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Techno-economic Modeling of Marine Energy Systems with the System Advisor Model

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INTRODUCTION

The system advisor model (SAM) is a free, open-source, techno-economic software developed by the National Renewable Energy Laboratory (NREL) with funds from the U.S Department of Energy. SAM was first released as a PV solar model in 2007. Since 2007, SAM has released two versions each year, each time adding new technologies and financial models. The marine energy (ME) module of SAM was added in 2019 for the evaluation of wave and tidal energy technologies. The ME module of SAM offers a fast, standardized approach for evaluating the power performance and economics of ME systems [1,2].

AIM

The aim of the ME module of SAM is to offer a user-friendly standardized tool to evaluate the power and economic performance of ME systems. ME SAM offers a stand alone power performance model, a levelized cost of energy (LCOE) financial model, and cash flow financial models. The wave energy module has interoperability with ME Atlas enabling users to access resource data at thousands of locations. For both wave and tidal energy technologies, the model offers cost modeling capability to get quick high-level cost estimation for unknown project costs. The tool has built in parametric analysis and plotting capability for comparing cases, as well as standardized reporting features.

RESULTS

Using the ME module of SAM, a 100-device RM3 array is modeled using SAM's default project parameters to compare power and financial performance at Humboldt Bay, Jennette's Pier, PacWave South, and CalWave Central Coast. Figure 1 shows the variation of LCOE at each resource, Figure 2 shows the AEP at PacWave South, and Figure 3 shows the LCOE breakdown for RM3 at PacWave South.

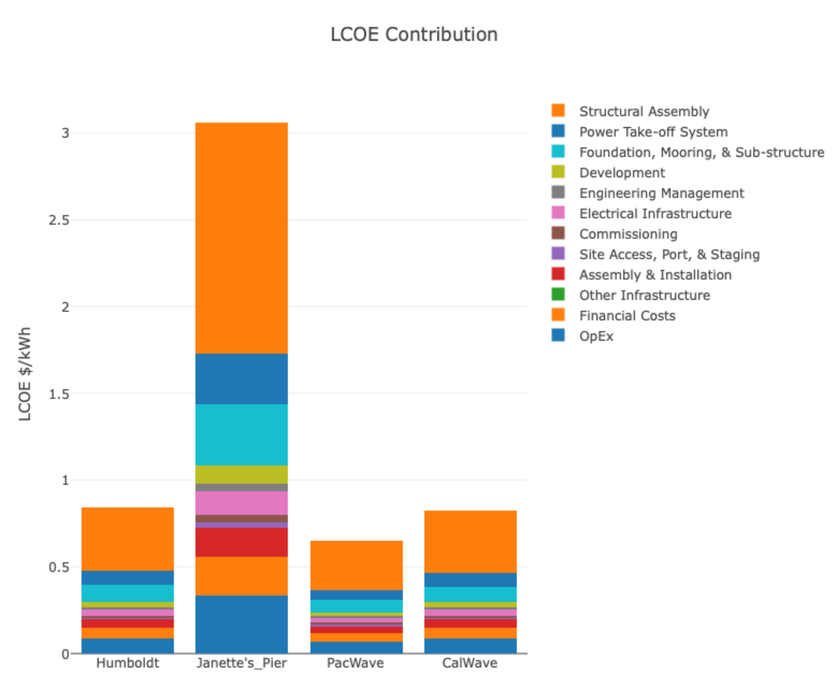

Figure 1: RM3 at four different resource locations

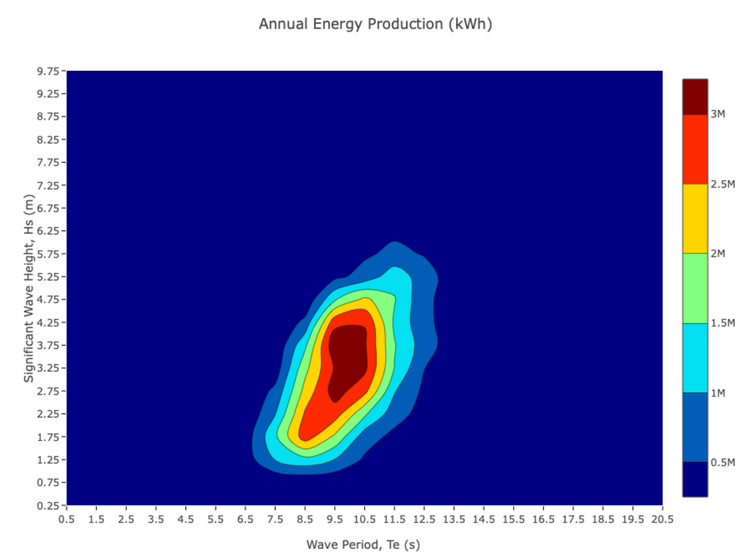

Figure 2: RM3 AEP at PacWave South

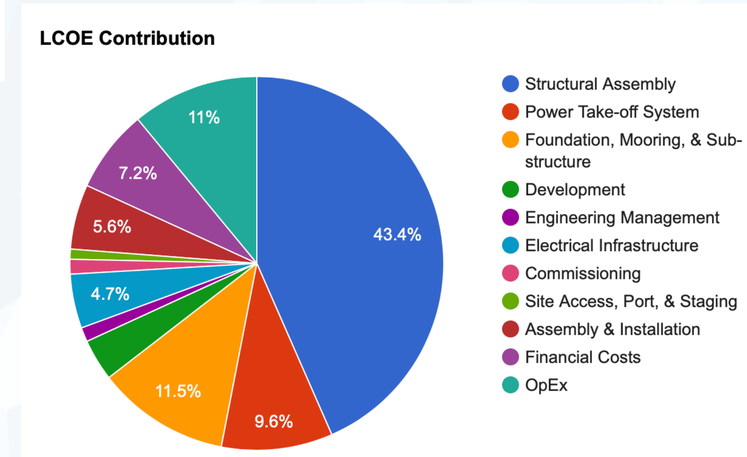

Figure 2: RM3 LCOE breakdown at PacWave South

METHOD

The ME module of SAM is used to evaluate the techno-economics of Reference Model 3 (RM3), a two-body point absorber, at multiple resource locations [3]. For each resource location, annual energy production (AEP), capital expenditures (CAPEX), operation and maintenance (O&M), capacity factor, and LCOE are estimated.

CONCLUSIONS

The ME SAM module can be used to conduct techno-economic evaluations of marine energy systems. ME SAM offers a standardized modeling approach that helps facilitate apple-to-apple comparisons with consistent modeling assumptions. SAM has many built in features such as parametric modeling, plotting, and reporting to aid users in their analysis.

ACKNOWLEDGEMENT

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