Response to Reviewer 3 Comments

Dear Reviewer,

Thank you for giving constructive comments for our manuscript. Our manuscript entitled ''Evaluating the applicability of mainstream wave energy converters in the South China Sea'' has been revised in response to the comments. Thank you for the opportunity to resubmit this revision manuscript for possible publication in the journal.

We have given serious consideration to your comments and suggestions and have revised the manuscript carefully. In order to make your review easy, we have reworked the content and format of the manuscript and have marked all modified sections by using red text in the file "Revised Manuscript with changes Marked". Manuscript revisions are addressed in detail below.

General comment: The paper deals with the applicability of mainstream wave converters in South China Sea. It should cover the resource assessment in China and the available Wave conversion technology.

Thank you very much for your professional suggestions of our manuscript. We have tried our best to modify and improve our manuscript according to your comments. The point-by-point responses are detailed below.

Point 1: Concerning the wave resource assessment an unbalanced presentation has been made. At the same time as a detailed presentation is made of some resource assessments in Spain (refs 4, 6, 7, 8 ,9) other areas are left without representation such as for example:

http://dx.doi.org/10.1016/j.cageo.2014.03.008

https://doi.org/10.1016/j.renene.2018.05.037

https://doi.org/10.1016/j.energy.2018.10.002

Including in Atlantic islands

http://dx.doi.org/10.1016/j.renene.2016.08.040

https://doi.org/10.1016/j.renene.2020.01.011

The studies in China, which should be the main concern are not well covered, also missing some relevant contributions

http://dx.doi.org/10.1016/j.renene.2015.12.060

https://doi.org/10.1016/j.renene.2019.01.011

Response 1: I am deeply sorry that our manuscript was not comprehensive and balanced enough in introducing the evaluation of wave energy resources in various countries. We have overlooked many other countries' evaluation work on wave energy resources, especially China's research on wave energy resources. Thank you very much for the supplementary literature you provided to us. According to your professional opinion, we have described the research of 7 literatures you provided in the introduction of the manuscript. In addition, another two literatures related to the assessment of wave energy resources in Chinese waters were added to our manuscript [1,2], hoping to address the issue of not giving enough attention to the evaluation work on wave energy resources in Chinese

waters in our original draft. Once again, we appreciate your professional advice, which is of great significance to improving and enhancing the quality of our manuscript.

[1] Zhou G, Huang J, Zhang G. Evaluation of the wave energy conditions along the coastal waters ofBeibu Gulf, China[J]. *Energy*, **2015**, 85(jun.1):449-457.

[2] Liang B, Fei F, Liu F, et al. 22-Year wave energy hindcast for the China East Adjacent Seas[J]. *Renewable Energy*, **2014**, 71(nov.):200-207.

Point 2: It should be possible to correct this limitation, but afterwards it is important to have a discussion of the different approaches adopted to the resource assessments and also on the levels of available resources in the various areas.

Response 2: Thank you very much for your professional comments. We have made modifications according to your comments. After adding the assessment work of wave energy resources in various waters and in Chinese waters, we subsequently discussed the different methods adopted by researchers in assessing wave energy resources, and stated that the abundance of wave energy resources varies in different waters due to factors such as geographic location and climate (lines 98 to 103 in revised version).

Point 3: This is particularly important because the authors chose ERA 5 to characterise the wave resource. However, ERA 5 is an oceanic hindcast, not providing very good assessment near the coast, where local effect start being important. In fact, this is the reason for the various dedicated studies mentioned in the Introduction.

Response 3: When assessing wave energy resources, the fundamental parameters of the waves are crucial because the accuracy of the selected data directly impacts the precision of the resource assessment results for the sea area. Currently, the main sources for obtaining fundamental parameters of waves include buoy data, numerical simulation data, and wave reanalysis data, among others. Among them, buoy data is a type of measured data that can obtain very accurate results. However, due to its disadvantages such as limited deployment and coverage, it cannot provide wave parameters for the entire research area and is usually used to verify the accuracy of other data. However, numerical simulation data also has some errors due to the limitations of model assumptions. Wave reanalysis data not only has a wide coverage range but also has relatively high data quality. Moreover, ERA 5, as the latest generation of data from the European Centre for Medium-Range Weather Forecasts (ECMWF), has higher accuracy and spatiotemporal resolution and has been widely recognized and used. Although ERA 5 may not be the most suitable data source for evaluating wave resources in nearshore areas, it is still a very reliable dataset. We have compared it with buoy data deployed in the South China Sea, and the comparison results show that ERA5 data has high accuracy. Therefore, we have selected ERA5 data to analyze the distribution of wave energy resources in the South China Sea in our manuscript.

Point 4: Economic considerations related with the cost of transmitting the converted energy to shore through electric cables, makes it more attractive for WECS to be located very close to shore, in areas where local effect of the coast and bottom are important. Thus it is important to recognise this limitation of the data used by the authors.

Response 4: Thank you very much for your professional advice. The predecessor of ERA5 is the ERA-Interim global atmospheric reanalysis data, which has higher spatiotemporal resolution and accuracy than ERA-Interim. ERA 5 May not be the most suitable data source for assessing wave resources in

offshore areas, but our manuscript compared H_s and T_e of ERA 5 data with those of buoys (deployed by the State Oceanic Administration of China in offshore areas of the South China Sea during the GHME Project). scattering index (SI), root mean square error (RMSE), bias and correlation coefficient (CC) are calculated. The accuracy of ERA 5 data is verified. Therefore, although ERA 5 data has some limitations in assessing wave resources in nearshore areas, it is still a very reliable dataset.

Point 5: Concerning the existing technology, the authors mention some concepts that are no longer being considered because their companies went bankrupt, such as AquaBuoy, and Archimedes Wave Swing (AWS), while some current devices are not considered:
https://doi.org/10.1016/j.renene.2019.11.097
https://doi.org/10.1115/1.4050268

Response 5: I'm sorry, our manuscript includes two devices that are no longer under development. After your professional comment, we also investigated the states of the wave energy converters (WECs). Due to the limitation of technical confidentiality of institutions or companies, it is difficult to grasp the latest states of the WECs. We would like to explain to you the reasons for our selection of several devices in our manuscript. Firstly, due to the protection of product information by many device development companies, some device performance parameters are relatively secret. Therefore, when introducing several types of devices in Section 2.1.2 of our manuscript, representative WEC devices of each type are selected. These devices are relatively well-known, and the required characteristic parameters can be queried in existing literature. Then, according to the actual sea conditions in the South China Sea, several classical WECs are selected to analyze their performance from the perspective of energy output. Although we considered several devices that are no longer under development, our study from the manuscript revealed that the RM5 and Sharp Eagle Wanshan wave energy conversion devices are most suitable for deployment in the South China Sea. Both of these devices are still under development and use. Therefore, the research results from our manuscript can provide a practical scientific basis for the future development of wave energy resources and the deployment of these devices in the South China Sea.

Secondly, although the AquaBuoy and Archimedes Wave Swing (AWS) devices are no longer developed due to the bankruptcy of the company, we found that researchers are still researching and analyzing the system or performance of these two devices in recent years. For example, Mahdy A et al. used AWS devices when studying the transient stability of power grid wave energy conversion system in 2022[3]. Rahman M. A. et al. studied the modeling and design of a Multiport Magnetic Bus-Based Novel Wind-Wave Hybrid Ocean Energy Technology in 2021. The system adopts the Archimedes wave swing (AWS) wave energy system [4]. Majidi et al. considered the AquaBuoy device when downscaling wave energy converters for optimum performance in low-energy seas in 2021[5]. In 2020, Ribeiro et al. evaluated the performance of the AquaBuoy device on the NW Coast of the Iberian Peninsula [6]. Therefore, considering the above factors, we believe that the performance or system of AquaBuoy and Archimedes Wave Swing (AWS) device still has certain research value.

In addition, thank you very much for supplementing us with several devices currently under development and use, for which we are very grateful. However, we are very sorry that even though we have researched a large number of literatures, within the limited modification time, we still cannot grasp all the characteristic parameters required for the performance evaluation of these devices, so as to evaluate their performance in the South China Sea. However, your opinion is of great

significance to our research. We will also strengthen the tracking of the latest state of each wave energy converter in the future work, and pay high attention to and study the several devices you mentioned. Thank you again for your professional advice and hope you can understand us.

[3] Mahdy A, Hasanien H M, Helmy W, et al. Transient stability improvement of wave energy conversion systems connected to power grid using anti-windup-coot optimization strategy[J]. *Energy*, **2022**, 245.

[4] Rahman M A, Islam M R, Muttaqi K M, et al. Modeling and Design of a Multiport Magnetic Bus-Based Novel Wind-Wave Hybrid Ocean Energy Technology[J]. *IEEE Transactions on Industry Applications*, **2021**, PP (99).

[5] Majidi A G, Binglbali B, Akpnar A, et al. Downscaling wave energy converters for optimum performance in low-energy seas[J]. *Renewable Energy*, **2021**, 168.

[6] Ribeiro A S, Decastro M, Rusu L, et al. Evaluating the Future Efficiency of Wave Energy Converters along the NW Coast of the Iberian Peninsula[J]. *Energies*, **2020**, 13(14):3563.

Point 6: Having the wave resource and locations, the authors conduct a reasonably good study by looking at how to combine the available information to lead to a conclusion about the best locations and converter type. Although this is a good discussion, the authors may want to check also one reference that did a similar study several years ago:

http://www.mdpi.com/1996-1073/6/3/1344

Response 6: Thank you very much for your recognition of our research work and for providing us with a valuable literature study. Although the assessment of wave energy resources in relevant sea areas and the applicability evaluation of devices is a relatively mainstream research work, different research methods are used in this manuscript in carrying out this research work. Compared to the literature you provided (Silva D et al. conducted a performance assessment of wave energy conversion devices in the Portuguese Nearshore area in 2013), our manuscript utilizes a a different evaluation method. Next, please allow us to explain to you the differences between our manuscript and the study of Silva D et al. from the following three aspects.

(1) Firstly, different methods are used to evaluate wave energy resources in the study area. Silva D et al. evaluated and analyzed the wave conditions and energy at each location by calculating the average value of parameters at the research location for total time and only for winter time; When evaluating the development potential of the research station, our manuscript not only considers the indicators such as the reserves of wave energy resources, but also the indicators that are oriented to the influence factors of the device. our manuscript establishes an areal classification method that comprehensively considers the three factors of wave energy resource reserves, the suitable water depth of the devices and how device placement mode will affect its energy absorption efficiency before determining the optimum development locations and key stations within the study area.

(2) Secondly, when evaluating the performance of the WEC device in the study area, Silva D et al. evaluated the performance of each device according to the electric power output level of the device; Our manuscript comprehensively considers four performance evaluation metrics of the device, namely average output power P_e (kW), energy conversion rate C_f (%), capture width C_w (m) and relative capture width R_{cw} (%). We utilized the CRITIC method to determine the importance of each metric and constructed a new comprehensive index, CI, which can evaluate

the overall performance of the device. Through this index, we comprehensively evaluated the performance of various WEC devices and determined the most suitable device for each station.

(3) Finally, our manuscript analyzed the wave energy propagation direction at key stations in the study area, as well as the power generation performance and economic benefits of the optimal device at each station. This provides a scientific basis for the selection, deployment, and operation of subsequent devices in the study area, as well as the power generation performance and economic benefits of the devices.

The above three points are the differences between our manuscript and the study of Silva D et al. Thank you again for your professional comments on our article. Your comments make the content of our manuscript more perfect and improve the quality of our manuscript.

Comments on the Quality of English Language： Minor improvements are possible

Thank you very much for your professional advice. Our manuscript has been edited throughout the article for proper English language, grammar, punctuation, spelling and scientific writing style by one or more of the highly experienced native English speaking editors according to your comments.

We would like to express special thanks to the reviewer for their constructive comments on this manuscript again. We hope this manuscript will be accepted by **Journal of Marine Science and Engineering.**

Thanks again, we look forward to your reply.

Best Regards.

Sincerely,

Dr. Yong Wan