A feasibility study of a nuclear power plant on the JBF Arctic

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A feasibility study is performed for JBF Arctic, a Mobile Offshore Drilling Unit (MODU), designed to operate year round in Arctic conditions. The original design relies on diesel generator sets and fuel burners for heating the unit. The heating of the JBF Arctic takes up to 50% of the total diesel fuel consumption. Consequently the JBF Arctic needs regular fuel supplies in an ice covered- and remoteness area, which can be quite challenging considering that the ice covered season can extend up to 9 months. The goal of the study was to investigate a feasibility of application of a nuclear power plant as an alternative solution.

A pressurized water reactor, the Ritm-200, with a refueling interval of approx. seven years, is considered. A cogeneration system (re)uses the heat from the nuclear reactor to heat the accommodation and working areas. A study is performed on a possible integration of the reactor into the JBF Arctic. Overall it can be concluded that a nuclear power plant in the JBF Arctic is technically feasible. The environmental effect of nuclear power is compared with a diesel fired power plant. A nuclear power plant saves approx. 2,000 t of HC and approx. 34,000 t of NOx in 20 years, however it produces in that same time approx. 400 kg of high level radioactive waste.

The study has also covered all relevant existing regulations. Further, an investigation is done to requirements for the infrastructure of a nuclear powered ship, from construction to decommissioning. It was concluded that at this time no infrastructure in the world is present to decommission the JBF Arctic and has the ability to safely store the nuclear waste.

A financial comparison is made between a diesel powered- and a nuclear powered JBF Arctic. A nuclear powered JBF Arctic can have a lower lifecycle cost than the original design. Overall can be concluded that diesel fuel price have to rise annually with approximately 2-4%, before a nuclear power plant become financially competitive with a diesel power plant.

In conclusion it should be pointed out that the zero emission and independency of diesel fuel supply are major advantages of the nuclear power plant, but other aspects also play a great role. These aspects include the public opinion towards the nuclear energy, the necessity of (not existing yet) dedicated infrastructure, potential risk of accidents, uncertainties related to investment and operational costs and to which countries and ports a nuclear ship will be allowed to enter etc. However the climate change and rising fossil fuel prices increase the attractiveness of nuclear power, making the civilian nuclear applications more acceptable option to the public in future.