Afro-Asian Journal of Scientific Research (AAJSR)
المجلة الأفروآسيوية للبحث العلمي (AAJSR)
E-ISSN: 2959-6505
Volume 2, Issue 1, January - March 2024, Page No: 245-254
Website: https://aajsr.com/index.php/aajsr/index
SJIFactor 2023: 3.908 | 0.51 :2023 (AIF) معامل التأثير العربي | ISI 2023: 0.337

Impacts of Renewable Energy Sources Integration on Charging Electric Vehicles

Mohamed Belrzaeg [1]*, Hassnen S. Snoussi [2]
[1] Department of Energy Systems Engineering, Karabuk University, Karabuk, Turkey
[2] Department of Electrical and Electronic Engineering, College of Technical Sciences Sebha, Sebha, Libya

*Corresponding author: mohamed.alrazgi86@gmail.com

Received: December 18, 2023	Accepted: February 11, 2024	Published: February 19, 2024

Abstract
Libya has a large potential for renewable energy due to its abundant sunshine and wind resources. Some renewable energy sources that Libya can harness are (solar, wind, and geothermal energy). The advanced growth in the transportation sector for using Electric Vehicles (EVs) made it popular among people to use hybrid electric vehicles instead of conventional cars. However, the transportation system become complex due to used components such as the integration of Renewable Energy Sources (RESs) into the grid for charging/discharging EVs, that is led to many challenges. The challenges of splitting the power between the thermal and electrical subsystems can be overcome by a supervisor's control method known as Energy Management Strategies (EMS), which results in the maximization of fuel economy and minimizing pollution. The acquired result is discussed in the result and discussion section. The RESs are capable of running systems with the integration of EVs.

Keywords: RESs, EV, EMS.

Cite this article as: M. Belrzaeg, H. S. Snoussi, "Impacts of Renewable Energy Sources Integration on Charging Electric Vehicles," *Afro-Asian Journal of Scientific Research (AAJSR),* vol. 2, no. 1, pp. 245–254, January - March 2024.

تأثيرات تكامل مصادر الطاقة المتجددة على شحن المركبات الكهربائية

محمد بالرازق [1]*، حسنين السنوسي الزين [2]
[1] قسم هندسة نظم الطاقة، جامعة كارابوك، كارابوك، تركيا
[2] قسم الهندسة الكهربائية والإلكترونية، كلية العلوم التقنية سبها، سبها، ليبيا

الملخص
تتمتع ليبيا بإمكانات كبيرة للطاقة المتجددة بسبب وفرة مواردها من أشعة الشمس والرياح. ومن مصادر الطاقة المتجددة التي يمكن لليبيا تسخيرها (الطاقة الشمسية وطاقة الرياح والطاقة الحرارية الأرضية). أدى النمو المتقدم في قطاع النقل لاستخدام السيارات الكهربائية إلى زيادة شعبية استخدام السيارات الكهربائية الهجينة بدلاً من السيارات التقليدية بين الناس. ومع ذلك، يصبح نظام النقل معقدًا بسبب المكونات المستخدمة مثل دمج مصادر الطاقة المتجددة (RESs) في الشبكة لشحن وتفريغ المركبات الكهربائية، مما يؤدي إلى العديد من التحديات. يمكن التغلب على تحديات تقسيم الطاقة بين الأنظمة الفرعية الحرارية والكهربائية من خلال طريقة تحكم المشرف المعروفة باسم استراتيجيات إدارة الطاقة (EMS)، والتي

تؤدي إلى تعظيم الاقتصاد في استهلاك الوقود وتقليل التلوث. تتم مناقشة النتيجة المكتسبة في قسم النتائج والمناقشة. إن **RESs** قادرة على تشغيل الأنظمة من خلال تكامل المركبات الكهربائية.

الكلمات المفتاحية: الطاقات المتجددة، السيارات الكهربائية، استراتيجيات إدارة الطاقة.

Introduction

The main problem with Renewable Sources (RS) is their unpredictability and the difficulties involved with regulating their generation [1]. The revolution of the transportation sector is rising among researchers by using different types of energy sources to meet a clean and protected environment [2], [3]. While using the integration operation between RESs with the grid, some of the challenges will be faced such as instability and low power due to the climatology changes [4]. To overcome the integration limitation by involving Battery (BT) through Energy Management Strategies (EMSs) to control and monitor the energy systems of RESs. Several types of RESs sources are used to produce energy such as Photovoltaic (PV), Fuel Cell (FC), Wind Turbine (WT), Tide and wave, and hydropower [5], [6]. The most exploited used RESs are three: PV [7], [8], FC [9], [10], and WT [11], [12] due to their easy installation, availability, and cost in comparison with other sources [13]. The mechanism of the aforementioned sources for producing electricity, PV is using the reflection of sunlight into the surface of the solar panel to produce DC energy with other electric components[14]. Several types of photovoltaic solar panels (PV) such as monocrystalline, polycrystalline, and thin film used to produce electricity with the help of optimization tools [15], [16]. While wind turbines depend on the kinetic energy by rotating the wind to produce Alternative Current (AC) energy with the help of other devices. Whereas the fuel cell is classified into seven types as reported in [17], [18], [19], [20][21].

As a microgrid can be classified into two forms, on-grid and off-grid [22], [23]. The former is connecting to the utility grid and using it as a backup in case of the absence of the sun, wind, or battery [24]. While the latter is classified into two categories which are autonomous basic and autonomous full. Autonomous basic is not supplying the demand for the whole day whereas the autonomous full is supplying for the whole day [25]. Libya has a large potential for renewable energy due to its abundant sunshine and wind resources [26]. Libya's potential for renewable energy is enormous and mostly unrealized as illustrated in Figure 1 [27]. Nevertheless, the development of these resources has been hampered by political unrest and a lack of funding [28]. Some of the RESs that Libya can harness are solar energy, wind energy, and geothermal energy [14]. Libya has one of the highest solar irradiance levels in the world, making it a favorable location for solar energy projects [16]. Currently, there are several ongoing projects for solar power plants in Libya [29]. The coastal areas of Libya have strong wind resources that can be harnessed for wind energy [30]. In recent years, there have been efforts to establish wind power projects in the country [31]. While geothermal energy is ongoing research to explore this potential.

The article's contribution is to estimate the impact on the EV charging station considering various sources. Based on the supervisory control method (EMS), the power flow in the system is evaluated. The rest of the article is organized as follows: Section 2 is denoted for the case study along with the analysis of the collected data. Section 3 positioned the impact of the most widely exploited sources as PV and WT together with the proposed system diagram. The supervisory control that monitors the power flow in the system is presented in Section 4. A summary discussion of the acquired result is discussed in Section 5. Concluded with the acknowledgement and list of references.

Cases Study and Data Collection

Libya is an oil and gas-producing country located in the North of the African continent with almost six million inhabitants [32]. Based on the World Bank group, almost 99% of Libya is electricity covered, and based on the load demand collected data from the General Electricity Company of Libya (GECOL) as the supplier source for the case study is almost (6 MW) as shown in Figure 1 along with the population [33].

The amount of direct normal solar irradiation is presented in Figure 2 and the first 48 hours of the annual radiation data is shown in Figure 3 maximum radiation is 1000 (W/m^2) [34]. The monthly collected data for the ambient temperature of the case study is demonstrated in Figure 4 with a maximum temperature of 45 ºC in June followed by the wind speed data of the case study as displayed in Figure 5 with a higher value at 39:00 (12 m/s) [35].

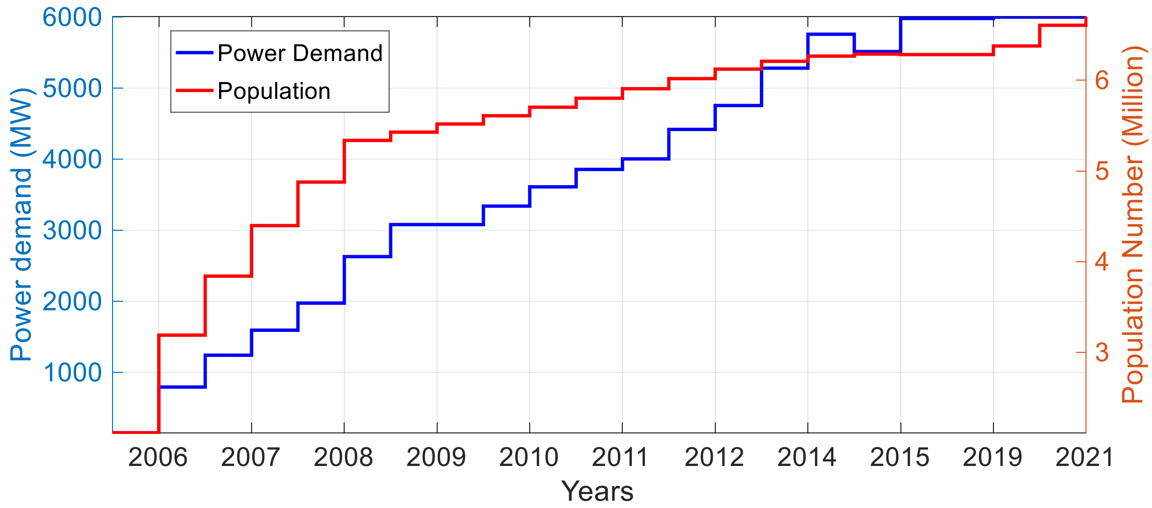

Fig. 1 Case study load demand and the population [14]

Considered PV and WT Integration Impacts

The integration of RESs into the grid system including with EVs causes impacts either positive or negative [36].

- PV Impacts:

One of the RES that produces zero-emission and environmentally friendly sources is Photovoltaic (PV), which uses the sun to obtain energy by reflecting the sunlight on the surface of the panel. Due to the obtained advantages of the integration system which integrates the RES (PV) into the network for charging EVs purposes such as EVs and PV can be installed closely, used EV as storage, and reduce the energy demand on the grid by obtaining the energy from PV system [37][38][39][40].

- WT Impacts:

Wind turbines can have both positive and negative impacts on Electric Vehicle (EV) integration systems. On the positive side, wind turbines can help to generate renewable energy that can be used to charge EVs [41]. This reduces the use of fossil fuels and decreases emissions from transportation [42]. In addition, wind turbines can be located near highways or other areas with high traffic volumes to help power charging stations for EVs [43]. However, wind turbines can also have negative impacts on EV integration systems [44]. For example, wind turbines can create a fluctuating power supply due to changes in wind speed, which can make it difficult to coordinate the charging and discharging of EV batteries [45]. This can also lead to issues with grid stability and reliability [46].

The location, capacity, and particular EV integration system being used are only a few of the variables that will affect how WT and PV will affect EV integration systems overall [35]. To ensure that RESs and EV integration systems can function together efficiently, proper planning and coordination are required [47].

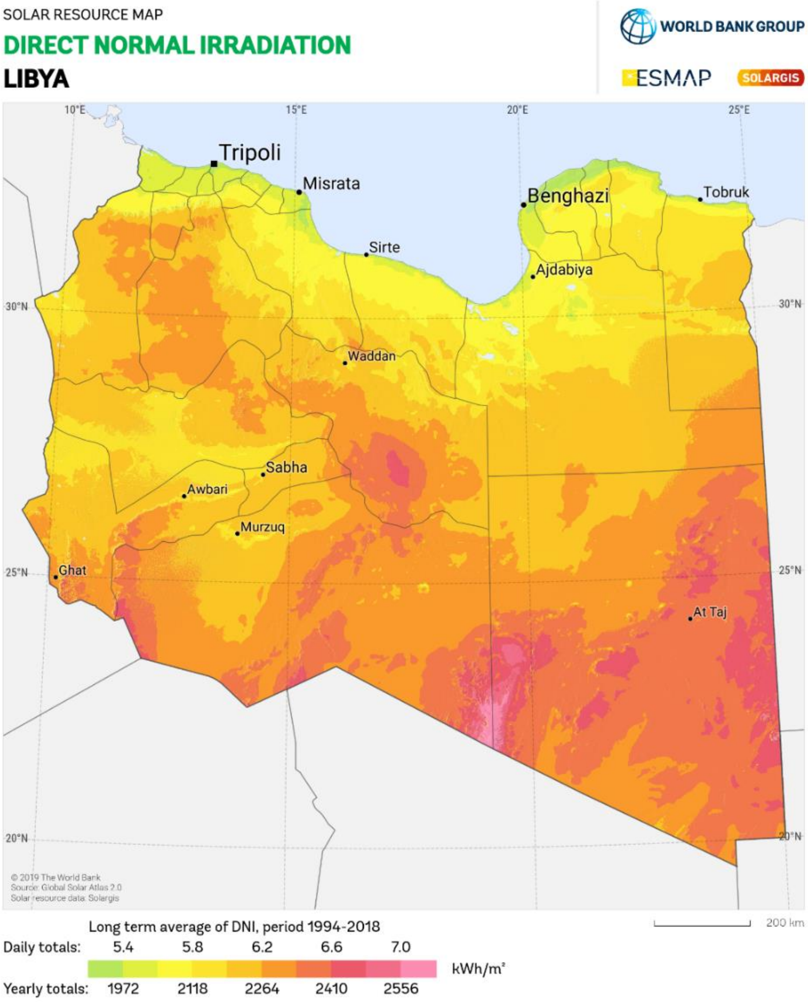

Fig. 2 Libya map [48]

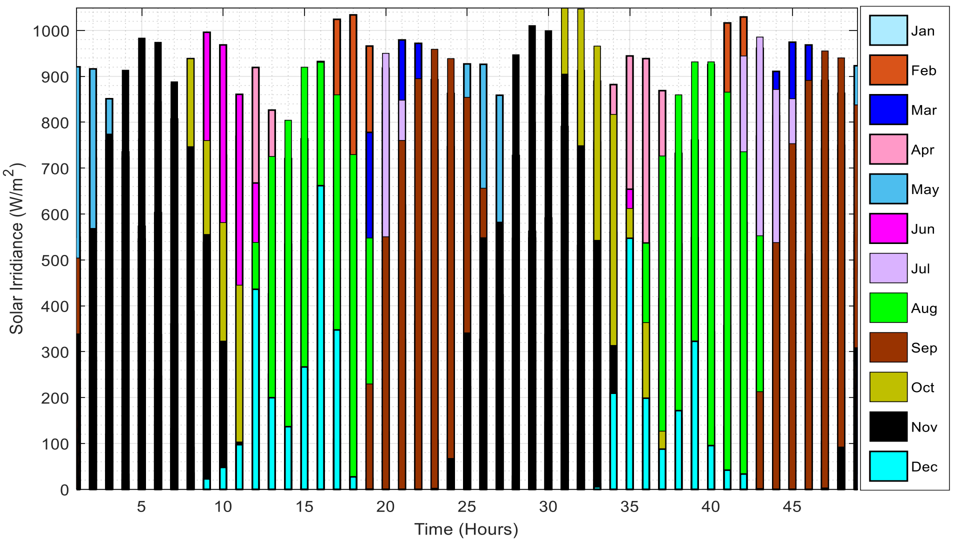

Fig. 3 Solar irradiance data of the case study.

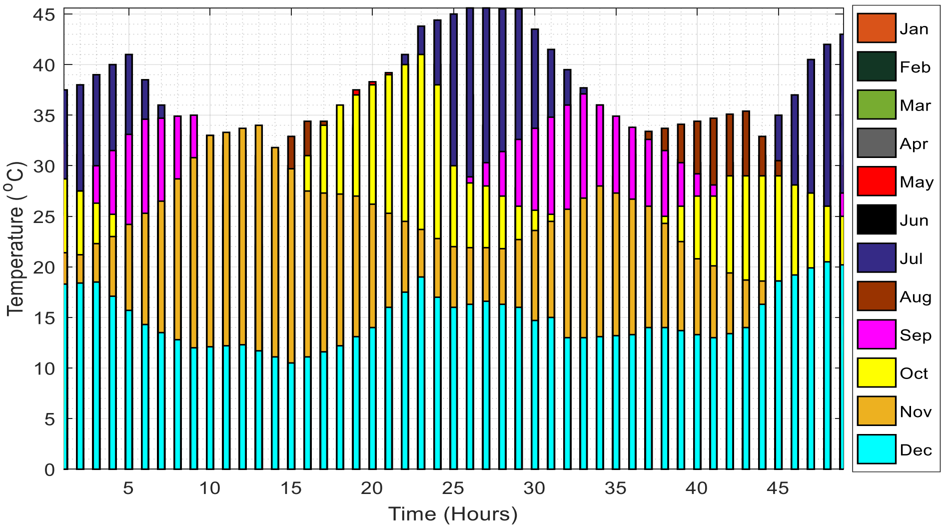

Fig. 4 Ambient temperature collected data of the case study.

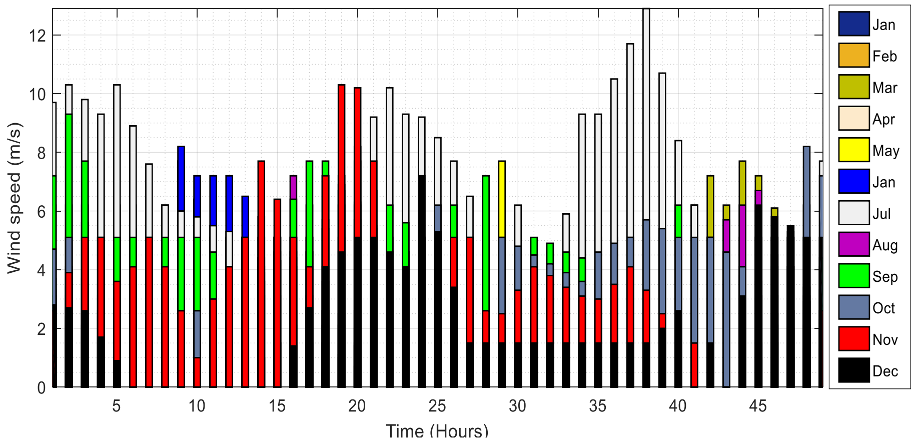

Fig. 5 Wind Speed data of the case study.

Energy Management Strategy

An energy management system (EMS) is a collection of instruments and procedures created to track and control energy use in industrial activities, buildings, and other facilities [49]. With the aid of EMS, businesses may use energy more efficiently, pay less for it, and raise their total energy effectiveness [50]. An EMS typically includes hardware and software components that measure, record, and analyze energy data from various sources such as meters, sensors, and control systems [51]. The system can be used to track energy usage patterns, identify energy conservation opportunities, and implement energy-saving measures such as adjusting and optimizing lighting, and managing equipment usage [52].

An effective EMS can help organizations to reduce their environmental footprint and improve their bottom line by lowering energy costs [53]. It can also enhance the overall performance of a building or facility by improving comfort, safety, and reliability [54].

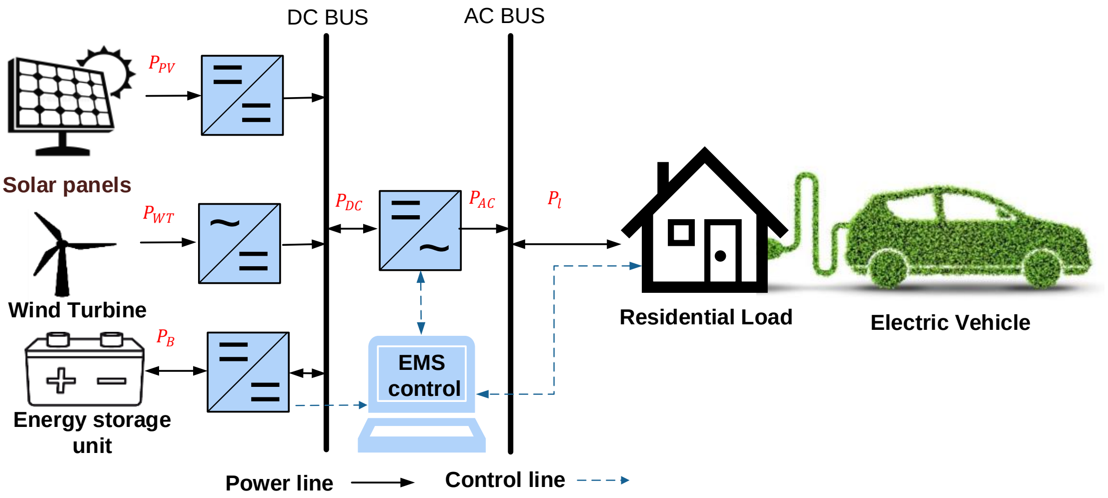

Fig. 6 Proposed System.

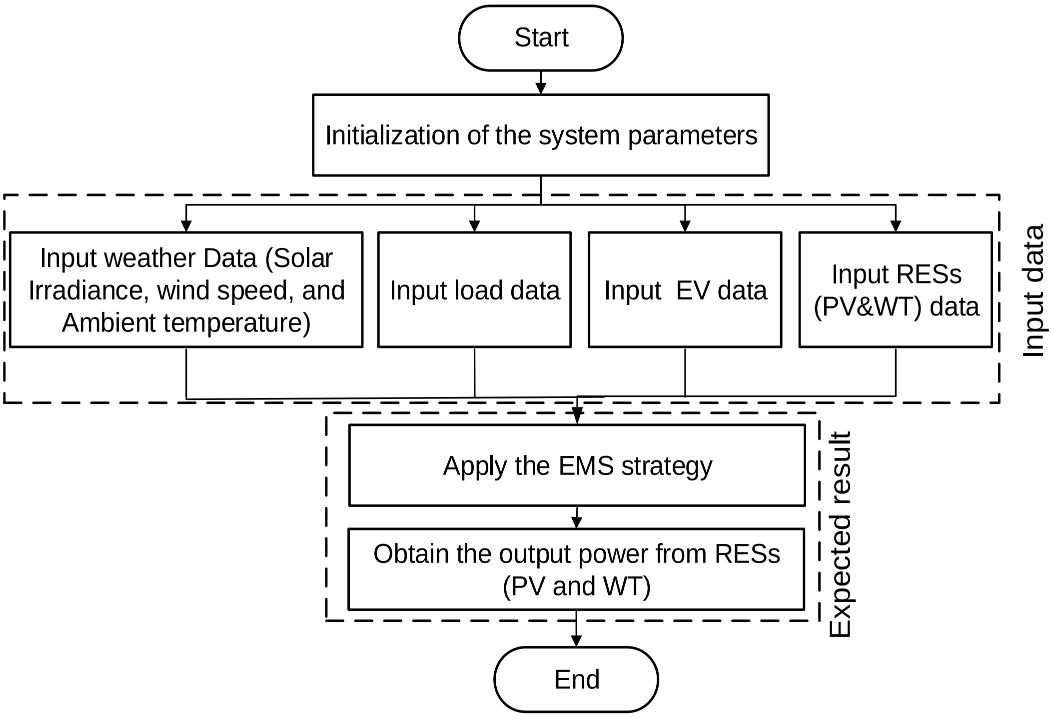

Fig. 7 Flowchart of proposed Energy Management Strategy

Results and Discussions

Based on the proposed microgrid system presented in Figure 6, the obtained result is discussed in this section. The acquired output power from the RESs for the period of 180 hours (a week) is demonstrated in Figure 8. The maximum output power obtained in hour 33 while the minimum output power 25. The variety in the power is due to the climatology changes in the exploited hours and through all the year. Simatinously, the obtained yielded power from then WT is presented in blue color with different outputs.

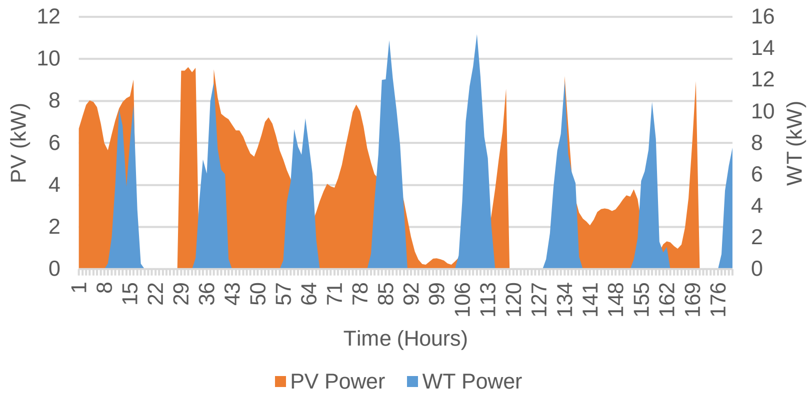

Fig. 8 Output power from the utilized RESs

Conclusion

The increasing adoption of electric vehicles (EVs) has the potential to significantly reduce greenhouse gas emissions and dependence on fossil fuels in transportation. However, the impact of EVs on the use of renewable energy sources depends on how the electricity used to power the vehicles is generated. If EVs are primarily charged using electricity generated from renewable energy sources such as wind, solar, and hydropower, then the use of EVs could lead to a substantial reduction in greenhouse gas emissions. In addition, the growth of the EV market could create new opportunities for renewable energy development and investment in infrastructure. On the other hand, if most of the electricity used to power EVs comes from fossil fuels, then the potential environmental benefits of EVs could be significantly reduced. Therefore, it is important to continue investing in and expanding the use of renewable energy sources to ensure that the growth of the EV market goes hand-in-hand with a shift towards cleaner energy.

References

[1] S. Habib, M. Kamran, and U. Rashid, "Impact analysis of vehicle-to-grid technology and charging strategies of electric vehicles on distribution networks - A review," *J Power Sources*, vol. 277, pp. 205–214, 2015, doi: 10.1016/j.jpowsour.2014.12.020.

[2] N. L. Panwar, S. C. Kaushik, and S. Kothari, "Role of renewable energy sources in environmental protection: A review," *Renewable and Sustainable Energy Reviews*, vol. 15, no. 3, pp. 1513–1524, Apr. 2011, doi: 10.1016/j.rser.2010.11.037.

[3] A. Q. Al-Shetwi, M. A. A. Hannan, K. P. Jern, M. Mansur, and T. M. I. M. I. Mahlia, "Grid-connected renewable energy sources: Review of the recent integration requirements and control methods," *J Clean Prod*, vol. 253, p. 119831, Apr. 2020, doi: 10.1016/j.jclepro.2019.119831.

[4] A. Demirci, S. M. Tercan, U. Cali, and I. Nakir, "A Comprehensive Data Analysis of Electric Vehicle User Behaviors Toward Unlocking Vehicle-to-Grid Potential," *IEEE Access*, vol. 11, pp. 9149–9165, 2023, doi: 10.1109/ACCESS.2023.3240102.

[5] R. H. Ashique, Z. Salam, M. J. Bin Abdul Aziz, and A. R. Bhatti, "Integrated photovoltaic-grid dc fast charging system for electric vehicle: A review of the architecture and control," *Renewable and Sustainable Energy Reviews*, vol. 69, no. December, pp. 1243–1257, Mar. 2017, doi: 10.1016/j.rser.2016.11.245.

[6] N. Sujitha and S. Krithiga, "RES based EV battery charging system: A review," *Renewable and Sustainable Energy Reviews*, vol. 75, no. July 2016, pp. 978–988, Aug. 2017, doi: 10.1016/j.rser.2016.11.078.

[7] M. S. Hossain and M. F. Rahman, "Hybrid solar PV/Biomass powered energy efficient remote cellular base stations," *International Journal of Renewable Energy Research*, vol. 10, no. 1, pp. 329–342, 2020.

[8] L. Tripathi, A. K. Mishra, A. K. Dubey, C. B. Tripathi, and P. Baredar, "Renewable energy: An overview on its contribution in current energy scenario of India," *Renewable and Sustainable Energy Reviews*, vol. 60. pp. 226–233, Jul. 2016. doi: 10.1016/j.rser.2016.01.047.

[9] L. Giorgi, "Fuel Cells: Technologies and Applications," *The Open Fuel Cells Journal*, vol. 6, no. 1, pp. 0–0, Jul. 2013, doi: 10.2174/1875932720130719001.

[10] J. J. C. Kopera, "Inside the Nickel Metal Hydride Battery," *Cobasys*, 2004.

[11] M. E. Khodayar, L. Wu, and M. Shahidehpour, "Hourly Coordination of Electric Vehicle Operation and Volatile Wind Power Generation in SCUC," *IEEE Trans Smart Grid*, vol. 3, no. 3, pp. 1271–1279, Sep. 2012, doi: 10.1109/TSG.2012.2186642.

[12] L. Liu, F. Kong, X. Liu, Y. Peng, and Q. Wang, "A review on electric vehicles interacting with renewable energy in smart grid," *Renewable and Sustainable Energy Reviews*, vol. 51, pp. 648–661, Nov. 2015, doi: 10.1016/j.rser.2015.06.036.

[13] H. Mehrjerdi, M. Bornapour, R. Hemmati, and S. M. S. Ghiasi, "Unified energy management and load control in building equipped with wind-solar-battery incorporating electric and hydrogen vehicles under both connected to the grid and islanding modes," *Energy*, vol. 168, pp. 919–930, 2019, doi: 10.1016/j.energy.2018.11.131.

[14] A. Alsharif *et al.*, "Impact of Electric Vehicle on Residential Power Distribution Considering Energy Management Strategy and Stochastic Monte Carlo Algorithm," *Energies (Basel)*, vol. 16, no. 3, p. 1358, Jan. 2023, doi: 10.3390/en16031358.

[15] N. Manoj Kumar, "Simulation Tools for Technical Sizing and Analysis of Solar PV Systems," in *6th World Conference on Applied Sciences, Engineering & Technology, UMPO, Indonesia*, 2017, p. 6.

[16] A. Alsharif, C. W. Tan, R. Ayop, K. Y. Lau, and C. L. Toh, "Sizing of Photovoltaic Wind Battery system integrated with Vehicle-to-Grid using Cuckoo Search Algorithm," in *2021 IEEE Conference on Energy Conversion (CENCON)*, IEEE, Oct. 2021, pp. 22–27. doi: 10.1109/CENCON51869.2021.9627291.

[17] A. Geetha and C. Subramani, "A comprehensive review on energy management strategies of hybrid energy storage system for electric vehicles," *International Journal of Energy Research*, vol. 41, no. 13. pp. 1817–1834, Oct. 25, 2017. doi: 10.1002/er.3730.

[18] W. Liu, "Hybrid Electric Vehicle System Modeling," in *Hybrid Electric Vehicle System Modeling and Control*, Chichester, UK: John Wiley & Sons, Ltd, 2017, pp. 38–96. doi: 10.1002/9781119278924.ch3.

[19] A. Kavousi-Fard and A. Khodaei, "Efficient integration of plug-in electric vehicles via reconfigurable microgrids," *Energy*, vol. 111, pp. 653–663, Sep. 2016, doi: 10.1016/j.energy.2016.06.018.

[20] Y. Huang, H. Wang, A. Khajepour, H. He, and J. Ji, "Model predictive control power management strategies for HEVs: A review," *J Power Sources*, vol. 341, pp. 91–106, 2017, doi: 10.1016/j.jpowsour.2016.11.106.

[21] Y. Huang, H. Wang, A. Khajepour, H. He, and J. Ji, "Model predictive control power management strategies for HEVs: A review," *J Power Sources*, vol. 341, pp. 91–106, Feb. 2017, doi: 10.1016/j.jpowsour.2016.11.106.

[22] A. Alsharif, A. Othman, M. Alsgear, F. Ben Kura, and I. Mahariq, "Utilization of Solar Power in Distributing Substation," *International Journal of Electronics and Electrical Engineering*, no. January, pp. 189–194, 2017, doi: 10.18178/ijeee.5.2.189-194.

[23] A. Alsharif, A. A. Ahmed, M. Khaleel, H. Hebrisha, and E. Almabsout, "Applications of Solar Energy Technologies in North Africa: Current Practices and Future Prospects," *International Journal of Electrical Engineering and Sustainability (IJEES)*, vol. 1, no. 3, pp. 164–174, 2023.

[24] E. Hossain, H. Faruque, Md. Sunny, N. Mohammad, and N. Nawar, "A Comprehensive Review on Energy Storage Systems: Types, Comparison, Current Scenario, Applications, Barriers, and Potential Solutions, Policies, and Future Prospects," *Energies (Basel)*, vol. 13, no. 14, p. 3651, Jul. 2020, doi: 10.3390/en13143651.

[25] L. M. Halabi and S. Mekhilef, "Flexible hybrid renewable energy system design for a typical remote village located in tropical climate," *J Clean Prod*, vol. 177, pp. 908–924, 2018, doi: 10.1016/j.jclepro.2017.12.248.

[26] M. Almaktar, A. M. Elbreki, and M. Shaaban, "Revitalizing operational reliability of the electrical energy system in Libya: Feasibility analysis of solar generation in local communities," *J Clean Prod*, vol. 279, p. 123647, 2021, doi: 10.1016/j.jclepro.2020.123647.

[27] H. S. Das, M. M. Rahman, S. Li, and C. W. Tan, "Electric vehicles standards, charging infrastructure, and impact on grid integration: A technological review," *Renewable and Sustainable Energy Reviews*, vol. 120, no. December, p. 109618, Mar. 2020, doi: 10.1016/j.rser.2019.109618.

[28] A. W. Thompson and Y. Perez, "Vehicle-to-Everything (V2X) energy services, value streams, and regulatory policy implications," *Energy Policy*, vol. 137, no. December 2019, p. 111136, Feb. 2020, doi: 10.1016/j.enpol.2019.111136.

[29] Md. R. H. Mojumder, F. Ahmed Antara, Md. Hasanuzzaman, B. Alamri, and M. Alsharef, "Electric Vehicle-to-Grid (V2G) Technologies: Impact on the Power Grid and Battery," *Sustainability*, vol. 14, no. 21, p. 13856, Oct. 2022, doi: 10.3390/su142113856.

[30] A. Alsharif, C. W. Tan, R. Ayop, M. N. Hussin, and A. L. Bukar, "Sizing Optimization Algorithm for Vehicle-to-Grid System Considering Cost and Reliability Based on Rule-Based Scheme," *ELEKTRIKA-Journal of Electrical Engineering*, vol. 21, no. 3, pp. 6–12, 2022, doi: 10.11113/elektrika.v21n3.353.

[31] A. M. A. A. Mohamed, A. Al-Habaibeh, and H. Abdo, "An investigation into the current utilisation and prospective of renewable energy resources and technologies in Libya," *Renew Energy*, vol. 50, no. February, pp. 732–740, Feb. 2013, doi: 10.1016/j.renene.2012.07.038.

[32] W. El-Osta and U. Elghawi, "Assessment of Energy Intensity Indicators in Libya: Case Study," *Sustainable Development Research (ISSN 2690-9898 e-ISSN 2690-9901)*, vol. 2, no. 1, p. p9, Mar. 2020, doi: 10.30560/sdr.v2n1p9.

[33] Y. F. Nassar, H. J. El-khozondar, A. A. Ahmed, A. Alsharif, M. M. Khaleel, and R. J. El-khozondar, "A new design for a built-in hybrid energy system , parabolic dish solar concentrator and bioenergy (PDSC / BG): A case study – Libya," *J Clean Prod*, vol. 441, no. January, p. 140944, 2024, doi: 10.1016/j.jclepro.2024.140944.

[34] A. Alsharif, C. W. Tan, R. Ayop, K. Y. Lau, and A. M. Dobi, "A rule-based power management strategy for Vehicle-to-Grid system using antlion sizing optimization," *J Energy Storage*, vol. 41, no. July, p. 102913, Sep. 2021, doi: 10.1016/j.est.2021.102913.

[35] A. Sharida, S. Bayhan, and H. Abu-Rub, "Enhancing Scalability of Fast Electric Vehicle Charging Stations: Solutions for AC–DC Side Integration and Regulation," *IEEE Open Journal of the Industrial Electronics Society*, vol. 4, pp. 720–731, 2023, doi: 10.1109/OJIES.2023.3349094.

[36] C. W. E. I. Tan, "Electric Vehicle Integration with Energy Sources : Problem and Solution Review".

[37] K. Mahmud, G. E. Town, S. Morsalin, and M. J. Hossain, "Integration of electric vehicles and management in the internet of energy," *Renewable and Sustainable Energy Reviews*, vol. 82, no. October 2016, pp. 4179–4203, Feb. 2018, doi: 10.1016/j.rser.2017.11.004.

[38] G. R. C. Mouli, P. Venugopal, and P. Bauer, "Future of electric vehicle charging," in *2017 International Symposium on Power Electronics (Ee)*, IEEE, Oct. 2017, pp. 1–7. doi: 10.1109/PEE.2017.8171657.

[39] A. Alsharif *et al.*, "Utilization of Solar Power in Distributing Substation," *International Journal of Electronics and Electrical Engineering*, vol. 5, no. 2, pp. 189–194, 2017, doi: 10.18178/ijeee.5.2.189-194.

[40] A. Tavakoli, S. Saha, M. T. Arif, M. E. Haque, N. Mendis, and A. M. T. Oo, "Impacts of grid integration of solar PV and electric vehicle on grid stability, power quality and energy economics: a review," *IET Energy Systems Integration*, vol. 2, no. 3, pp. 243–260, Sep. 2020, doi: 10.1049/iet-esi.2019.0047.

[41] A. Alsharif, W. Mazher, O. N. Uçan, and O. O. Bayat, "Optimization of Electrical Charging Station Capacity," *JOURNAL OF ENGINEERING SYSTEMS AND ARCHITECTURE*, vol. 1, no. 2, pp. 69–76, 2017.

[42] M. Khaleel *et al.*, "Effect of Fuel Cells on Voltage Sag Mitigation in Power Grids Using Advanced Equilibrium Optimizer and Particle Swarm Optimization," *Jordan Journal of Electrical Engineering*, vol. 9, no. 2, p. 175, 2023, doi: 10.5455/jjee.204-1669996684.

[43] M. M. Khaleel, T. Mohamed Ghandoori, A. Ali Ahmed, A. Alsharif, A. J. Ahmed Alnagrat, and A. Ali Abulifa, "Impact of Mechanical Storage System Technologies: A Powerful Combination to Empowered the Electrical Grids Application," in *2022 IEEE 2nd International Maghreb Meeting of the Conference on Sciences and Techniques of Automatic Control and Computer Engineering (MI-STA)*, IEEE, May 2022, pp. 628–636. doi: 10.1109/MI-STA54861.2022.9837670.

[44] A. A. Ahmed, A. A. Ahmed, A. S. D. Alarga, and A. Alsharif, "Simulation Research on Vehicle Handling and Stability Enhancement Based on PID Control Technology," in *Proceedings of 2021 IEEE International Conference on Power, Electrical, Electronic and Industrial Applications, PEEIACON 2021*, IEEE, Dec. 2021, pp. 10–15. doi: 10.1109/PEEIACON54708.2021.9930006.

[45] A. A. Ahmed, A. Alsharif, T. Triwiyanto, M. Khaleel, C. W. Tan, and R. Ayop, "Using of Neural Network-Based Controller to Obtain the Effect of Hub Motors Weight on Electric Vehicle Ride Comfort," *2022 IEEE 2nd International Maghreb Meeting of the Conference on Sciences and Techniques of Automatic Control and Computer Engineering, MI-STA 2022 - Proceeding*, pp. 189–192, 2022, doi: 10.1109/MI-STA54861.2022.9837608.

[46] A. Alsharif, A. Salem, D. Alarga, and A. A. Ahmed, "Stochastic Method and Sensitivity Analysis Assessments for Vehicle-to-Home Integration based on Renewable Energy Sources," *2023 IEEE 3rd International Maghreb Meeting of the Conference on Sciences and Techniques of Automatic Control and Computer Engineering (MI-STA)*, no. May, pp. 783–787, 2023, doi: 10.1109/MI-STA57575.2023.10169210.

[47] A. Alsharif, R. Y. Jomah, A. Alshareef, M. Almihat, A. Salah, and A. Al Smin, "Hybrid Systems Renewable Energy Based Street Lighting Planning: A Case Study," *African Journal of Advanced Pure and Applied Sciences (AJAPAS)*, vol. 1, no. 1, pp. 31–40, 2022.

[48] WDI, "World Bank indicator." Accessed: Sep. 05, 2019. [Online]. Available: https://data.worldbank.org.products/wdi

[49] A. Alsharif, C. W. Tan, R. Ayop, M. N. Hussin, and A. L. Bukar, “Sizing Optimization Algorithm for Vehicle-to-Grid System Considering Cost and Reliability Based on Rule-Based Scheme,” *ELEKTRIKA-Journal of Electrical Engineering*, vol. 21, no. 3, pp. 6–12, 2022, doi: 10.11113/elektrika.v21n3.353.

[50] A. A. Ahmed, A. Sami, A. Alsharif, A. S. D. Alarga, J. Santhosh, and A. Albagul, “Evaluation of Electric Vehicle Stability Using Fractional PID and Fuzzy PID Based Controllers,” in *2022 IEEE 2nd International Maghreb Meeting of the Conference on Sciences and Techniques of Automatic Control and Computer Engineering (MI-STA)*, IEEE, May 2022, pp. 116–120. doi: 10.1109/MI-STA54861.2022.9837532.

[51] A. A. Ahmed, “Suspension System Modelling And Control For An Electric Vehicle Driven by In-Wheel Motors,” *2021 IEEE International Conference on Robotics, Automation, Artificial-Intelligence and Internet-of-Things (RAAICON)*, pp. 1–5, 2021, doi: 10.1109/RAAICON54709.2021.9929611.

[52] A. Alsharif, A. A. Ahmed, M. M. Khaleel, A. S. Daw Alarga, O. S. M. Jomah, and I. Imbayah, “Comprehensive State-of-the-Art of Vehicle-To-Grid Technology,” in *Proceeding - 2023 IEEE 3rd International Maghreb Meeting of the Conference on Sciences and Techniques of Automatic Control and Computer Engineering, MI-STA 2023*, IEEE, May 2023, pp. 530–534. doi: 10.1109/MI-STA57575.2023.10169116.

[53] A. Alsharif, C. W. Tan, R. Ayop, A. Dobi, and K. Y. Lau, “A comprehensive review of energy management strategy in Vehicle-to-Grid technology integrated with renewable energy sources,” *Sustainable Energy Technologies and Assessments*, vol. 47, no. xxxx, p. 101439, Oct. 2021, doi: 10.1016/j.seta.2021.101439.

[54] A. Ali Ahmed, “Renewable Energy Home Design in Bani Walid City/Libya,” *Saudi Journal of Engineering and Technology*, vol. 04, no. 09, pp. 339–344, Sep. 2019, doi: 10.36348/SJEAT.2019.v04i09.002.