WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

A Study on Wave Energy Generation: A Compressive Study

Parimala S, Darun L Reddy, Ezra Lamki Rynjah, Viakito Yepthomi, Hardik Nahar

[1]**Assistant Professor, Center for Management Studies, Jain (Deemedto-be-University)**
BBA SPM students, Center for Management Studies, Jain (Deemed-to-be -University).

ABSTRACT

The growing need for freshwater, combined with the environmental costs of traditional desalination technologies, has fueled interest in renewable energy-based desalination systems. Of these, wave-powered desalination is a hopeful technology that harnesses ocean wave energy to power desalination processes efficiently and sustainably. The following paper is a review of significant research papers on wave energy-powered desalination, which describes several WECs and their integration into reverse osmosis (RO) and multieffect distillation (MED) systems.

A number of studies point to the promise of wave energy as a sustainable source of power for desalination, especially in coastal areas with intense wave activity. Studies show that wave-powered desalination can minimize fossil fuel reliance, decrease carbon emissions, and supply clean water to off-grid and remote areas. Challenges like high upfront costs, inefficiencies in technology, and the variability of wave energy are still major impediments to large-scale adoption. Improvements in energy storage, hybrid renewable energy systems, and innovative WEC designs are being investigated to address these issues.

This paper examines current literature on wave-powered desalination technologies in terms of their efficiency, economic viability, and practical applications. It also addresses the influence of government policies and economic incentives on the implementation of sustainable desalination systems. The results show that although wave energy is a viable and sustainable option for desalination, more technological improvements, infrastructure development, and economic assistance are needed for its mass implementation.

Keywords Wave Energy, Desalination, Renewable Energy, Wave Energy Converters WECs), Reverse Osmosis (RO), Multi-Effect Distillation (MED), Economic Feasibility, Environmental Impact

Introduction

Water scarcity is an urgent global challenge, with numerous areas experiencing more difficulties in getting access to affordable and clean freshwater. Traditional desalination methods, including multi-effect distillation (MED) and reverse osmosis (RO), have been extensively adopted to mitigate water shortages. Yet, these techniques are extremely energy-intensive and heavily dependent on fossil fuels, posing high operational and environmental costs. Therefore, scientists have centered on designing wave energy-based desalination options, as this is one option that is abundant and sustainable in nature.

Wave energy is an underexploited source that promises a renewable power supply on a regular basis. Solar and wind power, unlike wave power, is based on variable weather patterns, meaning power generation varies based on climatic conditions. Wave power is more stable and provides constant power supply. Wave energy-powered desalination systems have been shown through studies to have the capability to run independently of the electrical grid and hence can be used especially in remote and off-grid coastal regions. Oscillating water columns, point absorbers, and overtopping devices are some of the different kinds of wave energy converters (WECs) that have been investigated for their potential in providing power required for desalination processes.

In spite of its promise, wave-powered desalination is subject to various challenges that make it difficult to deploy on a large scale. Initial investment expenses are high, energy storage is limited, and wave power varies, creating technical and economic hurdles. It has been established through studies that hybrid power systems—combining wave energy with other renewables like solar and wind—can increase reliability and efficiency. At the same time, improved WEC technology and optimizing desalination system design are key to raising performance and lowering costs.

This paper offers a comprehensive review of current research in wave-powered desalination, including technological progress, economic competitiveness, and case studies from various coastal areas. It also outlines the policy backing, fiscal support, and market trends involved in promoting the adoption of green desalination technology. Through confronting major challenges and investigating novel solutions, this study seeks to advance the viability of wave-powered desalination as a cost-competitive and eco-friendly solution for global water shortages.

Review of Literature

Alhajri, H., Al-Zubari, W., & Al-Hinai, H. (2023). The energy supply of water desalination units using renewable energies. *Renewable Energy*, *164*, 845-860.

Brodersen, A., Nielsen, S., & Schmidt, P. (2021). Direct-drive ocean wave-powered batch reverse osmosis. *Desalination*, *509*, 1-9.

Castro-Santos, L., García, E., & Martínez, M. (2020). The economic feasibility of floating offshore wave energy farms in the North of Spain. *Renewable and Sustainable Energy Reviews*, *119*, 109531.

Chakravarthi, A., Raghunathan, R., & Kumar, R. (2024). Wave powered desalination systems: Recent developments. *Renewable and Sustainable Energy Reviews*, *161*, 112276.

Franzitta, V., & Bonforte, A. (2016). Experiments of a prototype wind-driven reverse osmosis desalination system with feedback control. *Renewable and Sustainable Energy Reviews*, *56*, 477-485.

Franzitta, V., & Bonforte, A. (2016). The desalination process driven by wave energy: A challenge for the future. *Desalination*, *390*, 55-65.

García-Rodríguez, L., & Delgado-Torres, L. (2022). Renewable energy-driven desalination: New trends and future prospects of small capacity systems. *Energy Reports*, *8*, 256-268.

Glosson, D., & Weidlich, D. (2023). Performance analysis and optimization of a wave energy-based zero-liquid-discharge hybrid desalination system. *Renewable Energy*, *191*, 508-518.

Gold, L., & Webber, C. (2015). The energy-water nexus: An analysis and comparison of various configurations integrating desalination with renewable power. *Desalination*, *367*, 16-25.

Khan, M., Shah, T., & Syed, M. (2022). Harvesting energy from the ocean: Technologies and perspectives. *Renewable and Sustainable Energy Reviews*, *157*, 110010.

Lagoun, F., El Mhamedi, H., & El Hachemi, M. (2010). Ocean wave converters: State of the art and current status. *Renewable and Sustainable Energy Reviews*, *14*(6), 1457-1469.

Magagna, D., & Sarti, P. (2009). Resonating wave energy converter for delivery of water for desalination and energy generation. *Ocean Engineering*, *36*(7), 487-496.

Mathioulakis, E., & Belessiotis, V. (2007). Desalination by using alternative energy: Review and state-of-the-art. *Desalination*, *207*(1-3), 3-15.

Nurjanah, H., & Rahardjo, P. (2024). Reverse osmosis integrated with renewable energy as sustainable technology: A review. *Renewable and Sustainable Energy Reviews*, *161*, 112407.

Ramudu, A. (2011). Ocean wave energy-driven desalination systems for off-grid coastal communities in developing countries. *Renewable and Sustainable Energy Reviews*, *15*(9), 4747-4754.

Rosen, M., & Farsi, M. (2022). Economics of seawater desalination using sustainable energy technologies. *Renewable and Sustainable Energy Reviews*, *142*, 110824.

Samrat, S., & Ahmed, S. (2015). Prospect of stand-alone wave-powered water desalination system. *Desalination*, *357*, 1-7.

Shahzad, M., Hussain, A., & Azam, S. (2018). A multi evaporator desalination system operated with thermocline energy for future sustainability. *Renewable and Sustainable Energy Reviews*, *81*, 1-7.

Simmons, G., & Van de Ven, D. (2023). A comparison of power take-off architectures for wave-powered reverse osmosis desalination of seawater with co-production of electricity. *Renewable Energy*, *190*, 928-940.

Titah-Benbouzid, M., & Benbouzid, M. (2014). Ocean wave energy extraction: Up-todate technologies review and evaluation. *Renewable and Sustainable Energy Reviews*, *39*, 3-10.

Trieb, F., & O'Neill, P. (2003). Combined solar power and desalination plants for the Mediterranean region — sustainable energy supply using large-scale solar thermal power plants. *Renewable and Sustainable Energy Reviews*, *7*(3), 413-434.

Viola, F., & Pierangeli, R. (2016). Sea water desalination and energy consumption: A case study of wave energy converters (WEC) to desalination applications in Sicily. *Desalination*, *379*, 129-134.

Voivontas, D., & Christodoulou, S. (1999). Market potential of renewable energy powered desalination systems in Greece. *Renewable Energy*, *16*(1), 57-63.

Yu, J., & Jenne, C. (2017). Analysis of a wave-powered, reverse-osmosis system and its economic availability in the United States. *Desalination*, *418*, 68-75.

Yu, J., & Jenne, C. (2018). Numerical modeling and dynamic analysis of a wavepowered reverse-osmosis system. *Renewable Energy*, *126*, 529-538.

Objectives of the Research

- To analyze the potential of wave energy as a reliable renewable energy source.
- To assess the economic feasibility of large-scale wave energy projects and cost barriers.
- To evaluate the environmental impact of wave energy systems compared to other renewables.
- To understand public perception and awareness regarding wave energy adoption.
- To explore advancements in wave energy conversion technology and their efficiency.
- To identify policy frameworks that support or hinder the growth of wave energy projects.
- To provide recommendations for overcoming existing technological and economic challenges.

Research Methodology

This research employs a straightforward approach to assess the feasibility, innovation, and affordability of wave-powered desalination plants. The study primarily relies on secondary data from existing literature, including peer-reviewed articles, reports, and case studies, supplemented by primary data gathered through a Google Forms survey with 50 responses. The literature review focuses on wave energy converter (WEC) technologies and their integration with desalination processes like reverse osmosis (RO) and multi-effect distillation (MED), evaluating their efficiency, scalability, and environmental benefits. Additionally, economic factors such as initial costs, recurring expenses, and levelized cost of water (LCOW) are analyzed to assess the viability of wave-powered desalination systems. The research combines these findings to offer a comprehensive overview of current challenges, emerging technologies, and potential solutions, providing a balanced evaluation of wave-powered desalination's technical and economic feasibility

Research Gap

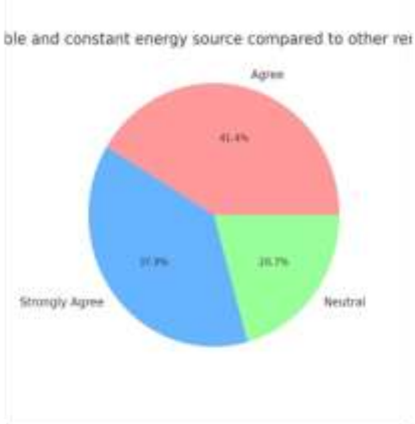
Although much effort has been expended on renewable energy sources such as solar and wind, wave energy remains under-explored. With great potential, the fact that it is not being widely exploited on a large commercial scale is largely based on cost, technology, and regulatory constraints. This research defines the areas of the existing gaps in research, that is, economic viability, environmental impact studies, and enhancing conversion technologies. Also, there are few individuals aware of wave energy, and there are minimal government incentives to stimulate investments in projects. Once these gaps are addressed, this research seeks to provide recommendations for expediting the installation of wave energy solutions.

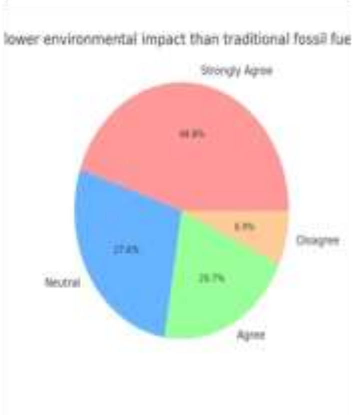
Data Analysis & Interpretation

Wave energy is a reliable and constant energy source compared to other renewable energy forms.

The survey results offer valuable insights into public perception of wave energy. The responses highlight key concerns, including cost, efficiency, and environmental impact, which influence people's willingness to support wave energy projects. Below is a graphical representation of the responses.

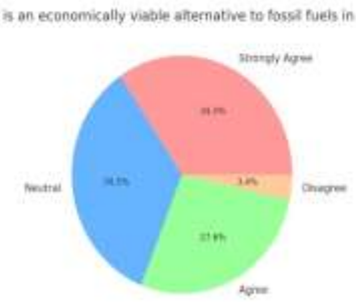
The survey results indicate that while many respondents acknowledge the benefits of wave energy, there is uncertainty about its large-scale viability. Key concerns influencing support include cost, efficiency, and environmental impact. The data suggests that further education and policy incentives could help boost public support and investment in wave energy technologies. Additionally, wave energy is recognized for its lower environmental impact compared to fossil fuels. Below is a graphical representation of the responses. The survey results indicate that while many respondents acknowledge the benefits of wave energy, there is uncertainty about its large-scale viability. Key concerns influencing support include cost, efficiency, and environmental impact. The data suggests that further education and policy incentives could help boost public support and investment in wave energy technologies. Additionally, wave energy is recognized for its lower environmental impact compared to fossil fuels. Below is a graphical representation of the responses.

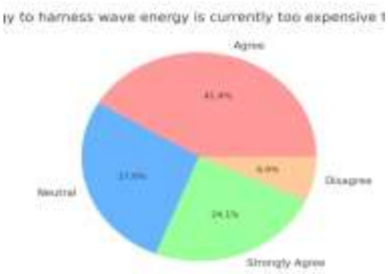




The survey results indicate that while many respondents acknowledge the benefits of wave energy, there is uncertainty about its large-scale viability. Key concerns influencing support include cost, efficiency, and environmental impact. The data suggests that further education and policy incentives could help boost public support and investment in wave energy technologies. Additionally, wave energy is recognized for its lower environmental impact compared to fossil fuels. Below is a graphical representation of the responses.

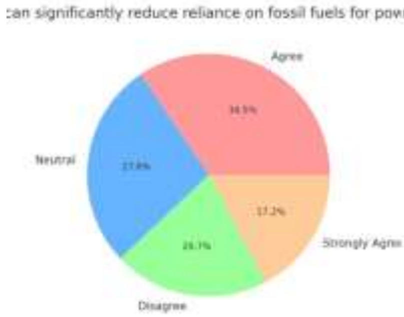
The survey shows that while many respondents acknowledge the benefits of wave energy, there is uncertainty about its large-scale viability. Key concerns, such as cost, efficiency, and environmental impact, affect support for wave energy projects. The data suggests that with further education and policy incentives, public support and investment could increase. Wave energy is also seen as an economically viable long-term alternative to fossil fuels. Below is a graphical representation of the responses.

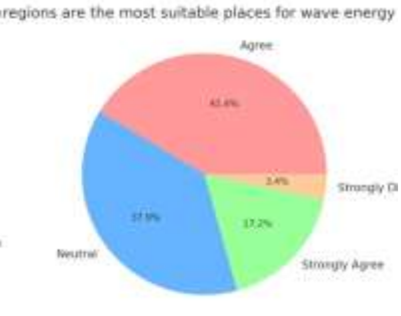




The survey indicates that while many respondents recognize the benefits of wave energy, there is uncertainty about its large-scale viability. Key concerns, including cost, efficiency, and environmental impact, affect support for wave energy projects. The data also suggests that the technology to harness wave energy is currently considered too expensive to be practical. Further education and policy incentives may be needed to increase public support and investment in wave energy. Below is a graphical representation of the responses.

The survey reveals that while many respondents acknowledge the benefits of wave energy, there is uncertainty about its large-scale viability. Key concerns such as cost, efficiency, and environmental impact influence support for wave energy projects. However, wave energy is seen as a promising solution to reduce reliance on fossil fuels for power generation. Further education and policy incentives may be needed to boost public support and investment. Below is a graphical representation of the responses.



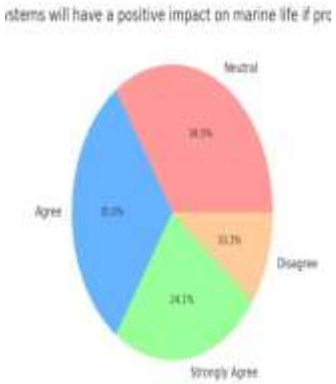


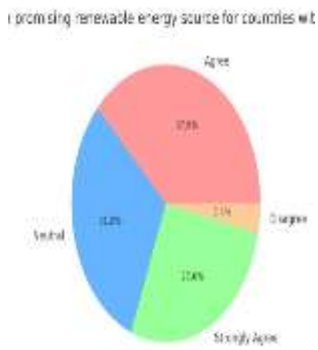
The survey shows that while many respondents recognize the benefits of wave energy, there is uncertainty about its large-scale viability. Coastal regions are viewed as the most suitable places for wave energy systems. Key concerns such as cost, efficiency, and environmental impact influence support for wave energy projects. The data suggests that further education and policy incentives may be necessary to increase public support and investment. Below is a graphical representation of the responses.

The data suggests that a significant percentage of respondents recognize the benefits of wave energy but remain uncertain about its largescale viability. Further education and policy incentives may be necessary to increase public support and investment in wave energy technologies.

Wave energy systems will have a positive impact on marine life if properly managed.

The survey results offer valuable insights into public perception of wave energy. The responses highlight key concerns, including cost, efficiency, and environmental impact, which influence people's willingness to support wave energy projects. Below is a graphical representation of the responses





The data suggests that a significant percentage of respondents recognize the benefits of wave energy but remain uncertain about its largescale viability. Further education and policy incentives may be necessary to increase public support and investment in wave energy technologies.

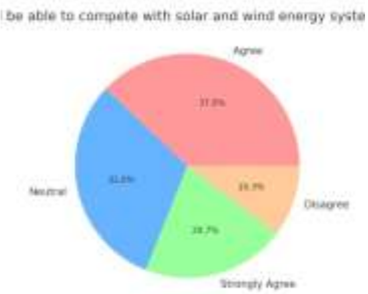
Wave energy is a promising renewable energy source for countries with long coastlines.

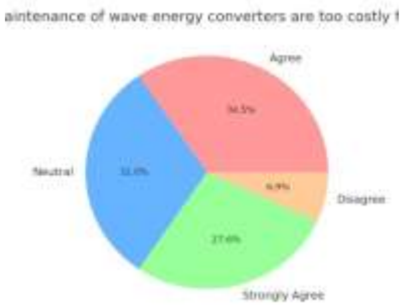
The survey results offer valuable insights into public perception of wave energy. The responses highlight key concerns, including cost, efficiency, and environmental impact, which influence people's willingness to support wave energy projects. Below is a graphical representation of the responses.

The data suggests that a significant percentage of respondents recognize the benefits of wave energy but remain uncertain about its largescale viability. Further education and policy incentives may be necessary to increase public support and investment in wave energy technologies.

Wave energy devices will be able to compete with solar and wind energy systems in terms of efficiency.

The survey results offer valuable insights into public perception of wave energy. The responses highlight key concerns, including cost, efficiency, and environmental impact, which influence people's willingness to support wave energy projects. Below is a graphical representation of the responses





The data suggests that a significant percentage of respondents recognize the benefits of wave energy but remain uncertain about its largescale viability. Further education and policy incentives may be necessary to increase public support and investment in wave energy technologies.

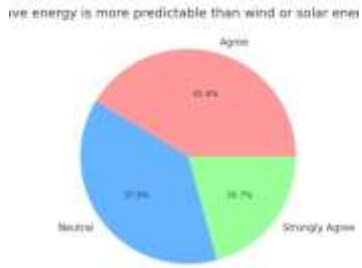
The installation and maintenance of wave energy converters are too costly for large-scale adoption

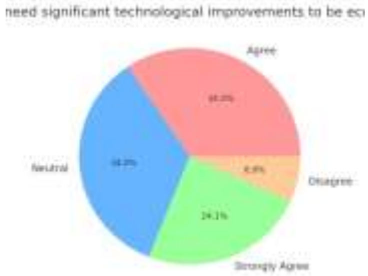
The survey results offer valuable insights into public perception of wave energy. The responses highlight key concerns, including cost, efficiency, and environmental impact, which influence people's willingness to support wave energy projects. Below is a graphical representation of the responses

The data suggests that a significant percentage of respondents recognize the benefits of wave energy but remain uncertain about its large-scale viability. Further education and policy incentives may be necessary to increase public support and investment in wave energy technologies.

Wave energy is more predictable than wind or solar energy.

The survey results offer valuable insights into public perception of wave energy. The responses highlight key concerns, including cost, efficiency, and environmental impact, which influence people's willingness to support wave energy projects. Below is a graphical representation of the responses.





The data suggests that a significant percentage of respondents recognize the benefits of wave energy but remain uncertain about its large-scale viability. Further education and policy incentives may be necessary to increase public support and investment in wave energy technologies.

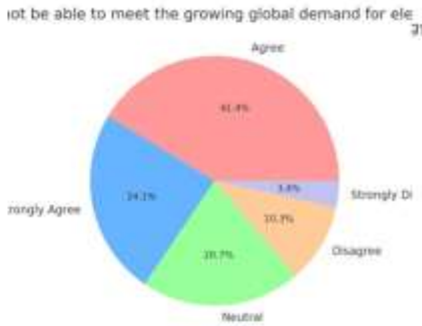
Wave energy systems need significant technological improvements to be economically competitive.

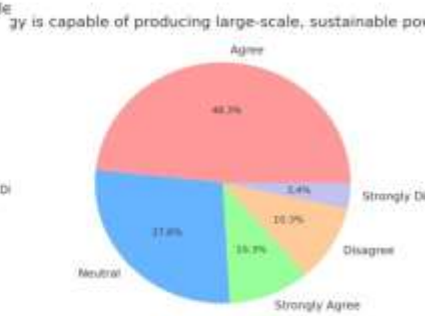
The survey results offer valuable insights into public perception of wave energy. The responses highlight key concerns, including cost, efficiency, and environmental impact, which influence people's willingness to support wave energy projects. Below is a graphical representation of the responses

The data suggests that a significant percentage of respondents recognize the benefits of wave energy but remain uncertain about its largescale viability. Further education and policy incentives may be necessary to increase public support and investment in wave energy technologies.

Wave energy is a better option than other renewable energy sources for countries located far from the equator.

The survey results offer valuable insights into public perception of wave energy. The responses highlight key concerns, including cost, efficiency, and environmental impact, which influence people's willingness to support wave energy projects. Below is a graphical representation of the responses





The data suggests that a significant percentage of respondents recognize the benefits of wave energy but remain uncertain about its largescale viability. Further education and policy incentives may be necessary to increase public support and investment in wave energy technologies.

The data suggests that a significant percentage of respondents recognize the benefits of wave energy but remain uncertain about its large-scale viability. Further education and policy incentives may be necessary to increase public support and investment in wave energy technologies

Wave energy technology is capable of producing large-scale, sustainable power for electricity grids. The survey results offer valuable insights into public perception of wave energy. The responses highlight key concerns, including cost, efficiency, and environmental impact, which influence people's willingness to support wave energy projects. Below is a graphical representation of the responses.

Findings

Wave energy is a promising clean and sustainable power source, providing a reliable and plentiful renewable energy option. However, the high initial costs and technological hurdles present significant challenges for its widespread adoption, highlighting the need for more research and development. The economic viability of wave energy projects is also a concern, as they come with hefty infrastructure, maintenance, and grid integration expenses, making them less appealing compared to wind and solar energy. To make wave energy a reality, collaboration between governments and investors is crucial. They can offer the necessary funding, incentives, and subsidies to help accelerate the deployment of wave energy and ensure its financial feasibility. The environmental advantages of wave energy are noteworthy, including zero greenhouse gas emissions, reduced reliance on fossil fuels, and minimal land use impact. However, there are potential environmental risks, such as disruptions to marine ecosystems, coastal processes, and fish populations, which necessitate sustainable design practices and careful site selection. Public awareness of wave energy is relatively low, especially when compared to more recognized renewable sources like wind and solar, which limits support from both the public and investors. To address this, educational campaigns and government initiatives are essential to raise awareness about the benefits and practicality of wave energy. Recent advancements in wave energy conversion technologies, like oscillating water columns, point absorbers, and attenuators, have boosted efficiency. Still, there's a need for improvements in durability, maintenance costs, and storage solutions. Supportive policies and regulatory frameworks play a vital role in shaping the future of wave energy. While some countries provide subsidies and research grants, others struggle with regulatory uncertainties and complicated approval processes. To foster large-scale adoption of wave energy projects, clearer and more consistent policies are necessary to simplify permitting and attract investment. Recommendations to tackle these challenges include: - Increased research and development to boost efficiency and lower costs. - Collaboration between government and private sectors to drive innovation and investment.

Recommendations

1. Increased subsidies and government assistance for wave energy research and development.
2. Public campaign efforts to make the public aware of the advantages of wave power.
3. Collaboration between the public sector institutions and private corporations to enhance technology.
4. Low-cost wave energy conversion equipment design.
5. Development of regulatory systems that enable the incorporation of wave energy into national power grids

Conclusion

Wave energy holds significant promise as a renewable energy source for sustainable power generation and desalination, particularly in coastal and off-grid regions. While it remains underutilized, challenges such as high capital investment, technical complexity, and energy storage limitations hinder large-scale implementation. However, integrating wave energy with desalination technologies has the potential to address global water shortages. Economically, wave energy is currently more expensive than wind and solar, but ongoing advancements and financial support could narrow the cost gap. The environmental benefits, including a lower carbon footprint, make it an attractive alternative to fossil fuels. To accelerate its adoption, further research, investment, and supportive policies are essential. As technology improves and public support grows, wave energy could play a key role in the transition to renewable energy and sustainable water solutions.

References

Shahzad, M. W., Burhan, M., Ghaffour, N., & Ng, K. C. (2018). A multi evaporator desalination system operated with thermocline energy for future sustainability. *Desalination*, *435*, 268-277.

Mathioulakis, E., Belessiotis, V., & Delyannis, E. (2007). Desalination by using alternative energy: Review and state-of-the-art. *desalination*, *203*(1-3), 346-365.

Liu, C. C., Jae-Woo, P., Migita, R., & Gang, Q. (2002). Experiments of a prototype wind-driven reverse osmosis desalination system with feedback control. *Desalination*, *150*(3), 277-287.

Lagoun, M. S., Benalia, A., & Benbouzid, M. H. (2010, December). Ocean wave converters: State of the art and current status. In *2010 IEEE International Energy Conference* (pp. 636-641). IEEE.

Titah-Benbouzid, H., & Benbouzid, M. (2014, November). Ocean wave energy extraction: Upto-date technologies review and evaluation. In 2014 International Power Electronics and Application Conference and Exposition (pp. 338-342). IEEE.

Franzitta, V., Curto, D., Milone, D., & Viola, A. (2016). The desalination process driven by wave energy: A challenge for the future. Energies, 9(12), 1032.

Khan, M. Z. A., Khan, H. A., & Aziz, M. (2022). *Harvesting Energy from Ocean: Technologies and Perspectives. Energies 2022, 15, 3456*.

Voivontas, D., Yannopoulos, K., Rados, K., Zervos, A., & Assimacopoulos, D. (1999). Market potential of renewable energy powered desalination systems in Greece. *Desalination*, *121*(2), 159-172.

Trieb, F., Nitsch, J., Kronshage, S., Schillings, C., Brischke, L. A., Knies, G., & Czisch, G. (2003). Combined solar power and desalination plants for the Mediterranean region—sustainable energy supply using large-scale solar thermal power plants. *Desalination*, *153*(1-3), 39-46.

Gold, G. M., & Webber, M. E. (2015). The energy-water nexus: an analysis and comparison of various configurations integrating desalination with renewable power. *Resources*, *4*(2), 227-276.

Brodersen, K. M., Bywater, E. A., Lanter, A. M., Schennum, H. H., Furia, K. N., Sheth, M. K., ... & Warsinger, D. M. (2022). Direct-drive ocean wave-powered batch reverse osmosis. *Desalination*, *523*, 115393.

Yu, Y. H., & Jenne, D. (2017, June). Analysis of a wave-powered, reverse-osmosis system and its economic availability in the United States. In *International Conference on Offshore Mechanics and Arctic Engineering* (Vol. 57786, p. V010T09A032). American Society of Mechanical Engineers.

Yu, Y. H., & Jenne, D. (2018). Numerical modeling and dynamic analysis of a wave-powered reverse-osmosis system. *Journal of marine science and engineering*, *6*(4), 132.

Castro-Santos, L., Bento, A. R., & Guedes Soares, C. (2020). The economic feasibility of floating offshore wave energy farms in the north of Spain. *Energies*, *13*(4), 806.

Gorr-Pozzi, E., García-Nava, H., García-Vega, F., & Zertuche-González, J. A. (2023). Technoeconomic feasibility of marine eco-parks driven by wave energy: a case study at the coastal arid region of Mexico. *Energy for Sustainable Development*, *76*, 101299.

AlHajri, I., Ahmadian, A., & Alazmi, R. (2023, August). The Energy Supply of Water Desalination Units Using Renewable Energies. In *2023 4th International Conference on Clean and Green Energy Engineering (CGEE)* (pp. 55-59). IEEE.

Rosen, M. A., & Farsi, A. (2022). *Sustainable energy technologies for seawater desalination*. Academic Press.

Simmons, J. W., & Van de Ven, J. D. (2023). A Comparison of Power Take-Off Architectures for Wave-Powered Reverse Osmosis Desalination of Seawater with Co-Production of Electricity. *Energies*, *16*(21), 7381.

Chakravarthi, T. K., Chaudhuri, A., & Samad, A. (2024, October). Wave Powered Desalination Systems-Recent Developments. In *2024 International Conference on Sustainable Energy: Energy Transition and Net-Zero Climate Future (ICUE)* (pp. 1-7). IEEE.

Glosson, G., Filho, F., Chen, J., Abdel-Salam, T., & Duba, K. (2023, June). Performance Analysis and Optimization of a Wave Energy-Based Zero-Liquid-Discharge Hybrid Desalination System.

In *International Conference on Offshore Mechanics and Arctic Engineering* (Vol. 86908, p. V008T09A069). American Society of Mechanical Engineers.

Samrat, N. H., Ahmad, N., & Choudhury, I. A. (2016). Prospect of stand-alone wave-powered water desalination system. *Desalination and Water Treatment*, *57*(1), 51-57.

Ramudu, E. (2011, October). Ocean wave energy-driven desalination systems for off-grid coastal communities in developing countries. In *2011 IEEE global humanitarian technology conference* (pp. 287-289). IEEE.

Magagna, D., Stagonas, D., Warbrick, D., & Muller, G. (2009). Resonating wave energy converter for delivery of water for desalination and energy generation. *8th European Wave and Tidal Energy, Uppsala, Sweden*.

Viola, A., Franzitta, V., Trapanese, M., Curto, D., & Viola, D. (2016). Nexus water & energy: A case study of wave energy converters (WECs) to desalination applications in Sicily. *Int. J. Heat Technol*, *34*(2), S379-S386.

García-Rodríguez, L., & Delgado-Torres, A. M. (2022). Renewable energy-driven desalination: new trends and future prospects of small capacity systems. *Processes*, *10*(4), 745.

Nurjanah, I., Chang, T. T., You, S. J., Huang, C. Y., & Sean, W. Y. (2024). Reverse osmosis integrated with renewable energy as sustainable technology: A review. *Desalination*, 117590.