Small Modular Reactor (SMR) Cost Risks

Presentation to the Nuclear-Free Pueblo Town Hall

David Schlissel

October 13, 2022

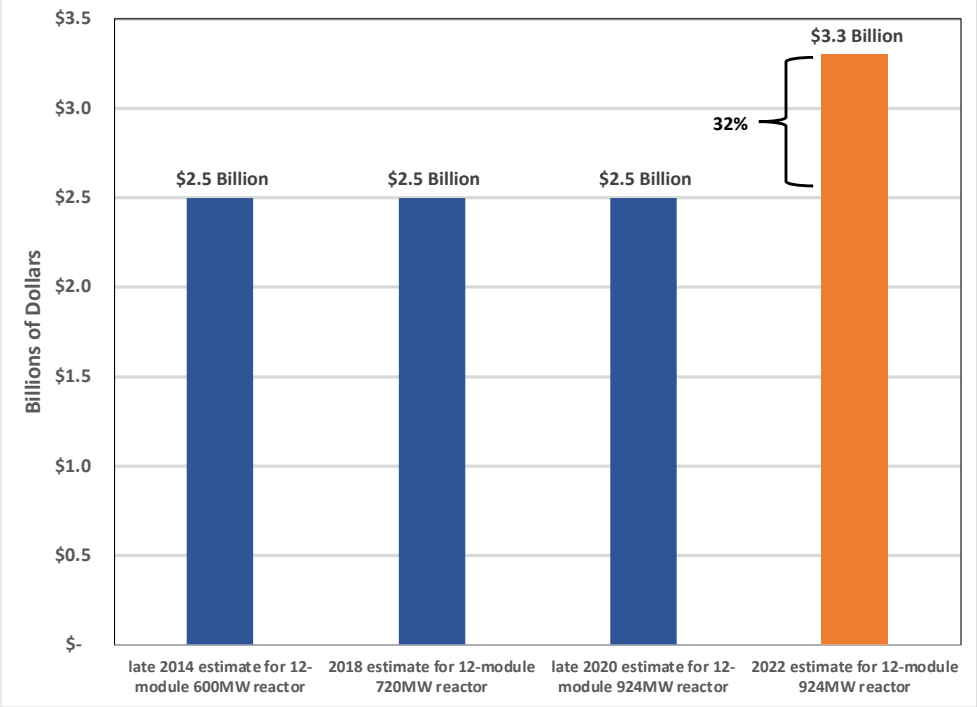
Institute for Energy Economics and Financial Analysis
IEEFA.org

Background

- At least nine different small modular reactor (SMR) designs are being marketed
- Key fact is that none of these have been built and operated at full commercial-scale
- The lead SMR design in the U.S. is being marketed by NuScale Power Corporation
- The original design was for each plant to include 12 nuclear reactor modules, each with 50MW of power.
- This has changed over time – first to include 12 modules each with 60MW of power, then to 77MW of power – for a total of 924MW
- Last year, NuScale and UAMPS announced that the size of the first NuScale SMR was being reduced from 12 to 6 modules of 77MW, for a total of 462MW
- Although neither NuScale nor UAMPS has yet announced a new cost estimate for the Carbon Free Power Project (CFPP), the costs for participants of building the project, and other NuScale SMRs, did increase significantly between 2020 and 2022

After saying for 6 Years that the cost of a new 12-Module SMR would be $2.5 billion, this year NuScale has been telling potential investors and the media that the cost will be $3.3 billion

This represents a 32% increase



Overnight construction cost estimates do not include financing costs or escalation

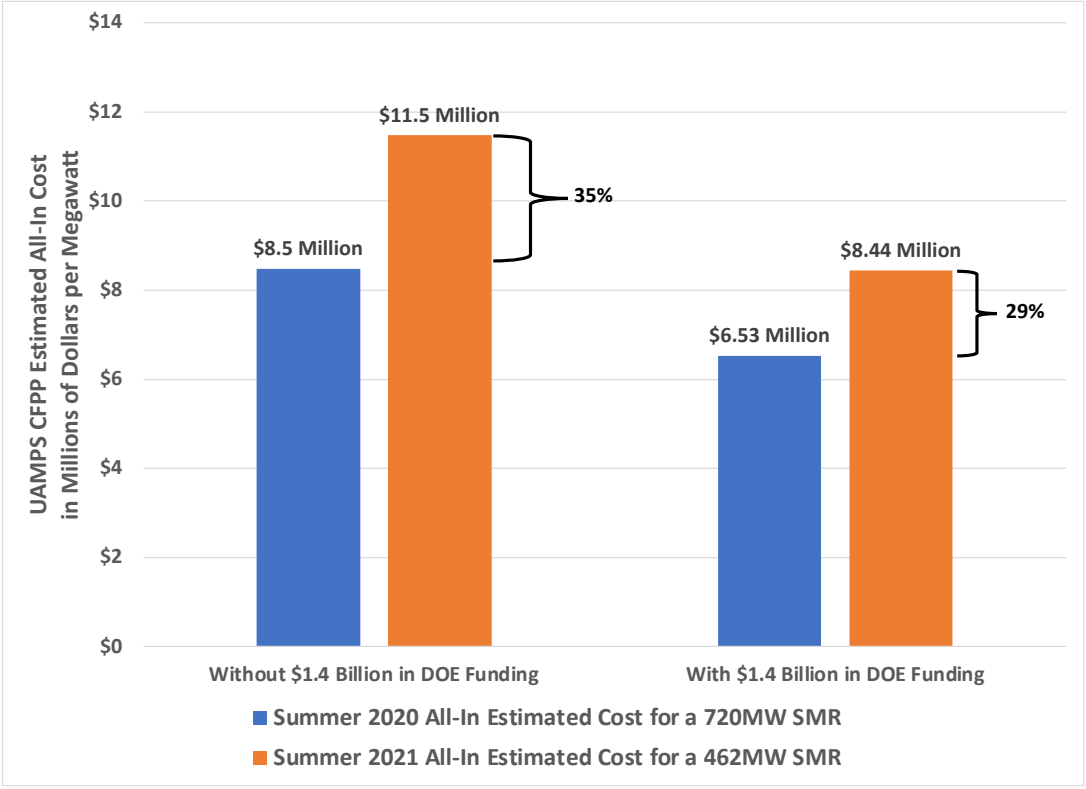
The per-megawatt cost the UAMPS Carbon Free Power Plant (CFPP- the first SMR NuScale wants to build) increased dramatically in 2021 when the project was downsized from 12 to 6 modules

In mid-2021 UAMPS announced that the size of the CFPP was being reduced from 12 modules to only 6, a 36% reduction in the CFPP's total size in MW.

At about the same time the project's estimated all-in cost was reduced by 13%, from $6.1 to $5.3 million.

Although this meant a lower total construction cost, it wasn't a decline in the cost per MW. It was an increase.

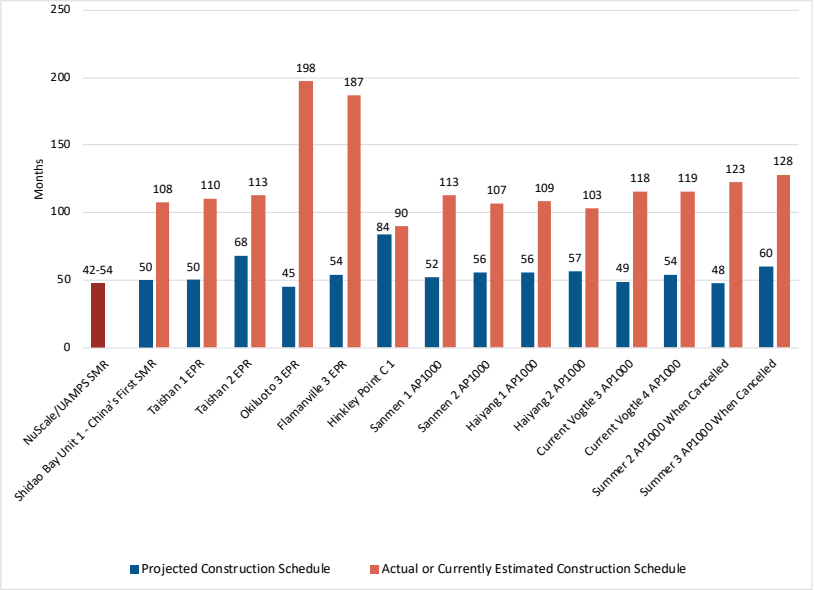
The per-MW cost is important because participants sign up for shares of the project measured in full or partial MWs and the per-MW cost reflects their financial risk and potential cost liability.



Recent Nuclear Plants With New Designs Have Experienced Significant Cost Increases and Construction Delays

- The cost of the Vogtle nuclear project in Georgia has grown by 140% during construction and another two years remain before both units will be in service. Georgia Public Service Commission Staff estimates cost of power from Vogtle will be $150/MWh.
- The cost of the two-unit Summer project in South Carolina rose by 57% before the project was cancelled in 2017.
- The cost of Okiluoto 3 (Finland) has tripled since construction began.
- The cost of the Flamanville plant (FR) has increased by 276%.
- The cost of the Hinkley Point C project (UK) has increased by 22% to 27% in just its first 4 years of construction.

NuScale says that the nuclear construction at its SMR will be completed in less than three years. All recent plants with new designs have taken much longer to build than that.



Achieving High Capacity Factors and While Load Following Renewable Resources is an Impossible Task

- NuScale claims its SMR will achieve a 95% capacity factor over its entire lifetime—a goal never achieved by a nuclear unit in the U.S.
- Only 5 of the 93 reactors still operating in the U.S. have achieved lifetime capacity factors above 90%. None of of the 22 reactors that have been retired achieved a lifetime capacity factor above 84%.
- In order to achieve such a high capacity factor, the SMR must basically run at 100% power in all the hours that it is online and not experience extended outages during its multi-decade-long operating life.
- However, NuScale (and developers of other SMR designs) tells current and prospective participants that the SMR also will be able to load follow and firm up the power from renewable generators.
- In order to do this, the plant must be running at less than full power so that it would have additional power to send into the grid in those hours when the renewable resource is not generating any power.

The Price of Power From An SMR Will Go Up if It Is Used to Load Follow Renewable Resources

- SMR promoters claim they will be able to firm up intermittent wind and solar resources.
- However, most nuclear plant costs are fixed, meaning they don't vary with how much power the plant is producing.

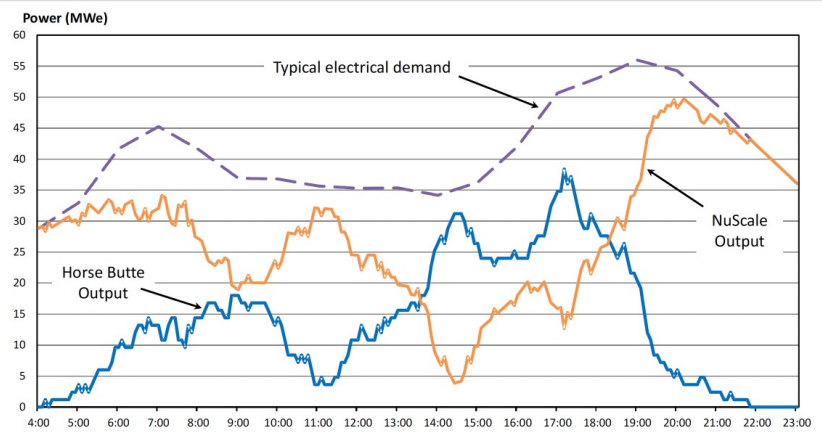
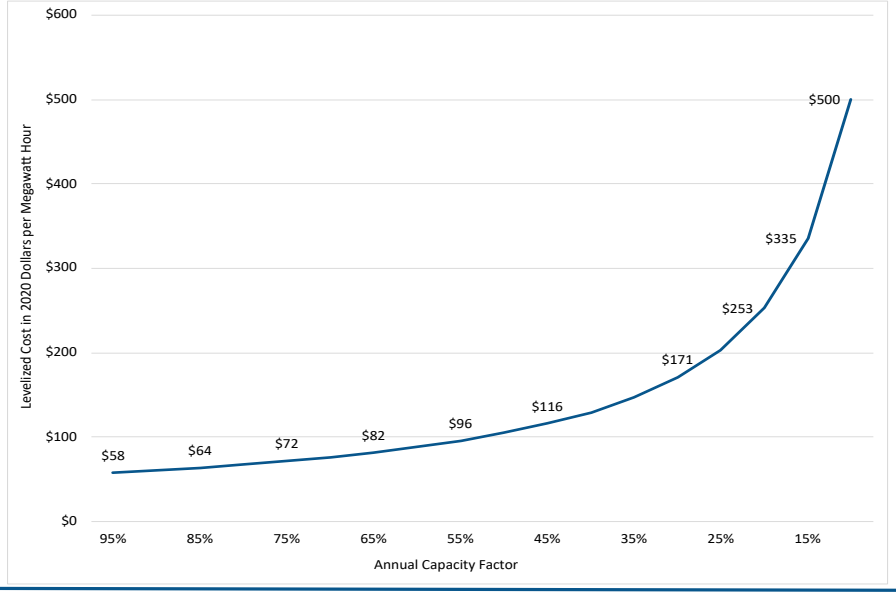
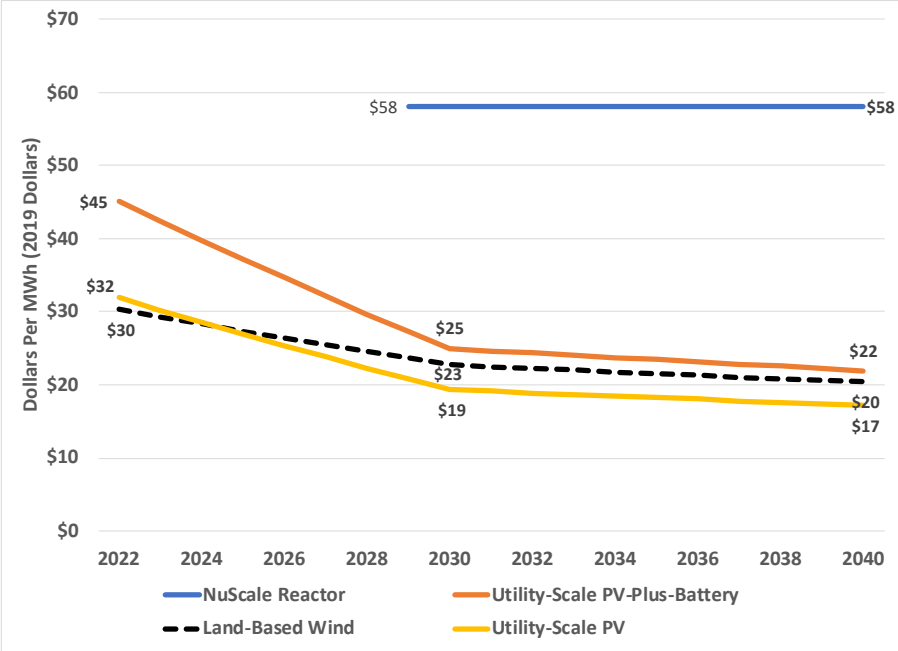


Fig. 5. Example of NuScale module load-following to compensate for generation from the Horse Butte wind farm and daily demand variation.

- Thus, if the plant produces fewer megawatt-hours of electricity when load following renewables, those fixed costs are spread over fewer units of output. As a result, if the SMR produces less electricity the price of its power will go up.



NuScale's Estimated Target Price for the Power From its SMR Is Much More Expensive than the Projected Costs of Power From Renewable Alternatives



Even if NuScale were to achieve its estimated power price of $58/MWh, that would still be much more expensive than the cost of solar, wind and storage resources.

For More Information Contact

David Schlissel at dschlissel@ieefa.org

Dennis Wamsted at dwamsted@ieefa.org