



ROLE OF RENEWABLE ENERGY FOR CLEAN ENERGY TRANSITION PLAN FOR INDIA AND DETERMINATION OF RETARIFF UNDER CERC TERMS AND CONDITIONS OF RESOURCES REGULATIONS, 2020

Abhijit Garai¹, Dr. Dinesh Kumar Pandey²

¹Research Scholar, Usha Martin University, Ranchi

²Asst Professor (Dept. of Business Management & Commerce) Usha Martin University, Ranchi

Article DOI: <https://doi.org/10.36713/epra10796>

DOI No: 10.36713/epra10796

ABSTRACT

India is second largest country in population and third largest greenhouse gas emitter in the world. India has committed 500 GW of RE by 2030 and aims to reach zero emissions by 2070. Also announce National Hydrogen Energy Mission to produce green H₂ and reduce CO₂ emission. Current share of renewable energy is not enough for decarbonised greenhouse effect. To make \$ 5 trillion economy and increasing GDP, drastic development of Industries and service sectors will increase energy demand. This is the perfect time to invest in green energy say renewable energy and create new employment in India. CERC has also set separate Tariff regulations for RE and it comes into force from 1.7.2020 and shall remain in force up to 31.3.2023.

KEYWORDS: Renewable Energy, Central Electricity Regulatory Commission, Carbon dioxide, Plant Load factor, Electricity Act, 2003, Ministry of New and Renewable Energy.

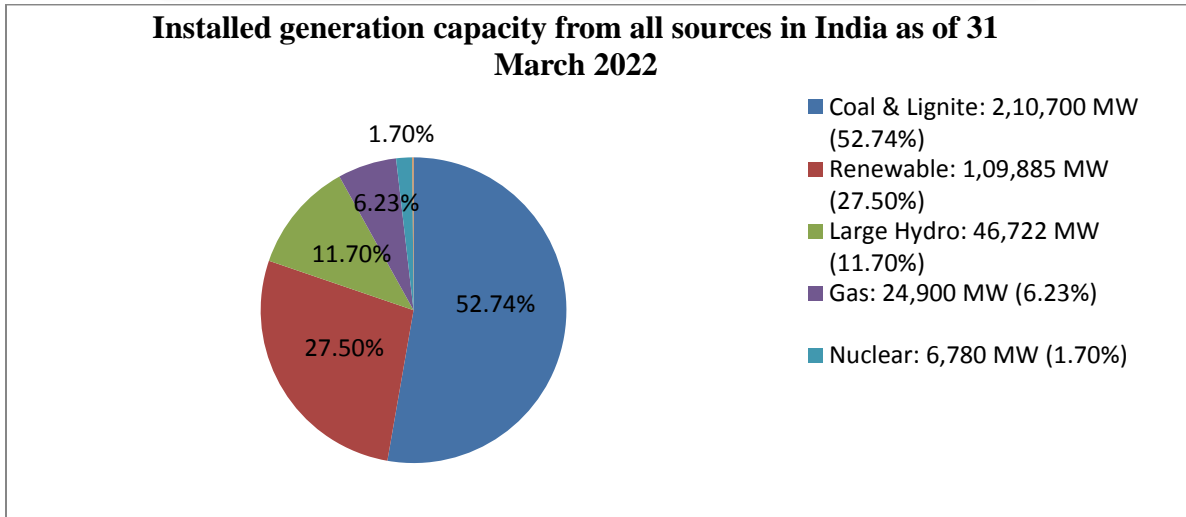
INTRODUCTION

The recent trend in the world is clean energy transition. India is also not an exception to this. India is working on that part and has set an ambitious target of installing 500 GW of renewable energy by 2030. It is a remarkable milestone target to fight against climatic changes. Economic growth of India is highest in the world over the last two decades. Drastic infrastructure development, construction of new factories and new service sectors have created huge demand of electricity. Coal and oil have been used as main sources of energy in recent past. Coal based power plants emit an average of 0.910 to 0.950 kg/kwh CO₂ and gas based power plants emit an average of 0.510 to 0.550 kg/kwh CO₂. Electricity demand of Indian people has rapidly increased. To meet the huge energy demand and rapidly growing economy green energy is most economical than fossil fuel based energy. The conventional Energy sources are basically based on fossil fuels which have finite reserves in nature and hence would become extinct in future. Grid connection has also reached almost all part of India. In spite of grid connection, several rural areas, remote areas are still far from electricity. All those areas are best for rooftop solar panel connection. India is working for energy security for 139 cr people. Many countries throughout the world have engaged themselves in searching and developing renewable energy sources that would be very essential to sustain the life cycle of human being. India's renewable power capacity is the fourth largest in the world and is growing at the fastest speed among all major countries. The renewable energy capacity including large hydro in India as on 31.03.2022 is currently 156.6 Giga Watts, which is about 39.2% of its total capacity.

Installed Generation Capacity from all sources as on 31st March, 2022

Source	Installed Capacity (MW)	Share
Coal & Lignite	2,10,700	52.74%
Large Hydro	46,722	11.70%
Other Renewable	1,09,885	27.50%
Gas	24,900	6.23%
Diesel	510	0.13%
Nuclear	6,780	1.70%
TOTAL	3,99,497	100.00%

Source: Ministry of Power, Govt of India.



Source: Own

The Union budget 2021-22 has allocated a capital fund of Rs. 1,000 cr. to Solar Energy Corporation of India and Rs. 1,500 cr. to the Indian Renewable Energy Development Agency to boost up in RE and increase liquidity.

The Union budget 2022-23 has allocated another Rs 19,500 crores under government's PLI scheme to boost local manufacturing of high-efficiency modules, preferring fully integrating manufacturing units into solar photovoltaic (PV) modules.

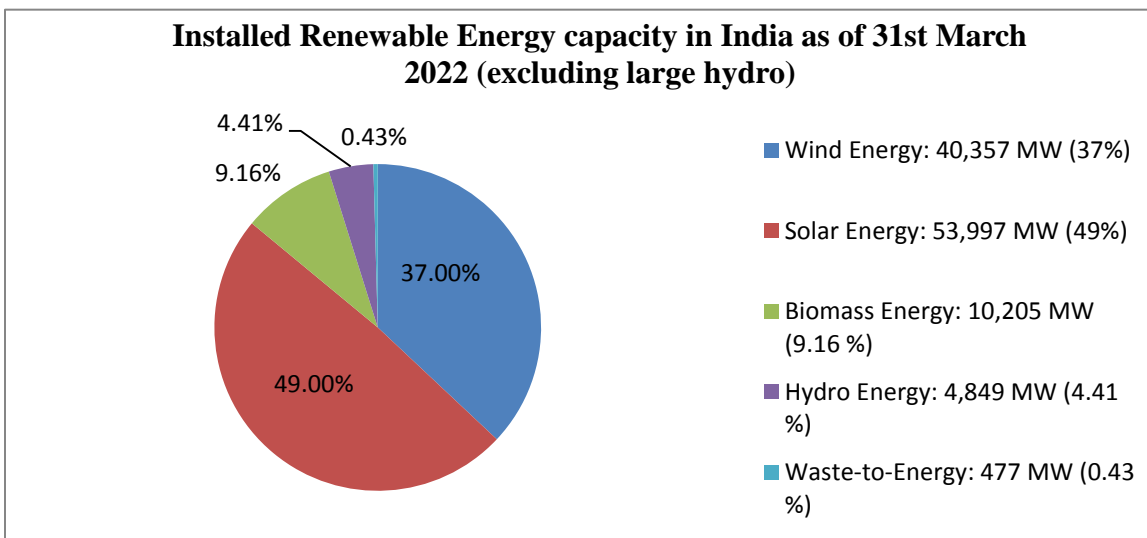
India received FDI of \$ 797.21 million in non-conventional energy sector during 2020-21.

Installed Renewable Energy capacity (excluding large hydropower) as of 31st Mar, 2022

Source	Installed Capacity (MW)	2022 Target (MW)
Wind Power	40,357	60,000
Solar Power	53,997	100,000
Biomass Power	10,205	10,000
Waste-to-Power	477	
Small Hydropower	4,849	5,000
TOTAL	1,09,885	175,000

Source: Ministry of New & Renewable Energy, Govt of India.

Source: Own



**What is the clean energy transition plan**

As per the CERC parameters like PLF, specific coal and oil consumption, technological obsolescence, age of thermal power plants, progressive retirement of 36 GW capacity of 211 thermal power plants has been outlined to reduce greenhouse gas. High efficiency low emission thermal power plants have to be increased to cope up with the shortfall in baseload electricity generation. Construction of 11 nuclear power plants capacity of 8,700 MW for supply of power without any CO₂ emissions.

Expected benefits of the plan

Installed capacity of thermal power plants will increase even after the retirement of obsolete thermal power plants and can save specific coal and oil consumption, water consumption may lead to reduce electricity tariffs. Total CO₂ emissions from thermal power sector will reduce. High Efficiency Low Emission thermal power plants minimizes the emissions of particulate matter (PM), SO₂, and NO₂ by installing high efficiency electrostatic precipitators and Flue gas desulfurization system.

Background of Electricity Act, 2003 (EA)

The Electricity Act, 2003 (EA) was introduced in Lok Sabha on 30.8.2001 and enacted w.e.f June,2003. It is the law which regulate generation, distribution and transmission of Power in India. Central Electricity Regulatory Commission (CERC) and State Electricity Regulatory Commission (SERC), both statutory bodies determine various tariff for regulating and controlling all power sectors in India. CERC Terms and Condition, 2019 for tariff of thermal, large hydro, transmission is applicable from the period 1.4.2019 – 31.3.2024.

Central Electricity Regulatory Commission (CERC) Renewable Energy Tariff, 2020

As per Electricity Act, 2003 (EA) CERC has issued Terms and Condition for tariff determination from Renewable Energy, 2020. The regulation was effected from 1.7.2020 and will be applicable up to 31.3.2023 unless any review or modification by commission to all grid connected generation station. These regulations are applicable only for tariff for a grid connected generation unit commissioned during the control period and tariff is determined Section 62 read with Section 79 of the Act of EA, 2003. Solar and small hydro power tariff regulations are discussed here. Tariff is determined on basis of capacity charges and energy charges.

1. Capacity charges means recovery of annual fixed cost which consist of the followings -

- a. Return of Equity
- b. Interest on Loan Capital
- c. Depreciation
- d. Interest on working capital
- e. Operation and Maintenance Expenses

2. Energy charges means recovery of landed fuel cost of power generating unit mainly for thermal power. In case of RE except few cases there are no scope of recovery of energy charges. Different parameter of capacity charges is discussed in brief.

a. Return on Equity – In case of solar PV power projects, solar thermal power projects and floating solar projects CERC is determined project specific cost as per market standard. Normal ROE is 14% on project cost and to be gross up with MAT. Total project cost includes land cost, interest during construction, all capital expenses. Debt equity ratio is to be maintained 70:30. Average project cost of solar power plant is Rs. 4.5 cr. to 4.75 cr.

b. Interest on Loan Capital - For tariff calculation, Prime lending rate of SBI plus 200 basis points of last six month normative interest rate has to be considered. 15 years loan tenure has to be considered. In excess of 30% equity cost to be considered as loan.

c. Depreciation – Depreciation has to be charged on capital cost admitted by CERC after taking into consideration 10% as salvage value. First 15 years depreciation has to be charged 4.67% annually and remaining amount shall be charged evenly up to the useful life of the project. Life of small hydro projects 40 years whereas 25 years for solar PV power project, solar thermal power project, floating solar project.

d. Interest on working capital – For working capital interest SBI Prime lending rate plus 350 basis points of last six month normative interest rate has to be considered. Working capital requirement for solar PV power projects, solar thermal power projects, floating solar projects, and small hydro project shall be determined as follows

- i. Operation and Maintenance expenses for 1 month.
- ii. Debtors for 45 days tariff as computed on capacity utilisation factor or plant load factor.
- iii. Spares for maintenance equal to 15% of O&M expenses.

8766 hours in year is to be considered for calculation of capacity utilisation factor and PLF. 21%, 23%, 19% are the capacity utilisation factor of solar PV power projects, solar thermal power projects and floating solar projects respectively. In case of small hydro projects located in HP, J&K, WB, Uttarakhand, Ladakh and NE states capacity utilisation factor is 45% and in rest states it is 30%.



e. Operation and Maintenance Expenses – CERC has the right to determine project specific O&M expenses as per prevailing market trends. O&M expenses escalate 3.84% yearly. Generally, 1 MW solar power plant O&M cost is Rs. 8 lakh p.a.

There are two category of small hydro projects one is below 5 MW and other is above 5 MW to 25 MW. In case of below 5 MW projects O&M expenses is Rs. 41.78 lakh/mw p.a. and other cases Rs. 31.34 lakh/mw p.a. if the projects located at HP, J&K, WB, Uttarakhand, Ladakh and NE states. For other states O&M expenses is Rs. 33.66 lakh/mw p.a. below 5 mw projects and Rs. 24.37 lakh/mw p.a. for above 5 mw projects.

Other general principles of RE energy tariff are

- For determination of project specific tariff separate petition has to be filed by petitioner to CERC with specific forms and deposit of requisite fees.
- In case of excess generation by generating unit over PLF the excess unit may be sold to third party if the beneficiary does not want to buy the excess unit. Excess unit beneficiary can buy 75% of tariff applicable of that year.
- Consent from beneficiary has to be obtained before submission of tariff petition to CERC.
- For any LC payment made by generating company within 5 days through RTGS or NEFT a rebate of 1.5% of bill amount shall be allowed.
- In case of delay payment beyond 45 days by Generation Company has to pay interest 1.5% per month.
- At the time of tariff determination CERC has to be considered any grant, subsidy or commission received from central or state govt.
- Where the grants or incentives received after determination of tariff then beneficiaries may deduct the amount from subsequent bills.
- Any generation based incentive received over and above tariff then it is the income of generating company. It is not adjustable with beneficiaries.
- RE project developer shall recover from beneficiary any statutory charges like water cess, electricity duty on auxiliary consumption subject to maximum of normative limit specified by CERC. Auxiliary consumption for solar PV power project and floating solar project is 0.75%. For solar thermal power project is 10%. In case of small hydro projects auxiliary consumption is 1%.

Solar tariff has been reduced to Rs. 1.99/ kwh from Rs. 6.47/ kwh. Similarly, wind tariff has been reduced to Rs. 3.00/ kwh from Rs. 5.92/ kwh in last six years.

In Uniform Renewable Purchase Obligations scheme all distribution licensees have to purchase minimum quantity of their total requirements from Renewable Energy Sources.

Projected cost 1 MW Solar Power Plant in India:

MNRE and State Govt nodal agencies has provided subsidy 20% - 70% for setting up a solar power plant with a capacity upto 1 MW in own land or rooftops for residential, institutional and non-profit organizations to promote Green Energy.

Estimated installation cost of 1 MW Solar Power Plant in India is discussed below

Capacity of Plant	1 MW	
Cost of the project	Solar Panel	3.00 cr
	Solar Inverter	1.00 cr
	Combiners Junction Boxes	0.20 cr
	Protective arrangements	0.10 cr
	Data Logger system & SCADA	0.07 cr
	Erection cost	0.50 cr
	Total Project cost (Approx)	4.87 cr

For 1 MW solar power plant 5 acre of Land is required. Cost of Land is not considered here. Solar power generation depends on sun light. It is assumed that 1 kw solar panel generates 4 units per day.

Generation in units for the year (4 units X 1000 kw = 4000 units per day) (1 mw = 1000 kw)

Yearly units generated (4000 units X 365 days)	14,60,000 units
Tariff per unit (Assumed)	Rs 4.45
Total Income per year as per tariff rate	Rs. 64,97,000
Debt: Equity ratio 70: 30 Rate of Interest on loan 10%. Total Debt (3.41 cr)	Rs. 34,00,000
Operation & Maintenance expenses as per CERC	Rs. 8,00,000
Depreciation (90% of project cost 4.87 Cr) @ 4.67%	Rs. 20,46,800
Total Expenses (Aprox)	Rs. 62,46,800
Generation cost per unit	Rs. 4.27



Surplus

Rs. 2,50,200

All the above calculations are on provisional basis for rough idea about generation cost. If the generation will increase then cost will decrease as the O&M expenses, interest and depreciation expenses are fixed.

Research Methodology: My present study is purely based on secondary data collected from different sources like various journals, magazines, newspaper, books and websites.

Research gap: This paper is based on solar and small hydro energy unit. Rest RE sources like Biomass energy, wind energy, tidal energy is not covered in this study. Study has not covered the EA, 2003. Paper has given overall idea about determination of RE tariff under CERC RE tariff, 2020. Paper has discussed expected benefits of clean energy transition in India.

Demerits of Clean energy transition

Indian solar PV manufacturing units are assembled the solar modules which are imported from China and Germany. Indian competency in solar technology is very low with only 246 patents as compared with leading solar manufacturing country China with 39784 patents. Huge capital incentives are required for incremental changes in technology. India must set up its own R&D for low cost latest technology savvy solar panel manufacturing.

Specialised skill like manufacturing and design engineers for manufacturing latest technology solar panel and assembly line skill workers are very much scare in India. NISE, IIT, ITI, National Skill Development Council should develop such skill to success Make in India project.

Setting up of solar manufacturing units require huge investment. Interest cost are main barrier to set up any manufacturing unit in India. Average interest rate from any financial loan in India is 11% as compared 5% in developed countries.

Regulatory body should regulate properly with standard terms and condition to control the monopoly of market.

Solar Power Plant takes 40 hectares to generate about 20 MW of energy using current solar energy generation technologies.

High need of energy storage facilities in low cost is required. Presently available storage technology in India is very expensive and has to be imported from Korea, Japan.

Renewable energy generation is totally depending on weather like sun light, rain, wind etc. If the dependent condition is not favorable then RE project could not feasible.

CONCLUSION: When it comes to renewable energy, the positives outweigh the negatives. Transitioning to clean energy on a personal, corporate, or governmental level will not only help you save money but also promote a cleaner, healthier environment for the future. Installing solar panels is one of the easiest ways to go green. Following commitment have been taken by Govt for clean energy transition

- India has made commitment to increase RE capacity to 500 GW by 2030.
- Govt has implemented so many reforms on RE policies and allocated huge funds in Union Budget 2021-22 and 2022-23.
- Announce National Hydrogen Energy Mission to produce 1 MT green H₂ by 2030 and reduce CO₂ emission.
- PLI scheme has been introduced to boost local manufacturing of high-efficiency modules, preferencing fully integrating manufacturing units into solar photovoltaic (PV) modules.
- Govt has announced to create 15 MMT production capacity of compressed biogas by 2024.
- 45 solar parks having capacity of 37 GW have been approved.
- The world's largest hybrid solar wind project is under installation in Gujarat.
- One solar city for every state have been approved by Govt.
- Major Central Public Sector Enterprises like NTPC, REC, PowerGrid, NHPC, THDC, PFC, NEEPCO have registered with Power Foundation under Society Act, under Power Ministry to promote clean energy transition.
- New opportunities for investment are wind solar hybrid, offshore wind energy, floating PV projects.

REFERENCES

1. Debnath, R., Mittal, V., & Jindal, A. (2022). A review of challenges from increasing renewable generation in the Indian Power Sector: Way forward for Electricity (Amendment) Bill 2020. *Energy & Environment*, 33(1), 3-40.
2. Gribkova, D., & Milshina, Y. (2022). Energy Transition as a Response to Energy Challenges in Post-Pandemic Reality. *Energies*, 15(3), 812.
3. Indrajayanthan, V., & Mohanty, N. K. (2022). Assessment of clean energy transition potential in major power-producing states of India using multi-criteria decision analysis. *Sustainability*, 14(3), 1166.



4. Kartal, M. T. (2022). *The role of consumption of energy, fossil sources, nuclear energy, and renewable energy on environmental degradation in top-five carbon producing countries*. *Renewable Energy*, 184, 871-880.
5. Lal SR, S., Herbert GM, J., Arjunan, P., & Suryan, A. (2022). *Advancements in renewable energy transition in India: A review*. *Energy Sources, Part A: Recovery, Utilization, and Environmental Effects*, 1-31.
6. Malik, A., & Bertram, C. (2022). *Solar energy as an early just transition opportunity for coal-bearing states in India*. *Environmental Research Letters*, 17(3), 034011.
7. *ibid.*
8. [https://cercind.gov.in/Terms and Conditions for Tariff determination from Renewable Energy Sources regulations, 2020. Order No.: RA-14026\(11\)/4/2020-CERC dt 23.06.2020](https://cercind.gov.in/Terms and Conditions for Tariff determination from Renewable Energy Sources regulations, 2020. Order No.: RA-14026(11)/4/2020-CERC dt 23.06.2020).
9. <https://cercind.gov.in/Terms and Conditions for Tariff determination from thermal & hydro power Sources regulations, 2019. Order No.: L-1/236/2018/CERC dt 07.03.2019>.
10. <https://cercind.gov.in/electricity act, 2003>
11. <https://cnbctv18.com/energy/how-indian-psus-can-impact-the-clean-energy-transition-12861992.htm>
12. <https://drishtias.com/pdf/1624876844-indian-initiatives-shaping-energy-transition.pdf>
India Stimulus Strategy - RMI
13. <https://energy.economictimes.indiatimes.com/news/renewable/opinion-indias-transition-to-a-clean-energy-system/88247507>
14. <https://energy.economictimes.indiatimes.com/news/renewable/budget-2022-emphasis-on-energy-transition-and-clean-energy/89377609>
15. <https://iea.org/commentaries/india-clean-energy-transition-is-rapidly-underway-benefiting-the-entire-world>
16. https://mnre.gov.in/img/documents/uploads/file_f-1612941710983.pdf, *Highlights - Budget 2021 - 22, Provisions for Renewable Energy (RE) Sector.*
17. <https://powermin.gov.in/power sector at a glance all India/>
18. <https://urbansolarise.com/1-mw-solar-power-plant-cost-in-india/>