J. Bangladesh Acad. Sci. 49(2); 215-225: December 2025 DOI:https://doi.org/10.3329/jbas.v49i2.81329

Journal of Bangladesh Academy of Sciences

Journal homepage: http://www.bas.org.bd/publications/jbas.html

Research Article

Mobile wave crawler for energy generation: Preliminary feasibility and opportunities for Bangladesh

Md Riad Khan*, Nusrat Sharmin[1] and SM Rashidul Hasan

Department of Naval Architecture and Offshore Engineering, Faculty of Engineering and Technology, Bangladesh Maritime University, Dhaka, Bangladesh

ARTICLE INFO

Article History

Received: 28 April 2025
Revised: 07 July 2025
Accepted: 18 August 2025

Keywords: Mobile wave crawler, Mobile wave energy harvesting system, Wave energy, Island powering.

ABSTRACT

One of the major challenges for a densely populated country like Bangladesh is energy shortage. For electricity generation, the country mostly relies on fossil fuels such as furnace oil, natural gas, and coal. With the environmental problems associated with fossil fuels, the global transition to renewable energy sources is inevitable. Ocean waves represent a promising renewable energy source in this regard. A large area of Bangladesh is covered by the sea, which offer significant potential for wave energy. Wave energy can be converted into electricity using a range of devices, including point absorbers, attenuators, wave surge devices, and oscillating water columns. However, these devices are fixed at specific locations, depend on particular wave profiles, and require expensive underwater cables. Against this background, the Mobile Wave Crawler (MWC), an autonomous wave energy converter, appears to be a promising solution. This work assesses the feasibility of the device, and evaluates its potential energy output. It also demonstrated a levelized cost of energy (LCOE) of USD 0.12 kWh for an energy-producing machine with an hourly rated capacity of 1 MW. Although this cost is higher than of traditional fossil-fuel-based power plants, the technology can be promoted as sustainable and environmentally friendly. This research illustrates that the proposed solution is a feasible source of green energy for the offshore islands of Bangladesh, identifies the major challenges, and suggests possible solutions. In addition, the study estimates the required number of Mobile Wave Crawlers for several example islands. For instance, four MWC units are required for each of Bhashan Char and Shah Porir Dwip, while only one unit is required for each St. Martin's Island and Dublar Char to meet their respective energy demands.

Introduction

One of the most densely populated nations in the world, Bangladesh set a goal in its 2008 renewable energy policy to produce 10% of its energy by 2015. However, the country fell significantly short of this goal, with renewables currently contributing only 2.93% - amounting to 650.14 MW out of a total 22,215 MW of energy produced. In response, the government has revised its objectives, aiming to

*Corresponding author:<riadkhan666@gmail.com>

[1]*Department of Electrical and Electronic Engineering, Ahsanullah University of Science and Technology, Bangladesh*

generate 15% of electricity from renewable sources by 2030, 40% by 2041, and ultimately 100% by 2050 (Uddin and Park, 2021; Mahbub et al., 2023). To achieve this goal, the vast ocean area and its wave energy could play a vital role.

A Mobile Wave Crawler is a portable Wave Energy Conversion Device that can convert wave energy from different ocean locations, store it, and deliver it to the larger grid. It generally comprises a ship with a Wave Energy Converter attached and an onboard energy storage system. This device is a wave energy converter that moves with wave motion, capturing the kinetic and potential energy of the ocean's surface. The wave crawler produces clean, renewable energy and has minimal environmental impact. There are at least three significant disadvantages associated with traditional methods of extracting energy by using waves and currents: 1) the power transmission cables installed in the ocean are costly, 2) the system is vulnerable to storms, and 3) the power cannot be predicted and delivered on demand (Mobile Wave Crawler, 2011). These are things that are translated to higher electricity costs. A Mobile Wave Crawler (MWC) can help overcome these problems. Fraunhofer USA CMI is currently developing an alternative approach to an economically viable ocean wave-harvesting technique, including a boat with an onboard wave energy-harvesting system and energy storage capacity (Mobile Wave Crawler, 2011).

This paper presents a preliminary feasibility analysis of the Mobile Wave Crawler installation in Bangladesh. The results indicate that it may be a viable energy solution for the country’s islands and coastal areas. It has also been recommended on the number of devices required and a possible solution to the challenges presented. The paper also provides the procedure fore implementing this system in Bangladesh.

Mobile Wave Crawler Technology

Key Features

a. Mobility: The mobile wave crawler can move across the ocean, unlike stationary converters of wave energy, enabling it to optimize its location to capture energy with peak efficiency depending on the direction and value of the waves.

b. Mechanism of Energy Conversion: Wave motion is converted to electrical energy by the crawler through the use of mechanical devices of levers, buoys, or hydraulic pumps.

c. Modular Design: Wave crawlers do not need underwater cables, which are costly to maintain.

d. Durability: These devices have been constructed to resist the severe marine conditions and are constructed out of corrosion-resistant material.

e. Connection to Energy Grids: The produced electricity is accumulated in onboard batteries and sent to the shore via the underwater cables.

f. Wave-Adaptive Design: The flotation discs are also adjusted in response to the height of the wave to maximize the energy conversion efficiency. This flexibility enables the system to operate even in rough seas, making it more effective as compared to the traditional wave energy buoys.

g. Continuous Power Generation: The Mobile Wave Crawler provides a steady energy supply since ocean waves are continuous and predictable. This makes it a more reliable renewable energy source compared to wind or solar, which can be intermittent.

Main Components and Working Principle

The Mobile Wave Crawler captures wave energy using its large circular flotation discs and converts the kinetic energy of moving waves into mechanical or electrical power. The mechanism is shown in Fig. 1. Below is a detailed breakdown of its working principle:

a. Ship for Transportation: Mobile Wave Crawler is a portable device consisting of a ship (Fig. 1) which travels to the place where the wave energy is the highest. The ship includes all the machinery required for wave energy capture, storage and transmission.

b. Floating Discs as Wave Energy Converters: The wave energy converters are designed to rise and fall with the motion of waves, collecting kinetic and potential energy from ocean swells. The up-and-down movement is transferred to a mechanical system that converts it into electricity.

c. Articulated Arms for Energy Transfer: Support arms connecting the flotation discs to the main hull serve as transmission mechanisms. As the waves push the flotation discs up and down, these arms convert wave motion into mechanical force. This force is then transmitted to an onboard system that drives turbines or hydraulic pumps, generating electricity.

d. Onboard Power Generation System: The mechanical energy from the flotation discs is used to:
   - Drive hydraulic pistons that pump fluid to a turbine for electricity generation.
   - Spin a generator shaft that converts kinetic energy directly into electrical power. The generated electricity can be stored in batteries, and used for ship operations.

e. Power Transmission: The ship sails back to the shore when the batteries are fully charged. The stored energy is transferred to a shore-based substation. From the substation, the energy is transferred to the national grid through cable.

Table 1. Differentiation between Traditional Wave Energy Devices and Mobile Wave Crawler.

Feature	Traditional Wave Energy Devices	Mobile Wave Crawler
Mobility	Fixed, stationary	Mobile (mounted on moving ships)
Installation	Complex offshore setup	Integrated with ship infrastructure
Underwater Cable Requirement	Yes	No
Maintenance	Offshore, costly and difficult	Onboard, simpler and more accessible
Energy Storage	Not required	Energy storage system needs to be installed onboard
Grid Connection	Directly through cable	Ship travels near the shore and connects with the substation for energy transfer
Environmental Impact	High (permanent marine footprint)	Low (no seabed disturbance)

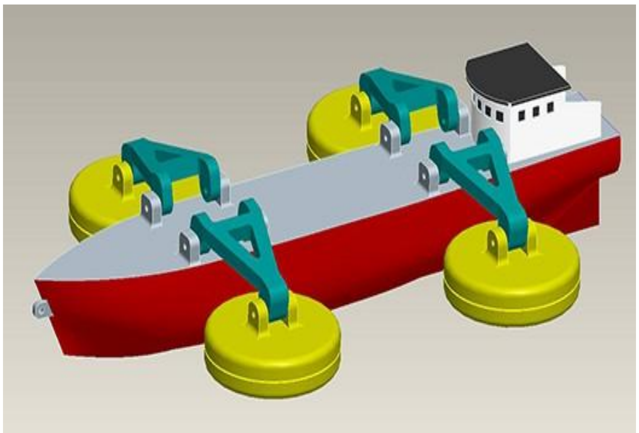

Fig. 1. Mobile Wave Crawler (Briggs et al., 2011).

Traditional Wave Energy Devices vs MWC

The difference between traditional wave energy devices and MWC is shown in Table 1.

Applications of the MWC

a. Offshore Renewable Energy Generation: The device can function as a floating power plant, supplying electricity to coastal areas or offshore facilities. It can be deployed near islands, marine research stations, or offshore oil rigs.
b. Remote & Island Energy Supply: Many remote islands depend on diesel generators for power, which is costly and polluting. The Mobile Wave Crawler can provide a clean and renewable energy source for these communities.
c. Energy to Power Marine Research and Underwater Equipment: Oceanographic sensors, underwater research stations, and underwater vehicles need energy. The crawler can provide green energy to support long-term marine research missions.
d. Military and Defence Applications: The system could be used to power offshore military bases or surveillance equipment. It can serve as a mobile energy station for naval operations.
e. Disaster Response and Emergency Power: After natural disasters, coastal regions often lose access to electricity. A Mobile Wave Crawler can be deployed to provide temporary energy for emergency relief operations.

Power Generation and Cost by MWC

Briggs et al. showed that a typical Mobile Wave Crawler system consists of a 50-meter boat with 1 MW of wave energy-harvesting capacity and 20 MWh of energy storage capability. Operationally, the boat cruises to a favorable offshore location, harvests energy for approximately 20 hours, returns to shore, connects to the electricity grid, and releases the stored energy during high-demand periods. Preliminary calculations promise an electricity cost of US$0.15/kWh (Briggs et al., 2011). For this work, the same type of boat is considered.

Feasibility for Bangladesh

Possible Application

Potential Contribution of MWC to Bangladesh are:

a. Coastal and Island Applications: Mobile crawlers could provide localized power for coastal villages, islands, or fishing operations. It can be a good solution to the electricity problem in Bangladesh's islands. There are a staggering number of islands (Fig. 2), estimated at 700-1,000 (Chouhan, n.d.). About 60 islands have been identified in the coastal zone (Islam, 2004). Most of the islands are located in the central coastal zone due to the dynamic flow of the Ganges-Brahmaputra-Meghna river system. Hatia, Sandweep, and Maishkhali are three upazilas, and Bhola, an administrative district, is the fourth-largest islands in the zone (Sarwar and Wallman, 2005). Some islands are limited to only a small village. St. Martin is the country's only coral island in the Bay of Bengal, about 9.8 km (Hossain, 2001) to southeast of the mainland. The island has an area of 7.5 km2 and is situated under the Teknaf thana of Cox's Bazar district. A total number of 177 char lands are also identified in the coastal zone (Islam, 2004). It could support off-grid communities in areas like St. Martin's Island or Kuakata.
b. National Grid Integration: If deployed in larger numbers, mobile crawlers could contribute a modest amount to the national grid, especially during the monsoon season when wave energy is highest. This energy can also be fed into the national grid, ideally near coastal substations like in Cox's Bazar, Chittagong, or Khulna.
c. Powering Offshore Structures: The only offshore gas extraction site of Bangladesh, Sangu, was abandoned in 2013 (Arzu et al., 2024). However, the government has announced plans to initiate oil and gas exploration in the Bay of Bengal. As 90% of the areas are remain unexplored, there is a high possibility of finding new oil and gas exploration sites (Sarker, 2024). MWCs can energize these offshore oil and gas exploration sites.

Fig. 2. Possible Mobile Wave Generation Sites

Technical Requirements

A Mobile Wave Crawler requires a vessel capable of travelling to locations with the highest wave energy potential. The desired electricity generation capacity determines the vessel's size, and the initial cost is directly related to it. Vessel design can follow the methodologies proposed by Khan et al. (2018), Khan et al. (2020) and Kundu et al. (2018). The vessel must be equipped with an appropriate number of wave energy converters and an onboard energy storage system. Additionally, a ground substation is necessary to transfer the collected energy to the national grid.

Energy Generation Probability for Bangladesh

From Fig. 3, it can be seen that the maximum power can be generated when the MWC is positioned at a wave period of approximately 7 seconds.

From Table 2, it can be observed that the mean wave period in Bangladesh is approximately 6s. From Fig. 3, for wave period 6s:

$$\frac{Power}{H^2} = 20\ kW/m^2$$

Table 2. Mean Wave Period of Bangladesh (Mansur et al.,2017).

Season	Mean Wave Period (s)	Significant Wave Height (m)
Spring	6.41	1.77
Summer	6.33	3.32
Autumn	6.45	2.01
Winter	5.25	0.99

Assuming the diameter of each Point Absorber attached to the ship is 2 m, the area of each Absorber is 3.1416 m^2. If 4 Point Absorbers are attached to the boat, then the total area is 12.57 m^2, and the mean wave height is 2 m (Table 2).

So, total power = 20 x 4 x12.57 = 1005.3 kW. So, energy per hour = P.t = 1005 kW. 1 hour ~ 1000 kW or 1 MW. So, if it works for 20 hours a day, one device can generate 20 MW of electricity in a day.

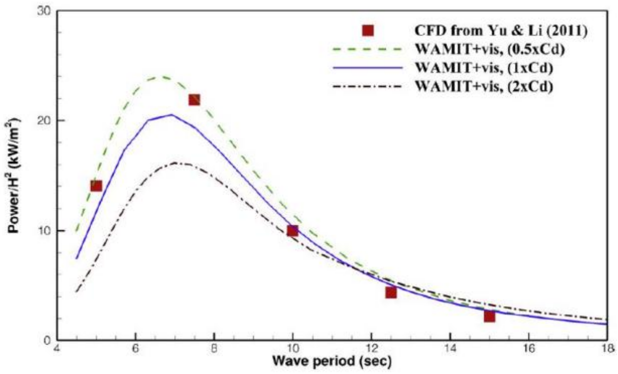

Fig. 3. Captured power of a point absorber WEC vs. wave period calculation using different numerical methods (Li and Yu, 2012)

Techno-Economic Model

A sample techno-economic model is given below:

Technical Parameters:Rated Power Output, P_r = 1000 kWCapacity Factor, CF = 0.35

Annual Operating Hours, H = 7300 hours/year (20 hours/day)

Design Life, N = 20 years

Wave Energy Conversion Efficiency,η=40%

Economic Parameters:

Capital Cost (including WECs + Ship), C_{cap} = 2,500,000 USDO&M Cost per Year, $C_{O\&M}$ = 50,000 USD

Discount Rate, r = 8% (.08)

Inflation Rate, i = 3%

Levelized Cost of Energy (LCOE)

$$LCOE = \frac{\text{Total Lifetime Energy Output (TLE)}}{\text{Total Lifetime Cost (TLC)}}$$

Where,

$TLC = C_{cap} + \sum_{n=1}^{N} (C_{O\&M} / (1+r)^n)$

$TLE = P_r \times CF \times H \times N$

Simplified LCOE Formula (Annuity Method):

$$LCOE = \frac{Ccap \cdot CRF + CO\&M}{Pr \times CF \times H}$$

$CRF = (r(1+r)^N / ((1+r)^N - 1)$

So, CRF = 0.1019

and LCOE = 0.12 USD/ kWh

Table 3. Per kWh production cost of electricity from different sources in Bangladesh.

Source of Electricity	Per kWh Cost (USD)	Reference
Furnace oil-Fired electricity	0.14	(Mohiuddin, 2024)
Gas-fired Electricity	0.033	
Coal-fired Electricity	0.049	
Mobile Wave Crawler	0.12	

The production cost of electricity from different sources in Bangladesh is given in Table 3.

The electricity generation cost from MWC is basically due to the boat's operational cost and equipment maintenance costs. The operational cost may vary for the following reasons:

a. Size and shape of the boat.

b. Type of fuel used in the boat.

c. Number of crew on the boat.

d. Efficiency of the equipment used for energy conversion

e. Availability of a position with a sound wave height capable of generating enough electricity.

The energy production cost may be reduced if any of the items stated above are favorable. However, the slightly higher cost for Mobile Wave Crawler can be mitigated for the following reasons:

a. Renewable and Sustainable: Unlike fossil fuels (coal, oil, gas), wave energy is a renewable resource that does not deplete over time. As long as there are ocean waves, electricity can be continuously generated.

b. Environmentally Friendly:

- Zero greenhouse gas emissions: Unlike coal or fuel-powered plants, wave energy does not contribute to air pollution or global warming.
- Less land use: MWCs are based on working in offshore areas, which results in a minimum of

land usage. Thus, it does not disturb land-based habitats.

c. Predictable and Reliable: Ocean waves are more predictable and reliable compared to solar and wind, which are affected by the weather conditions. It is possible to estimate the energy output more accurately, and it can be easily integrated to the grid.

d. Mobility and Accessibility: Mobile wave energy systems can to be installed and transported according to energy requirements. They are applicable for powering remote coastal regions and islands, where there is no conventional power infrastructure.

e. Energy Independence and Security: Reduces dependency on imported fossil fuels, enhancing a country's energy security. It may also help mitigate the impact of fuel price fluctuations.

f. Long-Term Cost Benefits: While the initial cost is higher, maintenance and fuel costs are lower compared to thermal power plants. Again, as technology advances, the cost of wave energy is expected to decline.

g. Good Solution for Islands: Connecting the islands with the national grid requires the installation of a submarine cable system, which is very expensive. To overcome this problem, Mobile Wave Crawler can be a good solution

Required Number of Mobile Wave Crawlers for Some Example Islands of Bangladesh

As of 2023, Bangladesh's per capita electricity consumption was approximately 0.70 megawatt-hours (MWh) annually (Electricity Demand per Capita in MWh in Bangladesh - ChartingTheGlobe, 2024). This translates to about 700 kilowatt-hours (kWh) per person per year, or approximately 1.92 kWh per person per day. Based on this, the required number of Mobile Wave Crawler for some of the islands are given in Table 4. From Table 4, it can be seen that the Mobile Wave Crawler can be used to generate

Table 4. Required No. of Mobile Wave Crawlerfor Some Example Islands of Bangladesh.

Sr No.	Island Name	Population	Current Source of Electricity*	Total Required Electricity per day (MWh)	Required No. of Mobile Wave Crawler as per Briggs et al.
1.	Bhashan Char	35,629 (Bhasan Char," 2024)	Solar Panel	68.41	04
2.	St. Martin	8,000 (Mazumder et al., 2014)	Solar Panel, Stand-alone generators.	15.36	1
3.	Dublar Char	3000 (Saad, 2024)	Solar Panel	5.7	1
4.	Shah PorirDwip	40000 (Islam, 2018)	Solar Panel	76.8	04
5.	Manpura Island	76582 (BBS, 2011)	Solar Panel	147	08

*Currently, small appliances are being run by generated electricity on these Islands.

electricity for the Offshore Islands of Bangladesh instead of expensive Coal or fuel-based electricity.

Steps of Integrating Mobile Wave Crawler in Bangladesh

Adding electricity generated by a mobile wave crawler to Bangladesh's national grid involves several steps and considerations, both technical and regulatory. Here's how it can be done:

Technical Steps

a. Energy Conversion and Stabilization:

- Power Conditioning: The electricity generated by a wave crawler (often variable and inconsistent due to wave conditions) must be converted into a. stable AC (Alternating Current) at standard grid voltage (usually 230V/50Hz in Bangladesh).
- Inverters and Transformers: Use inverters to convert DC (Direct Current) generated by the wave crawler into grid-compatible AC. Transformers may be needed to step up the voltage to match the grid requirements.

b. Grid Connection Infrastructure:

- Shore-Based Connection Hub: Establish an onshore connection point where power from the crawler is aggregated and fed into the national grid.
- Synchronization: Install synchronizing equipment to ensure the crawler's output matches the grid's frequency, phase, and voltage, preventing disruptions.

c. Energy Storage:

Since wave energy is intermittent, installing battery storage systems or other energy storage solutions can help smooth out fluctuations before feeding the electricity into the grid.

Regulatory and Policy Framework

a. Approval and Licensing: Seek approval from the Bangladesh Power Development Board (BPDB) or relevant authorities to feed wave energy into the grid and ensure compliance with grid codes (technical rules for connecting to the grid).

b. Feed-In Tariffs (FiTs) or Power Purchase Agreements (PPAs): Negotiate a feed-in tariff or PPA with the government or utilities. This determines how much will it be paid per kWh of electricity delivered to the grid.

c. Environmental and Safety Compliance: Conduct an environmental impact assessment (EIA), as Bangladeshi law requires, to ensure minimal ecological disruption and safety measures to handle extreme weather (cyclones, flooding, etc.) in the Bay of Bengal.

Logistics and Deployment

a. Best Site Location: Have the crawler around the available coastal grid infrastructure to reduce the cost of transmission. It is also expected to identify areas of high wave energy in the Bay of Bengal, including around Cox's Bazar, Kuakata, and St. Martin's Island.

b. Scaling the System: A pilot project will be necessary to determine the practicality and the performance of the wave crawler under the actual environment. Increase crawlers and connections gradually, if successful.

c. Maintenance and Monitoring: Have a strong crawler maintenance and periodic performance and grid integration monitoring systems.

Environmental Impact Assessment

When Mobile Wave Crawlers are implemented in the nearshore waters of the Bay of Bengal within Bangladesh's Exclusive Economic Zone (EEZ), specifically at Cox's Bazar, Kuakata, and Saint Martin Island, the possible environmental impacts and mitigation measures are illustrated in Table 5.

Factors Affecting Wave Energy Generation in Bangladesh

a. Wave Potential in Bangladesh: Moderate wave energy potential is available in the Bay of Bengal. Research indicates a range of wave power of 5-15 kW/m along the coastline, with the highest energy recorded during the monsoon months (June-September). Wave energy availability is seasonal, because when the seas are calmer in winter output is low.

b. MWC Capacity: In general, a small mobile crawler can produce 1-10 kW on its own, depending on the size of the crawler, its efficiency, and the waves. More advanced and bigger MWCs may scale to = 50-100 kW.

c. Deployment Scenario: A single crawler in ideal wave conditions in the Bay of Bengal would yield:
   - 5-1 kWh per day on smaller crawlers.
   - Larger systems have 50-200 kWh per day, depending on the intensity of the waves.

This production would be scaled by strategically positioning several crawlers.

Key Challenges and Solutions Electricity produced by the mobile wave crawler depends on its design, efficiency and the conditions of the waves in which it has been deployed. These devices utilize wave energy to generate electrical power via mechanical or hydraulic mechanisms. These are the general considerations:

a. Size and Design: A small mobile wave crawler could produce a few kilowatts (kW) that could serve to power small devices, sensors, or communication systems. The larger, more advanced design can produce tens or hundreds of kW, which can be added to a local grid or other larger power requirements.

b. Wave Conditions: The energy production is very much dependent on the height of the wave, the frequency and consistency. Areas that have high and consistent waves (e.g. along the shoreline or the open oceans) will produce more energy.

c. Efficiency: The conversion efficiency of a wave energy device is generally between 20 to 40 percent of the incoming energy.

d. Wave Conditions: Moderate wave power constrains output in areas with greater wave power potential (e.g. the North Sea).

e. Cost and Feasibility: It may be costly to install and maintain on a large scale.

f. Technology Adaptation: The devices should be able to withstand severe weather conditions such as cyclones, which are prevalent in the Bay of Bengal.

Table 6 presents likely solutions to address the issues outlined above in Bangladesh.

Table 6. Key Challenges and Solutions to Implementing MWC in Bangladesh.

Challenge	Solution
High initial investment	Find sources of funds through government subsidies or public- private associations.
Intermittent energy supply	Storing the energy or hybrid (e.g., solar or wind integration).
Cyclones and extreme weather	Install robust crawlers that have weatherproof designs.
Limited grid access in remote areas	Localized microgrids first with crawlers then scaled to national grid.
Transmission losses over long distances	Install offshore substations that are as close to the coast as possible.

Conclusion

To achieve the renewable energy goal, integrating mobile wave crawlers into Bangladesh’s grid can be a good solution. Bangladesh can also harness its blue energy potential with this device. Investment case: First-rollout costs are high, but they can lead to energy security and off-grid solutions tailored to coastal areas and islands. So, in other words, we won’t have mobile wave crawlers serving as a source of Bangladesh-wide energy by any means. Still, they could potentially be the difference in decentralized coastline or island dependence, especially when monsoons hit. The number of devices deployed, their efficiency, and the wave energy potential of the Bay of Bengal are some of the variables that determine how much power mobile wave crawlers can contribute to Bangladesh's national grid. The authors of this study outline the Mobile Wave Crawler's viability and operation in Bangladesh. The ship's size, the island's population, and relevant parameters determine how many devices are needed. Keeping these factors in mind, the authors propose a feasible solution for several islands in Bangladesh. The LCOE and energy generation capability presented in this paper can be significantly improved by modifying the other factors related to them. Thus, it can be a good solution for energy in the coastal areas and islands of Bangladesh. The authors plan to conduct detailed technical and economic studies, develop a prototype, and test it in a towing tank shortly.

Acknowledgment

The author received no financial support or external contribution for this work.

Authors contribution

Md Riad Khan: Conceptualisation, literature review, methodology, investigation, analysis, original draft preparation, review and editing

Nusrat Sharmin and SM Rashidul Hasan: Conceptualisation, supervision, review

Conflict of interest

The authors declare that this work has no conflict of interest.

References

Arzu F, Anjum N and Hassan MM. Offshore industry in Bangladesh: Present status and future prospect to contribute for national economy. *Bangladesh Mar. J.* 2024; 7(1): 85-98.

Bangladesh Bureau of Statistics (BBS). Population census - 2011. Preliminary report. Bangladesh Bureau of Statistics, Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka, 2011.

Bhasan Char Population Factsheet. Report on Rohingya Refugee Response/Bangladesh. GoB - UNHCR Joint Registration Exercise, September 30, 2024.

Briggs J, Sharon A and Wirz H. Mobile wave energy harvesting system.*NSTI-Nanotech*. 2011; 3: 683-686.

Chouhan MS. *How many islands does Bangladesh have? Largest one is...*: www.dnaindia.com/viral August 14, 2024.

Electricity demand per capita in MWh in Bangladesh. ChartingTheGlobe.com, 2024.

Hossain MS. Biological aspects of the coastal and marine environment of Bangladesh, *Ocean & Coastal Managemen*t, 2001; 44: 261-282.

Mobile Wave Crawler. Fraunhofer USA, Electrical Power Generation from Ocean Waves, 2011.

Islam MR. *Where Land Meets the Sea: A Profile of the Coastal Zone of Bangladesh*, The University Press Limited, Dhaka, 2004.

Islam S. *সড়ক পথে যাওয়া যাবে শাহপরীর দ্বীপ* :Bangla Tribune; Nov 9, 2018.

Khan MR, Islam A and Abdullah A. Time and Cost Effective Ship Design Process Using Single Parent Design Approach with Considerable Dimension Difference. In: *12th International Conference on Marine Technology*, 2020; 11–19.

Khan MR, Kundu R, Rahman W, Haque MM and Ullah MR. Efficiency study: Contra-rotating propeller system. In:*International Conference on Mechanical Engineering*, Proceedings of the 12th International Conference on Mechanical Engineering (ICME 2017), 2017 December 20–22; Dhaka, Bangladesh: AIP Conference Proceedings; 2018. vol. 1980. pp.060001-1–060001-7.

Kundu R, Khan MR, Rahman S and Saha GK. Design and structural analysis of a pontoon vessel. In: *International Conference on*

Mechanical Engineering, Proceedings of the 12th International Conference on Mechanical Engineering (ICME 2017), 2017 December 20–22; Dhaka, Bangladesh: AIP Conference Proceedings; 2018. vol. 1980. pp. 030006-1–030006-7.

Mahbub MAL and Islam ARMT. Current status of running renewable energy in Bangladesh and future prospect: A global comparison. *Heliyon*. 2023; 9(3): e14308.

Mansur M, Enam FB and Baree MS. Development of the wave spectrum of the northern region of the Bay of Bengal based on Indian National Centre for Ocean Information Services (INCOIS) moored buoy data. *J. Mech. Eng*. 2017; 47: 22-30.

Mazumder P, Jamil MH, Das CK and Matin MA. Hybrid energy optimization: An ultimate solution to the power crisis of St. Martin Island, Bangladesh. In: 2014 9th International Forum on Strategic Technology (IFOST), Cox's Bazar, Bangladesh; 2014, pp. 363-368

Mohiuddin. *Cost 3 times higher, yet electricity being purchased from oil-run power plants*:Prothomalo; February 28, 2024.

Sarker PK. *Offshore Exploration: Looking back at Bangladesh's historical footprints*: Dhaka Tribune; March12, 2024.

Sarwar GM and Wallman P. *Impacts of Sea Level Rise on the Coastal Zone of Bangladesh*, 2005.

Uddin MM and Park J. Renewable Energy Resources in Bangladesh: Current Status and Future Prospects. In: 2021 IEEE 48th Photovoltaic Specialist Conference (PVSC); 2021. pp. 2180-2186.