Testimony of NuScale Power before the
Committee on Science, Space, and Technology
Subcommittee on Energy of the
U.S. House of Representatives

The Future of Nuclear Energy

Testimony provided by Michael S. McGough, Chief Commercial Officer, NuScale Power

December 11, 2014

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NuScale Power is the leading developer of American Small Modular Reactor (SMR) technology. For 15 years, our innovative company, based in Corvallis, Oregon and majority-owned by the Fluor Corporation, has been advancing a unique SMR design, which offers the safest nuclear technology available today. This significant advance, coupled with the deployment characteristics of our SMR design, can play a significant role in the future needs for baseload carbon-free electricity generation.

Our design is uniquely safe. We have solved one of the most vexing problems of the nuclear industry with what we call the "Triple Crown of Nuclear Safety." In the case of a station blackout event where all sources of electricity are absent, the NuScale Power Module shuts itself down and self-cools for an indefinite period of time, with no operator action required, no additional water other than an 8-million gallon pool, and no electricity. The NuScale Power Module use simple properties of physics, convection, conduction and gravity to drive the flow of coolant in the reactor. This has been demonstrated and witnessed by the U.S. Nuclear Regulatory Commission (NRC) and is protected by patents issued or pending since 2011.

Our deployment characteristics make the NuScale Power Module an option for baseload generation. The NuScale Power Module is dramatically smaller than today's pressurized water reactors and eliminates many of the electrically -driven pumps, motors and valves necessary to protect the nuclear core. It can be factory-manufactured and transported to a site via rail truck or barge.

NuScale has a robust market demand for our technology and a line of site to our first dozen projects. We are in active negotiations for the first project known as the Utah Associated Municipal Power Authority Carbon Free Power Project, which will be sited in Idaho, with possible locations including the Department of Energy's Idaho National Laboratory site. We expect to deliver our first project of 12x50 MWe NPM's in a 600MWe (gross) plant to the owner, UAMPS, for a price of approximately $3 Billion with subsequent plants in the range of $2.5 Billion. Energy Northwest has joined this effort, and holds first right of offer to operate the UAMPS project.

Tomorrow will mark the one-year anniversary of NuScale's selection as the sole awardee for funding in round two of the DOE's Small Modular Reactor program, focusing on providing cost-share grants in support of licensing expenses. NuScale may receive up to $217MM of matching funds over 5 years, and we are the only developer proceeding full speed towards near-term commercialization. Successful completion of the SMR cost-share program depends on sustained Congressional support through continued appropriations. We appreciate your past support, and we ask that you continue to prioritize this program in a tight budgetary environment.

One of the highest risk components remaining in our project is the uncertainty of the time and process for the NRC licensing efforts. In order to meet our customers' urgent needs to deliver carbon-free baseload electricity to their grids, we must be in position for commercial operations in 2024. NuScale has been engaged with the NRC on pre-application review efforts since April of 2008. We expect to submit our Design Certification Application in the second half of 2016, and the NRC plan currently reflects a 39-month review schedule. We are currently waiting for the NRC to issue the NuScale Design Specific Review Standard, which will establish the basis for our technology review. Because of the unique NuScale technology, it is important that NRC resources are dedicated to reviewing the NuScale application to ensure timely completion.

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NuScale Power is the leading developer of American Small Modular Reactor (SMR) Technology. For 15 years, our innovative company, based in Corvallis, Oregon and majority-owned by the Fluor Corporation, has been advancing a unique SMR design which offers the safest nuclear technology available today. This significant advance, coupled with the deployment characteristics of our SMR design, can play a significant role in the future needs for baseload carbon-free electricity generation.

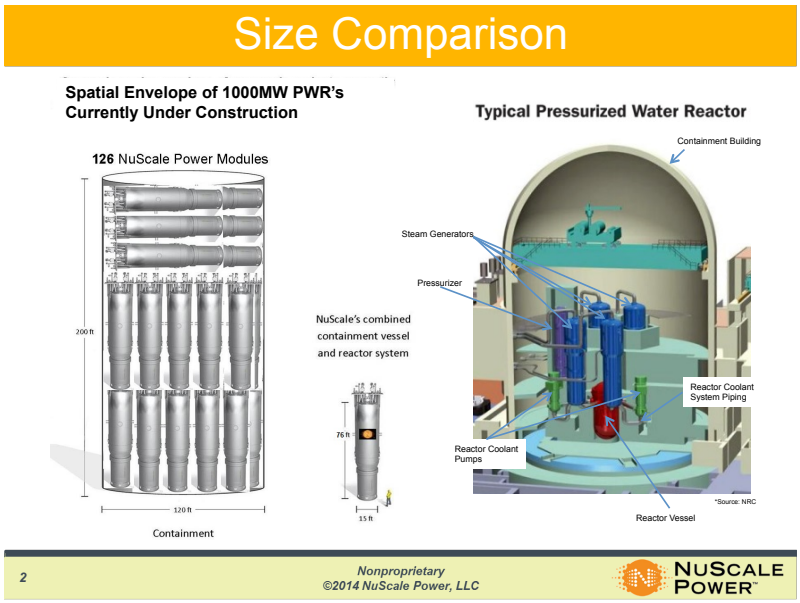
The genesis of our 50 MWe integral pressurized water reactor began 15 years ago with a U.S. Department of Energy (DOE) grant through the Idaho National Laboratory and included the construction of a one-third scale electrically-heated prototype test facility to validate the safety features of the plant. This prototype has been in operational testing since 2003.

Unique Safety Features

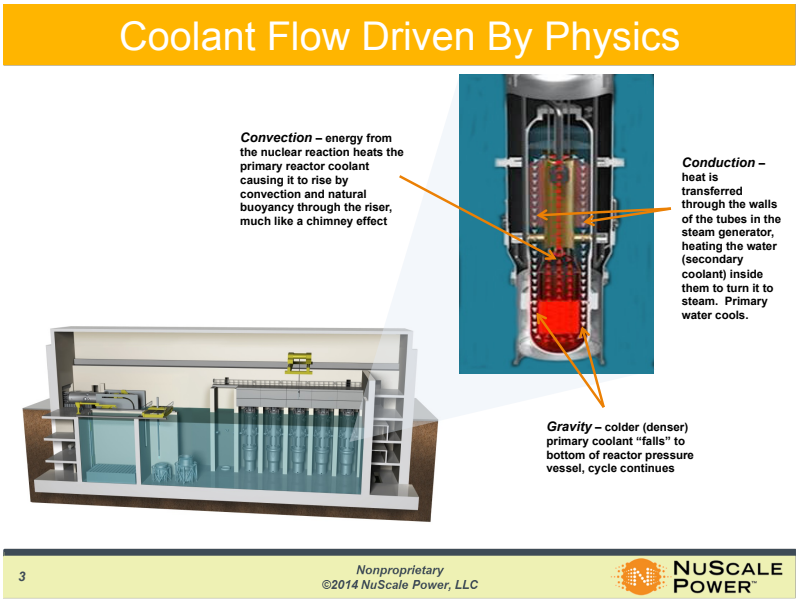
First, I will speak about the safety features of the NuScale SMR plant design. We eliminate many of the complex systems found in existing operating nuclear power plants and replace them with natural forces of physics. The result of this unique design is a nuclear plant immune to the effects of a station blackout event, like the one we observed at Fukushima.

As shown in this illustration, we have solved one of the most vexing problems of the nuclear industry with what we call the Triple Crown of Nuclear Safety. In the case of a station blackout event where all sources of electricity are absent, the NuScale Power Module (NPM) shuts itself down and self-cools for an indefinite period of time, with no operator action required, no additional water other than an 8-million gallon pool, and no electricity. This has been demonstrated and witnessed by the U.S. Nuclear Regulatory Commission (NRC) and is protected by patents issued or pending since 2011.

How exactly does this work?



This picture illustrates the size of a 50MWe NPM compared to a typical 1000MWe-class plant operating today (on the right) and the spatial envelope of the containment buildings being constructed today in Georgia and South Carolina (on the left). The image on the right shows reactor coolant pump motors, steam generators, a reactor containment building, pressurizer and hundreds of feet of large-diameter heavy-wall reactor coolant system piping through which approximately 20 million gallons per hour of high temperature reactor coolant water flow. The center image is the NPM which is a complete integrated factory-built unit, including the containment, reactor vessel and pressurizer, all contained in one cylindrical, road-transportable vessel (Note: By design the NPM does not contain reactor coolant pumps nor large bore reactor coolant system piping).



The NPM uses simple forces of physics to drive the coolant flow, as shown in this illustration. The image on the right shows the NPM which includes an outer steel vessel (containment vessel) containing an inner vessel (reactor vessel), installed underground and in an 8 million-gallon pool of water. NPMs are installed in a reactor building designed to accommodate up to 12 NPMs. The NPM operates when the heat from nuclear fission in the reactor core, represented by the red area at the bottom of the diagram, heats pressurized water causing the water to rise by buoyancy and convection through the bronze-colored tube, much like a chimney-effect. The bronze tube is surrounded by coiled tubes containing cooler water. As the hot water passes over these tubes it gives up energy by conduction through the walls of the tubes, causing the internal water to turn to steam. The steam is then directed to rotate a turbine and generate electricity. As the hot water gives up energy, it becomes cooler, thus denser, which causes it to fall by gravity to the bottom of the reactor vessel where the natural circulation flow cycle continues over and over again. The NPM eliminates many of the electrically-driven components required to protect the core in today's conventional nuclear plants.

The Role of the U.S. DOE in SMR Technology Development

In the early 2000's, Congress authorized a program known as NP-2010, to stimulate the revival of the U.S. nuclear industry with a cost-share of the private sector investments in design and licensing. This program resulted in the certification of two new nuclear plant designs, one of which is being built today in Georgia and South Carolina. Of note, the design certification testing for that design was performed under contract to the designer by NuScale founder and Chief Technology Officer, Dr. Jose Reyes, on facilities he constructed adjacent to the NuScale test facility in Corvallis, Oregon.

Congress also recently authorized a similar program for Small Modular Reactor design and licensing cost sharing. Tomorrow will mark the one-year anniversary of NuScale's selection as the sole awardee for funding in round two of DOE's SMR program, focusing on providing cost-share grants in support of licensing expenses. As such, we may receive up to $217 million of matching funds to aid in financing the approximately $1 billion necessary to complete the design and license it for construction. We have spent approximately $250 million on the project life-to-date. Successful completion of the SMR cost-

share program depends on sustained Congressional support through continued appropriations. We appreciate your past support, and ask that you continue to prioritize this program in a tight budgetary environment.

A substantial portion of DOE's cost-shared funding will help pay for NRC fees required of all NRC applicants. To date, NuScale has incurred $3.3 million in NRC fees to reimburse the approximately 12,000 hours of NRC staff time utilized to date. We estimate additional NRC fees of approximately $80 million will be necessary to complete a 39 month review of our design application.

The Importance of Timely NRC Licensing Actions

In order to ensure that the NuScale design is ready to meet the urgent needs of our prospective customer base as they begin to reduce their reliance on carbon-generating assets, we will need the NRC to complete preparations for submittal of our design certification application and to conduct the design certification review in a timeframe that meets our customer's needs. We hear two consistent concerns from prospective customers and investors: 1) regulatory uncertainty, and 2) skepticism the NRC can complete their review in the 39 months the NRC has planned.

NuScale is aggressively addressing both these concerns. With respect to regulatory uncertainty we have engaged the NRC in pre-application submittal preparation since early 2008, and we have collaboratively identified about 60 remaining technical, licensing and policy issues to discuss by the end of 2015. We are currently awaiting the NRC release of the NuScale Design Specific Review Standard, which will establish the basis for our technology review. As a result of our innovative design, regulations and guidance developed for active large light water reactors do not address the many differences in our passive SMR design. In some cases, literal compliance with existing regulations would reduce the safety of our design. Timely delivery by NRC of the Design Specific Review Standard as soon as possible is critical to ensuring that we are able to submit a quality application on schedule in the second half of 2016, and meet our customers' needs. We are working closely with the NRC to ensure that this happens. NRC has signaled willingness to potentially provide us with some draft sections early, and last month we provided them a list of sections that would be most helpful.

With respect to the NRC's ability to conduct the Design Certification Application review within in 39 months, we see two critical issues to address: 1) extending the NRC's review time on critical areas by submitting portions of the design in advance; and 2) obtaining dedicated NRC staff resources to review our design. To address the first issue NuScale is submitting portions of our application early, in the form of what are known as topical reports, on about 20 aspects of the design. By submitting these reports, we effectively extend the staff's review time and reduce the scope of work that needs to be done when the remainder of the application is submitted. Regarding the second issue, the NRC reviewed the initial wave of applications using a matrix organization, where the same staff person reviewed multiple designs. While that approach is efficient and makes sense when all the designs are similar, such an approach creates more schedule risk for a unique design such as NuScale's. Therefore, we believe a dedicated NRC staff review team, whose members' sole function is to review the NuScale design, is more likely to meet the NRC's commitment to 39 months. Such a focused approach ensures that sufficient resources are identified for our review in advance of submittal and that staff can be trained on the unique safety features of our design prior to submittal of the application. We began discussions with the NRC on this approach this month.

Customers and Markets

The most important driver for our development efforts is the marketplace demand for non-carbon-generating baseload electricity. In the face of increasing carbon regulation, accelerated coal plant retirements and increased integration of intermittent renewable generation assets from wind and solar, the NPM is uniquely positioned to provide a baseload resource that is complementary to renewables and designed for load-following. And, since a NuScale plant consists of twelve individual power modules, it has the additional ability to load follow incrementally by varying the output of individual modules to match variations in intermittent generation.

The first deployment of a NuScale plant is currently designated for the Utah Associated Municipal Power System (UAMPS) for the project known as the "UAMPS Carbon Free Power Project (UAMPS CFPP)." UAMPS intends to deploy its plant for commercial operations in the 2023-24 timeframe. The plant will be located somewhere in Idaho, possibly at the DOE's Idaho National Laboratory site. Energy Northwest has joined this effort, and holds the first right of offer to operate the UAMPS project. In addition to the UAMPS CFPP, we have a line of site to our first twelve projects, including some potential additional locations at DOE sites such as Hanford, ORNL, Paducah, Portsmouth, Savannah River and others.

The NuScale plant is expected to be delivered to UAMPS for a price of approximately $3 billion, with subsequent project pricing expected to be approximately $2.5 billion. We plan to construct it on a schedule of less than 36 months from the start of safety-related construction through commissioning of the first module.

Conclusion

NuScale is proud to have developed a new technology for the deployment of a nuclear power generating asset that sets a new safety standard for the sector, is carbon-free, factory-built, incrementally deployable, and significantly less costly than large generating units. The NuScale Power Module is a disruptive technology that will change the way the world views nuclear energy, and it will play an important role in next generation deployment of baseload electricity. We are grateful for the support of the U.S. DOE and the Congress. We take those responsibilities very seriously and are singularly focused on the re-establishment of U.S. leadership in nuclear energy technology.