



MESSE  
MÜNCHEN

# SOLAR LIGHTING UP THESE EIGHT SECTORS

Case Study

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This is a series of 8 case studies developed for **Messe Munchen's** The Smarter E India/ Intersolar India 2022 by WriteCanvas, and designed by Crazy Pencilz.



Renewable energy adoption has been at the forefront for a couple of decades now. Renewable energy (RE) is the best alternative to mitigate climate change; that in scale can replace fossil fuels. Countries globally, have initiated many efforts in this direction and have advanced progressively.

Wind, solar, biomass, hydro etc. constitute the renewable energy pack. However, the world is concentrating more on wind and solar energy. While wind energy has been in use for more than 40 years, solar as an energy form gained prominence only a couple of decades back. But solar power adoption has progressed faster and has caught up in the RE race.

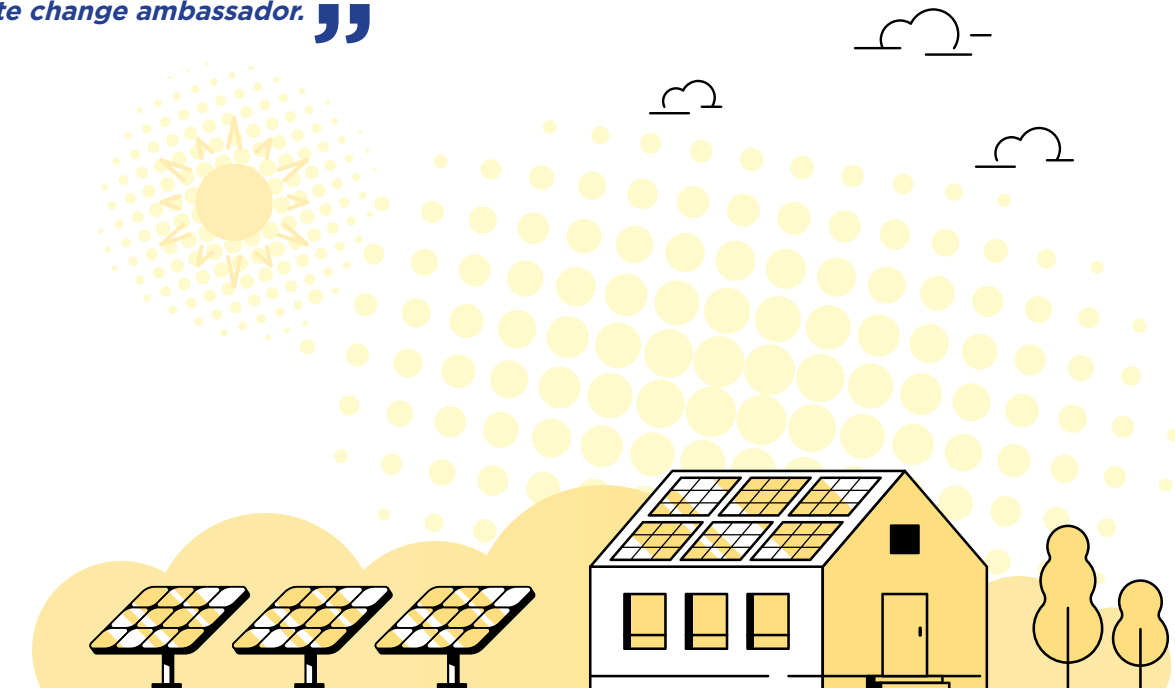
At their end, countries too are sparing no efforts to adopt solar power. China, the most populated country, has the largest solar installation with over 300 GW of installed capacity, followed by the US, Japan and India. This means that India has made major progress in capacity addition in solar energy. We have a solar installed capacity of 60.8+ GW which is steadily increasing every year. With an ambitious target set by the Government of India; and different stakeholders joining force, India achieved the 20-GW target set for 2022, in 2018 itself! A commendable feat considering India is largely dependent on imported technology and components.

Solar has been accepted as the best off-grid solution. Though progress has been made, gaps exist especially in the rooftop segment. Of the total installed capacity of solar, rooftop constitutes only 15 per cent. This is a low average as compared to the 85 per cent of utility scale installations. The major challenge is the lack of space, awareness, and resistance to adoption.

We want to bridge this gap. With this intent, we are presenting case studies, a sectoral analysis of how different enterprises are using solar energy. These case studies offer a bird's eye view on the solar installations at all these eight sectoral enterprises and some of the challenges they faced. But overall, they outline the benefits of solar adoption, especially ground mounted and rooftop installations.

At the same time, we are presenting a platform through our dedicated expo-cum-exhibition exclusively for the solar segment. Messe Munchen's The Smarter E India/ Intersolar India 2022, from 7 - 9 December 2022, in Gandhinagar, Gujarat is your platform to network and strike business deals.

**“Come. Join the solar journey.  
Be a climate change ambassador.”**



## India's solar rooftop journey

The pressing topic of climate change impacts nations, the society, and the individuals. The increasing temperature, melting glaciers, increased frequency of natural calamities—floods, heatwaves, landslides, cloudbursts, avalanches, the list is increasing. A fact is that 'climate change is a reality' and everybody must work in tandem to mitigate the effects. It is not as easy as it appears to be. The mitigation plan must have focused approach and collaborative efforts of all the stakeholders.

Taking into consideration the criticality of climate change, the United Nations has developed a structured approach to address the issue. Pinning the root cause to the greenhouse gas emissions, in 1995, UNFCCC structured the Conference of Parties (COP) to protect environment and development. And in 2015, 196 countries signed the Paris Accord that gives thrust to limit temperature rise to below 1.5 degree Celsius. Additionally, in 2015, the UN adopted the 17 Sustainable Development Goals (SDGs) for 2030, as a universal call to action.

However, globally countries are still dependent on fossil fuels. This, the majority agree, is compounding carbon emissions. One of the key focus areas is adoption of renewable energy. Countries that have agreed to the Paris Accord are already adopting renewable energy in a big way. Solar energy has swiftly made its mark in India's energy segment as well. Notably, India became is the 4th largest renewable energy producing country globally after China, US, and Japan.

Out of the total installed capacity of 403 GW, renewables contribute 28.6 per cent in India. As of May 2022, total non-fossil fuel installed capacity was 166 GW or 41.4 per cent total installed capacity. Within this, solar energy had the highest share at 14.1 per cent (60.8 GW) followed by hydro at 11.6 per cent and wind at 10.1 per cent. However, rooftop solar currently contributes only a little over 10 GW in the total portfolio.

To harness the full potential of solar energy, the Indian government laid the broader structure when it rolled out the National Solar Mission in 2010. The target was to achieve 20GW by 2022 which was revised to 100 GW in 2015. Of this, 80 GW of solar energy came from large scale plants and 20 GW from rooftops. The National Solar Mission also set the target to achieve parity with grid power tariff by 2022.

India has set ambitious target for renewable energy. It aims to touch 175 GW of RE by end of 2022, which will eventually reach 500 GW by 2030.

The nation's commitment to decarbonisation and climate mitigation policies is demonstrated by the government's revision of the addition of renewable energy capacity.

Though India has set its net zero targets for 2070, it must achieve its Nationally Determined Contribution (NDC) under the Paris Agreement. To achieve that, renewable energy is the only way available, and India has set its focus in the same direction.





**Ashok Pamidi**  
ESG Expert

## 1. How has solar power adoption picked up in India over the last few years?

India has set a target of about 450 Gigawatt (GW) of installed renewable energy capacity by 2030. Solar energy is expected to contribute 280-300 GW (about 60 per cent) of the total RE.

India's solar sector has emerged as a big player, from a mere 3 GW of solar energy installations five years back to 33 GW of solar energy today. In 2015, our honourable Prime Minister, Shri. Narendra Modi had proposed the International Solar alliance (ISA). The main objective of the ISA was to mobilise \$1 trillion in low-cost financing for the deployment of solar energy by 2030 and to harmonise efforts between the 121 countries that lie between Tropic of Cancer and Capricorn. Making solar energy available at affordable rates, establishing solar credit mechanisms, reducing the cost of finance and cost of technology have enabled the widespread adoption of solar power while enhancing energy security.

In fact, India has become the cheapest producer of solar power in the world. According to an analysis by IRENA (The International Renewable Energy Agency), the cost of setting up solar PV projects in India has dropped by about 80 per cent between 2010 and 2018.

## 2. What are the growth drivers?

There are three main drivers for solar power adoption:

- The image of responsible corporate citizenship, including CSR
- Compliance
- Tax Savings

The Company's Act 2013 mandates enterprises to focus on environmental sustainability. CSR activities are impact-oriented, for example, installing solar rooftops on the Pune railway station or hospitals or enabling farmers to use solar pumps, and solar lights.

Statutory mandates, including global guidelines, are driving external compliances for instance the BRSR compliance by SEBI and GRI, SASB and SBTI standards globally. As companies report on these data-driven disclosures, the value of installing and using solar/ renewable energy is gaining traction to show reduction in emissions.

Besides compliance, enterprises are investing in solar energy because of the tax benefits (about 30 per cent in tax savings) and cost efficiency.

According to numerous studies, it has been found that more than 2/3rds or about 67 per cent of millennials want to join companies that are socially responsible. Therefore, investing in solar power is also becoming a vector for organisations to attract and retain the talent.

### **3. Government policy has been a big enabler for adoption; please comment.**

The National Solar Mission was started in 2010 to establish India as a global leader in solar energy. The Mission targets installing 100 GW grid-connected solar power plants by the year 2022.

Over the years, the Government of India has launched various schemes to encourage generation of solar power in the country like solar parks, VGF, CPSU, defence, canal bank and canal top, bundling, grid connected solar rooftop etc.

All these schemes have been quite successful. Many states have also installed net meters.

### **4. How are the enterprises optimizing solar power?**

From an enterprise view, companies are thinking about the overall business cost of owning solar power and creating independent grids. Once installed, they do not have to worry for 25 to 30 years because of excellent tax benefits along with financial and environmental returns.

These organisations are utilizing solar power for withdrawing and heating water, cold storage, running their ACs, lighting etc. Large PSUs have also invested in solar lights. Solar-powered transportation is also taking off in a big way.

### **5. Who is driving the solar projects at organisations? What is the impact?**

The third party namely, the consumer or customer is driving solar adoption in the enterprises. Customers are becoming more loyal to brands that show commitment towards the environment and create positive impact. For example, Apple and Speedo. These companies are responding to the customer demand for recyclable products and a circular economy, while strengthening both long-term profitability and customer loyalty. From the perspective of the Board, the CEO, the CFO, and the compliance team are the chief drivers for adoption of solar power.

### **6. What is the RoI/TCO that an enterprise can expect with solar?**

The average industry data shows it will take 3-5 years. If you break it up into industrial and commercial, and residential—the former takes about 4-5 years whereas it takes 5-7 years for the residential segment.

### **7. Pricing, grid and infrastructure have emerged as major challenges in solar adoption? Besides, many enterprises are opting for ground mounted solar panels. What is the trend vis a vis solar rooftop?**

States like Rajasthan, Gujarat, Maharashtra, MP, Karnataka, Andhra Pradesh, Telangana have the highest penetration of solar energy. Solar energy is used to power cross sectoral infrastructure from schools and hospitals to power irrigation pumps.

Among the large-scale solar installations in India 87 per cent are ground mounted.

However, as smaller players enter the fray this trend is likely to change. While larger players will move toward grid installation, the smaller players are more likely to choose solar rooftops.



One of the reasons why solar rooftops will become the natural choice for some players is land scarcity. It is difficult to acquire land for sub-stations. A partnership between the industry and the government is required for acquiring land for solar sub-stations.

A parallel opportunity in increasing solar adoption could be education. There is an opportunity to empower women, especially rural women to lead the change. On average, women only make up about 11 per cent of the solar sector employment in India, significantly less than the global average of 32 per cent.

Gender-inclusive policies and programs would help in rural electrification as well as affordable and climate-friendly solar irrigation.

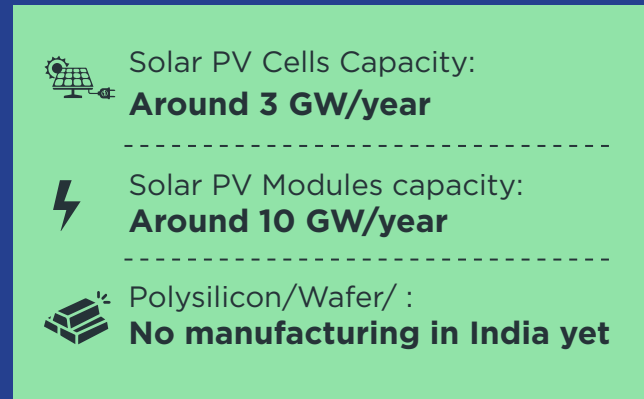
### 8. Among the vendors or OEM partners, what is the kind of consolidation that you are seeing?

Consolidation will happen. Looking at the overall size of the market, we need more players, but it will take time.

The reason being that the solar modules are imported. At present, all the companies are integrating the modules, all solar grid manufacturers have not yet localised their production. The focus must be on R&D and training. Local manufacturing requires a full value chain. And there is a need to develop a sustainable value chain.

### 9. From a component manufacturer's perspective, what are the key challenges that you have observed in the solar energy segment?

One of the biggest challenges faced by component manufacturers in India is that there is no installed capacity in India to manufacture polysilicon cells / wafers / ingots (the raw material for solar panels). These raw materials are mostly imported from China.



The Union Cabinet has cleared a ₹19,500-crore scheme to incentivise manufacturing of domestic solar cell modules to reduce the industry's reliance on China. This is a follow-up to ₹4,500-crore tranche that was cleared in November 2020.

Bidders for projects would be given performance-linked incentives (PLI) to set up and run manufacturing facilities that will span the entire production cycle of modules from making the polysilicon cells, ingots, wafers, and panels to

assembling modules that are used to produce electricity.

Officials from the Ministry of New and Renewable Energy (MNRE), estimate manufacturing capacity worth 65,000 MW of fully and partially integrated, solar PV modules to be installed over five years. The bulk of the allocation, of nearly ₹12,000 crore, is to incentivise the setting up of integrated manufacturing facilities.

Other challenges facing the utility-scale solar PV sector include land costs, high T&D losses and other inefficiencies, and grid integration challenges. There have also been conflicts with local communities and on account of biodiversity protection. However, despite these challenges, the growth of the industry is unabated.





## CASE STUDY

# 1

Segment:  
**Dairy**

Enterprise:  
**Anand Milk Union Limited  
- Amul**





## The Dairy sector

Dairy is a sizeable, large segment that involves a supply chain from the start of milk production till the products reach the customers or the last mile. The entire process is an energy intensive value chain. This includes milk pooling points, collection centres, transportation to factories where milk goes through various processes. Recalling here, Minister of Power and New & Renewable Energy RK Singh's statement: "Extensive use of solar energy in dairy value chain can significantly reduce operational cost and ensure usage of clean energy."

India has a substantial number of milk producers in the country. It is estimated that there are more than fifteen million milk procurers that are connected to the large network of dairy cooperatives in the country. As per the government data, there are 1.65 lakh village level dairy cooperatives, 218 district/regional/Taluka unions and 24 State Dairy Federations/Apex Milk Unions.

Most of the dairy farms, and even the dairy factories, depend on grid energy for their power needs. With the introduction of smart machineries and increasing number of milk products innovation, the energy demand is increasing by the day.

The use of solar energy in the dairy segment was limited to hot water supply to boiler, hot water generator for processing of milk or for CIP cleaning. Large milk producers adopt these. It is yet to trickle down to retail milk producers who form the critical element of a cooperative milk society. But the scenario is gradually changing. Solar has found multiple applications in the dairy industry, gradually.

For instance, solar-energized refrigeration system for milk cooling, cold storages, packaging rooms etc. In addition, solar energy is utilised in the milk processing units to reduce not just energy cost, but also improve overall efficiency and productivity.

Among the many dairies in India, Amul, the largest cooperative in the segment, has pioneered many initiatives in the solar power adoption.



### Amul's sustainability mission for 2030

**35 per cent**  
Reduction in Specific  
Carbon Emission

**50 per cent**  
Reduction in Ground  
Water Drawal

**20 per cent**  
Reduction in Chemical  
Consumption

**Carbon  
sequestering**  
through Forestry initiatives



**Mr. Amit Vyas**  
MD - Amul

*“We are prioritizing on renewable energy usage and have installed 1 MW solar rooftop PV system and renewable power contributes 2 per cent of total power consumption”*

## Solar shines through Amul Dairy

Amul, the largest dairy cooperative network not just in India, but globally, has embarked on an energy efficiency drive.

Amul is a brand of the Gujarat Cooperative Milk Marketing Federation, the leading federation of milk producers in the world.

The cooperative has drawn an impressive sustainability roadmap. This outline optimizing the use of natural, renewable resources to enable more than thirty-six million farmer members grouped into nearly 1,08,574 village-level dairy cooperative societies.

Being led from the top, the endeavour is spearheaded by Mr. Amit Vyas, MD; Mr. Vikramsinh Chavda, Head, Projects, and an entire team of engineers who work closely with the EPC partners.

“We are prioritising renewable energy usage and have installed the renewable power source which has seen reduction in power consumption by 21,00,000 kWh/annum,” said Mr. Amit Vyas, MD, Amul, who is presently spearheading the growth as well as the sustainability drive at the dairy.

For GCMF Limited, the shift to go solar, albeit slowly, is perhaps a natural extension of the efforts it makes to stay at the forefront of the curve as a responsible corporate citizen.

In what could be termed as the first such large scale solar power project in the country, Zodiac Energy installed 1.4 MW captive power plant with

### Highlights 2021-22

- Electricity saving of **21,00,000** kWh/annum
- Fuel saving **1,00,000** SCM/annum
- CO<sub>2</sub> emission reduction by **1800** MT/annum

co-generation facility at Amul Dairy on a Build, Own, Operate, and Transfer (BOOT) basis. Over the years EPCs such as Thermax, and Waaree Energy among others have enabled Amul to optimise solar power across applications.

For example, Thermax had in October 2016, installed a 560 m<sup>2</sup> parabolic trough collector field installed to allow for the feed-in of solar steam into the factory grid.

Waaree, on its part, used sophisticated tools and software to analyse the impact of the solar PVs and optimisation of the same across the federation's dairy partners, i.e., the dairy farmers. The company installed 320 Wp poly crystalline modules at the warehouse facility in Gandhinagar for captive consumption. The solar power has enabled the warehouse to run automated warehousing machines.

**Mr. Vyas of Amul acknowledges,**

**“ Dairy is a perishable product. Hence the products must be transported under specified temperatures, or else they spoil. Additionally, dairies are launching multiple products to meet new market demands. This further puts pressure on the segment to scout for renewable energy like solar power to optimise cost. ”**

## Utilisation of solar power

Year	Technology	Total installed capacity (KWp)	Total generation (Million kwh)	Per cent Overall Electrical energy
2018-19	Solar rooftop	520	0.36	0.55
2019-20	Solar rooftop	1000	1.15	1.72
2020-21	Solar rooftop	1000	1.68	2.19
2021-22	Solar rooftop	1000	1.64	1.92
Total capacity at AmulFed Dairy	Solar rooftop	1000	1.64	1.92

Among other applications nationally, Amul has pioneered the use of solar energy in the following areas:

Hybrid thermal-solar collector for air conditioning at its modern trade store: The system is installed at the company's modern trade store named Amul Green Terrace, in Anand. The system (SunX) increases Delta T in the refrigeration cycle. This combined with the increased kinetic energy of the gas molecules, effectively increases the surface area of the condenser. Due to increase in molecular velocity and subsequent volume conversion within the condenser, finally this results in a reduced energy demand of compressor.

With this system, Amul reduced daily electrical unit consumption of VRF system without HSTC System from 202 Units to 134 Units, i.e., 33.66 per cent.

Hybrid thermal solar collector for -2 °C chiller operation at TFC, Mogar: The system is installed for -2 Degree Chiller

Operation. HTSC system for operation of -2 °C chiller at its chocolate plant. The system is installed between compressor and condenser, with solar energy pressure of refrigerant is increased and overall electrical load on the chills is reduced. The chilled water generated with this system is used for refiner and tempering machine in chocolate manufacturing plant.

The HTSC system is unique and patented technology. With this system, Amul has saved 5000-6000 units of electric energy. ROI of this system is 2.5 years, Mr Vyas says.

Hybrid thermal solar collector for 7 °C chiller application: The hybrid thermal solar collector for 7 °C chiller was installed in May 2022. The chilled water generated with this system is used for refiner and tempering machine in chocolate manufacturing plant.



### Impact on energy consumption

**FY 2019-20 59.7**  
kWh/KLFY

**FY 2020-21 52.3**  
kWh/KLFY

**FY 2021-22 53.4**  
kWh/KLFY





**Meenesh Shah**  
Chairman,  
National Dairy  
Development  
Board

## Interview

NDDB is playing an instrumental role in the solar uptake in the dairy segment.

The dairy sector in India has always been at the forefront of adopting modern technologies. Solar power is one of them.

In line with the Government of India policy, to provide long term sustainable, clean, renewable, and viable source of energy, NDDB has implemented eighteen installations of Concentrated Solar Thermal (CST) in various dairy plants with the financial support from MNRE and UNDP-GEF. The combined financial support from MNRE and UNDP-GEF is about 30 per cent of the estimated project cost in the first fifteen projects across India.

A typical CST project targets to replace 5 - 15 per cent of the average daily thermal requirement of each plant with thermal energy from CST. Till date total installed heat output of 213 Lakh KCal/day (9900 m<sup>2</sup> of Aperture area) has been installed.

Heat from solar energy can be used in generation of hot water to meet requirement in low heat applications (@ 80-85 Deg. C) like can washer, crate washer and cleaning in place (CIP) of dairy plant equipment, and boiler feed water based on the dairy plant configuration and requirements. Excerpts from an edited interview:

### **We understand that solar based thermal storage solutions are being incorporated at the village level...**

NDDB supported farmers of the Mujkuva village and helped them to organise India's first grid connected solar pump irrigators' cooperative enterprise, wherein farmers affiliated with a collective have installed solar pumps into their fields. These farmers use solar energy for irrigation and export the surplus power to the power distribution company through a micro grid established and managed by them. These farmers are thus earning from sale of electricity up to Rs.5000/month apart from the savings on energy bills for irrigation. The farmers have also started rationing their water usage to maximise their income through energy sale.

The cooperative was inaugurated by Hon'ble Prime Minister of India on 30th Sep 2018, and its operations and design considerations have inspired the design of Gujarat's innovative Suryashakti Kisan Yojana, one of the three components of the Kisan Urja Surksha evam Utthan Mahabhiyan scheme of the Government of India.

### **Can you elaborate on the Mujkuva project?**

It started as a pilot project at Mujkuva in the fiscal year 2018-2019. We experimented with the augmentation of existing bulk milk coolers at the village milk collection points through solar PV and thermal storage system (TSS). We observed up to

# Case study 1

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50 per cent reduction in power drawn from grid and thermal storage backup. Based on the learnings, a completely off-grid solar PV system solution with TSS, instant milk chiller (IMC) was executed in Assam in 2021. The results of off-grid experimentation are encouraging, as there is near 60 per cent savings on grid power, 100 per cent reduction in milk spoilage and overall reduction in operational cost by 50 per cent.

## **The impact must be huge**

The pilot became a rationale to solarise operations of village level dairy cooperative societies.

With a purpose of propagating the usage of solar energy in dairies and especially helping a village level dairy cooperative society (DCS) from remote villages in conducting uninterrupted milk collection even during the hours of power failure, NDDDB piloted the idea of installing roof top solar PV system at the DCS. Grid connectivity and hybrid inverter attached with the system ensures an evacuation of the surplus energy to the grid and earn additional income through net metering.





# CASE STUDY 2

Industry:  
**Textile**

Company:  
**Aditya Birla Fashion Retail Ltd**





## Industry Scenario

Traditionally, India is known for its rich legacy in textiles. Cotton textiles is one of the key commodities traded. The historical data shows cotton trading started as early as 1818 AD. And India is the largest cotton producer of the world.

Also, in the earlier days, the silk industry propelled India into the international trade market. It was one of the driving forces that has etched the country's name in the global clothing and apparel map.

According to IBEF, the Indian textile and apparel industry is expected to grow at 10 per cent CAGR from 2019-20 to reach \$ 190 billion by 2025-26. India has a 4 per cent share of the global trade in textiles and apparel. A sizeable segment of textile industry concentrates on exports. The numbers back their claim. In FY22, India's textile and apparel exports (including handicrafts) stood at \$ 44.4 billion—an impressive 41per cent YoY increase.

This energy intensive industry has deep roots and is spread across the length and breadth of the country. It is estimated that the textile segment employs over 4.5 crore people, the second largest employment provider in the country. It is a significant contributor to India's GDP with more than 2 per cent.

The Textile Industry has been one of the early adopters of renewable energy in India. It has contributed significantly to the growth of renewable energy (mostly wind installations) in India. However, with the growth of the solar ecosystem, the segment is seeing increased adoption of solar power.

Many factors propel the adoption of solar energy. A major factor being the policies and initiatives announced by the Ministry of Power and Ministry of New and Renewable Energy.

For one, the Ministry of Textiles has proposed a solar energy scheme for the development and up-gradation of the powerloom sector in the country.



### Salient features of net-zero energy buildings



Improvement in energy efficiency and reduction in annual energy consumption by about 25-30 per cent with respect to the baseline



Compliance to national codes and standards on energy efficiency, increased daylighting, and enhanced thermal comfort for the workforce



Reliable source of power supply, if combined with energy storage devices



Overall reduction in energy cost of at least 30 per cent



Under this scheme, the Government will assist in installation of solar power plants to address power shortage issues.

Secondly, decentralised powerlooms and knitting segments are the key pillars of the industry. The top textile producing states of the country include Maharashtra, Gujarat, Tamil Nadu, Uttar Pradesh, Karnataka, Madhya Pradesh, Rajasthan and West Bengal which have abundant access to natural sunlight. Little doubt then that these states are pioneering the use of solar energy in the textile segment.

A labour intensive industry, driven by volumes, textile consumes a large quantity of natural resources, including power. That makes it important for the industry to shift towards renewable energy.

Though many stakeholders in the value-chain admit the need to shift to solar power, challenges exist.

Being dominated by unorganised players, the lack of awareness is the major challenge. The players are apprehensive about the infirmity of the solar power. Also lack of rooftops where solar panels can be mounted is also pointed out as a major roadblock. It is critical to create awareness among the stakeholders particularly about the cost effectiveness of going solar as a majority of the investments are covered under various subsidy schemes offered by both central and state governments.

Like any other manufacturing segment, textile should also adopt sustainable routes. As they say, energy saved is equal to power generated. Efficiency improvement is also imperative. This translates into effective use of technology for optimal energy consumption, and increased use of renewable energy.

This is where platforms like The smarter E India /Intersolar India 2022 show comes into the picture. Scheduled from 7 - 9 December at Gandhinagar, Gujarat, this is one of the best opportunities for all the textile stakeholders to visit and discuss various avenues to adopt solar power.

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“ 50 per cent renewable energy across own ops ”



**Mr. Naresh Tyagi**  
Chief Sustainability  
Officer - ABFRL

*“Over the years, we have adopted a pragmatic approach to increase our share of renewable energy through solar rooftops and biomass-based briquettes,”*

## ABFRL pens sustainability 2.0 roadmap with focus on solar

Aditya Birla Fashion and Retail Ltd (ABFRL), a part of the Aditya Birla Group, a global conglomerate, in the league of Fortune 500 corporates, has instituted a Sustainability 2.0 agenda.

One of the pioneers in the apparel retail segment to draw and augment a material circularity roadmap, ABFRL has placed equal focus on renewable energy—particularly solar power.

Mr. Naresh Tyagi, Chief Sustainability Officer, ABFRL, elucidates, “Over the years, we have adopted a pragmatic approach to increase our share of renewable energy through solar rooftops and biomass-based briquettes.”

“Along with the SRT PV system, we have leveraged biomass and wood as fuel across our boilers.”

What started as a task for resource efficiency, has culminated into a full-scale project to optimise natural resources. As the company pursues the pathway toward Sustainability 2.0, the focus will increase on recycling, circularity, and the agenda to meet Net Zero targets.

For instance, for energy efficiency, ABFRL has implemented initiatives like optimum internal and external lighting, installation of LED lights, VFDs and efficient equipment. “We have designed new facilities and stores embracing green concepts. These initiatives yielded a year-on-year reduction of 4 per cent in energy intensity at a garment manufacturing

level, Mr Tyagi says.

In addition to the ongoing efforts, in FY22, ABFRL signed a Power Purchase Agreement (PPA) of around 1 MW of additional solar rooftop systems across four more facilities which are currently heading towards the installation and commissioning phase. With this increase of solar energy, the company’s portfolio of SRT PV system will reach 3 MW, enhancing its renewable energy share.

Besides, ABFRL conducted a third-party assessment to identify hotspots and potential areas of intervention to reduce energy consumption and enhance the share of clean energy in the fiscal year.

The company’s IGBC certified facilities (LBRD Warehouse, Attibele) participated in a performance challenge under ‘Warehouse Building’ category. “Presently, the warehouse contributes to more than 2.3 Lakh kWh of electricity generated from Solar PV system in our annual energy consumption avoiding more than 185 tonnes of CO2 every year.”

“Going forward, we envisage to progress in this area by striving towards Net-Zero Building rating systems i.e., both Net-Zero Water Building (NZWB) and Net-Zero Energy Building (NZEB) across built environment. What is unique is that the NZEB and NZWB concepts align with IGBC and USGBC rating systems to achieve the goal of Net-Zero operations,” Mr Tyagi states.




2-MW solar rooftop PV system across six facilities has generated 8,197 MWh of power since FY19




Generated ~2,179 MWh of solar electricity in FY22



 6.6 per cent reduction in Scope 1 & 2 emissions across ABFRL operations due to renewable energy and energy efficiency measures

 Emission reduction of 1,810 tCO<sub>2</sub>e which included 1,721 tCO<sub>2</sub>e from solar PV systems, 35 tCO<sub>2</sub>e by switching boiler fuel from diesel to biomass boilers, and 54 tCO<sub>2</sub>e from energy-efficient lights and solar streetlights

 More than 80 solar streetlights across warehousing facilities will reduce energy consumption by 20,000 units, eliminating at least 17 tonnes of carbon emissions



# CASE STUDY 3

Industry vertical:  
**Hospitals**

Case in focus:  
**AMRI**





Hospitals as a vertical consumes a large quantity of electricity as the segment depends across operations from cleaning, washing to the critical oxygen supply and other intense workloads. Hospitals across the urban and rural areas are primarily dependent on grid power. It is a critical segment in our society that requires uninterrupted power supply, 24/7.

Unplanned outages, natural calamities, and supply interruptions are a nightmare to the healthcare industry. Sudden interruptions can stop critical machines including oxygen supplies thus impacting patient care. Many of us are familiar with heart-breaking stories of lives lost to such incidents in India. That is not all. In rural India, which is subject to erratic power supply, impacts the overall operations of the hospital for days together. This is a major challenge faced by the healthcare segment.

Currently, the healthcare segment is majorly dependent on diesel-based gensets as an alternative source of energy.

Areas in north-east region of India, where availability of diesel is a challenge, however, healthcare providers are looking at renewables as a sustainable power source. Solar energy, as a solution comes as an answer in such situations. The most advantageous property of solar energy is that it can be set up as a standalone power supply unit with battery storage, or as a micro-grid supplying to marked geographical area. In the above stated scenario, it is advisable to set it up as a standalone unit supplying to a hospital, preferably located inside the hospital premises itself.

But the challenges are many, point out industry experts. Lack of rooftop space free of shadow, weather, initial investment cost, lack of awareness on the benefits of solar installation, structural changes required for installations, segregation of critical service from direct supply of solar energy, battery backup etc. As per an industry expert in the hospital sector, at least 20 per cent of the diesel consumption can be reduced with solar installations immediately. That is significant, compared to the annual diesel expenses of hospitals. The calculation is as follows:







One hundred square feet of shadow-free rooftop of a hospital can generate 4 kWh of power per day on average. The more the roof area, the higher energy generation. However, considering the cost of the alternative source and the constraints attached to it, solar energy is the best solution.

In addition to the power needs, hospitals are using solar energy installations to reduce its carbon footprint. Hospitals, typically generate higher amount of waste in water, bio-medical and solid waste. There are many such examples from across India, where hospitals are shifting to solar energy as a purpose including in their business plan.

What makes solar more attractive proposition are the quick technological advancements in the segment, easy availability, subsidy support, easy installation, limited maintenance, and conducive weather conditions in large part of the country.

Many hospitals across India have installed rooftop anywhere between 100 kWh to 500 kWh and above. Of these, a majority has routed solar energy through battery back-up system to avoid interruption in the power supply. Many others are using direct solar power for hot water purpose lighting purpose.

How do we address the key challenges of solar adoption by hospitals as industry vertical?

Government agencies, solar panel suppliers, solar energy installers, consultants all play a crucial role in solar energy. It is critical for such sectors and entities that comes under high polluting category to shift to renewable energy.

Barring the initial cost involved, solar proves to be cost effective and has multiple benefits eventually. Thus, renewable energy is slowly becoming a major part of many of the hospitals' annual plans. Interestingly, many hospitals have allocated 20-30 per cent for renewable energy adoption in their annual budget. A welcome change.



**Mr. Rupak Barua**  
Director & Group  
CEO,  
AMRI Hospitals

*“Renewable energy is a major part of AMRI Hospitals’ plans, and the Group has been working towards reducing its carbon footprints”*

## AMRI banks on solar

AMRI Hospitals Ltd, one of the premier private healthcare providers in Eastern India is relying on solar energy to enhance operations, reduce cost and meet the UN SDG goals for the healthcare segment.

Affirming the same, Mr. Rupak Barua, Director & Group CEO, AMRI Hospitals, states, “Renewable energy is a major part of AMRI Hospitals’ plans, and the Group has been working towards reducing its carbon footprint since hospitals generally tend to generate a lot of biomedical and other forms of solid waste.”

AMRI Hospitals started its sustainability journey by integrating solar power into its power grid, with the aim of reducing dependence on conventional power sources over a period of time, Mr. Barua notes.

After testing various technologies and meeting EPCs and component manufacturers, the healthcare provider decided to adopt solar power. Easy availability and functionality coupled with the presence of ample sunlight throughout the year, made the decision easy. Rainwater harvesting and wastewater recycling are also part of the system.

The endeavors bore fruit for AMRI which received cGreen OT certification for hospitals in Kolkata and Bhubaneswar. “We ensure that anaesthetics used during surgeries and procedures are environment-friendly, and do not add carbon emission,” he says.

Further, AMRI is taking slow but steady steps

to ensure its carbon footprint can be reduced to a negligible percentage by 2027, using the UN Sustainable Development Goals and other climate statutes as route maps. “As a start, we started working towards paperless office a few years back and digitized much of our paperwork, including billing, investigation reports, and medical histories of patients,” Mr. Barua notes.

The RE journey at AMRI is bearing fruit. As of now, its dependency on renewable energy stands at around 6 per cent. It is taking the necessary steps to increase it over the next five years to around 30-40 per cent.

### The solar strategy:

Strategies to replace archaic infrastructure included setting into motion a blueprint that involved making some structural changes so that the hospital buildings can be adapted to these technologies.

While the hospitals are connected to a grid that produces electricity using thermal power, we use solar panels to provide back-up support to the UPS system at AMRI hospitals in Kolkata, and at the Bhubaneswar hospital the same is used to produce hot water for patients.

### Key drivers



Easy availability of technologies to reduce carbon footprint



Overall stress on being a more socially responsible



Cost saving

The challenges were taken into consideration looking at long term benefits.

Experts consulted by AMRI assured that even though the cost of adoption and installation could be high, the lasting benefits would help in meeting long term goals of reducing the carbon footprint.

As of now the budget outlay for renewable energy initiatives stands at around 6 per cent of the annual expenditure plan, it is expected to go up to 20 per cent in the 2027-28 budgetary allocation.

### Way forward:

As part of the future plan, AMRI has decided to extend the available technologies of renewable energy and carbon footprint reduction to all its four hospitals in Kolkata and Bhubaneswar. While one unit at Kolkata and the one at Bhubaneswar already have active renewable energy projects, the same facilities will be extended to the other two units so that the Group's overall carbon footprint can be reduced. The Group has set 2027 as the target date for reducing it to negligible levels. AMRI has also targeted to turn into a paperless workplace by the same date.

### Elements:



Although most existing technologies that help in the process are quite expensive, eventually this help save costs to a great extent and reduce dependence on outside agencies



As of now the budget outlay for renewable energy initiatives stands at around 6 per cent of the annual expenditure plan, it is expected to go up to 20 per cent in the 2027-28 budgetary allocation

### Challenges in a nutshell:



The cost of technology, which can be prohibitive, including installation and maintenance



The cost of technology, which can be prohibitive, including installation and maintenance







# CASE STUDY 4

Sector:  
**Infrastructure**

Case in focus:  
**Cochin International Airport Ltd  
(CIAL)**





## Case study 4

Airports are a part of the critical infrastructure for a growing economy. However, aviation, globally accounts for over two per cent of the total energy related CO<sub>2</sub> emissions. Leading aircraft manufacturers like Boeing and Airbus have implemented ways to increase efficiency and reduce CO<sub>2</sub> emissions as part of climate change mitigation plans. The efforts by airports are not too far behind.

As per the Ministry of Civil Aviation (MoCA), fifty-five airports in India have already installed solar power. These include both the private operators as well as AAI-operated facilities. It is a great initiative considering the GoI is promoting the use of renewable energy across sectors.

The airports have set up the solar power plants under the net metering captive model. Solar panels are installed in airports in two ways - as rooftops and ground mounted. Also, airports have vast area of unused land that can be used to install solar panels.

As part of the climate mitigation initiative of the country the MoCA has taken steps to work toward carbon neutrality and net-zero carbon emissions at the airport. Solar installations at the airport is one of the first visible steps in this direction. The Ministry has also advised the airport operators to map their carbon emissions and work toward carbon neutrality and net-zero emissions in a phased manner.

Airports Authority of India (AAI) is the apex body responsible for creating, upgrading, maintenance, and managing civil aviation infrastructure both on the ground and air space in the country. It has planned a cumulative solar capacity of 150 MW over a period of time. The plants will be installed on surplus land available with AAI and at large roof tops across the AAI structures. This is in addition to what the private airports are installing.

India can boast of having the world's first solar powered airport—the Cochin International Airport Limited (CIAL). It has total capacity of 40 MW on net metering basis. The details will be discussed a little later as CIAL is the airport in focus of this study.





In 2021, one of the busiest airports in the country, Delhi International Airport Limited (DIAL), popularly known as the Indira Gandhi International Airport announced its plan to achieve net zero by 2030. This will be achieved through a combination of controlling carbon emissions and reduction through carbon offsetting. A GMR-led consortium that operates the airport, is utilising renewable energy from solar rooftop panels, and in the first phase added a capacity of 7.84 MW, and the total capacity addition is 20 MW. Delhi is the second largest airport in the country in terms of solar capacity.

The third airport which has a large solar energy installation is in Hyderabad. Currently, GMR Hyderabad International Airport Ltd (GHIAL) has a capacity of 5 MW, which will be increased to 30 MW.

In June 2021, Bangalore International Airport Limited (BIAL), the operating company of Kempegowda International Airport, Bengaluru, announced that they have achieved net energy neutral status in fiscal year 2020-21. As per reports, the airport has saved approximately 22 lakh units of electricity. This, experts say is enough to power nearly 9,000 houses for a month.

Rooftop installations at airports may not be as tough as seen in the other segments. Airports have two major advantages that work in their favour, availability of large rooftops on the terminals, and large land parcels. However, reflections from the panels are a challenge that these installations faced in the beginning.

It is interesting to note that airports have jumped into adoption of solar in scale, though in a phased manner early in comparison to the other sectors. It is yielding results in a major way helping them to reduce the carbon footprints. This is one of the best examples one can highlight— if there is a will, solar energy can be harnessed in scale. Solar energy adoption is helping airports to increase sustainable operations.

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“ *CIAL has won the Champions of theEarth award instituted by the UN* ”





**S.Suhas**  
Managing Director  
CIAL

*“We all can be change agents in considering and designing sustainable outcomes in the world around us that affect systemic wellbeing. CIAL frames sustainability as a practice that helps us to create a future that we are excited about living in,”*

## CIAL adopts solar for sustainable development

Cochin International Airport Ltd (CIAL) is the world’s first airport fully powered by solar energy. A huge establishment like an airport requires a high volume of energy to run its operations. And by using green energy, CIAL hopes to contribute to a healthier and greener planet.

One of the innovations, which proved that relying on green energy is possible even for high-energy consumers like an airport, won CIAL the Champions of the Earth award instituted by the UN. It is a rarity for airport operators to tread into the business of green Energy Production.

“Aviation is one of the fields which is being reprimanded for producing greenhouse gases. Now, CIAL believes that it is our responsibility to venture into projects producing green energy and thereby reducing our carbon footprint,” opines S. Suhas, Managing Director, CIAL.

### CIAL’s solar initiatives:

CIAL became the first airport in the world to completely operate on solar power comprising 46,150 solar panels laid across 45 acres near the cargo complex.

Overall, the airport has 2.25 lakh sq. ft. of solar carport with an installed capacity to generate 2.7 MW power from around 8,500 solar panels. It can accommodate 2500 cars at a time.

### Solar history:

**2013**

Incepted first solar project

**2015**

Became the first airport in the world to completely operate on solar power

**2021**

Scaled up farming practice by incorporating agri-voltaic procedure

“We have seven plants near airport premises with a cumulative capacity of 40 MW. We are adding up to it,” informs S. Suhas.

### The green energy journey:

A huge establishment like an airport requires a high volume of energy to run operations. According to reports, the aviation industry accounts for 11 per cent of all transportation-related emissions in the United States. In India, the per centage may be much lower, yet it is quite significant, the company states.

CIAL’s trysts with the experiments in producing green energy achieved another milestone with this installation as the company has introduced cost-effective, high-density polyethylene floats; using French technology, upon which 1300 photovoltaic panels were mounted and laid over two artificial lakes located in the 130-acre CIAL golf course.

The plants covering a total area of one acre are connected to the Kerala State Electricity Board (KSEB) power grid. CIAL successfully executed the idea of Total Sustainability Management (TSM) in its golf course where treated water from the sewage treatment plant of the airport is used for water harvesting with the help of 12 artificial lakes. The water from these lakes is used for irrigating the lawns of the golf course.

The plants covering a total area of one acre are connected to the Kerala State Electricity Board (KSEB) power grid. CIAL successfully executed the idea of Total Sustainability Management (TSM) in its golf course where treated water from the sewage treatment plant of the airport is used for water harvesting with the help of 12 artificial lakes. The water from these lakes is used for irrigating the lawns of the golf course.

CIAL's objective was not to offset aeroplane-related emissions at the airport but to take a small step towards powering the entire airport and allied facilities through solar energy and to send out a message to the world that a medium-sized airport can become self-sufficient on solar power, Suhas says. CIAL has eight solar plants on the premises of the airport. The biggest one, near the cargo terminal has an area of 48 acres, of which 20 acres is being used for agri-voltaic practice.

### Agri voltaic procedure:

In 2021, CIAL scaled up the farming practice by incorporating the modern method of agri-voltaic procedure. Vegetables like yam, long yard bean, drumsticks, mountain ginger, turmeric, cabbage, cauliflower and green chilli are produced in these farms. Water used to clean solar photovoltaic panels is being used for irrigation.

“The crops can modify the micro-climates below PV modules by reducing the temperature which increases efficiency in power generation. Moreover, the crop coverage in between PV arrays prevents soil erosion and reduce the dust load on the PV module,” says Suhas.

“Another advantage is that the cultivation dampens the weed growth underneath the PV panel mounts,” he adds.

4.5MW Hydro-electric project at Arippara, Kozhikode  
The 4.5 MWp run-of-river small hydro project (SHP) was awarded to CIAL by the Power Department, Government of Kerala as per the Kerala Small Hydropower policy under Built-Own-Operate-Transfer (BOOT) for a lease period of 30 years. The CIAL SHP at Arippara works on limited storage of water causing no adverse effect on the environment.

12MWp terrain-based solar power plant at Payyannur, Kannur

The terrain-based installation increases the land utilisation compared to flat land and decreases the space between the solar module arrays.

As a result, the land area required for solar PV installation is reduced to approximately 2.75 Acres/ MW as compared to 3.75 Acres/ MW in flat land. CIAL was able to install 35 per cent additional capacity from the land area as compared to a typical flat ground South-oriented installation.

The cumulative capacity of CIAL's power plants now is 50MWp. Producing 2 lakh units of electricity per day and 7.3 crore units of power yearly.



### A cumulative installed capacity of 50 MWp connotes:



7.3 crore units of green energy produced annually



Reduces the carbon footprint by 28,000 metric tons per year



Equivalent to the fresh air that we get by planting 46 lakh trees for 10 years



Equivalent to saving 1.19 crore litres of fossil fuel every year



# CASE STUDY 5

Sector:  
**Government**

Case in focus:  
**SECI**





A stronger policy-making authority is essential for a widespread acceptance, whether it be green energy, technology, or a change in the fuel used in transportation. The roll out is made easier with a draught structure, supportive policies, and a nodal agency that can put it into action. Regular interventions guarantee that the aim is met within the allotted period. When innovative ideas are embraced or put into practice, governments all over the world operate in the aforementioned format. When India sought to harness solar energy as part of its energy security policy, it was no different from other nations. Solar was a natural choice because India experiences more than 300 sunny days annually in much of the nation.

India rolled out the Jawaharlal Nehru National Solar Mission (JNNSM) or the National Solar Mission (NSM) in the year 2010 setting a target of achieving 20 GW from solar by 2022. However, the target was later revised to 100 GW by 2022 in 2015.

One of the key organisations in charge of the development of renewable energy in India is the Solar Energy Corporation of India, or SECI. In 2011, it was established as a CPSU to expedite the use of solar energy through the National Solar Mission. However, by unifying the entire portfolio of renewable energy sources under one aegis, the corporation's mandate was further widened.

SECI's current mandate includes setting up turnkey solar power projects for the public sector entities. Additionally, the company has a licence for power trading. It aims to lead the nation in the use of renewable energy on a big scale and serve it as a repository of technical knowledge on solar energy. It also collaborates closely with businesses to maximise solar energy installations that are connected to the grid.

So, what distinguishes SECI? This nodal agency, which reports to the Ministry of New and Renewable Energy (MNRE), has a significant role to play in the segment. It also carries out many government plans for the solar industry. This includes grid-connected rooftop solar installations, large solar parks, and many more.

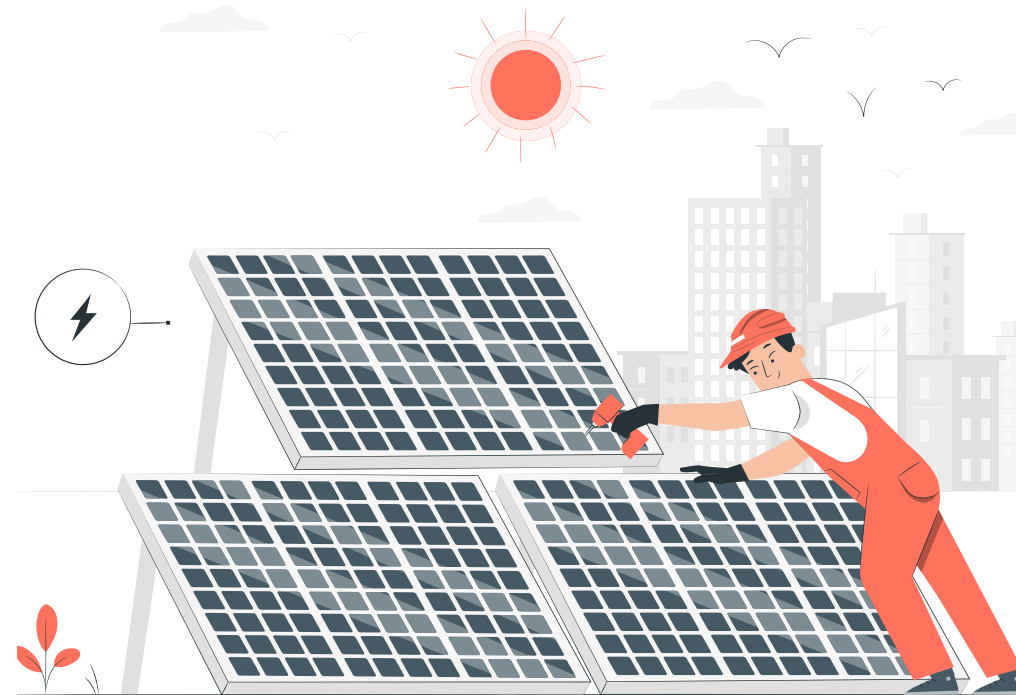






SECI is a self-generating and self-sustaining organisation in its existing form. Further, SECI is permitted to manufacture solar products and materials. Apart from solar energy, the corporation will actively participate in the development of all sectors of renewable energy, including geo-thermal, offshore wind, tidal, and others, under a broader mandate.

And it is crucial for a corporation like SECI to share the knowledge it has with other industry players.



**“** Installation of 30-MW solar plant at Ahmednagar, Maharashtra as EPC; the turnkey project included operations and maintenance for 25 years **”**



**Dr. Vikas Ghuwalewala**  
General Manager  
Solar

*We have installed ground-mounted solar panels across 200 acres of land for SECI. It is our endeavour to enable SECI that has ventured into solar project development on turnkey basis for several PSUs/Government departments,”*

## Enabling the green adoption

Gujarat-based Bagheria group of industries, a traditional chemical manufacturing company, ventured into solar energy in 2014 to offset captive energy needs.

The journey began with a 1 MW solar installation in Tarapur. Today, the company implements turnkey projects not just for the private sector, but also Central government agencies as an EPC partner.

A company of the Ministry of New and Renewable Energy, Government of India, SECI or the Solar Energy Corporation of India, is a Category-1 licensee for trading of power on pan-India basis, is one such customer.

SECI is a power procurement intermediary for projects being set up through its tenders, procuring power from developers and selling the same to discoms through long term PPAs/PSAs. Established to facilitate the implementation of the National Solar Mission, it is the only Central Public Sector Undertaking dedicated to the solar energy sector.

SECI turned to Bagheria industries for its requirements. Dr. Vikas Ghuwalewala, General Manager - Solar, Bagheria Industries, says, “We have installed ground-mounted solar panels across 200 acres of land for SECI. It is our endeavour to enable SECI that has ventured into solar project development on turnkey basis for several PSUs/Government departments.”

### Challenges in a nutshell:



Land acquisition



Resource mobilisation



Climate conditions



Cost

The objective, points out Mr Ghuwalewala, for SECI to install solar power is to meet increasing renewable energy demands from the DISCOMS. “So for example, if a state has renewable energy requirements, SECI as a nodal agency supplants those needs.”

“Besides, as a Category-1 power trading license holder, SECI actively trades solar power from projects set up under the schemes being implemented by it,” he quips.

The partnership with SECI started in 2015, when the EPC company won a 30-MW solar power project from the nodal agency.

Under this deal, it installed the plant at Ahmednagar District, Maharashtra over a span of two years, at a fixed tariff of Rs.4.41/unit. BIL executed the complete project on a turnkey basis. The agreement included operating and maintaining the plant for 25 years.

Consequent to stabilization of its solar power plants, there has been a steady contribution of around 7per cent to the topline leading to sustaining healthy contribution to BIL’s overall operating profit margins and cash flows.

Parallely, BIL has been scaling up the solar energy for captive use as well as for its EPC business unit.



Dr Ghuwalewala says, “It is against our policy to use agricultural land for commercial purpose. We use barren land to install solar panels. Overall, we have installed capacity of 39-MW DC solar power plant at Ahmednagar, Maharashtra and a 4.78-MW solar rooftop project in Chennai, which is now in operation. We have also installed solar power in open access solar parks. The idea is to reduce carbon emissions and make our planet sustainable.”

### Datasheet:

India is endowed with vast solar energy potential. About 5,000 trillion kWh per year energy is incident over India's land area with most parts receiving 4-7 kWh per sq. m per day. Hence both technology routes for conversion of solar radiation into heat and electricity, namely, solar thermal and solar photovoltaics, can effectively be harnessed providing huge scalability for solar in India. Solar also provides the ability to generate power on a distributed basis and enables rapid capacity addition with short lead times. Off-grid decentralised, and low-temperature applications will be advantageous from a rural electrification perspective and meeting other energy needs for power, heating and cooling in both rural and urban areas.

*(Source: National Solar Policy)*

### Project at a glance:

**30-MW**  
solar project

**25 years**  
PPA with SECI

**30MW**  
Capacity

**Rs 4.41/unit**  
Tariff

**Rs 180 cr**  
Total project capex

**Rs 26.7 cr**  
FY21 revenue





## CASE STUDY

# 6

Sector:  
**Energy**

Company in focus:  
**Hitachi Energy**





Energy demand is increasing with every passing day. This is due to various socio-economic factors such as urbanisation, population increase, rise in per capita electricity consumption, better living standards, changing consumer behaviour and digitisation.

This means there is a higher requirement to produce electricity, and fuel for transportation. Extracting fossil fuels to meet our energy requirements means that natural resources are being exploited for convenience. These natural resources include coal (for electricity generation), and oil and gas (for transportation and power generation).

What is ignored is that natural resources have taken millions of years to form. Also, at the current rate of usage, these natural resources will be depleted very soon. That is not all. Fossil fuels result in higher greenhouse gas emissions. These emissions are proving to be dangerous for people and the planet alike.

The low cost attached to fossil fuels makes them an attractive proposition for many developing countries. However, this fossil fuel dependency has resulted in a major setback to humankind in the form of climate change. Temperature has been identified as the most impactful factor of climate change followed by different climate-changing factors.

Globally, energy continues to be the top emitter of greenhouse gases with 30 per cent followed by transportation with 20 per cent. If you take energy as a segment (electricity, heat, transport), the per centage is much higher at approximately 73 per cent of the total emissions. This needs attention and curtailment. The United Nations has put together 17 Sustainable Development Goals (SDGs) which ask all countries to move away from fossil fuels and adopt renewable energy which is good for the planet.

According to data from the International Energy Agency (IEA), global carbon dioxide (CO<sub>2</sub>) emissions from energy combustion and industrial processes rebounded in 2021 to reach their highest-ever annual level. A 6 per cent increase from 2020 pushed emissions to 36.3 gigatonnes (Gt).





The world witnessed a dip in CO<sub>2</sub> emissions during the Covid-19 pandemic when energy demand dipped in 2020, reducing global CO<sub>2</sub> emissions by 5.2 per cent. However, the economy rebounded faster than expected when the restrictions were relaxed after the pandemic was brought under control.

It was reflected in the higher energy demand in 2021. Along with this, extreme weather conditions prevailed in many geographical regions. The result? Higher coal burning to produce more electricity despite the world seeing a record capacity addition in renewable energy.

IEA data shows that emissions increased by almost 2.1 Gt from 2020 levels. 2021 saw the biggest-ever year-on-year increase in energy-related CO<sub>2</sub> emissions in absolute terms. The rebound in 2021 more than reversed the pandemic-induced decline in emissions of 1.9 Gt experienced in 2020. CO<sub>2</sub> emissions in 2021 rose to around 180 megatonnes (Mt) above the pre-pandemic level of 2019.'

"The 6 per cent increase in CO<sub>2</sub> emissions in 2021 was in line with the jump in global economic output of 5.9 per cent. This marks the strongest coupling of CO<sub>2</sub> emissions with GDP growth since 2010, when global emissions rebounded by 6.1 per cent while economic output grew by 5.1 per cent as the world emerged from the global monetary crisis. Energy-related CO<sub>2</sub> emissions grew to 36.3 Gt in 2021, a record high.

These are not encouraging facts. However, there is one piece of news which comes as a relief. As per the latest report from IEA, the carbon emissions from the burning of fossil fuels are expected to rise again this year, but at a much lower pace. This is thanks to the increase in renewable energy generation, and because electric vehicles are gaining in popularity in the transport segment. "... CO<sub>2</sub> emissions from fossil fuels are on course to rise by almost 1 per cent in 2022 compared to the previous year. That is nearly 300 million metric tonnes of CO<sub>2</sub> more than in 2021, when the burning of gas, oil and coal released to about 33.5 billion tonnes of CO<sub>2</sub>," the report notes.

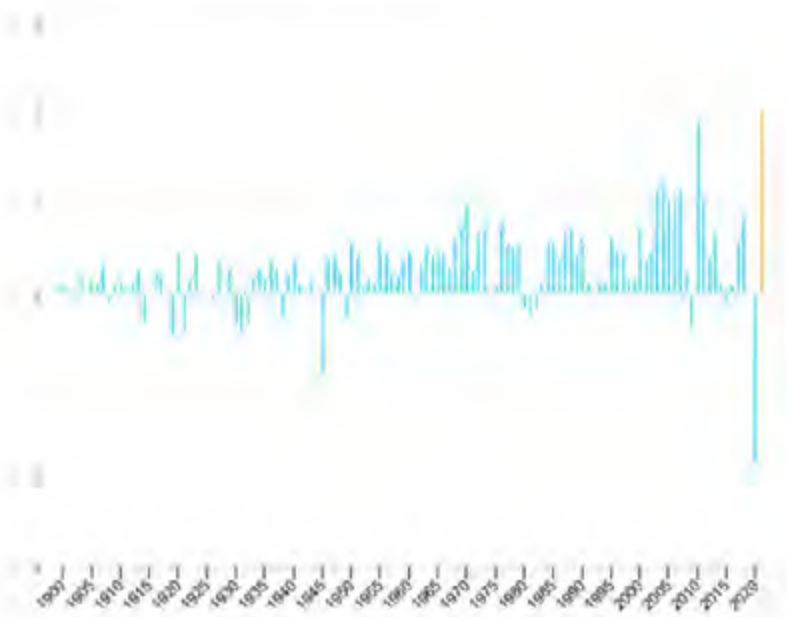


# Case study 6

## Annual change in CO<sub>2</sub> emissions from energy consumption and industrial processes, 1900-2021

Source: IEA

What does this indicate? It points to the need for more renewable energy adoption. In renewables, solar comes in as



an easy option because of the higher benefits it holds - easy installation, minimal maintenance, proximity of installation to the point of use, etc. For energy companies that are involved in energy generation it becomes crucial to reduce their own carbon footprint.

**“ In India, 30 per cent of green power in India flows through Hitachi Energy technologies. ”**





**Akilur Rahman**  
Chief Technology  
Officer

*“At present, around a quarter of renewable energy consumed is drawn from solar energy, which will soon move to almost one-third of it. In certain places, solar energy is the primary source of energy, In Q2FY23, our India operations’ carbon emissions declined ~40 per cent YoY,”*

## Hitachi Energy: accelerating energy transition through technology

Hitachi Energy, a leader in the worldwide energy industry, is well known for its solutions and services in sustainable energy. The company, which has its headquarters in North America, offers services in the generation, transmission, and distribution of power. The business is currently concentrating on offering the clients with innovative solutions for a flexible, resilient and sustainable energy future.

Therefore, it becomes even more crucial for a company like Hitachi Energy, which operates in the energy sector, to concentrate on decarbonising its own facilities. The corporation created the Sustainability 2030 plan and aims to achieve carbon neutrality in its operations by then. In addition, it targets to reduce emissions along the value chain by 50 per cent with customers, partners, and suppliers, supporting SDG 7 ‘Affordable and Clean Energy’ and align with the Paris agreement to limit global warming to 1.5 degrees.

As a first step towards becoming a carbon neutral company across operations, Hitachi Energy is investing in energy efficiency across its facilities.

For a start, the company has implemented technologies in the industrial facility in Vadodara, Gujarat, an area that experiences high levels of solar radiation year-round. “We used the plug-and-play containerized microgrid technology to commission

an industrial solar microgrid in 2018 to maximise the use of renewable energy. We are considering ways to enhance the current system to support anticipated growth,” states Akilur Rahman, Chief Technology Officer, Hitachi Energy India Limited. Besides, the company began its carbon-neutral journey last year.

“We quickly moved toward meeting our Sustainability 2030 goal of becoming carbon-neutral in our own operations, and by December 2021, we had achieved our first step goal of using 100 per cent fossil-free electricity in our operations. Through initiatives that produced our own fossil-free electricity, we achieved this,” informs Rahman.

He continues, “We considered a novel approach to optimise energy production and consumption. To reduce the use of fuel, we leveraged on digital and energy platforms to develop and engineer a special plug-and-play nano-grid for site offices.”

Hitachi Energy plans to use the trademarked tool for its EPC projects globally. They have worked with clients such as Sun Africa, the largest solar farm in Southern Africa (Angola), SIRAJ ENERGY, which created the largest solar project in Qatar, ENEL Green Power in Brazil who implemented world’s largest digital solar substation, the largest photovoltaic plant in Europe by Nuez de Balboa PV plant, powered by Hitachi transformers, and the remote-control centre for the entire solar and renewables fleet in Italy by ENGIE.

Meanwhile, 30 per cent of the India’s green energy is generated with Hitachi Energy technologies. The solar project in Tamil Nadu by Adani Green Energy Limited (AGEL) was supported by us. For the Kamuthi solar project in Tamil Nadu, which had a capacity of 648 MW—enough to supply 2.60 lakh homes with clean energy. The project included the electrification, automation systems, substation and solar inverters.

The largest solar park in India, 4.75 GW NTPC Renewable Energy Limited (NTPC REL), in Gujarat, which has the capacity to power over



8 million homes, will use Hitachi's made-in-India power transformers. The greatest rating of the transformer to be used by solar power evacuation so far for any operator in India would be the 315 MVA 400/33/33 kV transformers.

**The next step:**

The company is focusing on accelerating the energy transition through innovative technologies for a carbon-neutral future. While helping other companies in their energy pursuits, Hitachi is strongly focused on achieving Net Zero in its operations by 2030. This is by delivering products that lessen carbon emissions. By reducing dangerous substances and pollution throughout the life cycle of their services, Hitachi will reduce the negative effects on human health and the environment from its portfolio.

The company's goal is to become the go-to partner for a future powered by sustainable energy. As the forerunner in technology, we work with clients, partners, and other crucial stakeholders to allow a sustainable energy future for current and future generations.

**Hitachi Energy's carbon neutral journey**

Launched carbon neutral journey with Sustainability plan in 2021



To become Carbon Neutral (CO2e) in own operations by 2030



50 per cent reduction in CO2e emissions along the value chain



50 per cent reduction of waste disposed



per cent reduction of freshwater use

**Hitachi Energy's carbon neutral journey**



Achieved 100 per cent fossil-free electricity consumption in Dec 2021



Signatory to PPAs (Power Purchase Agreements) to switch to fossil-free power consumption



Potential reduction of 62 per cent CO2 emission y-o-y in FY23



In 2018, commissioned an industrial solar microgrid using our plug-and-play containerised microgrid solution at the Maneja factory.



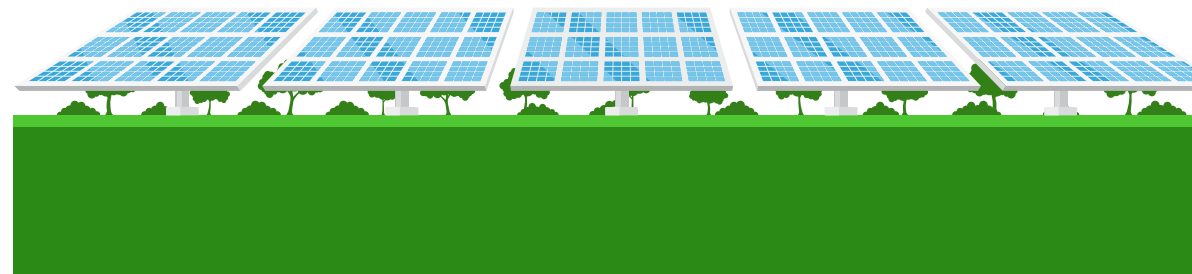
Green House Gas Standards' implementation



Reducing 4KL diesel consumption at our site offices through adoption of engineered plug & play nano-grid solution using green energy.



40 per cent YoY reduction in operational carbon footprint



# CASE STUDY 7

Sector:  
**Rural adoption**

Solar:  
**Standalone/ agriculture**





In India, the topic of solar energy conjures up images of grid-connected energy produced either by solar rooftops or grounded mounted ones. From here, we shift to rural India, where the scene is different. Here, solar energy is used for standalone applications as well as a mini-grid-connected energy source, occasionally. Why there has been such a significant shift in the adoption of solar energy across different geographies? This can be related to the country's electricity infrastructure challenges, and the financial factors that frequently act as barriers in rural areas.

Most Indians still live in rural areas, and agriculture continues to be their main source of income. It is expected that agriculture contributes significantly to the nation's GDP. However, many villages continue to struggle due to lack of access to energy.

As per an article published by the Massachusetts Institute of Technology, popularly known as MIT, in 2021, "More than 73 million households in remote areas of the world get electricity not from a conventional power grid but from sources such as solar lanterns, solar home systems (SHSs) that can power several devices, and local solar-based microgrids. Such off-grid devices and systems provide life-changing services to people who are off centralised electricity grids, and they help spread the use of renewable energy."

The National Solar Mission also envisioned the Rural Village Electrification Programme (RVEP), which used solar photovoltaic (PV) solutions to illuminate rural homes to fulfil the energy needs of the remote communities. This significantly raised the standard of living in the isolated settlements. Additionally, it lessened their reliance on kerosene, which served as the main source of fuel for lighting options. Depending on the local climate, light from solar sources lasted between three and seven hours.

Over the past decade, there have been many changes. International aid organisations and non-governmental organisations (NGOs) are working hard to promote solar energy adoption as they recognised the advantages it can offer to rural communities. As a result, off-grid microgrid solutions were created for certain geographic areas. As such, solar-related innovations



that address the problems in rural India were on display. Solar-powered appliances include lights, water pumps, water heater, streetlights, fans, and solar energy with home storage. Products like solar sewing machines, roti rolling machines, milking machines, blacksmith fan blowers, photocopy-printer emerged as the livelihood segment. Digital education tools that are solar connected, healthcare solutions etc., also saw acceptance in the rural area.

The government played a significant role—help in the form of subsidies were given to overcome the financial barrier. Then, companies offering integrated solutions emerged, offering solar products, financing, and customisation-based on regional requirements. For many people, this came in as a boon.

From challenges to villages that produce surplus energy using solar rooftops, India has walked a long way. In October 2022, Modhera in Gujarat became the first solar-powered village in India. The solar project has provided Modhera's residents with a surplus of renewable energy which they sell to the electricity grid.

There are other examples of how solar is being adopted, installed, and used that are eye-opening. Sewing machines that run on solar power, educational facilities that are on solar power, and even a waste management centre that depends on solar for its management.

However, there are still barriers to the adoption of solar power in rural areas due to lack of awareness and post-installation servicing. In villages, awareness sessions and workshops highlighting the advantages of solar energy are becoming a regular feature. And individuals, governments and business entities are collaborating to provide the practical knowledge to the people.

In this case study we are moving a little away from the usual format. We are talking about how solar solution providers are bringing socio-economic changes to the rural India— an integral part of the country.

**“ Villagers are migrating to cities. Besides the cost of transportation, migration is adding to burning fossil fuels, adding to the burden on the planet. ”**







**Guruprakash Shetty**  
AM (Expand)  
Selco- India.

*“As a not-for-profit enterprise, we enable the villagers’ easy access to bank loans for their solar power projects. One of the reasons the villagers trust us is costing, and the process is transparent. We do not make false promises of freebees,”*

## Solar power engineers integrated development in rural India

Bangalore-based Selco- India is a social energy enterprise. The company has revolutionised solar uptake in the rural areas of the country, thereby tick marking various UN SDGs through its projects pan India.

The company works on the basic principles laid down by Harish Hande, co-founder Selco- India and a social entrepreneur, who was awarded with the Ramon Magsaysay Award for 2011 for his pragmatic efforts to put solar power technology in the hands of the poor.

Guruprakash Shetty, AM (expand), Selco- India, informs, “We have installed solar rooftops for around 300 small landholders in the coastal village of Galihole, Udupi in Mangalore. They are using solar power not just for irrigation, but also to milk cows, power streetlights etc.”

Thereby, the enterprise has developed an end-to-end value chain of rural enterprises, enabled women empowerment, and developed an integrated line of stakeholders to create self-sufficient, holistic villages.

Apart from solar electrification, the enterprise has enabled solar-empowered sugarcane machines, photocopier machines in miscellaneous stores, rice mills, flour mills, blowers and power hammers, pottery making machines, millet processing units in and areas adjacent to Golihole village.

### Empowering the agriculture sector through solar:

Selco-India has empowered the agricultural segment through solar energy in some novel ways. The deployments are off grid solutions, battery backed solar rooftops.

One, farmers are using the solar-powered cold storage to store their yields. “Farmers now refuse to sell their produce for less. They store it in the cold storage, and only sell it for a fair market price,” informs Shetty.

Secondly, many farmers have set up solar powered workshops to impart making tomato ketchup and syrup—a value addition to the product portfolio, and an incremental source of income for the family.

Thirdly, the use of solar energy has changed the definition of many women dominated roles. For instance, milking cows is now gender agnostic, and cows can be milked any time of the day because of uninterrupted power supply. Farmers are churning buttermilk as an additional source of revenue.

### Some key offerings in the agri sector:



Sustainable energy access and rice value chain



Sustainable energy in tomato and potato value chains



Sustainable energy access for millets  
Climate conditions

## **Problem statement:**

India is a geographically diverse country. For instance, farmers in Udupi grow rice, coconut and betel leaves. Rest of the products are purchased from other states. “The same is true for all the regions across the country. Secondly, farmers, a majority of who are small land holders, do not get fair price for their labour or produce because of lack of technology, resources, and awareness. As a result, the bread winners migrate to metro cities. Pan India, many educated youths belonging to the traditional agri families are working in metro cities. All the same, the families back home continue to rely on the neighbouring states for their requirements,” notes Shetty.

After numerous interactions with the farmers and their families, Selco-India which has been electrifying the rural areas of India through solar energy, decided to take the sustainable route.

Shetty says, the enterprise focused on creating end- to-end value chain and present a produce to end-product shift at the village level. It convinced all stakeholders to unite for the cause and provided its expertise in solar power to the villagers. The villagers are now owners of a variety of enterprises, hitherto unheard of in the rural areas.

## **Demystifying the solar cost for the villagers:**

There is no one size fits all costing solution for solar, Shetty explains. For some, solar is a costly proposition. For example, a flour mill functions on 2 to 4 HP electrical pump which can cost approximately Rs 4 lakh. But investing the same amount in solar is huge. Selco-India provides grants to the needy villagers, and links them to a financial institution, for a loan. “As a not-for-profit enterprise, we provide the villagers easy access to bank loans for their solar power projects. One of the reasons the villagers trust us is costing, and the process is transparent. We do not make false promises of freebees. That is where sustainability works; popular projects must not be grant heavy,” he says.

After installing the solar pump, Selco-India educates farmers to optimize the use of solar energy to supplement the company’s green energy concept. “In the villages where electricity is available for 2-3 hours a farmer maximises







the use of the electric pump during those hours. However, solar energy is available for long, and we teach farmers to optimize the use of pump accordingly. Any project must be self-sustained,” Shetty states.

### **The impact:**

After a gruelling day of labour on the field, Sumanna, a rural woman was dependent on the traditional sewing machine to earn an extra income. Selco-India enabled her to utilise her rooftop and helped her to install a solar PV which is now not just providing electricity to her house, but also powering her sewing machine.

In the last two to three years, Sumanna has seen 50 per cent increased efficiency and productivity. It is because of such initiatives that women like Sumanna have taken leadership positions and are employing more women or inspiring more women to start their own small enterprise. In fact, Sumanna has inspired 50 women to start their enterprises from home.

Overall, Selco-India, is aligning the solar power projects with rural electrification in such a manner that enables holistic development, integrated community development, sustainable growth and stops migration.

### **Elements**



Villagers are migrating to cities. Besides the cost of transportation, migration is adding to burning fossil fuels, adding to the burden on the planet



Selco-India has installed 50,000 to 60,000 solar-powered home lighting equipment in rural households, and has enabled about 3,000 to 4,000 farmers across Karnataka, Maharashtra, Tamil Nadu, Andhra Pradesh, Telangana, and some part of North India, to generate income through solar

## CASE STUDY

# 8

Segment:

Enterprise:  
**Amazon**





## Case study 8

Solar energy is fast emerging as the preferred option in the IT-ITeS segment. The sector is powering up data centres with captive solar energy.

Research says that the ICT industry constitutes 2 per cent of global total CO2 emissions and 3 per cent of global energy expenditure. Data centres consume maximum energy in ICT, of this, the network infrastructure consumes nearly 30 per cent of the total power.

India has around 375MW of installed power capacity for data centres, which is expected to grow threefold by 2025. Also, there is a \$4.9 billion investment opportunity by 2025 for setting up data centre infrastructure, according to the government.

India is running the world's largest clean energy programme to achieve 175 GW of renewable capacity, to help reduce its carbon footprint by 33-35 per cent from the 2005 levels, as part of global climate change transition commitments adopted by 195 countries in Paris in 2015. The country currently has an installed renewable energy capacity of 89.63GW, with 49.59GW capacity under execution.

Amazon co-founded The Climate Pledge in 2019 with the goal of achieving Net-Zero carbon emissions across its businesses by 2040. According to its Sustainability Report, it aims to make 50 per cent of all shipments via its e-commerce platform Net-Zero Carbon by 2030 and by 2040, it wants to reach Net-Zero Carbon for all its operations. This would still be 10 years ahead of the Paris Agreement deadline.

With its latest announcement of adding more renewable energy projects, it aims to bring new investment, green jobs, and advance the decarbonisation of the electricity systems. Of its 274 renewable energy projects globally, 105 are utility-scale wind and solar projects, while 169 of them are rooftop solar projects at its stores and facilities.

“ The company announced 23 new solar rooftop projects on its fulfilment centres across 14 cities in India. These will generate 4.09 MW, taking the total number of solar rooftop projects in India to 41 with 19.7 MW of capacity. ”





**Abhinav Singh**  
Director, Customer Fulfilment,  
Supply Chain & Amazon  
Transportation  
Services, Amazon India

*“Our goal is to be powered by 100 per cent renewable energy by 2030. And we are on a path to achieve it by 2025. In 2021, we reached 85 per cent renewable energy across businesses. We are leading the corporate transition to renewable power worldwide and demonstrating that ambitious renewable targets are both achievable and widely beneficial.”*

## Using solar energy the Amazon way

As a global tech and with a large presence in the retail business, Amazon has been leading renewable energy adoption across its operations worldwide. The company has announced first utility-scale renewable energy projects in India—three solar farms in Rajasthan with a combined capacity to generate 1.07 MM megawatt hours (MWh).

Additionally, the company announced 23 new solar rooftop projects on its fulfilment centres across 14 cities in India. These will generate 4.09 MW, taking the total number of solar rooftop projects in India to 41 with 19.7 MW of capacity.

Abhinav Singh, Director, Customer Fulfilment, Supply Chain & Amazon Transportation Services, Amazon India, comments, “Investing in renewable energy is one of the many actions Amazon has been taking to decarbonise its operations globally.”

He says, “Our goal is to be powered by 100 per cent renewable energy by 2030. And we are on a path to achieve it by 2025. In 2021, we reached 85 per cent renewable energy across businesses. We are leading the corporate transition to renewable power worldwide and demonstrating that ambitious renewable targets are both achievable and widely beneficial.”

### The journey:

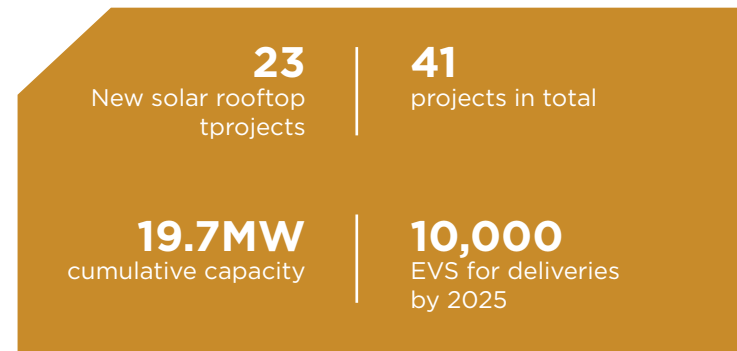
In the renewable energy journey, Amazon has collaborated with credible, knowledgeable, and innovative industry partners. For instance, in India, it

announced a 210-MW project with ReNew Power, a 100-MW project with Amp Energy India, and a 110-MW project with Brookfield Renewable, respectively.

Renewable energy remains the key focus area for the company. As of September 2022, Amazon has announced 379 renewable energy projects globally, and once fully operational they are expected to generate 50,000 gigawatt hours (GWh) of power. The company announced it will continue to invest in utility-scale renewable energy projects as it is committed to leveraging on their size and scale to make a difference.

Singh says, “We continue to expand our use of zero-emission transportation. In 2021, more than 110 million packages were delivered by electric vehicles or on foot in North America and Europe. More than 100 US cities will be served by these vehicles by end of this year. In India, we will add 10,000 EVs for deliveries by 2025. This is in addition to the global commitment of 100,000 EVs worldwide by 2030.”

### Highlights - India





The company has made substantial investments to transition to a low-carbon economy. “We continue to invest in visionary companies through our \$2 billion Climate Pledge Fund. For instance, in July 2021, we made our first investment in India through energy-tech start-up ION Energy. In 2019, Amazon also created the Right Now Climate Fund, a \$100 million fund for nature-based solutions to restore and conserve forests, wetlands, and grasslands.”

### Tying RE strategy with UN SDGS

Amazon is tying its renewable energy strategy with other UN sustainable development goals. For example, it has enabled more than 70,000 employees to learn new skills and advance their careers as part of the Upskilling 2025 pledge, and it is enabling thousands of hourly employees in 14 countries to earn certificates and degrees through Amazon Career Choice.

Along with renewable energy, the company is initiating steps to conserve and reuse water — collecting and recycling water through rainwater collection tanks, replenishing water into aquifers from recharge wells, implementing waterless urinals across sites located in water-stressed regions, and in-house sewage treatment plants that enable the reuse of water for flushing and gardening.



### Climate Pledge and other initiatives:



2019: Co-founded The Climate Pledge



2021: Developed the Agroforestry and Restoration Accelerator in Partnership with The Nature Conservancy, in Brazil



2020: Launched the Climate Pledge Fund with an initial \$2 bn



Created the Right Now Climate Fund, for \$100mn fund



2021: Helped create LEAF Coalition in 2021

### Solar journey



Co-founder & first signatory of The Climate Pledge



Net-zero carbon by 2040



100 per cent renewable energy by 2025



225 rooftop solar projects



50,000-gigawatt hours (GWh) capacity target



71 new RE projects including first solar farm in India



18.5 GW of RE capacity



154 wind and solar farms



**Navratan Katariya,**  
COE, -IoT  
Start-up  
(cleantech/  
deeptech/IOT/AI)  
Renewable energy  
Specialist,  
NASSCOM

### Synopsis:

The year 2022 has been a spectacular year for the technology industry in India. It recorded a 15.5 per cent growth (highest ever) to reach \$227 billion in revenue

According to industry association NASSCOM, the Indian IT-ITeS segment has the potential to achieve revenues of \$350 billion by 2025.

Enhanced productivity and operational efficiency are driving investments in the IT-ITeS segment, especially cloud computing. Moreover, cloud computing provides sustainability benefits to businesses, NASSCOM said.

Overall, the IT-ITeS as an industry segment is a torchbearer of innovative technologies in areas of energy optimization. One such gradual shift is towards solar power.

Navratan Katariya, CoE, -IoT, Start-up (cleantech/deeptech/IOT/AI) & Renewable energy Specialist, NASSCOM, said that multinational companies are driving the uptake of solar power; but it is the SMBs who must also be an area of focus. Edited excerpts from an interview.

### 1. What is the uptake of solar energy in the IT-ITeS segment in India?

The segment is a torchbearer in the uptake of solar energy. But one must address the issue with regards

to two market segments:

- a. Large enterprises and multinational companies and
- b. The large SMB segment in India.

Solar energy is a part of the overall strategy of large enterprises—MNCs and in India. Through open access, they are optimizing solar energy for data centres, cloud computing and disaster recovery. Many organisations are calculating TCO/RoI on these investments.

Secondly, global compliance and statutory mandates like sustainability and ESG are driving solar adoption in these organizations. However, the challenge lies with the SMBs and the MSMEs.





## 2. What are the challenges?

The builder community must understand that they can make more money by installing solar rooftops. Secondly, builders can develop large commercial spaces for the IT companies and mount the solar panels themselves. It is unfortunate that the IT companies do not invest in solar energy because there is a huge need for solar power, and they can start with the open access ecosystem.

### Even the policies are conducive...

Possible. But there is no intent. Besides, policies are about obtaining carbon neutrality.

The power requirement is high. They will invest in solar energy only if the grid is available. These are SMBs. Who will give the money to install? Instead, they will invest money on people or servers which will increase productivity. The operational cost is not high on their agenda.

They must pool resources and convince the builder. There should be someone to address questions on return on investment when the lease expires. Will the landholder compensate the bill amount against electricity charges or return the balance?

## 3. What is the solution?

According to the new government policy, any new building constructed should have a solar panel installed on the rooftop as part of ESG. Many of them are open access.

The technical solution to this is movable solar rooftops which work on a plug and play model—they can be mounted by the tenant and removed when he moves. These can be implemented at 5-7 per cent cost of the whole project.

## 4. Who is driving the solar projects at organisations (Is it a top-down approach?) What is the impact?

The bottom-up approach does not work in India. Decisions are largely taken outside India. The good thing is that people understand the importance of solar and deploy. For others it is not a high priority.

## 5. What is the trend for solar rooftops?

The demand may vary in the IT-ITeS segment. For instance, it requires a lot of cooling in the data centres and therefore, the need for power is high.

Solar energy has direct relationship with the weather. For instance, during the summer there is ample sunlight which can be converted to solar power that can run multiple applications. At the same time, the solar energy can be captured and stored in the form of chilled water rather than put into battery which is expensive. The ideal way is to store a high number of chilled water units.

Every DC needs a good power back up. If you can take off the cooling needs, there are systems today that solar can work with the traditional systems.

## 6. What will be the key changes and challenges in solar uptake in the next 3-5 years?

I do not see much change. Most of the small entities will continue to work in rental places. Instead of working in rented space, IT companies must start owning the asset and start their solar energy, especially when many state governments have made the clearance process easy.

Another way to promote solar uptake is to develop large solar parks on the lines of IT parks.

Thirdly, the government can invest in developing infrastructure and promote solar energy among tenants.



The journey has begun with a purpose. The purpose involves making India self-reliant in energy and reducing its dependence on fossil fuels, and drastically reducing carbon emissions. For a country like India which is progressing in a fast-paced manner, economically and socially, it is imperative to look at safeguarding the environment. The waking alarm given by mother nature in the form of water scarcity, increasing heat waves, natural calamities and natural imbalance must be addressed on an emergency note. The need of the hour is to create and propagate sustainable living methods. India with solar adaption and an ambitious target of adding capacity, we are sure that our country will be able to address climate change in an effective manner.







MESSE  
MÜNCHEN

Unit No. 762/862, Solitaire Corporate Park Building  
No. 7, 167, Guru Hargovindji Marg, Andheri (E) Mumbai – 400 093 INDIA  
Tel.: +91 22 4255-4700  
Fax: +91 22 4255-4719  
E-mail: [info@mm-india.in](mailto:info@mm-india.in)  
Website: [www.mm-india.in](http://www.mm-india.in)

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