



Finland's Success with Nuclear Repository to Affect Energy Mix in Countries

by Kamil Maqsood, *Research Analyst* at *Power Technology Research*

- According to Power Technology Research, Finland's conventional electricity generation installed capacity accounted for 15.16 GW in 2020.
- Wind and solar accounted for 2.58 and 0.25 GW of installed capacity respectively.
- Finland's nuclear waste repository at Onkalo will cost around USD 3.4 billion and is expected to begin operation in 2023.

Finland's electricity market is part of Nordic wholesale electricity market which includes markets of Nordic countries and Baltic states. Following the passing of Electricity Market Act in 1995, Finland's electricity market gradually opened for competition. That along with grid integration with Nordic countries has enhanced the overall efficiency of country's power sector.

In this article we will be discussing conventional/renewable generation trends in Finland, latest developments in the nuclear power sector and how it has the potential to affect the energy mix within and outside Finland.

Generation Trends in Finland

Thermal, nuclear and hydropower plants are the main sources of electricity generation in Finland followed by solar, wind (onshore and offshore) and solid biofuels in 2019 (see figure 1). According to Power Technology Research,

conventional electricity generation installed capacity accounted for 15.16 GW in 2020 whereas wind and solar accounted for 2.58 MW and 0.265 GW of installed capacity respectively. It is important to note that conventional generation installed capacity is expected to drop in 2021 and it will be replaced by growth in solar and wind (onshore and offshore).

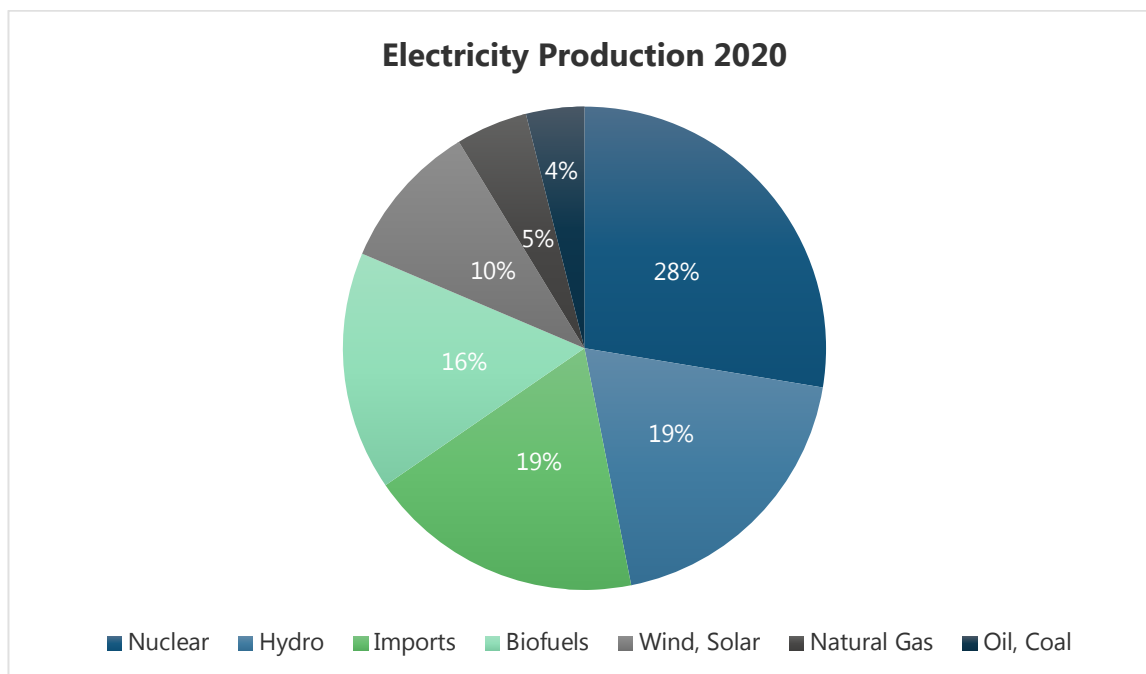


Figure 1: Finland's electricity production by energy source in 2020.

Source: Energinet- Finnish Energy

Power Technology Research shows conventional electricity generation in Finland is expected to grow with a CAGR of 1.4% from 2021-2026. Further, solar and wind generation installed capacity (onshore and offshore) is expected to grow with a CAGR of almost 15% and 13% respectively from 2021-2026.

Renewable generation trends

From 2001 until 2011 Finland did not have significant growth in renewable energy. This includes renewable hydro, solar and wind (onshore and offshore). Renewable installed capacity grew from 4,608 MW in 2001 to 5,256 MW in 2011. After 2011, the renewable sector picked up especially in the onshore wind energy and bioenergy segment. There was a slowdown in the growth of renewables around 2018-2019, but the installed capacity still reached 8,703 MW in 2020.

Ilmatar Energy, a Finnish renewable energy company, has been involved with over 500MW of new wind projects in Finland in the past two years and just started construction on a 216 MW onshore wind farm which will be operational in 2023. The company has three other ongoing wind farm projects. Still, Finland is expected to install more solar PV generation plants than onshore wind turbines in the later part of ongoing decade. This is mainly due to the further drop in the cost of generation from PV as compared to onshore wind generation with a price cross over expected in the last couple of years of this decade.

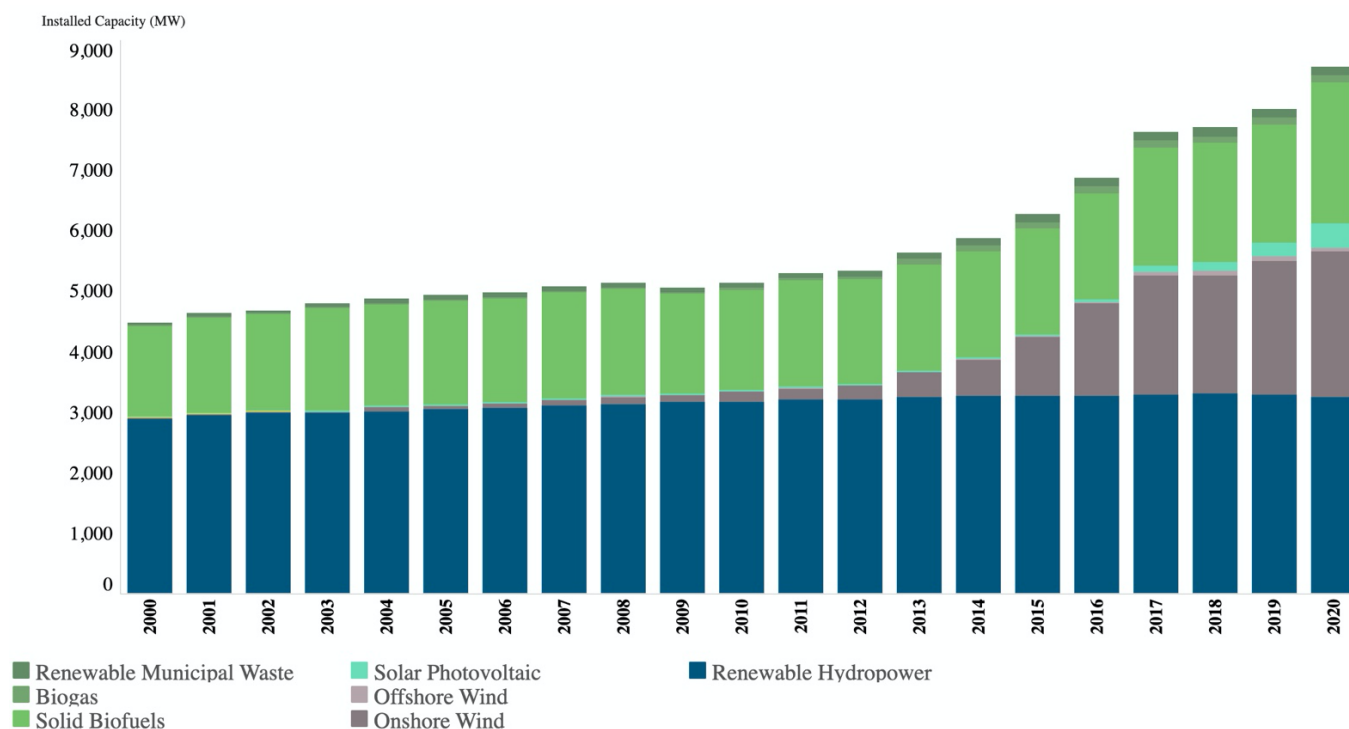


Figure 2: Finland's renewable installed capacity (2000-2020).

Source: IRENA

Grid interconnections

Fingrid is responsible for the supervision and operation of Finland's electricity transmission grid. Regional networks distribute electricity usually on 110 kV lines (about 7,300 km) while higher voltage levels, 400kV, are used to cover the long distances (5,100 km). There are also about 1,300 km of 220 kV. Fingrid is currently upgrading the transmission grid and plans to spend 1,200 million between 2015-2025 on new transmission lines and 30 new substations.

Finland is part of the synchronous inter-Nordic system which includes the transmission grids of Sweden, Norway, and Eastern Denmark. Finland is connected to Sweden via two DC lines from Rauma, one 400kV line and a 800kV line. There are additional DC connections from Finland to Estonia (350 MW and 650 MW). The three DC connections to Russia allow hydropower plants in Russia to furnish energy to the Finnish grid.

As far as AC interconnections are concerned, Finland's grid is connected to Sweden's grid through two 400 kV AC connections in northern Finland. There is also another AC interconnection (220 kV) between Finland and Norway.

Breakthrough in Nuclear Energy

One of the greatest challenges for nuclear power has been how to dispose the spent nuclear fuel and the highly radioactive nuclear waste. This issue, along with high price of building a nuclear power station from scratch, has led to the decline of nuclear power globally. But Finland is moving forward with a solution to one of these issues and they plan on using a natural geological repository for the waste material.

The U.S. also proposed similar projects for the storage of nuclear waste. One site was located underneath the Yucca Mountain in Nevada but after serious opposition was defunded. Another more recent storage proposal is near Carlsbad, New Mexico. This would serve as a temporary storage site for the spent nuclear fuel rods while a more permanent solution is built, but many fear that will not happen and Carlsbad will become a permanent repository. There are no nuclear power plants in New Mexico or Nevada, so it is harder to buy into storing radioactive material that powered plants elsewhere.

Finland, with nuclear reactors that supply 28% of the country's power, has a unified approach to storing the waste. Posiva Oy and the Swedish Nuclear Fuel and Waste Management Company worked together to develop the disposal facility called Onkalo which is located in Olkiluoto, near one of the country's nuclear plants, Finland's nuclear waste repository at Onkalo is expected to be opened in 2023. However, the total cost of the project is estimated to be around USD 3.4 billion. The repository has an operational period of 100 years where around one hundred deposition tunnels will be excavated throughout the project lifetime.

Finland presently has 4 nuclear power plants, and a fifth nuclear plant is expected to come online in June 2022. This will not only increase contribution of nuclear power in the generation mix of Finland, but it will completely replace coal generation. The efficiency of these nuclear reactors is quite high with an average lifetime capacity factor of over 90% and average capacity factor over the last decade of over 95%.

Looking Ahead

Finland's government is aiming to achieve net carbon neutrality by 2035 and nuclear, along with renewables, is expected to play a vital role in achieving that target. Renewables being an intermittent source of energy, require base load generation which can be provided with nuclear generation whereas excess renewable generation can be transmitted to neighboring countries through interconnections. As Finland is not looking at other forms of energy for base load requirements, so nuclear power's share is expected to increase with renewables side by side.

It is important to note that Finland's success with the nuclear waste management is expected to push countries into investing in extending lives of already built nuclear power plants but the countries like Japan that have experienced nuclear disaster are not expected to move towards nuclear life extension despite renewable being an expensive option there.

Contact:

Hassan Zaheer - Exec. Director Client Relations & Advisory

+49-89-12250950

(hassan.zaheer@powertechresearch.com)