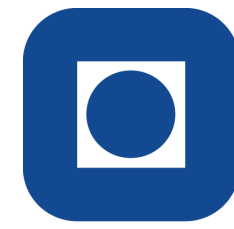


Utilization of VOC and LNG for Shuttle Tankers Operating in the Barents Sea

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Background

The Norwegian Petroleum Directorate estimates that almost 65% of the undiscovered petroleum resources on the Norwegian Continental shelf are located in the Barents Sea. The Korpffjell prospect is located north-east, 37km from the Russian boarder and is one of the potential larger oilfields in this region. It has a discovery potential of 18% and the volume estimates are in average of approximately 2.2 billion bbl (Petro.no 2016). A field development at this location would probably include a floating, production, storage and offloading (FPSO) unit, with shuttle-tankers transporting the oil. Korpffjell is located in a environmentally sensitive region that is covered by the Polar Code from IMO. This leads to strict requirements for emission reduction and pollution prevention measures.

Oil vapor, or volatile organic compounds (VOC), evaporates during loading, offloading and transportation. The VOC increases the pressure in the storage tanks of the shuttle tankers. Normally, oil tankers release the VOC, which causes emissions of greenhouse gasses and NOx.

A new shuttle tanker concept by Teekay is under development. It has a hybrid electric propulsion system, with a duel fuel engine which can use a mixture of VOC and LNG as fuel and has a 500 kWh battery capacity (Stensvold 2017). The vessel reduces the VOC emissions by utilizing it as fuel which is both environmentally friendly and reduces fuel consumption.

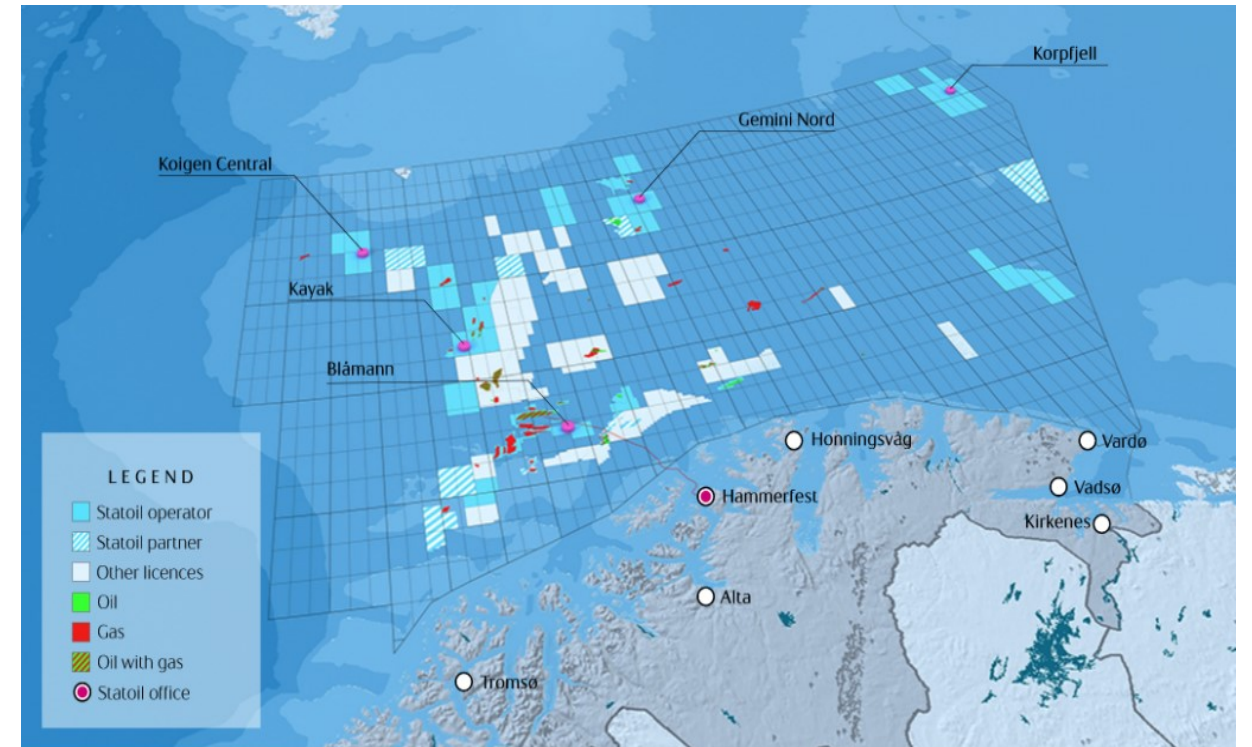
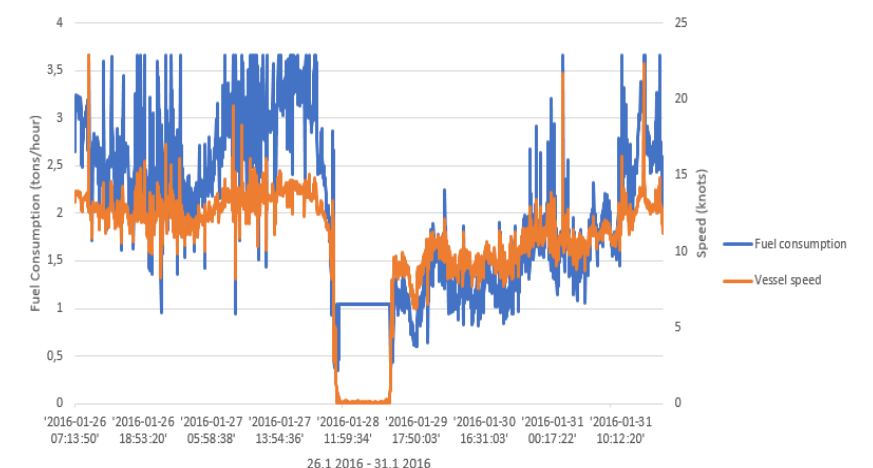


Illustration of prospects in the Barents Sea. Korpffjell is located north-east part of the region, close to the Russian boarder (Statoil 2017).

Objectives

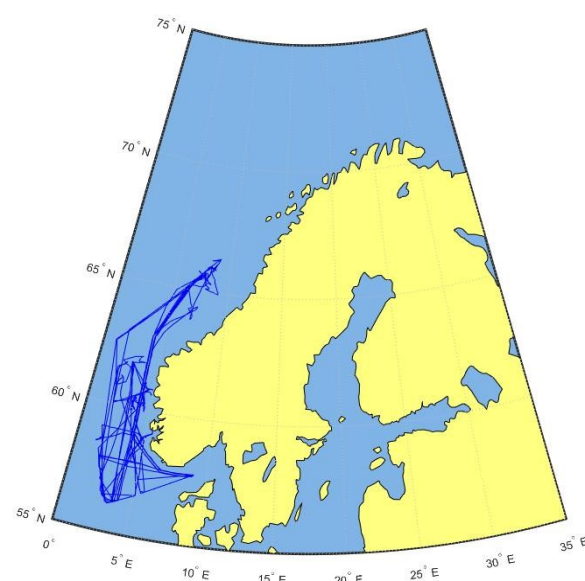
The overall objective of the master thesis has been to analyse how the utilization of VOC and LNG in a hybrid electric propulsion system affects the operations of shuttle tankers in the Barents Sea, and how this concept can contribute to meet the requirements of the Polar Code. To accomplish this, a comparative analysis of operational profiles for existing shuttle tankers and the new vessel concept operating at the Korpffjell oilfield is conducted.

The figure to the right illustrates the correlation between fuel consumption and vessel speed for approximately five days of operation. The time period where the fuel consumption clearly exceeds the vessel speed, while the vessel speed is close to zero, the shuttle tanker is located close to a FPSO. Here it is assumed that the shuttle tanker is loading oil and is in dynamic positioning (DP) mode.



Method

Automatic identification system (AIS) data has been used to create operational profiles for existing shuttle tankers. The data is obtained from the Norwegian Coastal Administration database "Havbase". They track and register AIS data for all vessels in Norwegian waters, and estimate emissions and fuel consumption based on machinery type, fuel and vessel size combined with the AIS data. In order to create an operational profile for the shuttle tankers, the data was categorized and analysed. The data does not contain information about the operational mode of the vessel. The operational modes had to be assumed based on position, distance to installation, sailing distance and fuel consumption. The figure to the right illustrates a plot of AIS position data for a shuttle tanker over a period of one year.



Results and Conclusion

Work still in progress

References

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