



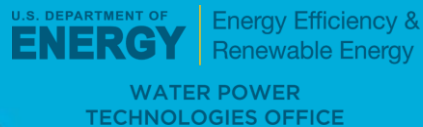
Exceptional service in the national interest

THE PIONEER ARRAY AND INTEGRATION OF A WAVE ENERGY CONVERTER (WEC)

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ABSTRACT

The purpose of this project is to create outreach media in Spanish and English for an audience of undergraduate students. The media will inform students about the scientific mission of integrating a wave energy converter (WEC) into the Pioneer Array and provide resources for students to get involved.



Figure1. CSM deployment



INTRODUCTION TO THE NSF OCEAN OBSERVATORIES INITIATIVE (OOI) ARRAYS AND PIONEER ARRAY

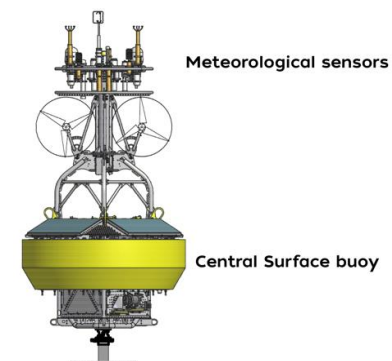


Figure 2. Map of OOI's arrays that continuously collect ocean data. Credit: Center for Environmental Visualization, University of Washington

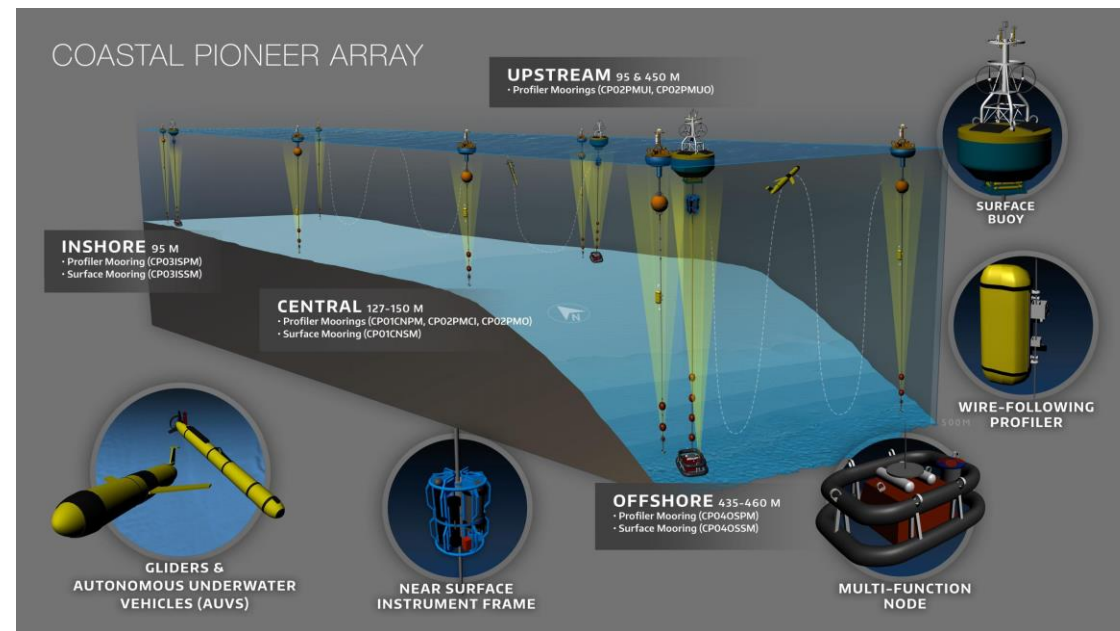


Figure 3. Instrumentation of coastal pioneer array. Courtesy of the NSF Ocean Observatories Initiative

PIONEER ARRAY LOCATION/RELOCATION

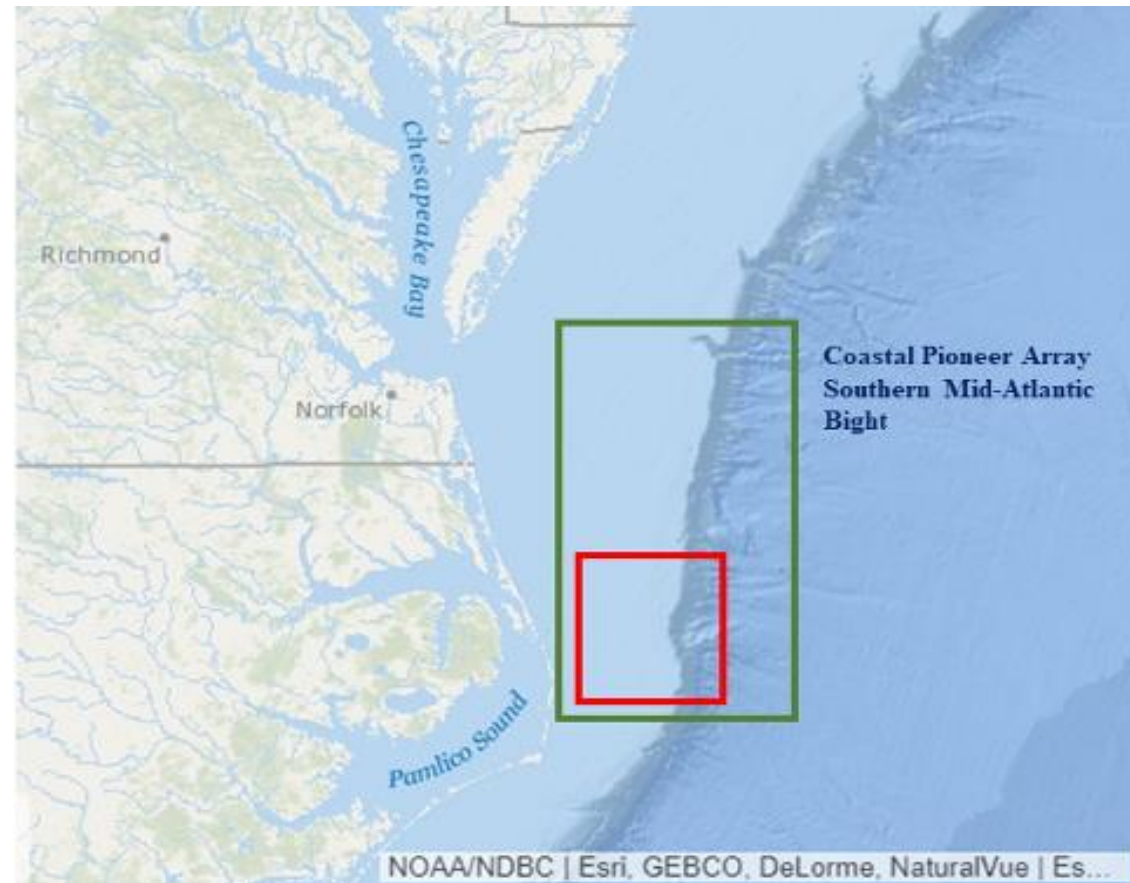


Figure 3. Boxes showing the approximate location of the Pioneer Array in the Southern Mid-Atlantic Bight. The red box represents the region where the moored array is expected to be deployed. The green box represents the region where the gliders and AUV are expected to operate. *Courtesy of the NSF Ocean Observatories Initiative.*

WHAT IS THE PROBLEM? HOW IS SANDIA HELPING?

- Low power in conditions when wind speeds are low or when solar irradiance is insufficient.
- Wave energy converter (or **WEC**) are devices that generate electricity with the motion of ocean waves.

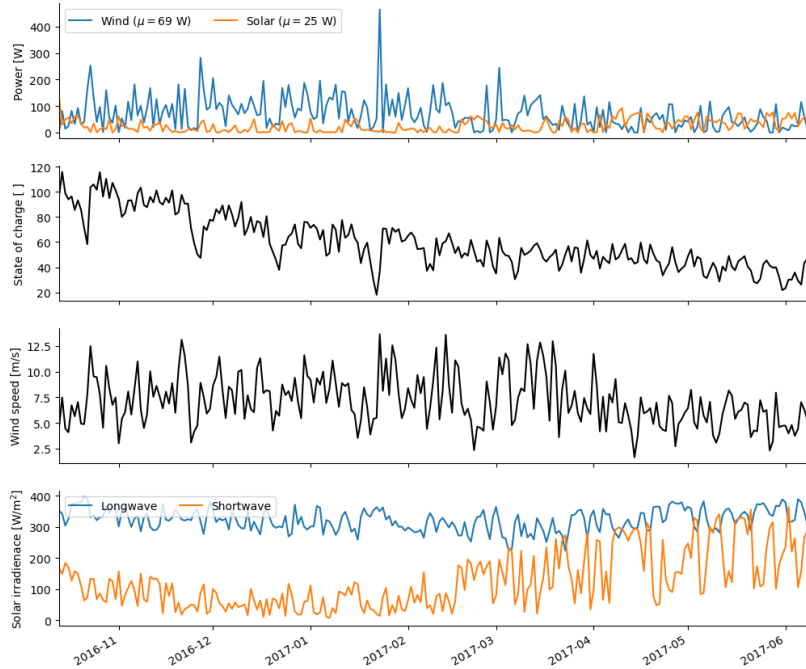


Figure 4. Electrical power accounting analysis.

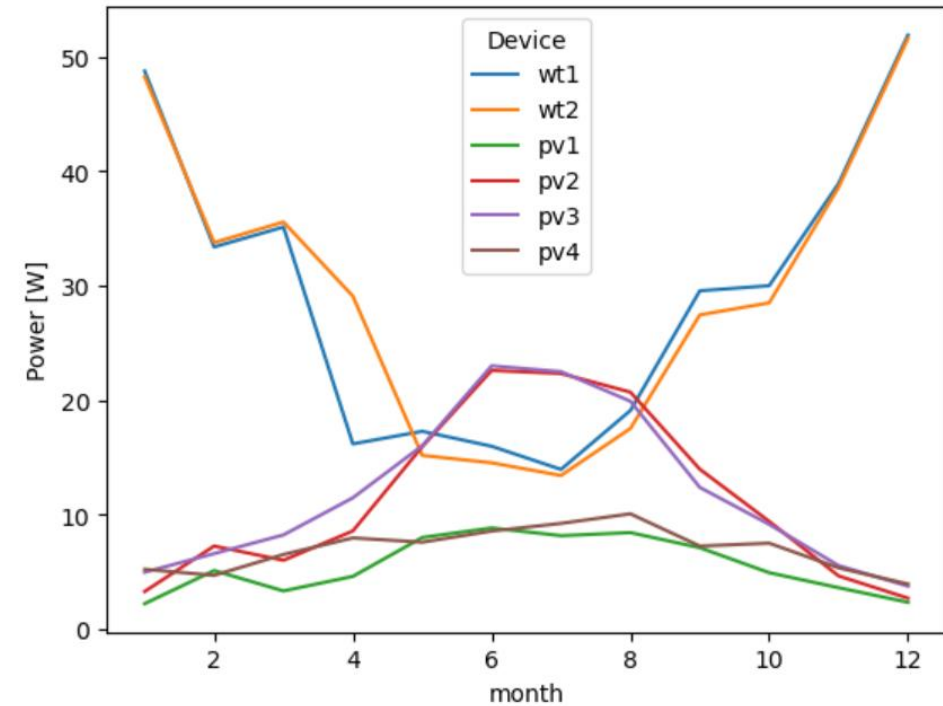
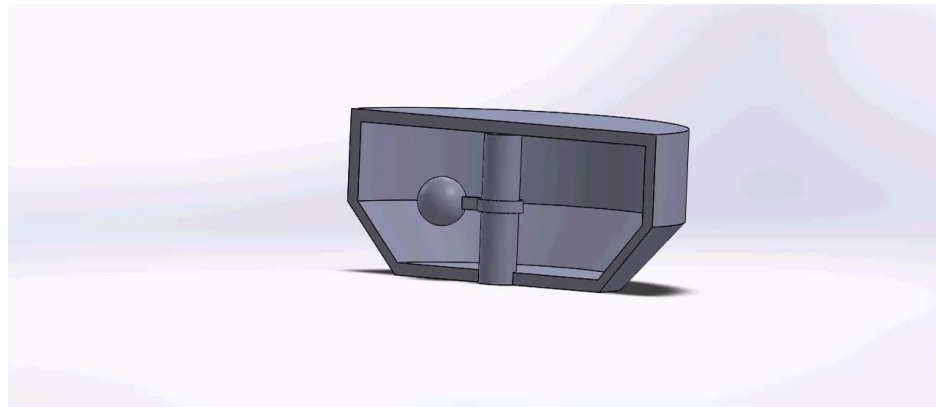


Figure 5. Mean power generation on a monthly basis.

PIONEER ARRAY ARCHETYPES

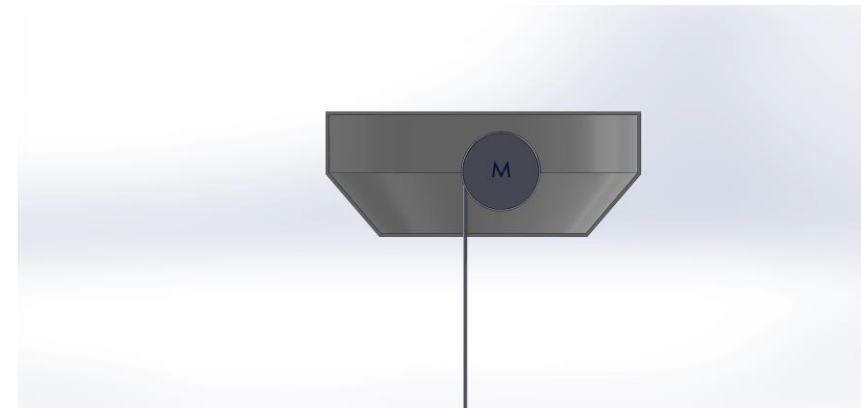
Sandia is currently considering and designing a WEC system to support the buoy. Which are concept A (Internal mass or moving mass) and concept B (In-line power take-off)

CONCEPT A



Internal mass or moving mass

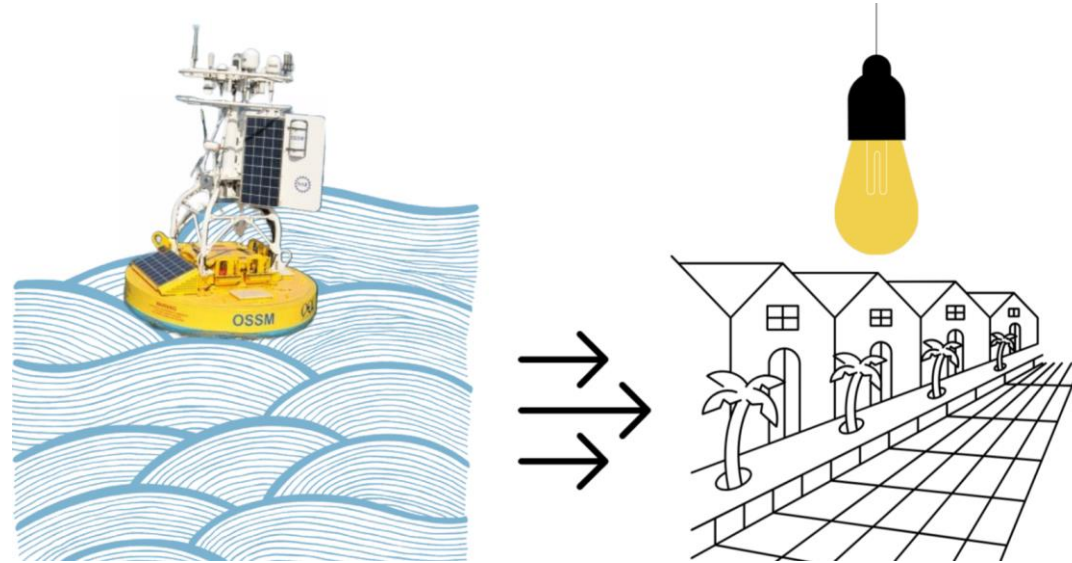
CONCEPT B



In-line power take-off

WHY IS THIS PROJECT IMPORTANT? WHY DOES IT MATTER?

- Although this specific WEC is small scale, the research could lead to a larger scale WEC that could power your community.



- This source of energy is consistent and emission free with substantial power even in low energy climates.
- Research is ongoing to determine optimal solutions for the project's power demands and constraints.



CONCLUSION

Wave energy is still in its early stages of research and development and although is an emission-free energy, the environmental impacts must be considered.

By informing and providing resources in Spanish and English we can reach a wider audience to get them interested in the research and development of WECs

Pioneer WEC
Why are we designing a Wave Energy Converter (WEC) for the Pioneer Array?
To provide electrical power to the Central Surface Mooring system within the Coastal Pioneer Array

What is the Ocean Observatories Initiative (OOI)?
The OOI consists of five arrays that are continually collecting data about ocean conditions, providing a wealth of information for research and education. The Pioneer Array is one part of the network located in the Atlantic, roughly 75 nautical miles off the coast of Martha's Vineyard.

The Coastal Pioneer Array
Unlike the other OOI arrays, which should last for 25 years in their original locations, the Pioneer Array is intended to be moved approximately every five years to explore different ocean environments. Redeployment to the Southern Mid-Atlantic Bight is set for Spring 2024.

Central Surface Mooring
The Central Mooring System (CSM) system within the Pioneer Array is specifically designed to take measurements in the continental shelf slope area, where a dynamic mixing of nutrients, pollutants, and bio-matter from the coast and deep ocean takes place.

Because of Stanford's reputation with renewable energy and waterpower technologies, they were given the opportunity to participate in the advancement of this project by integrating and designing a wave energy converter (WEC) system to support the buoy.

Wave energy converters are devices that generate electricity with the motion of ocean waves.

Although substantial progress has been achieved in the theoretical and numerical modelling of wave energy converters, wave energy is still in its early stages of development, and you could be part of the new technologies and advances to determine its power capabilities.

The main goal is to use renewable energy to have the sensors, communications and instrumentation online 100% of the time even in conditions when wind speeds are low or when solar irradiance is insufficient.

Get Involved!
OOI brings ocean data to your desktop, without ever having to go to sea. The purpose is to provide information to scientists, educators, and students like you, to change the ability to explore and understand the ocean to anyone with an internet connection.

<https://oceanobservatories.org/>
<https://openei.org/wiki/PRIMRE>
<https://energy.sandia.gov/programs/renewable-energy/water-power/>
<https://orise.orau.gov/marine-energy-research-program/>

Sandia National Laboratories

Call to action

For more information about how to get involved, visit the following links in the box description below:

- [https://openei.org/wiki/PRIMRE/Prizes_and_Competitions/Marine_Energy_Collegiate_Competition_\(MECC\)](https://openei.org/wiki/PRIMRE/Prizes_and_Competitions/Marine_Energy_Collegiate_Competition_(MECC))
- <https://orise.orau.gov/marine-energy-research-program/>
- <https://oceanobservatories.org/>
- <https://openei.org/wiki/PRIMRE>
- <https://energy.sandia.gov/programs/renewable-energy/water-power/>



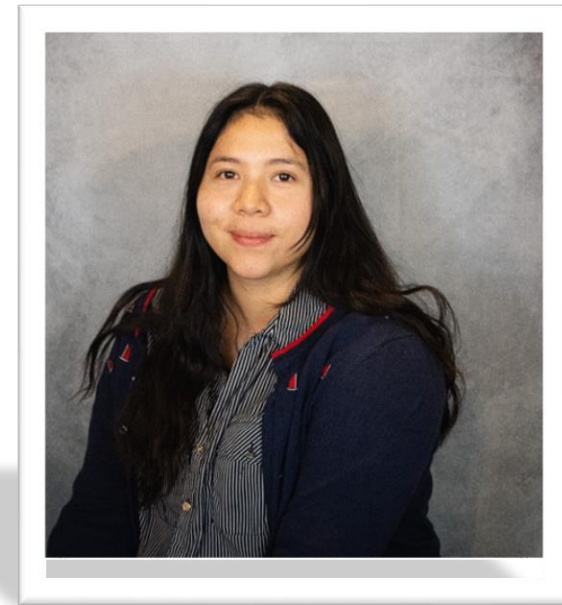


(ANDREA) WHAT YOU LIKE BEST ABOUT THE SUMMER RESEARCH PROJECT/EXPERIENCE:

This is my first internship, and I could not be more grateful for this opportunity and the help of my mentor. My experience at Sandia has been all I expected for. This project has been so enriching from researching wave energy, writing a proposal, a poster and presentations.

I was exposed to tours, met new people, and learned about the work they do. This gave me different perspectives on how an engineer works and the opportunities available within SNL.

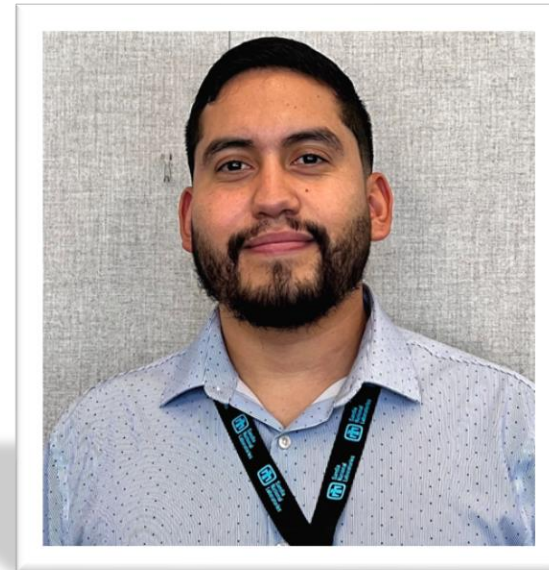
As a student with an untraditional background, is opportunities like this that motivate me to keep going and keep learning.





(GABRIEL) WHAT YOU LIKE BEST ABOUT THE SUMMER RESEARCH PROJECT/EXPERIENCE:

This summer research project gave me the opportunity to see how a team collaborates and works together towards a common goal. I got to participate in the everyday challenges of an engineer and develop my skills using different software. My mentor was knowledgeable of the project and was helpful in guiding me or answering any question or doubt. I liked how Sandia National Laboratories gives you the chance to see other work being done by offering tours of different departments so you can see other organizations you would like to work in.







Acknowledgements

Substantial support and collaboration were received by our mentor Ryan Coe, Carlos Michelen, and Spring Booth . The research was supported by OOI, WHOI, and NSF with their assistance in data acquisition. The authors thank members of the Water Power Technologies org. at Sandia National Laboratories for their insight and useful feedback. This research has taken place at Sandia National Laboratories in Albuquerque, New Mexico.

Thank you for your attention!

Questions? Email us
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