Determine the impact of changing the gearbox ratio for the generation of electricity

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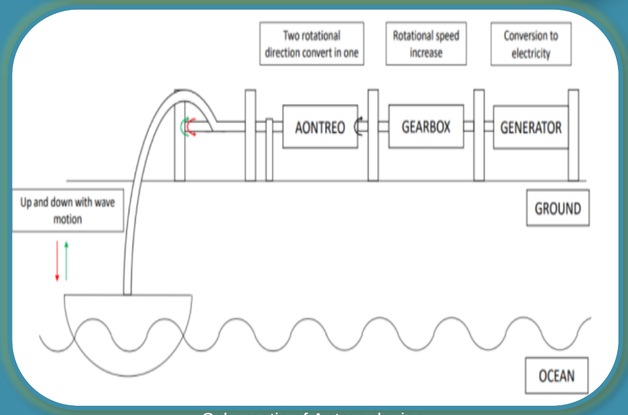
Aim of project

The project aims to offer insights into optimizing wave energy conversion systems for improved electricity generation efficiency through a comprehensive study encompassing theoretical modelling

Objectives

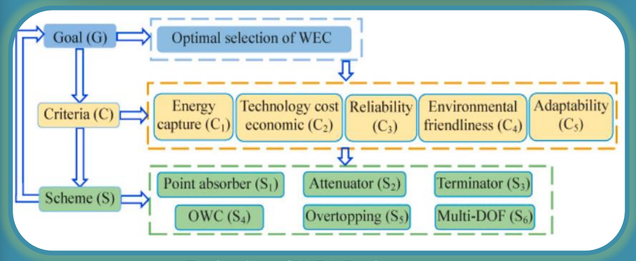
1. Briefly describe the essential concepts of wave energy conversion systems.
2. Highlighting the PTO system's role in transferring mechanical energy from wave motion to an electrical generator.
3. Discuss adjusting the generator's rotating speed to maximise power output under changing wave conditions
4. Defining the study's scope and restrictions, such as the types of wave energy converters or gearbox designs investigated.
5. Determine if the study relies on theoretical modelling, numerical simulations, or experimental testing.



Schematic of Antreo device

Background

The investigation is set within Limerick Wave Ltd.'s development of the Aontreo PTO technology, highlighting its innovative approach to converting bi-directional natural oscillation into uni-directional rotation for electrical generation. The research underscores the significance of the gearbox ratio in enhancing the system's mechanical advantage and operational efficiency, balancing between mechanical advantage and gearbox losses, and considering the added complexity and potential impacts on the system's dynamic behaviour.

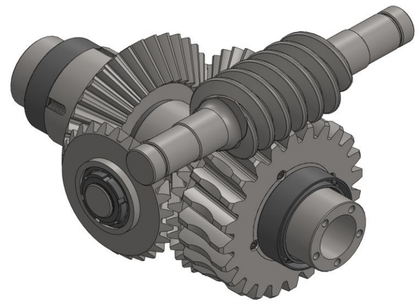


Evaluation of WEC Performance

Efficiently converting the irregular and fluctuating motion of waves into a consistent and usable form of power, emphasizing the importance of the Power Take-Off (PTO) mechanism in wave energy converters (WECs). It aims to explore how changing the gearbox ratio affects torque requirements, gearbox sizing, and generator sizing, thereby influencing the overall efficiency of electricity generation in wave energy systems.

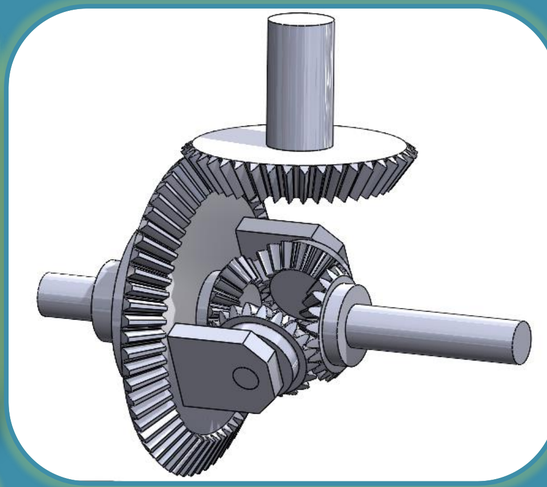
Methodology

The methodology section covers environmental analysis, material selection, and the theoretical and practical considerations of designing wave energy converters (WECs). The types of generators used in WECs emphasize selection based on operational efficiency, climatic conditions, and the WEC's design specifics.



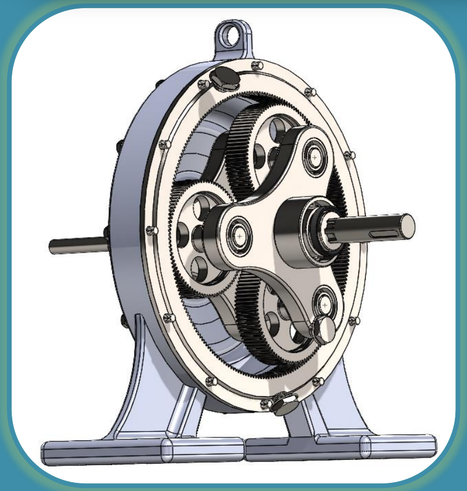
Model Differential Gear box with speed reducing worm

Detailed analyses of altering gearbox ratios in wave energy systems highlight the trade-offs between mechanical advantage and gearbox losses, the complexity of WEC systems, and their dynamic behaviour in response to wave conditions. Measured rotational speed of the gearbox's input shaft (from the wave energy converter) and output shaft (to the electrical generator) in RPM. Interpret the calculated ratio in the context of a wave energy system. A higher ratio means a more significant mechanical advantage, while a lower ratio indicates a speed reduction but potentially higher torque.



Model Differential

In systems where a gearbox is used to increase the rotational speed for electricity generation, torque calculations are crucial for determining the gearbox's output. The torque output depends on the gearbox's gear ratio, which amplifies the input torque from the wave energy converter.



Model Planetary Gearbox