Market Research Report on

Future & Growth

Renewable Energy Market in India

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Introduction

What is Renewable Energy?

Simply put, its energy sourced from renewable resources i.e. resources that can be replenished naturally on a human timescale. It can include sunlight, wind, rain, tides, waves, geothermal heat and biomass. Fossil fuels, which are currently the primary source of power in majority of the countries, are being used far more quickly than they are being replenished.

The G20 Summit

The G20 Summit is a congregation of countries with a view to avoid catastrophic climate change. They have come together to take strides to drive companies and consumers to reduce greenhouse-gas emissions and have begun to implement policies to achieve their goals.

The primary objectives of the G20 are:

a) Policy coordination between its members in order to achieve global economic stability, sustainable growth

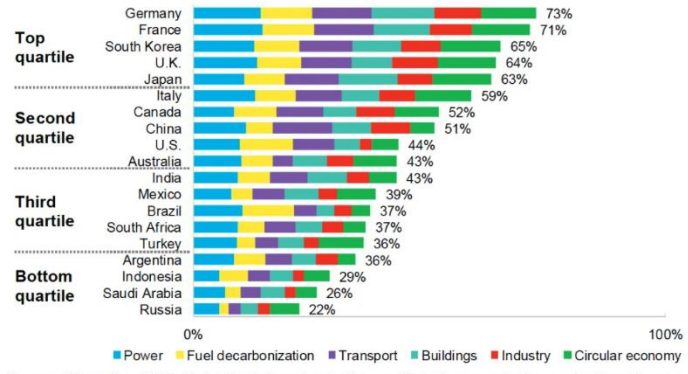
b) To promote financial regulations that reduce risks and prevent future financial crises; and

c) To create a new international financial architecture.

Currently, 19 countries and the European Union are part of G20.

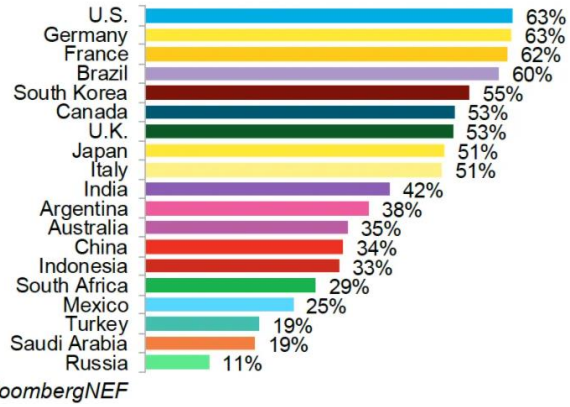
As per the 'G20 Zero Carbon Policy Scoreboard 2021' by BloombergNEF:

Figure 1: Policy Scoreboard – Issue 2021 results by sector



Source: BloombergNEF. Note: Fuel decarbonization = efforts to promote the production of green gas and biofuels, and CCUS.

Figure 22: Country scores – fossil-fuel decarbonization



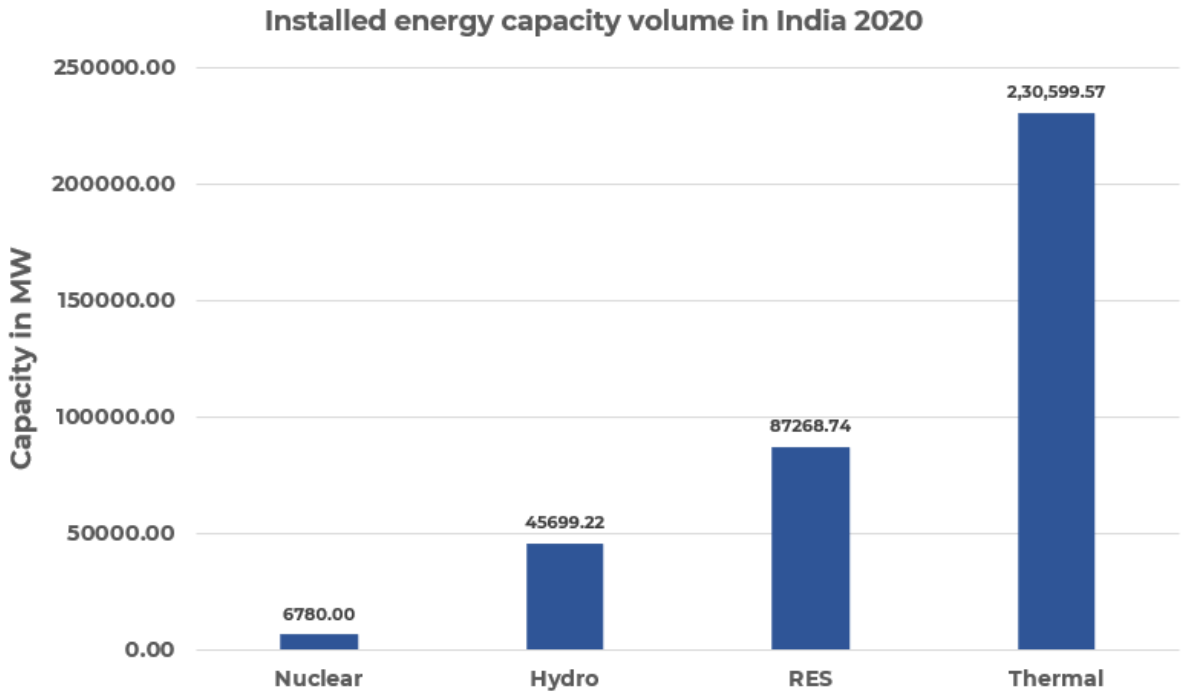
Source: BloombergNEF

Source: https://reglobal.co/g20-zero-carbon-policy-scoreboard-2021/

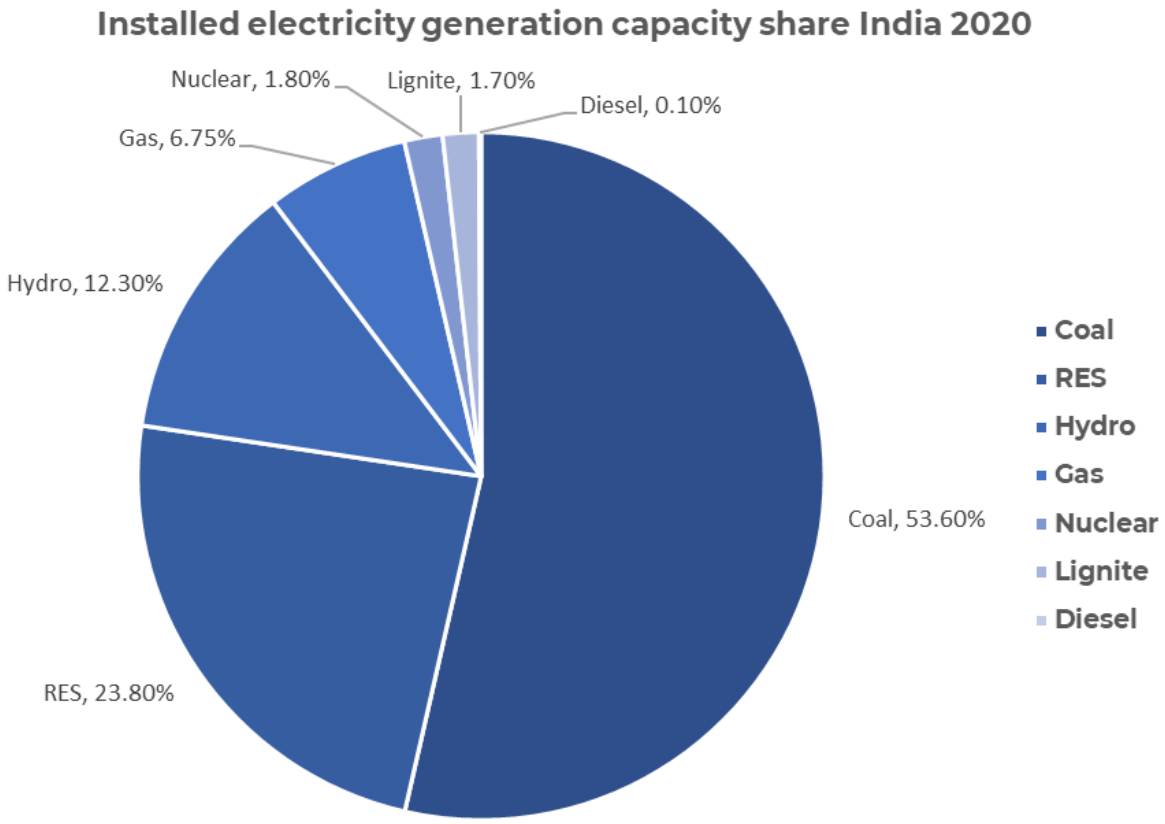
The scoreboard analyses the efforts and initiatives taken by the countries to achieve decarbonisation w.r.t their goals as per the Paris Agreement.

Existing Technologies

Currently:



Source: CEA India, http://www.statista.com/statistics/630209/installed-capacity-by-type-india

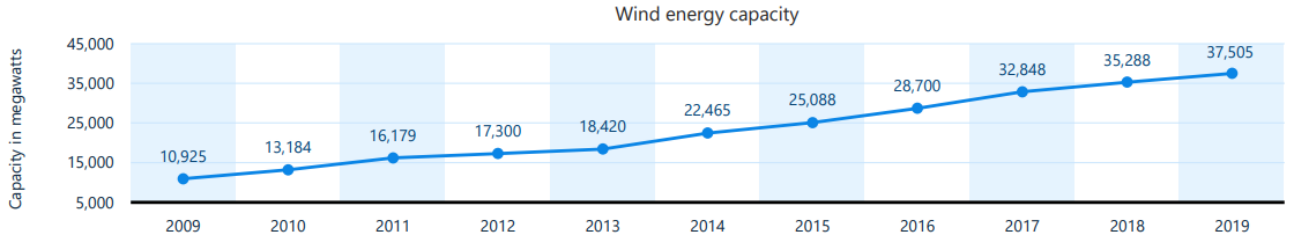


Source: Ministry of Power (India), http://www.statista.com/statistics/958754/india-installed-electricity-generation-capacity-share-by-source

Wind Power

Air flow used to turn wind turbines that in turn produce electricity, with modern day turbines providing 600kw to 9mw of rated power. At the end of 2020, worldwide installed wind power capacity was **733 GW**.

The development of wind power in India began in the 1990s, and has increased significantly in the last few years. As of 28 February 2021, the total installed wind power capacity was **38.789 GW**, the **fourth** largest installed wind power capacity in the world.



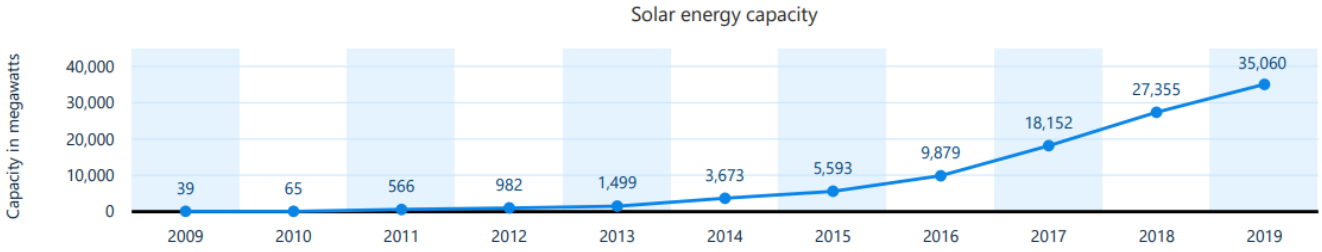
Source: IRENA, http://www.statista.com/statistics/865760/india-solar-energy-capacity

Some major wind plants in India are located in Rajasthan, Tamil Nadu and Maharashtra.

Solar Energy

Solar energy from the sun in the form of light and heat harnessed using solar panels and photovoltaic cells, converting light to electrical direct current. At the end of 2020, global installed solar capacity was **714 GW**.

India being densely populated and receiving high power per unit area from the sun (or solar insolation), is an ideal market for solar energy. In fact, the GoI's target of reaching 20GW capacity by 2022, was reached 4 years in advance, and was hence raised to **100 GW** by 2022. India has established nearly **42** parks, in nearly all states to promote solar plants.



Source: IRENA, http://www.statista.com/statistics/865745/india-wind-energy-capacity

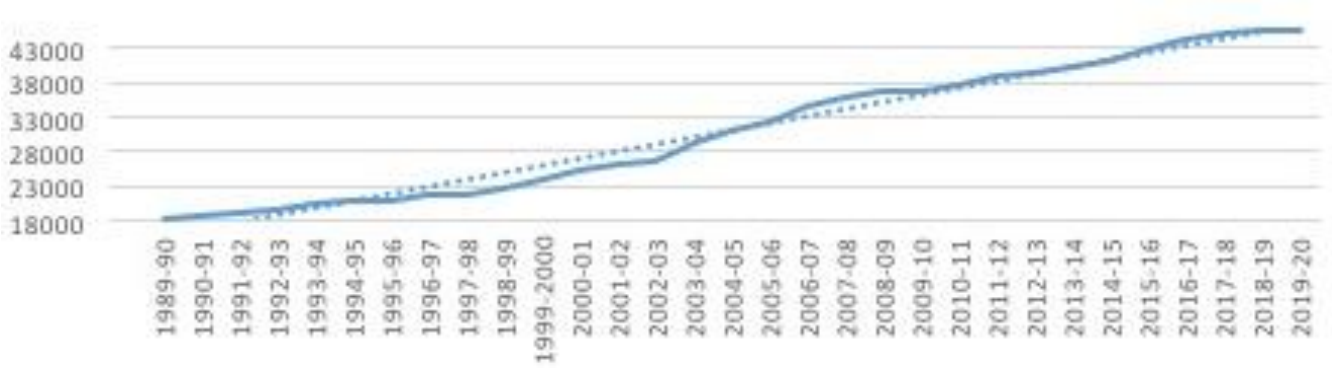
The country's solar installed capacity was **36.9 GW** as of 30 November 2020.

Hydro Power

Electricity generated by utilizing the potential energy of water to turn turbines. At the end of 2020, worldwide renewable hydropower capacity was **1,211 GW.**

Currently, India is the **5th largest** country globally to have installed hydroelectric power capacity, with **45,699 MW** utility-scale hydroelectric capacity or **12.35%** of its total utility power generation capacity as of 31st March, 2020.

Hydropower: Installed capacity in India (in MW)



Source: https://sandrp.in/2020/05/08/indias-hydro-generation-in-2019-20/

Geothermal Energy

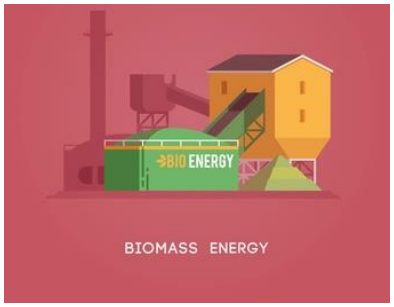
Electricity generated using thermal energy stored in the Earth. At the end of 2020, global geothermal capacity was **14 GW**.

India has **10,600 MW** of geothermal energy available. The resource map for India has been grouped into six geothermal provinces:

- Himalayan Province
- Aravalli range, Naga-Lushi, the west coast regions, and the Narmada-Son lineament
- Andaman and Nicobar arc
- Cambay basin
- Surajkund, Hazaribagh and Jharkhand

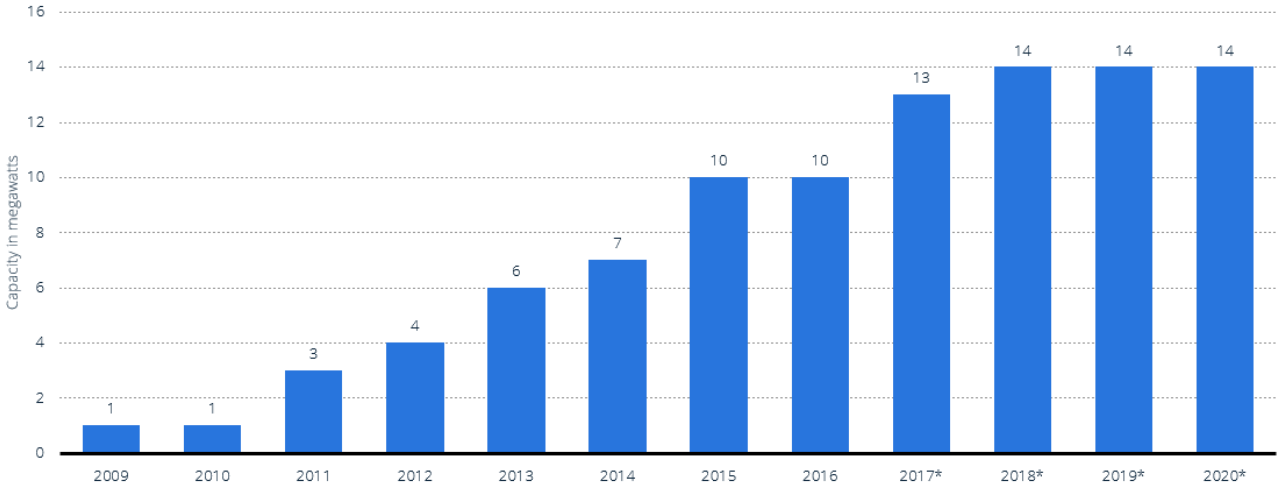
Bio Energy

Bio energy, as the name suggests, is derived from biological elements – living or recently living, mostly consisting of plant or animal matter. At the end of 2020, bioenergy global capacity was **127 GW**.



India is an ideal location for biomass production considering its massive population, the tropical location, and a vast agricultural potential.

Biogas energy capacity in India 2009-2020



Source: IRENA, https://www.statista.com/statistics/1044652/india-biogas-energy-capacity/

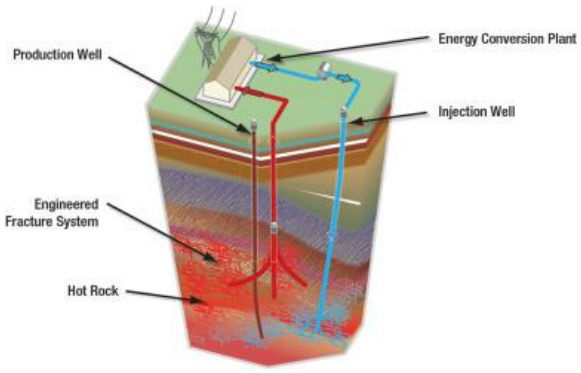
Emerging Global Technologies

Currently, India ranks 3rd globally in terms of its renewable energy investments and plans. The Government of India has successfully implemented a range of energy market reforms, carrying out a huge amount of renewable electricity deployment, notably in the solar energy sector. India's electricity security has improved remarkably due to the creation of a single national power system as well as major investments in thermal and renewable capacity. Although there's a major shift in the country's power and energy sector towards renewables, India still remains massively dependent on oil and fossil fuels, with the subcontinent being the 3rd largest consumer of oil, 4th largest oil refiner, and is set to surpass the People's Republic of China by mid-2020s.

While many significant strides have been made, energy research, development and deployment (RD&D) can be a catalyst for India's energy policy goals. Multiple organizations globally have looked into experimental forms of renewable energy to improve efficiency and increase overall energy yield of the process. Following are some processes explained in brief, that might become the key for India's dominance in the renewable energy market:

Enhanced Geothermal System

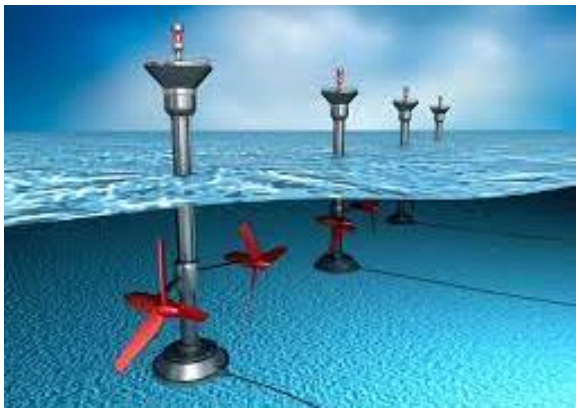
The traditional geothermal plant depends on naturally occurring hot springs to process and convert to electricity. In the "Enhanced" geothermal system, "hot dry rock" or HDR are drilled using hydraulic fracturing to generate heat and provide electricity 24 hours a day similar to fossil fuels. HDR and EGS systems are currently being developed and tested in France, Australia, Japan, Germany, the U.S., and Switzerland.



The largest EGS project globally is a 25 MW demonstration plant (under development) in the Cooper Basin, Australia and has the potential to generate 5,000–10,000 MW.

Marine Energy

Marine energy or ocean energy is the energy carried out by the ocean's surface waves, tides, salinity and temperature difference in parts of the water body. These movements of water carry a high amount of kinetic energy which can be harnessed as electricity to be provided to homes, transport, and industries. Usually, a large and concentrated population is situated near oceans, that carry a large amount of energy and hence it can become one of the vastest sources of energy in the future.



Currently, South Korea, France and Canada have marine energy stations generating 254 MW, 240 MW, and 20 MW of energy.

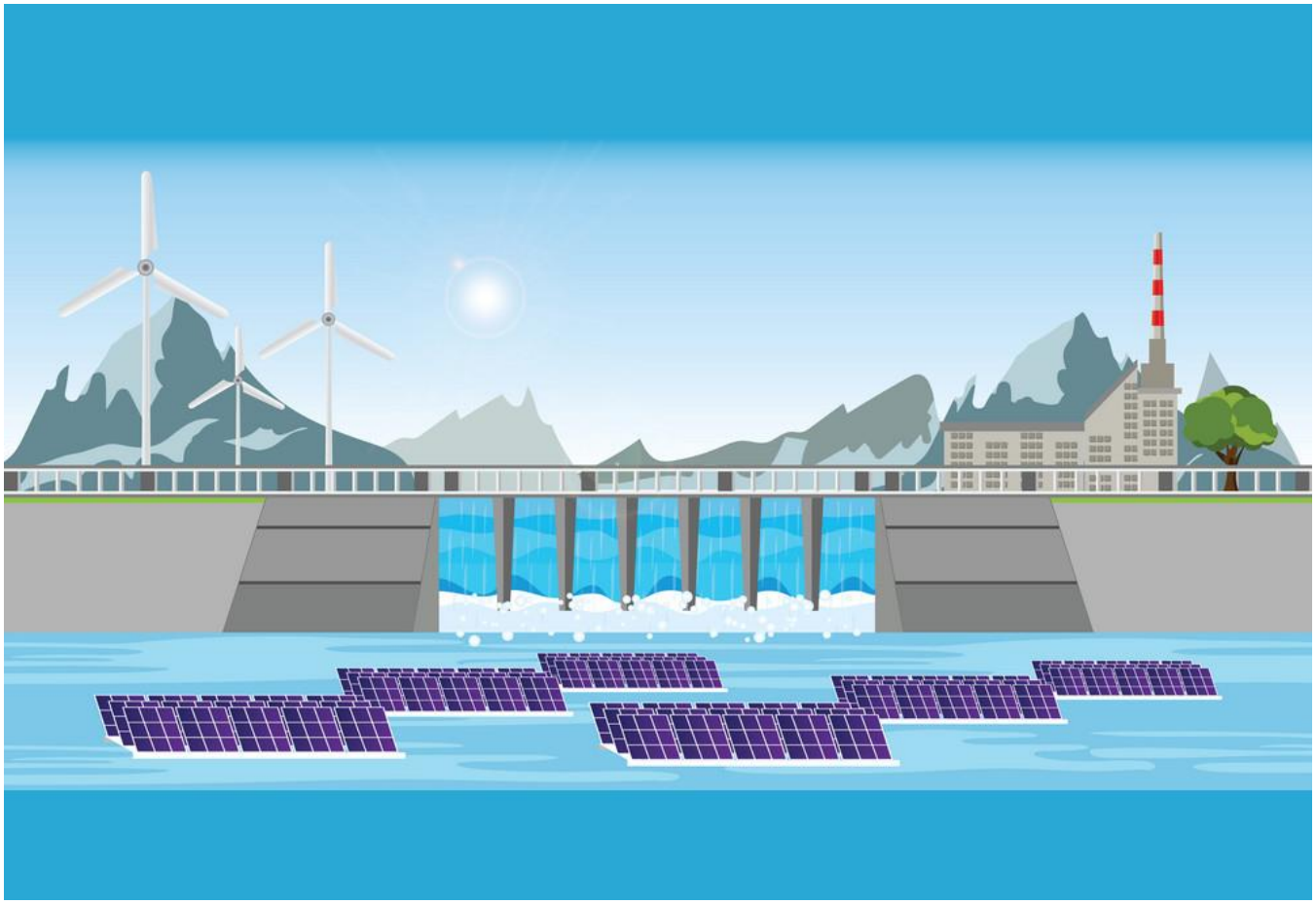
Advanced Solar Energy

The sun is a ginormous source of energy and hence there are multiple advancements and experiments in the solar energy sector to efficiently utilize this solar power:

- Thermoelectric, or "thermovoltaic" devices: converting the temperature difference between dissimilar materials into an electric current

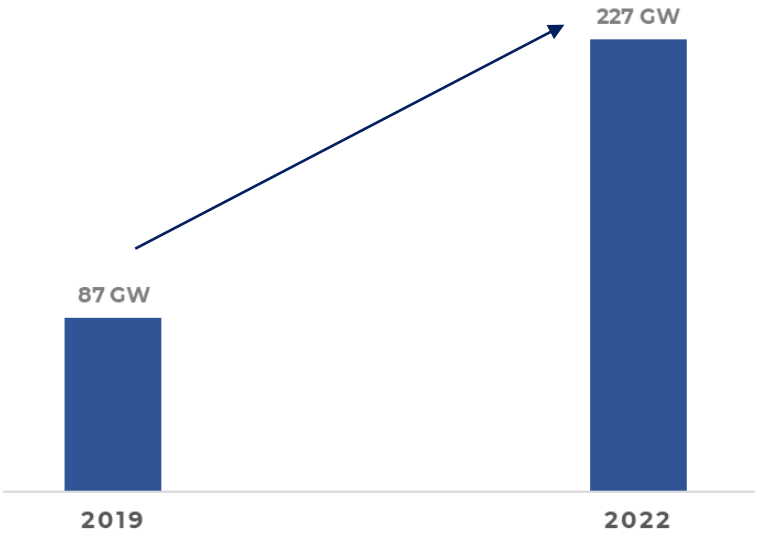
- Floating Solar Arrays: Photovoltaics systems that float on water instead of fixed on land. Its said to be more advantageous than the traditional system and can achieve higher efficiencies as the water cools down the panels and is also less expensive. Some of these systems exist in France, India, Japan, South Korea, the United Kingdom, Singapore, and the United States. While Japan is set to build the world's largest system of capacity 13.4 MW using 50,000 solar panels, Brazil has announced a "floatovoltaic project" with a capacity of 350 MW.

- Solar updraft tower: Used in areas with low-temperature solar heat. In this process, the sun's rays heat up the air below a wide greenhouse-like roofed "collector structure" that is surrounding the central base of a substantially tall chimney tower, which then causes an updraft of hot air due to the chimney effect, hence driving the wind turbines placed in the chimney updraft or around the chimney base to finally - produce electricity. Although prototypes of this system are still underway, India could advantage from a system like this to generate solar power even in parts that don't get intense sunlight.



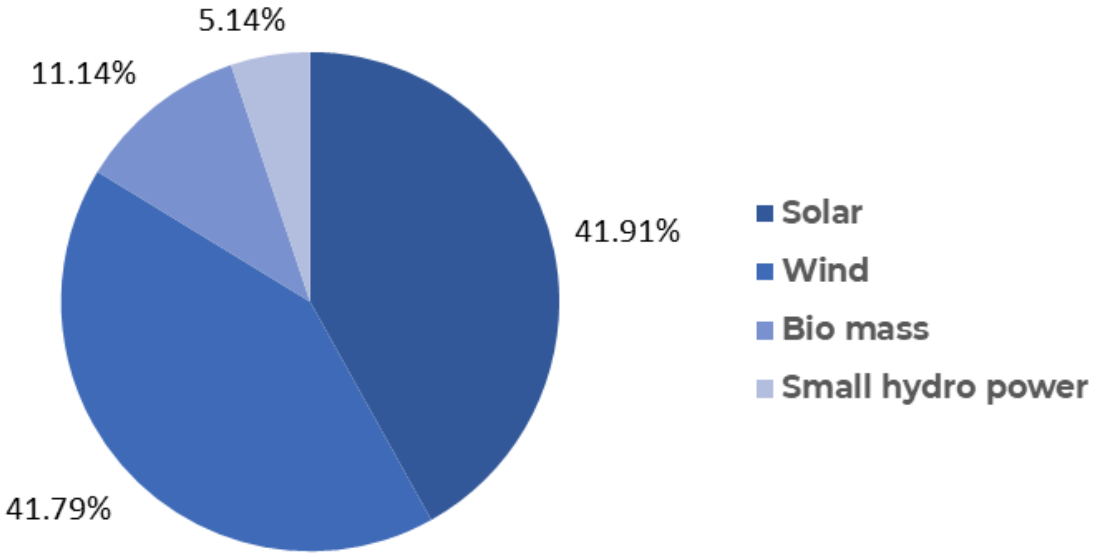
Market and Industry trends

In India, Renewable energy capacity, which includes wind, solar, bio power and small hydro energy is set to surpass the target of 175 GW set as per the Paris Agreement, aiming to achieve 227 GW capacity by 2022. India is also expected to attract investments up to $80 billion USD in the next 4 years.



Source: https://www.ibef.org/industry/renewable-energy/infographic

Currently, as of January 31, 2021, India's renewable energy capacity is distributed in the following manner:

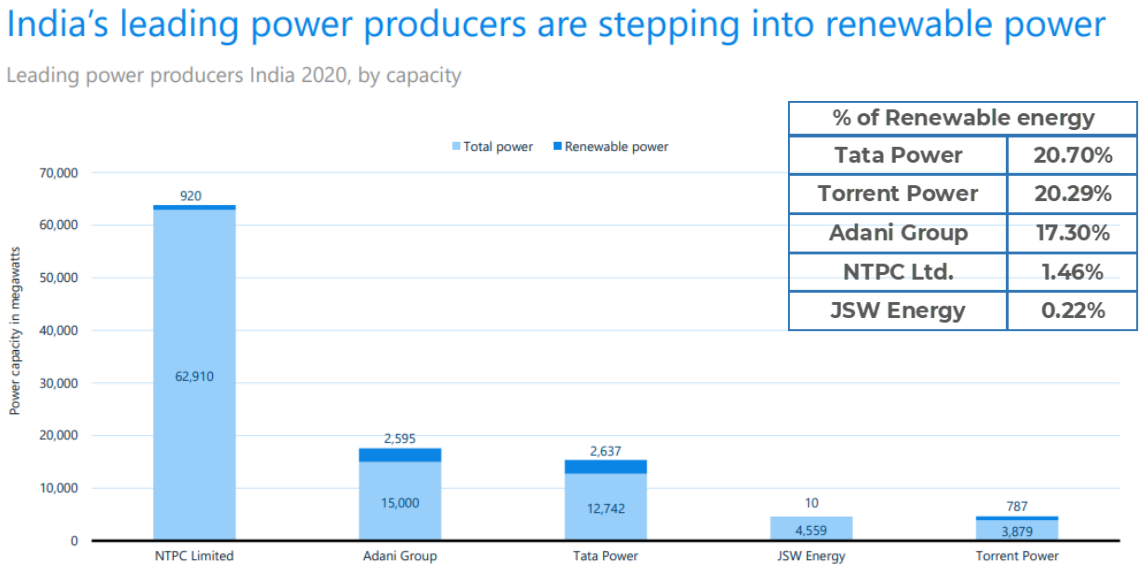


Source: https://www.ibef.org/industry/renewable-energy/infographic

- By December 2019, 15,100 MW of wind power projects were issued, of which, projects of 12,162.50 MW capacity i.e. 80.55% has already been awarded
- Power generation from renewable energy sources in India reached **127.01 billion units (BU**) in FY20.
- With a potential capacity of **363 GW** as well as government policies and initiatives focused on the renewable energy sector, Northern India is likely to become the hub for renewable energy in India

Landscape in India

Talking about the current industry landscape:



Source:

% of Renewable energy	
Tata Power	20.70%
Torrent Power	20.29%
Adani Group	17.30%
NTPC Ltd.	1.46%
JSW Energy	0.22%

saurenergy.com, http://www.statista.com/statistics/1168859/india-power-producers-capacity

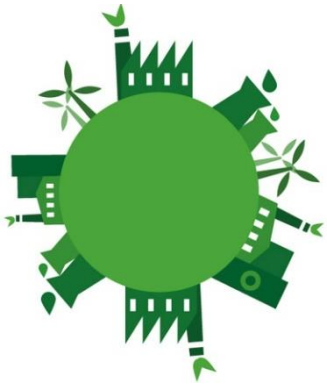
- Installed renewable power generation capacity has gained pace over the past few years, posting a CAGR of **17.33%** between FY16-20
- As India looks to meet its energy demand on its own, which is expected to reach **15,820 TWh** by 2040, renewable energy is set to play an important role
- The government plans to establish renewable energy capacity of **114 GW** of solar capacity addition and **67 GW** of wind power capacity by 2022, as well as **523 GW** (including **73 GW** from Hydro) by 2030
- In January 2021, the government approved **eight** hydropower projects of **144 MW** over the Indus River and its tributaries in Ladakh
- Between January 2020 to September 2020, amidst the COVID-19 pandemic, India added **2,320 MW** of solar capacity

Private companies dominate central and state agencies with much larger installed renewable energy capacity, with private companies having **83,279,41 MW** in capacity while Central and State agencies have **1623.3 MW** and **2357.03 MW** in capacity respectively.

- Around **Rs. 36,729.49 crore (US$ 5.26 billion)** investment was made during April-December 2019 by private companies in renewable energy.
- In October 2020, Tata Power announced its plan to develop **100 MW** solar project in Dholera Solar Park of Gujarat.
- In October 2020, post approval from NITI Aayog and the Department of Investment and Public Asset Management, NTPC set up a wholly owned company for its renewable energy business—**NTPC Renewable Energy Ltd**. NTPC is targeting to generate **~30% or 39 GW of its overall power capacity** from renewable energy sources by 2032
- Adani Group aims to become the world's largest solar power company by 2025 and the biggest renewable energy firm by 2030
- ReNew Power and Shapoorji Pallonji will invest nearly Rs. 750 crores (US$ 0.11 billion) in a 150 MW floating solar power project in Uttar Pradesh.

Important Policies in India

Some of the major government initiatives to boost India's renewable energy sector include:

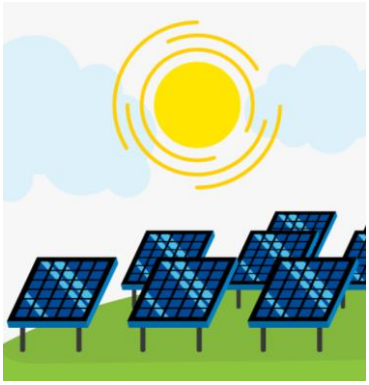


Green Energy Corridor

The Green Energy Corridor Project aims at synchronizing electricity produced from renewable sources, such as solar and wind, with conventional power stations in the grid. In the Union Budget 2021-22, MNRE was allocated Rs. 5,753 crores (US$ 788.45 million) with Rs. 300 crores (US$ 41.12 million) allocated for the 'Green Energy Corridor' scheme.

Wind-Solar Hybrid Policy

Government encouraged and incentivised development of hybrid wind and solar technology to provide a framework for promotion of large grid connected wind-solar PV hybrid system for optimal and efficient utilization of transmission infrastructure and land, reducing the variability in renewable power generation and achieving better grid stability



Solar Parks and ultra mega solar power projects

The objective was to set up at least 25 Solar Parks and Ultra Mega Solar Power Projects targeting over 20,000 MW of solar power installed capacity within a span of 5 years starting from 2014-15 which was later enhanced from 20,000 MW to 40,000 MW in 2017. These parks are proposed to be set up by 2021-22

Additionally,

- In Union Budget 2021-22, GoI has provided additional capital infusion of Rs. 1,000 crores (US$ 137.04 million) to Solar Energy Corporation of India (SECI) and Rs. 1,500 crores (US$ 205.57 million) to Indian Renewable Energy Development Agency
- To encourage domestic production, customs duty on solar inverters has been increased from 5% to 20%, and on solar lanterns from 5% to 15%
- Delhi Government decided to shut down thermal power plant in Rajghat and develop it into 5,000 KW solar park
- India plans to add 30 GW of renewable energy capacity along a desert on its western border such as Gujarat and Rajasthan
- MNRE has decided to provide custom and excise duty benefits to the solar rooftop sector, which will lower the installation cost as well as generate power, thus boosting growth
- Indian Railways is taking increased efforts through sustained energy efficient measures and maximum use of clean fuel to cut down emission level by 33% by 2030

Methodology Used

Secondary Research Methods were used as the main research methodology for the report.

Why Secondary Research?

- Readily available information, multiple relevant sources from where data can be collected, used and analysed
- Reduces cost and time spent as data is readily available from open sources and can be downloaded without cost/with very less cost
- Secondary research gives an opportunity to analyse historical data and compare with current situation, while also providing authentic sources backing the data

Sources of Data Collection

- Open-source articles and blogs
- Government websites like mnre.gov.in
- Platforms like EuroMonitor (Passport) and Statista
- News articles and websites
- Whitepapers and reports made by organizations
- Scorecards developed by entities like ibef,

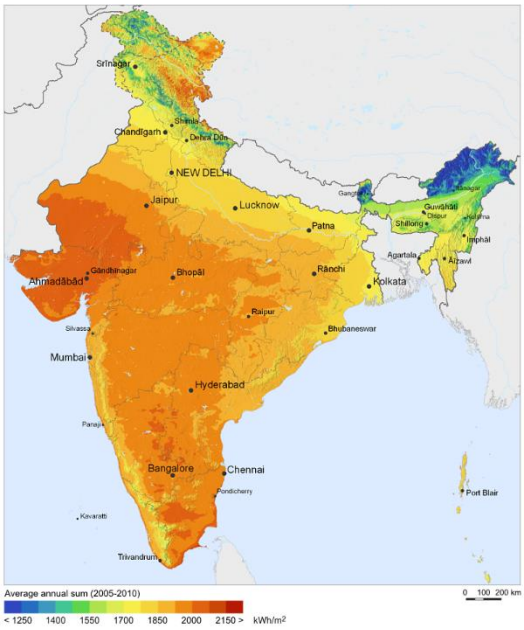
Conducting Secondary Research

1. **Identifying the topic of research**
   Prior to beginning the research, its crucial to identify the topic that needs to be studied. Preparing a hypothesis, or problem statement, or hyper-focusing on one part can help in narrowing down the search and giving direction to the efforts
2. **Identifying research sources**
   Next, streamlining sources of information will help providing the most relevant data and information applicable to the research, quickly
3. **Collecting existing data**
   Collecting data from authentic sources considering its relevance to the topic, and the time period of the research. The data can be obtained from both online & offline sources
4. **Combining and comparing**
   It might be the case that collected data is overlapping, or is irrelevant. Hence post collection, one must ensure they combine, compare and then assemble the data in a usable format.
5. **Analysing data**
   Analyse the data collected and try to answer the hypothesis or draw conclusions. If not, repeat the process and dwell deeper if necessary

Results

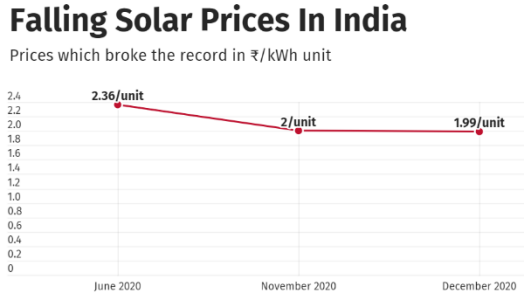
1. India has a massive potential for solar power generation

- **Environment**
  India being a tropical country receives solar power in abundance in majority parts of the subcontinent. Areas like Thar in Rajasthan and Kutch in Gujarat can act as grounds for huge solar parks, while water bodies can provide ground to floating solar plants

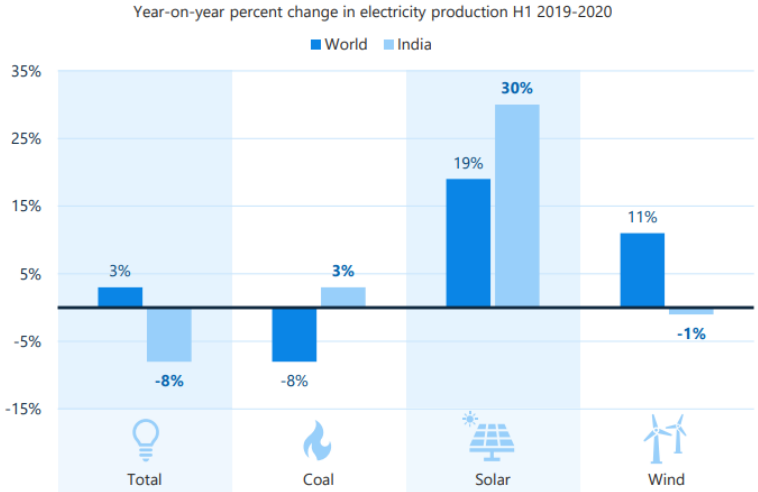


- **Government Policies**
  The policies and initiatives introduced by the government incentivizing utilization of solar power, encouraging its use – residentially as well as industrially, domestic development of solar products, planning "ultra" mega solar parks, and investing in research & development of new technologies, has led India to achieve its sustainability goals prematurely

- **Cost effective and easy source of electricity**
  Despite the pandemic and low demand of energy due to economic slowdown, cheap renewable energy was preferred over coal, with bids for solar projects hitting a record low, even lower than coal



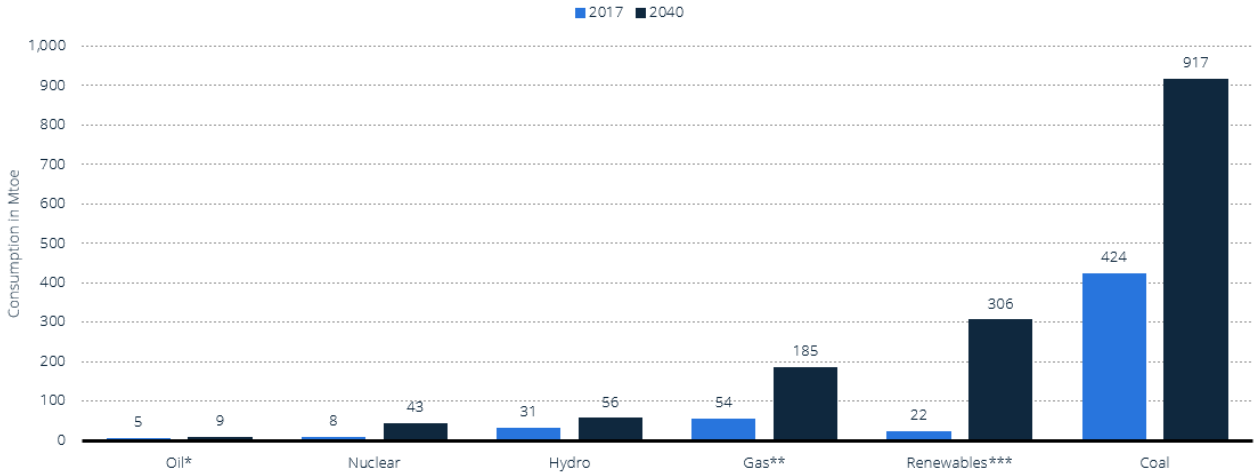
- **Beneficial to environment**
  Considering how India's population and energy demand is on a constant rise, tripling and doubling respectively over the next decades; moreover, the country wants to enhance energy security, resolve water security issue d combat air pollution – solar power checks all of these boxes, hence providing an ancillary benefit in solving the global climate crisis



Source(s): Google Images, Ember, saubhagya.gov.in, https://www.greentechmedia.com/articles/read/india-solar-energy-transition-pandemic-2020

2. Focus on integration of renewable energy sources with traditional systems

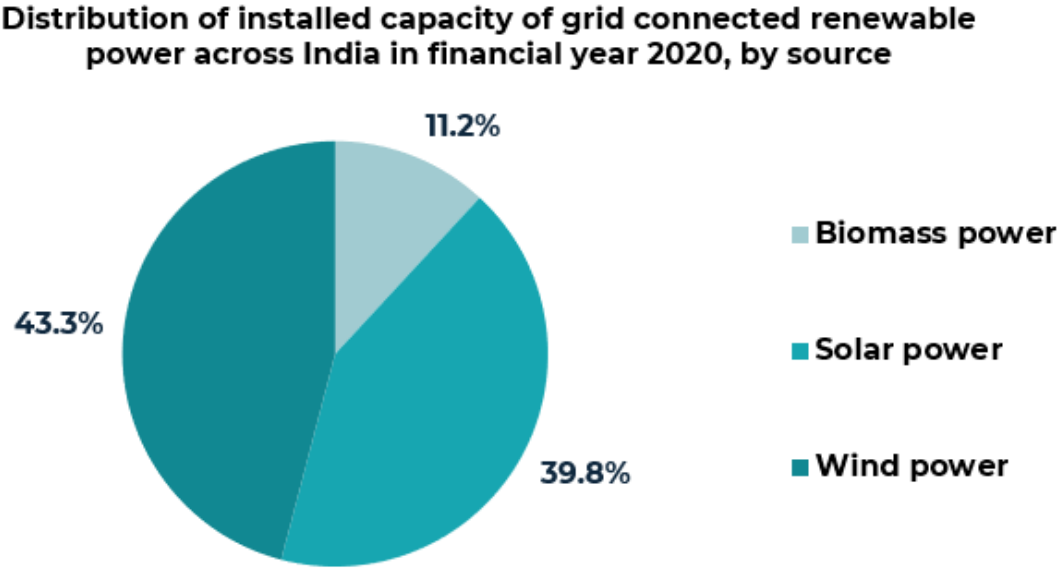
Although solar energy has proven to be more cost efficient and environmental-friendly than coal, the latter still dominates the country's electricity mix. By 2040, the power demand in India is set to **triple**, while the population is also on a consistent rise. Hence, even in 2040, the country's population is going to be dependent on coal, even if the renewables are set to expand manifold.



Source: BP, https://www.statista.com/statistics/900448/india-primary-energy-consumption-by-source/

As the **2nd largest** coal-producing and consuming country, as well as the **3rd largest** emitter of greenhouse gases, India is set to become the most populous country and one of the biggest economies in the world. India's transition from carbon-intensive resources to renewable energy – that is scaled to an extent that it can mitigate fossil fuel would be a crucial factor in the global climate change fight.

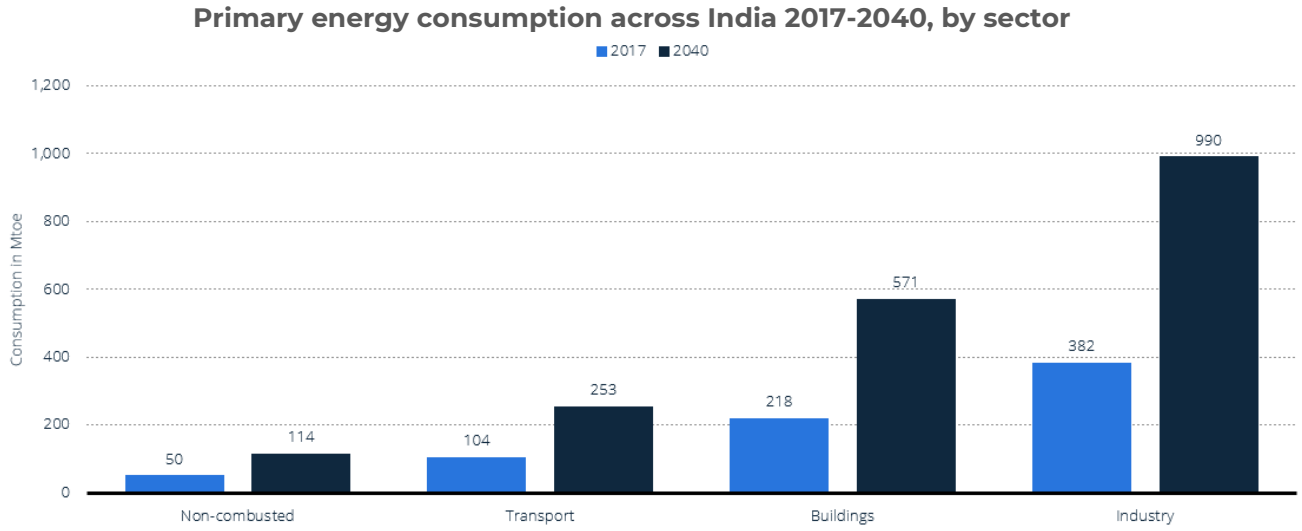
Of the **115** nations studied, India emerged at **74th rank**, and was applauded among **11** countries to have made a consistent and measurable effort towards transition to clean energy on a course of **6 years**. India has the potential to emerge as the top leader in the renewable energy sector. By 2040, **one in seven** of the dollars spent globally on solar PV, wind turbine and lithium-ion battery storage will be going to Indian companies.



Source: MOSPI, MNRE (India), https://www.statista.com/statistics/1167524/india-share-capacity-of-grid-connected-renewable-power-by-sourc

3. Policies needed to attract more investment to support growth and ensure easy transition to clean energy

As the economy and the population grows, so does the demand for energy. Electricity consumption is slated to reach 15,280 TWh by 2040, with majority of the demand coming from real estate, transport and industrial sector.



Source: BP, https://www.statista.com/statistics/900935/india-primary-energy-consumption-by-sector/

Solar energy currently accounts for just **4%** of India's power generation. As per the IEA, India needs to spend **$1.4 trillion** over a period of the next **20 years** to be able to make its energy supply sustainable – which is **70% more** than provided in the current policy plans of the government.

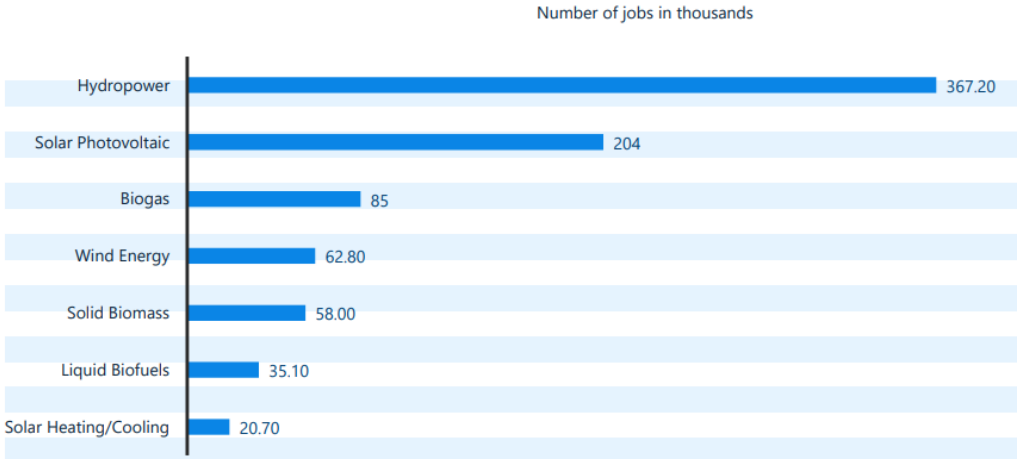
Domestic oil and gas supplies will be unable to keep up to pace with the growing energy demand which could lead to price and market volatility causing India problems unless it switches to renewable sources of energy, a green energy future.

One of the major challenges India faces currently is lack of infrastructure, considering exorbitant land prices and ownership issues that come with projects requiring a large part of land. Hence, big infrastructure and machinery investments are the need of the hour, that will be needed to deliver India's rapid economic growth.

Between April 2000 and December 2020, non-conventional sectors have received FDI inflows of **$9.83 Billion USD**. Considering the country's current performance and ambitious goals, India can expect an investment worth **$500 Billion USD** by 2028.

4. Investment in Research & Development of emerging technologies in renewable energy space

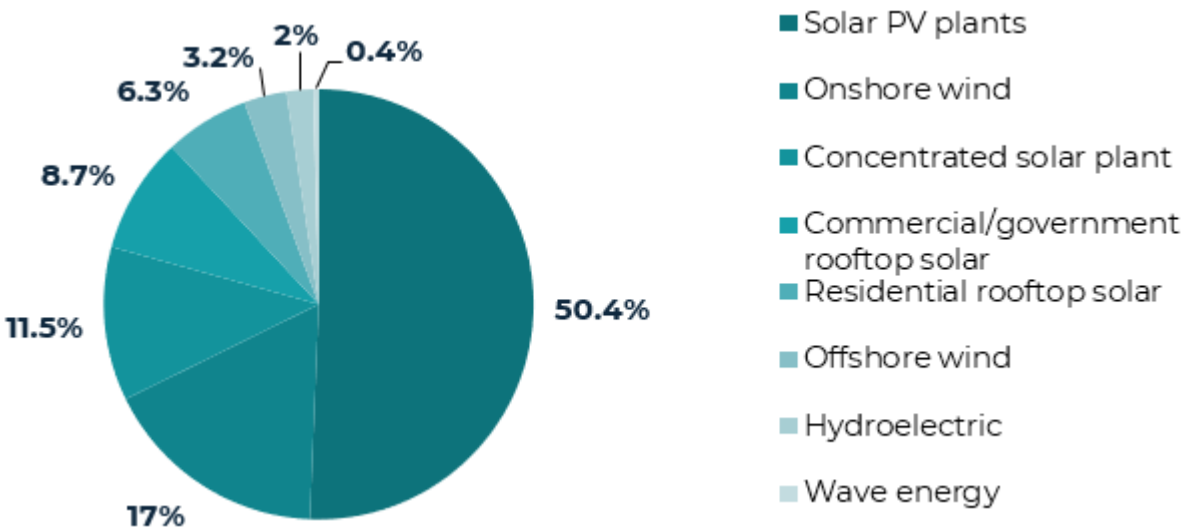
After Brazil and China, India is the third largest job provider in the renewable energy sector. According to IRENA's job database, India's on-grid solar employment was estimated at 109,000 jobs, with another 95,000 off-grid, comprising a total of 204,000 jobs. The renewable energy sector has employed about 824,000 workers across the country in a year.



Source: IRENA, http://www.statista.com/statistics/881758/india-value-of-private-equity-deals-by-company

Its established that India needs more investment for its green energy future. Expanding the structure, diversifying into other variants of existing technologies and developing new technologies can help increase the scale and reach of the projects to remote and rural parts of the country as well. Moreover, apart from its environmental benefits, it can also help in creating more employment.

Assuming 100% renewable energy transition in India by 2050, the energy mix is projected as follows:



Source: Stanford University; The Solutions Project, https://www.statista.com/statistics/512776/transition-to-renewable-energy-in-india-outlook-by-source/

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