https://doi.org/10.65646/3cp3es20dpp6e115

Sri Lanka's Energy Transition: Progress, Emerging Risks, and Pathways to Sustainability

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***Abstract*— Sri Lanka's energy sector is undergoing a significant transition, driven by rising electricity demand, continued dependence on imported fossil fuels, and ambitious renewable energy (RE) targets. Electricity generation reached approximately 17.8 TWh (17,800 GWh) in 2025, reflecting continued growth in electricity demand and generation capacity. Renewable energy sources, led by hydropower and increasingly supplemented by solar and wind power, account for a substantial share of the country's electricity generation. Sri Lanka has set a target of achieving 70% renewable electricity generation by 2030. This paper reviews current electricity consumption patterns and demand drivers, the potential and utilization of renewable energy resources, their contributions to sustainability and energy security, emerging market and investment opportunities, and key challenges, including grid stability, renewable-energy intermittency, limited energy-storage capacity, financing constraints, and policy and regulatory uncertainty. Evidence-based recommendations are provided for policymakers, investors, and other stakeholders to support the development of a resilient, secure, and low-carbon energy future for Sri Lanka.**

Keywords - Energy Policy, Energy Security, Energy Transition, Grid Stability, Renewable Energy

I. INTRODUCTION

Sri Lanka faces the dual challenge of meeting growing energy needs while reducing reliance on expensive imported fossil fuels and addressing climate vulnerabilities. The power sector has historically depended on hydropower and thermal generation (coal and oil), a structure whose vulnerabilities were laid bare by the 2022 economic crisis and the fuel-import pressures it exposed [1]. Recent years have seen rapid expansion of non-conventional renewable energy (NCRE), particularly rooftop and ground-mounted solar, alongside policy commitments to reach 70% renewable electricity by 2030 [2] and carbon-neutrality aspirations by mid-century. Beyond its technical and economic dimensions, the transition also has geopolitical dimensions, as dependence on energy imports has repeatedly shaped Sri Lanka's external relations and strategic choices [3]. This paper analyses energy consumption patterns and demand growth drivers, renewable energy utilization and potential, sustainability and security benefits, investment opportunities, and associated risks. It draws on planning documents and data from the Ceylon Electricity Board (CEB), the Sri Lanka Sustainable Energy Authority (SLSEA), the Public Utilities Commission of Sri Lanka (PUCSL), the International Renewable Energy Agency (IRENA), the World Bank, the Asian Development Bank (ADB), and the peer-reviewed literature.

II. METHODOLOGY

The review was conducted in two complementary streams. The first stream drew on primary institutional sources, including generation-expansion and resource-development plans issued by the Ceylon Electricity Board (CEB) and the Sri Lanka Sustainable Energy Authority (SLSEA), statistical digests and generation-performance reports from CEB and the Central Bank of Sri Lanka, regulatory and market reports from the Public Utilities Commission of Sri Lanka (PUCSL), and country-level assessments published by the International Renewable Energy Agency (IRENA), the World Bank, and the Asian Development Bank (ADB). For institutional statistics, the review prioritized the most recent publicly available releases from the issuing institutions, primarily covering 2024-2026.

The second stream searched academic literature for conference papers, technical reports, and review articles. Search terms combined "Sri Lanka" with energy-transition-related keywords, including "electricity demand," "renewable energy," "energy security," "grid stability," "energy storage," and "energy policy." The search covered publications from 2008 to 2026 to capture both foundational demand-

modelling work and the most recent techno-economic and policy literature. Records were screened for direct relevance to Sri Lanka's electricity sector or to technical and market issues (e.g., grid integration, storage, and regional trade) that bear materially on it. Studies concerned with unrelated energy systems or with no substantive link to the Sri Lankan case were excluded. Regional and technology-focused studies (e.g., SAARC-wide assessments and battery-storage and demand-response reviews) were retained where their findings could reasonably be extrapolated to the Sri Lankan context.

Findings from the two streams were synthesized thematically rather than through formal meta-analysis, given the heterogeneity of methods and reporting periods across sources. Institutional statistics were used to establish current consumption, generation-mix, and capacity trends (summarized in Table I and Fig. 1). In contrast, the academic literature was used to interpret, corroborate, or contrast these trends against independent modelling and resource-assessment findings, as reported in the Results and Discussion sections below. Where institutional sources disagreed on a figure (for example, alternative estimates of total installed capacity depending on whether rooftop solar is included), the range is reported explicitly rather than reconciled into a single point estimate.

III. Literature Review

Official planning documents, notably CEB's Long Term Generation Expansion Plan (LTGEP) 2025-2044, provide the core roadmap, projecting demand growth and prioritizing solar, wind, mini-hydro, and biomass additions while incorporating battery storage and flexible thermal capacity [2]. SLSEA's Renewable Energy Resource Development Plan 2025-2030 maps solar, wind, and biomass potential and prioritizes sites [4]. World Bank [5] and ADB assessments highlight the economic benefits of renewable energy scale-up, particularly reduced fuel-import bills, alongside persistent infrastructure and financing gaps.

The academic literature complements these planning documents. Early empirical work by Amarawickrama and Hunt [7] established that Sri Lankan electricity demand is closely tied to income and price dynamics, providing a methodological foundation that later demand-forecasting exercises, including the LTGEP, continue to build on. More recent modelling by Caldera et al. [1] argues that an island-wide, 100%-renewable power system is technically achievable and would substantially reduce Sri Lanka's exposure to imported fossil fuels, while Dasanayaka et al. [8] provide structural equation modelling evidence indicating that renewable energy consumption has no significant direct effect on economic growth, but may contribute positively to GDP indirectly through capital formation, providing conditional support for the economic case for renewable energy transition.

Koswatte et al. [9] provide supporting evidence and discuss the prospects, potential, and barriers for Sri Lanka's 2050 renewable-energy/net-zero target, but do not directly assess the technical or techno-economic feasibility of achieving net-zero electricity by 2050. A follow-up mixed-methods study by the same author group [10] examines the relationship between renewable energy consumption and economic growth in Sri Lanka from 1990-2018 using structural equation modelling (SEM) and path analysis. It finds that renewable energy consumption does not have a significant direct effect on GDP, but contributes positively to economic growth indirectly through capital formation, underscoring the importance of renewable energy in supporting long-term economic development and informing net-zero transition policies in emerging economies.

On the resource side, Yao et al. [12] conducted a resource-assessment study evaluating the spatial and temporal characteristics of offshore wind energy potential in Sri Lankan waters using 35 years of ERA5 (ECMWF Reanalysis v5) and CCMP (Cross-Calibrated Multi-Platform) reanalysis datasets, validated against measured flux-tower data. Statistical and resource-assessment techniques, including EOF analysis, wind power density (WPD), effective wind speed occurrence (EWSO), Weibull distribution, and coefficient of variation, were used to characterize wind conditions and estimate resource availability. The findings indicate substantial and relatively stable offshore wind energy potential, with technically exploitable resources estimated at approximately 1.60 GW, providing a useful basis for future offshore wind-energy planning in Sri Lanka. Ariyarathne [13] specifically targets hybrid renewable microgrids and energy-storage optimization in remote, monsoon-dominated island electrification contexts, focusing on Northern Sri Lanka. Rafique et al. [14] provide a quantitative assessment of power generation capacities, renewable energy potential, and grid line losses across the eight SAARC nations to evaluate the viability of cross-border energy trading, categorizing the region's existing energy infrastructure and highlighting regional interconnection as a key pathway to address energy shortfalls and leverage underutilized renewable resources.

A. Current Energy Consumption and Demand in Sri Lanka

Sri Lanka's total energy consumption was approximately 9,291 kTOE in 2023 and 9,654 kTOE in 2024. Electricity accounts for approximately 13% of total energy consumption [15], while per-capita electricity consumption is approximately 640-700 kWh per year [15],[16].

Electricity generation in Sri Lanka was approximately 16.8 TWh in 2024, while electricity consumption was around 15.2 TWh. In 2025, total electricity consumption increased to approximately 17.8 TWh [17]. The electricity generation mix during 2024–2025 comprised approximately 50–60% renewable energy sources, including major

hydropower, mini-hydropower, solar, wind, and biomass, with the remainder supplied primarily by coal- and oil-fired thermal power plants [17], [18]. Major hydropower remains an important contributor to Sri Lanka's electricity generation mix. the largest single renewable source, while solar, especially rooftop, has expanded rapidly [4].

Major consuming sectors include domestic/residential, industrial, commercial/general-purpose, and, to a lesser extent, agriculture [17]. Historical trends show steady growth interrupted by economic crises, notably in 2022, after which demand recovery has been uneven, consistent with the income- and price-sensitivity of Sri Lankan electricity demand documented by Amarawickrama and Hunt [7]. Peak demand has remained below earlier forecasts in some recent periods due to economic conditions, while daytime solar generation has altered load profiles [2].

Drivers of rising demand include economic recovery and GDP growth, industrial expansion, urbanization, increasing appliance ownership and air-conditioning use, digitization, and anticipated electrification of transport. CEB's LTGEP projects average annual electricity demand growth of roughly 4-5% in the medium term, requiring substantial capacity additions by the mid-2030s [2].

B. Renewable Energy Potential and Utilization

Sri Lanka possesses strong renewable resources. Hydropower (major and mini) forms the traditional backbone. Solar irradiance is high across much of the island, supporting both ground-mounted and extensive rooftop photovoltaic deployment. Wind resources are significant in the north and northwest; reanalysis-based assessments confirm meaningful offshore potential in Sri Lankan waters [12] and site-level feasibility for offshore development [11], while Ariyarathne [13] demonstrates that solar and wind generation in the Northern Islands are complementary across the diurnal and seasonal cycle, an attribute that can be exploited to reduce combined variability. Biomass and agricultural residues offer additional opportunities, alongside limited municipal solid-waste projects.

Installed renewable-energy capacity has expanded substantially in Sri Lanka, particularly through the rapid growth of rooftop solar. According to the Ceylon Electricity Board (CEB), total installed generation capacity reached 4,648 MW (approximately 4.65 GW) at the end of 2024, while rooftop solar capacity reached 1,141 MW (approximately 1.14 GW). CEB reported that non-conventional renewable energy (NCRE) sources, including mini-hydro, wind, solar, biomass, and other renewable technologies, accounted for approximately 20% of total installed capacity, while major hydropower accounted for a further 33%. Installed capacity should be distinguished from electricity-generation shares because renewable technologies have different capacity factors. In terms of electricity generation, renewable sources accounted for 53.5% of total generation in 2024 and approximately 60.2% in 2025, indicating a substantial increase in renewable electricity generation. [16] [17]

Utilization has accelerated through net-metering and related schemes for rooftop solar, feed-in arrangements for larger projects, and competitive procurement [4], [18]. However, absorption is constrained by transmission capacity in high-resource zones and the need for system flexibility [2]. Emerging technologies such as battery energy storage systems (BESS), pumped storage, and green hydrogen remain at early stages of deployment, though a broader review of renewable-generation technology trends suggests their costs and performance are improving quickly enough to alter deployment timelines in favour of earlier adoption [19].

Table I summarizes recent trends in Sri Lanka's electricity generation mix, and Fig. 1 illustrates the corresponding growth in the renewable share of total generation between 2022 and 2025.

TABLE I. SRI LANKA ELECTRICITY GENERATION MIX, 2022-2025 17][24]

Year	Total Generation (GWh)	Renewable Generation (GWh)	Renewable Share	Non-Renewable Share
2022	15,942	8,300	**52.1%**	47.9%
2023	15,576	7,795	**50.0%**	50.0%
2024	16,802	8,982	**53.5%**	46.5%
2025	17,812	10,726	**60.2%**	39.8%

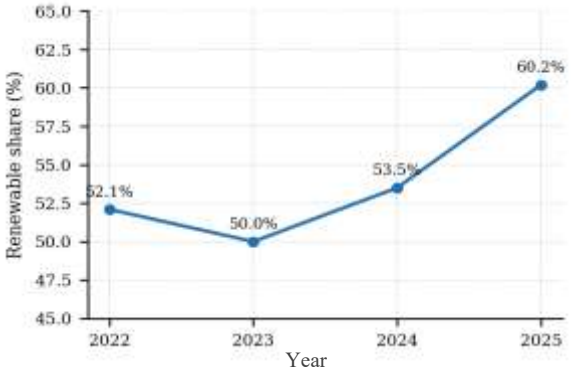


Fig. 1. Renewable share of Sri Lanka's total electricity generation, 2022-2025. [17][24].

C. Sustainability and Energy Security

Expanding renewables reduces dependence on imported coal and petroleum products, which expose the economy to price volatility and foreign-exchange pressures [5]. Avoided fuel costs from existing solar and hydro already deliver material savings [6], and system-level modelling suggests an island-wide, predominantly renewable power sector would meaningfully reduce this import exposure [1]. Lower fossil generation also decreases local air pollution and greenhouse-gas emissions, supporting Nationally Determined Contributions and long-term sustainability goals [5]. At the macroeconomic level, Dasanayaka et al. [8] find a positive relationship between renewable energy utilization and economic growth in Sri Lanka,

suggesting that the sustainability and growth objectives of the transition are complementary rather than competing.

Energy security benefits from diversified domestic resources, though hydropower variability linked to monsoon patterns and climate change introduces new risks [5]. Higher RE shares, when paired with adequate storage and flexible capacity, can enhance resilience. Full realization of these benefits requires complementary measures in energy efficiency, demand-side management, and grid modernization [6].

D. Market and Investment Opportunities

Significant opportunities exist across the value chain,

- Utility-scale solar and wind parks, particularly in identified resource zones.
- Continued rooftop and distributed solar for commercial, industrial, and residential consumers.
- Energy storage (BESS and pumped hydro) to manage intermittency and provide ancillary services.
- Smart grids, advanced metering, and digitization for better visibility and control of distributed resources.
- Electric mobility and associated charging infrastructure as transport electrification advances, a shift that will require grid-planning tools capable of anticipating localized load impacts [20].
- Energy-efficiency services, green buildings, and demand-response programs.
- Longer-term prospects in green hydrogen, offshore wind, and regional interconnection, including the cross-border trade opportunities identified across the SAARC region [14].

The 2024 Electricity Act and associated reforms aim to improve governance, introduce competitive procurement, and facilitate private investment [18]. As generation mixes shift toward variable renewable, market-design research becomes increasingly relevant: reserve-market mechanisms that account for participants' strategic bidding behaviour can help maintain reliability at lower cost [21], and linked electricity-carbon trading mechanisms offer a route to price emissions alongside energy [22]. Development partners, including the World Bank and ADB, support transmission upgrades and RE scale-up [5], [6]. Competitive auctions, clear offtake arrangements, and de-risking instruments can help attract both domestic and international capital [6].

E. Risks and Challenges

1) Grid Stability and Intermittency

Increasing variable renewable generation, particularly solar generation during daytime low-demand periods, creates additional requirements for system flexibility, voltage management, reserve provision and, where applicable, curtailment management.[2]. Ageing transmission and distribution infrastructure struggles with high variable renewable energy (VRE) penetration [18].

2) Energy Storage Deficit

Planned BESS and pumped-storage additions lag behind requirements for reliable integration [2]. Broader technical reviews of battery-storage integration emphasize that both the pace of deployment and the choice of storage architecture materially affect a grid's ability to absorb high VRE shares [23].

3) Financing Constraints

High capital needs, perceived policy and offtake risks, and the financial position of the utility can raise the cost of capital [5], [6].

4) Policy and Regulatory Uncertainty

Frequent shifts, lengthy permitting, and coordination gaps among institutions deter investment; mixed-methods evidence from Sri Lankan renewable-energy projects links these same institutional weaknesses to project delays and outright abandonment [10]. Energy import dependence has also periodically become entangled with wider geopolitical considerations, adding a further layer of policy uncertainty [3].

5) Infrastructure Limitations

Transmission bottlenecks in renewable-rich areas and delayed network upgrades continue to constrain the pace of RE absorption [2], [4].

6) Climate-Related Risk

Hydrological variability affecting hydro generation, along with extreme-weather impacts on infrastructure, poses an ongoing risk to system reliability [5].

7) Technology and Market Risks

Dependence on imported equipment, currency fluctuations, and evolving technology costs add further uncertainty, though the pace of global technology improvement may partly offset these pressures over time [19]. Recent operational incidents and curtailment episodes illustrate the urgency of addressing these issues [2].

IV. Results and Findings

Table I shows that the renewable share of Sri Lanka's electricity generation rose from 52.1% in 2022 to 60.2% in 2025, increase was supported by substantial growth in solar generation, particularly rooftop solar, together with higher hydropower generation. Hydropower generation varied with hydrological conditions but increased overall between 2022 and 2025. [17]. This trajectory is broadly consistent with, but still well short of, the 70%-by-2030 policy target and the fully renewable end-state modelled by Caldera et al. [1]; whereas that study finds an island-wide 100%-renewable system to be technically achievable given

sufficient storage and flexible capacity, the observed 2022-2025 trend implies that current deployment rates, absent faster storage and grid-code reform, would not close the remaining gap within the LTGEP's own 2030 horizon [2]. The finding therefore corroborates the direction of Caldera et al.'s modelling while suggesting its assumptions about deployment pace are more optimistic than recent outturns.

On the demand side, the post-2022 recovery pattern documented in institutional statistics is consistent with the income- and price-elasticity relationship established by Amarawickrama and Hunt [7]: electricity consumption tracked the pace of macroeconomic recovery rather than rising independently of it, and peak demand remained below pre-crisis forecasts through much of 2023-2024 before rising toward 17.8 TWh in 2025 [2], [17]. This agreement between a demand-elasticity model built on historical data and observed post-crisis behaviour strengthens confidence in CEB's continued use of similar elasticity assumptions in the LTGEP's medium-term demand projections [2].

The review's resource-potential findings and the utilisation figures reported by CEB and SLSEA point to a persistent gap between technical potential and deployment, particularly for offshore wind: Yao et al. [12] estimate approximately 1.60 GW of technically exploitable offshore wind potential in Sri Lankan waters, and Boopathi et al. [11] separately confirm site-level feasibility, yet installed offshore wind capacity remains negligible relative to this resource base, in contrast to the much faster uptake seen in rooftop solar. This asymmetry suggests that resource availability alone does not explain the pattern of renewable deployment; financing, permitting, and grid-connection barriers discussed under Risks and Challenges appear to be the binding constraints for offshore wind specifically, more so than for distributed solar.

On the economic-growth question, the results of this review align with the structural equation modelling evidence of Dasanayaka et al. [8] and the follow-up analysis by Koswatte et al. [10]: both find that renewable energy consumption has no significant direct effect on GDP but contributes positively and indirectly through capital formation. This conditional relationship is consistent with the market and investment findings reported here, where renewable energy scale-up is associated with avoided fuel-import costs and new investment activity [5], [6] rather than with a direct, immediate growth effect, indicating that the economic case for the transition rests primarily on capital-formation and import-substitution channels rather than a direct output effect.

Finally, comparing Sri Lanka's grid-stability findings with the regional evidence assembled by Rafique et al. [14] situates the country's challenges within a wider SAARC pattern: like several neighbouring systems, Sri Lanka combines a comparatively strong renewable resource base with grid-line losses and interconnection limitations that constrain full utilisation, reinforcing the case, made independently in both this review and in [14], for treating regional interconnection as a complement to, rather than a substitute for, domestic grid and storage investment.

V. Discussion

Sri Lanka's LTGEP 2025-2044 and SLSEA plans project continued RE expansion toward the 70% target by 2030, with solar leading capacity additions, supported by wind, mini-hydro, biomass, storage, and flexible thermal capacity, including LNG pathways. Longer-term studies suggest that near-100% renewable electricity is technically feasible by mid-century with substantial solar and wind capacity, storage, and system flexibility [1], [9], though achieving this will require large and sustained investment.

Taken together, the findings above indicate that Sri Lanka's energy transition is progressing broadly in the direction anticipated by the academic and institutional literature, but at a pace and in a pattern that departs from that literature in specific, policy-relevant ways. The gap between the near-100%-renewable systems modelled by Caldera et al. [1] and the 60.2% renewable share actually achieved by 2025 is not primarily a resource-availability problem: the resource-assessment literature [4], [11], [12] confirms ample solar, onshore wind, and offshore wind potential relative to current utilisation. Instead, the pattern of results points to grid absorption capacity and energy-storage deployment as the binding constraints, echoing the LTGEP's own emphasis on storage and flexible capacity [2] and the technical findings of the battery-storage integration literature [23]. This distinguishes Sri Lanka's transition bottleneck from that identified in some regional SAARC comparisons, where line losses and cross-border interconnection are highlighted as the primary constraint [14]; in Sri Lanka's case, domestic grid flexibility appears to be the more immediate limiting factor, with interconnection representing a longer-term complement rather than a near-term solution.

The uneven relationship between renewable energy consumption and GDP growth found by Dasanayaka et al. [8] and Koswatte et al. [10] also carries a discussion-worthy implication for policy framing: because the growth benefit operates indirectly through capital formation rather than directly through energy consumption, policy and investor communications that promise an immediate growth dividend from renewable deployment risk overstating the near-term macroeconomic case, even though the import-substitution and energy-security rationale for the transition remains strong on its own terms [5]. Similarly, the institutional-weakness findings linked to project delays and abandonment [10] suggest that the governance and permitting risks documented under Risks and Challenges are not incidental but are a recurring, structural feature of the investment environment that technical solutions (storage, grid codes) alone will not resolve.

A limitation of this review is that it relies on a narrative rather than a systematic synthesis, and on institutional statistics that are periodically revised and

occasionally inconsistent across sources (for example, differing capacity totals depending on whether rooftop solar is included [4], [16]); the comparisons drawn above should therefore be read as indicative of direction and magnitude rather than as precise reconciliations between modelled and observed figures.

VI. Recommendations

Policymakers, utilities, and investors should accelerate grid upgrades and VRE integration, prioritize battery and pumped-hydro storage, and strengthen policy stability, permitting, and transparent procurement [2,10,23]. Utility sustainability should be improved through cost-reflective tariffs, social protection, and efficiency, while demand-side management and energy-efficiency measures should better align consumption with renewable generation [5]. Concessional and private finance, climate-resilient planning, regional energy cooperation, and local technical capacity should be strengthened [6,14]. Finally, greater data transparency, distributed-solar monitoring, and coordination among CEB, SLSEA, PUCSL, and private actors are needed [18].

VII. Conclusion

Sri Lanka is making measurable progress in its energy transition, with renewable electricity increasing from 50.0% in 2023 to 53.5% in 2024 and 60.2% in 2025, supported by hydropower recovery and rapid solar growth. This can improve energy security, reduce fossil-fuel dependence and emissions, and create investment opportunities. Achieving the 70% renewable target by 2030 will require continued renewable expansion, grid and storage investment, system flexibility, effective project implementation, policy consistency, coordination, financing, and timely approvals.

References

[1] U. Caldera, A. Gulagi, N. Jayasinghe, and C. Breyer, "Looking island wide to overcome Sri Lanka's energy crisis while gaining independence from fossil fuel imports," *Renewable Energy*, vol. 218, Art. no. 119261, 2023, doi: 10.1016/j.renene.2023.119261.

[2] Ceylon Electricity Board, *Long Term Generation Expansion Plan 2025-2044*. Colombo, Sri Lanka: CEB.

[3] 2025G. M. Theiventhran, "Energy as a geopolitical battleground in Sri Lanka," *Asian Geographer*, vol. 41, no. 1, pp. 21-45, 2024, doi: 10.1080/10225706.2022.2098507.

[4] Sri Lanka Sustainable Energy Authority, *Renewable Energy Resource Development Plan 2025-2030*. Colombo, Sri Lanka: SLSEA, 2025.

[5] W. B. Group, *Sri Lanka Country Climate and Development Report*. 2025. doi: 10.1596/43995.

[6] Asian Development Bank, *Supporting Renewable Energy Pilot Projects in Sri Lanka*. Asian Development Bank, 2025.

[7] H. A. Amarawickrama and L. C. Hunt, "Electricity demand for Sri Lanka: A time series analysis," *Energy*, vol. 33, no. 5, pp. 724-739, 2008, doi: 10.1016/j.energy.2007.12.008.

[8] C. H. Dasanayaka, Y. S. Perera, and C. Abeykoon, "Investigating the effects of renewable energy utilization towards the economic growth of Sri Lanka: A structural equation modelling approach," *Cleaner Engineering and Technology*, vol. 6, Art. no. 100377, 2022, doi: 10.1016/j.clet.2021.100377.

[9] I. Koswatte, J. Iddawala, R. Kulasekara, P. Ranaweera, C. H. Dasanayaka, and C. Abeykoon, "Can Sri Lanka be a net-zero nation by 2050?—Current renewable energy profile, opportunities, challenges, and recommendations," *Cleaner Energy Systems*, vol. 8, Art. no. 100126, 2024, doi: 10.1016/j.cles.2024.100126.

[10] I. Koswatte, J. Iddawala, R. Kulasekara, P. Ranaweera, C. H. Dasanayaka, and C. Abeykoon, "Adoption of renewable energy in Sri Lanka: A mixed-methods exploration of success and negligence," *Cleaner Energy Systems*, Art. no. 100528, 2026, doi: 10.1016/j.uncres.2026.100528.

[11] K. Boopathi, B. Krishnan, J. Bastin, S. Hoti, and D. M. R. Prasad, "Feasibility study of offshore wind energy on the coast of Sri Lanka," *International Journal of Green Energy*, vol. 21, no. 9, pp. 2065-2083, 2024, doi: 10.1080/15435075.2023.2281354.

[12] J. Yao, Y. Miao, P. B. T. P. Kumara, K. Arulananthan, Z. Zhang, and W. Zhou, "Analysis of wind energy potential in Sri Lankan waters based on ERA5 (ECMWF Reanalysis v5) and CCMP (Cross-Calibrated Multi-Platform)," *Journal of Marine Science and Engineering*, vol. 12, no. 6, Art. no. 876, 2024, doi: 10.3390/jmse12060876.

[13] A. Ariyarathne, "Implications of solar-wind resource complementarity for hybrid renewable systems in Northern Islands, Sri Lanka," *International Journal of Smart Grid and Clean Energy*, vol. 15, no. 1, pp. 31-44, 2026, doi: 10.12720/sgce.15.1.31-44.

[14] U. Rafique, H. A. Zidan, F. Azeem, S. Amir, T. Manzoor, and H. U. Manzoor, "Evaluation of the potential power generation resources in SAARC region for sustainable energy trade," *Energy Science & Engineering*, vol. 12, no. 12, pp. 5739-5752, 2024, doi: 10.1002/ese3.1965.

[15] Central Bank of Sri Lanka, *Economic and Social Infrastructure Statistics*. Colombo, Sri Lanka: Central Bank of Sri Lanka, 2025.

[16] International Renewable Energy Agency, *Renewable Energy Capacity and Generation Statistics: Sri Lanka*. Abu Dhabi, UAE: IRENA, 2025.

[17] Ceylon Electricity Board, *Statistical Digest and Generation Performance Reports*. Colombo, Sri Lanka: Ceylon Electricity Board, 2024/2025.

[18] Public Utilities Commission of Sri Lanka, *Generation and Renewable Energy Reports*. Colombo, Sri Lanka: PUCSL, 2024/2025.

[19] H. Tiismus, V. Maask, V. Astapov, T. Korõtko, and A. Rosin, "State-of-the-art review of emerging trends in renewable energy generation technologies," *IEEE Access*, vol. 13, 2025, doi: 10.1109/ACCESS.2025.3528640.

[20] D. Sarathkumar, J. B. Sajin, M. Manivel, T. Jayakumar, S. Ragul, and S. Ponnusamy, "Impact of electric vehicle integration on power grids: A comprehensive review," in *Proc. 2025 IEEE Int. Students' Conf. Electrical, Electronics and Computer Science (SCEECS)*, Bhopal, India, 2025, doi: 10.1109/SCEECS64059.2025.10941398

[21] M. Fan, C. Lyu, X. Zhang, X. He, and Z. Jing, "Research on the reserve market adapted to the new power system considering strategic quotations of market participants," in *Proc. 2024 IEEE 2nd Int. Conf. Power Science and Technology (ICPST)*,Dali,China,2024,doi:10.1109/ICPST61417.2024.10601799.

[22] H. Zhang, Q. Tang, X. Du, T. Zhu, and D. Wang, "Research on electricity energy market trading mechanism based on electricity-carbon linkage," in *Proc. 2024 IEEE 7th IAEAC*, 2024, doi: 10.1109/IAEAC59436.2024.10504026.

[23] M. Javadi, X. Liang, Y. Gong, and C. Y. Chung, "Battery energy storage technology in renewable energy integration: A review," in *Proc. 2022 IEEE Canadian Conf. Electrical and Computer Engineering (CCECE)*, Halifax, NS, Canada, 2022, doi: 10.1109/CCECE49351.2022.9918504.

[24] Ceylon Electricity Board, "Electricity generation," Parliament of Sri Lanka, Colombo, Sri Lanka, Parliamentary Question Rep. 30642/0180, 2026. [Online]. Available: https://www.parliament.lk/en/business-of-parliament/parliamentary-questions/details/30642/0180