ST. MARY'S POLYTECHNIC COLLEGE

PALAKKAD-678705

(Under The Patronage of Diocese of Palakkad)

Approved by AICTE and affiliated to DTE Kerala

DEPARTMENT OF AUTOMOBILE ENGINEERING
2022-2023

SEMINAR REPORT

On

UNDERWATER WINDMILL

in partial fulfillment for the award of Diploma

Submitted by

JIBIN JOJI (20050277)

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CERTIFICATE

This is to certify that **JIBIN JOJI, (20050277)** has presented a seminar on **UNDERWATER WINDMILL** during final year in partial fulfilment of the award of Diploma in Automobile Engineering course under DTE Kerala during the course period.

Lecturer- in-charge **Head Of Section**

ACKNOWLEDGEMENT

First of all , I would like to thank God almighty for showering abundant grace and mercy which enabled me to successfully complete my seminar on "**UNDERWATER WINDMILL**" I am indebted to Mr. Raimon P Francis, principal of St. Mary's Polytechnic College, Palakkad and to the management of my college , for providing the best facilities and atmosphere . I thank our head of section , Mr.Binoy Pullani , and all the staffs in Automobile Department for their support and valuable suggestions . Never can I forget my friends who have lend me a helping hand to present this seminar . I acknowledge the development of underwater windmills, a promising innovation in renewable energy. These structures harness wind power beneath the ocean's surface, providing a potential solution for clean and sustainable electricity generation. Their deployment has the potential to contribute significantly to our efforts in combating climate change and transitioning to a greener future.

ABSTRACT

Under the Windmill unveils a serene and captivating world nestled beneath the towering blades of a windmill. Lush meadows, vibrant wildflowers, and crystal-clear streams compose a picturesque landscape. Diverse wildlife thrives, with butterflies and birds adding splashes of color. Guided walks and meditation sessions offer immersive experiences, fostering a deep connection with nature. Join us in discovering this tranquil oasis where the wind's power and nature's beauty intertwine.

Underwater windmills, also known as tidal turbines or ocean current turbines, have emerged as a promising renewable energy technology that harnesses the power of ocean currents to generate electricity. This paper provides an overview of underwater windmills, discussing their principle of operation, advantages, and challenges.

The principle of an underwater windmill involves capturing the kinetic energy of underwater currents with rotating blades. As the water flows, it imparts rotational motion to the blades, which are connected to a generator that converts the mechanical energy into electrical energy. Underwater windmills offer advantages such as utilizing a renewable energy source, high energy density, reduced visual impact, and consistent power generation. However, they face challenges including high installation and maintenance costs, limited deployment areas, potential environmental impact, and technological development needs.

To address these challenges, ongoing research and development are necessary to optimize the design, enhance efficiency, and mitigate potential environmental impacts. Further advancements in underwater windmill technology will contribute to the expansion of renewable energy sources, reducing reliance on fossil fuels and fostering a sustainable energy future.

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INTRODUCTION

The underwater windmill, a revolutionary concept in renewable energy, is poised to transform the way we harness the power of wind. As the world grapples with the urgent need to reduce carbon emissions, this innovative technology offers a promising solution. Designed to operate beneath the ocean's surface, the underwater windmill capitalizes on the powerful and consistent winds found in marine environments. Its unique design ensures maximum energy capture while minimizing visual and environmental impacts. By tapping into the virtually untapped potential of offshore winds, this groundbreaking device opens up new horizons for sustainable energy production. With its ability to provide clean, reliable, and abundant power, the underwater windmill marks a significant leap forward in our quest for a greener and more sustainable future.

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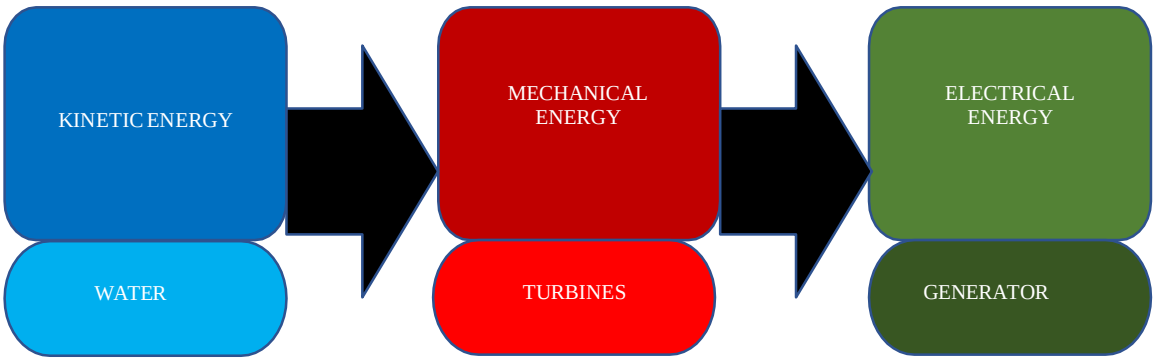
MAIN PARTS

- Turbines
- Gearbox
- Generator
- Cable
- Support



2.1 MAIN PARTS

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PRINCIPLE OF OPERATION

An underwater windmill, also known as a tidal turbine or an ocean current turbine, operates on the principle of harnessing the kinetic energy of underwater currents to generate electricity. It functions in a similar way to its terrestrial counterpart, the windmill, but it is designed to operate in the dynamic and often harsh marine environment.

The underwater windmill consists of a rotor with multiple blades that are submerged in the flowing water. As the water current passes through the rotor, it imparts rotational motion to the blades. This rotation is then transferred to a generator, typically located on the seabed, which converts the mechanical energy into electrical energy.

To ensure optimal performance, underwater windmills are strategically positioned in areas with strong and consistent tidal or ocean currents. The blades are designed to withstand the forces of the water flow and are often made from durable materials such as composite materials or metals.

The electricity generated by the underwater windmill can be transmitted to shore via underwater cables or used to power nearby offshore installations, such as desalination plants or offshore platforms. This renewable energy source provides a promising avenue for harnessing the immense power of the oceans to meet our growing energy needs while minimizing carbon emissions.

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WORKING

The working of an underwater windmill, also known as a tidal turbine or an ocean current turbine, involves several key steps.

1. Placement: The underwater windmill is strategically located in areas with strong tidal or ocean currents, where the flow of water is consistent and powerful.

2. Rotor and Blades: The turbine consists of a rotor with multiple blades, similar to a windmill. These blades are designed to capture the kinetic energy of the flowing water. They are often made of sturdy materials such as composite materials or metals to withstand the underwater environment.

3. Water Flow: As the water current passes through the rotor, it imparts rotational motion to the blades. The force of the water causes the blades to rotate.

4. Power Generation: The rotational motion of the blades is transferred to a generator located on the seabed. The generator converts the mechanical energy into electrical energy through the principle of electromagnetic induction.

5. Electricity Transmission: The generated electricity is transmitted through underwater cables to the shore or nearby installations for distribution or use. The cables are designed to withstand the corrosive effects of the marine environment.

By harnessing the power of underwater currents, these windmills generate renewable electricity that can contribute to the overall energy mix and help reduce reliance on fossil fuels.

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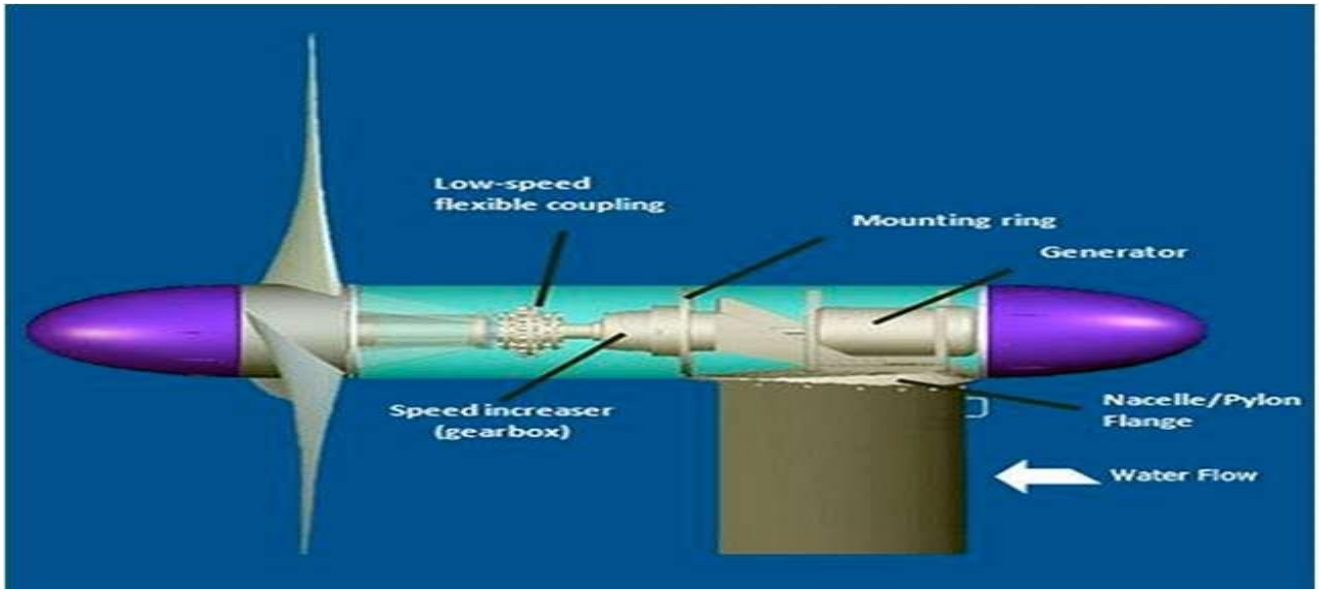
BLOCK DIAGRAM



5.1 BLOCK DIAGRAM

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COMPARISON BETWEEN WIND MILL AND UNDERWATER WINDMILL

Sources of energy	Power	Cost of estimation	Maintenance
Wind Mill	2.5 Mw to 3 Mw	1.3 M$ to 2.2 M$ for each mega watt	High
Underwater windmill	700K KW hrs One single turbine	10 Million	Medium

6.1 COMPARISON CHART

Windmills and underwater windmills have similarities in their purpose of harnessing kinetic energy to generate electricity but differ in their operating environments.

1. Environment: Windmills operate on land, exposed to wind currents, while underwater windmills are submerged in water, harnessing tidal or ocean currents.

2. Medium: Windmills use air as the medium for energy conversion, while underwater windmills utilize the flow of water.

3. Location: Windmills are commonly found in open fields or windy areas, whereas underwater windmills are strategically placed in areas with strong tidal or ocean currents.

4. Design: Windmills have large blades mounted on a tower, while underwater windmills have rotor blades submerged in water.

5. Challenges: Windmills face challenges such as intermittent wind patterns and the need for wind direction alignment, while underwater windmills encounter marine conditions like corrosion, marine life interactions, and underwater maintenance.

Both windmills and underwater windmills contribute to renewable energy production, with windmills being more widespread on land and underwater windmills tapping into the power of marine currents.

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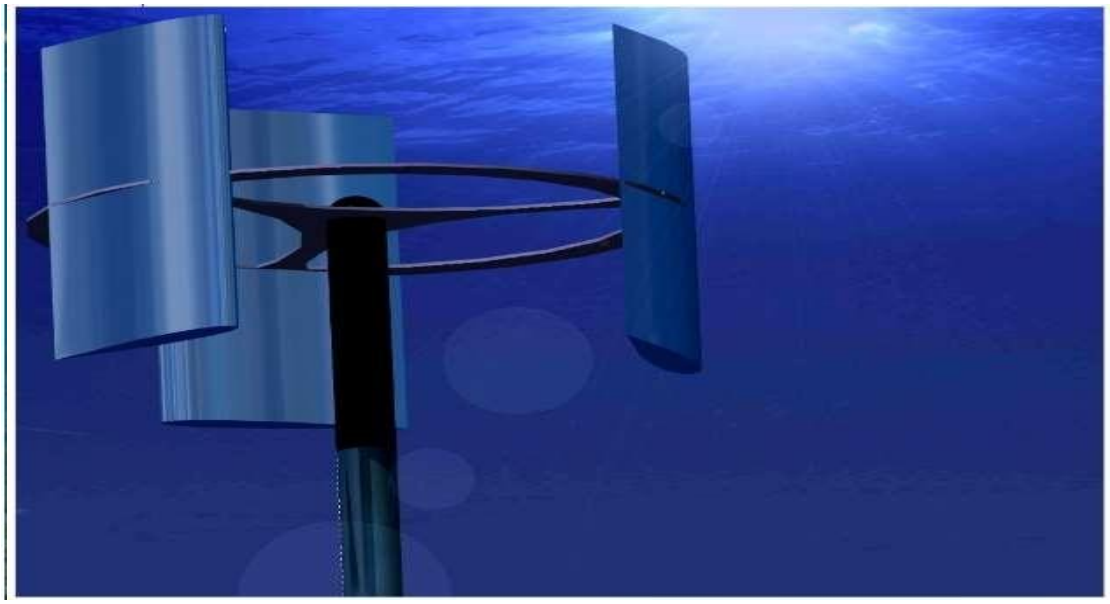
TYPES OF UNDERWATER WINDMILL

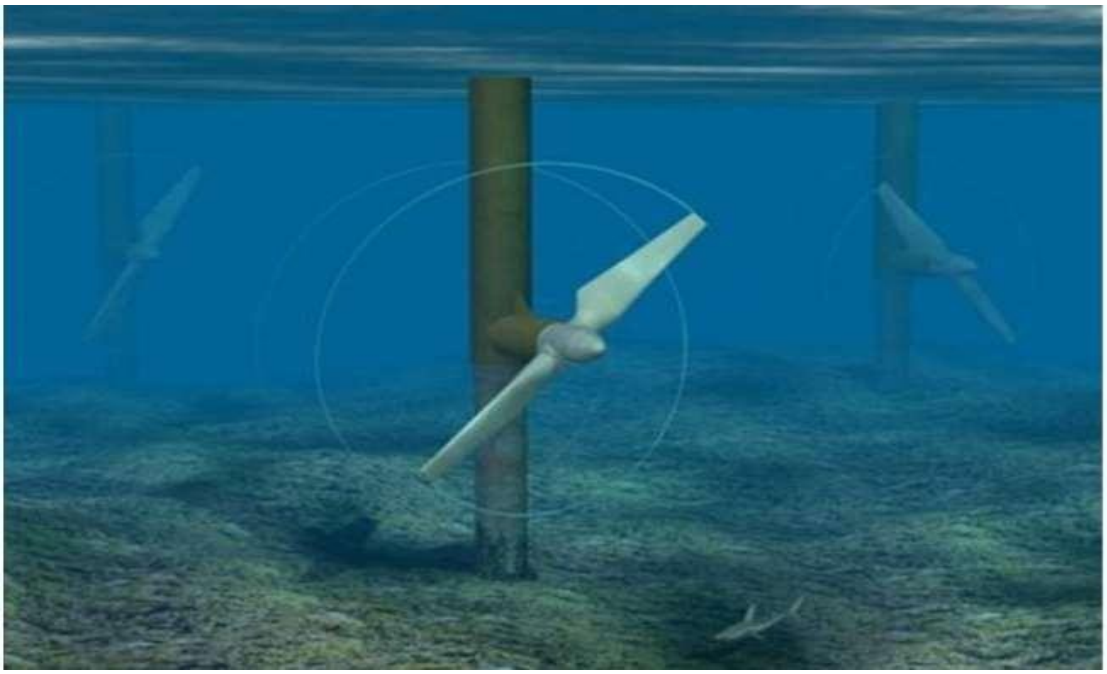
VERTICAL AXIS MILL



7.1 VERTICAL AXIS MILL

A vertical axis underwater windmill refers to a type of tidal or ocean current turbine that features a vertical axis of rotation for its blades. These turbines are designed to harness the kinetic energy of underwater currents and generate electricity in an efficient and effective manner.

HORIZONTAL AXIS MILL



7.2 HORIZONTAL AXIS MILL

A horizontal axis underwater windmill is a type of tidal or ocean current turbine where the blades are positioned horizontally. These turbines are designed to capture the energy of underwater currents and convert it into electricity, similar to their horizontal axis counterparts on land

The World's First Underwater Windmill Starts Turning

- Researchers launched the first offshore tidal energy turbine on Monday.
- The rotor on the English coast uses the power of the tides to generateelectricity.

7.3 OFFSHORE TIDAL ENERGY TURBINE

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ADVANTAGES

- Renewable Energy: They harness the power of ocean currents, a renewable and predictable energy source.
- High Energy Density: Ocean currents are denser than air, allowing underwater windmills to generate more power compared to wind turbines of the same size.
- Less Visual Impact: Being submerged, they have minimal visual impact on the landscape.
- Consistent Power Generation: Tidal currents are more predictable and consistent than wind, providing a reliable and continuous source of electricity.
- Reduced Maintenance: They are shielded from extreme weather conditions, resulting in lower maintenance requirements compared to offs

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DISADVANTAGES

- High Installation and Maintenance Costs: Building and installing underwater windmills can be expensive due to the challenging marine environment and the need for specialized equipment and infrastructure.
- Limited Deployment Areas: Underwater windmills require strong and consistent tidal or ocean currents, limiting their deployment to specific locations.
- Environmental Impact: The construction and operation of underwater windmills can potentially disturb marine ecosystems, affecting the movement of marine organisms and their habitats.
- Interference with Marine Activities: The presence of underwater windmills can pose navigational and fishing challenges in the vicinity, potentially conflicting with other marine activities.
- Technology Development: Underwater windmill technology is still in its early stages, and further research and development are needed to optimize efficiency and address potential challenges.

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CONCLUSION

In conclusion, underwater windmills, or tidal turbines, offer a promising avenue for harnessing the power of ocean currents to generate renewable electricity. They provide advantages such as utilizing a predictable and abundant energy source, higher energy density, reduced visual impact, and consistent power generation. However, challenges exist, including high installation and maintenance costs, limited deployment areas, potential environmental impact, interference with marine activities, and ongoing technology development needs. As the technology advances and our understanding of the marine environment improves, addressing these challenges will be crucial to fully realize the potential of underwater windmills as a sustainable energy solution, contributing to a cleaner and greener future.

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