International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Renewable Energy for Sustainable Rural Development in Karnataka

Dr. Basavaraja Malipatil

Field Investigator, ICSSR Short - term Empirical Collaborative Research Project, Department of Studies in Economics, Bangalore University, Bangalore - 560 056, Karnataka, India
Email: *bmpatilisback[at]gmail.com*

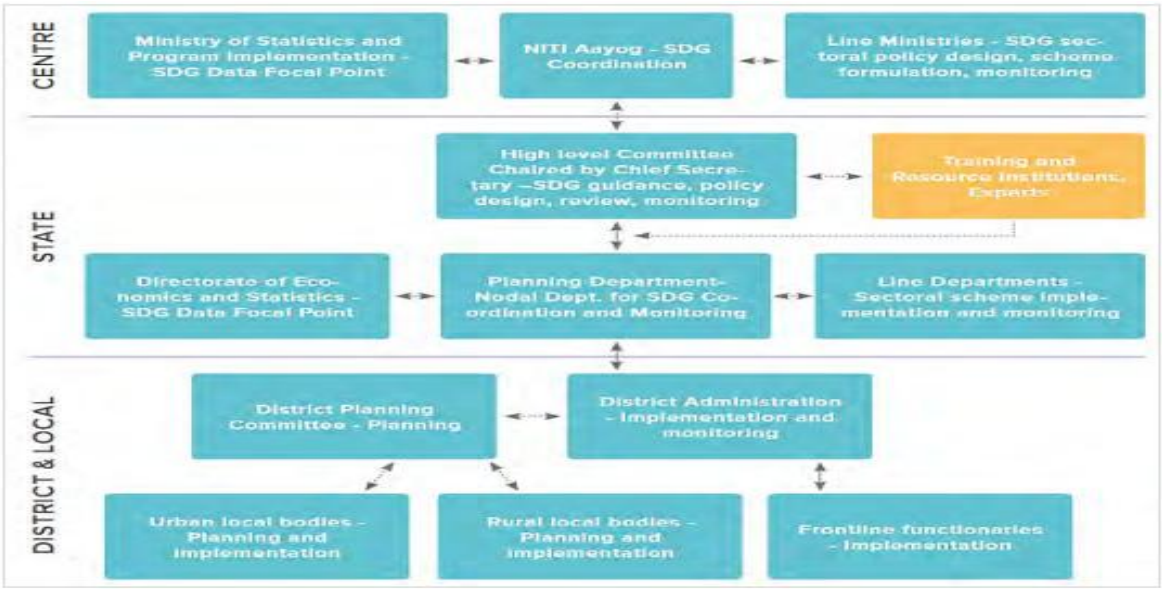
Abstract: ***Karnataka leads India's renewable energy sector with a substantial 15, 392 MW capacity as of December 2021, thanks to effective policies and programs. Its diverse renewable potential, including solar, wind, biomass, and more, attracts investments. With an estimated potential of 1, 55, 074 MW, Karnataka ranks among the top five states in renewable resources. Recent achievements surpass Tamil Nadu, with progressive policies reducing energy imports. Karnataka's global commitment is evident, scoring 52 on the 2018 SDG Index with NITI Aayog. Renewable energy is crucial for rural development amid growing energy demands. This study assesses rural energy programs and resource distribution, utilizing various secondary data sources to enlighten Karnataka's sustainable energy future.***

Keywords: Renewable Energy Programmes and Resource, Sustainable Development

1. Introduction

Karnataka is among the leading States in Renewable Energy (RE) sector in the country with a RE generation capacity of about 15, 392 MW (as on December, 2021). The State has achieved its stature through its effective Policy, programs and implementation. The State is endowed with RE potential which includes solar, wind, solar - wind hybrid, biomass, co - generation, Waste to energy, small hydro and other renewable energies that makes Karnataka a favorable destination for RE investments in India. Karnataka has about 1, 55, 074 MW of estimated RE potential, making it one of the country's top five renewable rich States (**Karnataka Renewable Energy Policy 2022 - 2027).** Karnataka has emerged as top state in installing RE overtaking Tamil Nadu, which had long been India's top RE performer. Recent report of institute for energy economics and financial analysis (IEEFA) has revealed that Karnataka has been taking advantage of several positive RE policies like open access, the introduction of a hybrid wind solar development policy and significant steps to reverse Karnataka's historic reliance on energy imports (**IEEFA).** Karnataka is leading state for RE in India, reaching 12.3 gig watts (GW) of total installed capacity as of march 2018, having added 5 GW in 2017 - 18 alone (**Tim Buckley**, director of energy finance studies). Karnataka State, in collaboration with NITI Aayog, has a 'Performer' score of 52 on the 2018 SDG Index, while Tamil Nadu has the highest score of 76. The SDG India Index Baseline Report and Dashboard cover 13 of the 17 SDGs, with Karnataka's score ranging from 36 to 88. Karnataka, a progressive state, is sensitive to universal development programs initiated by foreign agencies like UNDP, the World Bank, and others. It has been a pioneer in developing action plans and targets for sustainable development goals, proactively implementing programs to meet SDG targets.

Decentralization of Operationalization of SDGs:



Source: NITI Aayog, Localizing SDGs

The chart illustrates the decentralization structure for SDG operationalization, highlighted in the July 2019 report 'Localizing SDGs' at the HLPF forum, an annual forum for intergovernmental negotiated political declarations.

Table 1: Performance of Karnataka across all SDGs:

Category Karnataka	SDG Goal	Score Karnataka	Rank
Front Runner (65 - 99)	SDG 3: Good Health and Well - being	69	5
	SDG 4: Quality Education	76	5
	SDG 7: Affordable and Clean Energy	**77**	**5**
	SDG 8: Decent Work and Economic Growth	72	11
	SDG 10: Reduced Inequalities	68	16
	SDG 15: Life on Land	88	8
	SDG 16: Peace, Justice and Strong Institutions	74	12
Performer (50 - 64)	SDG 1: No Poverty	52	17
	SDG 2: Zero Hunger	54	11
	SDG 6: Clean Water and Sanitation	**62**	**14**
	SDG 9: Industry, Innovation and Infrastructure	57	7
Aspirants (0 - 49)	SDG 5: Gender Inequality	43	6
	SDG 11: Sustainable Cities and Communities	**36**	**16**
	Karnataka (All Goals)	**64**	**3**

Source: NITI Aayog, 2018

Karnataka ranks first in several goals, including good health and well - being, quality education, affordable and clean energy, decent work and economic growth, reduced inequalities, life on land, and peace, justice, and strong institutions. However, it falls short in other areas like no poverty, zero hunger, clean water and sanitation, and industry, innovation, and infrastructure. Aspirant goals include gender equality and sustainable cities and communities, highlighting the need for priority focus on these areas.

SDG 7: Affordable and Clean Energy:
SDG 7 aims to increase RE contribution to global energy supply and double energy efficiency. It includes diversifying energy sources, developing renewable energy, improving energy efficiency, raising public awareness, and connecting households to the energy grid. The GOI has implemented initiatives like the National Solar Mission, Green Energy Corridor, Off - Grid and Decentralized Solar PV Applications Programme, National Biogas and Manure Management Programme, Pradhan Mantri Sahaj Bijli Har Ghar Yojana, LPG Subsidy under PAHAL, DeenDayal Upadhyaya Gram Jyoti Yojana, and Pradhan Mantri Ujjwala Yojana.

Table 2: Performance of Karnataka and India for SDG7 on 'Affordable and Clean Energy'

Indicator	Raw Data			Score		
	Karnataka	India	T2030	Karnataka	India	T2030
Percentage of households electrified	96.45	94.57	100	85	78	100
Percentage of households using Clean Cooking Fuel	54.7	43.8	100	45	32	100
Renewable share of installed generating capacity (%)	40.7	17.51	40	100	43	100
SDG 7 Index Score				77	51	100

Source: NITI Aayog, 2018; T - Target

India's performance towards achieving SDG7 is measured by three national level indicators. The country has a score of 51, with top states Tamil Nadu and Mizoram achieving scores of 89 and 78 respectively. Karnataka ranks 77, with a higher percentage of households using clean cooking fuel.

2. Reviews of Literature

Ruth Kattumuri and Tobias Kruse (2018): This study show that enhancing green economy offers benefits that include the creation of jobs, but also delivers a much wider set of socio - economic and environmental welfare gains for emerging economies such as India. This paper revealed that valuable evidence - based analyses for policy - makers when assessing the benefits of low - carbon sustainable development.

Jagadeesha and Devaraja (2023): The present research paper aims to identify the current status and future potentials of renewable energy sources in the state of Karnataka. Overall, the outlook for Karnataka's renewable energy sector remains positive.

Objectives:

- To study the rural energy programmes in Karnataka
- To know the growth and distribution of renewable energy resource in Karnataka

3. Methodology

The study is based on purely secondary data and data from published and unpublished data such as literature, journals, working papers, books, magazines, newspapers, reports, and official websites, and tools and techniques

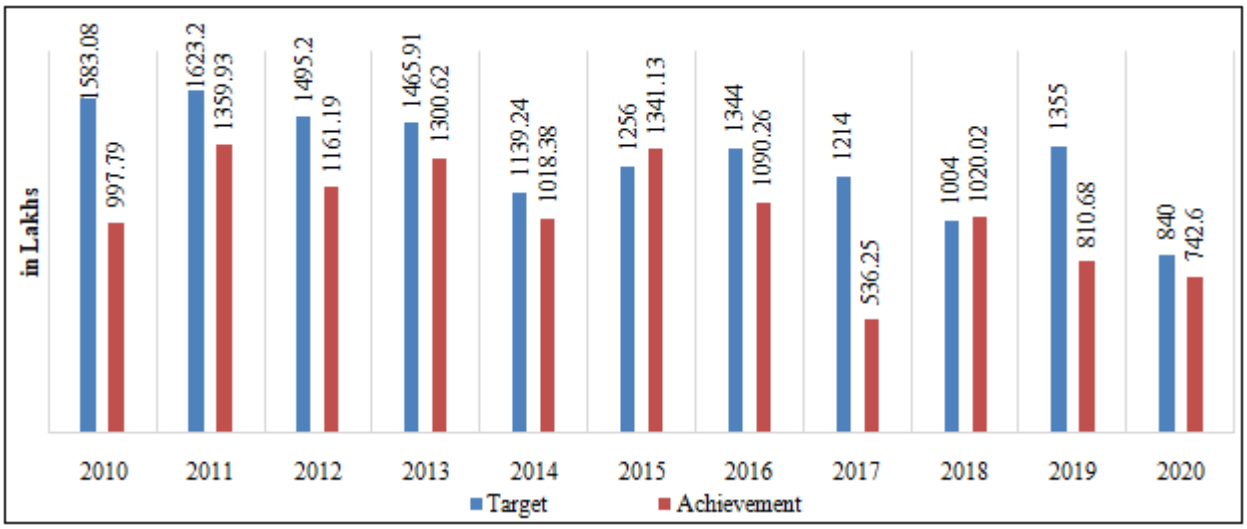
Rural Energy Programmes:
New National Biogas and Organic Manure Programme (NBOMP): Biogas is a clean, non - polluting, smoke and soot - free fuel, containing methane gas produced from cattle dung, human waste and other organic matter in a biogas

plant through a process called anaerobic digestion. The digested slurry can be used as good quality manure in agricultural fields.

Table 3: National Project on Biogas Development in Karnataka

Year	Financial (lakhs)		Physical (Nos)	
	Target	Achievement	Target	Achievement
2010 - 11	1583.08	997.79	16000	12902
2011 - 12	1623.2	1359.93	15000	10863
2012 - 13	1495.2	1161.19	12000	11985
2013 - 14	1465.91	1300.62	10300	9700
2014 - 15	1139.24	1018.38	10500	8419
2015 - 16	1256	1341.13	16000	6444
2016 - 17	1344	1090.26	10000	5294
2017 - 18	1214	536.25	8000	5423
2018 - 19	1004	1020.02	8900	6408
2019 - 20	1355	810.68	7000	6967
2020 - 21	840	742.6	7000	2261

Source: Various Karnataka Economic Survey 2010 - 11 to 2020 – 21



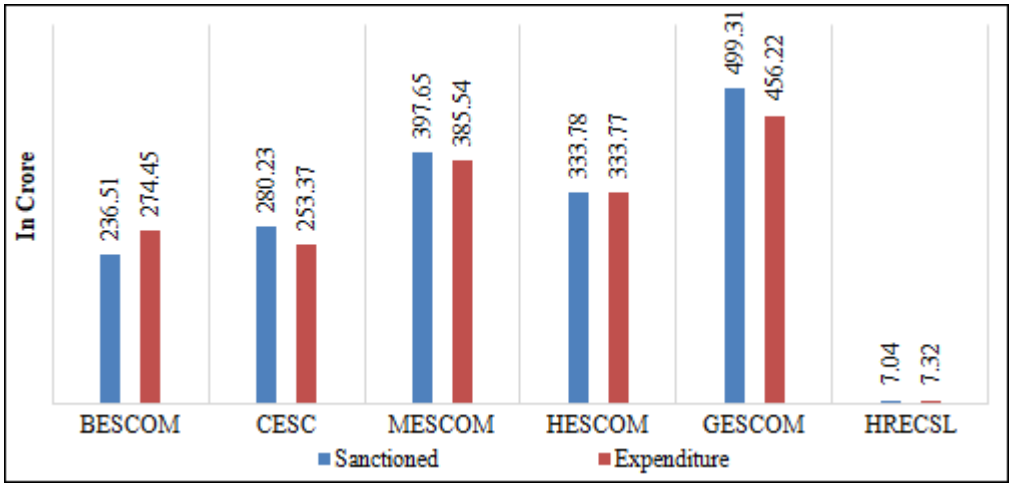
The table above depicts a national project on biogas development in Karnataka, with financial and physical performance data for the years 2010 - 2021. The covers financial (in lakhs) and physical (number of items) target and achievement data. The biogas objective for the fiscal year (2011 to 2020) is 1623.20 and the lowest is 840. At the same period, the highest biogas achievement year (2011 to 2017) is 1359.93, and the lowest is 536.25. The figure reveals that over the past decade, the financial target and achievement of biogas development in Karnataka have been the highest, while the achievement has been the lowest.

DeenDayal Upadhyaya Gram Jyothi Yojana (DDUGJY) is designed to provide continuous power supply to the entire rural India. The scheme was launched under leadership of Prime Minister Shri Narendra Modi in November 2014 announcing that "the government had decided to electrify 18, 452 unelectrified villages within 1000 days, by May 1, 2018. It is one of the key initiatives of Government of India and a flagship programmes. The DDUGJY can benefit rural households significantly as electricity is extremely vital for growth and development of the country.

Table 4: Sanction and Expenditure under DDUGJY (Crore)

Name of the Company	Sanctioned	Expenditure
BESCOM	236.51	274.45
CESC	280.23	253.37
MESCOM	397.65	385.54
HESCOM	333.78	333.77
GESCOM	499.31	456.22
HRECSL	7.04	7.32
Total	**1754.52**	**1710.67**

Source: Karnataka Economic Survey 2020 - 21



The allocation and expenditure on DDUGJ in Karnataka are shown in the table above. The numbers represent the sanctioned cost and the actual expenditure incurred by each company, with values in lakhs. GESCOM has the largest allocation (456.22) and expenditure (499.31), while HRECSL has the lowest (7.04 and 7.32). The chart indicates that GESCOM Company ranks highest in terms of customer satisfaction, while HRECSL ranks lowest.

Saubhagya Yojana – Pradhan Mantri Sahaj Bijli Har Ghar Yojanais launches by Prime Minister Narendra Modi on 25th September 2017; scheme has completed successful four years. Saubhagya scheme is one of the world's biggest Universal electrification initiatives with collaborative and concerted efforts of Centre and States.

Table 5: Sanction and Expenditure under Saubhagya (Crore)

Name of the Company	Sanctioned	Expenditure
CESC	12.72	10
MESCOM	15.68	14.26
HESCOM	93.69	61.69
GESCOM	73.72	50.72
HRECSL	9.59	4.91
Total	205.4	141.58

Source: Karnataka Economic Survey 2020 - 21

With values in crores of rupees, the following table indicates the sanctioned sums as well as the actual costs incurred by each company under the Saubhagya scheme. The "Total" row displays the total data for all companies. HESCOM's highest sanctioned amount is 93.69 crore, while HRECSL's lowest is 9.59 crore. HESCOM has the highest spending of 61.69 and HRECSL has the lowest expenditure of 4.91.

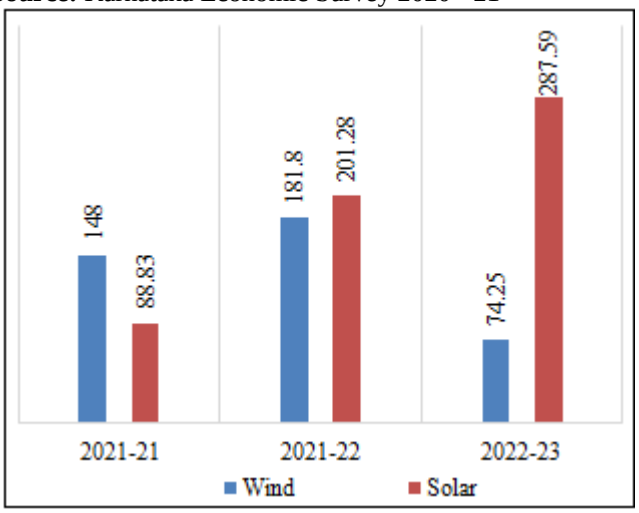
Karnataka Renewable Energy Policy 2022 - 27

State notified Karnataka Renewable Energy Policy 2022 - 27 to facilitate Government of India in meeting the RE target of 500 GW by 2030. KREDL is the nodal agency which envisages private sector investment for renewable energy development in the State. The capacity addition in private sector under renewable energy during 2021 - 22 was 383.09 MW and it is 361.84 MW during 2022 - 23.

Table 6: Capacity additions under Renewable Energy (in MW)

Sources	Capacity addition during		
	2021 - 21	2021 - 22	2022 - 23
Wind	148	181.8	74.25
Solar	88.83	201.28	287.59
Total	236.83	283.08	361.84

Source: Karnataka Economic Survey 2020 - 21



This table shows the capacity additions for wind power, solar energy, and overall renewable energy capacity for the corresponding years. In 2021, the maximum wind power capacity is 181.80 and the lowest capacity is 74.25. In the year 2022, the maximum solar energy is 287.59 and the minimum is 88.83. Wind power, which had a strong start in Karnataka, has had sluggish development in recent years, with solar dominating the renewable energy mix as government policies have changed. The figure indicates a rise in solar energy over the past few years, while wind energy has experienced a decline.

BELAKU: At the moment, 2, 39, 570 un - electrified houses have been identified, with an estimated cost of Rs.260.34 crore for electricity. As of November 2022, a total of 2, 23, 726 houses were electrified.

Table 7: Details of Electrified households under BELAKU

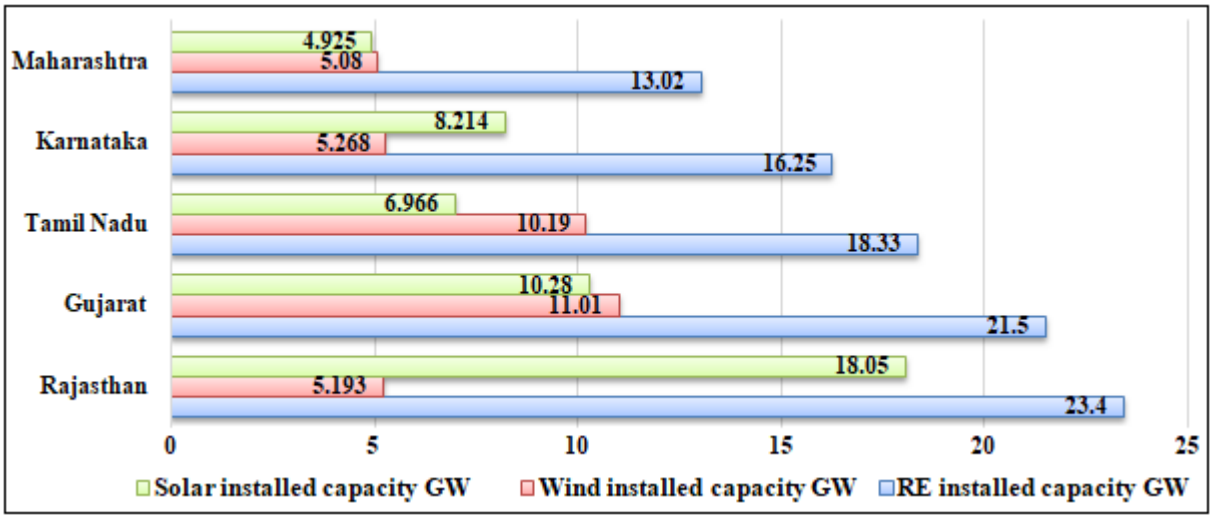
Name of the Company	No of Unelectrified Households	Estimated Cost in Crs	No of Households Electrified
BESCOM	61897	37.55	61673
CESC	19528	16.99	19253
MESCOM	28362	68.94	24494
HESCOM	75188	67.67	70448
GESCOM	49260	65.67	47539
HRECSL	5336	3.51	319
Total	239570	260.34	223726

Source: Karnataka Economic Survey 2020 - 21

Table 8: RE, Wind and Solar Installed Capacity of top Five States (GW)

Sl. No	States	RE installed capacity	Wind installed capacity	Solar installed capacity
1	Rajasthan	23.4	5.193	18.05
2	Gujarat	21.5	11.01	10.28
3	Tamil Nadu	18.33	10.19	6.966
4	Karnataka	16.25	5.268	8.214
5	Maharashtra	13.02	5.08	4.925

Source: Energy Department



The above table shows the installed renewable energy (RE), wind power, and solar power capacity in gigawatts (GW) for India's top five states. Rajasthan has the greatest renewable energy score of 23.4, while Maharashtra has the lowest value of 13.02. India's solar power capacity has doubled in the last decade, ranking fourth in installed solar, wind, and renewable energy capacity. Solar and wind costs are predicted to decrease 40 times in 30 years. The bar chart reveals India's top energy installed states, with Rajasthan having the highest solar capacity (18.05) and the highest renewable energy capacity (23.40), followed by Karnataka (16.25).

4. Conclusion

Karnataka's rural energy programs have made remarkable strides in sustainable development and electrification. The NBOMP harnesses biogas for cleaner energy and improved agriculture, though challenges persist in biogas development. Government initiatives like the Karnataka State Biofuel Policy, DDUGJY, and Saubhagya have boosted rural electrification, evident in budget allocations. Karnataka's commitment to 500 GW of renewable energy by 2030 is evident in wind and solar capacity growth. Household electrification under BELAKU is noteworthy, despite challenges. Karnataka leads in renewable energy, signaling a dedication to clean sources. These efforts drive sustainability, economic growth, and a brighter future for residents.

References

[1] **Jagadeesha, D., &Devaraja, T. (2023).** *Renewable Energy in Karnataka: Current Status and Future Potentials* (p.5951*5961). https: //www.eurchembull. com/uploads/paper/e188eb2c5c87085689c1c3f5349aad 6d. pdf

[2] **Kattumuri, R., & Kruse, T. (2017).** Renewable technologies in Karnataka, India: jobs potential and co - benefits. *Climate and Development*, *11* (2), 124–137. https: //doi. org/10.1080/17565529.2017.1410085

[3] **Liu, Z. (2017).** China's strategy for the development of renewable energies. *Energy Sources, Part B: Economics, Planning, and Policy*, *12* (11), 971–975. https: //doi. org/10.1080/15567249.2017.1336813