



Innovation in Nuclear Energy towards a Cleaner Future

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Nuclear power plays a very important role in generating electricity. For more than fifty years, nuclear energy provided electricity to many countries around the world with low emission of CO₂ and without the need for coal, natural gas, and oil.

Nuclear energy offers a good solution for energy problems. Nuclear fuel is considered a sustainable fuel more than other energy sources. Some innovations in nuclear reactor technology focused on the sustainability of nuclear fuel, advanced design of nuclear reactors, enhancing the public awareness of nuclear energy, and minimizing the probability of accidents.

Recently, some advanced nuclear reactors came online and started operations in some countries. Advanced nuclear reactors can bolster the role of nuclear power, by offering a good economical choice, low environmental impacts, and low proliferation risk. Advanced reactors use passive safety systems which depend on natural forces, such as gravity, natural circulation, etc. using passive safety systems will minimize the Core Damage Frequency (CDF) comparing with that of conventional reactors. Advanced nuclear reactors also can offer non-electric applications, such as seawater desalination, district heating, heat for industrial processes, and electricity and heat for hydrogen production.

Thorium has been tested as a nuclear fuel in some types of nuclear reactors. It was found to boast several advantages over the ordinary nuclear fuel, uranium-235. It is considered a viable and attractive option for generating power. Using thorium as a nuclear fuel, will enhance nuclear energy sustainability.

One of the promising advanced nuclear reactors are the Small Modular Reactors (SMRs) and Micro-reactors. SMRs are named be-

cause of their small size and their modular design. Some of the benefits of using SMRs, that they can offer a good solution for locations that are not suitable for large nuclear reactors and offer savings in cost and construction time. Micro-reactors are named because of their small size and they can be moved from one location to another where they are needed. Therefore, they can offer clean and carbon-free energy for areas dependent on fossil fuels. They can easily be transported to where they need to be, operated for weeks or months, then moved to their next location.

Public acceptance to build new nuclear reactors in different countries was greatly affected by previous nuclear reactor accidents, such as Chernobyl, TMI2, and Fukushima. However, with the development of advanced reactors, safety culture, and increase of passive safety systems' share, public acceptance to nuclear energy has been achieved.

Innovations in nuclear energy technology enhance the use of nuclear reactors and provide a reliable, sustainable, clean, and economical solution for the world energy problem