



# Financing Of Solar Energy In Karnataka

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## Abstract

Solar energy is an excellent source of alternative energy because it is renewable, economical and does not pollute the environment. Solar energy also helps to stabilise energy prices and give numerous social, environmental and economic benefits. This has been indicated by solar energy's contribution in achieving sustainable development through meeting energy demands, creating jobs and protecting the environment. However the crux of the issue is financing of solar energy projects.

Karnataka is leading in solar energy production with positive implications for economic development and sustainable development. The success of these depends on mobilization of financial resources and exploring new funding options. Hence, this study attempts to examine all these issues. In this context this paper is an attempt to examine policy environment and sources of financing of solar energy development in Karnataka.

**Key words:** Solar, Energy, Sustainable, Finance, Economic, Development

## Introduction

Karnataka is one of the leading states in India in the effective harvesting of electrical power from solar energy sources. However, there are and there will be many challenges for the effective harvesting of electrical power from these renewable energy sources. The changing scenario in the form of demand for power, technological developments, government policies, financing facilities and the sustainable development of a country largely depend on its energy production and efficient utilization of available natural resources for energy production. In this regard, the role of institutions is very much imperative to set the rules of the game.

Karnataka is among the leading States in solar energy sector in the country with a solar energy generation capacity of about 8250.09 MW (as on August 2023). The State has achieved its stature through its effective policy, programs and implementation. The State is endowed with renewable energy potential which includes solar, wind, solar-wind hybrid, biomass, co-generation, Waste to energy, small hydro and other renewable energies that make Karnataka a favourable destination for solar energy investments in India.

Against this background an attempt has been made to examine the following objectives.

- To examine the financing policies of solar energy in Karnataka.
- To discuss the sources of solar energy financing in Karnataka.
- To analyse the risk and challenges involved in financing of solar energy in Karnataka.
- To discuss the new methods of financing of solar energy in Karnataka.
- To highlight the prospects of financing of solar energy in Karnataka.

The present study is mainly based on secondary sources of data. The secondary data have been collected from various annual reports of Ministry of New and Renewable Energy (2023), International Energy Agency (IEA), Indian Renewable Energy Development Agency (IREDA), Finance Department, Government of Karnataka, Budget Volumes, Annual Financial Statement for the Year 2009-10 to 2023-24 and Karnataka Renewable Energy Development Limited (KREDL), published and unpublished theses, reputed journals and articles, newspapers, websites, etc. The study is carried out by using basic statistical tools like average, annual growth rate and compound annual growth rate.

### **Financial Requirements of Solar Energy Sector**

Karnataka is the leading State in installation of solar energy capacity in the country. As on 2023, the installed capacity of solar energy in the State is about 8250.09 MW which is the highest among renewable energy resources rich States in India.

**Table- 1: Cumulative Approx Investment Received and Expected Investment of Renewable Energy in Karnataka**

( inCrores)

RE Sources	Allotted Capacity (MW)	Commissioned Capacity (MW)	Cancelled Capacity (MW)	Approx Investment in Karnataka (Crores)	Expected Investment by IPPs for Allotted Capacity (Crores)
Wind	24684.87	5223.39	9941.41	31340.34 (37.08%)	57120.42 (63.32%)
Hydro	3010.25	903.46	1827.82	4517.3 (5.34%)	1394.85 (1.55%)
Co-gen	2212.65	1731.16	0	8655.8 (10.24%)	2407.45 (2.67%)
Biomass	395.13	139.03	0	695.15 (0.82%)	1280.5 (1.42%)
Municipal Solid Waste	51	0	0	0 (0.00 %)	255 (0.28%)
Solar	14260.82	7863.87	907	39319.35 (46.52%)	27449.75 (30.43%)
Hybrid Wind & Solar	50	0	0	0 (0.00%)	300 (0.33%)
<b>Total</b>	<b>44664.72</b>	<b>15860.91</b>	<b>12676.23</b>	<b>84527.94 (100%)</b>	<b>90207.97 (100%)</b>

Sources: KREDAL

In the above table, the details of the cumulative approx investment received and expected investment of renewable energy in Karnataka during the year 2022 are presented. As per the above table, Wind Energy with 24684.87MW allotted capacity and 5223.39MW of commission capacity, and also 9941.41MW of cancelled capacity has received around ₹ 31340.3crores of approximate investment received by the state which constitutes 37.08% of the total investment and the expected Investment by IPPs for allotted capacity is ₹57120.42crores which constitutes 63.32% of the total investment.

Similarly, Hydro Energy with 3010.25MW allotted capacity and 903.469MW of commission capacity, and also 1827.82MW of cancelled capacity has received around ₹4517.3crores of approximate investment received by the state which constitutes 5.34% of the total investment and the expected Investment by IPPs for allotted capacity is 1394.85crores which constitutes 1.55% of the total investment.

Likewise, Co-gen Energy with a ₹ 2212.65MW allotted capacity and 1731.16MW of commission capacity has received around ₹ 8655.8crores of approximate investment has received by the state which constitutes 10.24% of the total investment, and the expected Investment by IPPs for allotted capacity is ₹ 2407.45crores which constitute 2.67% of the total investment.

Further, Biomass Energy with 395.13MW allotted capacity and 139.03MW of commission capacity has received around ₹ 695.15crores of approximate investment has received by the state which constitutes 0.82% of the total investment, and the expected Investment by IPPs for allotted capacity is ₹ 1280.5crores which constitute 1.42% of the total investment.

Subsequently, for the Municipal Solid Waste and Hybrid Wind Solar Energy with 51 and 50 MW allotted capacity, the expected Investment by IPPs for allotted capacity is ₹ 255 crores and ₹ 300crores respectively which constitutes 0.28% and 0.33% of the total investment.

Most importantly, Solar Energy with a 14260.82MW allotted capacity and 7863.87MW of commission capacity, and also 907MW of cancelled capacity has received around ₹39319.35crores of approximate investment received by the state which constitutes 46.52% of the total investment and the expected Investment by IPPs for allotted capacity is Rs27449.75crores which constitutes 30.43% of the total investment.

It can be observed from the above analysis that, among all the renewable energies, solar energy has made a significant contribution. Hence the allotted investment as well as expectations is also very high in solar energy sources.

### **Financing Policies Relating to Solar Power Projects**

Government of Karnataka has introduced solar energy financing policy for the development of different forms of solar energy. The policy statements are as follows.

Solar energy requires strong and stable financial and physical security. The installation of solar energy devices is an expensive investment. Therefore, consumers, as well as the government, need a well-allocated security system to safeguard their property. Currently, there is an immense dearth of security provision in Karnataka in terms of solar projects. Some of these projects are in the experimental stage, which blocks the opportunity for steady financing in the sector. Creation of a financial framework with a holistic view of the sector is needed for better financing for solar energy. Proper policies and security provisions will safeguard users and encourage investors.

Many countries support solar energy growth through interest subsidies or production-based payments. Subsidies or capital grants were initially used and supported by the government. Businesses should be driven by the market, not just by government grants. This change will increase funding in the solar power sector and simultaneously decrease the government subsidy load. To ensure continuity in its development of adequate financing and fund flow is necessary.

### **Karnataka Renewable Energy Policy – 2009-2014**

This policy replaced all the policy guidelines/instructions issued earlier on this behalf. The provisions contained in this Renewable Energy Policy were applicable to all the Renewable Energy Projects. This policy was applicable to all the Renewable Energy projects financing and those Renewable Energy projects in the process of development including already commissioned Renewable Energy projects under the policy.

## **Karnataka's Solar Policy 2014-2021**

The Central Government introduced Jawaharlal Nehru National Solar Mission (JNNSM) in January 2010; with the main objective of achieving 34152 MW of solar power capacity by 2022, which will be nearly 3 percent of the total energy consumption and it is focused effort to tap country's naturally available energy resources and distribution to less carbon sustainable development in India. The State is rich in the solar resources and solar energy has complemented the conventional sources of energy in a huge way. Karnataka is blessed with 240 to 300 sunny days with good solar radiation of 5.4 to 6.2 kWh/ m<sup>2</sup> / day. Karnataka was the first southern State to notify its solar policy in 2011 and to commission utility scale solar project in the country. The solar energy Potential in the State projects was of 20 GW. Considering various factors like availability of wastelands, infrastructure etc., the modest potential may be nearly 10 GW. Karnataka has the potential to evolve as solar energy generation centre in the country due to a host of favourable factors.

## **Karnataka Renewable Energy Policy, 2016-2022**

This policy focuses on renewable energy resources of all forms including Wind, Wind-Solar Hybrid, Small Hydro, Biomass, Cogeneration, Waste-to-Energy, and Tidal. State Government is committed to give 24x7 power supplies to all by 2020, and after planning for in the long-term financing. In the beginning, State Government proposed "The Karnataka Renewable Energy Policy, 2009-14" to encourage and control the renewable energy potential in the State. The policy initiatives have enabled capacity addition of 1,970 MW during the five years of the policy term.

## **Karnataka Renewable Energy Policy, 2022-27**

As on December 2021, the installed capacity of solar energy in the State was about 7,523 MW which was the highest among renewable energy rich States in India. To tap the existing solar energy opportunities in the State and to cater to the demand of low-cost solar energy within the country, this Policy focuses on promotion and development of following solar markets in the State and to continue Karnataka State's position as a preferred investment destination in the solar energy sector and create an ecosystem for sustainable and green energy development in the State.

## **Sources of Finance of Solar Energy in Karnataka**

The Government is encouraging the adaption of solar energy for daily electricity purposes. Solar Panel is one of most efficient investments. They are durable and energy-saving and offer the best alternative to coal power. Solar Energy being the most reliable and environmentally friendly source of energy, gives the maximum output for investment. To harness maximum solar energy, solar panels are installed on the rooftop, in an open area where it can receive maximum sunlight.

While solar is the most convenient energy source, switching to it from the conventional energy source might not be feasible. While energy from the sun is free, manufacturing the solar plants with MW level of capacity, its equipment and the installation is expensive. Finding funding options is one of the most difficult challenges facing investors in the solar energy sector.

In the foreseeable future, there are numerous ideas to obtain energy from carbon-free sources in order to maintain energy sustainability. Now we are aware that renewable energy sources are an expensive, it is also obvious that the cost of installation is also enormous. So it becomes sensible to search for a reliable financing system. Let's discuss about a few financing options for solar energy:

### Public investment

Public investment plays a significant role in promoting renewable energy development in the state. These incentives are generally granted by the state governments through policy measures out of their corresponding yearly budgets. These schemes are significant in influencing the investment choice and decision by interested investors as the effective benefits in the form of subsidies and incentives have always been attraction for investors to initiate a project. Considering the fact, Government of Karnataka has adopted similar approach in attracting investments for renewable energy projects in the state.

**Table- 2: Budgetary Expenditure on Renewable Energy Development in Karnataka**

(Rs in Lakhs)			
Year	Budget Estimate	Revised Estimate	Actual Expenditure
2009-10	1192.23	1192.23	912.86
2010-11	1818.08	2018.08	1160.32
2011-12	1968.20	1968.20	1670.84
2012-13	1955.20	1955.20	1612.66
2013-14	1925.91	1925.91	1273.03
2014-15	1611.24	2621.21	2347.12
2015-16	1734.00	45403.00	45346.92
2016-17	1926.00	1926.00	830.68
2017-18	1808.00	1808.00	799.29
2018-19	871.00	871.00	358.39
2019-20	549.00	564.17	439.51
2020-21	28.00	37.00	26.14
2021-22	40.00	40.00	30.16
2022-23	1000.00	1000.00	-
2023-24	2000.00	-	-

**Source:** Finance Department, Government of Karnataka, Budget Volumes, Annual Financial Statement for the Year 2009-10 to 2023-24

The budgetary expenditure on renewable energy development in Karnataka from the year 2009-10 to 2023-24 is presented in table 2. As mentioned in the table, the expenditure made under Revenue account was Rs.912.86Lakhs and it has decreased drastically to Rs.30.16Lakhs during 2021-22. Whereas, the budget estimate on renewable energy sources in the year 2009-10 was Rs.1192.23Lakhs and it has increased to Rs. 2000 lakh during 2023-24. Further, the revised budget estimate of renewable energy sources in the year 2009-10 was Rs. 1192.23 Lakh and it has declined gradually to Rs.1000 Lakh during 2022-23. It is observed from the above analysis that, there have been significant variations in the budgetary estimates for solar energy sources in Karnataka during the study period.



## Bank finance

Owning a solar power plant is unquestionably one of the finest methods to get energy needs sorted. However, undoubtedly need to be loan eligible. Some of the major banks may be interested in approving loan if project is good enough. Of course, banks are the most convenient place to finance solar plant projects. Private Banks offer numerous schemes to take loans at affordable rates. Of all, the banks are the only ones that can assist in funding such enormously vast investment projects. Many private banks show interest in financing solar-related projects. Of course, the procedure could take a while, and need to meet the prerequisites and go over the project model in great detail.

State Bank of India (SBI), Punjab National Bank, Bank of Baroda, Central Bank, ICICI, Yes Bank, Axis Bank offer debt finance for various solar projects at interest rates ranging from 9.5% to 10.5% per annum. SBI is set to finance the largest capacity of 15,000 MW among public sector banks.

## Non-Banking Financial Companies

The finance is channeled through several modes, which include direct lending through numerous financial institutions such as NBFCs. The agency of national importance was established in New Delhi in year 1987. IREDA is a Government of India functionary working under the governmental control of MNRE primarily engaged in promoting, developing and extending financial assistance for setting up projects relating to new and renewable sources of energy.

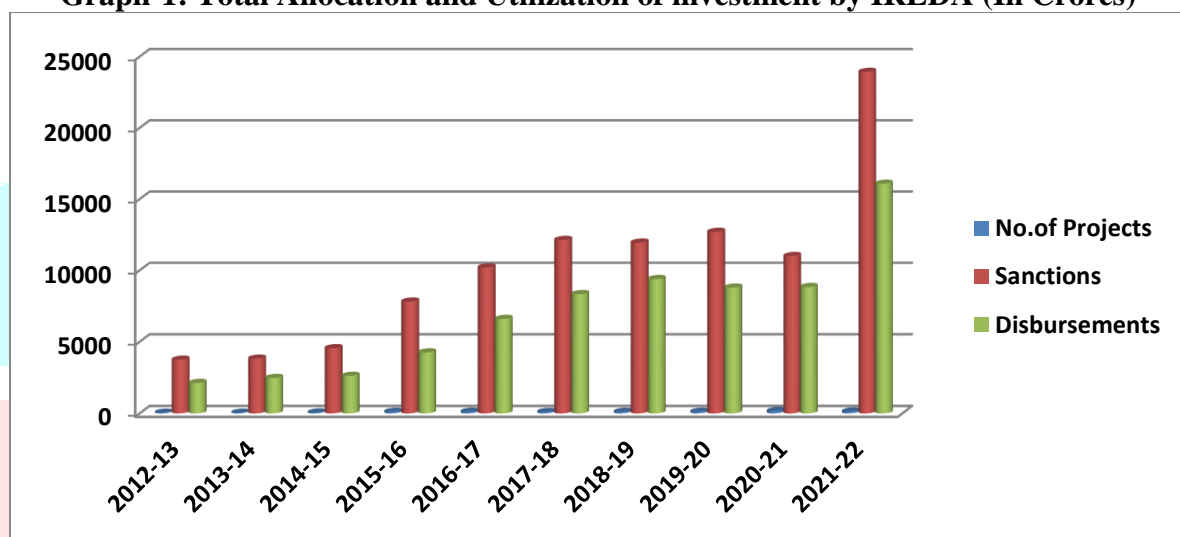
IREDA provides loans with little interest rates on it for encouraging investment in Renewable energy projects. Further IREDA also utilizes the funds from 'national clean energy fund' to offer sponsored a 5% rate for a RE projects via selected banks. IREDA also facilitates funds from international organizations and banks for example (EIB) has provided a long-standing loan of Euro 150 million to fund renewable energy projects in recent times, also the World Bank contributed \$100 million to IREDA to establish solar parks. The government intensified share capital of IREDA to INR 6000crore from INR 1000crore. This move facilitates IREDA to organize funds to the refrain in INR 14000crore to support 4800 MW of RE projects in 12th five year plan<sup>1</sup>.

<sup>1</sup> Cabinet nod to up authorized share capital of IREDA to Rs 6000 crore, available at: /economictimes.indiatimes.com/article show/, last accessed on 7 January, 2019 at 3 pm.

**Table-3: Total Allocation and Utilization of investment by IREDA**

Year	No.of Projects	AGR	Sanctions (In Crores)	AGR	Disbursements (In Crores)	AGR
2012-13	45	-	3,747.36	-	2,125.50	-
2013-14	44	-2.22	3,818.40	1.90	2,471.08	16.26
2014-15	61	38.64	4,548.79	19.13	2,619.45	6.00
2015-16	108	77.05	7,806.46	71.62	4,257.39	62.53
2016-17	112	3.70	10,199.01	30.65	6,593.49	54.87
2017-18	98	-12.50	12,130.01	18.93	8,328.38	26.31
2018-19	108	10.20	11,941.87	-1.55	9,385.37	12.69
2019-20	114	5.56	12,696.11	6.32	8,785.31	-6.39
2020-21	160	40.35	11,001.30	-13.35	8,828.35	0.49
2021-22	129	-19.38	23,921.06	17.44	16,070.82	82.04
<b>CGR</b>	<b>13.9231</b>	<b>-</b>	<b>20.42873</b>	<b>-</b>	<b>24.21245</b>	<b>-</b>

Sources: MNRE Annual Reports 2012-13 to 2020-21 and IREDA Annual Reports 2012-13 to 2021-22

**Graph-1: Total Allocation and Utilization of investment by IREDA (In Crores)**

The projects in Renewable Energy (RE), Energy Efficiency/Conservation (EE), and some other Environmental Sustainable technologies, including Power Generation, Transmission, Renovation, and modernization, are techno-commercially more viable and are eligible to obtain finance from IREDA. In the above table 3, the total allocation and utilization of investment on various energy projects from 2012-13 to 2021-22 are presented. As per the given information, in the year 2012-13, the number of energy projects was 45 which has increased to 129 in the year 2021-22 with a compound growth rate of 13.92. Here an attempt has been made to analyse the annual growth of the projects, as per the AGR, in the initial year i.e., 2013-14 the average annual growth was negative and it has reached 40.35 percent in the year 2020-21 and later in the next year drastically declined to -19.38 percent due to the impact of covid-19 and other consequences.

The above table also shows the total sanctioned amount for such energy projects during the study period from 2012-13 to 2021-22. As per the table, in the year 2012-13, the total sanctioned amount was Rs 3747.36crore and that has increased tremendously to Rs 23,921.06crores with a compound growth of 20.42 percent. The average annual growth of the same was only 1.90 percent during 2013-14 which has increased to 17.44 percent in the year 2021-22. Whereas, the growth of disbursed amount out of sanctioned amount was Rs2, 125.50crore in the initial year of the study and it has increased drastically to Rs16, 070.82crore in



the year 2021-22 with a compound growth rate of 24.21 percent. The AGR of the disbursed amount was 16.26 percent during 2013-14 which has been raised to 82.04 percent in the year 2021-22. It is very clear from the above analysis that, there has been a variation in the number of energy projects and also it has been negative in the last year due to covid-19 effect. Further, there has been considerable growth in the sanctioned amount for projects, but compared to the sanctioned amount, the annual growth of the amount disbursed has increased over a period of time.



**Table- 4: Source Wise Allocation and Utilization of Investment by IREDA****(In Crores)**

Year	Wind Power		Hydro Power		Biomass Power & Cogeneration		Solar Power		Waste to Energy	
	Sanction	Disbursements	Sanction	Disbursements	Sanction	Disbursements	Sanction	Disbursements	Sanction	Disbursements
2012-13	1792.17	1207.89	914.46	356.28	711.12	374.94	321.51	151.2	8.1	2.45
2013-14	1801.3	1173.55	724.52	724.5	402.17	198.17	787.41	274.86	3	6.88
2014-15	2556.76	1354.93	461.26	388.7	189.91	259.61	1291.45	576.1	1.18	2.19
2015-16	2738.51	873.5	395.92	340.87	310.63	305.32	2684.68	1519.18	13.67	0.85
2016-17	2460.5	2535.59	329.74	340.87	146.38	86.84	4778.39	1524.03	25.05	2.59
2017-18	3369.13	2823.49	510.49	330.2	164	59.25	4630.91	2746.31	317.6	60.55
2018-19	1524.94	1557.16	134.36	352.65	24.87	46.83	5748.62	3828.47	327.14	143.79
2019-20	1610.55	1057.11	295.28	295.97	44.12	118.11	4042.09	2666.1	118.38	78.12
2020-21	524.72	900.65	806.82	682.91	146.87	36.91	2289.49	1775.19	93.01	147.17
2021-22	2538.9	2114.38	2169.04	1195.09	42.79	16.57	4880.24	3406.15	110.26	107.2

Sources: MNRE Annual Reports 2012-13 to 2020-21 and IREDA Annual Reports 2012-13 to 2021-22

Source-wise distribution of sanctioned amount and disbursed amount towards energy projects has been indicated in the above table 4. Here energy sources such as Wind Power, Hydro Power, Biomass Power, Solar Power, and Waste to energy sources details are provided from 2012-13 to 2021-23.

- Firstly, in the year 2012-13, the total sanctioned amount for Wind Power was 1792.17crores which has been increased to Rs 2538.9crores during 2021-23. Similarly, the disbursements were also only Rs 1207.89crores at the beginning of the study period which was increased to Rs 2114.38crores in the year 2021-23. Here it can be noted that during 2019-20 there has been a steep decline in the allocation due to because of covid-19 health emergency.
- Similarly, for Hydropower energy also, in the year 2012-13, the total sanctioned amount wasRs914.46crores and the disbursement wasRs356.28crores which have been increased to Rs2169.04crores and Rs1195.09crores respectively in the year 2021-23.
- Likewise, in the year 2012-13, the total sanctioned amount towards Biomass Power was Rs711.12 crores and disbursement was 374.94crores but the allocations declined steeply during the year 2021-23 due to health emergency in the country.
- Solar energy consumption is becoming prominent nowadays, so in the year 2012-13 Rs321.51crore was with Rs151.2crores of disbursement which has increased substantially to Rs4880.24crores and 3406.15crores in the total allocation during the study period.
- Finally, in the waste to the energy sector, in the year 2012-13, only Rs8.1crores were initially sanctioned and the disbursed amount was only Rs2.45crores and it has increased significantly to Rs110.26crores and Rs 1072crores during the study period.

It is very clear from the above analysis that, every energy sector has been contributing towards generating alternative energies for domestic consumption but when compared to other energy sources, the Solar and Waste energy sectors have been performing well, hence both the sectors have registered substantial growth in the allocation.

### **Dedicated power sector financing**

**Rural Electrification Corporation:** As India and the world strive towards a cleaner and greener energy landscape, REC's dedication to fostering green finance initiatives and its pivotal role in India's energy transition reinforce its commitment to creating a sustainable and eco-friendly future.

REC provides financial assistance for power generation projects. They propose a debt-to-equity ratio of 70:30 for private-sector borrowers and follow the lead banks' ratio for other cases.

REC Limited is an NBFC focusing on Power Sector Financing and Development across India. Established in 1969, REC Ltd. has completed over fifty-four years in the area of its operations. It provides financial assistance to the complete power-sector value chain; for various types of projects including Generation, Transmission & Distribution and Renewable Energy. Recently, REC has also diversified into non-power Infrastructure and Logistics sector, to cover areas such as airports, metro, railways, ports, bridges, etc.

**Power Finance Corporation:** PFC's commitment to advancing energy transition and supporting green energy ambitions is reiterated through this partnership. The venture aligns with India's objectives in the renewable energy sector, emphasizing the country's on-going efforts to achieve sustainable and environmentally friendly solutions.

REC Limited has sanctioned debt funding of more than Rs. 3,081 crore to renewable energy company Serentica renewables for its 560 MW peak Greenfield solar-wind hybrid project in Gadag district of Karnataka. The loan documentation has been signed and disbursement of funds is being done.

REC Limited, a Maharatna company, has emerged as a frontrunner in catalyzing India's energy transition, in alignment with the nation's COP26 commitments and recent G20 pledges under India's G20 Presidency. With a resolute vision and unwavering commitment, REC is on a trajectory to achieve a green finance loan book of Rs. 3 lakh crore by the fiscal year 2030.

### **Investment Banks**

Government is encouraging adoption of solar energy. To promote convenient adoption and use of solar energy. Public sector banks and private banks have been given statutory instruction by Ministry of Finance to offer loan at reasonable cost.

Considering the need to accumulate significant financial resources for the introduction of solar PV technologies for electricity production, governments, international financial institutions and large commercial banks are making significant efforts to develop long-term financing programs for solar power plants, in particular, to simplify bank investment lending.

### **Karnataka Renewable Energy Development Limited**

Karnataka Renewable Energy Development Limited (KREDL) is established in 1996 as a Nodal Agency of the Government of Karnataka to identify, promote and develop Renewable Energy projects in the state. Besides, KREDL co-ordinates with all agencies both at state level and national level to promote Renewable Energy in the state. It also coordinates for all issues relating to development of Renewable Energy projects in the private sector and assists the independent power producers and Government at the state level and national level.

### **International Financing**

International Finance Corporation (IFC), the financing arm of the World Bank is engaged in financing of solar power projects in India. EXIM Bank is also a good option for getting finances of solar power projects. The Asian Development Bank has also emerged as a prominent lender to promote solar power projects in India. European Investment Bank (EIB) is also interested in financing solar parks in India. Apart from these institutions, many green energy funds are providing equity funding at a cheaper rate for solar power projects.

## Clean technology fund

Climate Investment Funds comprises two funds, the Clean Technology Fund and the Strategic Climate Fund. The Clean Technology Fund provides new large-scale financial resources to invest in clean technology projects in developing countries, which contribute to the demonstration, deployment, and transfer of low-carbon technologies with a significant potential for long-term greenhouse gas emissions savings.

## Solar Energy Financing Schemes in Karnataka

Karnataka is leading in solar energy production with positive implications for economic development and sustainable development. The success of these depends on governments framing role in the schemes and programs.

- **Akshaya Shakthi Nidhi (Green Energy Fund)**

In order to facilitate renewable energy project financing and energy conservation and efficiency measures, Green Energy Fund or Akshaya shakthi nidhi be established which draw upon resources raised through the green energy cess mentioned above. The Akshaya shakthi nidhi will be administered by KREDL for support of renewable energy mainly in public-private participation (PPP) mode for decentralized generation and distribution of renewables-based power for the benefit of the rural sector.

- **Renewable Energy Project Financing**

Various renewable energy projects have attracted substantial private investment. The profit making central and state public sector undertakings may also invest in renewable energy projects and lead to greater infusion of funds.

- **Off Grid Solar Water Pumpset Scheme**

Solar water pumpset (SWP) scheme of 5HP capacity is implemented to the bore wells of farmers from 2014-15 with funding from MNRE of Government of India & Government of Karnataka with beneficiary contribution. The funding pattern was MNRE provided CFA (Central Financial Assistance) 30% of benchmark cost of SWP from 2014-15 and 20% of benchmark cost from 2017-18. Beneficiary Contribution for General Category was Rs 1 lakh/SWP of 5HP capacity and free of cost for SC/ST beneficiaries. The balance portion after MNRE CFA and beneficiary contribution was funded by Government of Karnataka. As on Nov-2022, 3710 numbers of SWPs (General category: 3009 Nos., SC: 487 Nos., ST:214 Nos.) of 5 HP capacity has been installed in the State through KREDL.

- **Component-B of PM- Kusum (Pradhan Mantra Kisan Urja Suraksha Evamuttan Mahaabhiyan)**

MNRE provides Central Finance Assistance up to 7.5 HP solar water pumpset. Solar water pumpset above 7.5 HP capacities may be installed; however MNRE CFA is limited up to 7.5 HP capacities only. Funding pattern as per PM-KUSUM, Component-B guidelines is that MNRE provides 30% of

benchmark cost or tendered cost whichever is lower. Government of Karnataka has to provide State Financial Assistance of 30% and the beneficiary contribution is 40%. If State contributes more than 30% then the beneficiary share will be reduced accordingly.

As per GOK directions to implement off grid solar water pumpsets up to 7.5 HP capacity under PM-KUSUM, Component-B scheme, with sharing pattern as MNRE: 30%, GOK:50% and SC/ST beneficiary contribution: 20% (GOK share to be met from SCSP/TSP funds), Online application registration completed for SC/ST farmers and installation is under process.

Karnataka Government in its 2022-23 budget has estimated that 10,000 solar based irrigation pumpsets will be established through Karnataka Renewable Energy Development Limited (KREDL) at a cost of Rs.227 crore under PMKUSUMA component-B scheme.

- **Surya Raitha Scheme**

A scheme launched to encourage farmers to install solar panels for running their irrigation pumps. 2,400 pumps sets are expected to be deployed with the help of the central subsidy. The salient features of this scheme include:

- Farmers can opt for 90% subsidies on the solar systems
- Unsubsidised systems can sell excess electricity to the grid at 9.56 Rs/kWh; subsidised sets at 7.20 Rs/kWh

- **Ravi Kiran**

Karnataka Bank provides financial for solar projects Installation of solar lighting system, solar water heating system, solar lantern etc.

- **Development of Solar Parks and Ultra Mega Solar Power Projects.**

MNRE has sent a proposal to all states for development of Solar Parks and Ultra Mega Solar power projects. This proposal is envisaged to achieve development of one lakh MW of solar projects in the country. Under this scheme for development of solar Parks in Karnataka, a JV company “M/s. Karnataka Solar Power Development Corporation Pvt. Ltd (KSPDCPL)” has been formed by KREDL and SECI. 11,000 acres of land has been identified at Pavagada Taluk in Tumkur District, Karnataka.

The park, known as Shakti Sthala is located around 180 km away from Bengaluru in the Pavagada region of the Tumkur district. It is spread over 13,000 acres of land that has been taken from 2,300 farmers on a 25-year lease. The total capacity of this solar park is said to be 2,000 megawatts.

The park has a capacity of 2,050 MW. This will help increase Karnataka’s power capacity from 23,379 MW and help bridge the gap between demand and supply of power. The budget for this park is calculated to be approximately Rs 16,500 crore.



## New Methods of Financing or Innovative Financing

Financing is critical to solar development, because the costs of solar technologies are paid up front, while their benefits are realized over decades. Solar financing has been shaped by the government incentives designed to accelerate solar.

- **National Clean Energy and Environment Fund (NCEEF)**

NCEEF is one such funding mechanism available to support, inter alia, renewable energy financing in India. The fund was created to support entrepreneurial ventures and research in the clean energy technologies by mobilizing funds through a cess on coal of INR 400 per ton known as Clean Environment Cess.

- **Green Banks**

Green banks help secure low-cost capital for clean energy projects at favourable rates and terms. The purpose of green banks is to focus on funding green energy projects as an investment and not on providing grants – hence capital loaned for projects is expected to be returned or repaid at some point.

- **Green Bonds**

Green bonds are innovative market-based financing instruments. They are fixed-income financial instruments for raising funds for projects that are environmentally beneficial in nature. The risk holdings in the case of green bonds are similar to those of other bonds. Green bonds do have to acquire the desired credit rating to attract institutional financing. Another unique type of green bonds issued by IREDA is called Green Masala Bonds.

### Risks and Challenges in Solar Energy Financing

- **Lack of Long- Term Financing**

Solar energy tend to have high up-front costs and low on-going operating costs, making access to long term funding for such projects a need. Without long-term financing, investment decisions are biased toward conventional technologies that can be financially viable with shorter-term loans

- **Lack of Project Financing**

Solar energy projects also seek to access funds on a project finance basis. With project finance the security for the loan comes from future project cash flows and little no up-front collateral is required. There is still however, the need for a share of the project to be funded from equity. This type of funding allows solar energy projects to spread their costs over the project lifetime, funding the high-up front cost for the positive cash flows generated during operations.

- **High and Uncertain Project Development Costs**

Solar energy projects are quite susceptible to changes in the regulatory framework. Due to their lack of cost competitiveness, these projects are dependent on a supportive regulatory framework to proceed including commitments to pay premium prices, priority access to electricity grids as well as support for the necessary infrastructure investments and guarantees of purchases of their output

- **Lack of Equity Finance**

While large numbers of solar energy project developers exist, there are only limited numbers of large-scale project sponsors, particularly among those operating in low-income countries, with the ability and willingness to fund renewable energy projects on a corporate finance basis.

- **Small Scale Projects**

The small scale of many solar energy projects creates important problems in obtaining private financing. Economies of scale in due diligence are significant, and many larger financial institutions will be reluctant to consider small projects.

### **Prospects of Solar Energy Financing in Karnataka**

Solar energy has been gaining a lot of attention in recent years as a reliable and sustainable source of energy. With increasing concerns about climate change and the need for clean energy, many countries are turning to solar energy as a solution. Karnataka is no exception, as the state has a vast potential for solar energy and has been making significant strides in harnessing this potential. Solar energy in Karnataka and discuss the various ways in which the country is utilizing this solar energy source.

Karnataka has enormous potential for solar energy. The state receives on an average 300 sunny days per year, making it an ideal location for solar energy production. Karnataka has the potential to generate up to 25 GW of solar energy, which is more than enough to meet the state's energy needs. Additionally, Karnataka has a large area of land that is suitable for solar power plants, like the states of Rajasthan, Gujarat, and Tamil Nadu being particularly well-suited for solar energy production.

The Government of Karnataka has implemented several policies and initiatives to encourage the development and use of solar energy in the country. The National Solar Mission provides financial incentives and subsidies to encourage the development of solar energy projects.

Karnataka is also making significant progress in the field of rooftop solar energy. Rooftop solar power systems are becoming increasingly popular in state, as they provide a cost-effective and efficient way to generate electricity. Additionally, many private companies and organizations are investing in rooftop solar projects, making it easier for individuals and businesses to install solar panels on their rooftops.

The Karnataka solar energy sector is also experiencing significant growth in the form of solar power parks. These are large-scale solar power plants that are built on several hundred hectares of land, and can generate several GW of electricity. Solar Park has been built in state, including the Pawagada Solar Park in tumkuru, which is currently the second largest solar park in the country, with a capacity of 2050 MW.

### Policy implication of the study

The scope of solar energy in Karnataka is vast and the state has made significant strides in harnessing its solar energy potential. The Government of Karnataka has implemented several policies, initiatives and created financial specialities to encourage the development and use of solar energy.

- As far as solar energy is concerned currently only short term financing facility is available but it needs long time period to generate solar energy so long term financing facility should be allowed.
- **Land:** large land is required to install solar energy, large land should be provided
- **Solar energy policies through link budget:** the policies made by the government regarding solar energy should be linked to the budget made by the government
- If Government increase the rebate schemes and subsidy percentage, people decide to install solar is a large scale.
- Karnataka largely depend on thermal and hydropower energy. If Karnataka promoted for the installation of solar energy to each district, it can generate power and also it will not effect on environment.
- Government should create awareness programme for promoting solar energy sources.

### Conclusion

Solar energy is an excellent source of alternative energy because it is renewable, economical and does not pollute the environment. Solar energy would help steady energy prices and give numerous social, environmental and economic developments. This has been indicated by solar energy's contribution to achieving sustainable development through meeting energy demands, creating jobs and protecting the environment.

Karnataka is one of the leading states in India in the effective harvesting of electrical power from solar energy sources, particularly from solar and wind energy. However, there have been, there are and there will be many challenges for the effective harvesting of electrical power from these renewable energy sources. The changing scenario in the form of demand for power, technological developments, government policies, financing facilities and the sustainable development of a country largely depends on its energy production and an efficient utilization of available natural resources. In this regard, the role of institutions is very much imperative to set the rules of the game.

Solar energy can be used in sustainable development in several ways. It can be used to generate electricity, heat water or air in homes and buildings, or produce solar fuels. It can also help to reduce greenhouse gas emissions. As more people become interested in installing solar panels, more energy employees are needed to meet demand. This sector requires jobs for manufacturing, installation and maintenance. By investing in solar, also investing in a new job market, and bolstering your economic development.

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