

Abstract

The combustion of fossil fuels on which humanity is still mainly dependent produces large quantities of pollutants and greenhouse gases with harmful effects on ecology and health. These gases are partially responsible for global warming. In order to meet an increase of +2°C compared to the pre-industrial era by 2050, a large number of alternative energy production solutions to fossil fuels have been developed such as hydroelectric, wind power, solar power, etc.

This is the case in the Merchant Navy. It is responsible for approximately 3% of global greenhouse gas emissions with an estimated quantity in 2012 of 961 million tonnes of CO₂e (CO₂ equivalent is combination of CO₂, CH₄, NO₂) per year. This CO₂e production is only valid for the use of fossil fuel and not for its entire life cycle.

We already master nuclear propulsion technology, which provides a solution for greenhouse gas emissions. Unfortunately, nuclear propulsion is still little used outside of military ships, icebreakers or few tankers operating in the Arctic Ocean. Unlike fossil fuel, nuclear power does not generate greenhouse gases. This is no longer true if we consider the entire life cycle of nuclear fuel. Studies have shown that the ratio of gas emitted by energy produced over the entire nuclear fuel cycle is between 10 and 130 gCO₂e/kWh. Compared to coal, which is one of the most polluting fossil fuels, this value is 820 CO₂e/kWh.

The greenhouse gas reduction potential that nuclear energy could contribute is significant. We will investigate whether it is possible to replace conventional propulsion with nuclear propulsion in a sustainable way.