Indian Railways, the fourth largest railways in the world by network, has envisioned to become a Green Transporter by reducing its carbon footprint. The energy consumption of Indian Railways in FY 2020 was around 18,410 Million Units for traction and 2,338 Million Units for non-traction load.

Indian Railways has taken significant strides to reduce its carbon footprint & fuel cost and is committed to become a ‘net-zero’ carbon emissions organization by 2030. Some of its key initiatives towards decarbonization are 100% electrification of Railways broad gauge network, reduction in energy consumption and meeting energy demand through renewable energy (RE). Indian Railways already has 220 Megawatt (MW) capacity of RE power, with nearly 3,450 MW capacity in the pipeline.

Indian Railways is collaborating with several donor agencies and stakeholders to accelerate its low carbon journey. It has signed a Memorandum of Understanding with United Kingdom’s Foreign, Commonwealth and Development Office (FCDO) for collaboration on energy and sustainability under its Power Sector Reforms Programme.

1. APPROACH & IMPACT OF GREEN INITIATIVES OF INDIAN RAILWAYS

Ensure 100% broad gauge electrification by December 2023. A total of 42,354 Route Kilometre has been electrified as of January 2021. Due to its increased focus on electrification (Figure 1), Indian Railways has witnessed significant reduction in its diesel consumption (Figure 2).

Figure 1: Pace of Electrification in Indian Railways

Vision of Hon’ble PM on Solar Energy

“ We want to bring solar energy into our lives and homes, by making it cheaper, more reliable and easier to connect to grid ”

Hon’ble Prime Minister
Narendra Modi
Indian Railways has been continuously installing solar panels on rooftops of its various stations and service buildings for meeting its non-traction power requirements. More than 1000 stations have been covered with solar panels on rooftop and more are in pipeline.

Indian Railways has also planned for installation of one-of-the-kind solar plus storage hybrid pilot project at Dahod, Gujarat connected to the railway traction network.

Indian Railways has completely switched over to production of energy efficient 3-phase electric locomotives with regenerative features, in which there is provision of regeneration of electric energy while braking of train and regenerative energy is fed back to grid. Loco pilots are being regularly counselled for use of regenerative feature and to switch off blower, in case yard detention is more than 15 mins.

Trailing locomotives of a train carrying light load are switched off to save energy in case of multi-units. Energy consumption is regularly monitored through microprocessor-based energy meters, provided in all the electric locomotives.

269 (258 non AC + 11 AC) energy efficient EMU rake with 3 Phase Insulated Gate Bipolar Transistors propulsion system have been introduced in Mumbai suburban area with regenerative braking feature that helps in saving energy.

a) 3-Phase Non-AC, Electric Multiple Unit
During FY 2019-20, 21 non-AC Electric Multiple Unit EMU Rakes of 12 cars with energy efficient 3 phase Insulated Gate Bipolar Transistors-based propulsion system with regenerative braking feature have been introduced by the Railways. 27 Non-AC Electric Multiple Unit rakes with 3 phase Insulated Gate Bipolar Transistors-based propulsion system are planned to be manufactured by the end of FY 2022.

b) 3-Phase AC, Electric Multiple Unit
11 air-conditioned Electric Multiple Unit rakes of 12 cars equipped with energy efficient 3-phase propulsion system with regenerative braking feature for Mumbai suburban have been produced. 2 AC Electric Multiple Unit rakes with 3 phase Insulated Gate Bipolar Transistors-based propulsion system is likely to turn out in 2021.

Indian Railways has a potential of 20 GW of solar power and is planning to utilise its vacant land parcels to set up land-based solar plants for its traction power requirement. Railways initially plans to set up 3 GW of solar plant on the unused vacant land in three phases.

- Phase- I: 1.6 GW capacity in railway plots for open access states under developer model.
- Phase- II: 400 MW capacity in railway plots for non-open access states under ownership model of REMCL (captive use).
- Phase- III: 1 GW capacity in railway plots along the tracks under developer model for open access states.

These will be implemented under the Make in India initiative, making Indian Railways 'Atma-nirbhar'.

Figure 3: RE technologies for green power procurement by Indian Railways:

<table>
<thead>
<tr>
<th>Traction</th>
<th>Non-Traction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar Rooftop-Coaches</td>
<td>Solar Rooftop-Buildings</td>
</tr>
<tr>
<td>Land Based Solar</td>
<td>Solar PV Street Lights</td>
</tr>
<tr>
<td>Wind Energy</td>
<td>Solar Water Heaters</td>
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<td>Solar Pumps</td>
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</table>
2. GREEN ENERGY ACHIEVEMENTS

Some of the achievements regarding green energy procurement are:

1. **111 MW capacity installed at rooftops of various stations and administrative buildings by January 2021.**

   ![Figure 4: 3 MW Rooftop Solar plant at Howrah Railway Stations](image1)
   ![Figure 5: 1 MW Rooftop Solar at Katra Railway Stations](image2)

2. **3 MW Solar Land Based Project at Modern Coach Factory, Raebareli**

   ![Figure 6: 3 MW Solar Land Based Project at Modern Coach Factory, Raebareli](image3)

3. **Two pilot Land Based solar projects for powering of the railway traction network have been completed:**
   a. **1.7 MW pilot solar project for powering traction network of Indian Railways directly through solar power has been commissioned in Bina, Madhya Pradesh in June 2020.**

   ![Figure 7: 1.7 MW solar project powering traction network at Bina, MP](image4)
b. 2 MW pilot solar project on land along the railway track which will feed power at 132 KV system for the Railways electric traction network. This was commissioned at Diwana, Haryana in September 2020.

Figure 8: 2 MW solar project at Diwana, Haryana

Figure 9: Snapshot of Land Based Solar Project in IR solar projects

Figure 10: Snapshot of the news reports highlighting initiatives undertaken by IR

"First time in the world! Indian Railways sets up solar plant in Bina to directly power railway overhead line."

"The 2 MWp solar plant at Diwana (Haryana) which shall be connected to State Transmission utility (STU) is expected to be commissioned before 31st August, 2020."

"In the wind energy sector, 103 MW wind-based power plants have already been commissioned. Among them, 26 MW is in Rajasthan (Jaisalmer), 21 MW is in Tamil Nadu and 56.4 MW is in Maharashtra (Sangli)."

4. Solar integrated platform shelter

A 16-kW solar power plant has been installed as platform shelter at the Sahibabad Railway Station by Central Electronics Limited (CEL). This is a first-of-its-kind initiative in Indian Railways where a solar power plant is doubling as a shelter. This will reduce the combined cost of platform shelter plus rooftop solar plants and provide solar power to meet the non-traction demand.

https://scr.indianrailways.gov.in/view_detail.jsp?lang=0&dcd=14129&id=0,5,268
5. **Nandyal – Yerraguntla Section declared as the First Solar Section on South Central Railways (SCR)**

- The Nandyal – Yerraguntla section in Guntakal Division of SCR has been declared as the first solar section in SCR.
- All eight stations in the section—Madduru, Banaganapalle, Koilakunta, Sanjamala, Nossam, S. Uppalapadu, Jammalamadugu and Proddutur—have been provided with solar panel systems capable of meeting the entire power needs at these railway stations.

6. **Indian Railways has wind energy installations too across the country, including 56.4 MW wind project in Maharashtra, 2 X 10.5 (Total 21 MW) wind project in Tamil Nadu and 26 MW wind project in Rajasthan.**

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*Source: Press Information Bureau (PIB)*
7. Dual Voltage Green Tower Car

Eastern Railway (ER) has developed the first-of-its-kind on Indian Railways, an Overhead Equipment (OHE) cum battery-powered Tower Car for OHE inspection and maintenance. Old MEMU coaches have been suitably modified to suit various requirements such as the provision of an overhead inspection boom, bio-toilet, tool cabinets, crew rest area, roof mounted catwalk, etc.

Figure 14: Salient features of Indian Railways’ 1st Dual Voltage Green Tower Car ‘Navonmesh’

As advised by Railway Board vide Lr. No. 20111/Elect (G/0/181/1/EMU dated 21.9.2020, Eastern Railway Kanchrapara Workshop has converted two overage MEMU coaches (MC 21006/ASN and TC 22017/JAJ) to Dual Voltage Green Tower Car “NAVONMESH”, which can operate in dual voltage system, i.e., 25 KV OHE as well as Batteries in Unwired Sections.

Scheme

- Low Height Roof (3.6 M) for Hydraulic Platform
- Cost efficient
- LED Light fittings at Roof for Night Maintenance
- Very Less maintenance compared to conventional Diesel Tower Car
- Environment Friendly
- Low Height Roof (3.6 M) for Hydraulic Platform
- LED Light fittings at Roof for Night Maintenance
- Roof Ladder with OHE indication lighting
- Sliding Door
- Bio-Toilet
- Inspection Doom with Pantograph
- Seating arrangement for Staffs
- Aluminum Checker sheet flooring
- Catenary and Contact wire Drum Loading arrangement
- Provision of storage of spare mast
- Catwalk in Trailer coach
- LED headlights at both ends

The continuous efforts of the Indian Railways and Zonal Railways in energy conservation measures has resulted in winning 14 National Energy Conservation Awards (NECA) in 2020 under Three categories.

Under Industrial category 6 railway workshops were awarded at NECA-2020.

Under Transport category 4 zonal railways were awarded at NECA-2020.

Under Buildings category 4 Railway GOVT offices were awarded at NECA-2020.
3. KEY INITIATIVES TAKEN BY INDIAN RAILWAYS FOR PROLIFERATION OF SOLAR PLANTS

Some of the key initiatives to overcome challenges for harnessing full potential of solar energy by Railways are:

Figure 15: Key challenges for utilising full potential of solar energy on Railways land

01 No objection Certificate for Open Access

Open Access as deemed licensee taken in 11 states and DVC area. No objection Certificate (NoC) for open access for flow of electricity for Railways in West Bengal, Tamil Nadu, Chhattisgarh, Odisha, Andhra Pradesh, Kerala and Telangana has not been operationalised due to regulatory challenges which are being rigorously pursued by IR. In case, approval for procuring power through Open Access is allowed in these states, deployment of solar can further increase.

02 Wheeling and Banking provision

Full deployment of solar potential will be increasingly feasible if wheeling and banking arrangements are provided by states which is being rigorously pursued by IR.

03 Merger of Solar Purchase Obligation & Non Solar Purchase Obligation

Availability of banking facility & merger of solar and non-solar obligations will allow Railways to fulfill its Renewable Purchase Obligations (RPO).

04 Unrestricted Net Metering Regulations

Provision of unrestricted net metering for rooftop solar projects would further accelerate IR’s solar plants deployment.

It has been the endeavour of Indian Railways to follow the best practices and encourage ease of doing business. Indian Railways organised a stakeholders consultation wherein the Honourable Minister of Railways and Renewable Energy (RE) leaders came together to share insights and solutions to create more opportunities to achieve goal of Indian Railways of becoming “Net-Zero Carbon Emitter” before 2030 and to become ‘Atma-Nirbhar’ by adoption of “Make in India” technology.

4. WAY FORWARD

With the mega initiatives being undertaken, the Indian Railways is holding the flag high for India’s commitment and Prime Minister Shri Narendra Modi’s vision to fight climate challenge. The seemingly large strides undertaken by the Indian Railways thus far are however just small steps towards Honourable Railway Minister’s mega plan of being a net-zero carbon emissions organisation and meeting India’s Nationally Determined Contribution targets. Going forward, the Indian Railways will continue to master green energy procurement while being gracefully at the service of crores of fellow Indians.