

Are the North American Great Lakes part of our energy future? Resource assessments, challenges, and opportunities for marine energy development

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The North American Great Lakes are increasingly being pursued by marine technology developers as an inland marine testbed, exposing technologies to realistic and challenging sea states similar to many coastal ocean sites around the world. To better assist technology developers, particularly in the marine renewable energy space, we present a recent study updating the spatial and temporal wave energy resource assessment across all five Great Lakes. Wave energy conversion has proven to contribute towards energy demands at small scales, particularly for the blue economy, and the Great Lakes marine resource presents opportunities and unique challenges for wave energy research and development. Additionally, the results quantifying this valuable freshwater wave resource may potentially contribute to bi-national North American technology development interests and inform energy resource and planning databases. This talk will highlight seasonal and annual sea state variability and wave energy resources across the Great Lakes region, focusing on analysis from historical numerical modeling and buoy observations. The results are also discussed with relevance towards potential wave energy converter (WEC) deployments and annual energy production estimates. Among a variety of marine energy technologies, we begin exploring the feasibility of coastal structure integrated WECs and their potential incentives for generating energy in nearshore environments close to load or storage centers. As part of this project, we also explore Froude scaling from North American Great Lakes sea states to other global locations, and the potential for advancing WEC concepts through field-scale testing in energetic freshwater environments. Additional emphasis will explore the role this Great Lakes freshwater cold-climate region could have towards the development and testing of wave energy technologies and other marine systems targeting high-latitude region deployments where sea-ice interactions may impact device performance and operations.