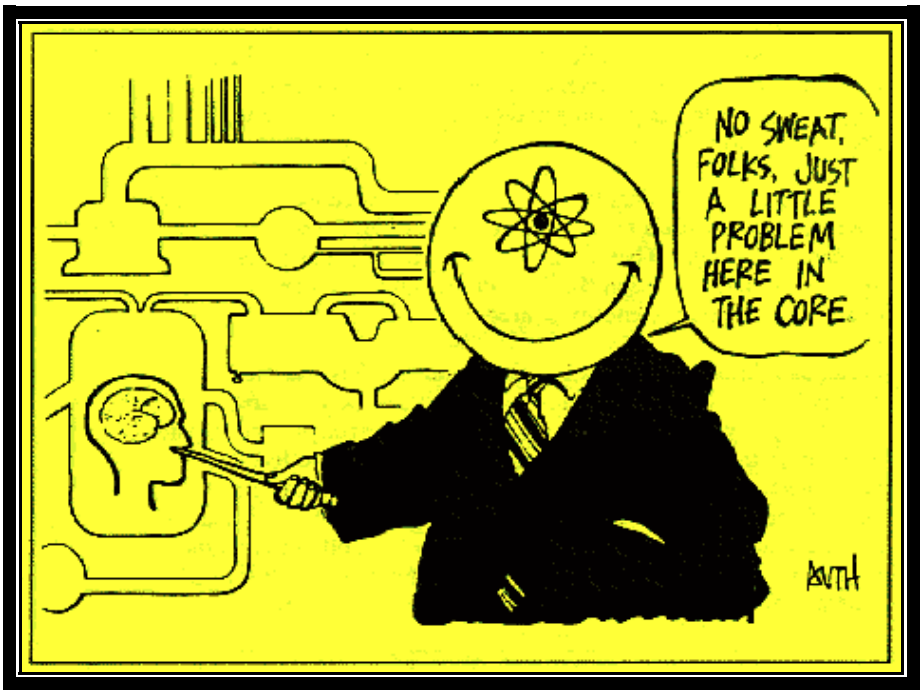
It was for this reason, and others, that Oregonians wisely chose to protect themselves by passing Ballot Measure 7 in 1980. Do not allow Nuscale/Fluor to do an end run around these protections in their quest for corporate profit. It will not be cities or unincorporated areas in counties that will end up paying the cost of nuclear power. It will be future generations.

Thank you for the opportunity to testify. We ask that you reject SB 990.

When you've got one planet and you've got to keep living there, you don't want to try anything irreversible.
– Amory Lovins

— EXHIBITS —


Mike Keefe THE DENVER POST 3-27-11
NUCLEAR WASTE CONTAINMENT VESSEL


NO SWEAT, FOLKS, JUST A LITTLE PROBLEM HERE IN THE CORE
AUTH

Environment https://www.dw.com/en/nuclear-climate-mycle-schneider-renewables-fukushima/a-56712368

'Every euro invested in nuclear power makes the climate crisis worse'

Can nuclear energy help us meet climate goals? The editor of the World Nuclear Industry Status Report, Mycle Schneider, says no. He explains his stance to DW.

Mycle Schneider says investing in nuclear power is the wrong way to go when it comes to tackling climate change

As Japan marks the 10th anniversary of the Fukushima Daiichi nuclear disaster, the global conversation around the merits of using nuclear power to tackle the climate crisis remains hot. Many environmentalists are opposed, pointing to the risk of nuclear meltdowns and the difficulty of properly disposing of nuclear waste.

However, it has been championed by others for its ability to produce huge amounts of carbon-free energy. DW spoke to Mycle Schneider, editor of the annual World Nuclear Industry Status Report (WNISR), which assesses the status and trends of the global nuclear power industry.

DW: The goal is to keep global warming below 1.5 degrees Celsius (2.7 degrees Fahrenheit). What role can nuclear power play?

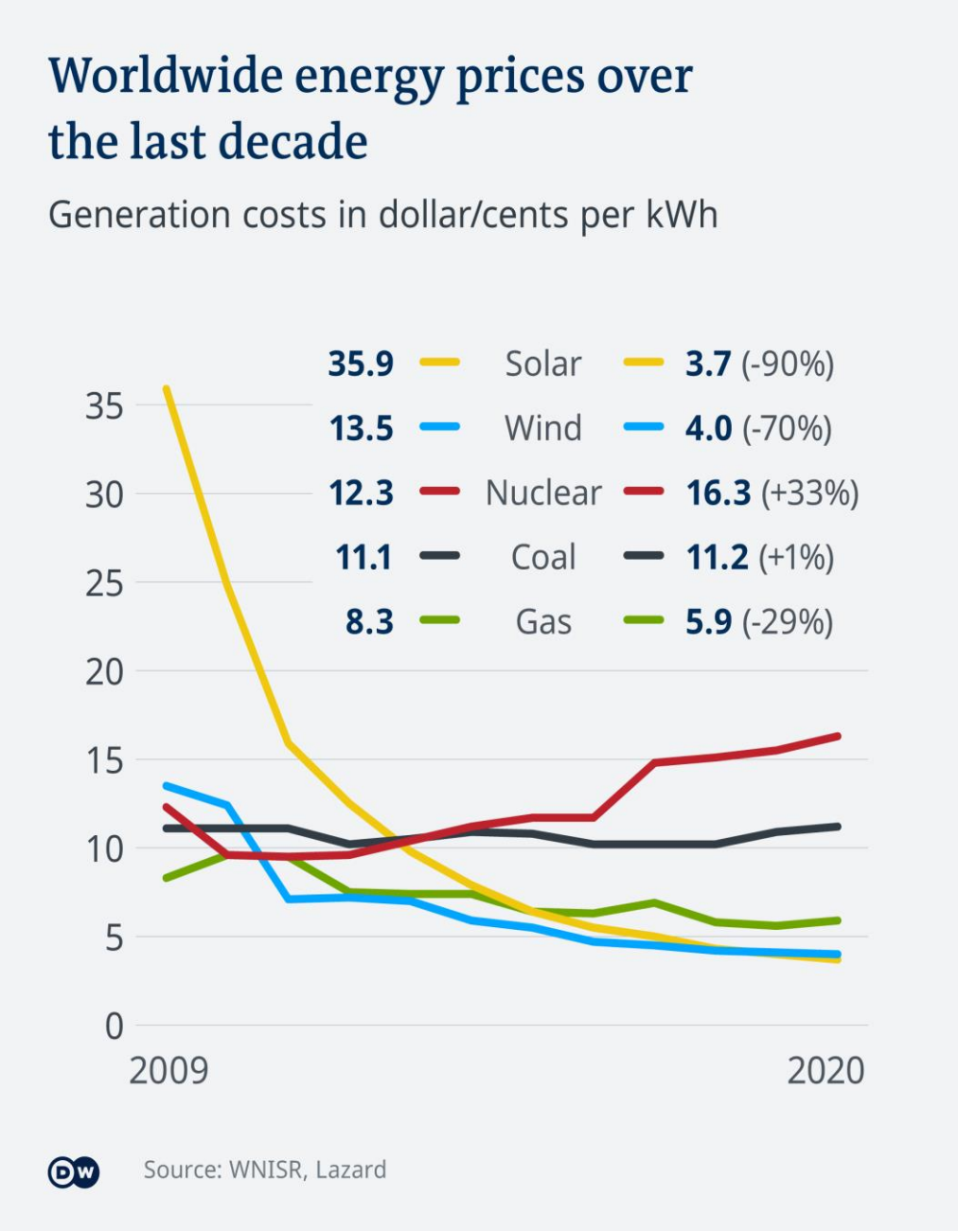
Mycle Schneider: Today we need to put the question of urgency first. It's about how much we can reduce greenhouse gases and how quickly for every euro ($1.21) spent. So, it's a combination between cost and feasibility, while doing it in the fastest possible way.

And if we're talking about the construction of new power plants, then nuclear power is simply excluded. Not just because it is the most expensive form of electricity generation today, but, above all, because it takes a long time to build reactors. In other words, every euro invested in new nuclear power plants makes the climate crisis worse because now this money cannot be used to invest in efficient climate protection options.

What about existing nuclear power plants?

The power plants exist, they provide electricity. However, many of the measures needed for energy efficiency are now cheaper than the basic operating costs of nuclear power plants. That is the first point, and unfortunately it is always forgotten.

The second point is that renewables today have become so cheap that in many cases they are below the basic operating costs of nuclear power plants.



Let me give you two examples: The world's lowest price for solar power in currently in Portugal, at 1.1 cents per kilowatt hour. And we now have the first results from Spain with costs for wind and solar power at around 2.5 cents per kilowatt hour. These are below the basic operating costs of the vast majority of nuclear power plants around the world.

It would often even be affordordable to pay 1 – 1.5 cents per kilowatt hour for electricity storage in addition to the generation costs for wind and solar power and still be below the operating costs of nuclear power plants. And here we have to ask the same question: How many emissions can I avoid with one euro, one dollar or one yuan?

So why are construction projects being announced now?

In the case of nuclear power, I often have the feeling that Trumpism prevails. Facts no longer matter. There is talk of plans and projects all over the place, but in reality, little or nothing actually happens. We document this in detail every year in the more than 300 pages of our World Nuclear Industry Status Report.

What sort of interests are behind this?

These are very clear self-interests. If the industry doesn't launch phantom projects, then it will die even faster.

Why do politicians go along with it?

There are different interests here. During a visit to the Le Creusot forge in December 2020, for example, French President [Emmanuel] Macron made it clear that there are also military strategic interests in maintaining the nuclear industry. And France has never made a secret of the links between military and civil interests when it comes to nuclear.

In other countries like China there are different interests. China is funding infrastructure in a large number of countries through its Belt and Road Initiative, also known as the New Silk Road. This is geopolitics on a grand scale.

The co-financing of the Hinkley Point C nuclear power plant in Great Britain, for example, puts this into context. In this case, the fact that it is an inefficient project is irrelevant. The scale of Chinese infrastructure investments is huge. There's talk of $1,000 billion (€821 billion). That means: You have to look at each country, because each country has their own self-interests.

France has shown interest in keeping its nuclear industry for economic reasons, including this power plant in Saint-Vulbas

China is still investing in nuclear plants which use new kinds of technology, such as this plant in southeast Fujian province

What other interests do energy companies have in continuing to operate unprofitable reactors?

The main reason is that an operating nuclear power plant generates income. As soon as a nuclear power plant is decommissioned, liabilities appear in the balance sheet and additional expenses appear.

You can see an example of this in Japan. If often took years to officially close nuclear power plants because companies could not afford to remove these plants from their assets. Some of these operators would have gone bankrupt overnight.

There's no doubt that energy companies like EDF in France face a serious financial crisis. The question is, how will they survive this? Certainly not without the help of massive state subsidies in the long term. But as long as they can keep earning money, even if it's no longer profitable, investing in demolition and waste management isn't a consideration.

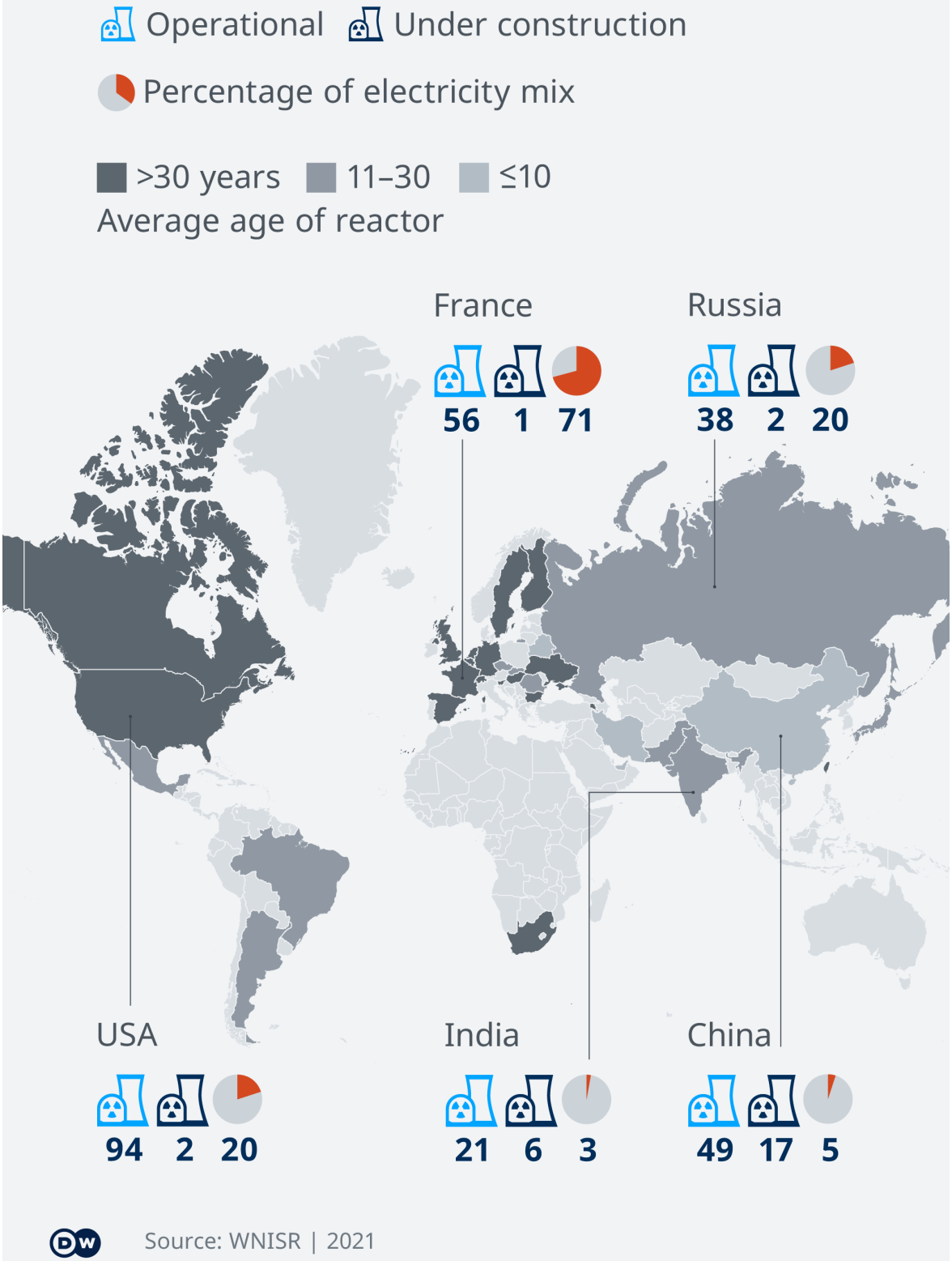
How much does demolition cost*?*

In the order of €1 billion per reactor. In France, only a third of [the required funds] have been put aside. This means the problem starts once the reactors go offline.

What about the costs of the storage of high-level radioactive waste?

No one knows how much this really costs, because there is no functioning permanent storage facility.

Nuclear power: An overview



Source: WNISR | 2021

Is there any chance of a permanent storage facility being operational in the future?

There is currently no operational permanent storage facility. The most advanced projects are in Finland and Sweden. However, the concept there is based on a design from the early 1980s, with storage in copper containers. However, recent research has shown that the copper containers are significantly more susceptible to corrosion than first thought. That means the viability of commissioning one of these facilities in Sweden or Finland is still totally unclear. It's the same situation for other countries. They are even further behind on development or they don't even have storage models, let alone locations.

How far along in this process are countries in Asia?

In Japan there is still no storage location or model. The same goes for Korea. In China they're discussing whether or not nuclear waste should be reprocessed. That's even further away.

Basically, these countries behave just like countries in the West where the nuclear power plants were built two or three decades ago. That means there is no advanced planning in place and no coherent concept as to how their highly radioactive nuclear waste should be stored for eternity.

Mycle Schneider is the initiator and lead author of the annual World Nuclear Industry Status Report, an independent reference report on the development of the global nuclear power industry. Schneider is an independent consultant to governments and international organizations around the world. In 1997 he was awarded the Alternative Nobel Prize (Right Livelihood Award).

This interview was conducted by Gero Rueter and adapted into English by Ineke Mules.

RethinkX

Disruption, Implications, and Choices

Rethinking Energy

The Great Stranding: How Inaccurate Mainstream LCOE Estimates are Creating a Trillion-Dollar Bubble in Conventional Energy Assets

A RethinkX Sector Disruption Report

February 2021

Adam Dorr & Tony Seba

Executive Summary

A large and rapidly-expanding global financial bubble now exists around conventional coal, gas, nuclear, and hydro power energy assets. This bubble has in part been created by mainstream energy analyses that have, for the last decade, significantly underestimated the levelized cost of electricity (LCOE) from conventional power plants because they assume these plants will be able to successfully sell the same quantity of electricity each year from now through 2040 and beyond. This assumption has been false for at least ten years. The rates at which conventional power plants are utilized will continue to decrease as competitive pressure from near-zero marginal cost solar photovoltaic and onshore wind power, and battery energy storage continue to grow exponentially worldwide.

Since 2010, the LCOE figures published in mainstream analyses and used by policymakers, regulators, civic leaders, utilities, asset owners, and investors have significantly underestimated the actual cost of electricity generated by prospective coal, gas, nuclear, and hydro power plants. This in turn means that conventional energy asset valuations are heavily overstated. Fundamental valuation of an asset is based on expected future cash flows that are, in turn, dependent upon projected revenues and costs. The projected revenues and costs of any power plant are dependent upon its assumed capacity factor (or utilization rate), which is the fraction of its generating capacity it is actually able to produce and sell.

The LCOE methodologies used in virtually all mainstream analyses contain the same critical error: they assume a high and constant capacity factor (utilization rate) for the entire lifetime of any individual power plant. In doing so, they assume both existing and newly-built power plants will be able to produce and sell the same number of kilowatt-hours each year throughout their 20+ year operational life. Widely-cited sources that commit this error include the International Energy Agency (IEA)[1], the United States Energy Information Administration (U.S. EIA)[2], the World Bank[3], the International Renewable Energy Agency (IRENA)[4], the Department for Business, Energy & Industrial Strategy of the UK government[5], the Australian Energy Regulator[6], the National Renewable Energy Laboratory (NREL and OpenEI)[7,8], Lazard[9], Stanford University[10], the University of Texas at Austin[11], the MIT Energy Initiative[12], and the Natural Resources Defense Council (NRDC)[13].

Capacity factor of conventional coal, gas, nuclear, and hydro power plants will not remain high or constant, but will instead decline dramatically over the next 10 to 15 years as they are outcompeted and disrupted by the combination of solar photovoltaics, onshore wind, and lithium-ion batteries (SWB). In fact, capacity factor in conventional energy has been dropping since at least 2010. For instance, the average capacity factor of coal in the United States has fallen from 67% in 2010 to just 40% in 2020 – first because of competition with cheap gas from fracking, and now because of SWB.[14] In the United Kingdom, coal capacity factor has collapsed even faster, from 58% in 2013 to just 8% by 2019.[15]

Mainstream LCOE analyses thus artificially understate the cost of electricity of prospective coal, gas, nuclear, and hydro power plants based on false assumptions about their potential to continue selling a fixed and high percentage of their electricity output in the decades ahead. Because LCOE figures and asset valuations

are very sensitive to the capacity factor parameter, these false assumptions have made conventional energy assets appear to be much more attractive than they actually are. As a result, they have attracted far more investment (over $2.2 trillion in fossil and nuclear energy in the electric power sector worldwide since 2010) than they otherwise would have based on a realistic assessment of capacity factor and LCOE.[16]

For instance, the United States Energy Information Administration (U.S. EIA) assumes that coal power plants entering service both today and in 2035 will enjoy a capacity factor of 85% for their entire operational lifetime, despite the fact that the real figure is already less than half of that, and thus inaccurately report their LCOE as about 7.5 cents per kilowatt-hour.[17] Our analysis indicates that even if such facilities could somehow retain a capacity factor of 10% after 2035, rather than collapsing altogether like they already have in the UK, the cost of their electricity would be more than 10 times higher than the U.S. EIA's published estimate. Investment in an asset class above and beyond what the fundamental value can return, based on shared and widespread false assumptions, is the very definition of a financial bubble.

In this report, we explain how the nonlinear dynamics of the SWB disruption of energy will rapidly drive the capacity factor of all conventional coal, gas, nuclear, and hydro power plants toward zero throughout the 2020s. The overwhelming majority of these conventional facilities will become financially unviable and their assets stranded over the next decade or so. Any of these facilities that linger on a few more years will have utilization and cost profiles comparable to those of today's peaking power plants, or peakers. It is important to note, however, that they will be 'peakers without peak prices' – meaning they will be unable to sell their electricity at the high prices needed to cover their costs because of competition from batteries. Thus, directly contrary to the prevailing narrative that SWB will require subsidies and other forms of support, governments may instead need to make market-distorting interventions to bail out and prop up coal, gas, nuclear, and hydro power plants in order to prevent electricity supply shortfalls from the stranding of these assets during the 2020s as the disruption unfolds.

If the gap between the mainstream mirage and reality is not corrected quickly, and incumbents continue to assume that coal, gas, nuclear, and hydro power plants will be utilized at 20th century historical rates in perpetuity, then pension/retirement funds and other asset managers may continue to be lured into investing not only in conventional power plants but in their entire value chains – including pipelines, ports, railways, and mines – under the false pretense that these are low-risk investments. At the same time, appropriate divestment from holdings that have little chance of performing as originally expected will be delayed as well. If we continue to accept deeply-flawed projections such as those of the U.S. EIA, whose Reference Case assumes that almost half of all new electricity generating capacity installed in the United States between now and 2050 will be natural gas (over 3 terawatts at a cost of roughly $3 trillion just for the power plants), then the conventional energy asset bubble that already exists could grow more dramatically during the 2020s.[17,18]

Our analysis has a number of important implications for energy and finance, as well as for society and the environment at large:

1. Conventional energy assets are severely mispriced, and their overvaluation is creating a growing asset valuation bubble in the conventional energy sector.
2. Coal, gas, nuclear, and hydro power are no longer competitive with the combination of SWB, even using inaccurate mainstream LCOE calculations.
3. Solar and wind power reached cost parity and became cheaper than coal, gas, nuclear, and hydro power several years sooner than mainstream analysts reported.
4. The widening gap between rapidly increasing conventional energy LCOE and rapidly decreasing SWB costs means that the SWB disruption will proceed faster than expected.
5. Coal and gas power plants with integrated carbon capture and storage (CCS) are doubly mispriced (overvalued).
6. Governments must protect people, not incumbent companies or industries, from the financial risk of the conventional energy asset bubble.
7. Carbon neutrality can be achieved more quickly and cheaply than generally expected.

The EIA, IEA, and other analysts are playing a critical role in mispricing conventional energy assets that is analogous to the role that the credit rating agencies played in mispricing subprime mortgage assets, which led to the housing bubble and financial crisis in 2007. We call on investors, policymakers, civic leaders, public utility commissions, and other decision-makers to demand reality-based conventional LCOE estimates in order to protect their stakeholders and society.