Control System Design Challenges in Renewable Energy-based Offshore DC Microgrids

Alamgir Hossain, Michael Negnevitsky, Xiaolin Wang, Evan Franklin, Waqas Hassan, Md. Alamgir Hossain, Evan Gray, Pooyan Alinaghi Hosseinabadi

Abstract—**Since the majority of modern electronic devices rectify an AC input to operate via DC power, and since many distributed renewable energy sources (DRESs) inherently generate DC power, DC microgrids (MGs) are an increasingly attracting approach. DC MGs can provide a sustainable alternative for offshore facilities such as oil and gas rigs, marine shipboards, and aquaculture facilities, offering a sustainable and efficient substitute to conventional power systems. This is because these industries have access to different DRESs, especially ocean wave energy, and often utilise DC-powered modern electronic devices. When integrating different DRESs into a DC MG network for powering offshore industries, a robust control system is essential for maintaining system stability under all feasible operating conditions. This paper reviews the control system design challenges for offshore DC MGs, considering variations in generation output and in load characteristics. This review summarises the current state and technical challenges of control system design for offshore DC MGs and provides perspectives on how to address these challenges.**

Keywords— **Challenge, control, microgrid, offshore.**

Part of a special issue for ICOE 2024. Manuscript submitted 27 June 2025; Accepted 4 September 2025. Published 13 April 2026.

The authors express gratitude for financial assistance from the Blue Economy Cooperative Research Centre, which was founded and is financed by the Australian Government's CRC Programme, grant number CRC-20180101. The CRC Programme facilitates industry-driven partnerships among industry, researchers, and the community.

Alamgir Hossain, Michael Negnevitsky, Xiaolin Wang, Evan Franklin, Waqas Hassan, and Pooyan Alinaghi Hosseinabadi are with the Centre for Renewable Energy and Power Systems, University of Tasmania, Hobart, Tasmania, Australia, 7005

Md. Alamgir Hossain and Evan Grey are with the Queensland Micro and Nanotechnology Centre, Griffith University, Nathan, Brisbane, Australia, 4111

Digital Object Identifier: https://doi.org/10.36688/imej.8.459-464

I. INTRODUCTION

THE idea of integrating various distributed renewable energy sources (DRESs), such as wind, solar, tidal, wave, fuel cell, and hydrogen, and energy storage systems, such as batteries and supercapacitors, into a low- or medium-voltage power system to meet power demand is called a microgrid (MG). It is also able to operate in either isolated or grid-connected mode [1]. Depending on the type of electrical structure, there are three primary groups into which MGs can be classified: AC MG, DC MG, and hybrid MG. Each type of MG has its own merits and is suitable for different applications.

Despite significant improvements in the performance of AC MGs, DC MGs have emerged as a more alternative choice for future energy systems owing to their higher efficiency potential, natural interface for integrating many DRESs, compatibility with modern electronic devices, and lack of skin effect, frequency, and reactive power flow issues [2, 3]. DC MGs show a potential solution for powering offshore industries, providing a reliable, efficient, and cleaner alternative to existing traditional power systems. These industries, being located far from the shore, experience high costs and complexity in transmitting power from the mainland [4]. Consequently, these industries require their own power generation systems to meet their power demands. At present, offshore industries predominately depend on fossil fuel-based power generation, which notably harms the marine environment [5].

DC MGs operate based on multiple power electronic converters. A control approach for each converter is essential to maintaining the voltage on the DC bus within a specified range, depending on the applications. Droop control serves as a widely adopted method for controlling the DC bus voltage, facilitating power distribution among converters and independent of digital communication links [6]. However, selecting a proper droop coefficient is a challenging task. A low droop coefficient can result in poor load sharing among the power converters. Conversely, while a large droop coefficient improves load sharing, it may lead to a significant voltage deviation. A new current sharing control approach is proposed with a droop control to obtain accurate load sharing among droop-controlled converters [7]. In [8], a voltage and current control approach has been presented that incorporates droop control, ensuring precise voltage on the DC bus and accurate power sharing among converters for offshore DC MGs. An ACM-based cascaded control is suggested to control the voltage on the DC bus and maintaining system's stability during disturbances [9]. Offshore DRESs are highly intermittent in nature and often use constant power loads (CPLs) and pulse power loads (PPLs), affecting system stability [10]. In DC MGs, multiple DC-DC power converters operate in series or parallel; their operating frequencies can superimpose on the DC bus bar frequency, which could have disastrous effects such as power oscillations [11]. These oscillations may destroy or weaken the sensitive devices and compromise the system's security. A damping-based control approach is designed to mitigate the power oscillations in DC MGs [12]. Most research works in the field of MGs are centred on DC MGs, with limited consideration given to their application in offshore industries, especially in attention to variable offshore power generations and offshore specialised loads.

This paper aims to review recent research on control system design in DC MGs, particularly considering offshore challenges, and explores future research trends to address these challenges.

II. OFFSHORE DC MICROGRID CONFIGURATION

An example of a typical structure of a DC MG network, considering an offshore platform, is shown in Fig. 1, incorporating various DRESs, ESDs, and loads. Solar panels are a mostly common and widely used source as a form of DRESs in both offshore and onshore platforms that convert sunlight into electricity. The solar panel has intermittent characteristics, highly depends on weather conditions. Many academics have suggested methods to track the solar panel's maximum power point in order to collect the most amount of energy possible [13].

Wind turbines are typically mounted with AC generators to produce electricity. However, permanent magnet DC generators can be used as wind power generators, especially suitable for offshore DC MGs [14]. This system is more reliable for offshore settings than traditional wind turbines in terms of cost, loss, and reliability. Ocean sustainable energy sources, such as tidal, ocean thermal energy, and wave are the most promising DRESs. Among them, the wave has the highest potential to harvest electricity because of its higher power density, low variability, greater forecastability, and consistency [15]. Floating wave energy converters (WECs), especially designed for offshore platforms, present the greatest potential for powering offshore platforms. However, this source of energy is currently less matured as compared to other renewable sources, such as solar and wind, indicating further extensive research to maximise their operational reliability and enhance their efficiency. Ref. [15] presented the generation profile of a single WEC at two different positions, revealing significant fluctuations in a short time, as illustrated in Fig. 2 (a). This fluctuating nature of WECs output may pose voltage fluctuations and reduce the power quality significantly. Integrating ESDs, such as batteries, fuel cells, supercapacitors, and superconducting magnetic devices, into WECs may be an effective solution to address these challenges in the output of WECs [16]. Fig. 2 (b) illustrates that integrating multiple WECs into an array can achieve a moderately constant output power A larger array with more WECs may deliver better smoothing of the output power. However, this method could increase its size, cost, and complexity, including potential impacts on marine life and navigation.

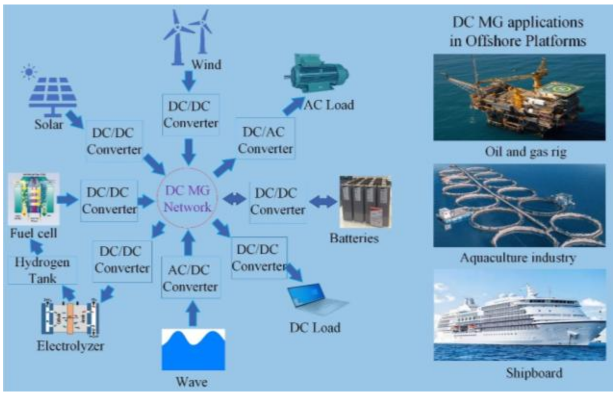
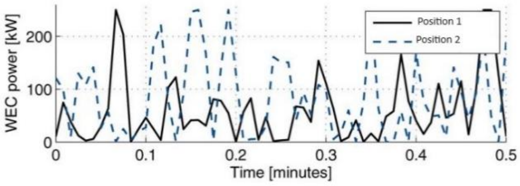
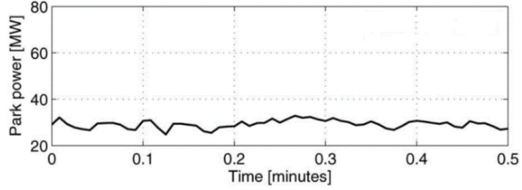


Fig. 1. A typical structure of DC MG for offshore industries.



(a) Output of a single WEC

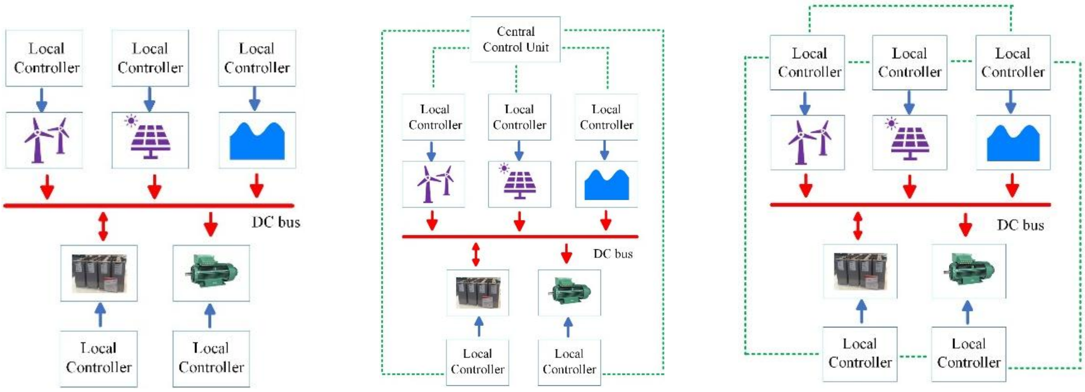


(b) Output of an array of multiple WECs

Fig. 2. Power generation profiles of wave energy sources [15]

Integrating hydrogen technology and ESDs into offshore DC MGs introduces a promising solution for balancing power generation and demand [17]. It is easy to store hydrogen for a long time and facilitate its export for application in various sectors, including hydrogen fuel-powered buses and vessels, aerospace, and industrial domains. Batteries are used as a backup generator instead of the diesel engine of traditional offshore DC MGs [5]. Batteries can respond very fast during disturbances, offering a reliable power supply and preventing prospective power outages [3].

Offshore DC MGs are capable of supplying electricity to AC and DC loads. Offshore loads have their own unique characteristics. For example, these industries use different variable frequency drives (VFDs), DC motor drives, pulse lasers, radar and navigation systems, propulsion motors, water pumps, equipment for aeration,



(a) Decentralised control (b) Centralised control (c) Distributed control

Fig. 3. Control strategies of DC MGs

heating, cooling, and feeding systems, modern monitoring equipment, and LED lighting [10]. Most of the loads behave like CPLSs and PPLs, posing significant voltage fluctuations and power quality issues [11].

III. CONTROL SYSTEM DESIGN FOR OFFSHORE DC MICROGRIDS

Offshore DC MGs must have an effective control system that controls the penetration and management of DRESs and ESDs, maintains power quality and stability, and improves resiliency of the system against harsh marine environments [3]. The control system significantly contributes to autonomous operation by optimising power distribution and consumption. Additionally, multiple power converters connect different DRESs, ESDs, and loads in DC MGs, necessitating a control system to maintain the voltage at the output terminal of each converter. The existing literature related to the control system design of DC MGs identifies three principal control strategies based on the communication requirements among converters: decentralised, centralised, and distributed [3]. The decentralised control strategy involves local levels, generating control outputs according to local voltage or current measurements, as shown in Fig. 3 (a). Since there are no communication links used, this strategy naturally faces performance limitations due to the absence of information exchange among different units. Furthermore, these methods typically rely on measuring the DC bus voltage, whose effectiveness and reliability are heavily affected by the accuracy of voltage sensors [18].

In a centralised control strategy, a single controller is centrally designed to collect information from all local controllers to achieve control objectives and then sends control outputs back to each local controller, as depicts in Fig. 3 (b). This strategy offers the excellent foundation for implementing advanced control functionalities, as all information is gathered and processed in a central control unit, providing strong observability and controllability of the entire system. However, the main demerit is its weakness at a single point of failure [19]. Additionally, other drawbacks of this method include low scalability and modularity, expensive, and inadequate fault tolerance ability [20].

The distributed control strategy merges the positive features of both centralised and decentralised control strategies, using a communication network that facilitates information exchange among local controllers to make decisions, as shown in Fig. 3 (b). The fundamental benefit of this strategy is that it can continue operation even if some communication links fail [21]. However, the main limitation of this method is the complexity concerned in analytical performance analysis [20]. Each control strategy has its own merits and demerits, as summarised in Table I. These control strategies can be adopted in the design of control systems for DC MGs in offshore industries according to the complexity of the structure, size, operational flexibility, and specific features of generation and load profiles [19].

TABLE I

SUMMARY OF DECENTRALISED, CENTRALISED, AND DISTRIBUTED CONTROL STRATEGY [18-21]

Features	Decentralised	Centralised	Distributed
Communication network	No	Yes	Yes
Control decision	local	global	local
Communication complexity	Not required	Low	High
Design complexity	Simple	Complex	Simple
Computational cost	Low	High	Medium
Scalability	High	Low	High
Functional reliability	High	Low	Medium
Flexibility	Very High	Low	High
Implementation difficulty	Easy	Difficult	Easy
Cost effectiveness	Economic	Costly	Cost effective

Decentralised, centralised, and distributed control strategies can be designed in a hierarchical manner to increase the system's performance and reliability [19], as shown in Fig. 4. A hierarchical configuration for control strategies featuring three levels: primary, secondary, and tertiary, is designed not only to effectively accomplish the control goals, such as voltage restoration and power allocation, but also to optimise power generation, load demands, and energy management [10]. The primary control level is designed to monitor the local units, maintain voltage, and current levels, and balance power among converters. The secondary control level acts as an intermediary between the primary level and tertiary level, addressing voltage or current deviations introduced by the primary controller, improving power sharing accuracy, and coordinating among different units. The main objective of designing the tertiary control level is overall monitoring, such as load and generation forecasting, decision-making, cost analysis, and load shedding based on priorities, optimising overall system performance.

AC MGs are currently leading the electricity market, while DC MGs represent a new research area. Initially, a detailed analysis is needed to identify whether control systems designed for conventional DC MGs are adaptable to offshore environments, which have distinctive generation and load characteristics. Thus, designing control systems, particularly for offshore DC MGs, presents an urgent and significant challenge. To date, only a limited number of studies has been presented, considering the specific requirements of offshore DC MGs.

A PI-based distributed control [22] and a decentralised grid-forming control [23] for frequency and voltage regulation have been suggested for a wind farm located in offshore environment, connecting it to the mainland utility grid through a diode-based high voltage DC network. A decentralised droop control approach for voltage regulation is designed to control the output voltage of a wind firm for powering the offshore oil industry [24]. Moreover, an adaptive droop-based voltage control method is introduced to regulate the output voltage of converters in an offshore wind farm, complemented by a model predictive-based secondary controller designed to minimise voltage fluctuations [25]. An adaptive inertia-transferring control approach has been developed using bidirectional virtual inertia for offshore oil rigs in [26]. A PI-based pitch-angle control system has been developed to analyse the system's stability of a tidal power generator [27]. An ocean renewable energy-based offshore MG is modelled, and stability is analysed by designing a PID-based decentralised damping control approach [28].

For efficient coordination of power generation and demand in a seawater desalination unit, a distributed fuzzy logic-based energy dispatch approach has been proposed in [29]. An advanced distributed control approach based on droop characteristics has been suggested for a hybrid offshore MG to regulate the frequency and voltage, ensuring that the suggested controller shares accurate power among DGs connected in parallel [30]. A PI-based control approach to regulate the voltage at the output terminal of each converter in a hybrid offshore MG has been proposed in [31], integrating wave and wind energy sources, and then power is transferred to the mainland distribution network.

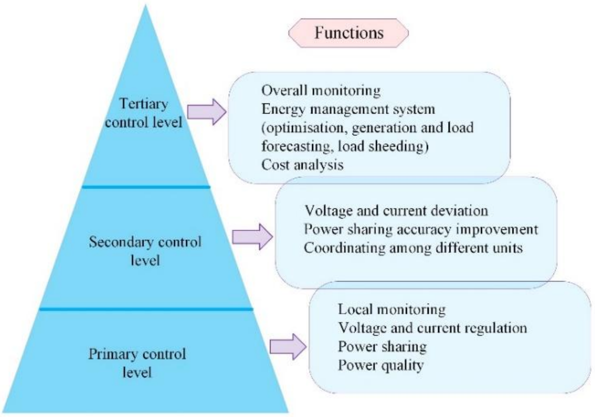


Fig. 4. Hierarchical control approach in offshore DC MGs.

Until this, as discussed in the mentioned articles, storage systems remained unconsidered, leading to the continued use of conventional engines, continuing environmental emissions. Moreover, these articles appear to be of limited concern for DC MGs, despite their substantial benefits over conventional AC MGs. A few studies have proposed DC and hybrid MGs for offshore settings. A gas-based power station with batteries and hydrogen technology has been suggested in [32]. A distributed control strategy based on PI controllers [33] and a two-layer control [34] have been designed to regulate the DC bus voltage designed for offshore applications. A hybrid MG for offshore platforms has been presented in [35], where a novel optimal fractional order fuzzy PD+I-based control approach is proposed to control the load frequency in a shipboard power system.

The summary of different control strategies used in offshore MGs is presented in Table II, including MG configurations, control levels, applications, and types of MG. Considering the control strategies, a decentralised method is appropriate for large-scale DC MGs for offshore platforms at the primary level. A centralised method is employed to design secondary level for small-scale compact DC MGs in offshore environments. If the offshore DC MGs are connected with multiple DGs, a distributed control strategy is most appropriate at the primary level. Lastly, a tertiary level can be considered for offshore DC MGs, including energy management systems, load forecasting, and generation forecasting.

IV. TECHNICAL CHALLENGES OF OFFSHORE DC MICROGRIDS AND POSSIBLE SOLUTIONS

This section discusses the technical challenges concerned in designing control systems for offshore DC MGs and suggests prospective solutions to address these challenges towards sustainable and efficient DC MG networks for offshore platforms.

TABLE II

SUMMARY OF CONTROL SYSTEMS FOR OFFSHORE PLATFORMS

Control strategies	Configurations	Control levels	Applications	MG types	Reference
Decentralised	Standalone DG	Primary, secondary	Grid connected	AC	[23]
		Primary	Offshore	AC	[24]
		Primary	Offshore	AC	[26]
		Primary	Grid connected	AC	[27]
	Multiple DGs	Primary	Grid connected	AC	[28]
	Standalone DG with storage systems	Primary, tertiary	Offshore	DC	[32]
	Multiple DGs with storage systems	Primary, tertiary	Offshore	DC	[34]
Centralised	Standalone DG	Primary, Secondary	Grid connected	AC	[25]
Distributed	Standalone DG	Primary	Grid connected	AC	[22]
	Multiple DGs	Tertiary	Offshore	Hybrid	[29]
		Primary	Offshore	Hybrid	[30]
		Primary	Grid connected	Hybrid	[31]
	Multiple DGs with storage systems	Primary	Offshore	DC	[33]
		Primary	Offshore	Hybrid	[35]

A. *Variations in output of power generation*

Offshore DC MGs experience fluctuations in the generation output because they are highly dependent on weather conditions. For example, clouds can cover the solar panels, wind speed can impact the output power generation of the wind turbines, and wave height can affect the power generation of wave energy converters. These variations in power generation can cause the system to become unstable. Employing sophisticated forecasting algorithms, such as machine learning, reinforcement learning, convolutional neural networks (CNNs), and neuro-fuzzy logic, can be the best option to predict energy more accurately. Moreover, integrating ESDs can address these challenges, providing fast responses during sudden changes in power generation.

B. *Load profiles*

Maintaining the stability of offshore DC MGs with a wide range of load profiles poses a significant challenge. Designing advanced, intelligent, and efficient load management systems based on load priorities can help mitigate these issues. Furthermore, these load management algorithms also ensure a balance between power generation and load demands.

C. *Voltage fluctuations and stability*

The DC bus voltage may fluctuate because of the intermittent characteristics of DRESs and variable load demands. Offshore MGs are not connected to the main grid, posing voltage instability issues because of lower inertia. This can cause sensitive equipment failures or malfunctions, which is very expensive and dangerous, especially in offshore settings. Designing a robust voltage control system can help to regulate the DC bus voltage within acceptable ranges, ensuring system's stability.

D. *Energy storage management*

Integrating various ESDs makes the system more complex. To optimise the lifespan of these devices, charging and discharging cycles are carefully maintained. To address these challenges, advanced and intelligent energy management systems (EMSs) would be the best solution to maximise the performance of ESDs. These EMSs can predict power generations and load demands, managing storage units accordingly to prevent overcharging or over-discharging.

E. *Power quality:*

Offshore industries often use highly sensitive loads that require high-quality power to operate efficiently. Otherwise, power quality issues, such as current and voltage harmonics, can increase losses and negatively impact the lifespan and operating conditions of electrical components. Offshore DC MGs are highly dependent on high switching power converters, variable generations, and unique load profiles that can influence power quality. Thus, careful consideration is essential when designing control systems for offshore DC MGs to maintain power quality standards.

V. CONCLUSION

This review highlights current research into the design of control systems for offshore DC MGs. Three control coordination strategies are analysed: decentralised, centralised, and distributed. Each strategy has its own advantages and disadvantages; however, a review of the literature reveals that the distributed strategy is typically the most appropriate approach for offshore DC MGs that consists of multiple generation sources and storage. The main technical challenges have been assessed, including effectively managing generation and load variations, handling voltage variations and ensuring stability, energy storage management, and power quality. Addressing these technical challenges is critical for enabling efficient and reliable offshore DC MGs. Advanced and robust control systems are needed to adapt to dynamic offshore environments. Prospective research must focus on overcoming these challenges to fully leverage renewable energy-based DC MGs, enhancing sustainability and energy security for offshore industries.

REFERENCES

[1] M. A. Hossain, H. R. Pota, M. J. Hossain, and F. Blaabjerg, "Evolution of microgrids with converter-interfaced generations: Challenges and opportunities," International Journal of Electrical Power & Energy Systems, vol. 109, pp. 160-186, 2019.

[2] D. Kumar, F. Zare, and A. Ghosh, "DC microgrid technology: system architectures, AC grid interfaces, grounding schemes, power quality, communication networks, applications, and standardizations aspects," Ieee Access, vol. 5, pp. 12230-12256, 2017.

[3] T. Dragičević, X. Lu, J. C. Vasquez, and J. M. Guerrero, "DC microgrids—Part I: A review of control strategies and stabilization techniques," IEEE Transactions on power electronics, vol. 31, no. 7, pp. 4876-4891, 2015.

[4] Q. Meng, H. Gao, Z. Zhong, and Q. Guan, "Safety analysis of offshore platform power system considering low voltage crossing capability," IEEE Access, vol. 8, pp. 140621-140631, 2020.

[5] W. Hassan, E. Semshikov, M. Negnevitsky, and M. A. Hossain, "Stability Assessment of Renewable Energy-Based DC Microgrids for Offshore Applications," in 2022 4th International Conference on Smart Power & Internet Energy Systems (SPIES), 2022: IEEE, pp. 1403-1407.

[6] S. Peyghami, H. Mokhtari, P. C. Loh, P. Davari, and F. Blaabjerg, "Distributed primary and secondary power sharing in a droop-controlled LVDC microgrid with merged AC and DC characteristics," IEEE Transactions on Smart Grid, vol. 9, no. 3, pp. 2284-2294, 2016.

[7] A. Kirakosyan, E. F. El-Saadany, M. S. El Moursi, A. H. Yazdavar, and A. Al-Durra, "Communication-free current sharing control strategy for DC microgrids and its application for AC/DC hybrid microgrids," IEEE Transactions on Power Systems, vol. 35, no. 1, pp. 140-151, 2019.

[8] F. Guo, L. Wang, C. Wen, D. Zhang, and Q. Xu, "Distributed voltage restoration and current sharing control in islanded DC microgrid systems without continuous communication," IEEE Transactions on Industrial Electronics, vol. 67, no. 4, pp. 3043-3053, 2019.

[9] A. Hossain et al., "Comparative Study of Different Controllers for Offshore DC Microgrids," in 2023 IEEE Fifth International Conference on DC Microgrids (ICDCM), 2023: IEEE, pp. 1-6.

[10] L. Xu et al., "A review of DC shipboard microgrids—Part II: Control architectures, stability analysis, and protection schemes," IEEE Transactions on Power Electronics, vol. 37, no. 4, pp. 4105-4120, 2021.

[11] M. Habibullah, N. Mithulananthan, K. N. Bhumkittipich, and M. Amin, "A comprehensive investigation on high-frequency oscillation in DC microgrid," IEEE Access, vol. 9, pp. 54850-54861, 2021.

[12] Y.-C. Jeung, D.-C. Lee, T. Dragičević, and F. Blaabjerg, "Design of passivity-based damping controller for suppressing power oscillations in DC microgrids," IEEE Transactions on Power Electronics, vol. 36, no. 4, pp. 4016-4028, 2020.

[13] A. Hossain et al., "Small-signal Stability Analysis of Offshore DC Microgrids," in 2023 IEEE International Conference on Energy Technologies for Future Grids (ETFG), 2023: IEEE, pp. 1-6.

[14] N. Holtsmark, H. J. Bahirat, M. Molinas, B. A. Mork, and H. K. Hoidalen, "An all-DC offshore wind farm with series-connected turbines: An alternative to the classical parallel AC model?," IEEE Transactions on industrial Electronics, vol. 60, no. 6, pp. 2420-2428, 2012.

[15] T. K. Brekken, H. T. Ozkan-Haller, and A. Simmons, "A methodology for large-scale ocean wave power time-series generation," IEEE Journal of Oceanic Engineering, vol. 37, no. 2, pp. 294-300, 2012.

[16] W. Yu, R. Ma, D. Xu, L. Huang, and S. Wang, "A Novel Multiport Hybrid Wave Energy System for Grid-Connected and Off-Grid Applications," Sustainability, vol. 15, no. 3, p. 2175, 2023.

[17] H. Yang, Q. Li, S. Zhao, W. Chen, and H. Liu, "A hierarchical self-regulation control for economic operation of AC/DC hybrid microgrid with hydrogen energy storage system," IEEE Access, vol. 7, pp. 89330-89341, 2019.

[18] M. Ahmed, L. Meegahapola, A. Vahidnia, and M. Datta, "Stability and control aspects of microgrid architectures–a comprehensive review," IEEE access, vol. 8, pp. 144730-144766, 2020.

[19] K. Bhargavi, N. Jayalakshmi, D. Gaonkar, A. Shrivastava, and V. K. Jadoun, "A comprehensive review on control techniques for power management of isolated DC microgrid system operation," IEEE access, vol. 9, pp. 32196-32228, 2021.

[20] F. Nawaz, E. Pashajavid, Y. Fan, and M. Batool, "A Comprehensive Review of the State-of-the-Art of Secondary Control Strategies for Microgrids," IEEE Access, 2023.

[21] E. Espina, J. Llanos, C. Burgos-Mellado, R. Cardenas-Dobson, M. Martinez-Gomez, and D. Saez, "Distributed control strategies for microgrids: An overview," IEEE Access, vol. 8, pp. 193412-193448, 2020.

[22] R. Blasco-Gimenez, S. Ano-Villalba, J. Rodríguez-D'Derlée, F. Morant, and S. Bernal-Perez, "Distributed voltage and frequency control of offshore wind farms connected with a diode-based HVdc link," IEEE Transactions on Power Electronics, vol. 25, no. 12, pp. 3095-3105, 2010.

[23] A. Bidadfar, O. Saborío-Romano, N. A. Cutululis, and P. E. Sørensen, "Control of offshore wind turbines connected to diode-rectifier-based HVdc systems," IEEE Transactions on Sustainable Energy, vol. 12, no. 1, pp. 514-523, 2020.

[24] A. R. Årdal, T. Undeland, and K. Sharifabadi, "Voltage and frequency control in offshore wind turbines connected to isolated oil platform power systems," Energy Procedia, vol. 24, pp. 229-236, 2012.

[25] S. Huang, Q. Wu, W. Liao, G. Wu, X. Li, and J. Wei, "Adaptive droop-based hierarchical optimal voltage control scheme for VSC-HVdc connected offshore wind farm," IEEE Transactions on Industrial Informatics, vol. 17, no. 12, pp. 8165-8176, 2021.

[26] J. Wang, W. Huang, N. Tai, M. Yu, R. Li, and C. Li, "An Adaptive Inertia Transferring Control Scheme for Interconnected Offshore-Platform Microgrids," IEEE Transactions on Power Delivery, 2023.

[27] L. Wang and C.-N. Li, "Dynamic stability analysis of a tidal power generation system connected to an onshore distribution system," IEEE Transactions on Energy Conversion, vol. 26, no. 4, pp. 1191-1197, 2011.

[28] L. Wang, C.-Y. Lin, H.-Y. Wu, and A. V. Prokhorov, "Stability analysis of a microgrid system with a hybrid offshore wind and ocean energy farm fed to a power grid through an HVDC link," IEEE Transactions on Industry Applications, vol. 54, no. 3, pp. 2012-2022, 2017.

[29] X. Fang, Q. Yang, and W. Dong, "Fuzzy decision based energy dispatch in offshore industrial microgrid with desalination process and multi-type DGs," Energy, vol. 148, pp. 744-755, 2018.

[30] S. Rasool, K. M. Muttaqi, and D. Sutanto, "A novel configuration of a hybrid offshore wind-wave energy conversion system and its controls for a remote area power supply," IEEE Transactions on Industry Applications, vol. 58, no. 6, pp. 7805-7817, 2022.

[31] S. Rasool, K. M. Muttaqi, and D. Sutanto, "An Investigation on the Integration of a Hybrid Offshore Wind-Wave Energy Conversion System with the Distribution Network," IEEE Transactions on Industry Applications, 2023.

[32] X. Zhu, Y. Wang, C. Liu, N. Hou, Y. Li, and Z. Chen, "A Dual-Level Optimal Control Strategy for Offshore Microgrid Considering Efficiency and Operation Cost in Wide Load Range," IEEE Transactions on Power Electronics, 2024.

[33] W. Nassar, O. Anaya-Lara, and K. Ahmed, "Coordinating control of an offshore LVDC microgrid based renewable energy resources for voltage regulation and circulating current minimization," Energies, vol. 14, no. 12, p. 3384, 2021.

[34] N. Ali, X. Shen, H. Armghan, and Y. Du, "Hierarchical control combined with higher order sliding mode control for integrating wind/tidal/battery/hydrogen powered DC offshore microgrid," Journal of Energy Storage, vol. 82, p. 110521, 2024.

[35] M.-H. Khooban, T. Dragicevic, F. Blaabjerg, and M. Delimar, "Shipboard microgrids: A novel approach to load frequency control," IEEE Transactions on Sustainable Energy, vol. 9, no. 2, pp. 843-852, 2017.