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NuScale Power

NuScale Power Corporation is a publicly traded American company that designs and markets small modular reactors (SMRs). It is headquartered in Tigard, Oregon. A 50 MWe version of the design was certified by the US Nuclear Regulatory Commission (NRC) in January 2023.[3] The current scalable 77 MWe SMR VOYGR design was submitted for NRC review on January 1, 2023, and as of December 2023 was about a third complete.[4]

NuScale's SMR designs employ 9 feet (2.7 m) diameter by 65 feet (20 m) high reactor vessels that use conventional cooling methods and run on low enriched uranium fuel assemblies based on existing light water reactor designs. Each module is intended to be kept in an underground pool and is expected to produce about 77 megawatts of electricity. Its coolant loop uses natural convection, fed from a large water reservoir that can operate without powered pumps.[5]

NuScale had agreements to build reactors in Idaho by 2030, but this was cancelled in 2023 due to the estimated cost having increased from $3.6 billion to $9.3 billion for a 460 MWe power plant.[6][7]

NuScale Power Corporation

Headquarters in Tigard, Oregon

Company type	Public
Traded as	NYSE: SMR (https://www.nyse.com/quote/XNYS:SMR)
Industry	Nuclear power
Founded	2007 in Corvallis, Oregon, U.S.
Founders	Paul G. Lorenzini José Reyes
Headquarters	Tigard, Oregon, U.S.
Key people	John Hopkins (President & CEO)
Products	Small modular reactors
Revenue	▲ US$11.8 million (2022)
Net income	▼ US$−142 million (2022)
Total assets	▲ US$349 million (2022)
Total equity	▲ US$277 million (2022)
Number of employees	329 (2024)
Website	nuscalepower.com (http://nuscalepower.com)

History

NuScale was founded based on research funded by the United States Department of Energy (DOE) and conducted by a team of nuclear scientists at Oregon State University and the Idaho National Laboratory.[8][9][10] beginning in 2000. Oregon State's nuclear department had been developing passive water-circulation techniques for cooling in nuclear plants.[11] DOE funded the research from 2000 to 2003.

Footnotes / references
[1][2]

The Oregon State team continued their work building a one-third scale test lab, while inheriting related patents from the university in 2007,[11][12] in exchange for an equity stake.[13] NuScale was founded that year. Its first funding round came in January 2008.[10] It began seeking certification with the NRC in February 2008.[11]

By 2011, NuScale had raised $35 million and had 100 employees in Tigard; Richland, Washington; and Corvallis, Oregon.[14] NuScale was the first to submit small reactor plans to the NRC[10] and the first to gain approval.[15][16] It was evaluated by a consortium of utility companies called Energy Northwest.[17]

Funding difficulties and rebound

In January 2011, NuScale's largest investor, Kenwood Group, was investigated by the U.S. Securities and Exchange Commission (SEC) and later pleaded guilty to operating a Ponzi scheme. The SEC investigation was not related to Kenwood's dealings with NuScale, but Kenwood's assets were frozen just as NuScale was expecting additional funding. The company started making staffing and pay cuts as executives looked for new funding sources[18][19] and most of the company's employees were laid off.[20]

That September, NuScale obtained a loan to re-hire 60 employees.[21] In October, Fluor Corporation acquired a majority interest in the company for $3.5 million and promised almost $30 million in working capital.[13] According to *The Energy Daily*, Fluor's investment saved the company, which had been "financially marooned" by its prior investor.[22] A separate agreement gave Fluor the rights to construct NuScale-based power plants.[23]

In August 2012, Rolls-Royce Holdings said it would support NuScale's commercialization efforts and help it obtain funding from DOE's funding opportunity announcement.[11] In December 2012, co-founder Paul G. Lorenzini was replaced by John Hopkins as CEO.[24] It was not funded in the first DOE's round.[25] In the second round in December 2013, NuScale won up to $226 million in "cost-sharing" funding to share the expense of obtaining government approval, through the SMR Licensing Technical Support program.[26] This was followed by an agreement in May 2014 for up to $217 million in funding over a five-year period, whereby DOE would match private funding.[27][28]

In September 2020, the U.S. Department of Energy reported that it had provided more than $400 million since 2014 to support the NuScale development and that of other earlier stage domestic SMR designs.[29]

2022 launch as a public company

In December 2021, the Fluor Corporation reported that it had invested over $600 million in NuScale since 2011, and that NuScale was expected to go public in 2022 with Fluor owning about 60% of the stock.[30] In May 2022, NuScale completed a merger with the special-purpose acquisition company (SPAC), Spring Valley Acquisition Corp, raising $380 million of investment. NuScale Power Corporation then listed on the New York Stock Exchange.[31]

Carbon Free Power Project, Idaho

In November 2014, NuScale announced it would build what it expected to be the first US SMR at the Idaho National Laboratory.[32] The plant was for Utah Associated Municipal Power Systems (UAMPS), a subdivision of the State of Utah, on the Carbon Free Power Project (CFPP).[33] UAMPS operates power plants in Wyoming, New Mexico, California, and Utah, selling to local utilities. The DOE could provide supporting funds of about $140 million/year over 10 years, awaiting more Congressional support.[34]

The company submitted designs to the NRC in January 2017 for a 12 reactor power plant producing 570 MWe at a build cost under $3 billion.[35][29] In 2020, DOE approved a $1.355 billion cost-share award.[36]

As of 2021, 8 cities had withdrawn from CFPP.[37] In July 2021, the proposal was downsized to 6 reactors, and the expected electricity price increased to $58/MWh (¢5.8/kWh).[38]

In April 2022, Doosan Enerbility was contracted to begin manufacturing power module components for CFPP. Doosan Enerbility expected to reach full-scale production at their plant in Changwon, South Korea, in the second half of 2023.[39][40]

In January 2023, CFPP approved a new Budget and Plan of Finance, establishing a target price of $89/MWh (¢8.9/kWh) after an estimated $30/MWh generation subsidy from the 2022 Inflation Reduction Act (IRA).[41][42] The projected build cost had increased to $9.3 billion for 462 MWe generation capacity from $3.6 billion for 720 MWe in 2020.[43] $4.2 billion of the cost would be covered by the DOE and IRA support, leaving $5.1 billion of acquisition and construction costs to be covered by UAMPS members.[44]

In November 2023, UAMPS announced it was unlikely that the project would have enough subscription to continue due to cost increases, and UAMPS and NuScale jointly decided to cancel the project.[45][7] *POWER magazine* reported that the project had received $232 million of DOE financial support by the time it was cancelled.[46]

Following the cancellation, NuScale laid off 154 of its staff (28%) as part of "taking steps to transition from R&D to commercialization".[47]

Other deployment history

In March 2012, NuScale signed an agreement with DOE that allowed NuScale and two partners to build and operate a NuScale-based nuclear power plant at a Savannah River site in South Carolina.[48] The following month, Energy Northwest said it had no immediate plans to construct a nuclear power plant, but had evaluated all the available SMR technologies and identified NuScale as the best available option.[49][50]

In July 2013, NuScale announced an effort to demonstrate NuScale reactors in the western United States, called Program WIN (Western Initiative for Nuclear),[27] with plans to build the first NuScale-based power plant there by 2024.[11]

In January 2018, the NRC agreed that the passive safety features allow NuScale's SMR design to operate safely without back-up power.[51]

In August 2020, the NRC issued a final safety evaluation report, certifying the design as having met safety requirements.[15][52][53][54]

In November 2021, NuScale announced its intent to build with Nuclearelectrica its first reactors in Romania by 2028.[55]

In February 2022, NuScale and mining conglomerate KGHM announced a contract to construct an SMR in Poland by 2029.[56] In April 2023, an application for a decision-in-principle to permit the project was submitted to the Polish government.[57]

On 28 December 2022, Romanian company RoPower Nuclear contracted for Front-End Engineering and Design. The location is expected to be Doicesti. RoPower is a joint venture between Nuclearelectrica and Nove Power & Gas.[58]

In January 2023, the NRC certified NuScale's 50 MWe design for use in the US.[59] However this was for an earlier version of the design to the current 77 MWe design expected to be deployed; this version was resubmitted to the NRC in January 2023 for standard design approval of a six reactor configuration called US460.[3] In its acceptance review of the application, the NRC identified a number of sufficiency issues in the application, and requested supplemental information be supplied before NRC staff could accept the application for docketing and detailed technical review.[60] The supplemental information was supplied in July 2023, and the NRC estimated the evaluation would be complete in July 2025.[61]

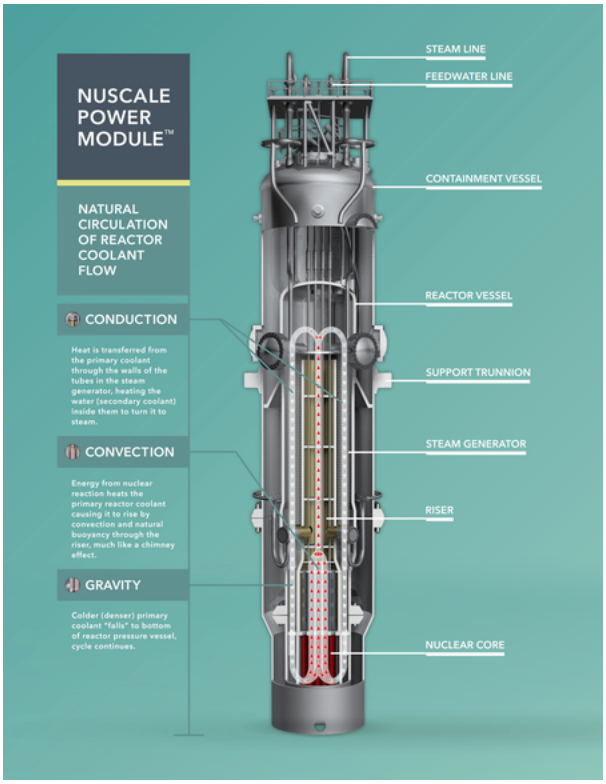
On 25 July 2024, RoPower Nuclear and Fluor Corporation signed the second stage Front-End Engineering and Design (FEED 2) contract, for the planned SMR project in Romania which will provide updated cost estimate and other analysis for a final investment decision.[62] The Export–Import Bank of the United States approved a $98 million loan to RoPower Nuclear to support this design study, which would support 400 US jobs.[63]

Reactors

NuScale reactors take 1% of the space of a conventional reactor and generate 77 MWe.[64][65][66] The design uses light water for cooling and power generation as in conventional nuclear plants. Water is heated by the nuclear core at the base of the reactor vessel. Heated water flows up the riser, then down over steam generators. As heat is transferred, the water cools and becomes denser, sinking to the bottom of the device, and the cycle is repeated. The heat creates steam that drives a small dedicated turbine generator producing electricity.[11][26][67]

The first version of the reactor vessel was expected to be 9 feet (2.7 m) in diameter and 65 feet (20 m) tall, weighing 650 short tons (590 metric tons).[26] The modules are pre-fabricated, delivered by rail, barge or truck[68] and assembled on-site.[21][69][70][71] As of 2021, the units are expected to produce 77 MWe (gross), or about 73.5 MWe (net),[64][72][73][a] and require refueling

with standard 4.95 percent low-enriched uranium-235 fuel every two years.[26]



NuScale's design does not rely on powered water pumps or circulatory equipment.[8][11] The original 50 MWe reactor was designed to shut down and cool itself indefinitely during most accidents.[11][b] The devices are intended to be installed in a below-ground pool to absorb earthquake shocks, with a concrete lid over the pool.[75] In the event that power is lost for normal cooling systems, the water in the pool absorbs heat and boils.[11] The pool stores enough water to safely cool the 77 MWe reactor design core for at least 72 hours without needing manual replenishment.[67]

In normal operating conditions the containment vessel pressure is at a near vacuum, which eliminates convection giving simpler heat transfer conditions. This also reduces component corrosion and improves instrumentation reliability.[11]

The reactors are installed in the reactor pool in individual bays separated by concrete walls. For refueling the entire reactor is moved underwater through a transfer channel to a connected pool which has the refueling equipment. There is also an extra reactor bay for maintenance or possible storage of a spare module. At a 12-reactor plant the bays are arranged in two rows of six reactors with the transfer channel centrally between the rows.[11]

Comparisons

NuScale is expected to be the first US SMR to market, because it is similar to the systems used in conventional power plants.[76] The company estimates a twelve-unit NuScale plant would cost $4,200 (an earlier estimate was $5,000) per kilowatt. In comparison, the Energy Information Administration in 2013 estimated overnight costs to be $4,700 per kilowatt for conventional nuclear power, $4,600 for a carbon sequestration coal plant and $931 at a gas-fired plant or in excess of $1,800 for a gas-fired plant with carbon sequestration (all 2011 dollars).[11] David Mohre, executive director of NRECA's Energy and Power Division, said SMRs like NuScale's are ideal for rural towns that need small power plants.[22]

NuScale power plants are expected to take less time, materials and space to construct than other power sources and can be expanded incrementally to meet growing power needs.[10][70][77][78] With the steam generators internal to the movable steel reactor assembly, the SMR does not have a large concrete secondary containment building as used in large PWRs. There is a single control room for up to 12 reactors.[79] One disadvantage of the design is that the reactors lie in a large pool of water, for emergency cooling, and this pool requires much more reinforced concrete per MWe produced than a conventional nuclear reactor building, adding considerably to cost.[66]

New Scientist reported peer-reviewed analysis from Stanford University that assessed nuclear waste production from SMR reactors and concluded that "SMR performed worse on nearly all of our metrics compared to standard commercial reactors".[80][81] The results of the study were rejected by NuScale as based on outdated information.[80]

Potential SMR competitors include Babcock & Wilcox, GE Hitachi Nuclear Energy, Gen4 Energy, Holtec International,[82] Intellectual Ventures, OPEN100,[83] Westinghouse Electric Company, Terrestrial Energy, and X-energy.[84]

Full-scale mockup of the upper one-third of the NuScale Power Module

Safety concerns

In March 2020, a panel of independent experts from the NRC's Advisory Committee on Reactor Safeguards (ACRS) claimed to find reactor design flaws.[85] The main issue was that in the event of an emergency shutdown condensed steam returning to the reactor vessel would be low in boron and might not absorb enough neutrons. NuScale modified its design to ensure that more boron would spread to the returning water. ACRS was concerned that operators could accidentally add deboronated water to the core. The panel found other problems: the steam generator could be prone to damaging vibrations. However, on 29 July ACRS recommended that the safety evaluation report be issued and the reactor be certified.[85]

Operations

NuScale has offices in Tigard, Oregon; Corvallis, Oregon; Charlotte, North Carolina; and Rockville, Maryland.[86] Its headquarters are in Tigard, while its factory is in Corvallis.[87] It maintains a test facility at Oregon State University[8] and Italy.[11]

The company is publicly traded as SMR on the New York Stock Exchange.[31]

See also

- List of small modular reactor designs
- TMSR-LF1 Thorium Molten-Salt Reactor, under construction in China
- HTR-PM High-temperature gas-cooled, commissioned for operation in China
- BREST Uranium-Plutonium Lead-Cooled Reactor, under construction in Russia
- ARC-100 Sodium Cooled Uranium Reactor, under construction in Canada

Companies portal

Notes

a. Previously 45, 50, then 60 MWe

b. Most sources say indefinitely, but NBC News reported 30 days.[74]

References

1. "NuScale Power Corp. 2022 Annual Report (Form 10-K)" (https://www.sec.gov/ix?doc=/Archives/edgar/data/1822966/000182296623000059/smr-20221231.htm). U.S. Securities and Exchange Commission. March 16, 2023.
2. Benshoff, Laura (June 30, 2022). "Nuclear power is gaining support after years of decline. But old hurdles remain" (https://www.npr.org/2022/06/30/1108264499/nuclear-power-gains-support-years-decline-hurdles). *NPR*.
3. Crownhart, Casey (February 8, 2023). "We were promised smaller nuclear reactors. Where are they?" (https://www.technologyreview.com/2023/02/08/1067992/smaller-nuclear-reactors/). *MIT Technology Review*. Retrieved March 29, 2023.
4. "NuScale US460 Standard Design Approval Application Review" (https://www.nrc.gov/reactors/new-reactors/smr/licensing-activities/current-licensing-reviews/nuscale-us460.html). *Nuclear Regulatory Commission*. Retrieved December 17, 2023. "dashboard ... Overall Review Progress: 31%"
5. Parks, Bradley W. (December 14, 2021), "An Oregon company is going public to raise money for nuclear power ambitions" (https://www.opb.org/article/2021/12/14/oregon-company-nuscale-power-going-public-nuclear-power-plans/), *Oregon Public Broadcasting*, retrieved May 7, 2023
6. Ridler, Keith (September 2, 2020). "US gives first-ever OK for small commercial nuclear reactor" (https://apnews.com/article/technology-or-state-wire-ut-state-wire-id-state-wire-science-910766c07afd96fbe2bd875e16087464). Associated Press. Archived (https://web.archive.org/web/20210802182425/https://apnews.com/article/technology-or-state-wire-ut-state-wire-id-state-wire-science-910766c07afd96fbe2bd875e16087464) from the original on August 2, 2021.
7. Bright, Zach (November 9, 2023). "NuScale cancels first-of-a-kind nuclear project as costs surge" (https://www.eenews.net/articles/nuscale-cancels-first-of-a-kind-nuclear-project-as-costs-surge/). *E&E News*. POLITICO. Retrieved November 9, 2023.
8. Durlin, Marty (March 30, 2009). "Mix-and-Match Nuclear Reactors" (https://www.hcn.org/issues/41.5/innovate-part-iii). *High Country News*. Archived (https://web.archive.org/web/20150912202931/http://www.hcn.org/issues/41.5/innovate-part-iii) from the original on September 12, 2015. Retrieved April 11, 2015.
9. Hyatt, Abraham (July 2008). "Start Me Up: NuScale Power" (http://www.oregonbusiness.com/archives/24-july-2008/364-start-me-up). *Oregon Business*. Archived (https://web.archive.org/web/20120830024753/http://www.oregonbusiness.com/archives/24-july-2008/364-start-me-up) from the original on August 30, 2012. Retrieved April 11, 2015.
10. "NIMBY: Nukes in my Backyard" (http://news.investors.com/111008-449804-nimby-nukes-in-my-backyard.htm?p=2). *Investors Business Daily*. November 11, 2008. Retrieved April 11, 2015.
11. Wagman, David (October 1, 2013). "NuScale Puts Single-Minded Focus on Small Modular Reactor" (http://www.powermag.com/nuscale-puts-single-minded-focus-on-small-modular-reactor/?pagenum=2). *Power Magazine*. Archived (https://web.archive.org/web/20150924080735/http://www.powermag.com/nuscale-puts-single-minded-focus-on-small-modular-reactor/?pagenum=2) from the original on September 24, 2015. Retrieved January 15, 2015.

12. "Small-Scale Nuclear Co. Hunts For Funds" (https://web.archive.org/web/20160310003029/https://business.highbeam.com/435572/article-1G1-199099402/smallscale-nuclear-co-hunts-funds). *Power Finance & Risk*. April 6, 2009. Archived from the original (http://business.highbeam.com/435572/article-1G1-199099402/smallscale-nuclear-co-hunts-funds) on March 10, 2016. Retrieved April 11, 2015.
13. Smith, Rebecca (October 13, 2011). "Fluor Buys Stake in Reactor Maker" (https://www.wsj.com/articles/SB10001424052970204774604576627360588957324). *The Wall Street Journal*. Archived (https://web.archive.org/web/20160304220355/http://www.wsj.com/articles/SB10001424052970204774604576627360588957324) from the original on March 4, 2016. Retrieved January 15, 2015.
14. Rogoway, Mike (January 20, 2011). "Corvallis-Based NuScale Suspends Operations after SEC Acts Against its Chief Investor" (http://www.oregonlive.com/business/index.ssf/2011/01/corvallis-based_nuscale_suspen.html). *The Oregonian*. Archived (https://web.archive.org/web/20160304070832/http://www.oregonlive.com/business/index.ssf/2011/01/corvallis-based_nuscale_suspen.html) from the original on March 4, 2016. Retrieved January 15, 2015.
15. "NRC Issues Final Safety Evaluation Report for NuScale Small Modular Reactor" (https://www.nrc.gov/reading-rm/doc-collections/news/2020/20-043.pdf) (PDF). *United States Nuclear Regulatory Commission*. August 28, 2020. Archived (https://web.archive.org/web/20200915214141/https://www.nrc.gov/reading-rm/doc-collections/news/2020/20-043.pdf) (PDF) from the original on September 15, 2020. Retrieved September 15, 2020.
16. Levitan, Dave (September 9, 2020). "First U.S. Small Nuclear Reactor Design Is Approved" (https://www.scientificamerican.com/article/first-u-s-small-nuclear-reactor-design-is-approved). *Scientific American*. Archived (https://web.archive.org/web/20200915214456/https://www.scientificamerican.com/article/first-u-s-small-nuclear-reactor-design-is-approved/) from the original on September 15, 2020. Retrieved September 15, 2020.
17. Barbe, Wayne (June 9, 2009). "Energy Northwest Considers Adding Capacity with Modular Nukes". *Generation Markets Week*.
18. "NuScale Cuts Back As Feds Sue Funder" (https://web.archive.org/web/20160304023616/http://connection.ebscohost.com/c/articles/59407581/nuscale-cuts-back-as-feds-sue-funder). *The Energy Daily*. February 7, 2011. Archived from the original (http://connection.ebscohost.com/c/articles/59407581/nuscale-cuts-back-as-feds-sue-funder) on March 4, 2016. Retrieved April 11, 2015.
19. Rogoway, Mike (January 31, 2011). "NuScale Furloughs 30, Cuts Pay and Hours for the Others, While it Seeks New Investment" (http://www.oregonlive.com/business/index.ssf/2011/01/nuscale_furloughs_30_cuts_pay.html). *The Oregonian*. Archived (https://web.archive.org/web/20160304115224/http://www.oregonlive.com/business/index.ssf/2011/01/nuscale_furloughs_30_cuts_pay.html) from the original on March 4, 2016. Retrieved April 11, 2015.
20. Patel, Sonal (July 1, 2011). "Holtec, Westinghouse Roll Out Small Modular Reactor Designs" (http://www.powermag.com/holtec-westinghouse-roll-out-small-modular-reactor-designs/). *Power Magazine*. Archived (https://web.archive.org/web/20140718081530/http://www.powermag.com/holtec-westinghouse-roll-out-small-modular-reactor-designs/) from the original on July 18, 2014. Retrieved January 18, 2015.
21. Hall, Bennett (August 21, 2011). "Power Struggle" (https://www.gazettetimes.com/news/local/power-struggle/article_933034dd-b0e8-5c17-bfda-ff1296c95e05.html). *Corvallis Gazette-Times*. Archived (https://web.archive.org/web/20190514111848/https://www.gazettetimes.com/news/local/power-struggle/article_933034dd-b0e8-5c17-bfda-ff1296c95e05.html) from the original on May 14, 2019. Retrieved January 15, 2015.
22. Lobsenz, George (October 14, 2011). "Fluor Moves Into Small Reactors With NuScale Buy" (https://web.archive.org/web/20160303234703/http://connection.ebscohost.com/c/articles/67547118/fluor-moves-small-reactors-nuscale-buy). *The Energy Daily*. Archived from the original (http://connection.ebscohost.com/c/articles/67547118/fluor-moves-small-reactors-nuscale-buy) on March 3, 2016.

23. "Fluor Gets Nuclear Firm Stranded By Illarramendi's Ponzi Scheme" (https://www.reuters.com/article/fluor-nuscale-idUSN1E79C13U20111013). Reuters. October 13, 2011. Archived (https://web.archive.org/web/20120223080410/http://www.reuters.com/article/2011/10/13/fluor-nuscale-idUSN1E79C13U20111013) from the original on February 23, 2012. Retrieved April 11, 2015.
24. Rogoway, Mike (December 13, 2012). "NuScale Power Replaces CEO" (http://www.oregonlive.com/business/index.ssf/2012/12/nuscale_power_replaces_ceo.html). *The Oregonian*. Archived (https://web.archive.org/web/20160304071010/http://www.oregonlive.com/business/index.ssf/2012/12/nuscale_power_replaces_ceo.html) from the original on March 4, 2016. Retrieved January 29, 2015.
25. Rogoway, Mike (March 27, 2013). "NuScale Power Begins Fresh Effort to Secure Federal Funds for its Nuclear Technology" (http://www.oregonlive.com/business/index.ssf/2013/03/nuscale_power_begins_fresh_eff.html). *The Oregonian*. Archived (https://web.archive.org/web/20140903192826/http://www.oregonlive.com/business/index.ssf/2013/03/nuscale_power_begins_fresh_eff.html) from the original on September 3, 2014. Retrieved January 29, 2015.
26. "NuScale joins B&W on the SMR bench" (http://www.modernpowersystems.com/features/featurenuscale-joins-bw-on-the-smr-bench-4264827/). *Modern Power Systems*. April 2014. Archived (https://web.archive.org/web/20140602012154/http://www.modernpowersystems.com/features/featurenuscale-joins-bw-on-the-smr-bench-4264827/) from the original on June 2, 2014. Retrieved January 15, 2015.
27. Patel, Sonal (May 29, 2014). "NuScale, DOE Complete Agreement for $217M SMR Development Funds" (http://www.powermag.com/nuscale-doe-complete-agreement-for-271m-smr-development-funds/). *Power Magazine*. Archived (https://web.archive.org/web/20140716044655/http://www.powermag.com/nuscale-doe-complete-agreement-for-271m-smr-development-funds/) from the original on July 16, 2014. Retrieved January 15, 2015.
28. Reddall, Braden (December 13, 2013). "Fluor's NuScale lands U.S. govt funding for new small reactors" (https://www.reuters.com/article/fluor-nuscale-funding-idUSL1N0JR2HF20131213). Reuters. Retrieved November 11, 2023.
29. "NRC Approves First U.S. Small Modular Reactor Design" (https://www.energy.gov/ne/articles/nrc-approves-first-us-small-modular-reactor-design). U.S. Department of Energy. September 2, 2020. Retrieved November 14, 2023.
30. Edwards, Jane (December 15, 2021). "Fluor-Backed NuScale Power to Go Public Through Spring Valley Merger; Alan Boeckmann Quoted" (https://www.govconwire.com/2021/12/fluor-backed-nuscale-power-to-go-public-through-spring-valley-merger/). *GovConWire*. Retrieved November 11, 2023.
31. "Nuclear-Tech Firm NuScale Gains After Completing SPAC Merger" (https://www.bloomberg.com/news/articles/2022-05-03/nuclear-company-nuscale-gains-day-after-completing-spac-merger). *Bloomberg*. May 3, 2022. Retrieved May 6, 2022.
32. "What is the Carbon Free Power Project?" (https://inl.gov/nuclear-energy/frequently-asked-questions/). *Idaho National Laboratory*. June 2, 2020. Retrieved November 27, 2023.
33. "CFPP LLC" (https://www.cfppllc.com/). *Carbon Free Power Project*. Retrieved November 9, 2023.
34. "UAMPS downsizes NuScale SMR plans" (https://www.ans.org/news/article-3087/uamps-downsizes-nuscale-smr-plans/). *Nuclear Newswire*. July 21, 2021. Retrieved December 4, 2022.
35. Geoff Brumfiel (January 13, 2017). "Miniaturized Nuclear Power Plant? U.S. Reviewing Proposed Design" (https://www.npr.org/sections/thetwo-way/2017/01/13/509673094/miniaturized-nuclear-power-plant-u-s-reviewing-proposed-design). *NPR*. Archived (https://web.archive.org/web/20180726201746/https://www.npr.org/sections/thetwo-way/2017/01/13/509673094/miniaturized-nuclear-power-plant-u-s-reviewing-proposed-design) from the original on July 26, 2018. Retrieved April 5, 2018.
36. "US government backs NuScale projects at home and abroad" (https://www.world-nuclear-news.org/Articles/US-government-backs-NuScale-projects-at-home-and-a). World Nuclear News. October 19, 2020. Retrieved January 10, 2023.

37. Patel, Sonal (October 29, 2020). "Shakeup for 720-MW Nuclear SMR Project as More Cities Withdraw Participation" (https://www.powermag.com/shakeup-for-720-mw-nuclear-smr-project-as-more-cities-withdraw-participation/). *POWER Magazine*. Retrieved August 10, 2022.
38. "UAMPS downsizes NuScale SMR plans" (https://www.ans.org/news/article-3087/uamps-downsizes-nuscale-smr-plans/). *NuclearNewswire*. American Nuclear Society. July 21, 2021. Retrieved January 10, 2023.
39. "Full-scale production of NuScale SMR to begin : New Nuclear – World Nuclear News" (https://www.world-nuclear-news.org/Articles/Full-scale-production-of-NuScale-SMR-to-begin). *www.world-nuclear-news.org*. Retrieved May 11, 2022.
40. Patel, Sonal (April 26, 2022). "Doosan Kicks Off NuScale SMR Production for Idaho Nuclear Project" (https://www.powermag.com/doosan-kicks-off-nuscale-smr-production-for-idaho-nuclear-project/). *POWER Magazine*. Retrieved May 11, 2022.
41. "Further cost refinements announced for first US SMR plant" (https://www.world-nuclear-news.org/Articles/Further-cost-refinements-announced-for-first-US-SM). World Nuclear News. January 9, 2023. Retrieved January 10, 2023.
42. Schlissel, David (January 11, 2023). "Eye-popping new cost estimates released for NuScale small modular reactor" (https://ieefa.org/resources/eye-popping-new-cost-estimates-released-nuscale-small-modular-reactor). *Institute for Energy Economics & Financial Analysis*. Retrieved January 27, 2023.
43. Morton, Adam (November 9, 2023). "Small modular nuclear reactor that was hailed by Coalition as future cancelled due to rising costs" (https://www.theguardian.com/australia-news/2023/nov/09/small-modular-nuclear-reactor-that-was-hailed-by-coalition-as-future-cancelled-due-to-rising-costs). *The Guardian*. Retrieved November 9, 2023.
44. Webb, LaVarr (January 2, 2023). "Meeting Talking Points" (https://cdnsm5-hosted.civiclive.com/UserFiles/Servers/Server_6435726/File/Government/Departments/Public%20Utilities/CFPP/Talking%20Points%20_%20Class%203%20_%2020230102%20_%20Final.pdf) (PDF). *Carbon Free Power Project*. Retrieved November 9, 2023.
45. "Idaho SMR project terminated" (https://www.world-nuclear-news.org/Articles/Idaho-SMR-project-terminated). *World Nuclear News*. November 9, 2023. Retrieved November 9, 2023.
46. Larson, Aaron (November 8, 2023). "UAMPS and NuScale Power Terminate SMR Nuclear Project" (https://www.powermag.com/uamps-and-nuscale-power-terminate-smr-nuclear-project/). *POWER magazine*. Retrieved November 14, 2023.
47. "NuScale lays off almost a third of its workforce" (https://www.neimagazine.com/news/nuscale-lays-off-almost-half-its-workforce-11422870/?cf-view). Nuclear Engineering International. January 9, 2024. Retrieved August 15, 2024.
48. Patel, Sonal (July 1, 2012). "Small Modular Reactors Vie for DOE Funding" (http://www.powermag.com/small-modular-reactors-vie-for-doe-funding/). Archived (https://web.archive.org/web/20140718083459/http://www.powermag.com/small-modular-reactors-vie-for-doe-funding/) from the original on July 18, 2014. Retrieved January 17, 2015.
49. Beattie, Jeff (June 18, 2012). "Washington Governor Nudging DOE For Small Nuke At Hanford" (http://www.theenergydaily.com/nuclear/Washington-Governor-Nudging-DOE-For-Small-Nuke-At-Hanford_8070.html). *The Energy Daily*. Archived (https://web.archive.org/web/20210201021624/https://www.theenergydaily.com/Login?returnUrl=%2Fted%2Fdocument%2F8070) from the original on February 1, 2021. Retrieved April 11, 2015.
50. Beattie, Jeff (July 26, 2012). "FirstEnergy Eyeing Possible B&W Small Reactor Project" (http://www.theenergydaily.com/publications/ed/2012-07-26/). *The Energy Daily*. Archived (https://web.archive.org/web/20160304135525/http://www.theenergydaily.com/publications/ed/2012-07-26/) from the original on March 4, 2016. Retrieved April 11, 2015.
51. "NRC agrees NuScale SMR needs no back-up power" (http://www.world-nuclear-news.org/RS-NRC-agrees-NuScale-SMR-needs-no-back-up-power-1001184.html). World Nuclear News. Archived (https://web.archive.org/web/20180126185512/http://www.world-nuclear-news.org/RS-NRC-agrees-NuScale-SMR-needs-no-back-up-power-1001184.html) from the original on January 26, 2018. Retrieved January 26, 2018.

52. Johnson, Scott K. (September 1, 2020). "NuScale's small nuclear reactor is first to get US safety approval" (https://arstechnica.com/science/2020/09/first-modular-nuclear-reactor-design-certified-in-the-us/). *Ars Technica*. Archived (https://web.archive.org/web/20200901233752/https://arstechnica.com/science/2020/09/first-modular-nuclear-reactor-design-certified-in-the-us/) from the original on September 1, 2020. Retrieved September 2, 2020.
53. "NRC Issues Final Safety Evaluation Report for NuScale Small Modular Reactor" (https://www.nrc.gov/reading-rm/doc-collections/news/2020/20-043.pdf) (PDF). *NRC*. August 28, 2020. Archived (https://web.archive.org/web/20200915214141/https://www.nrc.gov/reading-rm/doc-collections/news/2020/20-043.pdf) (PDF) from the original on September 15, 2020. Retrieved September 2, 2020.
54. Patel, Sona (November 11, 2020). "NuScale Boosts SMR Module Capacity; UAMPS Mulls Downsizing Nuclear Project" (https://www.powermag.com/nuscale-boosts-smr-module-capacity-uamps-mulls-downsizing-nuclear-project/). *Power Magazine*.
55. "NuScale SMR planned for Romania : New Nuclear – World Nuclear News" (https://world-nuclear-news.org/Articles/NuScale-SMR-planned-for-Romania). Archived (https://web.archive.org/web/20211106190149/https://www.world-nuclear-news.org/Articles/NuScale-SMR-planned-for-Romania) from the original on November 6, 2021. Retrieved November 6, 2021.
56. Patel, Sonal (February 15, 2022). "Poland Secures NuScale SMR as Urgency for Nuclear Energy Ramps Up Across Central, Eastern Europe" (https://www.powermag.com/poland-secures-nuscale-smr-as-urgency-for-nuclear-energy-ramps-up-across-central-eastern-europe/). *POWER Magazine*. Retrieved May 11, 2022.
57. "KGHM seeks approval for SMR project" (https://www.world-nuclear-news.org/Articles/KGHM-seeks-approval-for-SMR-project). *World Nuclear News*. April 18, 2023. Retrieved August 14, 2024.
58. "NuScale Power şi RoPower Nuclear au semnat un contract pentru amplasarea primei centrale SMR în România" (https://adevarul.ro/economie/nuscale-power-si-ropower-nuclear-au-semnat-un-2232244.html) (in Romanian). January 4, 2023.
59. McDermott, Jennifer (January 20, 2023). "1st small modular nuclear reactor certified for use in US" (https://apnews.com/article/us-nuclear-regulatory-commission-oregon-climate-and-environment-business-design-e5c54435f973ca32759afe5904bf96ac). *AP NEWS*. Retrieved January 21, 2023.
60. Tesfaye, Getachew (March 17, 2023). "Acceptance Review of the Nuscale US460 Standard Design Approval Application (Docket Nos. 05200050 and 99902078)" (https://www.nrc.gov/docs/ML2305/ML23058A160.pdf) (PDF). Nuclear Regulatory Commission. Retrieved August 20, 2024.
61. Tesfaye, Getachew (July 31, 2023). "Acceptance Review of the Nuscale US460 Standard Design Approval Application (Docket Nos. 05200050 and 99902078)" (https://www.nrc.gov/docs/ml2319/ml23198A163.pdf) (PDF). Nuclear Regulatory Commission. Retrieved August 20, 2024.
62. "RoPower and Fluor sign FEED 2 contract for SMR project : New Nuclear – World Nuclear News" (https://www.world-nuclear-news.org/Articles/RoPower-and-Fluor-Corporation-sign-FEED-2-contract). *www.world-nuclear-news.org*. Retrieved August 14, 2024.
63. "US Exim Bank approves loan for Romanian SMR project" (https://www.world-nuclear-news.org/articles/us-exim-bank-approves-loan-for-romanian-smr-project). *World Nuclear News*. October 2, 2024. Retrieved October 9, 2024.
64. "NuScale SMR Technology: An Ideal Solution for Repurposing U.S. Coal Plant Infrastructure and Revitalizing Communities NuScale" (https://mc-67443a0a-0a3b-4888-8568-874354-cdn-endpoint.azureedge.net/-/media/Nuscale/Files/Technology/Technical-Publications/nuscale-smr-technology-an-ideal-solution.ashx?rev=d48edd73fb5f464f8bdb593a76a4aa38&hash=23600A270CB394AC79C1F7B662648859). NuScale. 2021. Retrieved June 30, 2022.

65. Cho, Adrian (February 21, 2019). "Smaller, safer, cheaper: One company aims to reinvent the nuclear reactor and save a warming planet" (https://www.science.org/content/article/smaller-safer-cheaper-one-company-aims-reinvent-nuclear-reactor-and-save-warming-planet). *Science | AAAS*. Archived (https://web.archive.org/web/20200131154511/https://www.sciencemag.org/news/2019/02/smaller-safer-cheaper-one-company-aims-reinvent-nuclear-reactor-and-save-warming-planet) from the original on January 31, 2020. Retrieved January 31, 2020.
66. Cho, Adrian (November 10, 2023). "Deal to build pint-size nuclear reactors canceled" (https://www.science.org/content/article/deal-build-pint-size-nuclear-reactors-canceled). *Science*. Retrieved November 11, 2023.
67. "Final Safety Analysis Report, NuScale US460 SDAA Revision 0" (https://www.nrc.gov/docs/ML2236/ML22365A002.pdf) (PDF). *NuScale Power*. December 31, 2022. pp. 1.2–2, 1.2–10. Retrieved August 21, 2024 – via NRC.
68. Barnard, Jeff (December 13, 2013). "Department Of Energy Awards Grant to NuScale to Design Small Modular Nuclear Power Plants" (http://www.huffingtonpost.com/2013/12/13/department-of-energy-nuscale-grant_n_4438796.html). Associated Press. Archived (https://web.archive.org/web/20160309063803/http://www.huffingtonpost.com/2013/12/13/department-of-energy-nuscale-grant_n_4438796.html) from the original on March 9, 2016. Retrieved March 2, 2015.
69. Hise, Phaedra (December 18, 2009). "Mini Reactors Show Promise for Clean Nuclear Power's Future" (https://www.popularmechanics.com/science/energy/a3415/4273386/). *Popular Mechanics*. Archived (https://web.archive.org/web/20160427041151/http://www.popularmechanics.com/science/energy/a3415/4273386/) from the original on April 27, 2016. Retrieved January 15, 2015.
70. "The Race to Commercialize Mini-Nuclear Reactors" (http://www.powermag.com/the-race-to-commercialize-mininuclear-reactors/). *Power Magazine*. January 1, 2009. Archived (https://web.archive.org/web/20140718102721/http://www.powermag.com/the-race-to-commercialize-mininuclear-reactors/) from the original on July 18, 2014. Retrieved January 14, 2015.
71. Blumenthal, Les (June 14, 2009). "Northwest Utilities Turn to Nuclear, 25 years After Industry Collapsed" (http://www.mcclatchydc.com/2009/06/14/69983/northwest-utilities-turn-to-nuclear.html). *Tribune News Service*. Archived (https://web.archive.org/web/20130508210020/http://www.mcclatchydc.com/2009/06/14/69983/northwest-utilities-turn-to-nuclear.html) from the original on May 8, 2013. Retrieved April 11, 2015.
72. Cunningham, Nick (March 24, 2015). "A Look At The Future Of Nuclear Power" (http://oilprice.com/Alternative-Energy/Nuclear-Power/A-Look-At-The-Future-Of-Nuclear-Power.html). OilPrice. Archived (https://web.archive.org/web/20150328211343/http://oilprice.com/Alternative-Energy/Nuclear-Power/A-Look-At-The-Future-Of-Nuclear-Power.html) from the original on March 28, 2015. Retrieved April 9, 2015.
73. "NuScale Boosts SMR Capacity, Making it Cost Competitive with Other Technologies" (http://www.powermag.com/nuscale-boosts-smr-capacity-making-it-cost-competitive-with-other-technologies/). *Power Magazine*. June 6, 2018. Archived (https://web.archive.org/web/20180610023455/http://www.powermag.com/nuscale-boosts-smr-capacity-making-it-cost-competitive-with-other-technologies/) from the original on June 10, 2018. Retrieved June 6, 2018. "Optimization... will increase NuScale Power's small modular reactor (SMR) capacity by 20%... [This] would boost the power capacity of a 12-module SMR plant currently planned by Utah Associated Municipal Power Systems (UAMPS) from 600 MWe to 720 MWe." "
74. "Will Next-Gen Nuclear Power be Safe Enough?" (http://www.nbcnews.com/video/nbcnews.com/44793381). NBC News. October 10, 2011. Archived (https://web.archive.org/web/20160304093026/http://www.nbcnews.com/video/nbcnews.com/44793381) from the original on March 4, 2016. Retrieved January 15, 2015.
75. Maize, Kennedy (July 1, 2011). "Nuclear Power in the Shadow of Fukushima" (http://www.powermag.com/nuclear-power-in-the-shadow-of-fukushima/). *Power Magazine*. Archived (https://web.archive.org/web/20140718090930/http://www.powermag.com/nuclear-power-in-the-shadow-of-fukushima/) from the original on July 18, 2014. Retrieved April 27, 2015.

76. Freedman, David (June 2010). "The Big Potential of Micro Nukes" (https://www.discovermagazine.com/environment/the-big-potential-of-micro-nukes). Discover. Archived (https://web.archive.org/web/20191216130215/https://www.discovermagazine.com/environment/the-big-potential-of-micro-nukes) from the original on December 16, 2019. Retrieved January 18, 2015.
77. Barbe, Wayne (July 13, 2010). "NuScale Sees Large Upside in Small Nuclear Units". SNL Generation Markets Week.
78. Fairfield, Hannah (December 1, 2009). "New Scale for Nuclear Power" (https://query.nytimes.com/gst/fullpage.html?res=9405E6D7163BF932A35751C1A96F9C8B63). *The New York Times*. Archived (https://web.archive.org/web/20150619175353/http://query.nytimes.com/gst/fullpage.html?res=9405E6D7163BF932A35751C1A96F9C8B63) from the original on June 19, 2015. Retrieved April 11, 2015.
79. Bright, Zach; Dabbs, Brian (November 10, 2023). "Is advanced nuclear in trouble? What's next after NuScale cancellation" (https://www.eenews.net/articles/is-advanced-nuclear-in-trouble-whats-next-after-nuscale-cancellation/). *E&E News*. POLITICO. Retrieved November 28, 2023.
80. Vaughan, Adam (May 30, 2022). "Mini nuclear power stations may produce more waste than large ones" (https://www.newscientist.com/article/2322252-mini-nuclear-power-stations-may-produce-more-waste-than-large-ones/). *New Scientist*. ISSN 0262-4079 (https://search.worldcat.org/issn/0262-4079). Retrieved May 31, 2022.
81. Krall, Lindsay M; Macfarlane, Allison M; Ewing, Rodney C (June 7, 2022). "Nuclear waste from small modular reactors" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9191363). *Proceedings of the National Academy of Sciences*. **119** (23): –2111833119. Bibcode:2022PNAS..11911833K (https://ui.adsabs.harvard.edu/abs/2022PNAS..11911833K). doi:10.1073/pnas.2111833119 (https://doi.org/10.1073%2Fpnas.2111833119). ISSN 0027-8424 (https://search.worldcat.org/issn/0027-8424). PMC 9191363 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9191363). PMID 35639689 (https://pubmed.ncbi.nlm.nih.gov/35639689). S2CID 249237378 (https://api.semanticscholar.org/CorpusID:249237378).
82. "A Generation Ahead By Design" (https://holtecinternational.com/). *Holtec International*. Archived (https://web.archive.org/web/20210112142329/https://holtecinternational.com/) from the original on January 12, 2021. Retrieved January 11, 2021.
83. Proctor, Darrell (February 25, 2020). "Tech Guru's Plan—Fight Climate Change with Nuclear Power" (https://www.powermag.com/tech-gurus-plan-fight-climate-change-with-nuclear-power/). *Power Magazine*. Archived (https://web.archive.org/web/20211020031103/https://www.powermag.com/tech-gurus-plan-fight-climate-change-with-nuclear-power/) from the original on October 20, 2021. Retrieved October 18, 2021.
84. Proctor, Darrell (January 2, 2020). "U.S. Company Has Deal with Jordan for Nuclear Technology" (https://www.powermag.com/u-s-company-has-deal-with-jordan-for-nuclear-technology/). *Power Magazine*. Archived (https://web.archive.org/web/20211020011145/https://www.powermag.com/u-s-company-has-deal-with-jordan-for-nuclear-technology/) from the original on October 20, 2021. Retrieved October 18, 2021.
85. Cho (August 18, 2020). "Smaller, cheaper reactor aims to revive nuclear industry, but design problems raise safety concerns" (https://www.science.org/content/article/smaller-cheaper-reactor-aims-revive-nuclear-industry-design-problems-raise-safety). *Science | AAAS*. Archived (https://web.archive.org/web/20210227095017/https://www.sciencemag.org/news/2020/08/smaller-cheaper-reactor-aims-revive-nuclear-industry-design-problems-raise-safety) from the original on February 27, 2021. Retrieved February 25, 2021.
86. *locations* (http://www.nuscalepower.com/locations.aspx), NuScale, archived (https://web.archive.org/web/20141228040134/http://www.nuscalepower.com/locations.aspx) from the original on December 28, 2014, retrieved January 15, 2015
87. Giegerich, Andy (July 28, 2014). "NuScale set to add scores of Oregon jobs" (http://www.bizjournals.com/portland/blog/2014/07/nuscale-set-to-add-scores-of-oregon-jobs.html). *Portland Business Journal*. Retrieved January 15, 2015.

External links

- Official website (http://www.nuscalepower.com)
- A detailed description of NuScale devices in Power Magazine (http://www.powermag.com/nuscale-puts-single-minded-focus-on-small-modular-reactor/?pagenum=1)