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Comparison between a Small Modular Reactor and a traditional nuclear reactor in water desalination cogeneration application

Cogeneration applications of nuclear energy could present sustainable solutions for several energy challenges current and future generations will have to face. There is growing interest around the world in using nuclear energy for cogeneration applications such as seawater desalination, hydrogen production, district heating, and various industrial applications. Small modular reactors represent a key area of interest to nuclear industry developers, which have been making significant progress during the past few years. Generally, these reactors are promising owing to their improved safety due to passive systems, enhanced containment efficiency, and fewer capital costs in comparison to traditional nuclear reactors. The worldwide demand for potable water has been steadily growing and is projected to accelerate while natural reserves of fresh water are generally flat or diminishing. Desalination of seawater is expected to make up the difference; however, the desalination of water is energy intensive, requiring large amounts of electricity and/or thermal energy. Nuclear energy is an attractive option for large scale desalination application since the thermal energy produced in a nuclear plant can provide both electricity and heat for clean water production without the emission of greenhouse gases or the variability of renewable sources. A particularly attractive option for nuclear desalination is to couple a desalination plant with a new generation of designs, small modular reactors. In this research, a comparison between a Small Modular Reactor and a traditional nuclear reactor in water desalination cogeneration application is represented. The NuScale small modular reactor design is especially well suited for the cogeneration of electricity and clean water because of the enhanced safety, improved affordability, and deployment flexibilities of the plant design, which provides a cost-effective approach to expand a global desalination capacity, so it is compared with a pressurized water reactor. through evaluate the technical and economic considerations of coupling a NuScale plant.

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