ENERGY INNOVATION CHALLENGE 2019

PROJECT ABSTRACT

Team Name: Odyssey

School: Jurong Pioneer Junior College

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Project Title: Floating Charging Stations for Electric Ships that Generate Electricity through Solar and Tidal Energy

Project Code: J-25

Synopsis

The idea behind Odyssey is our pursuit for a shipping industry dominated by electric ships, where electricity is generated through clean energy, for a cleaner world. By studying Tesla's superchargers and its potential impacts, we aim to further develop the chosen innovation for charging electric ships. Our project thus aims to incentivise the entire shipping industry to switch to electricity as the main source of energy for their ships through convenience and accessibility.

Potential Stakeholders

Potential stakeholders for this project would be the Norwegian Maritime Authority (NMA), Rolls-Royce and electric ship companies.

Norway is leading the way in the adoption of electric ships. NMA has introduced strict regulations to reduce the environmental strain in the world heritage fjords. Odyssey will encourage the use of electric ships through its affordable and convenient charging stations, working towards NMA's of environmentally sustainable shipping.

Rolls-Royce produces a cost competitive, highly efficient and liquid cooled battery system for electric ships that complies with international legislations for low and zero emissions. We can work with Rolls-Royce to develop charging cables that are compatible with our charging stations.

Design

Charging stations measure 75m by 75m, consisting of solar panels on platforms above the sea that absorb solar energy (Figure 1) Tidal turbines that make use of underwater sea currents to generate electricity would be installed under the platforms (Figure 2). Electricity collected will be stored in a central battery cell on the platform. Ship owners can easily drop their charging cables into a receiving funnel on the charging ports, allowing their ships to be charged. As the charging stations do not contain flimsy components and moving parts, it is robust and reliable. Regular maintenance is also minimised.

Implementation

The charging stations will be installed in the North Atlantic ocean between North America continent and Europe. The Atlantic Ocean is a busy region with high shipping density, hence maritime traffic is high and charging stations would benefit more electric ships passing through.

The North Atlantic Ocean is busy region with high shipping density, hence maritime traffic is high and charging stations would benefit more electric ships passing through. The Gulf Stream is also found in the North Atlantic Ocean, a region with strong ocean currents with a mean of 6.4km/h and a maximum of 9km/h (Figure 3). These speeds would fulfill tidal turbines ideal speed of 1.5m/s-3.5m/s, allowing them to collect a steady stream of electricity.

The North Atlantic Ocean also has a high mean solar irradiance of 220-240 W/m2. Solar panels would be able to receive a high amount of solar energy at this region. Sea surface temperature is 10-12℃, which is within the optimum operating temperature of 25℃ for the solar panels (Figure 4).

Charging stations will be implemented in phases from 2020 onwards, given that electric ships are currently in production and there are only a limited number of operational electric ships. They will be opened in tandem with the production of electric ships.

Annex

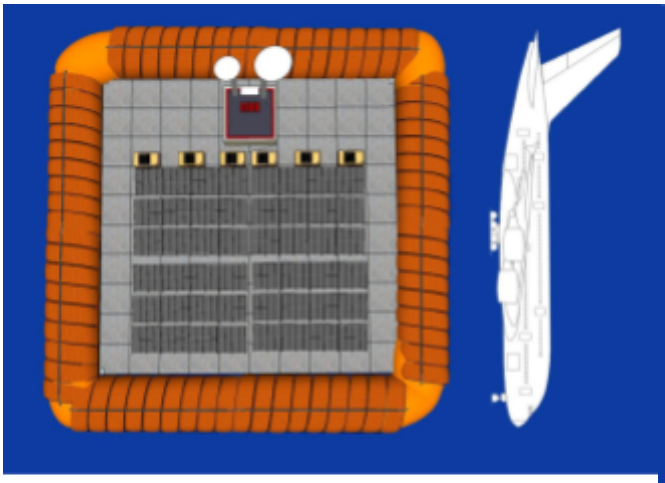

Figure 1. Top view of a charging station. An AirBus A380 airplane is shown for scale reference. Battery cell and charging port are located above solar panels

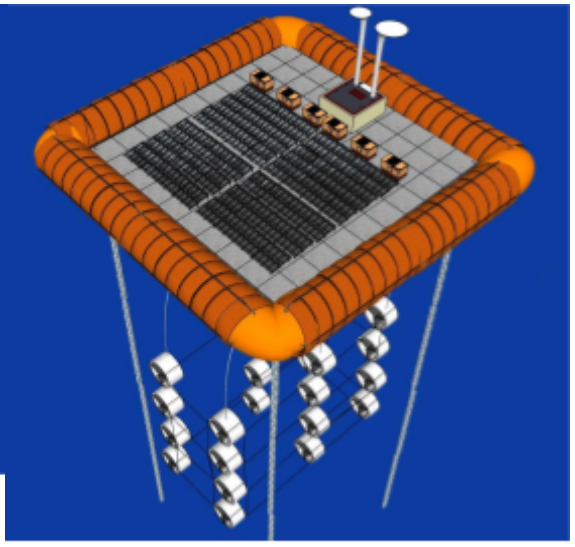

Figure 2. Side view of a charging station. Tidal turbines are located below the platforms

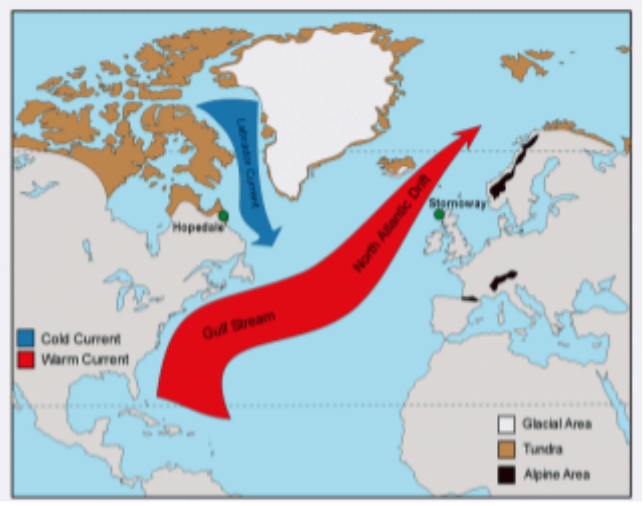

Figure 3 Visualisation and direction of Gulf Stream

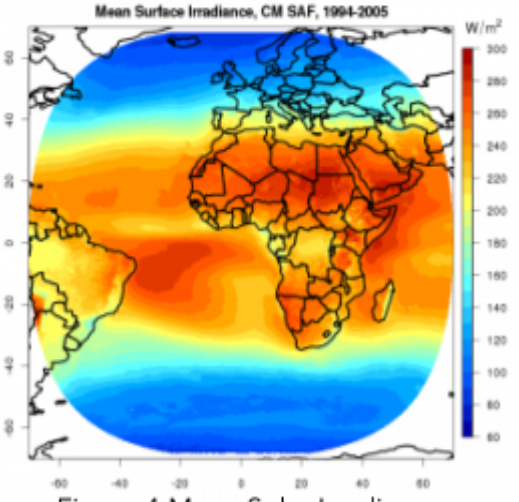

Figure 4 Mean Solar Irradiance