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# Large-Scale Combined Heat and Power (CHP) Generation at Loviisa Nuclear Power Plant Unit 3

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Fortum has applied for a Decision in Principle concerning the construction of a new nuclear power plant unit (Loviisa 3) ranging from 2800-4600 $MW_{th}$ at its Loviisa site located at the southern coast of Finland. An attractive alternative investigated is a co-generation plant designed for large-scale district heat generation for the Helsinki metropolitan area that is located approximately 75 km west of the Loviisa site. The starting point is that the district heat generation capacity of Loviisa 3 unit would be around 1 000 $MW_{th}$.

The possibility of generating district heat for the Helsinki metropolitan area by Loviisa's two existing nuclear power plant units was investigated back in the 1980s, but it proved unpractical at the time. With the growing concern of the climate change and the subsequent requirements on heat and power generation, the idea is much more attractive today, when recognising its potential to decrease Finland's carbon dioxide emissions significantly.

Currently the district heat generation in Helsinki metropolitan area is based on coal and natural gas, producing some five to seven million tonnes of carbon dioxide emissions annually. Large-scale combined heat and power (CHP) generation at the Loviisa 3 unit could cut this figure by up to four million tonnes. This would decrease Finland's carbon dioxide emissions by as much as six percent. In addition, large-scale CHP generation would increase the overall efficiency of the new unit significantly and hence, reduce the environmental impact on the local marine environment by cutting heat discharges into the Gulf of Finland.

Nuclear energy has been used for district heating in several countries both in dedicated nuclear heating plants and in CHP generation plants. However, the heat generation capacity is usually rather limited, maximum being around 250 $MW_{th}$ per unit. Set against this, the Loviisa 3 CHP concept is much more ambitious, not only because of the much larger heat generation output envisaged, but also because the district heating water would have to be transported over a rather long distance.

This paper describes the general concept of the Loviisa 3 CHP generation; it addresses the technical starting points as well as the general design and safety requirements with regard both to the co-generation plant and the district heat transport system. The use of APROS simulation software for preliminary safety analyses during the design phase is presented and discussed.

***Keywords:*** combined heat and power, co-generation, CHP, district heat, Loviisa 3