

## Nuclear renewable hybrid energy systems

Table 2. Technical details of different types of reactors (Bodansky, 2005; IEE, 2005; Fernandez-Arias et al., 2020; U. S. Energy Information Administration, 2020; World Nuclear Association, 2021; Britiannica; Institute for Energy and Environmental Research).

Citation: Arefin MA, Islam MT, Rashid F, Mostakim K, Masuk NI and Islam MHI (2021) A Comprehensive Review of Nuclear-Renewable Hybrid Energy Systems: Status, Operation, Configuration, Benefit, and Feasibility. Front. Sustain. Cities 3:723910. doi: 10.3389/frsc.2021.723910

Hybrid energy systems simultaneously address the need for grid flexibility and greenhouse gas emission reduction, while optimizing financial resources. While nuclear power plants are dispatchable sources of energy - they can adjust output accordingly to electricity demand - some renewables, such as wind and solar, are variable energy sources that depend on the weather and time of day.

"FRAMES represents a new and innovative model, which could provide unique analytical capability in the future to support the efforts of countries considering nuclear energy as a clean and sustainable option or for the larger community evaluating nuclear, fossil and renewable energy resources as part of a national energy portfolio," said Sean Tyson of the US Department of Energy.

The model features different power generation and storage units, from variable renewables to hydro resources and thermal generation units, as well as different operational constraints, system requirements and policy measures. "The model calculates unit commitment, which is the optimal dispatch of existing generating units subject to all relevant constraints. Simultaneously, FRAMES can determine the best investments in new generating technologies, known as capacity expansion," said Francesco Ganda, Nuclear Engineering Expert at the IAEA.



**Nuclear  
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**hybrid**

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